Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Pollutants of Concern Monitoring - Data Report

Water Year 2017

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

March 31, 2018

This report is submitted by the agencies participating in the

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

City of Campbell	City of Milpitas	City of Santa Clara
City of Cupertino	City of Monte Sereno	City of Saratoga
City of Los Altos	City of Mountain View	City of Sunnyvale
Town of Los Altos Hills	City of Palo Alto	County of Santa Clara
Town of Los Gatos	City of San Jose	Santa Clara Valley Water District

Prepared for:

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

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LIST OF ACRONYMS

BASMAA	Bay Area Stormwater Management Agency Association
BMP	Best Management Practice
CADDIS	Causal Analysis/Diagnosis Decision Information System
CEC	Contaminants of Emerging Concern
CEDEN	California Environmental Data Exchange Network
MRP	Municipal Regional Permit
NPDES	National Pollution Discharge Elimination System
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PFAS	Perfluoroalkyl Sulfonates
PFOS	Perfluorooctane Sulfonates
POC	Pollutant of Concern
RMP	Regional Monitoring Program
RWSM	Regional Watershed Spreadsheet Model
SAP	Sampling and Analysis Plan
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFEI	San Francisco Estuary Institute
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification
STLS	Small Tributary Loading Strategy
SWAMP	Surface Water Ambient Monitoring Program
TOC	Total Organic Carbon
USEPA	US Environmental Protection Agency
WY	Water Year

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1.0 INTRODUCTION

This Pollutants of Concern Monitoring - Data Report (POC Data Report) 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 issued by the San Francisco Regional Water Quality Control Board (Regional Water Board) on November 19, 2015 as Order R2-2015-0049. This report fulfills the requirements of Provision C.8.h.iii of the MRP for reporting a summary of MRP provision C.8.f POC Monitoring conducted during Water Year (WY) 2017.[1]

This POC Data Report builds on the POC Monitoring Reports that were submitted to the Regional Water Board on October 15, 2017 (SCVURPPP 2017a). In accordance with Provision C.8.h.iv, the POC Monitoring Report included POC monitoring locations, number and types of samples collected, purpose of sampling (i.e., Management Questions addressed), and analytes measured (SCVURPPP 2017a). The October 15, 2017 POC Monitoring Report also described the allocation of sampling effort for POC monitoring planned for WY 2018.

This POC Data Report is included as an appendix to the WY 2017 Urban Creeks Monitoring Report (UCMR) which was submitted to the Regional Water Board on March 31, 2018. Consistent with MRP Provision C.8.h.ii, POC monitoring data generated from sampling of receiving waters (e.g., creeks) were submitted to the San Francisco Bay Area Regional Data Center for upload to the California Environmental Data Exchange Network (CEDEN).[2]

1.1 POC Monitoring Requirements

Provision C.8.f of the MRP requires monitoring of several POCs including polychlorinated biphenyls (PCBs), mercury, copper, emerging contaminants[3], and nutrients. POC monitoring is conducted on a Water Year (WY) basis. Provision C.8.f specifies yearly (i.e., WY) and total (i.e., permit term) minimum numbers of samples for each POC. In addition, POC monitoring must address the five priority management information needs (i.e., Management Questions) identified in C.8.f:

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 or presence in local tributaries or urban stormwater discharges; and

[1] Most hydrologic monitoring occurs for a period defined as a water year, which begins on October 1 and ends on September 30 of the named year. For example, water year 2017 (WY 2017) began on October 1, 2016 and concluded on September 30, 2017.

[2] CEDEN has historically only accepted and shared data collected in streams, lakes, rivers, and the ocean (i.e., receiving waters). In late-2016, we were notified that there were changes to the types of data that CEDEN would accept and share. However, there is still some uncertainty and until the changes are clarified, SCVURPPP will continue to submit only receiving water data to CEDEN.

[3] Emerging contaminant monitoring requirements will be met through participation in the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) special studies. The special studies will account for relevant Contaminants of Emerging Concern (CECs) in stormwater and will address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

5. **Trends** – providing information on trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

The MRP specifies the minimum number of samples that must be collected and analyzed for each POC. For example, over the first five years of the permit, a minimum total of 80 PCBs samples must be collected and analyzed. On average 16 PCBs samples should be collected per year to meet the total requirement of 80 samples; however, the Permit requires a minimum of at least 8 PCB samples per year which gives flexibility to collect more samples some years and less other years. The MRP also specifies the minimum number of samples for each POC that must address each Management Question. For example, by the end of Year Four[4] of the permit term, each of the five Management Questions must be addressed with at least 8 PCB samples. It is possible that a single sample can address more than one Management Question. POC Monitoring requirements are summarized in Table 1. In addition to the required yearly and cumulative total number of samples, Table 1 lists the yearly average number of samples that would need to be analyzed to meet the total sample goal, a good benchmark to consider when planning annual sampling goals.

Other MRP provisions require studies or have information needs that could be addressed through Provision C.8.f (POC Monitoring) and for which related samples will count towards POC monitoring requirements. These other Permit provisions and their associated timelines are listed below.

- Provisions C.11.a.iii and C.12.a.iii require that Permittees provide a list of management areas (referred to in this report as Watershed Management Areas, or WMAs) in which new mercury and PCB control measures will be implemented during the permit term. The most recent POC Control Measures Plan (Version 2.0) (SCVURPPP 2017b) was submitted with the 2017 Annual Report on September 30, 2017 and will be updated with each subsequent Annual Report per Provision C.11.a.iii(3). Provision C.8.f (POCs Monitoring) supports C.11.a/12.a requirements by requiring monitoring directed toward source identification (i.e., identifying which WMAs provide the greatest opportunities for implementing controls to reduce loads of POCs in urban stormwater runoff and source areas within the WMAs).

- Provision C.12.e requires that Permittees collect at least 20 composite samples (region-wide) of the caulks and sealants used in storm drains or roadway infrastructure in public rights-of-way. Results of the investigation must be reported with the 2018 Annual Report, due by September 30, 2018. SCVURPPP is participating in a Bay Area Stormwater Management Agencies Association (BASMAA) regional project to address this requirement. The Final Study Design was approved by the BASMAA Project Management Team (PMT) in June 2017, sample collection was conducted in November and December 2017, and a report summarizing results of the study is anticipated for submittal with the 2018 Annual Report on September 30, 2018.

[4] Note that the minimum sampling requirements addressing information needs must be completed by the end of year four of the permit; whereas, the minimum number of total samples does not need to be met until the end of year five of the permit.

Table 1. MRP Provision C.8.f Pollutants of Concern monitoring requirements.

Pollutant of Concern	Media	Total Samples[d]	Yearly Minimum	Yearly Average	Minimum # of Samples that Must be Collected for Each Information Need by the End of Year Four				
					Source Identification	Contributions to Bay Impairment	Management Action Effectiveness	Loads and Status	Trends
PCBs	Water or sediment	80	8	16	8	8	8	8	8
Total Mercury	Water or sediment	80	8	16	8	8	8	8	8
Total & Dissolved Copper	Water	20	2	4	--	--	--	4	4
Nutrients[a]	Water	20	2	4	--	--	--	20	--
Emerging Contaminants[b]	--	--	--	--	--	--	--	--	--
Ancillary Parameters[c]	--	--	--	--	--	--	--	--	--

a. Ammonium[5], nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, total phosphorus (analyzed concurrently in each nutrient sample).

b. Must include perfluorooctane sulfonates (PFOS, in sediment), perfluoroalkyl sulfonates (PFAS, in sediment), alternative flame retardants. The Permittee shall conduct or cause to be conducted a special study that addresses relevant management information needs for emerging contaminants. The special study must account for relevant Contaminants of Emerging Concern (CECs) in stormwater and would address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

c. Total Organic Carbon (TOC) should be collected concurrently with PCBs data when normalization to TOC is deemed appropriate. Suspended sediment concentration (SSC) should be collected in water samples used to assess loads, loading trends, or Best Management Practice (BMP) effectiveness. Hardness data are used in conjunction with copper concentrations collected in fresh water.

d. Total samples that must be collected over the five-year Permit term.

[5] There are several challenges to collecting samples for "ammonium" analysis. Therefore, samples are analyzed for total ammonia which is the sum of un-ionized ammonia (NH3) and ionized ammonia (ammonium, NH4+). Ammonium concentrations are calculated by subtracting the calculated concentration of un-ionized ammonia from the measured concentration of total ammonia. Un-ionized ammonia concentrations are calculated using a formula provided by the American Fisheries Society that includes field pH, field temperature, and specific conductance. This approach was approved by Regional Water Board staff in an email dated June 21, 2016.

1.2 Third-Party Data

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. For example, samples collected in Santa Clara County through the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) and the State's Stream Pollution Trends (SPoT) Monitoring Program may supplement the Program's efforts towards achieving Provision C.8.f monitoring requirements. Third party monitoring conducted by the RMP and SPoT also provide context for reviewing and interpreting SCVURPPP monitoring results.

The RMP's Small Tributary Loading Strategy (STLS) Team typically conducts annual monitoring for POCs on a region-wide basis. SCVURPPP is an active participant in the STLS and works with other Bay Area municipal stormwater programs to identify opportunities to direct RMP funds and monitoring activities towards meeting both short- and long-term municipal stormwater permit requirements. During WY 2013 – WY 2014 POC monitoring activities by the STLS focused on pollutant loading monitoring at six region-wide stations including two stations in Santa Clara County. In WY 2015, the loading stations were discontinued and STLS monitoring shifted to wet weather characterization in catchments of interest. In WY 2017, the STLS Team continued wet weather characterization sampling using a similar approach to the PCBs and mercury sampling that was implemented by the Program. In Santa Clara County, the STLS sampled two catchments for PCBs and mercury in WY 2017, six catchments in WY 2016, and eight catchments in WY 2015. STLS wet weather characterization data are described in Gilbreath et al. (2018, in preparation).

In WY 2017, the STLS Team also mobilized for a five-day high flow event at the bottom of the Guadalupe River watershed. 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 mercury samples over five days. During that time, flow peaked three times in response to heavy and prolonged rainfall. One composite sample from the event was analyzed for PCBs.

