Spokane and Little Spokane Rivers Polychlorinated Biphenyls Total Maximum Daily Loads

U.S. Environmental Protection Agency

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AU	Assessment Unit
BMP	Best Management Practice
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CSO	Combined Sewer Overflow
CWA	Clean Water Act
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
HUC	Hydrologic Unit Code
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
LA	Load Allocation
LC	Loading Capacity
MGD	Millions of Gallons Per Day
MOS	Margin of Safety
MS4	Municipal Separated Storm Sewer System
NHD	USGS National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
PCB-"X"	Specific PCB Congener (NOTE: "X" is replaced with the number of chlorine substituents; e.g., PCB-42.)
PCBs	Polychlorinated Biphenyls (NOTE: Refers to total PCBs unless otherwise specified.)
pg/L	Picograms Per Liter
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RM	River Mile
SRRTTF	Spokane River Regional Toxics Task Force
SRTAC	Spokane River Toxics Advisory Committee
STP	Sewage Treatment Plan
TCP	Washington Department of Ecology Toxics Cleanup Program
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WAC	Washington Administrative Code
WLA	Wasteload Allocation
WQC	Water Quality Criteria
WQS	Water Quality Standards
WRIA	Ecology Water Resource Inventory Area
WWTP	Wastewater Treatment Plant

Executive Summary

Polychlorinated biphenyl (PCB) pollution has impacted Spokane River Basin surface waters for over a century, and the Spokane and Little Spokane Rivers contain assessment units (AUs) that the Washington Department of Ecology (Ecology) listed as impaired for PCB pollution in its approved 2014-2018 Clean Water Act (CWA) 303(d) list. PCB pollution poses significant human health implications due to its biologically toxic and environmentally persistent nature. PCBs bioaccumulate in food webs, and exposure increases the risks of many negative health impacts including developmental and neurological problems in children, disruptions of the endocrine system, immune system suppression, and an increased risk of certain cancers. PCBs reach humans through contaminated air, water, soil, or food, and PCB exposure is particularly concerning for communities that rely on impacted water bodies for recreational or subsistence fishing.

The U.S. Environmental Protection Agency (EPA) is developing the Total Maximum Daily Loads (TMDLs) for PCBs in the Spokane River to establish specific PCB water quality allocations and promote actions to protect public health. This TMDL project establishes pollution budgets that achieve the water quality standards of the State of Washington (Washington) and Spokane Tribe of Indians (Spokane Tribe) in the Spokane River from the Washington-Idaho border downstream to the confluence with the Columbia River, and in the Little Spokane River from the Washington-Idaho border to its confluence with the Spokane River.

The federal CWA requires the EPA, state, or authorized Tribe to establish TMDLs for AUs on the 303(d) list. Washington listed the Spokane River on the state's 2014-2018 303(d) list as impaired due to PCB levels in fish tissue that exceed the state's water quality standards at various monitoring locations. Current PCB levels in fish tissue and water quality also exceed the Spokane Tribe's water quality standards. The Spokane Tribe's water quality standards for PCBs are more stringent than Washington's water quality standards and drive the PCB reduction goals of this TMDL project.

The TMDL project applies a conservative, mass balance approach to allocate PCB loadings to achieve water quality standards. This approach assumes that there is no PCB mass loss from the release point into the Spokane River, and all PCB mass is transported downstream with the river flow. The EPA has applied these assumptions in mass balance spreadsheet models to support the TMDL project's source assessment and allocations.

This TMDL project puts forth wasteload and load allocations equal to the Spokane Tribe's numeric total PCB water quality criterion of 1.3 pg/L for all sources and to all AUs within the project's geographic scope. The TMDLs assign wasteload allocations (WLAs) to National Pollutant Discharge Elimination System (NPDES) permitted dischargers and assigns load allocations (LAs) to nonpoint source dischargers equal to their discharge volumes multiplied by the Spokane Tribe PCB water quality criterion. The EPA addressed margins of safety requirements through multiple conservative assumptions, including the assumption that PCBs introduced to the Spokane or Little Spokane Rivers water column remain in the water column and undergo no degradation, adsorption, volatilization, or are in any other way removed from the analytical hydrological model until the confluence with the Columbia River. By setting the TMDLs to the Spokane Tribe water quality criterion, the project accommodates future growth provided by effluent discharge concentrations remain at or below the water quality criterion. Total PCBs TMDLs for all PCB-impaired AUs addressed by this TMDL project are shown in Table 1.

Table 1: Total PCBs TMDL Loading Capacities for all AUs on the Spokane and Little Spokane Rivers listed as Category 5 for PCB impairment in Ecology's 2014-2018 303(d) list

Washington AU ID	AU Description (River Miles)	Loading Capacity (mg/day)
WA17010305000012_001_001	Confluence of Spokane River and Cable Creek to Washington-Idaho border (RMs 94.8 – 96.3)	5.9
WA17010305000011_001_001	Myrtle Point Natural Area to Cable Creek Confluence (RMs 84.7 – 94.8)	5.8
WA17010305000010_001_001	Felts Field Park to Myrtle Point Natural Area (RMs 80.9 – 84.7)	7.0
WA17010305000009_001_002	Upstream of Latah Creek and Spokane River confluence to south of Felts Field Municipal Airport (RMs 72.7 – 80.2)	7.5
WA17010307009102_001_001	Between West Davenport and Aubrey Ln (RMs 63.1 – 64.5)	8.1
WA17010307009085_001_001	Between Seven Mile Rd and West Davenport (RMs 62.4 – 63.1)	8.2
WA17010307009615_001_001	Between McLellan Trailhead and Seven Mile Rd (RMs 61.0 - 62.1)	8.2
WA17010307000774_001_001	Nine Mile Falls to Deep Creek (RMs 58.3 – 59.3)	8.4
WA17010308000018_001_001**	Little Spokane River AU: Spokane/Little Spokane River confluence to West Rutter Pkwy (Little Spokane RMs 0.0 – 4.7)	1.6
WA170103070106_01_01	East Side of Spokane Lake (RMs 45.5 – 58.3)	10.1
WA170103070107_01_01	West Side of Spokane Lake (RMs 34.2 – 45.5)	10.9
WA17010307000010_001_001	South side of Spokane Arm across from the Spokane Tribe reservation, from Porcupine Bay Campground to Blue Creek (RMs 11.0 -12.7)	11.4
Notes: * - Appendix A: Applicable PCB Water Quality Standards provides a crosswalk between the 12 AUs in the 2014-2018 303(d) list and the 19 AUs from the 2012 303(d) list cited in the consent decree and required to be completed under court order. ** - This is the single Little Spokane River AU currently listed as PCB-impaired.		

1 Introduction

This document establishes water column total PCB TMDLs for all PCB-impaired AUs on the Spokane and Little Spokane Rivers contained within Washington, as mandated by Section 303(d) of the CWA and its implementing regulations at Title 40 of the Code of Federal Regulations (CFR) Section 130.7. These TMDLs are required because Washington has identified portions of the rivers as impaired due to PCB levels in fish tissue that exceed the applicable water quality standards. Multiple PCB water quality standards apply to surface waters of the Spokane River basin, with the two most relevant to this TMDL project being those of Washington and the Spokane Tribe. This TMDL project addresses PCB-impaired AUs in the Spokane River under Washington's jurisdiction.

All water quality standards are designed to protect beneficial uses of those waters. For uses in the Spokane and Little Spokane Rivers, the Spokane Tribe's criterion for human consumption of water and organisms is the most stringent applicable criterion for total PCBs. The Spokane River Valley holds profound significance for many Tribes, particularly the Spokane Tribe, and it has been a vital resource and cultural focal point for generations. The rivers' abundant fisheries played a central role in the lives of native peoples who inhabited the region. Fish served as a primary source of sustenance, providing not only nourishment but also served as a focus for cultural and ceremonial practices. Today Spokane Tribe members still fish the waters of the Spokane River Basin, now joined by recreational fishing enthusiasts. Both groups will benefit from the PCB pollution budget put forth in this TMDL, designed to protect against adverse human health impacts of fish consumption.

Under the CWA, TMDLs help states, Tribes, other jurisdictions, and the EPA to assess and ultimately address water quality impairments. The TMDL process begins when an authorized jurisdiction identifies impaired waters – those waters that do not meet established water quality standards. TMDLs cap the total amount of the relevant pollutant the water body can receive without exceeding applicable water quality standards. TMDL calculations consider pollutant contributions from point sources (such as permitted industrial or stormwater discharges) and nonpoint sources (such as stormwater not routed through a permitted facility and atmospheric deposition). TMDLs assign point source pollution dischargers a WLA and assign nonpoint pollution sources an LA.

The CWA requires TMDLs to include a margin of safety (MOS) "which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR § 130.7(c)(1)). Understanding water quality is difficult and uncertainty can arise, for example, from limitations in effluent or environmental monitoring data (both in time and space), unrecognized errors in sample collection, transport, or analysis, and unknown yet complex instream processes. TMDL writers can use explicit or implicit MOS, or a combination of the two. Explicit MOS may be a percentage set-aside based on estimated uncertainty derived from analytical method precision or peer-reviewed literature values. Implicit MOS arise from clearly stated conservative assumptions throughout TMDL analysis.

1.1 Total Maximum Daily Loads and the Clean Water Act

CWA Section 303(c) requires states to establish water quality standards that identify each waterbody's designated uses and the criteria needed to support those uses. CWA Section 303(d) requires states to develop lists of impaired waters, referred to as Category 5 waters in states' CWA Section 305(b) integrated reports. When an AU does not attain a water quality standard, and a designated use is threatened or impaired by pollutants, such waters require TMDLs. Where more than one pollutant is associated with the impairment of a single AU, the AU will remain in Category 5 until TMDLs for all pollutants have been completed and approved by the EPA (EPA, 2002). Each pollutant-waterbody pairing requires a TMDL. A TMDL project combines two or more TMDLs to address related impairments in a single undertaking. In most cases, states issue TMDLs; In this case, the EPA is issuing the TMDLs directly to satisfy a 2022 consent decree.

A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet applicable water quality standards. This TMDL project sets PCB pollution inputs to the Spokane and Little

Spokane Rivers at or below levels that can safely be assimilated by the river while achieving and maintaining Washington's water quality standards in all reaches, and Spokane Tribe's water quality standards in reaches adjacent to their reservation.

1.2 Total Maximum Daily Loads Geographic Scope

This TMDL project includes all Washington waters of the Spokane River, including Lake Spokane (also known as Long Lake), from its confluence with the Columbia River to the Washington-Idaho border, and all waters of the Little Spokane River from its confluence with the Spokane River to its headwaters near the Washington-Idaho border. Between river mile 0.0, the confluence of the Spokane River with the Columbia River, and river mile 32.5, at the confluence of Chamokane Creek, the southern portion of the Spokane River is under Washington's jurisdiction, and the northern portion adjacent to the Spokane Tribe reservation is under Spokane Tribe's jurisdiction. The TMDLs address only waters within the state of Washington. Portions of the Spokane River in Idaho, and PCB sources in the Idaho portion of the Spokane River basin, are not addressed by this TMDL project, though the TMDLs assign a boundary condition concentration for PCBs at the Washington-Idaho state line necessary to achieve WQS in downstream waters of the state of Washington and Spokane Tribe. Similarly, the TMDL project does not address Spokane Tribe's waters, though the TMDLs assign a boundary condition concentration for PCBs in tribal waters to achieve Spokane Tribe's and Washington's water quality standards.

1.3 Spokane River Basin

The Spokane River basin encompasses 6,583 square miles of northeastern Washington and northern Idaho (Figure 1). The headwaters of the river drain the western slope of the hydrologic divide that defines the Idaho-Montana state border. The U.S. Geological Survey (USGS) designates the Spokane River Basin with hydrologic unit code[1] (HUC) 170103. The upper and lower basins have numerous natural and anthropogenic distinctions, and the PCB pollution dynamics between the two are unique.

The upper basin, covering 3,701 square miles, lies almost entirely (99.76%) within Idaho and is made up of four USGS subbasins; Upper Coeur d'Alene (HUC 17010301), South Fork Coeur d'Alene (HUC 17010302), Coeur d'Alene Lake (HUC 17010303), and St. Joe (HUC 17010304). Virtually all precipitation and surface runoff within the upper basin is routed through Lake Coeur d'Alene before entering the Spokane River or any of its tributaries. Precipitation or runoff that is not routed through Lake Coeur d'Alene passes through the Spokane Valley Rathdrum Prairie Aquifer as groundwater before draining to the Spokane River. In total, just 0.23% of the upper basin area is classified as "urban" by the U.S. Census Bureau (TIGER 2023), with notable population centers including Coeur d'Alene (16.91 square miles; population 42,976), Harrison (4.40 square miles; population 59), and Kellogg (4.01 square miles; population 225).

[1] USGS assigns each hydrologic unit a 2-digit to 12-digit number that uniquely identifies each of the six levels of classification within six two-digit fields. This system divides the country into 22 regions (2-digit), 245 subregions (4-digit), 405 basins (6-digit), about 2,400 subbasins (8-digit), about 19,000 watersheds (10-digit), and about 105,000 subwatersheds (12-digit). The Spokane River Basin has a 6-digit number, 170103, and its subbasins are designated by adding two digits to that code so that for example, the Upper Coeur d'Alene subbasin is 17010301.

The lower basin, covering 2,883 square miles, lies predominately (77.95%) within Washington and is made up of four USGS subbasins; Upper Spokane (HUC 17010305), Hangman[2] (HUC 17010306), Lower Spokane (HUC 17010307), and Little Spokane (HUC 17010308). These USGS subbasin boundaries are generally the same as Ecology's formally designated Water Resource Inventory Areas (WRIAs). Washington's natural resource agencies – Ecology, Department of Natural Resources, and Washington Department of Fish and Wildlife – decided the original WRIA boundaries in 1970 and updated them in 1998 and 2000. Ecology's WRIA 54: Lower Spokane is virtually identical to USGS subbasin Lower Spokane (HUC 17010307), while WRIA 55: Little Spokane, WRIA 56: Hangman (Latah), and WRIA 57: Middle Spokane, generally encompass the Washington portions of USGS subbasin Little Spokane (HUC 17010308), Hangman (Latah) (HUC 17010306), and Upper Spokane (HUC 17010305), respectively. The entire lengths of both the Spokane and Little Spokane Rivers lie within the lower basin. Virtually all precipitation and surface runoff within the lower basin is routed through surface tributaries or the shallow aquifer before draining to the Spokane River. In total, 7.55% of the lower basin area is classified as "urban" by the U.S. Census Bureau (TIGER 2023), with notable population centers including Spokane (69.52 square miles; population 218,922), Spokane Valley (38.01 square miles; population 90,512), and Post Falls (16.15 square miles; population 33,621).

[2] Note: The state of Washington and Spokane County have both elected to use "Latah Creek" as the official waterbody name, though "Hangman Creek" is still employed in other government resources.

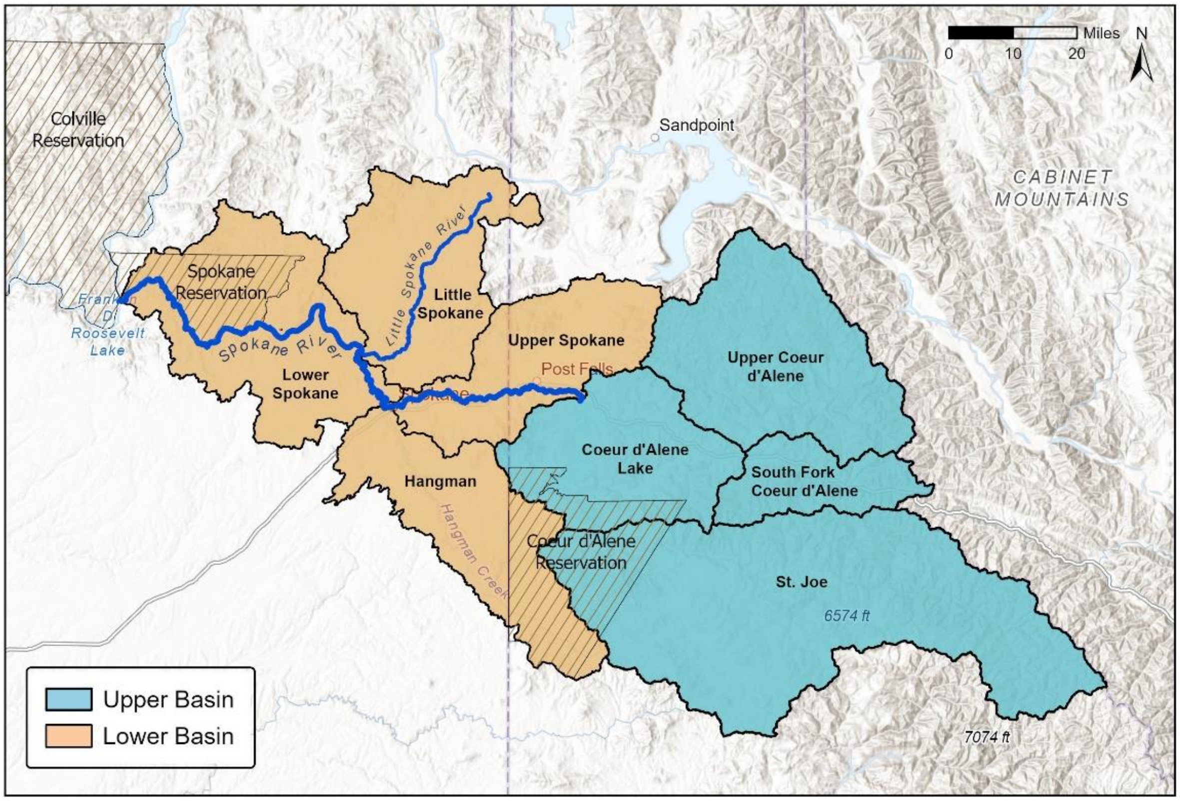


Figure 1: The Spokane River basin (HUC 170103) is comprised of eight subbasins. Four lie below the outlet of Lake Coeur d'Alene and make up the lower basin, while four more lie above Lake Coeur d'Alene and make up the upper basin.

1.3.1 Basin Geography

The Spokane River basin exhibits diverse topography (Table 2), soil types (Table 3), ecoregions (Figure 2), and land cover (Table 4). The entire basin experiences over 6,300 ft of elevation change, transitioning from mountainous terrain in the upper basin to rolling plains in the lower basin. The basin hosts diverse ecosystems ranging from montane forest and alpine meadows in the highlands to riparian corridors, wetlands, and shrub-steppe habitats in the lowlands. Coniferous forests, primarily pine, fir and cedar, cover substantial portions of the basin, provide critical habitat for wildlife, and support timber and recreational economic opportunities. Riparian zones along the Spokane River and its tributaries are characterized by dense vegetation, including cottonwoods, willows, and alders, which play a crucial role in stabilizing stream banks, filtering pollutants, and providing habitat for aquatic species.

The upper basin is dominated by the rugged peaks of the Selkirk and Bitterroot mountain ranges, characterized by steep slopes, deep valleys, and rocky outcrops. Geologically, the upper basin is comprised of complex geological formations, including granite, schist, and basalt, shaped by glacial and fluvial processes over millennia. High elevation, west-facing slopes drive precipitation, which feeds headwater streams that drain to Lake Coeur d'Alene, which in turn feeds the Spokane River.

The lower basin transitions to rolling hills and fertile valleys and is primarily composed of sedimentary deposits such as loess and alluvium. This gentler topography when compared to the upper basin supports extensive agriculture, with land cover dominated by croplands, orchards, and pasture lands. Urbanization is concentrated in the lower basin along both sides of the Spokane River, where residential, commercial, and industrial development dominate the riverbanks continuously for dozens of miles.

Table 2: Topographic parameters derived from the USGS 3D Elevation Program 1/3 arc-second digital elevation model (USGS 2023). The lower basin is considerably lower elevation and less steep than the upper basin, which contributes to different hydrological conditions between the lower and upper basins that are further exacerbated by additional aspects of their acutely different geographic settings.

Parameter	Lower basin	Upper basin	Total Basin
Area (square miles)	2,883	3,700	6,583
Elevation Minimum (ft)	1,280	2,123	1,280
Elevation Mean (ft)	2,466	3,768	3,198
Elevation Maximum (ft)	5,853	7,688	7,688
Slope Mean (°)	7.38	20.12	14.54

Table 3: Natural Resource Conservation Service (NRCS) Gridded National Soil Survey Geographic Database hydrologic soil group types differ considerably between the lower and upper basins (NRCS 2023). The lower basin hosts a diversity of hydrologic soil groups, including substantially more low-infiltration soils than the upper basin, which is dominated by Group B soils with moderate infiltration rates.

Hydrologic Soil Group*	Lower basin	Upper basin	Total Basin
Group A (%)	19.2	0.80	8.8
Group B (%)	36.2	80.4	61.3
Group C (%)	32.5	9.6	19.5
Group D (%)	3.6	3.6	3.6
Group A/D (%)	0.13	0.01	0.06
Group B/D (%)	2.8	1.1	1.8
Group C/D (%)	5.6	4.5	5.0

* Note:

- Group A soils consist of deep, well drained sands or gravelly sands with high infiltration and low runoff rates.
- Group B soils consist of deep well drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff.
- Group C consists of soils with a layer that impedes the downward movement of water or fine textured soils and a slow rate of infiltration.
- Group D consists of soils with a very slow infiltration rate and high runoff potential. This group is composed of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.
- Group A/D soils naturally have a very slow infiltration rate due to a high water table but will have high infiltration and low runoff rates if drained.
- Group B/D soils naturally have a very slow infiltration rate due to a high water table but will have a moderate rate of infiltration and runoff if drained.

