Spokane River
Total Maximum Daily Load

Lead and Zinc

Hydrologic Unit Code 17010205



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Abbreviations, Acronyms, and Symbols

§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
µ	micro, one-one thousandth
§	section (usually a section of federal or state rules or statutes)
AU	assessment unit
ASTM	American Society for Testing and Materials
AWS	agricultural water supply
BAG	basin advisory group
BEMP	Basin Environmental Monitoring Plan
BLM	United States Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CCC	Continuous Concentration Criteria
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cm	centimeters
CMC	Criteria Maximum Concentration
CWAL	cold water aquatic life
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
DOI	United States Department of the Interior
DWS	Drinking Water Supply
EC50	50% Effects Concentration
EPA	United States Environmental Protection Agency
F	Fahrenheit
FT	Feet
GIS	geographic information system
HUC	hydrologic unit code
IDAPA	Refers to citations of Idaho administrative rules
IN	Inches
IDFG	Idaho Department of Fish and Game
IPDES	Idaho Pollutant Discharge Elimination System
IWS	Industrial Water Supply
km	kilometer
LA	load allocation
LC	load capacity
LC50	50% Lethal Concentration

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m	meter
MEP	Maximum Extent Practicable
mi	mile
mgd	million gallons per day
mg/L	milligrams per liter
mL	milliliter
mm	millimeter
MOS	margin of safety
n/a	not applicable
NA	not assessed
ND	no discharge
NFS	not fully supporting
NPDES	National Pollutant Discharge Elimination System
NR	No Reduction Required
PCR	primary contact recreation
ppm	part(s) per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SBA	subbasin assessment
SCR	secondary contact recreation
SFI	DEQ's Stream Fish Index
SHI	DEQ's Stream Habitat Index
SMI	DEQ's Stream Macroinvertebrate Index
SVRP	Spokane Valley – Rathdrum Prairie aquifer
SS	salmonid spawning
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TP	total phosphorus
US	United States
USC	United States Code
USGS	United States Geological Survey
WAG	watershed advisory group
WBAG	*Water Body Assessment Guidance*
WER	Water Effects Ratio
WL	Wildlife
WLA	waste load allocation

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Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses one water body (2 assessment units) in the Upper Spokane subbasin that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2021).

This document describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Upper Spokane subbasin, located in north Idaho. The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting Idaho's water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

Subbasin at a Glance

The Spokane River in Idaho is in the Upper Spokane watershed (Hydrologic Unit Code 17010305) in Kootenai County, Idaho (Figure A). It drains a 4,345 square mile Coeur d'Alene basin which includes all tributaries to Coeur d'Alene Lake, including the Coeur d'Alene and St. Joe River watersheds. These rivers drain into the southern end of Coeur d'Alene Lake. The Spokane River is the only surficial outlet of Coeur d'Alene Lake, flowing from the northern end of the lake 15 miles in Idaho before exiting into Washington.

In the Coeur d'Alene basin, the climate is characterized by relatively dry summers and cold, wet winters. The annual hydrograph is characterized by a snowmelt-dominated system with peak flows normally occurring during April and May. In the elevation range of 900–1,400 m (3,000–4,500 ft), winter "rain-on-snow" events occur that cause peaks in stream discharge which may exceed those observed during snowmelt in the spring months.

Flow into the Spokane River is controlled by a natural outflow sill at Coeur d'Alene Lake. This outflow sill provides natural flood attenuation downstream into the Spokane River. Approximately 9 miles downstream of the outlet of Coeur d'Alene Lake in Post Falls, ID, the Spokane River flows through three natural channels incised into bedrock which have been

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dammed to regulate lake elevation and for turbine power generation. The dams currently are operated by AVISTA Corporation under the Post Falls Hydroelectric Project.

In 1994, the Spokane River from Coeur d'Alene Lake to the Idaho/Washington border was placed on Idaho's 303(d) list of impaired waters with metals (unknown) as a cause for impairment to the cold water aquatic life beneficial use. The unknown listing for metals was changed in Category 5 of Idaho's 2008 Integrated Report to cadmium, lead, and zinc being the metals that cause impairment. Cadmium was delisted from Idaho's 2016 Integrated Report.

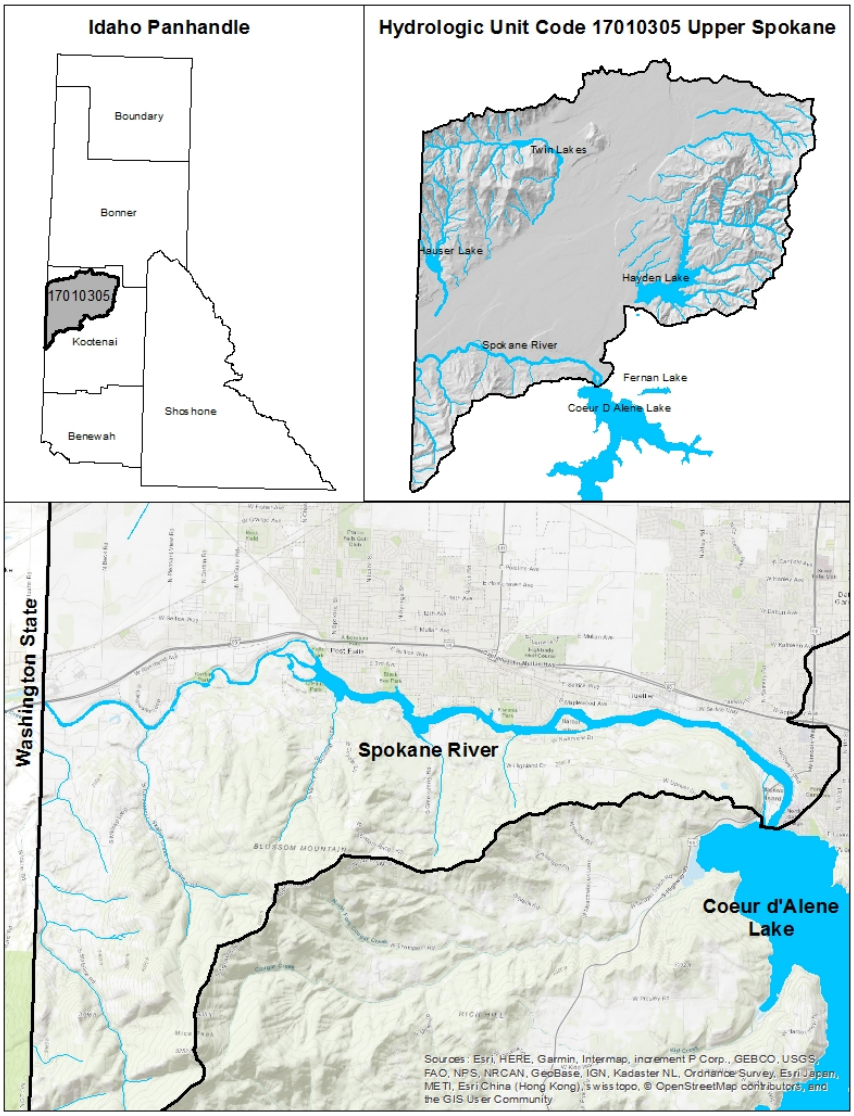


Figure A. Upper Spokane watershed (Hydrologic Unit Code 17010305).

Key Findings

Although direct discharge of mine tailings into streams ended in 1968, this practice resulted in an estimated 64.5 million tons of tailings discharged to the Coeur d'Alene River or tributaries (Stratus 2000). These deposits of metals-contaminated sediments (containing primarily lead, cadmium, and zinc) were subsequently transported and deposited along the bed, banks,

floodplain, and riparian areas of the North and South Forks of the Coeur d'Alene River, the mainstem, the 11 lateral lakes, numerous wetlands along the lower Coeur d'Alene River, the lakebed of Coeur d'Alene Lake, and into the Spokane River. Despite considerable effort to remediate environmental impacts of past mining in the basin, natural river flow, chemical processes, and food-chain interactions continue to redistribute metals-contaminated sediments throughout the entire system — including the Spokane River to the Idaho/Washington border (Stratus 2000).

