

# **Appendix G: Data Quality Assessment**

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# **Appendix G1: Data Quality Summary**

## **APPENDIX G1 – DATA QUALITY SUMMARY FOR CHEMISTRY SAMPLES**

This appendix summarizes the findings of the data quality assessment, which followed the steps outlined in Section 10.0 of the project Quality Assurance Project Plan (QAPP; King County 2016). The data collected for this project were reviewed midway through the project and again when the dataset was complete. This summary describes how well the chemistry data met the general project objectives and the specific data quality objectives, as well as any implications this may have on data usage. Quality of flow data are discussed in Appendix G4. Quality of toxicity test results are discussed in Appendix H3. Quality of water level data from the east and west bioretention facilities is discussed in Appendix J.

### **G1.1 General Project Objectives**

Project objectives were achieved with a few exceptions, which are listed below (see Section 1.1 of the main report for a list of project objectives):

- Flow was measured at each location to both enable flow-weighted sampling and estimate total flow volume per storm at each location. Flow data were of sufficient quality to estimate the beginning, peak and end of most storm events at most locations (see Appendix I), and thus, representative samples were collected from nearly all locations during each event. Flow volume data, however, were typically of lower quality. For most storms, storm volume data (as well as calculated pollutant loads) were flagged as estimates. Loads for the remaining storms were not calculated because flow volume data were rejected. See Appendix G4 for details.
- The project aimed to collect samples during 20 storm events. Eighteen storms were sampled successfully; however, the last two storms could not be sampled due to road construction near the facility (see Appendix A).

### **G1.2 Precision**

Precision is the agreement of a set of results among themselves and is a measure of the ability to reproduce a result. Precision was evaluated through analysis of field replicates, laboratory replicates and matrix spike duplicates according to the control limits specified in the QAPP.

- Section G2 describes a few instances where the King County Environmental Laboratory (KCEL) quality control (QC) results were outside precision control limits specified in the QAPP. The associated sample results were qualified as estimates, but no results were rejected.
- Precision control limits were met for polychlorinated biphenyl (PCB) analysis with the exception of several congeners in two laboratory duplicates. The associated sample results were qualified as estimates by the data validator. However, there were severe discrepancies between results for one of the duplicate/primary pairs (L66937-7). Total PCB concentration in the duplicate sample was more than 14 times higher than in the primary sample; 32 congeners were only detected in the duplicate. The primary sample results for PCBs were much more consistent with

results from other events at this location. PCB results in the primary sample were flagged, but were included in the data analysis. All other PCB laboratory duplicate data indicated excellent precision.

- Table 1 lists the 10 field replicate samples collected for the project, as specified in the QAPP. Results for most replicate pairs were very similar and the relative percent differences (RPDs) between primary and replicate samples were within control limits for laboratory replicates. Table 2 lists the exceptions. No field replicates were analyzed for PCBs.

**Table 1. Collection and analysis of field replicate samples.**

Site	Event	Sample IDs*	Conventional Parameters	Nutrients	Metals	PAHs
EBI	Storm 5	L66540-1 (-8)	X	✓	✓	✓
	Storm 7	L66937-1 (-8)	X	✓	✓	✓
	Storm 8	L67069-1 (-8)	X	✓	✓	✓
	Storm 9	L67141-1 (-8)	✓	✓	✓	✓
	Storm 10	L67231-1 (-8)	X	✓	✓	✓
WBI	Storm 1	L65007-3 (-8)	X	✓	✓	✓
	Storm 3	L66453-3 (-8)	X	X	✓	✓
	Storm 4	L66385-3 (-8)	✓	✓	✓	✓
	Storm 12	L67313-3 (-8)	✓	✓	✓	✓
	Storm 13	L67335-3 (-8)	X	✓	✓	✓

\*Replicate sample IDs in parentheses.

✓ - all results within laboratory replicate control limits

X – some results outside laboratory replicate control limits (Table G1-2).

PAH – polycyclic aromatic hydrocarbons; PCB – polychlorinated biphenyls

**Table 2. Results for field replicate samples that exceeded control limits.**

Parameter	Control Limits	Field Replicate Results Outside Control Limits (RPD)*
Alkalinity	10%	WBI Storm 3 (25%)
Conductivity	10%	EBI Storm 8 (11%) WBI Storm 3 (20%)

Parameter	Control Limits	Field Replicate Results Outside Control Limits (RPD)*
TSS	25%	EBI Storm 5 (31%) EBI Storm 7 (29%)
TOC	20%	EBI Storm 7 (21%) EBI Storm 8 (31%) WBI Storm 13 (22%)
DOC	20%	EBI Storm 8 (39%) EBI Storm 10 (21%) WBI Storm 1 (27%)
Ammonia Nitrogen	20%	WBI Storm 3 (39%)

\*Does not include pairs for which both results are less than the reporting detection limit (RDL), because of inherent analytical variability at lower concentrations.

Comparison of field replicate results to laboratory replicate control limits is a conservative measure of precision, and the slight variations do not indicate significant precision issues; however, the relatively greater difference between PCB results was investigated further.

## G1.3 Bias

Bias is a measure of difference between an analytical result and the true value of an analyte due to a systematic factor. Bias was evaluated through analysis of equipment blanks, method blanks, spike blanks, matrix spikes, certified reference materials (CRM), laboratory control samples and/or surrogates, along with laboratory recovery sample control charts.

- No systematic bias was observed in the KCEL analysis based on method blanks and spiked QC samples. However, there were a few isolated instances of bias which are described in the data validation memo, and some sample results were qualified as estimates with high or low bias. The severity of bias was low and did not indicate results should be rejected.
- Method blank contamination is an expected issue for PCB congener analysis due to the ubiquitous nature of PCBs and the low detection limits required for analysis. However, Pacific Rim Laboratories experienced elevated levels of PCB blank contamination while analyzing several samples for this project. The samples were reanalyzed to address the method blank contamination; however, total PCB results for two method blanks associated with samples analyzed in June and July 2017 were greater than 200 pg/L, which exceeds the acceptable level of bias. As result, the PCB congener results for these samples were flagged as non-detects when detected concentrations were within five times the method blank concentration during the data validation process. This adjustment could result in biased low total PCB results for the samples associated with “dirtier” method blanks. In most cases, samples from a given storm were associated with the same method blank, and thus similarly impacted by any low bias. As such, analysis of treatment effectiveness for PCBs was likely minimally influenced. Total PCBs concentrations for all samples were included in the data analysis presented in the report and in the data summary tables and figures in Appendix H. However, statistical analyses to assess reduction in total PCB concentrations were calculated twice: once with all PCB results and a second analysis that did not include samples impacted by contaminated method blanks

(Appendix E). In both cases, there were statistically significant decreases in total PCBs at each facility (i.e., East Bioretention, West Bioretention, and Wetland Complex). PCB-11 was the most influential contaminant detected in the method blanks when total PCB concentrations were less than 200 pg/L.

- As detailed in Section G3, several laboratory control samples for PCB analysis indicated high bias for at least one congener. This resulted in the need to flag some sample results as estimates in the data validation process; no results were rejected.
- An autosampler equipment blank sample was collected at the East Bioretention inlet (EBI) sample location and analyzed for nutrients, conventional parameters, metals, and PAHs. Concentrations of all parameters were below detection limits, except DOC at 0.55 mg/L. Although DOC concentrations in other samples were similar (4 field sample concentrations were <RDL), 96% of the field sample concentrations were >1.0 mg/L. The slight high bias suggested by the equipment blank results is not expected to negatively impact the results.
- PCB-11 (48 pg/L) was the only congener detected in the autosampler equipment blank sample. PCB-11 was only detected in five project samples and always at concentrations less than 30% of the total PCB concentration. Overall, PCB contamination associated with equipment likely had negligible influence on project findings.

## **G1.4 Sensitivity**

Sensitivity is a measure of the capability of an analytical method to meet the study goal. Detection limits were appropriate to assess differences between influent and effluent concentrations for almost all parameters. There was excellent frequency of detection (FOD) for TSS, nutrients, metals (except cadmium and dissolved lead), and total PCBs. Few PAHs were detected in samples collected from the inlet and outlet of the bioretention facilities (i.e., sites EBI, EBO, WBI, and WBO), limiting analysis of the effectiveness for PAH removal at these facilities. There is greater uncertainty in the statistical results for parameters with less than 100% FOD. Overall, sensitivity was sufficient to address the project objectives with the few exceptions described above.

## **G1.5 Accuracy**

Accuracy is an estimate of the difference between the true and measured values. The accuracy of a result is affected by both systematic and random errors. Accuracy of the analytical results was evaluated using matrix spikes, CRMs and/or laboratory control samples, and ongoing recovery sample control charts. Equipment blanks, method blanks, spiked QC samples, and laboratory control samples can also impact accuracy, but these are discussed under bias (Section G1.3). Accuracy of field measurements were assessed by check standards and end checks, which were all within control limits. Interferences for several bacteria samples affected accuracy of bacteria counts (Section G2). The bacteria results were qualified as estimates, but were not rejected by the data validator.

## **G1.6 Representativeness**

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at the sampling point, or an environmental condition. Sample collection followed established sample handling and holding times required for each analytical test, with a few exceptions: 1) filtration outside the 15 minute holding time limit for orthophosphate and dissolved metals, and 2) non-sterile pumps used to collect some bacteria samples, for which results were flagged as estimates. The equipment blank results demonstrate that equipment decontamination methods were successful.

In addition, representativeness was assessed indirectly in one instance. During Storm 9 on 2/16/2017, the autosampler at the west bioretention outlet (WBO) was affected by backflow in the pipe (Appendix I). The spike in flow caused the autosampler to accelerate sampling and stop before the peak of the hydrograph. When the original sample was retrieved, staff collected a “confirmatory sample” due to a concern that road runoff in the catch basin had contaminated the original composite sample. At the time the confirmatory sample was collected, back flow had subsided but the West Bioretention facility (WB) was still discharging. Concentrations of all parameters were quite similar between the two samples. This suggests there was little to no effect of back flow in the catch basin on the chemistry results. Data from the original sample were used in the summary statistics and statistical analysis.

An assumption of this study was there were minimal inflows from unmeasured sources; however, flow monitoring suggests there are unmeasured inflows to the bioretention facilities, particularly at WB. Flows were higher at WB outlet than at WB inlet during several storm events. The WB also remained saturated during most of the wet season, further indicating that groundwater may have influenced sampling at this site. Under these conditions, groundwater would mix with WB effluent. Samples from the WB outlet are therefore representative of flows from WB, but not necessarily representative of the WB’s effectiveness in treating runoff entering through the WB inlet.

## **G1.7 Comparability**

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Standard collection and analysis methods were followed throughout the project to assure comparability of project data. The QAPP describes how the stormwater treatment evaluated for this project can be compared to stormwater treatment throughout the region (King County 2016) and how facilities evaluated in this study compare to specifications in the 2005 Stormwater Management Manual for Western Washington (Ecology 2005).

## **G1.8 Completeness**

Completeness is defined as the total number of samples analyzed for which acceptable analytical data are generated, compared to the total number of samples submitted for analysis. The QAPP specified a goal of 20 samples per sampling location and 90% acceptable analytical data. Unfortunately, construction at the site necessitated that sampling conclude prematurely. Only 18 storm events were sampled at each location, and of these, volume in a few samples was insufficient for all analyses. Despite these shortcomings, study goals related to water quality improvements and toxicity reduction could still be met.

## **Appendix G References**

Ecology. 2005. Stormwater Management Manual for Western Washington (SWMMWW).  
Publication No. 05-10-33.

King County. 2016. Quality Assurance Project Plan: Effectiveness Monitoring of the South 356th Street Retrofit and Expansion Project, Federal Way, WA. Prepared by Kate Macneale, Water and Land Resources Division. Seattle, Washington.

# **Appendix G2: KCEL Data Validation**



## King County

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# TECHNICAL MEMORANDUM

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March 15, 2018

TO: Kate Macneale, Science and Technical Support Section, Water and Land Resources Division, Department of Natural Resources and Parks

FM: Carly Greyell, Science and Technical Support Section, Water and Land Resources Division, Department of Natural Resources and Parks

RE: Data Validation Report: Federal Way Stormwater Monitoring – SAM Effectiveness Study

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This technical memorandum summarizes the data validation review performed on 226 stormwater samples collected within the South 356th Street Retrofit and Expansion Project in Federal Way between March 9, 2016 and April 23, 2017. These samples included several field replicates and one grab sample that was collected to confirm the representativeness of a composite sample collected with sampling equipment failures (See Appendix G1 of the main report for details). Also included in the data validation are results from equipment blanks including one sample from an autosampler and 19 samples from filters used during processing of dissolved nutrient samples. These were collected between March 9, 2016 and May 8, 2017. The sampling and analysis of these samples are specified in the project Quality Assurance Project Plan (QAPP); *QAPP: Effectiveness Monitoring of the South 356th Street Retrofit and Expansion Project, Federal Way, WA* (King County 2016). Samples were analyzed for one or more of the following analyses: total and dissolved nutrients, total suspended solids (TSS), total and dissolved organic carbon (TOC/DOC), other conventional parameters (e.g., pH, turbidity, conductivity, and alkalinity), fecal coliforms, total and dissolved trace metals, and trace organics, mainly polycyclic aromatic hydrocarbons (PAHs). Table 1-1 provides an inventory of the samples included in this data validation review. All samples were collected and analyses performed by the King County Environmental Laboratory (KCEL).

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 March 2018

**Table 1-1. Sample Inventory**

Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/ DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-EBI	3/9/2016	1	L65007-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/9/2016	1	L65007-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/9/2016	1	L65007-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/9/2016	1	L65007-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/9/2016	1	L65007-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/9/2016	1	L65007-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/9/2016	1	L65007-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-WBI	3/9/2016	1	L65007-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/23/2016	2	L65095-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/23/2016	2	L65095-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/24/2016	2	L65095-3			X	X	X	X	X		
ES	FW-WBO	3/24/2016	2	L65095-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/23/2016	2	L65095-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/23/2016	2	L65095-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/24/2016	2	L65095-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	10/20/2016	3	L66453-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	10/20/2016	3	L66453-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	10/20/2016	3	L66453-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	10/20/2016	3	L66453-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	10/19/2016	3	L66453-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	10/19/2016	3	L66453-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	10/19/2016	3	L66453-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-WBI	10/20/2016	3	L66453-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	10/26/2016	4	L66385-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	10/26/2016	4	L66385-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	10/26/2016	4	L66385-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	10/26/2016	4	L66385-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	10/26/2016	4	L66385-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	10/26/2016	4	L66385-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	10/26/2016	4	L66385-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-WBI	10/26/2016	4	L66385-8	X	X	X	X	X	X	X	X	

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-EBI	10/31/2016	5	L66540-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	10/31/2016	5	L66540-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	10/31/2016	5	L66540-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	10/31/2016	5	L66540-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	10/31/2016	5	L66540-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	10/31/2016	5	L66540-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	11/1/2016	5	L66540-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-EBI	10/31/2016	5	L66540-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	12/19/2016	6	L66811-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	12/19/2016	6	L66811-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	12/19/2016	6	L66811-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	12/19/2016	6	L66811-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	12/19/2016	6	L66811-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	12/19/2016	6	L66811-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	12/19/2016	6	L66811-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	1/17/2017	7	L66937-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	1/17/2017	7	L66937-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	1/17/2017	7	L66937-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	1/17/2017	7	L66937-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	1/17/2017	7	L66937-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	1/17/2017	7	L66937-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	1/17/2017	7	L66937-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-EBI	1/17/2017	7	L66937-8	X	X	X	X	X	X		X	
ES	FW-EBI	2/8/2017	8	L67069-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	2/8/2017	8	L67069-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	2/8/2017	8	L67069-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	2/8/2017	8	L67069-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	2/8/2017	8	L67069-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	2/8/2017	8	L67069-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	2/8/2017	8	L67069-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-EBI	2/8/2017	8	L67069-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	2/15/2017	9	L67141-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	2/15/2017	9	L67141-2	X	X	X	X	X	X	X	X	

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/ DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-WBI	2/15/2017	9	L67141-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	2/15/2017	9	L67141-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	2/15/2017	9	L67141-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	2/15/2017	9	L67141-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	2/15/2017	9	L67141-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-EBI	2/15/2017	9	L67141-8	X	X	X	X	X	X	X	X	
ES-CONF	FW-WBO	2/16/2017	9	L67141-17	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/7/2017	10	L67231-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/7/2017	10	L67231-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/7/2017	10	L67231-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/7/2017	10	L67231-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/7/2017	10	L67231-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/7/2017	10	L67231-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/7/2017	10	L67231-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-EBI	3/7/2017	10	L67231-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/9/2017	11	L67283-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/9/2017	11	L67283-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/9/2017	11	L67283-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/9/2017	11	L67283-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/9/2017	11	L67283-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/9/2017	11	L67283-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/9/2017	11	L67283-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/13/2017	12	L67313-1						X	X		
ES	FW-EBO	3/13/2017	12	L67313-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/13/2017	12	L67313-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/13/2017	12	L67313-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/13/2017	12	L67313-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/13/2017	12	L67313-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/13/2017	12	L67313-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-WBI	3/13/2017	12	L67313-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/14/2017	13	L67335-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/14/2017	13	L67335-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/14/2017	13	L67335-3	X	X	X	X	X	X	X	X	

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/ DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-WBO	3/14/2017	13	L67335-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/14/2017	13	L67335-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/14/2017	13	L67335-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/14/2017	13	L67335-7	X	X	X	X	X	X	X	X	
ES-FREP	FW-WBI	3/14/2017	13	L67335-8	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/26/2017	14	L67398-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/26/2017	14	L67398-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/26/2017	14	L67398-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/26/2017	14	L67398-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/26/2017	14	L67398-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/26/2017	14	L67398-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/26/2017	14	L67398-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/29/2017	15	L67443-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	3/29/2017	15	L67443-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	3/29/2017	15	L67443-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	3/29/2017	15	L67443-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	3/29/2017	15	L67443-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	3/29/2017	15	L67443-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	3/29/2017	15	L67443-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	4/5/2017	16	L67499-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	4/5/2017	16	L67499-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	4/5/2017	16	L67499-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	4/5/2017	16	L67499-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	4/5/2017	16	L67499-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	4/5/2017	16	L67499-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	4/5/2017	16	L67499-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	4/19/2017	17	L67594-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	4/19/2017	17	L67594-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	4/19/2017	17	L67594-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	4/19/2017	17	L67594-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	4/19/2017	17	L67594-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	4/19/2017	17	L67594-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	4/19/2017	17	L67594-7	X	X	X	X	X	X	X	X	

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-EBI	4/23/2017	18	L67617-1	X	X	X	X	X	X	X	X	
ES	FW-EBO	4/23/2017	18	L67617-2	X	X	X	X	X	X	X	X	
ES	FW-WBI	4/23/2017	18	L67617-3	X	X	X	X	X	X	X	X	
ES	FW-WBO	4/23/2017	18	L67617-4	X	X	X	X	X	X	X	X	
ES	FW-WPCI	4/23/2017	18	L67617-5	X	X	X	X	X	X	X	X	
ES	FW-WPCEPO	4/23/2017	18	L67617-6	X	X	X	X	X	X	X	X	
ES	FW-NFWHC	4/23/2017	18	L67617-7	X	X	X	X	X	X	X	X	
ES	FW-EBI	3/9/2016	1	L65007-9									X
ES	FW-EBO	3/9/2016	1	L65007-10									X
ES	FW-WBI	3/9/2016	1	L65007-11									X
ES	FW-WBO	3/9/2016	1	L65007-12									X
ES	FW-WPCI	3/9/2016	1	L65007-13									X
ES	FW-WPCEPO	3/9/2016	1	L65007-14									X
ES	FW-NFWHC	3/9/2016	1	L65007-15									X
ES	FW-EBI	10/20/2016	3	L66453-9									X
ES	FW-EBO	10/20/2016	3	L66453-10									X
ES	FW-WBI	10/20/2016	3	L66453-11									X
ES	FW-WBO	10/20/2016	3	L66453-12									X
ES	FW-WPCI	10/20/2016	3	L66453-13									X
ES	FW-WPCEPO	10/20/2016	3	L66453-14									X
ES	FW-NFWHC	10/20/2016	3	L66453-15									X
ES	FW-EBI	11/1/2016	5	L66540-9									X
ES	FW-EBO	11/1/2016	5	L66540-10									X
ES	FW-WBI	11/1/2016	5	L66540-11									X
ES	FW-WBO	11/1/2016	5	L66540-12									X
ES	FW-WPCI	11/1/2016	5	L66540-13									X
ES	FW-WPCEPO	11/1/2016	5	L66540-14									X
ES	FW-NFWHC	11/1/2016	5	L66540-15									X
ES	FW-EBI	1/18/2017	7	L66937-9									X
ES	FW-EBO	1/18/2017	7	L66937-10									X
ES	FW-WBI	1/18/2017	7	L66937-11									X
ES	FW-WBO	1/18/2017	7	L66937-12									X
ES	FW-WPCI	1/18/2017	7	L66937-13									X

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-WPCEPO	1/18/2017	7	L66937-14									X
ES	FW-NFWHC	1/18/2017	7	L66937-15									X
ES	FW-EBI	2/9/2017	8	L67069-9									X
ES	FW-EBO	2/9/2017	8	L67069-10									X
ES	FW-WBI	2/9/2017	8	L67069-11									X
ES	FW-WBO	2/9/2017	8	L67069-12									X
ES	FW-WPCI	2/9/2017	8	L67069-13									X
ES	FW-WPCEPO	2/9/2017	8	L67069-14									X
ES	FW-NFWHC	2/9/2017	8	L67069-15									X
ES	FW-EBI	2/16/2017	9	L67141-9									X
ES	FW-EBO	2/16/2017	9	L67141-10									X
ES	FW-WBI	2/16/2017	9	L67141-11									X
ES	FW-WBO	2/16/2017	9	L67141-12									X
ES	FW-WPCI	2/16/2017	9	L67141-13									X
ES	FW-WPCEPO	2/16/2017	9	L67141-14									X
ES	FW-NFWHC	2/16/2017	9	L67141-15									X
ES	FW-EBI	3/7/2017	10	L67231-9									X
ES	FW-EBO	3/7/2017	10	L67231-10									X
ES	FW-WBI	3/7/2017	10	L67231-11									X
ES	FW-WBO	3/7/2017	10	L67231-12									X
ES	FW-WPCI	3/7/2017	10	L67231-13									X
ES	FW-WPCEPO	3/7/2017	10	L67231-14									X
ES	FW-NFWHC	3/7/2017	10	L67231-15									X
ES	FW-EBI	3/9/2017	11	L67283-9									X
ES	FW-EBO	3/9/2017	11	L67283-10									X
ES	FW-WBI	3/9/2017	11	L67283-11									X
ES	FW-WBO	3/9/2017	11	L67283-12									X
ES	FW-WPCI	3/9/2017	11	L67283-13									X
ES	FW-WPCEPO	3/9/2017	11	L67283-14									X
ES	FW-NFWHC	3/9/2017	11	L67283-15									X
ES	FW-EBI	3/13/2017	12	L67313-9									X
ES	FW-EBO	3/13/2017	12	L67313-10									X
ES	FW-WBI	3/13/2017	12	L67313-11									X

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Sample Type	Locator	Collect Date	Storm #	Sample ID	Other Conv.	Total Nutrients	Dissolved Nutrients	TOC/DOC	TSS	Total Metals	Dissolved Metals	Organics	Fecal Coliform
ES	FW-WBO	3/13/2017	12	L67313-12									X
ES	FW-WPCI	3/13/2017	12	L67313-13									X
ES	FW-WPCEPO	3/13/2017	12	L67313-14									X
ES	FW-NFWHC	3/13/2017	12	L67313-15									X
ES	FW-EBI	3/15/2017	13	L67335-9									X
ES	FW-EBO	3/15/2017	13	L67335-10									X
ES	FW-WBI	3/15/2017	13	L67335-11									X
ES	FW-WBO	3/15/2017	13	L67335-12									X
ES	FW-WPCI	3/15/2017	13	L67335-13									X
ES	FW-WPCEPO	3/15/2017	13	L67335-14									X
ES	FW-NFWHC	3/15/2017	13	L67335-15									X
FFB	FFBLANK	3/10/2016	1	L65007-16			X						
FFB	FFBLANK	10/20/2016	3	L66453-16			X						
FFB	FFBLANK	10/27/2016	4	L66385-16			X						
FFB	FFBLANK	11/1/2016	5	L66540-16			X						
FFB	FFBLANK	12/20/2016	6	L66811-8			X						
FFB	FFBLANK	1/18/2017	7	L66937-16			X						
FFB	FFBLANK	2/9/2017	8	L67069-16			X						
FFB	FFBLANK	2/16/2017	9	L67141-16			X						
FFB	FFBLANK	3/8/2017	10	L67231-16			X						
FFB	FFBLANK	3/10/2017	11	L67283-16			X						
FFB	FFBLANK	3/14/2017	12	L67313-16			X						
FFB	FFBLANK	3/16/2017	13	L67335-16			X						
FFB	FFBLANK	3/27/2017	14	L67398-16			X						
FFB	FFBLANK	3/30/2017	15	L67443-8			X						
FFB	FFBLANK	4/6/2017	16	L67499-8			X						
FFB	FFBLANK	4/20/2017	17	L67594-8			X						
FFB	FFBLANK	4/24/2017	18	L67617-8			X						
FFB	FFBLANK	5/8/2017	Blank	L67724-2			X						
EB	EQUIPBLANK	5/8/2017	Blank	L67724-1	X	X	X	X	X	X	X	X	

ES – environmental sample; EB – equipment blanks; FFB – field filter blanks; ES-FREP – field replicate, environmental sample; ES-CONF – confirmatory sample  
 X – analysis of full parameter list (QAPP); A – analysis of alkalinity only

## 1.0 INTRODUCTION

This data validation review was based, in part, on guidance in *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA 2016a) and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (EPA 2016b), as well as the project QAPP (King County 2016). Materials reviewed included Batch Reports and Analytical Quality Control (QC) Reports downloaded from the King County Laboratory Information Management System (LIMS) database and are available upon request. Also reviewed were data anomaly forms (DAF), which are available upon request. The QC parameters reviewed during this data validation include: holding time, method blanks, spike blanks, laboratory control samples, matrix spikes, matrix spike duplicates, laboratory duplicates, and surrogates, all of which are described below. Microbiology analyses include unique QC samples, which are described in Section 1.10.

### 1.1. Holding Time (HT)

The analytical HT is a method-specific timeframe, during which sample preparation and analysis should occur to provide valid data. All samples should be analyzed within this prescribed HT. For composite samples, the end of the composite period is considered the start of the HT period.

### 1.2. Method Blank (MB)

A MB is an aliquot of clean reference matrix that is typically processed through the entire analytical procedure. The MB is used to evaluate the levels of contamination that might be associated with the processing and analysis of samples. All MB results should be less than method detection limits (MDLs) or the quantitation limit (QL).

### 1.3. Spike Blank (SB)

A SB is an aliquot of the clean reference matrix used for the MB, to which a known concentration of target analyte(s) has been added. The SB is processed through the entire analytical procedure, and used as an indicator of method accuracy. SBs are not addressed in the *National Functional Guidelines*; however, King County has empirically-derived control limits for SB analytes, which are in QC reports that are available upon request. SB results should be within these control limits.

### 1.4. Spike Blank Duplicate (SBD)

A SBD is a second aliquot of the clean reference matrix used for the MB, to which a known concentration of target analyte(s) has been added. The SBD is used as an additional indicator of method accuracy as well as an indicator of method precision. The relative percent difference (RPD) between SB and SBD results should be within QAPP-specified control limits.

### 1.5. Matrix Spike (MS)

A MS is a sample aliquot fortified with a known concentration of a target analyte(s). The MS is processed through the entire analytical procedure. The MS is used as an indicator of sample matrix effect on the recovery of target analyte(s). The *National Functional Guidelines* specifies

control limits of 75% to 125% MS recoveries for trace metals (EPA 2016b). For all other analytes, King County has empirically-derived control limits, which are shown in QC reports that are available upon request. MS recoveries should be within these control limits.

#### **1.6. Matrix Spike Duplicate (MSD)**

A MSD is a second sample aliquot fortified with a known concentration of a target analyte(s). The MSD is used as an additional indicator of sample matrix effect on the recovery of target analyte(s) as well as an indicator of method precision. The relative percent difference (RPD) between MS and MSD results should be within QAPP-specified control limits.

#### **1.7. Laboratory Control Sample (LCS)**

A LCS is a sample of known analyte concentration(s) that is prepared in the lab from a separate source of analyte(s) relative to the calibration standards. The LCS analysis follows the entire analytical process and is stored and prepared following the same procedures as a field sample. The LCS is used as an indicator of method accuracy and long-term analytical precision. King County uses QAPP-specified percent recovery control limits, which are shown in QC reports that are available upon request. Percent recoveries for LCS results should be within these control limits.

#### **1.8. Laboratory Duplicate (LD)**

A LD is a second aliquot of a sample, processed concurrently and in an identical manner with the original sample. The LD is used as an indicator of method precision and laboratory subsampling procedures. The LD can also be used to provide information regarding the homogeneity of the sample matrix. QC results are reported as an RPD between the sample and LD results. The RPD between all trace metal LD results should be within 20% (EPA 2016b). QAPP-specified control limits are used for all other analytes. LD RPD results will not be qualified for samples in which the concentration is less than the reporting detection limit (RDL) or less than the QL, because of the inherent analytical variability at these concentrations, which are lower than the limit of practical quantitation.

#### **1.9. Surrogates**

A surrogate is a known concentration of non-target analyte which is added to each sample (both analytical and QC samples) prior to extraction and analysis for all trace organic analyses. Surrogate recovery is used as a sample-specific indication of method or matrix bias for target analytes. The surrogate is selected to behave in a similar manner to the target analytes. All surrogates and their control limits are listed in the QC report in Appendix A.

#### **1.10. Microbiology-Specific QC Samples**

A negative control sample is media streaked with a non-target organism and analyzed through the complete procedure. The negative control is expected to show no detectable target organisms thereby evaluating the specificity of the method.

A positive control is a QC sample prepared or obtained by the lab which is known or expected to yield a positive response. A positive control can be either a sample of contaminated water or media streaked with the target organism, which is analyzed through the complete procedure.

A “before membrane filtration blank” is an aliquot of sterile diluent added to challenge the testing apparatus and conditions prior to membrane filtration of samples. The before filtration blank is analyzed to evaluate the sterility of the materials, equipment and work area at the beginning of sample analysis.

An “after membrane filtration blank” is an aliquot of sterile diluent added to challenge the testing apparatus and conditions after membrane filtration of samples. The after filtration blank is analyzed to evaluate cross-contamination during sample analysis.

### 1.11. Validation Reporting

The following sections describe the data validation actions for each analyte group. This includes a table listing the HT and QC samples reviewed during the validation in each workgroup, a description of each result outside control limits, and the recommended actions for data validation. Any additional data quality issues are also discussed. Table A at the end of this memorandum lists all recommended validation qualifiers based on this review.

## 2.0 CONVENTIONALS

Conventional analytes included conductivity, alkalinity, pH, turbidity, TSS, TOC/DOC, and total and dissolved nutrients.

### 2.1. Conductivity

Conductivity was analyzed following Standard Method SM2510-B (APHA 1998) for 136 samples batched as 19 workgroups (Table 2-1). Each workgroup included analysis of two QC sample-types: LCS and LD. Results indicate acceptable data quality for all project samples (Table 2-1).

**Table 2-1. Conductivity Workgroups and QC Samples**

Workgroup	Samples	HT	LCS	LD
WG144854	L65007-1 through -8	✓	✓	✓
WG145203	L65095-1, -2, -4 through -7	✓	✓	✓
WG148770	L66385-1 through -8	✓	✓	✓
WG148642	L66453-1 through -8	✓	✓	✓
WG148816	L66540-1 through -8	✓	✓	✓
WG149618	L66811-1 through -7	✓	✓	✓
WG149930	L66937-1 through -8	✓	✓	✓
WG150224	L67069-1 through -8	✓	✓	✓
WG150340	L67141-1 through -8, -17	✓	✓	✓
WG150606	L67231-1 through -8	✓	✓	✓
WG150639	L67283-1 through -7	✓	✓	✓
WG150766	L67313-2 through -8	✓	✓	✓
WG150789	L67335-1 through -8	✓	✓	✓
WG150998	L67398-1 through -7	✓	✓	✓

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Workgroup	Samples	HT	LCS	LD
WG151030	L67443-1 through -7	✓	✓	✓
WG151168	L67499-1 through -7	✓	✓	✓
WG151426	L67594-1 through -7	✓	✓	✓
WG151481	L67617-1 through -7	✓	✓	✓
WG151823	L67724-1	✓	✓	✓
<b>Control Limits:</b>		28 days	90-110% Recovery	10% RPD

✓ – meets control limits

## 2.2. Alkalinity

Alkalinity was analyzed following Standard Method SM2320-B (APHA 1998) for 136 samples batched as 19 workgroups (Table 2-2). Each workgroup included analysis of two QC sample-types: LCS and LD. Results indicate acceptable data quality for all project samples (Table 2-2).

