Urban Creeks Monitoring Report

Water Quality Monitoring

Water Year 2014 (October 2013 – September 2014)

Submitted in Compliance with
NPDES Permit No. CAS612008, Provision C.8.g.iii

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

A Program of the City/County Association of Governments

March 15, 2015

CREDITS

This report is submitted by the participating agencies in the

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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 Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP)[1]. The RMC includes the following participants:

- Clean Water Program of Alameda County (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo Countywide 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 the MRP Reporting Provision C.8.g.iii for reporting of all data collected pursuant to Provision C.8 in Water Year 2014 (October 1, 2013 through September 30, 2014). Data presented in this report were produced under the direction of the RMC and the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) using probabilistic and targeted monitoring designs as described herein.

In accordance with the BASMAA RMC Multi-Year Work Plan (Work Plan; BASMAA 2012) and the Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011), monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Program Plan (QAPP; BASMAA, 2014a) and BASMAA RMC Standard Operating Procedures (SOPs; BASMAA, 2014b). Where applicable, monitoring data were derived using methods comparable with methods specified by the California Surface Water Ambient Monitoring Program (SWAMP) QAPP[2]. Data presented in this report were also submitted in electronic SWAMP-comparable formats by SMCWPPP to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) on behalf of SMCWPPP Permittees and pursuant to Provision C.8.g.ii.

[1] The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) adopted the MRP on October 14, 2009 (SFRWQCB 2009). 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area are permitted under the MRP. 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 QAPP is available at:
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/swamp_qapp_master090108a.pdf

List of Acronyms

ASBS	Area of Special Biological Significance
CEDEN	California Environmental Data Exchange Network
ACCWP	Alameda County Clean Water Program
BASMAA	Bay Area Stormwater Management Agency Association
BMP	Best Management Practice
CCCWP	Contra Costa Clean Water Program
CRAM	California Rapid Assessment Method
CW4CB	Clean Watersheds for a Clean Bay
FSURMP	Fairfield Suisun Urban Runoff Management Program
IBI	Benthic Macroinvertebrate Index of Biological Integrity
IPM	Integrated Pest Management
LID	Low Impact Development
MBNMS	Monterey Bay National Marine Sanctuary
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MWAT	Maximum Weekly Average Temperature
MYP	Multi-Year Plan
NPDES	National Pollution Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
POC	Pollutant of Concern
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program
RWSM	Regional Watershed Spreadsheet Model
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFEI	San Francisco Estuary Institute
SFRWQCB	San Francisco Regional Water Quality Control Board
SMCRCD	San Mateo County Resource Conservation District
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SOP	Standard Operating Procedures

SPLWG	Sources, Pathways, and Loadings Work Group
SPoT	Statewide Stream Pollutant Trend Monitoring
SSID	Stressor/Source Identification
S&T	Status and Trends
STLS	Small Tributaries Loading Strategy
SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TRC	Technical Review Committee
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
WLA	Waste Load Allocation
WQO	Water Quality Objective

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1.0 Introduction

This Urban Creeks Monitoring Report (UCMR), was prepared by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP), on behalf of its 22 member agencies (20 cities/towns, the County of San Mateo, and the San Mateo County Flood Control District) subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP; Order R2-2009-0074) adopted by the San Francisco Regional Water Quality Control Board (SFRWQCB or Regional Water Board) on October 14, 2009. This report fulfills the requirements of MRP Provision C.8.g.iii for comprehensively interpreting and reporting all monitoring data collected during Water Year 2014 (WY2014; October 1, 2013 – September 30, 2014) pursuant to Provision C.8 of the MRP. Monitoring data presented in this report were submitted electronically to the SFRWQCB and may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) (http://water100.waterboards.ca.gov/ceden/sfei.shtml).

Chapters in this report are organized according to the following topics and MRP provisions. Some topics are summarized briefly in this report but described more fully in appendices.

- **San Francisco Estuary Receiving Water Monitoring** (MRP Provision C.8.b)
- **Creek Status Monitoring** (MRP Provision C.8.c), including local targeted monitoring and SMCWPPP's contribution to the regional probabilistic monitoring program (Appendix A)
- **Monitoring Projects** (MRP Provision C.8.d):
- **Pollutants of Concern Monitoring** (MRP Provision C.8.e.i) (Appendix B)
- **Long-Term Trends Monitoring** (MRP Provision C.8.e.ii)
- **Citizen Monitoring and Participation** (MRP Provision C.8.f)
- **Recommendations and Next Steps**

Figure 1.1 shows the stations where monitoring associated with Creek Status Monitoring, the Monitoring Projects (Stressor/Source Identification, BMP Effectiveness Investigation, Geomorphic Project), Pollutants of Concern (POC) Monitoring, and Long-Term Trends Monitoring conducted at Stream Pollution Trend (SPoT) stations was conducted in compliance with the MRP (WY2012 – WY2014). This figure illustrates the geographic extent of monitoring conducted in San Mateo County.

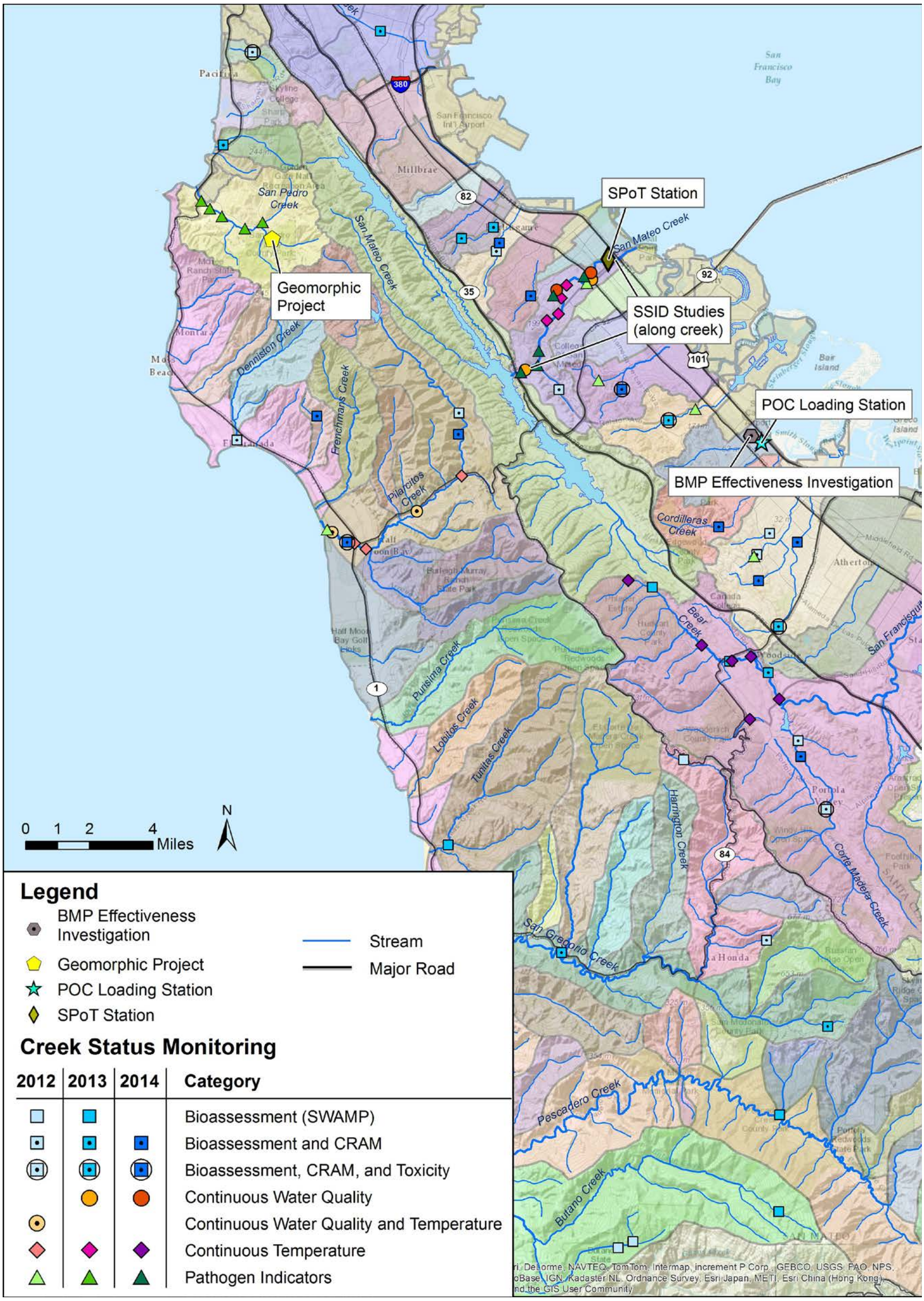

Figure. 1.1. San Mateo County MRP Provision C.8 monitoring locations: Creek Status Monitoring, Stressor/Source Identification (SSID) Studies, BMP Effectiveness Investigation, Geomorphic Project, POC Loading, and Long-Term Trends (SPoT), WY2012 – WY2014.

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 countywide stormwater program, and/or individually. In June 2010, Permittees notified the Regional 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 Agency Association (BASMAA) Regional Monitoring Coalition (RMC). With notification of participation in the RMC, Permittees were required to commence water quality data collection by October 2011. In a November 2, 2010 letter to the Permittees, the Regional 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) to provide a framework for implementing regional monitoring and assessment activities required under MRP provision C.8. The RMC Work Plan (updated in 2012) summarizes RMC projects planned for implementation between Fiscal Years 2009-10 and 2014-15 (BASMAA 2012). 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). A total of 27 regional projects are identified in the RMC Work Plan, based on the requirements described in provision C.8 of the MRP.

Regionally implemented activities in the RMC Work Plan 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 and are approved by the BASMAA BOD. MRP Permittees, through their stormwater program representatives on the BOD and its subcommittees, collaboratively authorize and participate in BASMAA regional projects or tasks. Regional project costs are shared by either all BASMAA members or among those Phase I municipal stormwater programs that are subject to the MRP.

Table 1.1 Regional Monitoring Coalition participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County
Clean Water Program of Alameda County (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7
Contra Costa Clean Water Program (CCCWP)	Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Danville, and Moraga; Contra Costa County; and, Contra Costa County Flood Control and Water Conservation District
San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)	Cities 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

2.0 San Francisco Estuary Receiving Water Monitoring (C.8.b)

As described in MRP provision C.8.b, 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 MRP, SMCWPPP has complied with this provision by making financial contributions to the RMP directly or through stormwater programs. Additionally, BASMAA and SMCWPPP staff actively participate in RMP committees and work groups as described in the following sections.