In 2000, the *Total Maximum Daily Load for dissolved metals in Surface Waters of the Coeur d'Alene Basin* was approved by the EPA. In this TMDL, load allocations and load reductions were written for the metals-impaired surface waters in the Coeur d'Alene basin from the South Fork Coeur d'Alene River downstream through Coeur d'Alene Lake and into the Spokane River to the Idaho/Washington border. In 2000, a district judge ruled the TMDL was invalid for failure to comply with statutory guidelines. According to Idaho Code §39 36-11, DEQ must follow rulemaking provisions for any TMDLs for metals in the Coeur d'Alene River Basin, upstream from the headwaters of the Spokane River. The rulemaking provisions do not apply to the Spokane River from the headwaters at Coeur d'Alene Lake to the Idaho/Washington border; therefore, a TDML is required for this water body.

Idaho's aquatic life criteria for metals (arsenic through zinc) are expressed as dissolved fraction for lead and zinc. Criteria for metals are set for both chronic and acute concentrations based on current standard toxicity testing protocols. Both chronic and acute criteria are expected to adequately protect the designated aquatic life use if not exceeded more than once every three (3) years. Metals criteria for lead and zinc are calculated based on hardness of the water, where hardness is the concentration of calcium (Ca) and magnesium (Mg).

The results of analyses for this TMDL development demonstrate dissolved cadmium concentrations did not exceed both Idaho's acute (CMC) and chronic (CCC) hardness-based criteria over the past 5 years. Based upon the results of this investigation, the EPA approved a delisting of cadmium from the list of causes of impairment for the Spokane River assessment units (Table A). For purposes of the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Detailed delisting rationale is provided in Appendix M in Idaho's 2016 Integrated Report. Dissolved lead concentrations did not exceed Idaho's acute criteria, but did exceed Idaho's chronic criteria. Dissolved zinc concentrations exceeded both Idaho acute and chronic criteria. Therefore, TMDLs for these pollutants were developed (Table A).

Table A. Summary of assessment outcomes for §303(d)-listed assessment units.

Water Body	Assessment Unit Number	TMDL Developed	Delisted In 2016 IR
Spokane River – Coeur d'Alene Lake to Post Falls dam	17010305PN003_04	Lead, Zinc	Cadmium
Spokane River – Post Falls dam to Idaho/Washington Border	17010305PN004_04	Lead, Zinc	Cadmium

Note: All assessment unit numbers begin with ID17010305.

After a thorough review of the 2010-2015 ambient water quality data from the Upper Spokane River and of the point source discharge data, TMDL targets (based on chronic water quality

standards) are met during the low flow, summer months (or the dry season) for lead. During periods in which river flow is dominated by runoff from upstream sources (wet season) lead and zinc TMDL targets are not met. During September through December, TMDL targets for zinc are not met. When TMDL targets are not met, load reductions are required. Load capacity for a pollutant with numeric criteria is based a state's water quality criteria. When a downstream state's water quality criteria is more stringent, as is the case for lead and zinc in the Spokane River, load capacity needs to ensure that downstream state criteria are met at the state line. Load capacity for this TMDL was calculated to assure WA criteria are met at the state line. Idaho Water Quality Standards are met from June to October, but when comparing to WA criterion, the zinc target is only met in August. Percent load reduction requirements that meet WA criteria (at the state line) for lead and zinc under this TMDL are provided in Table B.

Table B. Percent load reductions for lead and zinc required under this TMDL.

Analyte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dis-Lead	35.8%	89.0%	41.6%	88.1%	80.4%	16.5%	NRR	NRR	NRR	NRR	NRR	NRR
Dis-Zinc	76.2%	55.7%	73.3%	59.2%	59.2%	33.7%	30.6%	NRR	10.3%	18.6%	55.5%	53.2%

[1]NR = No reduction required

Loading analysis showed dissolved lead and zinc loads at the outlet of Coeur d'Alene Lake are not significantly different that loads at the state line.

Section 308 of the Clean Water Act and federal regulation 40 CFR 122.44(i) require monitoring in National Pollutant Discharge Elimination System (NPDES) permits to determine compliance with effluent limitations. Monitoring may also be required to determine effluent impacts on receiving water quality and whether additional effluent limitations are required in future permits. There are three wastewater treatment facilities with authorization under an NPDES/IPDES permit to discharge into the Spokane River in Idaho:

- City of Coeur d'Alene Advanced Wastewater Treatment Plant (NPDES/IPDES Permit No. ID0022853)
- Hayden Area Regional Sewer Board Publicly-owned Treatment Works (NPDES/IPDES Permit No. ID0026590)
- City of Post Falls Publicly-owned Treatment Works (NPDES/IPDES Permit No. ID0025852)

On June 5, 2018, EPA approved the Idaho Pollutant Discharge Elimination System (IPDES) program and authorized the transfer of permitting authority to the state beginning on July 1, 2018. The goal of IPDES, like NPDES, is to address water pollution by regulating point sources that discharge pollutants to waters of the United States. The IPDES program has assumed authority over the above permits and is in the process of renewing these permits.

Certain types of stormwater runoff are considered point source discharges that are regulated under the EPA's National Pollutant Elimination System (NPDES) program. Specifically, stormwater discharged from municipal separate storm sewer systems (MS4s) within U.S. Bureau of Census-delineated Urbanized Areas.

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The MS4s within the Coeur d'Alene Urbanized Area that are authorized to discharge pollutants into the Spokane River are the City of Coeur d'Alene (NPDES/IPDES Permit No. IDS028215), the City of Post Falls (NPDES/IPDES permit IDS028231), Idaho Transportation Department District #1 (NPDES/IPDES Permit No. IDS028223), and the Post Falls Highway District (NPDES/IPDES Permit No. IDS028207. The IPDES program will take over primacy for stormwater from MS4s on July 1, 2021.

During the months where load reductions are required, combined contributions from the point source discharges — from wastewater treatment plants, stormwater MS4 areas, — and nonpoint sources (excluding all sources upstream of the outlet of Coeur d'Alene Lake) are diminutive (less than 1.0% of monthly loading) when compared to the overall system loading. This means when the upstream load within the river is reduced, permitted and nonpoint discharges to the Spokane River would neither cause nor contribute to an exceedance of water quality standards. During months where TMDL targets are met, combined point source contributions are negligible. In addition, loading analysis concludes that lead and zinc loading at the state line is not significantly different from the loading at the mouth of Coeur d'Alene Lake.

Therefore, waste load allocations for wastewater treatment facilities are based on EPA 2014 NPDES-permitted effluent limits. These effluent limits were calculated to meet Idaho Water Quality Criteria for metals and were determined through the NPDES permitting process to have no reasonable potential to exceed Washington criteria for lead and zinc. Waste load allocations for MS4 stormwater entities were set at current loads. Waste load allocations are already implemented for WWTPs that currently have effluent limits for total recoverable lead and total zinc at end of pipe. The City of Post Falls and the Hayden Regional Sewer WWTPs currently have total recoverable lead and zinc effluent limits in the NPDES permits. The City of Coeur d'Alene AWTP currently has effluent limits for total recoverable zinc and monitoring requirements for lead. In future permit cycles, DEQ considers the waste load allocations are implemented consistent with the assumptions of this TMDL, if the WWTP's NPDES or IPDES permit include Water Quality Based Effluent Limits for lead and zinc at end of pipe based on Idaho Water Quality Standards. No mixing zone is allowed unless there is load reduction from upstream sources and/or assimilative capacity for lead or zinc in the river is proven to exist.