**Table 2-2. Alkalinity Workgroups and QC Samples**

Workgroup	Samples	HT	LCS	LD
WG144963	L65007-1 through -8	✓	✓	✓
WG145195	L65095-1, -2, -4 through -7	✓	✓	✓
WG148770	L66385-1 through -8	✓	✓	✓
WG148642	L66453-1 through -8	✓	✓	✓
WG148816	L66540-1 through -8	✓	✓	✓
WG149561	L66811-1 through -7	✓	✓	✓
WG149930	L66937-1 through -8	✓	✓	✓
WG150212	L67069-1 through -8	✓	✓	✓
WG150340	L67141-1 through -8, -17	✓	✓	✓
WG150606	L67231-1 through -8	✓	✓	✓
WG150639	L67283-1 through -7	✓	✓	✓
WG150766	L67313-2 through -8	✓	✓	✓
WG150789	L67335-1 through -8	✓	✓	✓
WG150998	L67398-1 through -7	✓	✓	✓
WG151030	L67443-1 through -7	✓	✓	✓
WG151168	L67499-1 through -7	✓	✓	✓
WG151426	L67594-1 through -7	✓	✓	✓
WG151481	L67617-1 through -7	✓	✓	✓
WG151823	L67724-1	✓	✓	✓
<b>Control Limits:</b>		14 days	85-115% Recovery	10% RPD

✓ – meets control limits

## 2.3. pH

pH was analyzed following Standard Method SM4500-H-B (APHA 1998) for 136 samples batched as 19 workgroups (Table 2-3). Each workgroup included analysis of two QC sample-types: LCS and LD. Results indicate some data quality issues for all project samples (Table 2-3 and Section 2.3.1). Table A lists all recommended data qualifications.

**Table 2-3. pH Workgroups and QC Samples**

Workgroup	Samples	HT	LCS	LD
WG144925	L65007-1 through -8	X	✓	✓
WG145128	L65095-1, -2, -4 through -7	X	✓	✓
WG148745	L66385-1 through -8	X	✓	✓
WG148622	L66453-1 through -8	X	✓	✓
WG148889	L66540-1 through -8	X	✓	✓
WG149561	L66811-1 through -7	X	✓	✓
WG149906	L66937-1 through -8	X	✓	✓
WG150178	L67069-1 through -8	X	✓	✓
WG150301	L67141-1 through -8, -17	X	✓	✓
WG150606	L67231-1 through -8	X	✓	✓
WG150639	L67283-1 through -7	X	✓	✓
WG150765	L67313-2 through -8	X	✓	✓
WG150789	L67335-1 through -8	X	✓	✓
WG150969	L67398-1 through -7	X	✓	✓
WG151030	L67443-1 through -7	X	✓	✓
WG151168	L67499-1 through -7	X	✓	✓
WG151426	L67594-1 through -7	X	✓	✓
WG151481	L67617-1 through -7	X	✓	✓
WG151995	L67724-1	X	✓	X
<b>Control Limits:</b>		15 minutes	98 - 102% Recovery	±0.2 unit Difference

✓ – meets control limits; X – outside control limits

### 2.3.1. Results Outside Control Limits

Holding time: all samples were analyzed for pH outside the prescribed 15-minute holding time. pH is usually measured in the field to meet this short holding time, but for this project, pH was measured after the samples were delivered to the lab. As a result, all pH results should be qualified with “J” flags and considered estimates with unknown bias.

Workgroup WG151995: The laboratory duplicate result associated with this workgroup was more than the QC limit of 0.2 pH units from the primary sample result (L67724-1). This sample was an equipment blank for the project, and so it is possible the low ionic strength of the sample resulted in greater than expected variability. The pH result in this sample should be qualified with a “J” flag and considered estimated with unknown bias.

### 2.4. Turbidity

Turbidity was analyzed following Standard Method SM2130-B (APHA 1998) for 136 samples batched as 19 workgroups (Table 2-4). Each workgroup included analysis of two QC sample-types: LCS and LD. Results indicate acceptable data quality for all project samples with the exception of one holding time exceedance (Table 2-4 and Section 2.4.1).

**Table 2-4. Turbidity Workgroups and QC Samples**

Workgroup	Samples	HT	LCS	LD
WG144877	L65007-1 through -8	✓	✓	✓
WG145129	L65095-1, -2, -4 through -7	✓	✓	✓

Workgroup	Samples	HT	LCS	LD
WG148705	L66385-1 through -8	✓	✓	✓
WG148548	L66453-1 through -8	✓	✓	✓
WG148772	L66540-1 through -8	✓	✓	✓
WG149594	L66811-1 through -7	X	✓	✓
WG149855	L66937-1 through -8	✓	✓	✓
WG150205	L67069-1 through -8	✓	✓	✓
WG150229	L67141-1 through -8, -17	✓	✓	✓
WG150592	L67231-1 through -8; L67283-1 through -7	✓	✓	✓
WG150640	L67313-2 through -8; L67335-1 through -8	✓	✓	✓
WG150971	L67398-1 through -7; L67443-1 through -7	✓	✓	✓
WG151103	L67499-1 through -7	✓	✓	✓
WG151424	L67594-1 through -7	✓	✓	✓
WG151451	L67617-1 through -7	✓	✓	✓
WG151694	L67724-1	✓	✓	✓
<b>Control Limits:</b>		2 days	90-110% Recovery	25% RPD

✓ – meets control limits; X – outside control limits

#### 2.4.1. Results Outside Control Limits

Samples in workgroup WG149594 were analyzed for turbidity one day outside the holding time, and so all turbidity results in these samples should be qualified with “J” flags and considered estimates with unknown bias.

#### 2.4.2. Other QC Information

Turbidity laboratory control samples should be run at two concentrations, 10 NTU and 100 NTU for each workgroup. However, in two workgroups (WG144877 and WG148548), only the 10 NTU laboratory control samples were analyzed due to analyst error. The sample results in these workgroups ranged from 2 to 21, and so the 10 NTU laboratory control sample is much closer to the environmental sample results and should be sufficient to evaluate accuracy. All recoveries in the laboratory control samples associated with all workgroups were within the 90 to 110% QC limits and can be used without qualification based on the laboratory control sample results.

### 2.5. Total Suspended Solids

TSS was analyzed following Standard Method SM2540-D (APHA 1998) for 139 samples batched as 19 workgroups (Table 2-5). Each workgroup included analysis of three QC sample-types: MB, LCS, and LD. Results indicate acceptable data quality for all project samples (Table 2-5).

**Table 2-5. TSS Workgroups and QC Samples**

Workgroup	Samples	HT	MB	LCS	LD
WG144865	L65007-1 through -8	✓	✓	✓	✓
WG145140	L65095-1 through -7	✓	✓	✓	✓
WG148748	L66385-1 through -8	✓	✓	✓	✓

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Workgroup	Samples	HT	MB	LCS	LD
WG148582	L66453-1 through -8	✓	✓	✓	✓
WG148800	L66540-1 through -8	✓	✓	✓	✓
WG149578	L66811-1 through -7	✓	✓	✓	✓
WG149840	L66937-1 through -8	✓	✓	✓	✓
WG150226	L67069-1 through -8	✓	✓	✓	✓
WG150384	L67141-1 through -8, -17	✓	✓	✓	✓
WG150611	L67231-1 through -8	✓	✓	✓	✓
WG150665	L67283-1 through -7	✓	✓	✓	✓
WG150742	L67313-2 through -8	✓	✓	✓	✓
WG150845	L67335-1 through -8	✓	✓	✓	✓
WG150975	L67398-1 through -7	✓	✓	✓	✓
WG151018	L67443-1 through -7	✓	✓	✓	✓
WG151140	L67499-1 through -7	✓	✓	✓	✓
WG151431	L67594-1 through -7	✓	✓	✓	✓
WG151458	L67617-1 through -7	✓	✓	✓	✓
WG151784	L67724-1	✓	✓	✓	✓
<b>Control Limits:</b>		7 days	<MDL	80-120% Recovery	25% RPD

✓ – meets control limits

## 2.6. Total and Dissolved Organic Carbon

TOC and DOC were analyzed following Standard Method SM5310-B (APHA 1998), which is a high-temperature combustion/infrared detection method. 137 samples were batched as 25 workgroups (Table 2-6). Each workgroup included analysis of five QC sample-types: MB, SB, LCS, MS, and LD. Results indicate acceptable data quality for all project samples, with a few exceptions (Table 2-6 and Section 2.6.1). Table A lists all recommended data qualifications.

**Table 2-6. TOC/DOC Workgroups and QC Samples**

Workgroup	Samples	HT	MB	SB	LCS	MS	LD
WG144901	L65007-1 through -8 (DOC)	✓	✓	✓	✓	✓	✓
WG145250	L65007-1 through -8 (TOC); L65095-1 through -7 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG148655	L66453-1 through -8 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG148873	L66385-1, -2, -3, -5 through -8 (TOC); L66540-1, -2, -3, -5 through -8 (TOC)	✓	✓	✓	✓	✓	✓
WG148983	L66385-4 (TOC); L66540-4 (TOC)	✓	✓	✓	✓	✓	✓
WG149032	L66385-1 through -8 (DOC); L66540-1, -2, -4 through -8 (DOC)	✓	✓	✓	✓	✓	✓
WG149205	L66540-3 (DOC)	✓	✓	✓	✓	✓	✓
WG149695	L66811-1 through -7 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG149959	L66937-1 through -8 (TOC)	✓	✓	✓	✓	✓	✓
WG150134	L66937-1 through -8 (DOC)	✓	✓	✓	✓	✓	✓
WG150290	L67069-1 through -8 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG150461	L67141-1 through -8, -17 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG150962	L67231-1 through -8 (TOC); L67335-2 through -8 (TOC)	✓	✓	✓	✓	✓	✓
WG150957	L67283-1 through -7 (TOC); L67313-2 through -8 (TOC)	✓	✓	✓	✓	✓	✓

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Workgroup	Samples	HT	MB	SB	LCS	MS	LD
WG151028	L67231-1 through -8 (DOC); L67283-1 through -7 (DOC); L67313-2 through -6 (DOC)	✓	✓	✓	✓	✓	✓
WG151031	L67398-1 through -7 (TOC)	✓	✓	✓	✓	✓	✓
WG151122	L67313-7 and -8 (DOC); L67335-2 through -8 (DOC); L67398-1 through -7 (DOC)	✓	✓	✓	✓	✓	✓
WG151181	L67335-1 (TOC/DOC)	✓	✓	✓	✓	✓	✓
WG151433	L67443-1, -3 through -7 (TOC); L67499-1 through -7 (TOC)	✓	✓	✓	✓	✓	✓
WG151506	L67594-1 through -7 (TOC); L67617-1 through -7 (TOC)	✓	✓	✓	✓	✓	✓
WG151507	L67594-1 through -7 (DOC); L67617-1 through -7 (DOC)	✓	✓	✓	✓	✓	✓
WG151508	L67443-2 (TOC/DOC);	✓	✓	✓	✓	✓	✓
WG151556	L67443-1, -3 through -7 (DOC); L67499-1 through -7 (DOC)	✓	✓	✓	✓	✓	✓
WG151692	L67724-1 (TOC)	✓	✓	✓	✓	✓	✓
WG151870	L67724-1 (DOC)	✓	✓	✓	✓	✓	✓
<b>Control Limits:</b>		28 days	<MDL	80-120% Recovery	85-115% Recovery	75-125% Recovery	20% RPD

✓ – project-specific samples meet control limits

### 2.6.1. Other QC Issues

Several samples had DOC results that were greater than the TOC result (L67283-1, L67283-3, and L67443-3). Reanalysis confirmed the original results. For sample L67283-1, the TOC and DOC results were relatively similar (i.e., <20% RPD). One possible explanation for this sample is that most of the TOC may be DOC and analytical and field variability resulted in slightly higher DOC results. These results may be used without qualification. However, the RPDs between DOC and TOC results in samples L67283-3 and L67443-3 were greater than 20%, indicating unacceptable levels of variability. DOC and TOC results for these samples were qualified with “J” flags and considered estimates with unknown bias.

Sample L67335-5 was not preserved at pH 2 until it was logged into the laboratory later on the day of collection. The sample aliquot was not preserved correctly for a relatively short window of time (<24 hours). The TOC and DOC results are not expected to be substantially affected. The results may be used without qualification.

### 2.7. Total Nutrients

Total nitrogen and total phosphorus were analyzed following Standard Methods SM4500-N-C and SM4500-P-B,F (APHA 1998), respectively, for 136 samples batched as 18 workgroups (Table 2-7). The QAPP specified each workgroup should include analysis of five QC sample-types for each analyte: MB, SB, MS, LCS, and LD. Results indicate acceptable data quality for all project samples (Table 2.7).

**Table 2-7. Total Nitrogen and Total Phosphorus Workgroups and QC Assessment**

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Workgroup	Samples	Analysis	HT	MB	SB	MS	LCS	LD
WG144930	L65007-1 through -8	TN	✓	✓	✓	✓	✓	✓
	L65007-1, -2, -3, -5 through -8	TP	✓	✓	✓	✓	✓	✓
WG144998	L65007-4	TP	✓	✓	✓	✓	✓	✓
WG145150	L65095-1, -2, -4 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG148580	L66453-1 through -8	TN, TP	✓	✓	✓	✓	✓	✓
WG148823	L66385-1 through -8; L66540-1 through -8	TN, TP	✓	✓	✓	✓	✓	✓
WG149628	L66811-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG149845	L66937-1 through -8	TN, TP	✓	✓	✓	✓	✓	✓
WG150174	L67069-1 through -8	TN, TP	✓	✓	✓	✓	✓	✓
WG150306	L67141-1 through -8, and -17	TN, TP	✓	✓	✓	✓	✓	✓
WG150689	L67231-1 through -8; L67283-1 through -7	TN	✓	✓	✓	✓	✓	✓
	L67231-1, -2, -3, -5 through -8; L67283-1 through -7	TP	✓	✓	✓	✓	✓	✓
WG150720	L67313-2 through -8	TN, TP	✓	✓	✓	✓	✓	✓
WG150782	L67335-1 through -8	TN	✓	✓	✓	✓	✓	✓
	L67231-4; L67335-1 through -8	TP	✓	✓	✓	✓	✓	✓
WG150972	L67398-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG151120	L67443-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG151134	L67499-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG151402	L67594-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG151478	L67617-1 through -7	TN, TP	✓	✓	✓	✓	✓	✓
WG151712	L67724-1	TN, TP	✓	✓	✓	✓	✓	✓
<b>Control Limits:</b>			28 days	<MDL	80-120% Recovery	75-125% Recovery	85-115% Recovery	20% RPD

✓ – meets control limits

## 2.8. Dissolved Nutrients

Nitrogen was analyzed as ammonia following Kerouel & Aminot (1997), as nitrite/nitrate following Standard Methods SM4500-NO3-F (APHA 1998) and phosphorus as orthophosphate following SM4500-P-F (APHA 1998). 155 samples were analyzed batched as 21 workgroups (Table 2-7). The QAPP specified each workgroup should include analysis of five QC sample-types for each analyte: MB, SB, MS, LCS, and LD. Results indicate acceptable data quality for all project samples, except for sample handling issues impacting orthophosphate phosphorus results (Table 2-8 and Section 2.8.1). Table A lists all recommended data qualifications.

**Table 2-8. Dissolved Nutrients Workgroups and QC Assessment**

Workgroup	Samples	Analysis	HT	MB	SB	MS	LCS	LD
WG144881	L65007-1 through -8, and -16	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG145131	L65095-1 through -7	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG148650	L66453-1 through -8, and -16	NH3, NO23,	X	✓	✓	✓	✓	✓

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Workgroup	Samples	Analysis	HT	MB	SB	MS	LCS	LD
		OP						
WG148709	L66540-1 through -8, and -16	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG148713	L66385-1 through -8, and -16	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG149575	L66811-1 through -8	NH3, NO23	✓	✓	✓	✓	✓	✓
	L66811-1, -2, -3, -5 through -8	OP	X	✓	✓	✓	✓	✓
WG149582	L66811-4	OP	X	✓	✓	✓	✓	✓
WG149912	L66937-1 through -8, and -16	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG150208	L67069-1 through -8, and -16	NO23, OP	X	✓	✓	✓	✓	✓
WG150256	L67069-1 through -8, and -16	NH3	✓	✓	✓	✓	✓	✓
WG150439	L67141-1 through -8, -16, and -17	NH3, NO23	✓	✓	✓	✓	✓	✓
WG150471	L67141-1 through -8, -16, and -17	OP	X	✓	✓	✓	✓	✓
WG150613	L67231-1 through -8, and -16	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG150774	L67283-1 through -7, and -16; L67313-2 through -8, and -16	NH3	✓	✓	✓	✓	✓	✓
	L67283-1, -2, -3, -5, and -16; L67313-2, -3, -5 through -8, and -16	NO23	✓	✓	✓	✓	✓	✓
WG150821	L67283-1 through -7, and -16; L67313-2 through -8, and -16; L67335-1 through -8, and -16	OP	X	✓	✓	✓	✓	✓
	L67283-6 and -7	NO23	✓	✓	✓	✓	✓	✓
WG150892	L67283-4 and L67313-4	NO23	✓	✓	✓	✓	✓	✓
WG150938	L67335-1 through -8, and -16	NH3; NO23	✓	✓	✓	✓	✓	✓
WG150997	L67398-1 through -7, and -16; L67443-1 through -8	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG151139	L67499-1 through -8	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG151474	L67594-1 through -8; L67617-1 through -8	NH3, NO23, OP	X	✓	✓	✓	✓	✓
WG151744	L67724-1 and -2	NH3, NO23, OP	X	✓	✓	✓	✓	✓
		<b>Control Limits:</b>	14 days	<MDL	80-120% Recovery	75-125% Recovery	85-115% Recovery	20% RPD

✓ – meets control limits; X – outside control limits

### 2.8.1. Results Outside Control Limits

All orthophosphate phosphorus samples were filtered outside of 15-minutes as specified in the method. All detected results should be qualified with “J” flags and considered estimates with unknown bias. All non-detect results should be qualified with “UJ” flags and considered estimated non-detects with unknown bias.

## 3.0 TRACE METALS

Trace metals analysis, as specified in the QAPP, included total and dissolved cadmium, copper, lead and zinc. Hardness as CaCO<sub>3</sub> was analyzed in all workgroups.

### 3.1. Total ICP-MS Metals and Hardness

Total metals were analyzed by inductively coupled plasma mass spectroscopy (ICP-MS) following EPA Method 200.8 (EPA 1995) for 138 samples batched as 15 workgroups (Table 3-1). The QAPP specified that each workgroup include four QC sample-types: MB, LCS, MS, and LD. However, all workgroups included SB instead of LCS. Since both can be used to assess method accuracy, the SB results are sufficient to complete the data quality review. Results indicate acceptable data quality for all project samples (Table 3-1 and Section 3.1.1).

**Table 3-1. Total ICP-MS and Hardness Workgroups and QC Samples**

Workgroup	Samples	HT	MB	SB	MS	LD
WG145262	L65007-1 through -8	✓	✓	✓	✓	✓
WG145370	L65095-1 through -7	✓	✓	✓	✓	✓
WG148782	L66385-1 through -4; L66453-1 through -8	✓	✓	✓	✓	✓
WG148827	L66385-5 through -8	✓	✓	✓	✓	✓
WG148998	L66540-1 through -8	✓	✓	✓	✓	✓
WG149765	L66811-1 through -7	✓	✓	✓	✓	✓
WG150180	L66937-1 through -8	✓	✓	✓	✓	✓
WG150452	L67069-1 through -8	✓	✓	✓	✓	✓
WG150719	L67141-1 through -8, -17	✓	✓	✓	✓	✓
WG151093	L67231-1 through -8; L67283-1 through -7; L67313-1 through -5	✓	✓	✓	✓	✓
WG151154	L67313-6 through -8; L67335-1 through -8	✓	✓	✓	✓	✓
WG151216	L67398-1 through -7; L67443-1 through -5; L67499-1 through -7	✓	✓	✓	✓	✓
WG151662	L67443-6 through -7	✓	✓	✓	✓	✓
WG151944	L67594-1 through -7	✓	✓	✓	✓	✓
WG152049	L67617-1 through -7; L67724-1	✓	✓	✓	✓	✓
<b>Control Limits:</b>		6 months	<MDL	85-115% Recovery	75-125% Recovery	20% RPD

✓ –meets control limits

### 3.1.1. MS Results

In seven workgroups, there were instances of low spike-to-sample concentration ratios for some total metals in the MS. The *National Function Guidelines* state that matrix influence on accuracy cannot be determined for trace metals when the sample concentration is greater than four times the spiked concentration (EPA 2016b). Almost all of the affected metals were part of the extended parameter list, and were not specified in the QAPP, or the MS was performed on a sample outside the project. No qualifications are recommended based on MS results.

### 3.2. Dissolved ICP-MS Metals

Dissolved metals were analyzed by inductively coupled plasma mass spectroscopy (ICP-MS) following EPA Method 200.8 (EPA 1995) for 137 samples batched as 17 workgroups (Table 3-2). The QAPP specified that each workgroup include four QC sample-types: MB, LCS, MS, and LD. However, all workgroups included SB instead of LCS. Since both can be used to assess method accuracy, the SB results are sufficient to complete the data quality review. QC results indicate acceptable data quality for all project samples; however, all samples were filtered outside 15-minutes (Table 3-2 and Sections 3.2.1 and 3.2.2). Table A lists all recommended data qualifications.

**Table 3-2. Dissolved ICP-MS Workgroups and QC Samples**

Workgroup	Samples	HT	MB	SB	MS	LD
WG145266	L65007-1 through -8	X	✓	✓	✓	✓
WG145305	L65095-1 through -7	X	✓	✓	✓	✓
WG148826	L66385-1, -2, -3, -5 through -8 L66453-1, -2, -3, -5 through -8	X	✓	✓	✓	✓
WG148971	L66453-4	X	✓	✓	✓	✓
WG149168	L66540-1, -3, -5 through -8	X	✓	✓	✓	✓
WG149178	L66385-4; L66540-2 and -4	X	✓	✓	✓	✓
WG149717	L66811-1 through -7	X	✓	✓	✓	✓
WG150217	L66937-1 through -7	X	✓	✓	✓	✓
WG150558	L67069-1 through -8	X	✓	✓	✓	✓
WG150618	L67141-4 and -17; L67231-4	X	✓	✓	✓	✓
WG150726	L67141-1, -2, -3, -5 through -8	X	✓	✓	✓	✓
WG151071	L67231-1, -3, -5 through -8; L67283-1, -3, -5 through -7; L67313-1, -3, -5 through -8; L67335-1, -3, and -5	X	✓	✓	✓	✓
WG151091	L67335-6 through -8 L67398-1, -3, -5 through -7; L67443-1, -3, -5 through -7	X	✓	✓	✓	✓
WG151118	L67231-2; L67283-2 and -4; L67313-2 and -4; L67335-2 and -4; L67398-2 and -4;	X	✓	✓	✓	✓

Workgroup	Samples	HT	MB	SB	MS	LD
	L67443-2 and -4					
WG151663	L67499-1, -3, -5 through -7	X	✓	✓	✓	✓
WG151685	L67499-2 and -4; L67594-2 and -4; L67617-2 and -4	X	✓	✓	✓	✓
WG152026	L67594-1, -3, -5 through -7; L67617-1, -3, -5 through -7; L67724-1	X	✓	✓	✓	✓
<b>Control Limits:</b>		15 minute (filter) 6 months (analysis)	<MDL	85-115% Recovery	75-125% Recovery	20% RPD

✓ –meets control limits; X – outside control limits

### 3.2.1. Results Outside Control Limits

All dissolved metals samples were filtered outside of the method-specified 15-minute HT. As a result, all detected dissolved ICP-MS metals results should be qualified with a “J” flag and considered estimated with an unknown bias. All undetected results should be qualified with “UJ” flags and considered estimated non-detects with unknown bias.

### 3.2.2. MS Results

In two workgroups, there were instances of low spike-to-sample concentration ratios for a dissolved metal in the MS. The *National Function Guidelines* state that matrix influence on accuracy cannot be determined for trace metals when the sample concentration is greater than four times the spiked concentration (2016b). All of the affected metals were part of the extended parameter list, and were not specified in the QAPP. SB results can also be used to assess method accuracy, and so no qualifications are recommended based on MS results.

## 4.0 TRACE ORGANICS

Trace organics analysis, as specified in the QAPP, included PAHs analyzed following SW846-8270D-SIM. Trace organics were analyzed in 136 samples batched as 17 workgroups (Table 2-3). Ideally, the QC samples for each workgroup would include MB, SB, MS, MSD, and surrogates; however, the QAPP specified that SBD could be substituted for MSD when sample volume was limited. In one workgroup, SB was analyzed instead of MS to assess accuracy. Results indicate acceptable data quality with the exceptions listed below (Table 4-1 and Section 4.1.1). Table A lists all recommended data qualifications.

**Table 4-1. Trace Organics Workgroups and QC Samples**

Workgroup	Samples	HT	MB	SB	SBD	MS	MSD	Surrogates
WG144921	L65007-1 through -8	✓	X	✓	NA	✓	✓	✓
WG145139	L65095-1, -2, -4 through -7	✓	✓	✓	NA	✓	✓	X
WG148652	L66453-1 through -8	✓	✓	X	NA	X	X	✓

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Workgroup	Samples	HT	MB	SB	SBD	MS	MSD	Surrogates
WG148779	L66385-1 through -8; L66540-1 through -8	✓	✓	X	NA	X	X	✓
WG149573	L66811-1 through -7	✓	X	✓	✓	✓	NA	✓
WG149895	L66937-1 through -8	✓	✓	✓	NA	✓	✓	✓
WG150221	L67069-1 through -8	✓	✓	✓	✓	✓	NA	✓
WG150370	L67141-1 through -8, -17	✓	✓	✓	NA	✓	✓	✓
WG150690	L67231-1 through -8; L67283-1 through -7	✓	✓	✓	✓	✓	NA	✓
WG150711	L67313-2 through -8	✓	✓	✓	✓	✓	NA	✓
WG150826	L67335-1 through -8	✓	✓	✓	✓	✓	NA	✓
WG150994	L67398-1 through -7	✓	✓	✓	✓	✓	NA	✓
WG151046	L67443-1 through -7	✓	✓	✓	NA	X	X	X
WG151189	L67499-1 through -7	✓	✓	✓	NA	✓	✓	✓
WG151422	L67594-1 through -7	✓	✓	✓	NA	X	X	X
WG151448	L67617-1 through -7	✓	✓	✓	NA	✓	✓	X
WG151691	L67724-1	✓	✓	✓	✓	NA	NA	✓
	<b>Control Limits:</b>	7 day (extraction) 40 day (analysis)	<MDL or <QL	Variable†	40% RPD	Variable†	40% RPD	Variable†

✓ – meets control limits; X – outside control limits; NA – not analyzed in the workgroup; † - Control limits vary by compound.

#### 4.1. MB Results Outside Control Limits

Workgroup WG144921:

- Naphthalene was detected at a concentration less than the RDL. Naphthalene was also detected in seven project samples associated with this workgroup (L65007-1, -2, -3, -5 through -8) at a concentration less than the RDL, and within five times the concentration detected in the MB. These sample results should be qualified with “U” flags and considered nondetects, using the RDL as the level of detection.

Workgroup WG149573:

- Benzo(g,h,i)perylene, dibenzo(a,h)anthracene, and indeno(1,2,3-Cd)pyrene were all detected at concentrations less than the RDL. All project sample results associated with this workgroup were detected within five times the concentrations detected in the MB. Sample results less than the RDL should be qualified with “U” flags and considered nondetects, using the RDL as the level of detection, while sample results greater than the RDL should be qualified with “U” flags and considered nondetects at the sample value.

#### 4.2. SB/SBD Results Outside Control Limits

Workgroup WG148652:

- Recoveries of benzo(b,j,k)fluoranthene and chrysene in the SB (121% and 122%, respectively) exceeded the upper QC limits of 114% and 121%, respectively. These compounds were detected in only one sample associated with this workgroup (L66453-

5), and the results should be qualified with “J” flags and considered estimated with high bias.

Workgroup WG148779:

- Recoveries of chrysene, indeno(1,2,3-Cd)pyrene, and dibenzo(a,h)anthracene in the SB (126%, 158%, and 145%, respectively) exceeded the upper QC limits of 114%, 152%, and 140%, respectively. For the samples with detected concentrations of one or more of these compounds (L66385-5 and L66540-5), the results should be qualified with “J” flags and considered estimated with high bias.

#### 4.3. MS/MSD Results Outside Control Limits

Workgroup WG148652:

- Recoveries of chrysene and benzo(b,j,k)fluoranthene exceeded the upper QC limits, in both the MS and MSD. This corroborates the high bias suggested by the SB results. The RPDs between the MS and MSD recoveries were within control limits. As stated above, the detected results of these compounds in project samples associated with this workgroup should be qualified with “J” flags and considered estimated with high bias.

Workgroup WG148779:

- Recoveries of chrysene, indeno(1,2,3-Cd)pyrene, and dibenzo(a,h)anthracene exceeded the upper QC limits, in both the MS and MSD. This corroborates the high bias suggested by the SB results. As stated above, the detected results of these compounds in project samples associated with this workgroup should be qualified with “J” flags and considered estimated with high bias.

Workgroup WG151046:

- Recoveries of acenaphthylene in the MS/MSD were both at 45%, which is below the 51% lower QC limit. Acenaphthylene was not detected in any samples in this workgroup. The surrogate results (Section 4.4) suggested there may be a systematic low bias for acenaphthylene in this workgroup, and so all acenaphthylene results in samples associated with this workgroup should be qualified with “UJ” flags and considered estimated non-detects with low bias.

Workgroup WG151422:

- Recoveries of 2-methylnaphtalene, acenaphthylene, acenaphthene, and fluorene were all below their respective lower QC limits in the MS, but within QC limits in the MSD. This resulted in RPDs that were outside the 40% QC limit for 2-methylnaphtalene and acenaphthene at 43% and 42%, respectively. A DAF for this workgroup states that the extraction for the matrix spike may have been too vigorous, resulting in loss of these early eluting compounds. The surrogate that is associated with these compounds also had low recovery in only the matrix spike sample, suggesting there was not systematic bias. No qualifications are recommended based on these results.

#### 4.4. Surrogates

Workgroup WG145139:

- The surrogates analyzed with sample L65095-2 were slightly lower than the lower control limits at 31% for 2-fluorobiphenyl and 63% for d14-terphenyl. This was the sample on which the MS and MSD were performed. Since all parameters were recovered within QC limits in both the MS and MSD, no qualifications are recommended for this sample based on the surrogate results.

Workgroup WG151046:

- Recoveries of 2-fluorobiphenyl were below the lower QC limit for all but two environmental samples. This surrogate is associated with acenaphthylene, which also had low recovery in the MS and MSD for this workgroup. This suggests a systematic low bias for this compound in this workgroup. Acenaphthylene was never detected in the associated samples and so all results should be qualified with a “UJ” flag and considered estimated nondetects with low bias.

Workgroup WG151422:

- The recovery of surrogate 2-fluorobiphenyl was below the lower QC limit for the MS sample. As discussed above, it appears vigorous extraction of this QC sample resulted in loss of compounds associated with this surrogate, but systematic bias is not suspected. No qualifications are recommended based on these results.

Workgroup WG151448:

- Recovery of the surrogate d14-terphenyl was below the lower QC limit in one of seven environmental samples (L67617-7), at 56%. This surrogate is associated with benzo(a)anthracene, chrysene, pyrene, and fluoranthene. None of the results of these compounds in this environmental sample were detected, and so these results should be qualified with “UJ” flags and considered estimated nondetects with a low bias.

## 5.0 MICROBIOLOGY

Fecal coliform was analyzed in 80 samples batched as 10 workgroups following Standard Method SM9222D (Table 5-1) The QAPP-specified the microbiology QC samples should include a negative and positive control sample (NC/PC) and before and after filtration blanks (BF/AF). Five workgroups also included a LD, which was not specified in the QAPP. QC samples are run for each workgroup or for all samples received over a four-hour period. Therefore, QC samples can be used to evaluate more than one workgroup if received within a four-hour period. Results indicate acceptable data quality with the exceptions listed below (Table 5-1 and Sections 5.1.1 and 5.1.2). Table A lists all recommended data qualifications.

**Table 5-1. Fecal Coliform Workgroups and QC Samples**

Workgroup	Samples	HT	PC	NC	BF	AF	LD
WG144841	L65007-9 through -15	✓	✓	✓	✓	✓	NA
WG148542	L66453-9 through -15	✓	✓	✓	✓	✓	✓*
WG148766	L66540-9 through -15	✓	✓	✓	✓	✓	NA

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Workgroup	Samples	HT	PC	NC	BF	AF	LD
WG149831	L66937-9 through -15	✓	✓	✓	✓	✓	✓*
WG150141	L67069-9 through -15	✓	✓	✓	✓	✓	NA
WG150293	L67141-9 through -15	✓	✓	✓	✓	✓	NA
WG150561	L67231-9 through -15	✓	✓	✓	✓	✓	NA
WG150605	L67283-9 through -15	✓	✓	✓	✓	✓	✓*
WG150661	L67313-9 through -15	✓	✓	✓	✓	✓	NA
WG150727	L67335-9 through -15	✓	✓	✓	✓	✓	NA
<b>Control Limits:</b>		24 hours	Pass	Pass	<MDL, Pass	<MDL, Pass	*

✓ – meets control limits; NA – not analyzed in the workgroup

\* The LD assessment is based on precision calculations with at least 15 LDs in a project. Only three LDs were included in this project, so precision could not be confidently assessed using LDs. However, LD results were comparable to previous stormwater projects, suggesting acceptable precision.

