Spokane River Regional Toxics Task Force
Phase 2 Technical Activities Report

Prepared for:
Spokane River Regional Toxics Task Force

DRAFT
May 20, 2015

LimnoTech
Water Environment | Scientists Engineers

Blank Page

LimnoTech
Water Environment | Scientists Engineers

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

Spokane River Regional Toxics Task Force
Phase 2 Technical Activities Report

DRAFT

Prepared for:

Spokane River Regional Toxics Task Force

May 20, 2015

Blank page

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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 concentrations of polychlorinated biphenyls (PCBs) that exceed water quality standards. To address these impairments, the Department of Ecology (Ecology) is pursuing a direct-to-implementation strategy that included the establishment of a Spokane River Regional Toxics Task Force (SRRTTF) to identify and reduce PCBs at their source in the watershed.

The Work Plan developed by the Task Force (SRRTTF, 2012) identified four distinct phases of work:

- Phase 1: Review of existing data and reports, development of a data gaps assessment with recommendations for additional sampling, preparation of a Quality Assurance Project Plan for collection of additional data, and recommendation of analytical modeling tools to be used in Phase 3.
- Phase 2: Collection of additional data
- Phase 3: Analysis of data to characterize and quantify PCB sources
- Phase 4: Assess potential Best Management Practices and develop a Comprehensive Plan

This report documents Phase 2 technical activities, which focused on carrying out a synoptic survey to identify potential unmonitored dry weather sources of PCBs to the Spokane River. The survey was successfully conducted between August 12 and 24, 2014. Activities were conducted in accordance with the Quality Assurance Project Plan (LimnoTech, 2014c) and Sampling and Analysis Plan (LimnoTech, 2014d) developed for this project.

Results of the survey were analyzed following a mass balance approach, which identified a likely groundwater source of PCBs entering the river in the reach between Barker Rd. and Trent Avenue Bridge. A second potential source was identified between Greene St. and the Spokane USGS gage. Phase 3 activities are now underway to characterize the specific nature of these sources.

Blank Page

1
INTRODUCTION

The Spokane River and Lake Spokane have been placed on the State of Washington's 303(d) list of impaired waters because of concentrations of polychlorinated biphenyls (PCBs) that exceed water quality standards. To address these impairments, the Department of Ecology (Ecology) is pursuing a direct-to-implementation strategy that included the establishment of a Spokane River Regional Toxics Task Force (SRRTTF) to identify and reduce PCBs at their source in the watershed. The stated objective of the Task Force (SRRTTF, 2012) is "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."

The Work Plan developed by the Task Force (SRRTTF, 2012) identified four distinct phases of work:

- Phase 1: Review of existing data and reports, development of a data gaps assessment with recommendations for additional sampling, preparation of a Quality Assurance Project Plan for collection of additional data, and recommendation of analytical modeling tools to be used in Phase 3.
- Phase 2: Collection of additional data
- Phase 3: Analysis of data to characterize and quantify PCB sources
- Phase 4: Assess potential Best Management Practices and develop a Comprehensive Plan

The majority of Phase 1 activities were completed in 2013, and are documented separately in LimnoTech (2013a, 2013b, 2013c, and 2013d). Findings from these Phase 1 activities were presented at a Technical Monitoring Workshop in Spokane on December 4-5, 2013. The key conclusions from this workshop were as follows (LimnoTech, 2014a):

- It is not feasible to gain a detailed understanding of all contributing PCBs sources in a one (or two) year monitoring program.
- The first year of monitoring should focus on gaining a better understanding of existing dry weather sources, through baseline monitoring of the Spokane River above Lake Spokane.
- Additional "data mining" should be conducted to identify potential source areas prior to conducting any additional direct monitoring. In particular, data mining efforts should focus on: reviewing historical land used information to identify potential source areas, review of recently collected fish tissue data, and finger-printing assessment of existing PCB data.

Based on the workshop consensus, first-year Phase 2 monitoring focused on the Spokane River upstream of Lake Spokane. This monitoring program consisted of two components:

- A synoptic survey, conducted during summer low flow period
- Seasonally integrated sampling

The intent of the low flow synoptic survey was to support a mass balance assessment to identify the potential significance of groundwater PCB sources. The intent of the seasonally integrated sampling was to provide information on the seasonal variability of loading from Lake Coeur d'Alene, composited over a wide flow regime.

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

- Synoptic Survey
- Mass Balance Assessment
- Seasonally Integrated Sampling

2
SYNOPTIC SURVEY

A dry weather synoptic survey was conducted between August 12 and 24, 2014. Activities were conducted in accordance with the Quality Assurance Project Plan (LimnoTech, 2014c) and Sampling and Analysis Plan (LimnoTech, 2014d) developed for this project. Field activities are documented in Gravity (2014).

2.1 Sampling Locations

Sampling locations (Figure 1) included seven Spokane River stations, one station near the mouth of Hangman Creek, and seven point source discharges. The Spokane River stations were located at:

- Spokane River at Lake Coeur d'Alene Outlet
- Spokane River at Post Falls
- Spokane River at Barker Rd. Bridge
- Spokane River below Trent Ave. bridge
- Spokane River at Greene St.
- Spokane River at Spokane USGS Gage
- Spokane River below Nine Mile Dam

Surface water samples were collected on August 12, 14, 16, 18, 20, 22, and 24. One additional river sample was collected on August 23rd in accordance with the SAP (LimnoTech, 2014c) due to a rain event in Idaho the evening of August 22.

The point source discharges consisted of:

- Coeur d'Alene Advanced WWTP
- Post Falls WWTP
- Liberty Lake Sewer & Water District
- Kaiser Aluminum
- Inland Empire Paper
- Spokane County Regional Water Reclamation Facility
- City of Spokane Riverside Park Advanced WWTP

Point source effluent was sampled on August 13, 19, and 24. Effluent from the Hayden Area Regional Sewer Board WWTP was not sampled, as there was no discharge to the river from this facility during the survey period.

