

Laboratory QA Summary

CW4CB Task 5

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Submitted to:

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1. Introduction

The Bay Area Stormwater Agencies Association (BASMAA) contracted with Applied Marine Sciences, Inc. (AMS) to support implementation of CW4CB Task 5. As part of its contract with BASMAA, AMS is providing project quality assurance for all Task 5 activities. SFEI has completed final data review of Task 5 Phase 3 analytes for water year 2016 (WY2016). Below are narrative summaries of reviews of QA/QC samples analyzed with reported field samples for the project. QA/QC samples were evaluated using the procedures and measurement quality objectives (MQOs) described in the project QAPP (BASMAA 2013). A separate memo previously addressed possible implications of reporting of blank contaminated samples used in this project as compared to others (e.g. SF Bay RMP), which may censor blank biased results; the impacts are relatively small other than in low concentration samples.

Task 5 Phase 3 field monitoring data assessed during this review encompasses water quality and sediment monitoring conducted at bioretention/bioswale demonstration projects in Richmond and San Carlos. Analytical laboratories employed for each study, along with analyses conducted by each, are described in the sections that follow. In some cases, data for specific analytes from multiple sampling efforts were batched and reviewed together to increase efficiency of data management and quality assurance process. The text below reflects these groupings where applicable.

2. CW4CB T5P3

2.1. Water Mercury – ALS

Mercury in water samples collected by AMS was analyzed by ALS. Samples were collected between December 10, 2015 and January 17, 2016, and were analyzed between December 17, 2015 and January 28, 2016. Total mercury results were reported for 18 water samples (influent and effluent) and two matrices (samplewater and samplewater, <10 um). One matrix spike/matrix spike replicate (MS/MSD), 3 field replicates, and 12 method blanks were also analyzed in 4 batches. Data were reported not blank corrected.

Samples were analyzed less than 12 days after collection or better, following acidification, satisfying the 6 month holding time criteria specified (BASMAA 2013).

2.1.1. Sensitivity

Sensitivity was sufficient with no non-detects reported for mercury.

2.1.2. Blanks

Mercury was found in at least one blank in 3 out of the 4 lab batches. Results were flagged VIP (analyte detected in field or lab generated blank, flagged by QAO) as a warning, and results <10x the blank

concentration were flagged with the non-censoring qualifier VJ (estimated value - EPA Flag, flagged by QAO), with a compliance code of Est to indicate the results are estimates.

2.1.3.Recovery

Recoveries for total mercury matrix spike results with an average error of 28% were just above the 25% target (QAPP Table 26-8 target 75-125% recovery (25% error)). All results were flagged with the qualifier VIU (percent recovery exceeds laboratory control limit, flagged by QAO) to indicate marginal recovery.

2.1.4.Precision

Precision for mercury was evaluated using field replicates as no lab replicates were analyzed. The average RPD of 0.2% was well below the 25% target MQO (QAPP Table 26-8). The matrix spike samples were examined, but not used for flagging. The average matrix spike RPD of 1.7% was also well below the target MQO.

2.2. Water Lead - ALS

Lead in water samples collected by AMS was analyzed by ALS. Samples were collected between December 10, 2015 and January 17, 2016, and were analyzed between December 22, 2015 and January 27, 2016. Total lead results were reported for 14 water samples (influent and effluent) for one matrix (samplewater). Four matrix spike/matrix spike replicates (MS/MSDs), 3 field replicates, 4 lab replicates, 4 method blanks, and 4 laboratory control samples (LCS) were also analyzed in 4 batches. Data were reported not blank corrected.

Samples were analyzed within 28 days after collection or better, well within the 6 months at room temperature (following acidification) as specified in the BASMAA QAPP (BASMAA 2013).

2.2.1.Sensitivity

Sensitivity was sufficient with no non-detects reported for lead.

2.2.2.Blanks

Lead was not found in any of the method blanks at concentrations above the method detection limit.

2.2.3.Recovery

Recoveries for total lead matrix spike results with an average error of 4% were well below the 25% target (QAPP Table 26-8 target 75-125% recovery (25% error)). The laboratory control samples were examined, but not used for flagging, and with an average error of 5% were also less than the 25% target MQO.

2.2.4.Precision

Precision for lead was evaluated using the lab replicates. The average RPD of 8% was well below the 25% target MQO (QAPP Table 26-8). Field replicates (combined with lab replicates), matrix spike

replicates, and laboratory control sample replicates were examined, but not used for flagging. The average RPDs in all cases, 7%, 1.3%, and ~4% respectively, were well below the target MQO.