Given the growth of the region, it is likely the impervious area within the MS4 area will continue to increase. Given the source assessment indicating almost all of the metal loading is coming from upstream sources, additional impervious within the Upper Spokane subbasin is unlikely to significantly increase lead and zinc loads. Waste load Allocations for MS4 permittees are not intended to be implemented as numeric effluent limits. A numeric reserve allocation for MS4 was not made in this TMDL; however, expanding impervious areas within the MS4 boundaries will be considered consistent with the WLAs developed in this TMDL as long as the MS4 permitees maintain permit coverage and are compliant with the conditions of the MS4 permit. This includes the requirement to reduce pollutants to the Maximum Extent Practical (MEP) and implementation of at least one pollutant reduction activity designed to reduce lead, and zinc loadings from the MS4 into the Spokane River.

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Public Participation

In compliance with Idaho Code §39-3611(8), the development of the Lower Clark Fork River Subbasin Assessment and TMDL included extensive public participation by the Watershed Advisory Group (WAG) and other interested parties in the subbasin. All meetings were open to the public and advertised at least one-week prior to the meeting, in addition to being noted on the DEQ public meeting calendar on the internet and posted at the DEQ regional office in Coeur d'Alene. The following are highlights of the WAG process.

2014-2015: DEQ collected samples to compare instantaneous concentrations of lead and zinc

April 2016: WAG meetings began.

May 2016: A call for data was initiated. A draft TMDL Strategy Paper was introduced to the WAG.

September 2016: Integrated Report public comment opportunity was presented to the WAG. Delisting cadmium from the Integrated Report was discussed. Comments were received on the draft TMDL Strategy Paper.

March & April 2017: TMDL loading analysis presentation and discussion with the WAG.

February 2018: Meeting WA water quality standards in the TMDL process – discussion with the WAG.

December 2020: Draft TMDL presented to the WAG. Comments were encouraged.

February 2021: WAG comments on the draft TMDL and DEQ response to comments were reviewed with the WAG.

April 2021: Second draft TMDL presented to the WAG for review. There were significant revisions to the TMDL, which required a second review.

June 2021: WAG comments on the second draft TMDL and DEQ response to comments were reviewed with the WAG.

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Introduction

The Spokane River in Idaho, from its headwaters to the Idaho/Washington border (Assessment Units 17010305PN003_04 and 17010305PN004_04), was listed in 1994 for metals (unknown) impairment on Idaho's §303(d) list of impaired waterbodies. The unknown listing for metals was changed in Category 5 of Idaho's 2008 Integrated Report to cadmium, lead, and zinc being the metals that cause impairment. In 2000, the *Total Maximum Daily Load for dissolved metals in Surface Waters of the Coeur d'Alene Basin* was approved by the EPA. In this TMDL, load allocations and load reductions were written for the metals-impaired surface waters in the Coeur d'Alene basin from the South Fork Coeur d'Alene River downstream through Coeur d'Alene Lake and into the Spokane River to the Idaho/Washington border. In 2000, a district judge ruled the TMDL was invalid for failure to comply with statutory guidelines. According to Idaho Code §39 36-11, DEQ must follow rulemaking provisions for any TMDLs for metals in the Coeur d'Alene Basin, upstream from the Spokane River. The rulemaking provisions do not apply to the Spokane River from its headwaters at Coeur d'Alene Lake to the Idaho/Washington border; therefore, this TDML has been developed for the Spokane River from its headwaters at Coeur d'Alene Lake.

The purpose of this TMDL is to characterize and document pollutant loads within the Upper Spokane River subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Upper Spokane River subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130) and support its designated uses. Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Idaho Department of Environmental Quality (DEQ) implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have

changed. The Clean Water Act has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through anti-degradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as "pollution." TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Characterization

The Spokane River in Idaho is in the Upper Spokane watershed (Hydrologic Unit Code 17010303) in Kootenai County, Idaho (Figure 1). It drains the 4,345 mi^2 Coeur d'Alene basin which includes all tributaries to Coeur d'Alene Lake, including the Coeur d'Alene River (1,194 $mi^{2)}$ and St. Joe River (1,745 mi^2) watersheds. These rivers drain into the southern end of Coeur d'Alene Lake. The Spokane River is the only surficial outlet of Coeur d'Alene Lake, flowing from the northern end of the lake 15 miles in Idaho before exiting into Washington. The Spokane River flows westward through the city of Spokane to join the Columbia River 110 miles from the outlet of Coeur d'Alene Lake.

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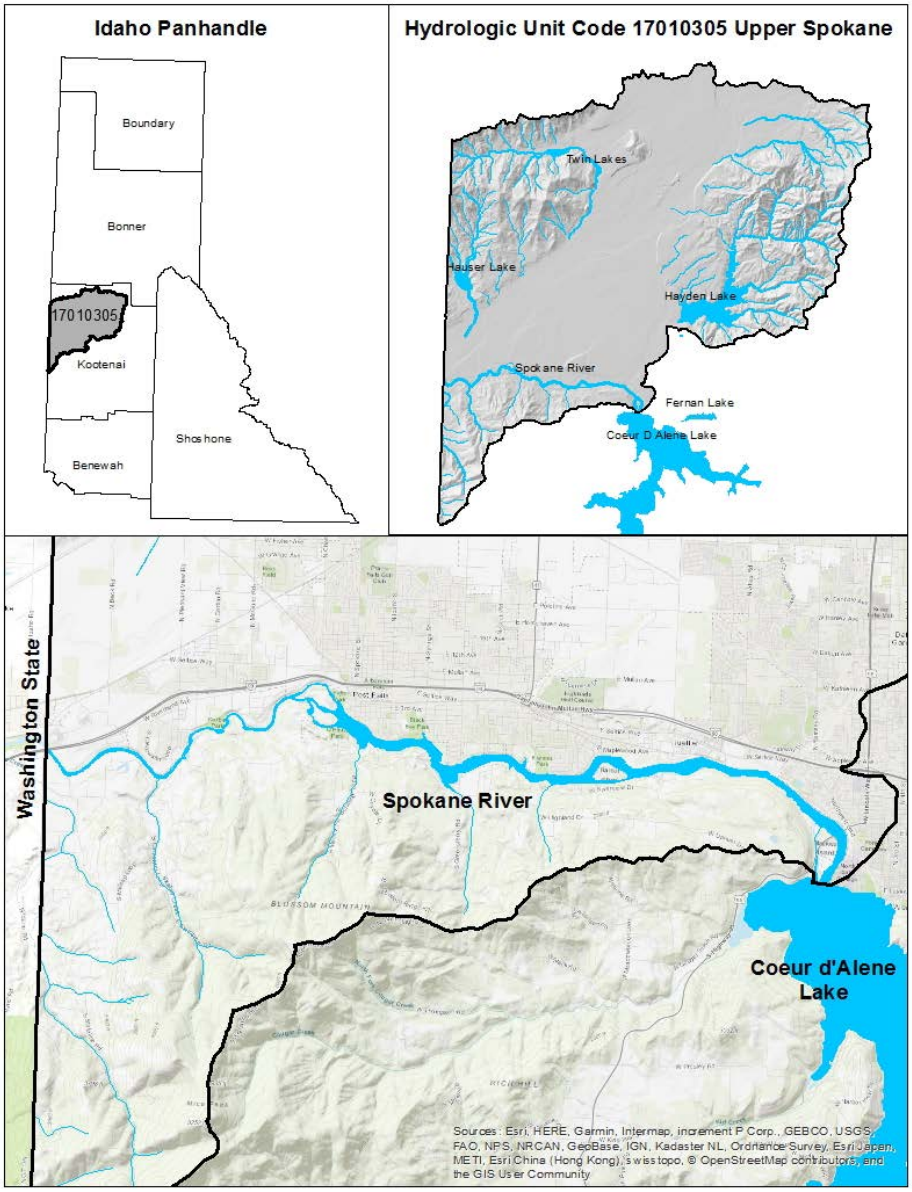


Figure 1. Upper Spokane watershed (Hydrologic Unit Code 17010305).

