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Addendum 3 to Quality Assurance Project Plan

Measuring PCBs in Biofilm, Sediment, and Invertebrates in the Spokane River: Screening Study

August 13, 2021 DRAFT

Publication Information

This Quality Assurance Project Plan Addendum pertains to a follow-up study being conducted by the Spokane River Regional Toxics Task Force (Task Force) with support from the Washington State Department of Ecology. This plan is available at the Task Force's website at: http://www.srrttf.org. This is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at EIM Database. Search Study ID SWON0001.

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Addendum 3 to
Quality Assurance Project Plan

Measuring PCBs in Biofilm, Sediment, and Invertebrates in the Spokane River: Screening Study

August 2021

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2.0 Abstract

The Washington State Department of Ecology (Ecology) has included language in the NPDES permits for the Spokane River dischargers in Washington that requires permittees to create and participate in the Spokane River Regional Toxics Task Force (Task Force), with a mission to "work collaboratively to characterize the sources of toxics in the Spokane River and identify and implement appropriate actions needed to make measurable progress towards meeting applicable water quality standards for the State of Washington" (http://srrttf.org/?page_id=607).

Sampling conducted by Ecology's Environmental Assessment Program in 2018 and 2019 showed elevated PCB concentrations in biofilm and sediments in the section of the Spokane River downstream of the Mission Avenue bridge in Spokane (termed the Mission Reach). Initial forensic analyses conducted for the Task Force could not positively identify the source of these elevated PCB concentrations, but did identify several potential categories of sources, i.e., groundwater contamination from upland sources, PCB-containing objects buried in the riverbed, contaminated artificial bottom fill material, legacy contamination in naturally occurring bottom sediments, and contaminated stormwater runoff.

This project consists of gathering information to help better define the source(s) of observed PCB contamination in the Mission Reach. It contains the following components:

- Water column sampling of PCBs in the Mission Reach and downstream areas to determine the spatial distribution of elevated water column concentrations.
- Sampling of PCBs in bottom sediments in the Mission Reach to supplement data from the single location in the Mission Reach where Ecology sampled sediment PCBs in 2018.
- Sampling of PCB concentrations in an artesian well observed discharging into the downstream section of the Mission Reach.
- A sub-bottom object detection survey to identify the presence of potential PCB-containing objects (e.g., drums, transformers) buried in the stream bed or banks.
- Use of a PCB-sniffing dog to identify potential PCB sources in riverbank areas along select areas of the Mission Reach.
- Scoping analysis of drive point piezometers to support future assessment of potential groundwater PCB loading to the Mission Reach.

3.0 Background

3.1 Introduction and problem statement

In August 2018 and 2019, Ecology's Environmental Assessment Program conducted spatial surveys of the Spokane River using biofilms to assess possible suspected and unknown sources of PCBs to the river (Wong and Era-Miller 2019). The primary goal of the sampling was to characterize the spatial distribution of PCB concentrations in biofilm, sediment, and invertebrates in the Spokane River, with the ultimate intent of assessing the presence of previously unidentified sources of PCBs to the river. The study was initiated in collaboration with the Spokane River Regional Toxics Task Force (Task Force), which has been working to identify PCB sources in the Spokane River watershed since 2012.

Both Ecology sampling events identified one segment of the river where biofilm and sediment PCB concentrations were particularly high (Section 3.2.2) and not clearly caused by any of the known PCB sources to the river. While the results of the sampling events indicated that a previously unidentified PCB source (or sources) likely exists in this area, they were not sufficient to support identification of the specific nature of the source(s) of PCBs. This addendum to the original Quality Assurance Project Plan (QAPP) describes sampling for 2021 designed to further assess the presence of previously unidentified sources of PCBs to the Spokane River. Similar to the original study, the 2021 sampling will characterize the spatial distribution of ambient PCB concentrations in the segment of river where the previous sampling identified elevated levels.

This work builds upon the 2018 and 2019 sampling by conducting sampling to characterize the spatial distribution of water column concentrations and providing additional information on bed sediment concentrations in the area of concern. This work also includes additional tasks designed to assess the presence of previously unidentified sources. These additional tasks consist of monitoring the PCB concentration of an artesian well found discharging to the area of concern; deployment of a PCB-sniffing dog and a sub-bottom object detection survey to identify the presence of PCB-containing objects buried in the stream bed or bank; and a scoping analysis of the use of drive point piezometers to support future assessment of the potential for contaminated groundwater to be the source of elevated PCB concentrations in the Mission Reach. This addendum only includes sections of the original QAPP that have been modified.

3.2.2 Summary of previous studies and existing data

The sampling for the original component of this study took place in August 2018. Biofilm samples were collected at 19 sites in the Spokane River between the Washington-Idaho state line (SL; Figure 1) and just below Nine-Mile Dam (NMD). Sediment and macroinvertebrate samples were also collected at a small subset of the biofilm sites and analyzed for PCBs. Follow-up biofilm sampling conducted in August 2019 provided additional sampling locations between the Mission Bridge (MIB) and Spokane Gage (SG) sites in the City of Spokane, the area termed the "Mission Reach" (Figure 2). Figure 3 shows that biofilm PCB concentrations were consistently higher in the Mission Reach than in other portions of the study area for both years of monitoring. In addition, the one sediment sample collected from the Mission Reach (GZ, near Gonzaga University) had higher PCB concentrations than any other recently sampled sediment site in the Spokane River.