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 San Francisco Bay. The regulated community includes Permittees, publicly owned treatment works (POTWs), dredgers and industrial dischargers.

The RMP is intended to help 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.

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 then redesigned in 2007 based on a more rigorous statistical design that enables the detection of trends. The Technical Review Committee (TRC) continues to assess the efficacy and value of the various elements of the S&T Program. In WY2014, the S&T Program was comprised of the following program elements that collect data to address RMP management questions described above:

- Long-term water, sediment, and bivalve monitoring
- Episodic toxicity monitoring
- Sport fish monitoring
- USGS hydrographic and sediment transport studies
    - Factors controlling suspended sediment in San Francisco Bay

  - Hydrography and phytoplankton
- Triennial bird egg monitoring (cormorant and tern)

Additional information on the S&T Program and associated monitoring data are available for downloading 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 usually are designed to investigate and develop new monitoring measures related to anthropogenic contamination or contaminant effects on biota in the Estuary. Special Studies address specific scientific issues that RMP committees and standing workgroups identify as priority for further study. These studies are developed through an open selection process at the workgroup level and selected for funding through RMP committees.

In WY2014, Pilot and Special Studies focused on the following topics:

- Continuous monitoring of nutrients and dissolved oxygen at moored sensors
- Nutrients loads modeling
- Algal toxins monitoring
- Small fish monitoring
- Emerging contaminants monitoring

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 WY2014, 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) and the STLS Multi-Year Monitoring Plan (MYP). 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 is provided on STLS-related studies under Section 5.0 (POC Loads Monitoring) of this report.

2.3 Participation in Committees, Workgroups and Strategy Teams

In WY2014, BASMAA staff actively participated in the following RMP Committees and workgroups:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Contaminant Fate Workgroup (CFWG)
- Exposure and Effects Workgroup (EEWG)
- Emerging Contaminant Workgroup (ECWG)
- Sport Fish Monitoring Workgroup

- Toxicity Workgroup
- Strategy Teams (e.g., PCBs, Mercury, Dioxins, Small Tributaries, Nutrients)

Committee and workgroup representation was provided by Permittee, stormwater program (including SMCWPPP) staff and/or individuals designated by RMC participants and the BASMAA BOD. Representation typically includes participating in meetings, reviewing technical reports and work products, co-authoring or reviewing articles included in the RMP's *Pulse of the Estuary*, and providing general program direction to RMP staff. Stormwater program representatives and Permittee staff share information about the RMP during RMC, MPC and BOD meetings.

3.0 Creek Status Monitoring (C.8.c)

Provision C.8.c requires Permittees to conduct creek status monitoring that is intended to help 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 Table 8.1 of the MRP. Based on the implementation schedule described in MRP Provision C.8.a.ii, creek status monitoring coordinated through the RMC began in October 2011.

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

Creek status monitoring data from WY2014 were submitted to the Regional Water Board by SMCWPPP. The analyses of results from creek status monitoring conducted by SMCWPPP in WY2014 are summarized below and presented in detail in Appendix A (SMCWPPP Creek Status Monitoring Report, WY2014).

The probabilistic monitoring design was developed to remove bias from site selection such that ecosystem conditions can be objectively assessed on local (i.e., SMCWPPP) and regional (i.e., RMC) scales. Probabilistic parameters consist of benthic macroinvertebrate and algae bioassessment, nutrients and conventional analytes, chlorine, water and sediment toxicity, and sediment chemistry. Ten probabilistic sites were sampled by SMCWPPP in WY2014. A small number of additional sites were sampled by the SFRWQCB as part of the Surface Water Ambient Monitoring Program (SWAMP), in collaboration with SMCWPPP.

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, pathogen indicators and riparian assessments. Hourly water temperature measurements were recorded during the dry season using HOBO® temperature data loggers installed at six sites in the San Francisquito Creek 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 two sites in San Mateo Creek. Water samples were collected at five sites in San Mateo Creek for analysis of pathogen indicators (*E. coli* and fecal coliform). Riparian assessments were conducted at probabilistic sites using the California Rapid Assessment Method (CRAM).

Probabilistic and targeted Creek Status monitoring stations are listed in Table 3.1 and mapped in Figure 3.1 (and Figure 1.1, with other types of monitoring stations).

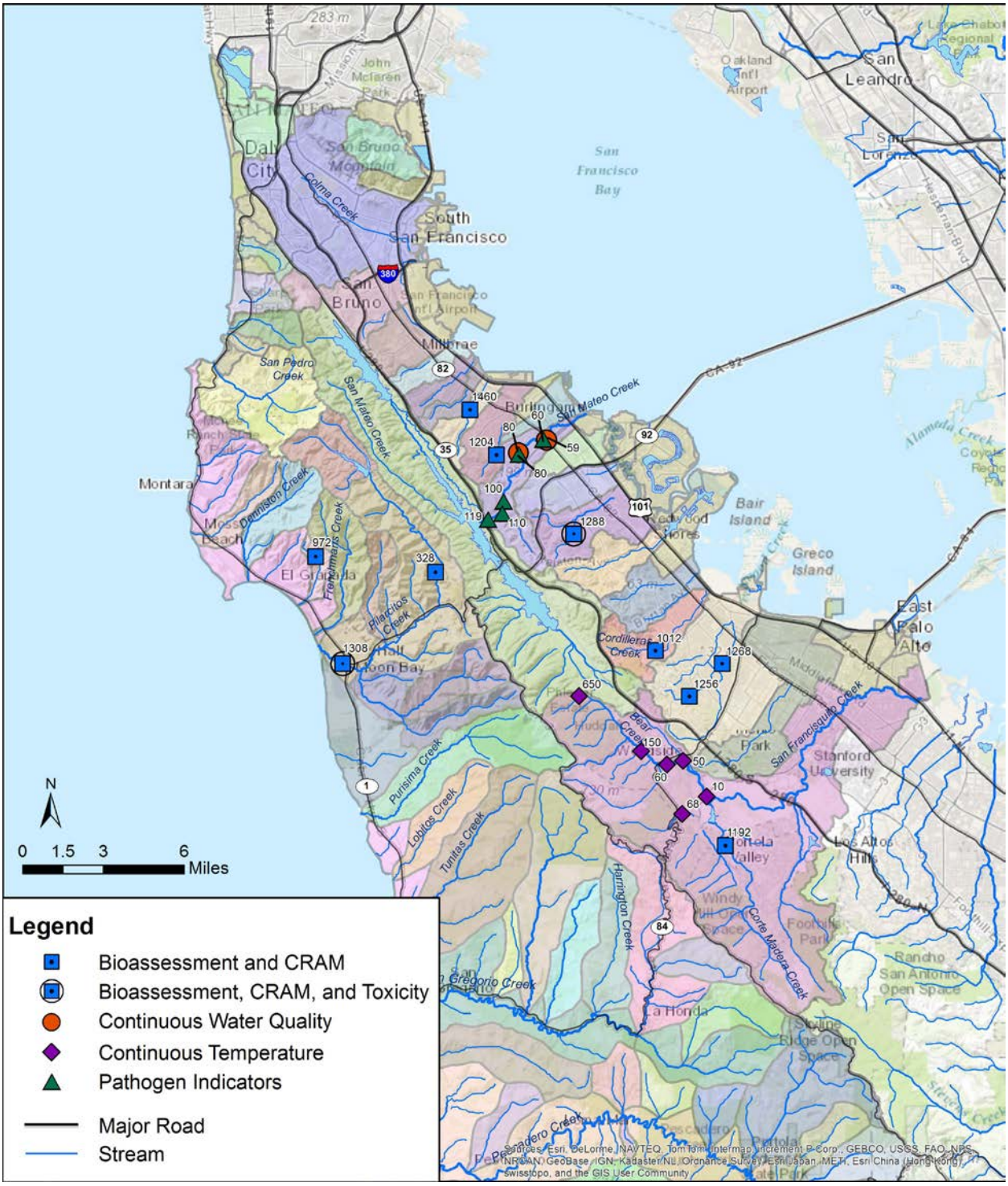

Figure 3.1. Map of major creeks and SMCWPPP stations monitored in WY2014 in compliance with MRP Provision C.8.c.

Table 3.1. MRP Provision C.8.c Creek Status monitoring stations in San Mateo County, WY2014.

Map ID	Station Number	Bayside or Coastside	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic		Targeted			
								Bioassessment, Nutrients, General WQ	Toxicity, Sediment Chemistry	CRAM	Temp	Continuous WQ	Pathogen Indicators
328	202R00328	Coastside	Pilarcitos Creek	Pilarcitos Creek	NU	37.507215	-122.38654	X		X			
972	202R00972	Coastside	Arroyo de en Medio	Arroyo de en Medio	U	37.51374	-122.45084	X		X			
1308	202R01308	Coastside	Pilarcitos Creek	Pilarcitos Creek	U	37.468314	-122.43627	X	X	X			
1012	204R01012	Bayside	Cordilleras Creek	Cordilleras Creek	U	34.473812	-122.26848	X		X			
1204	204R01204	Bayside	Burlingame Creek	Burlingame Creek	U	37.55699	-122.35379	X		X			
1256	204R01256	Bayside	Redwood Creek	Arroyo Ojo de Agua	U	37.45444	-122.25038	X		X			
1268	204R01268	Bayside	Redwood Creek	Redwood Creek	U	37.46835	-122.23277	X		X			
1288	204R01288	Bayside	Laurel Creek	Laurel Creek	U	37.523418	-122.31235	X	X	X			
1460	204R01460	Bayside	Sanchez Creek	Sanchez Creek	U	37.576703	-122.36803	X		X			
59	204SMA059	Bayside	San Mateo Creek	San Mateo Creek	U	37.56331	-122.32707					X	
60	204SMA060	Bayside	San Mateo Creek	San Mateo Creek	U	37.56244	-122.32828						X
80	204SMA080	Bayside	San Mateo Creek	San Mateo Creek	U	37.55731	-122.34204					X	X
100	204SMA100	Bayside	San Mateo Creek	San Mateo Creek	U	37.53719	-122.35001						X
110	204SMA110	Bayside	San Mateo Creek	Polhemus Creek	U	37.53235	-122.3508						X
120	204SMA119	Bayside	San Mateo Creek	San Mateo Creek	U	37.53312	-122.35073						X
68	205ALA015	Bayside	San Francisquito Creek	Alambique Creek	U	37.40443	-122.25430				X		
71	205BCR010	Bayside	San Francisquito Creek	Bear Creek	U	37.41179	-122.24106				X		
69	205BCR050	Bayside	San Francisquito Creek	Bear Creek	U	37.427017	-122.25378				X		
72	205BCR060	Bayside	San Francisquito Creek	Bear Creek	U	37.42550	-122.26243				X		
1192	205R01192	Bayside	San Francisquito Creek	Corte Madera Creek	U	37.39096	-122.23115	X		X			
70	205WUN150	Bayside	San Francisquito Creek	West Union Creek	U	37.431117	-122.27622				X		
73	205WUN650	Bayside	San Francisquito Creek	West Union Creek	NU	37.45467	-122.30986				X		

The first management question (***Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?***) is addressed primarily by comparison of probabilistic and targeted monitoring data to the triggers defined in Table 8.1 of the MRP. A summary of trigger exceedances observed for each site is presented 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 evaluation of stressor source identification (SSID) studies (see Section 4.0 for a discussion of ongoing SSID projects in San Mateo County).

