# 2022 Spokane River PCB Expanded Synoptic Survey and Mass Balance Assessment

Prepared for:
Spokane River Regional Toxics Task Force

May 19, 2023
TTWG REVIEW DRAFT

LimnoTech
Water Environment | Scientists Engineers

Blank Page

LimnoTech
Water | Scientists
Environment | Engineers

501 Avis Drive
Ann Arbor, MI 48108
734.332.1200
www.limno.com

# 2022 Spokane River PCB Synoptic Survey and Mass Balance Assessment

**Prepared for:**
**Spokane River Regional Toxics Task Force**

**May 19, 2023**
**TTWG REVIEW DRAFT**

Blank page

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

Blank page

# Executive Summary

The Spokane River and Lake Spokane have been placed on the State of Washington's 303(d) list of impaired waters because of elevated concentrations of polychlorinated biphenyls (PCBs). To address these impairments, the Washington State Department of Ecology (Ecology) has been pursuing a toxics reduction strategy that included the establishment of a Spokane River Regional Toxics Task Force (Task Force) to identify and reduce PCBs at their source in the watershed.

The Task Force conducted synoptic surveys and performed mass balance assessments in 2014, 2015, and 2018 to characterize both known and previously unknown sources of PCBs to the river. While these projects provided insight into characterizing PCB sources, some gaps in understanding still existed, namely: 1) whether previously unidentified PCB loads are entering the Spokane River between the Spokane USGS gage and Nine Mile Dam; 2) whether previously unidentified PCB loads are entering the Spokane River in the area termed the Mission Reach; and 3) which process(es) is causing the shift in observed homolog distributions in instream PCB concentrations between Plantes Ferry and downstream of Upriver Dam

This project consisted of a week-long synoptic PCB sampling event collecting grab samples under summer low flow conditions at eight Spokane River locations and four discharges into the river. Data on volume of flow was obtained for all samples at the time of their collection. Field data were processed via a mass balance assessment to calculate the magnitude of previously unidentified loads entering the river. Key findings from the mass balance assessment are:

- No new unidentified PCB loads were determined to be entering the Spokane River at a level to be discerned above the variability of underlying data.
- PCB concentrations decrease for most homologs between the monitoring stations located upstream and downstream of Upriver Dam.

Two other field activities were conducted as part of the overall effort to characterize previously unidentified sources. First, the discharge to the Mission Reach previously identified as an artesian well was sampled to determine if the elevated PCB concentration observed in 2021 still exists. Observed concentrations were 1300 to 1500 pg/l, compared to a concentration of 2100 pg/l observed in 2021. This indicates that this source is consistently discharging PCBs to the Spokane River at a concentrations order of magnitude larger than the concentrations in the river.

Second, solids from stormwater catch basins in the Springfield stormwater service area identified by the PCB detection dog as containing elevated PCB levels were collected and analyzed for PCB content. The PCB concentrations in these catch basins were not significantly higher than PCB concentration observed historically from other Spokane-area catch basins. These data suggest that the Springfield service area is not delivering atypically high levels of PCBs to the Spokane stormwater system, although more detailed review of the nature of the historical data is recommended.

Blank page

# 1 Introduction

Sections of the Spokane River are currently listed as water quality impaired for polychlorinated biphenyls (PCBs) under Section 303(d) of the Clean Water Act. The Washington State Department of Ecology 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). The Task Force was formed with the following vision statement:

> The Regional Toxics Task Force will 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…

The Task Force sponsored several synoptic sampling events to identify and quantify previously unknown sources of PCBs to the river. A synoptic survey was conducted in 2014 to identify potentially significant dry weather sources of PCBs to the Spokane River between Lake Coeur d'Alene and Nine Mile Dam. The results of this study showed the strong likelihood of a groundwater PCB source between Barker Road and Plantes Ferry. No information on potential groundwater PCB sources between the Spokane USGS gage and Nine Mile Dam could be obtained from this study, because fluctuations in river flow caused by maintenance activities at Nine Mile Dam violated the steady state assumption of the study design (LimnoTech, 2015). The Task Force sponsored a subsequent synoptic survey in 2015 that confirmed the presence of a large incremental PCB load entering the Spokane River between Barker Road and Plantes Ferry. The 2015 survey also showed the potential presence of another groundwater loading source entering the river downstream of Plantes Ferry. A third synoptic survey was conducted in 2018 to address data gaps, including: 1) the specific nature of groundwater loading sources suspected between Plantes Ferry and Greene Street and 2) the potential for groundwater loading sources between the Spokane USGS gage and Nine Mile Dam. The results of the 2018 monitoring downstream of Plantes Ferry showed similar results as for prior surveys, with a net loss of lower chlorinated homologs and a net gain of moderately chlorinated homologs. No explanation currently exists for this homolog shift. The 2018 mass balance analyses also indicated the potential for groundwater PCB loading in the portion of the river between the Spokane USGS gage and Nine Mile Dam (LimnoTech, 2019).

In addition to the mass balance assessments described above, the Task Force sponsored an additional study in 2021 to identify previously unknown sources of PCBs to the Mission Reach of the Spokane River. This study identified two potential previously unidentified sources: 1) PCB concentrations in an artesian well were measured at 2100 pg/l, a level approximately ten times greater than PCB concentrations observed in the river, and 2) Deployment of a PCB-detection dog qualitatively identified areas of elevated PCB concentrations in the City of Spokane's Springfield stormwater service area that discharges to the Mission Reach.

Based upon the above information, the Task Force identified the need for additional studies to address the following data gaps:

- whether previously unidentified PCB loads are entering the Spokane River between the Spokane USGS gage and Nine Mile Dam
- whether previously unidentified PCB loads are entering the Spokane River in the Mission Reach
- which process(es) causing the shift in observed homolog distributions between Plantes Ferry and downstream of Upriver Dam
- whether PCB concentrations in the artesian well discharge remain greater than PCB concentrations in the Spokane River
- whether PCB concentrations in the catch basins in the Springfield stormwater service area are elevated relative to other similar stormwater basins

The first three data gaps were addressed via conduct of a synoptic survey and semi-quantitative mass balance assessment designed to characterize previously unidentified sources of PCBs to the Spokane River. This study applied a similar methodology of performing mass balance assessments based upon synoptic sampling data as conducted in LimnoTech (2019). The latter two data gaps are addressed via direct monitoring of PCB concentrations in the artesian well discharge and catch basins in the Springfield stormwater service area, respectively.

This report documents the results of the above monitoring program and subsequent analyses. It is divided into sections of:

- Sampling activities
- Analytical results
- Data interpretation

Blank Page

# 2 Sampling Activities

The field monitoring program consisted of a week-long synoptic survey at eight Spokane River locations and one-day sampling event at the artesian well and stormwater catch basins.. Sampling activities are described below, divided into sections corresponding to:

- Sampling locations
- Monitoring dates
- Field sampling activities
- Quality assurance

## 2.1 Sampling Locations

Separate sampling locations were used for each individual component of this project:

- Synoptic Survey
- Artesian Well
- Springfield Catch Basin Sampling

Each is discussed below.

### 2.1.1 Synoptic Survey

River sampling locations consisted of eight stations between Plantes Ferry and Nine Mile Dam, described in Table 1 and shown in Figure 1.

**Table 1. Sampling Locations for Synoptic Survey**

| Location Descriptor | Latitude | Longitude |
|---|---|---|
| Spokane River below Trent Ave. Bridge near Plantes Ferry | 47.69708 °N | -117.2418 °W |
| Spokane River upstream of Upriver Dam | 47.68672 °N | -117.32678 °W |
| Spokane River downstream of Upriver Dam | 47.680847 °N | -117.334225 °W |
| Spokane River below Greene St. Bridge | 47.67808 °N | -117.3628 °W |
| Spokane River at Division St. | 47.66281 °N | -117.41133 °W |
| Spokane River at Spokane USGS Gage | 47.65888 °N | -117.4497 °W |
| Spokane River between the Spokane USGS Gage and Nine Mile Dam | 47.74049 °N | -117.52002 °W |
| Spokane River below Nine Mile Dam | 47.780556 °N | -117.544445 °W |

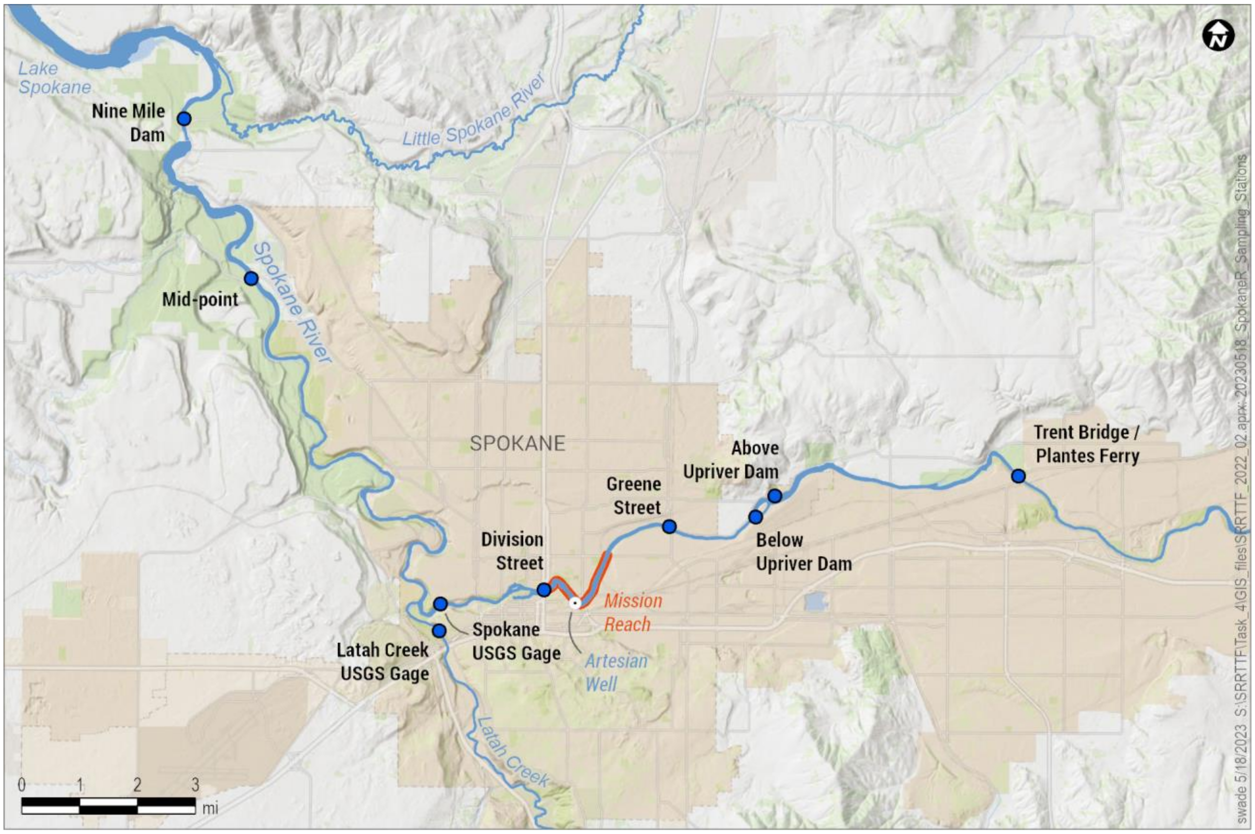


**Figure 1. Map of Synoptic Survey River Sampling Locations**

The external sources of PCBs that were monitored consisted of three wastewater treatment plants and one tributary:

