Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Urban Creeks Monitoring Report

Water Quality Monitoring

Water Year 2017 (October 2016 – September 2017)

Submitted in compliance with Provision C.8.h.iii of NPDES Permit # CAS612008
(Order No. R2-2015-0049)

March 31, 2018

PREFACE

In early 2010, several members of the Bay Area Stormwater Agencies Association (BASMAA) joined together to form the Regional Monitoring Coalition (RMC), to coordinate and oversee water quality monitoring required by the Municipal Regional National Pollutant Discharge Elimination System (NPDES) Stormwater Permit (in this document the permit is referred to as the MRP).[1] The RMC includes the following participants:

- 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 Urban Creeks Monitoring Report complies with MRP provision C.8.h.iii for reporting of all data in Water Year 2016 (October 1, 2015 through September 30, 2016). Data were collected pursuant to provision C.8 of the MRP. Data presented in this report were produced under the direction of the RMC and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) using probabilistic and targeted monitoring designs as described herein.

Consistent with the BASMAA RMC Multi-Year Work Plan (Work Plan; BASMAA 2011) and the Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2012), monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA, 2016a) and the BASMAA RMC Standard Operating Procedures (SOPs; BASMAA, 2016b). Where applicable, monitoring data were derived using methods comparable with methods specified by the California Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Program Plan (QAPrP).[2] Data presented in this report were also submitted in electronic SWAMP-comparable formats by SCVURPPP to the Regional Water Board on behalf of SCVURPPP Co-permittees and pursuant to provision C.8.h.ii of the MRP.

[1] The San Francisco Bay Regional Water Quality Control Board (SFRWQCB or Regional Water Board) issued the MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009). On November 19, 2015, the Regional Water Board updated and reissued the MRP (SFRWQCB 2015). The BASMAA programs supporting MRP Regional Projects include 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.

[2] The current SWAMP QAPrP is available at:
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/swamp_qapp_master090108a.pdf

LIST OF ACRONYMS

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agency Association
BASMAA BOD	BASMAA Board of Directors
BMI	Benthic Macroinvertebrate
BMP	Best Management Practice
CADDIS	Causal Analysis/Diagnosis Decision Information System
CCCWP	Contra Costa Clean Water Program
CEC	Chemicals of Emerging Concern
CEDEN	California Environmental Data Exchange Network
COLD	Cold Freshwater Habitat
CSCI	California Stream Condition Index
ECWG	Emerging Contaminant Workgroup
FSURMP	Fairfield Suisun Urban Runoff Management Program
FY	Fiscal Year
GIS	Geographic Information Systems
HDS	Hydrodynamic Separator
IBI	Index of Biological Integrity
IPM	Integrated Pest Management
IWRMP	Integrated Water Resources Master Plan
LID	Low Impact Development
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MWAT	Maximum Weekly Average Temperature
NMFS	National Marine Fisheries Service
NMS	Nutrient Management Strategy
NPDES	National Pollution Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PEC	Probable Effect Concentration
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PFOS	Perfluorooctane Sulfonate
PHAB	Physical Habitat Assessment
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
RAA	Reasonable Assurance Analysis
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program
RWSM	Regional Watershed Spreadsheet Model
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SCVWD	Santa Clara Valley Water District
SFEI	San Francisco Estuary Institute
SMCWPPP	San Mateo County Water Pollution Prevention Program
SOP	Standard Operating Procedures
SPLWG	Sources, Pathways, and Loadings Workgroup
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification

S&T	Status and Trends Monitoring Program
STLS	Small Tributary Loading Strategy
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
TIE	Toxicity Identification Evaluations
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TRC	Technical Review Committee
TRE	Toxicity Reduction Evaluations
TU	Toxic Unit
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WARM	Warm Freshwater Habitat
WMA	Watershed Management Area
WQ	Water Quality
WQO	Water Quality Objective
WY	Water Year

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TABLE E.1. WATER YEAR 2017 CREEK STATUS MONITORING STATIONS

In compliance with provision C.8.h.iii.(1), this table of all Creek Status Monitoring stations sampled by SCVURPPP in Water Year 2017 is provided immediately following the Table of Contents. See Section 3.0 for additional information on Creek Status Monitoring.

Table E.1. Water Year 2017 Creek Status Monitoring Stations.

Map ID *	Station ID	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic	Targeted				
							Bioassessment, Nutrients, General WQ	Chlorine	Toxicity, Sediment Chemistry	Temp	Cont WQ	Pathogen Indicators
570	205R00570	Guadalupe River	Aldercroft Trib	NU	37.181464	-122.002165	X	X				
609	205R00609	Coyote Creek	Hunting Hollow	NU	37.073721	-121.460268	X	X				
645	205R00645	Coyote Creek	Packwood Creek	NU	37.170717	-121.613387	X	X				
2693	205R02693	Coyote Creek	Packwood Creek	U	37.174793	-121.616695	X	X				
2755	205R02755	Lower Penitencia Cr	Berryessa Creek	U	37.420931	-121.840146	X	X				
2787	205R02787	Matadero Creek	Matadero Creek	U	37.432204	-122.124836	X	X				
2915	205R02915	Stevens Creek	Stevens Creek	U	37.306931	-122.069249	X	X				
2947	205R02947	Lower Penitencia Cr	Lower Penitencia	U	37.429177	-121.90895	X	X				
3011	205R03011	Lower Penitencia Cr	Berryessa Creek	U	37.41123	-121.858567	X	X				
3091	205R03091	Coyote Creek	Arroyo Aguague	U	37.399248	-121.785626	X	X				
3098	205R03098	Guadalupe River	Guadalupe Creek	U	37.243658	-121.874066	X	X				
3235	205R03235	Stevens Creek	Stevens Creek	U	37.334668	-122.064327	X	X				
3306	205R03306	San Tomas Aquino	Saratoga Creek	U	37.277387	-122.011719	X	X				
3331	205R03331	Guadalupe River	Los Gatos Creek	U	37.300891	-121.919698	X	X				
3354	205R03354	Guadalupe River	Guadalupe Creek	U	37.212368	-121.908596	X	X				
3386	205R03386	Guadalupe River	Aldercroft Creek	U	37.176762	-121.995876	X	X				
3418	205R03418	Guadalupe River	Alamitos Creek	U	37.22855	-121.861762	X	X				
3443	205R03443	Calabazas Creek	Calabazas Creek	U	37.388639	-121.986842	X	X				
3523	205R03523	Coyote Creek	Upper Penitencia Creek	U	37.393389	-121.83237	X	X				
3530	205R03530	Guadalupe River	Los Gatos Creek	U	37.25194	-121.963874	X	X				
400	205LGA400	Guadalupe River	Los Gatos Creek	U	37.2389	-121.97054						X
30	205MAT030	Matadero Creek	Matadero Creek	U	37.4099	-122.13831						X
64	205STE064	Stevens Creek	Stevens Creek	U	37.3174	-122.06182						X
225	205GUA225	Guadalupe River	Arroyo Calero	U	37.214116	-121.83444						X
75	205SAR075	San Tomas Aquino	Saratoga Creek	U	37.25826	-122.03445						X
210	205GUA210	Guadalupe River	Guadalupe Creek	U	37.21746	-121.91039				X		
202	205GUA202	Guadalupe River	Guadalupe Creek	U	37.23291	-121.89795				X		
190	205GUA190	Guadalupe River	Guadalupe Creek	U	37.24373	-121.87561				X		
270	205GUA270	Guadalupe River	Alamitos Creek	U	37.20129	-121.82891				X		
340	205GUA340	Guadalupe River	Arroyo Calero	U	37.20706	-121.82362				X		

Map ID *	Station ID	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic	Targeted				
							Bioassessment, Nutrients, General WQ	Chlorine	Toxicity, Sediment Chemistry	Temp	Cont WQ	Pathogen Indicators
225	205GUA225	Guadalupe River	Arroyo Calero	U	37.21403	-121.83442				X		
262	205GUA262	Guadalupe River	Alamitos Creek	U	37.220409	-121.845155				X		
255	205GUA255	Guadalupe River	Alamitos Creek	U	37.22607	-121.85842				X		
250	205GUA250	Guadalupe River	Alamitos Creek	U	37.23363	-121.87058				X		
235	205COY235	Coyote Creek	Coyote Creek	U	37.3536	-121.87417					X	
236	205COY236	Coyote Creek	Coyote Creek	U	37.35098	-121.87378					X	
239	205COY239	Coyote Creek	Coyote Creek	U	37.33722	-121.86953					X	
21	205STE021	Stevens Creek	Stevens Creek	U	37.40985	-122.06906			X			
10	205STQ010	San Tomas Aquino	San Tomas Aquino	U	37.38843	-121.96865			X			

U = urban, NU = non-urban

* Map ID applies to Figure 3.1.

1.0 INTRODUCTION

This Urban Creeks Monitoring Report (UCMR) was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and the Santa Clara Valley Water District) subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP).

The MRP was first adopted by the San Francisco Regional Water Quality Control Board (SFRWQCB or Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (SFRWQCB 2009). On November 19, 2015, the SFRWQCB updated and reissued the MRP as Order R2-2015-0049 (SFRWQCB 2015). This report fulfills the requirements of Provision C.8.h.iii of the MRP for comprehensively interpreting and reporting all monitoring data collected during the foregoing October 1 – September 30 period (i.e., Water Year 2017). Data were collected pursuant to water quality monitoring requirements in provision C.8 of the MRP. Monitoring data presented in this report were submitted electronically to the Regional Water Board by SCVURPPP and, if collected from a receiving water, may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) (http://www.ceden.org).

Chapters in this report are organized according to the following topics and MRP sub-provisions. Several of the topics are summarized in this report but described fully in appendices.

1.0 Introduction
2.0 San Francisco Estuary Receiving Water Monitoring (MRP provision C.8.c)
3.0 Creek Status Monitoring (MRP provision C.8.d) and Pesticides and Toxicity Monitoring (MRP provision C.8.g) (**Appendix A**)
4.0 Stressor/Source Identification (SSID) Projects (MRP provision C.8.e) (**Appendices B, C, and D**)
5.0 Pollutants of Concern (POC) Monitoring (MRP provision C.8.f) (**Appendices E and F**)
6.0 Recommendations and Next Steps

Figure 1.1 maps locations of monitoring stations associated with provision C.8 compliance in Water Year 2017 (WY 2017), including Creek Status Monitoring, the SSID project, Pesticides and Toxicity Monitoring, and POC Monitoring conducted by SCVURPPP and the Small Tributaries Loading Strategy (STLS). This figure illustrates the geographic extent of monitoring conducted in Santa Clara County in WY 2017.