The second management question (***Are conditions in local receiving waters supportive of or likely supportive of beneficial uses?***) is also addressed by comparison of probabilistic and targeted monitoring data to the triggers defined in Table 8.1 of the MRP. In addition this management question is addressed through calculation of indices of biological integrity (IBI) using benthic macroinvertebrate data collected at probabilistic sites and sites sampled prior to MRP implementation. Biological condition scores were compared to physical habitat and water quality data collected synoptically with bioassessments to evaluate whether any correlations exist that may help explain the variation in IBI scores.

Biological Condition

- Under the level of MRP-required monitoring, the RMC probabilistic design requires at least four years of data to develop a statistically-robust characterization of biological conditions of the creeks within San Mateo County. Therefore, a **biological condition assessment** based on the WY2014 bioassessment data should be considered preliminary.
- The California Stream Condition Index (CSCI) tool was used to assess biological condition based on benthic macroinvertebrate data collected at probabilistic sites. There was one site rated as “likely intact” (CSCI score $\geq$ 0.92); one site rated as “likely altered” (CSCI score 0.79 – 0.92), and eight sites rated as “very likely altered” ($\leq$ 0.63).
- An Algae IBI, based on a combination of soft algae and diatom metrics (referred to as “H20”), was used to assess biological condition based on benthic algae data collected at probabilistic sites. No condition categories have been developed for “H20” Algae IBI scores. The algae IBI results should be considered preliminary until additional date show that these tools perform well for evaluating algae collected in San Mateo County creeks.
- Algae IBI scores ranged from 36 to 59. They were poorly correlated with CSCI scores (R^2 = 0.02), indicating different stressors may be impacting benthic macroinvertabrates compared to benthic algae.
- Physical habitat (PHAB) and riparian assessment (CRAM) scores were both poorly correlated with CSCI and algae IBI scores. None of the environmental stressor variables were significantly correlated to CSCI or Algae IBI scores.
- There was very little difference in CSCI scores or Algae IBI scores between perennial (n=7) and non-perennial (n=3) sites. Both CSCI scores and Algae IBI scores had limited response to different levels of urbanization (calculated as percent impervious area).

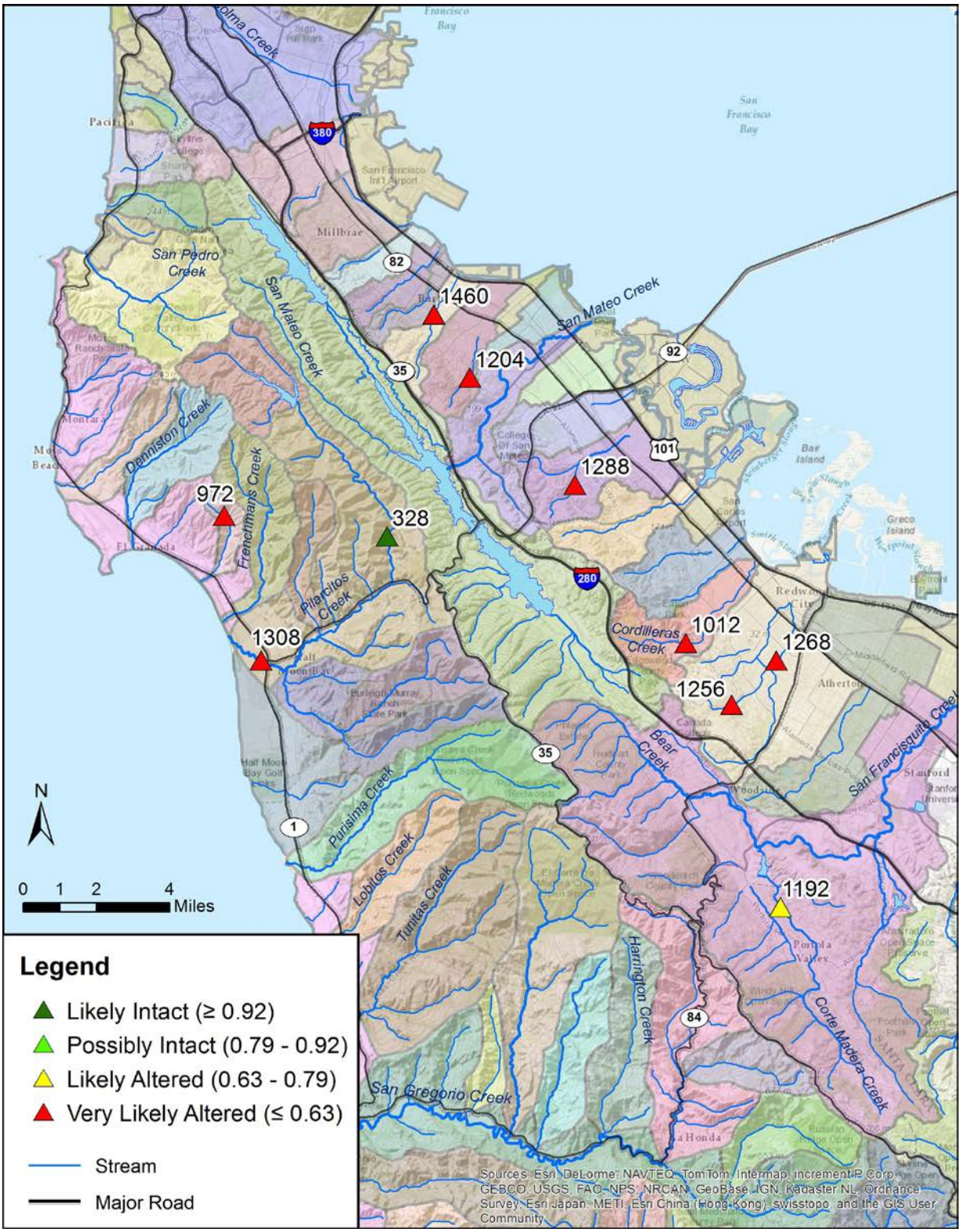

Figure 3.2. CSCI condition category for sites sampled in WY2014, San Mateo County.

Nutrients and Conventional Analytes

- Nutrients (nitrogen and phosphorus), algal biomass indicators, and other conventional analytes were measured in grab water samples collected concurrently with bioassessments which were conducted in the spring season. The unionized ammonia concentration calculated for one sample (Cordilleras Creek; 204R01012) exceeded the trigger threshold. However, this result was flagged as questionable due to an elevated field pH (9.46) used in the calculation. No other samples exceeded the MRP trigger thresholds.

Chlorine

- Free chlorine and total chlorine residual concentrations were measured using field meters during spring bioassessments at ten sites and summer toxicity and sediment sampling at two sites. Twelve measurements were collected at ten sites during WY2014. Two of the 12 samples, both collected during the spring event, exceeded the threshold for total chlorine residual. Both sites (204R01012 – Cordilleras Creek; 204R01288 – Laurel Creek) are within the urban envelope where chlorine residuals are commonly detected. Laurel Creek was resampled for chlorine during the summer toxicity sampling event and did not exceed the trigger.

Water Toxicity

- Water toxicity samples were collected twice (winter storm and dry season) from two sites during WY2014. No water toxicity samples exceeded the MRP trigger thresholds.

Sediment Toxicity and Chemistry/Sediment Triad Analysis

- Sediment toxicity and chemistry samples were collected concurrently with the dry season water toxicity samples. Neither of the sites exceeded the MRP trigger for sediment toxicity; however, both sites exceeded the trigger thresholds for sediment chemistry. Sediment chemistry trigger exceedances at both sites were the result of pyrethroid concentrations exceeding LC50s. Concentrations of metals associated with serpentinite geology contributed to the TEC trigger exceedance at Laurel Creek.

Spatial and Temporal Variability of Water Quality Conditions

- There was minimal spatial variability in water temperature across the six sites in Bear Creek watershed.

- Dissolved oxygen concentrations were similar between the two San Mateo Creek sites, but were slightly lower during Event 2 compared to Event 1.

Potential Water Quality Impacts to Aquatic Life

- There were no exceedances of the Maximum Weekly Average Temperature (MWAT) threshold at any of the temperature monitoring sites, with the exception of site 205BRC010 in Bear Creek where 6% of the measurements exceeded MWAT (not a trigger exceedance). Similarly, the two continuous monitoring stations in San Mateo Creek did not exceed MWAT. These results suggest that water temperature is not a limiting factor for resident steelhead population at any of the sites.

- In general, dissolved oxygen concentrations at both sites monitored in San Mateo Creek met WARM and COLD water quality objectives (WQOs) (i.e., triggers). Increased summer releases from Crystal Springs Reservoir in 2014 may have resulted in water quality conditions more supportive for aquatic life uses.

- Values for pH met WQOs at both sites in San Mateo Creek.

Potential Impacts to Water Contact Recreation

- In WY2014, pathogen indicator sites were focused in San Mateo Creek where a bacteria SSID study is in progress. Pathogen indicator triggers were exceeded at one of the five sites.
- 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. As a result, the comparison of pathogen indicator results to body contact recreation water quality objectives, may not be appropriate and should be interpreted cautiously.

Table 3.2. Summary of SMCWPPP trigger threshold exceedance analysis, WY2014. "No" indicates samples were collected but did not exceed the MRP trigger; "Yes" indicates an exceedance of an MRP trigger.