- Inland Empire Paper (47.68867 ºN, -117.2782 ºW)
- Spokane County Regional Water Reclamation Facility. Samples were collected at the facility itself (47.66705 ºN, -117.3532 ºW), while the location of the discharge to the river is north of the facility near Freya St. (47.675833ºN, -117.3469444ºW)
- City of Spokane Riverside Park Advanced WWTP (47.693547ºN, -117.471655ºW)
- Latah (Hangman) Creek Gage Station (47.6528668ºN, -117.44986ºW)

### 2.1.2 Artesian Well

The site that has been referred to as artesian well is located between Hamilton St and Spokane Falls Blvd. on the south bank of the Spokane River (47.659803 ºN, -117.399263 ºW) as shown above in Figure 1 and is depicted in Figure 2. One sample and a field replicate were collected from the discharge, for a total of two samples.

Figure 2. Artesian well observed flowing into Mission Reach (photo from Tighe Stuart, Ecology)

### 2.1.3 Springfield Catch Basin Sampling

Solids were sampled in four catch basins located in the Springfield stormwater service area identified by the PCB detection dog, with catch basin locations shown in Figure 3.

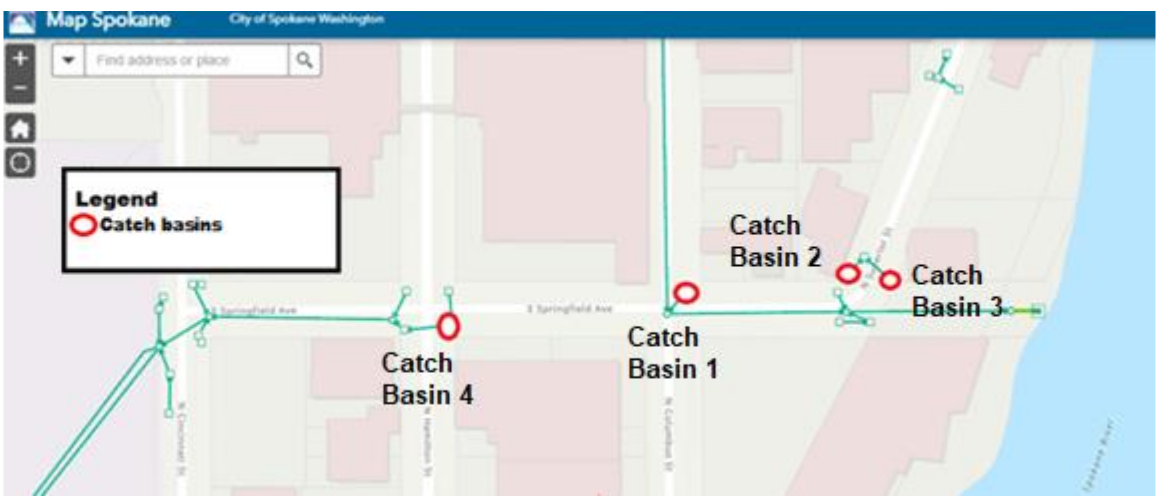


Figure 3. Catch Basins Sampled in the Springfield Basin

## 2.2 Monitoring Dates

The synoptic survey was conducted between August 29 and September 2, 2022. The river stations listed in Table 1 were sampled daily over that period. External sources were sampled every other day, i.e., August 29, August 31, and September 2. The artesian well was sampled on September 3 and the stormwater catch basins were sampled on September 7.

## 2.3 Field Sampling Activities

The field sampling activities as planned and implemented are detailed in the project QAPP (LimnoTech, 2022a). This section summarizes those activities. Samples from the Spokane River, external sources and the artesian well were all collected using a direct grab sampling technique. Sampling of catch basin sediment samples was performed under the oversight of staff from the City of Spokane. Sediment samples were collected in accordance with the operating procedures developed collaboratively by the City of Spokane and Ecology's Urban Waters Initiative (Fernandez, 2012) as described in City of Spokane (2014). Sediment samples were collected from random locations in each catch basin and mixed thoroughly using a stainless-steel spoon and bowl. Samples were transferred to a laboratory-provided jar and placed in ice and shipped to SGS/AXYS Analytical Laboratories, Ltd. in Sidney, British Columbia.

## 2.4 Quality Assurance

Field samples were shipped to SGS/AXYS for analysis of PCB concentrations (Method 1668). A separate set of samples were sent to SVL Analytical in Kellogg, ID for assessment of dissolved organic carbon, total organic carbon, and total suspended solids.

### 2.4.1 Data Quality Assessment - PCBs

All data were reviewed for quality assurance in accordance with the project QAPP and as noted in the laboratory EDD-Excel files provided in the appendix. Data quality indicators evaluated for PCBs included the following:

- Daily Calibration Verification
- Lab Control Sample Recovery
- Sample and Method Blank Surrogate Recovery
- Matrix Spike Sample Recovery
- Duplicate sample relative percent differences (RPDs)
- Completeness

All reviewed quality control (QC) results for PCBs comply with QAPP data quality indicators, with the following exceptions:

To be completed.

### 2.4.2 Blank Censoring

Total PCB concentrations were corrected for method blank contamination following the procedures defined in the QAPP. Specifically, individual congeners found in the sample at a concentration less than three times the associated blank concentration were flagged and excluded from calculation of homolog and total PCB concentration. All total PCB and homolog results reported below are blank corrected using the above method. It should be noted that there is no standard blank correction method, and numerous approaches are utilized, both nationally and within the Spokane River Basin. The selection of the most appropriate blank correction methodology must consider factors such as study objectives, sample matrix, sampling methodology, expected range of results, and tolerance for biased results.

### 2.4.3 Data Quality Assessment – Conventional Pollutants

Data quality indicators evaluated for conventional parameters included the following:

- Bias (laboratory control samples, matrix spikes, and blanks)
- Precision (RPD of matrix spikes and replicate samples)
- Completeness

All reviewed QC results for conventional parameters complied with QAPP data quality indicators.

# 3 Analytical Results

This section summarizes the results of the synoptic survey/artesian well/stormwater catch basin monitoring, in terms of concentrations of total PCBs and individual homologs.

## 3.1 Synoptic Survey

Total PCB concentrations at the Spokane River stations are listed in Table 2 and plotted in Figure 4. Observed PCB concentrations for the external sources are listed in Table 3. Furthermore, a detailed listing of individual PCB homolog concentrations and conventional parameters for each date at each sampling location is provided in Appendix A, and full laboratory data sheets are provided in Appendix D.

PCB concentrations are 67 to 90 pg/l at Plantes Ferry. Moving downstream, concentrations are between 37 and 131 pg/l upstream of Upriver Dam, and between 21 and 101 pg/l downstream of Upriver Dam. PCB concentrations range from 7 to 441 pg/l at Greene St. and are between 29 and 140 pg/l at Division St. PCB concentrations at the Spokane USGS Gage are between 31 and 98 pg/l. PCB concentrations between the USGS Gage and Nine Mile Dam are between 27 and 263 pg/l. Concentrations at Nine Mile Dam are in the range of 30 to 110 pg/l. All of the samples downstream exceed the Washington water quality standard of 7 pg/l. Three samples have concentrations more than 2.5x greater than any other sample measured at the same station and are treated as potential outliers. These outliers correspond to a concentration of 101 pg/l Upstream of Upriver Dam measured on August 31, a concentration of 441 pg/l below Greene St. measured on August 30, and a concentration of 263 pg/l measured between the USGS Gage and Nine Mile Dam on September 1. Separate mass balance assessments were conducted including and excluding these potential outlier values to estimate the uncertainty that these potentially anomalous values cause.

**Table 2. Spokane River Total PCB Concentrations (pg/l)**

| Location | 8/29 | 8/30 | 8/31 | 9/1 | 9/2 |
|---|---|---|---|---|---|
| Below Trent Ave. Bridge near Plantes Ferry | - | 66.782 | 83.743 | 67.415 | 89.643 |
| Upstream of Upriver Dam | 36.804 | 130.72 | 91.584 | 102.072 | 90.379 |
| Downstream of Upriver Dam | 34.738 | 22.76 | 101.019 | 30.578 | 20.604 |
| Below Greene St. Bridge | 21.458 | 440.769 | 44.479 | 25.159 | 7.347 |
| Division St. | 139.61 | 75.536 | 118.035 | 129.456 | 28.844 |
| Spokane USGS Gage | 75.391 | 89.356 | 97.813 | 70.304 | 31.328 |
| Between USGS Gage and Nine Mile Dam | 81.176 | 88.262 | 26.772 | 263.201 | 50.54 |
| Below Nine Mile Dam | 32.638 | 29.867 | 52.281 | 109.578 | 59.604 |