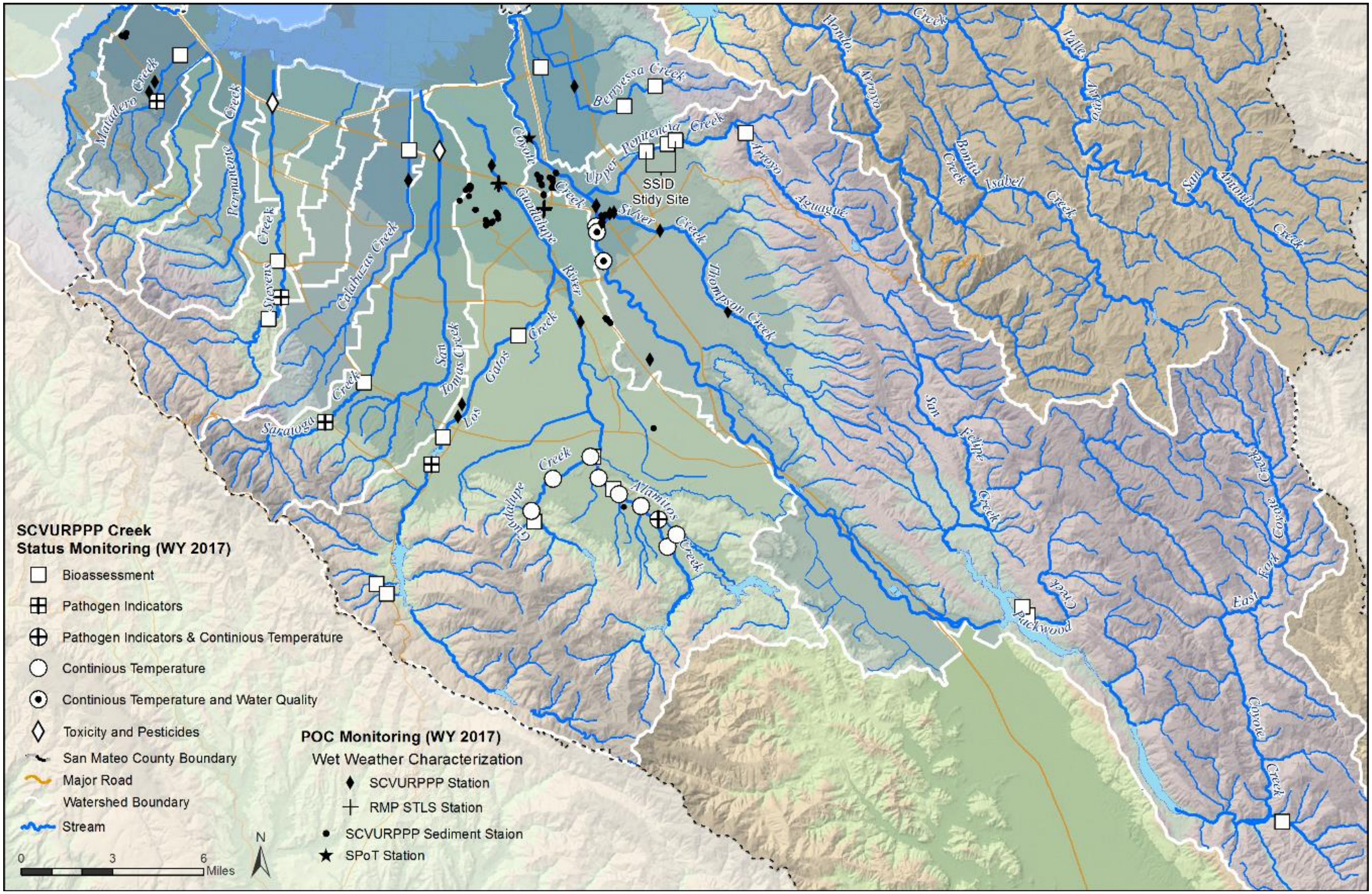

Figure 1.1. SCVURPPP Creek Status, Pollutants of Concern (POC), Pesticides and Toxicity, and Stressor/Source Identification (SSID) monitoring stations in WY 2017.

1.1 RMC Overview

Provision C.8.a (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a “regional collaborative effort,” their 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. The regional monitoring collaborative is referred to as the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC). In a November 2, 2010 letter to the Permittees, the Water Board’s Assistant Executive Officer (Dr. Thomas Mumley) acknowledged that all Permittees have opted to conduct monitoring required by the MRP through a regional monitoring collaborative, the BASMAA RMC. Participants in the RMC are listed in Table 1.1.

In February 2011, the RMC developed a Multi-Year Work Plan (RMC Work Plan; BASMAA 2011) to provide a framework for implementing regional monitoring and assessment activities required under provision C.8 of the 2009 MRP. The RMC Work Plan summarizes RMC 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 (BASMAA BOD). Although there are no plans to update the Multi-Year Work Plan, several regional projects have already been identified and will be conducted in compliance with the 2015 MRP. Current regional projects relevant to provision C.8 compliance include (but may not be limited to) projects to maintain and update the regional database, coordinate the RMC Workgroup meetings, and conduct POC monitoring.

Regionally implemented activities are conducted under the auspices of BASMAA, a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Scopes, budgets, and contracting or in-kind project 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 BASMAA 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.

Table 1.1 Regional Monitoring Coalition (RMC) 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 County Wide 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

1.2 Coordination with Third-party Monitoring Programs

SCVURPPP strives to work collaboratively with our water quality monitoring partners to find mutually beneficial monitoring approaches. Provision C.8.a.iii of the MRP allows Permittees to use data collected by third-party organizations to fulfill monitoring requirements, provided the data are demonstrated to meet the required data quality objectives.

In WY 2017, SCVURPPP continued to coordinate with water quality monitoring programs conducted by third parties. These programs include the Regional Monitoring Program for Water Quality in San Francisco Bay's (RMP) Small Tributaries Loading Strategy (STLS) and the Stream Pollutant Trends (SPoT) monitoring conducted by the State of California's Surface Water Ambient Monitoring Program (SWAMP). Water quality data from these programs are reported in this document and were utilized to supplement SCVURPPP compliance with provision C.8 of the MRP, consistent with sub-provision C.8.a.iii.[3,4] Data are specifically referenced in section 5.0 (POC Monitoring) of this report.

[3] Data reported by the RMP STLS are summarized in this report but were not included in the SCVURPPP electronic data submittal.

[4] In most years, including WY 2017, the SPoT Program monitors two stations in Santa Clara County for a subset of the constituents required by provision C.8.f of the MRP.

2.0 SAN FRANCISCO ESTUARY RECEIVING WATER MONITORING (C.8.C)

As described in provision C.8.c of the MRP, 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 the San Francisco Estuary (RMP). Since the adoption of the 2009 MRP, SCVURPPP has complied with this provision by making financial contributions to the RMP. Additionally, SCVURPPP staff actively participates in RMP committees, workgroups, and strategy teams as described in the following sections, which also provide a brief description of the RMP and associated monitoring activities conducted during WY 2017.

Now in its 25th year, 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. The regulated community includes municipal stormwater (MS4s), publicly owned treatment works (POTWs), dredger, and industrial dischargers. The San Francisco Estuary Institute (SFEI) is the implementing entity for the RMP and the fiduciary agent for RMP stakeholder funds. SFEI does not provide direct oversight of the RMP but does help identify stakeholder information needs, develop workplans that address these needs, and implement the workplans.

The RMP is intended to answer the following core management questions:

1. *Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?*
2. *What are the concentrations and masses of contaminants in the Estuary and its segments?*
3. *What are the sources, pathways, loadings, and processes leading to contaminant related impacts in the Estuary?*
4. *Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?*
5. *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 sections provide a brief overview of these programs. The *RMP 2017 Detailed Workplan and Budget*[5] provides more details and establishes deliverables for each component of the RMP budget. The RMP publishes annual summary reports. In odd years, the *Pulse of the Estuary Report* focuses on Bay water quality and summarizes information from all sources. In even years, the *RMP Update Report* has a narrower and specific focus. The *2017 Pulse of the Estuary*[6] celebrates the 25th anniversary of the RMP with a look back at the history of the program, along with articles on emerging contaminants, nutrients, and the Bay margins.

2.1 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, implemented thereafter, and was redesigned in 2007 based on a more rigorous statistical design that enables the detection of trends. The Technical Review Committee (TRC), in which SCVURPPP participates, continues to assess the efficacy and value of the various elements of the S&T Program and to recommend modifications to S&T Program activities based on ongoing findings. The current S&T sampling schedule, established in 2014, is listed in Table 2.1 with 2017 accomplishments and 2018 goals.

[5] http://www.sfei.org/documents/2017-rmp-detailed-workplan-and-budget

[6] http://www.sfei.org/documents/pulse-bay-25th-anniversary-rmp

Table 2.1. RMP Status and Trends Monitoring Schedule.

Program Element	Schedule	2017 Sampling	2018 Sampling
Water	Every two years	Yes	No
Bird Eggs	Every three years	No	Yes
Sediment	Every four years	Yes (Bay margins only)	Yes
Sport Fish	Every five years	No	No
Bivalves	Every two years	No	Yes
Support to the USGS for suspended sediment and nutrient monitoring	Every year	Yes	Yes

Additional information on the S&T Program and associated monitoring data are available for download via the RMP website at http://www.sfei.org/content/status-trends-monitoring.

2.2 RMP Pilot and Special Studies

The RMP also conducts Pilot and Special Studies on an annual basis. Studies are typically 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, workgroups, and strategy teams identify as priority for further study. These studies are developed through an open selection process at the workgroup level and selected for funding through the TRC and the Steering Committee.

In 2017, Pilot and Special Studies focused on the following topics:

- Nutrients Management Strategy
    - Continuous monitoring of nutrients, phytoplankton biomass, and dissolved oxygen at moored sensors
    - Continuous monitoring of dissolved oxygen in shallow margin habitats
    - Ship-based nutrient sampling
    - Data analysis and quantitative mechanistic interpretations to identify factors contributing to observed conditions
- Small Tributary Loadings Strategy (see below and Section 5.0 for more details)
- Chemicals of emerging concern (CEC) monitoring (imidacloprid, perfluorochemicals, phosphate flame retardants, bisphenol compounds, triclosan, and update of CEC Strategy)
- Development of conceptual PCB models for prioritized Bay margin units
- Dioxin data synthesis report
- Selenium in fish tissue monitoring
- Evaluation of toxicity testing protocols for marine sediments
- Implementation of a Sediment Monitoring Strategy

Results and summaries of the most pertinent Pilot and Special Studies can be found on the RMP website (http://www.sfei.org/rmp/rmp_pilot_specstudies).

In WY 2017, a considerable amount of RMP and Stormwater Program staff time was spent overseeing and implementing Special Studies associated with the RMP's Small Tributary Loading Strategy (STLS). Pilot and Special Studies associated with the STLS 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 on STLS-related studies is included in Section 5.0 (POC Loads Monitoring) of this report.

2.3 Participation in Committees, Workgroups and Strategy Teams

In WY 2017, SCVURPPP actively participated in the following RMP committees, workgroups, and strategy teams:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Emerging Contaminant Workgroup (ECWG)
- Nutrient Technical Workgroup
- Strategy Teams (e.g., Small Tributaries, PCBs, and Selenium)

Committee, workgroup, and strategy team representation was provided by Permittee, Stormwater Program staff, and/or individuals designated by RMC participants and the BASMAA BOD. Representation included participating in meetings, reviewing technical reports and work products, co-authoring or reviewing articles and publication, and providing general program direction to RMP staff. Representatives of the RMC also provided timely summaries and updates to and received input from, Stormwater Program representatives (on behalf of Permittees) during BASMAA Monitoring and Pollutants of Concern Committee (MPC) and/or BASMAA BOD meetings to ensure that Permittees' interests were represented.

3.0 CREEK STATUS (C.8.D) AND PESTICIDES/TOXICITY MONITORING (C.8.G)

This section summarizes the results of creek status monitoring and pesticides and toxicity monitoring required by provisions C.8.d and C.8.g of the MRP, respectively. Creek Status and Pesticides and Toxicity monitoring stations are listed in Table E-1 and mapped in Figure 3.1. Detailed methods and results are provided in **Appendix A.** Consistent with provision C.8.h.ii of the MRP, creek status and pesticides and toxicity monitoring data were submitted to the Regional Water Board by SCVURPPP in electronic SWAMP-comparable formats. These data were also provided to the Regional Data Center (i.e., SFEI) for upload to CEDEN.

Creek Status Monitoring (C.8.d)

Provision C.8.d of the MRP requires Permittees to conduct creek status monitoring that is intended to answer the following management questions:

1. *Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?*
2. *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. The RMC's regional monitoring strategy for complying with creek status monitoring requirements is described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2012). 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). Implementation began in WY 2012.

The probabilistic monitoring design was developed to remove bias from site selection such that ecosystem conditions can be objectively assessed on local (i.e., SCVURPPP) and regional (i.e., RMC) scales. Probabilistic parameters consist of bioassessments, nutrients, and conventional analytes conducted according to methods described in the SWAMP SOP (Ode et al. 2016). Free chlorine and total chlorine residual were also measured at probabilistic sites. Twenty probabilistic sites were sampled by SCVURPPP in WY 2017.

The targeted monitoring design focuses on sites selected based on the presence of significant fish and wildlife resources as well as historical and/or recent indications of water quality concerns. Targeted monitoring parameters consist of water temperature, general water quality, and pathogen indicators using methods, sampling frequencies, and number of stations required in provision C.8.d of the MRP. Hourly water temperature measurements were recorded during the dry season at eight sites using HOBO® temperature data loggers in the Guadalupe River watershed. General water quality monitoring (temperature, dissolved oxygen, pH and specific conductivity) was conducted using YSI continuous water quality equipment (sondes) for two 2-week periods (spring and late summer) at three sites in the Coyote Creek watershed. Water samples for analysis of pathogen indicators (*E. coli* and enterococcus) were collected at five sites located in parks.