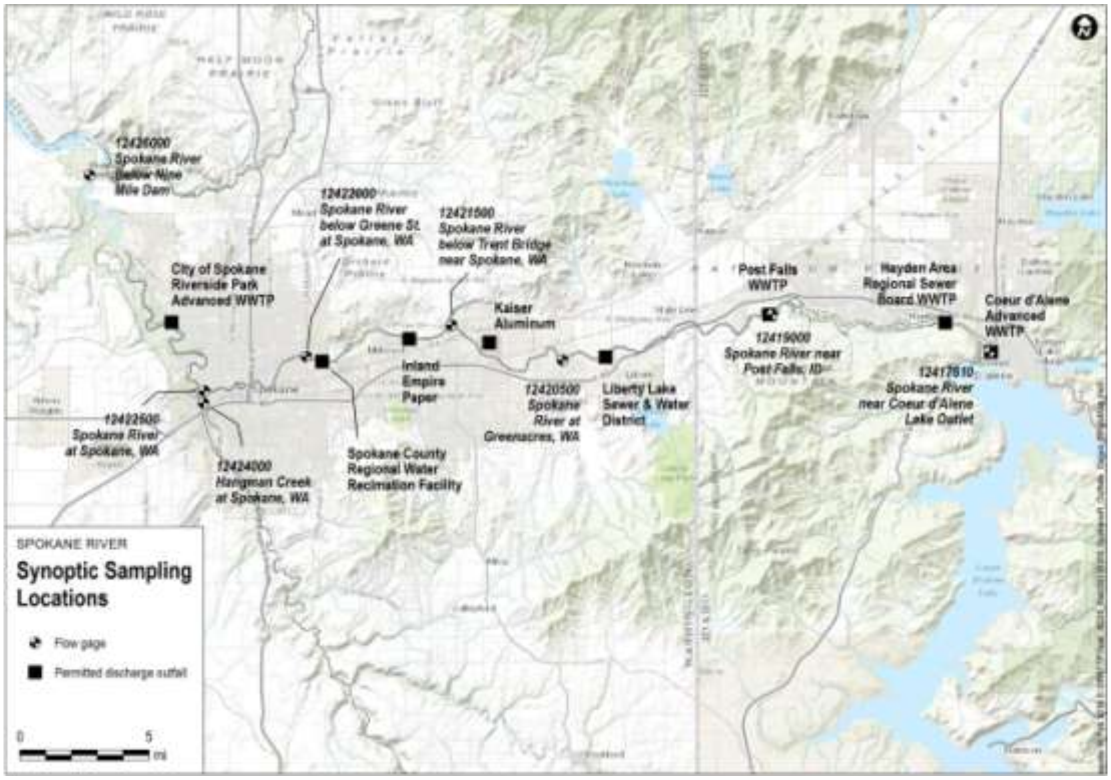

Figure 1. Sampling Locations for August 12-24, 2014 Synoptic Survey

2.2 Analytical Results

Field samples were shipped to AXYS Analytical Laboratories, Ltd. in Sidney, British Columbia, for analysis of PCB concentrations. PCB concentrations for individual congeners were blank-corrected following the process defined in the QAPP (LimnoTech, 2014c). A separate set of samples were taken to SVL Analytical, Inc. in Coeur d'Alene, ID for analysis of total dissolved solids, total suspended solids, total organic carbon, dissolved organic carbon. Data validation activities were conducted on both data sets.

Total PCB concentrations for the river stations are shown in Figure 2. Concentrations are largely below 50 pg/l from the Lake Coeur d'Alene outlet to the Barker Road Bridge. Concentrations are generally between 100 and 200 pg/l from the Trent Avenue Bridge downstream to Nine Mile Dam, with the range of concentrations in this lower section of the river being much greater than those observed at the upstream stations.

A detailed listing of PCB concentrations (total PCBs, plus individual homologs) and conventional parameters for each date at each sampling location is provided in Appendix A.

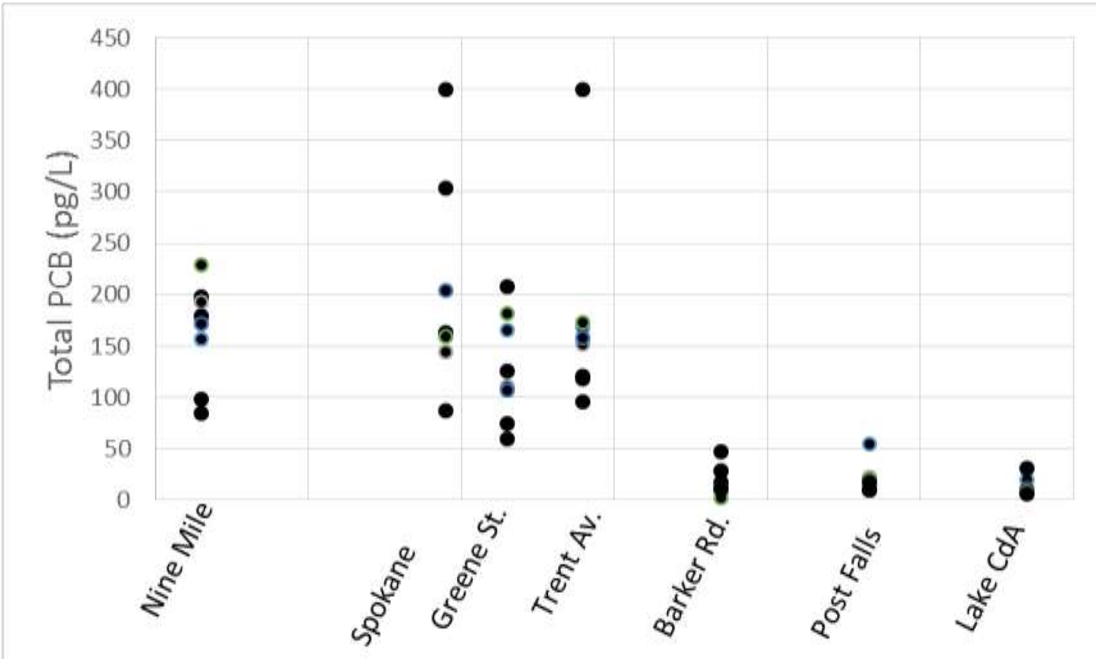

Figure 2. Spokane River Total PCB Concentrations Measured during Synoptic Survey

Blank

3
MASS BALANCE ASSESSMENT

The objective of the mass balance assessment is to use the results of the synoptic survey to determine if previously undocumented PCBs loads to the Spokane River exist during dry weather. This section describes the application of the mass balance assessment, and is divided into subsections of:

- Conceptual approach
- Initial application
- Revisions to initial application

3.1 Conceptual approach

The general conceptual approach of the mass balance assessment is to determine the presence of unmonitored loads 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 3 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.