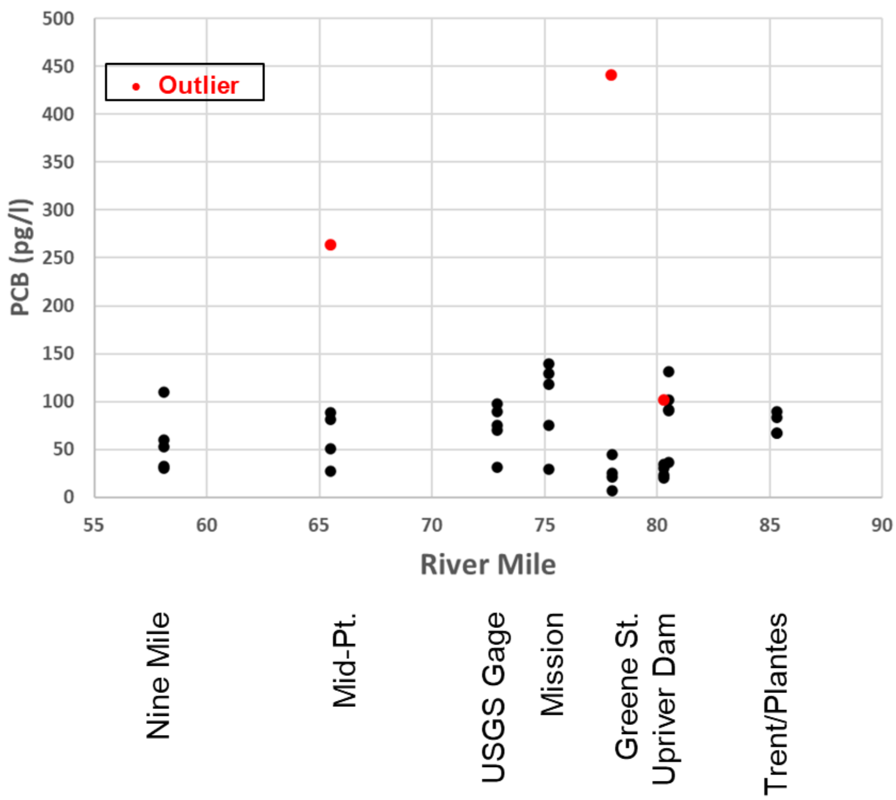


**Figure 4. Spokane River Total PCB Concentrations (pg/l)**

PCB concentrations measured in the external sources are shown in Table 3.

**Table 3. Total PCB Concentrations in External Sources (pg/l)**

| Location | 8/29 | 8/31 | 9/2 |
|---|---|---|---|
| Inland Empire Paper | 572 | 1677 | 1602 |
| Spokane County Regional Water Reclamation Facility | 253 | 200 | 121 |
| Latah (Hangman) Creek | 2.88 | 13.2 | 3.82 |
| City of Spokane Riverside Park Advanced WWTP | 221 | 199 | 139 |

### 3.1.1 Homolog Distributions

Homolog distributions are provided in Table 4, showing average concentration by homolog across all river stations. These data are provided in tabular format for each individual sample in Appendix A. Concentrations at locations Trent Ave, Above Upriver Dam, Below Upriver Dam, USGS Gage, Midpoint to Nine Mile Dam, and Nine Mile Dam are dominated by the tetra-chloro homolog, while concentrations at Greene St. and Division St. are dominated by the hexa-chloro homolog.

**Table 4. Average PCB Concentration by Homolog Across All River Stations**

| | Trent Ave. | Above Upriver Dam | Below Upriver Dam | Greene St. | Division St. | USGS Gage | Mid-Pt. to Nine Mile Dam | Nine Mile Dam |
|---|---|---|---|---|---|---|---|---|
| Mono- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Di- | 0 | 1.024 | 0.350 | 0 | 0.819 | 1.798 | 22.380 | 0.772 |
| Tri- | 27.540 | 11.862 | 6.148 | 4.092 | 8.711 | 6.209 | 2.797 | 2.760 |
| Tetra- | 43.864 | 40.755 | 23.964 | 17.652 | 24.345 | 27.492 | 40.505 | 17.437 |
| Penta- | 3.857 | 22.995 | 7.082 | 17.602 | 22.531 | 18.259 | 11.578 | 12.112 |
| Hexa- | 0.689 | 10.136 | 2.543 | 33.791 | 24.580 | 13.117 | 15.349 | 13.727 |
| Hepta- | 0.687 | 2.774 | 0.741 | 27.573 | 13.014 | 4.799 | 7.984 | 7.926 |
| Octa- | 0.115 | 0.601 | 1.014 | 5.609 | 3.045 | 0.952 | 1.054 | 1.567 |
| Nona- | 0.145 | 0.164 | 0.097 | 1.119 | 1.251 | 0.213 | 0.342 | 0.493 |
| Deca- | 0 | 0 | 0 | 0.404 | 0 | 0 | 0 | 0 |
| Sum | 76.896 | 90.312 | 41.940 | 107.842 | 98.296 | 72.838 | 101.990 | 56.794 |

## 3.2 Artesian Well

The total PCB concentrations observed in two samples collected at the artesian well were 1300 and 1500 pg/l. This corresponds to a concentration of 2100 pg/l observed in 2021 (LimnoTech, 2022b).

### 3.2.1 Homolog Distributions

The homolog distribution for the two artesian well samples is provided in Figure 5, showing average concentration by homolog across both samples. These data are provided in tabular format for each individual sample in Appendix A.

The tri- and tetra-chloro homologs dominate the total concentration. A cosine similarity analysis between the artesian well samples and various Aroclors showed the closest match to Aroclor 1248 with a value of 0.86. Analyses on the Artesian Well sample from 2021 showed a cosine similarity of 0.91 to Arochlor 1242 and a cosine similarity of 0.89 to Aroclor 1016. The 2022 artesian well samples showed much less similarity to these Aroclors, with a similarity value of 0.82 for Aroclor 1242 and 0.76 for Aroclor 1016.

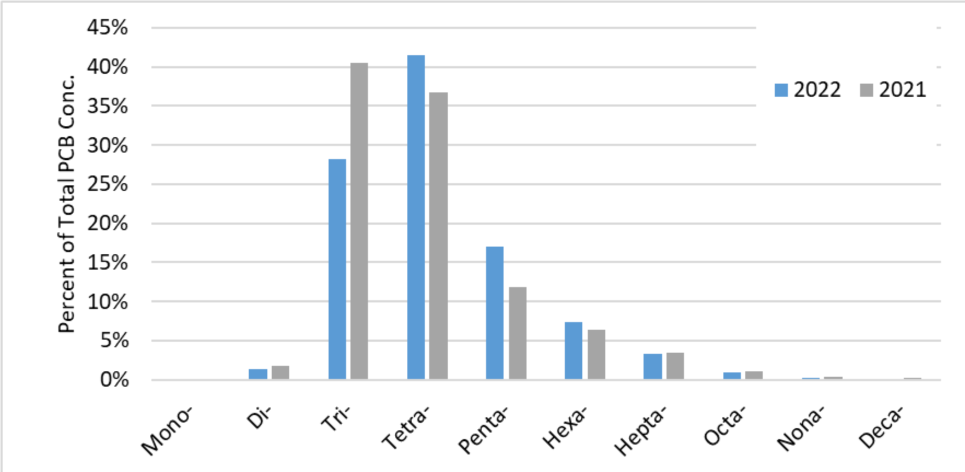


**Figure 5. Blank-Corrected Homolog Concentrations for the 2021 and 2022 Artesian Well Samples**

A detailed listing of individual PCB homolog concentrations for each of the artesian well samples is provided in Appendix A, and full laboratory data sheets are provided in Appendix D.

## 3.3 Stormwater Catch Basins

Total PCB concentrations at the Springfield stormwater catch basins are listed in Table 5. The total PCB concentrations observed range from 31.5 to 127 ug/kg.

**Table 5. Total PCB Concentrations for the Stormwater Catch Basins**

| Location | Total PCB Concentration (ug/kg) |
|---|---|
| Catch Basin 1 | 127 |
| Catch Basin 2 | 82.4 |
| Catch Basin 3 | 94.3 |
| Catch Basin 4 | 31.5 |

### 3.3.1 Homolog Distributions

Homolog distributions are provided in Table 6 for each of the catch basin samples. The hexa-chloro homolog had the highest concentrations in all four catch basins, with the penta-chloro homolog having the second-highest concentration.

**Table 6. Concentration by Homolog for each Catch Basin Sample (ug/kg)**

| Homolog | Catch Basin 1 | Catch Basin 2 | Catch Basin 3 | Catch Basin 4 |
|---|---|---|---|---|
| Mono- | 0.029 | 0.045 | 0.049 | 0.048 |
| Di- | 1.225 | 2.384 | 2.937 | 1.253 |
| Tri- | 1.092 | 1.609 | 1.369 | 1.200 |
| Tetra- | 9.852 | 6.140 | 5.251 | 3.278 |
| Penta- | 46.293 | 24.652 | 27.227 | 10.357 |
| Hexa- | 48.136 | 31.671 | 40.745 | 10.868 |
| Hepta- | 14.988 | 11.976 | 12.730 | 3.317 |
| Octa- | 3.876 | 3.264 | 3.177 | 0.907 |
| Nona- | 0.798 | 0.574 | 0.605 | 0.180 |
| Deca- | 0.208 | 0.116 | 0.187 | 0.045 |

# 4 Mass Balance Assessment and Data Interpretation

The objective of the mass balance assessment is to use the results of the synoptic survey to identify stream reaches where unmnitored incremental loads lead to a significant increase in river concentrations. This section describes the application of the mass balance assessment and interpretation of the artesian well and stormwater catch basin sampling. It is divided into subsections of:

- Conceptual approach to mass balance
- Application of mass balance
- Interpretation of the artesian well and stormwater catch basin data

## 4.1 Conceptual Approach to Mass Balance

The general conceptual approach of the mass balance assessment is to determine the presence of unmonitored loads (presumably from groundwater sources) by comparing the amount of mass passing through the Spokane River at two locations where flow and concentration measurements are available. The magnitude of the unmonitored load can be determined as the difference in monitored load at the downstream and upstream locations, as depicted below in Figure 6 and Equation 1. $Q_u$ and $Q_d$ represent the river flow at the upstream and downstream stations, respectively, while $C_u$ and $C_d$ represent the upstream and downstream PCB concentrations.

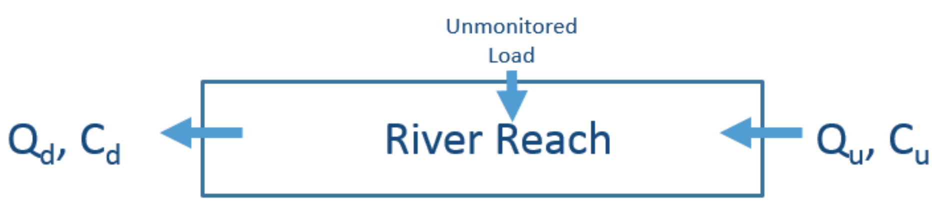


**Figure 6. Simplified Description of Mass Balance Approach**

The approach is described mathematically in Equation 1.

$$\text{Unmonitored load} = \text{Downstream load} - \text{Upstream load} \quad (1)$$

where:

Downstream load = Flow at downstream location ($Q_d$) x Concentration at downstream location ($C_d$)

Upstream load = Flow at Upstream location ($Q_u$) x Concentration at upstream location ($C_u$)

Equation 1 is based upon the assumption that environmental loss processes affecting PCBs are relatively insignificant between the two monitoring locations. This assumption was verified using low-flow hydraulic results from model of the Spokane River, observed data on suspended solids concentrations, and literature values for coefficients related to solids partitioning and volatilization.