Pesticides and Toxicity Monitoring (C.8.g)

Provision C.8.g of the MRP requires Permittees to conduct wet weather and dry weather pesticides and toxicity monitoring. Test methods, sampling frequencies, and number of stations required are described in the MPR. In WY 2017, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two bottom-of-the-watershed stations. Consistent with provision C.8.g.iii, wet weather pesticides and toxicity monitoring will be conducted on a regional basis in WY 2018.

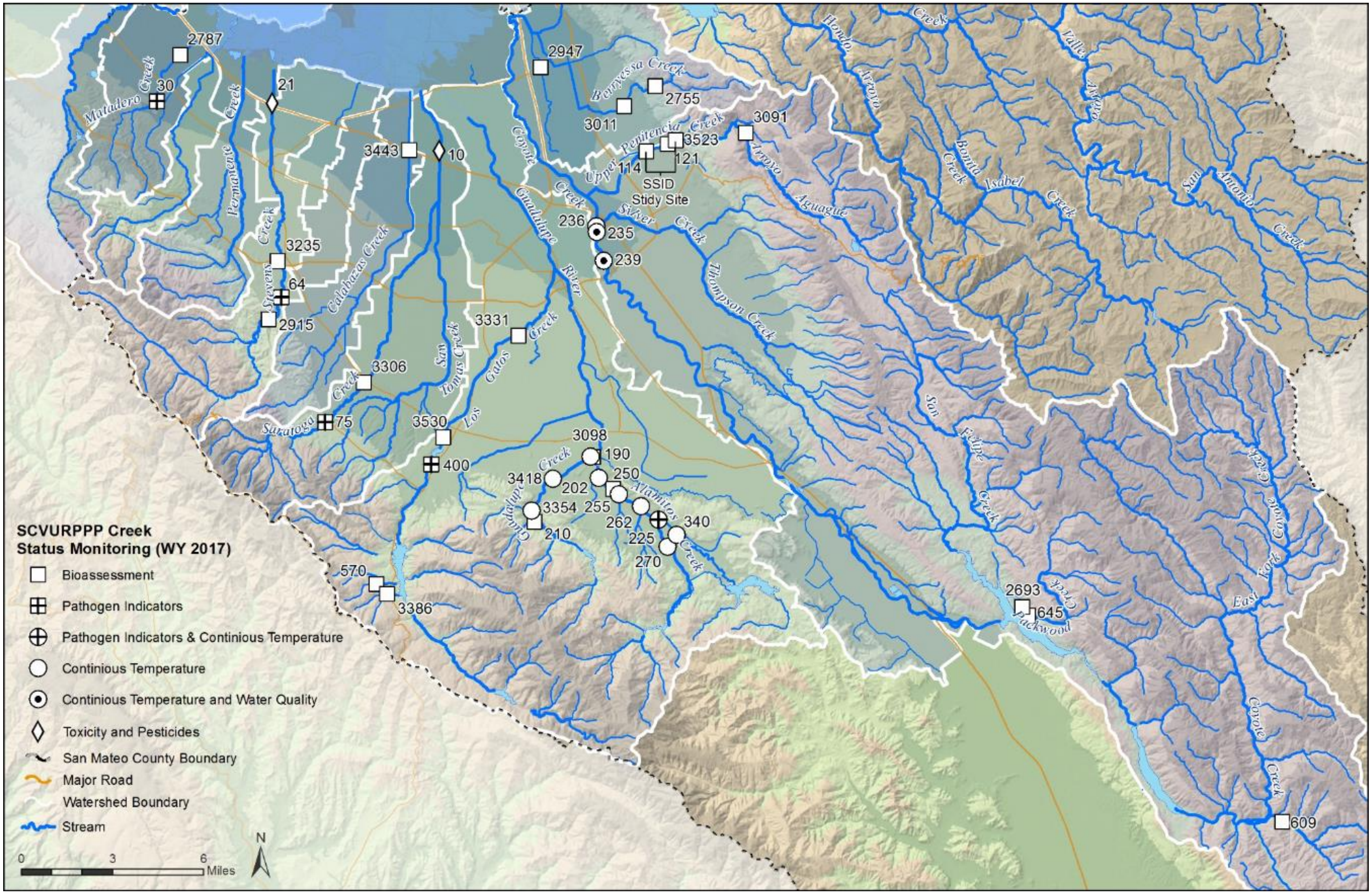

Figure 3.1. SCVURPPP Creek Status and Pesticides and Toxicity monitoring stations, WY 2017.

3.1 Approach to Management Questions

The first MRP creek status management question (*Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?*) is addressed primarily through the evaluation of probabilistic and targeted monitoring data with respect to the triggers defined in the MRP. The MRP also defines triggers for pesticides and toxicity monitoring data. A summary of trigger exceedances observed for each site is presented below in Table 3.2. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are considered for future stressor/source identification (SSID) projects (see Section 4.0 for a discussion of ongoing and completed SSID projects).

The second MRP creek status management question (*Are conditions in local receiving waters supportive of or likely supportive of beneficial uses?*) is addressed primarily by assessing indicators of aquatic biological health using benthic macroinvertebrate and algae data collected at probabilistic sites. Although the total number of probabilistic sites in Santa Clara Valley that have been sampled since WY 2012 (i.e., 132) is sufficient to evaluate the condition of aquatic life within known estimates of precision, the analysis presented in Appendix A is limited to the 20 sites monitored in WY 2017.

A more comprehensive analysis of a five-year dataset (WY 2012 – WY 2016) is currently being conducted by a BASMAA regional project. The BASMAA regional study will include the following analyses:

- Assess the biological condition of streams in the region and each county using indices of biological integrity (IBIs) based on benthic macroinvertebrate and algae data collected by each countywide program and SWAMP.
- Evaluate IBIs in distinct groupings such as imperviousness categories and type of stream.
- Assess stressors associated with poor stream condition using multivariate modeling analyses.
- Summarize regional data for each year in the five-year dataset.
- Introduce the analyses that will be needed to make recommended changes to the probabilistic monitoring design.

Results of the BASMAA regional study will be available by late 2018. Analytical tools that are found to be useful in evaluating stressor association with biological condition may be implemented in future annual monitoring reports.

3.2 Monitoring Results and Conclusions

3.2.1 Bioassessment Monitoring

Twenty sites were sampled for benthic macro-invertebrates (BMIs), benthic algae, physical habitat observations, and nutrients using methods consistent with the BASMAA RMC QAPP (BASMAA 2016a) and SOPs (BASMAA 2016b). Stations were randomly selected using a probabilistic monitoring design. Seventeen of the sites were classified as urban and three were classified as non-urban. The following conclusions are made based on the WY 2017 data. An assessment of biological condition is provided and potential stressors are compared to applicable water quality objectives (WQOs) and triggers identified in the MRP. Sites with monitoring results that exceed WQOs and triggers are considered as candidates for further investigation as SSID projects, consistent with provision C.8.e of the MRP. See **Appendix A** for detailed explanations of the findings.

Biological Condition Assessment

The California Stream Condition Index (CSCI) is a statewide tool that translates benthic macroinvertebrate data into an overall measure of stream health. The CSCI is currently the most robust method of assessing aquatic biological health. There are also three benthic algae indices of biological integrity available (D18, H20, S2); however, the applicability of the algae IBIs in Santa Clara Valley streams is uncertain. This is due to several factors including:

- There is an overall dearth of soft algae taxa found in Santa Clara Valley streams. This may not reflect stream health, but it can significantly lower the scores of two of the algae IBIs (H20 and S2).
- The algae IBIs were developed for Southern California streams and may not provide adequate interpretations of Northern California algae communities.
- Statewide Algae Stream Condition Indices are currently being developed and are anticipated to be available in 2018.

Of the 20 sites monitored in WY 2017, nine sites (45%) were rated in good condition (CSCI scores ≥ 0.795); four sites (20%) rated as likely altered condition (CSCI score 0.635 – 0.795), and seven sites (35%) rated as very likely altered condition (≤ 0.635). The three sites with the lowest CSCI scores had a high proportion of impervious watershed area (> 30%) and were characterized as modified channels.

Relationships between potential stressors (physical habitat and water chemistry) and biological condition were explored on a limited basis using the WY 2017 dataset.

- Physical Habitat Assessment (PHAB) scores, a qualitative tool that assesses the overall habitat condition of the sampling reach during the assessment, were compared to biological condition indictor scores. PHAB consists of three attributes that are assessed for the entire bioassessment reach. These include channel alteration, epifaunal substrate and sediment deposition. Total PHAB scores were moderately correlated with CSCI scores (r^2=0.30, p = 0.012) suggesting that physical habitat (e.g., substrate quality, channel alteration) has an influence on the BMI community. Individual physical habitat metrics associated with substrate size and composition were also slightly correlated with CSCI scores.
- Landscape variables were calculated for each of the watershed areas draining into the bioassessment sites. CSCI scores were moderately correlated (negatively) with impervious area and road density.

Stressor Assessment

Sites with CSCI scores and/or stressor levels exceeding applicable WQOs and triggers identified in the MRP will be considered as candidates for SSID projects.

- The eleven sites with CSCI scores below 0.795 will be considered as candidates for SSID projects.
- **General water quality** (pH, temperature, dissolved oxygen, specific conductance). Two measurements exceeded water quality objectives for pH: site 205R03011 (Berryessa Creek) and site 205R03443 (Calabazas Creek). The acute temperature threshold trigger (24°C) for salmonid fish was also exceeded at site 205R03443 (Calabazas Creek). These sites will be considered as candidates for SSID projects.
- **Nutrients and conventional analytes** (ammonia, unionized ammonia, chloride, AFDM, chlorophyll a, nitrate, nitrite, TKN, ortho-phosphate, phosphorus, silica). There were no water quality objective exceedances for water chemistry parameters, except for unionized ammonia (.025 mg/L) at site 205R03011 (Berryessa Creek), and site 205R03011 (Calabazas Creek). Both sites are at the bottom of highly urbanized watersheds and will be considered as candidates for SSID projects.

3.2.2 Targeted Monitoring Results/Conclusions

Targeted monitoring in WY 2017 was conducted in compliance with Provisions C.8.d.iii – v of the MRP. Hourly temperature measurements were recorded at nine sites in the Guadalupe River Watershed from April through September. Continuous (15-minute) general water quality measurements (pH, DO, specific conductance, temperature) were recorded at three sites in the Coyote Creek watershed during two 2-week periods in June (Event 1) and September (Event 2). Pathogen indicator grab samples were collected during a sampling event in July at five sites throughout Santa Clara County that coincide with public parks. Targeted monitoring stations were deliberatively selected using the Directed Monitoring Design Principle.

Conclusions and recommendations from targeted monitoring in WY 2017 are listed below. The sections below are organized based on three management questions. See **Appendix A** for detailed explanations of the findings.

1. *What is the spatial and temporal variability in water quality conditions during the spring and summer season?*
2. *Do general water quality measurements indicate potential impacts to aquatic life?*
3. *What are the pathogen indicator concentrations at creek sites where there is potential for water contact recreation to occur?*

Spatial and Temporal Variability in Water Quality

- **Spatial**. Water temperatures measured in three tributaries to Guadalupe River generally increased within decreasing site elevation due their distance from upstream reservoirs, which are the source of cooler water. General water quality parameters measured at three stations in Coyote Creek were similar across the stations except for dissolved oxygen which displayed different patterns at the sites. The findings were consistent with the Coyote Creek Dissolved Oxygen SSID Project which concluded that low channel gradients and high amounts of accumulated organic material in the studied reach cause low dissolved oxygen (DO) concentrations.
- **Temporal**. Temperatures increased at all nine sites in the Guadalupe River watershed from June to August 2017 and started to decline towards the end of September. In Coyote Creek, decreases in dissolved oxygen concentrations occurred following a period of hot weather during week of June 18, 2017. Following the heat wave, the DO levels increased, with pronounced diurnal variability observed at all three sites.

