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Memorandum

From:	Dave Dilks, Chelsie Boles	**Date:**	January 13, 2020
		Project:	SRRTTF9
To:	Spokane River Regional Toxics Task Force	CC:	

SUBJECT: DRAFT: Preliminary Assessment of Targeted Sampling during High River Flow

Summary

LimnoTech conducted a mass-balance assessment of the 2016 monthly Spokane River PCB sampling data to estimate nonpoint source PCB loads to the during non-low flow conditions. While it is recognized that the 2016 data were not specifically intended to support mass balance assessments, these analyses provide some insight into the potential for nonpoint source loads in various sections of the river during periods of higher river flow.

The results of the analysis show the greatest potential for higher flow nonpoint PCB loads in three segments of the river: 1) between Coeur d'Alene and Trent Avenue, 2) between Trent Ave. and Greene St., and 3) between the Spokane USGS Gage and Nine Mile Dam. The decision of which (if either) of these sections merit future sampling depend upon the Task Force's desire to focus on what appears to be the largest source (Coeur d'Alene to Trent) or focus on a previously uncharacterized source (between Trent Ave. and Greene St.)

Introduction

In May 2019, the Task Force held a multi-day Data Synthesis Workshop with two main goals:

- Review and discuss the analysis of the data that the Task Force has collected directly or supported the data collection work by others so that there would be a common level of understanding of the information that has been generated
- Gather input from the workshop attendees related to next steps that the Task Force could undertake for future work that can support meeting Task Force goals to find and reduce PCBs in the Spokane River basin.

The findings of this workshop indicated that nonpoint source loading of PCBs was relatively well understood during low river flow conditions, but that assessment of nonpoint source loading during higher river flow conditions had not been conducted. The Task Force subsequently approved a task assessing nonpoint source PCB loads to the River during non-low flow conditions. This memorandum describes that work, which has the following objectives.

- Review the 2016 monthly sampling data to estimate nonpoint source PCB contribution during month with non-low flows and develop a matrix of load by sampled river reaches
- Prioritize the reaches for potential future study.

The memorandum is divided into section of:

- Data used for assessment
- Loading assessment
- Prioritization of reaches

Data Used for Assessment

All analyses were conducted using data described in the original study report form the 2016 Monthly Monitoring (LimnoTech, 2017). Key aspects of those data are provided below. Sampling locations (Figure 1) included five Spokane River stations, as well as at the mouth of Hangman (Latah) Creek. The stations were at the following locations/latitudes and longitudes:

- Lake Coeur d'Alene Outlet (-116.7989162, 47.6816274)
- Spokane River below Trent Ave. Bridge near Plante's Ferry (-117.2418, 47.69708)
- Spokane River below Greene St. Bridge (-117.3628, 47.67808)
- Spokane River at Spokane USGS Gage (-117.4497, 47.65888)
- Spokane River Gage Station below Ninemile Dam (-117.5397324, 47.21437906)
- Latah (Hangman) Creek Gage Station (-117.44986, 47.6528668)