- Group C/D soils naturally have a very slow infiltration rate due to a high water table but will have a slow rate of infiltration if drained.

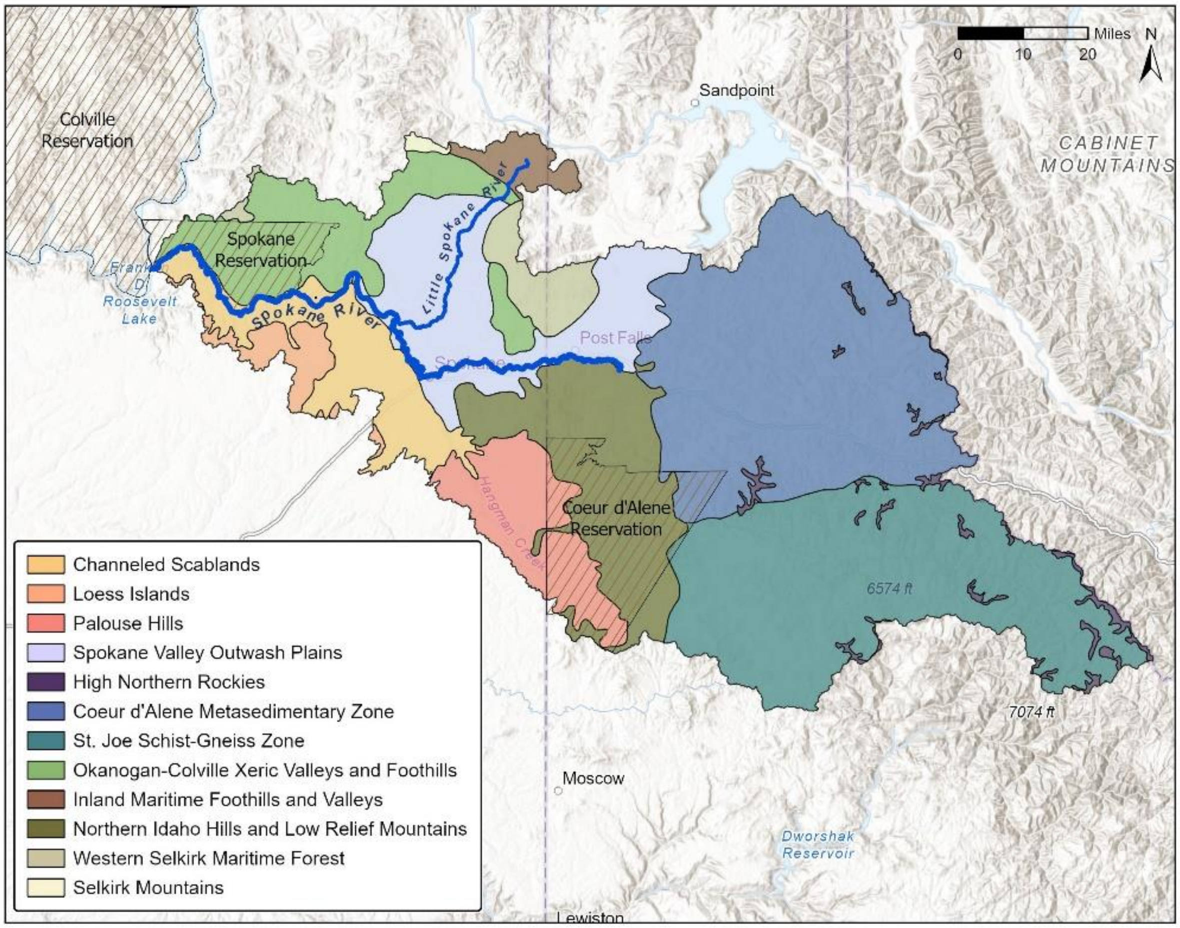


Figure 2: EPA Level 4 Ecoregions differ substantially between the upper and lower basins (EPA 2013). The lower basin is dominated by Spokane Valley Outwash Plains (26.8%), and roughly equal percentages of Okanogan-Colville Xeric Valleys and Foothills (19.4%), Channeled Scablands (15.8%), and Palouse Hills (13.77%), while the upper basin is dominated by Coeur d'Alene Metasedimentary Zone (42.4%) and St. Joe Schist-Gneiss Zone (41.0%).

Table 4: National Land Cover Dataset classifications differ considerably between the lower and upper basins (USGS 2003, Dewitz 2023). Percentages of developed and planted/cultivated land are 7.85 and 23.79 times higher, respectively, in the lower basin, while the percentage of forested land is 2.08 times higher in the upper basin. Between 2001 and 2021, the lower basin saw development spread at a rate 18.33 times faster than the upper basin, though the largest land cover change in those two decades for both the upper and lower basins was a loss of forest cover.

NLCD Level 1* Land Cover Classification	Lower basin % (% change since 2001)	Upper basin % (% change since 2001	Total Basin % (% change since 2001
Water	1.3 (-0.01)	1.7 (-0.06)	1.5 (-0.04)

Developed	11.3 (+1.65)	1.4 (+0.09)	5.8 (+0.77)
Barren	0.06 (0.00)	0.21 (+0.02)	0.14 (+0.01)
Forest	36.8 (-2.27)	76.8 (-2.28)	59.3 (-2.28)
Shrubland	19.4 (-0.68)	14.2 (+1.45)	16.5 (+0.52)
Herbaceous	8.4 (+0.94)	3.1 (+0.68)	5.4 (+0.79)
Planted/Cultivated	21.2 (+0.36)	0.89 (+0.04)	9.8 (+0.18)
Wetlands	1.7 (+0.01)	1.6 (+0.06)	1.6 (+0.04)
*Note: Level 1 classification aggregates the 20 nuanced classes available in Level 2 classification (e.g., four separate classes of "developed", three classes of "forest", etc.) into eight more readily distinguishable classes to maximize accuracy by combining those land cover designations most likely to be conflated (Wickham et al. 2023)			

1.3.2 Basin Climate and Surface Hydrology

The Spokane River basin exhibits diverse climate and surface hydrology. The entire basin receives an average of 34.5 inches of annual precipitation, with local annual precipitation increasing from west to east, following the generalized basin elevation gradient (Figure 3, PRISM 2022). Mean monthly air temperature for the entire basin is 45.0 °F, with local air mean temperatures generally following an inverse spatial relationship to precipitation, decreasing from west to east (Figure 4, PRISM 2022). This TMDL project focuses on the most recent 30-year period of record when considering all climatic and hydrological data. Section 3.2 discusses climate change impacts in more detail. Overall, the Spokane River basin contains 17,286 miles of surface streams (USGS 2019), leading to a surface drainage network density of 2.63 stream miles per square mile of basin area. This surface drainage network, when including reservoirs, lakes, ponds, covers 108.06 square miles (1.64%) of the basin area (Table 5).

Climatic and hydrologic differences mirror the previously discussed geographic distinctions between the upper and lower basins, driven by the increasing west to east elevation gradient. The upper basin, characterized by the higher elevations of the Rocky Mountains, experiences a substantially cooler and wetter climate than the lower basin. Mean annual precipitation is 85% higher (+19.9 inches) and mean monthly air temperatures are 3.15 °F cooler. The upper basin also receives and retains ample snowfall throughout the winter, resulting in a delayed snow melt runoff hydrograph in most streams and rivers, with peak flows typically occurring in the late spring and early summer. The three longest rivers/streams are the Saint Joe River (140 miles), North Fork Coeur d'Alene River (77 miles), and the Saint Maries River (47 miles). The three largest reservoirs/lakes are Coeur d'Alene Lake (42.02 square miles), Chatcolet Lake (5.52 square miles), and Cave Lake (1.19 square miles). In contrast, the lower basin rests on the Columbia plateau and has a much more arid climate characterized by lower precipitation and generally higher temperatures. The hydrology of the lower basin is largely controlled by regulated flow from upstream reservoirs, agricultural diversions, and urbanization, resulting in a highly altered flow pattern and relatively reduced interannual hydrograph variability in most streams and rivers. The three longest rivers are the Spokane River (114 miles), Latah (Hangman) Creek (80 miles), and the Little Spokane River (52 miles). The three largest lakes are the Spokane Arm of Franklin D. Roosevelt Lake (9.82 square miles), Lake Spokane (7.87 square miles), and Lake Hayden (6.03 square miles).

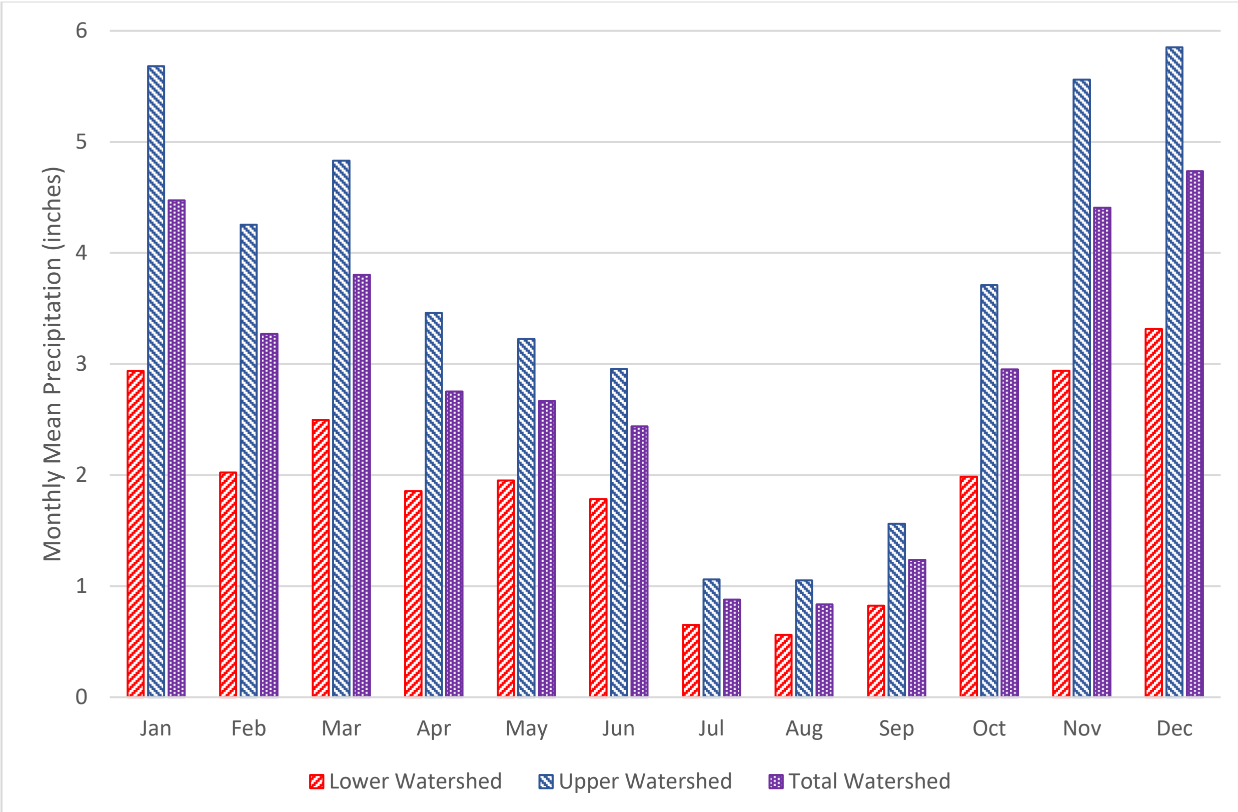


Figure 3: PRISM 30-year normal (1991-2020) precipitation shows considerable variation between the lower and upper basins. On average, the lower basin receives 1.66 inches less monthly precipitation than the upper basin (PRISM 2022).

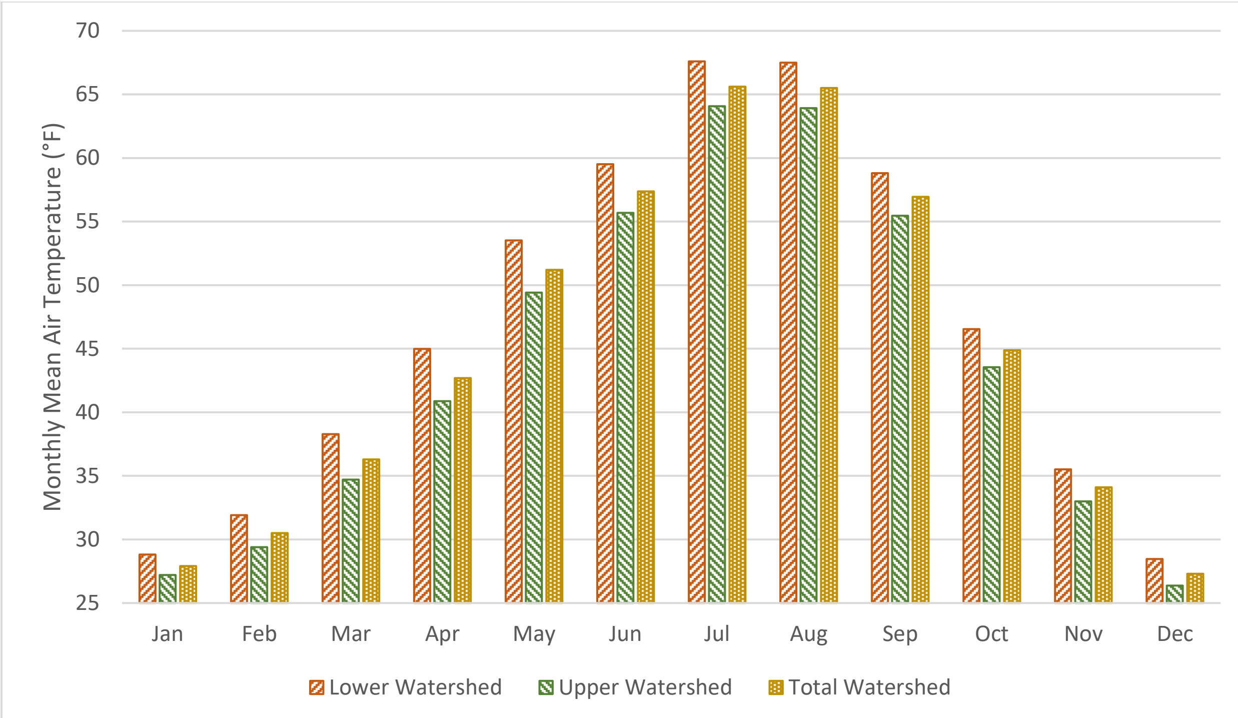


Figure 4: PRISM 30-year normal (1991-2020) mean temperature shows considerable variation between the lower and upper basins. On average, lower basin monthly mean temperatures are 3.15 °F warmer than in the upper basin (PRISM 2022).

Table 5: Surface hydrology network information derived from USGS NHD High Resolution GIS (USGS 2019). The upper basin hosts more lakes and ponds than the lower basin due primarily to the influence of Coeur d'Alene Lake, but the lower basin has a denser stream network given the generally flatter topography.

Surface Hydrology Feature Class	Lower basin	Upper basin	Total Basin
Rivers and Streams (miles)	8,113	9,173	17,286
Rivers and Streams (miles/square mile)	2.81	2.48	2.63
Reservoirs, Ponds, Lakes (square miles)	40.66	67.40	108.06
Reservoirs, Ponds, Lakes (% area)	1.41	1.82	1.64

1.3.3 Basin Demographics

Spokane River basin demographics and socioeconomics reflect a diverse urban, suburban, and rural community mixture. The largest city in the basin is Spokane, and its surrounding communities make up the most concentrated and contiguous zones of development in the basin, the majority of which is within 10 miles of the river. Spokane has seen considerable recent growth, jumping from a population of 195,629 in 2000 to 230,160 in 2022 (CENSUS, 2000, ACS 2022), and is emblematic of similar growth seen in other major population centers in the basin. With a population that is predominantly white (82%), Spokane also has significant and growing Hispanic (7.2%), Asian (2.6%), and Native American communities (0.9%) (Census 2022). The city's economy is multifaceted, encompassing health care, education, manufacturing, retail, and technology sectors. Outside Spokane and its suburbs, the basin is dotted with smaller towns and rural areas where agriculture, forestry, mining, and outdoor recreation prominently support local economies. These communities tend to have lower population densities and higher proportions of white residents, although there is also ethnic and cultural diversity in rural areas of the basin, particularly Native American populations such as the Spokane and Coeur d'Alene Tribes.

Socioeconomic indicators vary across the basin, with disparities in income, education, and access to healthcare observed within and between urban and rural areas. While Spokane and its surrounding suburbs boast higher median incomes and educational attainment levels, some rural communities in the basin face widespread economic challenges, including poverty and limited employment opportunities. Additionally, issues such as affordable housing, educational opportunities, health care access, and transportation infrastructure affect residents throughout the basin to varying degrees. As with ecological variability, the upper and lower portions of the basins are demographically distinct. The lower basin is over ten times more populous than the upper basin, and that population is more than twice as concentrated in urban areas. Residents of the lower basin are also exposed to considerably worse air pollution and live, on average, much closer to contaminated and toxic sites (CENSUS 2022, EPA 2015).

Environmental justice analysis requires integrating demographic and socioeconomic indicators that affect health outcomes with environmental pollution exposure information. One of the resources for evaluating environmental justice considerations with respect to the CWA is the EPA's EJScreen environmental justice mapping and screening tool, which the EPA used here to better describe population-level risk factors for negative health impacts related to environmental pollution (EPA 2015). EJScreen supplemental indices consider both environmental pollution exposure and a five-factor socioeconomic indicator. In total, there are 13 supplemental indices available in EJScreen (six relate to air quality, six relate to proximity to polluted sites/pollution sources, one relates to wastewater), which follow the same calculation formula:

a) Supplemental Index = Supplemental Demographic Index * Block Group Environmental Indicator

where:

b) Supplemental Demographic Index = (% Low Life Expectancy + % Low Income + % Unemployment Rate + % Limited English Speaking + % Less Than High School Education) / 5

It is important to note that, with the exception of the wastewater discharge supplemental index, currently available EJScreen metrics do not directly relate to water quality. A variety of socioeconomic indicators taken from the U.S. Census Bureau's American Community Survey and the EPA's EJScreen supplemental environmental justice indices are presented in Table 6.

Table 6: U.S. Census Bureau 2021 American Community Survey (ACS) population and EJScreen parameter Supplemental Index Percentiles for the lower and upper basins. On average, the lower basin scored 10.5% worse than the upper basin on EJScreen metrics. Note: SIP = Supplemental Index Percentile.

Parameter	Lower basin	Upper basin	Total Basin
Population	661,042	58,140	719,182
Population % Urban	69.3	31.7	66.3
Demographic Index Percentile	33.4	32.4	33.3
Supplemental Demographic Index Percentile	44.6	46.0	44.9
Particulate Matter 2.5 SIP	64.8	62.7	64.0
Ozone SIP	10.7	8.34	10.4
Diesel Particulate Matter SIP	46.1	20.8	43.6
Air Toxics Cancer Risk SIP	45.8	29.6	44.8
Air Toxics Respiratory Hazard Index SIP	59.6	48.2	59.0
Toxic Releases to Air SIP	31.0	16.7	29.5
Traffic Proximity SIP	46.0	30.4	44.8
Lead Paint SIP	46.7	49.3	47.5
Superfund Proximity SIP	63.0	46.2	61.6
RMP Facility Proximity SIP	48.5	31.7	46.2
Hazardous Waste Proximity SIP	46.1	14.4	43.6
Underground Storage Tanks SIP	43.6	35.2	42.7
Wastewater Discharge SIP	42.7	42.7	42.9

1.3.4 PCB-Impaired Assessment Units

These TMDLs address all AUs in Washington currently listed as PCB-impaired on the Spokane and Little Spokane Rivers. Ecology included 12 segments of the two rivers as Category 5 for PCB pollution in its combined 2014-2018 CWA Section 303(d) list. The impaired AUs do not meet harvesting and/or domestic water supply beneficial uses based on exceedances of the human health criteria. Ecology based these impairment determinations on fish tissue data with elevated PCB concentrations using its listing methodology from Policy 1-11, that provides a translator from PCB water quality criteria in the water column to PCBs in fish tissue. Current PCB concentrations in the Spokane and Little Spokane Rivers also exceed Washington's water quality criterion. Figure 5 shows these impaired AUs, and Table 7 shows their associated waterbody identification numbers, jurisdictions, and river mile extents. See Appendix A: Applicable PCB Water Quality Standards for additional information on PCB impairment designations.