1.1 Climate

The climate in the region is characterized by relatively dry summers and cold, wet winters. Based on the National Oceanic and Atmospheric Association National Climate Data Center 30-year normal (NOAA 2018), the average temperature in the summer is 19.2 °C (66.5 °F) and in winter -0.4 °C (31.2 °F). Average annual precipitation in the area is 65.3 cm (25.7 in) with average seasonal precipitation of 22.3 cm (8.8 in).

1.2 Geology

During the Pleistocene Epoch (the Ice Age), an advancing edge (lobe) of the Cordilleran Ice Sheet, called the Purcell Trench — during its last advance (18,000 – 17,000 years ago) — reached south to completely cover the area where the present-day Missoula, MT and Lake Pend Oreille in Idaho are located. This ice sheet effectively dammed the Clark Fork valley to form Glacial Lake Missoula. At its maximum, Lake Missoula was over 2,000 ft deep and covered an area of over 2,900 square miles. The present-day Spokane, WA and Coeur d'Alene, ID were also under water from damming of the Columbia River by the Okanogan lobe of the Cordilleran Ice Sheet (SVRP Atlas 2015).

Failure of the glacial ice dams resulted in catastrophic flooding with an estimated maximum discharge of 600 million cfs (Box and Wallace 2002). It is estimated there were over 40 ice dam reformation, failure and catastrophic flooding events (SVRP Atlas 2015). Each flood event carried with it course gravel that would deposit in the Spokane-Rathdrum valley. Coarse gravel deposition raised the valley floor and dammed tributary valleys forming the many lakes in the region, the largest of which is Coeur d'Alene Lake. Coeur d'Alene Lake is now the only tributary lake in the area with perennial outflow (Box and Wallace 2002). The thick glacial flood deposit of permeable gravel, cobbles and boulders became the sole source of water for most people in Spokane County, Washington, and Kootenai County, Idaho, called the Spokane Valley – Rathdrum Prairie (SVRP) aquifer, commonly known as the "Spokane-Rathdrum aquifer".

Because the Spokane-Rathdrum valley is essentially devoid of surface drainage, outburst-flood bedforms such as the primary (thalweg) channel, and interconnected secondary channels have been preserved since the last outburst floods between 13,000 and 11,000 years ago. The Spokane River outflow from Coeur d'Alene Lake flows into a secondary glacial outburst flood channel until it intersects with the glacial outburst flood thalweg west of the Idaho/Washington border (Box and Wallace 2002).

1.3 Hydrology

In the Coeur d'Alene basin, the annual hydrograph is characterized by a snowmelt-dominated system with peak flows normally occurring during April and May. In the elevation range of 900–1,400 m (3,000–4,500 ft), winter "rain-on-snow" events occur that cause peaks in stream discharge that may exceed those observed during snowmelt in the spring months.

The US Geological Survey has operated gages with a continuous record of discharge at several locations in the Spokane River. There currently are two active gages on the Spokane River (Table 1). In 2014, a gage at the Coeur d'Alene Lake outlet (USGS gage 12417650) was moved downstream to below Blackwell. While the Spokane River in Idaho has significant exchange of water with the Spokane-Rathdrum Aquifer, the Spokane River is perched above the outwash gravels of the Spokane-Rathdrum aquifer. Therefore, the section of the river in Idaho is a losing reach; recharging groundwater from the river. Losses increase with increasing river flow, and losses are higher during the hot summer (Caldwell and Bowers 2002).

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Table 1. USGS gaging stations in the Spokane River in Idaho.

Gaging Station	USGS ID	Latitude (NAD83)	Longitude (NAD83)	Drainage Area (miles^2)	Dates of Operation
Spokane River at Lake Outlet	12417610	47°40'55"	-116°47'51"	3,700	8/20/2009 – 7/21/2014
Spokane River below Blackwell	12417650	47°41'41"	-116°48'55"	3,702	7/22/2014-present
Spokane River near Post Falls	12419000	47°42'11"	-116°58'40"	3,830	1/1/2013-present

Flow into the Spokane River is controlled by a natural outflow sill at Coeur d'Alene Lake, which starts at an elevation of 2,112 ft and rises to an elevation of 2,118 ft farther downstream (AVISTA 2005). This outflow sill provides natural flood attenuation downstream into the Spokane River as evidenced by the highest recorded flow in December 1933. On this date, the Spokane River at Post Falls was flowing at 50,100 cfs, a flow that was less than half the combined flow measured on the same day by the USGS in the St. Joe River at Calder of 53,000 cfs and in the Coeur d'Alene River at Cataldo at 67,000 cfs. During this flood event, water surface elevation in Coeur d'Alene Lake peaked at 2,139.05 ft (Kootenai County 1998 and references therein).

Approximately 9 miles downstream of the outlet of Coeur d'Alene Lake in Post Falls, ID, the Spokane River flows through three natural channels incised into bedrock. Unrestricted flow through these channels is correlated with the elevation of Coeur d'Alene Lake (Box and Wallace 2002). Since 1906, the three bedrock channels have been dammed to regulate lake elevation with gates (north and south dams) and for turbine power generation (middle dam). Maximum flow through the turbines is 5,000 cfs. The dams currently are operated by AVISTA Corporation under the Post Falls Hydroelectric Project. The Project's storage capacity in Coeur d'Alene Lake is the 7.5-ft depth between the low pool elevation of 2,120.5 ft and the full pool elevation of 2,128 ft (AVISTA 2005).

From early December through the spring runoff period, the gates are completely open, and the Post Falls Hydroelectric Project facility does not significantly influence either lake levels or river flows downstream of the project. During spring snowmelt, lake elevation increases due to water backing up behind the natural sill at the lake outlet and Spokane River flow increases. From early June to early September, backwater conditions in the Spokane River continue as the dam gates are fixed to control the lake elevation at 2128 ft for recreational purposes on Coeur d'Alene Lake and for energy production. During this time period, flow in the Spokane River gradually declines. Minimum flows in the Spokane River are observed in late August and early September. Beginning in early September dam gates are adjusted to gradually lower the level of Coeur d'Alene Lake and to increase flow in the Spokane River (AVISTA 2005). Summer low flows have declined in the Spokane River over the period of record, with lowest flows observed in August (Figure 2).

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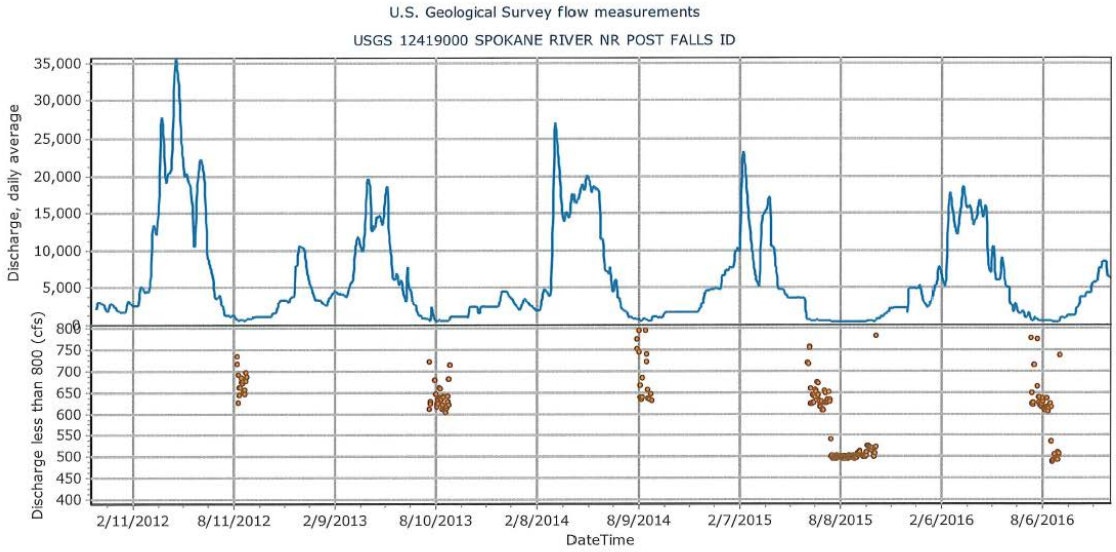


Figure 2. Flows in Spokane River at Post Falls USGS Gaging Station 12419000 (2012-2016).