2.3. Water PCBs - ALS

PCBs in water samples collected by AMS were analyzed by ALS. Samples were collected between December 10, 2015 and January 17, 2016 and were analyzed between January 22, 2016 and February 8, 2016. The 40 PCB congeners reported by the Regional Monitoring Program for Water Quality in the San Francisco Estuary¹ were reported in the total fraction for 21 water samples, including five field replicates, although many of the samples collected on the same day were separated by an hour, or sometimes more, so it is not clear if these represent field replicates that are meant to have similar concentrations. Four method blanks and 13 laboratory control samples (LCS) were also analyzed in 5 lab batches.

All samples were analyzed within 60 days, well within the 1 year holding time specified (BASMAA 2013).

2.3.1. Sensitivity

Sensitivity was sufficient with no non-detects (NDs) reported for most analytes. None had extensive NDs (>50% NDs), though PCB 008 had ~22% (4 samples), while PCB 195 and 201 had 1 ND each.

2.3.2. Blanks

A number of PCBs were detected in blanks, mostly the lighter congeners. Blank concentrations were greater than 10% of field sample concentrations for over half the samples for many of the lighter congeners (PCB 31 & lower), with those results flagged as estimated. PCB 194 also had nearly 30% of results flagged as estimated due to blank contamination.

2.3.3. Recovery

Laboratory control samples (LCS) were the only recovery samples provided; all the recoveries were good within the 50-150% recovery (50% error) allowed (QAPP Table 26-9 target for PCBs). Only 3 out of the 26 reported analytes in the LCS samples were in the RMP 40 target analytes; although a range of PCB homologs were included in the LCS, some interferences are congener specific and would not necessarily be identified in the LCS.

2.3.4. Precision

Although numerous samples were collected from a site within a day, the majority of them differed in sample time by an hour or more so were likely not expected to have similar concentrations. Blank spike replicates were very consistent, with all RPDs <10%, below the target MQO of 25% (QAPP Table 26-9).

2.4. Water TOC - ALS

Total organic carbon (TOC) in water samples collected by AMS was analyzed by ALS. Samples were collected between December 10, 2015 and January 17, 2016, and were analyzed between December 22, 2015 and January 29, 2016. TOC in the total fraction were reported for 28 water samples (influent and effluent) for one matrix (samplewater). Matrix spike/matrix spike replicates (MS/MSDs), 6 field

¹ The RMP 40 list of PCBs has been the historic suite of PCB congeners analyzed by BASMAA agencies.

replicates, 17 lab replicates, 5 method blanks, and 5 laboratory control samples (LCS) were also analyzed in 5 batches. Data were reported not blank corrected.

Samples were analyzed 20 days after collection or better, well within the 28 days (following acidification) specified (BASMAA 2013).

2.4.1. Sensitivity

The detection limits were above the project QAPP target of 0.01% for TOC, but all TOC results were above the detection limits (TOC MDLs ranged from 0.07 to 2%).

2.4.2. Blanks

TOC was not found in the method blanks at concentrations above the method detection limit (all non-detects).

2.4.3. Recovery

Matrix spike samples were used to evaluate the accuracy of Total Organic Carbon. Recoveries were good, with an average error of 1.2% that was well within the target MQO of 80-120% (QAPP Table 26-6). LCS recovery samples were examined and the average 5% error was well within the target MQO of 25% for TOC.

2.4.4. Precision

Lab replicates were used to evaluate precision for TOC. The average TOC RPD of 6.2% was less than the target MQO of 25% (QAPP Table 26-6). Field replicates (combined with lab replicates), matrix spike replicates, and laboratory control sample replicates were examined, but not used for flagging. The average RPDs in all cases, 22%, 0.2%, and ~3% respectively, were below the target MQO.

2.5. Water Turbidity - SCL

Turbidity in water samples collected by AMS was analyzed by SCL. Samples were collected between December 10, 2014 and January 17, 2016, and were analyzed between December 11, 2015 and January

19, 2016. Turbidity in the total fraction was reported for 14 water samples, blind field replicates, lab replicates and method blanks were also analyzed in 3 lab batches. Data were reported not blank corrected.

No holding time is specified in the BASMAA QAPP for Turbidity, but all samples were analyzed within 72-hours of collection.

2.5.1.Sensitivity

Sensitivity was sufficient with no non-detects reported for turbidity.

2.5.2.Blanks

Turbidity was not found in the blanks at concentrations over the method detection limit (all non-detects).