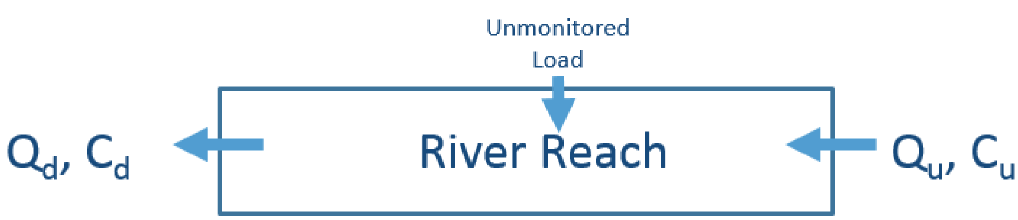

Figure 3. Simplified Description of Mass Balance Approach

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 CE-QUAL-W2 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 4.

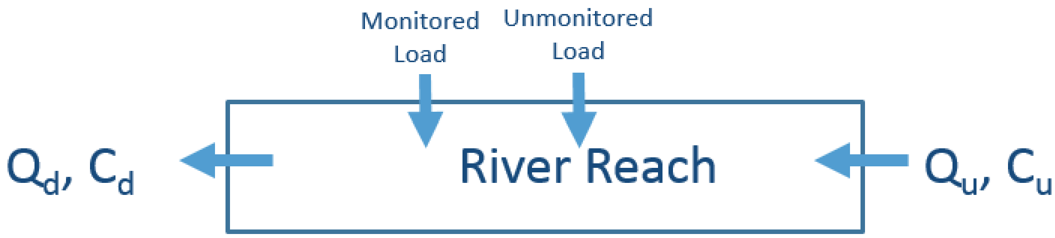

Figure 4. Mass Balance Approach in the Presence of a Monitored Load

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

Unmonitored load = Downstream load – Upstream load – Monitored Load (2)

3.2 Initial application

The mass balance assessment was initially applied prior to the Spokane River Toxics Workshop held in Spokane Valley on January 13th and 14th, 2015. The data on flows and concentrations used in the analysis are provided in Tables 1 through 4.

Table 1. River Flows (in cfs) Used in Mass Balance Assessment

	8/12	8/14	8/16	8/18	8/20	8/22	8/24
Post Falls	637	648	632	809	916	815	733
Barker Rd.	-	271	347	484	572	-	323
Trent Ave.	927	923	919	989	1060	1050	948
Spokane Gage	1030	1050	1080	1140	1250	1140	1140
Hangman Ck.	10	11	15	17	19	18	18
Nine Mile Dam	1040	1040	1060	1190	1250	1080	1120

Table 2. Point Source Flows (cfs) Used in Mass Balance Assessment

	8/13	8/19	8/24
Coeur d'Alene	5.3	5.4	5.4
HARSB	0	0	0
Post Falls	3.8	3.9	4.0
Liberty Lake	1.1	1.1	1.2
Kaiser Aluminum	13.3	14.4	13. 8
Inland Empire Paper	11.3	10.9	11.0
Spokane County	11.8	11.6	11.6
City of Spokane	43.6	45.7	43.0

Table 3. River Total PCB Concentrations (pg/l) Used in Mass Balance Assessment

	8/12	8/14	8/16	8/18	8/20	8/22	8/24	Composite
Nine Mile	156/ 197*	193	179	172	228	97	84	136
Hangman Ck.	64	66	67/ 73*	53	2444	265	35	95
Spokane Gage	163	163/ 144*	303	203	158	399	86	137
Greene St.	164	207	110	124/ 106*	181	74	59	124
Trent Ave.	168	117	152	399	158/ 172*	95	120	111
Barker Rd.	28	17	9	47	11	1/ 28*	10	29
Post Falls	53	9	22	19	17	19	17/ 9*	227
Coeur d'Alene	19	31	11	9	7	7	5	11

*Replicate sample

Table 4. Discharge Total PCB Concentrations (pg/l) Used in Mass Balance Assessment

	8/13	8/19	8/21	Composite
City of Spokane	771/ 955*	23404	1177	878
Spokane County	490	330/ 290*	333	274
Inland Empire Paper	3627	2957	2636/ 2629*	2766
Kaiser Aluminum	3276	4012	4625	2514
Liberty Lake	200	193	260	211
Post Falls	221	219	200	176
Coeur d'Alene	1227	534	531	668

*Replicate sample.

Some of the observed PCB concentrations were considered potentially anomalous, as they were much higher than other concentrations observed at the same site. These potentially anomalous values correspond to river concentrations of 2444 and 265 pg/l measured at Hangman Creek, the 303 and 399 pg/l measured at the Spokane Gage, the 399 pg/l measured at Trent Ave., and 53 pg/l measured at Post Falls. Potentially anomalous discharge PCB measurements were observed of 23,404 pg/l at the City of Spokane and 1227 pg/l at Coeur d'Alene. Because the mass balance analysis assumed steady-state conditions, the presence of concentrations un-representative of steady conditions provide the potential of biasing model results. For this reason, the mass balance analysis was conducted twice, once using all data values and once excluding potentially anomalous values. The analysis will be considered robust to the extent that the same conclusions are drawn using each of the above approaches for handling potentially anomalous data.

Results of the analysis are shown in Table 5 and graphed in Figure 5. The primary finding is the presence of a relative large unmonitored PCB source in the river reach between Barker Road and Trent Avenue, with an estimated magnitude of 166 to 241 mg/day depending upon the assumption made regarding potential anomalies. The potential exists for two smaller unknown sources, corresponding to 10 mg/day in the Coeur d'Alene to Post Falls reach and 52 mg/day in the Trent Avenue to Spokane Gage reach. Because the magnitude of these smaller sources strongly depends upon the assumption made regarding potential anomalies, no definitive conclusion can be made on them.

Table 5. Results of Initial Mass Balance Assessment

River Reach	Incremental Load (mg/day)	
	All Data	Potential Anomalies Excluded
Coeur d'Alene to Post Falls	10	-
Post Falls to Barker Road	-	1.3
Barker Road to Trent Avenue	241	166
Trent Avenue to Spokane Gage	52	-
Spokane Gage to Nine Mile	-	-