The concept can be extended to address situations where a monitored load (e.g. wastewater treatment plant discharge) enters the reach between the upstream and downstream monitoring locations, as shown in Figure 7.

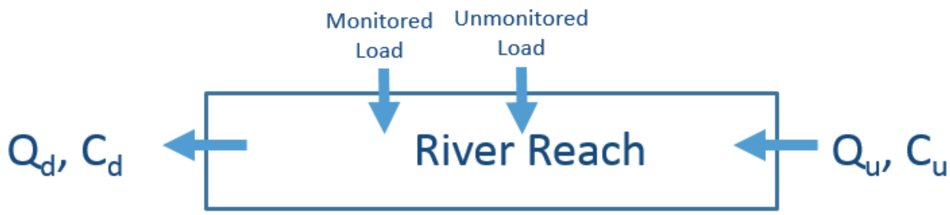


**Figure 7. Mass Balance Approach in the Presence of a Monitored Load**

In this situation, the mass balance equation is expanded to consider the monitored load as shown in Equation 2.

$$\text{Unmonitored load} = \text{Downstream load} - \text{Upstream load} - \text{Monitored Load} \qquad (2)$$

## 4.2 Application of Mass Balance

Mass balance analyses were conducted on total PCBs and individual homologs. The data on flows are provided in Tables 7 and 8, which show individual daily flows as well as the average flow used for the mass balance assessmens. Stream flow measurements were not available for below Trent Ave. Bridge, upstream and downstream of Upriver Dam, below Greene St., and between the USGS Gage and Nine Mile Dam on August 29 and 30 due to an equipment malfunction. Daily flow values generally remained within 3% of the average over the monitoring period, satisfying the requirement of the mass balance assessment that flows remain relatively steady.

**Table 7. River Flows (cfs) Used in 2022 Mass Balance Assessment**

| Location | 8/29 | 8/30 | 8/31 | 9/1 | 9/2 | Average |
|---|---|---|---|---|---|---|
| Below Trent Ave. Bridge near Plantes Ferry | - | - | 730 | 745 | 713 | 729 |
| Upstream of Upriver Dam | - | - | 650 | 633 | 630 | 638 |
| Downstream of Upriver Dam | - | - | 655 | 638 | 644 | 646 |
| Below Greene St. Bridge | 999 | 988 | 975 | 963 | 963 | 978 |
| Division St. | - | - | 725 | 740 | 721 | 729 |
| Spokane USGS Gage | 912 | 904 | 881 | 872 | 861 | 886 |
| Between USGS Gage and Nine Mile Dam | - | - | 1225 | 1104 | 1010 | 1113 |
| Below Nine Mile Dam | 1150 | 1177 | 1138 | 1142 | 1125 | 1146 |

**Table 8. Point Source and Tributary Flows (cfs) from External Sources Used in 2022 Mass Balance Assessment**

| Location | 8/29 | 8/30 | 8/31 | 9/1 | 9/2 | Average |
|---|---|---|---|---|---|---|
| Inland Empire Paper | 10.7 | 11.1 | 10.2 | 10.0 | 10.0 | 10.4 |
| Spokane County Regional Water Reclamation Facility | 10.8 | 10.7 | 10.8 | 10.9 | 10.7 | 10.8 |
| Latah (Hangman) Creek | 10.0 | 10.1 | 9.7 | 9.5 | 8.9 | 10 |
| City of Spokane Riverside Park Advanced WWTP | 41.4 | 43.0 | 39.8 | 39.8 | 40.1 | 40.8 |

The remainder of this section applies the conceptual approach described above, first to total PCBs, then on a homolog-specific basis.

### 4.2.1 Total PCB Mass Balance Assessment

Results of the total PCB mass balance assessment are shown in Table 9 and Figure 8. There is small negative incremental load (-8.1 mg/day) of total PCBs in the in the reach between Trent Avenue and upstream of Upriver Dam. There is a larger negative incremental load (-74 to -98 mg/day, depending upon the inclusion of potential outliers) of total PCBs in the reach between upstream of Upriver Dam and downstream of Upriver Dam. There is also a small negative incremental load (-17.6 mg/day) of total PCBs in the in the reach between Division St and the Spokane USGS Gage. Results for the remaining reaches strongly depend upon the assumption made regarding the inclusion of potential outliers.

**Table 9. Results of 2022 Mass Balance Assessment on Total PCBs**

| River Reach | Incremental Load (mg/day) | |
|---|---|---|
| | With Outliers | Without Outliers |
| **Trent Avenue to Upstream of Upriver Dam** | -8.1 | -8.1 |
| **Upstream of Upriver Dam to Downstream of Upriver Dam** | -74.8 | -98.2 |
| **Downstream of Upriver Dam to Greene St.** | 192.0 | 12.1 |
| **Greene St. to Division St.** | -20.2 | 155.8 |
| **Division St. to Spokane Gage** | -17.6 | -17.6 |
| **Spokane Gage to Mid-Point to Nine Mile Dam** | 101.3 | -8.6 |
| **Mid-Point to Nine Mile Dam to Nine Mile Dam** | -125.0 | -13.5 |

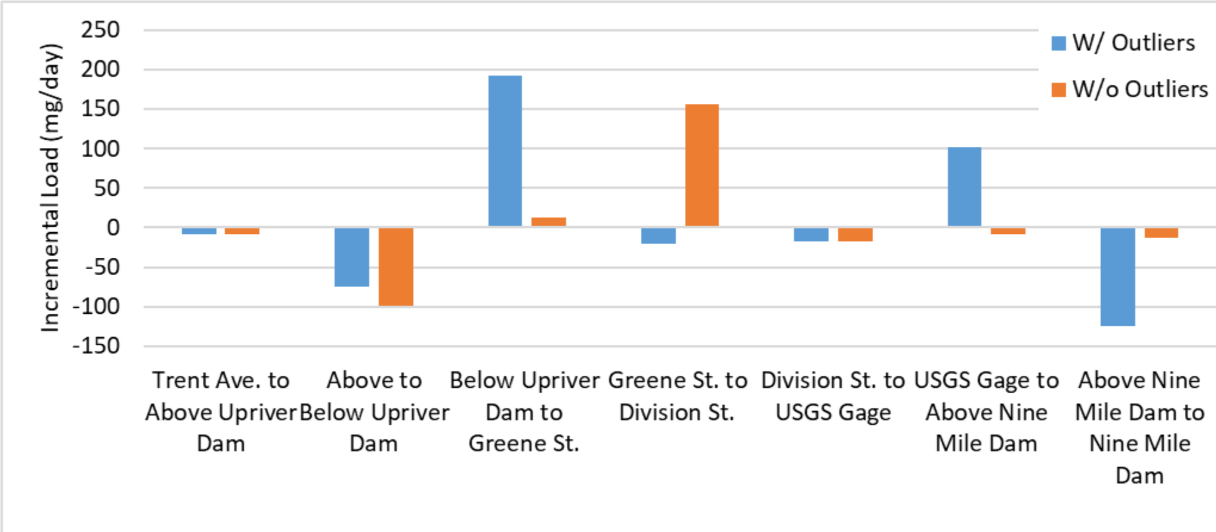


**Figure 8. Results of 2022 Mass Balance for Total PCBs**

### 4.2.2 Homolog-Specific Mass Balance Assessment

The mass balance assessment was also conducted on the individual homologs that comprise total PCB concentrations, with results summarized in Table 10 with outliers considered and Table 11 with outliers excluded. The uncertainty caused by potential outliers precludes drawing any firm conclusions for most reaches.

**Table 10. Incremental Loads (mg/day) Estimated by Homolog-Specific Mass Balance Assessment for 2022 with Potential Outliers Included**

| | Trent Ave to U/S of Upriver Dam | U/S to D/S of Upriver Dam | D/S of Upriver Dam to Greene St. | Greene St. to Division St. | Division St. to Spokane Gage | Spokane Gage to Mid-Point | Mid-Point to Nine Mile Dam |
|---|---|---|---|---|---|---|---|
| Mono- | -0.4 | 0.0 | -0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Di- | -6.0 | -1.0 | -1.7 | 1.7 | 2.4 | 54.8 | -59.7 |
| Tri- | -36.8 | -8.8 | -0.9 | 9.8 | -2.1 | -11.6 | -0.1 |
| Tetra- | -13.5 | -25.8 | 3.6 | 14.2 | 16.2 | 45.0 | -63.8 |
| Penta- | 29.7 | -24.7 | 31.3 | 10.4 | -0.6 | -11.9 | 1.5 |
| Hexa- | 15.0 | -11.8 | 78.4 | -19.5 | -15.4 | 12.7 | -4.5 |
| Hepta- | 3.2 | -3.2 | 66.2 | -30.8 | -12.8 | 11.1 | -0.2 |
| Octa- | 0.7 | 0.7 | 12.1 | -5.4 | -3.4 | 0.8 | 1.4 |
| Nona- | 0.0 | -0.1 | 2.6 | 0.3 | -1.8 | 0.5 | 0.4 |
| Deca- | 0.0 | 0.0 | 1.0 | -0.9 | 0.0 | 0.0 | 0.0 |
| Sum | -8.1 | -74.8 | 192.0 | -20.2 | -17.6 | 101.3 | -125.0 |

**Table 11. Incremental Loads (mg/day) Estimated by Homolog-Specific Mass Balance Assessment for 2022 with Outliers Excluded**

| | Trent Ave to U/S of Upriver Dam | U/S to D/S of Upriver Dam | D/S of Upriver Dam to Greene St. | Greene St. to Division St. | Division St. to Spokane Gage | Spokane Gage to Mid-Point | Mid-Point to Nine Mile Dam |
|---|---|---|---|---|---|---|---|
| Mono- | -0.4 | 0.0 | -0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Di- | -6.0 | -0.9 | -1.9 | 1.7 | 2.4 | 11.8 | -16.1 |
| Tri- | -36.8 | -10.7 | -4.4 | 14.4 | -2.1 | -11.5 | -0.2 |
| Tetra- | -13.5 | -31.6 | -0.3 | 22.5 | 16.2 | 13.2 | -31.6 |
| Penta- | 29.7 | -35.4 | 1.5 | 45.4 | -0.6 | -26.0 | 15.8 |
| Hexa- | 15.0 | -15.1 | 11.9 | 40.9 | -15.4 | 0.7 | 7.7 |
| Hepta- | 3.2 | -3.6 | 4.9 | 22.7 | -12.8 | 2.6 | 8.4 |
| Octa- | 0.7 | -0.7 | 0.6 | 5.7 | -3.4 | 0.2 | 2.0 |
| Nona- | 0.0 | -0.2 | 0.2 | 2.4 | -1.8 | 0.4 | 0.5 |
| Deca- | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sum | -8.1 | -98.2 | 12.1 | 155.8 | -17.6 | -8.6 | -13.5 |

One aspect of the homolog-specific mass balance that was not unduly confounded by the presence of outliers was the loss of PCBs across the range of homologs between the stations upstream and downstream of Upriver Dam (Figure 9). This loss could be caused by volatilization of PCBs as water passes through the dam. The presence of an activated carbon cap in the sediment bed to address historical sediment PCB contamination has also been identified as a mechanism that could potentially remove PCBs from the water column.