Potential Impacts to Aquatic Life

- Potential impacts to aquatic life were assessed through analysis of continuous temperature data collected at nine targeted stations in the Guadalupe River watershed from April through September and analysis of continuous general water quality data (pH, dissolved oxygen, specific conductance, and temperature) collected at three targeted stations in Coyote Creek during two two-week periods (June and September).
- All nine temperature stations in the Guadalupe River Watershed exceeded the MRP trigger threshold of having two or more weeks where the Maximum Weekly Average Temperature exceeded 17°C. None of the stations exceeded the maximum instantaneous trigger threshold of 24°C for more than 1% of total recorded samples.
    - All stations with Maximum Weekly Average Temperature (MWAT) trigger exceedances will be added to the list of candidate SSID projects; however, review of the monitoring data in the context of locally-derived temperature thresholds developed by National Marine Fisheries Services (NMFS) suggests that temperature may not be a limiting factor for salmonid habitat (i.e., summer rearing juveniles) in the study reaches, as long as

sufficient dam releases maintain longitudinal connectivity and provide cooler water temperatures and potential refugia for juvenile steelhead during the summer.

- Sites on Coyote Creek had no exceedances of the maximum temperature trigger threshold of 24°C but did exceed the MWAT trigger of 17.0 °C for two consecutive weeks during both events and will therefore be added to the list of candidate SSID projects.
- The WQO for DO in waters designated as having cold freshwater habitat (COLD) Beneficial Uses (i.e., 7.0 mg/L) was not met in over 20% of the measurements recorded at all three water quality stations in Coyote Creek. The results were similar to the findings from the WY 2013 SSID study carried out at the same locations. The Coyote Creek DO SSID Study concluded that low DO concentrations are caused by low gradient channels with high amounts of accumulated organic matter. Furthermore, this reach Coyote Creek currently supports habitat and water quality that may be suitable for a warm water fishery and not for cold water fishery.
- Values for pH and specific conductivity measured at the three sites in Coyote Creek during WY 2017 did not exceed their respective triggers during either event.

Potential Impacts to Water Contact Recreation

- Pathogen indicator densities were measured at five targeted sites during WY 2017. Although none of the stations could be considered "bathing beaches," monitoring locations were selected at city parks or trails that were considered to have a relatively high potential for public access. The MRP trigger threshold for *E. coli* (410 cfu/100 ml) was exceeded at two sites: Arroyo Calero at Singer Park and Saratoga Creek at Wildwood Park. The MRP trigger threshold for enterococcus (130 cfu/100 ml) was exceeded at four sites: Arroyo Calero at Singer Park, Saratoga Creek at Wildwood Park, Stevens Creek at Blackberry Farm, and Matadero Creek at Bol Park. These sites will be added to the list of candidate SSID projects.
- It is important to recognize that pathogen indicator thresholds are based on human recreation at beaches receiving bacteriological contamination from human wastewater, and may not be applicable to conditions found in urban creeks. Pathogen indicators observed at the WY 2017 stations may not be associated with human sources and therefore may not pose a threat to human health. As a result, the comparison of pathogen indicator results to water quality objectives and criteria for full body contact recreation may not be appropriate and should be interpreted cautiously.
- The State Water Resources Control Board is currently in the process of adopting modified WQOs for enterococci and *E. coli* based on USEPA criteria that will serve as new MRP Trigger Thresholds. A statistical threshold value for enterococci of 320 cfu/100mL will be used for samples in waters where the salinity is less than 10 parts per thousand 95% of the time, and a statistical threshold value for *E. coli* of 110 cfu/100mL will be used for samples in waters where the salinity is equal to or greater than 10 parts per thousand 95% of the time. The new statistical threshold values correspond with an Estimated Illness Rate (NGI) of 32 per 1,000 water contact recreators.[7]

3.2.3 Chlorine Monitoring Results/Conclusions

Free chlorine and total chlorine residual were measured concurrently with bioassessments at the twenty probabilistic sites (and two additional SSID sites) in compliance with provision C.8.c.ii. While chlorine residual is generally not a concern in Santa Clara Valley urban creeks, WY 2017 and prior monitoring results suggest there are occasional free chlorine and total chlorine residual exceedances in the County. In WY 2017, exceedances of the MRP trigger for chlorine (0.1 mg/L) were detected at one station (Lower Penitencia Creek). City of Milpitas illicit discharge staff were notified of the exceedance but did not observe exceedances during follow-up monitoring. The exceedance was likely the result of a one-time

[7] See http://www.waterboards.ca.gov/bacterialobjectives/ for more information.

potable water discharge and it is generally very difficult to determine the source of elevated chlorine from such episodic discharges. The Program will continue to monitor chlorine in compliance with the MRP and will follow-up with illicit discharge staff as needed.

3.2.4 Pesticides and Toxicity Monitoring Results/Conclusions

In WY 2017, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations (Stevens Creek and San Tomas Aquino) in compliance with provision C.8.g of the MRP.

Statistically significant toxicity to *C. dubia* (reproduction) was observed in water samples collected from both sites in July 2017. Although toxicity was observed in the sample from San Tomas Aquino, the magnitude of toxicity was not great enough to exceed the MRP trigger threshold. The magnitude of the toxic effects in the Stevens Creek sample did exceed the MRP threshold for re-sampling (i.e., 50 Percent Effect). Statistically significant toxicity to *C. dubia* was not observed in the second sample collected from Stevens Creek in August 2017. The cause of the toxicity observations is unknown. Pesticide concentrations in the sediment samples were all very low, most below MDLs and calculated TU equivalents did not exceed 0.09 in either sample from the Stevens Creek site.

TEC and PEC quotients were calculated for all metals and total PAHs (calculated as the sum of 24 individual PAHs) measured in sediment samples. Both sites had at least one TEC or PEC quotient exceeding 1.0. In compliance with the MRP, both stations will therefore be placed on the list of candidate SSID projects. Decisions about which SSID projects to pursue should be informed by the fact that most of the TEC and PEC quotient exceedances are related to naturally occurring chromium and nickel.

SCVURPPP will continue to sample the same two stations for dry weather pesticides and toxicity throughout the permit term. In WY 2018, SCVURPPP will work with the BASMAA RMC partners to implement a regional approach to wet weather pesticides and toxicity monitoring.

3.3 Trigger Assessment

The MRP requires analysis of the monitoring data to identify candidate sites for SSID projects. Trigger thresholds against which to compare the data are provided for most monitoring parameters in the MRP and are described in the foregoing sections of this report. Stream condition was based on CSCI scores that were calculated using BMI data. Water and sediment chemistry and toxicity data were evaluated using numeric trigger thresholds specified in the MRP. Nutrient data were evaluated using applicable water quality standards from the Basin Plan. In compliance with provision C.8.e.i of the MRP, all monitoring results exceeding trigger thresholds are added to a list of candidate SSID projects that will be maintained throughout the permit term. Follow-up SSID projects will be selected from this list. Table 3.1 lists candidate SSID projects based on WY 2017 Creek Status and Pesticides/Toxicity monitoring data.

Additional analysis of the data is provided in **Appendix A** and should be considered prior to selecting and defining SSID projects. The analyses include review of physical habitat (including channel type and location with respect to reservoirs) and water chemistry data to identify potential stressors that may be contributing to degraded or diminished biological conditions. Analyses in Appendix A also include historical and spatial perspectives that help provide context and deeper understanding of the trigger exceedances.

Table 3.1. Summary of SCVURPPP trigger threshold exceedance analysis in WY 2017. "No" indicates samples were collected, but did not exceed the MRP trigger threshold. "Yes" and shading indicates an exceedance of the MRP trigger threshold.

Station ID	Creek	Bioassessment [1]	Nutrients [2]	Chlorine [3]	Water Toxicity [4]	Sediment Toxicity [4]	Sediment Chemistry [5]	Continuous Temperature [6]	Dissolved Oxygen [7]	pH [8]	Specific Conductance [9]	Pathogen Indicators [10]
205R00570	Trib to Aldercroft Cr	No	No	No	--	--	--	--	--	--	--	--
205R00609	Hunting Hollow	Yes	No	No	--	--	--	--	--	--	--	--
205R00645	Packwood Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R02693	Packwood Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R02755	Berryessa Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R02787	Matadero Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R02915	Stevens Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R02947	Lower Penitencia	Yes	No	Yes	--	--	--	--	--	--	--	--
205R03011	Berryessa Creek	No	Yes	No	--	--	--	--	--	--	--	--
205R03091	Arroyo Aguague	No	No	No	--	--	--	--	--	--	--	--
205R03098	Guadalupe Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R03235	Stevens Creek	No	No	No	--	--	--	--	--	--	--	--
205R03306	Saratoga Creek	No	No	No	--	--	--	--	--	--	--	--
205R03331	Los Gatos Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R03354	Guadalupe Creek	No	No	No	--	--	--	--	--	--	--	--
205R03386	Aldercroft Creek	No	No	No	--	--	--	--	--	--	--	--
205R03418	Alamitos Creek	Yes	No	No	--	--	--	--	--	--	--	--
205R03443	Calabazas Creek	Yes	Yes	No	--	--	--	--	--	--	--	--
205R03523	Upper Penitencia Creek	No	No	No	--	--	--	--	--	--	--	--
205R03530	Los Gatos Creek	Yes	No	No	--	--	--	--	--	--	--	--
205LGA400	Los Gatos Creek	--	--	--	--	--	--	--	--	--	--	No
205MAT030	Matadero Creek	--	--	--	--	--	--	--	--	--	--	Yes
205STE064	Stevens Creek	--	--	--	--	--	--	--	--	--	--	Yes
205GUA225	Arroyo Calero	--	--	--	--	--	--	--	--	--	--	Yes
205SAR075	Saratoga Creek	--	--	--	--	--	--	--	--	--	--	Yes
205GUA210	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA202	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA190	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA270	Alamitos Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA340	Arroyo Calero	--	--	--	--	--	--	Yes	--	--	--	--
205GUA225	Arroyo Calero	--	--	--	--	--	--	Yes	--	--	--	--
205GUA262	Alamitos Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA255	Alamitos Creek	--	--	--	--	--	--	Yes	--	--	--	--
205GUA250	Alamitos Creek	--	--	--	--	--	--	Yes	--	--	--	--
205COY235	Coyote Creek	--	--	--	--	--	--	Yes	Yes	No	No	--
205COY236	Coyote Creek	--	--	--	--	--	--	Yes	Yes	No	No	--
205COY239	Coyote Creek	--	--	--	--	--	--	Yes	Yes	No	No	--
205STE021	Stevens Creek	--	--	--	No	No	Yes	--	--	--	--	--
205STQ010	San Tomas Aquino	--	--	--	No	No	Yes	--	--	--	--	--

Notes:

1. CSCI score ≤ 0.795.
2. Unionized ammonia (as N) ≥ 0.025 mg/L, nitrate (as N) ≥ 10 mg/L, chloride > 250 mg/L.
3. Free chlorine or total chlorine residual ≥ 0.1 mg/L.
4. Test of Significant Toxicity = Fail and Percent Effect ≥ 50 %.
5. TEC or PEC quotient ≥ 1.0 for any constituent.
6. Two or more MWAT ≥ 17.0°C or 20% of results ≥ 24°C.
7. DO < 7.0 mg/L in COLD streams or DO < 5.0 mg/L in WARM streams.
8. pH < 6.5 or pH > 8.5.
9. Specific conductance > 2000 uS.
10. Enterococcus ≥ 130 cfu/100ml or *E. coli* ≥ 410 cfu/100ml.

3.4 Management Implications

The Program's Creek Status and Pesticides and Toxicity Monitoring programs (consistent with MRP provisions C.8.c and C.8.g, respectively) focus on assessing the water quality condition of urban creeks in the Santa Clara Valley and identifying stressors and sources of impacts observed. The sample size from WY 2017 (overall n=20; urban n=17) is not sufficient to develop statistically representative conclusions regarding the overall condition of all creeks. However, it builds on data collected in WY 2012 through WY 2016 which are currently being analyzed by a BASMAA RMC regional project. The BASMAA regional project will assess stream conditions and stressors for the five-year dataset (WY 2012 – WY 2016) on regional and countywide basis. It will review and develop statistical tools that can be utilized in the future to analyze the growing dataset. It will also recommend options for modifying the RMC creek status monitoring program during the next reissue of the MRP, perhaps with a focus on trends monitoring.

