clean water PROGRAM

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Protecting Alameda County Creeks, Wetlands & the Bay

March 31, 2019

Mr. Michael Montgomery
Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: **SUBMITTAL OF THE ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM URBAN CREEKS MONITORING REPORT**

Dear Mr. Montgomery:

As you know, various submission and reporting provisions of the Municipal Regional Stormwater Permit (MRP) authorize Permittee implementation and compliance though coordination of the countywide storm water programs. The member agency Permittees of the Alameda Countywide Clean Water Program (ACCWP) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with submission of MRP-required reports.

Therefore, with this letter, I am submitting this ACCWP Urban Creeks Monitoring Report for Water Year 2018 on behalf of and for the benefit of the ACCWP member agency Permittees. By signing this letter on behalf of ACCWP, I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. [40CFR 122.22(d)].

Sincerely,

James Scanlin
Program Manager

Attachments: Certification Statement (1 page)
ACCWP Urban Creeks Monitoring Report

Certification Statement

Report components

This submittal by the Alameda Countywide Clean Water Program includes the main body of the Urban Creeks Monitoring Report (UCMR) for October 2017 through September 2018 and the following appendices and attachments:

- A.1 Creek Status Monitoring Report - Regional Parameters, Pesticides and Toxicity
- A.2 Creek Status Monitoring Report -Targeted Parameters
- A.3 ACCWP Pollutants of Concern Monitoring 2018 Sediment Sampling Report
- A.4 Exploring CSCI Results and the Outcomes of Restoration Activities along Sausal Creek WY 2018 Progress Report
- Attachment A: Electronic Data Submittal Transmittal Letter dated March 31, 2019 with attached file list
- Attachment B: BASMAA Regional Monitoring Coalition: Status of Regional Stressor/Source Identification (SSID) Projects, Updated March 2019

Third party monitoring

Please note that consistent with provision C.8.a.iii of the reissued MRP, portions of the Pollutants of Concern monitoring requirements were fulfilled or partially fulfilled by third party monitoring in Water Year 2018, as described in Section 6.2 of the attached UCMR and in the ACCWP Pollutants of Concern Monitoring Report for Water Year 2018 (submitted October 2018):

- The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) conducted a portion of the data collection in Water Year 2018 on behalf of Permittees, pursuant to provision C.8.f- Pollutants of Concern Monitoring. The results of that monitoring are reported in Appendix A.3 of the attached Urban Creeks Monitoring Report.
- Data addressing the Trends monitoring information need described in Provision C.8.f were collected by the State of California's Surface Water Ambient Monitoring Program (SWAMP) through its Stream Pollutant Trend (SPoT) Monitoring Program at two Alameda County locations in WY 2018. As stated in provision C.8.a.iii, Permittees may use these data to comply with the monitoring requirements included in this provision, provided the data meet the data quality objectives described in C.8.b, i.e. SWAMP comparable. However, the schedule for SWAMP's review and reporting of data collected for the SPoT Program differs from the schedule described in the MRP.

Electronic Data Submittal

ACCWP is also uploading to the Water Board’s ftp site the Program's monitoring data for Water Year 2018, as listed in Attachment A of the UCMR.

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

URBAN CREEKS MONITORING REPORT

OCTOBER 2017 THROUGH SEPTEMBER 2018

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

Report prepared by

Alameda Countywide Clean Water Program

399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2019

ACKNOWLEDGEMENTS

ACCWP acknowledges the contributions of Mr. Paul Salop and other staff of Applied Marine Sciences in planning, implementation and reporting of Creek Status Monitoring, Pesticides and Toxicity Monitoring and Pollutants of Concern sediment sampling. Horizon Water and Environment, LLC contributed substantially to the preparation of this report, in preparation of the data analysis, and discussion of results. Additional acknowledgements for preparation of specific Appendices are included in those documents.

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LIST OF ACRONYMS

Acronym	Definition
ACCWP	Alameda Countywide Clean Water Program
AFDM	Ash Free Dry Mass
AMS	Applied Marine Sciences
BASMAA	Bay Area Stormwater Management Agencies Association
BMI	Benthic Macroinvertebrate
BOD	Board of Directors of BASMAA
CCC	Criterion Continuous Concentration
CCCWP	Contra Costa Clean Water Program
CEC	Contaminants of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CMC	Criteria Maximum Concentration
CSCI	California Stream Condition Index
CTR	California Toxics Rule
CWA	Clean Water Act
DEM	Digital Elevation Model
DO	Dissolved oxygen
DQO	Data Quality Objective
DW	Dry Weight
E. coli	Escherichia coli
ECWG	Emerging Contaminant Workgroup of the RMP
EDD	Electronic Data Deliverable
EEWG	Exposure and Effects Workgroup of the RMP
FIB	Fecal Indicator Bacteria
FSURMP	Fairfield-Suisun Urban Runoff Management Program
GIS	Geographic Information System
GRTS	Generalized Random Tessellated Stratified
HVF	Highly Variable Flow
IBI	Index of Biological Integrity
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MPC	Monitoring and Pollutants of Concern Committee
MPN	Most Probable Number
MQO	Measurement Quality Objective
MRP	Municipal Regional Stormwater Permit
MRP1	Municipal Regional Permit, issued 2009
MRP2	Reissued Municipal Regional Stormwater Permit (2015)
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MUN	Municipal Beneficial Use
MWAT	Maximum Weekly Average Temperature
MYP	Multi Year Plan
ND	Non-detect
NPDES	National Pollutant Discharge Elimination System

NT	Non-Target
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effects Concentrations
PHab	(Bioassessment) Physical Habitat Assessment
POC	Pollutants of Concern
PR	Percent Recovery
PSA	Perennial Streams Assessment
PSD	Particle Size Distribution
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
RL	Reporting Limit
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program for Water Quality in San Francisco Bay
RWQCB	Regional Water Quality Control Board
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (California Regional Water Quality Control Board, San Francisco Bay Region)
SFEI	San Francisco Estuary Institute
SMC	Southern California Stormwater Monitoring Coalition
SMCWPPP	San Mateo County Wide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SPLWG	Sources, Pathways and Loadings Workgroup of the RMP
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification
STV	Statistical Threshold Value
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentrations
TKN	Total Kjeldahl Nitrogen
TNS	Target Not Sampled
TOC	Total Organic Carbon
TRC	Technical Review Committee of the RMP
TS	Target Sampleable
UCMR	Urban Creeks Monitoring Report
USEPA	United States Environmental Protection Agency
WQO	Water Quality Objective
WY	Water Year

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WY 2018 Summary of Creek Status and Pesticides/Toxicity Monitoring Sites and Parameters Sampled (See Legend below for abbreviations, Section 3 of this Urban Creeks Monitoring Report and its Appendices A.1 and A.2 for definitions, monitoring results and discussion).

Site ID	Creek Name	Land Use	Latitude	Longitude	Creek Status Monitoring Parameter							
					BA	N	Cl	WQ Tox	SED	PATH	TEMP	GWQ
204R03135	Sausal Creek	Urban	37.80393	-122.21675	X	X	X				X	X
204SAU070	Sausal Creek	Urban	37.80772	-122.21586	X	X	X				X	X
204SAU130	Palo Seco Creek	Urban	37.81597	-122.20023	X	X	X				X	
204SAU030	Sausal Creek	Urban	37.78593	-122.22430				X	X		X	
204SAU200	Sausal Creek	Urban	37.81906	-122.20766							X	X
204SAU110	Palo Seco Creek	Urban	37.81898	-122.20734							X	
204SAU055	Sausal Creek	Urban	37.80365	-122.21665							X	
204SAU090	Sausal Creek	Urban	37.81221	-122.21366							X	
204SAU100	Sausal Creek	Urban	37.817	-122.21103							X	
204R01415	Alameda Creek	Urban	37.58349	-122.03047	X	X	X					
204R03207	Alameda Creek	Urban	37.57059	-122.01134	X	X	X					
204R03463	Alameda Creek	Urban	37.5861	-122.03368	X	X	X					
204R03737	Altamont Creek	Urban	37.72393	-121.72450	X	X	X					
204R03620	Chabot Canal	Urban	37.68587	-121.90018	X	X	X					
204R01695	Cull Creek	Urban	37.71805	-122.05421	X	X	X					
204R02719	Cull Creek	Urban	37.71666	-122.05394	X	X	X					
204R03279	Cull Creek	Urban	37.75161	-122.05824	X	X	X					
204R03455	Estudillo Canal	Urban	37.68651	-122.14394	X	X	X					
204R02340	Gold Creek	Urban	37.68893	-121.92265	X	X	X					
204R03540	Martin Canyon Creek	Urban	37.70851	-121.95558	X	X	X					
204R02695	Middle Fork Dry Creek	Urban	37.60975	-122.00128	X	X	X					
204R03719	Middle Fork Dry Creek	Urban	37.60808	-122.00197	X	X	X					
204R03311	San Leandro Creek	Urban	37.7343	-122.13433	X	X	X					
204R03156	South San Ramon Creek	Urban	37.7082	-121.91702	X	X	X					

Site ID	Creek Name	Land Use	Latitude	Longitude	Creek Status Monitoring Parameter							
					BA	N	Cl	WQ Tox	SED	PATH	TEMP	GWQ
204R03695	Tributary to San Lorenzo Creek	Urban	37.70974	-122.02690	X	X	X					
204R03439	Ziele Creek	Urban	37.64675	-122.04241	X	X	X					
204AVJ020	Arroyo Viejo	Urban	37.76212	-122.17640				X	X			
204CVY010	Castro Valley Creek	Urban	37.68165	-122.08627				X	X			
204LME100	Glen Echo Creek	Urban	37.81846	-122.26078				X	X			
204R01198	Zone 6 Line G	Urban	37.50872	-121.96650				X	X			
205Z6M1010	Mission Creek	Urban	37.5507	-121.95530						X		
205Z6L2010	Mission Creek	Urban	37.55072	-121.95483						X		
205Z6M010	Mission Creek	Urban	37.55056	-121.95764						X		
205R02670	Mission Creek	Urban	37.55014	-121.95058						X		
205R03694	Mission Creek	Urban	37.5455	-121.94333						X		

Legend:
BA = Bioassessment (C.8.d.i); N = Nutrients (C.8.d.i); Cl = Chlorine (C.8.d.ii); WQ Tox = Water Column Toxicity (C.8.g.i&iii); SED = Sediment Toxicity and Chemistry (C.8.g.ii); PATH = Pathogen Indicators (C.8.d.v); TEMP = Continuous Temperature Monitoring (C.8.d.iii); GWQ = Continuous General Water Quality Monitoring (C.8.d.iv).
Note: Coordinates at first visit are reported where multiple sampling events were conducted at a particular site.

SECTION 1 - INTRODUCTION

This Urban Creeks Monitoring Report (UCMR) is submitted by the Alameda Countywide Clean Water Program (Program, ACCWP), on behalf of the Program's member agencies[1](i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (reissued on November 19, 2015 (Order R2015-0049) with effective date January 1, 2016. The term "MRP" refers to the current, reissued MRP. Where it is necessary to distinguish between the 2009 MRP and reissued MRP, the former is referred to as "MRP1", and the latter as "MRP2".

This report (including all appendices and attachments) fulfills the requirements of MRP Provision C.8.h for interpreting and reporting monitoring data collected during Water Year 2018 (WY 2018, October 1, 2017- September 30, 2018). Monitoring data presented in this report were submitted electronically to the Water Board by the Program on behalf of the represented Permittees and may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) at www.ceden.org/, for those types of data accepted by CEDEN[2].

This report follows the organization of the C.8 requirements in MRP2, and is organized into two main parts – the main body and appendices. The main body provides brief summaries of accomplishments made in Water Year 2018 in compliance with MRP provision C.8. Summaries are organized by sub-provisions of the MRP and grouped into the sections listed in Table 1-1.

Appendices include data analyses for interpretive reporting focused on specific types of water quality monitoring required by the MRP. Appendices are also grouped together by sub-provision as shown in Table 1-1and referenced within the applicable sections of the report's main body.

[1] The Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency).

[2] In September 2016 the Program and other MRP permittees became aware of a decision by the State Water Resources Control Board that in the future CEDEN will display certain types of non-receiving water data previously excluded from its scope. Due to uncertainties regarding implementation of this decision, The Program's submittal of WY 2018 data conforms to the definition of CEDEN in effect at the time the reissued MRP was adopted.

Table 1-1. UCMR Report Sections and Applicable MRP Provisions and Report Appendices

Urban Creeks Monitoring Report Section		MRP provision	UCMR Appendix with detailed reporting
1. Introduction		n/a	n/a
2. Monitoring Protocols and Data Quality		C.8.b	A.1- A.4 as applicable
3. San Francisco Estuary Receiving Water Monitoring		C.8.c	n/a
4. Creek Status Monitoring	Biological, Chlorine, Nutrients,	C.8.d	A.1
	General Water Quality, Temperature, Bacteria	C.8.d	A.2
5. Stressor/Source Identification Projects		C.8.e	A.4
6. Pollutants of Concern Monitoring		C.8.f	A.3
7. Pesticides and Toxicity Monitoring (including dry weather sediment chemistry)		C.8.g	A.1
8. Reporting		C.8.h	n/a

The main body of this report and associated appendices address the following reporting requirements for the annual Urban Creeks Monitoring Report (Provision C.8.h.iii) including as appropriate for each type of monitoring in Provision C.8:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat./long. coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for Provision C.8.d.;
- Pollutant load and concentration at each mass emissions station;
- A listing of third party entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards; and,
- A signed certification statement.

REGIONAL COLLABORATIVE MONITORING (BASMAA RMC)

Provision C.8.a (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a Regional Collaboration, their countywide Stormwater Program, and/or individually. In June 2010, Permittees notified the Water Board in writing of their agreement to participate in a regional monitoring collaborative to address requirements in Provision C.8[3]. The regional monitoring collaborative is referred to as the Bay Area Stormwater Management Agencies (BASMAA) Regional Monitoring Coalition (RMC). The goals of the RMC are to:

1. Assist Permittees in complying with requirements in MRP Provision C.8 (Water Quality Monitoring);
2. Develop and implement regionally consistent creek monitoring approaches and designs in the Bay Area, through the improved coordination among RMC participants and other agencies such as the Regional Water Quality Control Board (RWQCB) that share common goals; and
3. Stabilize the costs of creek monitoring by reducing duplication of effort and streamlining

In February 2011, the RMC developed a Multi-Year Work Plan (RMC Work Plan) to provide a framework for implementing regional monitoring and assessment activities required under MRP provision C.8. The RMC Work Plan summarized RMC-related projects planned for implementation between Fiscal Years 2009-10 and 2014-15. Projects were collectively developed by RMC representatives to the BASMAA Monitoring and Pollutants of Concern Committee (MPC), and were conceptually agreed to by the BASMAA Board of Directors (BOD). A total of 27 regional projects were identified in the RMC Work Plan, based on the requirements described in provision C.8 of MRP1, most of which have continued with minor changes in MRP2.

Regionally-implemented activities to provide standardization and coordination for the RMC Work Plan were conducted under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA), a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Scopes, budgets, and contracting implementation mechanisms for BASMAA regional projects follow BASMAA's Operational Policies and Procedures, approved by the BASMAA BOD. MRP Permittees, through their stormwater program representatives on the BOD and its subcommittees, collaboratively authorize and participate in BASMAA regional projects or tasks. Regional project costs are shared by either all BASMAA members or among those Phase I municipal stormwater programs that are subject to the MRP. ACCWP and other RMC participants coordinate their monitoring activities through meetings and communications of the RMC Work Group and the MPC.

SECTION 2 - MONITORING PROTOCOLS AND DATA QUALITY

Provision C.8.b requires monitoring data collected by Permittees in compliance with the MRP to be of a minimum data quality consistent with the applicable State of California's Surface Water Ambient Monitoring Program (SWAMP) standards, set forth in the SWAMP Quality Assurance Project Plan (QAPP). To assist Permittees in meeting

[3] See Appendix A.1 for a list of all participants in the collaborative Regional Monitoring Coalition.

SWAMP data quality standards and developing data management systems that allow for easy access of water quality monitoring data by Permittees, the RMC coordinated guidance for SWAMP comparable data collection through several regional projects:

STANDARD OPERATING AND QUALITY ASSURANCE PROCEDURES

For Creek Status Monitoring the RMC adapted existing creek status monitoring SOPs and QAPP developed by SWAMP to document the field procedures necessary to maintain comparable, high quality data among RMC participants. Version 1of these documents (BASMAA 2012a, 2012b) were completed in Water Year 2012 prior to field work. All interpretative issues or concerns raised during the initial two years of monitoring were resolved through the RMC Work Group and were documented in Version 2 (BASMAA 2014a, 2014b) along with minor revisions addressing lessons learned. The RMC produced Version 3 (BASMAA 2016a, 2016b) to reflect changes in the reissued MRP, which were finalized for use starting in WY 2016.[4]

INFORMATION MANAGEMENT

For Creek Status and related Monitoring, the RMC participants developed an Information Management System (IMS) to provide SWAMP-compatible storage and import/export of data for all RMC programs. A data management subgroup of the RMC Work Group met periodically for training and review of data management issues, and to suggest enhancements for data checking and to increase efficiency.

For POC Loads Monitoring in MRP 1 BASMAA contracted with SFEI to design and maintain an IMS for management of data from stations operated by the RMC programs. During WY 2015 stormwater programs initiated upgrades to the Creek Status Monitoring IMS to accommodate new sample types for POC Monitoring begun in WY 2014 and receiving increased emphasis during MRP2.

The IMSs provide standardized data storage formats, thus providing a mechanism for sharing data among RMC participants and efficient submittal of data electronically to the Water Board per provision C.8.h, as described in Section 8, Reporting.

MONITORING DATA QUALITY REVIEW

All Creek Status findings and data reported during Water Year 2018 were reviewed against RMC measurement quality objectives (BASMAA, 2016a). Appendices A.1 and A.2 contain statements of data quality resulting from data quality review for Creek Status and Pesticides/Toxicity Monitoring data.

Additional evaluations of data quality for data collected pursuant to provision C.8.f are provided in Appendix A.3.

[4] Available at www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_QAPP_v3_final-2016-0331_r2_signed.pdf
www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_SOP_V3_Final%20March%202016.pdf

SECTION 3 - SAN FRANCISCO ESTUARY RECEIVING WATER MONITORING (C.8.C)

As described in MRP provision C.8.c, Permittees are required to provide financial contributions towards implementing an Estuary receiving water monitoring program on an annual basis that at a minimum is equivalent to the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP). Since the adoption of the MRP1, Permittees have complied with this provision by making financial contributions to the RMP directly or through stormwater programs. Additionally, Permittees actively participated in RMP committees and work groups through Permittee and/or stormwater program staff as described in the following sections, which also provide a brief description of the RMP and associated monitoring activities conducted during this reporting period.

The RMP is a long-term monitoring program that is discharger funded and shares direction and participation by regulatory agencies and the regulated community with the goal of assessing water quality in the San Francisco Bay.[5] The regulated community includes Permittees, publicly owned treatment works (POTWs), dredgers and industrial dischargers. The RMP is intended to answer the following core management questions:

- Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?
- What are the concentrations and masses of contaminants in the Estuary and its segments?
- What are the sources, pathways, loadings, and processes leading to contaminant related impacts in the Estuary?
- Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?
- What are the projected concentrations, masses, and associated impacts of contaminants in the Estuary?

The RMP budget is generally broken into two major program elements: Status and Trends, and Pilot/Special Studies. The following paragraphs provide a brief overview of these programs.

RMP STATUS AND TRENDS MONITORING PROGRAM

The Status and Trends Monitoring Program (S&T Program) is the long-term contaminant-monitoring component of the RMP. The S&T Program was initiated as a pilot study in 1989 and redesigned in 2007 based on a more rigorous statistical design that enables the detection of trends. In Water Year 2018 the S&T Program was comprised of the following program elements that collect data to address RMP management questions described above:

- Water/Sediment/Biota Chemistry and Toxicity Monitoring

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[5] The RMP Annual Work Plans and other documents are available at http://www.sfei.org/programs/sf-bay-regional-monitoring-program

- Sediment Benthos Monitoring
- Small and Large Tributary Loading Studies and Small Fish and Sport Fish Contamination Studies
- Studies to Determine the Causes of Sediment Toxicity
- Suspended Sediment, Hydrography and Phytoplankton Monitoring
- Bird Egg Monitoring

In fall 2011 the RMP Steering Committee, as part of a 5-year Master Planning process reviewed the S&T Program and agreed to reduce the frequency of some of the data collection activities or elements in future years so that more funding will be available for pilot and special studies. Beginning in 2015, a component was added to the S&T program to characterize surface sediments through monitoring in nearshore Bay margin areas that have been largely unsampled by the RMP and were excluded from the previous S&T redesign. Additional information on the S&T Program and associated monitoring data are available for downloading via the RMP website using the Contaminant Data Download and Display (CD3) at http://www.sfei.org/rmp/data.

RMP PILOT AND SPECIAL STUDIES

The RMP also conducts Pilot and Special Studies (P/S Studies) on an annual basis. Studies usually are designed to investigate and develop new monitoring measures related to anthropogenic contamination or contaminant effects on biota in the Estuary. Special Studies address specific scientific issues that RMP committees and standing workgroups identify as priority for further study. These studies are developed through an open selection process at the workgroup level and selected for funding through RMP committees. Results and summaries of the most pertinent P/S Studies can be found on the RMP website (www.sfei.org/rmp/).

Water Year 2018 saw a continuation of special studies associated with the RMP's Small Tributary Loading Strategy (STLS), which are intended to fill data gaps associated with loadings of Pollutants of Concern (POC) from relatively small tributaries to the San Francisco Bay. Additional information is provided on STLS-related studies under Section 6.1 of this Report.

PARTICIPATION IN COMMITTEES, WORKGROUPS AND STRATEGY TEAMS

In Water Year 2018, RMC Permittees actively participated in the following RMP Committees and work groups:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Strategy Teams for PCBs, Mercury, Small Tributaries, Chemicals of Emerging Concern (CECs) Strategy and Nutrients

Committee and workgroup representation was provided by Permittee or stormwater program staff and/or individuals designated by RMC participants and the BASMAA BOD. During Water Year 2018 ACCWP Program staff actively participated in the SPLWG (see Section 6, POC Monitoring, below). Representation included participating in meetings or conference calls, reviewing technical reports and work products, reviewing articles included in the RMP's annual update, and providing general program direction to RMP staff. RMC representatives to the RMP also provided timely summaries and updates to other stormwater program representatives (on behalf of Permittees) during MPC and/or BOD meetings and solicited timely input as needed to ensure Permittees' interests were adequately represented.

SECTION 4 - CREEK STATUS MONITORING (C.8.D)

Provision C.8.d requires Permittees to conduct Creek Status Monitoring that is intended to answer the following management questions:

- Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?
- Are conditions in local receiving waters supportive of or likely supportive of beneficial uses?

Creek Status Monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program are described in Provision C.8.d of the MRP. Based on the implementation schedule described in Provision C.8.a.ii of MRP1, Creek Status Monitoring coordinated through the RMC began in October 2011. While MRP2 designates a separate section for Pesticides and Toxicity Monitoring, these parameters were originally included in the design for Creek Status Monitoring as described below, and are reported together for purposes of this report.

REGIONAL AND LOCAL MONITORING DESIGNS

The RMC's regional monitoring strategy for complying with MRP provision C.8.d - Creek Status Monitoring is described in its *Creek Status and Long-Term Trends Monitoring Plan* (BASMAA 2011). The strategy includes a regional ambient/probabilistic monitoring component and a component based on local "targeted" monitoring. The combination of these monitoring designs allows each individual RMC participating program to assess the status of beneficial uses in local creeks within its Program (jurisdictional)area, while also contributing data to answer management questions at the regional scale (e.g., differences between aquatic life condition in urban and non-urban creeks)[6].

The Program submitted its Creek Status Monitoring data for Water Year 2017 to the Water Board by March 31, 2018. The analyses of results from Creek Status and Pesticides/Toxicity Monitoring conducted by the Program in Water Year 2018 are presented in Appendices A.1 and A.2 to this report. Table 4-1 provides a list of which monitoring parameters are included in specific appendices.

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[6]Provision C.8.a.i of MRP1stated in reference to all subsections of C.8 that "provided these datatypes, quantities, and quality are obtained, a regional monitoring collaborative may develop its own sampling design" Provision C.8.a.i of MRP2 encourages Permittees to continue contributing to the RMC.

Table 4-1. Location of result analyses for each monitored parameter in MRP Provisions C.8.d and C.8.g.

Biological Response and Stressor Indicators	Monitoring Design		Reporting
	Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	X		Appendix A.1
Chlorine	X		Appendix A.1
Nutrients (with Bioassessment)[a]	X		Appendix A.1
Water Toxicity	X		Appendix A.1
Sediment Toxicity	X		Appendix A.1
Sediment Chemistry	X		Appendix A.1
General Water Quality		X	Appendix A.2
Temperature		X	Appendix A.2
Bacteria		X	Appendix A.2

[a] Nutrients sampled for Pollutants of Concern Monitoring are reported in Section 6 below.

SECTION 5 - STRESSOR/SOURCE IDENTIFICATION PROJECTS (C.8.E)

As described in MRP Provision C.8.e, Permittees who conduct Creek Status monitoring through a regional collaborative are required to collectively initiate a minimum of eight new Stressor/Source Identification (SSID) projects (minimum one for toxicity) during the MRP 2 permit term. Potential SSID projects are identified when monitoring results reach criteria or thresholds for follow-up action as indicated for each data type in MRP provision C.8.d or C.8.g.

To ensure consistency in interpretation of the SSID requirements (C.8.e) and a coordinated approach to compliance with that provision, RMC Permittee efforts in the previous permit term included a collaborative evaluation of Water Year 2012 Creek Status monitoring results and joint decision-making process for selecting sites for SSID follow-up by individual programs. RMC Program representatives reviewed the list of candidate SSID projects with Water Board staff in the April 2013 meeting of the RMC Work Group. Attachment B is a summary table of RMC SSID projects with their locations, rationales, and current status.

In consultation with Permittees, the Program developed workplans and initiated the first follow-up action for three Alameda County SSID projects in FY2013-14. As required by Provision C.8.d.i of MRP1 (Stressor/Source Identification), this first step was to conduct a site-specific study in a stepwise process to identify and isolate the cause(s) of the trigger stressor/source originally identified through Creek Status Monitoring results. Initial study design, data collection and results for the following stressor/source identification projects were provided in progress reports attached to the March 2014 Integrated Monitoring Report (IMR) for three studies. Two SSID projects were closed out in WY 2017. Additional monitoring was conducted for the third project in WY 2018, and the project was closed in October 2018. WY 2018 also saw the initiation of a new SSID project on Sausal Creek. The progress report provided in Appendix A.4 is summarized below:

> Appendix A.4 contains the progress report for the Sausal Creek SSID project that was initiated this WY. The project is exploring CSCI results and the outcomes of restoration activities along Sausal Creek. Triggers from WY 2016 and WY 2017 included low CSCI scores at two sites, high Enterococci concentrations, and several metals above PEC or TEC thresholds. Results this year included weekly average temperatures above 17 °C at three sites and low DO readings at two sites. The project will continue in WY 2019 with additional bioassessment and nutrient sampling and monitoring of DO and temperature.

SECTION 6 - POLLUTANTS OF CONCERN MONITORING (C.8.F)

The POC Monitoring provision of the reissued MRP reflects the evolution of knowledge and data needs achieved during the first MRP term. The management questions for this new permit term have become more articulated and monitoring priorities are shifting towards increased support of management decisions relating to implementation of TMDL load reductions for PCBs and mercury. In October 2018, the Program submitted a separate Pollutants of Concern (POC) Monitoring Report describing accomplishments during Water Year 2018 and the allocation of POC monitoring sampling effort planned for WY 2019. As required in provision C.8.h.iv, the POC Monitoring Report included monitoring locations, number and types of samples collected for each purpose of sampling (management question addressed), and analytes measured. POC monitoring activities and data for WY 2018 are summarized below.

Provision C.8.f of the MRP lists five priority POC management information needs to be addressed though POC monitoring:

1. Source Identification - identifying which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff;
2. Contributions to Bay Impairment - identifying which watershed source areas contribute most to the impairment of San Francisco Bay beneficial uses (due to source intensity and sensitivity of discharge location);
3. Management Action Effectiveness - providing support for planning future management actions or evaluating the effectiveness or impacts of existing management actions;
4. Loads and Status - providing information on POC loads, concentrations, and presence in local tributaries or urban stormwater discharges; and
5. Trends - evaluating trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

However, not all of the five information needs apply to all POCs. Table 8.2 of the MRP identifies the applicability of the five information needs to specific POC or POC groups.

The Program's WY 2018 POC Monitoring activities are described in Section 6.1 below and in Appendix A.3 to this report.

POC MONITORING BY ACCWP

The Program conducted POC Monitoring activities focused on the following POCs, for sample numbers and management information needs shown in Table 6-1:

- Polychlorinated Biphenyls (PCBs) and total mercury, for information needs 1&3;
- Copper and Nutrients (Ammonium, Nitrate, Nitrite, Total Kjeldahl Nitrogen, Orthophosphate and Total Phosphorus), for information needs 2, 4 and 5.

Table 6-1. Types and Numbers of POC monitoring samples collected by ACCWP in WY 2018

Information Need	Sample Matrix	Type of Sampling Event/ Location	Target POCs	No. of WY 2018 Samples
1	Sediment, urban	Dry weather / on or near ROW surface receiving runoff from potential / likely source	PCBs, mercury	19
1,3	Caulk	Subsampling of caulking present in MS4 facilities or local channels	PCBs	5[1]
3	Runoff	Stormwater influent/effluent samples from BMPs or experimental microcosms	PCBs, mercury	9[2]
4,5	Runoff	Wet weather grab sample / lower watershed integrative site	Copper, nutrients	3
4,5	Runoff	Dry weather grab sample / lower watershed integrative site	Copper, nutrients	2
1, 2, 4	Runoff	Stormwater grab or composite/ lower watershed site	PCBs, Mercury	1[3]
5	Sediment, bedded	Dry weather / in MS4 facilities or local channels	Copper, PCBs, mercury	2[4]
5	Sediment, urban	Dry weather / on or near ROW, resample	Mercury	2
4,5	Runoff	STLS Long Term Trends	PCBs, mercury	1[3]

1 Caulk samples as part of a BASMAA regional study on PCBs in infrastructure.
2 Samples collected as part of a BASMAA regional study on BMP effectiveness.
3 Samples collected by the RMP-STLS
4 Samples collected by the SPoT program.

As required by MRP Table 8.2, data on Ancillary Parameters such Total Organic Carbon, Suspended Sediment Concentration or hardness were collected as necessary for each sample to address management questions or information needs.

PCB SOURCE AREA IDENTIFICATION

In WY 2018 the Program continued sampling urban sediment in street right-of-ways for identification of potential source areas for TMDL pollutants to address Management Information Need 1), based on a multi-step PCB Implementation Planning process to identify watersheds or management areas for PCB load reduction activities. Background, goals, and progress on this effort are described in separate reports included in the 2018 Annual Report in accordance with Provision C.12.a of the MRP. Appendix A.3 reports the monitoring locations, numbers and types of samples collected by the Program during 2018 sediment sampling.

COPPER AND NUTRIENT POC MONITORING

Copper and nutrients were sampled in July 2018 at two creek sites in conjunction with dry weather sampling for Pesticides and Toxicity Monitoring. Locations of sites, methods of sampling and analysis and results of sediment sampling are reported in Appendix A.1. **Table 6-2** shows the results for water column sampling on the same date.

Table 6-2. Results of copper and nutrients water column monitoring at sites 204AVJ020 and 204RLME100 in Water Year 2018.

Analyte	Results		Units
	204AVJ020	204LME100	
Copper (dissolved)	0.88	1.3	ug/L
Hardness (as $CaCO_3$)	0.94	180	mg/L
Ammonia as N	0.087	0.045	mg/L
Nitrate	0.88	1.3	mg/L
Nitrite	0.039	0.0063	mg/L
Total Kjeldahl Nitrogen	0.31	0.31	mg/L
Orthophosphate	0.079	0.093	mg/L
Total Phosphorus	0.11	0.11	mg/L

COMPARISONS TO NUMERIC WATER QUALITY OBJECTIVES/CRITERIA FOR SPECIFIC ANALYTES

Provision C.8.h.iii requires RMC participants to assess all data collected pursuant to provision C.8 for compliance with applicable water quality standards. In compliance with this requirement, an assessment of data collected for ACCWP's POC monitoring of copper and nutrients in Water Year 2018 is provided below.

When conducting a comparison to applicable water quality objectives/criteria, certain considerations should be taken into account to avoid the mischaracterization of water quality data:

<u>Freshwater vs. Saltwater</u>- POC monitoring data were collected in freshwater receiving water bodies above tidal influence and therefore comparisons were made to freshwater water quality objectives/criteria.

<u>Aquatic Life vs. Human Health</u> - Comparisons were primarily made to objectives/criteria for the protection of aquatic life, not objectives/criteria for the protection of human health to support the consumption of water or organisms. This decision was based on

the assumption that water and organisms are not likely being consumed from the creeks monitored.

Acute vs. Chronic Objectives/Criteria - For POC monitoring required by provision C.8.e, data were collected in an attempt to develop more robust loading estimates from small tributaries. Therefore, detecting the concentration of a constituent in any single sample was not the primary driver of POC monitoring. Monitoring was conducted during episodic storm events and results do not likely represent long-term (chronic) concentrations of monitored constituents. POC monitoring data were therefore compared to "acute" water quality objectives/criteria for aquatic life that represent the highest concentrations of an analyte to which an aquatic community can be exposed briefly (e.g., 1-hour) without resulting in an unacceptable effect. For analytes for which no water quality objectives/criteria have been adopted, comparisons were not made.

It is important to note that acute water quality objectives or criteria have only been promulgated for a small set of analytes collected in the POC monitoring station, including objectives for trace metals, i.e. copper.

Water samples collected in WY 2018 were below applicable numeric water quality objectives (i.e., freshwater acute objective for aquatic life) for copper. Nitrate as N and Nitrite as N were below water quality objectives for MUN supply although these objectives were not applicable to the sites sampled.

Data Quality - In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a). However, as described in Section 4.1 of Appendix A.3, some lab results led to an inability to assess precision for certain parameters. Monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), developed for C.8 monitoring and in conformity with SWAMP protocols as described in Section 2 above.

POC MONITORING BY THIRD PARTIES

As discussed in the POC Monitoring Report, two third-party organizations met the criteria for their data to be used to partially fulfill POC monitoring requirements in WY 2018, as described below:

Regional Monitoring Program (RMP)

As described in Section 3 above, the RMP conducts pilot and special studies to support water quality management in the Bay and its tributary watersheds. These studies are overseen by different RMP work Groups or teams as described below:

Small Tributaries Loading Strategy (STLS): To assist participants in effectively and efficiently conducting POC monitoring required by the MRP and answer POC loads management questions listed in MRP1, an RMP Small Tributaries Loading Strategy (STLS) was developed in 2009 by the STLS Team, which included representatives from BASMAA, Water Board staff, RMP/SFEI and technical advisors. The objective of the STLS is to develop a comprehensive planning framework to coordinate POC loads monitoring and modeling (Management Information Needs 2, 4 and 5) between the RMP and RMC participants. This framework and a summary of activities and products to date were provided in an initial STLS Multi-Year Plan (STLS-MYP) under oversight of the STLS Team and the associated RMP Sources Pathways Loadings Work Group (SPLWG).

Watershed Modeling – In WY 2018 the Permittees continued oversight of refinements to Regional Watershed Spreadsheet Model for estimating regional-scale pollutant loads to the Bay, through participation in the STLS Team and SPLWG.
Watershed Characterization "Reconnaissance" Monitoring is based on collaboration with stormwater programs to identify and rank catchments with possible PCB and/or mercury sources, to address management information need 1.

RMP PCB Strategy is engaged in a multi-year effort to develop Conceptual Models of PCB fate and transport in selected nearshore portions of SF Bay called Priority Margin Units (PMUs), in order to clarify contributions from adjacent watersheds to Bay impairment, inform future management decisions and tracking of trends in PCB loads from those watersheds. The Emeryville Crescent was the first PMU to be studied. The Conceptual Model Report concluded that the Crescent experiences relatively quick turnover of PCB loads through exchange of water and sediment with the open Bay, and that foodweb monitoring would be a promising indicator for tracking future response to projected load reductions in the watershed. The second conceptual model study, developed for San Leandro Bay, is being conducted in phases. RMP funding for conceptual model development was substantially augmented by funding from two Supplemental Environmental Projects (SEPs). PCBs were analyzed in sediment, water and biota (sport fish, small prey fish, and benthos) collected at the confluence of 3 main "inputs" to San Leandro Bay: Airport Channel, the confluence of San Leandro Creek and Damon Slough (Zone 12 Line K) and the Oakland Estuary channel between Oakland and Alameda. Additional field data will be generated by a study of fish gut contents as well as additional stormwater sampling in one watershed (Line 12H at Coliseum Way, downstream of the General Electric Oakland property). This work and a final conceptual model report that incorporates all of the data from Phase 1, Phase 2, and the additional data will be completed in WY 2019.

Emerging Contaminants Special Study - Provision C.8.e.vii of MRP1 required Permittees to develop a work plan and schedule for initial loading estimates and source analyses for contaminants of emerging concern (CECs). Contaminants that were mentioned in MRP1 include: endocrine-disrupting compounds, PFOS/PFAS (Perfluorooctanesulfonates (PFOS), Perfluoroalkylsulfonates (PFAS), and NP/NPEs (nonylphenols/nonylphenol esters - estrogen-like compounds). The Permittees addressed this requirement through the CECs Strategy developed by the Emerging Contaminants Work Group (ECWG) of the RMP. The CECs Strategy is a "living" document that guides RMP special studies on CECs using a tiered risk and management action framework. For MRP 2, Table 8.2 of the MRP requires one or more special studies that address relevant management information needs for emerging contaminants to include at least PFOs, PFAs, and alternative flame retardants being used to replace polybrominated diphenyl ethers (PBDEs). BASMAA's representatives to the various RMP workgroups and Technical Review Committee are working to ensure that this strategy will address the requirement in MRP Table 8.2.

SWAMP Stream Pollution Trends (SPoT) Monitoring Program
The SPoT element of the SWAMP program aims to determine long-term trends in stream contaminant concentrations and effects statewide. For this purpose the program has established a network of approximately 100 sites throughout the state where it samples depositional stream sediments collected near the base of watersheds, including two sites in Alameda County that were sampled in WY 2018. Results of SPoT 2013 and 2014 monitoring were included in a 7-year report released in late 2016, with a future 10-year synthesis report planned to include data collected through 2017. A ten-year synthesis report is planned to include data collected through 2017.

SECTION 7 - PESTICIDES AND TOXICITY MONITORING (C.8.G)

Provision C.8.g, requires Permittees to conduct wet weather and dry weather monitoring of pesticides and toxicity in urban creeks. This includes monitoring of toxicity in the water column (dry weather), monitoring of toxicity and other pollutants in sediment (dry weather), and wet weather pesticides and toxicity monitoring. Appendix A.1 to this UCMR reports the results of ACCWP's dry and wet weather monitoring under this provision in WY 2018.

Provision C.8.g describes pesticide and toxicity monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program while recognizing a trend towards development of a coordinated statewide monitoring program. Due to previous inclusion of these parameters in the RMC's regional monitoring strategy as described in its *Creek Status and Long-Term Trends Monitoring Plan* (BASMAA 2011), the analyses of results from pesticide and toxicity monitoring conducted by the Program in Water Year 2018 are presented along with other regionally designed Creek Status Monitoring parameters in Appendix A.1.

SECTION 8 - REPORTING (C.8.H)

Provision C.8.h requires Permittees to report annually on water quality data collected in compliance with the MRP. Annual reporting requirements include: 1) water quality standard exceedances; 2) electronic reporting; 3) Urban Creeks Monitoring Reports; 4) Pollutants Of Concern Monitoring Reports, Integrated Monitoring Report; and 4) standard report content.

Data are submitted in SWAMP format, as described in more detail in Section 2, Monitoring Protocols and Data Quality. Data are submitted with quality controls required by CEDEN, in accordance with the electronic reporting requirements in MRP provision C.8.h.ii.

In accordance with the reporting schedule of the reissued MRP, the Program's WY 2018 creek status monitoring electronic data are being submitted to the Water Board by March 31, 2019, concurrent with the UCMR. Additionally, a separate Pollutants of Concern Monitoring Report was submitted to the Water Board by October 15, 2018. In the fifth year of the permit term (2020), an Integrated Monitoring Report will be submitted in lieu of the annual Urban Creeks Monitoring Report.