### 5.1. Sample Handling Issues

All project samples in workgroups WG144841, WG148542, WG148766 were collected into sterile bottles using non-sterile peristaltic pumps. The project changed the sample collection protocol so that subsequent samples were collected using sterile equipment. All fecal coliform results associated with these workgroups should be qualified with “J” flags and considered estimated with unknown bias.

### 5.2. Interference

Three project sample results (L66453-11 and -12; L67069-11) were flagged with “C” flags by the laboratory due to interferences that inhibited accurate colony counts. These results should be qualified with “J” flags and considered estimated with unknown bias.

## 6.0 DATA USABILITY

As a general data reporting format, sample results that are reported as “<MDL” or “<QL” should be assigned a “U” flag in all cases. Results that are reported as “<RDL” or “<QL,J” should be qualified with a “J” flag and considered estimated with an unknown bias. All other analytical results for all samples included in this dataset may be used as reported, without qualification, with the exceptions summarized in the previous sections and Table A at the end of this memorandum.

## 7.0 REFERENCES

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EPA 1995. *Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry. Method 200.8, Revision 5.4*. United States Environmental Protection Agency, Office of Research and Development. Cincinnati, Ohio.

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Should you have questions regarding any of the information contained in this data validation memorandum, please don't hesitate to contact me.

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG144881	FW-EBI	3/9/2016	1	L65007-1	Orthophosphate Phosphorus	0.00429	mg/L	H	0.0005	0.002	0.00429	J	unknown
WG144925	FW-EBI	3/9/2016	1	L65007-1	pH	6.73	pH	H			6.73	J	unknown
WG145266	FW-EBI	3/9/2016	1	L65007-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-EBI	3/9/2016	1	L65007-1	Copper, Dissolved, ICP-MS	1.8	ug/L	<RDL,H	0.2	2	1.8	J	unknown
WG145266	FW-EBI	3/9/2016	1	L65007-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145266	FW-EBI	3/9/2016	1	L65007-1	Zinc, Dissolved, ICP-MS	18.2	ug/L	H	0.5	2.5	18.2	J	unknown
WG144921	FW-EBI	3/9/2016	1	L65007-1	Naphthalene	0.0072	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144841	FW-EBO	3/9/2016	1	L65007-10	Fecal Coliform	25	CFU/100ml	SH,TA			25	J	unknown
WG144841	FW-WBI	3/9/2016	1	L65007-11	Fecal Coliform	1000	CFU/100ml	SH,TA			1000	J	unknown
WG144841	FW-WBO	3/9/2016	1	L65007-12	Fecal Coliform	25	CFU/100ml	SH,TA			25	J	unknown
WG144841	FW-WPCI	3/9/2016	1	L65007-13	Fecal Coliform	520	CFU/100ml	SH,TA			520	J	unknown
WG144841	FW-WPCEPO	3/9/2016	1	L65007-14	Fecal Coliform	10	CFU/100ml	SH,TA			10	J	unknown
WG144841	FW-NFWHC	3/9/2016	1	L65007-15	Fecal Coliform	50	CFU/100ml	SH,TA			50	J	unknown
WG144881	FFBLANK	3/10/2016	1	L65007-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG144881	FW-EBO	3/9/2016	1	L65007-2	Orthophosphate Phosphorus	0.324	mg/L	H	0.01	0.04	0.324	J	unknown
WG144925	FW-EBO	3/9/2016	1	L65007-2	pH	6.68	pH	H			6.68	J	unknown
WG145266	FW-EBO	3/9/2016	1	L65007-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-EBO	3/9/2016	1	L65007-2	Copper, Dissolved, ICP-MS	1.6	ug/L	<RDL,H	0.2	2	1.6	J	unknown
WG145266	FW-EBO	3/9/2016	1	L65007-2	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG145266	FW-EBO	3/9/2016	1	L65007-2	Zinc, Dissolved, ICP-MS	3.44	ug/L	H	0.5	2.5	3.44	J	unknown
WG144921	FW-EBO	3/9/2016	1	L65007-2	Naphthalene	0.0058	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144881	FW-WBI	3/9/2016	1	L65007-3	Orthophosphate Phosphorus	0.00445	mg/L	H	0.0005	0.002	0.00445	J	unknown
WG144925	FW-WBI	3/9/2016	1	L65007-3	pH	6.83	pH	H			6.83	J	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-3	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H	0.2	2	1.9	J	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-3	Zinc, Dissolved, ICP-MS	17.7	ug/L	H	0.5	2.5	17.7	J	unknown
WG144921	FW-WBI	3/9/2016	1	L65007-3	Naphthalene	0.0078	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144881	FW-WBO	3/9/2016	1	L65007-4	Orthophosphate Phosphorus	2.76	mg/L	H	0.01	0.04	2.76	J	unknown
WG144925	FW-WBO	3/9/2016	1	L65007-4	pH	6.75	pH	H			6.75	J	unknown
WG145266	FW-WBO	3/9/2016	1	L65007-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-WBO	3/9/2016	1	L65007-4	Copper, Dissolved, ICP-MS	3.26	ug/L	H	0.2	2	3.26	J	unknown
WG145266	FW-WBO	3/9/2016	1	L65007-4	Lead, Dissolved, ICP-MS	0.524	ug/L	H	0.1	0.5	0.524	J	unknown
WG145266	FW-WBO	3/9/2016	1	L65007-4	Zinc, Dissolved, ICP-MS	6.29	ug/L	H	0.5	2.5	6.29	J	unknown
WG144881	FW-WPCI	3/9/2016	1	L65007-5	Orthophosphate Phosphorus	0.00389	mg/L	H	0.0005	0.002	0.00389	J	unknown
WG144925	FW-WPCI	3/9/2016	1	L65007-5	pH	6.94	pH	H			6.94	J	unknown
WG145266	FW-WPCI	3/9/2016	1	L65007-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-WPCI	3/9/2016	1	L65007-5	Copper, Dissolved, ICP-MS	3.02	ug/L	H	0.2	2	3.02	J	unknown
WG145266	FW-WPCI	3/9/2016	1	L65007-5	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145266	FW-WPCI	3/9/2016	1	L65007-5	Zinc, Dissolved, ICP-MS	24.9	ug/L	H	0.5	2.5	24.9	J	unknown
WG144921	FW-WPCI	3/9/2016	1	L65007-5	Naphthalene	0.0099	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG144881	FW-WPCEPO	3/9/2016	1	L65007-6	Orthophosphate Phosphorus	0.0134	mg/L	H	0.0005	0.002	0.0134	J	unknown
WG144925	FW-WPCEPO	3/9/2016	1	L65007-6	pH	6.87	pH	H			6.87	J	unknown
WG145266	FW-WPCEPO	3/9/2016	1	L65007-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-WPCEPO	3/9/2016	1	L65007-6	Copper, Dissolved, ICP-MS	2.71	ug/L	H	0.2	2	2.71	J	unknown
WG145266	FW-WPCEPO	3/9/2016	1	L65007-6	Lead, Dissolved, ICP-MS	0.13	ug/L	<RDL,H	0.1	0.5	0.13	J	unknown
WG145266	FW-WPCEPO	3/9/2016	1	L65007-6	Zinc, Dissolved, ICP-MS	30.5	ug/L	H	0.5	2.5	30.5	J	unknown
WG144921	FW-WPCEPO	3/9/2016	1	L65007-6	Naphthalene	0.0057	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144881	FW-NFWHC	3/9/2016	1	L65007-7	Orthophosphate Phosphorus	0.0129	mg/L	H	0.0005	0.002	0.0129	J	unknown
WG144925	FW-NFWHC	3/9/2016	1	L65007-7	pH	7.3	pH	H			7.3	J	unknown
WG145266	FW-NFWHC	3/9/2016	1	L65007-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-NFWHC	3/9/2016	1	L65007-7	Copper, Dissolved, ICP-MS	2.96	ug/L	H	0.2	2	2.96	J	unknown
WG145266	FW-NFWHC	3/9/2016	1	L65007-7	Lead, Dissolved, ICP-MS	0.2	ug/L	<RDL,H	0.1	0.5	0.2	J	unknown
WG145266	FW-NFWHC	3/9/2016	1	L65007-7	Zinc, Dissolved, ICP-MS	15.1	ug/L	H	0.5	2.5	15.1	J	unknown
WG144921	FW-NFWHC	3/9/2016	1	L65007-7	Naphthalene	0.0058	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144881	FW-WBI	3/9/2016	1	L65007-8	Orthophosphate Phosphorus	0.00429	mg/L	H	0.0005	0.002	0.00429	J	unknown
WG144925	FW-WBI	3/9/2016	1	L65007-8	pH	6.95	pH	H			6.95	J	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-8	Copper, Dissolved, ICP-MS	1.8	ug/L	<RDL,H	0.2	2	1.8	J	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145266	FW-WBI	3/9/2016	1	L65007-8	Zinc, Dissolved, ICP-MS	17.9	ug/L	H	0.5	2.5	17.9	J	unknown
WG144921	FW-WBI	3/9/2016	1	L65007-8	Naphthalene	0.0071	ug/L	<RDL,B	0.0047	0.0236	0.0236	U	
WG144841	FW-EBI	3/9/2016	1	L65007-9	Fecal Coliform	830	CFU/100ml	SH,TA			830	J	unknown
WG145131	FW-EBI	3/23/2016	2	L65095-1	Orthophosphate Phosphorus	0.0105	mg/L	H	0.0005	0.002	0.0105	J	unknown
WG145128	FW-EBI	3/23/2016	2	L65095-1	pH	7.01	pH	H			7.01	J	unknown
WG145305	FW-EBI	3/23/2016	2	L65095-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-EBI	3/23/2016	2	L65095-1	Copper, Dissolved, ICP-MS	3.16	ug/L	H	0.2	2	3.16	J	unknown
WG145305	FW-EBI	3/23/2016	2	L65095-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145305	FW-EBI	3/23/2016	2	L65095-1	Zinc, Dissolved, ICP-MS	23.1	ug/L	H	0.5	2.5	23.1	J	unknown
WG145131	FW-EBO	3/23/2016	2	L65095-2	Orthophosphate Phosphorus	0.775	mg/L	H	0.01	0.04	0.775	J	unknown
WG145128	FW-EBO	3/23/2016	2	L65095-2	pH	6.76	pH	H			6.76	J	unknown
WG145305	FW-EBO	3/23/2016	2	L65095-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-EBO	3/23/2016	2	L65095-2	Copper, Dissolved, ICP-MS	2.63	ug/L	H	0.2	2	2.63	J	unknown
WG145305	FW-EBO	3/23/2016	2	L65095-2	Lead, Dissolved, ICP-MS	0.17	ug/L	<RDL,H	0.1	0.5	0.17	J	unknown
WG145305	FW-EBO	3/23/2016	2	L65095-2	Zinc, Dissolved, ICP-MS	2.81	ug/L	H	0.5	2.5	2.81	J	unknown
WG145131	FW-WBI	3/24/2016	2	L65095-3	Orthophosphate Phosphorus	0.0122	mg/L	H	0.0005	0.002	0.0122	J	unknown
WG145305	FW-WBI	3/24/2016	2	L65095-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-WBI	3/24/2016	2	L65095-3	Copper, Dissolved, ICP-MS	4.8	ug/L	H	0.2	2	4.8	J	unknown
WG145305	FW-WBI	3/24/2016	2	L65095-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG145305	FW-WBI	3/24/2016	2	L65095-3	Zinc, Dissolved, ICP-MS	24.3	ug/L	H	0.5	2.5	24.3	J	unknown
WG145131	FW-WBO	3/24/2016	2	L65095-4	Orthophosphate Phosphorus	3.13	mg/L	H	0.025	0.1	3.13	J	unknown
WG145128	FW-WBO	3/24/2016	2	L65095-4	pH	7.16	pH	H			7.16	J	unknown

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG145305	FW-WBO	3/24/2016	2	L65095-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-WBO	3/24/2016	2	L65095-4	Copper, Dissolved, ICP-MS	3.43	ug/L	H	0.2	2	3.43	J	unknown
WG145305	FW-WBO	3/24/2016	2	L65095-4	Lead, Dissolved, ICP-MS	0.791	ug/L	H	0.1	0.5	0.791	J	unknown
WG145305	FW-WBO	3/24/2016	2	L65095-4	Zinc, Dissolved, ICP-MS	5.69	ug/L	H	0.5	2.5	5.69	J	unknown
WG145131	FW-WPCI	3/23/2016	2	L65095-5	Orthophosphate Phosphorus	0.00492	mg/L	H	0.0005	0.002	0.00492	J	unknown
WG145128	FW-WPCI	3/23/2016	2	L65095-5	pH	7.12	pH	H			7.12	J	unknown
WG145305	FW-WPCI	3/23/2016	2	L65095-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-WPCI	3/23/2016	2	L65095-5	Copper, Dissolved, ICP-MS	5.36	ug/L	H	0.2	2	5.36	J	unknown
WG145305	FW-WPCI	3/23/2016	2	L65095-5	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H	0.1	0.5	0.21	J	unknown
WG145305	FW-WPCI	3/23/2016	2	L65095-5	Zinc, Dissolved, ICP-MS	33.8	ug/L	H	0.5	2.5	33.8	J	unknown
WG145131	FW-WPCEPO	3/23/2016	2	L65095-6	Orthophosphate Phosphorus	0.0245	mg/L	H	0.0005	0.002	0.0245	J	unknown
WG145128	FW-WPCEPO	3/23/2016	2	L65095-6	pH	7.2	pH	H			7.2	J	unknown
WG145305	FW-WPCEPO	3/23/2016	2	L65095-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-WPCEPO	3/23/2016	2	L65095-6	Copper, Dissolved, ICP-MS	5.24	ug/L	H	0.2	2	5.24	J	unknown
WG145305	FW-WPCEPO	3/23/2016	2	L65095-6	Lead, Dissolved, ICP-MS	0.17	ug/L	<RDL,H	0.1	0.5	0.17	J	unknown
WG145305	FW-WPCEPO	3/23/2016	2	L65095-6	Zinc, Dissolved, ICP-MS	33.5	ug/L	H	0.5	2.5	33.5	J	unknown
WG145131	FW-NFWHC	3/24/2016	2	L65095-7	Orthophosphate Phosphorus	0.0146	mg/L	H	0.0005	0.002	0.0146	J	unknown
WG145128	FW-NFWHC	3/24/2016	2	L65095-7	pH	7.7	pH	H			7.7	J	unknown
WG145305	FW-NFWHC	3/24/2016	2	L65095-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG145305	FW-NFWHC	3/24/2016	2	L65095-7	Copper, Dissolved, ICP-MS	2.8	ug/L	H	0.2	2	2.8	J	unknown
WG145305	FW-NFWHC	3/24/2016	2	L65095-7	Lead, Dissolved, ICP-MS	0.13	ug/L	<RDL,H	0.1	0.5	0.13	J	unknown
WG145305	FW-NFWHC	3/24/2016	2	L65095-7	Zinc, Dissolved, ICP-MS	12.4	ug/L	H	0.5	2.5	12.4	J	unknown
WG148713	FW-EBI	10/26/2016	4	L66385-1	Orthophosphate Phosphorus	0.0211	mg/L	H	0.0005	0.002	0.0211	J	unknown
WG148745	FW-EBI	10/26/2016	4	L66385-1	pH	6.74	pH	H			6.74	J	unknown
WG148826	FW-EBI	10/26/2016	4	L66385-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-EBI	10/26/2016	4	L66385-1	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H	0.2	2	1.9	J	unknown
WG148826	FW-EBI	10/26/2016	4	L66385-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG148826	FW-EBI	10/26/2016	4	L66385-1	Zinc, Dissolved, ICP-MS	17.3	ug/L	H	0.5	2.5	17.3	J	unknown
WG148713	FFBLANK	10/27/2016	4	L66385-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG148713	FW-EBO	10/26/2016	4	L66385-2	Orthophosphate Phosphorus	0.684	mg/L	H	0.005	0.02	0.684	J	unknown
WG148745	FW-EBO	10/26/2016	4	L66385-2	pH	6.45	pH	H			6.45	J	unknown
WG148826	FW-EBO	10/26/2016	4	L66385-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-EBO	10/26/2016	4	L66385-2	Copper, Dissolved, ICP-MS	6.67	ug/L	H	0.2	2	6.67	J	unknown
WG148826	FW-EBO	10/26/2016	4	L66385-2	Lead, Dissolved, ICP-MS	0.29	ug/L	<RDL,H	0.1	0.5	0.29	J	unknown
WG148826	FW-EBO	10/26/2016	4	L66385-2	Zinc, Dissolved, ICP-MS	3.84	ug/L	H	0.5	2.5	3.84	J	unknown
WG148713	FW-WBI	10/26/2016	4	L66385-3	Orthophosphate Phosphorus	0.0207	mg/L	H	0.0005	0.002	0.0207	J	unknown
WG148745	FW-WBI	10/26/2016	4	L66385-3	pH	6.48	pH	H			6.48	J	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-3	Copper, Dissolved, ICP-MS	2	ug/L	<RDL,H	0.2	2	2	J	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-3	Zinc, Dissolved, ICP-MS	16.7	ug/L	H	0.5	2.5	16.7	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG148713	FW-WBO	10/26/2016	4	L66385-4	Orthophosphate Phosphorus	2.34	mg/L	H	0.025	0.1	2.34	J	unknown
WG148745	FW-WBO	10/26/2016	4	L66385-4	pH	6.46	pH	H			6.46	J	unknown
WG149178	FW-WBO	10/26/2016	4	L66385-4	Cadmium, Dissolved, ICP-MS	0.053	ug/L	<RDL,H	0.05	0.25	0.053	J	unknown
WG149178	FW-WBO	10/26/2016	4	L66385-4	Copper, Dissolved, ICP-MS	11.4	ug/L	H	0.2	2	11.4	J	unknown
WG149178	FW-WBO	10/26/2016	4	L66385-4	Lead, Dissolved, ICP-MS	0.866	ug/L	H	0.1	0.5	0.866	J	unknown
WG149178	FW-WBO	10/26/2016	4	L66385-4	Zinc, Dissolved, ICP-MS	10.9	ug/L	H	0.5	2.5	10.9	J	unknown
WG148713	FW-WPCI	10/26/2016	4	L66385-5	Orthophosphate Phosphorus	0.0124	mg/L	H	0.0005	0.002	0.0124	J	unknown
WG148745	FW-WPCI	10/26/2016	4	L66385-5	pH	6.58	pH	H			6.58	J	unknown
WG148826	FW-WPCI	10/26/2016	4	L66385-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WPCI	10/26/2016	4	L66385-5	Copper, Dissolved, ICP-MS	3.81	ug/L	H	0.2	2	3.81	J	unknown
WG148826	FW-WPCI	10/26/2016	4	L66385-5	Lead, Dissolved, ICP-MS	0.2	ug/L	<RDL,H	0.1	0.5	0.2	J	unknown
WG148826	FW-WPCI	10/26/2016	4	L66385-5	Zinc, Dissolved, ICP-MS	25.6	ug/L	H	0.5	2.5	25.6	J	unknown
WG148779	FW-WPCI	10/26/2016	4	L66385-5	Chrysene	0.047	ug/L	<RDL,JL	0.0094	0.0472	0.047	J	high
WG148779	FW-WPCI	10/26/2016	4	L66385-5	Indeno(1,2,3-Cd)Pyrene	0.019	ug/L	<RDL,JL	0.0094	0.0472	0.019	J	high
WG148713	FW-WPCEPO	10/26/2016	4	L66385-6	Orthophosphate Phosphorus	0.0257	mg/L	H	0.0005	0.002	0.0257	J	unknown
WG148745	FW-WPCEPO	10/26/2016	4	L66385-6	pH	6.66	pH	H			6.66	J	unknown
WG148826	FW-WPCEPO	10/26/2016	4	L66385-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WPCEPO	10/26/2016	4	L66385-6	Copper, Dissolved, ICP-MS	4.83	ug/L	H	0.2	2	4.83	J	unknown
WG148826	FW-WPCEPO	10/26/2016	4	L66385-6	Lead, Dissolved, ICP-MS	0.683	ug/L	H	0.1	0.5	0.683	J	unknown
WG148826	FW-WPCEPO	10/26/2016	4	L66385-6	Zinc, Dissolved, ICP-MS	32.2	ug/L	H	0.5	2.5	32.2	J	unknown
WG148713	FW-NFWHC	10/26/2016	4	L66385-7	Orthophosphate Phosphorus	0.017	mg/L	H	0.0005	0.002	0.017	J	unknown
WG148745	FW-NFWHC	10/26/2016	4	L66385-7	pH	7.09	pH	H			7.09	J	unknown
WG148826	FW-NFWHC	10/26/2016	4	L66385-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-NFWHC	10/26/2016	4	L66385-7	Copper, Dissolved, ICP-MS	2.8	ug/L	H	0.2	2	2.8	J	unknown
WG148826	FW-NFWHC	10/26/2016	4	L66385-7	Lead, Dissolved, ICP-MS	0.33	ug/L	<RDL,H	0.1	0.5	0.33	J	unknown
WG148826	FW-NFWHC	10/26/2016	4	L66385-7	Zinc, Dissolved, ICP-MS	13.9	ug/L	H	0.5	2.5	13.9	J	unknown
WG148713	FW-WBI	10/26/2016	4	L66385-8	Orthophosphate Phosphorus	0.0205	mg/L	H	0.0005	0.002	0.0205	J	unknown
WG148745	FW-WBI	10/26/2016	4	L66385-8	pH	6.51	pH	H			6.51	J	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-8	Copper, Dissolved, ICP-MS	2.04	ug/L	H	0.2	2	2.04	J	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG148826	FW-WBI	10/26/2016	4	L66385-8	Zinc, Dissolved, ICP-MS	16.3	ug/L	H	0.5	2.5	16.3	J	unknown
WG148650	FW-EBI	10/20/2016	3	L66453-1	Orthophosphate Phosphorus	0.0128	mg/L	H	0.0005	0.002	0.0128	J	unknown
WG148622	FW-EBI	10/20/2016	3	L66453-1	pH	6.7	pH	H			6.7	J	unknown
WG148826	FW-EBI	10/20/2016	3	L66453-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-EBI	10/20/2016	3	L66453-1	Copper, Dissolved, ICP-MS	2.16	ug/L	H	0.2	2	2.16	J	unknown
WG148826	FW-EBI	10/20/2016	3	L66453-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG148826	FW-EBI	10/20/2016	3	L66453-1	Zinc, Dissolved, ICP-MS	14.9	ug/L	H	0.5	2.5	14.9	J	unknown
WG148542	FW-EBO	10/20/2016	3	L66453-10	Fecal Coliform	200	CFU/100ml	SH,TA			200	J	unknown
WG148542	FW-WBI	10/20/2016	3	L66453-11	Fecal Coliform	1500	CFU/100ml	C,SH,TA			1500	J	unknown
WG148542	FW-WBO	10/20/2016	3	L66453-12	Fecal Coliform	410	CFU/100ml	C,SH,TA			410	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG148542	FW-WPCI	10/20/2016	3	L66453-13	Fecal Coliform	600	CFU/100ml	SH,TA			600	J	unknown
WG148542	FW-WPCEPO	10/20/2016	3	L66453-14	Fecal Coliform	900	CFU/100ml	SH,TA			900	J	unknown
WG148542	FW-NFWHC	10/20/2016	3	L66453-15	Fecal Coliform	410	CFU/100ml	SH,TA			410	J	unknown
WG148650	FFBLANK	10/20/2016	3	L66453-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG148650	FW-EBO	10/20/2016	3	L66453-2	Orthophosphate Phosphorus	0.561	mg/L	H	0.013	0.05	0.561	J	unknown
WG148622	FW-EBO	10/20/2016	3	L66453-2	pH	6.5	pH	H			6.5	J	unknown
WG148826	FW-EBO	10/20/2016	3	L66453-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-EBO	10/20/2016	3	L66453-2	Copper, Dissolved, ICP-MS	7.09	ug/L	H	0.2	2	7.09	J	unknown
WG148826	FW-EBO	10/20/2016	3	L66453-2	Lead, Dissolved, ICP-MS	0.35	ug/L	<RDL,H	0.1	0.5	0.35	J	unknown
WG148826	FW-EBO	10/20/2016	3	L66453-2	Zinc, Dissolved, ICP-MS	3.88	ug/L	H	0.5	2.5	3.88	J	unknown
WG148650	FW-WBI	10/20/2016	3	L66453-3	Orthophosphate Phosphorus	0.0156	mg/L	H	0.0005	0.002	0.0156	J	unknown
WG148622	FW-WBI	10/20/2016	3	L66453-3	pH	6.56	pH	H			6.56	J	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-3	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H	0.2	2	1.9	J	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-3	Zinc, Dissolved, ICP-MS	16.4	ug/L	H	0.5	2.5	16.4	J	unknown
WG148650	FW-WBO	10/20/2016	3	L66453-4	Orthophosphate Phosphorus	1.98	mg/L	H	0.013	0.05	1.98	J	unknown
WG148622	FW-WBO	10/20/2016	3	L66453-4	pH	6.37	pH	H			6.37	J	unknown
WG148971	FW-WBO	10/20/2016	3	L66453-4	Cadmium, Dissolved, ICP-MS	0.09	ug/L	<RDL,H	0.05	0.25	0.09	J	unknown
WG148971	FW-WBO	10/20/2016	3	L66453-4	Copper, Dissolved, ICP-MS	14.1	ug/L	H	0.2	2	14.1	J	unknown
WG148971	FW-WBO	10/20/2016	3	L66453-4	Lead, Dissolved, ICP-MS	0.785	ug/L	H	0.1	0.5	0.785	J	unknown
WG148971	FW-WBO	10/20/2016	3	L66453-4	Zinc, Dissolved, ICP-MS	13.9	ug/L	H	0.5	2.5	13.9	J	unknown
WG148650	FW-WPCI	10/19/2016	3	L66453-5	Orthophosphate Phosphorus	0.0131	mg/L	H	0.0005	0.002	0.0131	J	unknown
WG148622	FW-WPCI	10/19/2016	3	L66453-5	pH	6.77	pH	H			6.77	J	unknown
WG148826	FW-WPCI	10/19/2016	3	L66453-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WPCI	10/19/2016	3	L66453-5	Copper, Dissolved, ICP-MS	2.64	ug/L	H	0.2	2	2.64	J	unknown
WG148826	FW-WPCI	10/19/2016	3	L66453-5	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG148826	FW-WPCI	10/19/2016	3	L66453-5	Zinc, Dissolved, ICP-MS	22.3	ug/L	H	0.5	2.5	22.3	J	unknown
WG148652	FW-WPCI	10/19/2016	3	L66453-5	Benzo(b,j,k)fluoranthene	0.032	ug/L	<RDL,JL	0.0094	0.0472	0.032	J	high
WG148652	FW-WPCI	10/19/2016	3	L66453-5	Chrysene	0.029	ug/L	<RDL,JL	0.0094	0.0472	0.029	J	high
WG148650	FW-WPCEPO	10/19/2016	3	L66453-6	Orthophosphate Phosphorus	0.033	mg/L	H	0.0005	0.002	0.033	J	unknown
WG148622	FW-WPCEPO	10/19/2016	3	L66453-6	pH	6.66	pH	H			6.66	J	unknown
WG148826	FW-WPCEPO	10/19/2016	3	L66453-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-WPCEPO	10/19/2016	3	L66453-6	Copper, Dissolved, ICP-MS	5.94	ug/L	H	0.2	2	5.94	J	unknown
WG148826	FW-WPCEPO	10/19/2016	3	L66453-6	Lead, Dissolved, ICP-MS	0.17	ug/L	<RDL,H	0.1	0.5	0.17	J	unknown
WG148826	FW-WPCEPO	10/19/2016	3	L66453-6	Zinc, Dissolved, ICP-MS	28.7	ug/L	H	0.5	2.5	28.7	J	unknown
WG148650	FW-NFWHC	10/19/2016	3	L66453-7	Orthophosphate Phosphorus	0.0246	mg/L	H	0.0005	0.002	0.0246	J	unknown
WG148622	FW-NFWHC	10/19/2016	3	L66453-7	pH	7.12	pH	H			7.12	J	unknown
WG148826	FW-NFWHC	10/19/2016	3	L66453-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG148826	FW-NFWHC	10/19/2016	3	L66453-7	Copper, Dissolved, ICP-MS	3.13	ug/L	H	0.2	2	3.13	J	unknown
WG148826	FW-NFWHC	10/19/2016	3	L66453-7	Lead, Dissolved, ICP-MS	0.34	ug/L	<RDL,H	0.1	0.5	0.34	J	unknown