1.4 Aquatic Life

Fish populations in the Spokane River differ upstream versus downstream of the Post Falls Hydroelectric Project. Above the Post Falls Hydroelectric Project, the fish community reflects that which is in Coeur d'Alene Lake, where both cold and warm water species are present. Native species include cutthroat trout, mountain whitefish, and tench. However, inundated conditions upstream of the Post Falls Hydroelectric Project have compromised habitat suitability for these fishes. Introduced cold water species include chinook and kokanee salmon. Warm water species include largemouth bass, northern pike, crappie, yellow perch, bluegill, brown bullhead, pumpkinseed, and smallmouth bass (IDFG 2018).

The Spokane River below the Post Falls Hydroelectric Project supports a wild rainbow and brown trout fishery; however, populations have fluctuated greatly with a general decline since the 1990. This decline has been attributed to increased temperatures and decreasing algal and invertebrate abundance in the river. Non-native smallmouth bass may also be affecting juvenile survival (IDFG 2018).

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2 Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

This document addresses metals impairments to the Spokane River in Idaho. The Spokane River is split between two Assessment Units: 1) Spokane River - Post Falls Dam to Idaho/Washington border (ID17010305PN003_04), and 2) Spokane River - Coeur d'Alene Lake to Post Falls Dam (ID17010305PN004_04) (Figure 3). Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits — primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

2.1.1 Idaho 303(d)-Listed Waters

In 1994, the Spokane River from Coeur d'Alene Lake to the Idaho/Washington border was placed on Idaho's 303(d) list of impaired waters with metals (unknown) as a cause for impairment. The unknown listing for metals was changed in Category 5 of Idaho's 2008 Integrated Report to cadmium, lead, and zinc being the metals that cause impairment. Total phosphorus was also added to this report. Table 2 shows the pollutants listed and the basis for listing for each §303(d)-listed AU in the subbasin. Originally cadmium was an objective under the monitoring plan and data analyses for development of this TMDL. Results demonstrate dissolved cadmium concentrations did not exceed both Idaho's acute (CMC) and chronic (CCC) hardness-based criteria over the past 5 years (year 1010 to 2015). Based upon the results of this investigation, the EPA approved a delisting of cadmium from the list of causes of impairment for the Spokane River assessment units (Table 2). For purposes of the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Detailed delisting rationale is provided in Appendix M in Idaho's 2016 Integrated Report.

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Table 2. Spokane River subbasin §303(d)-listed assessment units.

Assessment Unit Name	Assessment Unit Number	[1]2018/2020 IR-Listed Pollutants	Listing Basis
Spokane River – Coeur d'Alene Lake to Post Falls Dam	ID17010305PN004_04	Lead, Zinc, [2]Total Phosphorus	1994 §303(d) (original listing) 2008 Integrated Report
Spokane River – Post Falls Dam to Idaho/Washington Border	ID17010305PN003_04	Lead, Zinc, [2]Total Phosphorus	1994 §303(d) list (original listing) 2008 Integrated Report

1 Cadmium was delisted in Idaho's 2016 Integrated Report (delist rationale in Appendix M of the 2016 Integrated Report
2 Phosphorus is not a pollutant addressed in this TMDL.

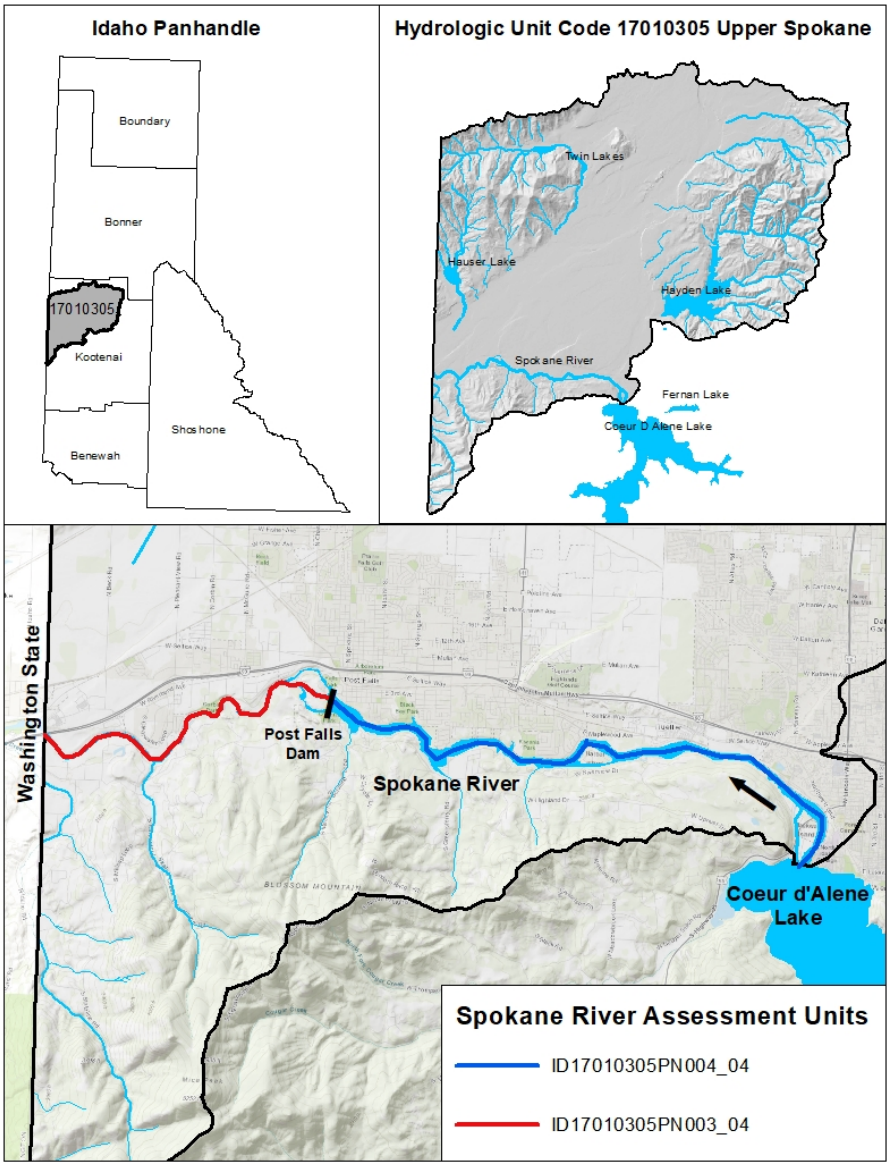


Figure 3. Spokane River Assessment Units.

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in Appendix A. The *Water Body Assessment Guidance* (DEQ 2016b) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (e.g., swimming) or secondary (e.g., boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

2.2.1 Beneficial Uses in the Subbasin

Beneficial uses in the Spokane River from Coeur d'Alene Lake to the Idaho/Washington Border are designated for cold water aquatic life, salmonid spawning, primary contact recreation, and domestic water source. Industrial water supply, agricultural water supply, and wildlife are also designated uses in the Spokane River (Table 3). Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the State of Idaho in Idaho's Water Quality Standards. Appendix A has a broader description of beneficial uses in Idaho. Appendix B has general information on Idaho Water Quality Standards.