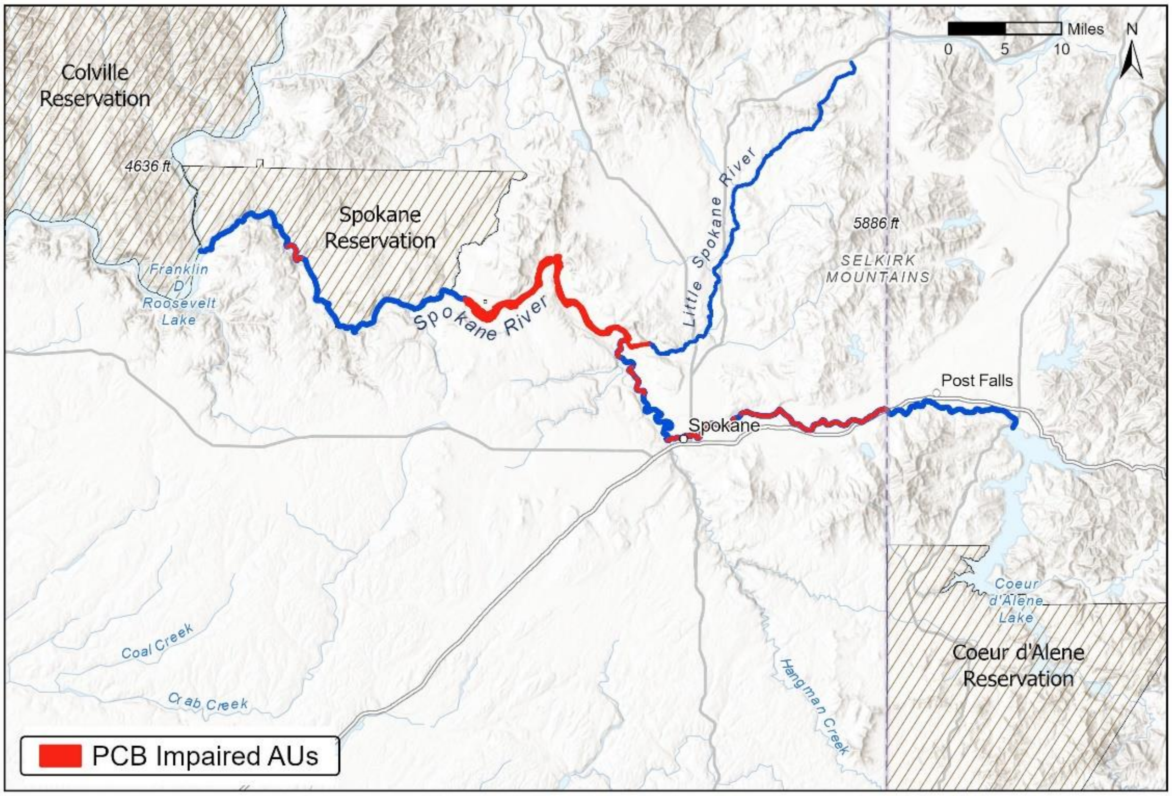


Figure 5: Spokane and Little Spokane River AUs impaired by PCBs, based on Ecology's most recent 2014-2018 303(d) listings.

Table 7: Location descriptions of all 12 Spokane and Little Spokane River AUs listed as PCB-impaired in Washington's combined 2014-2018 303(d) list, ordered from upstream (east) to downstream (west).

Washington AU ID	AU Description (River Miles)	Impaired Use(s)
WA17010305000012_001_001	Confluence of Spokane River and Cable Creek to Washington-Idaho border (RMs 94.8 – 96.3)	Multiple - Harvesting & Domestic Water
WA17010305000011_001_001	Myrtle Point Natural Area to Cable Creek Confluence (RMs 84.7 – 94.8)	Multiple - Harvesting & Domestic Water
WA17010305000010_001_001	Felts Field Park to Myrtle Point Natural Area (RMs 80.9 – 84.7)	Miscellaneous - Harvesting
WA17010305000009_001_002	Upstream of Latah (Hangman) Creek and Spokane River confluence to south of Felts Field Municipal Airport (RMs 72.7 – 80.2)	Miscellaneous - Harvesting
WA17010307009102_001_001	Between West Davenport and Aubrey Ln (RMs 63.1 – 64.5)	Miscellaneous - Harvesting

Washington AU ID	AU Description (River Miles)	Impaired Use(s)
WA17010307009085_001_001	Between Seven Mile Rd and West Davenport (RMs 62.4 – 63.1)	Multiple - Harvesting & Domestic Water
WA17010307009615_001_001	Between McLellan Trailhead and Seven Mile Rd (RMs 61.0 - 62.1)	Multiple - Harvesting & Domestic Water
WA17010307000774_001_001	Nine Mile Falls to Deep Creek (RMs 58.3 – 59.3)	Multiple - Harvesting & Domestic Water
WA17010308000018_001_001*	Little Spokane River AU: Spokane/Little Spokane River confluence to West Rutter Pkwy (Little Spokane RMs 0.0 – 4.7; Little Spokane River/Spokane River confluence is located at Spokane RM 56.3)	Multiple - Harvesting & Domestic Water
WA170103070106_01_01	East Side of Spokane Lake (RMs 45.5 – 58.3)	Miscellaneous - Harvesting
WA170103070107_01_01	West Side of Spokane Lake (RMs 34.2 – 45.5)	Multiple - Harvesting & Domestic Water
WA17010307000010_001_001	South side of Spokane Arm across from the Spokane Tribe reservation, from Porcupine Bay Campground to Blue Creek (RMs 11.0 -12.7)	Multiple - Harvesting & Domestic Water
*Note: This is the single Little Spokane River AU currently listed as PCB-impaired.		

1.4 PCB Human Health Impacts

PCBs are a class of synthetic organic compounds that were widely used for decades in industrial applications due to their chemical stability and insulating properties. Negative human health impacts of PCBs have been researched since the 1930s, almost immediately after large-scale commercial production began in the United States, with reports of acute toxicity in mammals appearing in the 1940s (Markowitz 2018). Their production and usage have largely been phased out since the 1970s due to their environmental persistence and known human health implications. The Toxic Substances Control Act (TSCA) banned the intentional manufacture of PCBs in the U.S. in 1979, though the law still allows low levels of inadvertently produced PCBs in many products (Ecology 2014).

PCB exposure implicates multifaceted known negative human health impacts. Epidemiological studies consistently link PCB exposure to an increased risk of myriad cancers, including liver cancer, melanoma, and non-Hodgkin lymphoma (Lauby-Secretan et al. 2013), leading to classification as probable carcinogens by the International Agency for Research on Cancer.

Mechanistically, PCBs can induce carcinogenesis through their ability to disrupt cellular signaling pathways, promote oxidative stress, and alter gene expression patterns (Safe 1994). Animal studies have demonstrated that PCBs can disrupt neurotransmitter systems, impair neuronal connectivity, and induce neuronal cell death in the developing brain (Kodavanti 2006). Prenatal exposure to PCBs has also been associated with impaired cognitive function, decreased IQ, and behavioral issues in children (Schantz et al. 2003). PCBs are potent endocrine disruptors capable of interfering with hormonal signaling pathways in the body and can mimic or antagonize the actions of endogenous hormones leading to disruptions in reproductive function, thyroid homeostasis, and metabolic regulation (Gore et al. 2015). PCB-induced endocrine disruption has been implicated in adverse reproductive outcomes such as infertility, miscarriage, and atypical sexual development (Chevrier et al. 2007). PCB exposure has also been associated with immunotoxic effects, including alterations in immune cell function and dysregulation of immune responses (Gascon et al. 2013). Animal studies have shown that PCBs can suppress immune system activity, impair antibody production, and increase susceptibility to infections (Busbee et al. 1999, Du et al. 2019). Furthermore, epidemiological evidence suggests an association between PCB exposure and autoimmune diseases, such as rheumatoid arthritis and systemic lupus erythematosus (Abella et al. 2016, Huang et al. 2023).

These diverse health impacts are especially concerning given that PCBs are lipophilic and bioaccumulative, with a recent literature review estimating average adult daily exposure to PCBs from background sources via ingestion, inhalation, and dermal contact at 3.4 ng/kg (Weitekamp et al. 2021).

The EPA's Integrated Risk Information System (IRIS) uses a tiered approach for determining the cancer potency of PCB mixtures. PCB human health water quality criteria use the high risk and persistence upper-bound cancer slope factor of 2.0 per (mg/kg)/day, because the PCB exposure occurs through the food chain and because of potential early life exposure, including to nursing infants (EPA 1996).

2 PCB Water Quality Standards

This section identifies the applicable PCB water quality standards for the portions of the Spokane and Little Spokane Rivers addressed by these TMDLs. An evaluation of upstream and downstream water quality standards, including the state of Idaho, the Confederated Tribes of the Colville Reservation (Colville Tribes) and the Coeur d'Alene Tribe can be found in Appendix A: Applicable PCB Water Quality Standards. All PCB-impaired AUs addressed by this TMDL project lie within Washington.

The Spokane Tribe and Washington have CWA-effective PCB water quality standards, and each government has jurisdiction over a portion of the Spokane River. On the Spokane River, the Spokane Tribe water quality standards apply within the reservation boundaries along a ≈32.5-mile reach, from the confluence of the Columbia and Spokane Rivers at RM 0.0 to the confluence of Chamokane Creek and the Spokane River, approximately 1.5 miles downriver from the Long Lake Dam. On this portion of the Spokane River, from RM 0.0 to RM 32.5, Spokane Tribe water quality standards apply to the northern portion of the river and Washington water quality standards apply to the southern portion of the river. Washington's water quality standards apply exclusively along a ≈64.1-mile reach, from the confluence of Chamokane Creek and the Spokane River at approximately RM 32.5 to the Washington-Idaho border at approximately RM 96.5. The Little Spokane River is entirely under Washington's jurisdiction.

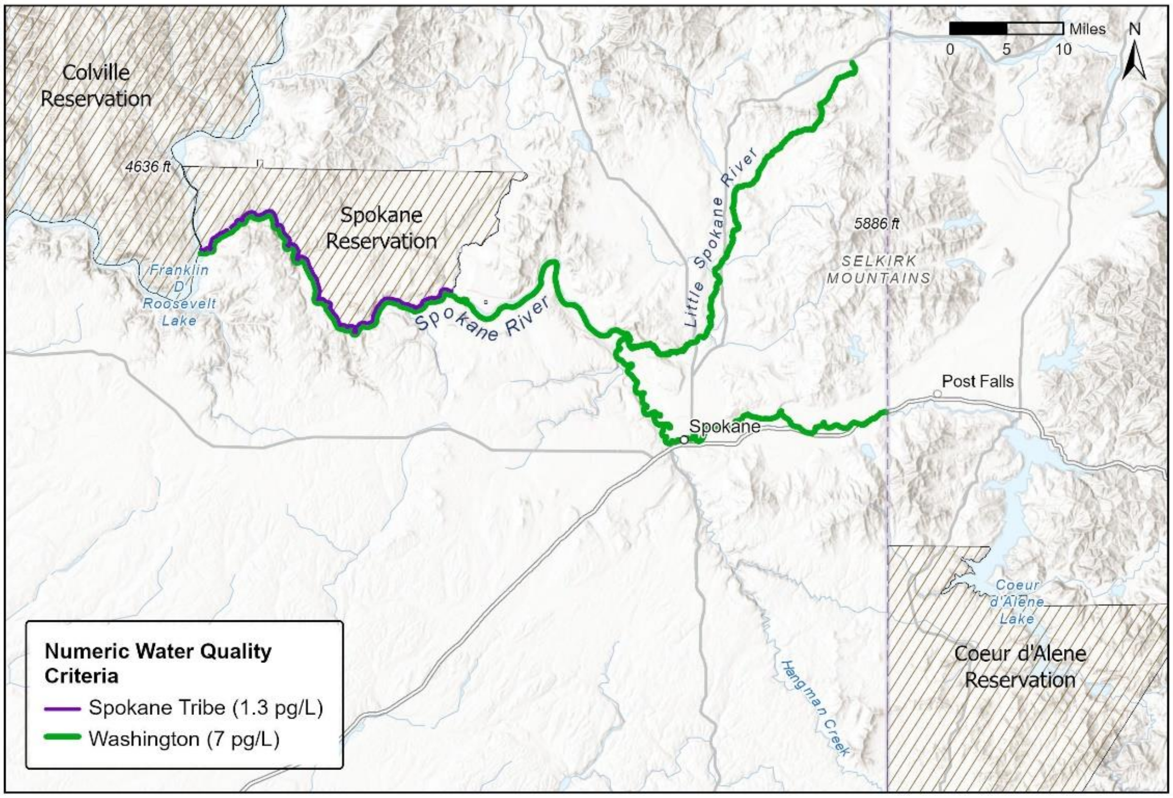


Figure 6: Applicability of relevant total PCBs Water Quality Criteria to the Spokane and Little Spokane Rivers.

Table 8: Summary of PCB aquatic life and human health water quality criteria and associated designated uses for Washington and the Spokane Tribe. More information can be found in Appendix A: Applicable PCB Water Quality Standards.

Jurisdiction	Aquatic Life Criteria (ALC: Acute, Chronic)	Total PCB Human Health Criteria (HHC: Water + Organisms, Organisms Only****)	Designated Uses
Washington Spokane R. at Washington-Idaho Border (RM 96.5) to Columbia R. (RM 0.0), all other fresh waters of the State of Washington	2.0E+06 pg/L (Acute) 1.4E+04 pg/L (Chronic)	7.0 pg/L	Aquatic Life- Spawning/Rearing*, Recreation- Primary Contact, All Water Supply** and All Misc.*** Uses.

Jurisdiction	Aquatic Life Criteria (ALC: Acute, Chronic)	Total PCB Human Health Criteria (HHC: Water + Organisms, Organisms Only****)	Designated Uses
Spokane Tribe Spokane R. Chamokane Creek (RM 32.5) to Columbia R. (RM 0.0), all other waters of the Spokane Tribe Reservation	2.0E+06 pg/L (Acute) 1.4E+04 pg/L (Chronic)	1.3 pg/L	Primary Contact Ceremonial & Spiritual, Cultural, Water Supply (Domestic, Industrial, Agricultural), Stock Watering, Fish and Shellfish (Salmonid/Other Fish/Crustacean Migration/Rearing/Spawning/Harvesting), Primary Contact Recreation, Commerce and Navigation
Notes: '*' – 'Aquatic Life – Spawning/Rearing' applies to all Washington AUs addressed as part of this TMDL with the exception of Spokane Lake (AU: WA170103070106_01_01), where the use is Aquatic Life – Summer Core Habitat. '**' – 'Water Supply' Uses include Domestic, Industrial, and Agricultural water supplies, in addition to Stock watering. '***' – 'Miscellaneous' Uses include Wildlife habitat, Fish harvesting, Commerce and navigation, Boating, and Aesthetic Values. '****' – The Human Health Criteria (in pg/L) has the same numeric standard for both water and organisms and organisms only, for all jurisdictions with applicable numeric water quality criteria.			

2.1 Spokane Tribe of Indians

The Spokane Tribe adopted its water quality standards on February 25, 2010, and the EPA approved them on December 19, 2013. The standards apply within the reservation boundaries, which extend from Chamokane Creek (starting at the 48th parallel in latitude) along the eastern bank of this creek until it joins the confluence of the Spokane River. The boundary continues westward along the southern bank until reaching the confluence with the Columbia River, then continues north along the Columbia River until reaching the 48th parallel in latitude (see Appendix A: Applicable PCB Water Quality Standards, Figure A-1).

The Spokane Tribe's assigned designated uses using classes for surface water protection: AA (extraordinary), A (excellent) and Lake. The Spokane River is assigned to Class A, which has water quality protections for several uses including primary contact ceremonial and spiritual, cultural, water supply, stock watering, fish and shellfish (i.e., migration, rearing, spawning and harvesting), primary contact recreation, and commerce and navigation (Section 9. Part 2 Subpart b: i-vii). For Class A waterbodies, numeric criteria for toxic substances apply to all surface waters with aquatic life and human health protections and consist of acute and chronic aquatic life and water + organism and organism-only human health criteria.

The Spokane Tribe's freshwater total PCB aquatic life criteria are 2E+06 pg/L (acute) and 1.4E+04 pg/L (chronic). The Spokane Tribe's human health numeric criterion for total PCBs is 1.3 pg/L, which is the most stringent human health criterion for PCBs applicable to this TMDL project. A more detailed description of Spokane Tribe's water quality standards can be found in Appendix A: Applicable PCB Water Quality Standards.

2.2 State of Washington

Washington has CWA-effective numeric water quality standards for toxic substances (including total PCBs) that apply to all surface waters of the state and include acute and chronic aquatic life and human health criteria for fresh and marine waters. Fresh water designated uses in Washington include aquatic life, recreational, water supply, and miscellaneous (e.g., wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics) uses (WAC 173-201A-200). Each impaired segment along the Spokane River is listed for harvesting and/or domestic water supply uses (See Appendix A: Applicable PCB Water Quality Standards, Table A-3). Washington's total PCB freshwater aquatic life criteria are 2E+06 pg/L (acute) and 1.4E+04 pg/L (chronic) (WAC 173-201A-240, Table 240). Washington's total PCBs human health criterion is 7 pg/L (40 CFR Part 131). In addition, Washington provides that all waters are to maintain a level of water quality when entering downstream waters to attain and maintain criteria of downstream waters including waters of another state (EPA-820-F-14-001). A more detailed description of Washington's standards and applicable uses can be found in Appendix A: Applicable PCB Water Quality Standards.

In addition to the above criteria, the following narrative criteria also apply to the Spokane River, Spokane Lake, and Little Spokane River in Washington (WAC 173-201A-260):

- *Upstream actions must be conducted in manners that meet downstream water body criteria (WAC 173-201A-260(3)(b)).*
- *Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criterion for each parameter is to be applied (WAC 173-201A-260(3)(c)).*
- *At the boundary between water bodies protected for different uses, the more stringent criteria apply (WAC 173-201A-260(3)(d)).*

3 PCB Sources and Monitoring Studies

While PCB pollution in the Spokane River basin has been monitored and assessed for decades, the most recent monitoring information for PCB sources and river conditions was produced by the Spokane River Regional Toxics Task Force (SRRTTF) from 2013 through 2023. The SRRTTF efforts culminated in a final Comprehensive Plan document in 2016 (LimnoTech 2016). This report provides valuable information on source loadings of PCBs in the basin and estimates of the relative mass loading rates among source categories. SRRTTF's summary of estimated PCB loading from different source categories is shown in Table 10. The EPA has built upon the SRRTTF analysis and developed mass balance models that provide additional insight into current PCB loadings from specific sources and source categories (See Section 4.1).

3.1 Overview of PCB Sources

Sources of PCB pollution to the Spokane River basin follow the same trends observed in many other urban watersheds and represent a mix of two primary reservoirs of PCBs: legacy PCBs and inadvertent PCBs. Legacy PCB pollution stems from historical practices that involved the widespread use of PCBs intentionally manufactured for those specific purposes before their ban in 1979 under TSCA. Common legacy sources include industrial and manufacturing facilities that used PCBs in transformers, capacitors, hydraulic fluids, machine oils, and other applications. Inadvertent PCB pollution stems from ongoing, unintentional production of PCBs in manufacturing processes after their ban, and while concentrations of inadvertent PCBs are regulated by TSCA, the wide range of products that contain them continue to contaminate many waste streams (Xiaoyu et al. 2022). Inadvertent PCBs are found in myriad types of plastics, cosmetics and body care products, dyes and pigments, pesticides and lawn care products, and a wide variety of building materials such as paints, caulks, and sealants (Ecology 2014).

Major sources of legacy PCB pollution in the Spokane River basin include electrical utilities and industrial facilities. The 2016 Magnitude of Source Areas and Pathways of PCBs in the Spokane River Watershed (LimnoTech) identified 56,817 transformers operated and maintained by Avista, Inland Power and Light, Vera Water and Power, and Kootenai Electric Company over several decades. The EPA estimated that if there were 4.5 gallons per transformer, approximately 250,000 gallons of insulating oil could be present in the watershed. The sheer number of transformers likely resulted in a large number of small spills and some larger spills, if they failed catastrophically or during their decommissioning and removal. After the TSCA ban on PCB manufacture, these spills likely declined. Industrial facilities, such as Kaiser Aluminum and General Electric are also sources of legacy PCB pollution owing to PCB use at their facilities and proximity to the Spokane River, but they are not unique as PCBs were intentionally used by a significant portion of the industrial business sector for decades. Many industrial facilities exhibit PCB-contaminated soils, which can be directly washed into surface waters by precipitation runoff, and/or lead to groundwater pollution and subsequent migration to surface waters. In addition to concerns over spills and disposal practices from the electrical utility sector, large industrial users of legacy PCBs historically discharged PCB-contaminated wastewater directly to the Spokane River and its tributaries.

Major sources of inadvertent PCB pollution in the Spokane River basin include wastewater treatment plants (WWTPs), publicly owned treatment works (POTWs), and municipal separate storm sewer systems (MS4s). Additionally, solid waste disposal and recycling operations are often sources of inadvertent PCB pollution. Inadvertent PCBs in ink dyes and pigments have been a challenge for the paper printing and recycling industry to fully address. Metal recyclers and building demolition waste processors have faced similar issues, though in many cases the PCBs in their waste streams contain a higher percentage of legacy PCBs than those encountered in the paper and printing industry. While inadvertent PCBs are found in consumer products at lower concentrations than legacy PCB products, their ubiquity across many different product classes means their cumulative impacts are considerable (Xiaoyu et al. 2022). As consumer products make their way into waste streams, the inadvertent PCBs they contain often pass through disposal or treatment processes not primarily designed to address persistent bioaccumulative toxics, making their way into soils, groundwater, and surface water.

3.1.1 Legacy Impacts

Like many areas that experienced rapid urbanization during the 20th century, the Spokane River Valley has been subjected to PCB pollution from a myriad of sources. Before their ban on production in the U.S.

in 1979, PCBs were used in many industrial and commercial applications (EPA 1979, Erickson and Kaley 2011). Electrical equipment manufacturing, especially the production and maintenance of many transformers and capacitors still in use today, has historically been a major contributor to environmental PCB releases. Other common applications include hydraulic equipment, fluorescent light ballasts, paints and pigments, caulking and finishes, and pesticides (Davies and Delistraty 2016). PCB-laden refuse soon became a regular component of many waste streams, a fraction of which were likely improperly disposed of before the environmental and health impacts were more widely understood (Interdepartmental Task Force on PCBs 1972, Waid 1986). PCB pollution is so widespread globally that the chemicals have been proposed as viable stratigraphic markers for the onset of the Anthropocene epoch, characterized by globally contemporaneous signatures of human impact on the natural environment (Agnieszka et al. 2020; Dong et al. 2021).