This report includes the standard report content required in MRP provision C.8.h.vi.

SECTION 9 - REFERENCES

BASMAA. 2011. Regional Monitoring Coalition Final Creek Status and Long-Term Trends Monitoring Plan. Prepared by EOA, Inc. Oakland, CA. 23 pp.

BASMAA. 2012a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Draft Version 1.0. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 80 pp plus appendices.

BASMAA. 2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 196 pp.

BASMAA. 2014a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Version 2. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 81 pp plus appendices.

BASMAA. 2014b. Creek Status Monitoring Program Standard Operating Procedures, Final Version 2. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 203 pp.

BASMAA. 2016a. Creek Status Monitoring Program Standard Operating Procedures. Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Version 3, March 2016.Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_QAPP_v3_final-2016-0331_r2_signed.pdf.

BASMAA. 2016b. Creek Status Monitoring Program Standard Operating Procedures. Version 3, March 2016. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_SOP_V3_Final%20March%202016.pdf.

SECTION 10 - ATTACHMENTS

Attachment A. Electronic Data Submittal Transmittal Letter dated March 31, 2019 with attached file list.

Attachment B. BASMAA Regional Monitoring Coalition: Status of Regional Stressor/Source Identification (SSID) Projects, Updated March 2019

clean water PROGRAM

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

CREEK STATUS MONITORING REPORT - REGIONAL PARAMETERS, PESTICIDES AND TOXICITY

APPENDIX A.1

URBAN CREEKS MONITORING REPORT OCTOBER 2017 THROUGH SEPTEMBER 2018

Report prepared by

Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2019

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgements

EOA, Inc. contributed substantially to this report in preparation of the data analysis and discussion for bioassessment data. Matthew R. Cover, working as a subconsultant to Horizon, Water and Environment, LLC, provided additional review of the bioassessment data and findings. Horizon Water and Environment, LLC contributed substantially to the preparation of this report in preparation of the data analysis and discussion for water quality, pesticides and sediment chemistry/toxicity. Applied Marine Sciences, Inc. contributed substantially to the site evaluation, implementation of monitoring and preparation of the data analysis and discussion for all other regionally designed parameters.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed a framework for preparation of the Urban Creeks Monitoring Report (UCMR) used by ACCWP and other stormwater programs to comply with the Municipal Regional Stormwater Permit (MRP)[1] requirements for reporting on monitoring data collected under the MRP Monitoring provision C.8.

The following participants make up the RMC and are responsible for preparing UCMR documents on behalf of their respective member agencies:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo County Wide Water Pollution Prevention Program (SMCWPPP)
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)
- Fairfield-Suisun Urban Runoff Management Program (FSURMP)
- City of Vallejo and Vallejo Sanitation and Flood Control District (Vallejo)

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Creek Status Monitoring data collected in Water Year 2018 (October 1, 2017 through September 30, 2018) in accordance with the RMC's Monitoring Plan (BASMAA 2011) for certain "regionally designed" parameters required by the MRP and conducted using a probabilistic monitoring design. Results of Pesticide and Toxicity Monitoring are also reported here since the sampling design is still driven by regional considerations under the reissued "MRP2", although no longer associated with the probabilistic design. This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

- The cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County;
- Alameda County Flood Control and Water Conservation District and

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015) which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

- Zone 7 of the Alameda County Flood Control and Water Conservation District.

Other data collected in Alameda County during this period pursuant to MRP provision C.8 are reported in the main body and other appendices of ACCWP's UCMR for Water Year (WY) 2018.

As described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011), RMC participants collected data by implementing BASMAA RMC Standard Operating Procedures (SOPs, BASMAA, 2012b, 2014b and 2016b) in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA, 2012a, 2014a and 2016a). Analytical laboratory analyses were also coordinated among all RMC participants.

In accordance with the reissued MRP (SFBRWQCB, 2015) ACCWP will also submit the data included in this report by March 31, 2019 to the California Environmental Data Exchange Network and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) in electronic SWAMP-comparable format.

In addition to the RMC participants, San Francisco Bay Regional Water Quality Control Board staff, Kevin Lunde and Jan O'Hara, also participated in RMC workgroup meetings that contributed to design and implementation of the RMC Monitoring Plan. Additionally, these staff also provided input regarding previous Urban Creeks Monitoring Reports and threshold "trigger" criteria for stressor analyses conducted therein.

List of Acronyms

Acronym	Definition
AFDM	Ash Free Dry Mass
AMS	Applied Marine Sciences, Inc.
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
BMI	Benthic Macroinvertebrate
CCC	Criterion Continuous Concentration
CCCWP	Contra Costa Clean Water Program
CMC	Criteria Maximum Concentration
CSCI	California Stream Condition Index
CTR	California Toxics Rule
CWA	Clean Water Act
DEM	Digital Elevation Model
DW	Dry Weight
FSURMP	Fairfield-Suisun Urban Runoff Management Program
GIS	Geographic Information System
GRTS	Generalized Random Tessellated Stratified
HVF	Highly Variable Flow
IBI	Index of Biological Integrity
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MRP	Municipal Regional Stormwater Permit
MRP2	Reissued Municipal Regional Stormwater Permit (2015)
MUN	Municipal Beneficial Use
MWAT	Maximum Weekly Average Temperature
ND	Non-detect
NPDES	National Pollutant Discharge Elimination System
NT	Non-Target
PAH	Polycyclic Aromatic Hydrocarbon

PEC	Probable Effects Concentrations
PHab	(Bioassessment) Physical Habitat Assessment
PR	Percent Recovery
PSA	Perennial Streams Assessment
PSD	Particle Size Distribution
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
RL	Reporting Limit
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (California Regional Water Quality Control Board, San Francisco Bay Region)
SFEI	San Francisco Estuary Institute
SMC	Southern California Stormwater Monitoring Coalition
SMCWPPP	San Mateo County Wide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SSID	Stressor Source Identification
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentrations
TKN	Total Kjeldahl Nitrogen
TNS	Target Not Sampled
TOC	Total Organic Carbon
TS	Target Sampleable
UCMR	Urban Creeks Monitoring Report
WY	Water Year

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Executive Summary

In 2010, the seventeen member agencies of the Alameda Countywide Clean Water Program (ACCWP) joined other members of the Bay Area Stormwater Agencies Association (BASMAA) to form the BASMAA Regional Monitoring Coalition (RMC), as a collaborative effort to coordinate and oversee water quality monitoring required by provision C.8 of the Municipal Regional Stormwater Permit (MRP). This report is an appendix to the Urban Creeks Monitoring Report (UCMR) prepared to assist ACCWP member agencies in complying with the MRP Reporting provision C.8.h, reporting the results of data collected by ACCWP during the Water Year (WY) 2018 extending from October 1, 2017 through September 30, 2018 pursuant to the following MRP provisions:

- Creek Status Monitoring (C.8.d) parameters that were sampled according to a regional probabilistic design; and
- Pesticides and Toxicity Monitoring (C.8.g) which also assesses problems widespread across the region.

Other Creek Status Monitoring parameters were addressed using a targeted design, with regional coordination and common methodologies and are reported in a separate Targeted Appendix A.2[2] to the UCMR.

During WY 2018, ACCWP monitored 17 sites under the regional probabilistic design for bioassessment, physical habitat, and related water chemistry parameters (an additional 3 sites were monitored for these parameters as part of the SSID project reported in Appendix A.4). Another two sites were monitored for water and sediment toxicity and sediment chemistry, to fulfill the dry season monitoring requirements in MRP provision C.8.g.i and ii. Two different sites were monitored for wet weather pesticides and toxicity, in fulfillment of MRP provision C.8.g.ii.

The bioassessment data were used to evaluate potential stressors that may affect aquatic habitat quality and beneficial uses through a preliminary condition assessment for the monitored sites.

The reissued MRP contains a separate provision C.8.g to combine all pesticide and toxicity monitoring into one section, instead of being distributed between Creek Status and Pollutants of Concern Monitoring provisions. For WY 2018 monitoring, ACCWP selected the two wet

[2] Similar methods and QA/QC procedures are being implemented for Stressor-Source Identification (SSID) studies reported in Appendix A.4 to the UCMR.

weather sites based on statistically significant toxicity measured during dry season sampling in previous WYs.

The following MRP reporting requirements (per provision C.8.h.vi) are addressed within this report or other portions of the UCMR, as applicable:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat./long. coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for provision C.8.c.;
- Pollutant load and concentration at each mass emissions station;
- A listing of volunteer and other non-Permittee entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards; and
- A signed certification statement.

In this report, the results of the stressor assessments are used to determine whether potential follow-up actions may be warranted to address the management questions underlying the RMC design (BASMAA 2011).

Biological community conditions were evaluated using the California Stream Condition Index (CSCI) which considers watershed attributes to identify comparable reference sites, along with the new draft Algae Stream Condition Index (ASCI) of biological integrity. The stressor analysis of bioassessment data revealed the following observations about ACCWP's WY 2018 sampling sites:

- Data from the sites show alteration of biological communities, and channel modification and other habitat changes associated with urbanization is a likely stressor for benthic macroinvertebrate and algal communities. The site with the highest CSCI score had 1% impervious area and a non-heavily modified channel. Four additional sites had CSCI scores above the 0.795 threshold. The remainder of the sites had CSCI scores below the threshold.

The stressor analysis for water quality, sediment chemistry and water and sediment toxicity data revealed the following indications of potential stressors for WY 2018 sites:

- **Water Quality –** Of 11 parameters[3] sampled in association with WY 2018 bioassessment monitoring, applicable water quality standards were only identified for ammonia, chloride, and nitrate + nitrite (for sites with MUN beneficial use only). Of the results generated at the 17 sites monitored by ACCWP reporting herein for those three parameters, two chloride, two un-ionized ammonia, and no nitrate + nitrite concentrations exceeded the applicable water quality standard or threshold. Monitoring was also performed at three additional sites as part of the active SSID project. Results from this monitoring are discussed in Appendix A.4.

- **Water Toxicity –** For WY 2018, 14 aquatic toxicity endpoints were derived through testing of 5 species at 2 sites county-wide during one dry season event. Of these endpoints, two sample / test combinations exhibited statistically-significant toxicity as reported by the analytical laboratory (*C. dilutus* survival at both sites). Results for *C. dilutus* survival at site 204LME100 exhibited toxicity at the threshold of ≥50% Effect. Follow-up sampling will be conducted in WY 2019.

  For the wet season sampling, one of the samples collected exhibited statistically-significant toxicity above the 50% threshold for followup sampling. Results from followup sampling at that site (204CVY010) for that species (*C. dilutus)* fell below the 50% trigger threshold.

- **Sediment Toxicity –** Of the bedded sediment collected from 2 sites, a toxic response of greater than 50% effect was not observed at either site.

- **Sediment Chemistry –** At site 204LME100, 5 constituents were present above the Probable Effect Concentration (PEC). Site 204LME100 had 13 constituents above theThreshold Effect Concentration (TEC) and site 204AVJ020 had 1.

The stressor analyses identified a number of sites that may deserve follow-up investigation to provide better understanding of the sources/stressors likely contributing to reduced ecological condition in Bay Area creeks.

[3] Algal mass (ash-free dry weight), Chlorophyll a, Ammonia, Nitrate, Nitrite, TKN, Total Nitrogen, OrthoPhosphate, Phosphorus, Silica and Chloride

1. Introduction

This report fulfills a portion of the reporting requirements of provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[4]) for monitoring data collected during Water Year (WY) 2018 (October 1, 2017 - September 30, 2018) pursuant to the following MRP provisions:

- Creek Status Monitoring (C.8.d) parameters that were sampled according to a regional probabilistic design; and
- Pesticides and Toxicity Monitoring (C.8.g).

The regional probabilistic design was developed and implemented by the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC). Additional data required by provision C.8.are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.1.

The RMC was formed in early 2010 as a collaboration among several BASMAA members representing all MRP Permittees (Table 1-1) to focus on development and implementation of a regionally-coordinated water quality monitoring program. The intent of the regional monitoring effort is to improve stormwater management in the region and address water quality monitoring required by the MRP[5]. Implementation of the RMC's Creek Status and Long-Term Trends Monitoring Plan allowed Permittees and the Water Board to effectively modify their existing creek monitoring programs, and improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and its associated RMC Work Group, a subgroup of the MPC that meets and communicates regularly to coordinate planning and implementation of monitoring-related activities. This workgroup includes staff from the SF Bay RWQCB at two levels – those generally engaged with the MRP as well as those working regionally with the State of California's Surface Water Ambient Monitoring Program (SWAMP).

[4] The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (SFRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

5. The RMC includes all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley, which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities. Note that the RMC regional monitoring design was expanded to include the portion of eastern Contra Costa County that drains to the San Francisco Bay in order to assist the CCCWP in fulfilling parallel provisions in their NPDES permit from the Region 5 Central Valley RWQCB.

Table 1-1. Regional Monitoring Coalition Participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County
Alameda Countywide Clean Water Program (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7
Contra Costa Clean Water Program (CCCWP)	Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Danville, and Moraga; Contra Costa County; and, Contra Costa County Flood Control and Water Conservation District
San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)	Cities and towns of Belmont, Brisbane, Burlingame, Daly City, East Palo Alto, Foster City, Half Moon Bay, Menlo Park, Millbrae, Pacifica, Redwood City, San Bruno, San Carlos, San Mateo, South San Francisco, Atherton, Colma, Hillsborough, Portola Valley, and Woodside; San Mateo County Flood Control District; and, San Mateo County
Fairfield-Suisun Urban Runoff Management Program (FSURMP)	Cities of Fairfield and Suisun City
Vallejo Permittees	City of Vallejo and Vallejo Sanitation and Flood Control District

This report presents the results of the portions of Creek Status Monitoring that were conducted using a regional ambient (probabilistic) monitoring design to comply with portions of provision C.8.d, and the closely related Pesticides and Toxicity Monitoring required by provision C.8.g (Table 1-2). The list of parameters in Table 1-2 derive from the MRP provisions C.8.d and C.8.g (SFBRWQCB 2015) and BASMAA's Creek Status Monitoring Standard Operating Procedures (BASMAA 2016a, 2016b).

Table 1-2. Creek Status and Pesticide/Toxicity Monitoring Parameters sampled in compliance with MRP provisions C.8.d and g, and the associated design approach and Appendix of the ACCWP UCMR.

Biological Response and Stressor Indicators	MRP Provision	Monitoring Design		Reporting
		Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	C.8.d.i	X		Appendix A.1
Nutrients[6]	C.8.d.i	X		Appendix A.1
Chlorine	C.8.d.ii	X		Appendix A.1
Water Toxicity	C.8.g.i&iii	X		Appendix A.1
Sediment Toxicity	C.8.g.ii	X		Appendix A.1
Sediment Chemistry	C.8.g.ii	X		Appendix A.1
General Water Quality	C.8.d.iv		X	Appendix A.2
Temperature	C.8.d.iii		X	Appendix A.2
Bacteria	C.8.d.v		X	Appendix A.2

Prior to formation of the RMC, San Francisco Bay Area stormwater programs implemented monitoring designs that targeted creek reaches of interest to address site-specific management questions. Because the representativeness of such targeted data was unknown, the overall condition of all creek reaches in the Bay Area was also unknown. The RMC addressed this issue by augmenting targeted monitoring designs with an ambient (probabilistic) creek status design that integrates many elements of the individualized monitoring programs that currently exist in the region.

The probabilistic monitoring design described in subsequent sections of this report complies with MRP provision C.8.d[7] by addressing the core monitoring questions listed below, which are further elaborated upon later in this report and in the main UCMR. This monitoring design allows each individual RMC participating program to assess stream ecosystem conditions within its program area (e.g., county boundary) while contributing data to answer regional management questions about water quality and beneficial use condition in San Francisco Bay Area creeks.

1. What is the condition of aquatic life in creeks in the San Francisco Bay Area; are water quality objectives met and are beneficial uses supported?
2. What are the major stressors[8] to aquatic life?

[6] Results of nutrient sampling conducted pursuant to provision C.8.f are reported in the main UCMR.

[7] The MRP states that provision C.8.d monitoring is intended to answer the following questions: "Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?"; "Are conditions in local receiving waters supportive of or likely to be supportive of beneficial uses?".

[8] Stressors are interpreted per MRP provision C.8.d (SFBRWQCB 2015) as results that "trigger" action based upon comparison with an identified threshold.

3. What are the long-term trends in water quality in creeks over time?

The remainder of this report addresses Study Area and Monitoring Design (Section 2), data collection and analysis methods (Section 3), results and discussion including Stressor Assessment (Section 4), and Conclusions and Next Steps (Section 5). More specifically, this report includes the standard report content as required by MRP provision C.8.h.vi in the respective sections referenced in Table 1-3. Additional details or discussion may also be found in other Appendices or in the main UCMR.

Table 1-3. Index to Standard Report Content per MRP Provision C.8.h.vi.

Report Section	Standard Report Content
2.0	Monitoring purpose and study design rationale
3.0	Sampling protocols and analytical methods
4.1	QA/QC summaries for sample collection and analytical methods
2.1	Sample location descriptions, sample dates, IDs
4.0	Sample concentrations detected, measurement units, detection limits
4.0	Data assessment, analysis and interpretation
5.0	List of volunteer and other non-Permittee entities whose data are included in the report
6.0	Assessment of compliance with applicable water quality standards

2. Study Area & Monitoring Design

2.1 RMC Area

Creek Status and Pesticide and Toxicity monitoring was conducted in non-tidally influenced, flowing water bodies (i.e., creeks, streams and rivers) interspersed among 3,407 square miles of land in the RMC area. The water bodies monitored were drawn from a master list that included all perennial and non-perennial creeks and channels that run through urban and non-urban areas within the portions of the five participating counties that fall within the SF Bay RWQCB boundary, and the eastern portion of Contra Costa County that drains to the Central Valley Regional Board (Figure 2-1). This report presents data collected by ACCWP during WY 2018.

2.2 Regional Monitoring Design

In 2011, the RMC developed a regional probabilistic monitoring design to identify ambient conditions of creeks in the five main counties subject to the requirements of the MRP[9] (SFBRWQCB 2009). The regional design was developed using the Generalized Random Tessellation Stratified (GRTS) approach developed by the United States Environmental Protection Agency (USEPA) and Oregon State University (Stevens and Olson 2004). GRTS offers multiple benefits for coordinating amongst monitoring entities including the ability to develop a spatially balanced design that produces statistically representative data with known confidence intervals. The GRTS approach has been implemented recently in California by several agencies including the statewide Perennial Streams Assessment (PSA) conducted by SWAMP (Ode et al. 2011) and the Southern California Stormwater Monitoring Coalition's (SMC) regional monitoring program conducted by municipal stormwater programs in Southern California (SMC 2007). For the purpose of developing the RMC's probabilistic design, the RMC area is considered to represent the "sample universe".

2.2.1 Site Selection

Bioassessment sample sites were selected and attributed using the GRTS approach from a sample frame consisting of a creek network geographic information system (GIS) data set within the RMC boundary[10] (BASMAA 2011). This approach was agreed to by SF Bay RWQCB staff

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[9] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP (MRP1) to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

[10]Based on discussion during RMC Workgroup meetings, with SF Bay RWQCB staff present, the sample frame was extended to include the portion of Eastern Contra Costa County that drains to the San Francisco Bay in order to address parallel provisions in CCCWP's Region 5 Permit for Eastern Contra Costa County. The rest of the sample frame is within the boundaries of SFBRWQCB jurisdiction.

during RMC workgroup meetings although it differed from that specified in provision C.8.c.iv of MRP 1, e.g., sampling on the basis of individual watersheds in rotation and selecting sites to characterize segments of a waterbody(s). The sample frame includes non-tidally influenced perennial and non-perennial creeks within five management units representing areas managed by the storm water programs associated with the RMC. The sample frame was stratified by management unit to ensure that provision C.8.c of MRP1 sample size requirements (SFBRWQCB 2009) would be achieved.

The National Hydrography Plus Dataset (1:100,000) was selected as the creek network data layer to provide consistency with both the Statewide PSA and the SMC, and the opportunity for future data coordination with these programs. The RMC sample frame was classified by county and land use (i.e., urban and non-urban) to allow for comparisons between these strata. Urban areas were delineated by combining urban area boundaries and city boundaries defined by the U.S. Census (2000). Non-urban areas were defined as the remainder of the areas within the sample universe (i.e., RMC area). Based on discussion during RMC Workgroup meetings, with SF Bay RWQCB staff present, RMC participants weighted their sampling efforts so that annual sampling efforts are approximately 80% in urban areas and 20% in non-urban areas for the purpose of comparison. During WYs 2012-2015 RMC participants coordinated with the SF Bay RWQCB by identifying additional non-urban sites from their respective counties for SWAMP sampling.

Bioassessment sites sampled by ACCWP during the reporting period are shown in Figure 2-1 and Table 2-1.

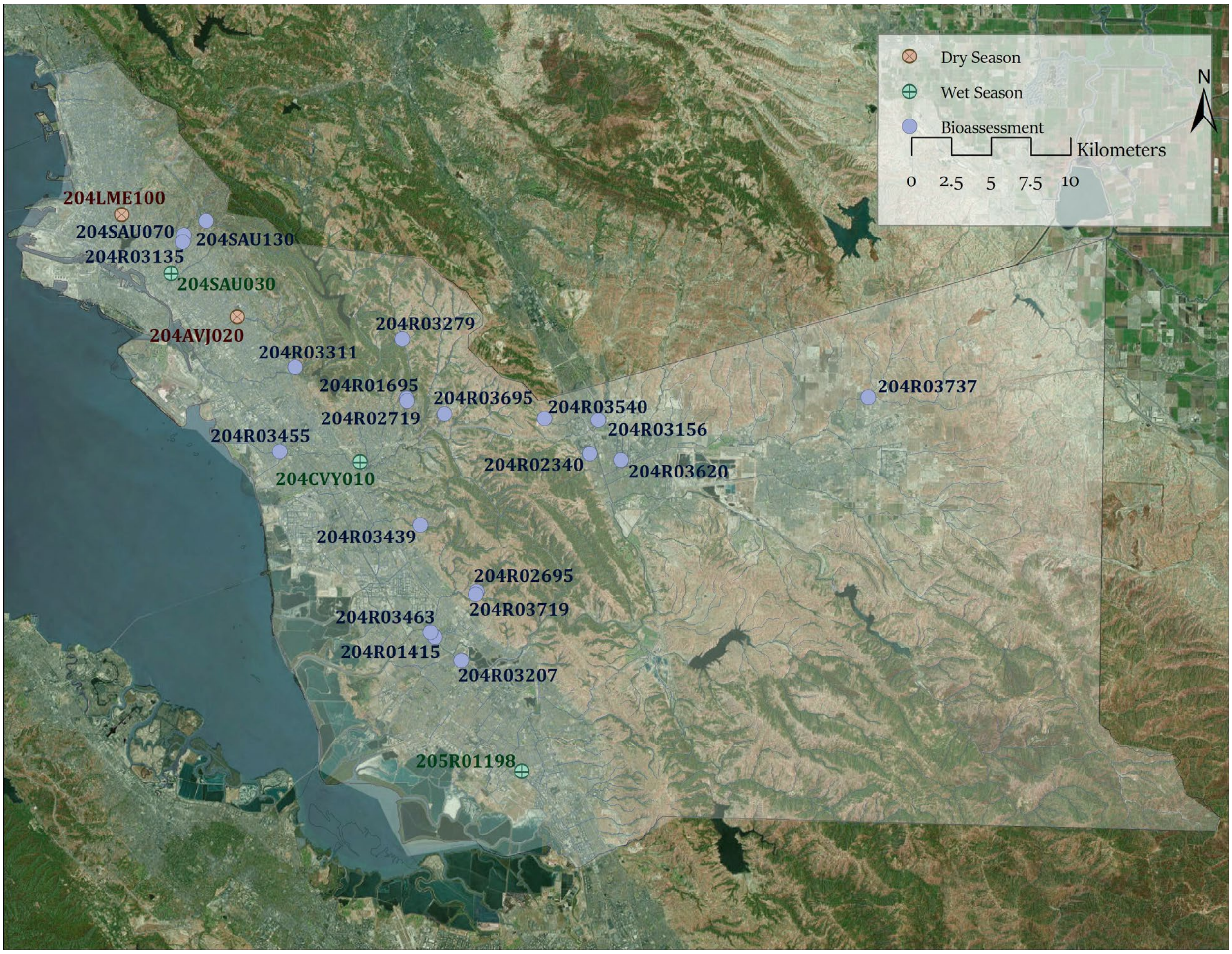

Figure 2-1. Alameda County sites sampled from the RMC probabilistic monitoring design and for Pesticides and Toxicity Monitoring in Water Year 2018.

Table 2-1. Alameda County Bioassessment Sites Sampled in Water Year 2018 by ACCWP.

Site ID	Creek Name	Land Use	Latitude	Longitude	Sampling Date
204SAU070	Sausal Creek*	Urban	37.80772	-122.21586	5/7/18
204SAU130	Palo Seco Creek*	Urban	37.81597	-122.20023	5/7/18
204R01415	Alameda Creek	Urban	37.58349	-122.03047	5/23/18
204R01695	Cull Creek	Urban	37.71805	-122.05421	5/21/18
204R02340	Gold Creek	Urban	37.68893	-121.92265	4/30/18
204R02695	Middle Fork Dry Creek	Urban	37.60975	-122.00128	5/2/18
204R02719	Cull Creek	Urban	37.71666	-122.05394	5/21/18
204R03135	Sausal Creek*	Urban	37.80393	-122.21675	5/24/18
204R03156	South San Ramon Creek	Urban	37.70820	-121.91702	6/13/18
204R03207	Alameda Creek	Urban	37.57059	-122.01134	5/2/18
204R03279	Cull Creek	Urban	37.75161	-122.05824	5/3/18
204R03311	San Leandro Creek	Urban	37.73430	-122.13433	5/8/18
204R03439	Ziele Creek	Urban	37.64675	-122.04241	5/22/18
204R03455	Estudillo Canal	Urban	37.68651	-122.14394	6/4/18
204R03463	Alameda Creek	Urban	37.58610	-122.03368	5/23/18
204R03540	Martin Canyon Creek	Urban	37.70851	-121.95558	4/30/18
204R03620	Chabot Canal	Urban	37.68587	-121.90018	5/9/18
204R03695	Tributary to San Lorenzo Creek	Urban	37.70974	-122.02690	5/10/18
204R03719	Middle Fork Dry Creek	Urban	37.60808	-122.00197	5/2/18
204R03737	Altamont Creek	Urban	37.72393	-121.72450	5/9/18

*These three sites were sampled as part of the SSID Project discussed in Appendix A4.

2.2.2 Management Questions

The RMC regional monitoring design was developed to address the management questions listed below. Those appearing in bolded font are addressed in this report in a preliminary manner. Those in normal font could not be addressed in this report due to the limited sample size from the Program's annual monitoring, but can be answered through collaborative review of cumulative data from all counties.

1. **What is the condition of aquatic life in creeks in the RMC area; are water quality objectives met and are beneficial uses supported?**
    a. **What is the condition of aquatic life in the urbanized portion of the RMC area; are water quality objectives met and are beneficial uses supported?**
    b. What is the condition of aquatic life in RMC participant counties; are water quality objectives met and are beneficial uses supported?
    c. **To what extent does the condition of aquatic life in urban and non-urban creeks differ in the RMC area?**
    d. To what extent does the condition of aquatic life in urban and non-urban creeks differ in each of the RMC participating counties?
2. **What are major stressors to aquatic life in the RMC area?**
    a. **What are major stressors to aquatic life in the urbanized portion of the RMC area?**

3. What are the long-term trends in water quality in creeks over time?

In the current fiscal year, BASMAA is completing a regional project to analyze bioassessment monitoring data collected during five years (WY 2012 – WY 2016) by all participating RMC programs. The resulting integrative report compiles, analyzes and maps data and evaluates the usefulness of the data and includes recommendations regarding the probabilistic design of the RMC Multi-year Monitoring Plan.

2.2.3 Pesticide and Toxicity Monitoring

The reissued MRP contains a separate provision C.8.g to combine all pesticide and toxicity monitoring into one section, instead of being distributed between Creek Status and Pollutants of Concern Monitoring provisions. This format is intended to provide for sampling designs that may provide more meaningful data for the region and potentially for statewide studies[11]. C.8.g requires Permittees to select monitoring sites where toxicity could be likely, so for WY 2018 ACCWP selected the following sites shown on Figure 2-1:

Wet Season

- 205R01198, Zone 6 Line G west of Grimmer, is located at the bottom of an urbanized subwatershed in Fremont east of I-880 for which bioassessment monitoring conducted in 2013 had identified a California Stream Condition Index (CSCI) within the poor condition category (ACCWP 2014). 2017 dry season sampling conducted here exhibited statistically significant aquatic toxicity to *C. dubia.*

- 204CVY010, Castro Valley Creek, is located just below the confluence of Castro Valley Creek and Chabot Creek and is part of the 48 mi^2 San Lorenzo Creek watershed. The smaller Chabot Creek subwatershed is mostly urban and contains Carlos Bee Park just upstream of the sampling site. The larger Castro Valley subwatershed (5.5 mi^2) contains mainly a mix of lower-density residential and open space. ACCWP has conducted a number of recent investigations at and upstream of this sampling site, including monitoring of bacteria, flow, bioassessment, and toxicity and chemistry.

- 204SAU030, Sausal Creek, is located just upstream of E. 22nd in Oakland. The Sausal Creek watershed, encompassing approximately 4.2 mi^2, drains a highly urbanized area of Oakland, with a mixture of mainly residential and park uses. The creek varies between daylighted and underground segments, with the E. 22nd location being the most downstream accessible area before the Oakland Estuary. In 2016, samples collected here during the dry season exhibited statistically significant aquatic toxicity to both *C. dubia* and *C. dilutus*.

[11] This provision may also be modified in the future in response to changes in pesticide use and efforts to develop a statewide coordinated program for monitoring pesticides and pesticide-related toxicity.

Dry Season

- 204AVJ020, Arroyo Viejo, is located with Arroyo Viejo Park in Oakland, a known area experiencing high water contact uses (i.e., recreation and encampments). The Arroyo Viejo watershed encompasses approximately 6.2 mi^2 of highly urbanized uses. Bioassessment monitoring conducted just downstream of this site in 2017 and at this site in 2004 and 2005 had identified CSCI scores within the "Very Likely Altered" condition (ACCWP 2014, ACCWP 2018).

- 204LME100 is located on Glen Echo Creek upstream of Lake Merritt, an area experiencing high levels of water contact recreation. The site lies within the 2.6 mi^2 Glen Echo Creek watershed. The watershed drains mixed residential, commercial, and open spaces areas of Oakland and Piedmont. ACCWP had previously conducted a source investigation of Glen Echo Creek watershed investigating potential sources of PCBs and Hg in the early 2000s. While this approach for pesticide and toxicity monitoring site selection is not explicitly linked to the probabilistic design used to select bioassessment sites, water quality problems due to pesticide-related toxicity are similar in urban waterways across the region and state and sampling will continue to be coordinated in a regional context.

2.2.4 Monitoring Design Implementation

Sampling was conducted in accordance with the RMC Multi-year Monitoring Plan (BASMAA 2011).

3. Monitoring Methods

This section describes the methods used to evaluate monitoring sites identified in the regional sample draw, consistent with the Southern California Coastal Water Research Project (SCCWRP) Bioassessment Program (SCCWRP 2012), and to sample field data, consistent with the RMC workplan (BASMAA 2011). Field parameters sampled at all sites included benthic macroinvertebrate community, algal community and biomass, and physical habitat. Physico-chemical measurements (dissolved oxygen, temperature, conductivity, and pH), chlorine, and nutrients were sampled concurrently as required by the SWAMP protocol or MRP.

3.1 Site Evaluation

Sites identified in the regional sample draw were evaluated by each RMC participant in chronological order using a two-step process, consistent with that described by SCCWRP[12] (2012). Each site was evaluated to determine if it met the following RMC sampling location criteria:

1. The location (latitude/longitude) provided for a site is located on or is within 300 meters of a non-impounded receiving water body;
2. Site is not tidally influenced;
3. Site is wadeable during the sampling index period;
4. Site has sufficient flow during the sampling index period to support standard operating procedures for biological and nutrient sampling.
5. Site is physically accessible and can be entered safely at the time of sampling;
6. Site may be physically accessed and sampled within a single day;
7. Landowner(s) grant permission to access the site[13].

In the first step, these criteria were evaluated to the extent possible using a “desktop analysis.” Site evaluations were completed during the second step via field reconnaissance visits. Based on the outcome of site evaluations, sites were classified into one of three categories:

- **Target** - Sites that met all seven criteria were classified as **target sampleable** status **(TS),** and sites that met criteria 1 through 4, but did not meet at least one of criteria 5 through 7 were classified as **target non-sampleable (TNS)**.

- **Non-Target (NT)** - Sites that did not meet at least one of criteria 1 through 4 were classified as non-target status.

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[12]Communication with managers for the SMC and the PSA are ongoing to ensure consistency of site evaluation protocols.

[13]If landowners who did not respond to at least two attempts to contact them either by written letter, email, or phone call, permission to access the respective site was effectively considered to be denied.

- **Unknown (U)** -Sites were classified with unknown status when it could be reasonably inferred either via desktop analysis or a field visit that the site was a valid receiving water body, but information for any of the seven criteria was unconfirmed.

During the site evaluation field visits flow status was recorded as one of five categories:

- **Wet Flowing** - Continuously wet or nearly so, flowing water.
- **Wet Trickle** - Continuously wet or nearly so, very low flow (trickle, less than 0.1 L/second).
- **Majority Wet** - Discontinuously wet, greater than 25% by length of stream bed covered with water (isolated pools).
- **Minority Wet** - Discontinuously wet, less than 25% of stream bed by length covered with water (isolated pools).
- **No Water -** No surface water present.

Observations of flow status during fall site reconnaissance events prior to occurrence of significant precipitation, and during spring sampling post-wet weather season were combined to classify sites as perennial or non-perennial as follows:

- **Perennial -** Fall flow status either Wet Flowing or Wet Trickle and spring flow sufficient to sample.
- **Non-Perennial** - Fall flow status either Majority Wet, Minority Wet, or No Water, and spring flow sufficient to sample.

3.2 Field Data Collection Methods

Field data were collected in accordance with existing SWAMP-comparable methods and procedures, as described in the RMC Quality Assurance Project Plan (QAPPv3) and the associated Standard Operating Procedures which were updated to maintain their currency and optimal applicability (BASMAA 2016a, 2016b). The SOPs were developed using a standard format that describes health and safety cautions and considerations, relevant training, site selection, and sampling methods/procedures, including pre-fieldwork mobilization activities to prepare equipment, sample collection, and de-mobilization activities to preserve and transport samples. The SOPs relevant to the monitoring discussed in this report are listed in Table 3-1.

Table 3-1. RMC Standard Operating Procedures (SOPs) pertaining to regional creek status monitoring.

SOP #	SOP
FS-1	Benthic Macroinvertebrate and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity Testing
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-6	Collection of Bedded Sediment Samples
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

3.2.1 Bioassessments

In accordance with the RMC QAPP (BASMAA 2016a), bioassessments are intended to be conducted during the spring index period (approximately April 15 – June 15) and at a minimum of 30 days after any significant storm (roughly defined as at least 0.5-inch of rainfall within a 24-hour period).

In WY 2018 sampling at all sites was conducted between 4/30/2018 and 6/13/2018 and conformed with the relevant protocols listed above. One reach had to be shortened due to impassable vegetation in the channel. The length and an explanation for the modified reach length, are shown in Table 3-2 below.

Table 3-2. 2018 ACCWP Sites with Modified Reach Lengths

SiteCode	Length (m)	Rationale for Modified Reach
204SAU130*	120	Blackberry in channel impassable

*Site sampled as part of SSID project

Benthic Macroinvertebrates

The BMI samples were collected using the Reachwide Benthos (RWB) method described in SOP FS-1 (BASMAA 2016b).

Each bioassessment sampling site consisted of an approximately 150-meter stream reach that was divided into 11 equidistant transects placed perpendicular to the direction of flow. The sampling position within each transect alternated between 25%, 50% and 75% distance of the wetted width of the stream. Benthic macroinvertebrates (BMIs) were collected from a 1 ft^2 area approximately 1 m downstream of each transect. The benthos were disturbed by manually rubbing coarse substrate followed by disturbing the upper layers of substrate to a depth of 4-6 inches to dislodge any remaining invertebrates into the net. Slack water habitat procedures were used at transects with deep and/or slow moving water (Ode 2007). Material collected from the eleven subsamples was composited in the field by transferring entire sample into one to two 1000 ml wide-mouth jar(s) and preserved with 95% ethanol.

Algae

Filamentous algae and diatoms were collected using the Reach-wide Benthos (RWB) method described in SOP FS-1 (BASMAA 2016b). Algae samples were collected synoptically with BMI samples. The sampling position within each transect was the same as used for BMI sampling, however, samples were collected six inches upstream of the BMI sampling position and prior to BMI collection from that location. The algae were collected using a range of methods and equipment, depending on the particular substrate occurring at the site (i.e., erosional, depositional, large and/or immobile, etc.) per SOP FS-1. Erosional substrates included any material (substrate or organics) that was small enough to be removed from the stream bed, but large enough in size to isolate an area equal in size to a rubber delimiter (12.6 cm^2 in area). When a sample location along a transect was too deep to sample, a more suitable location was selected, either on the same transect or from one further upstream. Algae samples were collected at each transect prior to moving on to the next transect. Sample material (substrate and water) from all eleven transects was combined in a sample bucket, agitated, and a suspended algae sample was then poured into a 500 mL cylinder, creating a composite sample for the site. A 45 mL subsample was taken from the algae composite sample and combined with 5 mL glutaraldehyde into a 50 mL sample tube for taxonomic identification of soft algae. Similarly, a 40 mL subsample was extracted from the algae composite sample and combined with 10 mL of 10% formalin into a 50 mL sample tube for taxonomic identification of diatoms. Laboratory processing included identification and enumeration of 300 natural units of soft algae and 600 diatom valves to the lowest practical taxonomic level.

The algae composite sample was also used for collection of chlorophyll *a* and ash free dry mass (AFDM) samples following methods described in Fetscher et al. (2009). For chlorophyll *a* samples, 25 mL of the algae composite volume was removed and run through glass fiber filter (47 mm, 0.7 um pore size) using a filtering tower apparatus. The AFDM sample was collected using a similar process using pre-combusted filters. Both samples were placed in whirlpaks, covered in aluminum foil and immediately placed on ice for transportation to the laboratory.

3.2.2 Physical Habitat

Physical habitat assessments (PHab) were conducted at each BMI bioassessment sampling event using the PHab protocols described in Ode (2007) and augmented by Fetscher et al. (2009) (see SOP FS-1, BASMAA 2016b). Physical habitat data were collected at each of the 11 transects and at 10 additional inter-transects (located between each main transect) by implementing the "Basic" level of effort, with the following additional measurements/assessments as defined in the

"Full" level of effort (as prescribed in the MRP): water depth and pebble counts, cobble embeddedness, flow habitat delineation, and instream habitat complexity. At algae sampling locations, additional assessment of presence of micro- and macroalgae was conducted during the pebble counts. In addition, water velocities were measured at a single location in the sample reach (when possible) using protocols described in Ode (2007).

3.2.3 Physico-chemical Measurements

Field personnel measured dissolved oxygen, temperature, conductivity, and pH during bioassessment sampling using a multi-parameter probe (see SOP FS-3, BASMAA 2016b). Dissolved oxygen, specific conductivity, water temperature and pH measurements were made either by direct submersion of the instrument probe into the sample stream, or by collection and immediate analysis of grab sample in the field. Water quality measurements were taken approximately 0.1 m below the water surface at locations of the stream that appears to be completely mixed, ideally at the centroid of the stream. Measurements should occur upstream of sampling personnel and equipment and upstream of areas where bed sediments have been disturbed, or prior to such bed disturbance.

3.2.4 Other Water Quality Analytes

Chlorine

Field personnel collected and analyzed water grab samples for free and total chlorine using CHEMetrics test kits (K-2511 for low range, and K-2504 for high range). Chlorine measurements in water were conducted during bioassessments and during dry season monitoring for sediment chemistry, sediment toxicity, and water toxicity.