The goal of the SPoT program is to monitor trends in sediment toxicity and sediment contaminant concentrations in selected large rivers throughout California, and relate contaminant concentrations and toxicity to watershed land uses. SPoT monitoring staff reported that both Coyote Creek (205COY060) and Guadalupe River (205GUA020) were monitored in June 2017. Sediment samples from both stations were analyzed for PCBs. The Guadalupe River sample was also analyzed for mercury and copper. Results of the WY 2017 SPoT monitoring are not yet available. The most recent report from this program describes 2008 – 2014 trends (Phillips et al. 2016). Results from these large catchment stations provide context for the monitoring conducted by the Program.

2.0 POC MONITORING RESULTS

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 met or exceeded for all POCs. The total number of samples collected for each POC, the agency conducting the monitoring, and the Management Questions addressed are listed in Table 2. Specific monitoring stations are listed in Table 3 (and Attachment 1 for sediment stations) and illustrated in Figure 1. The sections below describe the results of the monitoring accomplished in WY 2017. Compliance with applicable water quality standards is described in Section 3.0.

2.1 Statement of Data Quality

A comprehensive Quality Assurance/Quality Control (QA/QC) program was implemented by SCVURPPP covering all aspects of POC monitoring.

Monitoring for PCBs, mercury, and copper in water was performed according to protocols specified or referenced in the WY 2016 POC Sampling and Analysis Plan (SAP) (SCVURPPP 2015). Monitoring for PCBs and mercury in sediment was performed using methods similar to those implemented in WY 2015 for the reconnaissance sediment sampling program summarized in SCVURPPP (2016b). Both documents reference the Clean Watersheds for a Clean Bay (CW4CB) Quality Assurance Project Plan (QAPP; BASMAA 2013) as the basis for (QA/QC) procedures. Monitoring for nutrients in water was performed according to protocols specified in the BASMAA Standard Operating Procedures (SOPs) (BASMAA 2016a) and QAPP (BASMAA 2016b).

Data were assessed for seven data quality attributes, which include (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes are compared to Data Quality Objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. Overall, the results of the QA/QC review suggest that most of the POC monitoring data generated during WY 2017 were of sufficient quality. Although, some data were flagged in the project database, none were rejected according to DOQs. However, most of the concentrations of mercury in water reported in WY 2017 were significantly lower than prior years (i.e., approximately ten-fold). There is no reason to expect lower mercury concentrations. The population monitored was similar to prior years (e.g., geographic, storm size, land use). Therefore, all mercury in water data were rejected by the Program Quality Assurance Officer (QAO). Details of the QA/QC review are provided in Attachment 2.

Table 2. SCVURPPP and Third-Party POC Monitoring Accomplishments in WY 2017.

Pollutant of Concern/ Agency	Number of Samples (WY2017)	Management Question Addressed [a]					Sample Type and Comments
		1. Source Identification	2. Contributions to Bay Impairment	3. Management Action Effectiveness	4. Loads and Status	5. Trends	
PCBs & Mercury							
SCVURPPP	17 [b]	17	17	--	17	--	Stormwater runoff samples to characterize high interest catchments
SCVURPPP	76	76	--	--	--	--	Upland sediment samples to identify source properties
RMP STLS	2	2	2	--	2	--	Stormwater runoff samples to characterize high interest catchments
RMP STLS (PCBs only)	1	--	1	--	1	1	Composite sample collected during a high flow event in Guadalupe River
RMP STLS (Mercury only)	14	--	14	14	14	14	Series of samples collected during a high flow event in Guadalupe River
SPoT	2	--	--	--	--	2	Sediment samples to assess trends (only 1 analyzed for mercury)
Copper							
SCVURPPP	2	--	--	--	2	2	Copper analyzed on a subset of PCBs/Hg stormwater runoff samples
SCVURPPP	3	--	--	--	3	3	Creek water samples collected during storm event
SPoT	1	--	--	--	--	1	Sediment sample to assess trends at long-term monitoring station
Nutrients							
SCVURPPP	5 [c]	--	--	--	5	--	Samples collected during storm event and following dry weather event

a. Individual samples can address more than one Management Question simultaneously.
b. SCVURPPP (2017a) incorrectly reported that 16 water samples were analyzed for PCBs and mercury.
c. SCVURPPP (2017a) incorrectly reported that 4 samples were analyzed for nutrients.

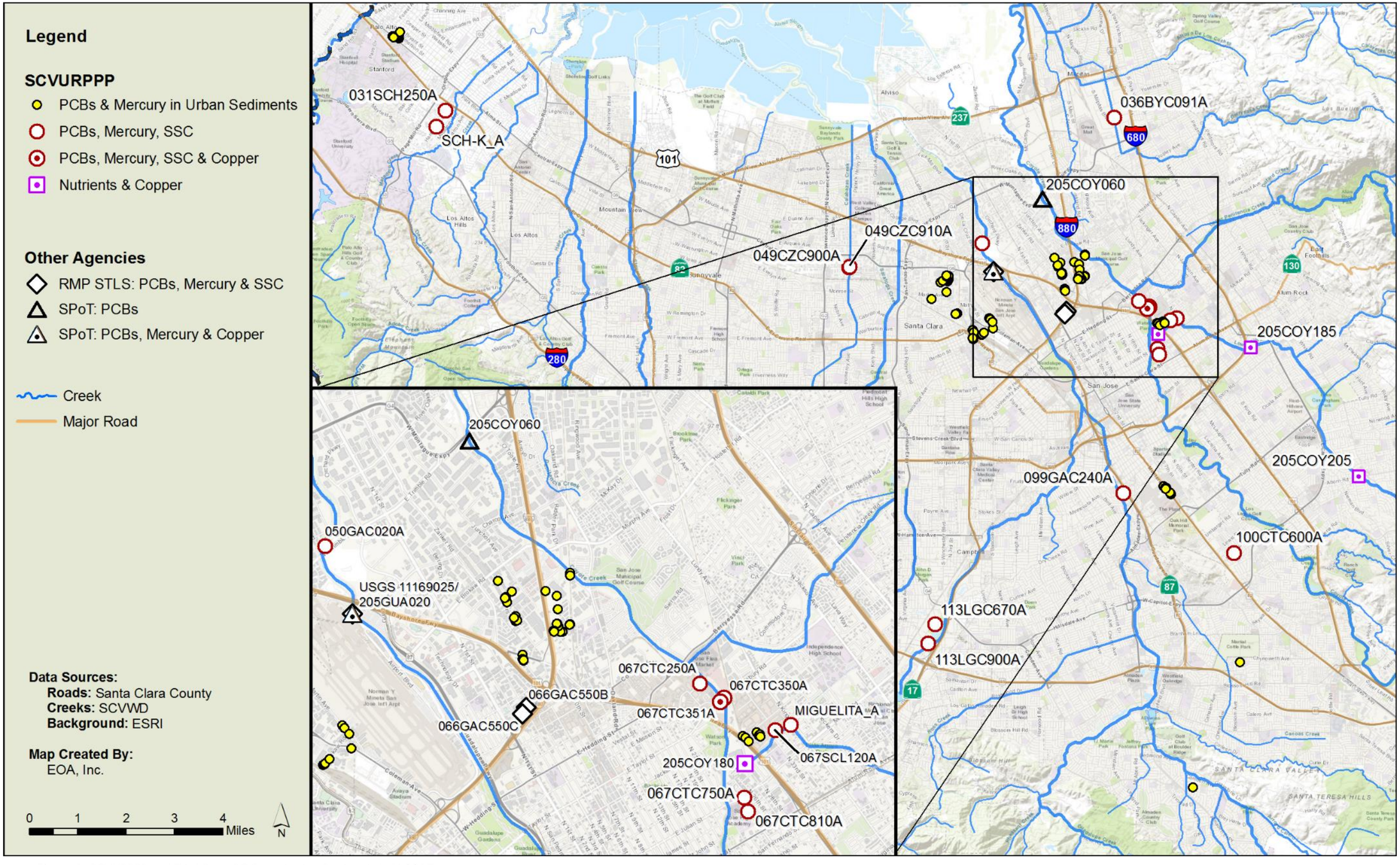

Figure 1. SCVURPPP and Third-Party POC Monitoring Stations in WY 2017.

Table 3. POC monitoring stations in Santa Clara County, WY 2017.

Agency	Station Code	Sample Date	Latitude	Longitude	Matrix	PCBs	Mercury	Suspended Sediment Concentration	Total Copper	Dissolved Copper	Hardness as CaCO3	Nutrients [b]
SCVURPPP												
SCVURPPP	MIGUELITA_A	12/15/2016	37.3604	-121.8637	water	x	x	x				
SCVURPPP	067SCL120A	12/15/2016	37.3597	-121.8661	water	x	x	x				
SCVURPPP	SCH-K_A	12/15/2016	37.4141	-122.1429	water	x	x	x				
SCVURPPP	031SCH250A	12/15/2016	37.4190	-122.1396	water	x	x	x				
SCVURPPP	036BYC091A	12/23/2016	37.4202	-121.8884	water	x	x	x				
SCVURPPP	099GAC240A	1/7/2017	37.3078	-121.8828	water	x	x	x				
SCVURPPP	050GAC020A	1/7/2017	37.3819	-121.9373	water	x	x	x				
SCVURPPP	049CZC900A	1/7/2017	37.3741	-121.9870	water	x	x	x				
SCVURPPP	049CZC910A	1/7/2017	37.3742	-121.9868	water	x	x	x				
SCVURPPP	067CTC350A	1/10/2017	37.3636	-121.8742	water	x	x	x	x	x	x	
SCVURPPP	067CTC351A	1/10/2017	37.3631	-121.8748	water	x	x	x	x	x	x	
SCVURPPP	100CTC600A	2/7/2017	37.2903	-121.8410	water	x	x	x				
SCVURPPP	067CTC750A	2/7/2017	37.3512	-121.8709	water	x	x	x				
SCVURPPP	067CTC810A	2/7/2017	37.3494	-121.8402	water	x	x	x				
SCVURPPP	113LGC670A	2/9/2017	37.2676	-121.9528	water	x	x	x				
SCVURPPP	113LGC900A	2/9/2017	37.2618	-121.9551	water	x	x	x				
SCVURPPP	067CTC250A [a]	2/9/2017	37.3654	-121.8781	water	x	x	x				
SCVURPPP	See Attachment 1 [c]				sediment	x	x					
SCVURPPP	205COY180	1/9/2017	37.3554	-121.8708	water				x	x	x	x
SCVURPPP	205COY180	6/1/2017	37.3554	-121.8708	water							x
SCVURPPP	205COY185	1/9/2017	37.3519	-121.8360	water				x	x	x	x
SCVURPPP	205COY185	6/1/2017	37.3519	-121.8360	water							x
SCVURPPP	205COY205	1/9/2017	37.3138	-121.7947	water				x	x	x	x
Third Party Organizations												
RMP STLS	066GAC550B	1/8/2017	37.3620	-121.9053	water	x	x	x				
RMP STLS	066GAC550C	1/8/2017	37.3612	-121.9059	water	x	x	x				
RMP STLS	USGS 11169025	1/8/2017	37.3734	-121.9328	water	x	x	x				
SPoT	205GUA020	June 2017	37.3734	-121.9328	sediment	x	x		x			
SPoT	205COY060	June 2017	37.3954	-121.9148	sediment	x						

a. This station (067CTC250A) was not included in the October 2017 report (SCVURPPP 2017a).
b. Ammonia (for ammonium), nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, and total phosphorus are analyzed concurrently in each nutrient sample.
c. SCVURPPP collected 76 sediment samples for PCBs and mercury analysis during the spring and summer of 2017. See Attachment 1 for station codes, sample dates, and latitude/longitude.
d. 205COY205 was not sampled in June due to dry creek conditions.