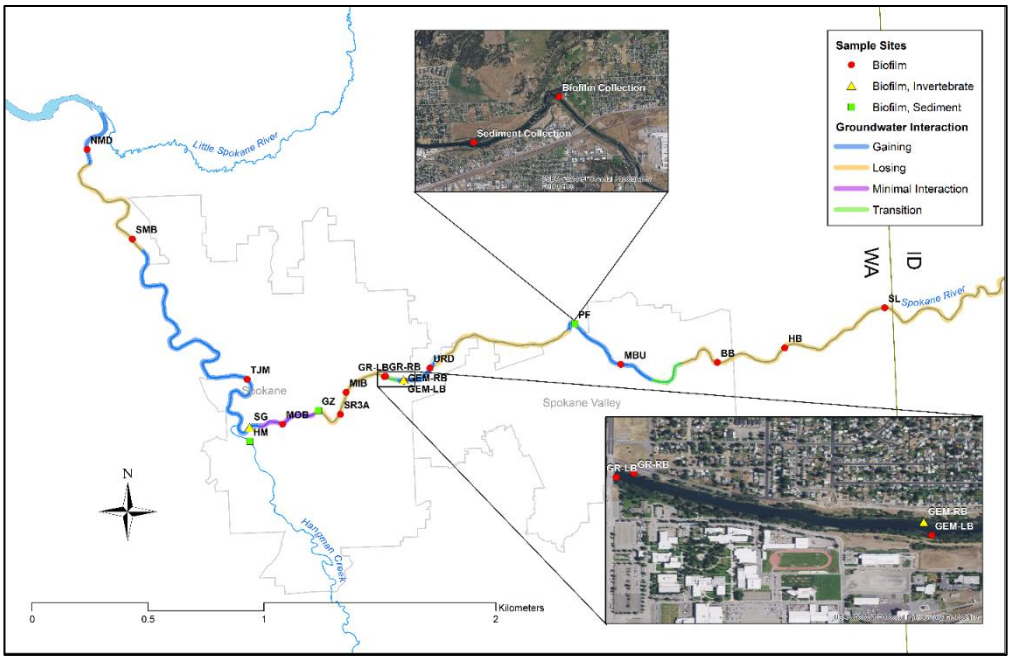

Figure 1. Map of the Spokane River showing 2018 sampling locations (from Ecology, 2020).

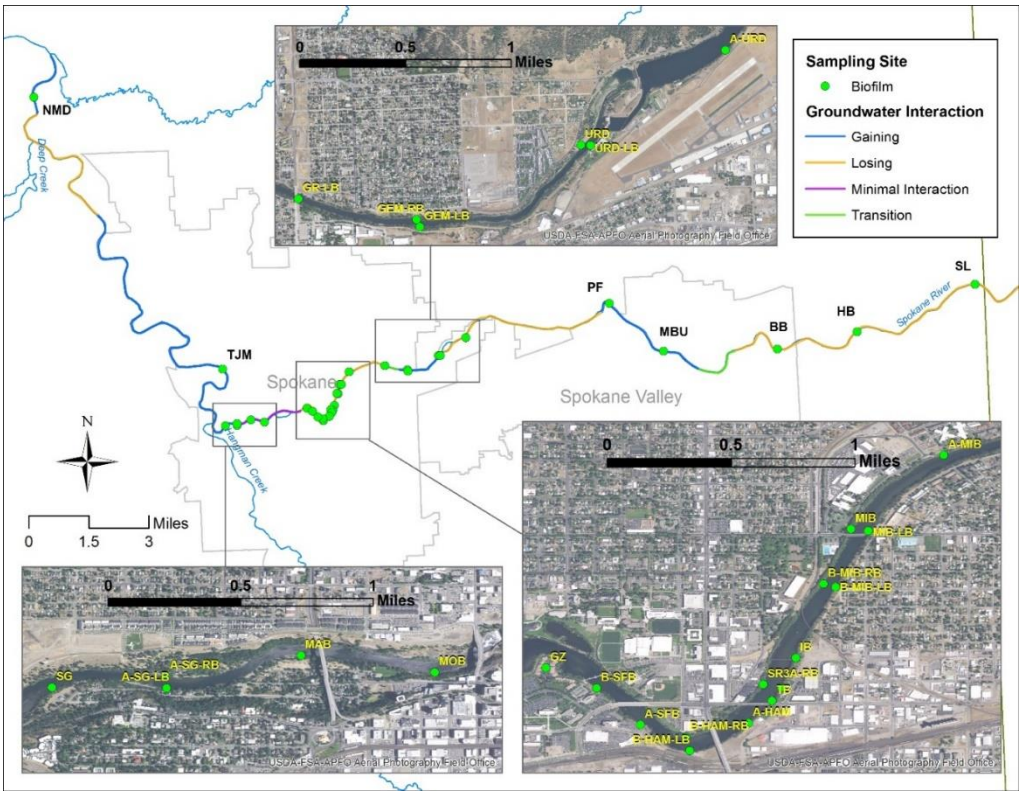

Figure 2. Map of the Spokane River showing 2019 sampling locations (from Ecology, 2020).

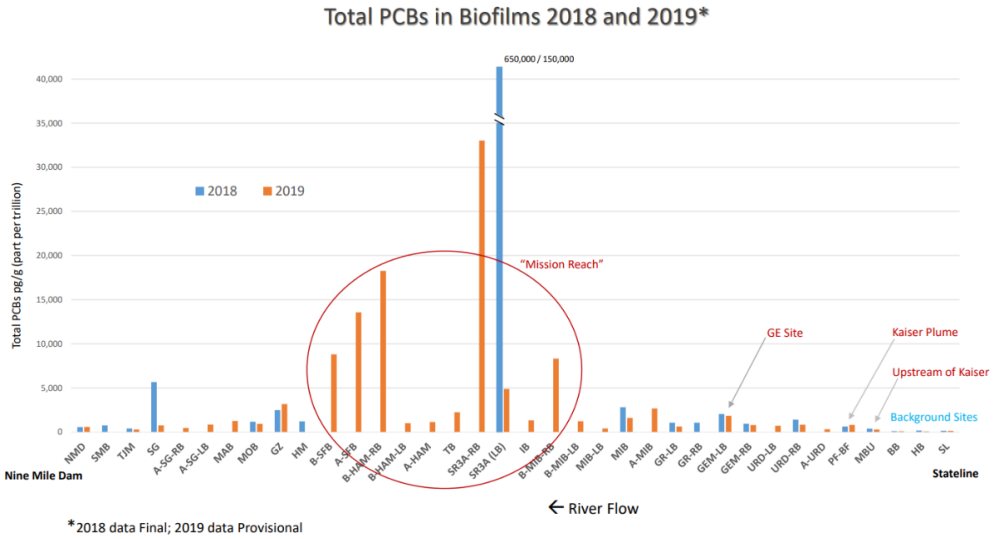

Figure 3. Total PCB concentrations measured in biofilms collected at sites in the Spokane River in 2018 and 2019 (from Era-Miller, 2020).