Nutrients and Conventional Analytes

Concurrent with bioassessments, field personnel collected water samples for nutrient analyses using the Standard Grab Sample Collection Method as described in SOP FS-2 (BASMAA 2016b). Sample containers were rinsed, as appropriate, using ambient water and completely filled and recapped below water surface whenever possible. An intermediate container was used to collect water for all sample containers pre-preserved by the laboratory. Syringe filtration method was used to collect samples for analyses of Dissolved Ortho-P, with Dissolved Organic Carbon now filtered in the lab within the requisite 48-hr hold time. Sample container size and type, preservative type and associated holding times for each analyte are described in Table 1 of FS-9 (BASMAA 2016b). All sample containers were labeled and stored on ice for transportation to laboratory, with exception of analysis of Ash Free Dry Mass and Chlorophyll *a* samples, which were field-frozen on dry ice by sampling teams upon collection.

3.2.5 Water Toxicity

Field personnel collected water samples using the Standard Grab Sample Collection Method described above, filling the required number of 4-L amber glass bottles with ambient water, putting them on ice to cool to 4 ±2 °C, and delivering to the laboratory within the required hold time. Bottle labels and COCs included station ID, sample code, matrix type, analysis type, project ID, and date and time of collection. The laboratory was notified of the impending sample delivery to meet the 36-hour sample delivery time requirement. Procedures used for sampling and transporting samples are described in SOP FS-2 (BASMAA 2016b).

3.2.6 Sediment Chemistry & Sediment Toxicity

In the case where sediment samples and water samples / measurements were collected at the same event, sediment samples were collected after any water samples were collected. Before conducting sampling, field personnel surveyed the proposed sampling area to identify appropriate fine-sediment depositional areas, to avoid disturbing possible sediment collection sub-sites. Personnel carefully entered the stream and started sampling at the closest appropriate reach, continuing upstream. Sediment samples were collected from the top 2 cm of sediment in a compositing container, thoroughly homogenized, and then aliquotted into separate jars for chemical and toxicological analysis using standard clean sampling techniques (see SOP FS-6, BASMAA 2016b). Sample jars were submitted to respective laboratories per SOP FS-9 (BASMAA 2016b).

3.3 Laboratory Analysis Methods

ACCWP and other RMC participants agreed to use the same laboratories for individual parameters, developed standards for contracting with the labs, and coordinated quality assurance issues. All samples collected by RMC participants that were sent to laboratories for analysis were analyzed and reported per SWAMP-comparable methods as described in the RMC QAPP (BASMAA 2016a). Analytical laboratory methods, are also reported in BASMAA (2012a). Analytical laboratory contractors used for analysis of benthic macroinvertebrate and algae taxonomic identification, chemistry, and toxicity included:

- BioAssessment Services, Inc. – BMI identification
- EcoAnalysts, Inc. – Algae identification
- CalTest, Inc. – Sediment Chemistry, Nutrients, Chlorophyll *a*, Ash Free Dry Mass
- Pacific EcoRisk, Inc. - Water and Sediment Toxicity

The laboratory analytical methods identified BMIs at a Level 1 Standard Taxonomic Level of Effort, with the additional effort of identifying chironomids (midges) to subfamily/tribe instead of family (Chironomidae). Soft algae and diatom samples were analyzed following Surface Water Ambient Monitoring Program (SWAMP) protocols (SWRCB 2011a, SWRCB 2011b, Stancheva et al. 2015). The taxonomic resolution for all data was compared and revised when necessary to match the SWAMP master taxonomic list.

3.4 Data Analysis

This section describes methods used to analyze bioassessment data collected during Water Year 2018 to address management questions related to condition of aquatic life and report on these per MRP provision C.8.h.iii.

3.4.1 Biological Condition

The California Stream Condition Index (CSCI) is a biological index, developed by the State Water Resources Control Board (State Board), used to score the condition of BMI communities in perennial wadeable rivers and streams. The CSCI translates benthic macroinvertebrate data into an overall measure of stream health. The CSCI was developed using a large reference data set that represents the full range of natural conditions in California (Rehn et al. 2015). The CSCI combines two types of indices: 1) taxonomic completeness, as measured by the ratio of observed-to-expected taxa (O/E); and 2) ecological structure and function, measured as a predictive multi-metric index (pMMI) that is based on reference conditions. The CSCI score is computed as the average of the sum of O/E and pMMI.

The State Board is continuing to evaluate the performance of CSCI in a regulatory context. In the re-issued MRP 2.0 (adopted on November 19, 2015), the Regional Water Board defined a CSCI score of 0.795 as a threshold for identifying sites with degraded biological condition that may be considered as candidates for Stressor Source Identification (SSID) projects.

The State Board and SCCWRP recently developed the draft Algae Stream Condition Index (ASCI) which uses benthic algae data as a measure of biological condition for streams in California (Theroux et al (in prep)). The ASCI is a non-predictive[14] scoring tool that consists of multi-metric indices comprised of single-assemblage metrics associated with either diatoms or soft algae, or combinations of metrics representing both assemblages (i.e, "hybrid").

The ASCI is very similar to the algae Indices of Biological Integrity (IBIs) developed in Southern California (Fetscher et al 2014), with the exception that metric development and testing was conducted using data collected throughout California. Analyses of the three ASCI tools (i.e., diatom, soft algae, hybrid) conducted by SCCWRP suggest that the hybrid ASCI index is the most responsive algae index, especially for nutrient stressor gradients (Theroux et al. (in

[14] Predictive indices (e.g., CSCI) utilize environmental variables that characterize immutable natural gradients as predictors for biological conditions. A predictive O/E and MMI model was developed and tested, but ultimately not recommended due to low precision and accuracy.

preparation). Additional study is needed however, to determine the best approach to apply the ASCI tools to evaluate bioassessment data. For example, it is not clear if ASCI should be used as a second line of evidence to understand CSCI scoring results, or if it would be more effective as an independent indicator to evaluate different types of stressors (e.g., nutrients). The ASCI is currently under review by the Biostimulatory-Biointegrity Policy Science Advisory Panel and the State Board.

Bioassessment Data Analysis

For BMI samples collected at 20 sites in Alameda County in WY 2018, the laboratory analytical methods identified BMIs at a Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) Level 1 Standard Taxonomic Level of Effort, with the additional effort of identifying chironomids (midges) to subfamily/tribe instead of family (Chironomidae).

Soft algae and diatom samples were analyzed following Surface Water Ambient Monitoring Program (SWAMP) protocols (Stancheva et al. 2015). The taxonomic resolution for all data was compared and revised when necessary to match the SWAMP master taxonomic list.

California Stream Condition Index Score

The CSCI is calculated using a combination of biological and environmental data following methods described in Rehn et al. (2015). Biological data include BMI data collected and analyzed using protocols described in the previous section. The environmental predictor data are generated in geographic information system (GIS) using drainage areas upstream of each BMI sampling location. The environmental predictors and BMI data were formatted into comma delimited files and used as input for the RStudio statistical package and the necessary CSCI program scripts, developed by Southern California Coastal Water Research Project (SCCWRP) staff (Mazor et al. 2016).

EOA staff compiled and/or created drainage areas in ArcGIS using 10-meter Digital Elevation Model (DEM) data and the Arc Hydro tool. In most cases, the watershed/catchment polygons created with the Arc Hydro tool required editing to adjust the downstream edge of the drainage area to the sampling locations. When necessary, other existing data sources, including watershed/catchment data developed by the San Francisco Estuary Institute (SFEI) and the Oakland Museum and storm drain network data provided by municipalities, were used to modify the DEM-derived watershed boundaries. These modifications were typical in the low gradient urban areas along the San Francisco Bay and in Livermore Valley. All delineations were independently reviewed for accuracy using Google Earth.

To develop the CSCI scores, eight GIS datasets from the California Department of Fish and Wildlife were analyzed in ArcGIS to calculate a range of environmental predictors for each sampling location. Site elevation, temperature, and annual precipitation values were obtained directly at the sampling location. Elevation range was calculated from the difference in elevation between the top and the bottom of the watershed/catchment. Mean monthly precipitation, bulk soil density, soil erodibility, and phosphorous geology are predictors that are averaged across each watershed, and are calculated in ArcGIS using zonal statistics.

The CSCI scores were evaluated using condition categories described in Rehn et al. (2015). Four classes representing a range of biological conditions were defined using a distribution of scores at reference calibration sites throughout the State of California (Table 3-3). The categories are described as “likely intact” (greater than 30th percentile of reference site scores); “possibly intact” (between the 10th and the 30th percentiles); “likely altered” (between the 1st and 10th percentiles; and “very likely altered” (less than the 1st percentile). The likely altered category coincides with the threshold identified in MRP 2.0.

Algae Stream Condition Index Scores

Similar to BMI’s, the abundance and type of benthic algae species living on a streambed can indicate stream health. When evaluated with the CSCI, biological indices based on benthic algae can provide a more complete picture of the streams biological condition because algae respond most directly to nutrients and water chemistry; whereas, BMIs are more responsive to physical habitat.

The State Board and SCCWRP recently developed the draft Algae Stream Condition Index (ASCI) which uses benthic algae data as a measure of biological condition for streams in California (Theroux et al (in prep)). The ASCI is a non-predictive[15] scoring tool that consists of multi-metric indices comprised of single-assemblage metrics associated with either diatoms or soft algae, or combinations of metrics representing both assemblages (i.e, “hybrid”).

The ASCI is very similar to the algae Indices of Biological Integrity (IBIs) that were used in previous UCMRs and developed in Southern California (Fetscher et al 2014), with the exception that metric development and testing was conducted using data collected throughout California. Analyses of the three ASCI tools (i.e., diatom, soft algae, hybrid) conducted by SCCWRP suggest that the hybrid ASCI index is the most responsive algae index, especially for nutrient stressor gradients (Theroux et al. (in preparation)). Additional study is needed however, to determine the best approach to apply the ASCI tools to evaluate bioassessment data. For example, it is not clear if ASCI should be used as a second line of evidence to understand CSCI scoring results, or if it would be more effective as an independent indicator to evaluate different

[15] Predictive indices (e.g., CSCI) utilize environmental variables that characterize immutable natural gradients as predictors for biological conditions. A predictive O/E and MMI model was developed and tested, but ultimately not recommended due to low precision and accuracy.

types of stressors (e.g., nutrients). The ASCI is currently under review by the Biostimulatory-Biointegrity Policy Science Advisory Panel and the State Board.

The algae data collected at sites in Alameda County during 2018 were evaluated using the ASCI scores for diatoms, soft algae and hybrid indices. ASCI scores were generated using a beta version reporting module developed by SCCWRP. These scores are considered provisional until the ASCI has been fully evaluated and finalized. ASCI scores condition categories developed by Mazor et al (in prep) for the 30th, 10th and 1st percentile of reference sites are listed in Table 3-3.

Physical Habitat Indicators

The condition of physical habitat is a major contributor to stream ecosystem health. Physical habitat components such as streambed substrate, channel morphology, microhabitat complexity, in-stream cover-type complexity, and riparian vegetation cover contribute to the overall physical and biological integrity of a stream. Physical characteristics of a stream reach are affected by both natural factors and human disturbance.

The State Board recently developed the Index of Physical Habitat Integrity (IPI) as an overall measure of physical habitat condition (Rehn, et al. 2018). Similar to the CSCI, the IPI is calculated using a combination of physical habitat data collected in the field and environmental data generated in GIS following the methods described in Rehn et al. (2018).

Table 3-3. Condition categories used to evaluate CSCI, Algae MMIs, and PHAB IPI scores.

Index	Likely Intact (>30th)	Possibly Intact (10th – 30th)	Likely Altered (1st – 10th)	Very Likely Altered (< 1st)
Benthic Macroinvertebrates (BMI)				
CSCI Score	≥ 0.92	≥ 0.79 to < 0.92	≥ 0.63 to < 0.79	< 0.63
Benthic Algae				
ASCI_Diatoms	≥ 0.92	≥ 0.80 to < 0.92	≥ 0.63 to < 0.80	< 0.63
ASCI_Soft Algae	≥ 0.93	≥ 0.82 to < 0.93	≥ 0.68 to < 0.82	< 0.68
ASCI_Hybrid	≥ 0.93	≥ 0.83 to < 0.93	≥ 0.70 to < 0.83	< 0.70
Physical Habitat				
PHAB IPI	≥ 0.94	≥ 0.84 to < 0.94	≥ 0.71 to < 0.83	< 0.70

3.4.2 Water and Sediment Chemistry and Toxicity

As part of the Stressor Assessment for this report, water and sediment chemistry and toxicity data generated during WY 2018 were analyzed and evaluated to identify potential stressors that may be contributing to degraded or diminished biological conditions. Creek status monitoring and pesticides and toxicity data must be evaluated with respect to thresholds or "triggers" specified in the MRP to identify whether a site is a candidate for SSID project followup. The trigger criteria listed in provisions C.8.d and C.8.g were used to identify sites where water quality impacts may have occurred. For water and sediment chemistry and toxicity data, the relevant trigger criteria are identified in provision C.8.g.iv and listed below as follows:

1) A toxicity test of growth, reproduction, or survival of any test organism is reported as "fail" in both the initial sampling and a second, followup sampling, and both have ≥ 50% Percent Effect;
2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan[16];
3) For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs).

For sediment chemistry trigger criteria, threshold effect concentrations (TECs) and probable effect concentrations (PECs) are as defined in MacDonald et al. (2000). For all applicable contaminants specified in MacDonald et al. (2000), the ratio of the measured concentration to the respective TEC value was computed as the TEC quotient. PEC quotients were also computed for those same sediment chemistry constituents using PEC values from MacDonald et al. (2000). All results where a TEC or PEC quotient was equal to or greater than 1.0 were identified.

Criterion (1) above applies to toxicity results of water column and sediment monitoring in both dry weather and wet weather. Criterion (2) applies to results of water column chemistry monitoring in both dry weather and wet weather, and is also appropriate for water quality samples collected at regional bioassessment monitoring sites per provision C.8.d.i, which does not specify trigger criteria for those parameters. Criterion (3) applies to chemical results of sediment monitoring in dry weather.

3.5 Quality Assurance and Control

Data quality assessment and quality control procedures are described in detail in the BASMAA RMC QAPP (BASMAA 2016a). They generally involved the following:

Measurement Quality Objectives (MQOs) were established to ensure that data collected were of sufficient and adequate quality for the intended use. MQOs include both quantitative and qualitative assessment of the acceptability of data. The qualitative goals include representativeness and comparability. The quantitative goals include completeness, sensitivity (detection and quantitation limits), precision, accuracy, and contamination. To ensure consistent

[16] The San Francisco Basin Water Quality Control Plan, SFBRWQCB (2013) does not contain water quality objectives for pollutants in sediment. Environmental screening levels or sediment target concentrations defined by Total Maximum Daily Loads for specific pollutants are not considered applicable to Criterion (2).

and comparable field techniques, pre-monitoring field training and in-situ field assessments were conducted.

Data were collected according to the procedures described in the relevant SOPs (BASMAA 2016b), including appropriate documentation of data sheets and samples, and sample handling and custody. Laboratories providing analytical support to the RMC were selected based on demonstrated capability to adhere to specified protocols.

All data were thoroughly reviewed for conformance with QAPP requirements and field procedures were reviewed for compliance with the methods specified in the relevant SOPs. Data quality was assessed and qualifiers were assigned as necessary in accordance with SWAMP requirements. See Section 7 for evaluations of Program-specific data quality associated with monitoring conducted in WY 2018.

4. Results & Discussion

The MRP places an emphasis on minimizing sources of pollutants that could impair water quality as a central purpose of urban runoff management programs. The MRP requires monitoring to address the management question,

- ***"What are the sources to urban runoff that contribute to receiving water problems?"***

The RMC accomplishes this through a multi-step process that involves conducting monitoring to provide data to inform an assessment of conditions and identification of stressors that may be impacting water quality and/or biological conditions. The information generated through the condition assessment and stressor assessment will then be used to help direct efforts to identify sources of problematic pollutants or other stressors in urban runoff discharges.

In this section, following a brief statement of data quality, the bioassessment data are evaluated against the trigger criteria found in C.8.d, and data for toxicity and sediment chemistry are evaluated against trigger criteria in C.8.g of the MRP (SFBRWQCB 2015) to provide a preliminary identification of potential stressors. The results of the initial stressor assessment evaluation (BASMAA 2013) were used to initiate a stressor-source identification project as described in the 2014 Integrated Monitoring Report (ACCWP 2014).

4.1 Statement of Data Quality

The RMC established a set of guidance and tools to help ensure data quality and consistency implemented through collaborating Programs. Additionally, the RMC participants continue to meet in an ongoing basis to plan and coordinate monitoring, data management, and reporting activities, among others.

A comprehensive QA/QC program was implemented by each of the RMC Programs, which is solely responsible for the quality of the data submitted on its behalf, covering all aspects of the regional / probabilistic monitoring. In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a), and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), and in conformity with SWAMP protocols. Details of the results of evaluations of laboratory-generated QA/QC results are included elsewhere in the ACCWP UCMR and other appendices if applicable. Issues noted by the laboratories and/or RMC field crews are summarized below; affected datapoints will be qualified in electronic data deliverables submitted.

4.1.1 Bioassessment Water Chemistry

Several issues were identified with respect to water chemistry analyses by either the laboratory or the QAO review, including:

- A relatively small number of samples for analysis of ammonia, nitrate, and chloride were reported below the associated reporting limit (RL) with elevated laboratory RLs that exceeded QAPP targets. In some cases, this was attributable to instrument failure at Caltest that precluded use of lower method detection limit-associated equipment and substitution of standard methodologies.

- Percent recovery (PR) reported for MS/MSD analyses of silica, Total Kjeldahl Nitrogen (TKN), and ammonia fell outside of control limits for a small number of lab batches.

- Relative percent difference (RPD) calculated on MS/MSD pairs for one batch of TKN samples fell outside control limits.

- Calculated field RPDs associated with analysis of blind field duplicate samples for single pairs of TKN, Chlorophyll *a*, and Ash Free Dry Mass exceeded QAPP MQOs.

4.1.2 Bioassessment Taxonomy

There were no issues identified associated with taxonomic analyses.

4.1.3 Creek Status Monitoring Sediment Chemistry

Overall data quality was generally good and the vast majority of datapoints achieved MQOs. As is typical for sediment blind duplicate samples, multiple analytes did not meet MQO for precision due to matrix heterogeneity. Additional exceptions are discussed below.

- Laboratory blanks for Pb and Zn both exhibited evidence of minor contamination. It should be noted that the level of contamination in the blanks was quite low relative to field sample concentrations, so impact is likely minor and shouldn't affect data interpretation.

- MS/MSD percent recovery for Cr fell outside of control limits.

- MS/MSD percent recoveries for ten individual PAHs fell outside of control limits.

- Analyses of surrogate samples fell outside of MQOs for a small number of organics analytes.

- MS/MSD percent recoveries for fipronil, fipronil sulfide, and bifenthrin fell outside of control limits.

4.1.4 Creek Status Monitoring Sediment Toxicity

There were no issues identified associated with sediment toxicity analyses.

4.1.5 Creek Status Monitoring Aquatic Toxicity

There were no issues identified associated with dry season aquatic toxicity analyses.

4.1.6 Pesticide and Toxicity Aquatic Chemistry

A small number of issues were identified with respect to water chemistry analyses by either the laboratory or the QAO review, including:

- Laboratory duplicates for imidacloprid fell outside of control limits for precision in two lab batches.
- Percent recovery (PR) reported for MS/MSD analyses of fipronil and its degradates fell slightly outside of control limits in one batch.

4.1.7 Pesticide and Toxicity Aquatic Toxicity

For the wet season aquatic toxicity analyses, there was an issue related to analysis of *Chironomus dilutus*. As is typical for this analysis, when the decision was made to mobilize to sample the event selected by RMC Programs for sampling, the analytical laboratory ordered test specimens to arrive in time to acclimate at the laboratory for a day prior to test initiation, to reduce the possibility of test failure due to shipping stress.

The majority of *C. dilutus* test specimens ordered from the commercial supplier for this event unfortunately died in shipping. The laboratory ordered replacement specimens and, following the recommendation of the toxicity laboratory project manager, the decision of the collaborating RMC Programs was to delay test initiation beyond the allowed hold time of 48 hours to allow for this acclimation period to proceed. Tests were therefore initiated outside of hold time and laboratory results were qualified to reflect this. Tests then proceeded as per protocol. There were no other QA issues identified with this test or other tests run.

Condition Assessment

Condition assessment addresses the RMC core management question

> "What is the condition of aquatic life in creeks in the RMC area; are aquatic life beneficial uses supported?"

Table 4-1 lists the beneficial uses of creeks sampled during WY 2018. By default creeks and other fresh water bodies not listed or included in larger creeks by the "tributary rule" are assigned the WARM and WILD presumptive uses in the Basin Plan (SFBRWQCB 2013).

Table 4-1. ACCWP creeks sampled in WY 2018 and associated designated beneficial uses listed in the San Francisco Bay Region Basin Plan. Sites not in or tributary to creeks listed in Chapter 2 of the Basin Plan do not appear in this table.

		Human Consumptive Uses					Aquatic Life Uses									Wildlife Use	Recreational Uses		
Site ID	**Waterbody**	**AGR**	**MUN**	**FRSH**	**GWR**	**IND**	**PROC**	**COMM**	**SHELL**	**COLD**	**EST**	**MAR**	**MIGR**	**RARE**	**SPWN**	**WARM**	**WILD**	**REC-1**	**REC-2**	**NAV**
ALAMEDA COUNTY																				
204R01415, 204R03207, 204R03463	Alameda Creek	E			E			E		E			E	E	E	E	E	E	E	
204R03737	Altamont Creek				E					E				E		E	E	E	E	
204AVJ020	Arroyo Viejo									E						E	E	E	E	
204CVY010	Castro Valley Creek									E				E		E	E	E	E	
204R01695, 204R02719	Cull Creek									E				E	E	E	E	E	E	
204R03455	Estudillo Canal															E	E	E	E	
204LME100	Glen Echo Creek															E	E	E	E	
204R03540	Martin Canyon Creek															E	E	E	E	
204R02695, 204R03719	Middle Fork Dry Creek													E		E	E	E	E	
205R02670, 205R03694, 205Z6L2010, 205Z6M1010, 205Z6M010	Mission Creek															E	E	E	E	
204R03311	San Leandro Creek (Lower)			E						E			E	E	E	E	E	E	E	
204R03695	San Lorenzo Creek		E	E	E					E			E		E	E	E	E	E	
204R03135, 204SAU030, 204SAU055, 204SAU070, 204SAU090, 204SAU100, 204SAU200, 204SAU110, 204SAU130	Sausal Creek & tributary Palo Seco Creek									E				E	E	E	E	E	E	
204R03156	South San Ramon Creek															E	E	E	E	

Abbreviations:

AGR = Agricultural Supply
COLD = Cold Fresh Water Habitat
COMM = Commercial & Sport Fishing
FRSH = Freshwater Replenishment
GWR - Groundwater Recharge
MIGR = Fish Migration
MUN = Municipal and Domestic Water
RARE= Preservation of Rare & Endangered Species
REC-1 = Water Contact Recreation
REC-2 = Non-contact Recreation
SPWN = Fish Spawning
WARM = Warm Freshwater Habitat
WILD = Wildlife Habitat
P = Potential Use
E = Existing Use
L = Limited Use

* = "Water quality objectives apply; water contact recreation is prohibited or limited to protect public health" (SFBRWQCB 2013).

4.2.1 Assessing Biological Condition

Table 4-2 summarizes the numbers of WY 2018 sites assigned to various condition categories by CSCI, ASCI, and IPI assessments.

Table 4-2. Distribution of CSCI, ASCI, and IPI condition categories for 17 probabilistic urban sites sampled in Alameda County during WY 2018.

Condition Category	CSCI	ASCI			IPI
		Diatom	Soft Algae*	Hybrid	
Likely Intact (LI)	1	0	4	0	3
Possibly Intact (PI)	4	8	0	5	6
Likely Altered (LA)	3	7	5	7	4
Very Likely Altered (VLA)	9	2	4	5	4

*4 sites had no soft algae ASCI scores due to an insufficient number of soft algae taxa needed to calculate a score.

Table 4-3 and Figure 4-1 show the condition categories assigned to the 17 probabilistic sites sampled in Alameda County during WY 2018. Biological condition scores for CSCI and ASCI as well as IPI scores are listed in Table 4-4. Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table for reference.

Using the categories shown in Table 3-3, the WY 2018 sites were rated as follows:

CSCI Scores

Five sites had CSCI scores that ranked above the threshold value of 0.795, indicating "possibly intact" or "likely intact" conditions. Site 204R03279, receiving the highest score (0.98), was located on Cull Creek. Four of the high scoring sites (204R01695, 204R03279, 204R03719, 204R03695) were located in undeveloped watersheds with impervious watershed area ranging from 1% to 4%. The remaining site (204R03439) occurred in a relatively developed watershed (18% imperviousness and 39% urban); however much of the drainage area upstream of the site is protected area within Garin Regional Park.

Twelve of the seventeen (72%) bioassessment sites had CSCI scores in the two lower condition categories, "likely altered" and "very likely altered" condition. These classifications are below the MRP trigger threshold value of 0.795. The nine lowest scoring sites were located in predominantly urban watersheds (percent urban >10%); six of these sites also had modified channels. The remaining three sites classified as "likely altered" condition were located in creeks with natural channels and minimal urbanization (percent urban <1%).

ASCI Scores

The benthic algae taxa identified in the 17 samples collected in Alameda County were used to calculate scores for the provisional statewide ASCI.

- **Diatoms.** Eight of the seventeen bioassessment sites had ASCI scores that were classified as “possibly intact” condition. The higher scoring sites occurred over a wide gradient of urbanization, ranging from 1% to 19% impervious area. Two of the eight sites received CSCI scores that were in two higher condition categories. The remaining nine sites were classified as “likely altered” (7) or “very likely altered” (2).

- **Soft Algae**. Four of the sites were categorized as “likely intact.” Three of the sites in that category had scores over 1.0 being representative of reference type conditions. Nine sites were classified as “likely altered” or “very likely altered.” The majority of the lower scoring sites were located in developed watersheds, with impervious area ranging from 7% to 60%. Soft algae ASCI scores could not be calculated at four sites, presumably due to an insufficient number of soft bodied algae taxa needed to score the metric.

- **Hybrid.** Four of the seventeen bioassessment sites had ASCI scores that were classified as “possibly intact” or “likely intact” condition. The higher scoring sites were located in watersheds with impervious area that ranged from 1% to 19%. One of the four high scoring sites received a CSCI score that was in the second highest condition category (“possibly intact”).

Table 4-3. CSCI, ASCI, and IPI condition categories for 17 probabilistic urban sites sampled in Alameda County during WY 2018.

Station Code	Creek	CSCI	ASCI			IPI
			Diatom	Soft Algae	Hybrid	
204R03207	Alameda Creek	Very Likely Altered	Possibly Intact	Very Likely Altered	Likely Altered	Likely Altered
204R01415	Alameda Creek	Very Likely Altered	Likely Altered	Very Likely Altered	Very Likely Altered	Possibly Intact
204R03463	Alameda Creek	Very Likely Altered	Possibly Intact	Likely Altered	Likely Altered	Likely Altered
204R03737	Altamont Creek	Very Likely Altered	Likely Altered	Likely Altered	Very Likely Altered	Very Likely Altered
204R03620	Chabot Canal	Very Likely Altered	Very Likely Altered	Likely Altered	Very Likely Altered	Likely Altered
204R01695	Cull Creek	Possibly Intact	Likely Altered	Likely Intact	Likely Altered	Likely Intact
204R03279	Cull Creek	Likely Intact	Possibly Intact	NS	Likely Altered	Possibly Intact
204R02719	Cull Creek	Likely Altered	Possibly Intact	NS	Possibly Intact	Possibly Intact
204R03455	Estudillo Canal	Very Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R02340	Gold Creek	Very Likely Altered	Possibly Intact	Likely Altered	Possibly Intact	Very Likely Altered
204R03540	Martin Canyon Creek	Likely Altered	Likely Altered	Likely Intact	Likely Altered	Very Likely Altered
204R02695	Middle Fork Dry Creek	Likely Altered	Possibly Intact	NS	Possibly Intact	Possibly Intact
204R03719	Middle fork Dry Creek	Possibly Intact	Likely Altered	Likely Altered	Likely Altered	Possibly Intact
204R03311	San Leandro Creek	Very Likely Altered	Possibly Intact	Likely Intact	Possibly Intact	Likely Intact
204R03156	South San Ramon Creek	Very Likely Altered	Likely Altered	Very Likely Altered	Very Likely Altered	Likely Altered
204R03695	Unnamed tributary to San Lorenzo Creek	Possibly Intact	Possibly Intact	NS	Possibly Intact	Possibly Intact
204R03439	Ziele Creek	Possibly Intact	Likely Altered	Likely Intact	Likely Altered	Likely Intact

NS = No score calculated due to insufficient soft algae

Table 4-4. CSCI, ASCI, and IPI scores for 17 probabilistic urban sites sampled in Alameda County during WY 2018.

Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table.

Station Code	Creek	Impervious Area%	Flow Status	Highly Modified Channel	CSCI Score	ASCI			IPI Score
						Soft Bodied Algae	Diatoms	Hybrid Algae	
204R03207	Alameda Creek	7%	NP	Y	0.51	0.48	0.80	0.76	0.79
204R01415	Alameda Creek	7%	NP	Y	0.42	0.43	0.71	0.66	0.89
204R03463	Alameda Creek	8%	NP	Y	0.59	0.70	0.84	0.79	0.80
204R03737	Altamont Creek	2%	P	Y	0.24	0.70	0.63	0.67	0.22
204R03620	Chabot Canal	52%	P	Y	0.43	0.76	0.34	0.48	0.78
204R01695	Cull Creek	1%	NP	N	0.80	0.94	0.79	0.75	1.06
204R03279	Cull Creek	1%	NP	N	0.98	NS	0.83	0.79	0.87
204R02719	Cull Creek	1%	NP	N	0.71	NS	0.83	0.85	0.93
204R03455	Estudillo Canal	60%	P	Y	0.37	0.44	0.20	0.37	0.14
204R02340	Gold Creek	19%	NP	N	0.38	0.79	0.81	0.86	0.48
204R03540	Martin Canyon Creek	1%	P	N	0.69	1.02	0.71	0.72	0.67
204R02695	Middle Fork Dry Creek	1%	NP	N	0.78	NS	0.82	0.86	0.87
204R03719	Middle fork Dry Creek	1%	NP	N	0.84	0.73	0.76	0.75	0.85
204R03311	San Leandro Creek	8%	P	N	0.43	1.01	0.91	0.90	0.95
204R03156	South San Ramon Creek	25%	P	Y	0.33	0.34	0.66	0.55	0.74
204R03695	Unnamed tributary to San Lorenzo Creek	4%	P	N	0.87	NS	0.80	0.83	0.91
204R03439	Ziele Creek	18%	P	N	0.84	1.00	0.73	0.76	1.04

Y = yes, N = no, P = perennial, NP = nonperennial, NS = not calculated due to insufficient soft algae

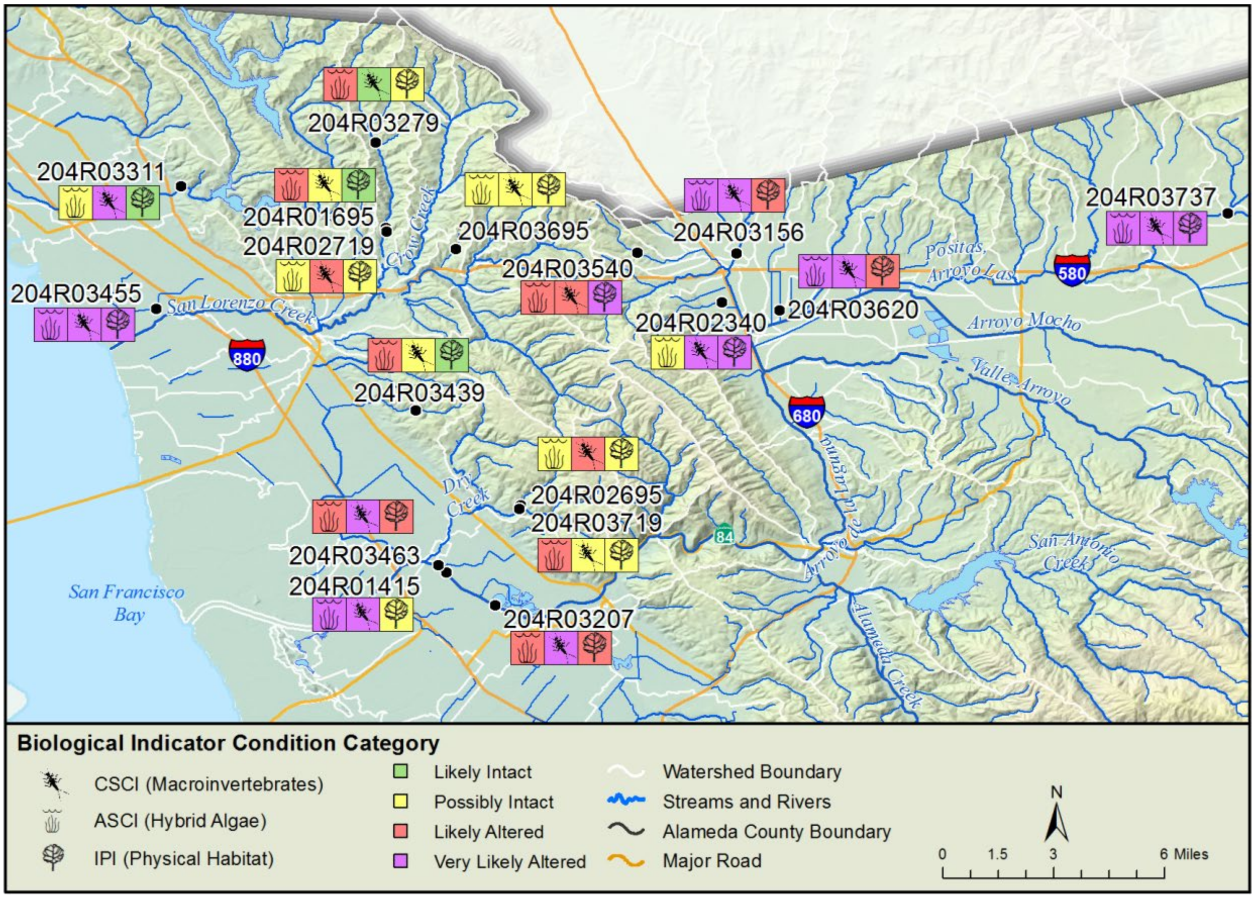

Figure 4-1. Condition categories for ASCI (hybrid), CSCU, and IPI scores for 17 bioassessment locations sampled by ACCWP during WY 2018.

4.2.2 Stressor Indicators: Biological Assessment

Descriptive statistics for CSCI, ASCI, and IPI scores are shown in Table 4-5.

Table 4-5. Descriptive statistics for CSCI, ASCI, and IPI scores for the 17 probabilistic sites sampled in Alameda County during Water Year 2018.

Statistic	CSCI	ASCI			IPI
		Diatom	Soft Algae	Hybrid	
Min	0.24	0.2	0.34	0.37	0.14
Median	0.59	0.79	0.73	0.76	0.85
Mean	0.60	0.72	0.72	0.73	0.76
Max	0.98	0.91	1.02	0.9	1.06

Site characteristic information, including watershed imperviousness, is presented in Table 4-4. As shown in Figure 4-2, there is a weak negative correlation between CSCI and percent imperviousness (r^2= 0.23). Conversely, there is a strong negative correlation (r^2= 0.66) between ASCI scores and percent imperviousness. It should be noted that other stressors, such as water chemistry and physical habitat conditions, could affect biological condition scores.

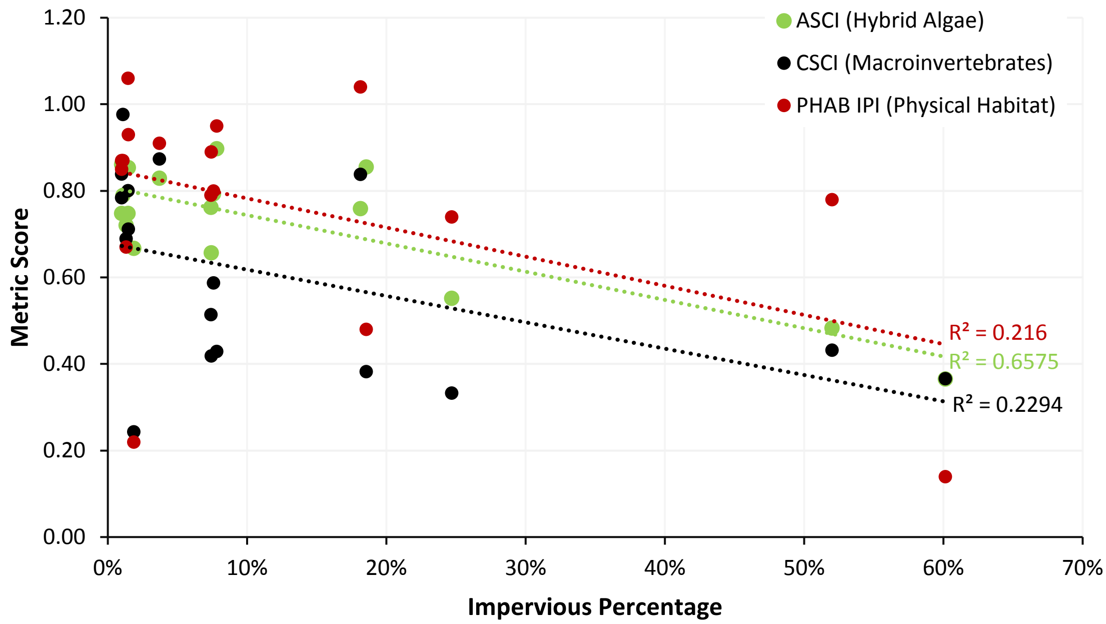

Figure 4-2. Linear correlation of CSCI, ASCI, and IPI scores with imperviousness percentage of watersheds for sites sampled during WY 2018.

Summary statistics for CSCI, ASCI, and IPI scores at non-perennial (n=9) and perennial sites (n=8) are presented in Table 4-6. Flow status was evaluated by ACCWP during site observations conducted in the dry season.

Table 4-6. Descriptive statistics of CSCI, ASCI, and IPI in relation to stream flow for data collected in WY 2018 in Alameda County.

Flow		CSCI	ASCI			IPI
			Diatom	Soft Algae	Hybrid	
Non-Perennial (n=9)	Min	0.38	0.71	0.43	0.66	0.48
	Max	0.98	0.84	0.94	0.86	1.06
	Mean	0.67	0.80	0.68	0.79	0.84
Perennial (n=8)	Min	0.24	0.2	0.34	0.37	0.14
	Max	0.87	0.91	1.02	0.9	1.04

	Mean	0.53	0.62	0.75	0.66	0.68

The ASCI Diatom and Hybrid index scores showed minimal positive correlation with the CSCI scores for the seventeen bioassessment sites sampled during WY 2018, as shown in Figure 4-3. Soft algae scores were not correlated with either CSCI scores or ASCI diatom scores.

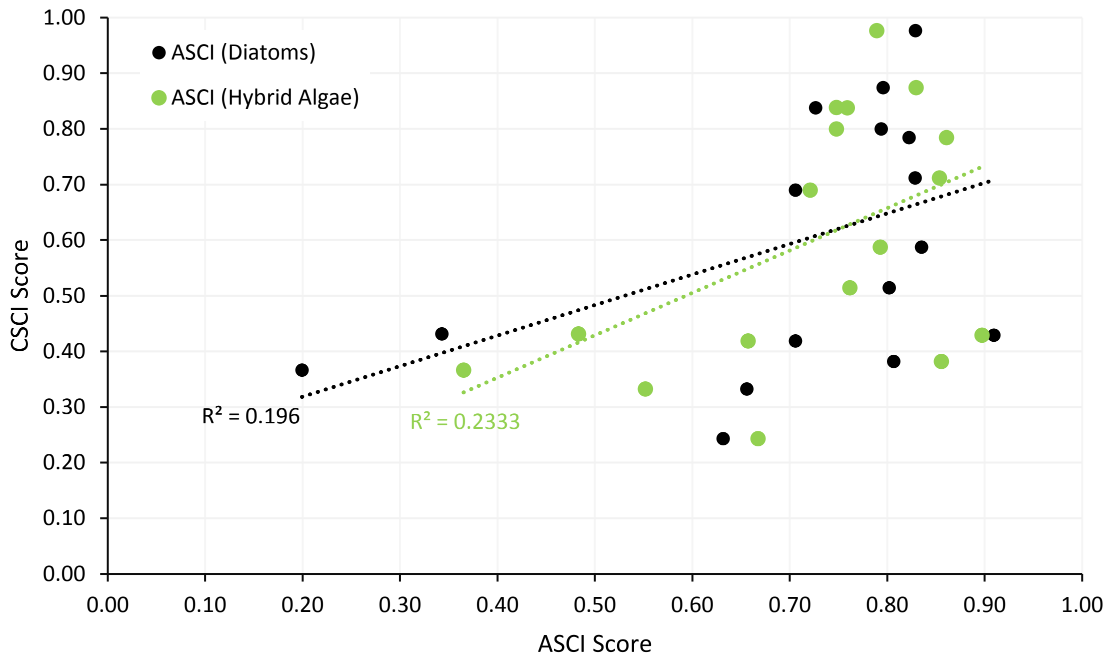

Figure 4-3. Linear correlation between ASCI (Diatom and Hybrid scores) and CSCI scores for 17 bioassessment sites sampled by ACCWP during WY 2018.