2.2 PCBs and Mercury

PCBs and mercury monitoring conducted by the Program in WY 2017 served two related purposes: WMA prioritization and source property identification. Monitoring results for WMA prioritization are described in detail in the section below. Monitoring results for source property identification are briefly summarized in this report and will be described in more detail in a separate report scheduled for completion in September 2018.

2.2.1 WMA Prioritization

During WY 2017, the Program collected 17 wet weather water samples from municipal separate storm sewer system (MS4) outfalls for PCBs and mercury analysis. An additional two samples were collected in Santa Clara County by the RMP's Small Tributary Loading Strategy (STLS) at similar types of stations using similar methods. These combined 19 samples address POC Management Questions #1 (Source Identification) and #2 (Contributions to Bay Impairment). Data may also be used to improve calibration of the Regional Watershed Spreadsheet Model (RWSM) which is a land use based planning tool for estimation of overall POC loads from small tributaries to San Francisco Bay at a regional scale (i.e., Management Question #4 – Loads and Status).

WMAs are land areas where PCBs and mercury control measures are or will be implemented. They have been delineated mostly at the catchment level using topographic and storm drain maps. To help identify where the most PCBs/mercury load reduction benefit can be achieved, the Program has focused efforts on identifying WMAs where we may find elevated PCBs and mercury concentrations.

WMA prioritization monitoring conducted by the Program was performed in accordance with the *Water Year 2016 Pollutant of Concern Monitoring - Sampling and Analysis Plan* (SCVURPPP 2015). The primary goal of the monitoring, as described in the SAP, is to provide information to identify Watershed Management Areas that disproportionately contribute PCBs and mercury to stormwater. Monitoring is 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).

The current WMA map is illustrated in Figure 2. This map shows the 19 catchments that were sampled in WY 2017 by the Program and RMP STLS, as well as the status of all other WMAs. Some WMAs contain confirmed source properties that have already been referred to agency staff for follow-up abatement. Some WMAs are identified as having "known high source areas." These are WMAs with water and/or sediment sampling results showing elevated concentrations of PCBs. These are currently under source property investigation or an investigation is planned for the near future. The remainder of the WMAs/catchments are of interest and may have been sampled but do not have elevated concentrations in those samples. All other land areas within a city that don't fit into one of the "high interest catchments" are lumped into a single city-wide WMA (that is not necessarily spatially contiguous). These city-wide WMAs are not shown in Figure 2.

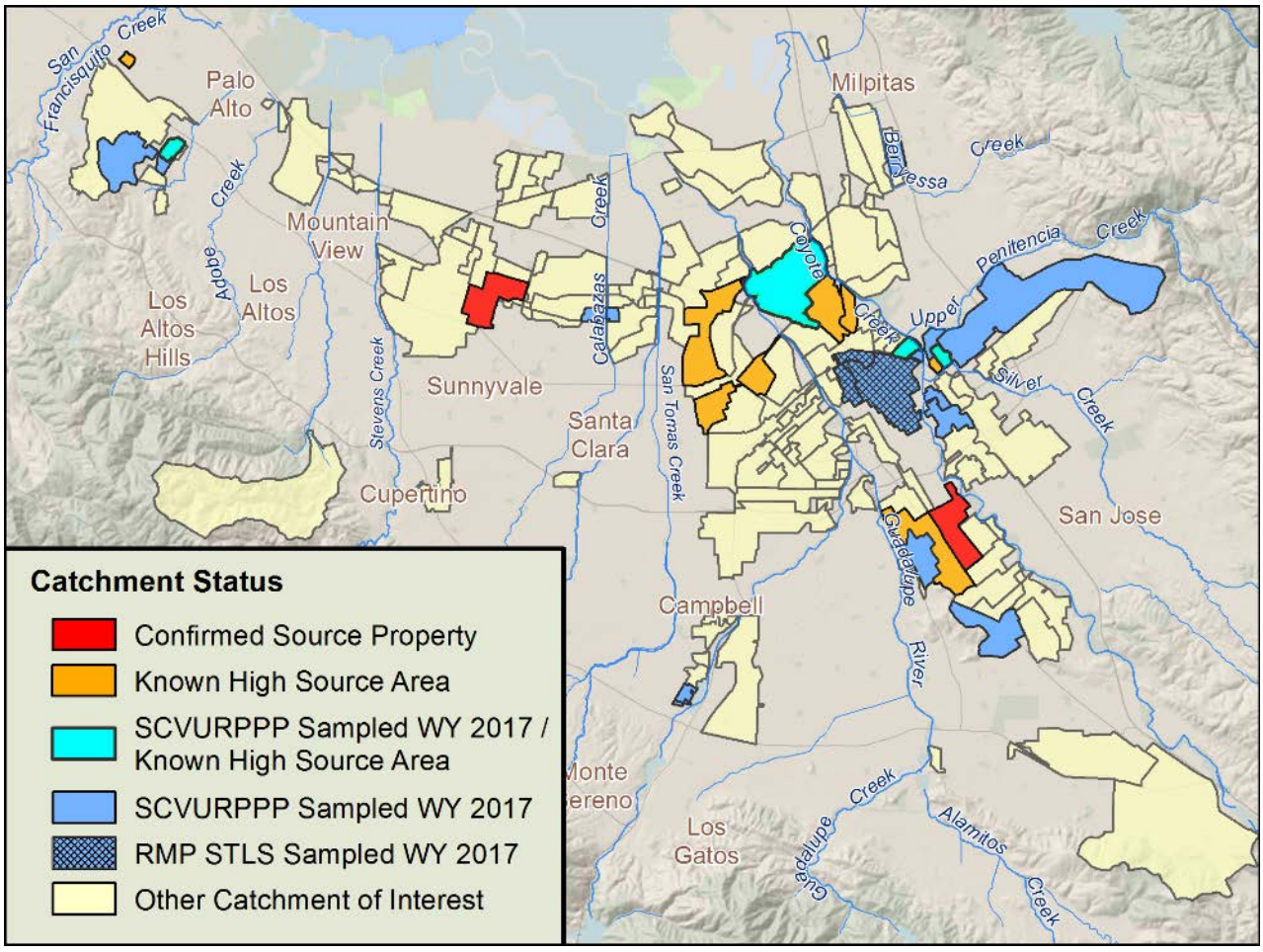

Figure 2. SCVURPPP current Watershed Management Area (WMA) map showing catchments sampled in WY 2017.

Composite samples consisting of four to eight aliquots collected during the rising limb and peak of the storm hydrograph (as determined through field observations) were analyzed for the "RMP 40" PCB congeners (method EPA 1668C), total mercury (method EPA 1631E), and SSC (method ASTM D3977-97). Two of the samples were also analyzed for total and dissolved copper (method EPA 200.8) and hardness (method SM 2340C). See Section 2.3 for a discussion of copper results.

Table 4 lists WMA prioritization monitoring results collected by SCVURPPP and the RMP STLS in WY 2017[6]. "Total PCBs" were calculated as the sum of the RMP 40 congeners. The "PCB Particle Ratio" and "Hg Particle Ratio" is calculated by dividing Total PCBs and Total Mercury by SSC. The PCB Particle Ratio and Hg Particle Ratio address the fact that PCBs are generally bound to sediment. Water concentrations and particle ratios are compared to countywide and regional datasets in order to "rank" monitoring stations and the WMAs they characterize. High ranking WMAs are flagged for future source property investigations which typically include property records review, aerial photography interpretation, public right-of-way surveys, facility site visits, and sediment sampling.

For the 17 samples that were collected by SCVURPPPP in WY 2017, total PCB concentrations ranged from 0.884 ng/L to 57.6 ng/L and PCB particle ratios ranged from 47.1 ng/g to 1,070 ng/g. Due to the data quality issues noted above in Section 2.1, mercury concentrations are only reported for the two urban catchments sampled by the RMP STLS. The concentrations of these two were 22.9 ng/L and 27.2 ng/L with Hg particle ratios of 477 ng/g and 591 ng/g. PCB monitoring results within the context of other water samples analyzed for PCBs in Santa Clara County and region-wide are described below.

[6] RMP STLS results are also reported separately by the San Francisco Estuary Institute (SFEI).

Table 4. PCB, mercury, and suspended sediment concentrations in water samples collected by SCVURPPP and STLS, WY 2017.