Forensic analyses conducted for the Task Force (LimnoTech, 2020) could not positively identify the source of the elevated Mission Reach PCB concentrations, but did propose several categories of potential sources:

- Contaminated artificial bottom fill material, associated with the large quantity of bricks and concrete observed on the river bottom in the Mission Reach.
- Contaminated bottom sediments caused by legacy sources of PCBs. These legacy sources could consist of buried PCB-containing objects or be a remnant of historical PCB loads to the river that are stored in naturally occurring sediment deposits.
- Upland surface contamination, delivered to the Mission Reach via stormwater runoff or combined sewer overflows.
- Upland subsurface contamination, delivered to the Mission Reach via groundwater. While the Mission Reach is characterized in Figure 1 as a losing reach, that characterization represents long-term average conditions. The potential exists that groundwater enters the river in the Mission Reach during certain periods of time.

A study in spring of 2021 sampled artificial bottom fill material from the Mission Reach. and found that PCB concentrations in bricks and concrete were lower than PCB concentrations in naturally occurring bottom sediments (LimnoTech, 2021). These results suggest that it is unlikely that artificial bottom fill material is the cause of the Mission Reach contamination.

4.0 Project Description

4.1 Project goals

Elevated concentrations of PCBs have been observed in the Mission Reach of the Spokane River, but the source of these elevated concentrations is not known. Initial forensic analyses have identified several potential categories of sources, i.e., contaminated artificial bottom fill material, contaminated bottom sediments, upland surface contamination, and upland subsurface contamination. Results of recent sampling indicated that contaminated artificial bottom fill material is likely not the cause of this contamination. The goal of this project addendum is to collect additional data to support continued forensic analysis of the nature of the source(s) causing the elevated PCB concentrations in the Mission Reach. This will be accomplished by:

(1) Measuring the spatial distribution of PCB concentrations in the water column and bed sediments in the Mission Reach of the Spokane River,
(2) Measuring PCB concentrations associated with an artesian well observed discharging to the Mission Reach.
(3) Assessing the presence of buried objects that could be contributing PCBs to the Mission Reach.
(4) Assessing the feasibility of using drive point piezometers to support future evaluation of the potential for contaminated groundwater to be the source of elevated PCB concentrations in the Mission Reach.

Actions that will result from this assessment depend on the specific findings, and could include:

(1) Targeted remediation activities, if project data fully identify a source of elevated PCB concentrations in the Mission Reach.
(2) More detailed follow-up analyses, if project data partially identify the source of elevated PCB concentrations in the Mission Reach.
(3) Elimination of specific source categories from consideration as the source of elevated PCB concentrations in the Mission Reach.

4.2 Project objectives

Objectives of this project addendum are to:

(1) Collect and analyze water column PCB concentrations at fifteen locations in the Spokane River in order to define the spatial distribution of the elevated water column concentrations in the Mission Reach.
(2) Collect and analyze bed sediment PCB concentrations at three locations in the Mission Reach. These samples will supplement the single Mission Reach sediment sample collected in 2018 and provide insight into the importance of legacy sediment PCB contamination as a source of Mission Reach contamination.
(3) Collect and analyze the PCB concentrations associated with an artesian well observed discharging to the Mission Reach.
(4) Conduct an object detection survey to identify the presence of buried objects that could be contributing PCBs to the Mission Reach.
(5) Employ the services of a PCB-sniffing dog to identify the presence of bank-side objects that could be contributing PCBs to the Mission Reach.

(6) Deploy drive point piezometers at three locations to test their suitability for assessing groundwater contribution to the Mission Reach.
(7) Assess the resulting information to support continued forensic analysis of the nature of the source(s) causing the elevated PCB concentrations in the Mission Reach.

4.4 Tasks required

Field data collection will occur as a one-time sampling event in late summer of 2021, prior to the seasonal increase in river flow that will dilute PCB loads and make source assessment more difficult. Tasks required include:

- Coordinate with field crew and laboratories in preparation for the sampling and analyses.
- Conduct field sampling in late summer of 2021 consisting of:
    - Collection of water column, sediment, and artesian well samples for subsequent analysis of PCB content.
    - Conduct an object detection survey.
    - Trial deployment of drive point piezometers.
- Deploy a PCB-sniffing dog in late summer of 2021 and identify potential sites for confirmation sampling.
- Review and assess laboratory data quality.
- Enter data into the Task Force database and Ecology's Environmental Information Management System (EIM).
- Conduct data analysis and complete final report.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

Project staff and responsibilities are described in Table 1.

Table 1. Organization of project staff and responsibilities.

Staff	Title	Responsibilities
Robert Lindsay President SRRTTF-ACE Phone: 509-477-7576	Task Force Client	Manage contracts: review and approve project specifications. Ensure project is completed in timely manner.
David Dilks LimnoTech Phone: 734-332-1200	Project Manager/ Principal Investigator	Prepare the QAPP addendum. Review/approve all work products prior to delivery to SRRTTF-ACE. Ensure that work is done in accordance with QAPP.
Adriane Borgias Water Quality Section Manager, Eastern Regional Office Phone: (509) 329-3515	Advisor	Review and approve QAPP addendum.
Karl Rains Water Quality Planner, Eastern Regional Office Phone: (509) 329-3601	Contract Manager	Review and approve QAPP, manage SRRTTF contract.
Renn Lambert LimnoTech Phone: 734-332-1200	Project Quality Assurance Officer	Performs systematic evaluation of data quality. Receives notices, initiates investigation, documents nonconformance with DQOs. Manage the Project QA/QC file.
Shea Hewage SGS AXYS Analytical Services, Ltd. Phone: (250) 655-5800	Laboratory General Manager	Responsible for all aspects of the daily operation of the laboratory. Oversees the completion of corrective actions to address any non-conformances.
Sean Campbell SGS AXYS Analytical Services, Ltd. Phone: (250) 655-5834	Laboratory Project Manager	Responsible for the execution of project-specific laboratory activities and interactions with the Task Force.
Richard Grace SGS AXYS Analytical Services, Ltd. Phone: 905-484-2314	Sales, Marketing, Service	Serves as the main point of contact for laboratory for contract management or maintenance. Works closely with clients and laboratory management to develop project technical specifications.
Shawn Hinz Gravity Environmental Phone: (425)281-1471	Field Manager	Collects samples in accordance with QAPP. Maintains equipment logs, field records and data sheets. Manages field equipment, conducts calibrations. Addresses nonconformance and responds to corrective actions.
Julianne Ubigau Univ. of Washington Conservation Canines Phone: (206) 406-7369	Research Scientist	Responsible for deploying PCB-sniffing dog.
Arati Kaza Phone: 360-407-6964	Ecology QA Officer	Reviews and approves the draft QAPP and the final QAPP.