Station Number	Creek Name	Probabilistic Sites						Targeted Sites			
		Bioassessment	Nutrients	Chlorine	Water Toxicity	Sediment Toxicity	Sediment Chemistry	Temperature	Dissolved Oxygen	pH	Pathogen Indicators
202R00328	Pilarcitos Creek	No	No	No	--	--	--	--	--	--	--
202R00972	Arroyo de en Medio	Yes	No	No	--	--	--	--	--	--	--
202R01308	Pilarcitos Creek	Yes	No	No	No	No	Yes	--	--	--	--
204R01012	Cordilleras Creek	Yes	Yes[a]	Yes	--	--	--	--	--	--	--
204R01204	Burlingame Creek	Yes	No	No	--	--	--	--	--	--	--
204R01256	Arroyo Ojo de Agua	Yes	No	No	--	--	--	--	--	--	--
204R01268	Redwood Creek	Yes	No	No	--	--	--	--	--	--	--
204R01288	Laurel Creek	Yes	No	Yes	No	No	Yes	--	--	--	--
204R01460	Sanchez Creek	Yes	No	No	--	--	--	--	--	--	--
204SMA059	San Mateo Creek	--	--	--	--	--	--	No	No	No	--
204SMA060	San Mateo Creek	--	--	--	--	--	--	--	--	--	Yes
204SMA080	San Mateo Creek	--	--	--	--	--	--	No	No	No	No
204SMA100	San Mateo Creek	--	--	--	--	--	--	--	--	--	No
204SMA110	Polhemus Creek	--	--	--	--	--	--	--	--	--	No
204SMA119	San Mateo Creek	--	--	--	--	--	--	--	--	--	No
205ALA015	Alambique Creek	--	--	--	--	--	--	No	--	--	--
205BCR010	Bear Creek	--	--	--	--	--	--	No	--	--	--
205BCR050	Bear Creek	--	--	--	--	--	--	No	--	--	--
205BCR060	Bear Creek	--	--	--	--	--	--	No	--	--	--
205R01192	Corte Madera Creek	Yes	No	No	--	--	--	--	--	--	--
205WUN150	West Union Creek	--	--	--	--	--	--	No	--	--	--
205WUN650	West Union Creek	--	--	--	--	--	--	No	--	--	--

[a] The unionized ammonia concentration was flagged as questionable due to an unusually high field pH measurement used in the calculation.

3.1 Management Implications

The Program's Creek Status Monitoring program (consistent with MRP Provision C.8.c) focuses on assessing the water quality condition of urban creeks in San Mateo County and identifying stressors and sources of impacts observed. Although the sample size from WY2014 (overall n=10) is not sufficient to develop statistically representative conclusions regarding the overall condition of all creeks, it is clear that most urban portions 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 and in-stream habitat complexity, and other modifications to the watershed and riparian areas

associated with urban development that has occurred over the past 50 plus years in the contributing watersheds. Additionally, pyrethroid pesticides are present in creek sediments at concentrations known to adversely affect sensitive aquatic organisms (i.e., LC50s), and episodic or site specific increases in temperature and decreases in dissolved oxygen (particularly in lower creek reaches) are not optimal for aquatic life in local creeks.

SMCWPPP 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 now required as part of development and redevelopment 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, 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 are also being reduced through implementation of new control measures in compliance with MRP Provision C.10 and other efforts by 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.

- 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) 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, street sweeping, and participation in statewide efforts to significantly reduce the level of copper vehicle brake pads.

Through the continued implementation of MRP-associated and other watershed stewardship programs, SMCWPPP 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 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.

4.0 Monitoring Projects (C.8.d)

Three types of monitoring projects are required by provision C.8.d of the MRP:

1. Stressor/Source Identification Projects (C.8.d.i);
2. BMP Effectiveness Investigations (C.8.d.ii); and,
3. Geomorphic Projects (C.8.d.iii).

The overall scopes of these projects are generally described in the MRP and the RMC Work Plan. The status of projects that SMCWPPP is conducting are described in the sections below and Figure 1.1 maps where these studies were (or are being) conducted.

4.1 Stressor/Source Identification Projects

Stressor/Source Identification (SSID) projects are required by Provision C.8.d.i of the MRP. This provision requires that SMCWPPP conduct monitoring projects to identify and isolate potential sources and/or stressors associated with observed water quality impacts. Creeks considered for SSID projects are those with creek status monitoring results that trigger follow-up actions per Table 8.1 of the MRP.

Based on creek status monitoring data collected by SMCWPPP, two SSID projects were selected and are nearing completion. Both projects are in San Mateo Creek.

4.1.1 San Mateo Creek Low Dissolved Oxygen SSID Project

San Mateo Creek drains approximately 33 square miles including parts of unincorporated San Mateo County, the City of San Mateo, and the Town of Hillsborough. Below the Crystal Springs reservoir dam, the watershed encompasses approximately five square miles and is mostly urbanized. In 2003, the SFRWQCB monitored several stations within the San Mateo Creek watershed to assess water quality impacts and establish regional reference sites as part of the Surface Water Ambient Monitoring Program (SWAMP). Sondes programmed to continuously monitor pH, dissolved oxygen (DO), temperature, and specific conductivity were deployed for one to two week “episodes” during three parts of the annual hydrograph: wet season, decreasing hydrograph/spring, and dry season (SFRWQCB 2007). DO concentrations measured at two of the stations below Crystal Springs reservoir were below the cold water minimum WQO of 7 mg/L during the spring (April 27 to May 12, 2003), summer (August 7 to 25, 2003) and fall (October 20 to 31, 2003) deployments. Citing maximum DO percent saturation levels above 120, SFRWQCB (2007) reported that the DO concentrations were consistent with excessive photosynthesis.

In WY2013, in an effort to further investigate the SFRWQCB findings, SMCWPPP conducted MRP Provision C.8.c continuous monitoring at one of the SFRWQCB stations (Arroyo Court/De Anza Historical Park). A second station on San Mateo Creek, just below Crystal Springs reservoir, was also monitored by SMCWPPP to further assess the extent of potential low DO conditions. Results of the two-week deployment in June 2013 at De Anza Park showed low DO concentrations that trigger follow-up actions per Table 8.1 of the MRP. A daily pattern of fluctuating DO concentrations was observed. However, the pattern was not consistent with excessive photosynthesis. Excessive photosynthesis typically results in maximum DO concentrations in late afternoon when photosynthesis (and oxygen production) is at a maximum followed by minimum DO concentrations at night when photosynthesis has stopped and micro-

organisms are consuming oxygen. The DO pattern was instead more consistent with late-afternoon thermal stratification of the pool (possibly as a result of low stream flow, high air temperatures, and cold groundwater seepage) followed by mixing at night as air temperatures cool. Similar patterns have been observed in Coyote Creek by SCVURPPP.

In WY2014, SMCWPPP began implementation of a work plan to further investigate the extent, duration, and cause of low DO concentrations in San Mateo Creek. Two stations in San Mateo Creek (De Anza Park and the USGS gage #11162753 located approximately 0.2 mile downstream of Crystal Springs Reservoir) were targeted for MRP Provision C.8.c Creek Status monitoring of general water quality parameters (DO, temperature, pH, specific conductance) during two continuous two-week periods. The field investigation included extended continuous monitoring at the De Anza station and a dry season creek walk in the vicinity of De Anza Park with a focus on DO and other field measurements within large, deep pools. DO concentrations below WQOs were not consistently observed in WY2014 and MRP Table 8.1 triggers were not exceeded. Review of flow and temperature recorded at the USGS gage suggest that the San Francisco Public Utilities Commission (SFPUC) dry season releases from Crystal Springs Reservoir were slightly higher in WY2014 compared to WY2013 (Figure 4.1). The change in the reservoir release schedule is the result of dam improvements that are currently being constructed by the SFPUC. Prior to the dam improvement project, dry season flows from the dam were limited to leakage (<1.0 cfs) through the impoundment. When the project is complete, dam releases will increase to 3 to 17 cfs, depending on the water year type (e.g., dry, normal, wet) and the time of year. It appears that the slight increases in flow and velocity below the dam recorded in WY2014 have already resulted in improved water quality at De Anza Park, approximately 3.7 miles downstream. Future increases in dam releases will likely further increase DO concentrations and should help keep them above levels of concern.

SMCWPPP anticipates completing a Final Report for the San Mateo Creek Low Dissolved Oxygen SSID project by July 2015.

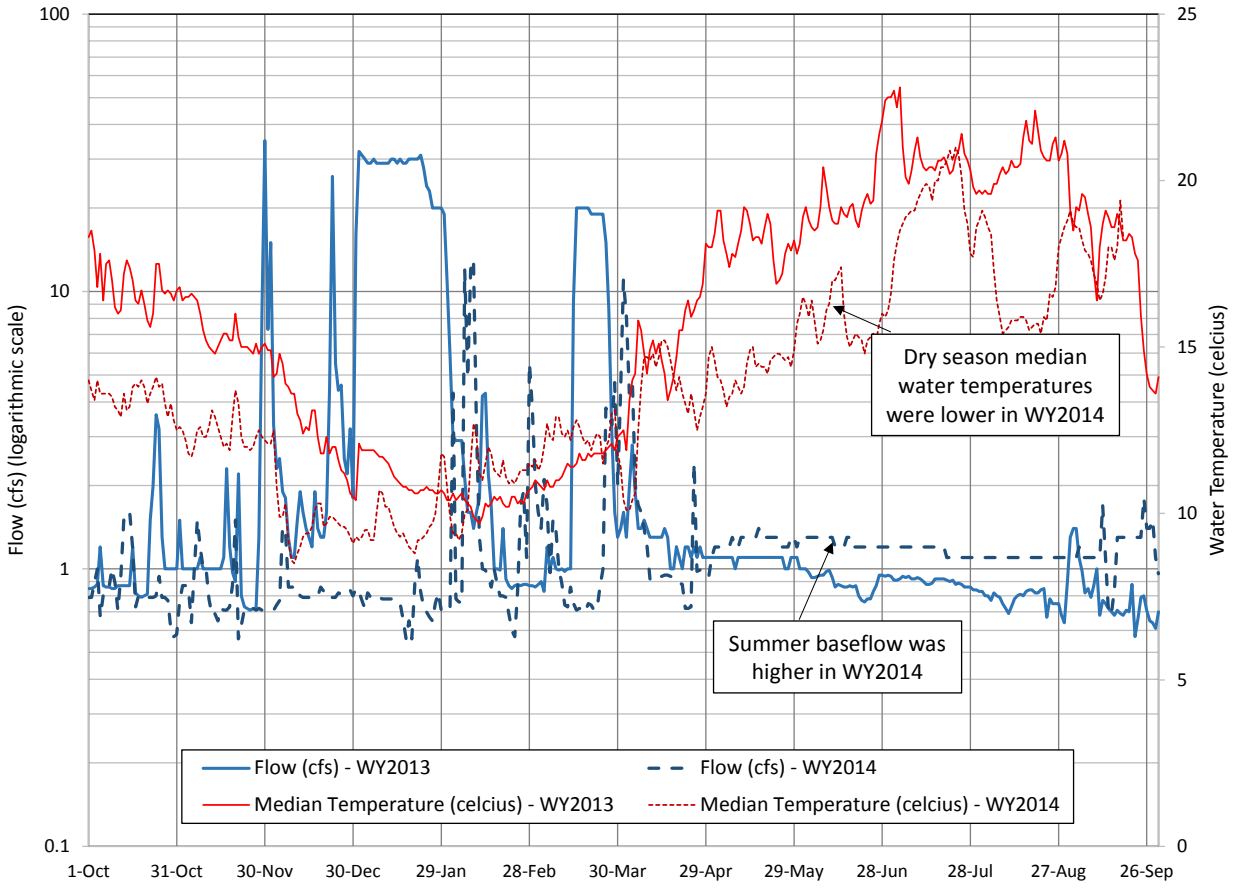

Figure 4.1. Flow and temperature measured at USGS gage #11162753 (San Mateo Creek below Lower Crystal Springs Reservoir), WY2013 and WY2014.