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG148826	FW-NFWHC	10/19/2016	3	L66453-7	Zinc, Dissolved, ICP-MS	13.7	ug/L	H		0.5	2.5	13.7	J	unknown
WG148650	FW-WBI	10/20/2016	3	L66453-8	Orthophosphate Phosphorus	0.0147	mg/L	H		0.0005	0.002	0.0147	J	unknown
WG148622	FW-WBI	10/20/2016	3	L66453-8	pH	6.75	pH	H				6.75	J	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-8	Copper, Dissolved, ICP-MS	1.7	ug/L	<RDL,H		0.2	2	1.7	J	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG148826	FW-WBI	10/20/2016	3	L66453-8	Zinc, Dissolved, ICP-MS	16.2	ug/L	H		0.5	2.5	16.2	J	unknown
WG148542	FW-EBI	10/20/2016	3	L66453-9	Fecal Coliform	1900	CFU/100ml	SH,TA				1900	J	unknown
WG148709	FW-EBI	10/31/2016	5	L66540-1	Orthophosphate Phosphorus	0.0143	mg/L	H		0.0005	0.002	0.0143	J	unknown
WG148889	FW-EBI	10/31/2016	5	L66540-1	pH	6.5	pH	H				6.5	J	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-1	Copper, Dissolved, ICP-MS	1.5	ug/L	<RDL,H		0.2	2	1.5	J	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-1	Zinc, Dissolved, ICP-MS	15.9	ug/L	H		0.5	2.5	15.9	J	unknown
WG148766	FW-EBO	11/1/2016	5	L66540-10	Fecal Coliform	48	CFU/100ml	SH,TA				48	J	unknown
WG148766	FW-WBI	11/1/2016	5	L66540-11	Fecal Coliform	110	CFU/100ml	SH,TA				110	J	unknown
WG148766	FW-WBO	11/1/2016	5	L66540-12	Fecal Coliform	150	CFU/100ml	SH,TA				150	J	unknown
WG148766	FW-WPCI	11/1/2016	5	L66540-13	Fecal Coliform	270	CFU/100ml	SH,TA				270	J	unknown
WG148766	FW-WPCEPO	11/1/2016	5	L66540-14	Fecal Coliform	180	CFU/100ml	SH,TA				180	J	unknown
WG148766	FW-NFWHC	11/1/2016	5	L66540-15	Fecal Coliform	55	CFU/100ml	SH,TA				55	J	unknown
WG148709	FFBLANK	11/1/2016	5	L66540-16	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG148709	FW-EBO	10/31/2016	5	L66540-2	Orthophosphate Phosphorus	1.01	mg/L	H		0.025	0.1	1.01	J	unknown
WG148889	FW-EBO	10/31/2016	5	L66540-2	pH	6.52	pH	H				6.52	J	unknown
WG149178	FW-EBO	10/31/2016	5	L66540-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG149178	FW-EBO	10/31/2016	5	L66540-2	Copper, Dissolved, ICP-MS	6.52	ug/L	H		0.2	2	6.52	J	unknown
WG149178	FW-EBO	10/31/2016	5	L66540-2	Lead, Dissolved, ICP-MS	0.56	ug/L	H		0.1	0.5	0.56	J	unknown
WG149178	FW-EBO	10/31/2016	5	L66540-2	Zinc, Dissolved, ICP-MS	4.86	ug/L	H		0.5	2.5	4.86	J	unknown
WG148709	FW-WBI	10/31/2016	5	L66540-3	Orthophosphate Phosphorus	0.0155	mg/L	H		0.0005	0.002	0.0155	J	unknown
WG148889	FW-WBI	10/31/2016	5	L66540-3	pH	6.6	pH	H				6.6	J	unknown
WG149168	FW-WBI	10/31/2016	5	L66540-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG149168	FW-WBI	10/31/2016	5	L66540-3	Copper, Dissolved, ICP-MS	1.8	ug/L	<RDL,H		0.2	2	1.8	J	unknown
WG149168	FW-WBI	10/31/2016	5	L66540-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG149168	FW-WBI	10/31/2016	5	L66540-3	Zinc, Dissolved, ICP-MS	16.6	ug/L	H		0.5	2.5	16.6	J	unknown
WG148709	FW-WBO	10/31/2016	5	L66540-4	Orthophosphate Phosphorus	2.22	mg/L	H		0.05	0.2	2.22	J	unknown
WG148889	FW-WBO	10/31/2016	5	L66540-4	pH	6.43	pH	H				6.43	J	unknown
WG149178	FW-WBO	10/31/2016	5	L66540-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG149178	FW-WBO	10/31/2016	5	L66540-4	Copper, Dissolved, ICP-MS	7.63	ug/L	H		0.2	2	7.63	J	unknown
WG149178	FW-WBO	10/31/2016	5	L66540-4	Lead, Dissolved, ICP-MS	0.897	ug/L	H		0.1	0.5	0.897	J	unknown
WG149178	FW-WBO	10/31/2016	5	L66540-4	Zinc, Dissolved, ICP-MS	10.6	ug/L	H		0.5	2.5	10.6	J	unknown
WG148709	FW-WPCI	10/31/2016	5	L66540-5	Orthophosphate Phosphorus	0.0104	mg/L	H		0.0005	0.002	0.0104	J	unknown
WG148889	FW-WPCI	10/31/2016	5	L66540-5	pH	6.76	pH	H				6.76	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG149168	FW-WPCI	10/31/2016	5	L66540-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149168	FW-WPCI	10/31/2016	5	L66540-5	Copper, Dissolved, ICP-MS	3.37	ug/L	H	0.2	2	3.37	J	unknown
WG149168	FW-WPCI	10/31/2016	5	L66540-5	Lead, Dissolved, ICP-MS	0.23	ug/L	<RDL,H	0.1	0.5	0.23	J	unknown
WG149168	FW-WPCI	10/31/2016	5	L66540-5	Zinc, Dissolved, ICP-MS	29.8	ug/L	H	0.5	2.5	29.8	J	unknown
WG148779	FW-WPCI	10/31/2016	5	L66540-5	Chrysene	0.017	ug/L	<RDL,JL	0.0094	0.0472	0.017	J	high
WG148709	FW-WPCEPO	10/31/2016	5	L66540-6	Orthophosphate Phosphorus	0.0254	mg/L	H	0.0005	0.002	0.0254	J	unknown
WG148889	FW-WPCEPO	10/31/2016	5	L66540-6	pH	6.53	pH	H			6.53	J	unknown
WG149168	FW-WPCEPO	10/31/2016	5	L66540-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149168	FW-WPCEPO	10/31/2016	5	L66540-6	Copper, Dissolved, ICP-MS	3.45	ug/L	H	0.2	2	3.45	J	unknown
WG149168	FW-WPCEPO	10/31/2016	5	L66540-6	Lead, Dissolved, ICP-MS	0.19	ug/L	<RDL,H	0.1	0.5	0.19	J	unknown
WG149168	FW-WPCEPO	10/31/2016	5	L66540-6	Zinc, Dissolved, ICP-MS	31.3	ug/L	H	0.5	2.5	31.3	J	unknown
WG148709	FW-NFWHC	11/1/2016	5	L66540-7	Orthophosphate Phosphorus	0.0168	mg/L	H	0.0005	0.002	0.0168	J	unknown
WG148889	FW-NFWHC	11/1/2016	5	L66540-7	pH	7.06	pH	H			7.06	J	unknown
WG149168	FW-NFWHC	11/1/2016	5	L66540-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149168	FW-NFWHC	11/1/2016	5	L66540-7	Copper, Dissolved, ICP-MS	2.77	ug/L	H	0.2	2	2.77	J	unknown
WG149168	FW-NFWHC	11/1/2016	5	L66540-7	Lead, Dissolved, ICP-MS	0.24	ug/L	<RDL,H	0.1	0.5	0.24	J	unknown
WG149168	FW-NFWHC	11/1/2016	5	L66540-7	Zinc, Dissolved, ICP-MS	16.6	ug/L	H	0.5	2.5	16.6	J	unknown
WG148709	FW-EBI	10/31/2016	5	L66540-8	Orthophosphate Phosphorus	0.0149	mg/L	H	0.0005	0.002	0.0149	J	unknown
WG148889	FW-EBI	10/31/2016	5	L66540-8	pH	6.7	pH	H			6.7	J	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-8	Copper, Dissolved, ICP-MS	1.5	ug/L	<RDL,H	0.2	2	1.5	J	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG149168	FW-EBI	10/31/2016	5	L66540-8	Zinc, Dissolved, ICP-MS	16.3	ug/L	H	0.5	2.5	16.3	J	unknown
WG148766	FW-EBI	11/1/2016	5	L66540-9	Fecal Coliform	140	CFU/100ml	SH,TA			140	J	unknown
WG149575	FW-EBI	12/19/2016	6	L66811-1	Orthophosphate Phosphorus	0.0116	mg/L	H	0.005	0.01	0.0116	J	unknown
WG149561	FW-EBI	12/19/2016	6	L66811-1	pH	7.14	pH	H			7.14	J	unknown
WG149594	FW-EBI	12/19/2016	6	L66811-1	Turbidity	5.39	NTU	H	0.2	0.5	5.39	J	unknown
WG149717	FW-EBI	12/19/2016	6	L66811-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-EBI	12/19/2016	6	L66811-1	Copper, Dissolved, ICP-MS	1.8	ug/L	<RDL,H	0.2	2	1.8	J	unknown
WG149717	FW-EBI	12/19/2016	6	L66811-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG149717	FW-EBI	12/19/2016	6	L66811-1	Zinc, Dissolved, ICP-MS	27.2	ug/L	H	0.5	2.5	27.2	J	unknown
WG149573	FW-EBI	12/19/2016	6	L66811-1	Benzo(g,h,i)perylene	0.0505	ug/L	B	0.0094	0.0472	0.0505	U	
WG149573	FW-EBI	12/19/2016	6	L66811-1	Dibenzo(a,h)anthracene	0.0501	ug/L	B	0.0094	0.0472	0.0501	U	
WG149573	FW-EBI	12/19/2016	6	L66811-1	Indeno(1,2,3-Cd)Pyrene	0.0507	ug/L	B	0.0094	0.0472	0.0507	U	
WG149575	FW-EBO	12/19/2016	6	L66811-2	Orthophosphate Phosphorus	0.626	mg/L	H	0.025	0.05	0.626	J	unknown
WG149561	FW-EBO	12/19/2016	6	L66811-2	pH	6.99	pH	H			6.99	J	unknown
WG149594	FW-EBO	12/19/2016	6	L66811-2	Turbidity	2.2	NTU	H	0.2	0.5	2.2	J	unknown
WG149717	FW-EBO	12/19/2016	6	L66811-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-EBO	12/19/2016	6	L66811-2	Copper, Dissolved, ICP-MS	2.04	ug/L	H	0.2	2	2.04	J	unknown
WG149717	FW-EBO	12/19/2016	6	L66811-2	Lead, Dissolved, ICP-MS	0.13	ug/L	<RDL,H	0.1	0.5	0.13	J	unknown
WG149717	FW-EBO	12/19/2016	6	L66811-2	Zinc, Dissolved, ICP-MS	3.07	ug/L	H	0.5	2.5	3.07	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG149573	FW-EBO	12/19/2016	6	L66811-2	Benzo(g,h,i)perylene	0.033	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-EBO	12/19/2016	6	L66811-2	Dibenzo(a,h)anthracene	0.032	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-EBO	12/19/2016	6	L66811-2	Indeno(1,2,3-Cd)Pyrene	0.032	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149575	FW-WBI	12/19/2016	6	L66811-3	Orthophosphate Phosphorus	0.0113	mg/L	H	0.005	0.01	0.0113	J	unknown
WG149561	FW-WBI	12/19/2016	6	L66811-3	pH	7.13	pH	H			7.13	J	unknown
WG149594	FW-WBI	12/19/2016	6	L66811-3	Turbidity	5.5	NTU	H	0.2	0.5	5.5	J	unknown
WG149717	FW-WBI	12/19/2016	6	L66811-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-WBI	12/19/2016	6	L66811-3	Copper, Dissolved, ICP-MS	1.6	ug/L	<RDL,H	0.2	2	1.6	J	unknown
WG149717	FW-WBI	12/19/2016	6	L66811-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG149717	FW-WBI	12/19/2016	6	L66811-3	Zinc, Dissolved, ICP-MS	27.1	ug/L	H	0.5	2.5	27.1	J	unknown
WG149573	FW-WBI	12/19/2016	6	L66811-3	Benzo(g,h,i)perylene	0.034	ug/L	<RDL,B	0.011	0.0541	0.0541	U	
WG149573	FW-WBI	12/19/2016	6	L66811-3	Dibenzo(a,h)anthracene	0.024	ug/L	<RDL,B	0.011	0.0541	0.0541	U	
WG149573	FW-WBI	12/19/2016	6	L66811-3	Indeno(1,2,3-Cd)Pyrene	0.033	ug/L	<RDL,B	0.011	0.0541	0.0541	U	
WG149582	FW-WBO	12/19/2016	6	L66811-4	Orthophosphate Phosphorus	2.52	mg/L	H	0.25	0.5	2.52	J	unknown
WG149561	FW-WBO	12/19/2016	6	L66811-4	pH	6.74	pH	H			6.74	J	unknown
WG149594	FW-WBO	12/19/2016	6	L66811-4	Turbidity	4.72	NTU	H	0.2	0.5	4.72	J	unknown
WG149717	FW-WBO	12/19/2016	6	L66811-4	Cadmium, Dissolved, ICP-MS	0.054	ug/L	<RDL,H	0.05	0.25	0.054	J	unknown
WG149717	FW-WBO	12/19/2016	6	L66811-4	Copper, Dissolved, ICP-MS	2.84	ug/L	H	0.2	2	2.84	J	unknown
WG149717	FW-WBO	12/19/2016	6	L66811-4	Lead, Dissolved, ICP-MS	0.62	ug/L	H	0.1	0.5	0.62	J	unknown
WG149717	FW-WBO	12/19/2016	6	L66811-4	Zinc, Dissolved, ICP-MS	7.78	ug/L	H	0.5	2.5	7.78	J	unknown
WG149573	FW-WBO	12/19/2016	6	L66811-4	Benzo(g,h,i)perylene	0.017	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-WBO	12/19/2016	6	L66811-4	Dibenzo(a,h)anthracene	0.018	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-WBO	12/19/2016	6	L66811-4	Indeno(1,2,3-Cd)Pyrene	0.018	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149575	FW-WPCI	12/19/2016	6	L66811-5	Orthophosphate Phosphorus	0.0125	mg/L	H	0.005	0.01	0.0125	J	unknown
WG149561	FW-WPCI	12/19/2016	6	L66811-5	pH	7.21	pH	H			7.21	J	unknown
WG149594	FW-WPCI	12/19/2016	6	L66811-5	Turbidity	35.1	NTU	H	0.2	0.5	35.1	J	unknown
WG149717	FW-WPCI	12/19/2016	6	L66811-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-WPCI	12/19/2016	6	L66811-5	Copper, Dissolved, ICP-MS	3.3	ug/L	H	0.2	2	3.3	J	unknown
WG149717	FW-WPCI	12/19/2016	6	L66811-5	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H	0.1	0.5	0.12	J	unknown
WG149717	FW-WPCI	12/19/2016	6	L66811-5	Zinc, Dissolved, ICP-MS	47	ug/L	H	0.5	2.5	47	J	unknown
WG149573	FW-WPCI	12/19/2016	6	L66811-5	Benzo(g,h,i)perylene	0.0759	ug/L	B	0.0094	0.0472	0.0759	U	
WG149573	FW-WPCI	12/19/2016	6	L66811-5	Dibenzo(a,h)anthracene	0.024	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-WPCI	12/19/2016	6	L66811-5	Indeno(1,2,3-Cd)Pyrene	0.035	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149575	FW-WPCEPO	12/19/2016	6	L66811-6	Orthophosphate Phosphorus	0.0207	mg/L	H	0.005	0.01	0.0207	J	unknown
WG149561	FW-WPCEPO	12/19/2016	6	L66811-6	pH	7.12	pH	H			7.12	J	unknown
WG149594	FW-WPCEPO	12/19/2016	6	L66811-6	Turbidity	15.1	NTU	H	0.2	0.5	15.1	J	unknown
WG149717	FW-WPCEPO	12/19/2016	6	L66811-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-WPCEPO	12/19/2016	6	L66811-6	Copper, Dissolved, ICP-MS	2.85	ug/L	H	0.2	2	2.85	J	unknown
WG149717	FW-WPCEPO	12/19/2016	6	L66811-6	Lead, Dissolved, ICP-MS	0.17	ug/L	<RDL,H	0.1	0.5	0.17	J	unknown
WG149717	FW-WPCEPO	12/19/2016	6	L66811-6	Zinc, Dissolved, ICP-MS	54	ug/L	H	0.5	2.5	54	J	unknown
WG149573	FW-WPCEPO	12/19/2016	6	L66811-6	Benzo(g,h,i)perylene	0.026	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG149573	FW-WPCEPO	12/19/2016	6	L66811-6	Dibenzo(a,h)anthracene	0.014	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-WPCEPO	12/19/2016	6	L66811-6	Indeno(1,2,3-Cd)Pyrene	0.018	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149575	FW-NFWHC	12/19/2016	6	L66811-7	Orthophosphate Phosphorus	0.0144	mg/L	H	0.005	0.01	0.0144	J	unknown
WG149561	FW-NFWHC	12/19/2016	6	L66811-7	pH	7.64	pH	H			7.64	J	unknown
WG149594	FW-NFWHC	12/19/2016	6	L66811-7	Turbidity	10	NTU	H	0.2	0.5	10	J	unknown
WG149717	FW-NFWHC	12/19/2016	6	L66811-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG149717	FW-NFWHC	12/19/2016	6	L66811-7	Copper, Dissolved, ICP-MS	1.7	ug/L	<RDL,H	0.2	2	1.7	J	unknown
WG149717	FW-NFWHC	12/19/2016	6	L66811-7	Lead, Dissolved, ICP-MS	0.17	ug/L	<RDL,H	0.1	0.5	0.17	J	unknown
WG149717	FW-NFWHC	12/19/2016	6	L66811-7	Zinc, Dissolved, ICP-MS	22.9	ug/L	H	0.5	2.5	22.9	J	unknown
WG149573	FW-NFWHC	12/19/2016	6	L66811-7	Benzo(g,h,i)perylene	0.016	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-NFWHC	12/19/2016	6	L66811-7	Dibenzo(a,h)anthracene	0.011	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149573	FW-NFWHC	12/19/2016	6	L66811-7	Indeno(1,2,3-Cd)Pyrene	0.013	ug/L	<RDL,B	0.0094	0.0472	0.0472	U	
WG149575	FFBLANK	12/20/2016	6	L66811-8	Orthophosphate Phosphorus		mg/L	<MDL	0.005	0.01	0.005	UJ	unknown
WG149912	FW-EBI	1/17/2017	7	L66937-1	Orthophosphate Phosphorus	0.0128	mg/L	H	0.0005	0.002	0.0128	J	unknown
WG149906	FW-EBI	1/17/2017	7	L66937-1	pH	7.33	pH	H			7.33	J	unknown
WG150217	FW-EBI	1/17/2017	7	L66937-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150217	FW-EBI	1/17/2017	7	L66937-1	Copper, Dissolved, ICP-MS	1.7	ug/L	<RDL,H	0.2	2	1.7	J	unknown
WG150217	FW-EBI	1/17/2017	7	L66937-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150217	FW-EBI	1/17/2017	7	L66937-1	Zinc, Dissolved, ICP-MS	21.1	ug/L	H	0.5	2.5	21.1	J	unknown
WG149912	FFBLANK	1/18/2017	7	L66937-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG149912	FW-EBO	1/17/2017	7	L66937-2	Orthophosphate Phosphorus	0.284	mg/L	H	0.01	0.04	0.284	J	unknown
WG149906	FW-EBO	1/17/2017	7	L66937-2	pH	6.82	pH	H			6.82	J	unknown
WG150217	FW-EBO	1/17/2017	7	L66937-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150217	FW-EBO	1/17/2017	7	L66937-2	Copper, Dissolved, ICP-MS	2.35	ug/L	H	0.2	2	2.35	J	unknown
WG150217	FW-EBO	1/17/2017	7	L66937-2	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150217	FW-EBO	1/17/2017	7	L66937-2	Zinc, Dissolved, ICP-MS	2.2	ug/L	<RDL,H	0.5	2.5	2.2	J	unknown
WG149912	FW-WBI	1/17/2017	7	L66937-3	Orthophosphate Phosphorus	0.0127	mg/L	H	0.0005	0.002	0.0127	J	unknown
WG149906	FW-WBI	1/17/2017	7	L66937-3	pH	7	pH	H			7	J	unknown
WG150217	FW-WBI	1/17/2017	7	L66937-3	Cadmium, Dissolved, ICP-MS	0.07	ug/L	<RDL,H	0.05	0.25	0.07	J	unknown
WG150217	FW-WBI	1/17/2017	7	L66937-3	Copper, Dissolved, ICP-MS	1.7	ug/L	<RDL,H	0.2	2	1.7	J	unknown
WG150217	FW-WBI	1/17/2017	7	L66937-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150217	FW-WBI	1/17/2017	7	L66937-3	Zinc, Dissolved, ICP-MS	21.7	ug/L	H	0.5	2.5	21.7	J	unknown
WG149912	FW-WBO	1/17/2017	7	L66937-4	Orthophosphate Phosphorus	1.08	mg/L	H	0.1	0.4	1.08	J	unknown
WG149906	FW-WBO	1/17/2017	7	L66937-4	pH	6.57	pH	H			6.57	J	unknown
WG150217	FW-WBO	1/17/2017	7	L66937-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150217	FW-WBO	1/17/2017	7	L66937-4	Copper, Dissolved, ICP-MS	2.83	ug/L	H	0.2	2	2.83	J	unknown
WG150217	FW-WBO	1/17/2017	7	L66937-4	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H	0.1	0.5	0.12	J	unknown
WG150217	FW-WBO	1/17/2017	7	L66937-4	Zinc, Dissolved, ICP-MS	4.96	ug/L	H	0.5	2.5	4.96	J	unknown
WG149912	FW-WPCI	1/17/2017	7	L66937-5	Orthophosphate Phosphorus	0.0106	mg/L	H	0.0005	0.002	0.0106	J	unknown
WG149906	FW-WPCI	1/17/2017	7	L66937-5	pH	6.94	pH	H			6.94	J	unknown
WG150217	FW-WPCI	1/17/2017	7	L66937-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG150217	FW-WPCI	1/17/2017	7	L66937-5	Copper, Dissolved, ICP-MS	2.96	ug/L	H		0.2	2	2.96	J	unknown
WG150217	FW-WPCI	1/17/2017	7	L66937-5	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H		0.1	0.5	0.11	J	unknown
WG150217	FW-WPCI	1/17/2017	7	L66937-5	Zinc, Dissolved, ICP-MS	31.2	ug/L	H		0.5	2.5	31.2	J	unknown
WG149912	FW-WPCEPO	1/17/2017	7	L66937-6	Orthophosphate Phosphorus	0.0187	mg/L	H		0.0005	0.002	0.0187	J	unknown
WG149906	FW-WPCEPO	1/17/2017	7	L66937-6	pH	6.9	pH	H				6.9	J	unknown
WG150217	FW-WPCEPO	1/17/2017	7	L66937-6	Cadmium, Dissolved, ICP-MS	0.057	ug/L	<RDL,H		0.05	0.25	0.057	J	unknown
WG150217	FW-WPCEPO	1/17/2017	7	L66937-6	Copper, Dissolved, ICP-MS	2.96	ug/L	H		0.2	2	2.96	J	unknown
WG150217	FW-WPCEPO	1/17/2017	7	L66937-6	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H		0.1	0.5	0.12	J	unknown
WG150217	FW-WPCEPO	1/17/2017	7	L66937-6	Zinc, Dissolved, ICP-MS	40.6	ug/L	H		0.5	2.5	40.6	J	unknown
WG149912	FW-NFWHC	1/17/2017	7	L66937-7	Orthophosphate Phosphorus	0.0178	mg/L	H		0.0005	0.002	0.0178	J	unknown
WG149906	FW-NFWHC	1/17/2017	7	L66937-7	pH	7.26	pH	H				7.26	J	unknown
WG150217	FW-NFWHC	1/17/2017	7	L66937-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150217	FW-NFWHC	1/17/2017	7	L66937-7	Copper, Dissolved, ICP-MS	2.29	ug/L	H		0.2	2	2.29	J	unknown
WG150217	FW-NFWHC	1/17/2017	7	L66937-7	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H		0.1	0.5	0.21	J	unknown
WG150217	FW-NFWHC	1/17/2017	7	L66937-7	Zinc, Dissolved, ICP-MS	15.7	ug/L	H		0.5	2.5	15.7	J	unknown
WG149912	FW-EBI	1/17/2017	7	L66937-8	Orthophosphate Phosphorus	0.013	mg/L	H		0.0005	0.002	0.013	J	unknown
WG149906	FW-EBI	1/17/2017	7	L66937-8	pH	7.01	pH	H				7.01	J	unknown
WG150208	FW-EBI	2/8/2017	8	L67069-1	Orthophosphate Phosphorus	0.00758	mg/L	H		0.0005	0.002	0.00758	J	unknown
WG150178	FW-EBI	2/8/2017	8	L67069-1	pH	6.96	pH	H				6.96	J	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-1	Copper, Dissolved, ICP-MS	0.94	ug/L	<RDL,H		0.2	2	0.94	J	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-1	Zinc, Dissolved, ICP-MS	17	ug/L	H		0.5	2.5	17	J	unknown
WG150141	FW-WBI	2/9/2017	8	L67069-11	Fecal Coliform	120	CFU/100ml	C				120	J	unknown
WG150208	FFBLANK	2/9/2017	8	L67069-16	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG150208	FW-EBO	2/8/2017	8	L67069-2	Orthophosphate Phosphorus	0.342	mg/L	H		0.0025	0.01	0.342	J	unknown
WG150178	FW-EBO	2/8/2017	8	L67069-2	pH	7.1	pH	H				7.1	J	unknown
WG150558	FW-EBO	2/8/2017	8	L67069-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-EBO	2/8/2017	8	L67069-2	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H		0.2	2	1.9	J	unknown
WG150558	FW-EBO	2/8/2017	8	L67069-2	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-EBO	2/8/2017	8	L67069-2	Zinc, Dissolved, ICP-MS	2.57	ug/L	H		0.5	2.5	2.57	J	unknown
WG150208	FW-WBI	2/8/2017	8	L67069-3	Orthophosphate Phosphorus	0.0083	mg/L	H		0.0005	0.002	0.0083	J	unknown
WG150178	FW-WBI	2/8/2017	8	L67069-3	pH	6.97	pH	H				6.97	J	unknown
WG150558	FW-WBI	2/8/2017	8	L67069-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-WBI	2/8/2017	8	L67069-3	Copper, Dissolved, ICP-MS	0.99	ug/L	<RDL,H		0.2	2	0.99	J	unknown
WG150558	FW-WBI	2/8/2017	8	L67069-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-WBI	2/8/2017	8	L67069-3	Zinc, Dissolved, ICP-MS	19	ug/L	H		0.5	2.5	19	J	unknown
WG150208	FW-WBO	2/8/2017	8	L67069-4	Orthophosphate Phosphorus	0.93	mg/L	H		0.01	0.04	0.93	J	unknown
WG150178	FW-WBO	2/8/2017	8	L67069-4	pH	6.49	pH	H				6.49	J	unknown
WG150558	FW-WBO	2/8/2017	8	L67069-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-WBO	2/8/2017	8	L67069-4	Copper, Dissolved, ICP-MS	2.08	ug/L	H		0.2	2	2.08	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG150558	FW-WBO	2/8/2017	8	L67069-4	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H		0.1	0.5	0.21	J	unknown
WG150558	FW-WBO	2/8/2017	8	L67069-4	Zinc, Dissolved, ICP-MS	5.39	ug/L	H		0.5	2.5	5.39	J	unknown
WG150208	FW-WPCI	2/8/2017	8	L67069-5	Orthophosphate Phosphorus	0.00388	mg/L	H		0.0005	0.002	0.00388	J	unknown
WG150178	FW-WPCI	2/8/2017	8	L67069-5	pH	6.96	pH	H				6.96	J	unknown
WG150558	FW-WPCI	2/8/2017	8	L67069-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-WPCI	2/8/2017	8	L67069-5	Copper, Dissolved, ICP-MS	2.05	ug/L	H		0.2	2	2.05	J	unknown
WG150558	FW-WPCI	2/8/2017	8	L67069-5	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-WPCI	2/8/2017	8	L67069-5	Zinc, Dissolved, ICP-MS	30.4	ug/L	H		0.5	2.5	30.4	J	unknown
WG150208	FW-WPCEPO	2/8/2017	8	L67069-6	Orthophosphate Phosphorus	0.023	mg/L	H		0.0005	0.002	0.023	J	unknown
WG150178	FW-WPCEPO	2/8/2017	8	L67069-6	pH	6.97	pH	H				6.97	J	unknown
WG150558	FW-WPCEPO	2/8/2017	8	L67069-6	Cadmium, Dissolved, ICP-MS	0.064	ug/L	<RDL,H		0.05	0.25	0.064	J	unknown
WG150558	FW-WPCEPO	2/8/2017	8	L67069-6	Copper, Dissolved, ICP-MS	2.62	ug/L	H		0.2	2	2.62	J	unknown
WG150558	FW-WPCEPO	2/8/2017	8	L67069-6	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-WPCEPO	2/8/2017	8	L67069-6	Zinc, Dissolved, ICP-MS	46.4	ug/L	H		0.5	2.5	46.4	J	unknown
WG150208	FW-NFWHC	2/8/2017	8	L67069-7	Orthophosphate Phosphorus	0.0117	mg/L	H		0.001	0.004	0.0117	J	unknown
WG150178	FW-NFWHC	2/8/2017	8	L67069-7	pH	7.39	pH	H				7.39	J	unknown
WG150558	FW-NFWHC	2/8/2017	8	L67069-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-NFWHC	2/8/2017	8	L67069-7	Copper, Dissolved, ICP-MS	5.52	ug/L	H		0.2	2	5.52	J	unknown
WG150558	FW-NFWHC	2/8/2017	8	L67069-7	Lead, Dissolved, ICP-MS	0.27	ug/L	<RDL,H		0.1	0.5	0.27	J	unknown
WG150558	FW-NFWHC	2/8/2017	8	L67069-7	Zinc, Dissolved, ICP-MS	25.3	ug/L	H		0.5	2.5	25.3	J	unknown
WG150208	FW-EBI	2/8/2017	8	L67069-8	Orthophosphate Phosphorus	0.00741	mg/L	H		0.0005	0.002	0.00741	J	unknown
WG150178	FW-EBI	2/8/2017	8	L67069-8	pH	7	pH	H				7	J	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-8	Copper, Dissolved, ICP-MS	0.99	ug/L	<RDL,H		0.2	2	0.99	J	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150558	FW-EBI	2/8/2017	8	L67069-8	Zinc, Dissolved, ICP-MS	17.9	ug/L	H		0.5	2.5	17.9	J	unknown
WG150471	FW-EBI	2/15/2017	9	L67141-1	Orthophosphate Phosphorus	0.00767	mg/L	H		0.0005	0.002	0.00767	J	unknown
WG150301	FW-EBI	2/15/2017	9	L67141-1	pH	7.14	pH	H				7.14	J	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-1	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H		0.2	2	1.9	J	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-1	Zinc, Dissolved, ICP-MS	13	ug/L	H		0.5	2.5	13	J	unknown
WG150471	FFBLANK	2/16/2017	9	L67141-16	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG150471	FW-WBO	2/16/2017	9	L67141-17	Orthophosphate Phosphorus	1.31	mg/L	H		0.005	0.02	1.31	J	unknown
WG150301	FW-WBO	2/16/2017	9	L67141-17	pH	6.72	pH	H				6.72	J	unknown
WG150618	FW-WBO	2/16/2017	9	L67141-17	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG150618	FW-WBO	2/16/2017	9	L67141-17	Copper, Dissolved, ICP-MS	4.83	ug/L	H		0.2	2	4.83	J	unknown
WG150618	FW-WBO	2/16/2017	9	L67141-17	Lead, Dissolved, ICP-MS	0.32	ug/L	<RDL,H		0.1	0.5	0.32	J	unknown
WG150618	FW-WBO	2/16/2017	9	L67141-17	Zinc, Dissolved, ICP-MS	5.04	ug/L	H		0.5	2.5	5.04	J	unknown
WG150471	FW-EBO	2/15/2017	9	L67141-2	Orthophosphate Phosphorus	0.452	mg/L	H		0.005	0.02	0.452	J	unknown
WG150301	FW-EBO	2/15/2017	9	L67141-2	pH	6.87	pH	H				6.87	J	unknown