5.3 Organization chart

The lines of reporting for the organizations in the project are shown in the organization chart (Figure 4).

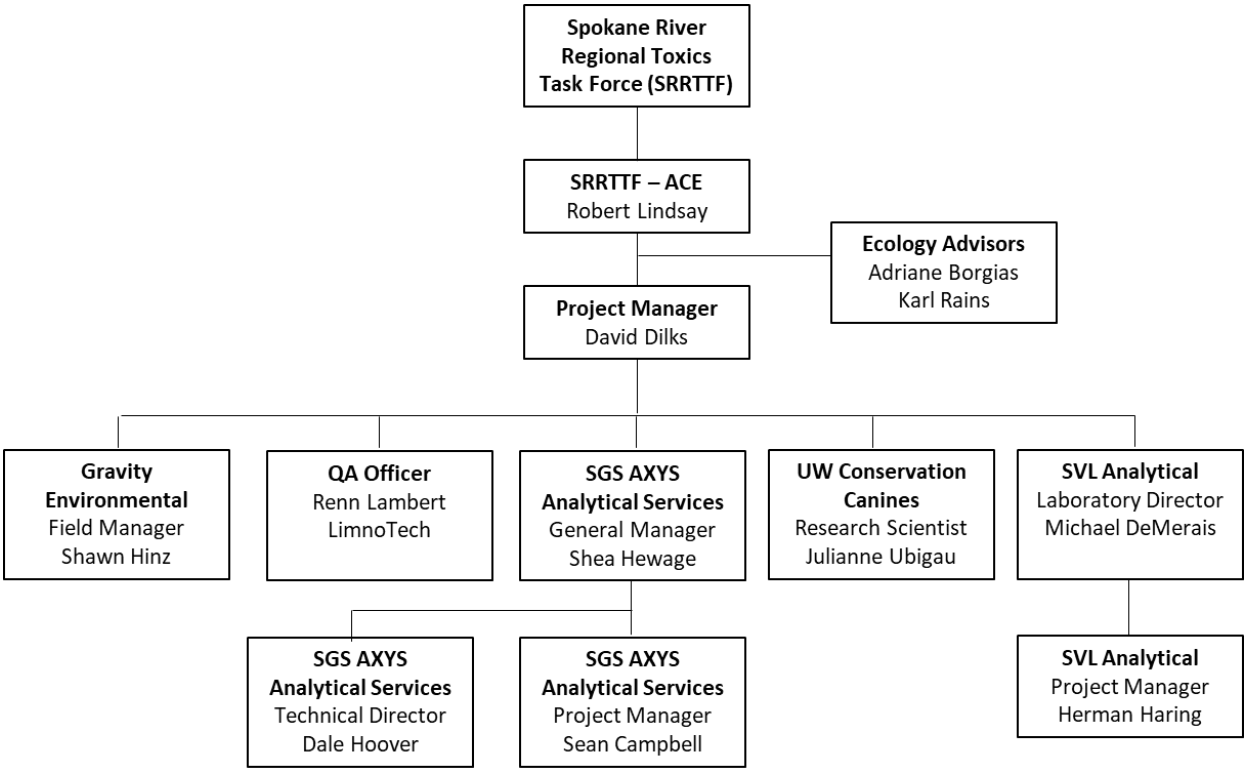

Figure 4. Project organization chart

5.4 Proposed project schedule

Start and end dates for key project activities are provided below in Table 2.

Table 2. Proposed schedule for completing field and laboratory work and reports.

Work type	Start Date	Due date	Lead staff
Field and laboratory work			
Field work	August, 2021	September, 2021	Shawn Hinz
Laboratory analyses	September, 2021	December, 2021	Sean Campbell
Laboratory data validation	January, 2022	February, 2022	Renn Lambert
Database			
SRRTTF database entry and review	March, 2022	April, 2022	Amy Sumner
EIM data entry and review	March, 2022	April, 2022	Renn Lambert
Final report			
Draft report to Task Force	March, 2022	April, 2022	David Dilks
Final report on web	April, 2022	April, 2022	David Dilks

5.5 Budget and funding

The total cost of this project is $87,342. Funding for this work was provided by the Spokane River Regional Toxics Task Force, supported in part by funding allocated to the Task Force by the WA State legislature. See Table 3 for a budget overview and detailed laboratory budget.

Table 3. Project budget and funding.

Budget Overview					**Total**
Salary, benefits, and indirect/overhead					$32,000
Field Sampling (water column, sediments, artesian well, object detection)					$29,625
PCB-sniffing dog					$4,663
Parameter	**Number of Samples**	**Number of Field QC Samples**	**Total Number of Samples**	**Cost Per Sample**	**Lab Subtotal**
PCB Congeners					
Water column	15	2	17	$880	$14,960
Artesian well	2	-	2	$1760	$1760
Sediment	3	1	4	$890	$3,560
Grain Size					
	3	1	4	$250	$1000
Total Organic Carbon					
Sediment	3	1	4	$35	$140
TOC/DOC/TSS					
Water column	15	2	17	$82	$1,394
				Project Grand Total	$87,342

6.0 Quality Objectives

6.1 Data quality objectives

It is noted that this work is generating two types of information: 1) quantitative data on the PCB content of the artesian well discharge and Spokane River water column and bottom sediments, and 2) qualitative information regarding the presence of potential PCB sources (i.e., object detection survey and PCB-sniffing dog) and the feasibility of future use of drive point piezometers to assess ground PCB contribution to the Mission Reach. Our overall quality objective for the PCB analyses is to obtain results that are of known and documented accuracy (e.g., bias and precision) and represent the conditions at the sampling sites at the time of sample collection. Our quality objective for the qualitative aspects of this study is to conduct each component in a manner consistent with best accepted practices.