4.1.2 San Mateo Creek Indicator Bacteria SSID Project

Based on WY2012 SMCWPPP Creek Status monitoring data with results exceeding fecal coliform and *Escherichia coli* (*E. coli*) trigger thresholds and historical data collected by others, SMCWPPP began implementation of a pathogen indicator SSID Project in the San Mateo Creek watershed. San Mateo creek drains a watershed with a high percentage of residential land uses. Based on this land use and anecdotal evidence, pet waste has been identified as one likely source of pathogen indicator bacteria, but human sources (e.g., leaking sanitary sewer collection system infrastructure) are also possible.

The San Mateo Creek Pathogen Indicator SSID Project seeks to better characterize the magnitude, seasonal variability, and predominant sources of pathogen indicators that have been found at two lower San Mateo Creek park locations. The study approach is based on recommendations in the California Microbial Source Identification Manual (SCCWRP 2013). From April, through November 2014, pathogen indicator samples were collected approximately monthly from San Mateo Creek at two stations (De Anza Historical Park and Gateway Park) during wet and dry conditions. Visual observations of fecal matter and/or sources of fecal contamination at the parks are noted during each site visit. The project includes microbial source tracking (MST) techniques (i.e., Bacteroidales analysis) designed to indicate whether the bacteria originated from humans, dogs, or wildlife. Preliminary laboratory results suggest that

human sources were present in most samples. SMCWPPP is currently investigating current and future management practices to reduce sources of pathogen indicator bacteria.

SMCWPPP anticipates completing a Final Report for the San Mateo Creek Pathogen Indicator SSID project by July 2015.

4.2 BMP Effectiveness Investigation

Provision C.8.d.ii of the MRP (BMP Effectiveness Investigation) requires that Permittees investigate the effectiveness of one BMP in San Mateo County for stormwater treatment or hydrograph modification control. The MRP encourages fulfillment of the requirement via investigation of BMP(s) used to fulfill requirements of Provisions C.3.b.iii, C.11.e, and C.12.e, provided the BMP Effectiveness Investigation includes the range of pollutants generally found in urban runoff.

The Clean Watersheds for a Clean Bay (CW4CB) project was initiated to evaluate pilot BMPs installed for the control of polychlorinated biphenyls (PCBs) and mercury in stormwater runoff from urban areas pursuant to MRP Provisions C.11 and C.12. In San Mateo County, CW4CB includes monitoring of a series of curb extension bioretention/biotreatment facilities located along Bransten Road in the City of San Carlos. The CW4CB monitoring design at Bransten Road includes paired influent and effluent sampling and volume/flow measurements to calculate PCB and mercury load reductions. CW4CB analytical constituents include suspended sediments, total organic carbon, lead, mercury, and PCBs. Additional constituents generally found in stormwater runoff (e.g., nutrients, cadmium, chromium, copper, nickel, zinc) were added by the Program to supplement the CW4CB investigation. Samples were collected and flow volumes were measured during three storm events in WY2014. Due to low precipitation in WY2014, the program was extended through WY2015. Two additional storms will be targeted in WY2015. Results will be summarized in the Program's WY2015 Urban Creeks Monitoring Report that is due to the Regional Water Board by March 15, 2016.

4.3 Geomorphic Project

MRP Provision C.8.d.iii requires Permittees to conduct a geomorphic monitoring project intended to help answer the management question:

- *How and where can our creeks be restored or protected to cost-effectively reduce the impacts of pollutants, increased flow rates, and increased flow durations of urban runoff?*

The provision requires that Permittees select a waterbody/reach, preferably one that contains significant fish and wildlife resources, and conduct one of three types of projects. SMCWPPP elected to conduct a geomorphic study to help in the development of regional curves which help estimate equilibrium channel conditions for different sized drainages. As part of this Geomorphic Study, SMCWPPP surveyed bankfull geometries at two consecutive riffles in the Middle Fork of San Pedro Creek. The survey location is mapped in Figure 1.1 and results of the Geomorphic Study were described in Part A of the Integrated Monitoring Report (SMCWPPP 2014).

5.0 POC Loads Monitoring (C.8.e)

Pollutants of Concern (POC) loads monitoring is required by Provision C.8.e.i of the MRP. Loads monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations (WLAs) for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. In particular, there are four priority management questions that need to be addressed though POC loads monitoring:

1. *Which Bay tributaries (including stormwater conveyances) contribute most to Bay impairment from POCs?*
2. *What are the annual loads or concentrations of POCs from tributaries to the Bay?*
3. *What are the decadal-scale loading or concentration trends of POCs from small tributaries to the Bay?*
4. *What are the projected impacts of management actions (including control measures) on tributaries and where should these management actions be implemented to have the greatest beneficial impact?*

The RMP Small Tributaries Loading Strategy (STLS) was developed in 2009 by the STLS Team, which included representatives from BASMAA, Regional Water Board staff, RMP staff, and technical advisors. The objective of the STLS is to develop a comprehensive planning framework to coordinate POC loads monitoring/modeling between the RMP and RMC participants. With concurrence of participating Regional Water Board staff, the framework presents an alternative approach to the POC loads monitoring requirements described in MRP Provision C.8.e.i, as allowed by Provision C.8.e. The framework is updated annually with summaries of activities and products to date. The current version (Version 2013a) of the STLS Multi-Year Plan (MYP) was submitted with the Regional Urban Creeks Monitoring Report in March 2013 (BASMAA 2013). The MYP includes four main elements that collectively help address the four priority management questions for POC monitoring:

1. Watershed Modeling (Regional Watershed Spreadsheet Model),
2. Bay Margins Modeling,
3. Source Area Runoff Monitoring, and
4. Small Tributaries Watershed Monitoring.

The STLS MYP elements and activities conducted during WY2014 are summarized in the Sections below. Results of the analysis do not trigger SSID projects.

5.1 Regional Watershed Spreadsheet Model

The STLS Team and SPLWG continued to provide oversight in WY2014 to the development and refinement of the Regional Watershed Spreadsheet Model (RWSM), which is a planning tool for estimation of overall POC loads from small tributaries to San Francisco Bay at a regional scale. The RWSM is being developed by the San Francisco Estuary Institute (SFEI) on behalf of the RMP, with funding from both the RMP and BASMAA agencies.

Pollutant loading from local watersheds needs to be estimated as part of evaluating the total loads entering San Francisco Bay. “Spreadsheet models” of stormwater quality potentially provide a useful and relatively inexpensive tool for estimating regional scale watershed loads.

Spreadsheet models have advantages over mechanistic models because the data for many of the input parameters required by the latter models do not currently exist. Mechanistic models also require large calibration datasets that are resource and time intensive to collect.

Development of a spreadsheet model for the Bay has been underway since 2010 and to-date, models and software development has been completed for water and copper, and draft models have been completed for suspended sediments, PCBs, and mercury. Resulting loads estimates for PCBs and mercury appear to be biased high leading to the conclusion that the RWSM can be used for estimating regional scale annual average loads and could be useful for comparing relative loading between sub-regions. However, accuracy and precision at smaller scales is challenged by the regional nature of the calibration process and the simplicity of the model. During 2014, work was planned to improve these models based on improved GIS layers being developed by BASMAA, an improved iterative calibration technique, and an improved method of modeling that includes generation of ranges in loads estimates as a component of the modeling process. The 2014 work remains on hold pending GIS layer delivery.

Tasks for 2015 depend upon the outcomes of the work planned for 2014, which has not yet been completed. Possible uses of the 2015 funds include improving the basis of the model by shifting the model to a water-based starting point, completing further structural improvements to the sediment based model, or incorporation of additional calibration watersheds and data from BASMAA studies. Decisions will be made in consultation with the STLS and after discussions at the SPLWG meeting scheduled for May 2015.

5.2 Small Tributaries Watershed Monitoring

The STLS MYP includes intensive monitoring at a total of six “bottom-of-the watershed” stations over several years to accumulate data needed to calibrate the Regional Watershed Spreadsheet Model and assist in developing loading estimates from small tributaries for priority POCs. Monitoring is also intended to provide a limited characterization of additional lower priority analytes. WY2014 was the third year of monitoring activities at four stations that were set up and became operational beginning in October 2011. Two additional stations were established in October 2012 to complete the monitoring network.

1. Lower Marsh Creek (Contra Costa County), established Water Year 2012
2. Guadalupe River (Santa Clara County), established Water Year 2012
3. Lower San Leandro Creek (Alameda County), established Water Year 2012
4. Sunnyvale East Channel (Santa Clara County), established Water Year 2012
5. North Richmond Pump Station (Contra Costa County), established Water Year 2013
6. Pulgas Creek Pump Station (San Mateo County), established Water Year 2013

In WY2014, the stations in Lower Marsh Creek, Guadalupe River and the Pulgas Creek Pump Station were operated by CCCWP, SCVURPPP, and SMCWPPP, respectively, on behalf of RMC participants. The stations in the Sunnyvale East Channel and North Richmond Pump Station were operated by SFEI on behalf of the RMP, as was the Lower San Leandro Creek Station in its first year before operation was transferred to ACCWP in summer 2012. The San Mateo County station at the Pulgas Creek Pump Station in San Carlos is mapped on Figure 1.1.

Monitoring methods implemented by SFEI are documented in the POC Monitoring Field Instruction Manual. This is a living document that is frequently updated on an as-needed-basis.

The current version is dated September 2013. SMCWPPP follows the same instructions but may allow for minor modifications depending on site-specific conditions. Laboratory analyses are implemented according to the BASMAA RMC Quality Assurance Project Plan (QAPP) (BASMAA 2014a).

For WY2014, BASMAA (on behalf of all RMC participants) contracted with SFEI to coordinate laboratory analyses, data management and data quality assurance. The goal was to ensure data consistency among all watershed monitoring stations.