Both industrial effluent discharges and stormwater have served to deliver PCB pollution to the Spokane and Little Spokane Rivers. As urban areas expand and grow denser, the fractional coverage and connectivity of impervious surfaces increases, leading to increased stormwater discharges to streams and rivers. Stormwater runoff across these impervious surfaces can pick up PCBs from various sources, including contaminated soils and sediments, and transport them to the rivers. This spatially distributed PCB pollution has added to the complexity of addressing PCB contamination in the rivers, as it requires comprehensive adaptive stormwater management strategies to fully mitigate impacts to water quality. The combination of legacy and ongoing PCB pollution sources has complicated source tracking and identification.

The legacy of past industrial waste management practices (Interdepartmental Task Force on PCBs 1972, EPA 1979), coupled with the widespread historic use of PCB-containing materials, has left an imprint on water quality in the Spokane River Valley. Over the past 75 years, the Spokane River has been impacted by many industrial sources of PCB pollution, with major contributions from companies such as Kaiser Aluminum and General Electric, both of which have been the focus of large-scale remediation efforts (Ecology 2022b, Haley Aldrich 2023). They, and many other since-shuttered industrial facilities, operated from the river's banks while historically using PCB-containing oils on site that likely led to occasional unmonitored releases into the surrounding environment during the prior decades (Interdepartmental Task Force on PCBs 1972, Waid 1986). The practices of these industrial entities, along with others, have left a legacy of PCB pollution in the Spokane River, necessitating comprehensive remediation efforts and ongoing environmental management to address the consequences of industrial discharges.

Concerning levels of PCBs in the Spokane and Little Spokane Rivers first came to light shortly after their 1979 manufacturing ban, and efforts to address them have gained momentum since the 1990s when Ecology and the EPA initiated studies to assess the extent and severity of toxics contamination. Numerous environmental monitoring campaigns over the past three decades have consistently shown water column PCB levels well above applicable water quality criteria. Though the chemicals have been detected in every type of environmental media sampled, including biomagnified concentrations in sport and game fish species (USGS 1999), this TMDL project focuses primarily on total water column PCB concentrations given that the applicable water quality standards are all written with respect to that metric. The associated numeric water quality criteria are intended to be protective of both aquatic life and fish consumption uses.

3.1.2 PCB Contaminated Industrial Sites

While a complete inventory of current and former industrial sites that have experienced PCB contamination is not available, several major industrial sites that have contributed and/or continue to contribute to PCB pollution of the Spokane River are well documented. These include sites presently or previously owned or occupied by Avista Development, Inc., General Electric Co., Spokane Transformer Co., and Kaiser Aluminum that have been shown to be contaminated with legacy PCB pollution. Avista Development, Inc. was identified as potentially liable for PCB pollution upstream of the Upriver Dam (RM ≈80.2) and Donkey Island. General Electric Co. operations are associated with PCB pollution at their former facility, located approximately 0.25 miles south of the Spokane River at RM ≈79.2. Spokane Transformer Co. operations also resulted in PCB pollution at their former facility, located approximately 0.85 miles east of the Spokane River at RM ≈76.3. Kaiser Aluminum operations are associated with PCB pollution at their current facility, located less than 0.25 miles east of the Spokane River at RM ≈86.0. However, it is worth reiterating that there are likely a large number of smaller, less well documented industrial sites in the Spokane River basin contaminated with legacy PCB pollution.

3.1.3 PCB Contaminated Groundwater

While PCB-contaminated groundwater plumes have been well documented at the General Electric and Kaiser Aluminum industrial sites referenced above (Ecology 2022a), the generalized impacts of legacy and ongoing PCB pollution to groundwater in the Spokane River basin is less well known than the impacts to surface water. However, the two are intertwined, and a reasonable estimation of groundwater PCB concentrations along several reaches of the Spokane River can be inferred from a comparison of monitoring data and known gaining reaches. This technique was employed by the SRRTTF in their synoptic river survey work (LimnoTech 2016, LimnoTech 2019), and confirmed by the mass balance analysis used for this TMDL.

3.1.4 NPDES Permitted Wastewater

There are a wide variety of NPDES permittees in the basin that contribute PCB pollution to the Spokane River. Stormwater runoff can readily transport PCBs to surface waters, though MS4 permittees have reduced both their regular stormwater and combined sewer overflow (CSO) discharge volumes over the past 20 years. Sewage treatment plants and POTWs receive residential, commercial, and some industrial wastewater that contains both legacy and inadvertent PCBs. Treatment plants and POTWs have been shown to be effective at reducing PCB concentrations through the treatment processes designed and installed for secondary treatment or other non-PCB specific reasons. The treatment levels at these facilities have dramatically increased after upgrades to comply with the 2010 Spokane River dissolved oxygen TMDL (Ecology 2010). Industrial NPDES wastewater permittees like Inland Empire Paper and Kaiser Aluminum have also been identified as sources of PCB pollution but have similarly taken steps to increase their treatment of wastewater and control their wastewater discharge volumes in the past decade. These upgrades are not designed for PCB treatment or removal although in some cases such technology may be providing additional reductions in PCB concentrations benefiting water quality as compared to before the upgrades were complete. Finally, a study by Ecology (2018) found PCBs in effluents from fish hatcheries.

3.1.5 Atmospheric PCB Deposition

Atmospheric bulk deposition (wet + dry) of PCBs is a topic garnering increased attention from the urban environmental management research community (Ahn et al. 2023), and significant atmospheric PCB deposition has been observed at sites even far removed from urban and industrial areas (Kannan et al. 2022; Kouimtzis et al. 2002). Atmospherically deposited PCBs can become a component of the surface water PCB pollution being addressed by this TMDL via two main pathways: direct bulk PCB deposition to the Spokane and Little Spokane Rivers and stormwater runoff and groundwater infiltration, both discussed above.

Compared to water and soil, far less monitoring of atmospheric PCB dynamics has been undertaken in the Spokane River basin. However, while available atmospheric PCB monitoring data suggests that flux is highly variable in space and time, relationships to local and surrounding land use follow trends similar to those observed in other urban areas (Ecology 2019). As in other studies of atmospheric PCB deposition in urban areas, bulk deposition in the Spokane River basin is positively correlated with developed land use fractional area and density. Atmospheric loading increases from rural areas, surrounded by natural and agricultural landscapes, to urban areas, surrounded by commercial and industrial landscapes (Diamond et al. 2010, Holsen et al. 1991). Some unique congener signatures were observed in the 2016-2017 study during concurrent passive sampler deployment, implying local origination of at least some fraction of bulk deposition. However, most of the atmospheric bulk deposition mass sampled did not differ significantly between sampling locations with respect to congener profiles, implying majority origination from regional or even farther flung sources (Stemmler and Lammel 2012, Xu et al. 2023).

When evaluating atmospherically deposited PCBs, the EPA addressed them in the analysis via other components of the source assessment. For example, in the lower basin, below Lake Coeur d'Alene, atmospherically deposited PCBs are transported to the Spokane River primarily through stormwater runoff, both permitted and nonpoint source, and shallow groundwater connectivity. This runoff may enter the Spokane River directly or as a component of tributary inflows. In the upper basin, atmospherically deposited PCBs are integrated into the source waters of the Spokane River flowing from the outlet of Lake Coeur d'Alene and are part of boundary conditions considerations.

3.1.6 PCB-Contaminated River Sediments

The Spokane River is defined by relatively steep gradients and rapid flows, dropping nearly 850 feet in elevation from its source at the outlet of Lake Coeur d'Alene to its confluence with the Columbia River just over 110 river miles downstream, and is bedrock-controlled along much of its length. Coeur d'Alene Lake traps fine sediments from the upper watershed. Owing primarily to the region's geologically recent history of continental glaciation and repeated large-scale glacial outburst floods (O'Connor et al. 2020), Spokane River sediments are dominated by boulders, cobble, and gravels (USGS 2007). The relative paucity of fine sediment fractions in the watershed may limit the adsorption of PCBs to suspended sediments. A previous investigation of Spokane River sediment PCB concentrations noted that the system is generally low in fine sediment and suspended solids (Ecology 2022a).

The primary depositional areas and stores of fine sediments in the Spokane River are found behind major impoundments of the Post Falls Dam, Upriver Dam, Upper Falls Dam, Monroe Street Dam, Nine Mile Dam, and Long Lake Dam. Localized PCB contamination of bottom sediments has been a concern in the watershed, and Ecology directed two sediment cleanup actions (Donkey Island and Upriver Dam) by

Avista Development, Inc. completed between 2003 and 2007. More broadly, the SRRTTF identified Lake Spokane bottom sediments as the largest current PCB loading area from river bottom sediments, calculating a screening-level estimate of the current diffusive flux to the water column (1.0 mg/day with a large uncertainty range of 0.05 – 20 mg/day).

Given that ongoing environmental PCB pollution has been an issue affecting the Spokane River for decades, and considering residence times for water in the Spokane River are generally measured in days rather than weeks or months (Ecology 2018), PCB-contaminated river sediments are assumed to be in equilibrium with water column PCB concentrations throughout most, if not all, of the year. At some point in the future, when average river water column PCB concentrations have been reduced by at least an order of magnitude, chemical dissolution kinetics may lead to contaminated sediments theoretically becoming a viable source of remobilized PCB pollution to the water column (Gdaniec-Pietryka et al. 2013). However, reductions of water column PCB concentrations to below applicable water quality standards are expected to be a methodical and incremental process even in the most ideal case and will likely unfold over years if not decades of sustained effort. During this period of anticipated gradual PCB reductions, “new” fine sediments will continue to be introduced to the river, and if entrained will adsorb PCBs until they come into dissolution kinetics equilibrium with the water column concentration at the time they are deposited, before slowly burying more highly contaminated sediments reflecting water quality conditions of decades prior. Ecology’s analysis of sediment cores from Lake Spokane show this is already happening (Ecology 2011).

3.2 Anticipated Climate Change Impacts

While not a direct result of climate change impacts, PCB pollution in the Spokane River basin is likely to be at least minimally influenced by climate change in the coming decades. Uncertainty exists, but virtually all downscaled climate change model predictions for the Pacific Northwest agree on themes of significant reductions in winter snowpack and precipitation event frequency generally (Mote et al. 2018), with some increased frequency of high intensity precipitation events (Hamlet et al. 2010, Tohver et al. 2014, Chen et al. 2017). These shifts in precipitation patterns may affect stormwater dynamics in the Spokane River basin and could lead to elevated runoff volumes and velocities, ultimately increasing erosional potential and sediment transport (Hamlet et al. 2010). Rising air temperatures, as documented by Tohver et al. (2014), will significantly increase potential evapotranspiration during summer months, likely leading to some reduction in summer low flows. These findings underscore the importance of continuing to implement adaptive stormwater management strategies and infrastructure upgrades in the Spokane River basin. However, detailed modeling explorations of the capacity of existing stormwater infrastructure that specifically included the Spokane River basin concluded that existing infrastructure is likely to be sufficient to effectively convey the anticipated stormwater volumes through the 2050s (Rosenberg et al. 2009). Therefore, climate change is not expected to have an appreciable impact on PCB pollution in the Spokane River basin for at least several decades, at which time the EPA could consider revising this TMDL project.

3.3 Current Conditions and Recent Exceedances

There are 12 AUs listed as PCB-impaired in Washington’s 2014-2018 CWA 303(d) list. From a human health perspective, it should also be noted that the Washington Department of Health has PCB-based fish consumption advisories in place for both the Spokane and Little Spokane Rivers (Washington Department of Health 2024).

To characterize current conditions in the PCB-impaired AUs, a specific subset of available monitoring data were evaluated. Given improvements in PCB sampling and analytical techniques, as well as considerable waste and stormwater infrastructure capital investment in the Spokane River basin over the past several decades, only Spokane and Little Spokane River surface water PCB samples collected after 2010 are discussed here. In addition, the EPA applied the following guidelines to constrain the monitoring data used to characterize current PCB conditions in the Spokane and Little Spokane Rivers:

- Sampled and analyzed using approved Quality Assurance Project Plans (QAPPs)
- Analyzed using congener-specific laboratory method 1668C (see Appendix D: Water Quality Monitoring Analytical PCB Methods for additional information)
- Included associated sample blank data in Ecology's Environmental Information Management database
- Verified and assessed (QA/QC) for usability

To reduce the influence of sample contamination, a common issue resulting from the ubiquity of PCBs and the extreme sensitivity of laboratory method 1668C, the EPA employed blank censoring to monitoring data using similar approaches employed by both Ecology and the SRRTTF (Ecology 2016, LimnoTech 2014). Conceptually, blank censoring compares environmental sample analytical concentrations to analytical concentrations from blank samples, deliberately intended to contain zero PCBs, that experienced the same handling. If the concentrations in the environmental samples do not exceed the concentrations in the associated blank sample by some pre-determined multiple, the environmental sample estimate is replaced with zero in subsequent data analysis. Low blank censoring thresholds are commonly applied when the environmental monitoring effort prioritizes analyte presence/absence and pollution source detection. High blank censoring thresholds are commonly applied when sample contamination is a concern and very low concentrations are being measured. Previous Spokane River PCBs data analysis by Ecology and the SRRTTF, which was heavily focused on source identification, applied a 3x blank censoring level to retain as many detections as possible and provide the most detailed spatial accounting of all suspected PCB sources. In contrast, the EPA has applied a 5x blank censoring level in this TMDL project to reduce the influence of low-level sample blank detections and increase confidence that observed river concentrations are reflective of actual environmental PCB pollution, not inadvertent sample contamination.

Filtering available monitoring data based on the aforementioned criteria and subsequently censoring samples at 5x the reported blank value as described above provides a subset of 199 individual surface water PCB samples, collected at 28 unique locations, over the course of seven separate studies from which to characterize current Spokane and Little Spokane River PCB concentrations. Of the entire subset of blank-corrected samples, 74.5% were above Spokane Tribe water quality criterion, and 64.0% were above Washington's water quality criterion. Mainstem Spokane River samples (n = 177) were collected at 17 unique locations between RM 57.8, approximately 1.4 river miles upstream of the confluence of the Little Spokane River, and RM 90.3, approximately 6.0 river miles downstream of the Washington-Idaho border (Figure 7). Of the mainstem Spokane River blank-corrected samples, 79.7% were above Spokane Tribe water quality criterion, and 68.4% were above Washington water quality criterion.

These samples can be used to directly estimate current PCB conditions in eight of the 12 impaired AUs, from impaired AU 170103070106_01_01 (East Side of Spokane Lake) to impaired AU 17010305000011_001_001 (Myrtle Point Natural Area to Cable Creek Confluence), through linear interpolation between sampled sites. Current PCB conditions in impaired Spokane River AUs upstream (n =1) and downstream (n = 2) of the sampled sites are assumed to be similar to adjacent upstream and downstream AUs. This assumption is supported by the mass balance source assessment (See Section 4.1 below) and the absence of discrete sources within these AUs. When compared to previous 3x blank-censored PCB monitoring data collected by the SRRTTF and Ecology, the EPA's extrapolated concentration predictions at those same monitoring locations diverge by less than an order of magnitude, lending confidence to the estimation approach (Ecology 2011, Ecology 2017). Current PCB conditions in the single impaired Little Spokane River AU (WA17010308000018_001_001) can be estimated from monitoring data collected from a groundwater-fed tributary of the river approximately 2.8 RMs upstream of the AU, though the estimate is likely lower than actual Little Spokane River PCB concentrations given the groundwater dominance of the samples. Previous monitoring data for the Little Spokane River AU is approximately an order of magnitude higher than the EPA's concentration estimate, though as in the previous comparison between monitoring data and the EPA's estimates, this monitoring data was also blank censored at 3x (Ecology 2011). Estimated current PCB concentrations for all PCB-impaired AUs addressed by this TMDL project are given in Table 9.

Table 9: Estimated current PCB conditions in Spokane and Little Spokane River AUs listed as PCB-impaired in Washington's combined 2014-2018 303(d) list, ordered from upstream (east) to downstream (west).

Washington AU ID	**AU Description (River Miles)**	**Mean total PCB Concentration (pg/L)**
WA17010305000012_001_001	Confluence of Spokane River and Cable Creek to Washington-Idaho border (RMs 94.8 – 96.3)	42[1]
WA17010305000011_001_001	Myrtle Point Natural Area to Cable Creek Confluence (RMs 84.7 – 94.8)	42[2]
WA17010305000010_001_001	Felts Field Park to Myrtle Point Natural Area (RMs 80.9 – 84.7)	53[2]
WA17010305000009_001_002	Upstream of Latah (Hangman) Creek and Spokane River confluence to south of Felts Field Municipal Airport (RMs 72.7 – 80.2)	110[2]
WA17010307009102_001_001	Between West Davenport and Aubrey Ln (RMs 63.1 – 64.5)	65[2]
WA17010307009085_001_001	Between Seven Mile Rd and West Davenport (RMs 62.4 – 63.1)	47[2]
WA17010307009615_001_001	Between McLellan Trailhead and Seven Mile Rd (RMs 61.0 - 62.1)	41[2]
WA17010307000774_001_001	Nine Mile Falls to Deep Creek (RMs 58.3 – 59.3)	57[2]
WA17010308000018_001_001*	Little Spokane River AU: Spokane/Little Spokane River confluence to West Rutter Pkwy (Little Spokane RMs 0.0 – 4.7)	6[3]

Washington AU ID	AU Description (River Miles)	Mean total PCB Concentration (pg/L)
WA170103070106_01_01	East Side of Spokane Lake (RMs 45.5 – 58.3)	130[2]
WA170103070107_01_01	West Side of Spokane Lake (RMs 34.2 – 45.5)	130[4]
WA17010307000010_001_001	South side of Spokane Arm across from the Spokane Tribe reservation, from Porcupine Bay Campground to Blue Creek (RMs 11.0 - 12.7)	130[4]

*Note: This is the single Little Spokane River AU currently listed as PCB-impaired.
[1]Note: Estimated concentration based on monitoring data for nearest downstream AU.
[2]Note: Estimated concentration based on interpolation of immediately upstream and downstream monitoring data.
[3]Note: Estimated concentration based on upstream groundwater-fed tributary monitoring data.
[4]Note: Estimated concentration based on monitoring data for nearest upstream AU.