6.2 Measurement quality objectives

Measurement quality objectives (MQOs) for this addendum are shown in Table 4. MQOs are the same as the specified in the original QAPP for sediment samples.

Table 4. Measurement quality objectives.

MQO →	Precision	Bias		Sensitivity
	Laboratory Duplicate/Field Split or Duplicate	Lab Control Standard[1]	Internal Standard Recovery[2]	Lowest Concentration of Interest
	Relative Percent Difference (RPD)	Recovery Limits (%)		Concentration Units
PCB Congeners				
Bed Sediment	± 30%	50 - 150%	50 - 150%	0.5 pg/g dw
Water	± 30%	50 - 150%	50 - 150%	10 pg/l total PCB
Grain Size				
Sediment	± 20%	-	-	-
Total Organic Carbon				
Bed Sediment	± 20%	75 - 125%	-	0.10% dw
Water	± 20%	75 - 125%	-	1 mg/l
Dissolved Organic Carbon				
Water	± 20%	75 - 125%	-	0.5 mg/l
Total Suspended Solids				
Water	± 20%	75 - 125%	-	1.0 mg/l

dw = dry weight

[1] Laboratory Control Standard is also referred to as Ongoing Precision and Recovery (OPR) Standard, in which a laboratory blank sample is spiked with known quantities of analyte.

[2] Internal Standard Recovery is also referred to as Surrogate or Labeled Compound Recovery, using $^{13}C_{12}$-labeled congeners.

6.2.2 Targets for comparability, representativeness, and completeness

6.2.2.1 *Comparability*

To ensure that data from this project are comparable to other studies, the following Standard Operating Procedures (SOPs) for field sample collection will be used:

- Sampling & Analysis Plan, Spokane River Toxics Reduction Strategy Study (LimnoTech, 2014)
- Standard Operating Procedure (SOP) SW-19 - Surface Sediment Sampling with Grab Sampler (Gravity, 2018)
- Standard Operating Procedure EAP061, Version 2.1: Installing, Monitoring, and Decommissioning Hand-driven In-water Piezometers (Sinclair and Pitz, 2018)

6.2.2.2 *Representativeness*

Field sampling will occur during the late summer low-flow period of the Spokane River in order to minimize the effects of dilution on external PCB loading sources. Study findings will take into account the fact that the water column data represent a snapshot from a single date and time rather than a longer-term average concentration. Water column sampling will be conducted at fifteen locations throughout the Mission Reach which is expected to be sufficient to capture a range of PCB concentrations across locations.

7.0 Study Design

7.1 Study boundaries

Ecology's 2018 and 2019 biofilm sampling locations ranged from the Washington-Idaho state line (SL) to just below Nine Mile Dam (NMD) as shown in Figure 5. The overall study boundaries for the 2021 work extends from the Mission Avenue bridge (MIB) to the USGS Spokane River gaging station (SG). The primary focus area of study for this project corresponds to the portion of the Spokane River between the Mission Avenue bridge and the Gonzaga site (GZ-BF) where elevated biofilm and sediment PCB concentrations have been observed.