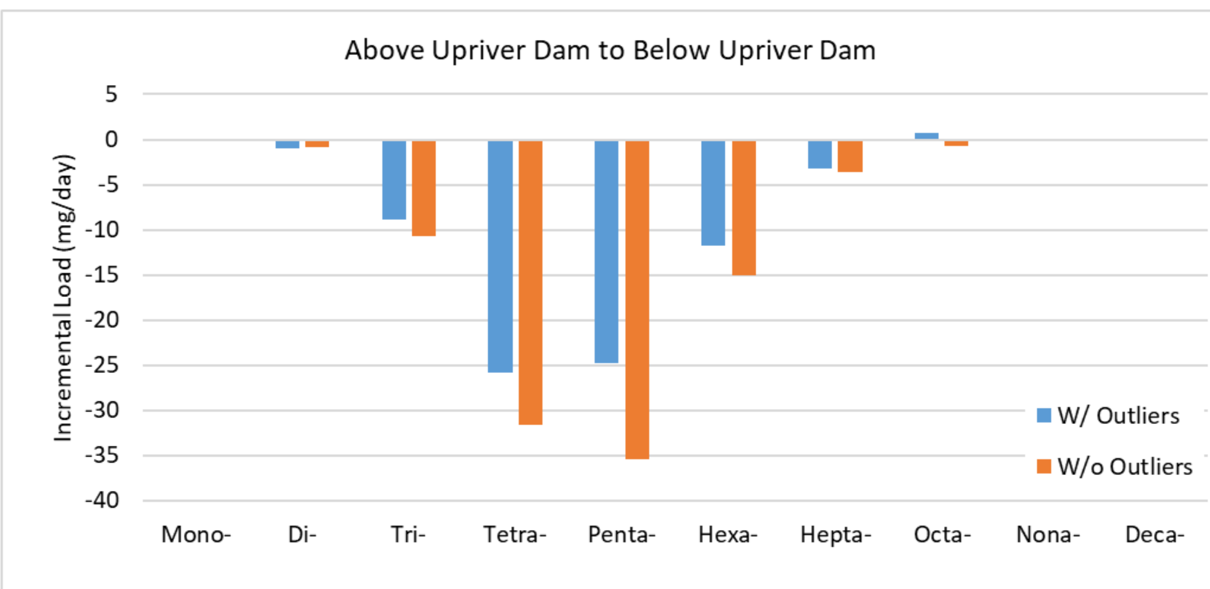


**Figure 9. Homolog Mass Balance for the Reach Upstream and Downstream of Upriver Dam**

### 4.2.3 PCB-11 Mass Balance

A separate mass balance assessment was also conducted on the congener PCB-11. This mass balance was confounded by: 1) PCB-11 concentrations were zero after blank censoring at all river stations except the midpoint between the Spokane USGS gage and Nine Mile, and 2) the PCB-11 concentrations at this location include a potential outlier value. These limitations precluded any meaningful conclusions from being drawn regarding PCB-11.

### 4.2.4 Assessment of Potential Outliers

The results of the mass balance for most reaches depend strongly upon whether potential outlier concentrations are included in the assessment. The homolog distribution for each potential outlier was therefore compared to the distribution of the other samples at the station to provide some information on the nature of each outlier. The homolog distributions for the potential outliers were similar to the distribution of remaining samples at the stations upstream of Upriver Dam and at the mid-point between the Spokane Gage and Nine Mile (Figure 10). The homolog distribution for the potential outlier at Greene St, was different than the distribution of the remaining samples (Figure 11), with the relative prevalence of the hexa- and hepta-chloro-homologs indicating the potential presence of Aroclor 1260 in the outlier sample.

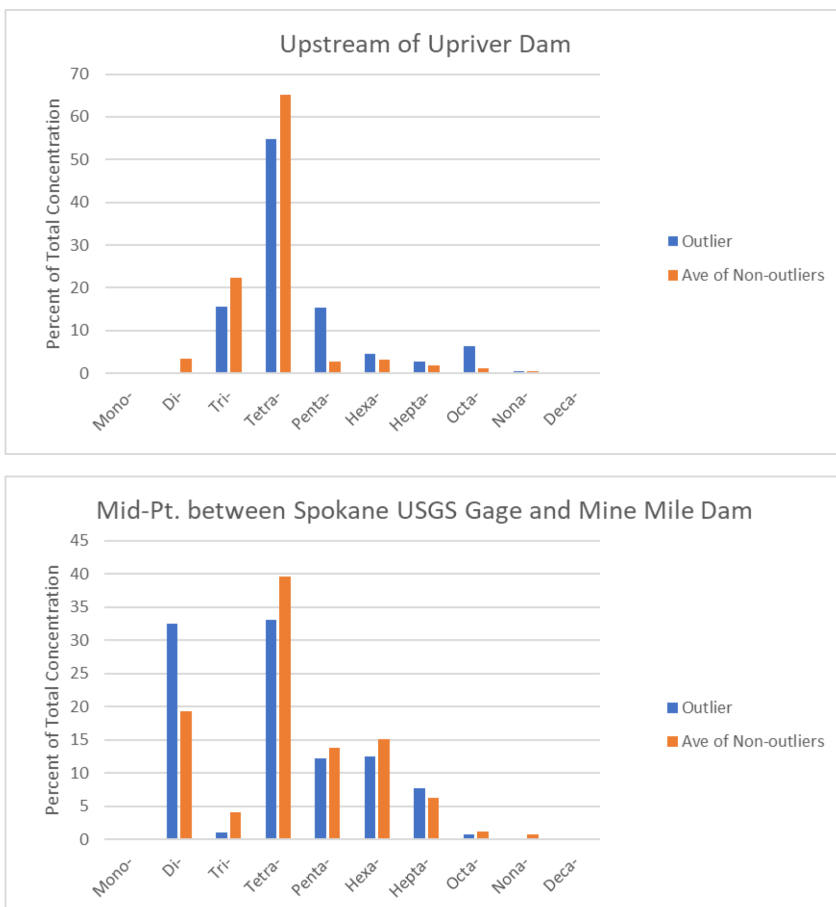


**Figure 10. Comparison of Homolog Distributions between Potential Outliers and Other Samples Upstream of Upriver Dam and between Spokane Gage and Nine Mile**

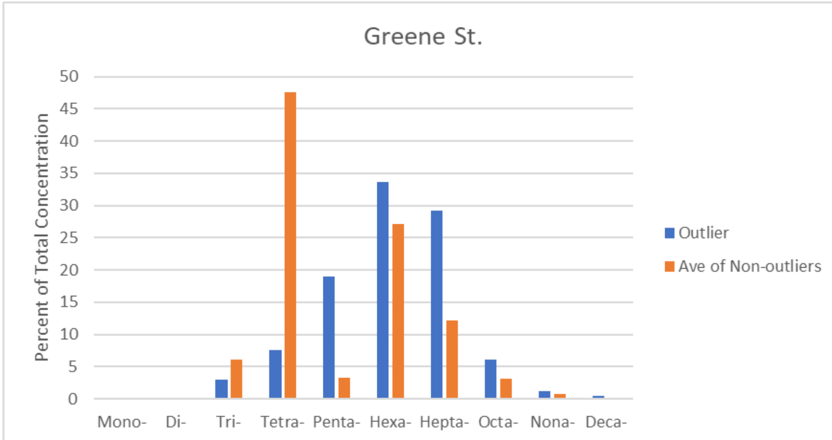


**Figure 11. Comparison of Homolog Distribution between Potential Outliers and Other Samples at Greene St.**

## 4.3 Interpretation of the Artesian Well and Stormwater Catch Basin Data

### 4.3.1 Artesian Well

Observed PCB concentrations in the artesian well were 1300 to 1500 pg/l, while average river PCB concentrations at the nearest upstream station of Greene St. ranged from 7 to 44 pg/l. (with a potential outlier concentration of 441 pg/l.) This indicates that well concentrations are an order of magnitude higher than PCB concentrations and are contributing to an increase in Spokane River PCB concentrations. The presence of the potential outlier concentration at Greene St. limits the ability of the mass balance assessment to discern whether the artesian well is contributing a significant PCB load to the river. If the potential outlier is included in the mass balance assessment, there is no indication that an unknown load (artesian well or otherwise) is entering the river between Greene and Division Streets. If the potential outlier is excluded from the mass balance assessment, there is indication that an unknown load of approximately 150 mg/day is entering the river between Greene and Division Streets. It is noted that water quality monitoring conducted as part of Mission Reach PCB source identification did not observe an increase in water column PCB concentration between stations located upstream (WA 290 Left Bank) and downstream (East Spokane Blvd. Left Bank) of the artesian well discharge.

### 4.3.2 Stormwater Catch Basins

Historic catch basin PCB concentration data were available from two studies (City of Spokane, 2014; Urban Waters Initiative [Fernandez, 2012]) providing a total of 27 measurements. Sampling station names and reported total PCB concentrations are shown in Table 12. Total PCB concentrations at catch basins 1-4 in 2022 were compared against this historic data by plotting the 2022 data against the observed cumulative distribution frequency curve (CDF) of the historic data. All of the 2022 total PCB concentrations are below the 65th percentile and arithmetic mean of the historic data, with three of the four catch basins having concentrations below the historic median (Figure 1212). These data suggest that the Springfield service area is not delivering atypically high levels of PCBs to the Spokane stormwater system, although more detailed review of the nature of the historical data is recommended.