Physical habitat conditions, as represented by IPI scores, are listed in Table 4-4. Scores for the seventeen sites ranged from 0.14 to 1.06. Nine of the sites had scores greater than 0.83 indicating "possibly intact" or "likely intact" conditions. The remaining eight sites were classified as either "likely altered" or "very likely altered".

The IPI scores were moderately positively correlated with CSCI scores, and slightly less so with ASCI hybrid scores (Figure 4-4). There was little to no correlation between IPI scores and elevation or percent imperviousness, which are two factors that strongly correlate with CSCI scores.

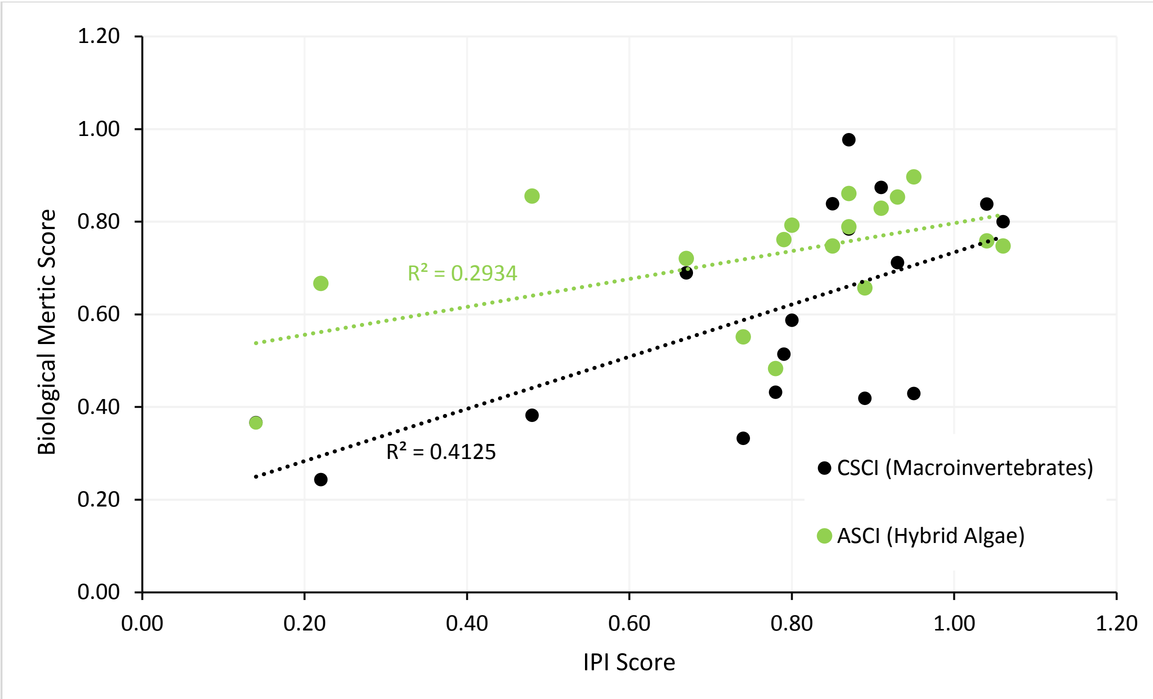

Figure 4-4. Linear regression between ASCI and CSCI scores and IPI scores for the 17 sites sampled by ACCWP during WY 2018.

During WY 2018 Alameda County staff sampled ten streams with unmodified channels and seven channels that were categorized as being highly modified or engineered. Box plots showing the distribution of the CSCI, Hybrid ASCI, and IPI scores for the two channel types are shown in Figure 4-5. The results show that median values for all indices were higher in unmodified channels. ASCI median scores were higher than CSCI median scores in modified channels, suggesting that degraded habitat conditions in modified channels may have less impact on the algal community compared to the benthic macro-invertebrate community.

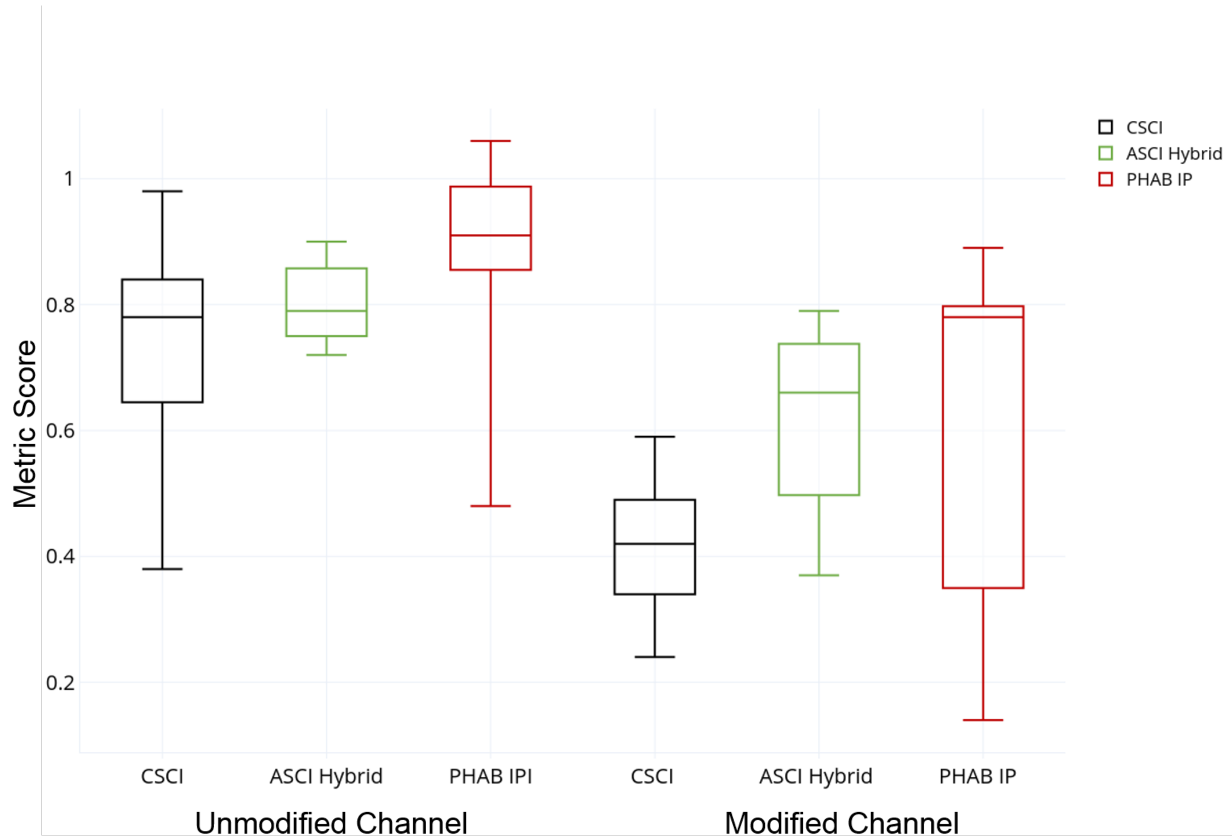

Figure 4-5. Box plots showing distribution of CSCI, Hybrid ASCI, and IPI scores for Unmodified Channel (n=10) and Modified Channel (n=7) sites sampled in Alameda County during WY 2018.

4.2.3 Stressor Indicators: Chemistry and Toxicity

Water Chemistry Parameters associated with bioassessment

Table 4-7 provides a summary of descriptive statistics for the nutrients[17] and algae-related analytes[18] collected in association with the bioassessment samples in receiving waters. For the purposes of data analysis, Total Nitrogen was calculated as the sum of nitrate + nitrite + Total Kjeldahl Nitrogen (TKN).

Table 4-7. Descriptive statistics for water chemistry results collected at RMC sites during WY 2018.

Nutrients and Algal analytes	N	N ≥ RL	Min	Max	Max Detected	Mean
Ammonia as N (mg/l)	17	11	<0.04	0.99	0.99	0.30
Nitrate as N (mg/l)	17	12	<0.02	1.3	1.3	0.25
Nitrite as N (mg/l)	17	2	0.001	0.085	0.085	0.011
Nitrogen, Total Kjeldahl (mg/l)	17	17	0.18	1.7	1.7	0.61
Nitrogen, Total (calculated) (mg/l)	17	NA	0.207	2.56	2.56	1.167
OrthoPhosphate as P (mg/l)	17	17	0.013	0.81	0.81	0.114
Phosphorus as P (mg/l)	17	14	<0.007	0.98	0.98	0.164
Silica as SiO2 (mg/l)	17	17	5.3	48	48	19.3
Chloride (mg/l)	17	17	24	2200	2200	198
Ash Free Dry Mass (mg/m^3)	17	17	14.4	613	613	221.5
Chlorophyll a (mg/l)	17	17	6.1	264	264	63.3

Water and Sediment Testing for Toxicity and Pesticides

The laboratory determines whether a sample is "toxic" by statistical comparison of the results from multiple test replicates of selected aquatic species in the environmental sample to multiple test replicates of those species in laboratory control water. The threshold for determining statistical significance between environmental samples and control samples is fairly small, with statistically significant toxicity often occurring for environmental test results that are as high as 90% of the Control. Therefore, there is a wide range of possible toxic effects that can be observed – from 0% to approximately 90% of the Control values.

For water and sediment sample toxicity and pesticide tests, provision C.8.g.iv requires Permittees to identify a site as a candidate SSID project when analytical results indicate any of the following, with applicability considerations noted in Section 3.4.3 above:

[17] Listed in C.8.d.i(4).

[18] Required in C.8.d.i(1) along with taxonomic and habitat-related parameters.

1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as "fail" if both the initial sampling and a second, followup sampling both have ≥ 50% Percent Effect;
2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan;
3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations.

The following sections discuss the results of WY 2018 monitoring in the context of MRP triggers. The tables that follow present the results of pesticide and toxicity tests conducted in WY 2018 evaluating the growth, reproduction, or survival of test organisms.

Wet and Dry Weather Aquatic Toxicity

Field personnel collected water samples in January, 2018 from three sites and in the summer from two sites. These samples were tested for aquatic toxicity using five test species: an aquatic plant (*Selenastrum capricornutum*), three aquatic invertebrates (*Ceriodaphnia dubia, Hyalella azteca, and Chironomous dilutus*), and one fish species (*Pimephales promelas* or fathead minnow). The following sections discuss the results of WY 2018 monitoring in the context of MRP triggers. The results are summarized in Table 4-8. For wet weather samples, in comparison to the control sample, one of the samples reached the toxicity threshold and follow-up sampling was conducted in March, 2018. That sample also exhibited statistically significant toxicity, but at a level below the trigger threshold. For dry weather samples, in comparison to the control samples, one of the samples reached the toxicity threshold and follow-up sampling will be conducted in WY 2019.

Table 4-8. Summary of WY 2018 dry season aquatic toxicity results.

Wet and Dry Weather Water Samples		Pass or fail in the initial sampling, and percent effect if toxic						
Sample Station	Collection Date	S. capricornutum	C. dubia		H. azteca	P. Promelas		C. dilutus
		Growth	Survival (% Effect)	Reproduction	Survival	Survival	Growth	Survival (% Effect)
205R01198	1/8/2018	Pass	Pass	Pass	Fail (17.6%)	Pass	Pass	Pass
204CVY010	1/9/2018	Pass	Pass	Pass	Pass	Pass	Pass	Fail (94.9%)
204SAU030	1/9/2018	Pass	Pass	Pass	Pass	Pass	Pass	Pass
204CVY010	3/1/2018							Fail (17.5%)
204AVJ020	7/17/2018	Pass	N/A (0%)	Pass	Pass	Pass	Pass	Fail (20%)
204LME100	7/17/2018	Pass	N/A (20%)	Pass	Pass	Pass	Pass	Fail (50%)

Dry Weather Sediment Toxicity

During the dry season, field personnel collected sediment samples concurrently with water toxicity samples, and tested sample material for both sediment toxicity and the sediment chemistry constituents identified in provision C.8.g.ii. As required in provision C.8.g.ii, for sediment toxicity, testing was performed with two species, *H. azteca*, a common benthic invertebrate, and C. *dilutus*. Acute (survival) endpoints were reported.

The results of the ACCWP WY 2018 sediment toxicity testing are summarized in Table 4-9 In comparison to the control samples, none of the samples surpassed the toxicity threshold therefore follow-up sampling was not required.

Table 4-9. Summary of WY 2018 dry season sediment toxicity results.

Dry Season Sediment Samples		Pass or fail in the initial sampling, and % effect if toxic	
Sample Station	Collection Date	H. azteca	C. dilutus
		Survival	Survival
204AVJ020	7/17/2018	Pass	Pass
204LME100	7/17/2018	Pass	Fail (15%)

Sediment Chemistry Parameters

Descriptive statistics for sediment chemistry data for samples collected in WY 2018 are provided in Table 4-10. Analytes are presented in alphabetical order. Table 4-10 lists additional properties of the sediment samples.

It should be noted that a number of the sediment chemistry constituents assessed per the list in MacDonald et al. (2000) required some grouping of analytes. For example, the MacDonald list includes 10 individual PAH compounds, as well as "Total PAHs". For this report, "Total PAHs" was computed as the sum of all 24 PAH compounds reported by the laboratory.

Table 4-10. Descriptive statistics for ACCWP WY 2018 sediment chemistry results

Analyte (units)	N	N ≥ MDL	Min	Max	Max Detected	Mean[1]
Arsenic (mg/Kg dw)	2	2	3.6	3.9	3.9	3.75
Bifenthrin (ng/g dw)	2	1	0.27*	2.7	2.7	1.5
Cadmium (mg/Kg dw)	2	2	0.09	0.3	0.3	0.2
Carbaryl (mg/Kg dw)	2	0	0.02*	0.02*	0	0.02
Chromium (mg/Kg dw)	2	2	23	26	26	24.5
Copper (mg/Kg dw)	2	2	18	30	30	24
Cyfluthrin, total (ng/g dw)	2	1	0.29*	2	2	1.15
Cyhalothrin, Total lambda- (ng/g dw)	2	0	0.16*	0.16*	0	0.16

Analyte (units)	N	N ≥ MDL	Min	Max	Max Detected	Mean[1]
Cypermethrin, total (ng/g dw)	2	1	0.27*	0.86	0.86	0.57
Deltamethrin/Tralomethrin (ng/g dw)	2	0	0.31*	0.32*	0	0.32
Esfenvalerate/Fenvalerate, total (ng/g dw)	2	0	0.34*	0.35*	0	0.345
Fipronil (ng/g dw)	2	0	0.26*	0.27*	0	0.27
Lead (mg/Kg dw)	2	2	15	71	71	43
Nickel (mg/Kg dw)	2	2	28	29	29	28.5
Permethrin (ng/g dw)	2	0	0.29*	0.29*	0	0.29
Total Organic Carbon (% dw)	2	2	1.6	2.6	2.6	2.1
Total PAHs (ng/g dw)	2	NA	484	15,200	15,197	7842
Zinc (mg/Kg dw)	2	2	81	200	200	141

Notes:

[1]As described below, the mean is calculated using a substitution of ½ MDL for non-detects.

* Indicates non-detect, a value that was below the detection limit.

Table 4-11. Total Organic Carbon and grain size statistics for ACCWP WY 2018 dry weather sediment samples.

Sample Station	Total Organic Carbon (% dw)	Percentages of sieved sample in small size classes			Percent of bulk sample in granule & pebble (> 2 mm)
		Silt & clay (<0.0625 mm)	Very fine to coarse sand (0.0625 - <1.0 mm)	Very coarse sand (1.0 - <2.0 mm)	
204AVJ020	2.6	14.4	76.7	9.0	7.0
204LME100	1.6	11.3	74.1	14.6	25.8

4.2 Stressor Assessment

This section addresses the question:

- ***"What are major stressors to aquatic life in the RMC area?"***

The monitoring requirements of MRP provisions C.8.d and C.8.g include evaluation of results with respect to specified trigger thresholds to identify whether a site is a candidate for a SSID project followup as required by provision C.8.e. The trigger criteria for each provision are listed below:

- **Bioassessment** - Sites scoring less than 0.795 according to the California Stream Condition Index (CSCI), or sites where there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites, as described in provision C.8.d.i.(8).

- **Chlorine -** A procedural follow-up is described in provision C.8.d ii(4) for chlorine samples when the initial field measurement is greater than 1.0 mg/L; the trigger is noted but not required to be listed as a candidate for SSID.

- **Pesticides and Toxicity** – Sites at which any of the following criteria in provision C.8.g.iv are met (as applicable, see discussion in Section 3.4.3 above):

  1) A toxicity test of growth, reproduction, or survival of any test organism is reported as "fail" in both the initial sampling and a second, followup sampling, and both have ≥ 50% Percent Effect;
  2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan;
  3) For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs).

The biological, physical, chemical and toxicity testing data produced by ACCWP during WY 2018 were compiled and evaluated against these trigger criteria. When the data analysis indicated that the associated trigger criteria were reached, those sites and results were identified as potentially warranting further investigation.

When interpreting analytical chemistry results, laboratory data often contain a relatively high proportion that is reported as either below method detection limits (MDLs) or between detection and reporting limits (RLs). Dealing with data in this range of the analytical spectrum introduces some level of uncertainty, especially when attempting to generate summary statistics for a dataset. In the compilation of statistics for analytical chemistry that follow, non-detect data (ND) were substituted with a concentration equal to one-half of the respective MDL as reported by the laboratory. This follows procedures agreed on for reporting the WY 2012 UCMR prepared for the four collaborating RMC Programs. The use of one-half of the MDL is the most common substitution in environmental science (e.g., Helsel 2010), and is thought to be more representative of laboratory results. Some of the results may therefore be slightly biased high or low with this associated analytical uncertainty, but this is not expected to affect the conclusions to any great extent.

4.3.1 Stressor Analysis: Bioassessment

Biological assessment condition categories (e.g., good, fair, poor) can assist in the presentation of bioassessment data and may or may not be tied to regulatory outcomes. 12 of the 17 sites sampled in WY 2018 had CSCI scores below the threshold of 0.795. Three additional sites were sampled but not included in the analysis here since they are part of an on-going SSID project (Appendix A4).

The stressor analysis revealed that most sites show alteration of biological communities, and channel modification and other habitat changes associated with urbanization are likely stressors for benthic macroinvertebrate communities. The low scores and condition categories for most sites sampled in WY 2018 are consistent with results from of previous years of monitoring in Alameda County and also supported by studies elsewhere.

Geomorphic changes to stream systems are commonly considered to begin as the effective impervious area of their catchment reaches approximately 10% (e.g. Schuler, 2004, SFBRWQCB 2012). However, Coleman et al. (2005) found that much lower thresholds of imperviousness initiated channel enlargement in the Southern California streams they studied, suggesting that arid-climate ephemeral to intermittent streams are very sensitive to slight changes in impervious area within their watersheds.

4.3.2 Stressor Analysis: Chemistry and Toxicity

Stressor analysis provides an analysis of water and sediment chemistry and toxicity testing results in comparison to various "trigger" thresholds included in the MRP. This analysis is intended to provide a means of identifying potential stressors that may impact beneficial uses at the Creek Status and Pesticide/Toxicity monitoring locations.

All monitoring conducted per provision C.8.g is subject to trigger criteria listed in C.8.g.iv:

1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as "fail" if both the initial sampling and a second, followup sampling, have ≥ 50% Percent Effect;
2) (2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;
3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations"

As noted in Section 3.4.3 above, Criterion (1) applies to toxicity results of water column and sediment monitoring in both dry weather and wet weather. Criterion (2) can apply to results of water column chemistry monitoring in both dry weather and wet weather, and also to water quality and chemistry samples collected at bioassessment sites. Criterion (3) applies to chemical results of sediment monitoring in dry weather.

Water Chemistry Parameters

Water chemistry parameters were analyzed using the trigger criterion in MRP provision C.8.g.iv(2) to compare each analyte's concentration with an applicable water quality objective (WQO) in the Basin Plan.

For consistency with bioassessment monitoring data analyses in previous years, this criterion was interpreted to include other relevant water quality standards or accepted thresholds developed from available sources beyond the SF Basin Water Quality Control Plan (Basin Plan)

(SFBRWQCB 2013), including the California Toxics Rule (CTR) (USEPA 2000a), and various USEPA sources. Of the nine nutrient-related water quality constituents monitored in association with the bioassessment monitoring, water quality standards or established thresholds are available only for ammonia (unionized form), chloride, and nitrate plus nitrite, the latter two for waters with MUN beneficial use only, as indicated in Table 4-12.

For ammonia, the standard provided in the Basin Plan (pp. 3-7) applies to the un-ionized fraction, as the underlying criterion is based on un-ionized ammonia, which is the more toxic form. Conversion of RMC monitoring data from the measured total ammonia to un-ionized ammonia was therefore necessary. The conversion was based on a formula provided by the American Fisheries Society[19], and calculates un-ionized ammonia in freshwater systems from analytical results for total ammonia and field-measured pH, temperature, and electrical conductivity.

For chloride, a Secondary Maximum Contaminant Level (MCL) of 250 mg/L applies to those waters with MUN beneficial use, per the Basin Plan (Table 3-5), Title 22 of the California Code of Regulations (CDPH, internet source), and the USEPA Drinking Water Quality Standards (USEPA, internet source). This same threshold is additionally established in the Basin Plan (Table 3-7) for waters in the Alameda Creek watershed above Niles. For all other waters, the Criteria Maximum Concentration (CMC) water quality criterion of 860 mg/L (acute) and the Criterion Continuous Concentration (CCC) of 230 mg/L (USEPA Water Quality Criteria[20]) for the protection of aquatic life were used for comparison purposes.[21]

[19]fisheries.org/hatchery

[20]National Recommended Water Quality Criteria**.** USEPA's compilation of national recommended water quality criteria is presented as a summary table containing recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants. These criteria are published pursuant to Section 304(a) of the Clean Water Act (CWA) and provide guidance for states and tribes to use in adopting water quality standards.

water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm

[21]As agreed by RMC members for the first UCMR (BASMAA (2012) the RMC participants used the 230 mg/L threshold as a conservative benchmark for comparison purposes for all locations not specifically identified within the Basin Plan, i.e. sites not within the Alameda Creek watershed above Niles nor identified as MUN; rather than the maximum concentration criterion of 830mg/L .

The nitrate + nitrite primary MCL applies to those waters with MUN beneficial use, per the Basin Plan (Table 3-5), Title 22 of the California Code of Regulations, and the USEPA Drinking Water Quality Standards.

Table 4-12. Water quality thresholds available for comparison to ACCWP WY 2018 water chemistry constituents

Sample Parameter	Threshold	Units	Frequency/ Period	Application	Source
Ammonia	0.025	mg/L	Annual median	Unionized ammonia, as N. [Maxima also apply to Central Bay and u/s (0.16) and Lower Bay (0.4)]	SF Bay Basin Plan Ch. 3, p. 3-7
Chloride	230	mg/L	Criterion Continuous Concentration	Freshwater aquatic life	USEPA Nat'l. Rec. WQ Criteria, Aquatic Life Criteria
Chloride	860	mg/L	Criteria Maximum Concentration	Freshwater aquatic life	USEPA Nat'l. Rec. WQ Criteria, Aquatic Life Criteria Table
Chloride	250	mg/L	Secondary Maximum Contaminant Level	Alameda Creek Watershed above Niles and MUN waters, Title 22 Drinking Waters	SF Bay Basin Plan Ch. 3, Tables 3-5 and 3-7; CA Code Title 22; USEPA Drinking Water Stds. Secondary MCL
Nitrate + Nitrite (as N)	10	mg/L	Maximum Contaminant Level	Areas designated as Municipal Supply	SF Bay Basin Plan Ch. 3, Table 3-5

The comparisons of the measured nutrients data to the thresholds listed in Table 4-12 are shown in Table 4-13. The results for these three constituents are plotted against the prevailing thresholds in Figure 4-6 through Figure 4-8.

Of the 17 sites monitored in 2018, the water quality standard was exceeded at two sites for unionized ammonia, and ammonia and unionized ammonia concentrations averaged 0.11 mg/L and 7.4 µg/L, respectively. Of the 22 sites monitored in 2017, the water quality standard was exceeded at one site for unionized ammonia and ammonia and unionized ammonia concentrations averaged 0.11 mg/L and 7.4 µg/L, respectively. In 2016, ammonia and unionized ammonia concentrations averaged 0.06 mg/L and 2.9 µg/L, respectively; an improvement over 2015 results where ammonia and un-ionized ammonia concentrations averaged 0.16 mg/L and 10.6 µg/L, respectively.

For chloride, the water quality standard was exceeded at two sites (12% of sites) in 2018 and averaged 198 mg/L across all probabilistic sites. For chloride, the water quality standard was exceeded at two sites (9% of sites) in 2017 and averaged 104 mg/L across all sites. The water quality standard was exceeded at one site (5% of sites) in 2016 (204R02116) and averaged 77.9 mg/L across all sites. There were four sites (18% of sites) above the threshold in 2015, with an average concentration of 172 mg/L.[22] There were 3 measurements of chloride (17% of sites) above the threshold in 2014.

No sites exceeded the nitrate + nitrite standard in 2018. One site exceeded the nitrate + nitrite standard in 2017, however the threshold did not apply to this site given its designated beneficial uses. In 2016, 2015, and 2014 no samples exceeded the nitrate + nitrite standard.

Based upon the above information, one or more water quality standards or applicable thresholds were exceeded at 4 of the 17 sites (24%) which is more than the 14% of sites in 2017 and 5% of sites in 2016 with at least one result above identified thresholds.

Table 4-13. Comparison of water quality (nutrient) data to associated water quality thresholds for WY 2018 water chemistry results. (NDs estimated as ½ MDL).

Site Code	Alameda Creek Above Niles	MUN	Parameter and Threshold			# of Parameters >Threshold/ Waterbody	% of Parameters >Threshold/ Waterbody
			Un-ionized Ammonia (as N)	Chloride	Nitrate + Nitrite (as N)		
			25 µg/L	230/250 mg/L [1]	10 mg/L [2]		
204R01415			19.12	86	0.06	0	0%
204R01695			**65.10**	49	0.16	1	33%
204R02340	X		1.63	100	0.01	0	0%
204R02695			1.11	35	0.07	0	0%
204R02719			22.90	49	0.19	0	0%
204R03156	X		2.46	140	0.03	0	0%
204R03207			0.28	79	0.05	0	0%
204R03279			0.51	38	0.28	0	0%
204R03311			2.22	24	0.18	0	0%
204R03439			17.73	39	0.15	0	0%
204R03455			24.41	34	1.39	0	0%
204R03463			**31.71**	83	0.06	1	33%
204R03540	X		0.67	50	0.11	0	0%
204R03620	X		7.41	**280**	1.38	1	33%
204R03695		X	0.62	41	0.21	0	0%

[22] This assessment would drop to two sites above the standard with usage of the CMC (860 mg/L) in place of the CCC of 230 mg/L, as two of the instances occurred sites within Alameda Creek above Niles, and would therefore be measured against the criterion of 250 mg/L.

Site Code	Alameda Creek Above Niles	MUN	Parameter and Threshold			# of Parameters >Threshold/ Waterbody	% of Parameters >Threshold/ Waterbody
			Un-ionized Ammonia (as N)	Chloride	Nitrate + Nitrite (as N)		
			25 µg/L	230/250 mg/L [1]	10 mg/L [2]		
204R03719			0.94	35	0.04	0	0%
204R03737	X		4.16	**2200**	0.01	1	33%
# Values >Threshold:			2	2	0		
% Values >Threshold:			12%	12%	0%		
Overall Number and % of Sites Meeting Trigger Criterion 3:						4	24%
Sites From SSID Project, Not Included In This WY's Probabilistic Analysis							
204R03135			0.45	32	0.34	0	0%
204SAU070			0.29	32	0.41	0	0%
204SAU130			0.33	33	0.56	0	0%

Bolded values exceed threshold

[1] 250 mg/L threshold applies for sites with MUN beneficial use and Alameda Creek above Niles per Basin Plan.

[2] Nitrate + nitrite threshold applies only to sites with MUN beneficial use.

[3] Sites where >20% of results exceed one or more water quality standard or established threshold.

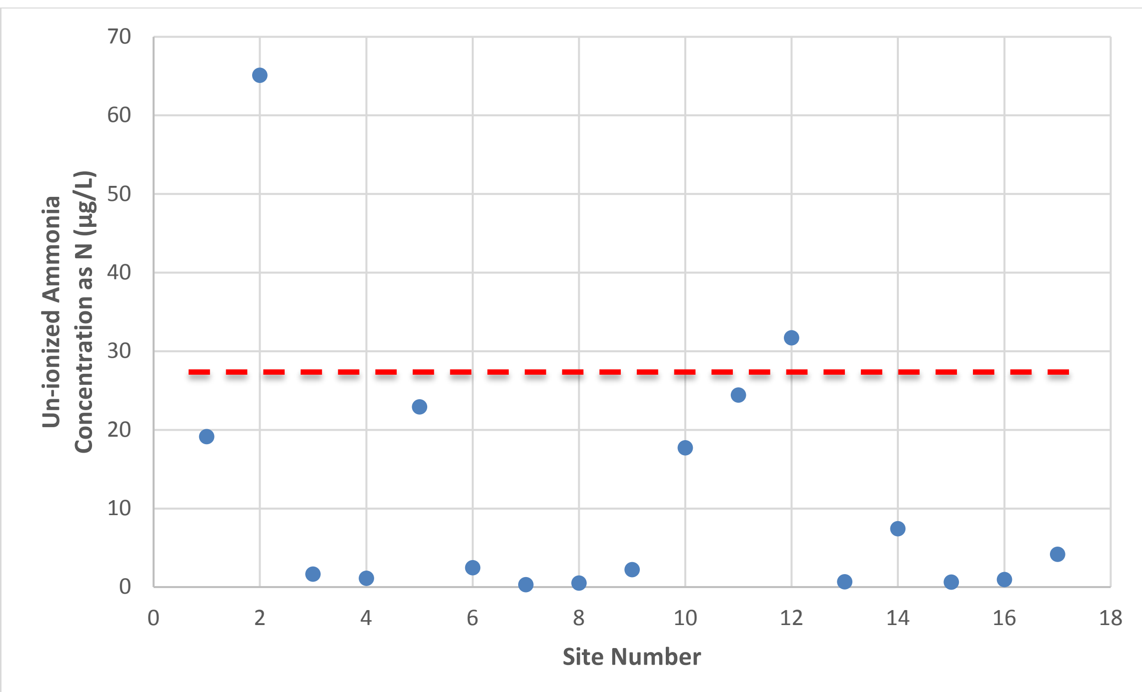

Figure 4-6. Plot of ACCWP WY 2018 unionized ammonia data (calculated from total ammonia, pH, temperature, and electrical conductivity) with threshold of 25 µg/L indicated.

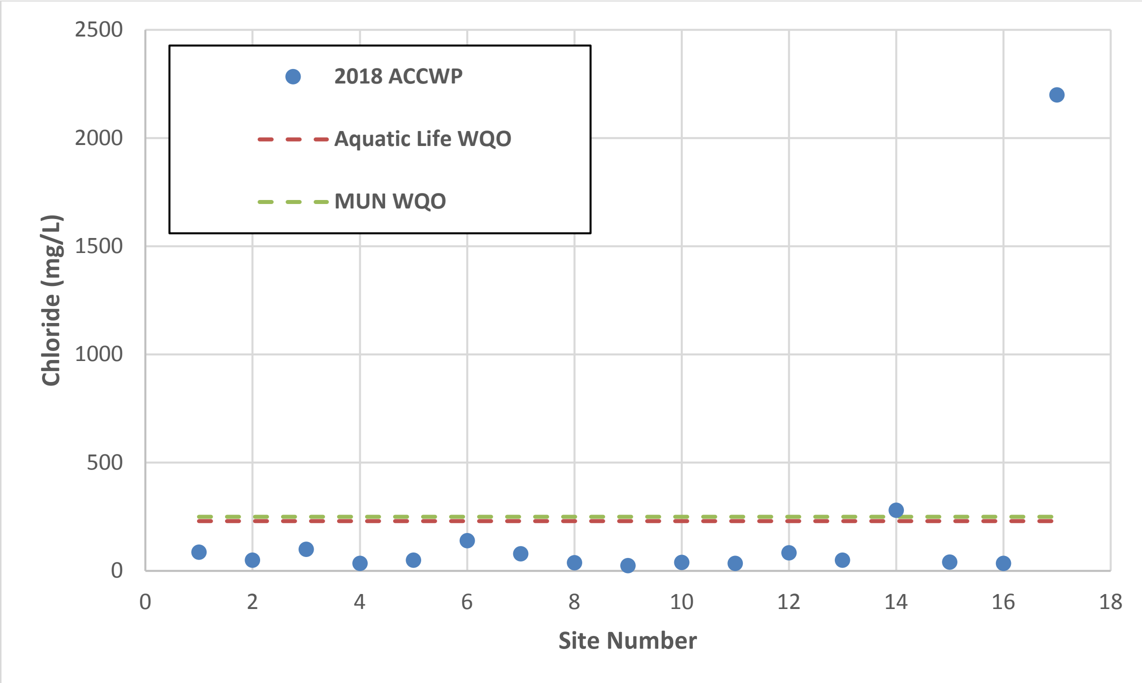

Figure 4-7. Plot of ACCWP WY 2018 chloride data with relevant Aquatic Life and MUN thresholds indicated.

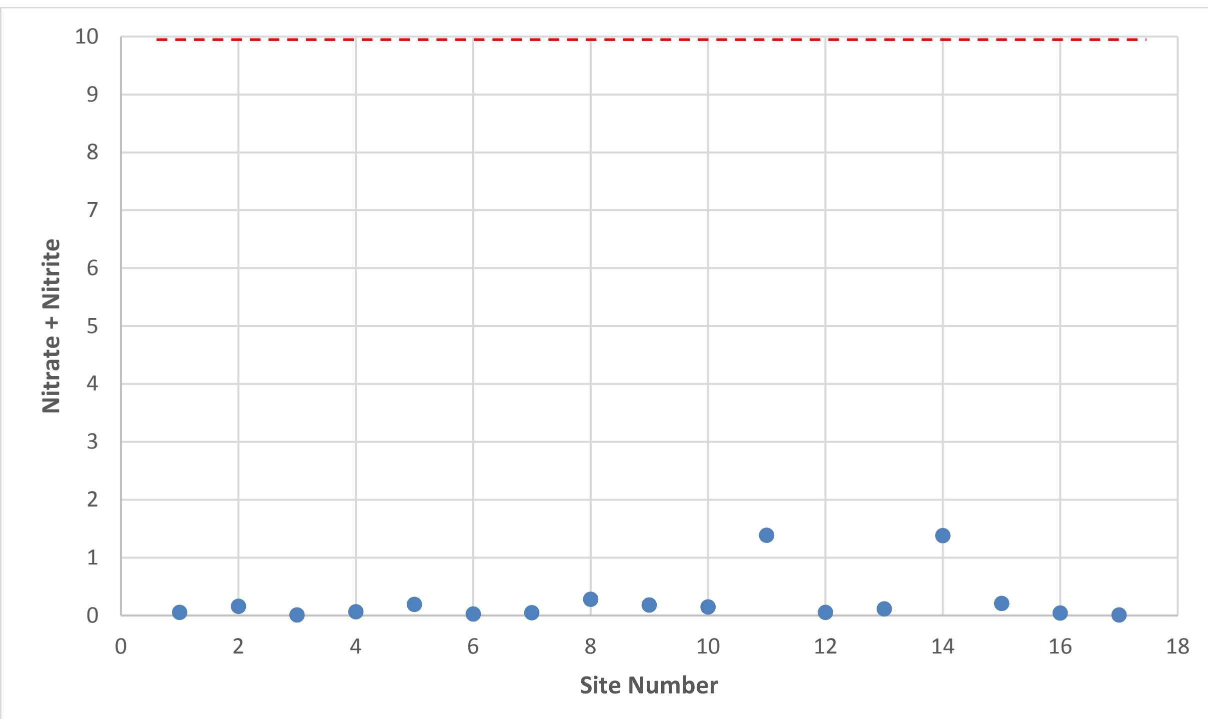

Figure 4-8. Plot of ACCWP WY 2018 nitrate + nitrite as N data, WY 2018 data (threshold = 10 mg/L for MUN only).

Free and Total Chlorine Testing

The results of field testing for free and total chlorine and comparisons to the MRP trigger threshold are summarized in Table 4-14. The MRP trigger criterion for chlorine states, “After immediate resampling, concentrations remain >0.10 mg/L.” If the resample is still greater than 0.1 mg/L, the observation is reported to the appropriate Permittee central contact point for illicit discharges, so that the illicit discharge staff can investigate and abate the associated discharge in accordance with its provision C.5.e – Spill and Dumping Complaint Response Program.

There were 20 site measurements (17 at probabilistic sites) for free and total chlorine collected by ACCWP in WY 2018. As was the case in 2017, 2016 and 2015, none of the sites exceeded the thresholds for free and total chlorine that would trigger follow-up testing.

Table 4-14. Summary of ACCWP WY 2018 chlorine testing results in comparison to Municipal Regional Permit trigger criteria.

Site Code	Sample Date	Chlorine, Free	Chlorine, Total	Meets Trigger Threshold?
204R01415	5/23/2018	<0.04	<0.04	No
204R01695	5/21/2018	<0.04	<0.04	No
204R02340	4/30/2018	<0.04	<0.04	No
204R02695	5/2/2018	<0.04	<0.04	No
204R02719	5/21/2018	<0.04	<0.04	No
204R03156	6/13/2018	<0.04	<0.04	No
204R03207	5/1/2018	<0.04	<0.04	No
204R03279	5/3/2018	<0.04	<0.04	No
204R03311	5/8/2018	<0.04	<0.04	No
204R03439	5/22/2018	<0.04	<0.04	No
204R03455	6/4/2018	<0.04	<0.04	No
204R03463	5/23/2018	<0.04	<0.04	No
204R03540	4/30/2018	<0.04	<0.04	No
204R03620	5/9/2018	0.02	0.08	No
204R03695	5/10/2018	<0.04	<0.04	No
204R03719	5/2/2018	<0.04	<0.04	No
204R03737	5/9/2018	<0.04	<0.04	No
204R03135*	5/24/2018	<0.04	<0.04	No
204SAU070*	5/7/2018	<0.04	<0.04	No
204SAU130*	5/7/2018	<0.04	<0.04	No
Number of samples exceeding 0.1 mg/L:		0	0	0
Percentage of samples exceeding 0.1 mg/L:		0%	0%	0%

*Sites were sampled as part of an SSID project and were not part of the current WY's probabilistic sampling

Water and Sediment Toxicity Testing

The analysis of toxicity testing results and comparisons to MRP trigger thresholds, as presented in detail earlier in this section, are summarized in Table 4-15 for those WY 2018 samples that exhibited statistically-significant toxicity.

The MRP provision C.8.g.iv trigger criteria for water column and sediment toxicity stipulates:

The Permittees shall identify a site as a candidate SSID project when analytical results indicate any of the following:

> (1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as "fail" if both the initial sampling and a second, followup sampling, have ≥ 50% Percent Effect;

(2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;

(3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations"

For the dry season sampling, one of the samples collected (site 204LME100) exhibited statistically-significant toxicity at the 50% threshold for followup sampling. This sampling will take place in WY 2019.