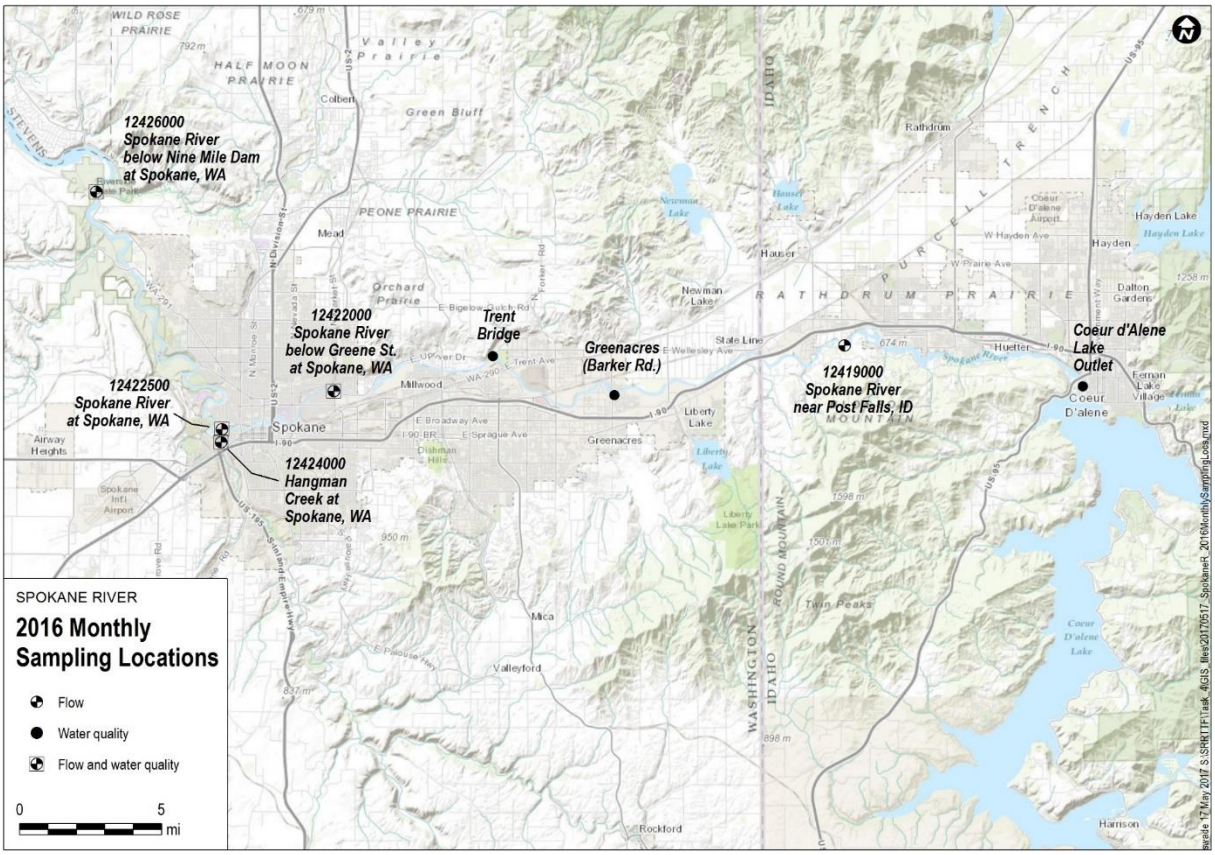

Figure 1. Sampling Locations for 2016 Monthly Sampling

A total of six monitoring events were conducted on the following dates:

- March 24, 2016
- April 19, 2016
- May 24, 2016
- June 16, 2016
- October 26, 2016
- December 13, 2016

Observed PCB concentrations are provided in Table 1. In April 2016, the sample normally collected at Trent Ave. was instead collected at Barker Road.

Table 1. Spokane River Total PCB Concentrations Measured during Monthly Surveys

Location	March	April	May	June	October	December
Lake Coeur d'Alene Outlet	14	33	17	3	18	
Trent Ave.	51		112	64	52	169
Barker Rd.		16				
Greene St.	67	76	87	78	135	9
Spokane Gage	64	57	50	63	207	10
Hangman (Latah) Creek	41	31	19	7	1053	38
Nine Mile	100	68	187	62	105	59

The flows to be used in the mass loading calculations for each month are provided in Table 2.

Table 2. Spokane River and Latah Creek Flows (cfs) Available for Loading Assessment

	3/24	4/19	5/24	6/16	10/26	12/13
Lake Coeur d'Alene	15700*	15100*	8540*	1830*	4340*	NA
Greene St.	15530	15050	8325	2703	4437	6581
Spokane USGS Gage	15400	15000	8180	2360	4280	6480
Hangman (Latah) Creek	1680	178	91	21	58	NA
Nine Mile	17080*	15178*	8271*	2632	4525	7024

*Direct flow measurement not available, estimated from other USGS gages as described in LimnoTech (2017)

Loading Assessment

Approach

The loading assessment conducted here was of a similar nature to prior mass balance assessments (LimnoTech, 2015; LimnoTech, 2016; LimnoTech, 2019), where nonpoint source load entering a given reach is calculated as:

Nonpoint Source Load Entering between Two Stations =
Load at Downstream Station - Load at Upstream Station – Known External Load (1)

The load at any station or external point source was calculated by multiplying observed (or assumed) flows by observed (or assumed) concentrations for the same time period. It is important to note that the load calculations conducted here differ from the prior studies in two important respects:

- In-river loads for these monthly events are estimated based upon a single day of sampling, compared to loads averaged over multiple days for the prior synoptic surveys.