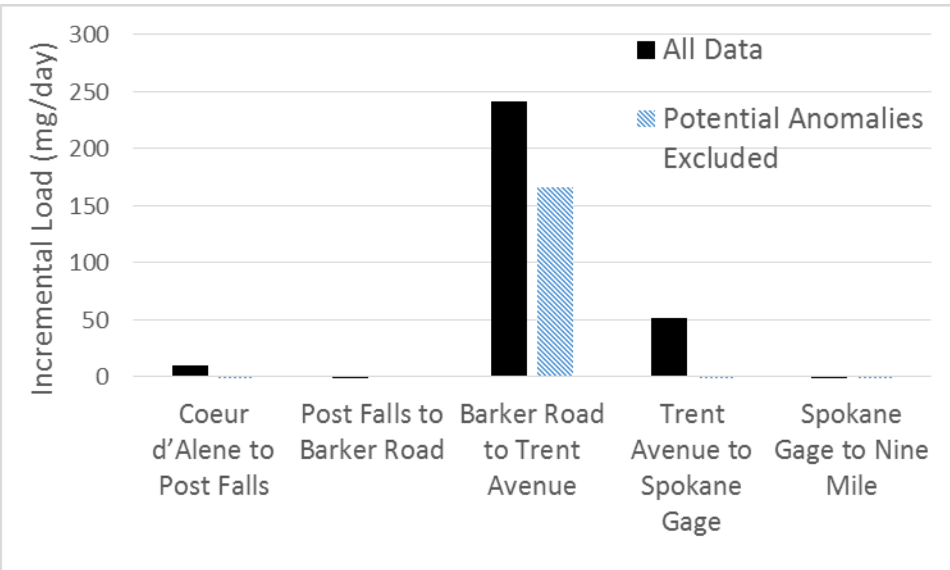

Figure 5. Results of Initial Mass Balance Assessment

3.3 Revisions to Initial Application

The results shown in Section 3.2 were presented at the Spokane River Toxics Workshop held in Spokane Valley on January 13th and 14th, 2015. Comments received at the workshop led to the following revisions being conducted to the mass balance assessment:

- Sensitivity analysis of groundwater quality assumption
- Evaluation of stormwater and CSO loading
- Evaluation of flows below Nine Mile Dam
- Add Greene St. segment

Revisions to the analysis made in response to each of these comments is discussed below.

3.3.1 Sensitivity analysis of groundwater quality assumption

The original mass balance assessment was based upon the assumption that groundwater lost from an upstream reach re-entered in the next downstream gaining reach at the same concentration at which it left the river. A comment was raised at the workshop that this assumption was not necessarily valid. To address this concern, a sensitivity analysis was conducted assuming that any groundwater leaving the river did not return in the study area, and that any groundwater addition to the river represented “new” groundwater. Although exact groundwater pathways are not defined, the results of these two simulations (i.e. the original analysis and the sensitivity analysis described above) will cover the full range of possible outcomes. Similar to the sensitivity analysis on potentially anomalous data, model results can be considered robust if the same conclusion is reached for the two alternate assumptions.

Results of the sensitivity analysis showed that the estimated unknown load in the Barker to Trent segment would change by less than ten percent if the groundwater assumption was changed from “groundwater lost from an upstream reach re-enters in the next downstream gaining reach” to “groundwater lost from an upstream reach does not re-enter in the study area.” Because the sensitivity of results to this assumption was so small, it was concluded that uncertainty in groundwater pathways was not a major source of uncertainty to the analysis.

3.3.2 Evaluation of stormwater and CSO loading

Although insufficient rainfall occurred at Felts Field in Spokane to violate the assumption of dry weather conditions as defined in the QAPP, it was noted at the January, 2014 workshop that some stormwater and CSO loading occurred during the synoptic survey in response to localized rainfall.

LimnoTech determined the significance of this stormwater and CSO loading on the mass balance assessment by repeating the assessment using best estimates of stormwater and CSO loads. Loading information was provided by the City of Spokane, which maintains flow meters on all CSO outfalls and three MS4 basins. CSO loads were calculated from monitored flows and average PCB concentration observed from in 2012-2014. Flows from the MS4 system were estimated based on the flow meter at the Cochran Basin, scaled to represent overall drainage area. Stormwater PCB concentrations were set at the average of values observed in 2012-2014. The resulting loads are shown by river segment in Table 6.

Table 6. Summary of Estimated CSO and Stormwater PCB Loads (mg/day) during Synoptic Survey

	8/12	8/13	8/20	8/22
CSO				
Greene St. to Spokane Gage	42.4		18.4	187.6
Spokane Gage to Nine Mile	20.1		1.8	13.4
Hangman Creek				2.4
MS4				
Trent Ave. to Greene St.		1.1	1.2	1.9
Greene St. to Spokane Gage		7.0	7.4	11.5
Spokane Gage to Nine Mile		26.3	27.9	43.4
Hangman Creek		1.74	1.84	2.87

The original mass balance assessment was revisited to reflect the loads shown in Table 6. Results changed minimally, indicating that stormwater and CSO loading did not bias the original mass balance conclusions.

3.3.3 Evaluation of Flows below Nine Mile Dam

Questions were raised at the workshop regarding the basis of the flows reported by Gravity for the Nine Mile Dam station. The reported flows were the sum of Spokane Gage and Hangman Creek Gages, which would not reflect potential short-term changes in flow caused by operations at Nine Mile Dam.

Conversations with staff in the field during the synoptic survey indicated that water levels were observed to be fluctuating at the Nine Mile Dam station. Follow-up discussions with Meghan Lunney from Avista indicated that Avista was doing work on Nine Mile Dam between August 14th and 18th, and confirmed that water levels would be fluctuating. Avista calculates flows at Nine Mile Dam for operational purposes, but these estimates are not intended to represent precise stream flows. While these estimates may be imprecise, they do indicate that flows varied several fold over the course of the synoptic survey period. Given the observed fluctuations in water levels and flows at the Nime Mile Dam station, we conclude that the assumption of steady conditions inherent to the mass balance approach is sufficiently violated such that mass balance calculations for the Spokane Gage to Nine Mile Dam segment should be given little credence.

3.3.4 Add Greene St. Segment

River flow measurements were not available at the Greene St. gaging station for the period of the synoptic survey, so the original mass balance assessment combined the originally intended “Trent to Greene” and “Greene to Spokane Gage” segments into a single “Trent to Spokane Gage” segment. The Spokane River Flow Monitoring Workgroup synthesized flow estimates for Greene Street, such that the combined segment could be divided back into its original component pieces. Their work (Lindsay, 2015) found a strong correlation between observed Greene St. flows and Spokane Gage flows from the period August 18 and September 13, 1999. Furthermore, for periods of flow approximating those observed during the 2014 synoptic survey, flows at Greene St. were consistently around 255 cfs higher than those observed at the Spokane Gage on the same date. The mass balance assessment was subsequently re-conducted to include the separate “Trent to Greene” and “Greene to Spokane Gage” segments by assuming Greene St. flows 255 cfs higher than Spokane Gage.

Results of the analysis are shown in Figure 6, and indicate that the majority of the incremental load that was originally tentatively identified for the lumped “Trent to Spokane Gage” segment is entering between Greene St. and the Spokane Gage, with an estimated loading rate of approximately 58 mg/day.