For the wet season sampling, one of the samples collected exhibited statistically-significant toxicity above the 50% threshold for followup sampling. Results from followup sampling at that site (204CVY010) for that species (*C. dilutus)* fell below the 50% trigger threshold.

Table 4-15. Overall summary of WY 2018 aquatic and sediment toxicity samples with toxic response in comparison to Municipal Regional Permit trigger criteria.

Test Initiation Date	Species Tested	Test Regimen	Treatment/ Sample ID	Comparison to Provision C.3.g.iv Trigger Criteria
Water				
1/9/2018	*C. dilutus*	Survival	204CVY010	≥ 50% Effect
7/17/2018	*C. dilutus*	Survival	204AVJ020	< 50% Effect
7/17/2018	*C. dilutus*	Survival	204LME100	≥ 50% Effect
Sediment				
7/17/2018	*C. dilutus*	Survival	204LME100	< 50% Effect

Sediment Chemistry Parameters

Sediment chemistry results could potentially be evaluated as potential stressors in two ways, based upon the criteria (2) and (3) from MRP provision C.8.g.iv:

(2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;

(3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations.

The Basin Plan currently contains no WQOs for bedded sediment.

Table 4-16 provides Threshold Effect Concentration (TEC) quotients and Probable Effects Concentrations (PEC) quotients as available for sediment chemistry constituents, calculated as the measured concentration divided by the TEC or PEC value given in MacDonald et al. (2000)[23]. This table also provides a count of the number of constituents that exceed TEC or PEC values for each site, as evidenced by a TEC or PEC quotient greater than or equal to 1.0.

For WY 2018 samples, the number of TEC quotients greater than or equal to 1.0 for each site, was 1 for site 204AVJ020 and 13 for site 204LME100, out of the 17 measured constituents that were included in MacDonald et al. (2000). Site 204LME100 had a PEC quotient greater than one for five constituents.

Some of the calculated numbers for TEC and PEC quotients may be artificially elevated due to the method used to account for filling in non-detect data (as discussed previously, concentrations equal to one-half of the respective laboratory MDLs were substituted for non-detect data so these statistics could be computed). This, however, is not expected to greatly influence interpretation.

Table 4-16. Threshold Effect Concentration (TEC) or Probable Effect Concentration (PEC) quotients for WY 2018 sediment chemistry constituents. Bolded values indicate individual TEC or PEC quotients > 1.0.

Site ID	TEC Quotient		PEC Quotient	
	204AVJ020	204LME100	204AVJ020	204LME100
Metals (mg/kg DW)				
Arsenic	0.40	0.37	0.12	0.11
Cadmium	0.09	0.30	0.02	0.06
Chromium	0.60	0.53	0.23	0.21
Copper	0.57	0.95	0.12	0.20
Lead	0.42	1.98	0.12	0.55
Nickel	1.28	1.23	0.60	0.58
Zinc	0.67	1.65	0.18	0.44
PAHs (µg/kg DW)				
Anthracene	0.03	5.42	0.00	0.37
Fluorene	0.02	8.01	0.00	1.16
Naphthalene	0.02	1.76	0.01	0.55
Phenanthrene	0.01	13.73	0.00	2.39
Benz(a)anthracene	0.19	2.87	0.02	0.30
Benzo(a)pyrene	0.14	2.73	0.01	0.28
Chrysene	0.51	10.84	0.07	1.40
Fluoranthene	0.26	6.15	0.05	1.17
Pyrene	0.56	11.28	0.07	1.45
Total PAHs	0.30	9.44	0.02	0.67
Number of constituents with TEC or PEC quotient > 1.0	1	13	0	5

[23] TEC and PEC values were not available in MacDonald et al. (2000) for the measured pesticides (pyrethroids, carbaryl and fipronil) and none were found in more recent literature.

5. Conclusions and Next Steps

During WY 2018, ACCWP monitored 17 sites under the RMC regional probabilistic design for bioassessment, physical habitat, and related water chemistry parameters. Five additional sites were monitored for water and sediment toxicity and sediment chemistry. The water and sediment chemistry and toxicity data were used to evaluate potential stressors that may affect aquatic habitat quality and beneficial uses. Each program also used bioassessment and related data to develop a preliminary condition assessment for the monitored sites, to be used in conjunction with the stressor assessment based on sediment chemistry and toxicity.

The following MRP reporting requirements (Provision C.8.h.vi) were addressed within this report as applicable:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat/longs coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for each monitoring program component;
- A listing of volunteer and other non-Permittee entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards;

5.1 Summary of Stressor Analyses

The stressor analysis revealed the following potential stressors or stress conditions at WY 2018 sites:

- **Water Quality** – Of 11 parameters[24] sampled in association with WY 2018 bioassessment monitoring, applicable water quality standards were only identified for

[24] Algal mass (ash-free dry weight), Chlorophyll a, Ammonia, Nitrate, Nitrite, TKN, Total Nitrogen, OrthoPhosphate, Phosphorus, Silica and Chloride

ammonia, chloride, and nitrate + nitrite (for sites with MUN beneficial use only). Of the results generated at the 20 sites monitored by ACCWP reporting herein for those three parameters, two chloride, two un-ionized ammonia, and no nitrate + nitrite concentrations exceeded the applicable water quality standard or threshold.

- **Water Toxicity –** For WY 2018, 14 aquatic toxicity endpoints were derived through testing of 5 species at 2 sites county-wide during one dry season event. Of these endpoints, two sample / test combinations exhibited statistically-significant toxicity as reported by the analytical laboratory (*C. dilutus* survival at both sites). Results for *C. dilutus* survival at site 204LME100 exhibited toxicity at the threshold of ≥50% Effect. Follow-up sampling will be conducted in WY 2019.

  For the wet season sampling, one of the samples collected exhibited statistically-significant toxicity above the 50% threshold for followup sampling. Results from followup sampling at that site (204CVY010) for that species (*C. dilutus)* fell below the 50% trigger threshold.

- **Sediment Toxicity –** Of the bedded sediment collected from 2 sites, a toxic response of greater than 50% effect was not observed at either site.

- **Sediment Chemistry –** At site 204LME100, 5 constituents were present above the Probable Effect Concentration (PEC). Site 204LME100 had 13 constituents above the Threshold Effect Concentration (TEC) and site 204AVJ020 had 1.

- **Bioassessment –** 12 of the 17 sites sampled in WY 2018 had CSCI scores below the threshold of 0.795.

5.2 Next Steps

MRP provisions C.8.d and C.8.g require monitoring results to be evaluated for triggers according to the criteria in these provisions of the MRP as shown above. During WY 2018, the RMC collaboratively reviewed trigger results from previous WYs and initiated new stressor/source identification (SSID) projects as required by provision C.8.e.ii(1) for regionally conducted projects. Additional projects will be initiated during WY 2019. Attachment B of the main UCMR provides a status update on SSID projects initiated during MRP1 and MRP2, and a progress report on the current SSID project in Alameda County is provided in Appendix A.4.

ACCWP and other RMC participants will continue to implement the regional probabilistic monitoring design in WY 2019. Site evaluation is underway for new bioassessment sites for WY 2019. Candidate sites classified with unknown sampling status as of WY 2019 may continue to be evaluated for potential sampling in WY 2019.

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Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

CREEK STATUS MONITORING REPORT - TARGETED PARAMETERS

APPENDIX A.2

URBAN CREEKS MONITORING REPORT

OCTOBER 2017 THROUGH SEPTEMBER 2018

Report prepared by

Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2019

Acknowledgements

Horizon Water and Environment, LLC contributed substantially to the preparation of this report. Applied Marine Sciences, Inc. contributed substantially to the implementation of monitoring activities and preparation of the data analysis and discussion for this report.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed framework for preparation of the Urban Creeks Monitoring Report (UCMR) used by ACCWP and other stormwater programs to comply with the Municipal Regional Stormwater Permit (MRP)[1] requirements for reporting on monitoring data collected under the MRP Monitoring Provision C.8.

The following participants make up the RMC and are responsible for preparing UCMR documents on behalf of their respective member agencies:

- Alameda Countywide Clean Water Program (ACCWP);
- Contra Costa Clean Water Program (CCCWP);
- San Mateo County Wide Water Pollution Prevention Program (SMCWPPP);
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP);
- Fairfield-Suisun Urban Runoff Management Program (FSURMP); and
- City of Vallejo and Vallejo Sanitation and Flood Control District (Vallejo).

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Creek Status Monitoring data collected in Water Year 2018 (October 1, 2017 through September 30, 2018) in accordance with the RMC's Monitoring Plan (BASMAA, 2011) for certain parameters monitored according to Provision C.8.d of the MRP. This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

- The cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City;
- Alameda County;
- Alameda County Flood Control and Water Conservation District and
- Zone 7 of the Alameda County Flood Control and Water Conservation District.

Data presented in this report were produced under the direction of the ACCWP using a targeted (non-probabilistic) monitoring design. Other data collected in Alameda County during this

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015) which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

period pursuant to MRP Provision C.8 are reported in the main body and other appendices of ACCWP's UCMR for Water Year (WY) 2018.

As described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA, 2011), targeted monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA, 2012a, 2014a and 2016a) and BASMAA RMC Standard Operating Procedures (SOPs, BASMAA, 2012b, 2014b and 2016b).

In accordance with the reissued MRP (also "MRP2", SFBRWQCB, 2015a) ACCWP will also submit the data included in this report by March 31, 2019 to the California Environmental Data Exchange Network and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) in electronic SWAMP-comparable format.

In addition to the RMC participants, San Francisco Bay Regional Water Quality Control Board staff, Kevin Lunde and Jan O'Hara, also participated in RMC workgroup meetings that contributed to design and implementation of the RMC Monitoring Plan. Additionally, these staff also provided input regarding previous Urban Creeks Monitoring Reports and threshold "trigger" criteria for stressor analyses conducted therein.

List of Acronyms

Acronym	Definition
AMS	Applied Marine Sciences
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
DO	Dissolved oxygen
DQO	Data Quality Objective
E.coli	Escherichia coli
EPA	United States Environmental Protection Agency
FIB	Fecal Indicator Bacteria
FSURMP	Fairfield Suisun Urban Runoff Management Program
MPC	Monitoring and Pollutants of Concern Committee
MPN	Most Probable Number
MRP	Municipal Regional Permit
MRP1	Municipal Regional Permit, issued 2009
MRP2	MRP, reissued 2015
MWAT	Maximum Weekly Average Temperature
NPDES	National Pollution Discharge Elimination System
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance Quality Control
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board; (California Regional Water Quality Control Board, San Francisco Bay Region)
SMCWPPP	San Mateo County Water Pollution Prevention Program
SOP	Standard Operating Protocol
SSID	Stressor/Source Identification
STV	Statistical Threshold Value
SWAMP	Surface Water Ambient Monitoring Program
UCMR	Urban Creek Monitoring Report
WQO	Water Quality Objective
WY	Water Year
°C	degrees centigrade

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Executive Summary

In 2010, the seventeen members of the Alameda Countywide Clean Water Program (ACCWP) joined other members of the Bay Area Stormwater Agencies Association (BASMAA) to form the Regional Monitoring Coalition (RMC), to coordinate and oversee water quality monitoring required by Provision C.8 of the Municipal Regional Stormwater Permit (MRP). This report is an appendix to the Urban Creeks Monitoring Report (UCMR) prepared to assist ACCWP member agencies in complying with the MRP Reporting Provision C.8.h, reporting details of the Creek Status Monitoring for parameters that use a targeted (non-probabilistic) monitoring design. Other parameters were addressed using a regional probabilistic design, and are reported in a separate Regional Appendix A.1[2] to the UCMR.

The ACCWP Targeted Creek Status Monitoring in Water Year 2018 (WY 2018) focused on the Sausal Creek and Mission Creek Watersheds. Overall targeted monitoring activities included:

- Continuous temperature monitoring at eight[3] locations at hourly intervals over six months with conductivity monitoring at four of those locations (continuous temperature monitoring was also conducted for approximately two months at a ninth location);
- General Water Quality monitoring at three locations with assessment of temperature, dissolved oxygen (DO), pH and specific conductivity at 15-minute intervals during two one- to two-week periods in Spring and Fall; and
- Pathogen indicator (*E. coli* and *Enterococci*) quantification at five sites;

The results of the targeted Urban Creek Monitoring are summarized below:

Continuous Temperature

The temperature "trigger" described in the MRP for a candidate SSID project is defined as when two or more weekly average temperatures, calculated as non-overlapping periods, exceed a Maximum Weekly Average Temperature (MWAT) of 17.0°C for a steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C. All WY 2018 temperature monitoring sites were in streams with COLD Beneficial use, and three sites experienced at least two MWATs above 17.0°C but none exceeded the 24°C instantaneous maximum in 20% of the results.

[2] Similar methods and QA/QC procedures are being implemented for Stressor-Source Identification (SSID) studies reported in Appendices A.4 to the UCMR;

[3] The minimum required number of temperature monitoring sites was eight.

General Water Quality

Results of the General Water Quality assessment are presented in Table E-1. No temperature or pH triggers were reached at any of the sites, while DO values at two sites fell below 7 mg/L for more than 20% of recorded measurements. For additional discussion of these results, see the report of the Stressor Source Identification Study in UCMR Appendix A.4.

Table E-1.Comparison of General Water Quality Observations to Trigger Thresholds at Sites 204R03135, 204SAU070, 204SAU200 in WY 2018.

Station	Monitoring Season (No of MWATs)	Applicable threshold or water quality standard					
		Temperature MWATs > 17°C (> 19°C)	Temp % > 24˚C	Specific Cond. >2000 µS/cm	pH < 6.5	pH > 8.5	DO < 7 mg/L (COLD)
204R03135	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	94%
204SAU070	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	42%
204SAU200	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	0%

°C = degrees centigrade

Pathogen Indicator Bacteria

Sampling of the required five sites was successfully completed on June 28, 2018. The results are presented in Table E-2. Of the 10 datapoints generated through ACCWP monitoring in 2018, five points from four sites exceeded the STV. Results in previous years have varied greatly. The same two tests were run in 2017 and 2016. Of the 10 datapoints generated through ACCWP monitoring in 2017, only one, a reported enterococcus concentration of 173 MPN/100 mL at site 204SAU110, exceeded the STV. In 2016, results for samples collected in Castro Valley Creek watershed for *E. coli* ranged from 800 to 3000 MPN/100 mL and those for enterococcus ranged from 800 to 9000 MPN/100 mL. Mission Creek is designated for both contact (REC-1) and non-contact (REC-2) recreation, and the four sampling sites are located near trails and in areas with easy access (Gomes Park, Fremont Park Golf Course, Lake Elizabeth, Mission San Jose Park).

Table E-2.Comparison of WY 2018 Pathogen Indicator Concentrations to Water Quality Objectives and Triggers – ACCWP June 28, 2018 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN*/100mL)	E. coli (MPN*/100 mL)
205Z6M010	Minor contribution to flow to Mission Creek, Public park (Lake Elizabeth)	Mission Creek	**>2419.2**	172.3
205Z6M1010	Golf course with public trail; flow appears recently disconnected from Mission Creek (i.e., sampled isolated pool)	Mission Creek	12.2	83.3
205Z6L2010	Minor contribution to flow to Mission Creek	Mission Creek	**>2419.2**	**435.2**
205R02670	Mission Creek approx 250 m upstream of Valdez Pl. (within Gomes Park)	Mission Creek	**154.1**	115.3
205R03694	Mission Creek SE of Driscoll Rd.	Mission Creek	**142.3**	325.5

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

Stressor Evaluation

Where applicable, targeted monitoring data were evaluated against numeric Water Quality Objectives or other applicable thresholds described for each parameter to determine whether “trigger” results qualify a site for a potential Stressor/Source Identification monitoring project as described in provision C.8.e of the MRP. The following trigger conditions were identified as the basis for potential SSID projects:

- Temperature[4]
    - For Temperature Monitoring data: Two or more weekly average temperatures exceed the Maximum Weekly Average Temperature of 17.0°C for a Steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C
    - For Continuous Monitoring data: Maximum Weekly Average Temperature exceeds 17.0°C for a Steelhead stream, or 20 percent of the instantaneous results exceed 24°C
- pH – <6.5 or >8.5 for $\geq 20\%$ of results

[4] The MRP’s use of a 17°C trigger criterion may be overly conservative for steelhead in central California. See discussion in 4.2 for more information.

- DO – <7 mg/L for ≥20% of results
- Conductivity - >2000 µS/cm for ≥20% of results
- Pathogen Indicators: Per the MRP, analytical results generated are to be compared against EPA's statistical threshold value (STV) for 36 per 1000 primary contact recreators. The STVs identified by EPA (2012) are 130 MPN/100 mL for enterococci and 410 MPN/ 100 mL for *E. coli*.

Where triggers or potential trigger conditions have been identified in WY 2018 results, ACCWP will work with local stormwater managers to identify appropriate follow-up activities.

1 Introduction

This report fulfills a portion of the reporting requirements of Provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[5]) for Creek Status Monitoring data collected pursuant to MRP Provision C.8.d during Water Year (WY) 2018 (October 1, 2017 - September 30, 2018) under a targeted (non-probabilistic) monitoring design. Additional data required by Provision C.8 are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.2.

The RMC was formed in early 2010 as a collaboration among a number of BASMAA members representing all MRP Permittees listed in Table 1-1. The RMC's focus is developing and implementing a regionally coordinated water quality monitoring program to improve stormwater management and address water quality monitoring required by the MRP[6]. Implementation of the RMC's Creek Status and Long-Term Trends Monitoring Plan allowed Permittees and the Water Board to effectively modify their existing creek monitoring programs, and improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and its associated RMC Work Group, a subgroup of the MPC that meets and communicates regularly to coordinate planning and implementation of monitoring-related activities. This workgroup includes staff from the SF Bay RWQCB at two levels – those generally engaged with the MRP as well as those working regionally with the State of California's Surface Water Ambient Monitoring Program (SWAMP).

[5] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

[6] The RMC includes all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley, which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities. Note that the RMC regional monitoring design was expanded to include the portion of eastern Contra Costa County that drains to the San Francisco Bay in order to assist the CCCWP in fulfilling parallel provisions in their NPDES permit from the Region 5 Central Valley RWQCB.

Table 1-1. Regional Monitoring Coalition Participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County.
Alameda Countywide Clean Water Program (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency).
Contra Costa Clean Water Program (CCCWP)	Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Danville, and Moraga; Contra Costa County; and, Contra Costa County Flood Control and Water Conservation District.
San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)	Cities of Belmont, Brisbane, Burlingame, Daly City, East Palo Alto, Foster City, Half Moon Bay, Menlo Park, Millbrae, Pacifica, Redwood City, San Bruno, San Carlos, San Mateo, South San Francisco, Atherton, Colma, Hillsborough, Portola Valley, and Woodside; San Mateo County Flood Control District; and, San Mateo County.
Fairfield-Suisun Urban Runoff Management Program (FSURMP)	Cities of Fairfield and Suisun City.
Vallejo Permittees	City of Vallejo and Vallejo Sanitation and Flood Control District.

This report includes the standard report content as required by MRP Provision C.8.h.vi and presents the results of the portions of Creek Status Monitoring that were conducted to comply with Provision C.8.d (Table 1-2) using a targeted (non-probabilistic) monitoring design as described in the RMC's Status and Long-Term Trends Monitoring Plan (BASMAA, 2011).

Table 1-2. Creek Status Monitoring and Pesticide/Toxicity Parameters Monitored in Compliance with MRP Provisions C.8.d and g. and the associated design approach and Appendix of the ACCWP UCMR.

Biological Response and Stressor Indicators	MRP Provision	Monitoring Design		Reporting
		Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	C.8.d.i	X		Appendix A.1
Nutrients	C.8.d.i	X		Appendix A.1
Chlorine	C.8.d.ii	X		Appendix A.1
Water Toxicity	C.8.g.i&iii	X		Appendix A.1
Sediment Toxicity	C.8.g.ii	X		Appendix A.1
Sediment Chemistry	C.8.g.ii	X		Appendix A.1
General Water Quality	C.8.d.iv		X	Appendix A.2
Temperature	C.8.d.iii		X	Appendix A.2
Bacteria	C.8.d.v		X	Appendix A.2

The remainder of this report describes the Study Area and Monitoring Design (Section 2), the Monitoring Methods (Section 3), the Results (Section 4), the preliminary Stressor Assessment (Section 5), and the Conclusions & Next Steps (Section 6). More specifically, this report includes the standard report content as required by MRP Provision C.8.h.vi in the respective sections referenced in Table 1-3. Additional details or discussion may also be found in other Appendices or in the main UCMR.

Table 1-3. Index to Standard Report Content per MRP Provision C.8.h.vi.

Report Section	Standard Report Content
2.0	Monitoring purpose and study design rationale
3.0	Sampling protocols and analytical methods
4.1	QA/QC summaries for sample collection and analytical methods
2.1	Sample location descriptions, sample dates, IDs
4..2-4.4	Sample concentrations detected, measurement units, detection limits
4.2-4.4, 5.1-5.3	Data assessment, analysis and interpretation
N/A	List of volunteer and other non-Permittee entities whose data are included in the report
5.1-5.3	Assessment of compliance with applicable water quality standards

2 Study Area & Design

2.1 Regional Monitoring Coalition Area

The RMC area encompasses 3,407 square miles of land in the San Francisco Bay Area. This includes the portions of the five participating counties that fall within the San Francisco Bay RWQCB boundary, as well as the eastern portion of Contra Costa County that drains to the Central Valley region (Figure2-1). Creek Status monitoring is being conducted in flowing water bodies (i.e., creeks, streams and rivers) interspersed among the RMC area, including perennial and non-perennial creeks and channels that run through both urban and non-urban areas.

2.2 Alameda County Targeted Monitoring Areas

Alameda County occupies 739 square miles (1,914 sq. km) of land area in the East Bay region of the San Francisco Bay Area, and discharges to portions of the Central Bay, South Bay and Lower South Bay. Its population of 1,510,271 (as of April 2010[7]) is densest in the Bay Plain western portion of the County, where the largest cities include Oakland, Fremont, Berkeley and Hayward. The eastern portion of the county includes the cities of Dublin, Livermore and Pleasanton occupying the Livermore-Amador Valley, a portion of the very large and mostly undeveloped Alameda Creek Watershed.

In WY 2018, ACCWP's targeted monitoring focused on the Sausal Creek and Mission Creek watersheds (Figure 2-2). Table 2-1 shows the Beneficial Uses assigned to these creeks in the Basin Plan (SFBRWQCB 2015b).

Watersheds were chosen considering accessibility of creek and channels, in conjunction with management issues and stakeholder concerns as described in the sections below.

2.2.1 Mission Creek

Beginning on the east side of the 2,517-foot Mission Peak in Fremont, Mission Creek, a tributary of Laguna Creek, flows northwest draining the east side of the Mission Hills until it reaches the first valley though which it can cross to the urban flatlands. It parallels Mill Creek Road to Mission Boulevard just south of I-680. From there, culverts carry it around the freeway and return it to its natural drainage to be joined by Vargas Creek. Continuing northwest it enters an engineered channel at Driscoll Road, flows through Gomes Park, then on to Lake Elizabeth in Central Park, where it is joined by Morrison Creek.

[7] Census 2016 population estimate for Alameda County is 1,647,704 www.census.gov/quickfacts/fact/table/alamedacountycalifornia/PST045216

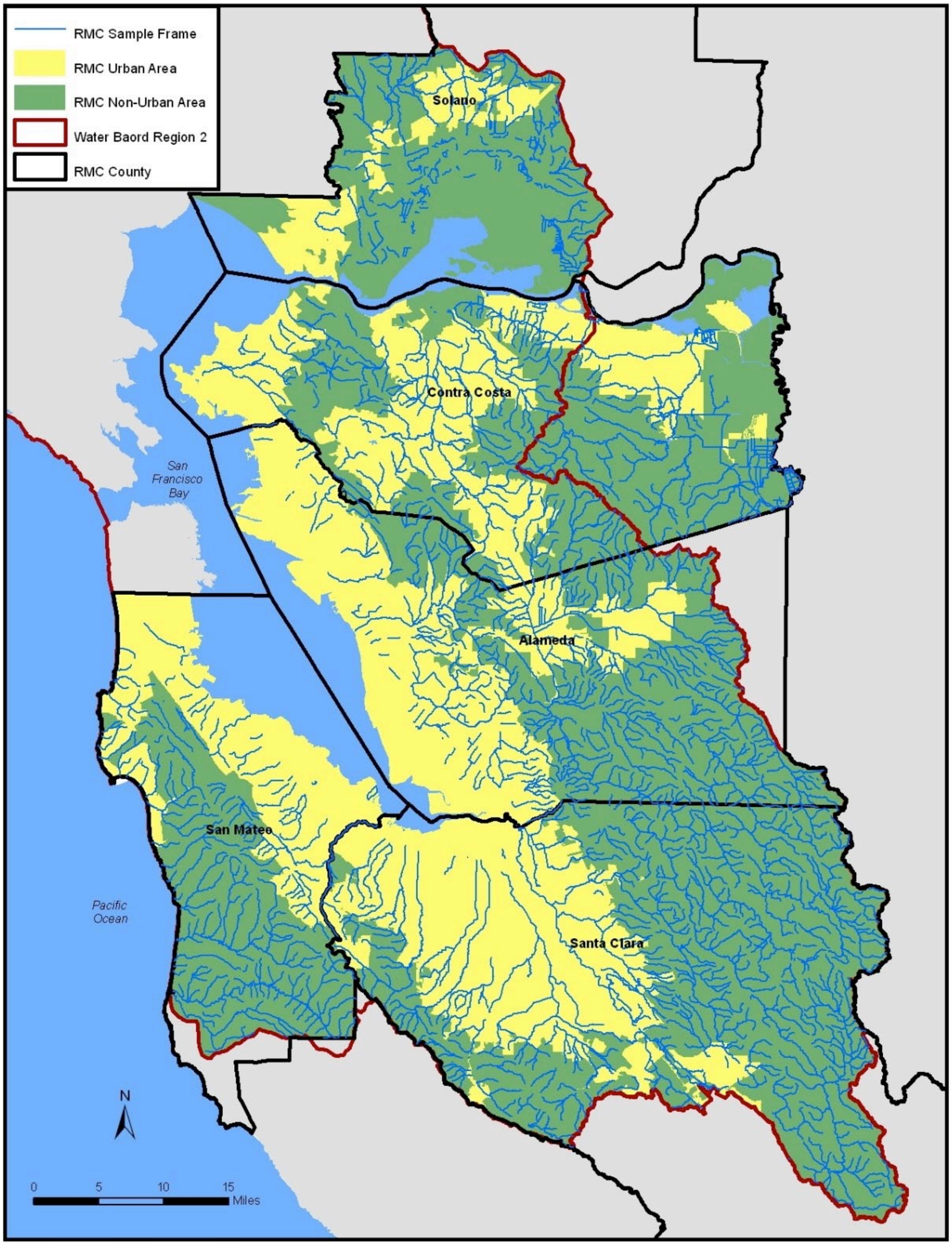

Figure 2-1. Map of BASMAA RMC Area and Major Creeks.

2.2.2 Sausal Creek Watershed

The Sausal Creek watershed begins as a series of ephemeral creeks 1,300 to 1,500 feet above sea level in the Oakland Hills. Its three main tributaries drain the western slope of the East Bay hills and are bounded by Snake Road and Montclair Village to the north, Skyline Boulevard to the east, and Joaquin Miller Road, Lincoln Avenue, and Fruitvale Boulevard to the south. Its natural channels course through Dimond Canyon and Dimond Park and then under Interstate 580. In the Oakland flatlands, culverted sections of the creek channel alternate with open stretches of creek before disappearing into the last culvert at East 22nd Street. The creek emerges from this culvert into the Oakland Estuary at the tidal channel that separates the city and island of Alameda from the mainland. This water year, a SSID project focusing on Sausal Creek was initiated (Appendix 4).

Palo Seco Creek

Palo Seco Creek is in the least developed of the four sub-basins of the Sausal Creek watershed. The majority of trees here are coastal redwoods and willows with blackberry in the understory. The creek channels for the most part remain open and unculverted. Palo Seco Creek has high quality aquatic habitat due to a great diversity of aquatic insects. A small population of rainbow trout lives in lower Palo Seco Creek.

Sausal Creek

Sausal Creek starts at the confluence of Shephard Creek and Palo Seco Creek, flowing almost straight south until it reaches the Oakland Estuary in San Francisco Bay. It makes its way through 100-foot deep Dimond Canyon, lined with California bay laurels, oaks, willows, and many native and invasive plant species. Above the Leimert Bridge, the creek is marred by grade control structures, culverts, and cement linings. Below the bridge is a restoration site where grade control structures were removed and thousands of native plants replaced invasive non-natives. At El Centro Avenue, the creek flows through a culvert into Dimond Park. In the Oakland flatlands, culverted sections alternate with open stretches of creek before disappearing into the final culvert at East 22nd Street.

Table 2-1. Selected Beneficial Uses Assigned to the Watersheds/Subwatersheds Monitored in Water Year 2018.

Creek	COLD	RARE	SPWN	WARM	WILD	REC-1, REC2
Mission Creek				X	X	X
Sausal Creek	X	X	X	X	X	X

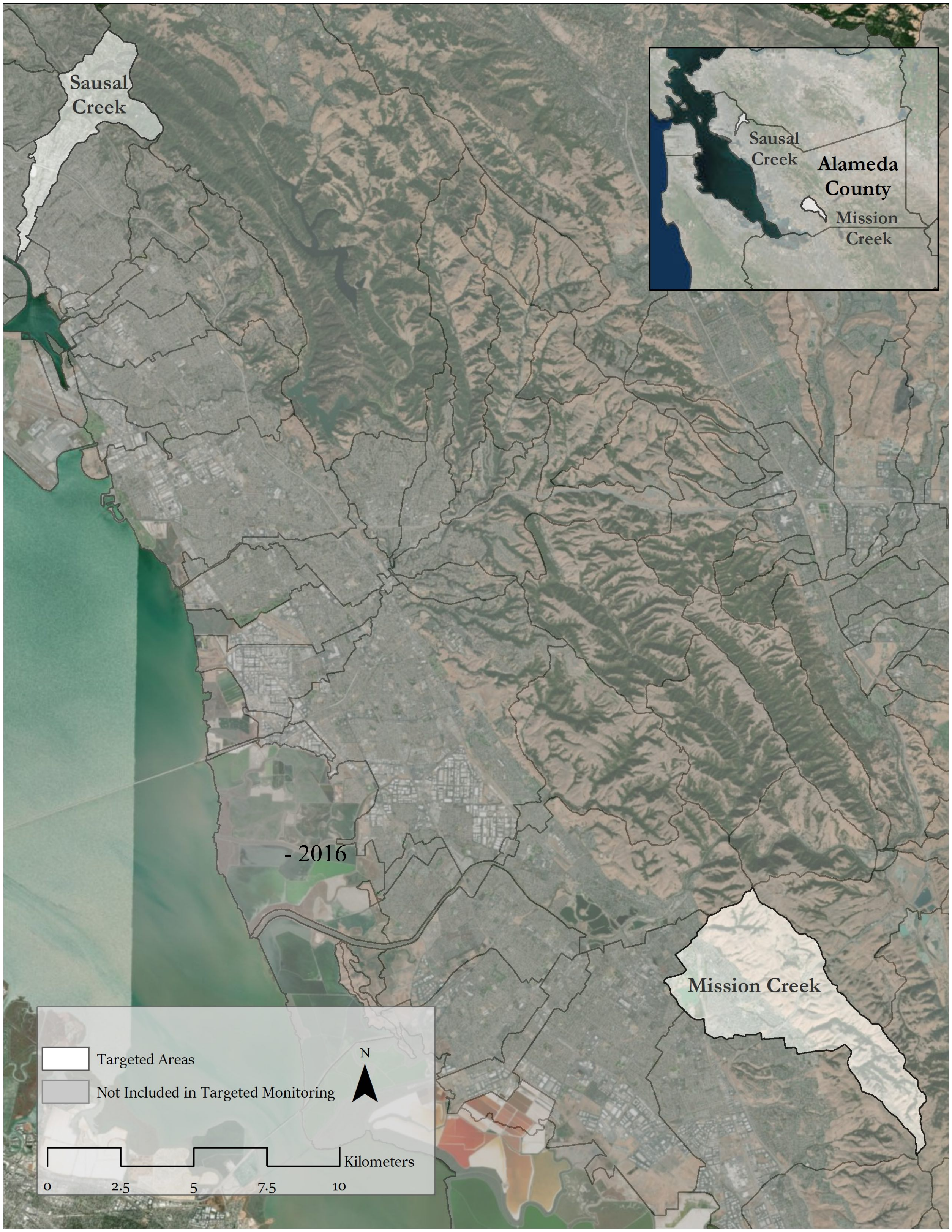

Figure 2-2. Map of the Sausal Creek Watershed and Mission Creek Watershed.

2.3 Targeted Monitoring Design

In the targeted monitoring program design, site locations were identified based on the directed principle[8] to address the following management questions:

(1) What is the range of general water quality measurements at targeted sites of interest?

(2) Do general water quality measurements indicate potential impacts to aquatic life?

(3) What are the pathogen indicator concentrations at creek sites where water contact recreation may occur?

(4) What are the overall physical and/or ecological conditions of creek reaches and specific point impacts within each reach?

Table 2-2 summarizes ACCWP targeted monitoring conducted during WY 2018 including:

- Nine Continuous Water Temperature monitoring locations[9] shown in Figure 2-3;
- Three General Water Quality monitoring locations shown in Figure 2-3;
- Five Pathogen Indicator monitoring locations shown in Figure 2-4;[10]

[8]The Directed Monitoring Design Principle is a deterministic approach in which points are selected deliberately based on knowledge of their attributes of interest as related to the environmental site being monitored. This principle is also known as “judgmental” “authoritative” “targeted” or “knowledge-based”.

[9] One more site than the required 8 was monitored to account for potential loss or creek drying out. One unit was lost partway through the monitoring period. Concurrent measurements of conductivity at 4 of these sites are reported in UCMR Appendix A.4.

[10] Includes initial tests plus any follow-up.

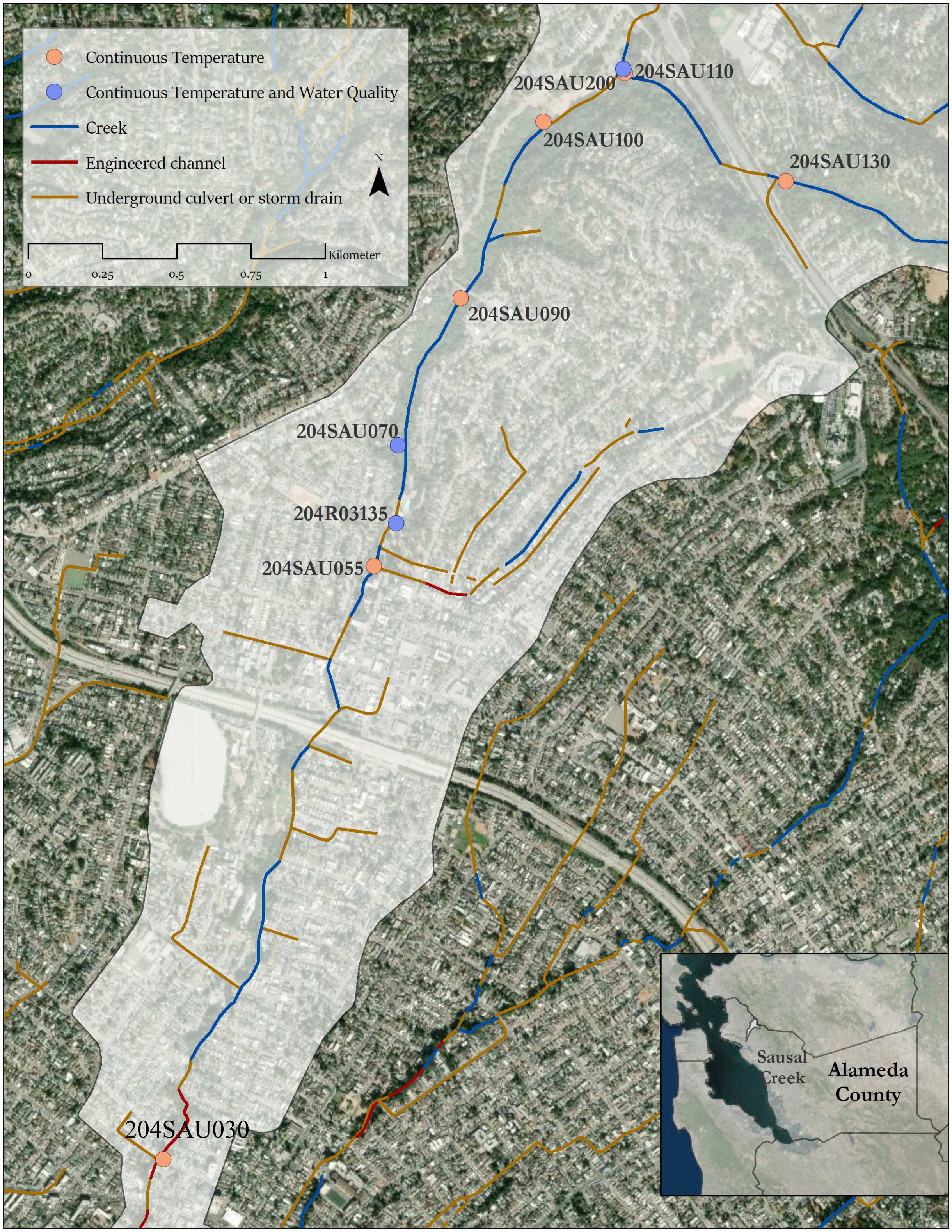

Figure 2-3. Continuous Monitoring and General Water Quality Monitoring Locations, Sausal Creek, WY 2018

Note that site 204SAU110 (icon obscured by nearby site 204SAU200) lies on the same branch as site 204SAU130 (Palo Seco) and 204SAU200 lies on the tributary entering from the north (Shepherd Creek).

Figure 2-4. Pathogen Indicator Sampling Locations, Mission Creek, WY 2018.

Table 2-2. Summary of Targeted Monitoring Locations and Parameters for Water Year 2018 in Alameda County

Site Characteristics					Parameters		
Creek/Sub-watershed	Site Code (RMC No)	Site Description	Latitude	Longitude	Pathogen Indicators	Water Temperature (continuous)	General Water Quality
Sausal Creek	204SAU030	Sausal at E.22nd	37.78591	-122.22419		X	
Sausal Creek	204SAU055	Sausal approx 200 m below Wellington St	37.80365	-122.21665		X	
Sausal Creek	204R03135	Sausal Creek approx 300 m downstream of El Centro Ave	37.80516	-122.21603		X	Spring, Fall
Sausal Creek	204SAU070	Sausal at El Centro	37.8074	-122.21585		X	Spring, Fall
Sausal Creek	204SAU090	Sausal at Leimert Ave.	37.81221	-122.21366		X	
Sausal Creek	204SAU100	Sausal below golf course	37.81700	-122.21103		X	
Palo Seco Creek	204SAU110	Palo Seco above Sausal	37.81898	-122.20734		X	
Palo Seco Creek	204SAU130	Palo Seco	37.81576	-122.20133		X	
Sausal Creek	204SAU200	Sausal above Palo Seco	37.81906	-122.20766		X	Spring, Fall
Mission Creek	205Z6M1010	Golf course with public trail; flow appears recently disconnected from Mission Creek (i.e., sampled isolated pool)	37.5507	-121.95530	X		
Mission Creek	205Z6L2010	Minor contribution to flow to Mission Creek	37.55072	-121.95483	X		
Mission Creek	205Z6M010	Minor contribution to flow to Mission Creek, Public park (Lake Elizabeth)	37.55056	-121.95764	X		
Mission Creek	205R02670	Mission Creek approx 250 m upstream of Valdez Pl. (within Gomes Park)	37.55014	-121.95058	X		
Mission Creek	205R03694	Mission Creek SE of Driscoll Rd.	37.5455	-121.94333	X		

2.3.1 Criteria for Site Selection

All target sampling sites were selected by the ACCWP Monitoring Program Coordinator, in coordination with others as described below. Specific considerations applied to selection of locations for the different parameters as described below:

Continuous Temperature

Each monitoring year, a minimum of eight continuous water quality monitoring locations are chosen based on a combination of criteria. In general, a predominant criterion is that the streams have COLD beneficial use designation for which these parameters are important indicators.