During WY2014 storms, discrete and composite samples were collected at the Pulgas Creek Pump Station POC loads monitoring station over the rising, peak and falling stages of the hydrographs. Samples collected were analyzed for multiple analytes (Table 5.1) consistent with MRP provision C.8.e. The turbidity of the water flowing through each station was recorded continuously during the entire wet weather season. Samples were collected and analyzed from a total of six storms.

Complete results of POC monitoring conducted by the STLS team are presented in Appendix B. This section focuses on comparisons of WY2014 water quality data to numeric WQOs and toxicity thresholds.

Table 5.1. Laboratory analysis methods used by the STLS Team for POC loads monitoring in WY2014.

Analyte	Analytical Method	Analytical Laboratory
Carbaryl	EPA 632M	DFC WPCL[a]
Fipronil	EPA 619M	DFC WPCL
Suspended Sediment Concentration	ASTM D3977	Caltest
Total Phosphorus	SM4500-P E	Caltest
Nitrate	EPA 300.0	Caltest
OrthoPhosphate	SM 4500-P E	Caltest
PAHs	AXYS MLA-021 Rev 10	AXYS[b]
PBDEs	AXYS MLA-033 Rev 06	AXYS
PCBs	AXYS MLA-010 Rev 11	AXYS
Pyrethroids	EPA 8270M_NCI	Caltest
Total Methylmercury	EPA 1630	Caltest
Total Mercury	EPA 1631E	Caltest
Copper	EPA 1638	Caltest
Selenium	EPA 1638	Caltest
Total Hardness	SM 2340 C	Caltest
Total Organic Carbon	SM 5310 B	Caltest

[a] California Department of Fish and Game Water Pollution Control Laboratory
[c] AXYS Analytical Services Ltd.

5.2.1 Comparisons to Numeric Water Quality Objectives/Criteria for Specific Analytes

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, as appropriate. Water quality objectives do not apply to Pulgas Creek Pump Station because it is not a receiving water and discharges from the station would be diluted by Pulgas Creek flows. However, they provide a useful benchmark for comparison of data collected at the SMCWPPP POC monitoring station in WY2014.

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

Freshwater vs. Saltwater - POC monitoring data were collected in freshwater outside of 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 pump station.

Acute vs. Chronic Objectives/Criteria - For POC monitoring required by provision C.8.e, data were collected in an attempt to develop more robust loading estimates from small tributaries. Therefore, detecting the concentration of a constituent in any single sample was not the primary driver of POC monitoring. Monitoring was conducted during episodic storm events and results do not likely represent long-term (chronic) concentrations of monitored constituents. POC monitoring data were therefore compared to “acute” 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. For analytes for which no WQOs/criteria have been adopted, comparisons were not made.

It is important to note that acute WQOs or criteria have only been promulgated for a small set of analytes collected at POC monitoring stations. These include objectives for trace metals (i.e., copper, selenium and total mercury). Table 5.2 provides a comparison of data collected at the Pulgas Creek Pump Station POC monitoring station in WY2014 to numeric WQOs/criteria adopted by the SFRWQCB or the State of California for these analytes.

All samples collected in WY2014 from the Pulgas Creek Pump Station were below numeric WQOs (i.e., freshwater acute objective for aquatic life) for mercury and selenium in receiving water. However, the dissolved copper concentration exceeded the hardness-dependent WQO. Stormwater management activities are currently underway for mercury (via MRP provision C.11), selenium (via MRP provision C.14), and copper (via MRP provision C.13). It is also important to note that dilution occurs when the pump station discharges urban stormwater runoff into Pulgas Creek, the receiving water. Thus it is unknown whether or not the discharge results in exceedances of the copper WQO in the receiving water itself, the location where there is the potential for exposure by aquatic life.

For all other analytes measured via POC monitoring (e.g., pyrethroid pesticides and polycyclic aromatic hydrocarbons), the State of California has yet to adopt numeric WQOs applicable to beneficial uses of interest. For these analytes, an assessment of compliance of applicable water quality standards cannot be conducted at this time. Descriptive statistics of these results are included in Appendix B.

Table 5.2. Comparison of WY2014 Pulgas Creek Pump Station POC monitoring data to numeric WQOs that apply to receiving waters.

Analyte	Fraction	Freshwater Acute Water Quality Objective for Aquatic Life[a]	Unit	Number of Samples > Objective (WY2014)[c]
Copper	Dissolved	13[b]	µg/L	5/6
Selenium	Total	20	µg/L	0/6
Mercury	Total	2.1	µg/L	0/25

[a] San Francisco Bay Water Quality Control Plan (SFRWQCB 2013)

[b] The copper water quality objective is dependent on hardness; therefore, comparisons were made based on hardness values of samples collected synoptically with samples analyzed for copper. The objective presented in the table is based on a hardness of 100 mg/L.

[c] It is important to note that dilution occurs when the pump station discharges urban stormwater runoff into Pulgas Creek, the receiving water. Thus it is unknown whether or not the discharge results in exceedances of the copper WQO in the receiving water itself, the location where there is the potential for exposure by aquatic life.

5.2.2 Summary of Toxicity Testing Results

In addition to comparisons of data for specific analytes, the results of toxicity testing conducted on water samples collected during storm events in WY2014 were also evaluated. Toxicity testing was conducted using four different types of test organisms:

- *Pimephales promelas* (freshwater fish)
- *Hyalella azteca* (amphipod)
- *Ceriodaphnia dubia* (crustacean)
- *Selenastrum capricornutum* (algae)

Both acute and chronic endpoints were recorded. A summary of toxicity results for the Pulgas Pump Station samples is presented in Table 5.3.

Table 5.3. Summary of WY2014 toxicity testing results for Pulgas Creek Pump Station POC monitoring station.

	Pimephales promelas		*Hyalella azteca*	*Ceriodaphnia dubia*		*Selenastrum capricornutum*
	Significant Reduction in Survival	Significant Reduction in Growth	Significant Reduction in Survival	Significant Reduction in Survival	Significant Reduction in Reproduction	Significant Reduction in Growth
Number of Samples with Significant Toxicity	0/6	2/6	5/6	0/6	0/6	1/6

Of the organisms exposed to water collected from the Pulgas Creek Pump Station POC monitoring station in WY2014, toxicity was primarily observed for the amphipod *Hyalella Azteca* (83% of samples). To a lesser extent, chronic (growth) toxic endpoints were observed for

fathead minnows (*Pimephales promelas)* (33% of samples) and algae (*Selenastrum capricornutum*) (17% of samples). No toxic endpoints were observed for *Ceriodaphnia dubia*.

Observations of toxicity to *H. azteca* are similar to those from recent wet weather monitoring conducted in Southern California (Riverside County Flood Control and Water Conservation District et al. 2007, Weston Solutions 2006), the Imperial Valley (Phillips et al. 2007), the Central Valley (Weston and Lydy 2010), and the Sacramento-San Joaquin Delta (Werner et al., 2010), where follow up toxicity identification evaluations indicated that pyrethroid pesticides were almost certainly the cause of the toxicity observed. Based on recent studies conducted in California receiving waters, pyrethroid pesticides have also been identified as the likely current causes of sediment toxicity in urban creeks (Ruby 2013, Amweg et al. 2005, Weston et al. 2005, Anderson et al. 2010). These results are not unexpected given that *H. azteca* is considerably more sensitive to pyrethroids than other species tested as part of the POC monitoring studies (Palmquist 2008).

To further explore the potential causes of toxicity to *H. azteca* in the six samples, pyrethroid concentrations in water samples collected at the same time as the toxicity samples were compiled and compared to thresholds (i.e., LC50s) known to be lethal to *H. azteca*. LC50s were identified through a review of the scientific literature and are only available for a limited number of types of pyrethroids.[3] The results of these comparisons are provided in Table 5.4. All water samples that resulted in a significant toxicity to *H. azteca* had pyrethroid concentrations above LC50 values, with the exception of the February 6, 2014 sample. However, the percent effect was below the evaluative threshold for this sample. Overall, there appears to be a correlation between *H. azteca* toxicity and pyrethroid concentrations. Thus, results from the Pulgas Creek Pump Station POC station suggest that pyrethroids caused toxicity to *H. azteca.* Management actions designed to reduce the impacts of pesticide-related toxicity are outlined in the TMDL and Water Quality Attainment Strategy for Diazinon and Pesticide-related Toxicity in Urban Creeks TMDL, and are currently underway via provision C.9 of the MRP. As discussed previously, it is also important to note that dilution occurs when the pump station discharges urban stormwater runoff into Pulgas Creek, the receiving water. Thus it is unknown whether or not the discharge results in toxicity in the receiving water itself, the location where there is the potential for exposure by aquatic life.

[3] Adverse effects concentrations for pyrethroids presented in Table 5.4 are not adopted Water Quality Objectives and should not be used to draw conclusions about compliance with water quality standards. The comparison contained in this table is only intended to facilitate an evaluation of the potential need for further evaluation of the stressors causing the toxicity.

Table 5.4. *Hyalella azteca* water toxicity sample results and concentrations of pesticides detected.

Sample Date	Mean % Survival *H. azteca*	Significant Effect?	Bifenthrin (ng/L)	Cyfluthrin (ng/L)	Cypermethrin (ng/L)	Delta/ Tralomethrin (ng/L)	Esfenvalerate (ng/L)	Permethrin (ng/L)	Carbaryl (ng/L)
LC50 (ng/L)			7.7[a]	2.3[a]	2.3[a]	10[b]	8[c]	48.9[d]	2100[e]
11/19/2013	64%	Yes	15	4.5	5.6	1.2 [f]	0.4 [f]	18	126
2/6/2014	82%	Yes [g]	2.3	0.4 [f]	1 [f]	--	--	--	45
2/8/2014	98%	No	1.4 [f]	0.6 [f]	0.8 [f]	--	--	5.7 [f]	41
2/26/2014	81.5%	Yes [g]	5.6	1.1	2.3	--	--	20 [f]	44
3/26/2014	6%	Yes	6.6	1.6	3.2	0.4 [f]	--	18 [f]	86
3/31/2014	88%	Yes [g]	3.8	1.1 [f]	3.1	1.2 [f]	--	11 [f]	189

[a] As reported by D. Weston, University of California, Berkeley.
[b] LC50 values for *Hyalella Azteca* unavailable. LC50 values listed are for Daphnia magna as reported by Xiu et al. (1989)
[c] Oros and Werner (2005)
[d] Brander et al. (2009)
[e] USEPA (2012)
[f] Measurement less than reporting limit
[g] Significant compared to control sample based on statistical test - probability less than critical p-value. The sample has greater similarity to control sample, The percent effect is equal to or smaller than evaluative threshold.
Dashes represent concentrations less than method detection limits.
Bold values exceed the LC50

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5.2.3 POC Loads Monitoring in WY2015

Based on the lessons learned through the implementation of the STLS Multi-Year Plan in Water Years 2012, 2013 and 2014; and the reprioritization of near-term information needs, SMCWPPP and its RMC partners are implementing a revised approach to POC Loads monitoring in FY 2014-15[4]. The alternative monitoring approach was discussed at numerous STLS workgroup meetings during FY 2013-14[5] and was agreed upon by STLS members, including Regional Water Board staff, as the best approach to addressing near-term high priority information needs regarding PCB and mercury sources and loadings. The approach will be implemented in compliance with MRP provision C.8.e[6] beginning in the fall of 2014. The alternative approach includes the discontinuation of most POC loads monitoring stations sampled in previous water years and includes the implementation of the following activities by SMCWPPP and the RMP via the STLS workgroup:

[4] The BASMAA Phase I stormwater managers discussed the approach with the Assistant Executive Officer of the SF Bay Regional Water Quality Control Board at the August 28, 2014 monthly meeting and amended the RMC to reflect the modification.