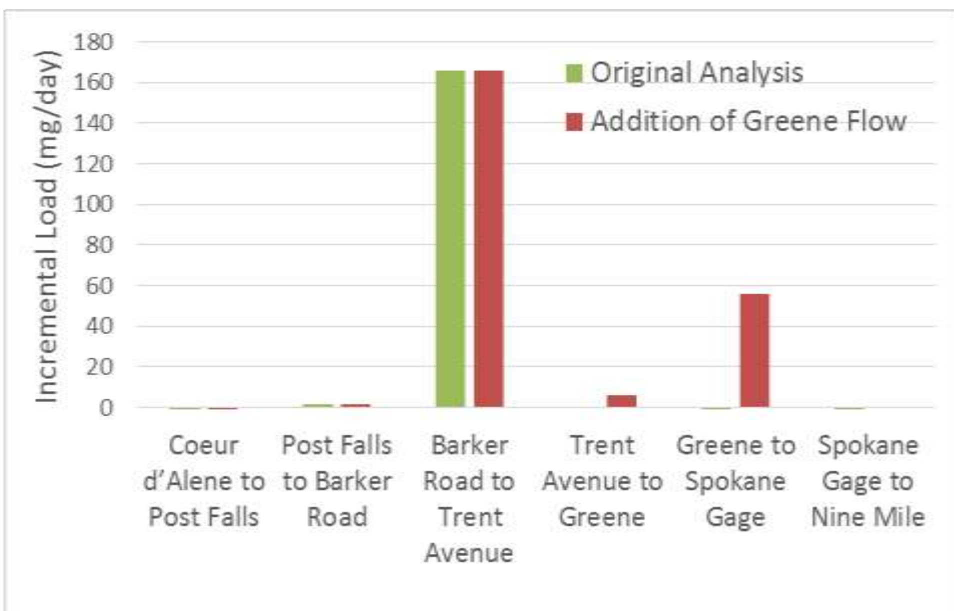

Figure 6. Revised Mass Balance Analysis Using Synthesized Greene St. Flows

Blank Page

4
SEASONALLY INTEGRATED SAMPLING

Seasonally Integrated Sampling was intended to provide information on the seasonal variability of upstream PCB loading to the Spokane River from Lake Coeur d'Alene, which will provide insight on the atmospheric contribution to the snow pack in the upstream watershed.

The sampling was originally intended to be conducted on a seasonally integrated basis, with multiple samples taken and composited over each of three different flow regimes:

- Spring high flow
- Summer low flow
- Winter moderate flows

Spring high flow monitoring was conducted May 13-21, 2014, and is documented in LimnoTech (2014b). Concentrations at the Lake Coeur d'Alene outlet were very low, with total PCB concentrations in river samples not being appreciably higher than concentrations observed in laboratory blanks. The summer low flow portion of the Seasonally Integrated Sampling was satisfied as part of the 2014 synoptic survey, with all results provided in Appendix A. Given the relatively small snow pack that occurred in the winter of 2014-2015, and the lack of observable concentrations during the spring high flow portion of the Seasonally Integrated Sampling, it was concluded at the January 2014 workshop to indefinitely forego sampling for the winter moderate flow condition.

Blank Page

5 REFERENCES

Gravity Consulting, L.L.C., 2014. 2014 Spokane River Field Sampling Report. Spokane River Regional Toxics Task Force. Washington and Idaho. Prepared for SRRTTF. October 2014

LimnoTech. 2013a. Data Request Memorandum in Support of PCB and Dioxin Control. April 17, 2013. Prepared for the Spokane River Regional Toxics Task Force. April 17, 2013.

LimnoTech. 2013b. Review of Standard Operating Procedures for PCB Data Collection and Analysis. Prepared for the Spokane River Regional Toxics Task Force. June, 28, 2013.

LimnoTech. 2013c. Data Acquisition Contact Log. Prepared for the Spokane River Regional Toxics Task Force. June, 28, 2013.

LimnoTech. 2013d. Review and Evaluation of Existing Data - Final. Prepared for the Spokane River Regional Toxics Task Force. August 30, 2013.

LimnoTech. 2013e. Identification of Data Gaps - Final. Prepared for the Spokane River Regional Toxics Task Force. November 14, 2013.

LimnoTech. 2014a. Data Collection Strategy for PCB Comprehensive Plan. Prepared for the Spokane River Regional Toxics Task Force. February 4, 2014.

LimnoTech. 2014b. Confidence Testing Results from Spokane River PCB Sampling. Prepared for the Spokane River Regional Toxics Task Force. July 16, 2014.

LimnoTech. 2014c. Quality Assurance Project Plan. Spokane River Toxics Reduction Strategy Study. Prepared for the Spokane River Regional Toxics Task Force. July 23, 2014.

LimnoTech. 2014d. Sampling and Analysis Plan. Spokane River Toxics Reduction Strategy Study. Prepared for the Spokane River Regional Toxics Task Force. July 31, 2014.

Lindsay, Rob. 2015. Correlation between Greene Street Bridge flow and Spokane Gage flow measurements. E-mail and spreadsheet sent March 5, 2015.

Serdar, D., B. Lubliner, A. Johnson, and D. Norton. 2011. Spokane River PCB Source Assessment, 2003-2007. Washington Department of Ecology, Toxics Studies Unit, Environmental Assessment Program. Department of Ecology Publication No. 11-03-013.

SRRTTF, 2012. Spokane River Regional Toxics Task Force (SRRTTF) First Draft Work Plan. Adopted 10-24-2012. http://srrttf.org/wp-content/uploads/2012/10/SRRTTF-Work-Plan-First-Draft-Adopted-10-24-12-CLEAN1.pdf

Blank Page

APPENDIX: SYNOPTIC SURVEY RESULTS

Blank Page

Table A-1: Analytical Results for Hangman Creek

Station HC1	8 / 12	8 / 14	8 / 16	8 / 16-R	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	76.2	104	101	110	77.3	2450	297	103
Total Monochloro Biphenyls (pg/l)	5.2	1.26	1.01	0.814	0.895	2.09	1.52	0.892
Total Dichloro Biphenyls (pg/l)	8.59	11.5	13.1	11.4	8.81	50.7	13.6	8.5
Total Trichloro Biphenyls (pg/l)	8.4	13.5	8.74	11.9	9.64	341	18.1	12.8
Total Tetrachloro Biphenyls (pg/l)	15.2	19.3	17.4	19.4	16.8	672	39.3	18
Total Pentachloro Biphenyls (pg/l)	21.8	26.8	28.8	29.1	22.1	704	93.6	29.7
Total Hexachloro Biphenyls (pg/l)	11.5	21.4	24.1	26.8	15.9	443	80.3	22.6
Total Heptachloro Biphenyls (pg/l)	4.38	7.47	7.84	8.91	2.57	183	33	7.42
Total Octachloro Biphenyls (pg/l)	0.873	2.43	0.3	UJ	0.556	44.7	12	1.64
Total Nonachloro Biphenyls (pg/l)	0.307	UJ	UJ	0.618	UJ	8.26	3.54	1.19
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	0.784	UJ	5.05	2.18	UJ
Total Dissolved Solids (mg/l)	241	260	256	256	245	243	250	245
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	2.69	2.86	2.86	2.86	2.94	2.65	3.33	3.05
Dissolved Organic Carbon (mg/l)	2.74	2.86	2.59	2.59	2.8	2.48	2.97	2.59