For WY 2018, ACCWP chose sites on Sausal Creek to support the new SSID study, and also deployed sensors capable of collecting electrical conductivity data as well as temperature data at four of the nine temperature stations (for study design and discussion of results see Appendix A.4 to the main UCMR).

Sampling sites were adjusted in the field in order to deploy continuous monitoring equipment at locations where (1) water level was expected to be of sufficient depth to cover loggers over the course of the entire dry season, and (2) avoid highly trafficked areas.

General Water Quality

The goal of site selection for the three general water quality monitoring locations was to support the SSID follow-up study. Continuous temperature and conductivity were also measured at the three sites and bioassessment was performed at two.

Pathogen Indicators

In WY 2018, five pathogen indicator sampling sites were distributed along an approximately 1.5 km segment of Mission Creek and tributaries. The lower section of Mission Creek is in an urban setting and multiple reaches are located in parks or adjacent to trails and have public access.

3 Monitoring Methods

This section provides a brief overview of methods employed to measure each parameter in the targeted monitoring design. Greater detail on each method is included in the referenced SOPs.

3.1 Data Collection Methods

Field data were collected in accordance with SWAMP-comparable methods and procedures described in the BASMAA RMC Quality Assurance Project Plan (QAPP) (BASMAA 2016a) and Standard Operating Procedures (SOP) (BASMAA 2016b), updated in 2013 from the earlier 2012 versions to reflect lessons learned through 2012 implementation; these revisions also incorporated updated data Quality Assurance procedures consistent with added data checking functions of the RMC database to supplement the tools available from SWAMP[11]. The SOPs relevant to the monitoring discussed in this report are listed in Table 3-1.

Table 3-1. Standard Operating Procedures for BASMAA RMC Monitoring at Targeted Sites.

SOP #	SOP Title
FS-1	BMI and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-5	Temperature, Automated, Digital Logger
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

3.1.1 Continuous Temperature Monitoring

All sampling conformed to protocols identified in the RMC QAPP and SOPs (Table 3-1). Field crews deployed digital temperature loggers in April at nine sites as shown in Table 3-2. Temperature loggers were programmed to record temperature data at sixty-minute intervals.

AMS personnel conducted a mid-term maintenance and data download of the deployed temperature probes on July 5, 2018. Each of the nine maintained units were found submerged and in good condition. The continuous temperature monitor deployed at site 204SAU030 was

[11] See waterboards.ca.gov/water_issues/programs/swamp/data_management_resources/index.shtml

taken from its deployment location sometime after the July maintenance effort and the unit and any subsequent data collected here was lost.

Table 3-2. Water Year 2018 Continuous Water Temperature Monitoring at Alameda County Targeted Monitoring Locations.

Site Code (RMC No)	Site Name / Location	Latitude	Longitude	Install Date	Mid-term Re-install	Removal Date
204SAU030	Sausal at E.22nd	37.78591	-122.22419	4/17/18	7/5/18	*
204SAU055	Sausal approx 200 m below Wellington St	37.80365	-122.21665	4/17/18	7/5/18	10/4/18
204R03135	Sausal Creek approx 300 m downstream of El Centro Ave	37.80516	-122.21603	4/17/18	7/5/18	10/4/18
204SAU070	Sausal at El Centro	37.8074	-122.21585	4/17/18	7/5/18	10/4/18
204SAU090	Sausal at Leimert Ave.	37.81221	-122.21366	4/17/18	7/5/18	10/4/18
204SAU100	Sausal below golf course	37.81700	-122.21103	4/17/18	7/5/18	10/4/18
204SAU110	Palo Seco above Sausal	37.81898	-122.20734	4/17/18	7/5/18	10/4/18
204SAU130	Palo Seco	37.81576	-122.20133	4/17/18	7/5/18	10/4/18
204SAU200	Sausal above Palo Seco	37.81906	-122.20766	4/17/18	7/5/18	10/4/18

*Unit and data collected after mid-term maintenance lost.

3.1.2 General Water Quality Measurements

General water quality monitoring included continuous measurements for temperature, DO, pH and specific conductivity for deployment at three sites (Table 3-3). Parameters were measured for a period of between one and two weeks twice per year, once during the spring index period (April/May) for bioassessment sampling and again during the summer/fall (August/September). All sampling conformed to protocols identified in the RMC QAPP and SOPs. Automated monitoring equipment (YSI 6600 V2 or YSI EXO) was deployed with the data recorded automatically at fifteen-minute intervals.

Table 3-3. General Water Quality Monitoring at Alameda County Targeted Monitoring Locations, WY 2018.

Site Code (RMC No)	Description	Deployment	Latitude	Longitude	Dates
204R03135	Sausal Creek approx 300 m downstream of El Centro Ave	Spring	37.80516	-122.21603	4/17/18 to 4/27/18
		Summer-Fall	37.80516	-122.21603	8/24/18 to 9/4/18
204SAU070	Sausal at El Centro	Spring	37.8074	-122.21585	4/17/18 to 4/27/18
		Summer-Fall	37.8074	-122.21585	8/24/18 to 9/4/18
204SAU200	Sausal above Palo Seco	Spring	37.81906	-122.20766	4/22/18 to 5/8/18
		Summer-Fall	37.81906	-122.20766	9/14/18 to 9/30/18

3.1.3 Pathogen Indicators Sampling

Single samples were collected for pathogen indicator enumeration in accordance with the requirements of provision C.8.d.v of the permit. Field crews conducted pathogen indicator sampling using the RMC SOPs (Table 3-1). Sampling techniques included direct filling of containers, and immediate transfer of samples to analytical laboratories within specified holding time requirements.

Field crews collected water samples for analysis of *Escherichia coli* (*E. coli*) and Enterococci at five sites on June 28, 2018 (Table 3-4).

Table 3-4. Pathogen Indicator Monitoring at Alameda County Targeted Monitoring Locations, June 28, 2018.

Site Code	Description	Latitude	Longitude
205Z6M010	Public park (Lake Elizabeth); minor contribution to flow to Mission Creek	37.55056	-121.95764
205Z6M1010	Golf course with public trail; flow appears recently disconnected from Mission Creek (i.e., sampled isolated pool)	37.55070	-121.95530
205Z6L2010	Minor contribution to flow to Mission Creek	37.55072	-121.95483
205R02670	Mission Creek approx 250 m upstream of Valdez Pl. (within Gomes Park)	37.55014	-121.95058
205R03694	Mission Creek SE of Driscoll Rd.	37.5455	-121.94333

3.1.4 Quality Assurance/Quality Control

Data quality assessment and quality control procedures are described in detail in the BASMAA RMC QAPP (BASMAA 2016a). Data Quality Objectives (DQOs) were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data. The qualitative goals include representativeness and comparability. The quantitative goals include specifications for completeness, sensitivity (detection and quantization limits), precision, accuracy, and contamination. To ensure consistent and comparable field techniques, pre-survey field training and *in-situ* field assessments were conducted. Data were collected according to the procedures described in the relevant SOPs, including appropriate documentation of data sheets and samples, and sample handling and custody. Laboratories providing analytical support to the RMC were selected based on demonstrated capability to adhere to specified protocols.

3.2 Data Quality Assessment Procedures

Following completion of the field and laboratory work, the field data sheets and laboratory reports were reviewed by the Local Monitoring Coordinator or Quality Assurance Officer, and compared both against the methods and protocols specified in the SOPs and QAPP. The findings and results then were evaluated against the relevant DQOs to provide the basis for an assessment of programmatic data quality. The data quality assessment included the following elements:

- Conformance with field and laboratory methods as specified in SOPs and QAPP, including sample collection and analytical methods, sample preservation, sample holding times, etc.;
- Numbers of measurements/samples/analyses completed vs. planned, and identification of reasons for any missed samples;
- Results of duplicate analyses based on calculation of relative percent differences (precision results);
- Results of field blanks associated with filtered samples (bias results);
- Results of spiked sample analyses based on spike percent recovery (accuracy results); and
- Identification of any contamination issues based on analyses of lab blanks and field blanks.

3.3 Data Analysis and Interpretation

Continuous temperature (C.8.d.iii) and General Water Quality (C.8.d.iv) data from each deployment were graphed for each site. As specified in MRP Provision C.8.d.iii, Maximum Weekly Average Temperatures (MWATs) were calculated throughout the deployment from all data recorded for each seven-day, non-overlapping deployment period. For General Water Quality parameters the frequency of measurements was higher (15 minutes for General Water Quality vs. one hour for continuous temperature) and most analyses focused on comparing all available instantaneous values from a deployment to specified thresholds. By using the non-overlapping data averaging technique specified in the MRP, the number of weekly averages for General Water Quality temperature measurements was limited to a maximum of two for a one- to two-week deployment. Where these deployments extended for longer than a week, the weekly average for the 2nd week was calculated from data available for the subset of the week beginning after the initial seven-day calculation period.

Targeted monitoring data were evaluated against Water Quality Objectives (WQO) or other applicable thresholds, as described in Section 5, to determine whether results may “trigger” a site for a candidate stressor/source identification monitoring project (per MRP Provisions C.8.d.iii and C.8.d.iv).

4 Results

This section presents monitoring results based on each program component. Each section addresses the study question:

> *What are the ranges of general water quality, continuous water temperature, pathogen indicators, and stream ecosystem conditions at locations sampled in the Program area?*

4.1 Statement of Data Quality

The RMC established a set of guidance and tools to help ensure data quality and consistency implemented through collaborating Programs. Additionally, the RMC participants continue to meet and coordinate in an ongoing basis to plan and coordinate monitoring, data management, and reporting activities, among others.

A comprehensive QA/QC program was implemented by each of the RMC Programs, which is solely responsible for the quality of the data submitted on its behalf, covering all aspects of the regional/probabilistic monitoring. In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a), and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), and in conformity with SWAMP protocols.

Details of the results of evaluations of laboratory-generated QA/QC results are included elsewhere in the ACCWP UCMR and other appendices if applicable. Issues noted by the laboratories and/or RMC field crews are summarized below.

4.1.1 Continuous Temperature

In general, continuous hourly temperature and conductivity monitoring sites exhibited fairly smooth, predictable curves, suggesting few quality assurance concerns or perturbations to the system. There are, however, a few exceptions:

- At site 204R03135, monitoring over the course of the April through September deployment exhibited four distinct hourly intervals with rapid, unexplained decreases in conductivity that were followed fairly quickly by returns to more typical readings. These four intervals included June 1st at 10:00 (24% decrease in conductivity), June 2nd at 03:00 (45% decrease), June 4th at 16:00 (27% decrease), and June 19th at 01:00 (52% decrease). The deployment area is in an urban park that experiences heavy use, including homeless activity, which may be a contributing factor to these rapid fluctuations.
- At site 204RSAU090, there were multiple instances of unusual temperature fluctuations recorded. On the afternoon of May 29, the measured temperature increased 7ºC in a two-hour period between 1 and 3 pm, then dropped approximately 4ºC in the following hour. This short-term increase / decrease pattern was noted on other dates around the same time (e.g., a 3.7ºC increase followed by a 3ºC decrease between 2 pm and 4 pm on May 30 and a 6ºC increase followed by a 4.8ºC decrease between 2 pm and 4 pm on May 31). A

cursory review of other dates during this time interval indicate that measurements did not exhibit this same pattern.

- The temperature-only probe deployed at site 204SAU030 was removed sometime after a maintenance visit performed by AMS personnel on July 5th. Any data collected after this data was therefore lost and flagged with an "FIF" qualifier in data deliverables indicating instrument failure.

- The temperature-only probe deployed at site 204SAU090 experienced a brief spike in temperature on May 29th starting at 14:00 (approximately 7ºC rise over a two-hour period). This was followed by a measured drop of 4ºC between 15:00 and 16:00. Similar to the case for 204R03135 above, this is an area of fairly heavy public use, which may be a contributing factor.

4.1.2 Continuous Water Quality

For all deployment periods, YSI sondes achieved all associated data quality checks, including pre-deployment calibration and post-deployment drift checks. Therefore, no data required qualification.

4.1.3 Fecal Indicator Bacteria

There were no quality assurance issues identified associated with fecal indicator bacteria analyses. However, enterococcus results reported for two of the sites (Zone 6 Line M and Zone 6 Line L-2) exceeded the range of the non-diluted test (i.e., 2419.2 MPN/100 mL). Concurrent tests run with 1000:1 dilution generated non-detects for both tests, with reporting limit of 2200 MPN/100 mL. These results in combination suggest that true concentrations at both sites are likely only slightly above the 2419.2 MPN/100 mL reporting limit for the non-diluted test; as for example, an order of magnitude increase in concentration would likely have been detectable with the diluted sample.

4.2 Continuous Water Temperature Monitoring

Data were collected over an approximately six-month period from the middle of April through September 2018 with measurements recorded at 60-minute intervals at the nine sites.

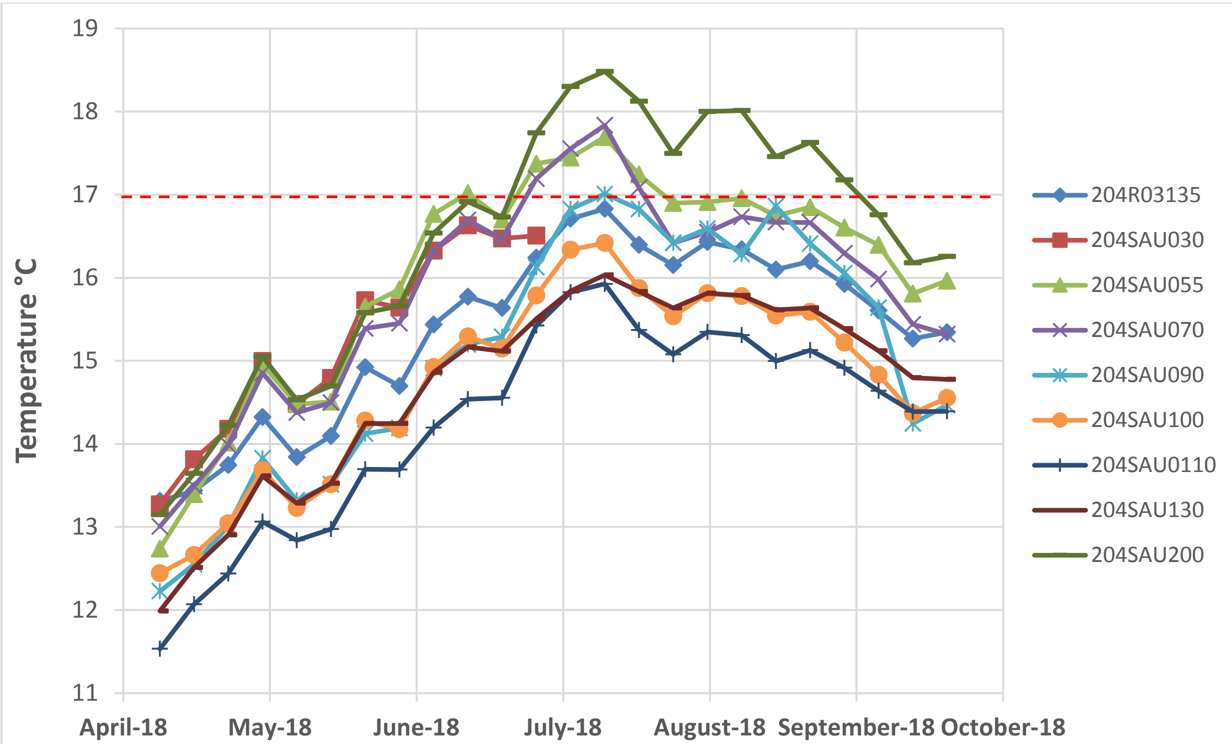

Figure 4-1 presents the results of the continuous monitoring results for WY 2018, and box plots[12] of the temperature data are shown in Figure 4-2.

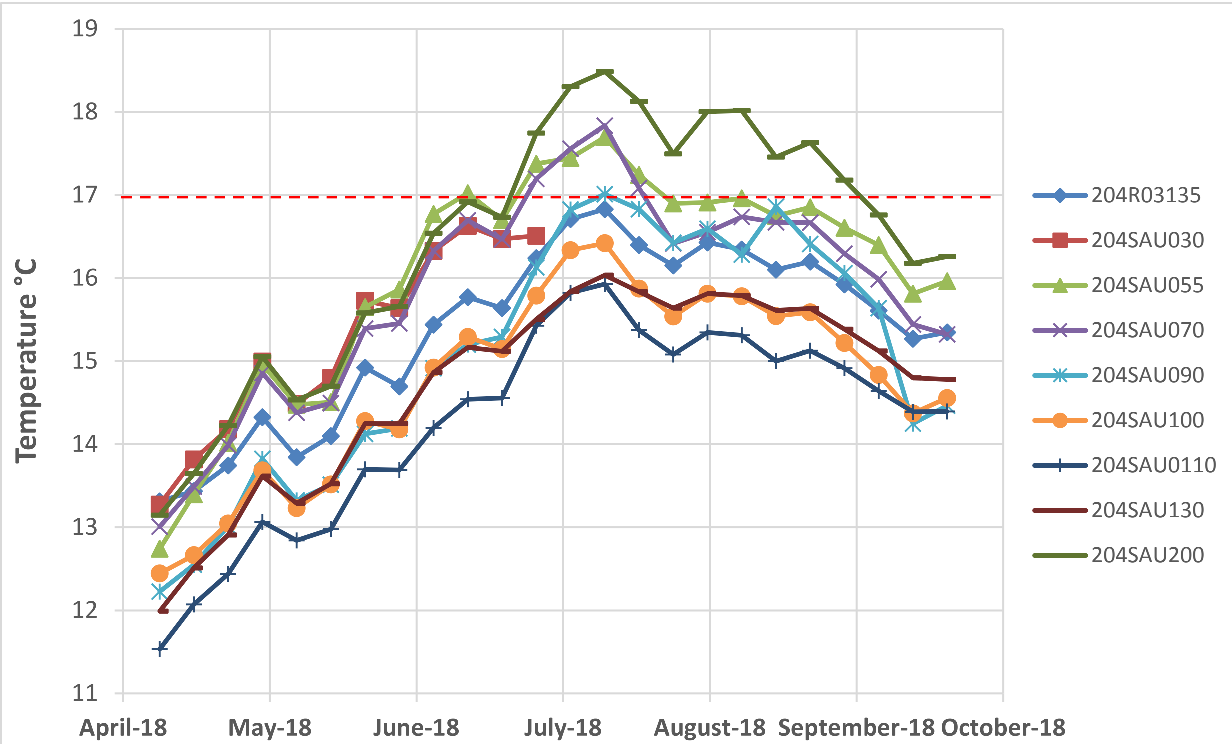

Figure 4-1. Temperature (Discrete 7-Day Average) Line Graph at Sausal Creek Sites, April 17 through September 30, 2018.

[12] A box plot splits the data set into quartiles. The body of the plot consists of a "box", which goes from the first quartile to the third quartile. Within the box, a vertical line is drawn at the median of the data set. Two horizontal lines, called whiskers, extend from the front and back of the box. The front whisker goes from the first quartile to the smallest non-outlier in the data set, and the back whisker goes from the third quartile to the largest non-outlier. If the data set includes one or more outliers, they are plotted separately as points.

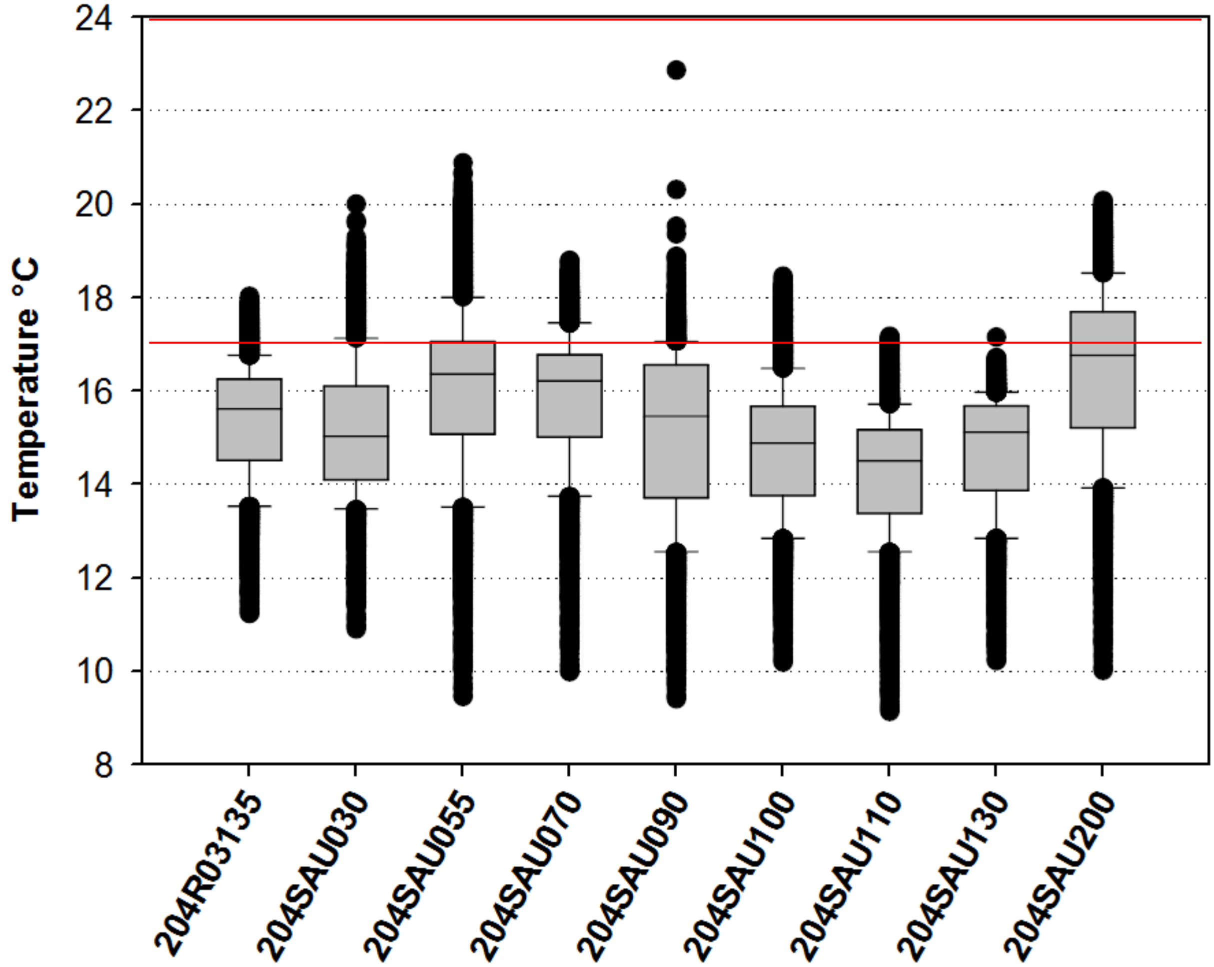

Figure 4-2. Temperature Box Plot at Sites, April 17 through September 30, 2018. 17°C & 24°C thresholds are illustrated with red lines.

Summary 2018 statistics are presented for temperature monitoring data from Sausal Creek in Table 4-1. The highest temperature was recorded at 204SAU090 on May 29. The lowest temperature was recorded at site 204SAU110 on April 19. Average temperatures ranged from 14.3°C to 16.4°C.

Table 4-1. Summary of Continuous Temperature Data Statistics from WY 2018 at Sausal Creek Sampling Locations.

Station	Mean	St. Dev	Min	Max	Range
204R03135	15.36	1.22	11.24	18.03	6.79
204SAU030	15.15	1.45	10.91	20.01	9.10
204SAU055	16.04	1.73	9.46	20.89	11.43
204SAU070	15.85	1.44	9.99	18.80	8.81
204SAU090	15.09	1.78	9.41	22.87	13.46
204SAU100	14.75	1.40	10.20	18.46	8.26
204SAU110	14.26	1.31	9.14	17.18	8.04
204SAU130	14.72	1.24	10.23	17.16	6.93
204SAU200	16.43	1.78	10.02	20.08	10.06

Table 4-2 shows the number of exceedances of Maximum Weekly Average Temperatures (MWATs) compared to the threshold of 17°C. Three sites had at least 2 MWATs greater than 17°C. Table 4-3 shows percent exceedance of the 24°C temperature threshold for each continuous monitoring site. The trigger of 20% exceedance of this threshold was not met at any of the sites.

Sullivan et al. (2000) is referenced in C.8.d.iii (4) of the MRP as a potential source for applicable thresholds to use for evaluating water temperature data for creeks that have salmonid fish communities, and illustrates the risk-based approach to evaluating temperature effects on salmonid communities in terms of relative reductions in growth at temperatures other than optimum. However, that study established its MWAT thresholds using data from salmonid populations in the Pacific Northwest and is likely overly conservative for steelhead in central California. Since fish growth is a function of both temperature and available food, optimum temperature and the incremental effect of temperature shifts on growth are ration-dependent and affected by other ecosystem factors, (for example see reviews in Myrick and Cech, 2001 and Atkinson et al., 2011). Streams in the Bay Area and Central California in general tend to be higher-nutrient systems than the glacially-derived geology of the Pacific Northwest, and can thus deliver the larger food supplies to support salmonid growth at warmer temperatures.

Table 4-2. Comparison of 2018 Continuous Temperature Maximum Weekly Average Temperature Measurements with 17°C Temperature Threshold at Sausal Creek Sampling Locations in WY 2018. Bold values indicate two or more MWATs above the temperature trigger criterion.

Station	Site Description	# Weeks Deployed[1]	MWAT > 17º C	
			# Weeks	% Weeks
204R03135	Sausal at E.22nd	24	0	0%
204SAU030	Sausal approx 200 m below Wellington St	12	0	0%
204SAU055	Sausal Creek approx 300 m downstream of El Centro Ave	24	5	21%
204SAU070	Sausal at El Centro	24	4	17%
204SAU090	Sausal at Leimert Ave.	24	1	4%
204SAU100	Sausal below golf course	24	0	0%
204SAU110	Palo Seco above Sausal	24	0	0%
204SAU130	Palo Seco	24	0	0%
204SAU200	Sausal above Palo Seco	24	10	42%

[1] Full or partial weeks

Table 4-3. Comparison of 2018 Continuous Temperature Records with 24°C Temperature Threshold at Sausal Creek Sampling Locations.

Station	Number of Hourly Records	Mean Temp (˚C)	Number of readings > 24°C	% of readings > 24°C
204R03135	3996	15.36	0	0%
204SAU030	1894	15.15	0	0%
204SAU055	3996	16.04	0	0%
204SAU070	3995	15.85	0	0%
204SAU090	3995	15.09	0	0%
204SAU100	3993	14.75	0	0%
204SAU110	3996	14.26	0	0%
204SAU130	3995	14.72	0	0%
204SAU200	3994	16.43	0	0%

4.3 General Water Quality Measurement

General water quality measurements of temperature, DO, pH and specific conductivity were taken at locations during two periods: spring (April/May) and late summer to fall (August/September). In WY 2018, these data were collected from 3 sites (see Table 3-3):

- 204R03135 – Sausal Creek approximately 300 m downstream of El Centro Ave; and
- 204SAU070 – Sausal Creek at El Centro.
- 204SAU200 – Sausal Creek above Palo Seco.

Table 4-4 summarizes WY 2018 spring and summer-fall data in relation to the temperature, pH, and dissolved oxygen thresholds at each site; Figure 4-3, Figure 4-4, and Figure 4-5 show graphical plots of temperature and DO for these sites (only the first week of each deployment are graphed). Summer-fall discrete 7-day averages or MWATs for full or partial weeks of deployment were all below 17°C and the temperature thresholds were not exceeded. The water quality thresholds for conductivity, high pH, and low pH were not exceeded more than 20% of the time at any of the General Water Quality monitoring sites, while the threshold for low DO was exceeded more than 20% of the time at two sites.

Table 4-4. Comparison of General Water Quality Observations to Trigger Thresholds at Sites 204R03135, 204SAU070, 204SAU200 in WY 2018.

Station	Monitoring Season (No of MWATs)	Applicable threshold or water quality standard					
		Temperature MWATs > 17˚C (> 19°C)	Temp % > 24˚C	Specific Cond. >2000 µS/cm	pH < 6.5	pH > 8.5	DO < 7 mg/L (COLD)
204R03135	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	94%
204SAU070	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	42%
204SAU200	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Fall (2)	0(0)	0%	0%	0%	0%	0%

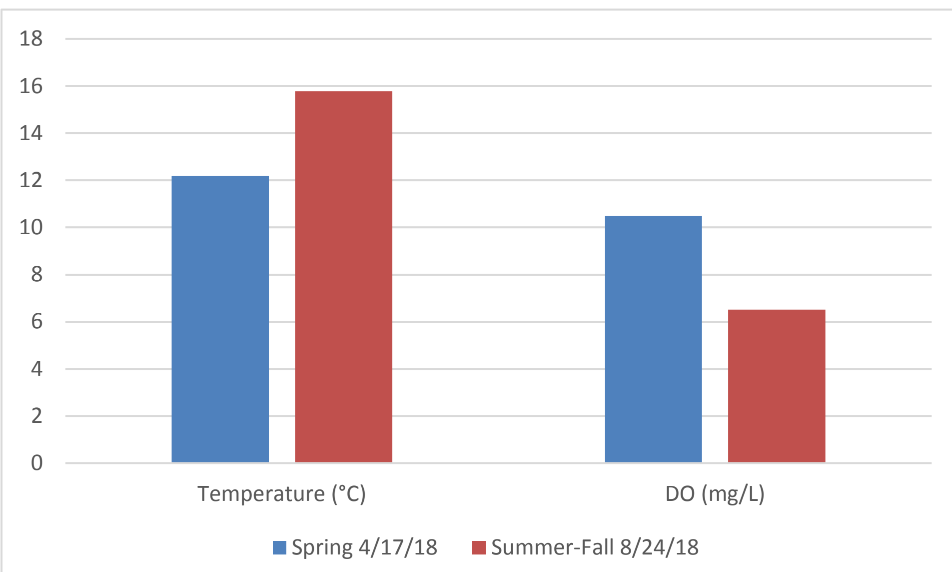

Figure 4-3. General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204R03135 in Spring and Summer-Fall, WY 2018

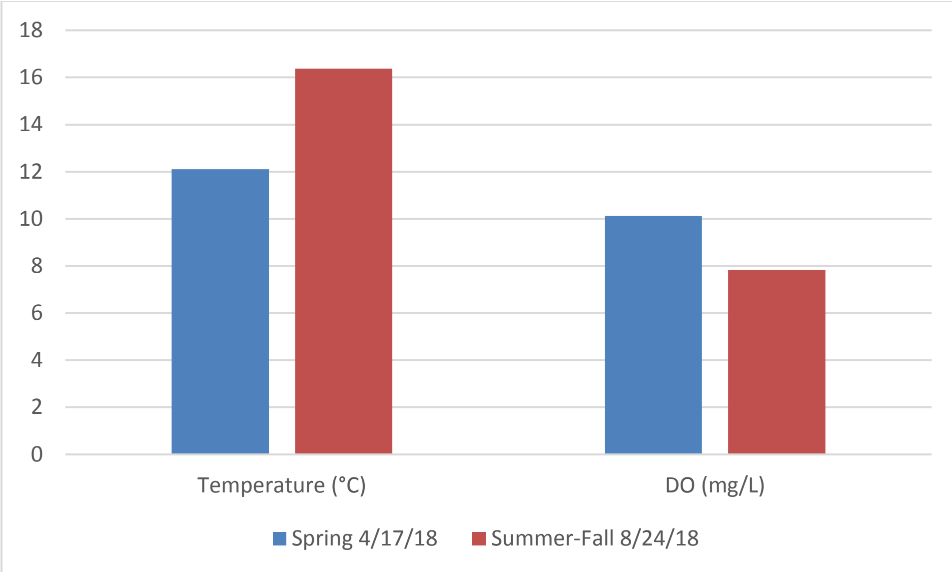

Figure 4-4. General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204SAU070 in Spring and Summer-Fall, WY 2018.

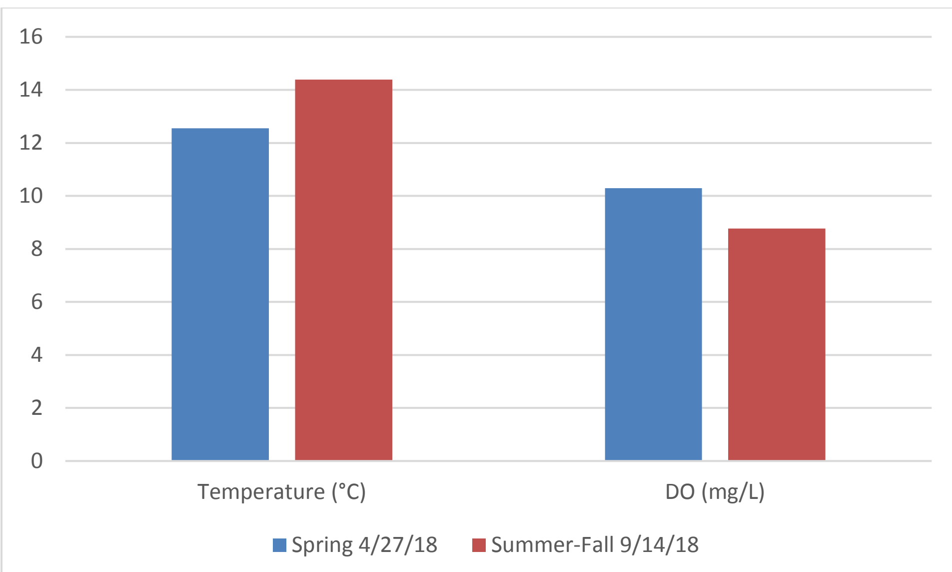

Figure 4-5. General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204SAU200 in Spring and Summer-Fall, WY 2018.

4.4 Pathogen Indicators

Single grab water samples for pathogen indicators were collected at five locations in the Mission Creek watershed on June 28, 2018. *E. coli* and Enterococci were enumerated as individual grab samples as presented in Table 4-5.

The highest counts were measured in the sample from 205Z6L2010, which had Enterococci at >2419.2 MPN and *E. coli* at 435.2 MPN.

Table 4-5. Enterococci and *E. coli* enumerations at Mission Creek Monitoring Sites - June 28, 2018 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN*/100mL)	*E. coli* (MPN*/100 mL)
205Z6M010	Minor contribution to flow to Mission Creek, Public park (Lake Elizabeth)	Mission Creek	>**2419**.2	172.3
205Z6M1010	Golf course with public trail; flow appears recently disconnected from Mission Creek (i.e., sampled isolated pool)	Mission Creek	12.2	83.3
205Z6L2010	Minor contribution to flow to Mission Creek	Mission Creek	**>2419.2**	**435.2**
205R02670	Mission Creek approx 250 m upstream of Valdez Pl. (within Gomes Park)	Mission Creek	**154.1**	115.3
205R03694	Mission Creek SE of Driscoll Rd.	Mission Creek	**142.3**	325.5

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

5 Stressor Assessment

This section is a preliminary review of targeted monitoring data to identify samples with results that meet the "trigger" conditions for potential further investigation via a SSID project, or other actions to reduce the stressor effect of urban runoff. Stressor assessment was conducted according to the trigger criteria in MRP Provisions C.8.d.iii through C.8.d.v, as listed in the following subsections).

5.1 Temperature

The reissued MRP (SFRWQCB 2015) defines the temperature trigger as when two or more weekly average temperatures exceed the Maximum Weekly Average Temperature of 17.0°C for a Steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C[13].

All WY 2018 temperature monitoring sites were in streams with COLD Beneficial Use, and three sites experienced at least two MWATs above 17.0°C during the summer (Table 4-2 and Figure 4-1). No sites exceeded the 24°C instantaneous maximum for 20% or more of the records.

5.2 Continuous Monitoring of Dissolved Oxygen, Temperature, and pH

MRP trigger criteria occur when results at one sampling station exceed the applicable temperature or dissolved oxygen trigger or demonstrate a spike in temperature or drop in dissolved oxygen with no obvious natural explanation. The temperature trigger is defined as any of the following: Maximum Weekly Average Temperature exceeds 17.0°C for a Steelhead stream, or 20 percent of the instantaneous results exceed 24°C.

These trigger criteria were compared against the results obtained during General Water Quality monitoring. No MWAT triggers were observed during spring or summer-fall deployments (Table 4-4). Comparisons with other threshold values identified in the MRP indicate that thresholds for conductivity, high pH, and low pH were not exceeded more than 20% of the time at any of the General Water Quality monitoring sites, while the threshold for low DO was exceeded more than 20% of the time at two sites.

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[13] Permittees shall calculate the weekly average temperature by breaking the measurements into non-overlapping, 7-day periods.

5.3 Pathogen Indicators

The pathogen trigger criteria consist of the following[14]:

- Enterococci (marine and freshwater):
  - Geometric mean of 35 colony forming units (cfu) per 100 milliliters (mL)
  - Statistical threshold value of 130 cfu per 100 mL
- *E. coli* (freshwater)
  - Geometric mean of 126 colony forming units (cfu) per 100 milliliters (mL)
  - Statistical threshold value of 410 cfu per 100 mL

Table 5-1 presents the results of the pathogen indicator enumeration with comparison against the trigger criteria identified above. ACCWP conducted fecal indicator bacteria monitoring at five sites within the Mission Creek watershed of Fremont on June 28, 2018. Mission Creek is designated for both contact (REC-1) and non-contact (REC-2) recreation, and all of the five sampling sites are located in areas with easy access in parks or along public trails adjacent to the creek (Central Park, Fremont Park Golf Course, Gomes Park). Of the 10 datapoints generated through ACCWP monitoring, 5 exceeded the relevant STV.

Table 5-1. Comparison of WY 2018 Pathogen Indicator Concentrations to Water Quality Objectives and Triggers – ACCWP June 28, 2018 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN*/100mL)	*E. coli* (MPN*/100 mL)
205Z6M010	Minor contribution to flow to Mission Creek, Public park (Lake Elizabeth)	Mission Creek	**>2419.2**	172.3
205Z6M1010	Golf course with public trail; flow appears recently disconnected from Mission Creek (i.e., sampled isolated pool)	Mission Creek	12.2	83.3
205Z6L2010	Minor contribution to flow to Mission Creek	Mission Creek	**>2419.2**	**435.2**
205R02670	Mission Creek approx 250 m upstream of Valdez Pl. (within Gomes Park)	Mission Creek	**154.1**	115.3
205R03694	Mission Creek SE of Driscoll Rd.	Mission Creek	**142.3**	325.5

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

[14] Water Board staff have confirmed to the RMC Work Group that for the purposes of trigger assessment, units of cfu/100ML can be considered equivalent to the units of MPN/100ML reported in laboratory analysis results.

6 Next Steps

All sites identified in Section 5 as meeting trigger criteria as candidates for new SSID projects will be reviewed by the Program in conjunction with relevant Permittees and RMC programs to determine potential follow-up actions pursuant to MRP Provision C.8.e. ACCWP initiated three SSID projects developed through the RMC selection process in the previous permit term, and together with other RMC participants will initiate new SSID projects as stipulated in MRP Provision C.8.e.ii (1). One SSID project was initiated in WY 2018 and is described in Appendix A4. Where triggers or potential trigger conditions have been identified in WY 2018 results, ACCWP will also work with local stormwater managers to identify appropriate follow-up activities, which may be either incorporated in WY 2018 Creek Status Monitoring or conducted outside the scope of MRP Provision C.8.d.

7 References

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BASMAA. 2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 196 pp.

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clean water
PROGRAM

AGENCIES:

Alameda

Albany

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Emeryville

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Hayward

Livermore

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San Leandro

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County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

POLLUTANTS OF CONCERN MONITORING 2018 SEDIMENT SAMPLING REPORT

APPENDIX A.3
URBAN CREEKS MONITORING REPORT OCTOBER 2017 THROUGH SEPTEMBER 2018

Report prepared by
Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:
California Regional Water Quality Control Board, San Francisco Bay Region

FINAL
March 31, 2019

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgement

Applied Marine Sciences, Inc. contributed substantially to the site reconnaissance, implementation of monitoring and preparation of the data analysis in this report.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed an outline for preparation of the first Urban Creeks Monitoring Report (UCMR) that was submitted in March 2013 in compliance with the Municipal Regional Stormwater Permit (MRP)[1] Reporting Provision C.8.g.v regarding all monitoring conducted during the MRP permit term.