- Point source loads were not measured in conjunction with the monthly river sampling, and had to be estimated from historical data.

The combined effect of the above items means that the resulting loads should be interpreted in more of a qualitative sense than as a specific estimate of loading rates. There is still value to be obtained from such an analysis, as a consistent prediction of large nonpoint source loads across many events for a given station provides evidence that an actual nonpoint source load exists.

External Loads

Direct measurements of external PCB loads were not available corresponding to each of the monthly survey events. In order to perform a mass balance calculation as shown in Equation 1, estimates for these loads must be provided. Loads for point sources were based upon available flow and effluent concentrations collected as part of SRRTTF and routine discharger monitoring. These concentrations and resulting loads were held constant across all monthly events and are listed in Table 3. External loads for Hangman (Latah) Creek varied by month and were based upon the flows and concentrations provided in Tables 1 and 2.

Table 3. Estimate of External Loads Used for 2016 Monthly Mass Balance Calculations.

Point Source	PCB Conc. (pg/l)	Flow (cfs)	Load (mg/day)
Coeur d'Alene	532.5	5.19	6.77
HARSB	143.8	1.71	0.60
Inland Empire Paper	3180.4	10.83	84.28
Kaiser Aluminum	3264.2	18.40	146.98
Liberty Lake	218.7	1.15	0.61
Post Falls	213.4	3.88	2.03
City of Spokane	974.8	48.94	116.73
Spokane County	361.3	11.79	10.42

Calculated Loads

Nonpoint source PCB loads for each reach for each month were calculated for each reach and each month (except December) using Equation 1 and the data provided above. Loads were not calculated for the December sampling due to quality control issues with those samples as discussed in LimnoTech (2017). Loading estimates for June can also be discounted as being non-representative of higher-flow conditions, as observed river flows were close to summer low-flow levels. Results for the months considered to provide representative data are listed in Table 4 and displayed graphically in Figure 2.

Table 4. Calculated Nonpoint Source PCB Load by River Segment and Month

	March	April	May	June	October
Cdal-Trent	1285	1328	1869	165	241
Trent-Greene	473	1328	-703	86	783
Greene-USGS	-134	-707	-771	-152	702
USGS-Ninemile	1482	303	2662	-82	-1271