Like previous years, WY 2017 data suggest that most urban streams have likely or very likely altered populations of aquatic life indicators (e.g., aquatic macroinvertebrates). These conditions are likely the result of long-term changes in stream hydrology, channel geomorphology, in-stream habitat complexity, and other modifications to the watershed and riparian areas associated with the urban development that has occurred over the past 50 plus years. Additionally, episodic or site-specific increases in temperature (particularly in lower creek reaches) may not be optimal for aquatic life in local creeks.

The Program and its Co-permittees are actively implementing many stormwater management programs to address these and other stressors and associated sources of water quality conditions observed in local creeks, with the goal of protecting these natural resources. For example:

- In compliance with MRP provision C.3, new and redevelopment projects in the Bay Area are now designed to more effectively reduce water quality and hydromodification impacts associated with urban development. Low impact development (LID) methods, such as rainwater harvesting and use, infiltration and biotreatment are required as part of development and redevelopment projects. In addition, Green Infrastructure planning is now part of all municipal projects. These LID measures are expected to reduce the impacts of urban runoff and associated impervious surfaces on stream health.
- In compliance with MRP provision C.9, the Program and Co-permittees are implementing pesticide toxicity control programs that focus on source control and pollution prevention measures. The control measures include the implementation of integrated pest management (IPM) policies/ordinances, public education and outreach programs, pesticide disposal programs, the adoption of formal State pesticide registration procedures, and sustainable landscaping requirements for new and redevelopment projects. Through these efforts, it is estimated that the amount of pyrethroids observed in urban stormwater runoff will decrease by 80-90% over time, and in turn significantly reduce the magnitude and extent of toxicity in local creeks.
- Trash loadings to local creeks have been reduced through implementation of new control measures in compliance with MRP provision C.10 and other efforts by Co-permittees to reduce the impacts of illegal dumping directly into waterways. These actions include the installation and maintenance of trash capture systems, the adoption of ordinances to reduce the impacts of litter prone items, enhanced institutional controls such as street sweeping, and the on-going removal and control of direct dumping. The MRP establishes a mandatory trash load reduction schedule, minimum areas to be treated by full trash capture systems, and requires development of receiving water monitoring programs for trash.
- In compliance with MRP provisions C.2 (Municipal Operations), C.4 (Industrial and Commercial Site Controls), C.5 (Illicit Discharge Detection and Elimination), and C.6 (Construction Site Controls) Co-permittees continue to implement programs that are designed to prevent non-stormwater discharges during dry weather and reduce the exposure of contaminants to stormwater and sediment in runoff during rainfall events.

- In compliance with MRP provision C.13, copper in stormwater runoff is reduced through implementation of controls such as architectural and site design requirements, prohibition of discharges from water features treated with copper, and industrial facility inspections.
- Mercury and polychlorinated biphenyls (PCBs) in stormwater runoff are being reduced through implementation of the respective TMDL water quality restoration plans. In compliance with MRP provisions C.11 (mercury) and C.12 (PCBs), the Program will continue to identify sources of these pollutants and will implement control actions designed to achieve new minimum load reduction goals. Monitoring activities conducted in WY 2017 that specifically target mercury and PCBs are described in Section 5.0 of this report.

In addition to the Program and Co-permittee controls implemented in compliance with the MRP, numerous other efforts and programs designed to improve the biological, physical and chemical condition of local creeks are underway. For example, the Santa Clara Valley Water District's "One Water Plan" is an ongoing, multi-year process to develop a framework and watershed-specific plans for long-term management of Santa Clara county water resources. The One Water Plan will identify, prioritize and implement activities at a watershed scale to meet flood protection, water supply, water quality and environmental stewardship goals and objectives. The Santa Clara Valley Water District is also using Proposition 1 grant funds to develop a Storm Water Resource Plan for the Santa Clara Basin that will support the development and implementation of MRP-required Green Infrastructure Plans and produce a list of prioritized runoff capture and use projects eligible for future State implementation grant funds. Through the continued implementation of MRP-associated and other watershed stewardship programs, SCVURPPP anticipates that stream conditions and water quality in local creeks will continue to improve overtime. In the near term, toxicity observed in creeks should decrease as pesticide regulations better incorporate water quality concerns during the pesticide registration process. In the longer term, control measures implemented to "green" the "grey" infrastructure and disconnect from creeks those impervious areas constructed over the course of the past 50-plus years will take time to implement. Consequently, it may take several decades to observe the outcomes of these important, large-scale improvements to our watersheds in our local creeks. Long-term creek status monitoring programs designed to detect these changes over time are therefore beneficial to our collective understanding of the condition and health of our local waterways. Where possible, creek status monitoring should support and/or compliment metrics and targets of long-term and/or watershed plans such as the One Water Plan.

4.0 STRESSOR/SOURCE IDENTIFICATION (C.8.E)

Provision C.8.e of the MRP requires that Permittees evaluate creek status (provision C.8.d) and pesticides and toxicity (provision C.8.g) monitoring data with respect to triggers defined in the MRP, and maintain a list of all results exceeding trigger thresholds. Table 3.1 lists the results of the trigger evaluation for WY 2017 data. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are therefore considered as candidates for future Stressor/Source Identification (SSID) projects. SSID projects are selected from the list of trigger exceedances based on criteria such as magnitude of threshold exceedance, parameter, and likelihood that stormwater management action(s) could address the exceedance. The MRP requires that Permittees initiate a minimum number of SSID projects during the permit term, with a minimum of one for toxicity. Four of the SSID projects must be initiated with a work plan by the third year of the permit term (i.e., 2018). All SSID project reports must be summarized in a unified, regional-level report. In 2017, SCVURPPP, SMCWPPP, ACCWP, and CCCWP each developed an SSID project work plan in compliance with the 2015 MRP. These new SSID projects are summarized in the regional SSID report (**Appendix B**) along with all SSID projects initiated under the 2009 MRP. All SSID projects initiated in compliance with the 2009 MRP are now complete including the three projects initiated by SCVURPPP.

SSID projects must identify and isolate potential sources and/or stressors associated with observed water quality impacts. They are intended to be oriented to taking action(s) to alleviate stressors and reduce sources of pollutants. The 2015 MRP describes the stepwise process for conducting SSID projects initiated under the current permit:

- Step 1: Develop a work plan for each SSID project that defines the problem to the extent known, describes the SSID project objectives, considers the problem within a watershed context, lists candidate causes of the problem, and establishes a schedule for investigating the cause(s) of the trigger. The MRP recommends study approaches for specific triggers. For example, toxicity studies should follow guidance for Toxicity Reduction Evaluations (TRE) or Toxicity Identification Evaluations (TIE), physical habitat and conventional parameter (e.g., dissolved oxygen, temperature) studies should generally follow Step 5 (Identify Probable Causes) of the Causal Analysis/Diagnosis Decision Information System (CADDIS), and pathogen indicator studies should generally follow the California Microbial Source Identification Manual (SCCWRP 2013).

- Step 2: Conduct SSID investigation according to the schedule in the SSID work plan and report on the status of SSID investigations annually in the UCMR.

- Step 3: Conduct follow-up actions based on SSID investigation findings. These may include development of an implementation schedule for new or improved best management practices (BMPs). If a Permittee determines that MS4 discharges are not contributing to an exceedance of a water quality standard, the Permittee may end the SSID project upon written concurrence of the Executive Officer. If the SSID investigation is inconclusive, the Permittee may request that the Executive Officer consider the SSID project complete.

In 2017, SCVURPPP followed-up the Upper Penitencia Creek SSID Project that was initiated in compliance with the 2009 MRP (**Appendix C**). SCVURPPP also developed a work plan for the Coyote Creek Toxicity SSID Project (**Appendix D**), which will fulfil the regional requirement of one toxicity project. Both projects are summarized in the sections below. SCVURPPP will continue to collaborate with RMC partners on additional SSID projects.

4.1 Upper Penitencia Creek SSID Project

In WY 2016, the Program conducted the Upper Penitencia Creek SSID Project (Project). Project results were presented in a Final Report that was submitted to the Water Board on March 31, 2017 (SCVURPPP 2017). The Project was the third and final SSID project the Program was required to complete during the term of MRP 1.0.

Based on findings from the Project, the reduced biological integrity observed in Upper Penitencia Creek is believed to be associated with intermittent stream flow in the segment associated with the case site, that has been exacerbated by preceding two years of dry conditions associated with the drought. The source of stressors that may reduce the biological condition in the study area do not appear to be linked to stormwater impacts. As a result, the Upper Penitencia Creek SSID Project was considered complete. However, in effort to assist in future management of natural resources in Upper Penitencia Creek watershed, the Program identified additional follow-up actions. These actions include:

- Conduct biological assessments at Project study sites for a second year (WY 2017) to evaluate potential variability in biological conditions during years with different hydrological conditions.
- Conduct a brief evaluation of current management practices associated with water quality and water flows in Upper Penitencia Creek, and provide recommendations on how biological conditions may be improved in the water body.
- .

The monitoring results showed biological conditions, based on CSCI scores, at the case site were much higher in 2017 compared to 2016 (0.84 and 0.65, respectively). The increase in CSCI scores were likely associated with longer periods of wetted channel during the spring season of WY 2017 due to wet winter season and higher groundwater levels.

The management practices assessment (included as **Appendix C**) evaluated three types of practices in Upper Penitencia Creek that may impact the Project reach, including: 1) water operations; 2) channel maintenance, and 3) sediment controls in upper watershed. Recommended management/monitoring actions were as follows:

- Evaluate management scenarios to release water from Robert Gross Percolation Ponds that would enhance aquatic life uses in Upper Penitencia Creek. Management scenarios may include operations to enhance the timing, duration and magnitude of water releases to potentially benefit downstream migration of juvenile steelhead.
- Consider removal of non-native plant species (e.g., ivy) and encourage natural recruitment of native riparian vegetation at the case site to improve aquatic conditions as part of actions taken by the District's Safe Clean Water and Natural Flood Protection Program, Priority D[8]. Priority D focuses on Restoring Wildlife Habitat and Providing Open Space in Santa Clara County. Funding for this priority pays for control of non-native, invasive plants, revegetation of native species, and maintenance of previously revegetated areas. Other projects include removal of fish barriers, improvement of steelhead habitat and stabilization of eroded creek banks.
- Consider the installation of large woody debris to increase habitat type diversity (e.g., scour pools) to increase the diversity of aquatic biota, leveraging the District's Safe Clean Water and Natural Flood Protection Program, Priority D opportunities when possible. Large woody debris placement should consider habitat benefit versus flood risk. Consider use of SCVWD's gravel placement and large-wood placement site prioritization criteria which aims to integrate geomorphic analysis and aquatic ecology principles to increase in-stream complexity in select urbanized waterways throughout the county[9]. Other sources of information may include SCVWD's Stream Maintenance Program large woody debris guidelines.

To support these and future restoration projects the District will create a comprehensive, updated database on stream conditions countywide. The District and other agencies can then use the new

[8] https://www.valleywater.org/project-updates/safe-clean-water-and-natural-flood-protection-program/priority-d-restore-wildlife-habitat-and-provide-open-space

[9] Countywide Gravel and Large Wood Augmentation Program (Draft)

information to make informed decisions on where and how to use restoration dollars so they have the greatest value for wildlife.

Monitoring results and management practices assessment are summarized in the Upper Penitencia Creek SSID Project Follow-up Monitoring and Management Assessment Report which is included as **Appendix C**.

4.2 Coyote Toxicity

Consistent with MRP provision C.18.e, SCVURPPP has initiated an SSID project in Coyote Creek to investigate sources of sediment toxicity observed over the past decade. The Regional Water Board recently recommended listing of Coyote Creek for toxicity in sediment in the 2016 Integrated Report (303(d) List/305(b) Report) for the San Francisco Bay Region. The SSID project design is described in the Coyote Creek SSID Work Plan (see Appendix D) and is designed to:

1. Identify the magnitude and extent of toxicity in a reach of the Coyote Creek mainstem where previous data were collected; and
2. Identify potential causes of sediment toxicity (if observed).

Depending on results of the investigation, management actions to control toxicity in Coyote Creek will be identified in the project report. Although several potential stressors will be evaluated, it is likely that the cause of sediment toxicity in Coyote Creek will be pesticides. This hypothesis is based on previous monitoring throughout California that has concluded that urban applications of pyrethroid pesticides are causing toxicity to the amphipod *Hyalella azteca* in water and sediment from urban creeks. Fipronil, a common pyrethroid replacement pesticide, is also found in substantial numbers of water and sediment samples and the concentrations of this pesticide and its degradates are typically well above published toxicity (LC50) values.