The following participants make up the RMC and are responsible for preparing IMR documents on behalf of their respective member agencies:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo County Wide Water Pollution Prevention Program (SMCWPPP)
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)
- Fairfield-Suisun Urban Runoff Management Program (FSURMP)
- City of Vallejo and Vallejo Sanitation and Flood Control District (Vallejo)

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Pollutants of Concern Loads Monitoring data collected in Water Year 2018 (October 1, 2017 through September 30, 2018). This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

- The cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County;
- Alameda County Flood Control and Water Conservation District and
- Zone 7 of the Alameda County Flood Control and Water Conservation District.

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015), which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

Contents

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1. Introduction

This report fulfills a portion of the reporting requirements of Provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[2]) for Pollutants of Concern (POC) Monitoring data collected pursuant to MRP Provision C.8.f during Water Year (WY) 2018 (October 1, 2017 - September 30, 2018). Additional data required by Provision C.8 are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.3A.

Provision C.8.f of the MRP lists five priority POC management information needs to be addressed though POC monitoring:

1. Source Identification - identifying which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff;
2. Contributions to Bay Impairment - identifying which watershed source areas contribute most to the impairment of San Francisco Bay beneficial uses (due to source intensity and sensitivity of discharge location);
3. Management Action Effectiveness - providing support for planning future management actions or evaluating the effectiveness or impacts of existing management actions;
4. Loads and Status - providing information on POC loads, concentrations, and presence in local tributaries or urban stormwater discharges; and
5. Trends - evaluating trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

As required in provision C.8.h.iv, ACCWP's Pollutants of Concern (POC) Monitoring Report (ACCWP 2018) described accomplishments during Water Year 2018 and the allocation of POC monitoring sampling effort planned for WY 2019 to address these information needs. This report covers monitoring for Polychlorinated Biphenyls (PCBs) and total mercury primarily to address information need #1, to assist in PCBs source identification studies as part of a process outlined in ACCWP (2016). The main objective of this monitoring is to identify individual properties (parcels) with elevated concentrations of PCBs that may be abated as a means of attaining pollutant load reduction targets.

This report covers data collected by sampling street dirt accumulating in public rights-of-way (ROWs) within the cities of Hayward, San Leandro, Oakland, Emeryville, and Berkeley. All sampling was performed in September 2018 by personnel of Applied Marine Sciences, Inc.

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[2] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

(AMS). Prospective sampling sites were identified to focus on specific properties exhibiting potential to be important contributors of loadings of POCs to County waterways.

2. Methods

The Program prepared a draft Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) describing methods based on those used for Task 3 of Clean Watersheds for a Clean Bay (CW4CB), a regional program of pilot PCB implementation projects under the coordination of the Bay Area Stormwater Management Agencies Association (BASMAA 2012).

Surface soil samples were collected in public right-of-way areas using the general procedures described in the RMC SOP FS-6, Collection of Bedded Sediment Samples for Chemical Analysis & Toxicity (BASMAA 2016). Soil was only collected in areas where a direct linkage between the accumulated soil and the suspected source property could be made.

Prior characterization efforts conducted on behalf of BASMAA member agencies have regularly used laboratory analyses with target Reporting Limits (RLs) consistent with California Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Project Plan (SWAMP 2017); this project, however, as more of a screening level monitoring project, is not restricted to use of lowest obtainable RLs. Instead, the project selected laboratory methods that provide data at concentrations required to inform management actions, but at lower cost in order to allow a greater number of samples to be analyzed. Target Minimum RLs for this study are listed in Table 2-1 and Table 2-2.

Table 2-1. Target MRLs for Sediment Quality Parameters.

Analyte	MRL
Sediment Total Organic Carbon	0.01% OC
%Moisture	n/a
%Lipids	n/a
Mercury	30 µg/kg

Table 2-2. Target MRLs for Analyte PCB Congeners in Soils/Sediment.

Congener	Soils MRL (µg/kg)	Congener	Soils MRL (µg/kg)
PCB 8	10	PCB 118	10
PCB 18	10	PCB 128	10
PCB 28	10	PCB 132	10
PCB 31	10	PCB 138	10
PCB 33	10	PCB 141	10
PCB 44	10	PCB 149	10
PCB 49	10	PCB 151	10
PCB 52	10	PCB 153	10
PCB 56	10	PCB 156	10
PCB 60	10	PCB 158	10
PCB 66	10	PCB 170	10
PCB 70	10	PCB 174	10
PCB 74	10	PCB 177	10
PCB 87	10	PCB 180	10
PCB 95	10	PCB 183	10
PCB 97	10	PCB 187	10
PCB 99	10	PCB 194	10
PCB 101	10	PCB 195	10
PCB 105	10	PCB 201	10
PCB 110	10	PCB 203	10

3. Field Sampling

3.1. Objectives

The objectives of the sampling effort were to analyze the following:

- Soil samples collected from up to 25 sites in western Alameda County for analysis of PCB congeners, Hg, Total Organic Carbon (TOC), density, and particle size analysis (analyzed as % fines, < 63 µm) by ALS Group (ALS).

3.2. Sampling Locations

A total of 25 properties were prioritized for their potential to be contributing significant loads of POCs, namely Hg and PCBs, to County waterways. Over time, ACCWP has developed and updated a source property tracking database that compiles various attributes (e.g., location, ownership, information leading to inclusion, prior monitoring results) for sites of potential interest. ACCWP, Geosyntec, and AMS staff participated in a prioritization effort to identify a pool of 25 properties from the database for assessment and potential monitoring in WY 2018. A list of sites that were assessed / sampled in WY 2018 is shown in Table 3-1; it should be noted that two of these sites, ROW_18-24 and ROW_18-25, were included to follow up on elevated analytical results for Hg from a prior investigation and were only analyzed for Hg for this event. Figure 3-1 and Figure 3-2 show the relative locations of the sites successfully sampled.

Table 3-1. WY2018 POC Source Properties Investigated

SiteID	Property ID	Date	Lat	Long
ROW_18-01	Berkeley Industrial Court	9/17/18	NS	NS
ROW_18-02	Shellmound Venture Project	9/17/18	37.83482	-122.29390
ROW_18-03	EBMUD	9/17/18	37.83388	-122.29379
ROW_18-04	PG&E, Emeryville	9/17/18	37.83467	-122.28716
ROW_18-05	California Electric Co.	9/17/18	37.82242	-122.28193
ROW_18-06	Unlicensed Construction Debris Operation	9/17/18	NS	NS
ROW_18-07	Custom Alloy Scrap Sales (CASS)	9/17/18	37.82025	-122.28621
ROW_18-08	Heroic War Dead Memorial, EBMUD	9/17/18	37.82450	-122.29949
ROW_18-09	City of Oakland, Subaru Lot	9/17/18	37.82076	-122.29536
ROW_18-10	Southern Pacific Oakland	9/17/18	37.81703	-122.29538
ROW_18-11	Commair Mechanical Service	9/18/18	37.81076	-122.28858
ROW_18-12	Container Freight	9/18/18	37.80306	-122.29911
ROW_18-13	Cypress Freeway – Third St. Soundwall	9/18/18	37.80315	-122.29339
ROW_18-14	Amco Chemical (Superfund)	9/18/18	37.80282	-122.29486
ROW_18-15	Schnitzer Steel	9/18/18	37.79806	-122.28912
ROW_18-16	Port of Oakland – Embarcadero Cove	9/18/18	37.77980	-122.24324
ROW_18-17	Pacific Thomas Corp.	9/18/18	NS	NS
ROW_18-18	Southern Pacific Trans. Co.	9/19/18	37.76818	-122.21843
ROW_18-19	SLE-31, aka OSL-31 (prior sampling location)	9/19/18	37.76688	-122.21633
ROW_18-20	General Electric - Oakland	9/19/18	37.76538	-122.20592
ROW_18-21	Coliseum Gardens	9/19/18	NS	NS
ROW_18-22	SLE-41A (prior sampling location)	9/19/18	37.75309	-122.19498
ROW_18-23	Alco Iron and Metal Company	9/19/18	37.71698	-122.18855
ROW_18-24	Fry's Metals (AC-HAY-029)	9/19/18	37.65377	-122.12695
ROW_18-25	American Auto Salvage (AC-HAY-004)	9/19/18	37.63713	-122.13179

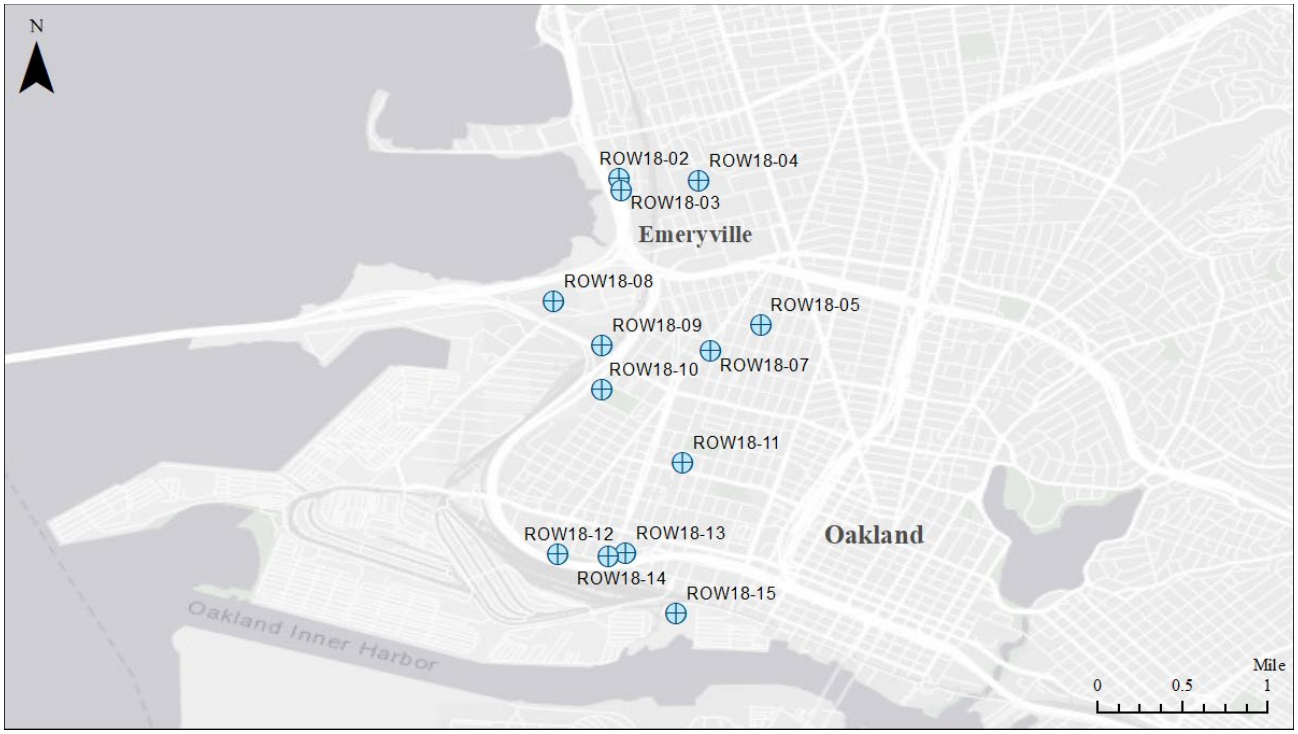

Figure 3-1. Overview of WY18 POC Source Properties Successfully Sampled in North Oakland Emeryville, and Berkeley

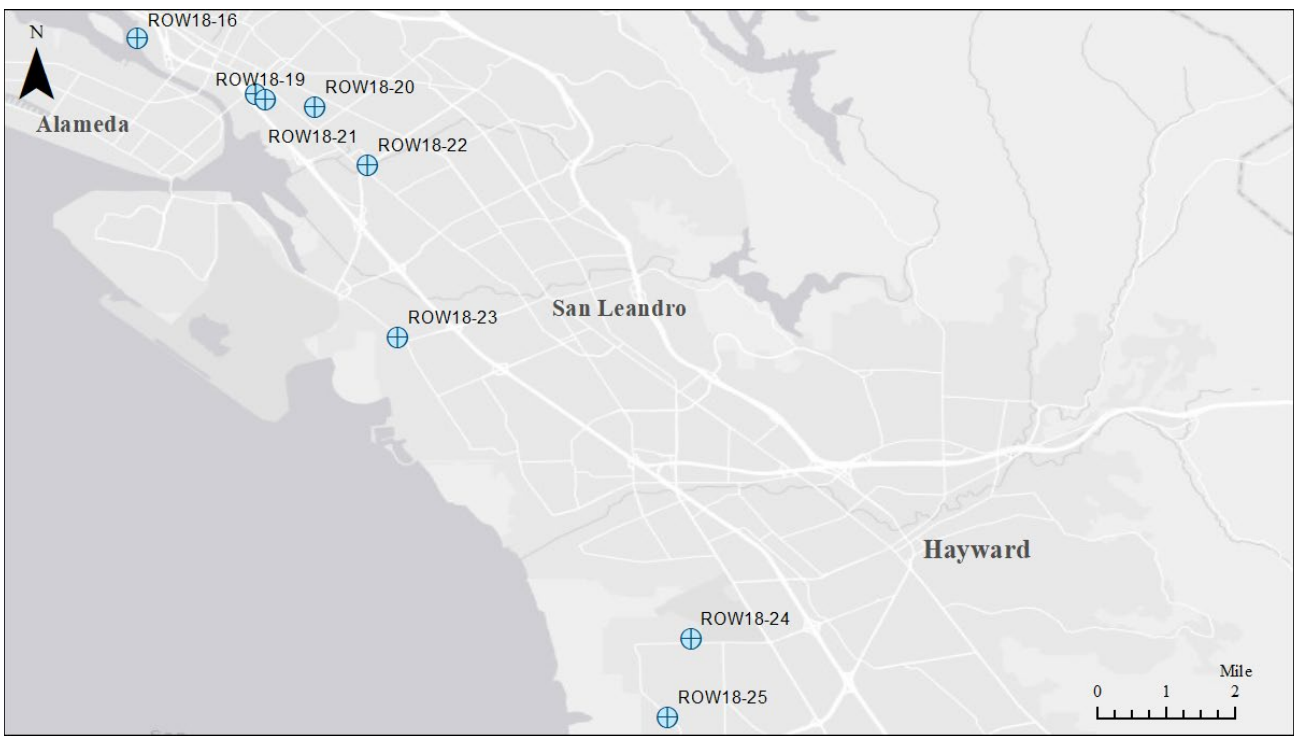

Figure 3-2. Overview of WY18 POC Source Properties Successfully Sampled in South Oakland, San Leandro, and Hayward

4. Results and Discussion

4.1. Completeness

Sampling personnel collected samples at 21 of 25 identified sites for which a field reconnaissance was performed. The sampling failures are attributed to one of the following factors: (1) soils present, but no evidence they originated from the target property (e.g., adjacent sidewalk at higher elevation than site; soils appear to be product of dumping); or (2) limited volume of depositional soils present.

4.2. Quality Assurance

Upon receipt of draft data deliverables, AMS performed validation and verification on laboratory data consistent with SWAMP Measurement Quality Objectives (MQOs).[3] QA review indicated that data quality was generally good, with the following observations as noted by analyte group. It should be noted that many of the issues identified related to heterogeneity present in the media affecting precision metrics, which is typical for soil and sediment samples.

Particle Size Distribution
There were multiple size categories that did not achieve control limits for precision in either lab duplicates or blind field duplicates.

Mercury
One lab duplicate pair in lab batch exceeded control limits for precision. A field duplicate pair in two lab batches exceeded control limits for precision.

PCBs
A small number of congener analyses reported detection and reporting limits elevated by an approximate order of magnitude. It should be noted that matrix interferences or analytical dilutions that elevated these limits may have biased calculated total PCBs high to some extent. The potential effects of these interferences are discussed in more detail in the Results section below relative to interpretation of analytical results.

Other issues noted in various batches included individual congeners that did not achieve control limits for lab control sample (LCS) recovery, matrix spike / matrix spike duplicate (MS/MSD) accuracy, and blind field duplicate precision. In addition, a single congener exhibited blank contamination in one batch. None of these issues is thought to affect interpretation.

[3] https://www.waterboards.ca.gov/water_issues/programs/swamp/mqo.html

4.3. Results and Discussion

The summary results associated with all WY 2018 monitoring are presented in Table 4-1 and graphically represented in Figure 4-1. As a practice, ALS does not report sum of PCBs associated with analysis by EPA method 8082M. AMS calculated total PCBs from laboratory EDDs using a substitution of ½ of the MDL reported for affected congeners for any non-detects, consistent with methodology employed for sum of various organic constituents for the RMC Creek Status Monitoring Program reporting.

Table 4-1. Summary Results for WY2018 POC Soil Monitoring.

Site	TOC (%)	Density (g/cm3)	Hg (mg/kg dw)	PCBs (ug/kg dw)	Silt & Clay (%)
ROW_18-02	12.50	0.83	0.08	43	4.94
ROW_18-03	2.57	1.33	0.13	153	9.07
ROW_18-04	4.66	1.05	0.12	204	16.9
ROW_18-05	8.44	0.95	0.13	684	17.43
ROW_18-07	7.79	1.02	1.07	1182	27.83
ROW_18-08	2.44	1.64	0.14	106	8.36
ROW_18-09	0.79	1.53	0.27	108	18.48
ROW_18-10	11.10	1.24	0.08	52	10.5
ROW_18-11	4.31	1.19	0.29	124	21.68
ROW_18-12	2.62	1.08	0.14	109	12.6
ROW_18-13	3.28	1.51	0.32	64	11.35
ROW_18-14	4.70	1.25	0.14	76	6.2
ROW_18-15	5.77	1.30	2.16	1571	8.77
ROW_18-16	3.50	1.40	0.50	49	7.12
ROW_18-18	7.03	1.06	0.27	87	15.73
ROW_18-19	2.63	1.59	0.38	846	16.62
ROW_18-20	3.48	1.46	0.06	98	19.12
ROW_18-22	5.33	1.39	0.16	159	19.74
ROW_18-23	6.09	1.10	0.78	615	21.5
ROW_18-24	4.92	1.54	0.40	#N/A	13.58
ROW_18-25	3.10	1.30	0.16	#N/A	18.51

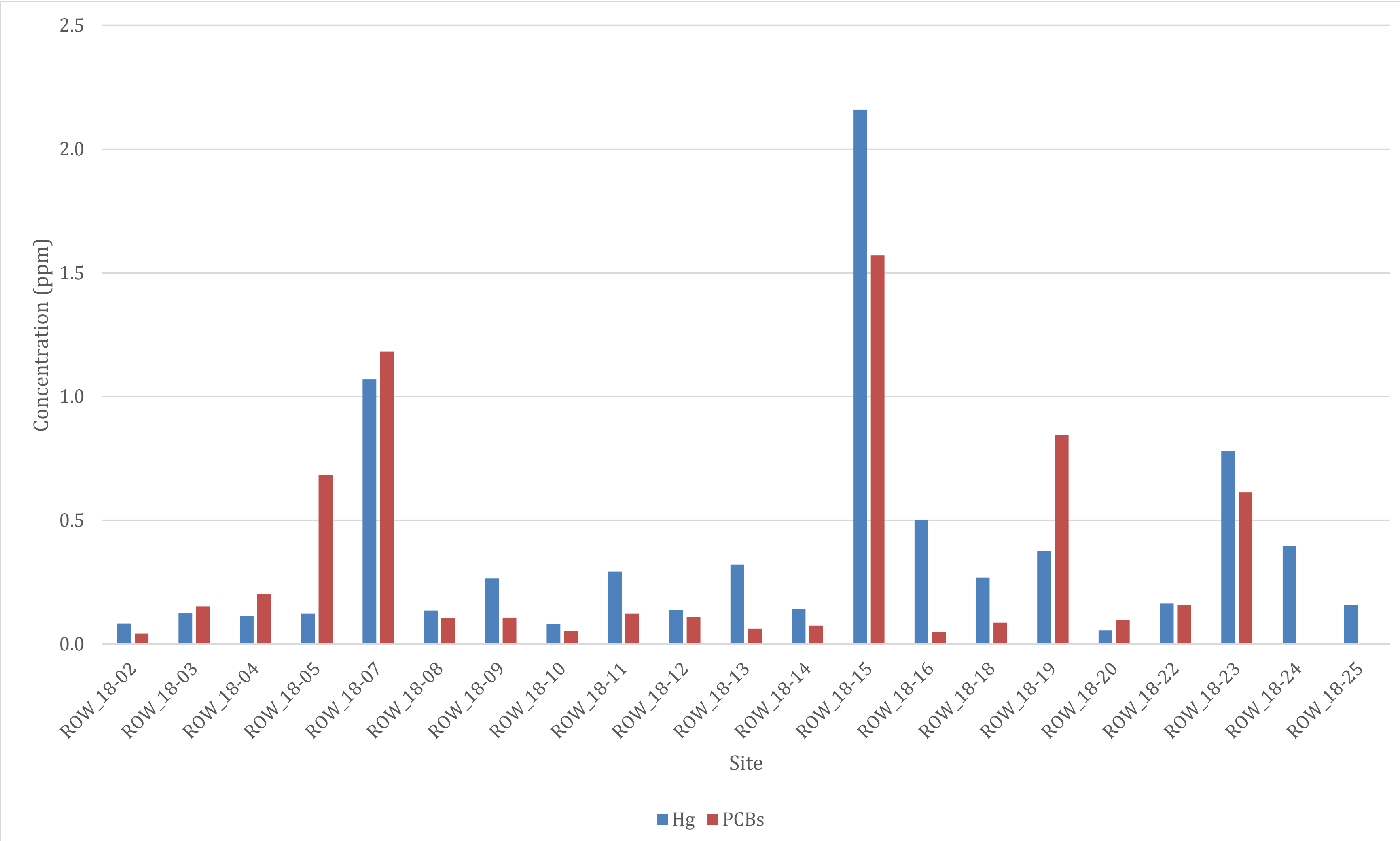

Figure 4-1. Relative Concentrations of Total Hg and Sum PCBs across 2018 ACCWP POC Soil Sampling Sites

Two of the 2018 sampling sites exhibited both total Hg and total PCB concentrations above 1 mg/kg (or ppm): site ROW_18-07 at Custom Alloy Scrap Sales (CASS) site and site ROW_18-15 at Schnitzer Steel. The Schnitzer Steel site (ROW_18-15) is particularly interesting in that it had the highest concentration of PCBs (1571 ug/kg) but among the lowest proportion of fine materials (8.8% fines).

The CASS facility, home to an iron smelting operation in the 1950s and 1960s and currently a metal recycling facility that covers four city blocks. The site was originally identified as a potential source property of PCBs through a 2005 investigation conducted as part of a Proposition 13 grant project in the Ettie Street watershed. For that project, Kleinfelder (2006) conducted sampling on private property belonging to the facility and identified a maximum PCB concentration of 14.7 ppm at the CASS east facility. Follow-up right-of-way monitoring conducted around the CASS facilities identified concentrations of approximately 2 to 4 ppm (AMS 2007). CASS was originally referred to the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) as part of the Clean Water for Clean Bay (CW4CB) Task 3 effort to identify on-land sources of PCBs in five pilot watersheds, including the Ettie Street Pump Station Watershed (ESPSW) in West Oakland. CASS was also included as a referral in the 2018 Annual Report.

The Schnitzer Steel facility, currently a scrap metal recycling facility, has been under review of the State Board since at least 1987 and is currently identified on the State Board's Geotracker website with metals and PCBs listed as potential contaminants of concern.[4] The Regional Water Board issued a Cleanup and Abatement Order[5] to the facility in 2013. Schnitzer Steel Industries prepared a Final Soil and Groundwater Management Plan (Terraphase Engineering 2017) in August 2017 that summarizes the POCs for the site (total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, semi-volatile organic compounds, volatile organic compounds, PCBs, polybrominated diphenyl ethers, and metals). This report also summarizes soil and groundwater data collected on this site. PCBs have been detected in 116 of 116 soil samples, with total PCBs concentrations ranging from 0.016 mg/kg to 104 mg/kg. PCBs have been detected in 1 of 52 groundwater samples, with a total PCBs concentration of 2.11 µg/L. ACCWP is currently working on a referral form for this site based upon monitoring conducted to-date.

As discussed previously, matrix interferences or analytical dilutions that elevated detection and reporting limits for analyses of a small subset of individual PCB congeners may have elevated calculated total PCBs to some extent. However, a sensitivity analysis performed to examine the contributions of these non-detects to the overall totals calculated estimated this possible bias to be less than 10% of total PCBs calculated at these two sites in a worst-case scenario, still leaving them both above 1 ppm in concentration and elevated relative to other sites sampled.

Three other sampling sites exhibited concentrations of Hg or total PCBs above 0.5 ppm (Figure 4-1). These sites were California Electric Company (ROW_18-05, 684 ug/kg), an industrialized block that contains supply yards and metal, concrete, and asphalt recyclers (ROW_18-19, 846 ug/kg), and Alco Iron and Metal Company (ROW_18-23, 615 ug/kg).

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[4] Geotracker website accessed December 7, 2018, geotracker.waterboards.ca.gov/profile_report?global_id=SL0600116612
[5] Cleanup and Abatement Order No. R2-2013-1001 and Rescission of Order No. 88-023.

The two follow-up sites analyzed for Hg only did not exhibit elevated concentrations relative to remaining sample sites for this sampling event. The two sites, Fry's Metals and American Auto Salvage, both in Hayward, generated total Hg concentrations of 0.4 and 0.16 ppm, respectively.

4.4. Next Steps

Pursuant to Provision C.8.h in MRP2, in October of each year the Program submits a separate POC Monitoring Report describing accomplishments during the preceding Water Year and the allocation of POC monitoring sampling effort for the forthcoming Water Year, i.e. for WY 2019 in the October 2018 report (ACCWP 2018). The POC Monitoring Report also considers other data sources; for example, prior monitoring through by the RMP at an outfall in West Berkeley provided an alternative line of evidence indicating possible sources or reservoirs of sediment with elevated concentrations of both PCBs and mercury.

Based upon results of WY2018 monitoring, ACCWP is targeting three high priority areas for possible follow-up activity in WY2019:

1. Schnitzer Steel (ROW_18-07) – Concentrations of both PCBs and Hg were among the highest measured in WY2018. Plans for 2019 include further investigation and recon of ROW areas that drain to the MS4 system. Follow-on sampling would then be conducted at additional areas identified through recon activities, potentially including storm drain inlets in addition to areas of accumulated street dirt.
2. Alco Iron and Metal (ROW_18-23) – Concentrations of both PCBs and Hg were also high relative to remaining WY2018 sampling sites. Follow-on sampling will be targeted for this metal recycling facility, again with potential for sampling directly from storm drain inlets.
3. City of Oakland / Subaru Lot (ROW_18-09) – ACCWP will follow-up with City of Oakland staff to determine development plans for multiple City-owned parcels in the vicinity of the 2018 sampling site. Depending on the outcome of these conversations, ACCWP may collect additional samplings on or around these parcels to better characterize pollutant concentrations associated with each.

5. References

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ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

STRESSOR / SOURCE IDENTIFICATION PROJECT:

EXPLORING CSCI RESULTS AND THE OUTCOMES OF RESTORATION ACTIVITIES ALONG SAUSAL CREEK

PROGRESS REPORT
WATER YEAR 2018
URBAN CREEKS MONITORING REPORT, APPENDIX A.4

Report prepared by
Alameda Countywide Clean Water Program
399 Elmhurst Street,
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Submitted to:
California Regional Water Quality Control Board, San Francisco Bay Region

March 31, 2019

clean water PROGRAM

MEMBER AGENCIES:

Alameda

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Fremont

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Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

Protecting Alameda County Creeks, Wetlands & the Bay

List of Acronyms

Acronym	Definition
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CSCI	California Stream Condition Index
CSM	Creek Status Monitoring
DO	Dissolved Oxygen
I-	Interstate Highway
MRP, MRP 2.0	Municipal Regional Stormwater Permit (reissuance from previous "MRP 1.0")
NPDES	National Pollutant Discharge Elimination System
PEC	Probable Effects Concentration
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board(California Regional Water Quality Control Board, San Francisco Bay Region)
SSID	Stressor/Source Identification
SOP	Standard Operating Procedure
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
USEPA	United States Environmental Protection Agency
WY	Water Year

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1. Introduction

The Alameda Countywide Clean Water Program (ACCWP) conducts Creek Status Monitoring as required by Provision C.8.d of the Municipal Regional Stormwater Permit (MRP, SFBRWQCB 2015)[1]. ACCWP's 17 member agencies have joined with 56 other MRP Permittees to form the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative to coordinate monitoring conducted pursuant to MRP Provision C.8, Water Quality Monitoring. The RMC prepared a Quality Assurance Project Plan (QAPP, BASMAA 2014a and 2016a) and Standard Operating Procedures (SOPs, BASMAA 2012b, 2014b and 2016b) to standardize monitoring methods and ensure comparability of monitoring data with the state's Surface Water Ambient Monitoring Program (SWAMP) (see Table 1-1).

Table 1-1. Standard Operating Procedures Pertaining to BASMAA RMC Creek Status Monitoring.

SOP #	SOP Title
FS-1	BMI and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

The RMC's Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011) assigns each of the Creek Status Monitoring (CSM) parameters listed in MRP Table 8.1 to one of two sub-design components:

- **Regional:** ambient monitoring to assess the condition of aquatic life in creeks across the San Francisco Bay Area. Candidate monitoring sites were drawn from a probabilistically generated master list that included all perennial and non-perennial creeks and rivers within the applicable portions of the five participating counties. Sites from the RMC

[1]The MRP was initially issued as SFBRWQCB 2009 (MRP 1.0) and reissued on November 19, 2015 with minor revisions in monitoring provisions regarding Stressor/Source Identification. Unless otherwise noted, references to trigger values and other permit requirements in this report refer to the original MRP 1.0 unless identified as referring to the reissued MRP 2.0.

master list are identified by an alphanumeric code in which the last 6 characters are "Rnnnnn" with "R" designating the RMC probabilistic design and "nnnnn" the site's numeric sequence number generated through the RMC master draw[2]. RMC sites can also be assigned an alternative ID using the SWAMP naming procedure described in RMC SOP FS-11.

- **Targeted:** monitoring design and site selection address local watershed management questions. The last 6 characters of each Site ID reflect the watershed and numbering from the base of the watershed per the RMC SOP FS-11.

Creek Status Monitoring (CSM) was initiated in WY 2012 (October 2011 through September 2012) and reported in the first Urban Creeks Monitoring Report (UCMR, BASMAA 2013) submitted to the Regional Water Quality Control Board (RWQCB) in March 2013. The UCMR evaluated all data against "trigger criteria" listed for each parameter in MRP Table 8.1, which identified potential follow-up actions including Stressor/Source Identification (SSID) projects as required by Provision C.8.d.i of the Municipal Regional Stormwater Permit (MRP), subject to several conditions:

1. Creek Status Monitoring results meet one or more trigger criteria in MRP Table 8.1
2. When conducting monitoring through a regional collaborative, Permittees were collectively required to initiate no more than ten SSID projects during the MRP 1 Permit term, and ACCWP's proportionate share was assumed to be three projects out of the 10.
3. If results indicated toxicity, at least 2 of the 10 SSID projects must be for toxicity
4. No need to repeat for continuing or recurring occurrences of the trigger in later results from the same receiving water limitations, unless directed to do so by the Water Board
5. No need to follow up on trigger results that are caused by Pollutants of Concern, which are already being addressed by other portions of the MRP (e.g. pesticides).

The RMC programs developed a collaborative decision-making process for selecting sites for SSID follow-up. Program representatives reviewed the previous year's CSM results that reached "trigger" criteria, and prioritized sites for SSID follow-up based on several criteria including environmental significance of the trigger results and the feasibility of completing the project steps outlined in the MRP (see below). After consultation with affected Permittee(s), the RMC confirmed the candidate SSID project list with Water Board staff in April 2012 and individual programs planned initiation of SSID studies in their areas for FY 2013-14.

MRP 1.0 listed four steps[3] for a SSID project, with ACCWP and other Countywide Programs leading the technically oriented steps 1 and 4 and collaborating with relevant Permittees on step

[2]As recommended for SWAMP data compatibility per RMC SOP FS-11, all site ID codes begin with a 3 digit Hydrologic Unit Code.

[3] The reissued MRP modifies details and reporting requirements of these steps.

2. Permittee(s) will be the lead on step 3 to the extent that effective stormwater BMPs are within their power and jurisdiction. The four steps are:

(1) Conduct a site-specific study (or non-site specific if the problem is widespread) to identify and isolate the cause(s) of the trigger stressor/source. If the trigger stressor or source is already known (e.g. toxicity), proceed directly to step 2.
(2) Identify and evaluate the effectiveness of options for controlling the cause(s) of the trigger stressor/source.
(3) Implement one or more controls.
(4) Confirm the reduction of the cause(s) of trigger stressor/source.

The three projects initiated by ACCWP during the MRP 1.0 Permit term have been completed. In line with MRP 2.0 requirements for SSID projects conducted through a regional collaborative, ACCWP initiated this new SSID project in WY 2018, exploring CSCI results and the outcomes of restoration activities along Sausal Creek. The workplan for this project was submitted in August, 2018.

2. Background

2.1 Study Area

2.1.1 Sausal Creek Watershed

The Sausal Creek Watershed encompasses roughly 2,700 acres in Oakland. With headwaters in the Oakland hills, Sausal Creek flows generally southwest through the city and multiple city parks before discharging into the tidal canal that separates the island of Alameda from Oakland, which in turn flows into San Francisco Bay. Approximately 20 percent of the watershed is open space. Other land uses in the watershed range from low-density residential development in the hills to a dense mix of commercial and residential uses in the lower reaches. Approximately one-half of the length of the creek is culverted or channelized (Friends of Sausal Creek 2018).

Multiple restoration projects have taken place on Sausal Creek. The Dimond Canyon Restoration Project of 2001 involved removing concrete structures and revegetation of a reach of the creek. The Sausal Creek Restoration Project in Dimond Park was completed in 2016 and involved the daylighting of a new channel, with some recontouring and revegetation of the downstream reach (Cover 2018, City of Oakland 2016). Numerous sites along Sausal Creek and its tributary Palo Seco Creek have been sampled in the past two decades, mainly by ACCWP, but monitoring has also been performed by SFBRWQCB and Friends of Sausal Creek, including sites at, upstream, and downstream of these restoration projects (Cover 2018). Historic CSCI scores are available for multiple sites.

The sites in Dimond Park (204SAU055, 204R03135, 204SAU070) and Dimond Canyon Park (204SAU090, 204SAU100) are located at, upstream, and downstream of two stream restoration projects. Towards the lower end of the watershed, Site 204SAU030 is located 1.3 miles downstream of Dimond Park at 22nd St. in a residential area. Upper watershed sites include 204SAU110, 204SAU130, and 204SAU200.

2.1.2 Beneficial Uses

Beneficial uses (SFRWQCB, 2015) assigned to Sausal Creek include:

- Cold freshwater habitat (COLD);
- Preservation of Rare & Endangered Species (RARE);
- Fish Spawning (SPWN)
- Warm freshwater habitat (WARM);
- Wildlife habitat (WILD); and
- Water Contact and Non-contact Recreation (REC-1 and REC-2). Public parks or other facilities allow access or approaches to sections of Sausal Creek.

2.2 Problem Statement

Stream restoration projects are generally designed to improve channel or bank stability and vegetative cover, which can also improve instream habitat conditions for benthic macroinvertebrates (BMIs). This SSID study will evaluate whether BMI metrics improved from pre-project conditions in reaches with restoration projects by resampling sites at or close to ones previously sampled by ACCWP on Sausal Creek in Oakland.

The MRP states that "sites where there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites are also appropriate for a SSID project". This SSID study also involves sampling on Palo Seco Creek upstream of the Sausal Creek restoration-related sites in the vicinity of sites in which there have previously been suboptimal CSCI scores.

The project will:

1. enable a more focused study of monitoring data collected over many years in a single watershed,
2. allow analysis of before[4] and after data at sites upstream and downstream of previously completed restoration activities, and
3. provide additional data to better understand whether biological conditions associated with previously measured sub-optimal CSCI scores within the restored area (site 3135 = 0.56) are a function more of where the site is in its recovery / maturation process or are simply typical of reaches in Sausal Creek proper (i.e., there are other stressors present lowering the score that haven't previously been identified).

2.2.1 Water Quality Triggers

A comparison of WY 2016 and WY 2017 sampling results with MRP trigger criteria are presented in Table 2-1. Triggers for sediment quality were based on calculation of Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) for each analyte as determined following MacDonald et al. (2000). It should be noted that there are some limitations in the MacDonald method, which are discussed below. When examining pyrethroid concentrations, a similar degree of uncertainty exists. Weston (2005) reported that predictions of sediment toxicity to *H. azteca* were supported by observed results for sites with TU ratios below one (little or no mortality) and above four (high or full mortality). For TUs between one and four, however, the predictive ability of the TU is less certain (Weston 2005). The Toxicity Unit calculation for pyrethroids was eliminated as a trigger criterion in MRP 2.0, as was the complex linkage of sediment chemistry, toxicity, and bioassessment.

[4] Pre-restoration data were collected in Dimond Park by ACCWP from 2001-2005.

Table 2-1. WY 2016 and WY 2017 MRP Triggers and Significance at Sausal Creek and Palo Seco Creek Sites

Sites Name / Year	Trigger type	Trigger status at site	Comment
204SAU030 WY 2016	Sediment Chemistry	**Chromium & Copper > TEC, Nickel > PEC**	In WY 2016, site also exhibited statistically significant toxicity (but below trigger threshold) during wet season aquatic toxicity monitoring.
204R01343 WY 2017	CSCI Score	**Score of 0.69 (below 0.795)**	Condition Category - Likely Altered
204R03135 WY 2017	CSCI Score	**Score of 0.56 (below 0.795)**	Condition Category - Very Likely Altered
204SAU110 WY 2017	Enterococci	**>130 CFU/100 mL**	

2.2.2 Potential Sources and Activities Contributing to Triggers

The Causal Analysis/Diagnosis Decision Information System (CADDIS) was developed by the US EPA as an online guidance tool for conducting causal assessments of impacts to aquatic ecosystems (US EPA 2010). The online tool provides a framework and resource base for Stressor Identification (SI) using a five-step process for conducting a causal assessment:

Step 1: Define the Case
Step 2: List Candidate Causes
Step 3: Evaluate Data from the Case
Step 4: Evaluate Data from Elsewhere
Step 5: Identify Probable Causes

The Stressor Identification process may be iterative, and if the stressor cannot be adequately identified in the first attempt, the process may continue with collection of additional data or testing other suspected stressors.

For the channel section found at site 204R03135, physical habitat alteration and lack of mature vegetation connected to a restoration project completed in 2016 is the most likely cause of biological community degradation. Figure 2-1 shows a simple conceptual diagram from CADDIS, illustrating causal pathways related to physical habitat change as a candidate cause of biological impairment. CADDIS also notes that "urbanization" comprises several types of causal activities that together result in an "urban stream syndrome" of co-occurring, interacting changes in five general stressor categories:

- Water/Sediment Quality
- Temperature
- Hydrology
- Physical Habitat
- Energy Sources

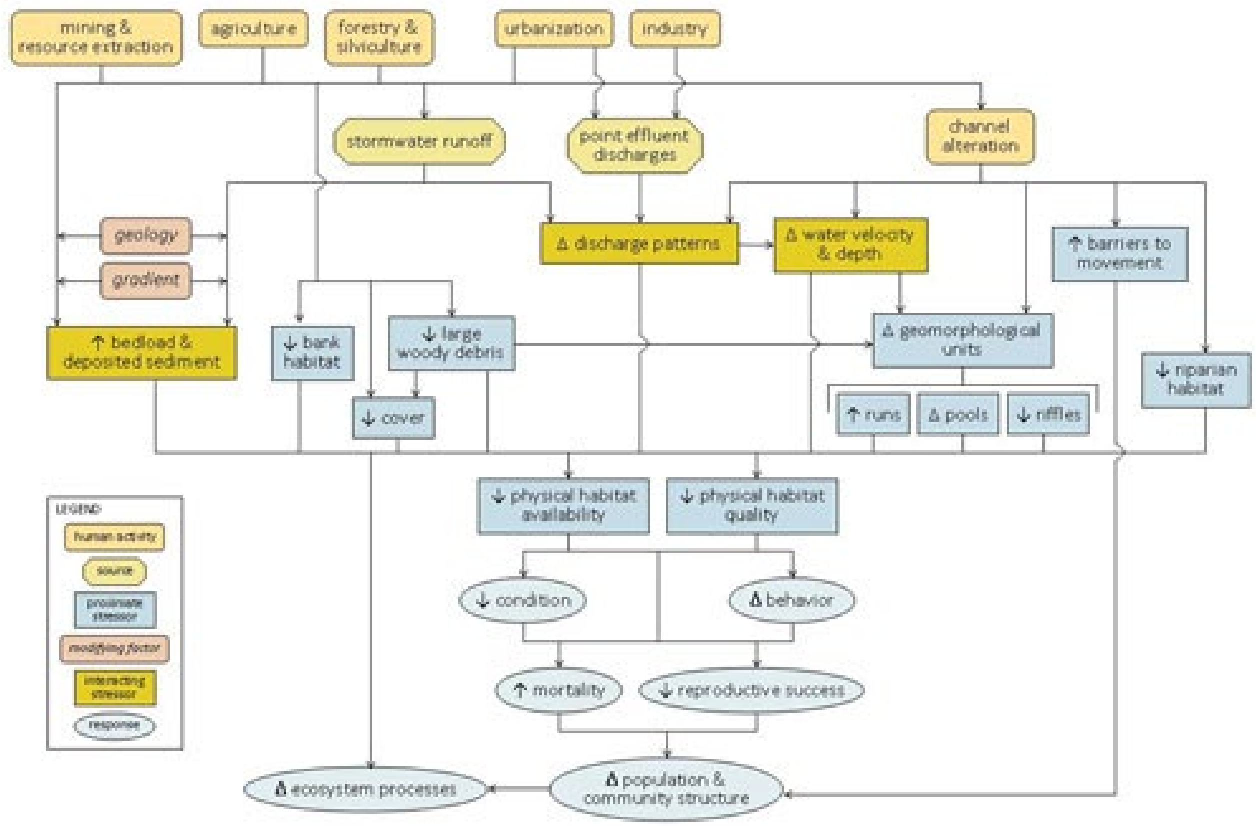

Figure 2-1. Conceptual diagram illustrating causal pathways, from sources to impairments, related to physical habitat (USEPA 2010).