Station Code	Sample Date	SSC (mg/L)	Total PCBs (ng/L) [a]	PCB Particle Ratio (ng/g) [b]	Hg (ng/L)	Hg Particle Ratio (ng/g) [b]
SCVURPPP Samples						
031SCH250A	12/15/2016	12.2	13.0	1066	(c)	(c)
036BYC091A	12/23/2016	66	8.74	132	(c)	(c)
049CZC900A	1/7/2017	18.6	2.76	148	(c)	(c)
049CZC910A	1/7/2017	10.3	2.03	197	(c)	(c)
050GAC020A	1/7/2017	13.2	7.00	530	(c)	(c)
067CTC250A	2/9/2017	518	57.6	111	(c)	(c)
067CTC350A	1/10/2017	55	9.75	177	(c)	(c)
067CTC351A	1/10/2017	168	9.32	55.5	(c)	(c)
067CTC750A	2/7/2017	27.9	2.84	102	(c)	(c)
067CTC810A	2/7/2017	37.4	2.85	76.2	(c)	(c)
067SCL120A	12/15/2016	55.9	27.1	485	(c)	(c)
076CTC503A	1/10/2017	61.2	11.2	183	(c)	(c)
099GAC240A	1/7/2017	43.2	6.42	149	(c)	(c)
100CTC600A	2/7/2017	98.6	14.5	147	(c)	(c)
113LGC670A	2/9/2017	31.2	3.20	103	(c)	(c)
113LGC900A	2/9/2017	16	0.884	55.3	(c)	(c)
MIGUELITA_A	12/15/2016	84.7	3.99	47.1	(c)	(c)
SCH-K_A	12/15/2016	51.6	10.1	196	(c)	(c)
RMP STLS Samples						
066GAC550B	1/8/2017	48	4.17	86.9	22.9	477
066GAC550C	1/8/2017	46	4.11	89.3	27.2	591
Guadalupe River	1/8/2017	560	32.7	58.5	1,053 [d]	1,880 [d]

[a] Total PCBs calculated as sum of RMP 40 congeners.
[b] PCB and Hg Particle Ratios calculated by dividing Total PCBs and Hg concentrations by SSC.
[c] SCVURPPP mercury data was rejected.
[d] Guadalupe River mercury values are average of 14 individual samples.

Comparison with Region-wide Storm Sampling Results

The current storm sample dataset includes samples collected from 107 MS4 catchments and 20 natural waterways throughout the Bay Area.[7] The MS4 catchment sites include storm drain manholes, outfalls, pump stations, and artificial channels.[8] The 20 sites in natural waterways have watersheds ranging in size from less than 3,000 acres (i.e., Lower Penitencia Creek) to the entire Sacramento–San Joaquin River Delta watershed (i.e., Mallard Island). Many of the sites have been sampled more than once and/or have multiple sample results reported for individual storm events. Nine of the 107 MS4 sites also have multiple sample results (2 to 80). Five of the 20 natural waterway sites have multiple sample results (3 to 126). For sites with more than

[7] This dataset includes samples collected by SCVURPPP, the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP), and the RMP's STLS.
[8] Stormwater samples have also been collected from inlets and/or LID systems as part of special studies. However, those were not included in this analysis.

one sample, the particle ratio is calculated by dividing the sum of PCB concentrations by the sum of suspended sediment concentrations. Performing the calculation in this way is effectively the equivalent of compositing all the individual samples that have been collected at a site. This is consistent with the RMP STLS approach to data evaluation (Gilbreath et al. 2017).

Table 5 lists descriptive statistics on PCB (n=127) and mercury concentrations (n=71) for the Bay Area stormwater dataset. The median concentration of PCBs in water is 7.89 ng/L, and the mean is 20.5 ng/L. The median PCB particle ratio is 113 ng/g, and the mean is 350 ng/g. As can be seen in Figures 3 and 4, there are a few catchments with highly elevated samples that increase the average concentration statistic over the median (i.e., 50th percentile). Both SCVURPPP and the RMP are collecting additional stormwater composite samples in WY 2018 in an effort to grow this dataset. In future years, it may be informative to correlate measured concentrations to various factors such as storm size, rainfall intensity, antecedent dry weather, land use characteristics, and age of development.

Table 5. Descriptive statistics of PCB and mercury concentrations in water and particle ratios.

	PCBs (ng/L) [a]	Hg (ng/L)	SSC (mg/L)	PCB Particle Ratio (ng/g) [b]	Hg Particle Ratio (ng/mg) [b]
N	127	71	127	127	71
Min	ND	3.90	5.80	ND	0.045
10th Percentile	1.71	6.65	19.2	16.0	0.155
25th Percentile	2.84	11.5	35.0	45.6	0.215
50th Percentile	7.89	22.9	58.0	113	0.346
75th Percentile	18.4	42.5	131	221	0.557
90th Percentile	46.8	85.7	296	784	0.896
Max	448	1,050	2,630	8,220	5.29
Mean	20.5	54.7	146	350	0.505

[a] Total PCBs calculated as sum of RMP 40 congeners.
[b] PCB and Hg Particle Ratios calculated by dividing Total PCBs and Hg concentrations by SSC.

PCB concentrations in water samples for the Bay Area dataset (n=127) are plotted in Figure 3. PCB particle ratios are plotted in Figure 4. Figures 3 and 4 identify sites by location (i.e., County) and sample type (i.e., MS4 or natural waterway/creek). There are 50 sites in Santa Clara County of which 17 were sampled by SCVURPPP in WY 2017 and nine in WY 2016. Two sites were sampled by RMP STLS in WY 2017, nine in WY 2016, and thirteen in WY 2015. Eight sites were sampled multiple times by the RMP in prior water years.

Overall, Santa Clara County has relatively low PCB concentrations and PCB particle ratios compared to the other three counties in the region (Alameda, Contra Costa, and San Mateo). However, some of the highest water concentrations and particle ratios measured in the Bay Area to-date have been observed in Santa Clara County. The highest PCB concentrations in Santa Clara County have been measured at:

- Sunnyvale East Channel (96.6 ng/L),
- 067CTC250A (Yard Court San Jose) (57.6 ng/L),
- 051CTC400A (Ridder Park Dr Storm Drain) (55.5 ng/L),
- 067SCL080A (Outfall to Lower Silver Creek) (44.6 ng/L), and
- 067SCL120A (Las Plumas Ave San Jose) (27.1 ng/L).

The sites with the highest PCB particle ratios are:

- 031SCH250A (Hansen Way Palo Alto) (1,070 ng/g),
- 067SCL080A (Outfall to Lower Silver Creek) (783 ng/g),
- 050GAC020A (Rincon 2 PS San Jose) (530 ng/g),
- 051CTC400A (Ridder Park Dr Storm Drain) (488 ng/g), and
- 067SCL120A (Las Plumas Ave San Jose) (485 ng/g).

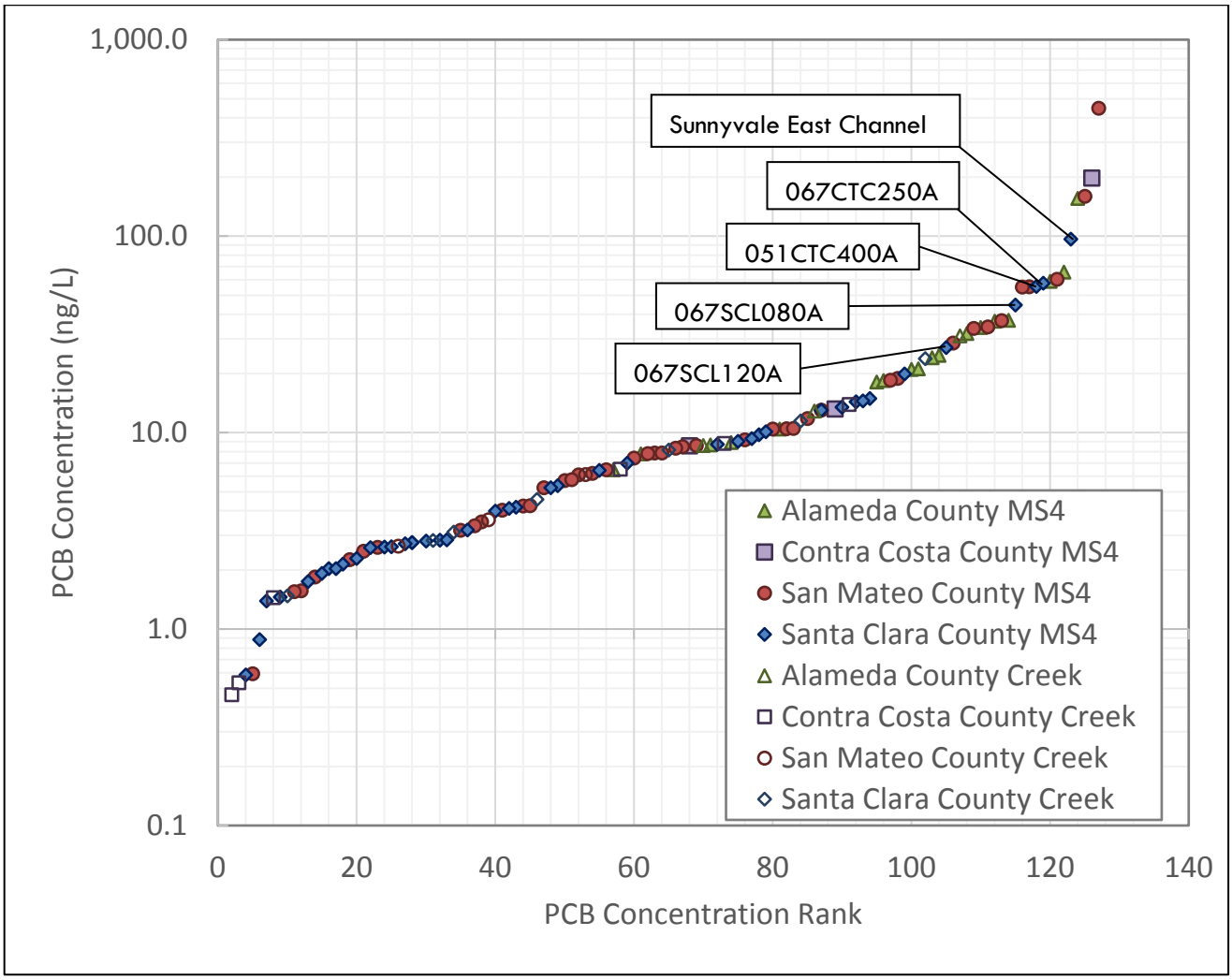

Figure 3. PCB concentrations for water samples collected in large MS4s in the Bay Area