Table A-2: Analytical Results for Spokane River below 9 Mile Dam

Station SR1	8 / 12	8/12-R	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	159	200	195	183	171	234	168	150
Total Monochloro Biphenyls (pg/l)	1.65	2.72	1.74	1.44	2.69	1.7	1.33	3.03
Total Dichloro Biphenyls (pg/l)	48.9	50.6	37.6	35.4	30.3	32.3	28.4	29.2
Total Trichloro Biphenyls (pg/l)	26.2	34.4	33.1	28.9	28.2	35.1	26.3	25.2
Total Tetrachloro Biphenyls (pg/l)	36.5	45.8	42.2	48.2	42.1	56.1	44.3	38.3
Total Pentachloro Biphenyls (pg/l)	25.9	39.2	43.4	34.1	36.5	56.5	38.8	32.7
Total Hexachloro Biphenyls (pg/l)	15.2	19.2	26	30.1	24.3	36	21.5	16.7
Total Heptachloro Biphenyls (pg/l)	4.4	5.53	6.97	3.29	5.59	13.4	6.66	3.74
Total Octachloro Biphenyls (pg/l)	0.411	1.3	3.9	1.51	1.18	2.76	1.14	1.03
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	0.572	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.805	0.474	UJ	UJ	0.65	UJ	UJ
Total Dissolved Solids (mg/l)	146	146	137	157	160	155	142	143
Total Suspended Solids (mg/l)	5	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.31	1.31	1.64	1.32	1.29	1.32	1.39	1.18
Dissolved Organic Carbon (mg/l)	1.5	1.5	1.57	1.4	1.24	1.27	1.16	1.12

Table A-3: Analytical Results for Liberty Lake Sewer & Water District			
Station SR10	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	203	195	267
Total Monochloro Biphenyls (pg/l)	15.5	13.6	21.3
Total Dichloro Biphenyls (pg/l)	58	58.5	67
Total Trichloro Biphenyls (pg/l)	40.5	40.3	52.6
Total Tetrachloro Biphenyls (pg/l)	45.9	42.6	59
Total Pentachloro Biphenyls (pg/l)	31.2	30.1	46.9
Total Hexachloro Biphenyls (pg/l)	8.23	8.4	14.9
Total Heptachloro Biphenyls (pg/l)	2.48	1.07	4.37
Total Octachloro Biphenyls (pg/l)	0.326	0.363	0.272
Total Nonachloro Biphenyls (pg/l)	0.446	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.49
Total Dissolved Solids (mg/l)	277	288	294
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	6.43	6.64	6.36
Dissolved Organic Carbon (mg/l)	6.6	6.16	6.16

Table A-4: Analytical Results for Post Falls WWTP			
Station SR11	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	226	219	213
Total Monochloro Biphenyls (pg/l)	15.4	16.4	18.3
Total Dichloro Biphenyls (pg/l)	30	31.9	18.4
Total Trichloro Biphenyls (pg/l)	40.6	41.9	29.9
Total Tetrachloro Biphenyls (pg/l)	62.1	52.5	64.5
Total Pentachloro Biphenyls (pg/l)	45.7	43.7	47.1
Total Hexachloro Biphenyls (pg/l)	23.6	25.5	24.4
Total Heptachloro Biphenyls (pg/l)	8.59	7.07	9.44
Total Octachloro Biphenyls (pg/l)	UJ	0.319	0.577
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	353	349	361
Total Suspended Solids (mg/l)	5	<5.0	<5.0
Total Organic Carbon (mg/l)	7.98	7.8	7.04
Dissolved Organic Carbon (mg/l)	7.66	6.79	6.69

Table A-5: Analytical Results for Spokane River at Post Falls								
Station SR12	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24	8/24-R
Total PCBs (pg/l)	65.9	51.4	44.4	61.2	40.8	50.1	71.3	40.8
Total Monochloro Biphenyls (pg/l)	3.24	1.18	1.66	1.24	1.29	0.515	0.674	1.69
Total Dichloro Biphenyls (pg/l)	9.45	8.19	3.87	7.48	7.39	5.08	5.78	5.3
Total Trichloro Biphenyls (pg/l)	9.51	6.02	6.31	10.1	8.48	3.74	9.54	5.21
Total Tetrachloro Biphenyls (pg/l)	14.4	14.3	8.34	13.3	9.38	7.39	16.3	7.09
Total Pentachloro Biphenyls (pg/l)	18.6	11.3	10.5	15.3	8.63	6.03	21.6	11.1
Total Hexachloro Biphenyls (pg/l)	5.29	8.93	10	11.7	2.91	18	14.6	7.17
Total Heptachloro Biphenyls (pg/l)	3.57	1.17	1.63	1.66	2.44	8.46	1.62	2.34
Total Octachloro Biphenyls (pg/l)	0.561	UJ	1.84	0.334	UJ	0.844	0.771	0.4
Total Nonachloro Biphenyls (pg/l)	1.33	0.344	0.269	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	0.331	UJ	0.505	0.46
Total Dissolved Solids (mg/l)	39	36	33	31	35	37	32	32
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.69	1.76	1.6	1.61	1.54	1.72	1.55	1.55
Dissolved Organic Carbon (mg/l)	1.72	1.69	1.52	1.68	1.5	1.45	1.38	1.38