The Coyote Toxicity SSID project will focus on evaluating if sediment toxicity is present in Coyote Creek and if so, evaluate pesticides as the stressor that may be causing the toxicity. The Program will implement an adaptive monitoring approach to further investigate potential sources and causes of sediment toxicity in Coyote Creek. The approach includes an initial evaluation of sediment chemistry and toxicity testing during the dry season of WY 2018. If results indicate the following, the described next steps will be implemented:

- If toxicity tests exhibit significant toxicity and percent effect is greater than 20% reduction in survival (compared to the Lab Control) AND sediment chemistry results indicate the presence of pyrethroid or fipronil pesticide at adverse effects levels (i.e., greater than LC50 threshold), then the SSID project will be considered complete.

- If toxicity tests exhibit significant toxicity, BUT the sediment chemistry results are inconclusive, the Program will implement a Toxicity Identification Evaluation (TIE) consistent with guidance provided in the EPA sediment TIE manual (EPA/600/R-08/080). The TIE will consist of a series of treatments designed to identify the type of chemicals that may be causing toxicity (Anderson 2009). The Program will implement a TIE that includes three targeted tests: 1) Baseline sample (i.e., re-test of sample); 2) Activated Carbon (i.e., general organic contaminants); and 3) Cationic Resin (metals). The TIE will confirm toxicity is present (or not), and the type of contaminant (i.e., metal and/or organic) that may be causing the toxicity. TIEs are more effective when there is sufficient toxicity in the sample. Thus, a TIE will only be conducted for samples that exhibit toxicity with percent effect that is greater than 50% reduction in survival (compared to Lab Control). A maximum of one TIE will be conducted at two sites (total of two TIEs) for the SSID Project, providing all sites meet the 50% reduction in survival criterion. The TIE(s) will be conducted immediately following receipt of the sediment chemistry laboratory.

All toxicity testing, sediment chemistry results and TIE results from WY 2018 will be evaluated prior to any additional monitoring being considered for WY 2019. Should additional monitoring be planned for WY 2019, the evaluation of WY 2018 and description of planned WY 2019 monitoring will be included in a revised Work Plan that will be submitted with the Program's WY 2018 UCMR. If monitoring results suggest that Coyote Toxicity SSID project is complete (i.e., toxicity observed is associated with pesticides), the Program will prepare a Final Report with data results and interpretation, and submit the report with the Program's WY 2018 UCMR.

5.0 POLLUTANTS OF CONCERN MONITORING

Pollutants of Concern (POC) monitoring is required by provision C.8.f of the MRP. POC monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, provide information to support implementation of total maximum daily load action plans (TMDLs) and other pollutant control strategies, assess progress toward achieving wasteload allocations (WLAs) for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. The MRP identifies five priority POC management information needs that need 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.

Provision C.8.f of the MRP requires POC monitoring of polychlorinated biphenyls (PCBs), mercury, copper, emerging contaminants, and nutrients.[10] The MRP defines yearly and total (i.e., permit term) minimum number of samples for each POC and specifies the minimum number of samples for each POC that must address each information need. Progress toward POC monitoring requirements accomplished in WY 2017 and the planned allocation of effort for WY 2018 are described in the SCVURPPP POC Monitoring Report (SCVURPPP 2017) that was submitted to the Regional Water Board on October 15, 2017 in compliance with provision C.8.h.iv of the MRP.

In WY 2017, SCVURPPP complied with Provision C.8.f of the MRP through the following activities:

- Implementation of a catchment-scale storm sampling program for PCBs and mercury (n=17), and copper analysis (n=2);
- Collection of upland sediment samples for PCBs and mercury analysis (n=76);
- Collection of wet weather samples for nutrients and copper analysis (n=3) and dry weather samples for nutrients analysis (n=1);
- Participation in SWAMP's Stream Pollutant Trends monitoring program; and
- Participation in the RMP Small Tributaries Loading Strategy Team (STLS).[11]

POC monitoring in WY 2017 continued to focus primarily on identification of source areas of PCBs and mercury to the MS4 and San Francisco Bay. WY 2017 data are being used by SCVURPPP to implement a process to identify and prioritize watershed management areas (WMAs) and identify specific source properties in the Santa Clara Valley. This process is generally consistent with the approaches currently being implemented by other RMC partners. WMAs are priority watersheds or catchments in the urban landscape where control measures for PCBs and mercury are currently being implemented or will be

[10] Emerging contaminant monitoring requirements will be met through participation in RMP special studies and will address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

[11] SCVURPPP strives to work collaboratively with our water quality monitoring partners to find mutually beneficial monitoring approaches. Provision C.8.a.iii of the MRP allows Permittees to use data collected by third-party organizations to fulfill monitoring requirements, provided the data are demonstrated to meet the required data quality objectives. Samples collected in Santa Clara County through the RMP are used to supplement the Program's efforts towards achieving provision C.8.f monitoring requirements.

implemented during the MRP permit term, to the extent that feasible and cost-effective controls can be identified.

A report describing the results of all POC monitoring conducted by SCVURPPP is included as **Appendix E** to this report and a report describing the results of POC monitoring conducted by the STLS is included as **Appendix F**. Appendices E and F are summarized in the sections below.

5.1 SCVURPPP POC Monitoring (C.8.f)

In compliance with provision C.8.f of the MRP, the Program conducted POC monitoring in WY 2017 for PCBs, mercury, copper, and nutrients. The MRP-required yearly minimum number of samples was exceeded for all POCs. Results are summarized in the sections below and described in more detail in **Appendix E**.

5.1.1 PCBs and Mercury

PCBs and mercury monitoring by the Program in WY 2017 served two related purposes: WMA prioritization and source property identification.

WMA Prioritization

Wet weather samples were collected from MS4 outfalls or manholes to provide information to identify WMAs where control measures could be implemented to comply with MRP requirements for load reductions of PCBs and mercury. This is the same approach that was implemented in WY 2016 and monitoring was conducted in accordance with the Water Year 2016 Pollutant of Concern Monitoring - Sampling and Analysis Plan (SCVURPPP 2015). The sampling was focused on collection of storm composite samples from high interest WMAs that may contain PCB and/or mercury source properties. High interest WMAs were identified and prioritized for sampling by evaluating several types of data, including: PCBs and mercury concentrations from prior sediment and water sampling efforts, land use data showing old industrial parcels, municipal storm drain data showing pipelines and access points (e.g., manholes, outfalls, pump stations), catchment areas delineated from municipal storm drain data, and logistical/safety considerations (SCVURPPP 2015).

During WY 2017, the Program collected seventeen samples for PCBs and mercury analysis. Each sample was a composite consisting of four to eight aliquots collected during the rising limb and peak of the storm hydrograph (as determined through field observations). Samples were analyzed for the “RMP 40” PCB congeners (method EPA 1668C), total mercury (method EPA 1631E), and suspended sediment concentration (SSC; method ASTM D3977-97).

In summary, WY 2017 results included:

- Total PCB concentrations, calculated as the sum of the “RMP 40” congeners, ranged from 0.884 ng/L to 57.6 ng/L; and PCB particle ratios, calculated by dividing total PCB concentrations by SSC, ranged from 47.1 ng/g to 1,070 ng/g.
- Mercury concentrations ranged from ND to 3.01 ng/L. Although the data appeared to be of sufficient quality for comparison of stations sampled in WY 2017, the mercury concentrations reported in WY 2017 were significantly lower than prior years. Therefore, all mercury data were rejected by the Program Quality Assurance Officer (QAO) due to potential QA concerns.

When compared to the growing dataset of wet weather characterization monitoring conducted in the Bay Area over the past 12 years (i.e., n=118), three of the PCBs samples that were collected in WY 2017 ranked in the top quartile of PCB particle ratios. The WMAs associated with these samples have been flagged for follow-up monitoring to investigate specific source properties. Figure 5.1 illustrates those WMAs (i.e., catchments) that have been identified as high interest source areas (11) or are confirmed to contain source properties (2).

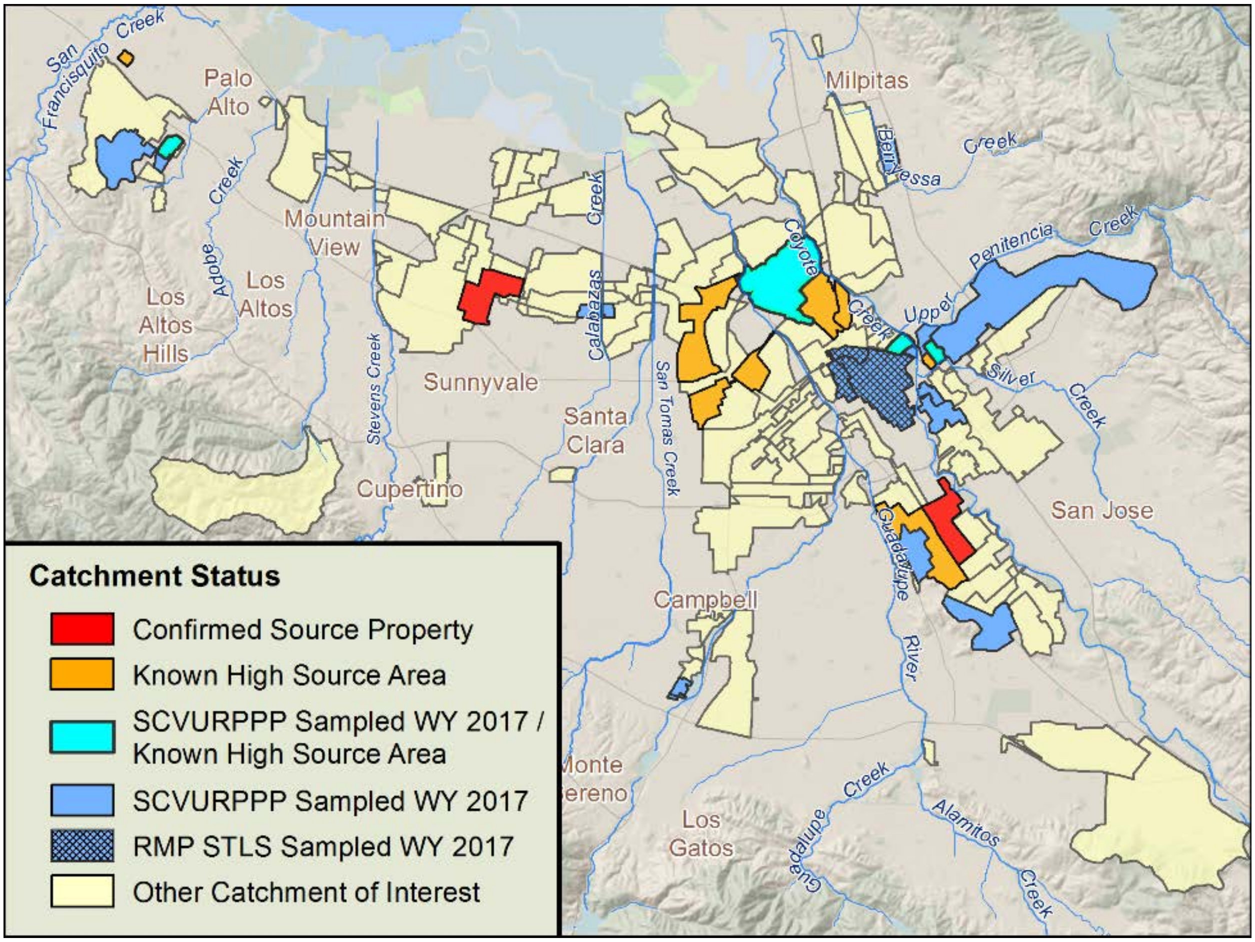

Figure 5.1. WMA map of Santa Clara County, showing catchments sampled in WY 2017.