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG150726	FW-EBO	2/15/2017	9	L67141-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-EBO	2/15/2017	9	L67141-2	Copper, Dissolved, ICP-MS	2.86	ug/L	H	0.2	2	2.86	J	unknown
WG150726	FW-EBO	2/15/2017	9	L67141-2	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG150726	FW-EBO	2/15/2017	9	L67141-2	Zinc, Dissolved, ICP-MS	2.5	ug/L	H	0.5	2.5	2.5	J	unknown
WG150471	FW-WBI	2/15/2017	9	L67141-3	Orthophosphate Phosphorus	0.00963	mg/L	H	0.0005	0.002	0.00963	J	unknown
WG150301	FW-WBI	2/15/2017	9	L67141-3	pH	6.92	pH	H			6.92	J	unknown
WG150726	FW-WBI	2/15/2017	9	L67141-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-WBI	2/15/2017	9	L67141-3	Copper, Dissolved, ICP-MS	1.8	ug/L	<RDL,H	0.2	2	1.8	J	unknown
WG150726	FW-WBI	2/15/2017	9	L67141-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150726	FW-WBI	2/15/2017	9	L67141-3	Zinc, Dissolved, ICP-MS	12.4	ug/L	H	0.5	2.5	12.4	J	unknown
WG150471	FW-WBO	2/15/2017	9	L67141-4	Orthophosphate Phosphorus	1.32	mg/L	H	0.005	0.02	1.32	J	unknown
WG150301	FW-WBO	2/15/2017	9	L67141-4	pH	6.65	pH	H			6.65	J	unknown
WG150618	FW-WBO	2/15/2017	9	L67141-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150618	FW-WBO	2/15/2017	9	L67141-4	Copper, Dissolved, ICP-MS	5.07	ug/L	H	0.2	2	5.07	J	unknown
WG150618	FW-WBO	2/15/2017	9	L67141-4	Lead, Dissolved, ICP-MS	0.35	ug/L	<RDL,H	0.1	0.5	0.35	J	unknown
WG150618	FW-WBO	2/15/2017	9	L67141-4	Zinc, Dissolved, ICP-MS	5.88	ug/L	H	0.5	2.5	5.88	J	unknown
WG150471	FW-WPCI	2/15/2017	9	L67141-5	Orthophosphate Phosphorus	0.00396	mg/L	H	0.0005	0.002	0.00396	J	unknown
WG150301	FW-WPCI	2/15/2017	9	L67141-5	pH	7.01	pH	H			7.01	J	unknown
WG150726	FW-WPCI	2/15/2017	9	L67141-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-WPCI	2/15/2017	9	L67141-5	Copper, Dissolved, ICP-MS	2.47	ug/L	H	0.2	2	2.47	J	unknown
WG150726	FW-WPCI	2/15/2017	9	L67141-5	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150726	FW-WPCI	2/15/2017	9	L67141-5	Zinc, Dissolved, ICP-MS	21	ug/L	H	0.5	2.5	21	J	unknown
WG150471	FW-WPCEPO	2/15/2017	9	L67141-6	Orthophosphate Phosphorus	0.0222	mg/L	H	0.0005	0.002	0.0222	J	unknown
WG150301	FW-WPCEPO	2/15/2017	9	L67141-6	pH	6.92	pH	H			6.92	J	unknown
WG150726	FW-WPCEPO	2/15/2017	9	L67141-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-WPCEPO	2/15/2017	9	L67141-6	Copper, Dissolved, ICP-MS	3.07	ug/L	H	0.2	2	3.07	J	unknown
WG150726	FW-WPCEPO	2/15/2017	9	L67141-6	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG150726	FW-WPCEPO	2/15/2017	9	L67141-6	Zinc, Dissolved, ICP-MS	29.1	ug/L	H	0.5	2.5	29.1	J	unknown
WG150471	FW-NFWHC	2/15/2017	9	L67141-7	Orthophosphate Phosphorus	0.0263	mg/L	H	0.005	0.02	0.0263	J	unknown
WG150301	FW-NFWHC	2/15/2017	9	L67141-7	pH	7.24	pH	H			7.24	J	unknown
WG150726	FW-NFWHC	2/15/2017	9	L67141-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-NFWHC	2/15/2017	9	L67141-7	Copper, Dissolved, ICP-MS	2.39	ug/L	H	0.2	2	2.39	J	unknown
WG150726	FW-NFWHC	2/15/2017	9	L67141-7	Lead, Dissolved, ICP-MS	0.22	ug/L	<RDL,H	0.1	0.5	0.22	J	unknown
WG150726	FW-NFWHC	2/15/2017	9	L67141-7	Zinc, Dissolved, ICP-MS	13.9	ug/L	H	0.5	2.5	13.9	J	unknown
WG150471	FW-EBI	2/15/2017	9	L67141-8	Orthophosphate Phosphorus	0.00788	mg/L	H	0.0005	0.002	0.00788	J	unknown
WG150301	FW-EBI	2/15/2017	9	L67141-8	pH	6.95	pH	H			6.95	J	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-8	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H	0.2	2	1.9	J	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG150726	FW-EBI	2/15/2017	9	L67141-8	Zinc, Dissolved, ICP-MS	12.9	ug/L	H	0.5	2.5	12.9	J	unknown
WG150613	FW-EBI	3/7/2017	10	L67231-1	Orthophosphate Phosphorus	0.00823	mg/L	H	0.0005	0.002	0.00823	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG150606	FW-EBI	3/7/2017	10	L67231-1	pH	6.98	pH	H			6.98	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-1	Copper, Dissolved, ICP-MS	2.22	ug/L	H	0.2	2	2.22	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-1	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-1	Zinc, Dissolved, ICP-MS	18.8	ug/L	H	0.5	2.5	18.8	J	unknown
WG150613	FFBLANK	3/8/2017	10	L67231-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG150613	FW-EBO	3/7/2017	10	L67231-2	Orthophosphate Phosphorus	0.579	mg/L	H	0.0025	0.01	0.579	J	unknown
WG150606	FW-EBO	3/7/2017	10	L67231-2	pH	6.8	pH	H			6.8	J	unknown
WG151118	FW-EBO	3/7/2017	10	L67231-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151118	FW-EBO	3/7/2017	10	L67231-2	Copper, Dissolved, ICP-MS	3.84	ug/L	H	0.2	2	3.84	J	unknown
WG151118	FW-EBO	3/7/2017	10	L67231-2	Lead, Dissolved, ICP-MS	0.29	ug/L	<RDL,H	0.1	0.5	0.29	J	unknown
WG151118	FW-EBO	3/7/2017	10	L67231-2	Zinc, Dissolved, ICP-MS	3.41	ug/L	H	0.5	2.5	3.41	J	unknown
WG150613	FW-WBI	3/7/2017	10	L67231-3	Orthophosphate Phosphorus	0.00828	mg/L	H	0.0005	0.002	0.00828	J	unknown
WG150606	FW-WBI	3/7/2017	10	L67231-3	pH	6.93	pH	H			6.93	J	unknown
WG151071	FW-WBI	3/7/2017	10	L67231-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151071	FW-WBI	3/7/2017	10	L67231-3	Copper, Dissolved, ICP-MS	2.17	ug/L	H	0.2	2	2.17	J	unknown
WG151071	FW-WBI	3/7/2017	10	L67231-3	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG151071	FW-WBI	3/7/2017	10	L67231-3	Zinc, Dissolved, ICP-MS	18.4	ug/L	H	0.5	2.5	18.4	J	unknown
WG150613	FW-WBO	3/7/2017	10	L67231-4	Orthophosphate Phosphorus	2.21	mg/L	H	0.013	0.05	2.21	J	unknown
WG150606	FW-WBO	3/7/2017	10	L67231-4	pH	6.75	pH	H			6.75	J	unknown
WG150618	FW-WBO	3/7/2017	10	L67231-4	Cadmium, Dissolved, ICP-MS	0.052	ug/L	<RDL,H	0.05	0.25	0.052	J	unknown
WG150618	FW-WBO	3/7/2017	10	L67231-4	Copper, Dissolved, ICP-MS	6.18	ug/L	H	0.2	2	6.18	J	unknown
WG150618	FW-WBO	3/7/2017	10	L67231-4	Lead, Dissolved, ICP-MS	1.14	ug/L	H	0.1	0.5	1.14	J	unknown
WG150618	FW-WBO	3/7/2017	10	L67231-4	Zinc, Dissolved, ICP-MS	8.26	ug/L	H	0.5	2.5	8.26	J	unknown
WG150613	FW-WPCI	3/7/2017	10	L67231-5	Orthophosphate Phosphorus	0.00581	mg/L	H	0.0005	0.002	0.00581	J	unknown
WG150606	FW-WPCI	3/7/2017	10	L67231-5	pH	7.12	pH	H			7.12	J	unknown
WG151071	FW-WPCI	3/7/2017	10	L67231-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151071	FW-WPCI	3/7/2017	10	L67231-5	Copper, Dissolved, ICP-MS	3.1	ug/L	H	0.2	2	3.1	J	unknown
WG151071	FW-WPCI	3/7/2017	10	L67231-5	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H	0.1	0.5	0.12	J	unknown
WG151071	FW-WPCI	3/7/2017	10	L67231-5	Zinc, Dissolved, ICP-MS	21.3	ug/L	H	0.5	2.5	21.3	J	unknown
WG150613	FW-WPCEPO	3/7/2017	10	L67231-6	Orthophosphate Phosphorus	0.0198	mg/L	H	0.0005	0.002	0.0198	J	unknown
WG150606	FW-WPCEPO	3/7/2017	10	L67231-6	pH	7.07	pH	H			7.07	J	unknown
WG151071	FW-WPCEPO	3/7/2017	10	L67231-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151071	FW-WPCEPO	3/7/2017	10	L67231-6	Copper, Dissolved, ICP-MS	3.36	ug/L	H	0.2	2	3.36	J	unknown
WG151071	FW-WPCEPO	3/7/2017	10	L67231-6	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG151071	FW-WPCEPO	3/7/2017	10	L67231-6	Zinc, Dissolved, ICP-MS	29.4	ug/L	H	0.5	2.5	29.4	J	unknown
WG150613	FW-NFWHC	3/7/2017	10	L67231-7	Orthophosphate Phosphorus	0.0154	mg/L	H	0.0005	0.002	0.0154	J	unknown
WG150606	FW-NFWHC	3/7/2017	10	L67231-7	pH	7.49	pH	H			7.49	J	unknown
WG151071	FW-NFWHC	3/7/2017	10	L67231-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151071	FW-NFWHC	3/7/2017	10	L67231-7	Copper, Dissolved, ICP-MS	2.45	ug/L	H	0.2	2	2.45	J	unknown
WG151071	FW-NFWHC	3/7/2017	10	L67231-7	Lead, Dissolved, ICP-MS	0.24	ug/L	<RDL,H	0.1	0.5	0.24	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG151071	FW-NFWHC	3/7/2017	10	L67231-7	Zinc, Dissolved, ICP-MS	15.4	ug/L	H		0.5	2.5	15.4	J	unknown
WG150613	FW-EBI	3/7/2017	10	L67231-8	Orthophosphate Phosphorus	0.00863	mg/L	H		0.0005	0.002	0.00863	J	unknown
WG150606	FW-EBI	3/7/2017	10	L67231-8	pH	6.98	pH	H				6.98	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-8	Copper, Dissolved, ICP-MS	2.13	ug/L	H		0.2	2	2.13	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-8	Lead, Dissolved, ICP-MS	0.1	ug/L	<RDL,H		0.1	0.5	0.1	J	unknown
WG151071	FW-EBI	3/7/2017	10	L67231-8	Zinc, Dissolved, ICP-MS	18.2	ug/L	H		0.5	2.5	18.2	J	unknown
WG150821	FW-EBI	3/9/2017	11	L67283-1	Orthophosphate Phosphorus	0.00903	mg/L	H		0.0005	0.002	0.00903	J	unknown
WG150639	FW-EBI	3/9/2017	11	L67283-1	pH	6.92	pH	H				6.92	J	unknown
WG151071	FW-EBI	3/9/2017	11	L67283-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151071	FW-EBI	3/9/2017	11	L67283-1	Copper, Dissolved, ICP-MS	2.3	ug/L	H		0.2	2	2.3	J	unknown
WG151071	FW-EBI	3/9/2017	11	L67283-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG151071	FW-EBI	3/9/2017	11	L67283-1	Zinc, Dissolved, ICP-MS	18.9	ug/L	H		0.5	2.5	18.9	J	unknown
WG150821	FFBLANK	3/10/2017	11	L67283-16	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG150821	FW-EBO	3/9/2017	11	L67283-2	Orthophosphate Phosphorus	0.574	mg/L	H		0.0025	0.01	0.574	J	unknown
WG150639	FW-EBO	3/9/2017	11	L67283-2	pH	6.81	pH	H				6.81	J	unknown
WG151118	FW-EBO	3/9/2017	11	L67283-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151118	FW-EBO	3/9/2017	11	L67283-2	Copper, Dissolved, ICP-MS	3.71	ug/L	H		0.2	2	3.71	J	unknown
WG151118	FW-EBO	3/9/2017	11	L67283-2	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H		0.1	0.5	0.21	J	unknown
WG151118	FW-EBO	3/9/2017	11	L67283-2	Zinc, Dissolved, ICP-MS	3.29	ug/L	H		0.5	2.5	3.29	J	unknown
WG151028	FW-WBI	3/9/2017	11	L67283-3	Dissolved Organic Carbon	2.13	mg/L	J		0.5	1	2.13	J	unknown
WG150821	FW-WBI	3/9/2017	11	L67283-3	Orthophosphate Phosphorus	0.0082	mg/L	H		0.0005	0.002	0.0082	J	unknown
WG150639	FW-WBI	3/9/2017	11	L67283-3	pH	6.94	pH	H				6.94	J	unknown
WG150957	FW-WBI	3/9/2017	11	L67283-3	Total Organic Carbon	1.24	mg/L	J		0.5	1	1.24	J	unknown
WG151071	FW-WBI	3/9/2017	11	L67283-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151071	FW-WBI	3/9/2017	11	L67283-3	Copper, Dissolved, ICP-MS	2.28	ug/L	H		0.2	2	2.28	J	unknown
WG151071	FW-WBI	3/9/2017	11	L67283-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG151071	FW-WBI	3/9/2017	11	L67283-3	Zinc, Dissolved, ICP-MS	18.7	ug/L	H		0.5	2.5	18.7	J	unknown
WG150821	FW-WBO	3/9/2017	11	L67283-4	Orthophosphate Phosphorus	1.73	mg/L	H		0.01	0.04	1.73	J	unknown
WG150639	FW-WBO	3/9/2017	11	L67283-4	pH	6.74	pH	H				6.74	J	unknown
WG151118	FW-WBO	3/9/2017	11	L67283-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151118	FW-WBO	3/9/2017	11	L67283-4	Copper, Dissolved, ICP-MS	6.4	ug/L	H		0.2	2	6.4	J	unknown
WG151118	FW-WBO	3/9/2017	11	L67283-4	Lead, Dissolved, ICP-MS	0.37	ug/L	<RDL,H		0.1	0.5	0.37	J	unknown
WG151118	FW-WBO	3/9/2017	11	L67283-4	Zinc, Dissolved, ICP-MS	7.18	ug/L	H		0.5	2.5	7.18	J	unknown
WG150821	FW-WPCI	3/9/2017	11	L67283-5	Orthophosphate Phosphorus	0.00381	mg/L	H		0.0005	0.002	0.00381	J	unknown
WG150639	FW-WPCI	3/9/2017	11	L67283-5	pH	7.09	pH	H				7.09	J	unknown
WG151071	FW-WPCI	3/9/2017	11	L67283-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151071	FW-WPCI	3/9/2017	11	L67283-5	Copper, Dissolved, ICP-MS	2.6	ug/L	H		0.2	2	2.6	J	unknown
WG151071	FW-WPCI	3/9/2017	11	L67283-5	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H		0.1	0.5	0.11	J	unknown
WG151071	FW-WPCI	3/9/2017	11	L67283-5	Zinc, Dissolved, ICP-MS	23.5	ug/L	H		0.5	2.5	23.5	J	unknown
WG150821	FW-WPCEPO	3/9/2017	11	L67283-6	Orthophosphate Phosphorus	0.0205	mg/L	H		0.0005	0.002	0.0205	J	unknown

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG150639	FW-WPCEPO	3/9/2017	11	L67283-6	pH	6.99	pH	H				6.99	J	unknown
WG151071	FW-WPCEPO	3/9/2017	11	L67283-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WPCEPO	3/9/2017	11	L67283-6	Copper, Dissolved, ICP-MS	3.14	ug/L	H	0.2	2		3.14	J	unknown
WG151071	FW-WPCEPO	3/9/2017	11	L67283-6	Lead, Dissolved, ICP-MS	0.16	ug/L	<RDL,H	0.1	0.5		0.16	J	unknown
WG151071	FW-WPCEPO	3/9/2017	11	L67283-6	Zinc, Dissolved, ICP-MS	30.7	ug/L	H	0.5	2.5		30.7	J	unknown
WG150821	FW-NFWHC	3/9/2017	11	L67283-7	Orthophosphate Phosphorus	0.0164	mg/L	H	0.0005	0.002		0.0164	J	unknown
WG150639	FW-NFWHC	3/9/2017	11	L67283-7	pH	7.41	pH	H				7.41	J	unknown
WG151071	FW-NFWHC	3/9/2017	11	L67283-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-NFWHC	3/9/2017	11	L67283-7	Copper, Dissolved, ICP-MS	2.41	ug/L	H	0.2	2		2.41	J	unknown
WG151071	FW-NFWHC	3/9/2017	11	L67283-7	Lead, Dissolved, ICP-MS	0.2	ug/L	<RDL,H	0.1	0.5		0.2	J	unknown
WG151071	FW-NFWHC	3/9/2017	11	L67283-7	Zinc, Dissolved, ICP-MS	15.8	ug/L	H	0.5	2.5		15.8	J	unknown
WG151071	FW-EBI	3/13/2017	12	L67313-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-EBI	3/13/2017	12	L67313-1	Copper, Dissolved, ICP-MS	3.61	ug/L	H	0.2	2		3.61	J	unknown
WG151071	FW-EBI	3/13/2017	12	L67313-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5		0.1	UJ	unknown
WG151071	FW-EBI	3/13/2017	12	L67313-1	Zinc, Dissolved, ICP-MS	19.8	ug/L	H	0.5	2.5		19.8	J	unknown
WG150821	FFBLANK	3/14/2017	12	L67313-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002		0.0005	UJ	unknown
WG150821	FW-EBO	3/13/2017	12	L67313-2	Orthophosphate Phosphorus	0.566	mg/L	H	0.0025	0.01		0.566	J	unknown
WG150765	FW-EBO	3/13/2017	12	L67313-2	pH	7.06	pH	H				7.06	J	unknown
WG151118	FW-EBO	3/13/2017	12	L67313-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151118	FW-EBO	3/13/2017	12	L67313-2	Copper, Dissolved, ICP-MS	4.25	ug/L	H	0.2	2		4.25	J	unknown
WG151118	FW-EBO	3/13/2017	12	L67313-2	Lead, Dissolved, ICP-MS	0.36	ug/L	<RDL,H	0.1	0.5		0.36	J	unknown
WG151118	FW-EBO	3/13/2017	12	L67313-2	Zinc, Dissolved, ICP-MS	3.6	ug/L	H	0.5	2.5		3.6	J	unknown
WG150821	FW-WBI	3/13/2017	12	L67313-3	Orthophosphate Phosphorus	0.00761	mg/L	H	0.0005	0.002		0.00761	J	unknown
WG150765	FW-WBI	3/13/2017	12	L67313-3	pH	6.97	pH	H				6.97	J	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-3	Copper, Dissolved, ICP-MS	3.99	ug/L	H	0.2	2		3.99	J	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5		0.1	UJ	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-3	Zinc, Dissolved, ICP-MS	19.3	ug/L	H	0.5	2.5		19.3	J	unknown
WG150821	FW-WBO	3/13/2017	12	L67313-4	Orthophosphate Phosphorus	1.72	mg/L	H	0.01	0.04		1.72	J	unknown
WG150765	FW-WBO	3/13/2017	12	L67313-4	pH	6.89	pH	H				6.89	J	unknown
WG151118	FW-WBO	3/13/2017	12	L67313-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151118	FW-WBO	3/13/2017	12	L67313-4	Copper, Dissolved, ICP-MS	5.74	ug/L	H	0.2	2		5.74	J	unknown
WG151118	FW-WBO	3/13/2017	12	L67313-4	Lead, Dissolved, ICP-MS	0.672	ug/L	H	0.1	0.5		0.672	J	unknown
WG151118	FW-WBO	3/13/2017	12	L67313-4	Zinc, Dissolved, ICP-MS	7.38	ug/L	H	0.5	2.5		7.38	J	unknown
WG150821	FW-WPCI	3/13/2017	12	L67313-5	Orthophosphate Phosphorus	0.00807	mg/L	H	0.0005	0.002		0.00807	J	unknown
WG150765	FW-WPCI	3/13/2017	12	L67313-5	pH	7.14	pH	H				7.14	J	unknown
WG151071	FW-WPCI	3/13/2017	12	L67313-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WPCI	3/13/2017	12	L67313-5	Copper, Dissolved, ICP-MS	3.48	ug/L	H	0.2	2		3.48	J	unknown
WG151071	FW-WPCI	3/13/2017	12	L67313-5	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H	0.1	0.5		0.21	J	unknown
WG151071	FW-WPCI	3/13/2017	12	L67313-5	Zinc, Dissolved, ICP-MS	25.5	ug/L	H	0.5	2.5		25.5	J	unknown
WG150821	FW-WPCEPO	3/13/2017	12	L67313-6	Orthophosphate Phosphorus	0.0299	mg/L	H	0.0005	0.002		0.0299	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG150765	FW-WPCEPO	3/13/2017	12	L67313-6	pH	7.11	pH	H				7.11	J	unknown
WG151071	FW-WPCEPO	3/13/2017	12	L67313-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WPCEPO	3/13/2017	12	L67313-6	Copper, Dissolved, ICP-MS	3.32	ug/L	H	0.2	2		3.32	J	unknown
WG151071	FW-WPCEPO	3/13/2017	12	L67313-6	Lead, Dissolved, ICP-MS	0.22	ug/L	<RDL,H	0.1	0.5		0.22	J	unknown
WG151071	FW-WPCEPO	3/13/2017	12	L67313-6	Zinc, Dissolved, ICP-MS	29.8	ug/L	H	0.5	2.5		29.8	J	unknown
WG150821	FW-NFWHC	3/13/2017	12	L67313-7	Orthophosphate Phosphorus	0.0188	mg/L	H	0.0005	0.002		0.0188	J	unknown
WG150765	FW-NFWHC	3/13/2017	12	L67313-7	pH	7.52	pH	H				7.52	J	unknown
WG151071	FW-NFWHC	3/13/2017	12	L67313-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-NFWHC	3/13/2017	12	L67313-7	Copper, Dissolved, ICP-MS	2.46	ug/L	H	0.2	2		2.46	J	unknown
WG151071	FW-NFWHC	3/13/2017	12	L67313-7	Lead, Dissolved, ICP-MS	0.25	ug/L	<RDL,H	0.1	0.5		0.25	J	unknown
WG151071	FW-NFWHC	3/13/2017	12	L67313-7	Zinc, Dissolved, ICP-MS	15.2	ug/L	H	0.5	2.5		15.2	J	unknown
WG150821	FW-WBI	3/13/2017	12	L67313-8	Orthophosphate Phosphorus	0.00823	mg/L	H	0.0005	0.002		0.00823	J	unknown
WG150765	FW-WBI	3/13/2017	12	L67313-8	pH	7	pH	H				7	J	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-8	Copper, Dissolved, ICP-MS	4.01	ug/L	H	0.2	2		4.01	J	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5		0.1	UJ	unknown
WG151071	FW-WBI	3/13/2017	12	L67313-8	Zinc, Dissolved, ICP-MS	18.9	ug/L	H	0.5	2.5		18.9	J	unknown
WG150859	FW-EBI	3/14/2017	13	L67335-1	Orthophosphate Phosphorus	0.00742	mg/L	H	0.0005	0.002		0.00742	J	unknown
WG150789	FW-EBI	3/14/2017	13	L67335-1	pH	7.03	pH	H				7.03	J	unknown
WG151071	FW-EBI	3/14/2017	13	L67335-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-EBI	3/14/2017	13	L67335-1	Copper, Dissolved, ICP-MS	4.27	ug/L	H	0.2	2		4.27	J	unknown
WG151071	FW-EBI	3/14/2017	13	L67335-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5		0.1	UJ	unknown
WG151071	FW-EBI	3/14/2017	13	L67335-1	Zinc, Dissolved, ICP-MS	18.9	ug/L	H	0.5	2.5		18.9	J	unknown
WG150859	FFBLANK	3/16/2017	13	L67335-16	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002		0.0005	UJ	unknown
WG150859	FW-EBO	3/14/2017	13	L67335-2	Orthophosphate Phosphorus	0.514	mg/L	H	0.0025	0.01		0.514	J	unknown
WG150789	FW-EBO	3/14/2017	13	L67335-2	pH	7.03	pH	H				7.03	J	unknown
WG151118	FW-EBO	3/14/2017	13	L67335-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151118	FW-EBO	3/14/2017	13	L67335-2	Copper, Dissolved, ICP-MS	3.89	ug/L	H	0.2	2		3.89	J	unknown
WG151118	FW-EBO	3/14/2017	13	L67335-2	Lead, Dissolved, ICP-MS	0.2	ug/L	<RDL,H	0.1	0.5		0.2	J	unknown
WG151118	FW-EBO	3/14/2017	13	L67335-2	Zinc, Dissolved, ICP-MS	3.1	ug/L	H	0.5	2.5		3.1	J	unknown
WG150859	FW-WBI	3/14/2017	13	L67335-3	Orthophosphate Phosphorus	0.00802	mg/L	H	0.0005	0.002		0.00802	J	unknown
WG150789	FW-WBI	3/14/2017	13	L67335-3	pH	7.04	pH	H				7.04	J	unknown
WG151071	FW-WBI	3/14/2017	13	L67335-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151071	FW-WBI	3/14/2017	13	L67335-3	Copper, Dissolved, ICP-MS	4.23	ug/L	H	0.2	2		4.23	J	unknown
WG151071	FW-WBI	3/14/2017	13	L67335-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5		0.1	UJ	unknown
WG151071	FW-WBI	3/14/2017	13	L67335-3	Zinc, Dissolved, ICP-MS	18.5	ug/L	H	0.5	2.5		18.5	J	unknown
WG150859	FW-WBO	3/14/2017	13	L67335-4	Orthophosphate Phosphorus	1.53	mg/L	H	0.01	0.04		1.53	J	unknown
WG150789	FW-WBO	3/14/2017	13	L67335-4	pH	7.01	pH	H				7.01	J	unknown
WG151118	FW-WBO	3/14/2017	13	L67335-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25		0.05	UJ	unknown
WG151118	FW-WBO	3/14/2017	13	L67335-4	Copper, Dissolved, ICP-MS	5.49	ug/L	H	0.2	2		5.49	J	unknown
WG151118	FW-WBO	3/14/2017	13	L67335-4	Lead, Dissolved, ICP-MS	0.47	ug/L	<RDL,H	0.1	0.5		0.47	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG151118	FW-WBO	3/14/2017	13	L67335-4	Zinc, Dissolved, ICP-MS	6.91	ug/L	H		0.5	2.5	6.91	J	unknown
WG150859	FW-WPCI	3/14/2017	13	L67335-5	Orthophosphate Phosphorus	0.00481	mg/L	H		0.0005	0.002	0.00481	J	unknown
WG150789	FW-WPCI	3/14/2017	13	L67335-5	pH	7.11	pH	H				7.11	J	unknown
WG151071	FW-WPCI	3/14/2017	13	L67335-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151071	FW-WPCI	3/14/2017	13	L67335-5	Copper, Dissolved, ICP-MS	3.08	ug/L	H		0.2	2	3.08	J	unknown
WG151071	FW-WPCI	3/14/2017	13	L67335-5	Lead, Dissolved, ICP-MS	0.37	ug/L	<RDL,H		0.1	0.5	0.37	J	unknown
WG151071	FW-WPCI	3/14/2017	13	L67335-5	Zinc, Dissolved, ICP-MS	26.4	ug/L	H		0.5	2.5	26.4	J	unknown
WG150859	FW-WPCEPO	3/14/2017	13	L67335-6	Orthophosphate Phosphorus	0.0219	mg/L	H		0.0005	0.002	0.0219	J	unknown
WG150789	FW-WPCEPO	3/14/2017	13	L67335-6	pH	7.12	pH	H				7.12	J	unknown
WG151091	FW-WPCEPO	3/14/2017	13	L67335-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151091	FW-WPCEPO	3/14/2017	13	L67335-6	Copper, Dissolved, ICP-MS	2.8	ug/L	H		0.2	2	2.8	J	unknown
WG151091	FW-WPCEPO	3/14/2017	13	L67335-6	Lead, Dissolved, ICP-MS	0.16	ug/L	<RDL,H		0.1	0.5	0.16	J	unknown
WG151091	FW-WPCEPO	3/14/2017	13	L67335-6	Zinc, Dissolved, ICP-MS	29.2	ug/L	H		0.5	2.5	29.2	J	unknown
WG150859	FW-NFWHC	3/14/2017	13	L67335-7	Orthophosphate Phosphorus	0.0188	mg/L	H		0.0005	0.002	0.0188	J	unknown
WG150789	FW-NFWHC	3/14/2017	13	L67335-7	pH	7.49	pH	H				7.49	J	unknown
WG151091	FW-NFWHC	3/14/2017	13	L67335-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151091	FW-NFWHC	3/14/2017	13	L67335-7	Copper, Dissolved, ICP-MS	2.49	ug/L	H		0.2	2	2.49	J	unknown
WG151091	FW-NFWHC	3/14/2017	13	L67335-7	Lead, Dissolved, ICP-MS	0.24	ug/L	<RDL,H		0.1	0.5	0.24	J	unknown
WG151091	FW-NFWHC	3/14/2017	13	L67335-7	Zinc, Dissolved, ICP-MS	14.9	ug/L	H		0.5	2.5	14.9	J	unknown
WG150859	FW-WBI	3/14/2017	13	L67335-8	Orthophosphate Phosphorus	0.00752	mg/L	H		0.0005	0.002	0.00752	J	unknown
WG150789	FW-WBI	3/14/2017	13	L67335-8	pH	6.95	pH	H				6.95	J	unknown
WG151091	FW-WBI	3/14/2017	13	L67335-8	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151091	FW-WBI	3/14/2017	13	L67335-8	Copper, Dissolved, ICP-MS	3.93	ug/L	H		0.2	2	3.93	J	unknown
WG151091	FW-WBI	3/14/2017	13	L67335-8	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG151091	FW-WBI	3/14/2017	13	L67335-8	Zinc, Dissolved, ICP-MS	17	ug/L	H		0.5	2.5	17	J	unknown
WG150997	FW-EBI	3/26/2017	14	L67398-1	Orthophosphate Phosphorus	0.00785	mg/L	H		0.0005	0.002	0.00785	J	unknown
WG150969	FW-EBI	3/26/2017	14	L67398-1	pH	7.15	pH	H				7.15	J	unknown
WG151091	FW-EBI	3/26/2017	14	L67398-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151091	FW-EBI	3/26/2017	14	L67398-1	Copper, Dissolved, ICP-MS	3.47	ug/L	H		0.2	2	3.47	J	unknown
WG151091	FW-EBI	3/26/2017	14	L67398-1	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H		0.1	0.5	0.11	J	unknown
WG151091	FW-EBI	3/26/2017	14	L67398-1	Zinc, Dissolved, ICP-MS	21.5	ug/L	H		0.5	2.5	21.5	J	unknown
WG150997	FFBLANK	3/27/2017	14	L67398-16	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG150997	FW-EBO	3/26/2017	14	L67398-2	Orthophosphate Phosphorus	0.743	mg/L	H		0.0025	0.01	0.743	J	unknown
WG150969	FW-EBO	3/26/2017	14	L67398-2	pH	6.72	pH	H				6.72	J	unknown
WG151118	FW-EBO	3/26/2017	14	L67398-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151118	FW-EBO	3/26/2017	14	L67398-2	Copper, Dissolved, ICP-MS	5.13	ug/L	H		0.2	2	5.13	J	unknown
WG151118	FW-EBO	3/26/2017	14	L67398-2	Lead, Dissolved, ICP-MS	0.43	ug/L	<RDL,H		0.1	0.5	0.43	J	unknown
WG151118	FW-EBO	3/26/2017	14	L67398-2	Zinc, Dissolved, ICP-MS	4.76	ug/L	H		0.5	2.5	4.76	J	unknown
WG150997	FW-WBI	3/26/2017	14	L67398-3	Orthophosphate Phosphorus	0.00909	mg/L	H		0.0005	0.002	0.00909	J	unknown
WG150969	FW-WBI	3/26/2017	14	L67398-3	pH	7	pH	H				7	J	unknown
WG151091	FW-WBI	3/26/2017	14	L67398-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG151091	FW-WBI	3/26/2017	14	L67398-3	Copper, Dissolved, ICP-MS	3.67	ug/L	H	0.2	2	3.67	J	unknown
WG151091	FW-WBI	3/26/2017	14	L67398-3	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG151091	FW-WBI	3/26/2017	14	L67398-3	Zinc, Dissolved, ICP-MS	22.1	ug/L	H	0.5	2.5	22.1	J	unknown
WG150997	FW-WBO	3/26/2017	14	L67398-4	Orthophosphate Phosphorus	2.02	mg/L	H	0.01	0.04	2.02	J	unknown
WG150969	FW-WBO	3/26/2017	14	L67398-4	pH	6.71	pH	H			6.71	J	unknown
WG151118	FW-WBO	3/26/2017	14	L67398-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151118	FW-WBO	3/26/2017	14	L67398-4	Copper, Dissolved, ICP-MS	6.09	ug/L	H	0.2	2	6.09	J	unknown
WG151118	FW-WBO	3/26/2017	14	L67398-4	Lead, Dissolved, ICP-MS	1.01	ug/L	H	0.1	0.5	1.01	J	unknown
WG151118	FW-WBO	3/26/2017	14	L67398-4	Zinc, Dissolved, ICP-MS	8.26	ug/L	H	0.5	2.5	8.26	J	unknown
WG150997	FW-WPCI	3/26/2017	14	L67398-5	Orthophosphate Phosphorus	0.00553	mg/L	H	0.0005	0.002	0.00553	J	unknown
WG150969	FW-WPCI	3/26/2017	14	L67398-5	pH	7.07	pH	H			7.07	J	unknown
WG151091	FW-WPCI	3/26/2017	14	L67398-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-WPCI	3/26/2017	14	L67398-5	Copper, Dissolved, ICP-MS	3.8	ug/L	H	0.2	2	3.8	J	unknown
WG151091	FW-WPCI	3/26/2017	14	L67398-5	Lead, Dissolved, ICP-MS	0.16	ug/L	<RDL,H	0.1	0.5	0.16	J	unknown
WG151091	FW-WPCI	3/26/2017	14	L67398-5	Zinc, Dissolved, ICP-MS	31.9	ug/L	H	0.5	2.5	31.9	J	unknown
WG150997	FW-WPCEPO	3/26/2017	14	L67398-6	Orthophosphate Phosphorus	0.0205	mg/L	H	0.0005	0.002	0.0205	J	unknown
WG150969	FW-WPCEPO	3/26/2017	14	L67398-6	pH	7.18	pH	H			7.18	J	unknown
WG151091	FW-WPCEPO	3/26/2017	14	L67398-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-WPCEPO	3/26/2017	14	L67398-6	Copper, Dissolved, ICP-MS	3.24	ug/L	H	0.2	2	3.24	J	unknown
WG151091	FW-WPCEPO	3/26/2017	14	L67398-6	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG151091	FW-WPCEPO	3/26/2017	14	L67398-6	Zinc, Dissolved, ICP-MS	28.2	ug/L	H	0.5	2.5	28.2	J	unknown
WG150997	FW-NFWHC	3/26/2017	14	L67398-7	Orthophosphate Phosphorus	0.014	mg/L	H	0.0005	0.002	0.014	J	unknown
WG150969	FW-NFWHC	3/26/2017	14	L67398-7	pH	7.61	pH	H			7.61	J	unknown
WG151091	FW-NFWHC	3/26/2017	14	L67398-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-NFWHC	3/26/2017	14	L67398-7	Copper, Dissolved, ICP-MS	1.9	ug/L	<RDL,H	0.2	2	1.9	J	unknown
WG151091	FW-NFWHC	3/26/2017	14	L67398-7	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG151091	FW-NFWHC	3/26/2017	14	L67398-7	Zinc, Dissolved, ICP-MS	12.5	ug/L	H	0.5	2.5	12.5	J	unknown
WG150997	FW-EBI	3/29/2017	15	L67443-1	Orthophosphate Phosphorus	0.00696	mg/L	H	0.0005	0.002	0.00696	J	unknown
WG151030	FW-EBI	3/29/2017	15	L67443-1	pH	6.95	pH	H			6.95	J	unknown
WG151091	FW-EBI	3/29/2017	15	L67443-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-EBI	3/29/2017	15	L67443-1	Copper, Dissolved, ICP-MS	2.35	ug/L	H	0.2	2	2.35	J	unknown
WG151091	FW-EBI	3/29/2017	15	L67443-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG151091	FW-EBI	3/29/2017	15	L67443-1	Zinc, Dissolved, ICP-MS	18.8	ug/L	H	0.5	2.5	18.8	J	unknown
WG151046	FW-EBI	3/29/2017	15	L67443-1	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FW-EBO	3/29/2017	15	L67443-2	Orthophosphate Phosphorus	0.658	mg/L	H	0.0025	0.01	0.658	J	unknown
WG151030	FW-EBO	3/29/2017	15	L67443-2	pH	6.84	pH	H			6.84	J	unknown
WG151118	FW-EBO	3/29/2017	15	L67443-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151118	FW-EBO	3/29/2017	15	L67443-2	Copper, Dissolved, ICP-MS	4.1	ug/L	H	0.2	2	4.1	J	unknown
WG151118	FW-EBO	3/29/2017	15	L67443-2	Lead, Dissolved, ICP-MS	0.27	ug/L	<RDL,H	0.1	0.5	0.27	J	unknown
WG151118	FW-EBO	3/29/2017	15	L67443-2	Zinc, Dissolved, ICP-MS	3.88	ug/L	H	0.5	2.5	3.88	J	unknown
WG151046	FW-EBO	3/29/2017	15	L67443-2	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG151556	FW-WBI	3/29/2017	15	L67443-3	Dissolved Organic Carbon	1.73	mg/L	TA	0.5	1	1.73	J	unknown
WG150997	FW-WBI	3/29/2017	15	L67443-3	Orthophosphate Phosphorus	0.00663	mg/L	H	0.0005	0.002	0.00663	J	unknown
WG151030	FW-WBI	3/29/2017	15	L67443-3	pH	7	pH	H			7	J	unknown
WG151433	FW-WBI	3/29/2017	15	L67443-3	Total Organic Carbon	1.29	mg/L	TA	0.5	1	1.29	J	unknown
WG151091	FW-WBI	3/29/2017	15	L67443-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-WBI	3/29/2017	15	L67443-3	Copper, Dissolved, ICP-MS	2.41	ug/L	H	0.2	2	2.41	J	unknown
WG151091	FW-WBI	3/29/2017	15	L67443-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG151091	FW-WBI	3/29/2017	15	L67443-3	Zinc, Dissolved, ICP-MS	19	ug/L	H	0.5	2.5	19	J	unknown
WG151046	FW-WBI	3/29/2017	15	L67443-3	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FW-WBO	3/29/2017	15	L67443-4	Orthophosphate Phosphorus	1.72	mg/L	H	0.01	0.04	1.72	J	unknown
WG151030	FW-WBO	3/29/2017	15	L67443-4	pH	6.69	pH	H			6.69	J	unknown
WG151118	FW-WBO	3/29/2017	15	L67443-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151118	FW-WBO	3/29/2017	15	L67443-4	Copper, Dissolved, ICP-MS	5.05	ug/L	H	0.2	2	5.05	J	unknown
WG151118	FW-WBO	3/29/2017	15	L67443-4	Lead, Dissolved, ICP-MS	0.654	ug/L	H	0.1	0.5	0.654	J	unknown
WG151118	FW-WBO	3/29/2017	15	L67443-4	Zinc, Dissolved, ICP-MS	7.75	ug/L	H	0.5	2.5	7.75	J	unknown
WG151046	FW-WBO	3/29/2017	15	L67443-4	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FW-WPCI	3/29/2017	15	L67443-5	Orthophosphate Phosphorus	0.00286	mg/L	H	0.0005	0.002	0.00286	J	unknown
WG151030	FW-WPCI	3/29/2017	15	L67443-5	pH	7.05	pH	H			7.05	J	unknown
WG151091	FW-WPCI	3/29/2017	15	L67443-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-WPCI	3/29/2017	15	L67443-5	Copper, Dissolved, ICP-MS	2.37	ug/L	H	0.2	2	2.37	J	unknown
WG151091	FW-WPCI	3/29/2017	15	L67443-5	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG151091	FW-WPCI	3/29/2017	15	L67443-5	Zinc, Dissolved, ICP-MS	25.8	ug/L	H	0.5	2.5	25.8	J	unknown
WG151046	FW-WPCI	3/29/2017	15	L67443-5	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FW-WPCEPO	3/29/2017	15	L67443-6	Orthophosphate Phosphorus	0.0295	mg/L	H	0.0005	0.002	0.0295	J	unknown
WG151030	FW-WPCEPO	3/29/2017	15	L67443-6	pH	7.18	pH	H			7.18	J	unknown
WG151091	FW-WPCEPO	3/29/2017	15	L67443-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-WPCEPO	3/29/2017	15	L67443-6	Copper, Dissolved, ICP-MS	2.93	ug/L	H	0.2	2	2.93	J	unknown
WG151091	FW-WPCEPO	3/29/2017	15	L67443-6	Lead, Dissolved, ICP-MS	0.18	ug/L	<RDL,H	0.1	0.5	0.18	J	unknown
WG151091	FW-WPCEPO	3/29/2017	15	L67443-6	Zinc, Dissolved, ICP-MS	32	ug/L	H	0.5	2.5	32	J	unknown
WG151046	FW-WPCEPO	3/29/2017	15	L67443-6	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FW-NFWHC	3/29/2017	15	L67443-7	Orthophosphate Phosphorus	0.0191	mg/L	H	0.0005	0.002	0.0191	J	unknown
WG151030	FW-NFWHC	3/29/2017	15	L67443-7	pH	7.65	pH	H			7.65	J	unknown
WG151091	FW-NFWHC	3/29/2017	15	L67443-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151091	FW-NFWHC	3/29/2017	15	L67443-7	Copper, Dissolved, ICP-MS	2.32	ug/L	H	0.2	2	2.32	J	unknown
WG151091	FW-NFWHC	3/29/2017	15	L67443-7	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H	0.1	0.5	0.21	J	unknown
WG151091	FW-NFWHC	3/29/2017	15	L67443-7	Zinc, Dissolved, ICP-MS	14.6	ug/L	H	0.5	2.5	14.6	J	unknown
WG151046	FW-NFWHC	3/29/2017	15	L67443-7	Acenaphthylene		ug/L	<MDL,JG	0.0047	0.0236	0.0047	UJ	low
WG150997	FFBLANK	3/30/2017	15	L67443-8	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG151139	FW-EBI	4/5/2017	16	L67499-1	Orthophosphate Phosphorus	0.0109	mg/L	H	0.0005	0.002	0.0109	J	unknown
WG151168	FW-EBI	4/5/2017	16	L67499-1	pH	7.02	pH	H			7.02	J	unknown
WG151663	FW-EBI	4/5/2017	16	L67499-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV			
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias	
WG151663	FW-EBI	4/5/2017	16	L67499-1	Copper, Dissolved, ICP-MS	2.99	ug/L	H		0.2	2	2.99	J	unknown
WG151663	FW-EBI	4/5/2017	16	L67499-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG151663	FW-EBI	4/5/2017	16	L67499-1	Zinc, Dissolved, ICP-MS	24.3	ug/L	H		0.5	2.5	24.3	J	unknown
WG151139	FW-EBO	4/5/2017	16	L67499-2	Orthophosphate Phosphorus	0.74	mg/L	H		0.01	0.04	0.74	J	unknown
WG151168	FW-EBO	4/5/2017	16	L67499-2	pH	6.77	pH	H				6.77	J	unknown
WG151685	FW-EBO	4/5/2017	16	L67499-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151685	FW-EBO	4/5/2017	16	L67499-2	Copper, Dissolved, ICP-MS	4.38	ug/L	H		0.2	2	4.38	J	unknown
WG151685	FW-EBO	4/5/2017	16	L67499-2	Lead, Dissolved, ICP-MS	0.29	ug/L	<RDL,H		0.1	0.5	0.29	J	unknown
WG151685	FW-EBO	4/5/2017	16	L67499-2	Zinc, Dissolved, ICP-MS	3.74	ug/L	H		0.5	2.5	3.74	J	unknown
WG151139	FW-WBI	4/5/2017	16	L67499-3	Orthophosphate Phosphorus	0.0124	mg/L	H		0.0005	0.002	0.0124	J	unknown
WG151168	FW-WBI	4/5/2017	16	L67499-3	pH	7.02	pH	H				7.02	J	unknown
WG151663	FW-WBI	4/5/2017	16	L67499-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151663	FW-WBI	4/5/2017	16	L67499-3	Copper, Dissolved, ICP-MS	2.64	ug/L	H		0.2	2	2.64	J	unknown
WG151663	FW-WBI	4/5/2017	16	L67499-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H		0.1	0.5	0.1	UJ	unknown
WG151663	FW-WBI	4/5/2017	16	L67499-3	Zinc, Dissolved, ICP-MS	24.4	ug/L	H		0.5	2.5	24.4	J	unknown
WG151139	FW-WBO	4/5/2017	16	L67499-4	Orthophosphate Phosphorus	2.01	mg/L	H		0.02	0.08	2.01	J	unknown
WG151168	FW-WBO	4/5/2017	16	L67499-4	pH	6.91	pH	H				6.91	J	unknown
WG151685	FW-WBO	4/5/2017	16	L67499-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151685	FW-WBO	4/5/2017	16	L67499-4	Copper, Dissolved, ICP-MS	5.39	ug/L	H		0.2	2	5.39	J	unknown
WG151685	FW-WBO	4/5/2017	16	L67499-4	Lead, Dissolved, ICP-MS	0.723	ug/L	H		0.1	0.5	0.723	J	unknown
WG151685	FW-WBO	4/5/2017	16	L67499-4	Zinc, Dissolved, ICP-MS	7.11	ug/L	H		0.5	2.5	7.11	J	unknown
WG151139	FW-WPCI	4/5/2017	16	L67499-5	Orthophosphate Phosphorus	0.00524	mg/L	H		0.0005	0.002	0.00524	J	unknown
WG151168	FW-WPCI	4/5/2017	16	L67499-5	pH	7.11	pH	H				7.11	J	unknown
WG151663	FW-WPCI	4/5/2017	16	L67499-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151663	FW-WPCI	4/5/2017	16	L67499-5	Copper, Dissolved, ICP-MS	4.38	ug/L	H		0.2	2	4.38	J	unknown
WG151663	FW-WPCI	4/5/2017	16	L67499-5	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H		0.1	0.5	0.12	J	unknown
WG151663	FW-WPCI	4/5/2017	16	L67499-5	Zinc, Dissolved, ICP-MS	28.2	ug/L	H		0.5	2.5	28.2	J	unknown
WG151139	FW-WPCEPO	4/5/2017	16	L67499-6	Orthophosphate Phosphorus	0.0207	mg/L	H		0.0005	0.002	0.0207	J	unknown
WG151168	FW-WPCEPO	4/5/2017	16	L67499-6	pH	7.35	pH	H				7.35	J	unknown
WG151663	FW-WPCEPO	4/5/2017	16	L67499-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151663	FW-WPCEPO	4/5/2017	16	L67499-6	Copper, Dissolved, ICP-MS	3.37	ug/L	H		0.2	2	3.37	J	unknown
WG151663	FW-WPCEPO	4/5/2017	16	L67499-6	Lead, Dissolved, ICP-MS	0.13	ug/L	<RDL,H		0.1	0.5	0.13	J	unknown
WG151663	FW-WPCEPO	4/5/2017	16	L67499-6	Zinc, Dissolved, ICP-MS	30.9	ug/L	H		0.5	2.5	30.9	J	unknown
WG151139	FW-NFWHC	4/5/2017	16	L67499-7	Orthophosphate Phosphorus	0.0148	mg/L	H		0.0005	0.002	0.0148	J	unknown
WG151168	FW-NFWHC	4/5/2017	16	L67499-7	pH	7.71	pH	H				7.71	J	unknown
WG151663	FW-NFWHC	4/5/2017	16	L67499-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H		0.05	0.25	0.05	UJ	unknown
WG151663	FW-NFWHC	4/5/2017	16	L67499-7	Copper, Dissolved, ICP-MS	2.14	ug/L	H		0.2	2	2.14	J	unknown
WG151663	FW-NFWHC	4/5/2017	16	L67499-7	Lead, Dissolved, ICP-MS	0.16	ug/L	<RDL,H		0.1	0.5	0.16	J	unknown
WG151663	FW-NFWHC	4/5/2017	16	L67499-7	Zinc, Dissolved, ICP-MS	14.3	ug/L	H		0.5	2.5	14.3	J	unknown
WG151139	FFBLANK	4/6/2017	16	L67499-8	Orthophosphate Phosphorus		mg/L	<MDL		0.0005	0.002	0.0005	UJ	unknown
WG151474	FW-EBI	4/19/2017	17	L67594-1	Orthophosphate Phosphorus	0.0102	mg/L	H		0.0005	0.002	0.0102	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG151426	FW-EBI	4/19/2017	17	L67594-1	pH	6.95	pH	H			6.95	J	unknown
WG152026	FW-EBI	4/19/2017	17	L67594-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-EBI	4/19/2017	17	L67594-1	Copper, Dissolved, ICP-MS	3.33	ug/L	H	0.2	2	3.33	J	unknown
WG152026	FW-EBI	4/19/2017	17	L67594-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG152026	FW-EBI	4/19/2017	17	L67594-1	Zinc, Dissolved, ICP-MS	24.6	ug/L	H	0.5	2.5	24.6	J	unknown
WG151474	FW-EBO	4/19/2017	17	L67594-2	Orthophosphate Phosphorus	0.741	mg/L	H	0.005	0.02	0.741	J	unknown
WG151426	FW-EBO	4/19/2017	17	L67594-2	pH	6.84	pH	H			6.84	J	unknown
WG151685	FW-EBO	4/19/2017	17	L67594-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151685	FW-EBO	4/19/2017	17	L67594-2	Copper, Dissolved, ICP-MS	3.64	ug/L	H	0.2	2	3.64	J	unknown
WG151685	FW-EBO	4/19/2017	17	L67594-2	Lead, Dissolved, ICP-MS	0.21	ug/L	<RDL,H	0.1	0.5	0.21	J	unknown
WG151685	FW-EBO	4/19/2017	17	L67594-2	Zinc, Dissolved, ICP-MS	3.84	ug/L	H	0.5	2.5	3.84	J	unknown
WG151474	FW-WBI	4/19/2017	17	L67594-3	Orthophosphate Phosphorus	0.0101	mg/L	H	0.0005	0.002	0.0101	J	unknown
WG151426	FW-WBI	4/19/2017	17	L67594-3	pH	6.95	pH	H			6.95	J	unknown
WG152026	FW-WBI	4/19/2017	17	L67594-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WBI	4/19/2017	17	L67594-3	Copper, Dissolved, ICP-MS	3.4	ug/L	H	0.2	2	3.4	J	unknown
WG152026	FW-WBI	4/19/2017	17	L67594-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG152026	FW-WBI	4/19/2017	17	L67594-3	Zinc, Dissolved, ICP-MS	25.4	ug/L	H	0.5	2.5	25.4	J	unknown
WG151474	FW-WBO	4/19/2017	17	L67594-4	Orthophosphate Phosphorus	2.1	mg/L	H	0.01	0.04	2.1	J	unknown
WG151426	FW-WBO	4/19/2017	17	L67594-4	pH	6.76	pH	H			6.76	J	unknown
WG151685	FW-WBO	4/19/2017	17	L67594-4	Cadmium, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.05	0.25	0.15	J	unknown
WG151685	FW-WBO	4/19/2017	17	L67594-4	Copper, Dissolved, ICP-MS	5.22	ug/L	H	0.2	2	5.22	J	unknown
WG151685	FW-WBO	4/19/2017	17	L67594-4	Lead, Dissolved, ICP-MS	0.695	ug/L	H	0.1	0.5	0.695	J	unknown
WG151685	FW-WBO	4/19/2017	17	L67594-4	Zinc, Dissolved, ICP-MS	8.57	ug/L	H	0.5	2.5	8.57	J	unknown
WG151474	FW-WPCI	4/19/2017	17	L67594-5	Orthophosphate Phosphorus	0.00455	mg/L	H	0.0005	0.002	0.00455	J	unknown
WG151426	FW-WPCI	4/19/2017	17	L67594-5	pH	7.04	pH	H			7.04	J	unknown
WG152026	FW-WPCI	4/19/2017	17	L67594-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WPCI	4/19/2017	17	L67594-5	Copper, Dissolved, ICP-MS	3.6	ug/L	H	0.2	2	3.6	J	unknown
WG152026	FW-WPCI	4/19/2017	17	L67594-5	Lead, Dissolved, ICP-MS	0.12	ug/L	<RDL,H	0.1	0.5	0.12	J	unknown
WG152026	FW-WPCI	4/19/2017	17	L67594-5	Zinc, Dissolved, ICP-MS	27.6	ug/L	H	0.5	2.5	27.6	J	unknown
WG151474	FW-WPCEPO	4/19/2017	17	L67594-6	Orthophosphate Phosphorus	0.0343	mg/L	H	0.0005	0.002	0.0343	J	unknown
WG151426	FW-WPCEPO	4/19/2017	17	L67594-6	pH	7.25	pH	H			7.25	J	unknown
WG152026	FW-WPCEPO	4/19/2017	17	L67594-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WPCEPO	4/19/2017	17	L67594-6	Copper, Dissolved, ICP-MS	3.32	ug/L	H	0.2	2	3.32	J	unknown
WG152026	FW-WPCEPO	4/19/2017	17	L67594-6	Lead, Dissolved, ICP-MS	0.18	ug/L	<RDL,H	0.1	0.5	0.18	J	unknown
WG152026	FW-WPCEPO	4/19/2017	17	L67594-6	Zinc, Dissolved, ICP-MS	32.4	ug/L	H	0.5	2.5	32.4	J	unknown
WG151474	FW-NFWHC	4/19/2017	17	L67594-7	Orthophosphate Phosphorus	0.0187	mg/L	H	0.0005	0.002	0.0187	J	unknown
WG151426	FW-NFWHC	4/19/2017	17	L67594-7	pH	7.67	pH	H			7.67	J	unknown
WG152026	FW-NFWHC	4/19/2017	17	L67594-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-NFWHC	4/19/2017	17	L67594-7	Copper, Dissolved, ICP-MS	2.63	ug/L	H	0.2	2	2.63	J	unknown
WG152026	FW-NFWHC	4/19/2017	17	L67594-7	Lead, Dissolved, ICP-MS	0.18	ug/L	<RDL,H	0.1	0.5	0.18	J	unknown
WG152026	FW-NFWHC	4/19/2017	17	L67594-7	Zinc, Dissolved, ICP-MS	12.3	ug/L	H	0.5	2.5	12.3	J	unknown