**Table 12. Historic Catch Basin PCB Data**

| Source | Catch Basin Name | Total PCB (ug/kg) | Source | Catch Basin Name | Total PCB (ug/kg) |
|---|---|---|---|---|---|
| Urban Waters | Trent-TPC | 5.82 | City of Spokane | 13-id-3 | 1185 |
| Urban Waters | Cook - Sprg | 980 | City of Spokane | 13-id-4 | 279 |
| Urban Waters | FMCB | 93 | City of Spokane | 13-id-11 | 5 |
| Urban Waters | BrownCBAvg | 12.4 | City of Spokane | 24-id-10 | 103 |
| City of Spokane | 1-C | 754 | City of Spokane | 24-id-11 | 121 |
| City of Spokane | 2-C | 296 | City of Spokane | 25-id-1 | 115 |
| City of Spokane | 8-C | 115 | City of Spokane | 13-id-3 | 767 |
| City of Spokane | 11-C | 179 | City of Spokane | 13-id-4 | 120 |
| City of Spokane | 12-C | 731 | City of Spokane | 13-id-11 | 5.6 |
| City of Spokane | 1-C | 464 | City of Spokane | 24-id-10 | 69.4 |
| City of Spokane | 2-C | 126 | City of Spokane | 24-id-11 | 95.1 |
| City of Spokane | 8-C | 87.9 | City of Spokane | 25-id-1 | 93.9 |
| City of Spokane | 11-C | 74 | City of Spokane | Garland-Normandie | 13.1 |
| City of Spokane | 12-C | 612 | | | |

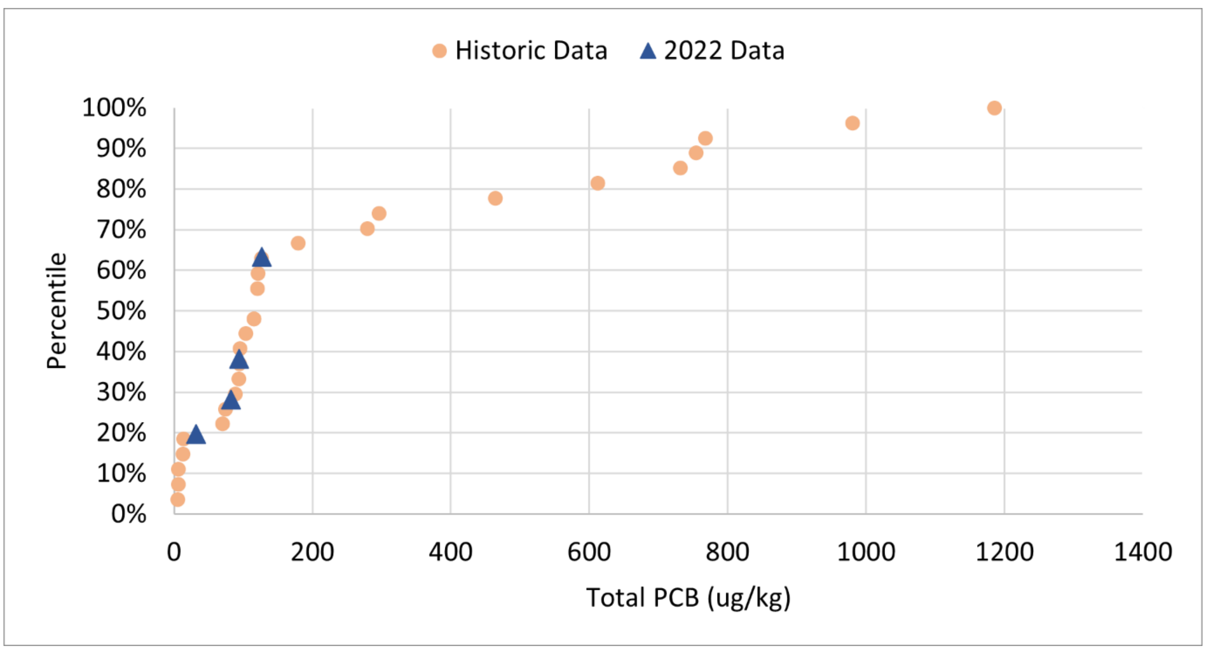


**Figure 12. 2022 Catch Basin Data Compared to Cumulative Distribution Frequency Plot of Historic Catch Basin Data.**

# 5
# Next Steps

Three actions are suggested for potential next steps to build upon the findings of this work:

1. Determine the magnitude of PCBs being loaded from the artesian well: The monitoring conducted for this project confirms that the artesian well is discharging PCBs to the Spokane River at a greatly elevated level but is unable to quantify the magnitude of the load. The magnitude of the load could be reasonably estimated simply via periodic monitoring of the rate of discharge flow. A more refined loading estimate could be attained via collection of additional PCB samples in conjunction with seasonal flow rate monitoring.
2. Determine the source of PCBs being loaded from the artesian well: The artesian well was not identified as a PCB source to the Spokane River at the time that the "Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River" (LimnoTech, 2016) was developed. As such, neither the source of these PCBs nor potential efforts to control them were considered. Additional study to determine the source of these PCBs is recommended to inform future control activities.
3. More thoroughly assess the nature of the historical catch basin PCB data: The determination from this study that the Springfield service area is not contributing atypically high levels of PCBs to the Spokane stormwater system was based on a high-level assessment of the historical data. The historical data could be reviewed more thoroughly in terms of basin size, land use, etc. to verify that that the comparison made in this study is appropriate.

Blank Page

# 6 References

City of Spokane, 2014. Adaptive Management Plan for Reducing PCBs in Stormwater Discharges Reporting Period: May, 2013 to May, 2014. Wastewater Management Department. June, 2014.

Fernandez, A., 2012. Spokane River Urban Waters Source Investigation and Data Analysis Progress Report (2009-2011): Source Tracing for PCB, PBDE, Dioxin/Furan, Lead, Cadmium, and Zinc. Urban Waters Initiative, Washington State Department of Ecology, Spokane, Washington. September 2012. Publication No. 12-04-025

LimnoTech, 2022a Quality Assurance Project Plan, Spokane River Regional Toxics Task Force 2022 PCB Synoptic Survey and Mass Balance Assessment. Prepared for the Spokane River Regional Toxics Task Force. August 17, 2022.

LimnoTech, 2022b. Monitoring to Assist in Defining the Sources of PCB Contamination in the Spokane River Mission Reach. Prepared for Spokane River Regional Toxics Task Force. April 14, 2022.

LimnoTech, 2020. Follow-up Investigations from Spokane River Multi-media Data Collection. Prepared for the Spokane River Regional Toxics Task Force. August 18, 2020 draft.

LimnoTech, 2019. 2018 Technical Activities Report: Continued Identification of Potential Unmonitored Dry Weather Sources of PCBs to the Spokane River. Prepared for the Spokane River Regional Toxics Task Force. March 27, 2019

LimnoTech, 2016. 2016 Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River. Prepared for the Spokane River Regional Toxics Task Force. November 16, 2016.

LimnoTech, 2015. Phase 2 Technical Activities Report: Identification of Potential Unmonitored Dry Weather Sources of PCBs to the Spokane River. Prepared for the Spokane River Regional Toxics Task Force. August 12, 2015.

Blank page

# Appendix A:
# Synoptic Survey Results - PCBs by Homolog

Blank Page

| Table A-1: Blank-Corrected Analytical Results for Spokane River below Trent Ave. Bridge near Plantes Ferry | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR7** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | | 66.782 | 83.743 | 67.415 | 89.643 | |
| Total Monochloro Biphenyls (pg/l) | | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | | 0 | 0 | 0 | 0 | |
| Total Trichloro Biphenyls (pg/l) | | 30.01 | 23.509 | 23.569 | 33.071 | |
| Total Tetrachloro Biphenyls (pg/l) | | 35.876 | 55.022 | 41.435 | 43.123 | |
| Total Pentachloro Biphenyls (pg/l) | | 0.196 | 3.725 | 1.518 | 9.987 | |
| Total Hexachloro Biphenyls (pg/l) | | 0.185 | 0.628 | 0.519 | 1.423 | |
| Total Heptachloro Biphenyls | | 0.25 | 0.859 | 0.374 | 1.264 | |
| Total Octachloro Biphenyls (pg/l) | | 0 | 0 | 0 | 0.459 | |
| Total Nonachloro Biphenyls (pg/l) | | 0.265 | 0 | 0 | 0.316 | |
| Total Decachloro Biphenyls (pg/l) | | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 0.57 | 0.64 | 0.61 | 0.60 | <1.00 | |
| Total Organic Carbon (mg/l) | 1.75 | <1.00 | <1.00 | <1.00 | <1.00 | |
| Total Suspended Solids (mg/l) | <1.0 | <1.0 | <1.0 | <1.0 | 1.0 | |

| Table A-2: Blank-Corrected Analytical Results for Inland Empire Paper | | | | |
|---|---|---|---|---|
| **Station SR6** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total PCBs (pg/l) | 572.058 | 1676.7 | 1601.525 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 34.33 | 9.87 | |
| Total Dichloro Biphenyls (pg/l) | 205.24 | 417.7 | 291.4 | |
| Total Trichloro Biphenyls (pg/l) | 208.37 | 550.51 | 541.8 | |
| Total Tetrachloro Biphenyls (pg/l) | 146.17 | 456.9 | 502.16 | |
| Total Pentachloro Biphenyls (pg/l) | 9.212 | 143.09 | 163.73 | |
| Total Hexachloro Biphenyls (pg/l) | 1.02 | 53.125 | 61.547 | |
| Total Heptachloro Biphenyls | 1.478 | 17.998 | 23.706 | |
| Total Octachloro Biphenyls (pg/l) | 0.332 | 3.06 | 6.108 | |
| Total Nonachloro Biphenyls (pg/l) | 0.232 | 0 | 1.21 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| | | | | |
| Dissolved Organic Carbon (mg/l) | 67.9 | 87.3 | 70.2 | |
| Total Organic Carbon (mg/l) | 68.2 | 94.6 | 75.3 | |
| Total Suspended Solids (mg/l) | 2.4 | 10.0 | 13.2 | |

| Table A-3: Blank-Corrected Analytical Results for Spokane River Upstream of Upriver Dam | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR5b** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 36.804 | 130.72 | 91.584 | 102.072 | 90.379 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0 | 5.12 | 0 | 0 | 0 | |