Table 3. Spokane River subbasin beneficial uses of §303(d)-listed streams.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Spokane River – Coeur d'Alene Lake to Post Falls Dam	ID17010305PN004_04	CWAL, SS, PCR, DWS, IWS[b], AWS[b], WL[b]	Designated
Spokane River – Post Falls Dam to Idaho/Washington Border	ID17010305PN003_04	CWAL, SS, PCR, DWS IWS[b], AWS[b], WL[b]	Designated

Note: All assessment unit numbers begin with ID17010305.
a domestic water supply (DWS), cold water aquatic life (CWAL), salmonid spawning (SS), primary contact recreation (PCR), industrial water supply (IWS), agricultural water supply (AWS), wildlife (WL)
b These uses are designated for all Idaho water bodies (DEQ 2016a)

2.2.2 Water Quality Criteria to Support Beneficial Uses

2.2.3 Idaho Water Quality Criteria

Idaho's aquatic life criteria for metals (arsenic through zinc) as defined in Subsection 210.02 of Idaho's Water Quality Standards are set to protect aquatic life from chronic and acute toxicity

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effects. They are expressed as dissolved fraction for metals. For purposes of these criteria, dissolved fraction means that which passes through a forty-five hundredths (0.45) micron filter. Criteria for metals are set for both chronic and acute concentrations based on current standard toxicity testing protocols (e.g., those published by the American Society for Testing and Materials (ASTM)), or other comparable methods. The chronic criterion value is determined from appropriate hypothesis testing or regression analysis of measurements of growth, reproduction, or survival from life cycle, partial life cycle, or early life stage tests. The acute criterion value is the concentration lethal to one-half (1/2) of the test organisms (i.e., LC50) after ninety-six (96) hours of exposure (e.g., fish toxicity tests) or the effect concentration to one-half of the test organisms, (i.e., EC50) after forty-eight (48) hours of exposure (e.g., daphnia toxicity tests).

Idaho's aquatic life criteria for lead and zinc are expressed as a function of total hardness (mg/L as calcium carbonate), the metal's water effect ratio (WER), and multiplied by an appropriate dissolved conversion factor (as defined in Subsection 210.02 of Idaho's Water Quality Standards). Idaho's metals criteria to protect aquatic life from chronic toxicity effects (or continuous concentration criterion, or CCC) are a 4-day average concentration of a toxic substance to ensure adequate protection of sensitive species of aquatic organisms from **chronic** toxicity. Chronic criteria are expected to adequately protect the designated aquatic life use if not exceeded more than once every three (3) years. The hardness-dependent metals Criteria Continuous Concentration is calculated using the following equation:

$$CCC = WER \times e^{(mc \times \ln(hardness) + bc)} \times Chronic\ Conversion\ Factor$$

Where WER, mc and bc are defined for the specific metal in Subsection 210.01 of Idaho's Water Quality Standards. The chronic conversion factor for lead and zinc are 0.791 and 0.986, respectively (as defined in section 210.02 of Idaho's Water Quality Standards).

The minimum hardness allowed for use in the CCC equation is 25 mg/L for lead and zinc. Numeric CCC can only be exceeded during low-flow conditions when the lowest one-day flow with an average recurrence frequency of once in ten (10) years (or 1Q10).

Idaho's metals criteria to protect aquatic life from acute toxicity effects (or Criteria for Maximum Concentrations, or CMC) are the maximum instantaneous or 1-hour average concentration to protect aquatic organisms from **acute** toxicity. Acute criteria are expected to adequately protect the designated aquatic life use if not exceeded more than once every three (3) years. The hardness-dependent metals Criteria Maximum Concentrations is calculated using the following equation:

$$CMC = WER \times e^{(mA \times \ln(hardness) + bA)} \times Acute\ Conversion\ Factor$$

Where WER, mA and bA are defined for the specific metal in Subsection 210.01 of Idaho's Water Quality Standards. The acute conversion factor for lead and zinc are 0.791 and 0.978, respectively (as defined in section 210.02 of Idaho's Water Quality Standards).

The minimum hardness allowed for use in the CMC equation is 25 mg/L for lead and zinc. Numeric CMC can only be exceeded during lowest average seven (7) consecutive day low flow with an average recurrence frequency of once in ten (10) years (or 7Q10).

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DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations.

2.2.4 Washington Water Quality Criteria

Pursuant to sections 303 and 101(a) of the Clean Water Act ("CWA" or "the Act"), the federal regulation at 40 CFR 131.10(b) requires that "In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." Section 707.08 of Idaho Water Quality Standards requires that "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." A discussion of Washington Toxic Substances Criteria for lead and zinc with a comparison to Idaho Water Quality Standards is provided in Section 5.5 and Appendix C.

2.3 Pollutant/Beneficial Use Support Relationships

Water quality must be maintained to protect the most sensitive beneficial use — in this case is aquatic life is the most sensitive use. A thorough literature review on the toxicity of lead and zinc to aquatic life and wildlife is beyond the scope of this document. The following is a brief summary of some of the mechanisms for toxic effects of lead and zinc to aquatic life and wildlife — resources relevant to the designated beneficial uses in the Spokane River. Much of the following information is based on research conducted in the Coeur d'Alene Basin. For a thorough literature review of toxicity of these metals to aquatic life and wildlife resources of the Coeur d'Alene Basin, see references such as (but not limited to) the National Academy of Sciences (2005), Dillon and Mebane (2002), and Stratus (2000). While excellent information exists in many other references, the National Academy of Sciences (2005), Dillon and Mebane (2002), and Stratus (2000) were the primary source of information for the following summary on pollutant/beneficial use support relationships.

The risk of metals contamination of aquatic life and wildlife depends on exposure to the contaminated material and the concentration and chemical form or speciation of the metal. Metals can exist in the environment in a variety of molecular formulas which is driven by biotic and abiotic factors such as pH, hardness, and dissolved organic carbon. Bioavailable metals (free metal ion, inorganic complexes, and weakly bound organic complexes) are the toxic species of metals. Free metal ions or metal complexes exert toxicity to fish by interacting with target (receptor) sites on the gills or passing through the gill to interact with internal target sites. The toxicity of zinc is less in hard water (hardness is the concentration of calcium and magnesium). This is because calcium and magnesium can compete for receptor sites in fish gills (Dillon and Mebane 2002, National Academy of Sciences 2005). Zinc can disrupt ion regulation in the gills and cause damage to gills leading to respiratory failure and death (Stratus 2000 and references within).

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There have been numerous studies to confirm lead and zinc cause a number of toxic injuries to fish, including death, behavioral avoidance, physiological damage, and reduced growth (Stratus 2000 and references within). Ingestion of metals-contaminated algae and/or benthic invertebrates is an additional pathway for exposure to fish. Transfer of metals in the food web has been determined by studies that showed elevated metal concentrations in most components of the food web, including water, sediment, periphyton, invertebrates, and fish from identical locations in the Coeur d'Alene River system. Fewer taxa and lower benthic macroinvertebrate densities are observed in the Coeur d'Alene River basin versus reference sites. These differences strongly correlate with metals concentrations in water and sediment (Dillon and Mebane 2002).

Lead toxicity is influenced by exposure. While the dominant species of environmental lead most often exists in its insoluble (less toxic) form, biotic and abiotic processes (e.g., oxidation and weathering) acting on ultrafine particles (e.g., floatation tailings), will drive changes to lead speciation, solubility, and bioavailability. Finer particles (e.g., dust) pose an additional risk of exposure and toxicity through ingestion or inhalation. Once a contaminated particle is ingested, soluble lead readily moves into the bloodstream where it exerts its toxic effects (National Academy of Sciences 2005). The severity of toxicity is related to the extent of exposure. Wildlife exposure to lead-contaminated sediment, vegetation, and prey in the Coeur d'Alene basin is well documented. Such exposure is associated with adverse effects to multiple systems and behaviors. Affected organs and tissues include those in the hematological (blood), renal (kidney), muscular, nervous, and reproductive systems. Numerous studies with amphibians, birds, and mammals have shown that lead causes increased disease susceptibility, behavioral abnormalities, physiological malfunctions, physical deformations, and death (Stratus 2000 and references within).