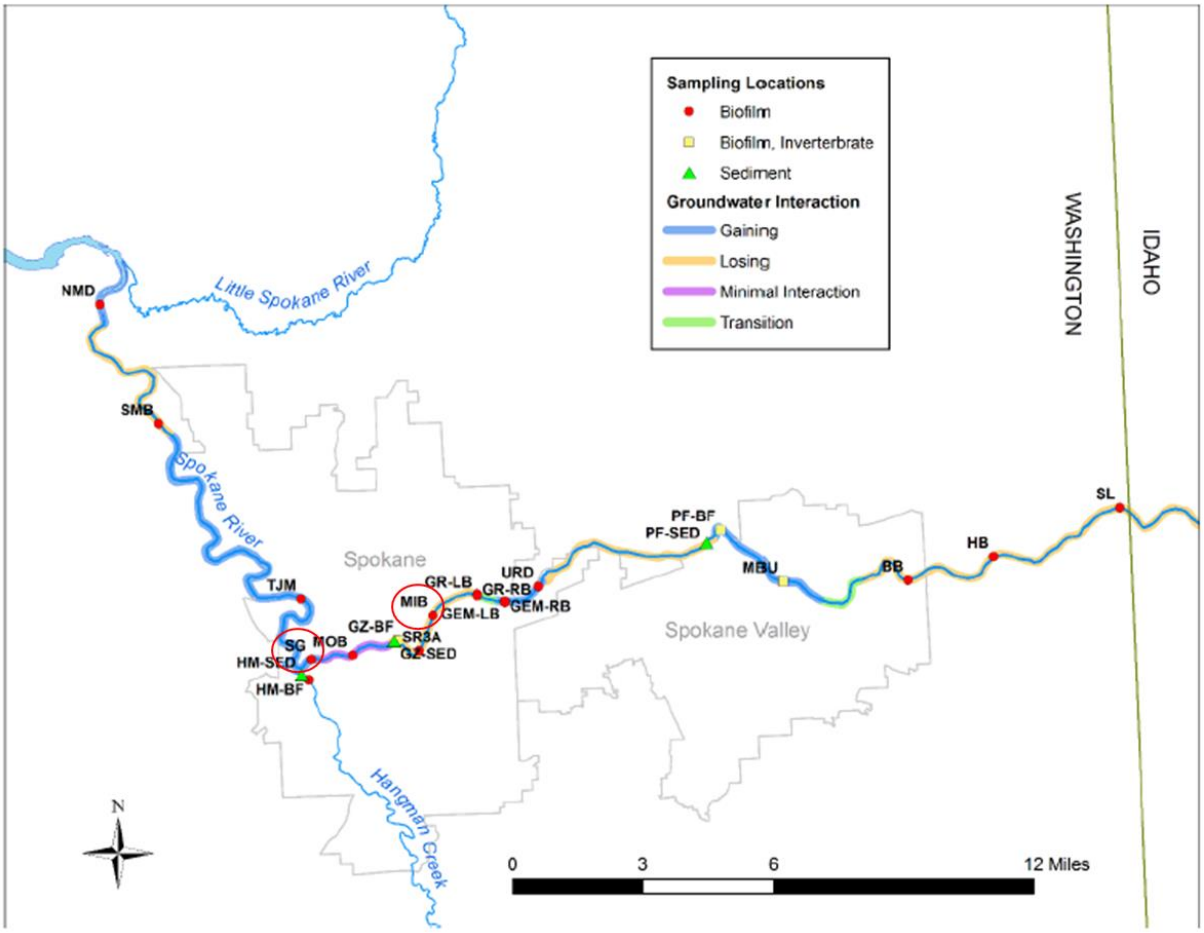

Figure 5. Map showing boundaries of project study area (circled areas) relative to historical biofilm sampling locations (adapted from Wong and Era-Miller, 2019).

7.2 Field data collection

7.2.1 Sampling locations and frequency

Separate sampling locations will be used for water column sampling, sediment sampling, and artesian well sampling as described below. Sampling frequency will consist of a one-time sampling event during late summer of 2021.

Water column sampling will be conducted at fifteen locations, corresponding to (Figure 6):

- Three transverse locations at East Mission Ave.
- Three transverse locations at E. Trent Ave.
- Three transverse locations at N. Hamilton St. (WA-290)
- Three transverse locations at East Spokane Falls Blvd.
- One mid-channel location at Division St.
- One mid-channel location at N. Monroe St.
- One mid-channel location at USGS Gaging Station.

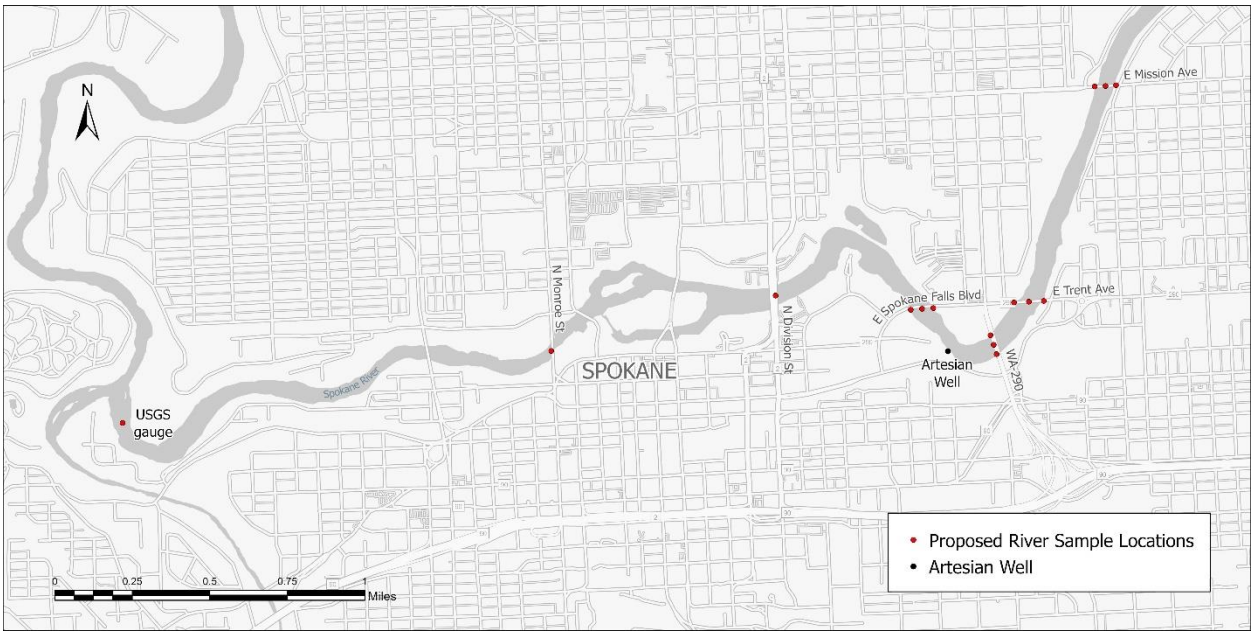

Figure 6. Map showing proposed water sampling locations.

Sediment sampling will be conducted at three unique locations within the study area. Specific sampling locations are not predefined (other than being collected from within the Mission Reach) because the locations are contingent on where bedded sediment deposits are located.

The artesian well is located halfway between Hamilton St and Spokane Falls Blvd. on the south bank of the Spokane River, and is depicted in Figure 7.

Figure 7. Artesian well observed flowing into Mission Reach (photo from Tighe Stuart, Ecology)

The object detection survey and PCB-sniffing will broadly cover the river and bankside areas of the Mission Reach, and do not have specific sampling locations.

7.2.2 Field parameters and laboratory analytes to be measured

All samples of river water, artesian well discharge, and bottom sediments will be analyzed in the laboratory for the 209 PCB congeners and for total organic carbon and grain size. All samples of river water will be analyzed in the laboratory for total and dissolved organic carbon and total suspended solids. Groundwater will be analyzed in the field by probe for conductivity via the drive point piezometer.

7.4 Assumptions underlying design

This study will use the measurement of PCBs in water and sediment, along with qualitative information (from the object detection survey, PCB-sniffing dog, and piezometer feasibility assessment) as a means for supporting forensic analyses related to the source of elevated biofilm PCB concentrations in the Mission Reach. While the environmental data collected through this

project are intended to represent an accurate snapshot of point-in-time water column and sediment PCB concentrations, it is recognized that these data alone are unlikely to provide definitive identification of the specific source(s) of observed PCB contaminations in Mission Reach. Rather, these data will be used as part of a weight-of-evidence approach to either: 1) Support more targeted investigations into specific source categories (e.g., confirmation sampling of areas identified by the PCB-sniffing dog), or 2) Eliminate source categories from future consideration as the cause of the Mission Reach contamination.