Source Property Identification

One strategy to reduce PCBs and mercury loadings to the Bay is to identify properties that disproportionately contribute these pollutants to the MS4 and abate these properties via referrals to appropriate agencies. In this effort, the Program collected 76 PCBs and mercury samples in WY 2017 from seven prioritized WMAs. Total PCB concentrations in the samples, calculated as the sum of the "RMP 40" congeners, ranged from 0.004 mg/kg to 11.9 mg/kg. Mercury concentrations ranged from 0.03 mg/kg to 4.29 mg/kg. The data are being evaluated in concert with other source property investigation approaches such as property record and aerial photography reviews, public right-of-way surveys, and facility site visits to identify specific properties for referrals. A report describing the investigations and results is currently under development and will be included with the Program's FY 17-18 Annual Report (September 2018). It is anticipated that up to six properties will be referred as a result of the WY 2017 investigations.

SCVURPPP plans to continue working with other Bay Area countywide stormwater programs (through the BASMAA MPC Committee) and the RMP STLS to evaluate the results of the ongoing efforts in the Bay Area to identify PCBs and mercury source areas and plan next steps in Santa Clara County.

5.1.2 Copper

In WY 2017, the Program collected a total of five samples for copper analysis (i.e., total and dissolved copper, and hardness). Two samples from storm drain outfalls (067CTC350A and 067CTC351A) concurrently with PCBs and mercury storm composite samples. The goal of these samples is to address

Management Question #4 (Loads and Status) by characterizing copper concentrations in stormwater runoff from highly urban catchments. Three samples were collected during a large storm event at upstream and downstream locations in the Silver Creek watershed to address Management Question #4 (Loads and Status) by characterizing copper concentrations in stormwater runoff from upstream and downstream locations in mixed land-use catchments.

Based on the laboratory results, the following findings are noted:

- As expected, dissolved copper concentrations are lower than total copper concentrations.
- Copper concentrations reported for the stormwater outfalls were comparable to concentrations measured in creeks. However, the hardness of the outfall water was less than the creek water.
- Copper concentrations increased in the downstream direction in the Silver Creek watershed.
- All dissolved copper concentrations were below the hardness-dependent acute and chronic WQOs.

5.1.3 Nutrients

In WY 2017, the Program collected samples for nutrients analysis (i.e., ammonium[12], nitrate, nitrite, total Kjeldahl nitrogen (TKN), dissolved orthophosphate, and total phosphorus) from three locations along Silver Creek (upstream, middle, and downstream) to address Management Question #4 (loads and status). Samples were collected during a large storm event on January 9, 2017 and during dry season baseflows on June 1, 2017. The upstream location was dry during the June sampling event.

Based on the laboratory results, the following findings are noted:

- During the January storm event, total nitrogen concentrations were lower at the downstream station (205COY180) compared to the upstream (205COY205) and middle (205C07185) stations. In June, this trend was reversed with higher total nitrogen concentrations at the downstream station compared to the middle station.
- In contrast to total nitrogen, phosphorus concentrations increased in the downstream direction during the January storm event and decreased in the downstream direction in June.
- Inorganic nitrogen (nitrate and nitrite) concentrations were higher in June compared to the January storm event and organic nitrogen (i.e., TKN) concentrations were lower in June compared to the January storm event.
- Organic nitrogen (i.e., TKN) made up a greater proportion of the total nitrogen concentration during the January storm event compared to the June event. It is likely that organically-bound nitrogen washed off surfaces during the January storm had not yet had time to cycle through the ammonification and nitrification processes before samples were collected. In June, TKN made up just a small percent of the total nitrogen.
- Phosphorus concentrations were higher during the January storm runoff sampling event compared to the June baseflow event. This finding is consistent with the draft conceptual model developed by the “San Francisco Bay Nutrient Management Strategy” (NMS) which suggests that nutrient loads to San Francisco Bay from creeks are highest during the wet season, although considerably less than loads from publicly owned wastewater treatment works (POTWs) (Senn and Novick 2014). However, nutrient concentrations (primarily nitrate) were higher during the

[12] Ammonium was calculated as the difference between ammonia and un-ionized ammonia. Un-ionized ammonia was calculated using the formula provided by the American Fisheries Society Online Resources (http://fishculture.fisheries.org/resources/fish-hatchery-management-calculators/).

baseflow event. It unknown why nitrate patterns in Silver Creek were not consistent with the NMS model.

- No applicable WQOs were exceeded.

5.1.4 Recommendations for WY 2018 POC Monitoring

As described in **Appendix E**, the Program identified the following recommendations for POC monitoring in WY 2018 and beyond:

- SCVURPPP and the RMP's STLS will continue to conduct PCB and mercury monitoring with the goal of identifying WMAs and specific source properties where new PCB and mercury control measures can be implemented during the permit term.

- At least eight PCBs and mercury samples that address Management Question #3 (Management Action Effectiveness) must be collected by the end of year four of the permit (i.e., 2020). BASMAA is currently implementing a regional project that addresses POC Management Action Effectiveness. The Study Design, approved by the Project Management Team in August 2017, addresses the effectiveness of hydrodynamic separator (HDS) units and various types of biochar-amended bioretention soil media (BSM) at removing PCBs and mercury from stormwater. Findings from the regional project will be reported in the WY 2018 UCMR which will be submitted by March 31, 2019. Findings will also be used to support development of the Reasonable Assurance Analysis (RAA) that is required by provision C.12.c.iii.(3) of the MRP and which must be submitted with the 2020 Annual Report (September 30, 2020).

- At least eight samples that address Management Question #5 (Trends) must be collected by the end of year four of the permit (i.e., 2020). SCVURPPP will continue to participate in the STLS Trends Strategy Team to meet this requirement. The STLS Trends Strategy Team, initiated in WY 2015, is currently developing a regional monitoring strategy to assess trends in POC loading to San Francisco Bay from small tributaries (see Section 5.2.3). The STLS Trends Strategy will initially focus on PCBs and mercury, but will not be limited to those POCs. Analysis of recent and historical data collected at region-wide loadings stations suggests that PCB concentrations are highly variable. Therefore, a monitoring design to detect trends with statistical confidence may require more samples than is feasible with current financial resources. The STLS Trends Strategy Team is continuing to evaluate available data from the Guadalupe River watershed to explore more economical monitoring opportunities. The Team is also considering modeling options that could be used in concert with monitoring to detect and predict trends in POC loadings. A Trends Strategy Road Map is currently being developed via the STLS.

- SCVURPPP will continue to work with the SPoT Program to address Management Question #5 (Trends). The *SPoT Monitoring Program* conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of large rivers. The goal of the SPoT Program is to investigate long-term trends in water quality (Management Question #5 – Trends). Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, including two stations in Santa Clara County (Coyote Creek and Guadalupe River). In most years, sediments are analyzed for PCBs, mercury, other metals, toxicity, pesticides, and organic pollutants (Phillips et al. 2014).

- Copper and nutrient samples will be collected from mixed land use watersheds during storm events.

- SCVURPPP will continue to participate in the RMP's STLS and the RMP's CEC Strategy.

5.2 Small Tributaries Loading Strategy

The RMP Small Tributaries Loading Strategy was developed in 2009 by the STLS Team, which includes representatives from BASMAA, Regional Water Board staff, RMP staff, and technical advisors and is overseen by the Sources, Pathways, and Loadings Workgroup (SPLWG). The objective of the STLS is to develop a comprehensive planning framework to coordinate POC monitoring/modeling between the RMP and RMC participants. In 2017, the following management policies and decisions were identified:

- Refining pollutant loading estimates for future TMDL updates,
- Informing provisions of the current and future versions of the MRP,
- Identifying small tributaries to prioritize for management actions, and
- Informing decisions on the best management practices for reducing concentrations and loads.

The sections below describe the tasks implemented by the RMP STLS in WY 2017 to address the relevant management policies.

5.2.1 Wet Weather Characterization

With a goal of identifying watershed sources of PCBs and mercury, STLS field monitoring in WY 2017 continued to focus on collection of storm composite samples in the downstream reaches of catchments located throughout the region. In WY 2017, 17 catchments ranging in size from 0.09 km^2 to 36.57 km^2 and representing engineered MS4 drainage areas throughout the Bay Area were sampled during storm events. Storm composite water samples were analyzed for concentrations of PCBs, total mercury, and suspended sediment concentration. In addition, a pilot study was continued at a subset of locations to collect fine sediments using specialized settling chambers. A full description of the methods and results from WY 2015, WY 2016, and WY 2017 monitoring is included in **Appendix F** (Pollutants of Concern Reconnaissance Monitoring Final Progress Report, Water Years 2015, 2016, and 2017).

In WY 2017 two catchments were targeted in Santa Clara County based on recommendations by Program staff evaluating land uses in the County that have the highest likelihood of generating PCBs in stormwater runoff. Both of the Santa Clara County sampling stations were located at manholes accessing the MS4. Results of these STLS stations are summarized with SCVURPPP monitoring results in **Appendix E**. Wet weather characterization monitoring by the RMP STLS is planned to continue in WY 2018.

Findings

The RMP STLS has a growing database of nearly 75 stations that have been sampled at least once during wet weather events for PCBs, mercury, and SSC since 2003. (Some stations have also been sampled for a larger suite of constituents.) Prior to WY 2015, most of the stations were located in natural creeks, whereas the 55 stations sampled in WY 2015 through WY 2017 were primarily located in small catchments draining primarily old industrial land uses. At 16 of the stations, a second sample was collected with either a Hamlin or Walling tube remote sediment sampler.

Acknowledging that dynamic climatic conditions and individual storm characteristics may affect data interpretation, the following conclusions have been identified:

- PCBs positively correlate with impervious cover, old industrial land use, and mercury. They inversely correlate with watershed area. Although mercury and PCBs positively correlate, the relationship is relatively weak, probably due to the larger role of atmospheric recirculation in the mercury cycle and the differences in use history of each POC.

- Neither PCBs nor mercury have strong correlations with other trace metals (As, Cu, Cd, Pb, and Zn). Therefore, there is no support for the use of trace metals as surrogate investigative tools for either PCBs or mercury sources.

- The testing of the remote samplers showed mixed results and further testing is needed to determine their utility in investigating PCB and mercury sources.

- Resampling of some stations (i.e., those that return lower than expected concentrations) is recommended to test for false negatives.

5.2.2 Regional Watershed Spreadsheet Model

The Regional Watershed Spreadsheet Model (RWSM) is a land use based planning tool for estimation of annual POC loads from small tributaries to San Francisco Bay at a regional scale. Development of the RWSM began in 2010 and, in WY 2017, the STLS Team (with support and input from BASMAA representatives) published a beta version of the RWSM tool-kit.

The RWSM is based on the idea that to accurately assess total contaminant loads entering San Francisco Bay, it is necessary to estimate loads from local watersheds. “Spreadsheet models” of stormwater quality provide a useful and relatively inexpensive means of estimating regional scale watershed loads. Spreadsheet models have advantages over mechanistic models because the data for many of the input parameters required by mechanistic models may not currently exist, and also require large calibration datasets which take money and time to collect.

The RWSM is based on the assumption that an estimate of mean annual **volume** for each land use type within a watershed can be combined with an estimate of mean annual **concentration** for that same land use type to derive a **load** which can be aggregated for a watershed or many watersheds within a region of interest. It may be used to provide hypotheses about which sub-regions or watersheds export relatively higher or lower loads to the Bay relative to area. It can also serve as a baseline for analyzing changes in loadings due to large scale changes in land use (e.g., associated with redevelopment and new development) and runoff (e.g., associated with climate change and changes in impoundment). However, the RWSM is less reliable for predicting real loadings for individual watersheds and for estimating load changes in relation to implementation of treatment BMPs.

The RWSM beta tool-kit published in June 2017 includes:

- Hydrology Model coded using ArcPy and drawing on a user interface accessible through ArcGIS;
- Pollutant Model Spreadsheet for taking the outputs from the Hydrology Model and inputting land use coefficients to estimate pollutant loads;
- Two optional calibration tools – a spreadsheet for manual calibration, and an R script for an optimized automated calibration; and
- User Manual

5.2.3 STLS Trends Strategy

In WY 2017, the STLS Trends Strategy team continued to meet. The STLS Trends Strategy was initiated in 2015 by recommendation of from the SPLWG which advised the STLS to define where and how trends may be most effectively measured in relation to management effort so that data collection methods deployed over the next several years will support this management information need. The STLS Trends Strategy team is comprised of SFEI staff, RMC participants, and Regional Water Board staff. Invitations to key meetings are expanded to additional interested parties (e.g., EPA) and technical advisors (e.g., USGS) are consulted to review specific technical work products.