ACCWP (2018) described a study design for WY 2018 sampling along much of Sausal Creek. Figure 2-2 presents a schematic of the creek system with illustration of channelization and hydromodification, as well as general watershed land uses.

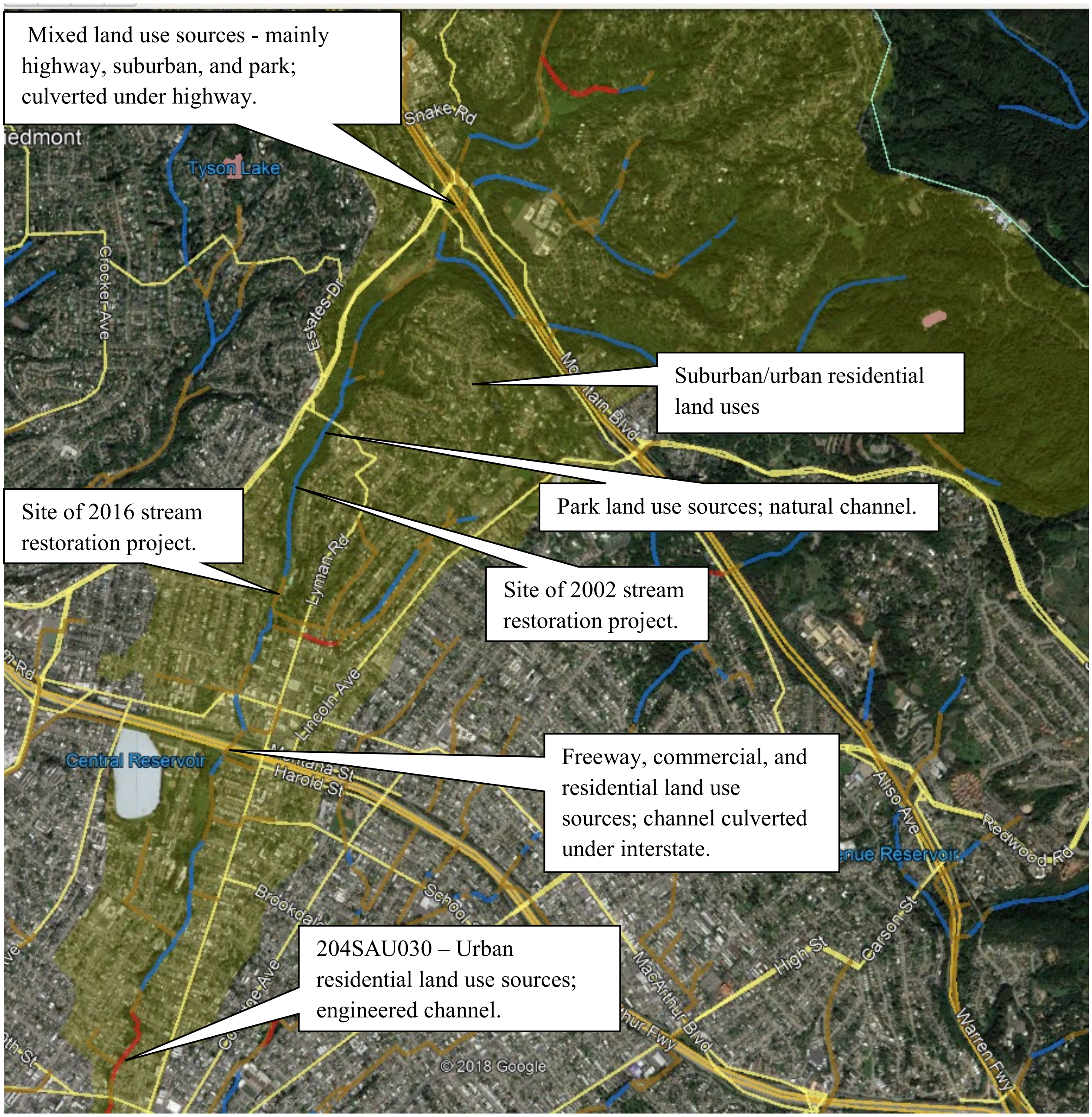

Figure 2-2. Conceptual Model of Candidate Causal Stressors in the Sausal Creek Watershed

2.2.3 Other Available Data

As discussed above, one of the goals of this SSID project is to compare data from before and after the completion of restoration projects. A range of sampling and data collection work has been conducted previously along Sausal Creek at, and close to, sites monitored in WY 2018 as part of this project. A summary of the available information is provided in Table 2-2 below.

Table 2-2. WY 2018 Monitoring Locations and Available Data for Sausal Creek SSID Study.

Site Code	Latitude	Longitude	Available Data From Previous WYs
204R03135	37.80393	-122.21675	Bioassessment, nutrients, and chlorine WY 2017.
204SAU070	37.80772	-122.21586	Continuous Water Temperature WY 2014 & WY 2012
204SAU130	37.81597	-122.20023	Sampled by Regional Board 2005, Pathogen Indicators WY 2017
204SAU030	37.78593	-122.22430	Sampled by Regional Board 2005, Water column and sediment toxicity WY 2016
204SAU200	37.81906	-122.20766	Pathogen Indicators WY 2017, Continuous Water Temperature WY 2014 & WY 2012
204SAU110	37.81898	-122.20734	Pathogen Indicators WY 2017, Continuous Water Temperature WY 2012
204SAU055	37.80365	-122.21665	Pathogen Indicators WY 2017
204SAU090	37.81221	-122.21366	Sampled by Regional Board 2005, Pathogen Indicators WY 2017
204SAU100	37.817	-122.21103	Continuous Water Temperature WY 2012
Other Available Data From Nearby Sites			
204SAU035	37.7913	-122.2212	Continuous Water Temperature WY 2014 & WY 2012
204SAU090			Sampled by Regional Board 2005
204R01343	37.81122	-122.18439	Bioassessment, nutrients, and chlorine WY 2017.
204R02367	37.81388	-122.18865	Bioassessment, nutrients, and chlorine WY 2017.
204R01087	37.81374	-122.19398	Bioassessment WY 2014
SAUS-D			Bioassessment in 2001-2005
SAUS-R			Bioassessment in 2003-2005
Palo-JM1			Bioassessment in 2003-2006

3. WY 2018 SSID Monitoring

The sampling locations and sampling strategies for SSID monitoring in the Sausal Creek Watershed in WY 2018 are presented in Table 3-1 and shown in Figure 3-1.

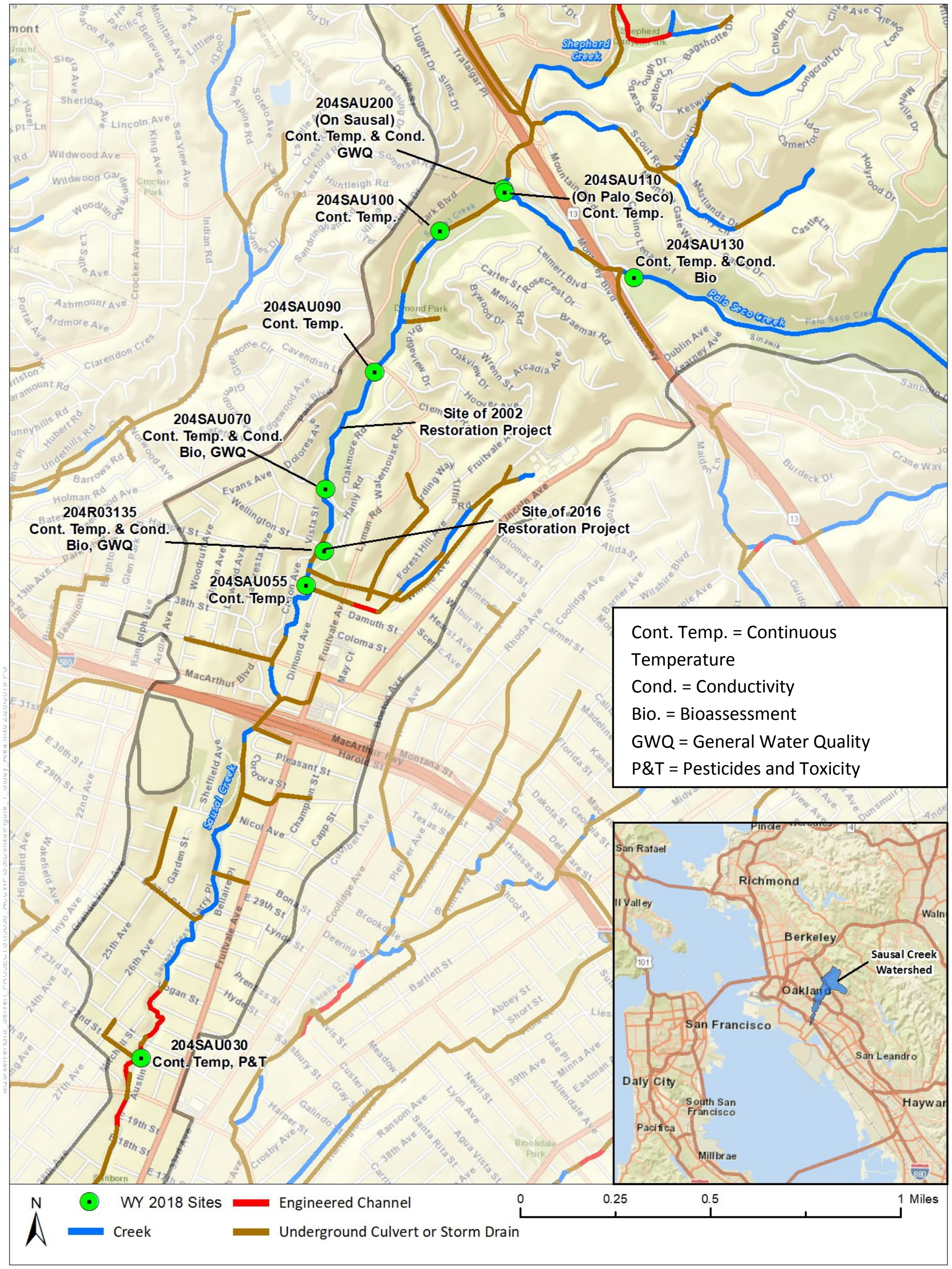

Figure 3-1. Relative Location of 2018 ACCWP SSID Sampling & Monitoring Sites.

Table 3-1. WY 2018 Monitoring Locations and Sampling for Sausal Creek SSID.

Site ID	Site Description	Latitude	Longitude	Creek Status Monitoring Parameter						
				BA	N	Cl	WQ Tox	SED	TEMP	GWQ
204R03135	Sausal Creek approximately 300 m downstream of El Centro Ave	37.80393	-122.21675	X	X	X			X	X
204SAU070	Sausal Creek at El Centro	37.80772	-122.21586	X	X	X			X	X
204SAU130	Palo Seco Creek between trash rack and culvert	37.81597	-122.20023	X	X	X			X	
204SAU030	Sausal Creek at E.22nd	37.78593	-122.22430				X	X	X	
204SAU200	Sausal Creek above Palo Seco Creek	37.81906	-122.20766						X	X
204SAU110	Palo Seco Creek above Sausal Creek	37.81898	-122.20734						X	
204SAU055	Sausal Creek approximately 200 m below Wellington St	37.80365	-122.21665						X	
204SAU090	Sausal Creek at Leimert Ave.	37.81221	-122.21366						X	
204SAU100	Sausal Creek below golf course	37.817	-122.21103						X	

Legend:
BA = Bioassessment; N = Nutrients; Cl = Chlorine; WQ Tox = Water Column Toxicity; SED = Sediment Toxicity and Chemistry; TEMP = Continuous Temperature Monitoring; GWQ = Continuous General Water Quality Monitoring.

3.1 Bioassessment Monitoring

In WY 2018, ACCWP conducted bioassessment monitoring at 3 sites in the Sausal Creek Watershed. The calculated CSCI, ASCI, and IPI scores for these sites are shown in Table 3-1. Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table. More detailed descriptions of these scores and methods can be found in Appendix A.1.

Table 3-2. CSCI, ASCI, and IPI scores for Sausal Creek sites sampled in Alameda County during WY 2018.

Station Code	Creek	Impervious Area%	Flow Status	Highly Modified Channel	CSCI Score	ASCI			IPI Score
						Soft Bodied Algae	Diatoms	Hybrid Algae	
204R03135	Sausal Creek	32%	P	N	0.63	0.43	0.77	0.68	1.00
204SAU070	Sausal at El Centro	32%	P	N	0.76	1.02	0.62	0.68	0.93
204SAU130	Palo Seco	8%	P	N	1.11	0.79	0.87	0.89	0.97
Y = yes, N = no, P = perennial, NP = nonperennial, NS = not calculated due to insufficient soft algae									

The ratings for these sites are provided in Table 3-2 below, using the categories described in Table 3-3 of Appendix A-1.

Table 3-3. CSCI, ASCI, and IPI condition categories for 17 probabilistic urban sites sampled in Alameda County during WY 2018.

Station Code	Creek	CSCI	ASCI			IPI
			Soft Algae	Diatom	Hybrid	
204R03135	Sausal Creek	Likely Altered	Very Likely Altered	Likely Altered	Very Likely Altered	Very Likely Altered
204SAU070	Sausal at El Centro	Likely Altered	Likely Intact	Very Likely Altered	Very Likely Altered	Likely Altered
204SAU130	Palo Seco	Likely Intact	Likely Altered	Possibly Intact	Possibly Intact	Likely Intact

The site with the lowest CSCI score was 204R03135, which had a similar, but slightly lower score of 0.56 in WY 2017 which was one of the triggers that lead to the initiation of this SSID project. This site is located just downstream of a culverted section of the creek in a section of the creek that was part of a restoration project completed in 2016. Compared to WY 2017, this site's condition category improved from Very Likely Altered to Likely Altered in WY 2018. These low scores are likely due to the disturbance caused by the recent restoration activities. Future sampling will help determine if the score continues increasing as the restored area matures. CSCI scores increased heading upstream with 204SAU130 rated "Likely Intact". Nutrient and chlorine measurements were taken during the bioassessment sampling. No measured values for these variables exceeded relevant thresholds (shown in Appendix A.1 Table 4-12). Habitat modification due to urbanization is the main source of biological community alteration, especially for highly modified channels but also where natural channels have experienced changes due to increased watershed imperviousness and nearby roads (e.g. Schuler, 2004, SFBRWQCB, 2012).

3.2 Continuous Temperature Monitoring

Data were collected over an approximately six-month period from the middle of April through September 2018 with measurements recorded at 60-minute intervals at the nine sites.

Figure 3-2 presents the results of the continuous monitoring results for WY 2018.

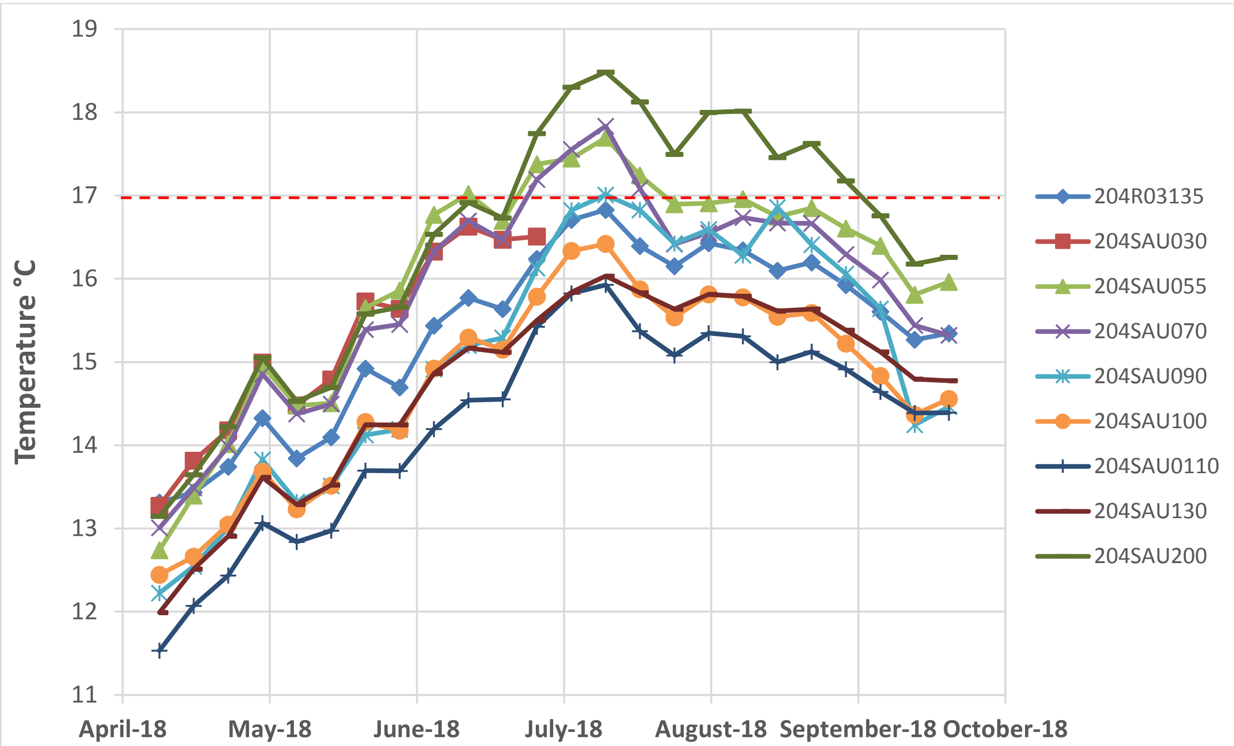

Figure 3-2. Temperature (Discrete 7-Day Average) Line Graph at Sausal Creek Sites, April 17 through September 30, 2018.

Three sites had two or more weekly average temperatures above the 17°C threshold, and an additional site had one weekly average temperature above the threshold.

In general, the highest sustained temperatures were recorded at 204SAU200 which drains the Shepherd Creek subwatershed, which is largely culverted and higher density residential compared with the Palo Seco branch. Site 204SAU055 is at the downstream end of a recent restoration project. Higher temperatures there may be due to current lack of mature vegetation along the restored section. Continuous temperature data from 2012 is available for 204SAU200 and 204SAU070. No MWATs above the threshold were recorded for those two sites during 2012 monitoring.

At site 204RSAU090, there was at least one instance of unusual temperature rise recorded. On the afternoon of May 29, the measured temperature increased 7 ºC in a two-hour period between 1 and 3 pm, then dropped approximately 4 ºC in the following hour. This short-term increase / decrease pattern was noted on other dates around the same time (e.g., a 3.7 ºC increase followed by a 3 ºC decrease between 2 pm and 4 pm on May 30 and a 6 ºC increase followed by a 4.8 ºC decrease between 2 pm and 4 pm on May 31). A cursory review of other dates during this time interval indicate that measurements did not exhibit this same pattern.

3.3 General Water Quality Monitoring

General water quality monitoring that included measurement of temperature, specific conductivity, pH, and DO at 15-minute intervals over a period of between one and two weeks twice per year, once during the spring index period (April/May) for bioassessment sampling and again during the summer/fall (August/September). The results of this monitoring are summarized in Table 3-3 below.

Table 3-4. Comparison of General Water Quality Observations to Trigger Thresholds at Sites 204R03135, 204SAU070, 204SAU200 in WY 2018.

Station	Monitoring Season (No of MWATs)	Applicable threshold or water quality standard					
		Temperature MWATs > 17˚C (> 19°C)	Temp % > 24˚C	Specific Cond. >2000 µS/cm	pH < 6.5	pH > 8.5	DO < 7 mg/L (COLD)
204R03135	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Summer/Fall (2)	0(0)	0%	0%	0%	0%	94%
204SAU070	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Summer/Fall (2)	0(0)	0%	0%	0%	0%	42%
204SAU200	Spring (2)	0(0)	0%	0%	0%	0%	0%
	Summer/Fall (2)	0(0)	0%	0%	0%	0%	0%

Greater than 20% of instantaneous dissolved oxygen measurements at sites 204R03135 and 204SAU070 collected in fall deployments did not achieve the MRP target of ≥ 7 mg/L. Site 204R0315 receives a lot of direct sunlight and large clumps of algae were observed at the site during monitoring.

3.4 Wet Season Pesticides and Toxicity Monitoring

In WY 2018 wet season pesticides and toxicity monitoring was conducted at site 204SAU030, which is on Sausal Creek just upstream of E. 22nd Street in Oakland. In 2016, samples collected here during the dry season exhibited statistically significant aquatic toxicity to both *C. dubia* and *C. dilutus*. Table 3-4 contains the results of the WY 2018 toxicity testing. No statistically significant toxicity was observed for the site.

Table 3-5. Results of January 2018 ACCWP Wet Season Aquatic Toxicity Testing

Sample Station	Toxicity Relative to the Lab Control Treatment						
	Selenastrum capricornutum	***Ceriodaphnia dubia***		***Chironomus dilutus***	***Hyalella azteca***	**Fathead Minnow**	
	Algal Cell Density (cells/mL x 10^6)	**% Survival**	**Repro. (# neonates /female)**	**Mean % Survival**	**10-Day Mean % Survival**	**% Survival**	**Growth (mg)**
Control	2.48	90	35.1	97.5	94	97.5	0.81
204SAU030	5.38	100	35.5	100	98	100	0.85

Table 3-5 contains measured pesticide concentrations from the January sampling event and relevant aquatic life benchmarks from the EPA Office of Pesticide Programs.

Table 3-6. Analytical Chemistry Results for January 8-9, 2018 Sampling Event, Imidacloprid, Fipronil, and Fipronil Degradates

Station	Fipronil (ug/L)	Fipronil Desulfinyl (ug/L)	Fipronil Sulfide (ug/L)	Fipronil Sulfone (ug/L)	Imidacloprid (ug/L)
204SAU030	**0.054**	0.0023	0.0035	0.0103	**0.0366**
Fish – Acute	41.5	10	12.5	12.5	114500
Fish – Chronic	2.2	0.59	0.67	0.67	9000
Invertebrate – Acute	0.11	100	0.36	0.36	0.385
Invertebrate - Chronic	**0.011**	10.31	0.037	0.037	**0.01**

Concentrations of Fipronil and Imidacloprid were above chronic benchmarks for invertebrates. The values for Fipronil and its degradates are below the average values reported to CEDEN, which represents samples collected from across the state in creeks and stormdrains, during storm and non-storm events, and both grab and integrated samples since 2008. Table 3-6 compares data obtained at site 204SAU030 against that historic data.

Table 3-7. Comparison of ACCWP Chemistry Results with CEDEN Data for Creeks and Storm Drains.

Source / Site	Parameter	Fipronil (ug/L)	Fipronil Desulfinyl (ug/L)	Fipronil Sulfide (ug/L)	Fipronil Sulfone (ug/L)
CEDEN	# samples	126	77	24	102
CEDEN	Avg	0.0922	0.0236	0.0289	0.0368
CEDEN	Max	0.6181	0.1090	0.2575	0.2010
CEDEN	Min	0.0002	0.0001	0.0001	0.0002
204SAU030	Jan 2018 result	0.0540	0.0023	0.0035	0.0103
204SAU030	Jan 2018 percentile	45th	17th	47th	33rd

4. Discussion and Planned Activities

The WY 2018 sampling and monitoring activities conducted during the first year of this SSID project have provided additional insight into current water quality issues on Sausal Creek and have enabled an initial look into how water quality and habitat have changed in recent years and in relation to recent restoration projects on the creek. Multiple weekly average temperatures above 17 °C were measured at several sites and low DO levels were observed at two sites. In WY 2019, work on this SSID project will include nutrient sampling, bioassessment, and additional DO and temperature monitoring. This additional sampling and monitoring will provide additional data that will help determine if water quality and habitat are improving around the restoration sites and along the creek in general.

5. References

BASMAA. 2011. Regional Monitoring Coalition Final Creek Status and Long-Term Trends Monitoring Plan. Prepared by EOA, Inc. Oakland, CA. 23 pp.

BASMAA.2012a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Draft Version 1.0.Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.80 pp plus appendices.

BASMAA.2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.196 pp.

BASMAA.2014a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Version 2.Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.81 pp plus appendices.

BASMAA.2014b. Creek Status Monitoring Program Standard Operating Procedures, Final Version 2.Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.203 pp.

BASMAA. 2016a. Creek Status Monitoring Program Standard Operating Procedures. Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Version 3, March 2016.Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. www.waterboards.ca.gov/sanfranciscobay/water_issues/ programs/SWAMP/BASMAA_RMC_QAPP_v3_final-2016-0331_r2_signed.pdf, BASMAA. 2016b. Creek Status Monitoring Program Standard Operating Procedures. Version 3, March 2016. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_SOP_V3_Final%20March%202016.pdf

MacDonald, D.D., G.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39(1):20-31.

SFBRWQCB. 2012. The Reference Site Study and the Urban Gradient Study Conducted in Selected San Francisco Bay Region Watersheds in2008-2010 (Years 8 to 10). Surface Water Ambient Monitoring Program, San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

SFBRWQCB. 2015. California Regional Water Quality Control Board, San Francisco Bay Region, Municipal Regional Stormwater NPDES Permit, Order R2-2015-0049 NPDES Permit No. CAS612008, November 19, 2015.

Schuler, T. 2004. Urban Subwatershed Restoration Manual Series, No. 1: An integrated Framework to Restore Small Urban Watersheds. Version 1.0. Center for Watershed Protection. Ellicott City, Maryland. March 2004.

U.S. EPA (U.S. Environmental Protection Agency). 2010. Causal Analysis/Diagnosis Decision Information System (CADDIS). Office of Research and Development, Washington, DC. Available online at www.epa.gov/caddis. Last updated September 23, 2010.

Weston, D.P., Holmes, R.W., You, J., and Lydy, M.J., 2005, Aquatic toxicity due to residential use of pyrethroid insecticides: Environmental Science and Technology 39(24): 9778-9784.

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Protecting Alameda County Creeks, Wetlands & the Bay

March 31, 2019

Mr. Michael Montgomery
Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: Electronic Data Submittal - ACCWP Creek Status Monitoring from October 2017 through September 2018 Pursuant to Provision C.8.h

Dear Mr. Montgomery:

The member agency Permittees of the Alameda Countywide Clean Water Program (Program) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with Monitoring requirements of the Municipal Regional Stormwater NPDES Permit CAS612008 (MRP, reissued on November 19, 2015 as Order No. R2015-0049).

With this letter I am submitting via the Regional Board's file transfer protocol (ftp) site the Program's Monitoring data collected between October 1, 2017 and September 30, 2018 pursuant to the following provisions of Order No. R2015-0049:

- C.8.d Creek Status Monitoring
- C.8.e Stressor/Source Identification Projects
- C.8.f Pollutants Of Concern Monitoring
- C.8.g Pesticides And Toxicity Monitoring

These data are provided in Microsoft Excel files listed in Attachment A, which are formatted according to templates compatible with data management requirements of the Surface Water Ambient Monitoring Program (SWAMP). The Program is submitting these data to the Regional Water Board by March 31, 2019 and also to the Regional Data Center for upload into the California Environmental Data Exchange Network (CEDEN) as specified in Provision C.8.h.ii of Order No. R2015-0049, with the exception of the non-surface water data collected pursuant to C8.f.[1]

[1] As stated in a letter sent on March 20, 2017, by the Bay Area Stormwater Management Agencies Association to Jarma Bennett, manager of the CEDEN at the State Water Resources Control Board regarding changes to CEDEN's scope that were previously announced, the SWRCB's decision for CEDEN to include and display non-surface water data (previously explicitly excluded) is insufficiently supported by guidance and documentation to clarify whether MRP Permittees should now submit non-surface water data to CEDEN for compliance with MRP Provision C.3.h.ii, which was written on the basis of CEDEN's original scope.

Other data addressing the requirements of Provision C.8.f, which are fulfilled in part or in whole through the efforts of third parties other than the Program, will be submitted through the entities responsible for Quality Assurance in a time schedule determined by their respective programs.[2]

By signing this letter on behalf of the program, I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. [40CFR 122.22(d)].

The quality of all monitoring data was evaluated through data collection and evaluation methods consistent with the 2016 updates of the Standard Operating Procedures and Quality Assurance Project Plan developed through the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative that includes all ACCWP member Permittees. These documents have been reviewed by Region 2 SWAMP staff for SWAMP-comparability where applicable, as provided in Provision C.8.b of Order No. R2015-0049.

Please contact me if you have any questions or comments.

Sincerely,

James Scanlin
Program Manager

Attachment A: list of data files submitted to the Regional Water Board's ftp site (2 pp)

Copy via email: Alameda Countywide Clean Water Program Management Committee Representatives

[2] As described in the ACCWP Pollutants of Concern Monitoring Report submitted October 2018, this will include electronic submittal of Regional Monitoring Program monitoring results by the San Francisco Estuary Institute and of data collected by the SWAMP Sediment Pollution Trends (SPoT) program.

Attachment A

Data files for ACCWP Creek Status, Stressor-Source Identification, Pesticides and Toxicity and Pollutants of Concern Monitoring
October 1, 2017-September 30, 2018

Sources of templates for data files (see TOC file ACCWP-RMC_deliverables_ToC_WY2018.xlsx for details):

SWAMP v2.5 Database references currently available through
http://www.waterboards.ca.gov/water_issues/programs/swamp/data_management_resources/index.shtml
Kevin Lunde, SFRWQCB SWAMP Program (Continuous Monitoring)

Filename	Comment
AC_2018_BA_PHAB_BIOTA_Export_1of2.xls	File 1 of 2, compiles data for stations 204R01415, 204R01695, 204R02340, 204R02695, 204R02719, 204R03135, 204R03156, 204R03207, 204R03279, and 204R03311
AC_2018_BA_PHAB_BIOTA_Export_2of2.xls	File 2 of 2, compiles data for stations 204R03439, 204R03455, 204R03463, 204R03540, 204R03620, 204R03695, 204R03719, 204R03737, 204SAU070, and 204SAU130
AC_2018_BIOASSMT_WQ_Export_20sites.xls	Compiles data for all 22 stations (2 additional stations sampled due to difficulty in obtaining permits and atypically wet conditions that caused creeks to flow longer)
AC_2018_DrySeason_WQ_Export_071718_18-12-19-09-18-53_chem_only.xls.xls	Dry season sed chem, compiles data for sites 204AVJ020 and 204LME100
AC_2018_DrySeason_WQ_Export_071718_18-12-19-09-18-53_tox_only.xls	Dry season aquatic and sed tox, compiles data for sites 204AVJ020 and 204LME100
AC_2018_FIB_WQ_Export_062818_18-12-05-14-02-28.xls	Compiles data for sites 205R02670, 205R03694, 205Z6L2010, 205Z6M010, and 205Z6M1010
AC_2018_CM_YSI_204R03135_Spring.xlsx	Continuous general water quality
AC_2018_CM_YSI_204SAU070_Spring.xlsx	Continuous general water quality
AC_2018_CM_YSI_204SAU200_Spring.xlsx	Continuous general water quality
AC_2018_CM_YSI_204R03135_Fall.xlsx	Continuous general water quality
AC_2018_CM_YSI_204SAU070_Fall.xlsx	Continuous general water quality
AC_2018_CM_YSI_204SAU200_Fall.xlsx	Continuous general water quality
AC_2018_CM_HOBO_204R03135.xlsx	Probe lost midway through deployment
AC_2018_CM_HOBO_204SAU030.xlsx	
AC_2018_CM_HOBO_204SAU055.xlsx	
AC_2018_CM_HOBO_204SAU070.xlsx	
AC_2018_CM_HOBO_204SAU090.xlsx	
AC_2018_CM_HOBO_204SAU100.xlsx	
AC_2018_CM_HOBO_204SAU110.xlsx	
AC_2018_CM_HOBO_204SAU130.xlsx	
AC_2018_CM_HOBO_204SAU200.xlsx	
AC_2018_POC_WQ_2018-1210.xls	Dry season POC aquatic chemistry, compiles data for sites 204AVJ020 and 204LME100
AC_2018_Pest&Tox_WQ_Export_010818_18-12-19-10-42-29_chem_only.xls	Aquatic chemistry data for ACCWP portion of RMC pesticides and toxicity monitoring project, sites 204CVY010, 204SAU030, and 205R01198; includes re-test at site 204CVY010
AC_2018_Pest&Tox_WQ_Export_010818_18-12-19-10-42-29_tox_only.xls	Aquatic toxicity data for ACCWP portion of RMC pesticides and toxicity monitoring project, sites 204CVY010, 204SAU030, and 205R01198; includes re-test at site 204CVY010

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						Bioassess	General WQ	Chlorine	Temp	Water Tox	Sed Tox	Sed Chem	Pathogen Indicators	Other				
AL-1	1/14/19	ACCWP	Palo Seco Creek		Exploring Unexpected CSCI Results and the Impacts of Restoration Activities	X									Sites where there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites, including sites on Palo Seco Creek upstream of the Sausal Creek restoration-related sites, that had substantial and unexpected differences in CSCI scores.	The project will provide additional data to aid consideration of unexpected and unexplained CSCI results from previous water year sampling on Palo Seco Creek, enable a more focused study of monitoring data collected over many years in a single watershed, and allow analysis of before and after data at sites upstream and downstream of previously completed restoration activities.	The work plan was submitted in August 2018. WY 2018 sampling and monitoring took place April – September and the data are currently being processed.	
AL-2	3/5/19	ACCWP	Arroyo Las Positas		Arroyo las Positas Stressor Source Identification Project	X									CSCI scores below the threshold were recorded on Arroyo Las Positas in WYs 2016 and 2017. In 2017, one site exceeded the Basin Plan threshold for chloride. The creek is also listed on the 303(d) list for eutrophication and has an approved TMDL for Diazinon.	ACCWP is exploring a potential SSID project on Arroyo las Positas. The Water Board is conducting sampling in the watershed as part of their TMDL development efforts and an SSID project may combine well with those efforts and generate a better overall picture of stressors impacting the waterbody.	The SSID project is under development. The Final SSID project may end up focusing on a different waterbody depending on the outcome of communications with Water Board staff and analysis of WY 2018 triggers.	
CC-1	1/2/19	CCCWP	Lower Marsh Creek		Marsh Creek Stressor Source Identification Study									X	9 fish kills have been documented in Marsh Creek between September 2005 and October 2017. A conclusive cause has not been identified.	This SSID study addresses the root causes of fish kills in Marsh Creek. Monitoring data collected by CCCWP and other parties are being used to investigate multiple potential causes, including low dissolved oxygen, warm temperatures, daily pH swings, fluctuating flows, physical stranding, and pesticide exposure.	The CCCWP SSID work plan was submitted in 2018 and is currently being implemented. The Year 1 Status Report is included in this WY 2018 UCMR.	
SC-1	1/12/19	SCVURPPP	Coyote Creek	NA	Coyote Creek Toxicity SSID Project						X				The SWRCB recently added Coyote Creek to the 303(d) list for toxicity.	This SSID study is investigating sources of toxicity to sediments in Coyote Creek. Results of sediment toxicity and chemistry monitoring conducted during the WY 2018 dry season were inconclusive. Sediment chemistry results were inconclusive and toxicity results too inconsistent to proceed with a TIE study. The WY 2018 results support earlier	The work plan was submitted with SCVURPPP's WY 2017 UCMR. A project report describing the results of the WY 2018 and WY 2019 monitoring will be	

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						Bioassess	General WQ	Chlorine	Temp	Water Tox	Sed Tox	Sed Chem	Pathogen Indicators	Other				
																findings from SCVURPPP and SPoT that toxicity and pesticide concentrations in Coyote Creek are sporadic. Additional monitoring will be conducted in WY 2019 to confirm the findings.	submitted with the WY 2019 UCMR.	
SC-2	2/19/19	SCVURPPP	TBD	TBD	TBD										TBD	TBD	Project options currently under discussion by Monitoring Ad Hoc Task Group	
SM-1	1/12/19	SMCWPPP	Pillar Point / Deer Creek / Denniston Creek	NA	Pillar Point Harbor Bacteria SSID Project								X		FIB samples from 2008, 2011-2012 exceeded WQOs.	A grant-funded Pillar Point Harbor MST study conducted by the RCD and UC Davis in 2008, 2011-2012 pointed to urban runoff as a primary contributor to bacteria at Capistrano Beach and Pillar Point Harbor. The study, however, did not identify the specific urban locations or types of bacteria. This SSID project is investigating bacteria contributions from the urban areas within the watershed. In WY 2018, Pathogen indicator and MST monitoring was conducted at 14 freshwater sites during 2 wet and 2 dry events. Very few samples contained “controllable” source markers (i.e., human and dog). Additional field studies are being conducted in WY 2019 to understand hydrology and specific source areas.	The work plan was submitted with SMCWPPP’s WY 2017 UCMR. A project report describing the results of the WY 2018 and WY 2019 investigations will be submitted with the WY 2019 UCMR.	
FSV-1	2/4/2019	City of Vallejo in assoc. with FSURMP	Rindler Creek	207R03504	Rindler Creek Bacteria and Nitrogen Study								X		E. coli result of 2800 MPN/100mL in Sept., 2017.	A source identification study is warranted in Rindler Creek due to the elevated FIB result, other (non-RMC) monitoring indicating elevated ammonia levels, and the presence of a suspected pollutant source upstream of the data collection point. Rindler Creek is a highly urbanized and modified creek that originates in open space northeast of the City of Vallejo. Monitoring is conducted just downstream of the creek crossing under Columbus Parkway; upstream of this site there is City-owned land that is grazed by cattle roughly from December-June.	Project planning is proceeding in FY 2018-19. Follow-up monitoring is being performed during early 2019 to verify the spatial and temporal extent of the water quality issues during the grazing period.	

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						Bioassess	General WQ	Chlorine	Temp	Water Tox	Sed Tox	Sed Chem	Pathogen Indicators	Other				
RMC-1	1/12/19	RMC/ Regional	NA (entire RMC area)	NA	Regional SSID Project: Electrical Utilities as a Potential PCBs Source to Stormwater in the San Francisco Bay Area									X	Fish tissue monitoring in San Francisco Bay led to the Bay being designated as impaired on the CWA 303(d) list and the adoption of a TMDL for PCBs in 2008. POC monitoring suggests diffuse PCBs sources throughout region.	PCBs were historically used in electrical utility equipment, some of which still contain PCBs. Although much of the equipment has been removed from services, ongoing releases and spills may be occurring at levels approaching the TMDL waste load allocation. This regional SSID project will investigate opportunities for BASMAA RMC partners to work with RWQCB staff to: 1) improve knowledge about the extent and magnitude of PCB releases and spills, 2) improve the flow of information from utility companies, and 3) compel cooperation from utility companies to implement improved control measures.	A work plan is currently under development and is anticipated for submittal with the WY 2018 UCMRs.	

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