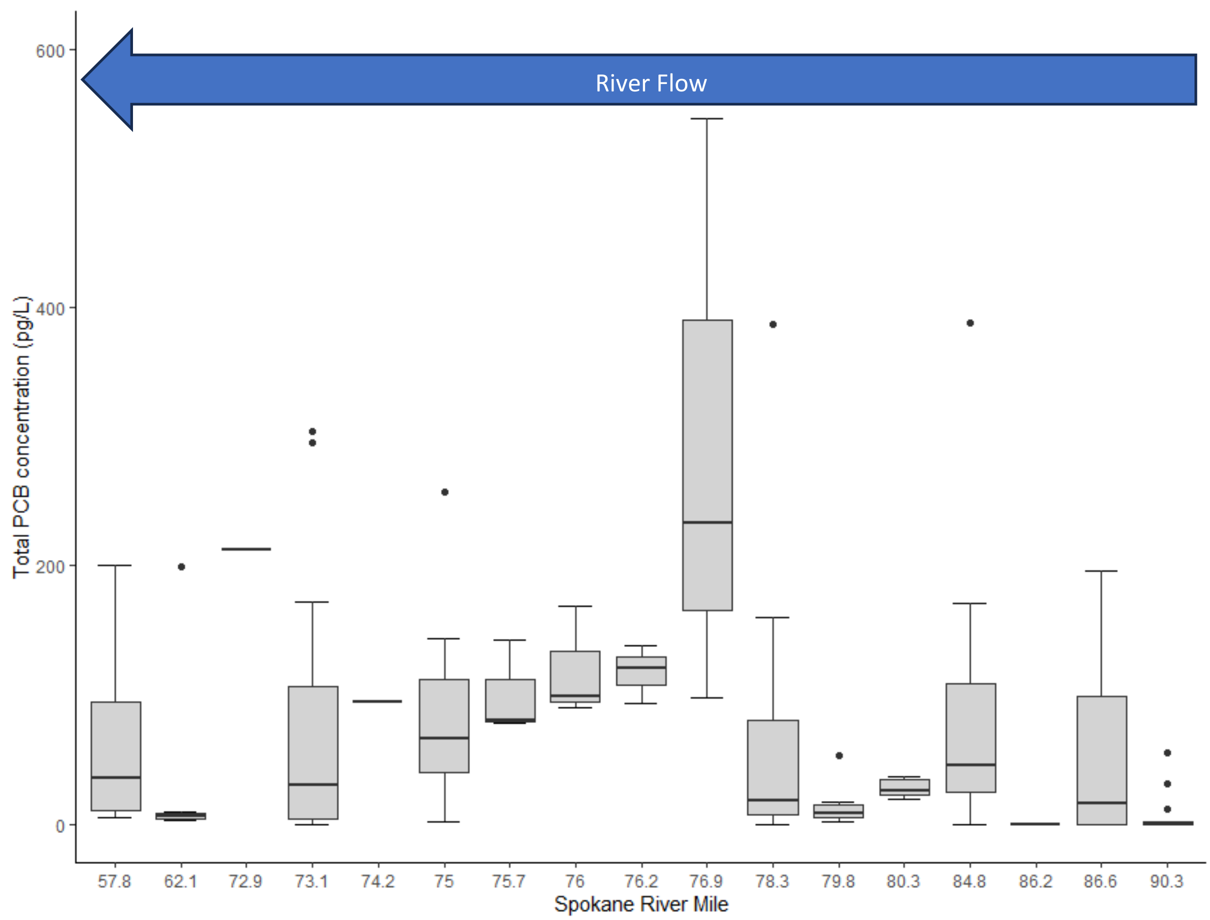


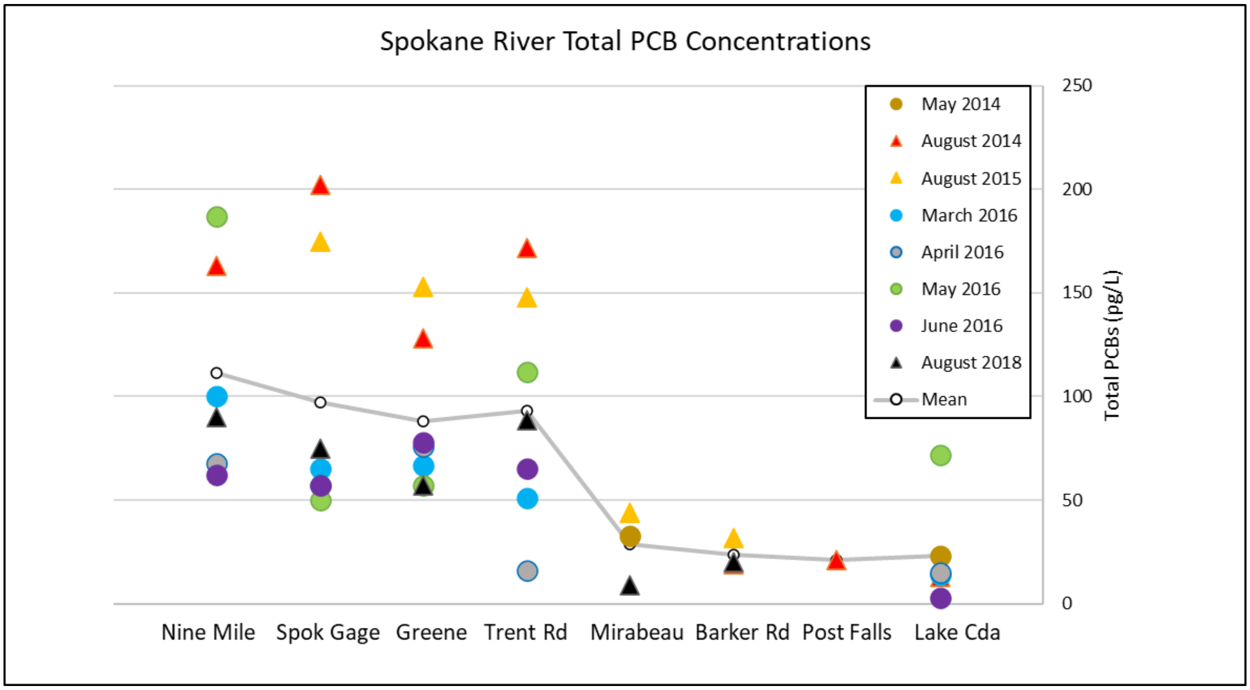
Figure 7: Blank-corrected (5x) method 1668C Spokane River PCB monitoring data collected post-2010 show regular exceedances of applicable water quality criteria. As in other studies of surface water

pollution in urbanized watersheds, elevated PCB levels, relative to immediately upstream and downstream concentrations, are observed in and along the city of Spokane's urban-industrial core.

3.4 Synoptic Monitoring Studies

SRRTTF conducted sampling studies of the Spokane River and tributaries between 2014 and 2018 from Lake Coeur d'Alene to Nine Mile Dam. In these focused monitoring studies, daily grab samples were taken at a set of river locations, over a period of several days. The mean values at each location are used to provide a "snapshot" of conditions for the sampling time frame. In some studies, this effort was also coordinated with point source monitoring. Information included total PCB concentrations in Idaho at the Lake Coeur d'Alene outlet and Post Falls dam and several Spokane River mainstem locations in the TMDL study area. The results of this monitoring are shown in Figure 8 (see LimnoTech 2016, Table 1 and LimnoTech 2019, Table 1).

Figure 8: SRRTTF Spokane River synoptic survey PCB monitoring results. Spokane River flow in this figure is from right (east) to left (west).



These synoptic field studies provide valuable information for estimating PCB loadings to specific reaches of the river. This information, combined with mass loading data for tributaries and point sources collected over the same time frame, supports an assessment of relative impact of different sources.

These data indicate that PCB concentrations are consistently lowest from Lake Coeur d'Alene to Mirabeau Point. Downstream of this location, industrial and municipal point sources, contaminated groundwater, and tributaries enter the river increasing water column PCB concentrations. Observed increases in concentrations are most pronounced during summer low-flow periods, whereas higher river flows in spring appear to dilute these source inputs.

4 TMDL Technical Approach

A wide variety of technical tools and analytical approaches are used to develop TMDLs, ranging from simple step-back calculations to complex water quality models. The selection of an approach is based on the characteristics of the waterbody and pollutant of concern, as well as existing monitoring data, project resources and schedule. Fundamentally, the selected approach must establish the linkage between the water quality criteria, loading capacity, and source loading. Calculating TMDL waste load and LAs for this TMDL project necessitated an approach that was scientifically defensible and reasonably accurate, while also recognizing the complexity involved in environmental PCB monitoring generally and limitations in existing PCB monitoring data for the Spokane and Little Spokane Rivers specifically.
The TMDL project establishes a quantitative budget that assigns loadings to all known sources that, when combined, will achieve the applicable water quality criteria. While linked water quality and food web models can be used to incorporate some of the complex fate and transport processes affecting

PCBs in the environment, the EPA selected a conservative mass balance approach that assumes all PCBs that reach the river are fully mixed, conserved within the water column along the length of the Spokane River, and not subject to significant degradation, volatilization, stable long-term sequestration, or otherwise removed from the Spokane River water column by any process other than discharge to the Columbia River. In other words, the EPA assumed that there is no loss of PCB mass from the point of release into the river, and all mass is transported downstream with the river flow. The following are key advantages of this approach:

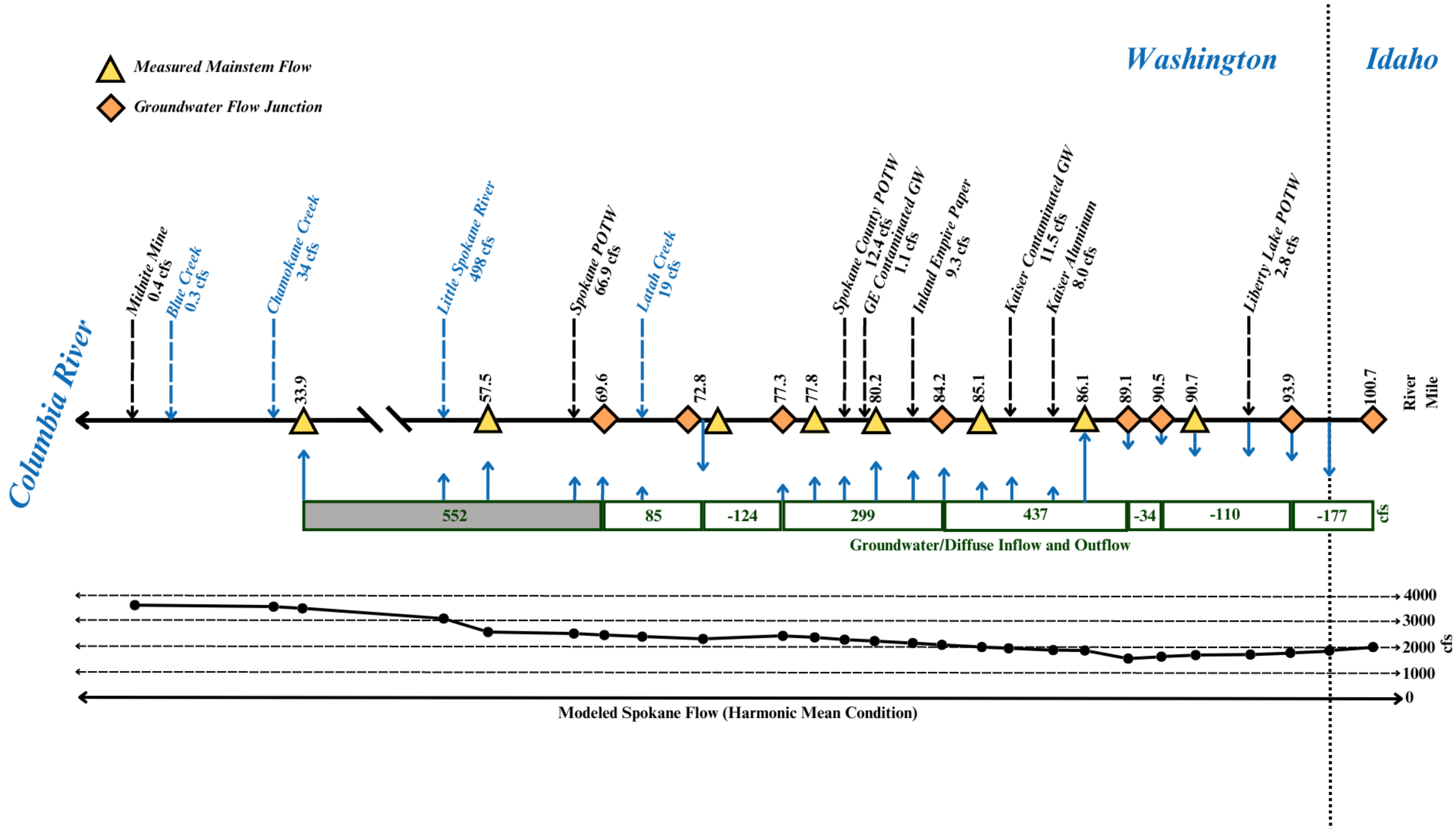
- Reasonable approach for a pollutant (PCBs) that is persistent in the environment and undergoes chemical transformations slowly
- Provides environmentally conservative approach that provides an inherent margin of safety (MOS)
- Allows simple spreadsheet calculations that stakeholders can readily understand and reproduce
- Requires fewer agency staff resources and contract funds

The EPA developed two mass balance spreadsheets: the first spreadsheet characterizes the sources of PCB loading and where and how much they discharge; the second spreadsheet allows for exploration of different allocation approaches to achieve water quality standards in a TMDL. The mass balance analysis extends from the USGS gauge station near Post Falls, Idaho (RM 100.7) to the confluence at the Columbia River. The upstream boundary of the TMDL project is the Washington-Idaho border, approximately 4 miles downstream of the Post Falls gauge. Figure 9 shows the structure of the TMDL mass balance spreadsheet with the river, point source, and groundwater flows applied in the TMDL project.

Detailed information about these mass balance models is available in Appendix C: Spokane River PCB Mass Balance Assessment Tools.

Figure 9 shows the topology of the mass balance model. Flow and PCB concentration are calculated at each junction point. All inflows are assumed to mix completely and instantaneously within the mainstem river.

Figure 9: PCB mass balance model components. Spokane River flow in this figure is from right (east) to left (west).



Description of the information on the mass balance schematic:
The top portion of the schematic shows the locations where point sources (black hatched lines) and tributaries (blue hatched lines) enter the mainstem Spokane River. The flow values for the TMDL analysis are average annual discharge for industrial point sources, design flow for municipal point sources, and harmonic mean flow for tributaries (in cfs).

The symbols on the river line show locations (including river miles) of monitoring locations for USGS flow measurement (diamonds) and locations monitored for a special groundwater study (diamonds).

The bar below the river line shows the groundwater inflows (up arrows toward the river) and outflows (down arrows from the river line). The magnitude of flow in cfs is provided for each segment of groundwater inflows.

The bottom plot is the model-calculated river flow (cfs) at the harmonic mean flow condition.

The flow of the river is from right to left; the left side of the diagram is downstream, the right side is upstream.

4.1 Mass Balance for Source Assessment and Characterization

To understand the sources of PCB loading into the Spokane River, the spreadsheet uses measurements of flows and total PCBs in the basin. This includes data from the mainstem river, tributaries, point source discharges and estimates of groundwater inflow and outflow from USGS studies. The most comprehensive data collection was conducted in August 2014, when the SRRTTF conducted coordinated sampling throughout the Spokane River reach of interest.

There are two core steps to model development for this type of model. First, the flow balance is constructed, and predicted flows are compared to measured flows at USGS gauge stations. Second, once the flow balance is established, the available data for PCB concentrations are assigned to the flow inputs (e.g., municipal and industrial point sources, groundwater, contaminated groundwater plumes, tributaries) and the predicted instream PCB concentrations are compared to measured concentrations. The spreadsheet calculates instream flow and PCB concentration at numerous locations (termed "junctions") including USGS gauge station locations, junctions where discrete inflows occur (e.g., tributary inflows and point source discharges), and key monitoring locations from past river studies.

Flow Balance

The first step in model development is building the flow structure. This involves the incremental addition of each inflow to the mainstem river downstream of the USGS gauge at Post Falls Dam, including tributaries and point sources. In the Spokane River, groundwater inflows and outflows are substantial, so accounting for groundwater is an important element of flow prediction.

The model-estimated and measured monthly average flow for August 2014 is shown in Figure 10.

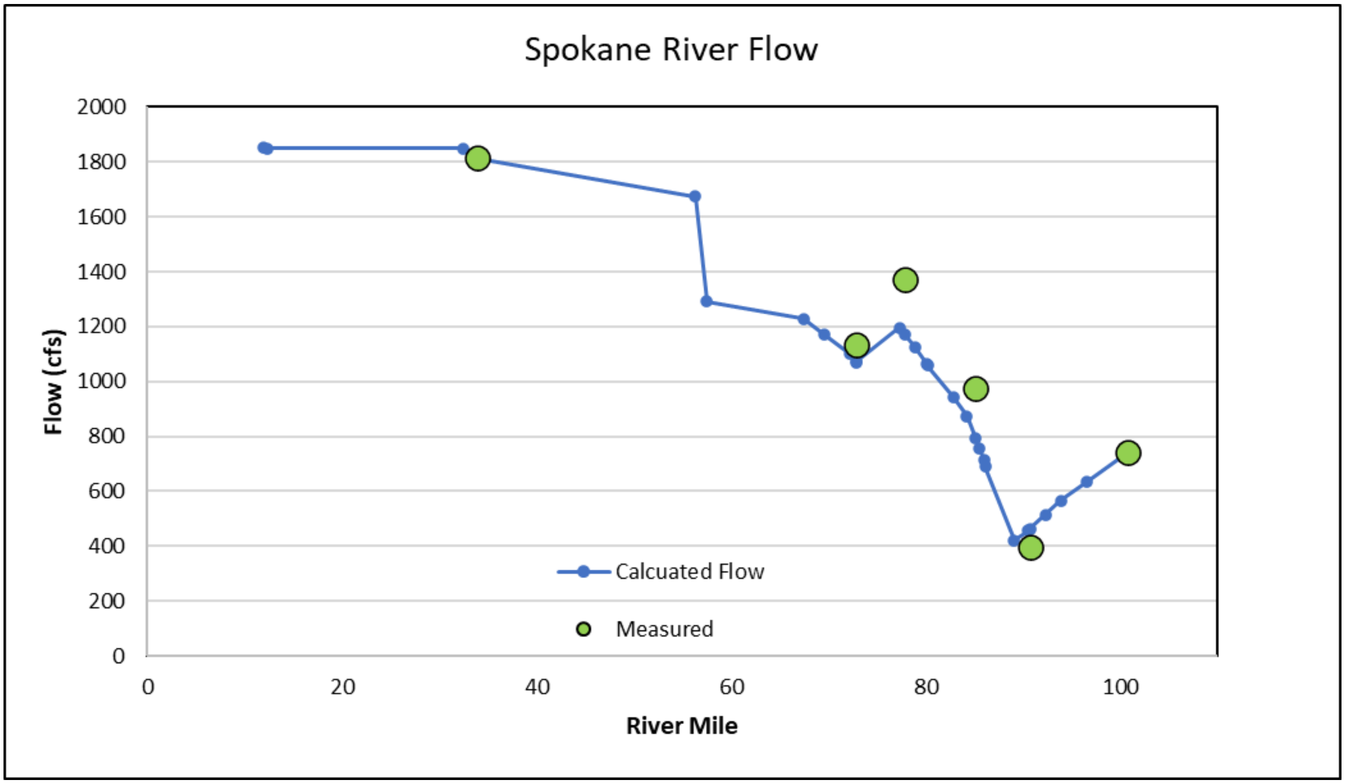


Figure 10: Comparison of measured and model-predicted Spokane River mean flow in August 2014. Spokane River flow in this figure is from right (east) to left (west).

4.1.1 Mass Balance and Source Contributions

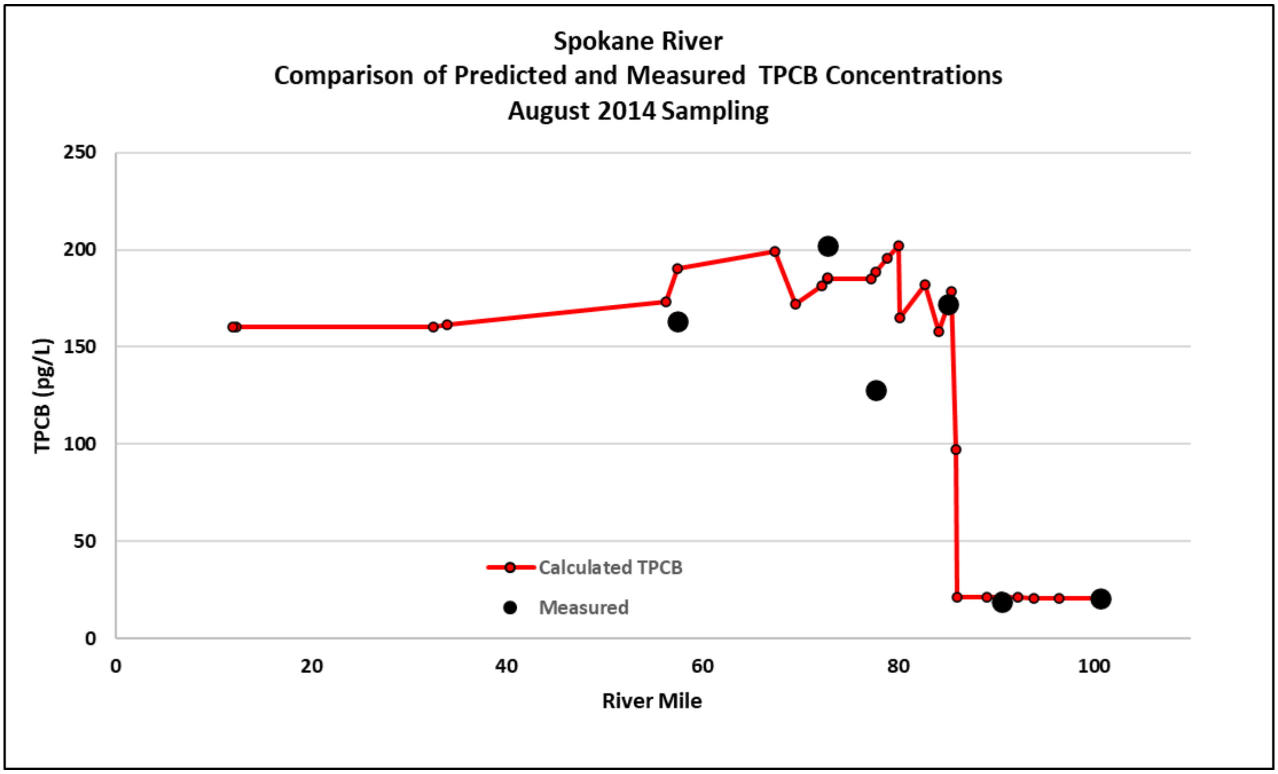
Once the flow balance is complete, the EPA can determine a PCB mass balance by assigning PCB concentrations to each boundary input (upstream boundary, tributaries, point sources, contaminated site groundwater, regional groundwater, and stormwater) and tracking the mass load in the river (and associated concentration).

The assessment spreadsheet predicts flow and PCB concentration in August 2014 for purposes of assessing current conditions and PCB sources. For August 2014 predictions, SRRTTF sampling information included total PCB concentrations at the upstream boundary (Post Falls), tributaries, and several Spokane River mainstem locations. Point source effluent flows were obtained from NPDES permit fact sheets for each facility. For point source PCB concentrations, the SRRTTF's comprehensive plan document (SRRTTF 2016) only includes summary information for 25th and 75th percentile loadings. More specific information for August 2014 is provided in a workshop map posted on the SRRTTF website (City of Spokane, 2016). These 2014 estimates are used for assessment purposes and do not factor into TMDL allocation decisions or calculations.

Some PCB source loadings and/or concentrations have not been measured and the EPA estimated them through best professional judgment or trial-and-error based on instream PCB levels. This category of unmeasured sources includes regional groundwater inflow loadings and loadings from contaminated groundwater. For information on how the EPA estimated groundwater loadings, see Appendix C: Spokane River PCB Mass Balance Assessment Tools.