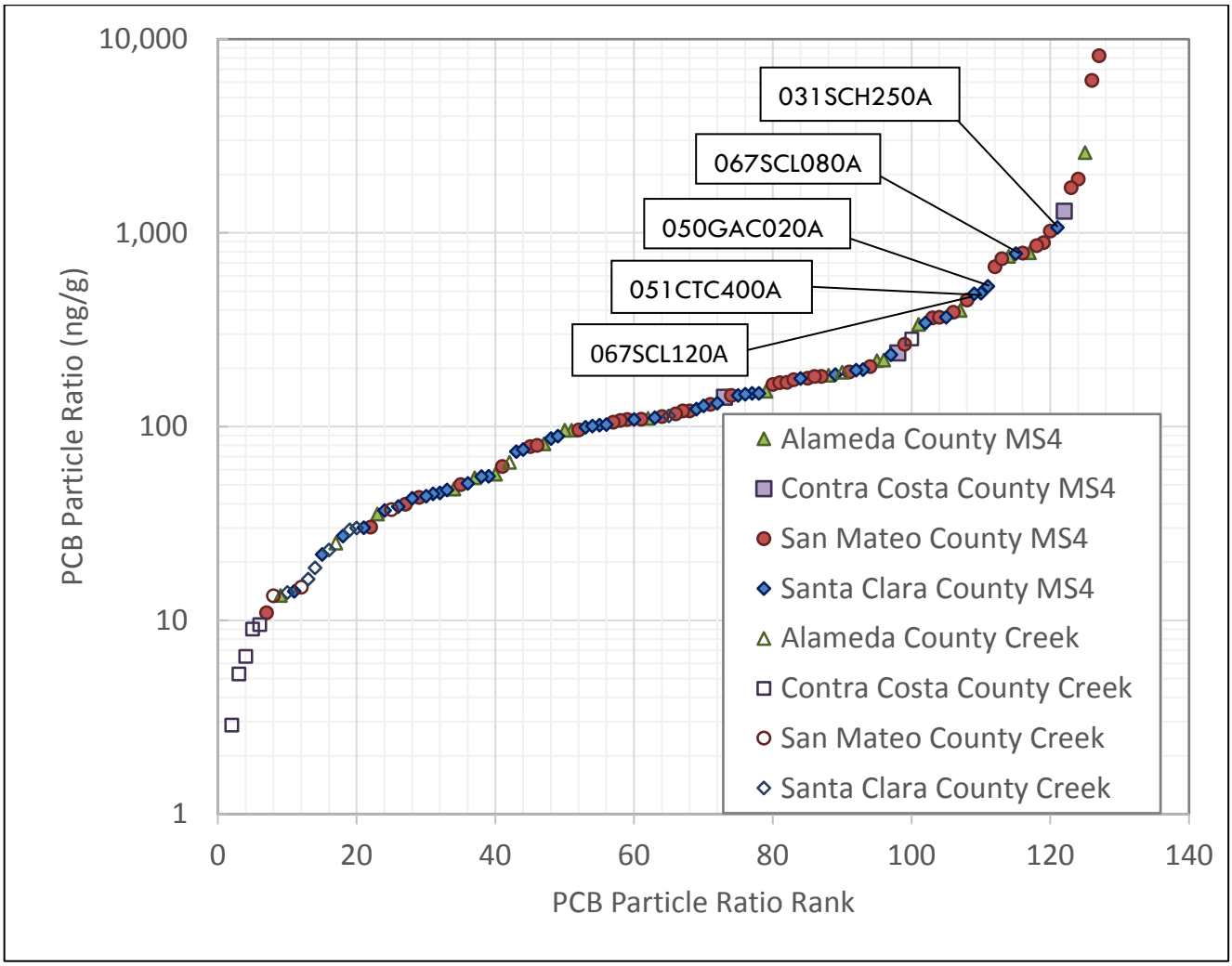

Figure 4. PCB particle ratios for water samples collected in MS4s and small tributaries (i.e., creeks/rivers) draining to the Bay.

WMA Update

PCB and mercury sampling data are used to identify specific source properties and/or WMAs where control measures will be implemented. There are currently no thresholds established for classifying or prioritizing PCB or mercury concentrations in stormwater. Therefore, the Program is currently focusing on PCBs and applying the BASMAA RMC sediment concentration thresholds to PCB particle ratio data which can be expressed in the same units (mg/kg). A PCB particle ratio greater than 0.5 mg/kg (or 500 ng/g) is used as a preliminary threshold for classifying water samples as high, 0.2 – 0.5 mg/kg (200 – 500 ng/g) is moderate, and less than 0.2 mg/kg (200 ng/g) is low.

Sites are also ranked within the regional dataset (n=127) based on concentrations in water and particle ratios and these rankings differ. Rankings of the sites monitored in WY 2017 are listed in Table 4. A sample that has a relatively low concentration in water but a high particle ratio may suggest that the storm that was sampled was relatively small, and the rainfall was not enough to mobilize much sediment. A larger storm may mobilize more sediment and PCBs, so catchments with an elevated concentration or particle ratio may be considered for a source investigation.

Based on WY 2017 sampling, four WMAs were identified as high priority catchments where source investigations should be considered.

- **WMA 031SCH250.** This 42-acre catchment located in the City of Palo Alto was characterized in WY 2017 with sample 031SCH250A which had a total PCBs concentration of 13 ng/L and a PCB particle ratio of 1.07 mg/kg. The catchment area contains primarily old industrial (38%) and new urban (48%) land uses, many of which house technology companies. This catchment drains to Matadero Creek via the Stanford Channel.

- **WMA 050GAC020.** This 843-acre catchment located in the City of San Jose was characterized in WY 2017 with sample 050GAC020A which had a total PCBs concentration of 7.0 ng/L and a PCB particle ratio of 0.53 mg/kg. The catchment area contains old industrial (36%), old urban (10%), new urban (45%), and open space (9%) land uses and is crossed by several rail lines. This catchment drains directly to the Guadalupe River via a large pump station (Rincon 2) that was constructed in 2004.

- **WMA 067SCL120.** This 40-acre catchment located in the City of San Jose was characterized in WY 2017 with sample 067SCL120 which had a total PCBs concentration of 27.1 ng/L and a PCB particle ratio of 0.48 mg/kg. The catchment area is almost entirely light industrial with a mixture of older and new construction dates. There is also an old railroad right-of-way that passes through the catchment. This catchment drains directly to Lower Silver Creek. WMA 067SCL120 borders another small catchment (WMA 067SCL080) that was targeted for a source investigation in WY 2017. Results of the WMA 067SCL080 source investigation will be reported under separate cover.

- **WMA 067CTC250.** This 41-acre catchment located in the City of San Jose was characterized in WY 2017 with sample 067CTC250A which had a total PCBs concentration of 57.6 ng/L and a PCB particle ratio of 0.11 mg/kg. Although the particle ratio is relatively low, the PCBs concentration was one of the highest measured in Santa Clara County. Furthermore, a sediment sample collected in WY 2015 in the WMA had a PCBs concentration of 0.24 mg/kg. The catchment area is primarily old industrial land uses (61%) and includes multiple large recycling facilities. Several industrial properties in the catchment are unpaved, including a pallet company, and these properties may contribute sediment to stormwater. This catchment drains directly to Coyote Creek.

WY 2018 POC sampling will include the collection of sediment samples within several WMAs to investigate suspected PCBs and mercury source properties. It is likely that the four WMAs described above will be targeted. If WY 2018 sediment sampling results in the identification of source properties, the Program will work with local municipalities to cleanup and abate the properties, and/or refer these properties to Regional Water Board for follow up action.

2.2.2 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 soil or sediment samples in seven prioritized WMAs. Station IDs, locations, and analytical results (total PCBs and mercury) are listed in Attachment 1. Total PCB concentrations in the samples, calculated as the sum of the "RMP 40" congeners, ranged from 0.004mg/kg to 11.9 mg/kg[9]. 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 submitted with the Program's FY 2017-18 Annual Report. At least six PCB or mercury source properties and seven potential PCB or mercury source properties have been identified to-date in priority WMAs. It is anticipated that up to six of these properties may be referred to the Water Board as a result of the WY 2017 investigations. Should they occur, referrals will be presented under separate cover.

[9] Results of individual PCB congeners can be made available upon request.

2.3 Copper

In WY 2017, SCVURPPP collected a total of five samples for copper analysis:

- Two copper samples were collected 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 copper samples were collected during a large storm event on January 9, 2017 at upstream and downstream locations in the Silver Creek watershed which is tributary to Coyote Creek (upstream [205COY205], middle [205COY185], downstream [205COY180]). The goal of this approach is 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.

All samples were analyzed for total copper, dissolved copper[10], and hardness. Results are listed in Table 6. Comparisons to freshwater water quality objectives are described in Section 3.0.

Table 6. Total and dissolved copper concentrations in water samples collected by SCVURPPP, WY 2017.

Station Code	Sample Date	Total Copper (µg/L)	Dissolved Copper (µg/L)	Hardness as $CaCO_3$ (mg/L)
067CTC750A	2/7/2017	8.8	3.0	146
067CTC810A	2/7/2017	28	7.2	58.4
205COY180 (downstream)	1/9/2017	31	9.6	160
205COY185 (middle)	1/9/2017	29	8.7	170
205COY205 (upstream)	1/9/2017	14	7.5	200

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.

2.4 Nutrients

Nutrients were included in the POC monitoring requirements to support Regional Water Board efforts to develop nutrient numeric endpoints (NNE) for the San Francisco Bay Estuary. The "San Francisco Bay Nutrient Management Strategy" (NMS) is part of a statewide initiative to address nutrient over-enrichment in State waters (Regional Water Board 2012). Its goal is to lay out a well-reasoned and cost-effective program to generate the scientific understanding needed to fully support major management decisions such as establishing/revising objectives for nutrients and dissolved oxygen, developing/implementing a nutrient monitoring program, and specifying nutrient limits in NPDES permits. The NMS monitoring program currently focuses on stations located within San Francisco Bay rather than freshwater tributaries.

The suite of nutrients required in MRP Provision C.8.f (i.e., ammonium, nitrate, nitrite, total Kjeldahl nitrogen

[10] In order to simplify the field effort and reduce the risk of sample contamination, the analytical laboratory was asked to conduct the sample filtration required for dissolved copper analysis.

(TKN), orthophosphate, and total phosphorus) closely reflects the list of analytes measured by the RMP and BASMAA partners at the six regional loading stations (including Santa Clara County stations in Guadalupe River and the Sunnyvale East Channel) monitored in WY 2012 - WY 2014. The prior data collected in freshwater tributaries to San Francisco Bay were used by the Nutrient Strategy Technical Team to develop and calibrate nutrient loading models.

In WY 2017, POC monitoring for nutrients in Santa Clara County was conducted at three stations along Silver Creek (upstream, middle, and downstream) during a large storm event. Follow-up monitoring at all three stations was attempted during the dry season; however, one of the stations (205COY205) was dry. Nutrient POC monitoring addresses Management Question #4 (Loads and Status). Results are listed in Table 7. Comparisons to applicable freshwater water quality objectives are described in Section 3.0.

Table 7. Nutrient concentrations (mg/L) in water samples collected by SCVURPPP, WY 2017.