[5] Discussions about revised POC loads monitoring approaches for FY 2013-14 (WY2015) were discussed and ultimately agreed upon by Regional Water Board staff and other STLS and RMC partners at the following STLS meetings: October 13, 2013; March 19, 2014; April 1, 2014; April 16, 2014; May 15, 2014; and June 9, 2014.

[6] The FY 14-15 revised alternative approach summarized in this section addresses each of the POC Loads Monitoring management information needs described in provision C.8.e and will be performed at an equivalent level of monitoring effort as the effort described in this MRP provision.

- **PCB and Mercury Opportunity Area Analysis (SMCWPPP)** - As part of the development of PCB and mercury loading estimates presented in Part C of the Program's Integrated Monitoring Report (SMCWPPP 2014), SMCWPPP (in collaboration with the San Francisco Estuary Institute) developed preliminary GIS data layers illustrating potential PCB and mercury source areas. These data layers along with existing data on PCBs/mercury concentrations in sediment and stormwater represent the current state-of-knowledge of source areas for these pollutants in San Mateo County. These preliminary data layers, however, are based on limited and potentially outdated information on land uses and current activities at properties that may contribute or limit the level of pollutants transported to the Bay via stormwater. In an effort to collect additional information on current land uses, facility practices and contributions of PCBs and mercury from these properties, SMCWPPP is currently conducting a *PCB and Mercury Opportunity Area Analysis* as part of the Program's revised POC loads monitoring approach in FY 2014-15 to assist Permittees in identifying potential source areas in San Mateo County (i.e., within the SMCWPPP program area).
- **POC Monitoring (RMP/STLS)** - Working through the STLS workgroup, SMCWPPP is also collaborating with RMP staff on the implementation of a stormwater characterization field study that is intended to complement the opportunity area analysis described above. The goal of the project is to assist Permittees in identifying watershed sources of PCBs and mercury through sampling of stormwater and sediment transported from the watershed to stormwater conveyances during storm events. This monitoring is funded through the RMP and is being implemented during the 2014/15 wet weather season.

In addition to these activities conducted as part of the revised POC loads monitoring approach for FY 2014-15, the Program also intends to continue participating in other STLS activities during this fiscal year.

6.0 Long-Term Trends Monitoring (C.8.e)

In addition to POC loads monitoring, Provision C.8.e requires Permittees to conduct long-term trends monitoring to evaluate if stormwater discharges are causing or contributing to toxic impacts on aquatic life. Required long-term monitoring parameters, methods, intervals and occurrences are included as Category 3 parameters in Table 8.4 of the MRP, and prescribed long-term monitoring locations are included in MRP Table 8.3. Similar to creek status and POC loads monitoring, long-term trends monitoring began in October 2011 for RMC participants.

As described in the RMC Creek Status and Trends Monitoring Plan (BASMAA 2011), the State of California's Surface Water Ambient Monitoring Program (SWAMP) through its Statewide Stream Pollutant Trend Monitoring (SPoT) Program currently monitors the seven long-term monitoring sites required by Provision C.8.e.ii. Sampling via the SPoT program is currently conducted at the sampling interval described in Provision C.8.e.iii in the MRP. The SPoT program is generally conducted to answer the following management question:

- *What are the long-term trends in water quality in creeks?*

Based on discussions with Regional Water Board staff, RMC participants are complying with long-term trends monitoring requirements described in MRP provision C.8.e via monitoring conducted by the SPoT program. This manner of compliance is consistent with the MRP language in provisions C.8.e.ii and C.8.a.iv. RMC representatives coordinate with the SPoT program on long-term monitoring to ensure MRP monitoring and reporting requirements are addressed. The three specific goals of the SPoT program are:

1. Determine long-term trends in stream contaminant concentrations and effects statewide.

2. Relate water quality indicators to land-use characteristics and management effort.

3. Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, and federal monitoring.

Additional information on the SPoT program can be found at http://www.waterboards.ca.gov/water_issues/programs/swamp. A technical report describing five-year trends from the initiation of the program in 2008 through 2012 was published in 2014 (Phillips et al. 2014).

The statewide network of SPoT sites represents approximately one half of California's watersheds and includes one station in San Mateo County at the base of San Mateo Creek (Figure 1.1). Sites are targeted in locations with slow water flow and appropriate micro-morphology to allow deposition and accumulation of sediments. Stream sediments are collected annually (funding permitting) during summer base flow conditions. Sediments are analyzed for a suite of water quality indicators including organic contaminants (organophosphate, organochlorine, and pyrethroid pesticides, and PCBs), trace metals, total organic carbon (TOC), polycyclic aromatic hydrocarbons (PAHs), and polybrominated diphenyl ethers (PBDEs). Samples are also assessed for toxicity using the amphipod *Hyalella azteca* at standard protocol temperature (23°C) and cooler temperatures (15°C) that more closely reflect the ambient temperature in California watersheds. Although the data are not yet available, the SPoT analyte list was expanded in 2013 to include algal toxins (microcystin-LR) and the insecticide fipronil. The insecticide Imidacloprid and an additional test organism (*Chironomus dilutus*) more sensitive to fipronil and imidacloprid will likely be added in 2015.

The SPoT report (Phillips et al. 2014) summarizes the 2008 – 2012 data on statewide and regional scales. In addition, pollutant concentrations are correlated to SWAMP bioassessment data and land use characteristics (i.e., urban, agriculture, open space) on the 1 km, 5 km, and watershed scales. The SPoT report made the following *statewide* conclusions:

- There is a significant relationship between land use and stream pollution.
- Sediment toxicity remained relatively stable statewide between 2008 and 2012.
- Significantly more samples were toxic when tested at average ambient temperatures (15°C) compared to the standard protocol temperature (23°C). This is likely the result of the presence of pyrethroids which are slower to breakdown (metabolically) at lower temperatures (i.e., less pyrethroid is necessary to create the same toxic response).
- Percent *H. azteca* survival was significantly positively correlated with Index of Biological Integrity (IBI) scores[7]; whereas, pyrethroid pesticides and chlorinated compounds were significantly negatively correlated with IBI scores.
- IBI scores at toxic sites ranged from 0.1 to 13.6 and IBI scores at non-toxic sites ranged from 0 to 73.3, suggesting that factors other than contaminants (e.g., physical habitat) are influencing macroinvertebrate communities.
- There has been a steady decline statewide in organophosphate pesticide concentrations.

Regional conclusions include:

- Between 2008 and 2011, there was an overall regional trend of decreasing toxicity with a significant increase in *H. azteca* survival in San Mateo Creek.
- There was a statistically significant decrease in PCB and DDT concentrations at the San Mateo Creek station.

SMCWPPP evaluated the data from the San Mateo Creek site (204SMA020) using the same methods used to evaluate MRP Provision C.8.c sediment data. Threshold Effect Concentration (TEC) (Table 6.1) and Probable Effect Concentration (PEC) quotients (Table 6.2) as defined in MacDonald et al. (2000) were calculated for all non-pyrethroid constituents[8]. In addition, pyrethroid Toxic Unit (TU) equivalents (Table 6.3) were calculated using TOC-normalized data and LC50 values from Maund et al. (2002) and Amweg et al. (2005). Overall, the results appear typical of urban watersheds.

[7] IBI scores were calculated using methods that were appropriate to each region. The California Stream Condition Index (CSCI) will likely be used in the next reporting cycle.

[8] The TEC and PEC equivalents for metals reported here differ from those reported in the IMR (SMCWPPP 2014) because they were calculated from total sediment concentrations rather than the fine sediment concentrations considered in previous years. Fine sediment concentration data were not available for 2008 to 2012 data set.

Table 6.1. Threshold Effect Concentration (TEC) quotients for sediment chemistry constituents measured by SPoT in San Mateo Creek. Bolded values exceed 1.0.

Site ID – Creek Sample Date	TEC	204SMA020 – San Mateo Creek				
		6/18/08	6/16/09	6/30/10	7/8/11	8/24/12
Metals (mg/kg DW)						
Arsenic	*9.79*	0.62	0.43	0.47	0.59	0.37
Cadmium	*0.99*	0.43	0.18	0.20	0.32	0.22
Chromium	*43.4*	3.48	4.22	3.04	3.18	2.04
Copper	*31.6*	2.27	0.94	1.02	1.56	0.95
Lead	*35.8*	1.43	0.75	0.81	0.82	0.60
Mercury	*0.18*	0.96	0.82	1.01	0.77	0.34
Nickel	*22.7*	6.04	4.67	4.85	5.64	4.04
Zinc	*121*	1.85	0.81	0.89	1.23	0.88
PAHs (µg/kg DW)						
Anthracene	*57.2*	0.35	0.17	--	0.31	0.92
Fluorene	*77.4*	0.10	0.06	--	0.00	0.17
Naphthalene	*176*	0.10	0.08	--	0.09	0.06
Phenanthrene	*204*	0.69	0.42	--	0.47	0.73
Benz(a)anthracene	*108*	0.94	0.48	--	0.76	1.48
Benzo(a)pyrene	*150*	0.80	0.50	--	0.45	1.25
Chrysene	*166*	0.84	0.44	--	0.76	1.21
Dibenz[a,h]anthracene	*33.0*	0.94	0.55	--	0.81	1.35
Fluoranthene	*423*	0.77	0.38	--	0.49	0.86
Pyrene	*195*	1.46	0.76	--	0.98	1.61
Total PAHs	*1,610*	1.20	0.71	--	0.89	1.40
Pesticides (µg/kg DW)						
Chlordane	*3.24*	9.29	7.87	--	6.23	3.70
Dieldrin	*1.90*	4.76	3.29	--	0.00	0.00
Endrin	*2.22*	0.00	0.00	--	0.00	0.00
Heptachlor Epoxide	*2.47*	0.70	0.62	--	0.00	0.00
Lindane (gamma-BHC)	*2.37*	0.00	0.00	--	0.00	0.00
Sum DDD	*4.88*	6.08	4.61	--	1.45	0.74
Sum DDE	*3.16*	13.68	11.84	--	9.97	4.49
Sum DDT	*4.16*	3.84	4.86	--	0.00	0.00
Total DDTs	*5.28*	16.83	15.18	--	7.31	3.37
Total PCBs	*59.8*	0.52	0.27	--	0.00	0.00

Table 6.2. Probable Effect Concentration (PEC) quotients for sediment chemistry constituents measured by SPoT in San Mateo Creek. Bolded values exceed 1.0.