7.5 Possible challenges and contingencies

7.5.1 Logistical problems

Two challenges related to the logistics of sample collection impact the study design. The first is that seasonal increases in river flow may mask the identification of potential PCB sources if sampling is conducted in October or later. To alleviate this issue, sampling is planned to be conducted no later than mid-September of 2021 to incorporate the seasonal period where river flows are typically lowest. The second logistical challenge is public access will be required prior to placement of piezometers in river banks. The first task of the piezometer feasibility assessment is public access assessment. If no suitable sites are determined to be publicly accessible in the Mission Reach, the remainder of the feasibility assessment will be terminated and the decision made that piezometers are not suitable for use in assessing groundwater PCB loading to the Mission Reach due to accessibility issues.

Atmospheric PCB contamination from the atypically high preponderance of fires this summer is another potential concern, but its effect on this study should be negligible because the water column sampling submerges the sample bottle prior to opening, eliminating exposure of the open sample bottle to potential atmospheric contamination.

7.5.2 Practical constraints

The one known practical constraint corresponds to potential travel and enterprise restrictions related to COVID-19. We will monitor applicable guidelines and adjust our activities accordingly.

8.0 Field Procedures

8.2 Measurement and sampling procedures

Separate sampling procedures will be performed for collection of water and bottom sediments.

Prior to collecting the surface water grab samples, in-situ measurements of temperature, dissolved oxygen, pH, conductivity and turbidity will be made by lowering a YSI 600 OMS or equivalent below the water surface. The results will be recorded on the field log sheet. All in stream water quality samples will be collected by wading into the main channel flow, if possible. The best effort will be made without jeopardizing the safety of the sampling crew. If wading is not possible the samples will be collected using a boat. The sample bottles will be filled by direct immersion into the sample bottle as a surface grab at a depth of 0.15 m below the water surface. The general collection procedures for surface water sampling are as follows:

1. One member of the two person sampling team is designated as “dirty hands” and the second member is designated as “clean hands”. All operation involving contact with the sample bottle and transfer of the sample from the sample collection device to the sample bottle are handled by the individual designated as “clean hands”. “Dirty hands” is responsible for preparation of the sampler, operation of any machinery or boat, and for all other activities that do not involve direct contact with the sample.

2. Clean all sampling equipment prior to sample collection according to the procedures in the Standard Operating Procedure for Equipment Cleaning (LimnoTech, 2014).

3. Don appropriate personal protective equipment (as required by the Health and Safety Plan).

4. Don clean disposable nontalc nitrile gloves, which are worn at all times when handling sampling equipment and sample containers.

5. Record pertinent data on the appropriate field log sheet.

6. Label all sample containers with the date, time, site location, sampling personnel, and other requested information (such as preservative used or filtering if appropriate).

7. Whenever possible, samples will be collected facing upstream and upwind to minimize the introduction of contamination.

8. If at all possible, the samples will be collected using a direct grab sampling technique. The principle of the direct grab technique is to fill a sample bottle by rapid immersion in water and capping under water to minimize exposure to airborne particulate matter.

9. Record sample collection information on the field log sheet and store the samples in an iced cooler as described in the Standard Operating Procedure for the Shipping and Handling of Samples (LimnoTech, 2014).

10. Handle, pack, and ship samples according to the procedures in Standard Operating Procedure for the Shipping and Handling of Samples, including the completion of a

Chain of Custody (COC) Form for each cooler containing sample bottles that are shipped to a laboratory for analyses.

Surface sediment samples will be collected using a decontaminated Power Grab ST dredge following SOP SW-19: Surface Sediment Sampling with Grab Sampler (Gravity, 2018). A watercraft will be used to access the site to collect the grab sample. Any excess water from the grab will be siphoned off. The top two centimeters of sediment from the grab will be scooped into a decontaminated stainless steel bowl using a decontaminated spoon, homogenized, then scooped into separate certified clean sampling jars for PCB, TOC, grain size and percent moisture analyses. Samples will be stored in a cooler on ice until further processing.

8.3 Containers, preservation methods, holding times

Sample containers, preservation, and holding times are identical to those used for sediment analysis as provided in the original QAPP. Sample containers, preservation, and holding times for water are identical to those used in all prior Task Force QAPPs. Both are listed in Table 5.

Table 5. Sample containers, preservation and holding times.

Parameter	Matrix	Minimum Quantity Required	Container	Preservative	Holding Time
PCB congeners	Sediment	10 g dw	8 oz certified clean glass jar w/Teflon lid	Cool to < 4°C; store at < -10°C	1 year if frozen
PCB congeners	Water	2.36 L	Amber glass	< 4°C	1 year
TOC	Sediment	25 g dw	2 oz certified clean glass jar w/ Teflon lid	< 4°C	14 days; 6 months if frozen
TOC	Water	60 ml	125 mL pre-acidified poly bottle	1:1 HCl to pH<2; Cool to 6°C	28 days
Grain Size	Sediment	100 - 500 g dw	8 oz plastic jar (or 1 gallon resealable storage bag)	Cool to < 4°C	6 months
DOC/TOC	Water	2 L	2L HDPE container	Cool to 6°C	7 days

8.5 Sample ID

Laboratory sample IDs will be assigned by Gravity, SGS AXYS and SVL.

9.0 Laboratory Procedures

9.1 Lab procedures table

Table 6 summarizes the number of samples, sample matrices, expected range of results, reporting limits, and analytical methods for collection and analysis of TSS/TOC/DOC and PCB congeners.