| Table A-3: Blank-Corrected Analytical Results for Spokane River Upstream of Upriver Dam | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR5b** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total Trichloro Biphenyls (pg/l) | 14.131 | 13.235 | 17.209 | 11.077 | 3.656 | |
| Total Tetrachloro Biphenyls (pg/l) | 19.209 | 63.427 | 41.587 | 39.514 | 40.04 | |
| Total Pentachloro Biphenyls (pg/l) | 0.227 | 36.298 | 21.987 | 30.895 | 25.57 | |
| Total Hexachloro Biphenyls (pg/l) | 0.73 | 10.303 | 6.045 | 15.087 | 18.517 | |
| Total Heptachloro Biphenyls | 1.714 | 1.781 | 3.357 | 4.761 | 2.255 | |
| Total Octachloro Biphenyls (pg/l) | 0.366 | 0.556 | 1.399 | 0.345 | 0.341 | |
| Total Nonachloro Biphenyls (pg/l) | 0.427 | 0 | 0 | 0.393 | 0 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.79 | 1.63 | 1.79 | 1.88 | 2.02 | |
| Total Organic Carbon (mg/l) | 1.70 | 1.77 | 1.74 | 1.82 | 1.81 | |
| Total Suspended Solids (mg/l) | 3.2 | <1.0 | 6.8 | 4.0 | 5.6 | |

| Table A-4: Blank-Corrected Analytical Results for Spokane River Downstream of Upriver Dam | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR5a** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 34.738 | 22.76 | 101.019 | 30.578 | 20.604 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 1.75 | |
| Total Trichloro Biphenyls (pg/l) | 11.795 | 5.419 | 11.018 | 0.685 | 1.825 | |
| Total Tetrachloro Biphenyls (pg/l) | 21.717 | 16.727 | 38.603 | 28.169 | 14.606 | |
| Total Pentachloro Biphenyls (pg/l) | 0.227 | 0 | 34.021 | 1.163 | 0 | |
| Total Hexachloro Biphenyls (pg/l) | 0.286 | 0.22 | 10.71 | 0 | 1.497 | |
| Total Heptachloro Biphenyls | 0.448 | 0.394 | 1.945 | 0.561 | 0.357 | |
| Total Octachloro Biphenyls (pg/l) | 0.265 | 0 | 4.468 | 0 | 0.336 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 0 | 0.254 | 0 | 0.233 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.30 | 1.19 | 1.33 | 1.33 | 1.30 | |
| Total Organic Carbon (mg/l) | 1.26 | 1.29 | 1.17 | 1.20 | 1.18 | |
| Total Suspended Solids (mg/l) | <1.0 | <1.0 | 1.0 | <1.0 | 1.2 | |

| Table A-5: Blank-Corrected Analytical Results for Spokane County Regional Water Reclamation Facility | | | | |
|---|---|---|---|---|
| **Station SR5** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total PCBs (pg/l) | 252.689 | 200.469 | 120.943 | |
| Total Monochloro Biphenyls (pg/l) | 24.8 | 4.76 | 18.5 | |
| Total Dichloro Biphenyls (pg/l) | 68.511 | 55.52 | 11.41 | |
| Total Trichloro Biphenyls (pg/l) | 49.463 | 52.786 | 34.988 | |
| Total Tetrachloro Biphenyls (pg/l) | 99.689 | 49.832 | 36.196 | |
| Total Pentachloro Biphenyls (pg/l) | 9.132 | 28.063 | 16.501 | |
| Total Hexachloro Biphenyls (pg/l) | 0 | 8.683 | 2.601 | |

| Table A-5: Blank-Corrected Analytical Results for Spokane County Regional Water Reclamation Facility | | | | |
|---|---|---|---|---|
| **Station SR5** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total Heptachloro Biphenyls | 0.58 | 0.825 | 0.326 | |
| Total Octachloro Biphenyls (pg/l) | 0.514 | 0 | 0 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 0 | 0.421 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| | | | | |
| Dissolved Organic Carbon (mg/l) | 5.60 | 5.10 | 4.48 | |
| Total Organic Carbon (mg/l) | 5.34 | 5.01 | 4.46 | |
| Total Suspended Solids (mg/l) | <1.0 | <1.0 | 1.2 | |

| Table A-6: Blank-Corrected Analytical Results for Spokane River below Greene St. Bridge | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR4** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 21.458 | 440.769 | 44.479 | 25.159 | 7.347 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Trichloro Biphenyls (pg/l) | 2.182 | 12.948 | 3.391 | 0.234 | 1.704 | |
| Total Tetrachloro Biphenyls (pg/l) | 12.915 | 33.468 | 27.776 | 12.354 | 1.747 | |
| Total Pentachloro Biphenyls (pg/l) | 0 | 83.86 | 3.05 | 1.102 | 0 | |
| Total Hexachloro Biphenyls (pg/l) | 4.755 | 148.02 | 6.574 | 7.11 | 2.495 | |
| Total Heptachloro Biphenyls | 1.606 | 128.75 | 3.046 | 3.394 | 1.07 | |
| Total Octachloro Biphenyls (pg/l) | 0 | 26.595 | 0.406 | 0.713 | 0.331 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 5.108 | 0.236 | 0.252 | 0 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 2.02 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.50 | 1.12 | 1.10 | 1.09 | 1.06 | |
| Total Organic Carbon (mg/l) | 1.13 | 1.04 | 1.00 | 1.12 | <1.00 | |
| Total Suspended Solids (mg/l) | <1.0 | 4.2 | <1.0 | <1.0 | 1.0 | |

| Table A-7: Blank-Corrected Analytical Results for Spokane River at Division St. | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR3a** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 139.61 | 75.536 | 118.035 | 129.456 | 28.844 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0.498 | 0 | 1.938 | 0 | 1.66 | |
| Total Trichloro Biphenyls (pg/l) | 20.21 | 5.593 | 14.089 | 1.767 | 1.894 | |
| Total Tetrachloro Biphenyls (pg/l) | 32.629 | 21.167 | 34.174 | 25.893 | 7.864 | |
| Total Pentachloro Biphenyls (pg/l) | 26.658 | 5.236 | 33.957 | 42.207 | 4.596 | |
| Total Hexachloro Biphenyls (pg/l) | 34.252 | 26.141 | 21.559 | 34.494 | 6.455 | |
| Total Heptachloro Biphenyls | 17.337 | 15.066 | 9.154 | 19.488 | 4.027 | |
| Total Octachloro Biphenyls (pg/l) | 5.829 | 1.725 | 2.357 | 4.104 | 1.208 | |
| Total Nonachloro Biphenyls (pg/l) | 2.197 | 0.608 | 0.807 | 1.503 | 1.14 | |

| Table A-7: Blank-Corrected Analytical Results for Spokane River at Division St. | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR3a** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.05 | 1.16 | 1.14 | 1.07 | 1.06 | |
| Total Organic Carbon (mg/l) | 1.02 | 1.10 | 1.03 | <1.00 | 1.18 | |
| Total Suspended Solids (mg/l) | 2.4 | 1.6 | 2.8 | <1.0 | <1.0 | |

| Table A-8: Blank-Corrected Analytical Results for Spokane River at Spokane USGS Gage | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR3** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 75.391 | 89.356 | 97.813 | 70.304 | 31.328 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 4.51 | 2.94 | 1.54 | 0 | 0 | |
| Total Trichloro Biphenyls (pg/l) | 2.066 | 9.953 | 16.634 | 0.577 | 1.815 | |
| Total Tetrachloro Biphenyls (pg/l) | 48.406 | 28.834 | 30.66 | 21.615 | 7.945 | |
| Total Pentachloro Biphenyls (pg/l) | 5.033 | 26.877 | 28.281 | 25.448 | 5.656 | |
| Total Hexachloro Biphenyls (pg/l) | 9.597 | 15.712 | 13.976 | 16.689 | 9.611 | |
| Total Heptachloro Biphenyls | 4.338 | 4.618 | 4.999 | 5.423 | 4.615 | |
| Total Octachloro Biphenyls (pg/l) | 1.045 | 0.422 | 1.723 | 0.263 | 1.308 | |
| Total Nonachloro Biphenyls (pg/l) | 0.396 | 0 | 0 | 0.289 | 0.378 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.07 | 1.13 | 1.49 | 1.13 | 1.24 | |
| Total Organic Carbon (mg/l) | 1.03 | 1.03 | 1.59 | 1.08 | 1.02 | |
| Total Suspended Solids (mg/l) | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | |

| Table A-9: Blank-Corrected Analytical Results for Latah (Hangman) Creek | | | | |
|---|---|---|---|---|
| **Station HC1** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total PCBs (pg/l) | 221.079 | 199.007 | 138.515 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 42.103 | 13.356 | 13.279 | |
| Total Trichloro Biphenyls (pg/l) | 58.066 | 58.706 | 56.31 | |
| Total Tetrachloro Biphenyls (pg/l) | 78.347 | 67.511 | 27.951 | |
| Total Pentachloro Biphenyls (pg/l) | 38.127 | 44.64 | 32.456 | |
| Total Hexachloro Biphenyls (pg/l) | 2.835 | 10.942 | 6.741 | |
| Total Heptachloro Biphenyls | 1.082 | 3.852 | 1.232 | |
| Total Octachloro Biphenyls (pg/l) | 0.519 | 0 | 0.319 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 0 | 0.227 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| | | | | |
| Dissolved Organic Carbon (mg/l) | 2.37 | 2.67 | 2.29 | |
| Total Organic Carbon (mg/l) | 2.40 | 2.64 | 2.42 | |

| Table A-9: Blank-Corrected Analytical Results for Latah (Hangman) Creek | | | | |
|---|---|---|---|---|
| **Station HC1** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total Suspended Solids (mg/l) | 1.8 | 2.0 | 3.0 | |

| Table A-10: Blank-Corrected Analytical Results for City of Spokane Riverside Park Advanced WWTP | | | | |
|---|---|---|---|---|
| **Station SR2** | **8 / 29** | **8 / 31** | **9 /2** | |
| Total PCBs (pg/l) | 2.878 | 13.229 | 3.82 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0 | 1.35 | 0 | |
| Total Trichloro Biphenyls (pg/l) | 0 | 1.403 | 0 | |
| Total Tetrachloro Biphenyls (pg/l) | 1.469 | 0.891 | 0 | |
| Total Pentachloro Biphenyls (pg/l) | 0 | 2.61 | 0 | |
| Total Hexachloro Biphenyls (pg/l) | 0.239 | 4.249 | 1.209 | |
| Total Heptachloro Biphenyls | 0.614 | 2.322 | 1.545 | |
| Total Octachloro Biphenyls (pg/l) | 0.236 | 0 | 0.357 | |
| Total Nonachloro Biphenyls (pg/l) | 0.32 | 0.404 | 0.709 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | |
| | | | | |
| Dissolved Organic Carbon (mg/l) | 4.59 | 4.87 | 4.25 | |
| Total Organic Carbon (mg/l) | 4.69 | 4.31 | 4.23 | |
| Total Suspended Solids (mg/l) | <1.0 | <1.0 | 1.2 | |