A comparison of model-estimated and measured total PCB concentration in the Spokane River is shown in Figure 11. The model uses the measured concentration at Post Falls as the upstream boundary condition, so the measured and model-estimated concentrations are identical at this location. They are also identical at the Trent Bridge location (RM 85.5), because the EPA used the measured concentration at Trent Bridge to back-estimate the Kaiser groundwater loading just upstream of this location. From this point downstream, changes in the model-estimated concentration are calculated from estimated source flows and PCB concentrations.

Figure 11: Comparison of measured and model-predicted total PCB concentrations for August 2014. Spokane River flow in this figure is from right (east) to left (west).



Based on this mass balance representation on August 2014 conditions, the EPA could estimate the relative contribution from specific source categories. These percent contributions by category are shown in Figure 12.

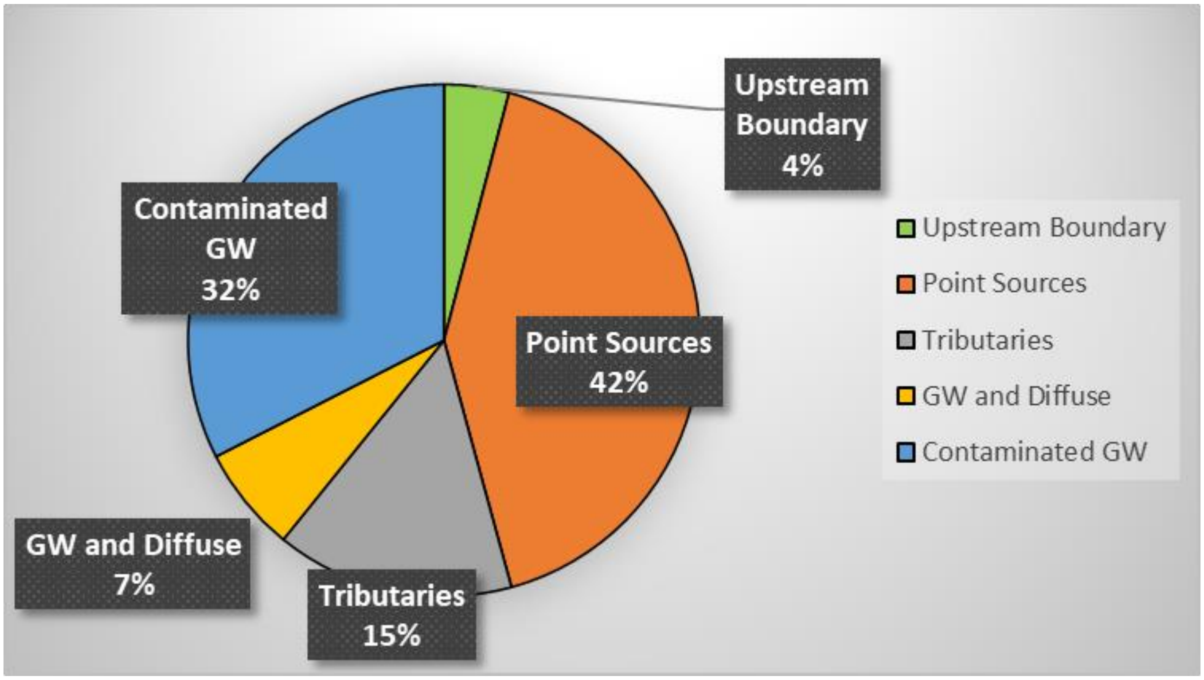


Figure 12: Estimated relative PCB loadings by major category from the August 2014 mass balance assessment.

In its Comprehensive Plan, SRRTTF provided a range of total PCB loadings by source category based on the full body of sampling information from SRRTTF studies (SRRTTF 2016; Table 5). The EPA's August 2014 assessment relies on a subset of the SRRTTF data, so we expect that the EPA's source loadings would fall within the range of loadings estimated by SRRTTF. A comparison of loading values in the SRRTTF and EPA assessments is provided in Table 10.

Table 10: Comparison of SRRTTF and EPA PCB source loading estimates.

Source Category[1]	SRRTTF PCB Loading Range (mg/day)	EPA Aug 2014 PCB Loading (mg/day)	Notes
Upstream Sources	33 - 444	33	SRRTTF value estimated at Coeur d'Alene Lake; EPA estimate location is Post Falls Dam
Groundwater Loading	60 - 300	311 (Total) 53 (Regional) 258 (Contaminated)	SRRTTF estimate not split into regional and contaminated contributions
Tributaries			
Latah (Hangman) Creek	0 - 215	2	
Little Spokane River	15 - 200	108	
WWTPs			
Total Industrial	126 - 165	215	
Total Municipal			
Idaho	4-10	NA	EPA assessment includes only WA sources
Washington	47-115	116	
MS4 Stormwater/CSOs	15 - 94	NA	Not estimated in EPA analysis
Bottom Sediments	0.05 – 20	NA	Not estimated in EPA analysis
Fish Hatcheries	Unknown	NA	Incorporated into Little Spokane River loading
Atmospheric Deposition to Surface Water	< 0	NA	Deposition to Lake Coeur d'Alene incorporated in Upstream Sources estimate

[1]Source category listing label from SRRTTF Comprehensive Plan

The upstream and tributary source category loadings are lower in the August 2014 analysis, because this is a low-flow period in the late summer. Point source effluent flows have less seasonal variation, so they have a higher relative contribution in the summer.

The available source assessments have important limitations. One key limitation is that the August 2014 assessment provides a seasonal snapshot of estimated source loadings under low-flow conditions in the Spokane River, whereas the TMDL project is designed to meet an annual average condition. In general, higher river flows during non-summer periods will increase the upstream boundary and tributary loading contributions, compared to groundwater and point source contributions, and precipitation events will cause additional loading from stormwater sources in the mainstem and tributaries.

Finally, the EPA notes that these source loading estimates reflect conditions during the 2014 monitoring study. Since that time, the point source facilities have upgraded wastewater treatment technologies, and Kaiser has taken actions to address the groundwater contamination plume at its Trentwood facility.

4.2 TMDL Technical Framework

The EPA uses a mass balance spreadsheet to track the cumulative impact of the allocated loading to sources throughout the study area. The spreadsheet estimates in-river PCB concentrations and loadings at multiple key locations, including locations with known tributary or groundwater inflows and point source discharges. The model provides the necessary calculations to assign allocations in a manner that meets all applicable water quality standards in all locations of the river.

4.2.1 Achieving Water Quality Criteria Throughout the System

While the Washington criterion (7 pg/L total PCBs) applies to waters within Washington's jurisdiction, the more stringent Spokane Tribe criterion (1.3 pg/L total PCBs) requires achieving lower PCB concentrations in Washington and at the Washington-Idaho and Washington-Spokane Tribe border waters and drives the allocation assignment throughout the TMDL study area.[3] The mass balance spreadsheet provides calculations necessary to demonstrate that the assigned allocations meet all applicable water quality standards at all river locations.

The Spokane River enters the Columbia River at the downstream TMDL project boundary. Washington and the Colville Tribes split Columbia River jurisdiction at this location. The Colville Tribes water quality standards do not include a human health criterion for total PCBs. The water quality standard for the Columbia River under Washington jurisdiction is 7 pg/L total PCBs; therefore, achievement of the Spokane Tribe water quality standard of 1.3 pg/L total PCBs at the Spokane River mouth will meet applicable water quality standards for the Columbia River at the confluence with the Spokane River.

4.2.2 River Flow Assumptions

4.2.2.1 Seasonal Variation and Critical Conditions

The TMDLs must first determine the appropriate flow to calculate the loading capacity and allocations that will achieve criteria during critical conditions. The CWA requires TMDLs to consider seasonal variation to assess the critical condition. These factors drive the assumptions for river flows in the TMDL calculations.

The EPA developed this TMDL project to meet the human health water quality standards for PCBs. Protection of human health requires achievement of water quality standards over a lifetime, so the critical condition for this TMDL project is the long-term average loading capacity. Unlike many TMDLs, intra annual (i.e., seasonal) variability of river flows or PCB concentrations are less relevant than the long term annual concentration. As such, the critical condition does not relate to seasonal variation in this TMDL project. Specifically, as recommended in the EPA's promulgation of Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (65 FR 66444), this TMDL project applies the annual harmonic mean river flow as the critical condition for applying the water quality criteria to protect human health. The following section describes the data used to calculate the harmonic mean river flow.

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[3] See Section 2: Water Quality Standards, Section 4.2.3: Assimilative Capacity Analysis, Section 4.2.4: Boundary Condition Concentrations in Border Waters, and Appendix A: Applicable PCB Water Quality Standards for additional information on the location of applicable WQS.

4.2.2.2 River Flow Analysis

To represent the current river regime, the EPA used a 30-year record period (1991-2021) to compute the harmonic mean flow for the TMDL project (Table 11). While Spokane River flows have been monitored since 1891, the earliest data may not represent current and future flows. In recent decades different water uses, dam operations, and climate change effects have potentially altered the flow regime from historic data.

Table 11: Spokane River harmonic mean flows, ordered from upstream (east) to downstream (west).

Station Name	USGS Station Number	Spokane River Mile	Period of Record Complete years through 2021	30-year Harmonic Mean Flow (1991-2021) (cfs)
Spokane River (Full naming convention: "Spokane River [suffix below])"				
Near Post Falls, ID	12419000	100.7	1913-2021	1988
At Barker Road, WA	NA	90.7	NA	NA
At Greenacres, WA	12420500	90.5	1948-2011	NA
Below Trent Bridge near Spokane, WA	12421500	85.1	1949-1954	NA
Below N Greene St at Spokane, WA	12422000	77.8	1950-1952; 2018-2021	NA
At Spokane, WA	12422500	72.8	1891-2021	2639
At 7-mile Bridge near Spokane, WA	12424500	69.6	1948-1952	NA
Below Nine Mile Dam at Spokane, WA	12426000	57.5	1949-1950; 2017-2021	NA
At Long Lake, WA	12433000	33.9	1939-2021	3535
Below Little Falls near Long Lake, WA	12433500	29.3	1913-1940	NA
Tributaries to the Spokane River				
Latah (Hangman) Creek at Spokane, WA	12424000	NA	1949-2021	19
Little Spokane River near Dartford	12431500	NA	1949-1951; 1998-2021	498[1]
Chamokane Creek below falls near Long Lake, WA	12433200	NA	1972-1978; 1988-2021	34

Blue Creek near mouth near Wellpinit, WA	12433561	NA	1984-1998	0.3[2]
[1] 23-year harmonic mean flow (1998-2021) [2] 7-year harmonic mean flow (1991-1998)				

Continuous flow gauge records for Little Spokane River (1998-2021) and Blue Creek (1991-1998) are not of sufficient length to estimate a 30-year harmonic mean flow, so the harmonic mean flow for the available period of record is used for these tributaries.

The river flow at locations between monitoring locations is estimated at each location as described in mass balance model documentation (Appendix C: Spokane River PCB Mass Balance Assessment Tools). The "Calculated Flow" in Figure 13 shows the estimated harmonic mean flow used for the TMDL calculations.

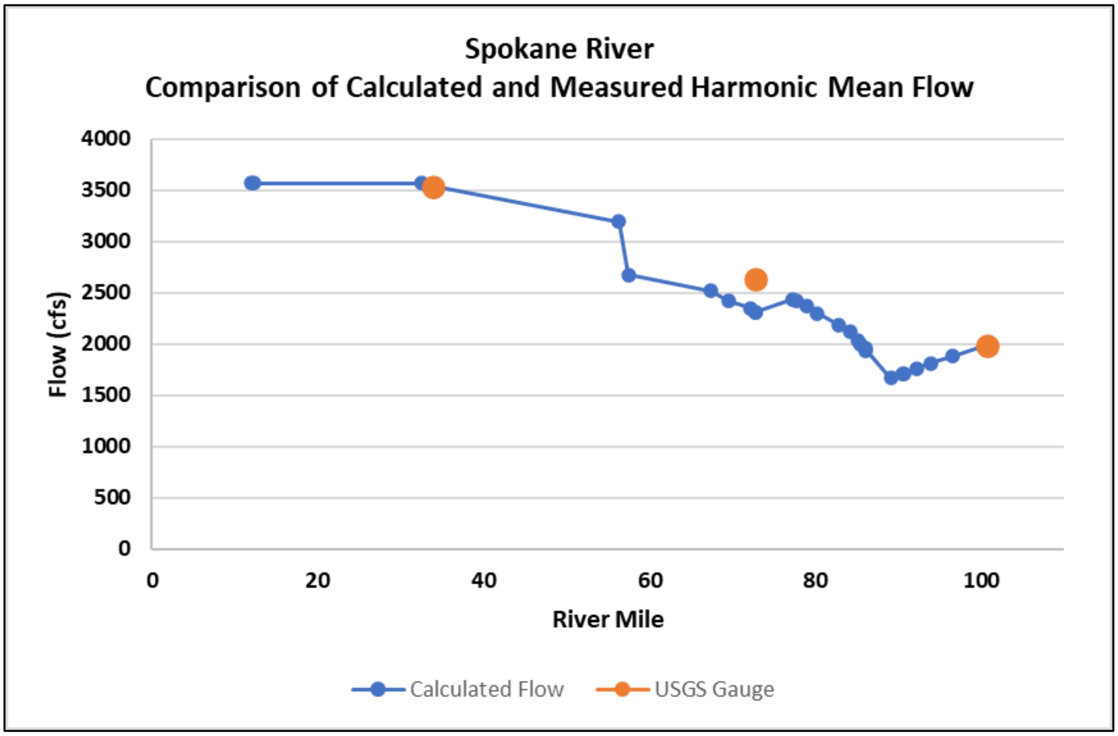


Figure 13: Comparison of measured and model-predicted Spokane River 30-year harmonic mean flow. Spokane River flow in this figure is from right (east) to left (west).

4.2.3 Assimilative Capacity Analysis

The EPA assessed the loading that could meet the Washington and Spokane Tribe water quality standards in all locations in the river. This included evaluation of allocation alternatives and resulting river conditions at locations where inflows and outflows alter the assimilative capacity of the river. In addition to changes in river flow from upstream to downstream, the water quality criteria for the river differ in Washington waters (7 pg/L) and Spokane Tribe waters (1.3 pg/L), with the Spokane Tribe water quality standards applying between Long Lake Dam and the mouth of the Spokane River.

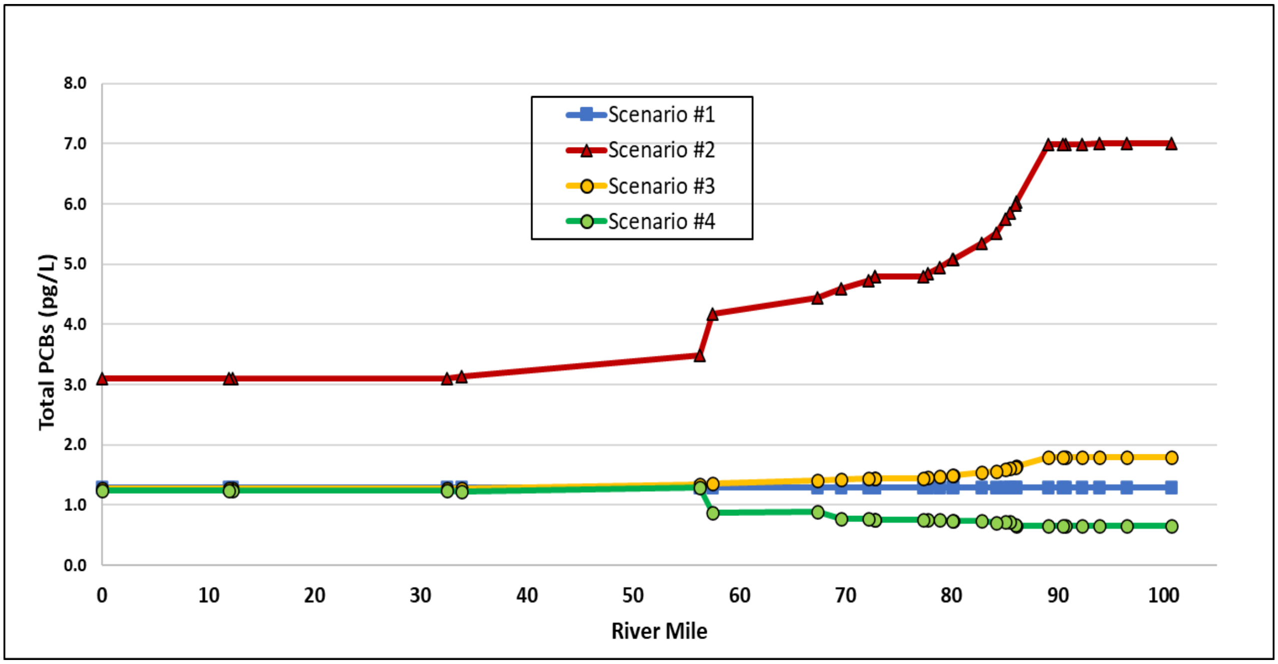
The EPA ran four simple scenarios through the TMDL mass balance spreadsheet. The first scenario is a baseline scenario where PCB concentrations in all inflows are set to the Spokane Tribe's water quality criterion for total PCBs of 1.3 pg/L. As would be expected, the resulting concentration is 1.3 pg/L at each calculation junction in the spreadsheet. The second scenario adjusts the instream concentration at the Washington-Idaho border to the Washington criterion of 7 pg/L and reduces all other inflow concentrations to zero. The third scenario is similar to Scenario 1 but the EPA reduced the regional groundwater concentration by half and increased the border concentration by trial-and-error to a concentration (1.8 pg/L) that achieved the 1.3 pg/L water quality criterion at the mouth. In the fourth scenario, the EPA reduced the border concentration and groundwater/diffuse concentrations to half the 1.3 pg/L water quality criterion, set tributaries to half the 7.0 pg/L water quality criterion, and set point sources and contaminated groundwater to 7.0 pg/L; this combination meets the water quality standard at the mouth.

The scenario specifications are shown in Table 12 and graphical results are shown in Figure 14. See Appendix C: Spokane River PCB Mass Balance Assessment Tools for more information.

Table 12: Four distinct TMDL assimilative capacity scenarios, of the many that were explored.

Source Category	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	TPCB (pg/L)	TPCB (pg/L)	TPCB (pg/L)	TPCB (pg/L)
Washington-Idaho Border	1.3	7.0	1.8	0.65
Point Sources	1.3	0	1.3	7.0
Tributaries	1.3	0	1.3	3.5
Stormwater	1.3	0	1.3	7.0
Groundwater/Diffuse	1.3	0	0.65	0.65
Contaminated Groundwater	1.3	0	1.3	7.0

Figure 14: Four distinct assimilative capacity scenario results. Symbols show locations where mass-balance based concentrations are calculated in the model. Spokane River flow in this figure is from right (east) to left (west).



These scenario results indicate that achieving the Spokane Tribe criterion (1.3 pg/L) in the lower river requires a PCB concentration at the Washington-Idaho state line below the Washington criterion (7 pg/L). Additionally, these results illustrate the trade-offs between higher point source allocation concentrations and lower state line and regional groundwater allocation concentrations.

4.2.4 Boundary Condition Concentrations in Border Waters

The TMDL project considers PCB loading coming from jurisdictions outside Washington to set allocations in the project area that will meet the Spokane Tribe standards. The total PCB concentrations in the Spokane River at the Washington-Idaho border exceed both Washington and Spokane Tribe criteria, so the TMDL project assigns a concentration to the river at the border that applies in concert with the allocations to sources in Washington. As described above, the EPA evaluated alternatives for the Washington-Idaho border assignment, including setting the border concentration at values between the Washington total PCB criterion concentration (7 pg/L) and the Spokane Tribe criterion (1.3 pg/L). The mass balance analysis indicates that the concentration assigned to the river at the border cannot be substantially higher than the 1.3 pg/L Spokane Tribe criterion concentration and meet the criterion in waters under the Tribe's jurisdiction. Based on these considerations, and consistent with the overall allocation approach in this TMDL project, the EPA assigned a boundary condition concentration of 1.3 pg/L to the river at the Washington-Idaho border. This assignment is identical to the PCB concentrations the EPA assigned to Washington sources as described in the TMDL allocations (See Section 5).

The EPA also assigned a PCB boundary condition concentration to tributaries and groundwater that flow directly into the Spokane River at their point of exit from the Spokane Tribe reservation. Consistent with the boundary condition concentration assignment to the Spokane River at the Washington-Idaho border, and allocations to Washington tributary and groundwater sources, the EPA assigned a boundary condition concentration of 1.3 pg/L to the waters at the Washington-Spokane Tribe reservation border.

4.3 Accounting for Uncertainty

The EPA develops and applies all environmental models with a recognition of the uncertainties and limitations in model predictions. The mass balance model we used for this analysis is a simplified representation of the system and factors affecting PCB fate and transport. The model provides a steady state snapshot of conditions, so predictions are limited to the time frames and/or flow conditions selected for analysis.

Both model-based and measurement-based assessments include some element of uncertainty. Models and measurements (data) are complementary information sources used to assess the condition of the environment. Models are often developed and used to address gaps and limitations in measurement systems because measurement at every location at every time across a large-scale watershed is infeasible. At the same time, measurement data are critical inputs for model development, and gaps and/or imprecision in data affect model accuracy (see Appendix D: Water Quality Monitoring Analytical PCB Methods for information on analytical methods and detection limits).

Data gaps present a significant uncertainty in model development because the model represents single snapshots of river conditions. Ideally, for the given period chosen for the analysis, flow and PCB samples would be available in that period at all tributaries, point sources, and mainstem locations. Some of the sampling programs to date have employed synoptic, or simultaneous, data collection as a goal, but others include only a fraction of the locations/times of interest, requiring the model developer to fill gaps in the available information. The gaps are more substantial in the PCB data than the flow data because flow is systematically monitored for water management purposes. The EPA strives to use values that are reasonably representative of the conditions in the system.