2.4 Summary and Analysis of Water Quality Data

Water quality monitoring and subsequent data analysis for TMDL development was done with the following objectives:

1. evaluate ambient water quality conditions in the Spokane River,
2. evaluate concentrations of dissolved cadmium, lead, and zinc in the Spokane River against acute (CMC) and chronic (CCC) toxics criteria as defined in Subsection 210.02 of Idaho's Water Quality Standards and to evaluate beneficial use support,
   a. *Note: As a result of analysis from this effort, the EPA approved delisting of cadmium from the list of causes of impairment for the Spokane River assessment units. Detailed delisting rationale is provided in Appendix M in Idaho's 2016 Integrated Report.*
3. evaluate point and nonpoint sources of lead and zinc along the Spokane River.
4. develop waste load allocations for point sources along the Spokane River
5. develop load allocations for nonpoint sources along the Spokane River

Objectives were met with analyses of data from existing data sources and data collected by DEQ. Existing data used for development of this TMDL document included:

- USGS's Coeur d'Alene Basin Environmental Monitoring Program (BEMP)
- Washington Department of Ecology (Station # 57A150)
- City of Coeur d'Alene
  - Wastewater Treatment Plant

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- Stormwater
- City of Post Falls
  - Wastewater Treatment Plant
  - Stormwater
- Hayden Area Regional Sewer Board
  - Wastewater Treatment Plant

A schematic of the location of these data sources along the Spokane River is illustrated in Figure 4 below.

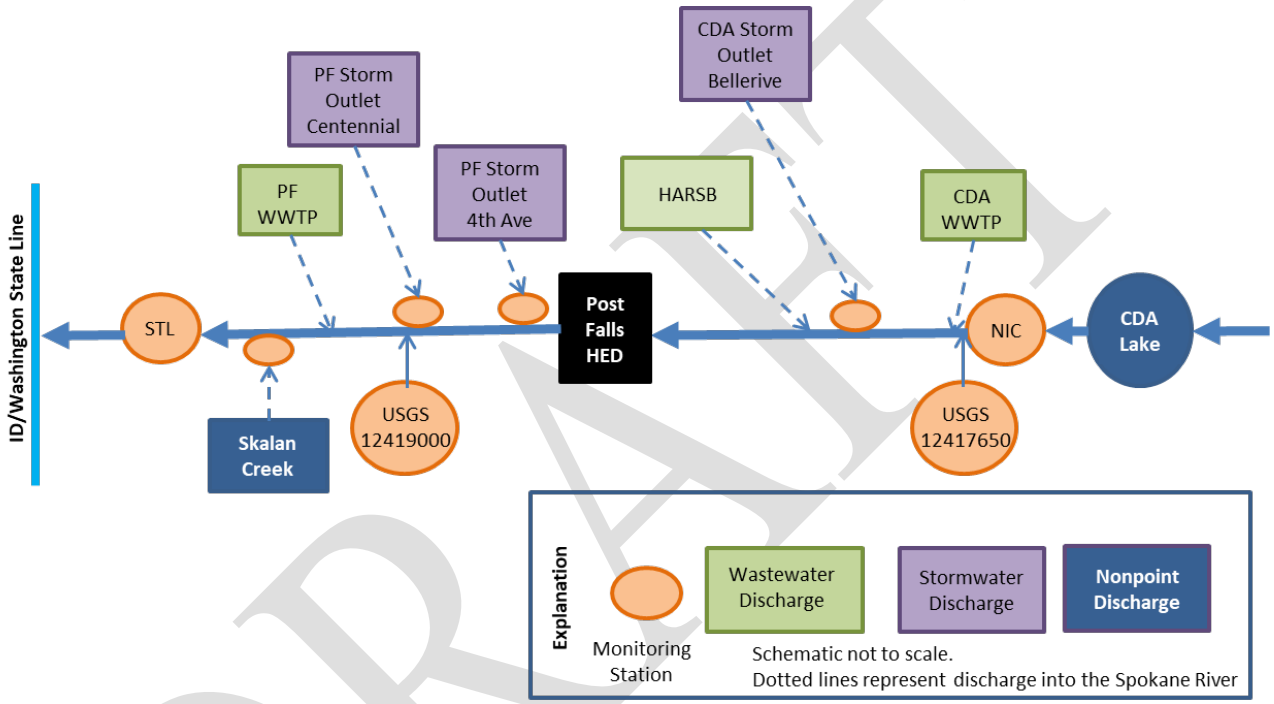


Figure 4. Schematic of discharges and monitoring stations along the Spokane River, between North Idaho College (NIC) and the ID/WA State Line (STL); Hydroelectric Dam: HED.

2.4.1 Ambient Water Quality Conditions

This section describes ambient water quality conditions in the Spokane River relevant to this TMDL are characterized by concentrations of total and dissolved lead and zinc. Characterization of ambient hardness was also necessary to evaluate concentrations of lead and zinc against acute (CMC) and chronic (CCC) toxics criteria and beneficial use support in Spokane River. Ambient water quality conditions were determined from analysis of outside data from the USGS Basin Environmental Monitoring Program, the Washington Department of Ecology (Washington Ecology), and data collected by the Idaho Department of Environmental Quality. Section 2.4.4 summarizes the ambient conditions against Idaho's metals toxicity criteria as defined in Idaho Water Quality Standards.

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2.4.1.1 Data Sources

2.4.1.1.1 Outside Data - Basin Environmental Monitoring Plan (BEMP)

Routine water quality monitoring in streams and rivers of the Coeur d'Alene basin is conducted under the Basin Environmental Monitoring Plan (BEMP). The purpose of the BEMP is to collect surface water (including lead and zinc), soil/sediment, and biological resources to evaluate time-history trends in support of environmental cleanup efforts, and to optimize remedial activities in the basin (U.S. EPA, 2004). The US Geological Survey has been charged with implementation of BEMP. There currently is only one active annual water quality monitoring site in the Spokane River under BEMP, which is at the Idaho/Washington State Line (USGS station #12417610).

2.4.1.1.2 Outside Data – Washington Department of Ecology

Washington Department of Ecology collects water quality data at the Idaho/Washington State Line (Station #57A150, N 47º 41' 54.64", W -117º 2' 40.718") as part of their statewide water quality monitoring network.

2.4.1.1.3 Idaho Department of Environmental Quality Monitoring

During 2014-2015, DEQ collected samples to compare instantaneous concentrations of lead and zinc to the acute criteria in Idaho Water Quality Standards. During 2014, additional samples were collected over four consecutive day periods to compare the average concentration of lead and zinc to the chronic criteria in Idaho Water Quality Standards. Monitoring frequency was based on a statistically representative sampling design. DEQ developed and followed a Quality Assurance Project Plan (QAPP) as part of this monitoring effort (DEQ 2014b). The laboratory analytical data (i.e., data from samples submitted to a laboratory for analysis) are at data quality Level III (standard laboratory procedures and data reviewed against the QAPP data quality objectives). Data not meeting data quality objectives were excluded from the assessment.

DEQs monitoring network consisted of two fixed stations on the Spokane River, upstream and downstream, and one tributary to the Spokane River (Table 4):

- The upstream station (NIC) close to the Coeur d' Alene Lake sill was selected to represent the ambient upstream conditions prior to direct contributions from Idaho sources of lead and zinc into the Spokane River.
- The downstream station (STL) at the Idaho/Washington State line was selected to represent the cumulative contributions of all Idaho sources of lead and zinc to the Spokane River.
- Skalan Creek is the only known perennial tributary along the Idaho portion of the Spokane River. Monitoring was near the mouth of Skalan Creek, but upstream of any backwater effects from the Spokane River.

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Table 4. 2014-2015 DEQ Stream Monitoring Station Locations.

Station ID	Station Name	Latitude	Longitude
NIC	Headwaters of Spokane River	47° 40’ 55.17”	-116° 47’ 54.79”
STL	Upstream of ID/WA State Line	47° 40 ’39.00”	-117° 00’ 13.32”
SKL	Skalan Creek	47° 41’ 29.70”	-117° 00’ 23.82”

2.4.1.2 Hardness

Dissolved calcium and magnesium concentrations were sampled in 2014. Hardness was calculated using the following equation:

$$\text{Total Hardness} = (2.497 \times [\text{Ca}]) + (4.118 \times [\text{Mg}])$$

Where hardness is expressed as mg/L as Calcium Carbonate, and, Ca, and Mg are all expressed in concentrations of mg/L.