Date/Station	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen (TKN)	Ammonia as N	Un-ionized Ammonia as N [1]	Ammonium [2]	Total Nitrogen [3]	Dissolved Orthophosphate as P	Phosphorus as P
January 9, 2017 (storm event)									
205COY205 (upstream)	2.7	0.014	1.9	0.069	0.0022	0.067	4.6	0.18	0.43
205COY185 (middle)	1.4	0.012	2.0	0.095	0.0016	0.093	3.4	0.20	0.87
205COY180 (downstream)	1.2	0.011	2.1	0.073	0.0016	0.071	3.3	0.18	0.88
June 1, 2017 (spring baseflow)									
205COY205 (upstream)	no samples collected – creek bed dry								
205COY185 (middle)	4.2	0.044	0.62	0.11	0.0073	0.10	4.9	0.046	0.10
205COY180 (downstream)	5.3	0.031	0.22	0.082	0.0067	0.075	5.6	0.024	0.051

Notes:

All constituents reported as mg/L..

[1] Un-ionized ammonia calculated using formula provided by the American Fisheries Society Online Resources.

[2] Ammonium = ammonia – un-ionized ammonia.

[3] Total nitrogen = TKN + nitrate + nitrite. Non-detects valued at ½ method detection limit in calculation.

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 (TKN) concentrations were lower in June compared to the January storm event.

- Organic nitrogen (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 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 baseflow event. It unknown why nitrate patterns were not consistent with the NMS model.

2.5 Emerging Contaminants

Emerging contaminant monitoring is being addressed through Program participation in the RMP. The RMP has been investigating Chemicals of Emerging Concern (CECs) since 2001 and established the RMP Emerging Contaminants Work Group (ECWG) in 2006. The goal of the ECWG is to identify CECs that have the potential to impact beneficial uses in the Bay and to develop cost-effective strategies to identify, monitor, and minimize impacts. The RMP published a CEC Strategy "living" document in 2013 and completed a full revision in 2017 (Sutton et al. 2013; Sutton and Sedlak 2015; Sutton et al. 2017). The CEC Strategy document guides RMP special studies on CECs using a tiered risk and management action framework. PFOS compounds are identified in the CEC Strategy as "moderate" concern due to Bay occurrence data suggesting a high probability of a low-level effect on Bay wildlife. PFAS compounds and alternative flame retardants (AFRs) are identified as "possible" concern due to uncertainties in measured or predicted Bay concentrations or in toxicity thresholds. RMP staff recently published reports summarizing PFOS and PFAS monitoring results (Houtz et al. 2016; Sedlak et al. 2017). The RMP is currently reviewing data available on AFRs to help inform a conceptual model that is currently under development.

3.0 COMPARISON TO APPLICABLE WATER QUALITY STANDARDS

MRP provision C.8.h.i 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 POC data collected in WY 2017 by SCVURPPP were compared to applicable numeric water quality objectives (WQOs) included in the SF Bay Water Quality Control Plan.

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. All of the PCB and mercury samples and two of the five copper samples collected by the Program were within the engineered storm drain network, not receiving waters. Dilution is likely to occur when the MS4 discharges urban stormwater (and non-stormwater) runoff into the local receiving water. Therefore, it is unknown whether discharges that exceed WQOs result in exceedances in the receiving water itself, the location where there is the potential for exposure by aquatic life.

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 – All monitoring (in water) for PCBs, mercury, and copper was conducted during episodic storm events and results do not likely represent long-term (chronic) concentrations of monitored constituents. The same is true for three out of five nutrient samples. Storm 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. Spring baseflow monitoring data were also compared to "chronic" WQOs/criteria.

Of the analytes monitored by SCVURPPP at POC stations in WY 2017, WQOs or criteria for the protection of aquatic life have only been promulgated for total mercury, dissolved copper, and un-ionized ammonia. In WY 2017, there were no exceedances of applicable water quality standards for these analytes in samples collected in receiving waters. Details of the analyses are provided below.

- **Total Mercury**. All mercury concentrations measured in SCVURPPP samples in WY 2017 were well below the freshwater acute objective for mercury of 2.4 ug/L (see Table 4).
- **Nutrients**. All un-ionized ammonia concentrations measured in SCVURPPP samples were below the annual median objective for un-ionized ammonia of 0.025 mg/L (see Table 7).
- **Dissolved Copper.** Acute (1-hour average) WQOs for copper are expressed in terms of the dissolved fraction of the metal in the water column and are hardness dependent[11]. The acute copper WQO was calculated using the online spreadsheet posted by the State Water Resources Control Board (http://www.waterboards.ca.gov:8080/WaterQualityGoal/wq_docs/23.xls) which applies hardness values measured at the sample station. Dissolved copper concentrations measured at those

[11] The current copper standards for freshwater in California do not account for the effects of pH or natural organic matter and can be overly stringent or underprotective (or both, at different times). Therefore, the California Stormwater Quality Association (CASQA) has asked the USEPA to considering updating the California Toxics Rule for copper using the Biotic Ligand Model (BLM) which accounts for the effect of water chemistry in addition to hardness (i.e., temperature, pH, dissolved organic carbon, major cations and anions).

stations were compared to the calculated WQO. None of the MS4 or receiving water stations exceeded the calculated WQO for dissolved copper (Table 8).

Table 8. Comparison of WY 2017 Monitoring Data to the Copper WQO.

Station Code	Sample Date	Dissolved Copper (µg/L)	Hardness as $CaCO_3$ (mg/L)	Acute WQO for Dissolved Copper at Measured Hardness (µg/L)
067CTC750A	2/7/2017	3.0	146	19.2
067CTC810A	2/7/2017	7.2	58.4	8.1
205COY180 (downstream)	1/9/2017	9.6	160	20.9
205COY185 (middle)	1/9/2017	8.7	170	22.2
205COY205 (upstream)	1/9/2017	7.5	200	25.8

4.0 CONCLUSIONS AND RECOMMENDATIONS

In WY 2017, SCVURPPP collected and analyzed POC samples in compliance with Provision C.8.f of the MRP. Yearly minimum requirements were met for all monitoring parameters. In addition, SCVURPPP continued to work with the RMP's STLS to supplement WY 2017 monitoring accomplishments.

Conclusions from WY 2017 POC monitoring include the following:

- SCVURPPP collected 17 wet weather samples from high interest catchments for PCBs and mercury analysis. Results from SCVURPPP monitoring were compiled with results from RMP STLS monitoring (2 samples) to potentially identify new high interest WMAs in which new PCB or mercury source investigations should be considered. Based on the monitoring results, four new WMAs were added to the list of catchments warranting source property investigations.

- SCVURPPP collected 76 sediment samples from seven prioritized WMAs in an effort to identify specific PCB source properties. Based on the combined results of this monitoring effort and other aspects of the source property investigations, SCVURPPP has preliminarily identified six PCB or mercury source properties and one additional property for PCBs. These properties My warrant follow up action, which may include referral to the Regional Water Board or further investigation.

- Two of the wet weather catchment samples were analyzed for total and dissolved copper. An additional three samples were collected along a creek gradient during a storm event. None of the samples exceeded applicable water quality standards which generally apply to receiving waters rather than pipelines within the MS4.

- Three nutrient samples were collected along a gradient in the Silver Creek watershed during a storm event. Two of these stations were re-sampled for nutrients during spring baseflow conditions. None of the samples exceeded applicable water quality standards.

Recommendations for WY 2018 POC monitoring include the following:

- 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.

- 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 to address Management Question # 4 (Loads and Status). Stations should be resampled for copper during summer baseflow conditions to address Management Question #5 (Trends).

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

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Attachment 1

Sediment Monitoring Stations and Analytical Results

Permittee	WMA	Sample	Sample Source	Latitude	Longitude	Total PCBs (ug/kg)	Mercury (mg/kg)
Palo Alto	001SFC100A	SC-PAO-18-C	Street Dirt	37.44105	-122.16002	0.02	0.07
		SC-PAO-18-D	Street Dirt	37.44094	-122.15985	0.03	0.08
		SC-PAO-18-G	Street Dirt	37.44036	-122.15763	0.17	0.12
		SC-PAO-18-H	Street Dirt	37.44072	-122.15790	0.06	0.04
		SC-PAO-18-N (Dup of SC-PAO-18-H)				0.05	0.04
		SC-PAO-18-I	Street Dirt	37.44086	-122.15814	0.02	0.15
		SC-PAO-18-J	Street Dirt	37.44117	-122.15810	0.01	0.05
		SC-PAO-18-K	Street Dirt	37.44128	-122.15756	0.01	0.05
		SC-PAO-18-L	Manhole	37.44184	-122.15749	0.01	0.08
		SC-PAO-18-M	Manhole	37.44219	-122.15168	0.02	0.11
Santa Clara	066GAC150	SC-SCL-01-C	Manhole	37.35447	-121.93710	3.81	0.48
		SC-SCL-01-E	Street Dirt	37.35445	-121.93688	0.04	0.06
		SC-SCL-01-F	Street Dirt	37.35466	-121.93670	0.02	0.08
		SC-SCL-01-G	Street Dirt	37.35519	-121.93608	0.19	0.07
		SC-SCL-01-I (Dup of SC-SCL-01-G)				0.20	0.07
		SC-SCL-01-H	Street Dirt	37.35656	-121.93269	0.09	0.14
		SC-SCL-23-B	Inlet	37.35593	-121.94040	0.02	0.12
		SC-SCL-23-C	Street Dirt	37.35529	-121.93995	0.02	0.11
		SC-SCL-23-D	Street Dirt	37.35946	-121.93418	0.64	0.07
		SC-SCL-23-E	Manhole	37.35917	-121.93379	0.11	0.09
		SC-SCL-23-F	Street Dirt	37.35843	-121.93300	0.13	0.14
		SC-SCL-26-A	Street Dirt	37.35327	-121.94012	0.01	0.12
	050GAC400	SC-SCL-02-F	Manhole	37.37103	-121.94970	0.05	0.26
		SC-SCL-02-G	Street Dirt	37.37042	-121.95014	0.05	0.81
		SC-SCL-02-H	Street Dirt	37.37078	-121.95011	0.02	0.10
		SC-SCL-02-I	Street Dirt	37.37124	-121.95012	0.07	0.18
		SC-SCL-02-J	Street Dirt	37.37144	-121.95007	0.02	0.20
		SC-SCL-02-K	Street Dirt	37.37150	-121.95005	0.02	0.23
		SC-SCL-02-L	Street Dirt	37.36068	-121.94839	0.01	0.05
		SC-SCL-03-E	Street Dirt	37.36497	-121.95602	0.02	0.09
		SC-SCL-04-D	Inlet	37.36717	-121.95043	0.07	0.21
		SC-SCL-04-G (Dup of SC-SCL-04-D)				0.06	0.13
		SC-SCL-04-E	Manhole	37.37205	-121.94967	0.00	0.09