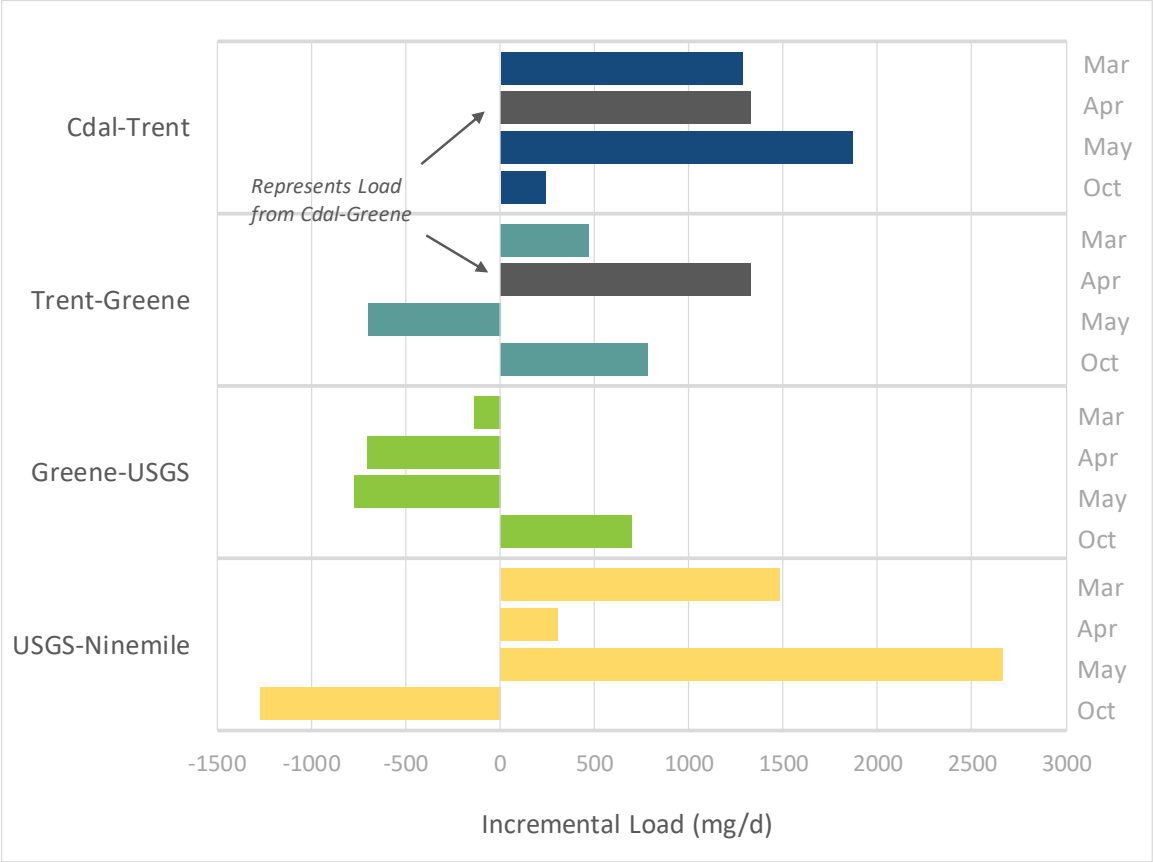

Figure 2. Nonpoint Source PCB Loads by River Segment and Month

The segment between Coeur d'Alene and Trent Avenue shows consistent nonpoint source loads across all months. The segments of Trent Avenue-Greene St. and Spokane USGS gage-Ninemile Dam both indicate potential nonpoint source loads in three of the four months. The segment between Greene St. and the Spokane USGS gage indicate potential nonpoint source loads in only one of the four months.

Prioritization of Reaches

The ultimate intent of this memorandum is to prioritize reaches for potential future study to characterize non-point source PCB loads during higher-flow conditions. The primary factors considered here are:

- Magnitude of potential load
- Utility of loading information

Magnitude of potential load

The magnitude of nonpoint source loads at high flow can only be roughly estimated at this point, given that the data used to support this assessment was not collected with the intention of supporting a mass balance assessment. The reach between Greene St. and the USGS can be eliminated from consideration from a magnitude perspective, as results for three of the four

months show a net negative nonpoint source loads. The segment between Coeur d'Alene and Trent Avenue can be considered highest priority from a magnitude perspective, as results indicate the presence of nonpoint for all four months, plus this segment has the highest overall load and median monthly load. The segments of Trent Avenue-Greene St. and Spokane USGS gage-Ninemile Dam are of slightly lower priority from a magnitude perspective, as results indicate the presence of potential nonpoint source loads in three of the four months, with the overall load and median monthly load similar between the two reaches.

Utility of loading information

The second consideration when prioritizing reaches for potential future study is the utility of the loading information gained with respect to supporting future reduction efforts. While the segment between Coeur d'Alene and Trent Avenue may be highest priority from a magnitude perspective, it may be less useful in terms of supporting future reduction efforts because:

1. The load is most likely entering in the vicinity of the Kaiser facility, given known groundwater contamination there as well as evidence of very low PCBs upstream of the facility at Barker Rd. during April
2. Groundwater PCB control efforts are already in place at Kaiser, under the direction of Ecology's Toxics Control Program.

For that reason, identification of high-flow nonpoint source loads for this section may not necessarily provide information of a "new" source to control.

Results from the 2018 synoptic survey (LimnoTech, 2019) identified a potential nonpoint source of PCBs in the Spokane USGS gage to Ninemile Dam section, although a specific location for this potential source was not identified due to the nearly fifteen mile reach of this section. The Trent Avenue to Greene St. segment covers less than half this distance, such that determination of the existence of high-flow nonpoint source loads would provide somewhat more detail on the location of the loading source.

References

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

LimnoTech, 2016. Spokane River Regional Toxics Task Force 2015 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. November 16, 2016

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