5 PCB Total Maximum Daily Loads

5.1 TMDL Overview

In a TMDL project, the loading capacity is allocated to all known sources in a manner that achieves water quality standards. PCB sources to the Spokane River in Washington include municipal and industrial wastewater discharges, stormwater discharges, sources in tributary subbasins, regional groundwater inflows, and contaminated groundwater. There are many alternatives for allocating the loading capacity to source categories and individual sources in a TMDL project. For example, the availability of control technologies and best management practices to reduce the pollutant can support different allocations for point and nonpoint sources in a basin. In this TMDL project, the stringency of the water quality criteria presents substantial challenges for all source categories in the basin.

As discussed in the analysis of current sources and assimilative capacity (Chapter 4), the Spokane Tribe water quality criterion (1.3 pg/L) is substantially lower than the current concentrations at the Washington-Idaho border as well as concentrations in regional groundwater and tributaries. For the TMDL project, the EPA evaluated alternatives that assigned PCB concentrations both higher and lower than 1.3 pg/L to different inflows to the Spokane River. This analysis indicated that the concentration assigned to the river at the Washington-Idaho border cannot be substantially higher than 1.3 pg/L, and the TMDL project assigned 1.3 pg/L to the river as the boundary condition concentration. Additionally, the EPA does not currently have information that control technologies and best management practices can achieve PCB concentrations below the criterion in regional groundwater and tributaries. For consistency and simplicity, the TMDL project allocates a PCB concentration of 1.3 pg/L to all sources to the Spokane and Little Spokane Rivers within Washington, including tributary inflows, regional groundwater, contaminated groundwater, and point sources. The combination of these allocations and assigned boundary conditions will achieve the Spokane Tribe water quality standards.

5.2 Loading Capacity

A TMDL is the sum of the individual WLAs for point sources, the LAs for nonpoint sources and natural background, and a MOS [CWA § 303(d)(1)(C); 40 CFR 130.2(i)]:

TMDL = ∑WLA + ∑LA + MOS

where…

TMDL = loading capacity = total maximum daily load of pollutant(s) that can be assimilated by the waterbody without violating water quality standards.

WLA = wasteload allocation, or the portion of the TMDL allocated to existing and future point sources.

LA = load allocation, or the portion of the TMDL attributed to existing and future nonpoint sources and natural background (zero in the case of PCBs). The total LA loading includes loadings associated with tributaries, groundwater, and assigned boundary conditions.

MOS = margin of safety, or the portion of the TMDL that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. The MOS can be provided implicitly by applying conservative analytical assumptions or explicitly by reserving a portion of the loading capacity.

In this TMDL project, the selected allocation approach (described above) and sum of WLAs and LAs defines the TMDL loading capacity. Assigning a uniform concentration of 1.3 pg/L total PCBs to every inflow to the river results in an in-stream concentration of 1.3 pg/L total PCBs at each evaluation location. The EPA calculated the loading capacity as:

Equation 1
Loading Capacity (mg/day) = Flow (cfs) x 1.3 pg/L x 0.002447 (conversion factor)

Table 13 lists loading capacity values for model evaluation locations. Table 14 lists loading capacity values for AU boundaries.

Table 13: Total PCB loading capacities for the Spokane River, upstream (east) to downstream (west)

Evaluation Location	River Mile	Harmonic Mean River Flow (cfs)	TMDL Total PCB River Concentration (pg/L)	TMDL Total PCB Loading Capacity (mg/day)
Spokane R@ Stateline	96.5	1878	1.3	5.97

Evaluation Location	River Mile	Harmonic Mean River Flow (cfs)	TMDL Total PCB River Concentration (pg/L)	TMDL Total PCB Loading Capacity (mg/day)
GW Junction - abv Liberty Bridge	93.9	1811	1.3	5.76
Liberty Lake POTW	92.3	1762	1.3	5.60
Barker Road	90.7	1710	1.3	5.44
GW Junction – Greenacres	90.5	1703	1.3	5.42
GW Junction - Flora Rd	89.1	1669	1.3	5.31
Mirabeau Point	86.1	1937	1.3	6.16
Kaiser Aluminum	86.0	1955	1.3	6.22
Kaiser contaminated GW	85.5	1999	1.3	6.36
Trent Bridge	85.1	2035	1.3	6.47
GW Junction - Centennial ped bridge	84.2	2115	1.3	6.73
Inland Empire Paper	82.8	2187	1.3	6.96
Upriver Dam	80.2	2300	1.3	7.32
Spokane County POTW	78.9	2369	1.3	7.54
Spokane R@Greene St	77.8	2417	1.3	7.69
GW Junction - blw Greene St	77.3	2438	1.3	7.76
Spokane R@Spokane	72.8	2314	1.3	7.36
GW Junction - at Spokane gauge	72.8	2314	1.3	7.36
Latah (Hangman) Creek confluence	72.2	2349	1.3	7.47
GW Junction - blw TJ Meenach bridge	69.6	2418	1.3	7.69
Spokane POTW	67.4	2521	1.3	8.02
Spokane R@Nine Mile	57.5	2673	1.3	8.50
Little Spokane River confluence	56.3	3190	1.3	10.15
Spokane R@Long Lake Dam	33.9	3535	1.3	11.25
Chamokane Creek confluence	32.5	3569	1.3	11.35
Blue Creek confluence	12.3	3570	1.3	11.35
Midnite Mine	12.0	3571	1.3	11.36
Confluence with Columbia River	0.0	3571	1.3	11.36

Table 14: Total PCB loading capacities for the Spokane and Little Spokane Rivers, upstream (east) to downstream (west)

Washington AU ID	AU Description (River Miles)	Harmonic Mean River Flow (cfs)	TMDL Total PCB Loading Capacity (mg/day)
WA17010305000012_001_001	Confluence of Spokane River and Cable Creek to Washington-Idaho border (RMs 94.8 – 96.3)	1854	5.90
WA17010305000011_001_001	Myrtle Point Natural Area to Cable Creek Confluence (RMs 84.7 – 94.8)	1806	5.74
WA17010305000010_001_001	Felts Field Park to Myrtle Point Natural Area (RMs 80.9 – 84.7)	2181	6.94
WA17010305000009_001_002	Upstream of Latah (Hangman) Creek and Spokane River confluence to south of Felts Field Municipal Airport (RMs 72.7 – 80.2)	2366	7.53
WA17010307009102_001_001	Between West Davenport and Aubrey Ln (RMs 63.1 – 64.5)	2555	8.13
WA17010307009085_001_001	Between Seven Mile Rd and West Davenport (RMs 62.4 – 63.1)	2572	8.18
WA17010307009615_001_001	Between McLellan Trailhead and Seven Mile Rd (RMs 61.0 - 62.1)	2591	8.24
WA17010307000774_001_001	Nine Mile Falls to Deep Creek (RMs 58.3 – 59.3)	2635	8.38
WA17010308000018_001_001*	Little Spokane River AU: Spokane/Little Spokane River confluence to West Rutter Pkwy (Little Spokane RMs 0.0 – 4.7)	498	1.58
WA170103070106_01_01	East Side of Spokane Lake (RMs 45.5 – 58.3)	3187	10.14
WA170103070107_01_01	West Side of Spokane Lake (RMs 34.2 – 45.5)	3440	10.94
WA17010307000010_001_001	South side of Spokane Arm across from the Spokane Tribe reservation, from Porcupine Bay Campground to Blue Creek (RMs 11.0 -12.7)	3570	11.36
*Note: This is the single Little Spokane River AU currently listed as PCB-impaired.			

5.3 Wasteload Allocations

As noted above, this TMDL project allocates a total PCB concentration (1.3 pg/L) at the point of discharge for point sources. The WLAs are also expressed as a daily loading (mg/day) based on design flows for municipalities and annual average effluent flows for industrial facilities (see discussion of long-term averaging under Seasonal Variation and Critical Conditions). The EPA calculates WLAs as follows:

Equation 2
WLA (mg/day) = Annual Avg Effluent Flow (mgd) x PCB allocation concentration (pg/L) x 0.003788 (conversion factor)

The effluent flow used for WLAs was the average flow reported in facility Discharge Monitoring Reports (DMRs) for the 12-month period from December 2022 through November 2023.

5.3.1 Municipal and Industrial Wastewater Discharges

Six individual NPDES facilities discharge directly to the Spokane River in the TMDL project reach. The WLAs for these facilities are listed in Table 15. One hatchery facility discharges to the Little Spokane River (via Griffith Slough) under a NPDES general permit, and the WLA for this facility is provided in Table 16.

Table 15: Total PCB WLAs for NPDES permitted municipal and industrial wastewater discharges to the Spokane River

Facility	NPDES Permit Number	River Mile	Wasteload Allocation Concentration Total PCBs (pg/L)	Effluent Flow (mgd)	Wasteload Allocation Total PCBs (mg/day)
Liberty Lake	WA0045144	92.3	1.3	1.8	0.0089
Kaiser Aluminum	WA0000892	86.0	1.3	5.2	0.026
Inland Empire Paper	WA0000825	82.8	1.3	6.0	0.030
Spokane County	WA0093317	78.9	1.3	8.0	0.039
City of Spokane	WA0024473	67.4	1.3	43.2	0.21
Midnite Mine	WA0026841	12.0	1.3	0.28	0.0014
Total					0.318

Table 16: Total PCB WLAs for NPDES permitted wastewater discharges to the Little Spokane River.

Facility	NPDES Permit Number	River Mile	Wasteload Allocation Concentration	Effluent Flow	Wasteload Allocation

			Total PCBs (pg/L)	(mgd)	Total PCBs (mg/day)
Spokane Fish Hatchery	WAG137007	7.5	1.3	13.6	0.067
Total					0.067

The WLAs represent substantial reductions relative to current PCB effluent limits; all sources to the Spokane River listed in Table 15 currently have final average monthly PCB effluent limits of 170 pg/L, except for Midnite Mine, which has only PCB monitoring requirements and no PCB effluent limits. The Spokane Fish Hatchery is covered by a NPDES general permit that requires PCB reduction actions and monitoring. The WLAs also represent large reductions relative to historic average PCB point source loads (Table 10).

Consistent with the human health protection approach, the NPDES permitting authority can translate these daily loads into annual permit limits (mg/year) by multiplying the daily load by 365 days. Additionally, the translation from these WLAs to permit limits can incorporate future growth in approved facility plans. Since the EPA set the allocation concentration at the water quality criterion, an increase in effluent flow at this PCB concentration will not contribute to water quality exceedances. Thus, a point-of-discharge permit limit of 1.3 pg/L would be consistent with the TMDL project's requirements and assumptions.

5.3.2 Permitted Stormwater and Combined Sewer Overflows

The EPA assigned WLAs to stormwater and combined sewer overflows as shown in Table 17.

Table 17: Total PCB WLAs for City of Spokane NPDES permitted stormwater and combined sewer overflow discharges

Facility	Discharge Type	Wasteload Allocation Concentration Total PCBs (pg/L)	Annual Average Effluent Flow (mgd)	Wasteload Allocation Total PCBs (mg/day)
City of Spokane	Stormwater[1]	1.3	1.03	0.0051
City of Spokane	CSOs[2]	1.3	0.16	0.00079
Total Loading	0.0059			

[1] Discharges covered under Eastern Washington Phase II Municipal Stormwater Permit
[2] Discharges covered under NPDES permit WA0024473

5.3.3 General NPDES Permits and Diffuse Stormwater Discharges

The EPA assigned NPDES general permit discharges and unpermitted stormwater discharges the same allocation concentration (1.3 pg/L total PCBs) as other sources. Since flow information is not generally available for these discharges, we are unable to assign WLAs expressed in mg/day. Based on the annual average effluent flow, the wasteload allocation for a given source can be computed using Equation 2 above.

5.4 Load Allocations

5.4.1 Tributaries

The LAs for tributaries under Washington jurisdiction, based on an allocation concentration of 1.3 pg/L, are shown in Table 18. The LAs apply at the mouth of each tributary. The LAs are expressed as daily load, but these values can be converted to annual loadings (multiplying by 365) for compliance evaluations.

Table 18 : Total PCB LAs for major tributaries of the Spokane River.

Tributary	Harmonic Mean Flow (cfs)	Load Allocation Concentration Total PCBs (pg/L)	Load Allocation at Mouth Total PCBs (mg/day)
Latah (Hangman) Creek	19	1.3	0.060
Little Spokane River	498	1.3	1.6
Total			1.66

The tributary LAs apply to the combination of point and nonpoint source loadings within tributary subbasins. The EPA assigned point sources in tributary subbasins the same allocation concentration (1.3 pg/L total PCBs) as other point sources. Based on the annual average effluent flow, the wasteload allocation for a given source can be computed using Equation 2 above.

Two tributaries under Spokane Tribe jurisdiction, Chamokane Creek and Blue Creek, enter the Spokane River. The EPA assigned these waters boundary condition PCB concentrations as described in Section 4.2.4.

5.4.2 Regional Groundwater and Diffuse Sources

For regional groundwater and diffuse sources of PCBs into the Spokane River, the EPA assigned load allocations based on the same allocation concentration (1.3 pg/L) assigned to other sources. The EPA estimated the total flow from groundwater and unmonitored inflows into the Spokane River, used to compute the load allocation as a loading value, from USGS hydrologic studies and differences in measured river flows between gauges (see Appendix C: Spokane River PCB Mass Balance Assessment Tools). The annual average groundwater/unmonitored inflows are substantially more uncertain than other flow values in this TMDL project and are subject to revision based on future studies.

The EPA combines unmonitored flows with groundwater estimates because the method we used to estimate the magnitude of total groundwater and unmonitored inflows identifies a gain in mainstem flow between river gauges and does not distinguish the source of the inflow. Since the overall inflows are relatively large, the EPA assumes that a high percentage of these flows is groundwater entering the river from the aquifer.

In addition to regional groundwater, the types of sources in the diffuse sources sub-category include relatively small discharges from unmonitored tributaries, small stormwater or general permit discharges that are not assigned individual WLAs, and contaminated bed sediments. The LA applies to the combined loading from all sources in this category.

Regarding riverbed sediments, this LA applies to PCBs entering the water column by diffusive flux from the bed sediments and resuspension of contaminated sediments from the bed. Since the mechanism of PCB loadings from this source are not associated with a discharge, evaluation of bed sediment contributions should focus on estimating mass loads to the river (mg/day). Over the long term, the need for improvements in the quality of bed sediments may be influenced by other allocations in the TMDL, because PCB allocations are assigned to the total (unfiltered) water samples for all other sources to the river. To the extent that ongoing source loadings are comprised of substantial PCB levels in suspended and settleable solids, implementation of the TMDL project will result in reductions in contaminated solids in source discharges. For example, stormwater utilities can reduce PCB levels in stormwater by removing settled solids in stormwater catch basins so they do not become re-entrained in stormwater events. As described in Section 3, long term reductions in sediment-bound PCBs in discharges to the river should improve the quality of river bed sediments, with gradual burial of contaminated sediments as cleaner sediments are deposited over time. This will reduce the diffusion and resuspension of PCBs into the water column.

LAs for this category are provided in Table 19.

Table 19: Total PCB LAs for groundwater and diffuse sources to the Spokane River.

Reach (River Mile)	Flow to Spokane River (cfs)	Load Allocation Concentration (pg/L)	Load Allocation (mg/day)
89.1 to 84.2	437	1.3	1.4
84.2 to 77.3	299	1.3	1.0
72.8 to 69.6	85	1.3	0.3
69.6 to 0.0	575	1.3	1.8
Total			4.4

5.4.3 Contaminated Groundwater Sites

The allocation concentration (1.3 pg/L total PCBs) that applies to regional groundwater also applies to groundwater reaching the river from contaminated sites. LAs in mg/day can be computed using Equation 2 and the flow of contaminated groundwater to the river from the site. The sites the EPA assigned this load allocation to include any site with known PCB contamination, including but not limited to the following sites:

- Kaiser Trentwood Site
  - Washington Toxics Cleanup Program Site
    - Facility Site ID: 7093
    - Cleanup Site ID: 53481373
  - Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
    - EPA ID: WAD009067281
  - Location: Adjacent to Spokane River; West of Sullivan Road and South of Highway 290.

- General Electric Spokane Site
  - Washington Toxics Cleanup Program Site
    - Facility Site ID: 630
    - Cleanup Site ID: 1082
  - CERCLA National Priorities List
    - EPA ID: WAD001865450
  - Location: 4323 East Mission Avenue, Spokane
  - Approximately 1,200 feet south of the Spokane River

5.4.4 Atmospheric Deposition

This TMDL project does not allocate PCB loadings to atmospheric deposition. Based on the pathways described in Section 3, atmospheric deposition in the upper watershed, particularly deposition across the large surface area of Coeur d'Alene Lake, is captured in the assignment of boundary condition concentrations at the Washington-Idaho border. Similarly, atmospheric deposition in tributary watersheds in Washington and Spokane Tribe areas is captured in tributary allocations and boundary condition concentrations to those waters, respectively.

5.5 Total Assigned and Allocated Loading

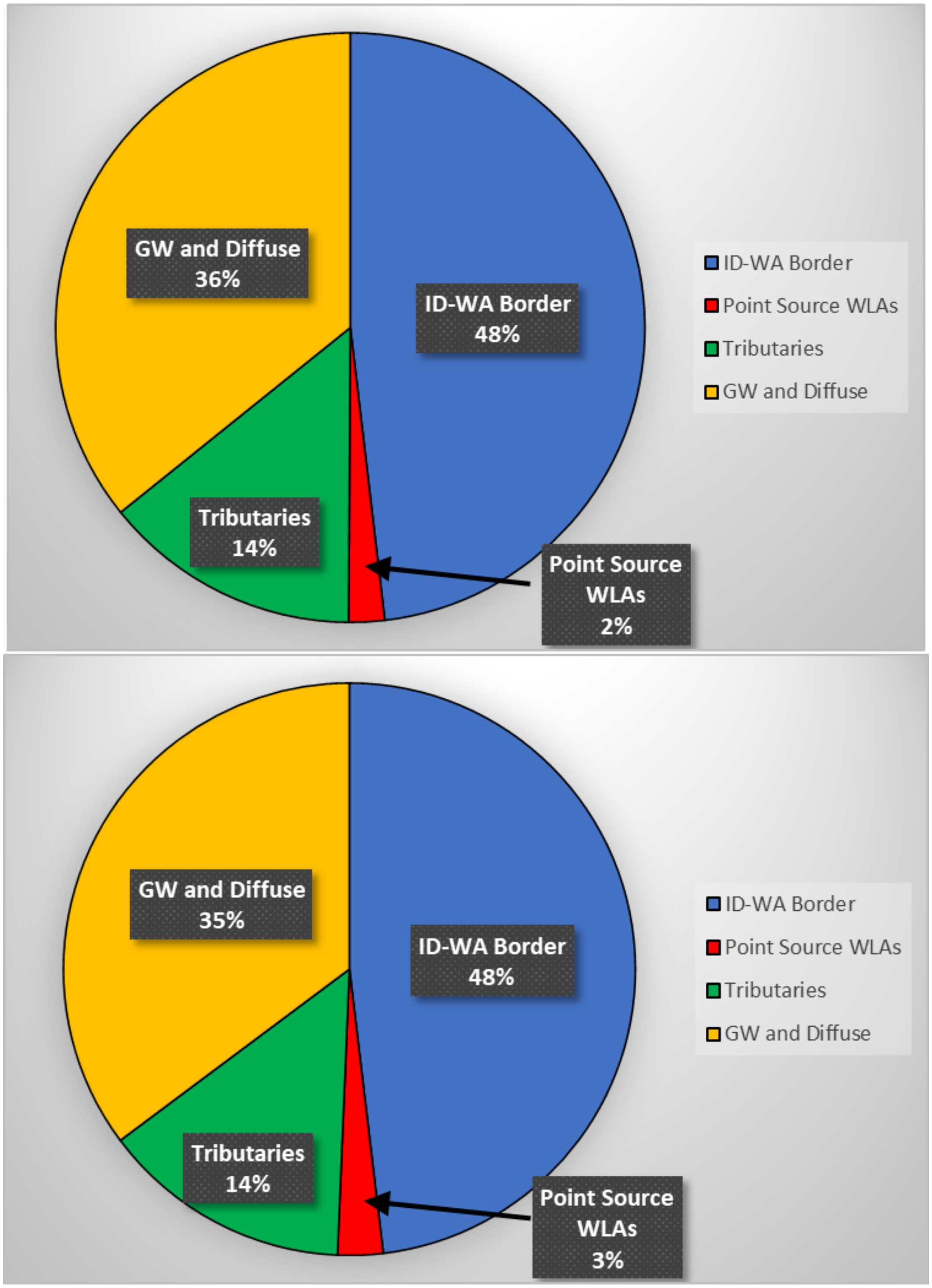
The TMDL project assigns boundary condition concentrations to waters at the Washington-Idaho and Washington-Spokane Tribe borders and allocates loadings to Washington sources. The EPA summed the total assigned and allocated loads by category to compute the total loading under the TMDL (Table 20*)*. The EPA tracked groundwater inflows and outflows separately to develop a load allocation for the inflows. The TMDLs include the loss in PCB mass due to groundwater outflows to compute the net allocated loading to the system based on the TMDL allocations. The EPA calculated the outflow load assuming the outflow carries the concentration of PCBs in the river when all allocations are implemented (1.3 pg/L at all locations).