Permittee	WMA	Sample	Sample Source	Latitude	Longitude	Total PCBs (ug/kg)	Mercury (mg/kg)
		SC-SCL-04-F	Manhole	37.37250	-121.94967	0.01	0.50
		SC-SCL-05-C	Manhole	37.36996	-121.95262	0.29	0.24
		SC-SCL-05-D	Inlet	37.37176	-121.95042	0.20	0.17
		SC-SCL-05-E	Street Dirt	37.37215	-121.95045	0.15	0.09
San Jose	051CTC400	SC-SJY-07-A	Street Dirt	37.37903	-121.89875	2.80	0.38
		SC-SJY-08-H	Street Dirt	37.37844	-121.89870	0.18	0.17
		SC-SJY-08-I	Street Dirt	37.37668	-121.90253	0.00	0.06
		SC-SJY-08-J	Street Dirt	37.37612	-121.90079	0.00	0.23
		SC-SJY-08-K	Manhole	37.37444	-121.90063	0.07	0.10
		SC-SJY-08-L		37.37255	-121.89857	0.05	0.09
		SC-SJY-08-M	Street Dirt	37.37243	-121.89868	0.21	0.14
		SC-SJY-08-N	Street Dirt	37.37160	-121.89980	0.02	0.09
		SC-SJY-08-O	Street Dirt	37.37185	-121.90025	0.05	0.12
		SC-SJY-08-S (Dup of SC-SJY-08-O)				0.06	0.08
		SC-SJY-08-P	Manhole	37.37222	-121.90040	0.02	0.06
		SC-SJY-08-Q	Street Dirt	37.37231	-121.90045	0.03	0.13
		SC-SJY-08-R	Inlet	37.37258	-121.90076	0.03	0.07
		SC-SJY-08-T	Street Dirt	37.37176	-121.90114	0.28	0.06
		SC-SJY-08-U	Manhole	37.37176	-121.90114	0.05	0.06
		SC-SJY-08-V	Manhole	37.37175	-121.90110	0.03	0.20
		SC-SJY-08-W	Street Dirt	37.37160	-121.90106	0.02	0.11
		SC-SJY-08-X (Dup of SC-SJY-08-W)				0.01	0.13
	051CTC275	SC-SJY-10-G	Street Dirt	37.36864	-121.90599	0.03	0.22
		SC-SJY-10-H	Street Dirt	37.36798	-121.90583	2.04	0.25
		SC-SJY-10-I	Inlet	37.36800	-121.90584	11.91	1.32
		SC-SJY-10-M (Dup of SC-SJY-10-I)				17.11	1.22
		SC-SJY-10-J	Street Dirt	37.37349	-121.90716	0.03	0.09
		SC-SJY-10-K	Inlet	37.37325	-121.90746	0.03	0.15
		SC-SJY-10-L	Inlet	37.37292	-121.90695	0.01	0.04
		SC-SJY-10-N	Street Dirt	37.37521	-121.90857	0.57	3.01
		SC-SJY-10-O	Street Dirt	37.37657	-121.90778	0.28	0.12
		SC-SJY-10-P	Street Dirt	37.37783	-121.91004	0.24	1.57
		SC-SJY-10-Q	Street Dirt	37.37569	-121.90890	0.04	0.15
	067SCL080	SC-SJY-17-B	Street Dirt	37.35887	-121.87121	0.01	0.14

Permittee	WMA	Sample	Sample Source	Latitude	Longitude	Total PCBs (ug/kg)	Mercury (mg/kg)
San Jose		SC-SJY-17-C	Inlet	37.35936	-121.86900	0.12	0.03
		SC-SJY-17-D	Street Dirt	37.35900	-121.86863	0.05	0.11
		SC-SJY-17-E	Street Dirt	37.35909	-121.86850	0.03	0.12
		SC-SJY-17-F	Street Dirt	37.35869	-121.87077	0.03	0.12
		SC-SJY-17-G	Street Dirt	37.35821	-121.87025	0.04	0.26
		SC-SJY-17-H	Manhole	37.35885	-121.86840	0.09	0.09
		SC-SJY-47-E	Street Dirt	37.30763	-121.86494	0.12	0.32
		SC-SJY-47-F	Street Dirt	37.30802	-121.86531	0.23	0.95
		SC-SJY-47-G	Street Dirt	37.30817	-121.86549	0.25	0.77
		SC-SJY-47-I (Dup of SC-SJY-47-G)				0.22	2.58
		SC-SJY-47-H	Street Dirt	37.30962	-121.86691	0.30	1.95
		SC-SJY-47-J	Manhole	37.30996	-121.86778	7.06	1.88
		SC-SJY-47-K	Street Dirt	37.30948	-121.86730	0.07	0.42
		SC-SJY-47-L	Street Dirt	37.30918	-121.86699	0.08	0.42
	Other - San Jose	SC-SJY-90-A	Street Dirt	37.25767	-121.83825	0.00	0.09
		SC-SJY-91-A	Street Dirt	37.22004	-121.85523	0.08	4.29

Attachment 2
Quality Assurance/Quality Control Report

Pollutants of Concern Monitoring - Quality Assurance/Quality Control Report, WY 2017

1.0 INTRODUCTION

The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) conducted Pollutants of Concern (POC) Monitoring in Water Year (WY) 2017 to comply with Provision C.8.f (Pollutants of Concern Monitoring) of the National Pollutant Discharge Elimination Program (NPDES) Municipal Regional Permit for the San Francisco Bay Area (i.e., MRP). Monitoring included analysis for polychlorinated biphenyls (PCBs), total mercury, total and dissolved copper, suspended sediment concentration (SSC), and nutrients (i.e., ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, and total phosphorus).

This project utilized the Clean Watersheds for Clean Bay Project (CW4CB) Quality Assurance Project Plan (QAPP; BASMAA2013) as a basis for Quality Assurance and Quality Control (QA/QC) procedures. Missing components were supplemented by the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) QAPP (BASMAA 2016) and the QAPP for the California Surface Water Ambient Monitoring Program (SWAMP), specifically for nutrient and copper samples, respectively. Data were assessed for seven data quality attributes, which include (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes are compared to Data Quality Objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data – representativeness and comparability are qualitative while completeness, sensitivity, precision, accuracy, and contamination are quantitative assessments. Specific DQOs are based on Measurement Quality Objectives (MQOs) for each analyte.

The MQOs for each of the POC analytes are summarized in Table 1 for water and Table 2 for sediment. As there was no reporting limit listed in the QAPP for copper, results were compared the SWAMP recommended reporting limits for inorganic analytes in freshwater. Overall, the results of the QA/QC review suggest that the data generated during this study were of sufficient quality for the purposes of the project. Further details regarding the QA/QC review are provided in the sections below. While some data were flagged in the project database, none of the data were rejected based on the MQOs or DQOs identified in the QAPPs. However, mercury data collected in water were later rejected by the project QA/QC officer based on comparison of results to similar data collected in recent years by SCVURPPP and other programs from the same population of urban catchments.

Table 1. Measurement quality objectives for analytes in water from the Clean Watersheds for a Clean Bay (CW4CB) Quality Assurance Project Plan (BASMAA 2013) and BASMAA RMC Quality Assurance Project Plan (BASMAA 2016)

Sample	Nutrients[1]	Hardness[1]	SSC[2]	Copper[2]	Mercury[2]	PCBs[2]
Laboratory Blank	< RL	<RL	< RL	< RL	< RL	< RL
Reference Material (Laboratory Control Sample) Recovery	90-110%	80-120%	NA	75-125%	75-125%	50-150%
Matrix Spike Recovery	80-120%	80-120%	NA	75-125%	75-125%	50-150%
Duplicates (Matrix Spike, Field, and Laboratory)[3]	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%
Reporting Limit	0.01mg/L for all except: Ammonia (0.02mg/L) TKN[4] (0.5mg/L)	1 mg/L[5]	0.5 mg/L	0.10 µg/L[6]	0.0002 µg/L (0.2 ng/L)	0.002 µg/L (2000 pg/L)

RL = Reporting Limit; RPD = Relative Percent Difference

[1] From the BASMAA QAPP

[2] From the CW4CB QAPP

[3] NA if native concentration for either sample is less than the reporting limit

[4] TKN = Total Kjeldahl Nitrogen

[5] No hardness RL listed in either QAPP. Value is from SWAMP-recommended reporting limits for conventional analytes in freshwater. (https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/tools/19_tables_fr_water/1_conv_fr_water.pdf)

[6] No copper RL listed in either QAPP. Value is from SWAMP-recommended reporting limits for inorganic analytes in freshwater. (http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/tools/19_tables_fr_water/4_inorg_fr_water.pdf)

Table 2. Measurement quality objectives for analytes in sediment from the Clean Watersheds for a Clean Bay (CW4CB) Quality Assurance Project Plan (BASMAA 2013).

Sample	Total Solids	Mercury	PCBs
Laboratory Blank	< RL	< RL	< RL
Reference Material (Laboratory Control Sample) Recovery	N/A	75-125%	50-150%
Matrix Spike Recovery	N/A	75-125%	50-150%
Duplicates [1] (Matrix Spike, Field, and Laboratory)	RPD < 25%	RPD < 25%	RPD < 25%[2]
Reporting Limit	0.1%[3]	30 µg/kg 0.03 mg/kg 30,000 ng/kg	0.2 µg/kg 0.0002 mg/kg 200 ng/kg

RL = Reporting Limit; RPD = Relative Percent Difference

[1] NA if native concentration for either sample is less than the reporting limit

[2] Only applicable for matrix spike duplicates. Method specific for field and laboratory duplicates

[3] RL for total solids in water

2.0 REPRESENTATIVENESS

Data representativeness assesses whether the data were collected so as to represent actual conditions at each monitoring location. For this project, all samples are assumed to be representative if they are collected and analyzed according to protocols specified in the CW4CB QAPP and RMC QAPP. All field and laboratory personnel received and reviewed the QAPPs, and followed prescribed protocols including laboratory methods.