Table A-6: Analytical Results for Coeur d'Alene Advanced WWTP			
Station SR14	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	1240	534	535
Total Monochloro Biphenyls (pg/l)	7.66	9.03	10.6
Total Dichloro Biphenyls (pg/l)	135	102	103
Total Trichloro Biphenyls (pg/l)	127	85.4	87.2
Total Tetrachloro Biphenyls (pg/l)	277	106	118
Total Pentachloro Biphenyls (pg/l)	341	122	119
Total Hexachloro Biphenyls (pg/l)	244	71.9	65.9
Total Heptachloro Biphenyls (pg/l)	81.5	28.4	24.5
Total Octachloro Biphenyls (pg/l)	17	7.12	6.06
Total Nonachloro Biphenyls (pg/l)	3.59	1.28	UJ
Total Decachloro Biphenyls (pg/l)	2	UJ	UJ
Total Dissolved Solids (mg/l)	392	410	433
Total Suspended Solids (mg/l)	16	5	<5.0
Total Organic Carbon (mg/l)	13.4	8.49	7.46
Dissolved Organic Carbon (mg/l)	11.7	7.25	6.92

Table A-7: Analytical Results for Lake Coeur d'Alene Outlet

Station SR15	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 23
Total PCBs (pg/l)	30.6	40.6	32.5	36.9	27.4	37.1	33.3
Total Monochloro Biphenyls (pg/l)	1.75	1.11	1.03	0.423	0.374	1.67	0.883
Total Dichloro Biphenyls (pg/l)	4.71	5.16	3.47	6.2	5.91	4.64	4.33
Total Trichloro Biphenyls (pg/l)	3.51	2.65	3.59	6.33	3.81	5.48	5.72
Total Tetrachloro Biphenyls (pg/l)	7.44	7.94	7.84	7.84	8.32	6.87	8.99
Total Pentachloro Biphenyls (pg/l)	8.67	11.3	8.21	10	6.65	9.35	6.94
Total Hexachloro Biphenyls (pg/l)	3.81	11.1	6.3	3.59	1.42	7.78	4.67
Total Heptachloro Biphenyls (pg/l)	0.422	0.847	1.81	1.63	0.56	1.31	1.54
Total Octachloro Biphenyls (pg/l)	0.294	UJ	0.278	0.343	0.348	UJ	0.241
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.414	UJ	0.517	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	23	33	31	29	32	34	29
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.46	1.61	1.41	1.38	1.58	1.42	1.48
Dissolved Organic Carbon (mg/l)	1.62	1.61	1.5	1.47	1.4	1.39	1.28

Table A-8: Analytical Results for City of Spokane Riverside Park Advanced WWTP

Station SR2	8 / 13	8/13-R	8 / 19	8 / 21
Total PCBs (pg/l)	771	965	23400	1190
Total Monochloro Biphenyls (pg/l)	5.09	7.84	3.77	9.1
Total Dichloro Biphenyls (pg/l)	78.1	80.1	141	102
Total Trichloro Biphenyls (pg/l)	126	122	887	169
Total Tetrachloro Biphenyls (pg/l)	172	221	3390	248
Total Pentachloro Biphenyls (pg/l)	229	296	6250	349
Total Hexachloro Biphenyls (pg/l)	122	170	6340	217
Total Heptachloro Biphenyls (pg/l)	32	44.7	4530	77.3
Total Octachloro Biphenyls (pg/l)	2.76	16.7	1690	19.5
Total Nonachloro Biphenyls (pg/l)	2.03	3.97	150	3.1
Total Decachloro Biphenyls (pg/l)	0.86	1.64	15.6	1.19
Total Dissolved Solids (mg/l)	418	418	446	414
Total Suspended Solids (mg/l)	11	11	10	9
Total Organic Carbon (mg/l)	9.1	9.1	8.02	7.54
Dissolved Organic Carbon (mg/l)	8.72	8.72	6.63	6.98

Table A-9: Analytical Results for at Spokane Gage								
Station SR3	8 / 12	8 / 14	8/14-R	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	164	184	144	308	205	172	409	165
Total Monochloro Biphenyls (pg/l)	2.61	1.83	2.38	1.58	1.55	0.914	3.15	1.92
Total Dichloro Biphenyls (pg/l)	27.8	28.5	20.7	35.4	29.1	12.7	24.6	20.7
Total Trichloro Biphenyls (pg/l)	34.3	43.8	31.2	48.9	41	29.1	50.2	32.7
Total Tetrachloro Biphenyls (pg/l)	42	50.6	38.8	73.4	52.3	57.1	85.8	45.6
Total Pentachloro Biphenyls (pg/l)	35.1	33.9	32	81.2	44.8	42.3	121	38.2
Total Hexachloro Biphenyls (pg/l)	20	21.3	15	45.4	25	23.4	83.5	20.7
Total Heptachloro Biphenyls (pg/l)	1.97	4.03	3.68	14.6	9.05	5.68	28.6	4.11
Total Octachloro Biphenyls (pg/l)	0.53	UJ	0.654	4.35	0.78	0.568	8.55	1.02
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.88	0.315	UJ	2.12	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.13	0.72	UJ	0.717	UJ
Total Dissolved Solids (mg/l)	124	132	132	127	129	125	119	121
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.26	1.13	1.13	1.14	1.14	1.18	1.17	1.26
Dissolved Organic Carbon (mg/l)	1.29	1.05	1.05	1.07	1.21	1.05	1.16	1.05

Table A-10: Analytical Results for Spokane River at Greene Street Bridge								
Station SR4	8 / 13	8 / 14	8 / 16	8 / 18	8/18-R	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	173	214	138	152	121	190	138	124
Total Monochloro Biphenyls (pg/l)	3.24	7.24	1.06	1.77	2.89	UJ	4.58	4.42
Total Dichloro Biphenyls (pg/l)	21.6	23.2	18.6	17.7	17.1	9.23	14.7	15.9
Total Trichloro Biphenyls (pg/l)	32.9	42.1	36.8	40.2	34.4	50.1	37.6	32.1
Total Tetrachloro Biphenyls (pg/l)	45	54.9	44.5	54	40.2	76.8	50.3	43.8
Total Pentachloro Biphenyls (pg/l)	31.7	28.7	18.7	24.1	16.4	29.5	19.3	15.7
Total Hexachloro Biphenyls (pg/l)	20.8	28.9	14.6	11.8	6.97	18.3	8.98	8.84
Total Heptachloro Biphenyls (pg/l)	11.4	21.6	2.3	2.27	2.44	5.32	1.67	2.53
Total Octachloro Biphenyls (pg/l)	5.24	5.49	0.943	0.389	0.221	1.21	UJ	0.302
Total Nonachloro Biphenyls (pg/l)	1.52	1.57	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.641	UJ	UJ	UJ	UJ	0.39	0.481
Total Dissolved Solids (mg/l)	126	133	138	153	153	129	124	125
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.48	1.2	1.5	1.14	1.14	1.06	<1	1.32
Dissolved Organic Carbon (mg/l)	1.5	1.09	1.26	1.12	1.12	<1	<1	1.04