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Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG151474	FFBLANK	4/20/2017	17	L67594-8	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG151474	FW-EBI	4/23/2017	18	L67617-1	Orthophosphate Phosphorus	0.0146	mg/L	H	0.0005	0.002	0.0146	J	unknown
WG151481	FW-EBI	4/23/2017	18	L67617-1	pH	7	pH	H			7	J	unknown
WG152026	FW-EBI	4/23/2017	18	L67617-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-EBI	4/23/2017	18	L67617-1	Copper, Dissolved, ICP-MS	3.78	ug/L	H	0.2	2	3.78	J	unknown
WG152026	FW-EBI	4/23/2017	18	L67617-1	Lead, Dissolved, ICP-MS	0.11	ug/L	<RDL,H	0.1	0.5	0.11	J	unknown
WG152026	FW-EBI	4/23/2017	18	L67617-1	Zinc, Dissolved, ICP-MS	25	ug/L	H	0.5	2.5	25	J	unknown
WG151474	FW-EBO	4/23/2017	18	L67617-2	Orthophosphate Phosphorus	0.8	mg/L	H	0.005	0.02	0.8	J	unknown
WG151481	FW-EBO	4/23/2017	18	L67617-2	pH	6.96	pH	H			6.96	J	unknown
WG151685	FW-EBO	4/23/2017	18	L67617-2	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151685	FW-EBO	4/23/2017	18	L67617-2	Copper, Dissolved, ICP-MS	3.77	ug/L	H	0.2	2	3.77	J	unknown
WG151685	FW-EBO	4/23/2017	18	L67617-2	Lead, Dissolved, ICP-MS	0.24	ug/L	<RDL,H	0.1	0.5	0.24	J	unknown
WG151685	FW-EBO	4/23/2017	18	L67617-2	Zinc, Dissolved, ICP-MS	3.57	ug/L	H	0.5	2.5	3.57	J	unknown
WG151474	FW-WBI	4/23/2017	18	L67617-3	Orthophosphate Phosphorus	0.0135	mg/L	H	0.0005	0.002	0.0135	J	unknown
WG151481	FW-WBI	4/23/2017	18	L67617-3	pH	6.99	pH	H			6.99	J	unknown
WG152026	FW-WBI	4/23/2017	18	L67617-3	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WBI	4/23/2017	18	L67617-3	Copper, Dissolved, ICP-MS	3.38	ug/L	H	0.2	2	3.38	J	unknown
WG152026	FW-WBI	4/23/2017	18	L67617-3	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG152026	FW-WBI	4/23/2017	18	L67617-3	Zinc, Dissolved, ICP-MS	24.4	ug/L	H	0.5	2.5	24.4	J	unknown
WG151474	FW-WBO	4/23/2017	18	L67617-4	Orthophosphate Phosphorus	2.14	mg/L	H	0.01	0.04	2.14	J	unknown
WG151481	FW-WBO	4/23/2017	18	L67617-4	pH	6.95	pH	H			6.95	J	unknown
WG151685	FW-WBO	4/23/2017	18	L67617-4	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG151685	FW-WBO	4/23/2017	18	L67617-4	Copper, Dissolved, ICP-MS	4.57	ug/L	H	0.2	2	4.57	J	unknown
WG151685	FW-WBO	4/23/2017	18	L67617-4	Lead, Dissolved, ICP-MS	0.642	ug/L	H	0.1	0.5	0.642	J	unknown
WG151685	FW-WBO	4/23/2017	18	L67617-4	Zinc, Dissolved, ICP-MS	7.47	ug/L	H	0.5	2.5	7.47	J	unknown
WG151474	FW-WPCI	4/23/2017	18	L67617-5	Orthophosphate Phosphorus	0.00314	mg/L	H	0.0005	0.002	0.00314	J	unknown
WG151481	FW-WPCI	4/23/2017	18	L67617-5	pH	7	pH	H			7	J	unknown
WG152026	FW-WPCI	4/23/2017	18	L67617-5	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WPCI	4/23/2017	18	L67617-5	Copper, Dissolved, ICP-MS	4.65	ug/L	H	0.2	2	4.65	J	unknown
WG152026	FW-WPCI	4/23/2017	18	L67617-5	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG152026	FW-WPCI	4/23/2017	18	L67617-5	Zinc, Dissolved, ICP-MS	27.9	ug/L	H	0.5	2.5	27.9	J	unknown
WG151474	FW-WPCEPO	4/23/2017	18	L67617-6	Orthophosphate Phosphorus	0.0172	mg/L	H	0.0005	0.002	0.0172	J	unknown
WG151481	FW-WPCEPO	4/23/2017	18	L67617-6	pH	7.22	pH	H			7.22	J	unknown
WG152026	FW-WPCEPO	4/23/2017	18	L67617-6	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-WPCEPO	4/23/2017	18	L67617-6	Copper, Dissolved, ICP-MS	3.3	ug/L	H	0.2	2	3.3	J	unknown
WG152026	FW-WPCEPO	4/23/2017	18	L67617-6	Lead, Dissolved, ICP-MS	0.15	ug/L	<RDL,H	0.1	0.5	0.15	J	unknown
WG152026	FW-WPCEPO	4/23/2017	18	L67617-6	Zinc, Dissolved, ICP-MS	29.2	ug/L	H	0.5	2.5	29.2	J	unknown
WG151474	FW-NFWHC	4/23/2017	18	L67617-7	Orthophosphate Phosphorus	0.0166	mg/L	H	0.0005	0.002	0.0166	J	unknown
WG151481	FW-NFWHC	4/23/2017	18	L67617-7	pH	7.7	pH	H			7.7	J	unknown
WG152026	FW-NFWHC	4/23/2017	18	L67617-7	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	FW-NFWHC	4/23/2017	18	L67617-7	Copper, Dissolved, ICP-MS	2.42	ug/L	H	0.2	2	2.42	J	unknown

**Table A. Federal Way Stormwater Monitoring - SAM Effectiveness Study- Data Validation Flags and Bias Notation**

Workgroup	Locator	Collect Date	Storm		Parameter	NUMVALUE	Units	Lab			DV		
			#	Sample ID				Qual	MDL	RDL	DV Value	Qual	DV Bias
WG152026	FW-NFWHC	4/23/2017	18	L67617-7	Lead, Dissolved, ICP-MS	0.16	ug/L	<RDL,H	0.1	0.5	0.16	J	unknown
WG152026	FW-NFWHC	4/23/2017	18	L67617-7	Zinc, Dissolved, ICP-MS	12.5	ug/L	H	0.5	2.5	12.5	J	unknown
WG151448	FW-NFWHC	4/23/2017	18	L67617-7	Benzo(a)anthracene		ug/L	<QL	0.024	0.0472	0.024	UJ	low
WG151448	FW-NFWHC	4/23/2017	18	L67617-7	Chrysene		ug/L	<QL	0.024	0.0472	0.024	UJ	low
WG151448	FW-NFWHC	4/23/2017	18	L67617-7	Fluoranthene		ug/L	<QL	0.024	0.0472	0.024	UJ	low
WG151448	FW-NFWHC	4/23/2017	18	L67617-7	Pyrene		ug/L	<QL	0.024	0.0472	0.024	UJ	low
WG151474	FFBLANK	4/24/2017	18	L67617-8	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG151744	EQUIPBLANK	5/8/2017	Blank	L67724-1	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown
WG151995	EQUIPBLANK	5/8/2017	Blank	L67724-1	pH	6.08	pH	H			6.08	J	unknown
WG152026	EQUIPBLANK	5/8/2017	Blank	L67724-1	Cadmium, Dissolved, ICP-MS		ug/L	<MDL,H	0.05	0.25	0.05	UJ	unknown
WG152026	EQUIPBLANK	5/8/2017	Blank	L67724-1	Copper, Dissolved, ICP-MS		ug/L	<MDL,H	0.2	2	0.2	UJ	unknown
WG152026	EQUIPBLANK	5/8/2017	Blank	L67724-1	Lead, Dissolved, ICP-MS		ug/L	<MDL,H	0.1	0.5	0.1	UJ	unknown
WG152026	EQUIPBLANK	5/8/2017	Blank	L67724-1	Zinc, Dissolved, ICP-MS		ug/L	<MDL,H	0.5	2.5	0.5	UJ	unknown
WG151744	FFBLANK	5/8/2017	Blank	L67724-2	Orthophosphate Phosphorus		mg/L	<MDL	0.0005	0.002	0.0005	UJ	unknown

# **Appendix G3: PCB Data Validation**



**LABORATORY DATA CONSULTANTS, INC.**

2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

King County Environmental Laboratory  
322 W. Ewing Street  
Seattle WA 98119  
ATTN: Mr. Fritz Grothkopp

September 9, 2016

SUBJECT: LDW Federal Way SW Monitoring, Data Validation

Dear Mr. Grothkopp,

Enclosed is the final validation report for the fraction listed below. This SDG was received on August 18, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

**LDC Project #36926:**

<b><u>SDG #</u></b>	<b><u>Fraction</u></b>
PR161851	Polychlorinated Biphenyls as Congeners

The data validation was performed under Level III guidelines. The analyses were validated using the following documents, as applicable to each method:

- Quality Assurance Project Plan: Effectiveness Monitoring of the South 3256<sup>th</sup> Street Retrofit and Expansion Project, Federal Way, WA, February 2016
- US Environmental Protection Agency Region 10 SOP for the Validation of Polychlorinated Biphenyl Data, Revision 1.0, December 8, 1995

Please feel free to contact us if you have any questions.

Sincerely,

Stella Cuenco  
Operations Manager/Senior Chemist



## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** LDW Federal Way SW Monitoring

**LDC Report Date:** September 7, 2016

**Parameters:** Polychlorinated Biphenyls as Congeners

**Validation Level:** Level III

**Laboratory:** Pacific Rim Laboratories, Inc.

**Sample Delivery Group (SDG):** PR161851

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
L65007-1	PR161851	Water	03/09/16
L65007-2	PR161852	Water	03/09/16
L65007-5	PR161853	Water	03/09/16
L65007-6	PR161854	Water	03/09/16
L65007-7	PR161855	Water	03/09/16
L65095-1	PR161856	Water	03/23/16
L65095-2	PR161857	Water	03/23/16
L65095-5	PR161858	Water	03/23/16
L65095-6	PR161859	Water	03/23/16
L65095-7	PR161860	Water	03/23/16
L65095-7DUP	PR161860DUP	Water	03/23/16

## Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Quality Assurance Project Plan: Effectiveness Monitoring of the South 356<sup>th</sup> Street Retrofit and Expansion Project, Federal Way, WA (February 2016) and US Environmental Protection Agency (EPA) Region 10 SOP for the Validation of Polychlorinated Biphenyl (PCB) Data (Revision 1.0, December 8, 1995). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
  - J1 Blank Contamination: Indicates possible high bias and/or false positives.
  - J2 Calibration Range exceeded: Indicates possible low bias.
  - J3 Holding times not met: Indicates low bias for most analytes.
  - J4 Other QC parameters outside control limits: bias not readily determined.
  - J5 Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
  - J6 Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

## II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

The static resolving power was at least 10,000 (10% valley definition).

## III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

## IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

## V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MBFS06291606	06/25/16	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls	69.8 pg/L 5.87 pg/L 6.3 pg/L 7 pg/L 69.8 pg/L 12.2 pg/L 7 pg/L	All samples in SDG PR161851

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
L65007-1	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	102 pg/L 7.85 pg/L 10.3 pg/L 10.8 pg/L 102 pg/L 33.6 pg/L	102U pg/L 7.85U pg/L 10.3U pg/L 10.8U pg/L 102J pg/L 33.6J pg/L
L65007-2	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	6.51 pg/L 9.87 pg/L 7.86 pg/L 28.1 pg/L 18.2 pg/L	6.51U pg/L 9.87U pg/L 7.86U pg/L 28.1J pg/L 18.2J pg/L
L65007-5	PCB-011 PCB-031 Dichlorobiphenyls	56.4 pg/L 14.6 pg/L 56.4 pg/L	56.4U pg/L 14.6U pg/L 56.4J pg/L
L65007-6	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	33.1 pg/L 7.69 pg/L 14.5 pg/L 27.7 pg/L 33.1 pg/L 44.8 pg/L	33.1U pg/L 7.69U pg/L 14.5U pg/L 27.7U pg/L 33.1J pg/L 44.8J pg/L
L65007-7	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls	8.14 pg/L 15 pg/L 19.3 pg/L 44.2 pg/L	8.14U pg/L 15U pg/L 19.3U pg/L 44.2J pg/L
L65095-1	PCB-011 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls	45.2 pg/L 8.58 pg/L 6.48 pg/L 53.8 pg/L 24.6 pg/L 33.5 pg/L	45.2U pg/L 8.58U pg/L 6.48U pg/L 53.8J pg/L 24.6J pg/L 33.5J pg/L
L65095-2	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls	26.7 pg/L 5.89 pg/L 7.72 pg/L 6.42 pg/L 26.7 pg/L 20.9 pg/L 30.2 pg/L	26.7U pg/L 5.89U pg/L 7.72U pg/L 6.42U pg/L 26.7J pg/L 20.9J pg/L 30.2J pg/L
L65095-5	PCB-011 PCB-031 Dichlorobiphenyls	72.8 pg/L 25.4 pg/L 72.8 pg/L	72.8U pg/L 25.4U pg/L 72.8J pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L65095-6	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	29.9 pg/L 5.84 pg/L 9.09 pg/L 9.78 pg/L 29.9 pg/L 25.6 pg/L	29.9U pg/L 5.84U pg/L 9.09U pg/L 9.78U pg/L 29.9J pg/L 25.6J pg/L
L65095-7	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	3.74 pg/L 6.79 pg/L 7.42 pg/L 21.2 pg/L 20.5 pg/L	3.74U pg/L 6.79U pg/L 7.42U pg/L 21.2J pg/L 20.5J pg/L
L65095-7DUP	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	5.02 pg/L 5.72 pg/L 7.64 pg/L 15 pg/L 25.2 pg/L	5.02U pg/L 5.72U pg/L 7.64U pg/L 15J pg/L 25.2J pg/L

Laboratory blank results flagged "NJ" by the laboratory as estimated maximum possible concentration (EMPC) and reported below the quantitation limit (QL) are considered not detected.

#### VI. Field Blanks

No field blanks were identified in this SDG.

#### VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

#### VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

#### IX. Field Duplicates

No field duplicates were identified in this SDG.

#### X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

## XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG PR161851	All compounds flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC).	U	A

Raw data were not reviewed for Level III validation.

## XII. Target Compound Identification

Raw data were not reviewed for Level III validation.

## XIII. System Performance

Raw data were not reviewed for Level III validation.

## XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to results reported by the laboratory as EMPCs, data were qualified as not detected in eleven samples.