Table 20: Total assigned and allocated PCB loading

Source Category	Assigned and Allocated Loading (mg/day)
Washington-Idaho Border	5.97
Municipal and Industrial Point Sources	0.32
Stormwater and Combined Sewer Overflows	0.01
Tributaries[1]	1.75
Groundwater and Diffuse Sources[2]	4.44
River Load lost to Groundwater	-1.07

Sum of Loads	**11.4**
[1]Incorporates tributaries in Washington and Washington-Spokane Tribe tributaries [2]Incorporates inflows from contaminated groundwater and general permit discharges	

These loading contributions by category are shown in Figure 15.



Note: Stormwater and CSO loading fraction not shown (0.05%)

Figure 15: Relative distribution of assigned and allocated total PCB loadings by category.

5.6 PCB reductions

PCB reductions necessary for attainment of applicable water quality standards are provided in Table 21. The values exceed 95% in all but one impaired AU, on the Little Spokane River. However, as noted in Section 3.3: Current Conditions and Recent Exceedances, the current conditions estimate used for this TMDL analysis likely underestimates the current conditions in the Little Spokane River.

Table 21: Estimated PCB reductions necessary to achieve TMDL allocations in Spokane and Little Spokane River AUs listed as PCB-impaired in Washington's combined 2014-2018 303(d) list, ordered from upstream (east) to downstream (west).

Washington AU ID	**AU Description (River Miles)**	Mean total PCB Concentration (pg/L)[1]	Necessary PCB Reduction (%)
WA17010305000012_001_001	Confluence of Spokane River and Cable Creek to Washington-Idaho border (RMs 94.8 – 96.3)	42	97
WA17010305000011_001_001	Myrtle Point Natural Area to Cable Creek Confluence (RMs 84.7 – 94.8)	42	97
WA17010305000010_001_001	Felts Field Park to Myrtle Point Natural Area (RMs 80.9 – 84.7)	53	98
WA17010305000009_001_002	Upstream of Latah (Hangman) Creek and Spokane River confluence to south of Felts Field Municipal Airport (RMs 72.7 – 80.2)	110	99
WA17010307009102_001_001	Between West Davenport and Aubrey Ln (RMs 63.1 – 64.5)	65	98
WA17010307009085_001_001	Between Seven Mile Rd and West Davenport (RMs 62.4 – 63.1)	47	97
WA17010307009615_001_001	Between McLellan Trailhead and Seven Mile Rd (RMs 61.0 - 62.1)	41	97
WA17010307000774_001_001	Nine Mile Falls to Deep Creek (RMs 58.3 – 59.3)	57	98
WA17010308000018_001_001*	Little Spokane River AU: Spokane/Little Spokane River confluence to West Rutter Pkwy (Little Spokane RMs 0.0 – 4.7)	6	77
WA170103070106_01_01	East Side of Spokane Lake (RMs 45.5 – 58.3)	130	99
WA170103070107_01_01	West Side of Spokane Lake (RMs 34.2 – 45.5)	130	99

Washington AU ID	AU Description (River Miles)	Mean total PCB Concentration (pg/L)[1]	Necessary PCB Reduction (%)
WA17010307000010_001_001	South side of Spokane Arm across from the Spokane Tribe reservation, from Porcupine Bay Campground to Blue Creek (RMs 11.0 -12.7)	130	99
*Note: This is the single Little Spokane River AU currently listed as PCB-impaired. [1]Note: See Section 3.3 and Table 9 for method of estimation.			

5.7 Future Growth and New Sources

As noted in Section 5.3: Wasteload Allocations, the EPA set the allocation concentration for point sources at the applicable water quality standard for PCBs (1.3 pg/L) at the point of discharge. The addition of a new source or expansion of an existing source, when restricted to this allocation concentration, will not contribute to exceedance of the water quality criteria.

5.8 Margin of Safety

The margin of safety (MOS) accounts for a lack of knowledge concerning the relationship between LAs and WLAs and water quality [CWA § 303(d)(1)(C) and 40 CFR 130.7(c)(1)]. For example, knowledge may be incomplete regarding the exact nature and magnitude of PCB loads from various sources. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. In general, a TMDL project can incorporate a MOS through two approaches: (1) implicitly using conservative model assumptions to develop allocations, or (2) explicitly specifying a portion of the TMDL load capacity as the MOS (EPA 2002).

This TMDL project applies an implicit MOS using conservative assumptions. The principal conservative assumption is that total PCBs released into the river will flow downstream with no loss of instream PCBs due to mechanisms such as settling, volatilization, biological uptake, and chemical breakdown. To the extent these processes may be affecting PCB levels, the TMDL project provides conservative estimates of the impact of PCB releases on mainstem concentrations.

The TMDL project also assumes that all surface water and groundwater inflows to the rivers contain PCB concentrations at or above the water quality criteria, so there is effectively no dilution of total PCB loadings entering the rivers. To the extent that some water inputs contain lower PCB concentrations, the TMDL conservatively estimates dilution impacts on mainstem PCB concentrations. Taken together, these assumptions support that the implicit MOS is adequate and appropriately conservative.

5.9 Water Quality Standards Attainment

By assigning an allocation concentration to all inflows equal to the most stringent water quality criterion (1.3 pg/L), the TMDL project allocations attain applicable water quality standards for total PCBs throughout the TMDL project study area, from the Washington-Idaho border to the confluence with the Columbia River. This result is supported in the TMDL mass balance model. See Appendix C: Spokane River PCB Mass Balance Assessment Tools.

5.10 Reasonable Assurance

CWA Section 303(d) requires that a TMDL be "established at a level necessary to implement the applicable water quality standard." According to 40 C.F.R. §130.2(i), "[i]f best management practices or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent." Providing reasonable assurance that point and nonpoint source control measures will achieve expected load reductions increases the probability that the pollution reduction levels specified in the TMDLs will be achieved, and therefore, that applicable standards will be attained.

The EPA recognizes that implementing this TMDL project and meeting PCB allocations requires a long-term, regional effort. A collection of past, ongoing and future individual and regional efforts to reduce PCBs show a high level of commitment and provide reasonable assurance that the TMDL project will be implemented. Appendix E of this TMDL document (Implementation Actions) includes portions of public comment letters that describe some of the commitments and activities to prevent and reduce PCB discharges.

These commitments and activities provide reasonable assurance that actions will be taken to make progress towards achieving the TMDL allocations, including the following:

- Past work and engagement of regional stakeholders in the SRRTTF
- Wastewater treatment upgrades, which have reduced PCBs by approximately 99%
- Spill prevention measures implemented by several dischargers preventing PCB discharges
- Current regional engagement through the SRTAC to develop a implementation plan for these TMDLs
- The EPA's $6.9 million grant to Ecology for toxics reduction in the Spokane River basin
- NPDES permit requirements
- Idaho's water quality standards that protect downstream jurisdiction's standards

Regional Planning and Implementation

SRRTTF

The SRRTTF represents important work and collaboration in the basin, resulting in a better understanding of PCB sources and actions needed to reduce PCBs in the Spokane and Little Spokane Rivers. In 2011, Ecology issued NPDES permits to dischargers in the Spokane River Basin requiring them to participate in the SRRTTF to address PCBs. In March 2012, the SRTTF was created through the signing of a memorandum of agreement (MOA) with a goal of developing "a comprehensive plan to bring the Spokane River into compliance with applicable water quality standards for PCBs" (SRRTTF 2012). Following the original MOU, the SRRTTF embarked on completing analyses and actions over the next decade that yielded valuable information on the state of PCBs in the watershed. SRRTTF accomplishments included: collecting and analyzing data on PCBs and other toxics, better characterization of the amounts, sources, and locations of PCBs and other toxics entering the Spokane River, implementation of actions such as pilot testing treatment processes and upgrading wastewater treatment plants, toxic management plans, pilot testing of PCB groundwater regulations, and stormwater low impact development ordinances. For more detailed information, see SRRTTF task force annual activities/accomplishments from 2012 to 2020 (https://srrttf.org/?page_id=777). In 2023, members of the SRRTTF included County of Spokane, Liberty Lake Sewer and Water District, Inland Empire Paper Company, Kaiser Aluminum, City of Spokane, Spokane Regional Health District, Washington State Department of Health, Lake Spokane Association, The Lands Council, City of Coeur d'Alene, Ecology, the EPA, Idaho Department of Environmental Quality, Coeur d'Alene Tribe, Washington Department of Fish and Wildlife, Avista, City of Post Falls, Hayden Area Regional Sewer Board, Washington State Department of Transportation.

Under SRRTTF, the William D. Ruckelshaus Center assessed public engagement effectiveness to date. The final report, based on over 40 interviews with dozens of interested groups, suggested ways to improve on previous efforts (Ruckelshaus Center 2023). The report recommended lowering public participation barriers wherever possible, especially among Tribes and economically disadvantaged communities. The report summarized participants' priorities to further reduce Spokane River basin PCB pollution, including tighter source controls on inadvertent PCBs, aligning the Model Toxics Control Act cleanup levels with water quality standards, and collaborating with the EPA and Idaho Department of Environmental Quality (IDEQ) to address less restrictive PCB water quality standards in Idaho.

The extensive involvement of many entities over a decade shows a past level of commitment that help provide reasonable assurance to future activities to continue reducing PCB levels.

SRTAC and EPA Support for Regional Planning

Ecology helped create the Spokane River Toxics Advisory Committee (SRTAC) in fall 2023 to expand and carry forward SRRTTF's work after the SRRTTF officially concluded operations in summer 2023. The SRTAC is a monthly forum for state agencies, local and Tribal governments, environmental groups, consultants, and other community members to collaborate to reduce toxics in the Spokane River basin. The SRTAC will help inform the forthcoming PCB TMDL implementation plan working together, which will rely on the actions of many entities in the watershed including Idaho Department of Environmental Quality, other state agencies, local governments, the federal government (including EPA), Tribes, permittees in Washington and Idaho, private landowners, and other entities that address PCB discharges through on-the-ground actions.

In 2023, the EPA awarded Ecology a $6.9 million grant as part of the Columbia River Basin Restoration Program for toxics reduction in the Spokane River basin, which includes funds to develop a regional plan specific to the Spokane River and for on-the-ground implementation activities after the plan is developed (EPA 2023). The EPA also provides funding to Ecology's 319 Nonpoint Source program, which funds nonpoint source projects.

Past, Ongoing and Future Technology/Programs

The activities and programs below provide examples of some of the work being done in the basin. These examples were provided by dischargers in their public comment letters. (See Appendix E: Implementation Actions.) Other dischargers may also be implementing these or other activities but did not provide information in a comment letter.

Wastewater Treatment Upgrades/Investigations

Several dischargers in the Spokane River Watershed have invested significant resources to upgrade their treatment plants to ultrafiltration membrane systems, which have resulted in up to 99% removal of PCBs in their discharges. Inland Empire Paper stated in their public comments that their tertiary membrane system is the most advanced wastewater treatment system for a pulp and paper mill in North American, removing 99% of PCBs from their influent. The City of Spokane also updated their Riverside Park Water Reclamation Facilities in 2021, installing a tertiary membrane filtration system. Kaiser is investigating the use of ultraviolet/advanced oxidation (UV/AOP) in their Trentwood facility after a pilot project showed that the technology removed up to 98% of PCBs in contaminated groundwater. Liberty Lake Sewer and Water District spent $25M to upgrade its plants, which included an ultrafiltration membrane system that removes 97% of PCBs in influent. Likewise Spokane County upgraded its treatment plant to include an ultrafiltration membrane system, which has removed up to 99% of PCBs in influent. The investment of these entities to research, pilot and implement these upgrades shows commitment to addressing and reducing PCB discharges, and has resulted in significant reductions in PCB discharges to the Spokane River. Maintenance of these upgrades through the commitment of dischargers and compliance with NPDES permit requirements provide reasonable assurance that this low level of discharge will continue.

Spill Prevention Measures and Other Prevention Measures

Avista provided information in their public comment letter about their spill policy for “discovering, reporting, mitigating and removing oil spills,” which can include PCBs. The policy requires staff to notify appropriate personnel upon discovery of an oil spill, 24 hours a day and seven days a week. Avista also noted that utility groups have evaluated and shared information on effective best practices for spill response.

Kaiser noted their reduced water usage, reducing their discharge volume and PCBs in permitted effluent. In addition, Kaiser noted their implementation of the PCB pollutant minimization plan, an NPDES permit requirement, which includes treatment system performance improvements, operational modifications, and material substitutions.

Eliminating Legacy PCBs

In Kaiser’s public comment letter, they discussed their work to identify and eliminate historical PCBs in their facility. Activities included maintaining and replacing wastewater pipes impacted by historical contamination and removing contaminated sediment from their wastewater lagoons. The City of Spokane included information in their public comment letter of a comprehensive program to identify and control PCB sources by the removal of PCB-containing equipment from City departments, public education on PCB sources and source control measures, and procurement practices supporting the use of “PCB-free” products.

Similarly, Avista has taken actions to eliminate legacy PCBs. In the 2016 Magnitude of Source Areas and Pathways of PCBs in the Spokane River Watershed (LimnoTech) and the 2016 Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River (LimnoTech) prepared for the SRRTTF, the reports stated that "by the end of 2016, Avista will have no detectable levels using EPA test method 8082 of PCBs in their overhead transformers."

Groundwater Treatment

Kaiser's public comment letter noted that they constructed a UV/AOP system to address contaminated groundwater which can destroy up to 98% of PCBs. Ecology's public comment letter describes requirements of the Kaiser Trentwood Site to operate a full-scale pump-and-treat system for PCB-contaminated groundwater, which is expected to contain and decrease PCB concentrations in groundwater.

Stormwater Treatment

Dischargers are implementing measures to reduce stormwater discharges to the Spokane River, which can be a source of PCBs. The City of Spokane's public comment letter describes improvements to manage combined sewer overflows (CSOs) with over $100M spent in recent years. These included construction and maintenance of storage capacity in the collection system, operation and maintenance of the sewer network to maximize flow capacity to RPWRF, and replacement of pipe liners to reduce groundwater and stormwater infiltration into sewer lines. CSO events have declined in number and magnitude from 2016 through 2023.

The City of Spokane also completed several projects in 2015 and 2020 to disconnect the Union Basin stormwater system, identified as having elevated PCB concentrations, from the river. The projects converted the basin into an infiltration system with green infrastructure technologies. The City is currently working on converting the Cochran Basin stormwater system to an infiltration system. Covering approximately 5,160, this basin is the largest in the city and will greatly decrease the amount of stormwater flows in the Spokane River.

The City of Spokane has also implemented low impact development incentives and green infrastructure products that eliminate direct discharge of stormwater to the Spokane River.

TMDL Implementation Plan

In a state-issued TMDL, the state documents reasonable assurance in the TMDL report (or an implementation plan) through a description of how the load and WLAs will be met. The TMDL or the implementation plan generally describes both the potential actions for achieving the load and WLAs and the state's authorities and mechanisms for implementing nonpoint and point source pollution reductions. A state's implementation plan for nonpoint and point sources provides reasonable assurance that loads are set at a level that will attain and maintain the applicable water quality standards to implement the applicable water quality standard.

While the EPA is issuing these TMDLs, Ecology will be working with the SRTAC and other regional partners to develop the state's implementation plan. The TMDL implementation plan is a critical component of water quality management, which should be designed to achieve and maintain the PCB water quality standards of the Spokane Tribe. Effective TMDL implementation plans outline specific strategies for reducing PCB loads and impaired water bodies to levels that meet the established TMDL LAs and ensure compliance with the CWA and other relevant statutes. The TMDL plan may include implementation strategies such as point source controls, nonpoint source management practices, and regulatory measures to minimize PCB inputs into the water bodies. The EPA recommends that the implementation plan include the following critical focus areas for further PCB pollution reductions:

- Continued focus on reducing stormwater connectivity to streams and rivers by installing and maintaining BMPs such as infiltration basins and rain gardens;
- Increased permitted wastewater discharge treatment, possibly using novel methods specially designed to address chemically persistent toxics;
- Strengthened source controls, especially on inadvertent PCB production.

Ecology anticipates specifying measurable goals, timelines, and milestones for PCB load reductions in their TMDL implementation plan. The EPA recommends that the plan include monitoring and assessment, and incorporate adaptive management principles as regularly updated data will allow better evaluation of the plan's success and identify necessary adjustments throughout implementation.

NPDES Permits

The EPA has authorized Ecology to issue all NPDES permits for point sources that discharge to Washington waters, except for federally-owned facilities and for Tribal waters where the EPA is the permitting authority. The EPA has authorized IDEQ to issue NPDES permits for Idaho waters. The EPA acknowledges the challenge of reducing PCBs in the influent streams to municipal treatment plants and supports continued efforts to identify and reduce sources. POTWs may be able to reduce influent concentrations or loads of PCBs from industrial sources through pretreatment requirements, including local limits for PCBs (40 CFR 403.5(c) and (d)), which may be in the form of best management practices in lieu of or in addition to numeric limits (40 CFR 403.5(c)(4)). Other approaches may include water conservation, education and outreach to residential ratepayers, and encouraging graywater reuse for irrigation (WAC 246-274). The issuance of NPDES permits further provides reasonable assurances that PCB reductions will occur and actions will be taken to meet TMDL allocations.

Nonpoint Sources

Ecology's nonpoint source program uses a combination of technical and financial assistance to protect water quality. The Water Quality Management Plan to Control Nonpoint Sources of Pollution (Ecology 2015) outlines Washington's approach to addressing water quality impacts from nonpoint sources, including suburban and urban runoff, that contribute PCB pollutants to the Spokane River. Some examples include providing funding for stormwater improvement projects (e.g., stormwater infiltration basins), education and outreach about PCBs in the river and PCB-containing products, monitoring, and riparian buffer projects. In addition, the Washington State Pollution Control Act provides Ecology with jurisdiction to control water pollution in the state, including nonpoint pollution sources. Ecology has authority to require a nonpoint source polluter to implement specific best management practices (BMPs), as necessary.

Boundary Condition concentrations

The EPA has assigned boundary conditions to the river at the Washington-Idaho border and to tributaries and groundwater at the Washington-Spokane Tribe border. These boundary conditions do not establish allocations for any sources contributing to waters outside of Washington but rather recognize that existing regulations affect the load that can be anticipated to enter Washington at these borders. The EPA expects Idaho and the Spokane Tribe to meet their CWA obligations to attain and maintain applicable WQS, which can include numeric criteria for PCB concentrations and/or narrative components such as the protection of WQS in downstream jurisdictions. Idaho's water quality standards at IDAPA 58.01.02.08 state that for the protection of downstream water quality, "All waters shall maintain a level of water quality at their pour point into downstream waters that provides for the attainment and maintenance of the water quality standards of those downstream waters, including waters of another state or tribe." The EPA expects that these jurisdictions will account for downstream WQS, for example, in NPDES permits and nonpoint source actions. The EPA's modeling demonstrates the necessity for a boundary condition concentration to the river of 1.3 pg/L at the Washington-Idaho border to meet the applicable water quality standards. The boundary condition expectation is reasonable because of the operation of Sections 303(c), 303(d) and 402 of the CWA, implementing regulations, and the approved WQS for the two states and the Spokane Tribe.

6 Tribal Consultation, Public Outreach, and Next Steps

Consistent with the EPA's Policy on Consultation with Indian Tribes (EPA 2023), the EPA engages in government-to-government consultation with affected Tribes, in addition to ensuring meaningful public and stakeholder participation throughout the TMDL development process. Executive Order 13175 directs federal agencies to establish regular and meaningful consultation with Tribal governments in the development of federal policies or actions that have Tribal implications. During TMDL development and review, the EPA consults with affected Tribes to consider their perspectives and concerns regarding water quality issues on and around reservations or usual and accustomed areas that are relevant to the federal action being considered. Effective Tribal consultation processes are founded on the principles of open and transparent communication between the EPA and Tribal governments. During TMDL development, the EPA works with Tribes to provide timely and relevant information, allow for meaningful input, and consider their recommendations and concerns during the decision-making process. This process recognizes Tribal sovereignty and the government-to-government relationship between the EPA and Tribes.

In addition to Tribal consultation, the EPA also provides opportunities for meaningful participation by the wider public. This includes sharing information with the public, especially affected communities, the regulated community, and other directly impacted stakeholders, in the TMDL development process. These steps help ensure development of TMDLs is a transparent and inclusive process.

6.1 Tribal Consultation

During development of the Spokane River PCBs TMDL, the EPA staff met informally with representatives of the Spokane Tribe and Coeur d'Alene Tribe on several occasions. On May 15, 2024, the EPA sent offers of coordination and government-to-government consultation to the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Colville Reservation, Coeur d'Alene Tribe, Kalispel Tribe of Indians, Kootenai Tribe of Idaho, and Spokane Tribe of Indians. No Tribes responded to the EPA's invitations for government-to-government consultation.

6.2 Public Outreach

During 2023 and 2024, the EPA hosted a series of quarterly public informational webinars. These online meetings, held in March, June, and September of 2023, and January of 2024, were each attended by more than 50 participants and generally consisted of a 30-45 minute presentation followed by 45-60 minutes of comments, questions, and answers. The EPA held a public comment period for the draft TMDLs from May 15 through July 15, 2024. On May 29, 2024, the EPA held a hybrid in-person informational meeting regarding the draft TMDLs, where approximately 20 people attended in person, and approximately 40 people attended virtually. Additionally, the EPA hosts a public-facing website to provide project updates, webinar summaries, TMDL documents, notifications of actions, and the opportunity to sign up for email updates and meeting invitations. Appendix F of this TMDL document includes the EPA's response to comments received during the public comment period.

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