Site ID – Creek Sample Date	TEC	204SMA020 – San Mateo Creek				
		6/18/08	6/16/09	6/30/10	7/8/11	8/24/12
Metals (mg/kg DW)						
Arsenic	*33.0*	0.18	0.13	0.14	0.18	0.11
Cadmium	*4.98*	0.09	0.04	0.04	0.06	0.04
Chromium	*111*	**1.36**	**1.65**	**1.19**	**1.24**	0.80
Copper	*149*	0.48	0.20	0.22	0.33	0.20
Lead	*128*	0.40	0.21	0.23	0.23	0.17
Mercury	*1.06*	0.16	0.14	0.17	0.13	0.06
Nickel	*48.6*	**2.82**	**2.18**	**2.26**	**2.63**	**1.89**
Zinc	*459*	0.18	0.13	0.14	0.18	0.11
PAHs (µg/kg DW)						
Anthracene	*845*	0.02	0.01	--	0.02	0.06
Fluorene	*536*	0.02	0.01	--	0.00	0.02
Naphthalene	*561*	0.03	0.02	--	0.03	0.02
Phenanthrene	*1170*	0.12	0.07	--	0.08	0.13
Benz(a)anthracene	*1050*	0.10	0.05	--	0.08	0.15
Benzo(a)pyrene	*1450*	0.08	0.05	--	0.05	0.13
Chrysene	*1290*	0.11	0.06	--	0.10	0.16
Fluoranthene	*2230*	0.15	0.07	--	0.09	0.16
Pyrene	*1520*	0.19	0.10	--	0.13	0.21
Total PAHs	*22,800*	0.09	0.05	--	0.06	0.10
Pesticides (µg/kg DW)						
Chlordane	*17.6*	**1.71**	**1.45**	--	**1.15**	0.68
Dieldrin	*61.8*	0.15	0.10	--	0.00	0.00
Endrin	*207.0*	0.00	0.00	--	0.00	0.00
Heptachlor Epoxide	*16*	0.11	0.10	--	0.00	0.00
Lindane (gamma-BHC)	*4.99*	0.00	0.00	--	0.00	0.00
Sum DDD	*28*	**1.06**	0.80	--	0.25	0.13
Sum DDE	*31.3*	**1.38**	**1.19**	--	**1.01**	0.45
Sum DDT	*62.9*	0.25	0.32	--	0.00	0.00
Total DDTs	*572*	0.16	0.14	--	0.07	0.03
Total PCBs	*676*	0.05	0.02	--	0.00	0.00

Table 6.3. Pyrethroid Toxic Unit (TU) equivalents for sediment chemistry constituents measured in San Mateo Creek.

Site ID – Creek Sample Date	LC50 (µg/g dw)	204SMA020 – San Mateo Creek				
		6/17/08	6/16/09	6/30/10	7/21/11	7/5/12
Pyrethroid						
Bifenthrin	0.52	0.44	0.00	0.22	0.80	0.45
Cyfluthrin	1.08	0.00	0.00	0.16	0.23	0.00
Cypermethrin	0.38	0.00	0.00	0.09	0.25	0.34
Deltamethrin	0.79	0.00	0.00	0.02	0.10	0.23
Esfenvalerate	1.54	0.00	0.00	0.00	0.01	0.02
Lambda-Cyhalothrin	0.45	0.00	0.00	0.01	0.09	0.08
Permethrin	10.83	0.01	0.00	0.03	0.16	0.10
Sum of Toxic Unit Equivalents per Site	--	0.45	0	0.53	1.64	1.22
Survival as % of Control *Hyalella azteca*	--	59	79	88	91	101

7.0 Citizen Monitoring and Participation (C.8.f)

MRP Provision C.8.f states that:

i. "*Permittees shall encourage Citizen Monitoring.*

ii. *In developing Monitoring Projects and evaluating Status and Trends data, Permittees shall make reasonable efforts to seek out citizen and stakeholder information and comment regarding waterbody function and quality.*

iii. *Permittees shall demonstrate annually that they have encouraged citizen and stakeholder observations and reporting of waterbody conditions. Permittees shall report on these outreach efforts in the annual Urban Creeks Monitoring Report*."

During the MRP term, SMCWPPP staff has actively sought opportunities to encourage volunteer monitoring and/or incorporate information from such monitoring into SMCWPPP's water quality monitoring program. As part of this process, SMCWPPP staff has researched and documented related activities in San Mateo County. The County has a wealth of watershed stewardship organizations that primarily engage citizens and stakeholders in environmental education and restoration, and to a lesser extent, in classical water quality monitoring. Citizen monitoring of watershed resources in San Mateo County therefore occurs in several ways:

- In association with habitat restoration efforts, citizens monitor native plant survival and growth, and avian use of constructed bird boxes.
- The majority of citizen water quality monitoring focuses on identifying and cleaning up trash in water bodies, and sampling pathogen indicator organisms such as fecal coliform and *E. coli*. Many organizations conduct monthly trash cleanups in their local watersheds in addition to annual events coinciding with Earth Day, California Coastal cleanup day, and National River Cleanup Day. Groups that monitor pathogen indicators typically sample swimming beaches and associated creek confluences on a weekly basis. For example, the San Mateo County Department of Health coordinates with the San Mateo County Resource Conservation District (SMCRCD) and nine citizen volunteers, including those active with Surfrider Foundation and the Monterey Bay National Marine Sanctuary (MBNMS) to sample pathogen indicators weekly. During fall "first flush" events, the SMCRCD and the MBNMS coordinate to sample a broader suite of water quality parameters at several targeted storm drain outfalls in the San Mateo County designated Area of Biological Significance (ASBS). Such monitoring includes pathogen indicators, nutrients, and general water quality parameters.
- During the spring, the MBNMS coordinates with numerous volunteers as part of "snapshot day" to sample 27 sites on creeks and rivers in San Mateo County coastal watersheds for a broad suite of water quality analytes. Trained volunteers measure dissolved oxygen, pH, conductivity, air and water temperature, transparency/ turbidity, and collect water samples to be lab tested for nutrients (nitrates and orthophosphate) and bacteria. Every year Snapshot Day data are compiled to determine "Areas of Concern" - sites at where at least three of the nine analytes measured exceed associated water quality objectives. Snapshot Day data are used by the State of California, in conjunction with other data, to list water bodies as impaired under the Clean Water Act. Other resource managers use Snapshot Day data to further engage citizenry and agencies to address problems of pollution in waterways.

- Citizens volunteer with the San Gregorio Environmental Resource Center to conduct general water quality monitoring and measure stream discharge and stage weekly. This group was recently awarded an EPA grant to demonstrate the feasibility of increasing water quality and restoring habitat while maintaining agricultural productivity.
- Acterra is an environmental non-profit serving the Silicon Valley area that provides a broad range of volunteer opportunities (e.g., habitat restoration) for adults and youth. Through their Streamkeeper Program, Acterra encourages citizens to note observations on San Francisquito Creek about four types of indicators: animals (presence/absence of uncommon or threatened and endangered species), plants (notably invasives), chemical (indicators of pollution), physical (including evidence of erosion, human disturbance), and social (including evidence of different types of human disturbance).

In WY2014, SMCWPPP staff identified multiple sources of local water quality data collected by San Mateo County organizations that incorporate citizen monitoring data. The water quality data were reviewed to inform identification of creeks reaches most suitable for monitoring several MRP Provision C.8.c targeted parameters including pathogen indicators and general water quality (temperature, dissolved oxygen, pH and specific conductivity). The organizations included the San Mateo County Resource Conservation District, Monterey Bay National Marine Sanctuary, Surfrider Foundation San Mateo County Chapter, San Pedro Creek Watershed Coalition, San Gregorio Environmental Resource Center, Pacifica Beach Coalition, Half Moon Bay Coastside Foundation, San Mateo County Department of Health Services, and Acterra. During WY2014 SMCWPPP staff focused on Bear Creek in the San Francisquito Creek Watershed for monitoring temperature. SMCWPPP also purchased a portable watershed/nonpoint source model for Acterra to use as a citizen volunteer training tool.

8.0 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 San Mateo County Permittees, SMCWPPP conducts creek water quality monitoring and monitoring projects in San Mateo County in collaboration with the Regional Monitoring Coalition (RMC), and actively participates in the San Francisco Bay Regional Monitoring Program (RMP), which focuses on assessing Bay water quality and associated impacts.

The following list of next steps will be implemented in WY2015:

- SMCWPPP will continue to collaborate with the RMC (MRP Provision C.8.a).
- SMCWPPP will continue to provide financial contributions towards the RMP and to actively participate in the RMP committees and work groups described in Section 2.0 (MRP Provision C.8.b).
- SMCWPPP will continue to conduct probabilistic and targeted Creek Status Monitoring consistent with the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011) (MRP Provision C.8.c).
- SMCWPPP will continue to implement the two SSID Projects in San Mateo Creek investigating the extent, causes, and potential control measures for low DO concentrations and high pathogen indicator densities (MRP Provision C.8.d.i).
- SMCWPPP will continue to implement the BMP Effectiveness Investigation which consists of adding general stormwater runoff constituents to the suite of parameters monitored by the CW4CB project at Bransten Street (MRP Provision C.8.d.ii).
- SMCWPPP will implement the revised approach to POC Loads monitoring (described in Section 5.1.3) which consists of the PCB and Mercury Opportunity Area Analysis and the RMP stormwater characterization field study (MRP Provision C.8.d.e).
- SMCWPPP will continue to conduct long-term trends monitoring through the SPoT program (MRP Provision C.8.e).
- SMCWPPP will continue to encourage citizen monitoring (MRP Provision C.8.f).
- Results of WY2015 monitoring will be described in the Programs WY2015 Urban Creeks Monitoring Report that is due to the Regional Water Board by March 15, 2016 (MRP Provision C.8.g).

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