Due to laboratory blank contamination, data were qualified as not detected or estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**LDW Federal Way SW Monitoring  
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG  
PR161851**

Sample	Compound	Flag	A or P	Reason
L65007-1 L65007-2 L65007-5 L65007-6 L65007-7 L65095-1 L65095-2 L65095-5 L65095-6 L65095-7 L65095-7DUP	All compounds flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC).	U	A	Compound quantitation (EMPC)

**LDW Federal Way SW Monitoring  
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification  
Summary - SDG PR161851**

Sample	Compound	Modified Final Concentration	A or P
L65007-1	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	102U pg/L 7.85U pg/L 10.3U pg/L 10.8U pg/L 102J pg/L 33.6J pg/L	A
L65007-2	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	6.51U pg/L 9.87U pg/L 7.86U pg/L 28.1J pg/L 18.2J pg/L	A
L65007-5	PCB-011 PCB-031 Dichlorobiphenyls	56.4U pg/L 14.6U pg/L 56.4J pg/L	A
L65007-6	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	33.1U pg/L 7.69U pg/L 14.5U pg/L 27.7U pg/L 33.1J pg/L 44.8J pg/L	A
L65007-7	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls	8.14U pg/L 15U pg/L 19.3U pg/L 44.2J pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L65095-1	PCB-011 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls	45.2U pg/L 8.58U pg/L 6.48U pg/L 53.8J pg/L 24.6J pg/L 33.5J pg/L	A
L65095-2	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls	26.7U pg/L 5.89U pg/L 7.72U pg/L 6.42U pg/L 26.7J pg/L 20.9J pg/L 30.2J pg/L	A
L65095-5	PCB-011 PCB-031 Dichlorobiphenyls	72.8U pg/L 25.4U pg/L 72.8J pg/L	A
L65095-6	PCB-011 PCB-031 PCB-028 PCB-052/069 Dichlorobiphenyls Trichlorobiphenyls	29.9U pg/L 5.84U pg/L 9.09U pg/L 9.78U pg/L 29.9J pg/L 25.6J pg/L	A
L65095-7	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	3.74U pg/L 6.79U pg/L 7.42U pg/L 21.2J pg/L 20.5J pg/L	A
L65095-7DUP	PCB-031 PCB-028 PCB-052/069 Trichlorobiphenyls Tetrachlorobiphenyls	5.02U pg/L 5.72U pg/L 7.64U pg/L 15J pg/L 25.2J pg/L	A

LDC #: 36926A31

**VALIDATION COMPLETENESS WORKSHEET**

Date: 3/5/16

SDG #: PR161851

Level III

Page: 1 of 1

Laboratory: Pacific Rim Laboratories, Inc.

Reviewer: [Signature]

2nd Reviewer: A

**METHOD:** HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICX	A	RSD ≤ 20/25%
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW/A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /OUT	N/A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Internal standards	A	
XI.	Compound quantitation RL/LOQ/LODs	M	N or NT flag - ZHP c
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable  
N = Not provided/applicable  
SW = See worksheet

ND = No compounds detected  
R = Rinsate  
FB = Field blank

D = Duplicate  
TB = Trip blank  
EB = Equipment blank

SB=Source blank  
OTHER:

	Client ID	Lab ID	Matrix	Date
1	L65007-1	PR161851	Water	03/09/16
2	L65007-2	PR161852	Water	03/09/16
3	L65007-5	PR161853	Water	03/09/16
4	L65007-6	PR161854	Water	03/09/16
5	L65007-7	PR161855	Water	03/09/16
6	L65095-1	PR161856	Water	03/23/16
7	L65095-2	PR161857	Water	03/23/16
8	L65095-5	PR161858	Water	03/23/16
9	L65095-6	PR161859	Water	03/23/16
10	L65095-7	PR161860	Water	03/23/16
11	L65095-7DUP	PR161860DUP	Water	03/23/16
12				
13				
14				
15				

**VALIDATION FINDINGS WORKSHEET**  
**Blanks**

**METHOD:** HRGC/HRMS PCB Congeners (EPA Method 1668C)

**Blank extraction date:** 6/25/16 **Blank analysis date:** 6/29/16

**Conc. units:** pg/L

**Associated samples:** All Qualify U

Compound	Blank ID	Sample Identification												
		5x	1	2	3	4	5	6	7	8	9	10	11	
	MBFS06291606													
PCB-011	69.8	349	102		56.4	33.1		45.2	26.7	72.8	29.9			
PCB-031	5.87	29.35	7.85	6.51	14.6	7.69	8.14		5.89	25.4	5.84	3.74	5.02	
PCB-028	6.3	31.5	10.3	9.87		14.5	15	8.58	7.72		9.09	6.79	5.72	
PCB-052/069	7	35	10.8	7.86		27.7	19.3	6.48	6.42		9.78	7.42	7.64	
Dichlorobiphenyls	69.8	349	102J		56.4J	33.1J		53.8J	26.7J	72.8J	29.9J			
Trichlorobiphenyls	12.2	61	33.6J	28.1J		44.8J	44.2J	24.6J	20.9J		25.6J	21.2J	15J	
Tetrachlorobiphenyls	7	35		18.2J				33.5J	30.2J			20.5J	25.2J	

Laboratory blank results flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC) are considered not detected.

All contaminants within five times the blank concentration were qualified as not detected, "U".

LDC #: 36926

### EDD POPULATION COMPLETENESS WORKSHEET

Date: 9/9/16  
Page: 1 of 1  
2nd Reviewer: JK

The LDC job number listed above was entered by JK.

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	- 10% or 100% verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	-	
IIb.	- Reason Codes used? If so, note which codes	Y	LOC
IIc.	-Additional Information (QC Level, Validator, Date, Validated Y/N, etc.)	-	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	Y	
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	Y	
IIIc.	- If reason codes used, do all qualified results have reason code field populated?	Y	
IIId.	-Does the detect flag require changing for blank qualifiers? If so, are all U results marked ND?	+	
IIIe.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	Y	
IIIf.	- Were any results rejected for overall assessment? If so, were results changed to nonreportable?	+	
IIIg.	- Is the readme complete? If applicable, were edits or discrepancies listed in the readme?	Y	

Notes: \_\_\_\_\_

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The zip file provided contains two files:

<u>File</u>	<u>Format</u>	<u>Description</u>				
1) Readme_FederalWay_090916.docx	MS Word 2007	A "Readme" file (this document).				
2) EDD Federal Way SW Monitoring 421879-240 - PR161851-1860.xlsx	MS Excel 2007	<table border="1"> <thead> <tr> <th><u>SDG</u></th> <th><u>LDC#</u></th> </tr> </thead> <tbody> <tr> <td>PR161851</td> <td>36926A</td> </tr> </tbody> </table>	<u>SDG</u>	<u>LDC#</u>	PR161851	36926A
<u>SDG</u>	<u>LDC#</u>					
PR161851	36926A					

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during EDD population of validation qualifiers. A 100% verification of the EDD was not performed.

Please contact Stella Cuenco at (760) 827-1100 if you have any questions regarding this electronic data submittal.



**LABORATORY DATA CONSULTANTS, INC.**

2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

King County Environmental Laboratory  
322 W. Ewing Street  
Seattle WA 98119  
ATTN: Mr. Fritz Grothkopp

September 21, 2017

SUBJECT: LDW Federal Way SW Monitoring, Data Validation

Dear Mr. Grothkopp,

Enclosed is the final validation report for the fraction listed below. This SDG was received on August 23, 2017. Attachment 1 is a summary of the samples that were reviewed for analysis.

**LDC Project #39333:**

**SDG #**

**Fraction**

PR164584

Polychlorinated Biphenyls as Congeners

The data validation was performed under Level III guidelines. The analyses were validated using the following documents, as applicable to each method:

- Quality Assurance Project Plan: Effectiveness Monitoring of the South 3256<sup>th</sup> Street Retrofit and Expansion Project, Federal Way, WA, February 2016
- US Environmental Protection Agency Region 10 SOP for the Validation of Polychlorinated Biphenyl Data, Revision 1.0, December 8, 1995

Please feel free to contact us if you have any questions.

Sincerely,

Stella Cuenco  
Operations Manager/Senior Chemist



## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** LDW Federal Way SW Monitoring

**LDC Report Date:** September 11, 2017

**Parameters:** Polychlorinated Biphenyls as Congeners

**Validation Level:** Level III

**Laboratory:** Pacific Rim Laboratories, Inc.

**Sample Delivery Group (SDG):** PR164584

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
L66540-1	PR164577	Water	10/31/16
L66540-2	PR164578	Water	10/31/16
L66540-3	PR164579	Water	10/31/16
L66540-4	PR164580	Water	10/31/16
L66540-5	PR164581	Water	10/31/16
L66540-6	PR164582	Water	10/31/16
L66540-7	PR164583	Water	11/01/16
L66453-1	PR164584	Water	10/20/16
L66453-2	PR164585	Water	10/20/16
L66453-3	PR164586	Water	10/20/16
L66453-4	PR164587	Water	10/20/16
L66453-5	PR164588	Water	10/19/16
L66453-6	PR164589	Water	10/19/16
L66453-7	PR164590	Water	10/19/16
L66385-1	PR164591	Water	10/26/16
L66385-2	PR164592	Water	10/26/16
L66385-3	PR164593	Water	10/26/16
L66385-4	PR164594	Water	10/26/16
L66385-5	PR164595	Water	10/26/16
L66385-6	PR164596	Water	10/26/16
L66385-7	PR164597	Water	10/26/16
L66453-5DUP	PR164588DUP	Water	10/19/16
L66385-1DUP	PR164591DUP	Water	10/26/16

## Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Quality Assurance Project Plan: Effectiveness Monitoring of the South 356<sup>th</sup> Street Retrofit and Expansion Project, Federal Way, WA (February 2016) and US Environmental Protection Agency (EPA) Region 10 SOP for the Validation of Polychlorinated Biphenyl (PCB) Data (Revision 1.0, December 8, 1995). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
  - J1 Blank Contamination: Indicates possible high bias and/or false positives.
  - J2 Calibration Range exceeded: Indicates possible low bias.
  - J3 Holding times not met: Indicates low bias for most analytes.
  - J4 Other QC parameters outside control limits: bias not readily determined.
  - J5 Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
  - J6 Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

## **I. Sample Receipt and Technical Holding Times**

All samples were received in good condition.

The chain-of-custodies were reviewed for documentation of temperatures. Although the cooler temperatures for all samples were reported at 9.5°C upon receipt by the laboratory, no data was qualified based on these cooler temperatures since the compounds are not expected to degrade significantly during shipping or storage.

All technical holding time requirements were met.

## **II. HRGC/HRMS Instrument Performance Check**

Instrument performance was checked at the required frequency.

The static resolving power was at least 10,000 (10% valley definition).

## **III. Initial Calibration**

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

## **V. Laboratory Blanks**

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
PC170001B	01/04/17	PCB-003 PCB-005/008 PCB-011 PCB-018 PCB-017 PCB-031 PCB-028 PCB-020/033 PCB-022 PCB-052/069 PCB-159 PCB-194 Monochlorobiphenyls Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Hexachlorobiphenyls Octachlorobiphenyls	1.58 pg/L 7.07 pg/L 46 pg/L 8.67 pg/L 3.9 pg/L 7.71 pg/L 8.18 pg/L 3.39 pg/L 2.6 pg/L 10.3 pg/L 1.4 pg/L 18.4 pg/L 1.6 pg/L 53.1 pg/L 34.5 pg/L 10.3 pg/L 1.4 pg/L 18.4 pg/L	L66540-1
PC170006B	01/06/17	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Pentachlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	56.9 pg/L 11.7 pg/L 10.9 pg/L 8.06 pg/L 8.57 pg/L 2.33 pg/L 6.24 pg/L 3.51 pg/L 31 pg/L 6.96 pg/L 56.9 pg/L 30.7 pg/L 10.9 pg/L 9.8 pg/L 31 pg/L 7 pg/L	L66540-2 L66540-3 L66540-4 L66540-5 L66540-6 L66540-7 L66453-1 L66453-2 L66453-3 L66453-4 L66453-5 L66453-6 L66453-7 L66453-5DUP

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
PC170012B	01/10/17	PCB-005/008	6.1 pg/L	L66385-1
		PCB-011	34.5 pg/L	L66385-2
		PCB-018	9.87 pg/L	L66385-3
		PCB-031	5.29 pg/L	L66385-4
		PCB-028	5.07 pg/L	L66385-5
		PCB-020/033	3.25 pg/L	L66385-6
		PCB-022	2.54 pg/L	L66385-7
		PCB-052/069	6.17 pg/L	L66385-1DUP
		PCB-047/048	4.15 pg/L	
		PCB-044	5.01 pg/L	
		PCB-070	4.8 pg/L	
		PCB-093/098/095	7.45 pg/L	
		PCB-101	7.77 pg/L	
		PCB-118	2.08 pg/L	
		PCB-139/149	6.34 pg/L	
		PCB-153	2.99 pg/L	
		PCB-138	5.69 pg/L	
		PCB-156	1.98 pg/L	
		PCB-182/187	6.36 pg/L	
		PCB-180	37 pg/L	
		PCB-201	1.84 pg/L	
		PCB-199	8.78 pg/L	
		PCB-203	7.14 pg/L	
		PCB-194	6.56 pg/L	
		PCB-205	2.27 pg/L	
		PCB-209	6.97 pg/L	
Dichlorobiphenyls	40.6 pg/L			
Trichlorobiphenyls	26 pg/L			
Tetrachlorobiphenyls	20.1 pg/L			
Pentachlorobiphenyls	17.3 pg/L			
Hexachlorobiphenyls	17 pg/L			
Heptachlorobiphenyls	43.4 pg/L			
Octachlorobiphenyls	26.6 pg/L			

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
L66540-1	PCB-011	51.6 pg/L	51.6U pg/L
	PCB-018	7.68 pg/L	7.68U pg/L
	PCB-031	7.45 pg/L	7.45U pg/L
	PCB-028	9.59 pg/L	9.59U pg/L
	PCB-020/033	3.58 pg/L	3.58U pg/L
	PCB-052/069	12.5 pg/L	12.5U pg/L
	PCB-194	16.5 pg/L	16.5U pg/L
	Dichlorobiphenyls	51.6 pg/L	51.6U pg/L
	Trichlorobiphenyls	28.3 pg/L	28.3J pg/L
	Tetrachlorobiphenyls	12.5 pg/L	12.5U pg/L
	Octachlorobiphenyls	54.9 pg/L	54.9J pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L66540-2	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	58.5 pg/L 16.8 pg/L 10.9 pg/L 12.6 pg/L 10.8 pg/L 48 pg/L 7.43 pg/L 58.5 pg/L 56.2 pg/L 25.3 pg/L 62.3 pg/L 7.4 pg/L	58.5U pg/L 16.8U pg/L 10.9U pg/L 12.6U pg/L 10.8U pg/L 48U pg/L 7.43U pg/L 58.5U pg/L 56.2J pg/L 25.3J pg/L 62.3J pg/L 7.4U pg/L
L66540-3	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Decachlorobiphenyl	45.7 pg/L 12.3 pg/L 6.2 pg/L 8.9 pg/L 5.39 pg/L 1.86 pg/L 15.6 pg/L 106 pg/L 8.53 pg/L 45.7 pg/L 47.1 pg/L 36.5 pg/L 8.5 pg/L	45.7U pg/L 12.3U pg/L 6.2U pg/L 8.9U pg/L 5.39U pg/L 1.86U pg/L 15.6U pg/L 106U pg/L 8.53U pg/L 45.7U pg/L 47.1J pg/L 36.5J pg/L 8.5U pg/L
L66540-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	54.9 pg/L 15.7 pg/L 7.43 pg/L 8.46 pg/L 12.8 pg/L 3.42 pg/L 11.6 pg/L 16.6 pg/L 18.5 pg/L 9.32 pg/L 63.2 pg/L 60 pg/L 54.5 pg/L 58.7 pg/L 9.3 pg/L	54.9U pg/L 15.7U pg/L 7.43U pg/L 8.46U pg/L 12.8U pg/L 3.42U pg/L 11.6U pg/L 16.6U pg/L 18.5U pg/L 9.32U pg/L 63.2J pg/L 60J pg/L 54.5J pg/L 58.7J pg/L 9.3U pg/L
L66540-5	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	98.9 pg/L 14.7 pg/L 12.5 pg/L 24 pg/L 30.2 pg/L 15.8 pg/L 61.8 pg/L 108 pg/L 106 pg/L 144 pg/L	98.9U pg/L 14.7U pg/L 12.5U pg/L 24U pg/L 30.2U pg/L 15.8U pg/L 61.8U pg/L 108J pg/L 106J pg/L 144J pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L66540-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	85.7 pg/L 23.6 pg/L 7.87 pg/L 6.62 pg/L 15.5 pg/L 6.98 pg/L 11.4 pg/L 47.3 pg/L 4.66 pg/L 107 pg/L 38.1 pg/L 86.6 pg/L 4.7 pg/L	85.7U pg/L 23.6U pg/L 7.87U pg/L 6.62U pg/L 15.5U pg/L 6.98U pg/L 11.4U pg/L 47.3U pg/L 4.66U pg/L 107J pg/L 38.1J pg/L 86.6J pg/L 4.7U pg/L
L66540-7	PCB-011 PCB-018 PCB-028 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	77.4 pg/L 14.1 pg/L 6.54 pg/L 19.1 pg/L 5.95 pg/L 87.2 pg/L 77.4 pg/L 20.6 pg/L 136 pg/L	77.4U pg/L 14.1U pg/L 6.54U pg/L 19.1U pg/L 5.95U pg/L 87.2U pg/L 77.4U pg/L 20.6J pg/L 136J pg/L
L66453-1	PCB-011 PCB-018 PCB-031 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	52.3 pg/L 14.6 pg/L 4.84 pg/L 14.7 pg/L 12.4 pg/L 64.6 pg/L 52.3 pg/L 19.4 pg/L 87.4 pg/L	52.3U pg/L 14.6U pg/L 4.84U pg/L 14.7U pg/L 12.4U pg/L 64.6U pg/L 52.3U pg/L 19.4J pg/L 87.4J pg/L
L66453-2	PCB-011 PCB-018 PCB-052/069 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	54.8 pg/L 26.8 pg/L 19.5 pg/L 13.5 pg/L 144 pg/L 14.7 pg/L 54.8 pg/L 26.8 pg/L 14.7 pg/L	54.8U pg/L 26.8U pg/L 19.5U pg/L 13.5U pg/L 144U pg/L 14.7U pg/L 54.8U pg/L 26.8J pg/L 14.7U pg/L
L66453-3	PCB-011 PCB-018 PCB-031 PCB-052/069 PCB-064 PCB-097 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	53 pg/L 20 pg/L 4.12 pg/L 11.5 pg/L 6.19 pg/L 9.86 pg/L 13.4 pg/L 56.4 pg/L 4.78 pg/L 53 pg/L 24.1 pg/L 123 pg/L 4.8 pg/L	53U pg/L 20U pg/L 4.12U pg/L 11.5U pg/L 6.19U pg/L 9.86U pg/L 13.4U pg/L 56.4U pg/L 4.78U pg/L 53U pg/L 24.1J pg/L 123J pg/L 4.8U pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L66453-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	47.4 pg/L 30.6 pg/L 5.82 pg/L 6.17 pg/L 23 pg/L 7.66 pg/L 16.7 pg/L 85.1 pg/L 10.2 pg/L 47.4 pg/L 54.9 pg/L 147 pg/L 10.2 pg/L	47.4U pg/L 30.6U pg/L 5.82U pg/L 6.17U pg/L 23U pg/L 7.66U pg/L 16.7U pg/L 85.1U pg/L 10.2U pg/L 47.4U pg/L 54.9J pg/L 147J pg/L 10.2U pg/L
L66453-5	PCB-011 PCB-031 PCB-028 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	69.8 pg/L 8.14 pg/L 16.9 pg/L 14.9 pg/L 87 pg/L 8.91 pg/L 69.8 pg/L 44.8 pg/L 8.9 pg/L	69.8U pg/L 8.14U pg/L 16.9U pg/L 14.9U pg/L 87U pg/L 8.91U pg/L 69.8U pg/L 44.8J pg/L 8.9U pg/L
L66453-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	66.6 pg/L 12.6 pg/L 6.14 pg/L 12.4 pg/L 28.9 pg/L 11.2 pg/L 13.6 pg/L 85.8 pg/L 13.6 pg/L 66.6 pg/L 34.6 pg/L 13.6 pg/L	66.6U pg/L 12.6U pg/L 6.14U pg/L 12.4U pg/L 28.9U pg/L 11.2U pg/L 13.6U pg/L 85.8U pg/L 13.6U pg/L 66.6U pg/L 34.6J pg/L 13.6U pg/L
L66453-7	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-097 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	56.3 pg/L 10.8 pg/L 8.12 pg/L 10.6 pg/L 18.3 pg/L 20.5 pg/L 9.63 pg/L 63.8 pg/L 42.6 pg/L 9.6 pg/L	56.3U pg/L 10.8U pg/L 8.12U pg/L 10.6U pg/L 18.3U pg/L 20.5U pg/L 9.63U pg/L 63.8J pg/L 42.6J pg/L 9.6U pg/L
L66453-5DUP	PCB-011 PCB-018 PCB-031 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	46.4 pg/L 20.8 pg/L 6.62 pg/L 19.9 pg/L 136 pg/L 9.42 pg/L 46.4 pg/L 30.6 pg/L 9.4 pg/L	46.4U pg/L 20.8U pg/L 6.62U pg/L 19.9U pg/L 136U pg/L 9.42U pg/L 46.4U pg/L 30.6J pg/L 9.4U pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L66385-1	PCB-011	44 pg/L	44U pg/L
	PCB-018	13.2 pg/L	13.2U pg/L
	PCB-031	4.94 pg/L	4.94U pg/L
	PCB-028	4.39 pg/L	4.39U pg/L
	PCB-052/069	8.71 pg/L	8.71U pg/L
	PCB-047/048	4.76 pg/L	4.76U pg/L
	PCB-070	12.6 pg/L	12.6U pg/L
	PCB-093/098/095	20.3 pg/L	20.3U pg/L
	PCB-118	9.73 pg/L	9.73U pg/L
	PCB-182/187	11.3 pg/L	11.3U pg/L
	PCB-180	100 pg/L	100U pg/L
	PCB-199	11.4 pg/L	11.4U pg/L
	PCB-203	14.3 pg/L	14.3U pg/L
	PCB-194	16.2 pg/L	16.2U pg/L
	PCB-209	10.8 pg/L	10.8U pg/L
	Dichlorobiphenyls	44 pg/L	44U pg/L
	Trichlorobiphenyls	22.5 pg/L	22.5J pg/L
	Tetrachlorobiphenyls	38.9 pg/L	38.9J pg/L
	Pentachlorobiphenyls	83.4 pg/L	83.4J pg/L
	Heptachlorobiphenyls	177 pg/L	177J pg/L
Octachlorobiphenyls	41.9 pg/L	41.9J pg/L	
Decachlorobiphenyl	10.8 pg/L	10.8U pg/L	
L66385-1DUP	PCB-011	49.5 pg/L	49.5U pg/L
	PCB-018	15.4 pg/L	15.4U pg/L
	PCB-031	3.56 pg/L	3.56U pg/L
	PCB-028	7.2 pg/L	7.2U pg/L
	PCB-052/069	10 pg/L	10U pg/L
	PCB-047/048	4.53 pg/L	4.53U pg/L
	PCB-070	10.3 pg/L	10.3U pg/L
	PCB-093/098/095	23 pg/L	23U pg/L
	PCB-101	24.2 pg/L	24.2U pg/L
	PCB-156	7.25 pg/L	7.25U pg/L
	PCB-182/187	17 pg/L	17U pg/L
	PCB-180	67.4 pg/L	67.4U pg/L
	PCB-203	9.88 pg/L	9.88U pg/L
	PCB-194	10 pg/L	10U pg/L
	PCB-205	6.64 pg/L	6.64U pg/L
	PCB-209	12.6 pg/L	12.6U pg/L
	Dichlorobiphenyls	49.5 pg/L	49.5U pg/L
	Trichlorobiphenyls	26.2 pg/L	26.2J pg/L
	Tetrachlorobiphenyls	34.1 pg/L	34.1J pg/L
	Heptachlorobiphenyls	132 pg/L	132J pg/L
Octachlorobiphenyls	12.6 pg/L	26.5J pg/L	
Decachlorobiphenyl	12.6 pg/L	12.6U pg/L	

Sample	Compound	Reported Concentration	Modified Final Concentration
L66385-2	PCB-011	36.3 pg/L	36.3U pg/L
	PCB-018	17.8 pg/L	17.8U pg/L
	PCB-031	8.13 pg/L	8.13U pg/L
	PCB-028	8.5 pg/L	8.5U pg/L
	PCB-020/033	3.76 pg/L	3.76U pg/L
	PCB-022	2.32 pg/L	2.32U pg/L
	PCB-052/069	10.5 pg/L	10.5U pg/L
	PCB-047/048	3.49 pg/L	3.49U pg/L
	PCB-070	12.1 pg/L	12.1U pg/L
	PCB-093/098/095	25.3 pg/L	25.3U pg/L
	PCB-101	25.6 pg/L	25.6U pg/L
	PCB-139/149	14.5 pg/L	14.5U pg/L
	PCB-138	22.8 pg/L	22.8U pg/L
	PCB-156	4.66 pg/L	4.66U pg/L
	PCB-182/187	15.3 pg/L	15.3U pg/L
	PCB-180	90.6 pg/L	90.6U pg/L
	PCB-199	11.5 pg/L	11.5U pg/L
	PCB-203	23.6 pg/L	23.6U pg/L
	PCB-194	11.8 pg/L	11.8U pg/L
	PCB-209	9.51 pg/L	9.51U pg/L
Dichlorobiphenyls	36.3 pg/L	36.3U pg/L	
Trichlorobiphenyls	40.5 pg/L	40.5J pg/L	
Tetrachlorobiphenyls	36.4 pg/L	36.4J pg/L	
Heptachlorobiphenyls	154 pg/L	154J pg/L	
Octachlorobiphenyls	51.6 pg/L	51.6J pg/L	
Decachlorobiphenyl	9.5 pg/L	9.5U pg/L	
L66385-3	PCB-005/008	5.61 pg/L	5.61U pg/L
	PCB-011	47 pg/L	47U pg/L
	PCB-018	10.5 pg/L	10.5U pg/L
	PCB-031	4.89 pg/L	4.89U pg/L
	PCB-028	7.5 pg/L	7.5U pg/L
	PCB-020/033	2.83 pg/L	2.83U pg/L
	PCB-052/069	9.13 pg/L	9.13U pg/L
	PCB-047/048	4.23 pg/L	4.23U pg/L
	PCB-044	11.6 pg/L	11.6U pg/L
	PCB-070	10.7 pg/L	10.7U pg/L
	PCB-093/098/095	22.9 pg/L	22.9U pg/L
	PCB-101	24 pg/L	24U pg/L
	PCB-139/149	23.9 pg/L	23.9U pg/L
	PCB-156	6.22 pg/L	6.22U pg/L
	PCB-182/187	14.4 pg/L	14.4U pg/L
	PCB-180	75.1 pg/L	75.1U pg/L
	PCB-199	11.4 pg/L	11.4U pg/L
	PCB-203	14.6 pg/L	14.6U pg/L
	PCB-194	11.3 pg/L	11.3U pg/L
	PCB-205	5.99 pg/L	5.99U pg/L
PCB-209	7.31 pg/L	7.31U pg/L	
Dichlorobiphenyls	52.6 pg/L	52.6J pg/L	
Trichlorobiphenyls	38.4 pg/L	38.4J pg/L	
Tetrachlorobiphenyls	53.9 pg/L	53.9J pg/L	
Heptachlorobiphenyls	151 pg/L	151J pg/L	
Octachlorobiphenyls	47.8 pg/L	47.8J pg/L	
Decachlorobiphenyl	7.3 pg/L	7.3U pg/L	

Sample	Compound	Reported Concentration	Modified Final Concentration
L66385-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-047/048 PCB-044 PCB-093/098/095 PCB-101 PCB-138 PCB-156 PCB-182/187 PCB-180 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Hexachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	47 pg/L 12.5 pg/L 11.9 pg/L 12.9 pg/L 20.3 pg/L 9.02 pg/L 24.4 pg/L 26.9 pg/L 37.6 pg/L 21 pg/L 9.89 pg/L 18.3 pg/L 79 pg/L 18.2 pg/L 13.5 pg/L 12.4 pg/L 5.85 pg/L 9.95 pg/L 47 pg/L 37.3 pg/L 98.7 pg/L 68 pg/L 155 pg/L 57.1 pg/L 10 pg/L	47U pg/L 12.5U pg/L 11.9U pg/L 12.9U pg/L 20.3U pg/L 9.02U pg/L 24.4U pg/L 26.9U pg/L 37.6U pg/L 21U pg/L 9.89U pg/L 18.3U pg/L 79U pg/L 18.2U pg/L 13.5U pg/L 12.4U pg/L 5.85U pg/L 9.95U pg/L 47U pg/L 37.3J pg/L 98.7J pg/L 68J pg/L 155J pg/L 57.1J pg/L 10U pg/L
L66385-5	PCB-005/008 PCB-011 PCB-018 PCB-031 PCB-020/033 PCB-199 PCB-194 PCB-209 Dichlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	16.4 pg/L 104 pg/L 25.5 pg/L 25 pg/L 11.2 pg/L 34.7 pg/L 15.3 pg/L 11.9 pg/L 140 pg/L 103 pg/L 11.9 pg/L	16.4U pg/L 104U pg/L 25.5U pg/L 25U pg/L 11.2U pg/L 34.7U pg/L 15.3U pg/L 11.9U pg/L 140J pg/L 103J pg/L 11.9U pg/L
L66385-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-020/033 PCB-052/069 PCB-047/048 PCB-044 PCB-156 PCB-180 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	47.1 pg/L 13.4 pg/L 10.7 pg/L 12.7 pg/L 7.37 pg/L 17.1 pg/L 6.52 pg/L 16.5 pg/L 6.82 pg/L 109 pg/L 18.5 pg/L 19.8 pg/L 10.9 pg/L 6.23 pg/L 7.74 pg/L 47.1 pg/L 58.1 pg/L 214 pg/L 61.3 pg/L 7.7 pg/L	47.1U pg/L 13.4U pg/L 10.7U pg/L 12.7U pg/L 7.37U pg/L 17.1U pg/L 6.52U pg/L 16.5U pg/L 6.82U pg/L 109U pg/L 18.5U pg/L 19.8U pg/L 10.9U pg/L 6.23U pg/L 7.74U pg/L 47.1U pg/L 58.1J pg/L 214J pg/L 61.3J pg/L 7.7U pg/L

Sample	Compound	Reported Concentration	Modified Final Concentration
L66385-7	PCB-005/008	9.85 pg/L	9.85U pg/L
	PCB-011	58 pg/L	58U pg/L
	PCB-018	24.7 pg/L	24.7U pg/L
	PCB-031	4.84 pg/L	4.84U pg/L
	PCB-028	8.02 pg/L	8.02U pg/L
	PCB-022	3.27 pg/L	3.27U pg/L
	PCB-052/069	14.5 pg/L	14.5U pg/L
	PCB-047/048	4.77 pg/L	4.77U pg/L
	PCB-044	10.9 pg/L	10.9U pg/L
	PCB-070	8.98 pg/L	8.98U pg/L
	PCB-199	31.4 pg/L	31.4U pg/L
	PCB-203	34.9 pg/L	34.9U pg/L
	PCB-194	14.6 pg/L	14.6U pg/L
	PCB-205	8.49 pg/L	8.49U pg/L
	PCB-209	11.5 pg/L	11.5U pg/L
	Dichlorobiphenyls	67.9 pg/L	67.9J pg/L
	Trichlorobiphenyls	45 pg/L	45J pg/L
	Tetrachlorobiphenyls	48.5 pg/L	48.5J pg/L
Octachlorobiphenyls	108 pg/L	108J pg/L	
Decachlorobiphenyl	11.5 pg/L	11.5U pg/L	

Laboratory blank results flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC) are considered not detected.

#### VI. Field Blanks

No field blanks were identified in this SDG.

#### VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

#### VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

#### IX. Field Duplicates

No field duplicates were identified in this SDG.

#### X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

## XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG PR164584	All compounds flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC).	U	A

Raw data were not reviewed for Level III validation.

## XII. Target Compound Identification

Raw data were not reviewed for Level III validation.

## XIII. System Performance

Raw data were not reviewed for Level III validation.

## XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to results reported by the laboratory as EMPCs, data were qualified as not detected in twenty-three samples.