Table 6. Laboratory measurement methods

Analyte	Sample Matrix	Samples (Number/ Arrival Date)	Expected Range of Results	Detection or Reporting Limit	Sample Prep Method	Analytical (Instrumental) Method
Analytical Lab: SVL						
Total Suspended Solids (mg / L)	Surface water	17 (August, 2021)	0.5-20	1.0	N/A	SM 2540D
Total Organic Carbon (mg / L)	Surface water	17 (August, 2021)	1-10	1.0	N/A	SM 5310B
Dissolved Organic Carbon (mg / L)	Surface water	17 (August, 2021)	0.5-5	0.5	N/A	SM 5310B
Total Organic Carbon (mg / L)	Sediment	4 (August, 2021)	0.10 – 10% dw	0.15% dw	N/A	EPA 600
Grain Size	Sediment	4 (August, 2021)	Unknown	0.40%	N/A	ASTM D422
Analytical Lab: SGS AXYS						
PCBs Congeners	Sediment	4 (August, 2021)	0.5 – 10,000 pg/g	0.5 pg/g dw per congener	N/A	EPA 1668C
PCBs Congeners	Water	18 (August, 2021)	10-10,000 pg/l	1-20 pg/l per congener	N/A	EPA 1668C

9.4 Laboratories accredited for methods

A summary of lab responsibilities is shown in Table 6. All laboratories are accredited for the analytical methods specified, except that SVL is not accredited to perform method ASTM D422 for grain size.

10.0 Quality Control Procedures

10.1 Table of field and laboratory quality control

The number and type of QC samples to be collected in the field and analyzed in the lab are summarized in Tables 7 and 8.

Table 7. Quality control samples, types, and frequency for PCBs.

Parameter	Matrix	Field	Laboratory		
		Duplicates	Method Blanks	Matrix Spikes	OPR Standards
PCB congeners	Water	2	1/batch	1/batch	1/batch
PCB congeners	Sediment	1	1/batch	1/batch	1/batch

Table 8. Quality control samples, types, and frequency for conventional pollutants.

Parameter	Field	Laboratory			
	Duplicates	Check Standards	Method Blanks	Analytical Duplicates	Matrix Spikes
Total Suspended Solids	10% of samples	1/batch	1/batch	1/batch	-
TOC/DOC	10% of samples	1/batch	1/batch	1/batch	1/batch

11.0 Data Management Procedures

11.3 Electronic transfer requirements

Laboratory data will be delivered in the form of an Electronic Data Deliverable that meets LimnoTech's formatting requirements.

11.4 EIM/STORET data upload procedures

Data for this project will be loaded into the Task Force data base and EIM.

12.0 Audits and Reports

12.3 Frequency and distribution of reports

After all data have been received, reviewed, and analyzed, the results of this project will be presented in the form of a draft final report summarizing the study and describing how the information obtained supports forensic efforts regarding the source of PCB contamination in the Mission Reach. The draft will be distributed to the Task Force and Ecology for review and revised in response to comments.

12.4 Responsibility for reports

The report will be authored by the project manager.

13.0 Data Verification

13.1 Field data verification, requirements, and responsibilities

The field assistant will review field notes once they are entered into Excel spreadsheets. Oversight will be provided by the project manager.

13.2 Laboratory data verification

The laboratory conducting the analyses will review laboratory results prior to submitting the data package. The LimnoTech Quality Assurance Coordinator will serve as an independent third party validator and will review the complete PCB congener data package submitted by the external lab following EPA guidelines (EPA, 2016), and this QAPP. The LimnoTech Quality Assurance Coordinator will prepare a report of the Level III data validation, which includes an overall assessment of data quality, usability, and whether project MQOs were met.

14.0 Data Quality (Usability) Assessment

14.3 Data analysis and presentation methods

Data collected as part of this addendum will be analyzed and presented similarly as stated in the original QAPP, including calculations and graphic analyses of total PCBs and homologs. We will also provide the following analyses:

- Comparison of observed water column total PCB concentrations at each Mission Reach location to historically observed low flow concentrations at Greene St. The spatial distribution of PCB concentrations above historical levels will be assessed in order to determine whether individual elevated measurements provide information on the location of a previously undefined source or reflect downstream transport of elevated upstream concentrations. Water column concentrations will also be qualitatively compared to the PCB concentrations estimated via SPMD in the Mission Reach during 2020 low flow conditions.
- Comparison of observed total PCB concentrations in the artesian well discharge to observed Spokane River PCB concentrations upstream of the discharge. Artesian well PCB concentrations greater than river concentrations will serve as evidence that groundwater PCB loading is causing an increase in Spokane River PCB concentrations.
- Comparison of observed sediment total PCB concentration at each Mission Reach location to: 1) recently observed sediment PCB concentrations at other Spokane River locations, and 2) sediment PCB concentration expected to occur if sediments are in equilibrium with water column concentrations using a simple partitioning model as described at the SRRTTF Data Synthesis Workshop (Dilks, 2019). The results of the first comparison will indicate whether the elevated sediment PCB concentration observed in 2018 is representative of more widespread Mission Reach sediment contamination. The second comparison will indicate one of two situations:
    - Bedded sediment PCB concentrations are not greater than levels expected if they were in equilibrium with water column concentrations, indicating that bedded sediments are not a source of PCBs to the River.
    - Bedded sediment PCB concentrations are greater than levels expected if they were in equilibrium with water column concentrations, indicating that bedded sediments are a source of PCBs to the River.
- The results of the object detection survey, PCB-sniffing dog and piezometer feasibility study will be assessed in a more qualitative manner.
    - The best professional judgment of those trained to conduct the object detection survey and deploy the PCB-sniffing dog will be relied upon in terms of concluding whether either method identified potential PCB sources that merit further investigation.
    - The piezometer feasibility study results will be assessed to determine whether: 1) public access to install piezometers could be obtained, and 2) it was feasible to install piezometers in the Mission Reach and measure groundwater conductivity. If either determination proves negative, the currently proposed Task Force project of using piezometers in the future to assess groundwater PCB loading will not be conducted.

14.4 Sampling design evaluation

This project is designed to support future forensic analyses related to the source of the elevated PCB concentrations observed in biofilm in the Mission Reach. The river water column sampling is designed to be a spatial survey of the Spokane River, with the goal of the data analysis to identify and evaluate unknown potential sources of PCBs. The number of water column sample locations is expected to be adequate to draw conclusions in this regard. The intent of the sediment sampling is to characterize existing sediment PCB concentrations and supplement the single 2018 sample. Given that the number of sediment deposits present in the Mission Reach are limited, three samples are expected to be adequate.

In terms of supporting future forensic analyses of potential ongoing PCB sources to the Spokane River, data obtained from this project should be interpreted in conjunction with data collected from other studies assessing water column and mass balance data and source identification.

15.0 References

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