Table A-11: Analytical Results for Spokane County Regional Water Reclamation Facility				
Station SR5	8 / 13	8 / 19	8/19-R	8 / 21
Total PCBs (pg/l)	496	331	296	338
Total Monochloro Biphenyls (pg/l)	5.04	3.94	6.11	5.74
Total Dichloro Biphenyls (pg/l)	77.6	71.1	65.9	75.2
Total Trichloro Biphenyls (pg/l)	78.3	90.8	88.2	97.8
Total Tetrachloro Biphenyls (pg/l)	98.3	87	76.5	92.5
Total Pentachloro Biphenyls (pg/l)	98.3	58.9	47.9	54.1
Total Hexachloro Biphenyls (pg/l)	87	13.7	10.5	9.72
Total Heptachloro Biphenyls (pg/l)	40.8	3.42	0.962	2.74
Total Octachloro Biphenyls (pg/l)	8.58	1.02	UJ	UJ
Total Nonachloro Biphenyls (pg/l)	1.49	0.41	UJ	UJ
Total Decachloro Biphenyls (pg/l)	0.769	0.352	UJ	0.594
Total Dissolved Solids (mg/l)	602	524	524	500
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	5.96	4.99	4.99	4.28
Dissolved Organic Carbon (mg/l)	6.01	4.62	4.62	4.22

Table A-12: Analytical Results for Inland Empire Paper				
Station SR6	8 / 13	8 / 19	8 / 21	8/21-R
Total PCBs (pg/l)	4190	2970	2640	2630
Total Monochloro Biphenyls (pg/l)	69.5	52.2	45	45.8
Total Dichloro Biphenyls (pg/l)	1010	692	588	590
Total Trichloro Biphenyls (pg/l)	1840	1390	1190	1210
Total Tetrachloro Biphenyls (pg/l)	1040	684	621	622
Total Pentachloro Biphenyls (pg/l)	176	130	138	121
Total Hexachloro Biphenyls (pg/l)	40.4	14.6	31.7	29.3
Total Heptachloro Biphenyls (pg/l)	8.18	4.41	12.7	11.2
Total Octachloro Biphenyls (pg/l)	4.43	2.17	4.66	1.95
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.03
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	695	528	487	487
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	52.5	42.2	32.7	32.7
Dissolved Organic Carbon (mg/l)	50.9	37.7	29.7	29.7

Table A-13: Analytical Results for Spokane River Below Trent Bridge								
Station SR7	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 20-R	8 / 22	8 / 24
Total PCBs (pg/l)	177	138	171	414	169	187	128	148
Total Monochloro Biphenyls (pg/l)	1.78	0.741	1.61	1.32	1.11	1.44	1.29	1.6
Total Dichloro Biphenyls (pg/l)	10	8.79	10.8	11.3	10.9	11.5	2.88	7.81
Total Trichloro Biphenyls (pg/l)	39.4	41.2	44.6	95.1	45.3	49.7	37.3	44.6
Total Tetrachloro Biphenyls (pg/l)	86.8	66.2	87.1	211	81	87.5	65.6	72.3
Total Pentachloro Biphenyls (pg/l)	29	15.9	20.4	79.3	23	25.6	16	17.4
Total Hexachloro Biphenyls (pg/l)	7.27	4.46	4.26	12.7	6.1	8.08	4.38	4.37
Total Heptachloro Biphenyls (pg/l)	2.43	0.548	2.43	1.93	0.735	1.85	0.799	0.198
Total Octachloro Biphenyls (pg/l)	0.833	UJ	UJ	0.62	0.521	1.06	UJ	UJ
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.385	UJ	UJ	0.398	UJ	UJ
Total Dissolved Solids (mg/l)	126	129	125	108	108	108	113	116
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	<1	<1	1.31	<1	<1	<1	<1	<1
Dissolved Organic Carbon (mg/l)	<1	<1	<1	<1	<1	<1	<1	<1

Table A-14: Analytical Results for Kaiser Aluminum			
Station SR8	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	3290	4020	4640
Total Monochloro Biphenyls (pg/l)	5.79	4.64	6.39
Total Dichloro Biphenyls (pg/l)	227	227	238
Total Trichloro Biphenyls (pg/l)	1370	1570	1860
Total Tetrachloro Biphenyls (pg/l)	1410	1810	2120
Total Pentachloro Biphenyls (pg/l)	234	319	372
Total Hexachloro Biphenyls (pg/l)	27.3	52.2	35.2
Total Heptachloro Biphenyls (pg/l)	7.99	21	7.13
Total Octachloro Biphenyls (pg/l)	0.499	9.61	1.12
Total Nonachloro Biphenyls (pg/l)	UJ	0.383	UJ
Total Decachloro Biphenyls (pg/l)	0.61	UJ	UJ
Total Dissolved Solids (mg/l)	179	184	179
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.7	1.98	1.51
Dissolved Organic Carbon (mg/l)	1.62	1.34	1.22

Table A-15: Analytical Results for Spokane River at Barker Road Bridge								
Station SR9	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8/22-R	8 / 24
Total PCBs (pg/l)	43.3	56.7	35.4	80.6	42	26.9	73.2	37.1
Total Monochloro Biphenyls (pg/l)	1.72	2.79	1.24	9.8	1.66	1.78	1.07	1.26
Total Dichloro Biphenyls (pg/l)	7.35	9.14	5.64	15.4	9.24	5.36	5.31	6.65
Total Trichloro Biphenyls (pg/l)	3.9	7.84	5.31	22.7	7.28	4.99	5.15	7.75
Total Tetrachloro Biphenyls (pg/l)	9.85	13.5	8.24	15.2	10.1	5.89	11.6	8.9
Total Pentachloro Biphenyls (pg/l)	9.66	12.2	7.18	12.1	5.94	3.85	18.6	6.55
Total Hexachloro Biphenyls (pg/l)	8.27	6.7	5.45	3.16	5.14	4.39	19.6	4.04
Total Heptachloro Biphenyls (pg/l)	2.04	4.53	1.88	1.41	2.23	0.225	10.3	1.57
Total Octachloro Biphenyls (pg/l)	0.537	UJ	UJ	0.377	0.39	0.391	1.25	0.334
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	0.353	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.402	0.511	UJ	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	39	31	28	33	37	39	39	30
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.75	1.63	1.64	1.49	1.48	1.61	1.61	1.43
Dissolved Organic Carbon (mg/l)	1.74	1.61	1.54	1.8	1.51	1.43	1.43	1.42