Due to laboratory blank contamination, data were qualified as not detected or estimated in twenty-three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**LDW Federal Way SW Monitoring  
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG  
PR164584**

Sample	Compound	Flag	A or P	Reason
L66540-1 L66540-2 L66540-3 L66540-4 L66540-5 L66540-6 L66540-7 L66453-1 L66453-2 L66453-3 L66453-4 L66453-5 L66453-6 L66453-7 L66385-1 L66385-2 L66385-3 L66385-4 L66385-5 L66385-6 L66385-7 L66453-5DUP L66385-1DUP	All compounds flagged "N" or "NJ" by the laboratory as estimated maximum possible concentration (EMPC).	U	A	Compound quantitation (EMPC)

**LDW Federal Way SW Monitoring  
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification  
Summary - SDG PR164584**

Sample	Compound	Modified Final Concentration	A or P
L66540-1	PCB-011 PCB-018 PCB-031 PCB-028 PCB-020/033 PCB-052/069 PCB-194 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Octachlorobiphenyls	51.6U pg/L 7.68U pg/L 7.45U pg/L 9.59U pg/L 3.58U pg/L 12.5U pg/L 16.5U pg/L 51.6U pg/L 28.3J pg/L 12.5U pg/L 54.9J pg/L	A
L66540-2	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	58.5U pg/L 16.8U pg/L 10.9U pg/L 12.6U pg/L 10.8U pg/L 48U pg/L 7.43U pg/L 58.5U pg/L 56.2J pg/L 25.3J pg/L 62.3J pg/L 7.4U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66540-3	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Decachlorobiphenyl	45.7U pg/L 12.3U pg/L 6.2U pg/L 8.9U pg/L 5.39U pg/L 1.86U pg/L 15.6U pg/L 106U pg/L 8.53U pg/L 45.7U pg/L 47.1J pg/L 36.5J pg/L 8.5U pg/L	A
L66540-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	54.9U pg/L 15.7U pg/L 7.43U pg/L 8.46U pg/L 12.8U pg/L 3.42U pg/L 11.6U pg/L 16.6U pg/L 18.5U pg/L 9.32U pg/L 63.2J pg/L 60J pg/L 54.5J pg/L 58.7J pg/L 9.3U pg/L	A
L66540-5	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	98.9U pg/L 14.7U pg/L 12.5U pg/L 24U pg/L 30.2U pg/L 15.8U pg/L 61.8U pg/L 108J pg/L 106J pg/L 144J pg/L	A
L66540-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	85.7U pg/L 23.6U pg/L 7.87U pg/L 6.62U pg/L 15.5U pg/L 6.98U pg/L 11.4U pg/L 47.3U pg/L 4.66U pg/L 107J pg/L 38.1J pg/L 86.6J pg/L 4.7U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66540-7	PCB-011 PCB-018 PCB-028 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	77.4U pg/L 14.1U pg/L 6.54U pg/L 19.1U pg/L 5.95U pg/L 87.2U pg/L 77.4U pg/L 20.6J pg/L 136J pg/L	A
L66453-1	PCB-011 PCB-018 PCB-031 PCB-052/069 PCB-064 PCB-180 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls	52.3U pg/L 14.6U pg/L 4.84U pg/L 14.7U pg/L 12.4U pg/L 64.6U pg/L 52.3U pg/L 19.4J pg/L 87.4J pg/L	A
L66453-2	PCB-011 PCB-018 PCB-052/069 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	54.8U pg/L 26.8U pg/L 19.5U pg/L 13.5U pg/L 144U pg/L 14.7U pg/L 54.8U pg/L 26.8J pg/L 14.7U pg/L	A
L66453-3	PCB-011 PCB-018 PCB-031 PCB-052/069 PCB-064 PCB-097 PCB-118 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	53U pg/L 20U pg/L 4.12U pg/L 11.5U pg/L 6.19U pg/L 9.86U pg/L 13.4U pg/L 56.4U pg/L 4.78U pg/L 53U pg/L 24.1J pg/L 123J pg/L 4.8U pg/L	A
L66453-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Decachlorobiphenyl	47.4U pg/L 30.6U pg/L 5.82U pg/L 6.17U pg/L 23U pg/L 7.66U pg/L 16.7U pg/L 85.1U pg/L 10.2U pg/L 47.4U pg/L 54.9J pg/L 147J pg/L 10.2U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66453-5	PCB-011 PCB-031 PCB-028 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	69.8U pg/L 8.14U pg/L 16.9U pg/L 14.9U pg/L 87U pg/L 8.91U pg/L 69.8U pg/L 44.8J pg/L 8.9U pg/L	A
L66453-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-064 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	66.6U pg/L 12.6U pg/L 6.14U pg/L 12.4U pg/L 28.9U pg/L 11.2U pg/L 13.6U pg/L 85.8U pg/L 13.6U pg/L 66.6U pg/L 34.6J pg/L 13.6U pg/L	A
L66453-7	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-097 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	56.3U pg/L 10.8U pg/L 8.12U pg/L 10.6U pg/L 18.3U pg/L 20.5U pg/L 9.63U pg/L 63.8J pg/L 42.6J pg/L 9.6U pg/L	A
L66453-5DUP	PCB-011 PCB-018 PCB-031 PCB-097 PCB-180 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Decachlorobiphenyl	46.4U pg/L 20.8U pg/L 6.62U pg/L 19.9U pg/L 136U pg/L 9.42U pg/L 46.4U pg/L 30.6J pg/L 9.4U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66385-1	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-047/048 PCB-070 PCB-093/098/095 PCB-118 PCB-182/187 PCB-180 PCB-199 PCB-203 PCB-194 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Pentachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	44U pg/L 13.2U pg/L 4.94U pg/L 4.39U pg/L 8.71U pg/L 4.76U pg/L 12.6U pg/L 20.3U pg/L 9.73U pg/L 11.3U pg/L 100U pg/L 11.4U pg/L 14.3U pg/L 16.2U pg/L 10.8U pg/L 44U pg/L 22.5J pg/L 38.9J pg/L 83.4J pg/L 177J pg/L 41.9J pg/L 10.8U pg/L	A
L66385-1DUP	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-047/048 PCB-070 PCB-093/098/095 PCB-101 PCB-156 PCB-182/187 PCB-180 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	49.5U pg/L 15.4U pg/L 3.56U pg/L 7.2U pg/L 10U pg/L 4.53U pg/L 10.3U pg/L 23U pg/L 24.2U pg/L 7.25U pg/L 17U pg/L 67.4U pg/L 9.88U pg/L 10U pg/L 6.64U pg/L 12.6U pg/L 49.5U pg/L 26.2J pg/L 34.1J pg/L 132J pg/L 26.5J pg/L 12.6U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66385-2	PCB-011 PCB-018 PCB-031 PCB-028 PCB-020/033 PCB-022 PCB-052/069 PCB-047/048 PCB-070 PCB-093/098/095 PCB-101 PCB-139/149 PCB-138 PCB-156 PCB-182/187 PCB-180 PCB-199 PCB-203 PCB-194 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	36.3U pg/L 17.8U pg/L 8.13U pg/L 8.5U pg/L 3.76U pg/L 2.32U pg/L 10.5U pg/L 3.49U pg/L 12.1U pg/L 25.3U pg/L 25.6U pg/L 14.5U pg/L 22.8U pg/L 4.66U pg/L 15.3U pg/L 90.6U pg/L 11.5U pg/L 23.6U pg/L 11.8U pg/L 9.51U pg/L 36.3U pg/L 40.5J pg/L 36.4J pg/L 154J pg/L 51.6J pg/L 9.5U pg/L	A
L66385-3	PCB-005/008 PCB-011 PCB-018 PCB-031 PCB-028 PCB-020/033 PCB-052/069 PCB-047/048 PCB-044 PCB-070 PCB-093/098/095 PCB-101 PCB-139/149 PCB-156 PCB-182/187 PCB-180 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	5.61U pg/L 47U pg/L 10.5U pg/L 4.89U pg/L 7.5U pg/L 2.83U pg/L 9.13U pg/L 4.23U pg/L 11.6U pg/L 10.7U pg/L 22.9U pg/L 24U pg/L 23.9U pg/L 6.22U pg/L 14.4U pg/L 75.1U pg/L 11.4U pg/L 14.6U pg/L 11.3U pg/L 5.99U pg/L 7.31U pg/L 52.6J pg/L 38.4J pg/L 53.9J pg/L 151J pg/L 47.8J pg/L 7.3U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66385-4	PCB-011 PCB-018 PCB-031 PCB-028 PCB-052/069 PCB-047/048 PCB-044 PCB-093/098/095 PCB-101 PCB-138 PCB-156 PCB-182/187 PCB-180 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Hexachlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	47U pg/L 12.5U pg/L 11.9U pg/L 12.9U pg/L 20.3U pg/L 9.02U pg/L 24.4U pg/L 26.9U pg/L 37.6U pg/L 21U pg/L 9.89U pg/L 18.3U pg/L 79U pg/L 18.2U pg/L 13.5U pg/L 12.4U pg/L 5.85U pg/L 9.95U pg/L 47U pg/L 37.3J pg/L 98.7J pg/L 68J pg/L 155J pg/L 57.1J pg/L 10U pg/L	A
L66385-5	PCB-005/008 PCB-011 PCB-018 PCB-031 PCB-020/033 PCB-199 PCB-194 PCB-209 Dichlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	16.4U pg/L 104U pg/L 25.5U pg/L 25U pg/L 11.2U pg/L 34.7U pg/L 15.3U pg/L 11.9U pg/L 140J pg/L 103J pg/L 11.9U pg/L	A
L66385-6	PCB-011 PCB-018 PCB-031 PCB-028 PCB-020/033 PCB-052/069 PCB-047/048 PCB-044 PCB-156 PCB-180 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Heptachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	47.1U pg/L 13.4U pg/L 10.7U pg/L 12.7U pg/L 7.37U pg/L 17.1U pg/L 6.52U pg/L 16.5U pg/L 6.82U pg/L 109U pg/L 18.5U pg/L 19.8U pg/L 10.9U pg/L 6.23U pg/L 7.74U pg/L 47.1U pg/L 58.1J pg/L 214J pg/L 61.3J pg/L 7.7U pg/L	A

Sample	Compound	Modified Final Concentration	A or P
L66385-7	PCB-005/008 PCB-011 PCB-018 PCB-031 PCB-028 PCB-022 PCB-052/069 PCB-047/048 PCB-044 PCB-070 PCB-199 PCB-203 PCB-194 PCB-205 PCB-209 Dichlorobiphenyls Trichlorobiphenyls Tetrachlorobiphenyls Octachlorobiphenyls Decachlorobiphenyl	9.85U pg/L 58U pg/L 24.7U pg/L 4.84U pg/L 8.02U pg/L 3.27U pg/L 14.5U pg/L 4.77U pg/L 10.9U pg/L 8.98U pg/L 31.4U pg/L 34.9U pg/L 14.6U pg/L 8.49U pg/L 11.5U pg/L 67.9J pg/L 45J pg/L 48.5J pg/L 108J pg/L 11.5U pg/L	A

LDC #: 39333A31

## VALIDATION COMPLETENESS WORKSHEET

Date: 08/31/17

SDG #: PR164584

Level III

Page: 1 of 2

Laboratory: Pacific Rim Laboratories, Inc.

Reviewer: JVG

2nd Reviewer: R

**METHOD:** HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	cooler temp = 9.5°C (Text)
II.	HRGC/HRMS Instrument performance check	A	JVG
III.	Initial calibration/ICV	A / N	1 CAL $\leq$ 20% UL/35% L + 1 $\leq$ 20% UL/35% L
IV.	Continuing calibration	A	CCV $\leq$ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates / LD	N / A	LD = 12/22, 15/27
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Internal standards	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable  
N = Not provided/applicable  
SW = See worksheet

ND = No compounds detected  
R = Rinsate  
FB = Field blank

D = Duplicate  
TB = Trip blank  
EB = Equipment blank

SB=Source blank  
OTHER:

	Client ID	Lab ID	Matrix	Date
1	L66540-1	PR164577	Water	10/31/16
2	L66540-2	PR164578	Water	10/31/16
3	L66540-3	PR164579	Water	10/31/16
4	L66540-4	PR164580	Water	10/31/16
5	L66540-5	PR164581	Water	10/31/16
6	L66540-6	PR164582	Water	10/31/16
7	L66540-7	PR164583	Water	11/01/16
8	L66453-1	PR164584	Water	10/20/16
9	L66453-2	PR164585	Water	10/20/16
10	L66453-3	PR164586	Water	10/20/16
11	L66453-4	PR164587	Water	10/20/16
12	L66453-5	PR164588	Water	10/19/16
13	L66453-6	PR164589	Water	10/19/16
14	L66453-7	PR164590	Water	10/19/16
15	L66385-1	PR164591	Water	10/26/16

LDC #: 39333A31

### VALIDATION COMPLETENESS WORKSHEET

Date: 08/31/17

SDG #: PR164584

Level III

Page: 2 of 2

Laboratory: Pacific Rim Laboratories, Inc.

Reviewer: JVB

2nd Reviewer:

**METHOD:** HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

	Client ID	Lab ID	Matrix	Date
16	L66385-2	PR164592	Water	10/26/16
17	L66385-3	PR164593	Water	10/26/16
18	L66385-4	PR164594	Water	10/26/16
19	L66385-5	PR164595	Water	10/26/16
20	L66385-6	PR164596	Water	10/26/16
21	L66385-7	PR164597	Water	10/26/16
22	L66453-5DUP	PR164588DUP	Water	10/19/16
23	L66385-1DUP	PR164591DUP	Water	10/26/16
24				
25				
26				
27				
28				

Notes:

1	PC170001B				
2	PC170006B				
3	PC170012B				

VALIDATION FINDINGS WORKSHEET

Blanks

Reviewer: JVG  
2nd Reviewer: *[Signature]*

**METHOD:** HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?

Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?

Y N N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 01/04/17

Blank analysis date: 3/09/17

Conc. units: pg/L

Associated samples: 1 *qual U except totals*

Compound	Blank ID	Sample Identification <i>(either U or S)</i>							
(PRL023)	PC170001B	5x		1					
PCB-003	1.58	7.90							
PCB-005/008	7.07	35.35							
PCB-011	46	230.00		51.6					
PCB-018	8.67	43.35		7.68					
PCB-017	3.9	19.50							
PCB-031	7.71	38.55		7.45					
PCB-028	8.18	40.90		9.59					
PCB-020/033	3.39	16.95		3.58					
PCB-022	2.6	13.00							
PCB-052/069	10.3	51.50		12.5					
PCB-159	1.4	7.00							
PCB-194	18.4	92.00		16.5					
Monochlorobiphenyls	1.6	8.00							
Dichlorobiphenyls	53.1	265.50		51.6/U					
Trichlorobiphenyls	34.5	172.50		28.3/S					
Tetrachlorobiphenyls	10.3	51.50		12.5/U					
Hexachlorobiphenyls	1.4	7.00							
Octachlorobiphenyls	18.4	92.00		59.9/S					

*totals* ↓

All results qualified by the lab as N or NJ were qualified as not detected, "U".

VALIDATION FINDINGS WORKSHEET

Blanks

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- Y  N  N/A Were all samples associated with a method blank?
- Y  N  N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Y  N  N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 01/06/17

Blank analysis date: 3/09/17

Conc. units: pg/L

Associated samples: 2-14, 22 qual U except totals (either U or S)

Compound	Blank ID	Sample Identification								
		5x	2	3	4	5	6	7	8	9
(PRL024)	PC170006B									
PCB-011	56.9	284.50	58.5	45.7	54.9	98.9	85.7	77.4	52.3	54.8
PCB-018	11.7	58.50	16.8	12.3	15.7	14.7	23.6	14.1	14.6	26.8
PCB-031	10.9	54.50	10.9	6.2	7.43	12.5	7.87		4.84	34 <sup>JVG</sup>
PCB-028	8.06	40.30	12.6	8.9	8.46	24	6.62	6.54		
PCB-052/069	8.57	42.85	16.8	5.39	12.8	30.2	15.5	19.1	14.7	19.5
PCB-064	2.33	11.65		1.86	3.42	15.8	6.98	5.95	12.4	
PCB-097	6.24	31.20			11.6					
PCB-118	3.51	17.55		15.6	16.6	<del>36.5</del> <sup>JVG</sup>	11.4			13.5
PCB-180	31	155.00	48	106	18.5	61.8	47.3	87.2	64.6	144
PCB-208 <sup>9</sup>	6.96	34.80	7.43	8.53	9.32	<del>6.24</del> <sup>JVG</sup>	4.66			14.7
<sup>mls</sup> Dichlorobiphenyls	56.9	284.50	58.5/U	45.7/U	63.2/J	108/J	107/J	77.4/U	52.3/U	54.8/U
Trichlorobiphenyls	30.7	153.50	56.2/J	47.1/J	60	106/↓	38.1/J	20.6/J	19.4/J	26.8/J
Tetrachlorobiphenyls	10.9	54.50	25.3/J	36.5/↓	54.5					
Pentachlorobiphenyls	9.8	49.00								
Heptachlorobiphenyls	31	155.00	62.3/J		58.7/↓	144/J	86.6/J	136/J	87.4/J	
Decachlorobiphenyls	7	35.00	7.4/↓	8.5/↓	9.3/↓		4.7/↓			14.7/↓

All results qualified by the lab as N or NJ were qualified as not detected, "U".

## VALIDATION FINDINGS WORKSHEET

### Blanks

**METHOD:** HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- Y N N/A Were all samples associated with a method blank?
- Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Y N N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 01/06/17

Blank analysis date: 3/09/17

Conc. units: pg/L

Associated samples: 2-14, 22

*good U except totals (either U or S)*

Compound	Blank ID	Sample Identification								
		5x	10	11	12	13	14	22		
(PRL024)	PC170006B									
PCB-011	56.9	284.50	53	47.4	69.8	66.6	56.3	46.4		
PCB-018	11.7	58.50	26	30.6	4 <sup>JVG</sup>	12.6	10.8	20.8		
PCB-031	10.9	54.50	4.12	5.82	8.14	6.6 <sup>14</sup>	8.12	6.62		
PCB-028	8.06	40.30		6.17	16.9	12.4	10.6			
PCB-052/069	8.57	42.85	11.5	23	8	28.9	18.3			
→ PCB-064	2.33	11.65	6.19	7.66		11.2				
PCB-097	6.24	31.20	9.86	16.7	14.9	13.6	20.5	19.9		
PCB-118	3.51	17.55	13.4				38.7 <sup>JVG</sup>			
PCB-180	31	155.00	56.4	18.85.1	87	85.8		136		
PCB-208 <sup>9</sup>	6.96	34.80	4.78	10.2	8.91	13.6	9.63	9.42		
7Ade) Dichlorobiphenyls	56.9	284.50	53/U	47.4/U	69.8/U	66.6/U	63.8/J	46.4/U		
Trichlorobiphenyls	30.7	153.50	24.1/J	54.9/J	44.8/J	34.6/J	42.6/J	30.6/J		
Tetrachlorobiphenyls	10.9	54.50								
Pentachlorobiphenyls	9.8	49.00								
Heptachlorobiphenyls	31	155.00	123/J	147/J						
Decachlorobiphenyls	7	35.00	4.8/U	10.2/U	8.9/U	13.6/U	9.6/J	9.4/U		

All results qualified by the lab as N or NJ were qualified as not detected, "U".

VALIDATION FINDINGS WORKSHEET

Blanks

Reviewer: JVG  
2nd Reviewer:   

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- Y N N/A Were all samples associated with a method blank?
- Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Y N N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 01/10/17

Blank analysis date: 3/17/17

Conc. units: pg/L

Associated samples:

15-21, 23

Qual U except totals (either U or J)

Compound	Blank ID	Sample Identification								
		5x	15	23	16	17	18	19	20	21
(PRL025)	PC170012B									
PCB-005/008	6.1	30.5				5.61		16.4		9.85
PCB-011	34.5	172.5	44	49.5	36.3	47	47	104	47.1	58
PCB-018	9.87	49.35	13.2	15.4	17.8	10.5	12.5	25.5	13.4	24.7
PCB-031	5.29	26.45	4.94	3.56	8.13	4.89	11.9	25	10.7	4.84
PCB-028	5.07	25.35	4.34	7.2	8.5	7.5	12.9		12.7	8.02
PCB-020/033	3.25	16.25			3.76	2.83		11.2	7.37	
PCB-022	2.54	12.7			2.32					3.27
PCB-052/069	6.17	30.85	8.71	10	10.5	9.13	20.3		17.1	14.5
PCB-047/048	4.15	20.75	4.76	4.53	3.49	4.23	9.02		6.52	4.77
PCB-044	5.01	25.05				<del>4.23</del> 11.6	24.4		16.5	10.9
PCB-070	4.8	24	12.6	16.3	12.1	10.7				8.98
PCB-093/098/095	7.45	37.25	20.3	23	25.3	22.9	26.9			
PCB-101	7.77	38.85		24.2	25.6	24	37.6			
PCB-118	2.08	10.4	9.73	.			.			
PCB-139/149	6.34	31.7			14.5	23.9				
PCB-153	2.99	14.95								
PCB-138	5.69	28.45			22.8		21			
PCB-156	1.98	9.9		7.25	4.66	6.22	9.89		6.82	
PCB-182/187	6.36	31.8	11.3	17	15.3	14.4	18.3			
PCB-180	37	185	160	67.4	90.6	75.1	79		109	

All results qualified by the lab as N or NJ were qualified as not detected, "U".

**VALIDATION FINDINGS WORKSHEET**  
**Blanks**

**METHOD:** HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- Y N N/A Were all samples associated with a method blank?
- Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Y N N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 01/10/17

Blank analysis date: 3/17/17

15-21, 23

Conc. units: pg/L

Associated samples:

Compound	Blank ID	Sample Identification								
		5x	15	23	16	17	18	19	20	21
(PRL025)	PC170012B									
PCB-201	1.84	9.2								
PCB-199	8.78	43.9	11.4		11.5	11.4	18.2	34.7	18.5	31.4
PCB-203	7.14	35.7	14.3	9.88	26.23.6	14.6	13.5		19.8	34.9
PCB-194	6.56	32.8	16.2	10	11.8	11.3	12.4	15.3	10.9	14.6
PCB-205	2.27	11.35		6.64		5.99	5.85		6.27	8.99
PCB-209	6.97	34.85	10.8	12.6	9.51	7.31	9.95	11.9	7.74	11.5
Dichlorobiphenyls	40.6	203.00	44/U	49.5/U	36.3/U	52.6/J	47/U	140/J	47.1/U	67.9/J
Trichlorobiphenyls	26	130.00	22.5/J	26.2/J	90.5/J	38.4/J	37.7/J		58.1/J	45/J
Tetrachlorobiphenyls	20.1	100.50	38.9/J	34.1/J	36.4/J	53.9/J	98.7/J			48.5/J
Pentachlorobiphenyls	17.3	86.50	83.4/J							
Hexachlorobiphenyls	17	85.00					68/J			
Heptachlorobiphenyls	43.4	217.00	177/J	132/J	154/J	151/J	155/J		219/J	
Octachlorobiphenyls	26.6	133.00	41.9/J	26.5/J	51.6/J	47.8/J	57.1/J	103/J	61.7/J	108/J
Decachlorobiphenyls	6.97*	34.85	10.8/U	12.6/U	9.5/U	7.7/U	9.95/U	11.9/U	7.7/U	11.5/U

\* Value from PCB-209

10

All results qualified by lab as N or NJ were qualified as not detected, "U".



LDC #: 39333

**EDD POPULATION COMPLETENESS WORKSHEET**

Date: 9/20  
 Page: 1 of 1  
 2<sup>nd</sup> Reviewer: [Signature]

The LDC job number listed above was entered by JE

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	- 10% or 100% verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	-	
IIb.	- Reason Codes used? If so, note which codes.	Y	LDC
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	N	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y	
IIId.	- Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	+	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	Y	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	+	
IIIg.	- Are there any discrepancies between the data packet and the EDD?	Y	

Notes: \*see discrepancy sheet Sample PR164588D PCB-174 Lab qual N changed to NJ

**Appendix G4:  
DATA QUALITY SUMMARY FOR  
CONTINUOUS FLOW, TURBIDITY AND  
TEMPERATURE MONITORING**

## **APPENDIX G4 – DATA QUALITY SUMMARY FOR CONTINUOUS FLOW, TURBIDITY AND TEMPERATURE MONITORING**

This appendix summarizes the data quality assessment conducted for continuous flow, turbidity and temperature measurements. Daily average and maximum values for turbidity and temperature were evaluated for the period before and after the retrofit and expansion. The post-retrofit period includes, but is not limited to, data collected during the 18 sampled storm events (Appendix K).

Flow data included in the final report are limited to data collected during sampled storm events. This summary describes how the quality of flow data collected during the storm sampling interval (March 2016 – April 2017) was assured and assessed, and a description of uncertainties associated with the data. Continuous flow data collected before the sampling interval were also reviewed extensively to ensure meters were functioning correctly, but those data were not included in any data analyses and were not included in the report.

### **G4.1 Flow meter calibration and verification**

Water levels measured by the flow meters were calibrated upon installation and verified directly in the field on a regular basis. Flow data were reviewed regularly and field conditions were checked when anomalies were apparent. Once installed and calibrated the flow meters did not require recalibration, but they did require special considerations.

The meter at the inlet to the wetland complex (WCI) was calibrated to a depth of 0.00 ft in air when it was installed and did not require any further adjustments. At one point a large rock became nestled in front of the velocity meter which resulted in anomalous velocity readings, but this was quickly resolved by removing the obstruction. Because WCI required confined space entry protocol, depth measurements were confirmed visually from above.

The meter at the creek site (NFWHC) fared similarly, only needing maintenance when rocks impeded velocity measurements. We were able to manually confirm the accuracy of the depth measurements at this site with a ruler.

The meter measuring the combined flow from the wetland complex and the east bioretention facility (WCEBO) was easier to access and depth measurements were checked and confirmed regularly.

The bubbler flow meters at the bioretention facility outlets (EBO and WBO) were installed in conjunction with Thel-mar volumetric weirs, which require a 0.00 depth calibration when the water is at the bottom of the notch of the weir. This required filling the stormwater pipes with water until the water level just reached the bottom of the weir's v-notch. To fill the pipes with water we borrowed a water tank truck from the City of Federal

Way and pumped water into the pipes, calibrating the flow meter to 0.00 right as the water crested the weir. During higher flows the flow meter could be checked manually with a ruler to confirm its accuracy. These flow meters did not need to be recalibrated after the initial calibration, but due to the growth of a biofilm they required regular cleaning. As the tube became clogged, the depth measurements would read erroneously high, but scrubbing the bubbler tube outlets as well as blowing forced air through the bubbler tube resolved this issue.

The meters at the bioretention inlets (WBI and EBI) also had bubbler flow meters, but these were calibrated to a depth of 0.00 ft in air and did not require any maintenance or recalibration once installed.

In addition, bucket tests were done to verify recorded flow rates at the three locations where flow data could be collected (Table 1). Bucket tests involved capturing flow in a calibrated bucket over a timed interval to estimate the flow rate. At least three bucket tests were done at each site on each date and average bucket flow rates (Table 1) were compared to flow rates recorded by the flow meter. The relative percent difference (RPD) between the two measurements was then calculated (Table 1). The high RPDs (>20% for at least one test at each location) for a number of comparisons suggested the data may be biased; therefore, all flow data were flagged as estimates (Table 1).

**Table 1. Comparison of flow rates measured by flow meters and bucket tests at three locations.**

Location	Date	Average flow (cfs) recorded by meter	Average flow (cfs) recorded with bucket test	RPD (%)	Bias
EBI	2/8/2017	0.0625	0.0364	52.78	Meter overestimating flow
EBI	2/15/2017	0.1929	0.1697	12.79	Meter overestimating flow
EBI	4/5/2017	0.1205	0.1113	7.92	Meter overestimating flow
EBO	3/16/2017	0.0170	0.0089	62.14	Meter overestimating flow
EBO	4/5/2017	0.0827	0.0726	13.01	Meter overestimating flow
EBO	4/20/2017	0.0380	0.0125	100.70	Meter overestimating flow
WBO	3/16/2017	0.0400	0.0491	-20.41	Meter underestimating flow
WBO	3/27/2017	0.0340	0.0076	127.00	Meter overestimating flow

It should be noted that bucket tests could only be performed when flows were relatively low, and therefore do not necessarily represent data quality during higher flow periods. In addition, the highest RPDs were observed during the lowest flows. Bucket testing was done during relatively low flow conditions to facilitate the ability to time and physically collect flow in the bucket. It was challenging to quickly get the bucket in and out of the confined catch basins during high flow conditions. However, field tests indicate flow meters may be more accurate when flow rates are higher. Although bucket testing could only be conducted at three locations, it is assumed the accuracy of the other flow meters is similar.

## **G4.2 Reconciling flow data**

It was assumed that influent and effluent flow volumes at each facility (east and west bioretention facilities [EB and WB], and the wetland complex [WC]) would be comparable because most, if not all, of the flow was accounted for by monitoring the sample locations (QAPP 2016). For example, it was assumed flow into EB would be approximately equal to flow out of EB because there were no other known inputs and it was anticipated that infiltration would be minimal. Thus, an additional line of evidence that flow meters were accurately recording flow data was assumed to be confirmation that inflow and outflow volumes were similar during a storm, and the ratio of inflow to outflow was consistent across storms. However, results indicate that the average RPD between inflow and outflow volumes was 43% at both the EB and WB (Table 2). During some storms, flows into the facilities exceeded outflows, while the opposite was true for other storms (Table 2). Possible causes for the inconsistent flow pattern and high RPDs include: 1) periodic ground water inputs to the facilities, 2) periodic infiltration from the facilities to ground water, and/or 3) flow meters were inaccurate and variable.

Staff suspect that ground water inputs to the facilities and infiltration of flow to ground water may have affected flow volumes for two reasons. The first is that wetlands are ubiquitous in the area upstream and to the west of the S. 356<sup>th</sup> Street regional detention facility (RDF). Geologic tests prior to the retrofit and expansion indicated the water table near the RDF was high and as a result a deep pond initially planned for the site was altered (Fei Tang, personal communication). Complex sub-surface flows would therefore be expected in this area. Second, throughout the study, staff observed a small but steady discharge from each bioretention facility outlet, even after long dry periods and no measured inflow to the facilities. The continuous discharge suggests groundwater inflow likely contributed some input to the facilities, though it is unclear if and how this changed during storm events.

Based on the data collected for this study it is not possible to resolve the sources of error in the flow monitoring data. Results of the bucket testing suggest there were some errors in flow meter measurements, and field observations suggest complex groundwater flow paths were also likely affecting flow into and out of the facilities. Additional ground water monitoring data would be necessary to better discern the possible sources of error.

**Table 2. Estimates of total volume, flowing into and out of EB and WB, during each storm event. Relative percent difference (RPD) between inlet and outlet flow was calculated when data were available for both locations.**

Storm Number	East Bioretention Facility				West Bioretention Facility			
	Total Storm Volume In (cubic feet)	Total Storm Volume Out (cubic feet)	RPD (%)	Summary	Total Storm Volume In (cubic feet)	Total Storm Volume Out (cubic feet)	RPD (%)	Summary
1	10503	19133	58	Out > In	18587	ND	NA	NA
2	886	3948	127	Out > In	276	ND	NA	NA
3	ND	17624	NA	NA	16083	9593	51	In > Out
4	32254	25584	23	In > Out	17017	10154	51	In > Out
5	4236	11105	90	Out > In	2442	3332	31	Out > In
6	3587	6606	59	Out > In	2267	ND	NA	NA
7	ND	27124	NA	NA	21386	14100*	41	In > Out*
8	47779	ND	NA	NA	21404	17791*	18	In > Out*
9	62077	32689	62	In > Out	29678	ND	NA	NA
10	12197	8278	38	In > Out	6492	ND	NA	NA
11	19162	13010	38	In > Out	9017	5388	50	In > Out
12	ND	12065	NA	NA	8319	4347	63	In > Out
13	28602	18874	41	In > Out	12918	9097*	35	In > Out*
14	3465	3562	3	Out > In	2315	ND	NA	NA
15	14190	10380	31	In > Out	6398	ND	NA	NA
16	5238	5799	10	Out > In	4034	ND	NA	NA
17	7160	7896	10	Out > In	4242	6450	41	Out > In
18	4365	5047	14	Out > In	2834	4756	51	Out > In
Average			43				43	

\* Facility overflowed; measured outflow volume is likely an underestimate of total outflow.

ND - no data or unreliable data.

NA - insufficient data to make comparison.

Due to the uncertainties outlined above, all flow data are flagged as estimates. Flow data were rejected when the meter malfunctioned or a blockage led to erroneous measurements. In addition, flow volume estimates from the WB outlet were rejected when water overflowed from the facility and not accounted for at WBO. Table 3 includes the summary of locations where flow volume data were acceptable and therefore used to calculate pollutant load estimates.

**Table 3. Summary of flow volume estimates by location and storm event that were of acceptable quality and used for load calculations.**

Storm Number	EBI	EBO	WBI	WBO	WCI	WCEBO	NWH
1	✓	✓	✓	X	✓	✓	✓
2	✓	✓	X	X	✓	✓	✓
3	X	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓
6	✓	✓	✓	X	✓	✓	✓
7	X	✓	✓	X	✓	✓	✓
8	✓	X	✓	X	✓	✓	X
9	✓	✓	✓	X	X	✓	✓
10	✓	✓	✓	X	✓	✓	✓
11	✓	✓	✓	✓	✓	✓	✓
12	X	✓	✓	✓	✓	✓	✓
13	✓	✓	✓	X	✓	✓	✓
14	✓	✓	✓	X	✓	✓	✓
15	✓	✓	✓	X	X	✓	✓
16	✓	✓	✓	X	X	✓	✓
17	✓	✓	✓	✓	✓	✓	✓
18	✓	✓	✓	✓	✓	✓	✓

✓ - volume data used to calculate loads

X and shaded – volume data not available or not of sufficient quality to be used to calculate loads

### G4.3 Turbidity and temperature monitoring

The YSI sondes used to continuously record turbidity and temperature at the inlet and main outlet of the S. 356<sup>th</sup> Street RDF were replaced monthly. When each sonde was deployed, the turbidity measurement was checked against two standards and calibrated and rechecked if needed. When each was retrieved, a turbidity end check was done and all end checks passed the accepted tolerance limit ( $\pm 5\%$  of reading or 4 NTU, whichever is greater, King County 2016). There was no evidence of systematic drift resulting in biased measurements. The temperature measurements were checked with a certified thermometer when each sonde was initially deployed and again at the end of the project. All measurements were within  $\pm 0.09^\circ\text{C}$ , and therefore were within acceptable tolerance limits ( $\pm 0.3^\circ\text{C}$ , King County 2016).

## **References**

King County. 2016. Quality Assurance Project Plan: Effectiveness Monitoring of the South 356th Street Retrofit and Expansion Project, Federal Way, WA. Prepared by Kate Macneale, Water and Land Resources Division. Seattle, Washington.