The Trends Strategy document and Technical Appendix, drafted in WY 2016, serves as a foundation for this team. The main document summarizes the background, management questions, and guiding principles of the Trends Strategy. It also describes coordination between the RMP and BASMAA within the context of the MRP, proposed tasks to answer the management questions, anticipated deliverables, and the overall timeline. The current priority POCs are PCBs and mercury and trend indicators under consideration (i.e., PCB concentrations and particle-ratios) were identified within the context of existing datasets (e.g., POC loading stations) and TMDL timelines. However, the Strategy recognizes that priorities can change in the future. The Technical Appendix (Melwani et al. 2016) presents an evaluation of variability and statistical power for detecting trends based on POC loading station PCBs data. It presents sample size and revisit frequency scenarios needed to detect declining trends in PCBs in 25 years with > 80% statistical power. Due to high variability in baseline PCB concentrations, the modeled sampling scenarios would likely be too expensive and unrealistic to implement. Therefore, the Technical Appendix recommends additional analyses and monitoring that should be considered prior to developing a trends monitoring design.

In WY 2017, the STLS Trends Strategy team followed up on some of the recommendations from the Technical Appendix. A statistical model for trends in PCB loads in the Guadalupe River (as a case study) was developed. The model incorporates the significant turbidity-PCB relationships that exist and evaluates climatic, seasonal, and inter-annual factors as potential drivers of PCB loads. More intensive review of the Guadalupe River dataset resulted in two main findings: 1) No trends in PCB loads were apparent for the period of 2003 through 2014: 2) A monitoring design that includes sampling at least two storms in 13 out of 20 years (with 4 to 6 grab samples per storm) would detect inter-annual trends of 25% or more over 20 years with > 80% power[13] (Melwani et al. 2018). Results of the statistical analyses were presented at key stages in the analysis to USGS technical advisors with expertise in trends analysis of water data. It is uncertain how the Guadalupe River model and analysis could be applied to other watersheds which have distinct characteristics.

In WY 2018, the Trends Strategy team is updating the Trends Strategy document to include an evaluation of how various tasks to date have and could be used to address the five POC information needs from the MRP (see list at the beginning of Section 5.0. This review will focus on the Guadalupe River statistical analysis, RWSM, BASMAA source identification and BMP effectiveness monitoring, and POC loads monitoring (loading stations and wet weather characterization). The updated document will also propose conceptual ideas for a regional load model that may be supplemented, optimized, and/or calibrated with data from field monitoring. A five-year workplan with estimates of annual budget allocations will be presented.

5.2.4 Guadalupe River Loading Station Contingency Monitoring

POC loads monitoring activities were conducted from 2003 through 2014 in the Guadalupe River near the Highway 101 overpass. These efforts occurred via a combination of RMP, SCVURPPP and Santa Clara Valley Water District (SCVWD) funding and were generally aimed at developing robust estimates of annual mercury and other POC loading to the Bay from the watershed (see Section 5.2.3 for more information). One key information gap that remains is the concentrations and loading associated with high intensity storm events that necessitate the release of water from reservoirs located in the upper watershed. These events rarely occur and, for the past few years, the Program has been prepared to institute contingency monitoring to sample water at the Highway 101 station in the event of a qualifying storm. In WY 2017, a qualifying event occurred and was successfully sampled.

McKee et al. (2018) describes monitoring methods and results from the five-day sampling event that occurred in January 2017. SFEI staff implemented an adaptive sampling strategy and captured a total of 14 samples over five days. During that time, flow peaked three times in response to heavy and prolonged

[13] Power is defined as the probability of detecting a trend of a certain magnitude during a specified monitoring period (years), where a Type I error rate is set at 5%.

rainfall. **Figure 5.2** (i.e., Figure 4 from McKee et al. 2018) illustrates how mercury concentrations varied throughout the storm hydrograph.

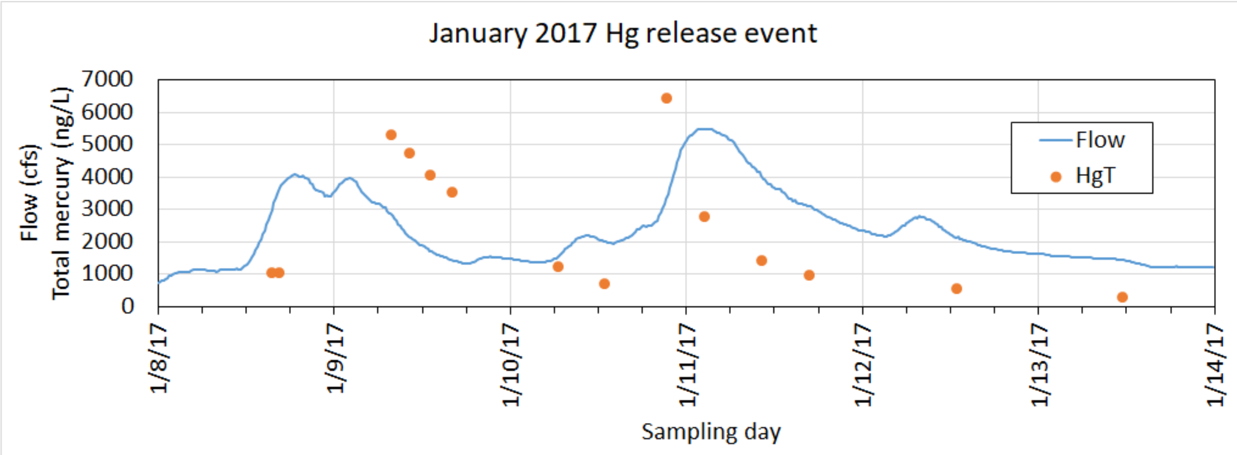

Figure 5.2. January 2017 storm hydrograph and total mercury concentrations in Guadalupe River at Highway 101 (Figure 4 from McKee et al. 2017; flow data are provisional and subject to change).

Two methods were applied to estimate mercury loads during the event. The first method was used to generate a load estimate for every 15-minute interval during the sampling period (using linear interpolation between grab samples) and resulted in a total event load of 70 kg. The second method combined a flow-weighted average concentration with total event flow for a load estimate of 82 kg. Approximately 86% of the load is assumed to emanate from the historic mining district in the upper watershed, rather than the urbanized areas in the lower watershed. Regardless of which method is used, a load equivalent of more than half of the previously estimated average annual baseline load for the Guadalupe River was transported during this one storm. The loads during this one storm exceeded the TMDL wasteload allocation of 9.4 kg/year by a factor of over 7. These findings illustrate the very episodic nature of loads in this system.

Comparison to Applicable Water Quality Standards

MRP provision C.8.g.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, comparisons of data collected in the Guadalupe River in WY 2017 to applicable numeric WQO is provided below.

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

Discharge vs. Receiving Water – WQOs apply to receiving waters, not discharges. WQOs are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effect on organisms using the aquatic system as habitat, on people consuming those organisms or water, and on other current or potential beneficial uses. POC monitoring data collected as part of the wet weather characterization effort (Section 5.2.1) were not collected in receiving waters; instead, they were collected within the engineered storm drain network where WQOs do not apply.

Freshwater vs. Saltwater - POC monitoring data were collected in freshwater, above tidal influence and therefore comparisons were made to freshwater WQOs/criteria.

Aquatic Life vs. Human Health - 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 stations monitored.

Acute vs. Chronic Objectives/Criteria - 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" WQOs/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. Of the analytes monitored in Guadalupe River in WY 2017, WQOs or criteria have only been promulgated for total mercury. Therefore, the comparison of data collected in WY 2017 to applicable numeric WQOs or criteria adopted by the Regional Water Board is limited to total mercury.

Six of the 14 samples collected in the Guadalupe River in WY 2017 were above the freshwater acute objective for mercury of 2.4 µg/L. Total mercury concentrations ranged from 0.28 µg/L to 6.45 µg/L with the highest concentrations occurring during storm peak flows. Mercury discharges from urban areas that drain through the MS4 are being addressed through provision C.11 of the MRP which implements the San Francisco Bay and Guadalupe River Watershed mercury TMDLs.

6.0 NEXT STEPS

Water quality monitoring required by provision C.8 of the MRP is intended to assess the condition of water quality in the Bay area receiving waters (creeks and the Bay); identify and prioritize stormwater associated impacts, stressors, sources, and loads; identify appropriate management actions; and detect trends in water quality over time and the effects of stormwater control measure implementation. On behalf of Co-permittees, SCVURPPP conducts creek water quality monitoring and monitoring projects in the Santa Clara Valley (Lower South Bay) in collaboration with the Regional Monitoring Coalition (RMC), and actively participates in the San Francisco Bay Regional Monitoring Program, which focuses on assessing Bay water quality and associated impacts.

In WY 2018, SCVURPPP will continue to comply with water quality monitoring requirements of the MRP. The following list of next steps will be implemented in WY 2018:

- SCVURPPP will continue to collaborate with the RMC (MRP provision C.8.a).
- Where applicable, monitoring data collected and reported by SCVURPPP will continue to be SWAMP comparable (MRP provision C.8.b).
- SCVURPPP will continue to provide financial contributions towards the RMP and to actively participate in the RMP committees and work groups described in Sections 2.0 and 5.0 (MRP provision C.8.c).
- SCVURPPP will continue to conduct probabilistic and targeted Creek Status Monitoring consistent with the specific requirements in the MRP (MRP provision C.8.d).
- SCVURPPP will continue to implement dry weather Pesticides and Toxicity Monitoring and will work with RMC partners to develop and implement a wet weather Pesticides and Toxicity Monitoring program consistent with MRP provision C.8.g.
- SCVURPPP will continue to review monitoring results and maintain a list of all results exceeding trigger thresholds (MRP provision C.8.e.i). SCVURPPP will coordinate with the RMC to initiate a region wide goal of eight new SSID projects by the end of the permit term including four new SSID projects by the third year of the permit (MRP provision C.8.e.iii). This will include implementation of the Coyote Creek Toxicity SSID Project.
- SCVURPPP will continue to participate in the STLS and SPLWG which address MRP provision C.8.f POC management information needs and monitoring requirements through wet weather characterization monitoring, refinement of the RWSM, and advancement of the STLS Trends Strategy.
- SCVURPPP will continue to support mercury monitoring at the Guadalupe River loading stations which is now conducted through the Coordinated Monitoring Program for the Guadalupe River watershed, a collaboration of entities subject to the Guadalupe River Mercury TMDL.
- SCVURPPP will implement a POC monitoring framework to comply with provision C.8.f of the MRP. The monitoring framework will address the annual and total minimum number of samples required for each POC (i.e., PCBs, mercury, copper, emerging contaminants, nutrients) and each management information need (i.e., Source Identification, Contributions to Bay Impairment, Management Action Effectiveness, Loads and Status, Trends). WY 2018 monitoring will include collection of wet weather composite water samples from catchments and collection of dry weather sediment samples from the public right-of-way to identify areas where PCB and mercury control measures may be implemented. WY 2018 monitoring will also include sampling for nutrients and copper.
- WY 2018 POC monitoring accomplishments and allocation of sampling efforts for POC monitoring in WY 2098 will be submitted in the Pollutants of Concern Monitoring Report that is due to the Water Board by October 15, 2018 (MRP provision C.8.h.iv).

- Results of WY 2018 monitoring will be described in the Programs WY 2018 Urban Creeks Monitoring Report that is due to the Water Board by March 31, 2019 (MRP provision C.8.h.iii).

7.0 REFERENCES

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Appendix A

SCVURPPP Creek Status Monitoring Report, Water Year 2017

Appendix B

Regional Stressor/Source Identification (SSID) Report

Appendix C

SCVURPPP Upper Penitencia Creek Stressor/Source Identification Project, Follow-up Monitoring and Management Practice Assessment

Appendix D

SCVURPPP Coyote Creek Toxicity Stressor/Source Identification Work Plan

Appendix E

SCVURPPP Pollutants of Concern Data Report, Water Year 2017

Appendix F

Regional Monitoring Program for the SF Bay
Pollutants of Concern (POC) Reconnaissance Monitoring Final Progress Report
Water Years 2015, 2016, and 2017