| Table A-11: Blank-Corrected Analytical Results for Spokane River between USGS Gage and Nine Mile Dam | | | | | | |
|---|---|---|---|---|---|---|
| **Station SR1a** | **8 / 29** | **8 / 30** | **8 / 31** | **9 / 1** | **9 /2** | |
| Total PCBs (pg/l) | 81.176 | 88.262 | 26.772 | 263.201 | 50.54 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 24.89 | 0 | 1.51 | 85.5 | 0 | |
| Total Trichloro Biphenyls (pg/l) | 5.158 | 3.89 | 2.004 | 2.592 | 0.343 | |
| Total Tetrachloro Biphenyls (pg/l) | 46.154 | 44.339 | 9.819 | 87.081 | 15.132 | |
| Total Pentachloro Biphenyls (pg/l) | 0 | 5.507 | 2.924 | 32.282 | 17.177 | |
| Total Hexachloro Biphenyls (pg/l) | 2.775 | 22.325 | 6.085 | 32.934 | 12.628 | |
| Total Heptachloro Biphenyls | 1.565 | 9.617 | 3.913 | 20.441 | 4.386 | |
| Total Octachloro Biphenyls (pg/l) | 0.634 | 1.62 | 0.517 | 1.936 | 0.564 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 0.964 | 0 | 0.435 | 0.31 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.35 | 1.04 | 1.15 | 1.21 | 0.98 | |
| Total Organic Carbon (mg/l) | 2.91 | 1.01 | 1.10 | 1.04 | 1.11 | |
| Total Suspended Solids (mg/l) | 1.0 | 1.2 | <1.0 | 1.2 | 2.2 | |

| Table A-12: Blank-Corrected Analytical Results for Spokane River at Nine Mile Dam | | | | | | |
|---|---|---|---|---|---|---|
| Station SR1 | 8 / 29 | 8 / 30 | 8 / 31 | 9 / 1 | 9 /2 | |
| Total PCBs (pg/l) | 32.638 | 29.867 | 52.281 | 109.578 | 59.604 | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| Total Dichloro Biphenyls (pg/l) | 0 | 0 | 2.679 | 1.18 | 0 | |
| Total Trichloro Biphenyls (pg/l) | 4.871 | 3.877 | 1.37 | 2.072 | 1.612 | |
| Total Tetrachloro Biphenyls (pg/l) | 14.423 | 14.726 | 20.751 | 27.636 | 9.648 | |
| Total Pentachloro Biphenyls (pg/l) | 0.211 | 0.331 | 14.59 | 35.257 | 10.17 | |
| Total Hexachloro Biphenyls (pg/l) | 5.262 | 5.111 | 8.337 | 27.448 | 22.477 | |
| Total Heptachloro Biphenyls | 6.923 | 4.288 | 3.593 | 12.913 | 11.911 | |
| Total Octachloro Biphenyls (pg/l) | 0.948 | 1.283 | 0.666 | 2.262 | 2.677 | |
| Total Nonachloro Biphenyls (pg/l) | 0 | 0.251 | 0.295 | 0.81 | 1.109 | |
| Total Decachloro Biphenyls (pg/l) | 0 | 0 | 0 | 0 | 0 | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.19 | 1.22 | 1.23 | 2.15 | 1.12 | |
| Total Organic Carbon (mg/l) | 1.21 | 1.26 | 1.12 | 1.63 | 1.00 | |
| Total Suspended Solids (mg/l) | <1.0 | 7.8 | <1.0 | 1.8 | 1.4 | |

| Table A-13: Blank-Corrected Analytical Results for Artesian Well | | | | | | |
|---|---|---|---|---|---|---|
| Station AW | 9/30 | 9/30-R | | | | |
| Total PCBs (pg/l) | 1549.569 | 1307.64 | | | | |
| Total Monochloro Biphenyls (pg/l) | 0 | 0 | | | | |
| Total Dichloro Biphenyls (pg/l) | 21.69 | 17.66 | | | | |
| Total Trichloro Biphenyls (pg/l) | 436.282 | 338.584 | | | | |
| Total Tetrachloro Biphenyls (pg/l) | 643.209 | 550.577 | | | | |
| Total Pentachloro Biphenyls (pg/l) | 263.727 | 237.302 | | | | |
| Total Hexachloro Biphenyls (pg/l) | 114.544 | 105.065 | | | | |
| Total Heptachloro Biphenyls | 50.888 | 43.303 | | | | |
| Total Octachloro Biphenyls (pg/l) | 14.076 | 12.457 | | | | |
| Total Nonachloro Biphenyls (pg/l) | 3.303 | 2.692 | | | | |
| Total Decachloro Biphenyls (pg/l) | 1.85 | 0 | | | | |
| | | | | | | |
| Dissolved Organic Carbon (mg/l) | 1.77 | 1.71 | | | | |
| Total Organic Carbon (mg/l) | 1.72 | 1.59 | | | | |
| Total Suspended Solids (mg/l) | 1.4 | 1.8 | | | | |

| Table A-14: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| Station CB1 | 9/7 | | | | | |
| Total PCBs (pg/g) | 126496.876 | | | | | |
| Total Monochloro Biphenyls (pg/g) | 29.25 | | | | | |
| Total Dichloro Biphenyls (pg/g) | 1225.488 | | | | | |
| Total Trichloro Biphenyls (pg/g) | 1092.194 | | | | | |

| Table A-14: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| Station CB1 | 9/7 | | | | | |
| Total Tetrachloro Biphenyls (pg/g) | 9852.061 | | | | | |
| Total Pentachloro Biphenyls (pg/g) | 46292.546 | | | | | |
| Total Hexachloro Biphenyls (pg/g) | 48135.548 | | | | | |
| Total Heptachloro Biphenyls (pg/g) | 14988.194 | | | | | |
| Total Octachloro Biphenyls (pg/g) | 3875.595 | | | | | |
| Total Nonachloro Biphenyls (pg/g) | 798 | | | | | |
| Total Decachloro Biphenyls (pg/g) | 208 | | | | | |
| | | | | | | |
| Percent Solids (%) | 98.8 | | | | | |
| Percent Organic Carbon (%) | 6.81 | | | | | |

| Table A-15: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| Station CB2 | 9/7 | | | | | |
| Total PCBs (pg/g) | 82430.929 | | | | | |
| Total Monochloro Biphenyls (pg/g) | 44.9 | | | | | |
| Total Dichloro Biphenyls (pg/g) | 2383.609 | | | | | |
| Total Trichloro Biphenyls (pg/g) | 1608.691 | | | | | |
| Total Tetrachloro Biphenyls (pg/g) | 6140.274 | | | | | |
| Total Pentachloro Biphenyls (pg/g) | 24651.763 | | | | | |
| Total Hexachloro Biphenyls (pg/g) | 31671.3 | | | | | |
| Total Heptachloro Biphenyls (pg/g) | 11976.443 | | | | | |
| Total Octachloro Biphenyls (pg/g) | 3263.649 | | | | | |
| Total Nonachloro Biphenyls (pg/g) | 574.3 | | | | | |
| Total Decachloro Biphenyls (pg/g) | 116 | | | | | |
| | | | | | | |
| Percent Solids (%) | 98.7 | | | | | |
| Percent Organic Carbon (%) | 8.37 | | | | | |

| Table A-16: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| Station CB3 | 9/7 | | | | | |
| Total PCBs (pg/g) | 94276.033 | | | | | |
| Total Monochloro Biphenyls (pg/g) | 48.8 | | | | | |
| Total Dichloro Biphenyls (pg/g) | 2936.864 | | | | | |
| Total Trichloro Biphenyls (pg/g) | 1368.994 | | | | | |
| Total Tetrachloro Biphenyls (pg/g) | 5251.267 | | | | | |
| Total Pentachloro Biphenyls (pg/g) | 27226.731 | | | | | |
| Total Hexachloro Biphenyls (pg/g) | 40745.11 | | | | | |
| Total Heptachloro Biphenyls (pg/g) | 12729.726 | | | | | |
| Total Octachloro Biphenyls (pg/g) | 3176.841 | | | | | |
| Total Nonachloro Biphenyls (pg/g) | 604.7 | | | | | |

| Table A-16: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| **Station CB3** | **9/7** | | | | | |
| Total Decachloro Biphenyls (pg/g) | 187 | | | | | |
| | | | | | | |
| Percent Solids (%) | 96.7 | | | | | |
| Percent Organic Carbon (%) | 8.54 | | | | | |

| Table A-17: Blank-Corrected Analytical Results for Stormwater Catch Basin | | | | | | |
|---|---|---|---|---|---|---|
| **Station CB4** | **9/7** | | | | | |
| Total PCBs (pg/g) | 31452.614 | | | | | |
| Total Monochloro Biphenyls (pg/g) | 47.7 | | | | | |
| Total Dichloro Biphenyls (pg/g) | 1253.197 | | | | | |
| Total Trichloro Biphenyls (pg/g) | 1200.04 | | | | | |
| Total Tetrachloro Biphenyls (pg/g) | 3278.405 | | | | | |
| Total Pentachloro Biphenyls (pg/g) | 10356.56 | | | | | |
| Total Hexachloro Biphenyls (pg/g) | 10867.822 | | | | | |
| Total Heptachloro Biphenyls (pg/g) | 3317.43 | | | | | |
| Total Octachloro Biphenyls (pg/g) | 906.56 | | | | | |
| Total Nonachloro Biphenyls (pg/g) | 180.2 | | | | | |
| Total Decachloro Biphenyls (pg/g) | 44.7 | | | | | |
| | | | | | | |
| Percent Solids (%) | 99.4 | | | | | |
| Percent Organic Carbon (%) | 6.96 | | | | | |

# Appendix B: Quality Assurance Project Plan

***Provided separately as an electronic document***

Blank Page

# Appendix C:
# Laboratory Results

***Provided separately as electronic spreadsheets***

Blank Page