2.5.3.Recovery

No spiked samples were analyzed/required per the QAPP.

2.5.4.Precision

Lab replicates were used to evaluate precision for turbidity. The average turbidity RPD of 9.3% was less than the target MQO of 25%. Field replicates (combined with lab replicates) were examined but not used for flagging; with the average RPD of 23% being also less than the 25% target MQO.

2.6. Water TSS, SSC, and Settleable Solids - SCL

Total Suspended Solids (TSS), Suspended Sediment Concentration (SSC), and Settleable Solids in water samples collected by AMS were analyzed by SCL. Samples were collected between December 10, 2015 and January 17, 2016, and were analyzed between December 101, 2015 and January 19, 2016.

Results were reported in 10 analyte/fraction/matrix combinations for 14 water samples as shown in the table below.

AnalyteName	FractionName	MatrixName
Settleable Solids	Particulate	runoff
Suspended Sediment Concentration	Particulate	runoff
Suspended Sediment Concentration	Particulate	runoff, particulate, >2000 um
Suspended Sediment Concentration	Particulate	runoff, particulate, 500 to <2000 um
Suspended Sediment Concentration	Particulate	runoff, particulate, 63 to <500 um
Total Suspended Solids	Particulate	runoff
Total Suspended Solids	Particulate	runoff, particulate, 1 to <25 um
Total Suspended Solids	Particulate	runoff, particulate, 25 to <63 um
Total Suspended Solids	Volatile	runoff
Total Suspended Solids and Salts	Total	runoff, <1 um

Blind field replicates, lab replicates (except for Suspended Sediment Concentration), and method blanks were also analyzed in 3 lab batches (the three Total Suspended Solids/Particulate matrices were analyzed in 6 batches). Data were reported not blank corrected.

All samples were analyzed within the specified 7-day holding time listed in the QAPP (BASMAA 2013).

2.6.1.Sensitivity

Sensitivity was generally sufficient, with extensive non-detects (NDs>50%) were reported for Settleable Solids/Particulate/runoff (~90%), Suspended Sediment Concentration/Particulate/runoff, particulate, >2000 um (~82%), and Suspended Sediment Concentration/Particulate/runoff, particulate, 500 to <2000 um (53%). Suspended Sediment Concentration/Particulate/runoff, particulate, 63 to <500 um had ~35% non-detects.

2.6.2.Blanks

TSS, SSC, and Settleable Solids were not found in the blanks at concentrations over the method detection limit (all non-detects).

2.6.3.Recovery

No spiked samples were analyzed/required per the QAPP.

2.6.4.Precision

Lab replicate samples were used to evaluate the precision of the results except for Suspended Sediment Concentration. The average RPDs for the Total Suspended Solids and Total Suspended Solids and Salts were all less than the 25% target MQO (QAPP Table 26-7) as shown in the table below. Settleable Solids with non-detects for all pairs could not be evaluated.

Field replicates (combined with lab replicates) were examined but not used for flagging (no lab replicates were run for SSC so the RPD's shown are for blind field replicates alone), with the average RPDs ranging from 11.72% for Total Suspended Solids/Volatile/runoff to 163% for Suspended Sediment Concentration/Particulate/runoff, particulate, >2000 um.

AnalyteName	RPDlab	RPDfield
Total Suspended Solids/Particulate/runoff, particulate, 25 to <63 um	10.81%	44.15%
Total Suspended Solids and Salts/Total/runoff, <1 um	8.75%	20.20%
Total Suspended Solids/Particulate/runoff	7.68%	13.99%
Total Suspended Solids/Particulate/runoff, particulate, 1 to <25 um	5.78%	28.55%
Total Suspended Solids/Volatile/runoff	4.01%	11.72%
Suspended Sediment Concentration/Particulate/runoff		105.19%
Suspended Sediment Concentration/Particulate/runoff, particulate, 500 to <2000 um		151.72%
Suspended Sediment Concentration/Particulate/runoff, particulate, 63 to <500 um		161.26%
Suspended Sediment Concentration/Particulate/runoff, particulate, >2000 um		163.61%
Settleable Solids/Particulate/runoff	All pairs non-detects	

3. References

BASMAA, 2013. *Quality Assurance Project Plan: Clean Watersheds for a Clean Bay – Implementing the San Francisco Bay’s PCBs and Mercury TMDLs with a Focus on Urban Runoff*, EPA San Francisco Bay Water Quality Improvement Fund Grant # CFDA 66.202. Prepared by Applied Marine Sciences, Inc. August 15, 2013.