3.0 COMPARABILITY

The QA/QC officer ensures that the data may be reasonably compared to data from other programs producing similar types of data. For POC monitoring, individual stormwater programs try to maintain comparability within in RMC. The key measure of comparability for all RMC data is the California Surface Water Ambient Monitoring Program.

Electronic data deliverables (EDDs) are submitted to the San Francisco Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by SWAMP, to ensure data comparability with SWAMP. In addition, data entry follows SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on SWAMP's look up lists[1]. Completed templates are reviewed using SWAMP's online data checker[2], further ensuring SWAMP-comparability.

[1] Look up lists available online at http://swamp.waterboards.ca.gov/swamp_checker/LookUpLists.php.

[2] Checker available online at http://swamp.waterboards.ca.gov/swamp_checker/SWAMPUpload.php

4.0 COMPLETENESS

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. For chemical data and field measurements an overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

During WY 2017, SCVURPPP collected over 100% of planned samples. Nutrients were collected during two events – three samples were collected in January and two were collected in June 2017. Three copper and hardness samples were also collected concurrently with nutrients during the January event. A total of 17 aqueous samples were collected in WY 2017 and analyzed for PCBs, mercury, and SSC. Three additional aqueous hardness samples and six aqueous copper samples were collected concurrently with PCBs and mercury. Seventy-six (76) sediment samples were also collected in WY 2017 and analyzed for PCBs and mercury. A comparison of the total and actual samples collected for POC monitoring in WY 2017 is shown in Table 2.

Table 2. Comparison of the targeted number of samples with the actual number of samples collected during POC monitoring in WY 2017

Analyte	Matrix	Target	Actual
Nutrients[1]	Water	4	5
Suspended Sediment Concentration	Water	10-20	17
Hardness	Water	4	6
Copper	Water	4	9
Mercury	Water	10-20	17
PCBs	Water	10-20	17
Mercury	Sediment	40-60	76
PCBs	Sediment	40-60	76
Total Solids	Sediment	40-60	83

[1] Nutrients include ammonia, nitrate, nitrite, total Kjeldahl nitrogen, phosphorus, orthophosphate.

5.0 SENSITIVITY

5.1. Water

Sensitivity analysis determines whether the methods can identify and/or quantify results at low enough levels. For the aqueous chemical analyses in this project, sensitivity is considered to be adequate if the reporting limits (RLs) comply with the specifications in RMC QAPP Appendix E (RMC Target Method Reporting Limits) and the CW4CB QAPP Appendix B (CW4CB Target Method Reporting Limits).

A summary of the target and actual reporting limits for each analyte is shown in Table 3. Nutrient analysis, except for nitrate, and PCB analysis met their respective target reporting limits listed in the RMC QAPP and CW4CB QAPP. However, the reporting limits for all nitrate, suspended sediment concentration (SSC), hardness, and mercury samples exceeded their respective target reporting limits. Additionally, all but two copper samples exceeded the target reporting limit for copper.

Table 3. Target and actual reporting limits for SCVURPPP pollutants of concern monitoring in water in WY 2017.

Analyte	Unit	Target	Actual	Exceeds Target?
Ammonia	mg/L	0.02	0.02	No
Nitrate	mg/L	0.01	0.05	Yes
Nitrite	mg/L	0.01	0.005	No
Total Kjeldahl Nitrogen	mg/L	0.5	0.1	No
Phosphorus	mg/L	0.01	0.01	No
Orthophosphate	mg/L	0.01	0.01	No
Suspended Sediment Concentration	mg/L	0.5	1.0-1.1	Yes
Hardness	mg/L	1	2-20	Yes
Copper	µg/L	0.1	0.1-0.5	Yes
Mercury	ng/L	0.2	0.5	Yes
PCBs	pg/L	2000	19.9-383	No

5.2. Sediment Analysis

The project manager identified 0.5 mg/kg as an elevated/high total PCBs concentration threshold for sites to be considered for additional investigation. Because a different analytical method was used in this project for PCBs congeners (i.e., 8082M) compared to the CW4CB project (i.e., 1668A), a reporting limit requirement had to be developed. To maintain a conservative approach, QA/QC goals for this project focused on concentrations greater than 1/5 of the high concentration threshold (i.e., 0.1 mg/kg), and applied a reporting limit requirement of 10 µg/kg (i.e., 0.01 mg/kg), or 1/10 of this new lower threshold, for each of the forty PCB congeners analyzed.

Approximately 4% of congener samples (146 of 3320) did not meet the reporting limit requirement of 10 µg/kg. However, the majority of these exceedances are explained by dilutions, necessary to conduct the analysis, resulting in elevated reporting limits. Only a small minority (32; 1%) of the samples that did not meet the reporting limit requirements were not diluted, and therefore, did not have a justification for the elevated reporting limits. Slightly more than one-quarter (13) of the 40 congeners were affected.

The target method reporting limits for mercury (0.30 mg/kg) and total solids (0.1%) were met for all mercury and total solids samples.

6.0 CONTAMINATION

For chemical data, contamination is assessed as the presence of analytical constituents in blank samples.

6.1. Water Analysis

Laboratory blanks that were run during the nutrient and copper analyses were all non-detect and met the measurement quality objectives for nutrients (< reporting limit). Two laboratory blanks analyzed for hardness were above the method detection limit, but below reporting limit. Similarly, analytes were detected in laboratory blanks for mercury and several PCBs above the method detection limit, but below the reporting limit. The PCBs that were detected in laboratory blanks include PCB 8, PCB 11, PCB 52, PCB 44/47/65, PCB 153/168, and PCB129/138/163.

6.2. Sediment Analysis

Laboratory blanks that were run during sediment analysis, and several PCBs were detected in the blanks above the method detection limits. However, concentrations were below the reporting limit and therefore met the MQO. PCBs that were detected above the method detection limit, but below the reporting limit include the following:

- PCB 153
- PCB 158
- PCB 018
- PCB 028
- PCB 033
- PCB 044
- PCB 052
- PCB 138
- PCB 180
- PCB 008

7.0 ACCURACY

Accuracy is assessed as the percent recovery of samples spiked with a known amount of a specific chemical constituent. The analytical laboratory evaluated and reported the Percent Recovery (PR) of Laboratory Control Samples (LCS; in lieu of reference materials) and Matrix Spikes (MS)/Matrix Spike Duplicates (MSD), which were recalculated and compared to the target ranges in the RMC and CW4CB QAPPs . If a QA sample did not meet MQOs, all samples in that batch for that analyte were flagged.

7.1. Water Analysis

All nutrient LCS and MS/MSD samples were within the MQO specified by the BASMAA QAPP for both the January and June analysis. All of the copper laboratory control samples met the MQOs. However, one copper MS sample did not meet the MQO, and the associated copper samples were flagged. All of the hardness LCS and MS/MSD samples met the MQO. All SSC laboratory control samples met the MQO. No SSC MS/MSD samples were run. Laboratory control samples exceeded the MQOs for 19 PCBs, and three MS/MSD samples exceeded the MQO for PCBs. No MS/MSD samples were run for mercury and accuracy could not be assessed.

7.2. Sediment Analysis

All laboratory control samples met the MQOs during the sediment analysis, but three MS/MSD samples exceeded the MQOs, including PCB 18 and PCB 56.

8.0 PRECISION

Precision is the repeatability of a measurement and is quantified by the Relative Percent Difference (RPD) of two duplicates samples. Three measures of precision were used for this project – matrix spikes duplicates , laboratory duplicates, and field duplicates. The MQO for RPD specified by both the CW4CB QAPP and the BASMAA QAPP is <25%.

8.1. Water Analysis

8.1.1. Laboratory Duplicates

Matrix spike duplicates and laboratory control sample duplicates for nutrients, copper, and hardness were well below the targeted range of < 25%. One MS/MSD pair for PCB 144 did not meet the MQO. Laboratory duplicates were analyzed for PCBs, and most of the duplicates were less than 25% and met the MQO except for the following:

- PCB 017
- PCB 018/030
- PCB 031
- PCB 041/071/040
- PCB 128/166
- PCB 135/151/154
- PCB 144
- PCB 176
- PCB 201
- PCB 209

The PCB samples associated with these QA samples were flagged.

The laboratory did not analyze matrix spikes or laboratory duplicates for mercury, and precision could not be assessed.

8.1.2. Field Duplicates

One nutrient field duplicate was collected during WY 2017 POC monitoring at site 205COY185. The field duplicate sample met the MQO for RPD for all analytes.

One field duplicate was collected during this project at site 067CTC350A for hardness, copper, mercury, and PCBs. The duplicate sample was run as a blind duplicate by the laboratory. The duplicatesample met the MQO for RPD for all analytes except for hardness (55%) and PCB 144 (31%). If either measurement was less than the reporting limit, the RPD was not calculated, in accordance with both the CW4CB and BASMAA QAPPs.

8.2. Sediment Analysis

8.2.1. Laboratory Duplicates

Matrix spike duplicates for 31 PCBs exceeded MQO (<25%). One out of four laboratory duplicates for mercury exceeded the MQO. Nine laboratory duplicates were run for total solids, and their RPDs were all well below the MQOs. Samples associated with laboratory duplicates that exceeded MQOs were flagged.

8.2.2. Field Duplicates

Five sediment field blind duplicates were collected in WY 2017. The field duplicates exceed the RPD MQO for mercury and 28 PCBs. Most duplicates exceeded the MQO for very few analytes, but the sample at SC-SJY-10-M exceeded the MQO for 27 analytes. The following analytes exceeded the MQO for field duplicates (the number of samples that exceeded the MQO for that analyte are included in parentheses):

- Mercury (2)

- PCB 28 (1)
- PCB 44 (1)
- PCB 49 (1)
- PCB 52 (1)
- PCB 70 (1)
- PCB 87 (1)
- PCB 95 (2)
- PCB 97 (1)
- PCB 99 (2)
- PCB 101 (1)
- PCB 110 (2)
- PCB 118 (1)
- PCB 128 (1)
- PCB 138 (1)
- PCB 141 (2)
- PCB 149 (2)
- PCB 151 (1)
- PCB 153 (2)
- PCB 156 (1)
- PCB 158 (1)
- PCB 170 (1)
- PCB 174 (1)
- PCB 177 (1)
- PCB 180 (1)
- PCB 183 (1)
- PCB 187 (1)
- PCB 195 (1)
- PCB 203 (2)

9.0 REFERENCES

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