Analysis of 2014 monitoring data indicated that dissolved calcium, dissolved magnesium, and hardness concentrations were highest during spring runoff and lowest in June and July (Figure 5). All three parameters were consistently higher at the downstream (STL) station than the upstream (NIC) station, as indicated by the third graph in Figure 5. Hardness at both the upstream (NIC) and downstream (STL) stations were below the 25 mg/L minimum hardness for calculating acute and chronic toxicity criteria for lead and zinc.

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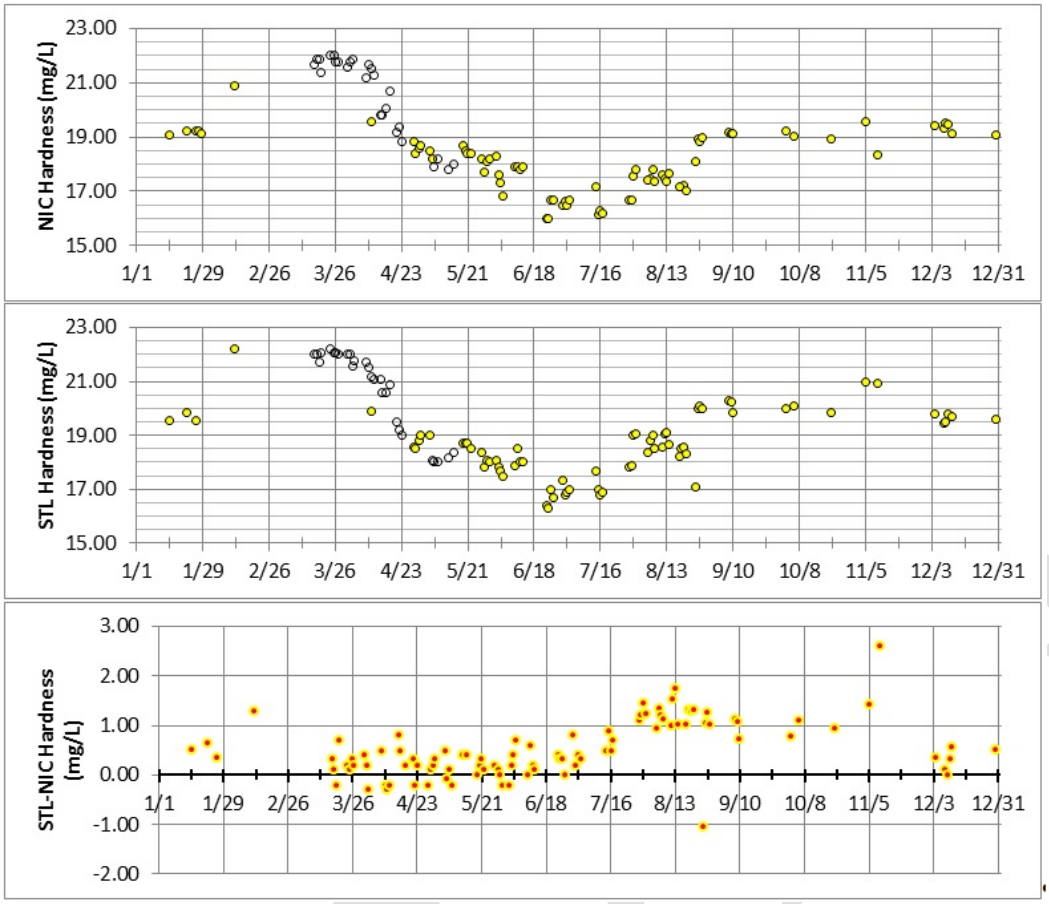


Figure 5. Hardness at upstream (NIC) and downstream (STL) stations on the Spokane River, 2014. Numbers on the bottom graph above zero indicate an increase in hardness from upstream to downstream locations.

2.4.1.3 Lead

General statistics for ambient concentrations of total and dissolved lead in the Spokane River are included in Table 5. Analysis of 2014 Total and dissolved lead (Pb) monitoring data collected from the upstream (NIC) and downstream (STL) stations indicate that both species of lead are at the highest concentrations during spring runoff and lowest during base flow (Figure 6-Figure 7). Between mid-June and early December, total lead concentrations are higher at the upstream (NIC) site, and during high flow conditions, dissolved lead concentrations are slightly higher at the downstream (STL) site (as indicated in the bottom graph in Figure 6-Figure 7). When comparing total and dissolved lead data from all stations on or near the Spokane River assessment units since 1995, the DEQ samples fall within the same range of results reported by U.S. Geologic Survey and WA Ecology (Figure 8-Figure 9).

Table 5. Ambient lead general statistics at NIC and STL locations.

		Concentration (µg/L)							
		Min	Max	Mean	Median	Upper 95% CI	SD	SE	n
NIC	Dissolved Lead	0.1	2.77	0.356	0.216	0.546	0.39	0.043	92
	Total Lead	0.12	4.93	1.549	1.15	1.926	1.24	0.122	103
STL	Dissolved Lead	0.1	3.21	0.42	0.284	0.667	0.548	0.057	93
	Total Lead	0.426	4.92	1.692	0.969	2.245	1.288	0.127	103

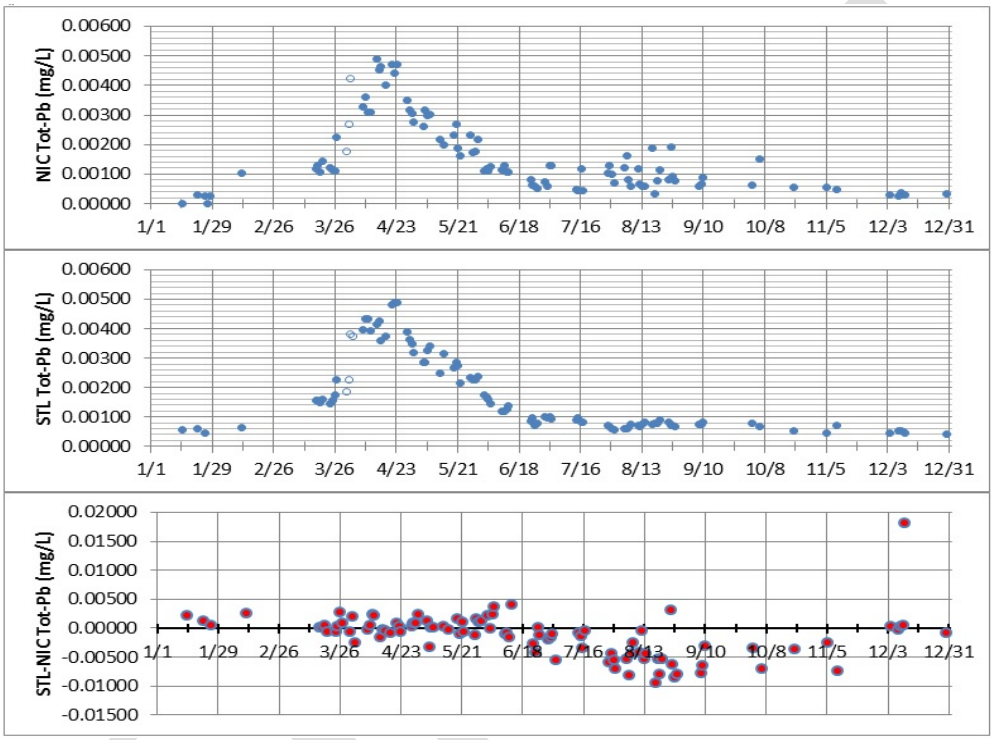


Figure 6. Total lead concentrations at upstream (NIC) and downstream (STL) stations on the Spokane River, 2014. (Below detect concentrations are graphed at zero). Numbers on the bottom graph above zero indicate an increase in lead from upstream to downstream locations. Numbers on the bottom graph below zero indicate a decrease in lead from upstream to downstream locations.

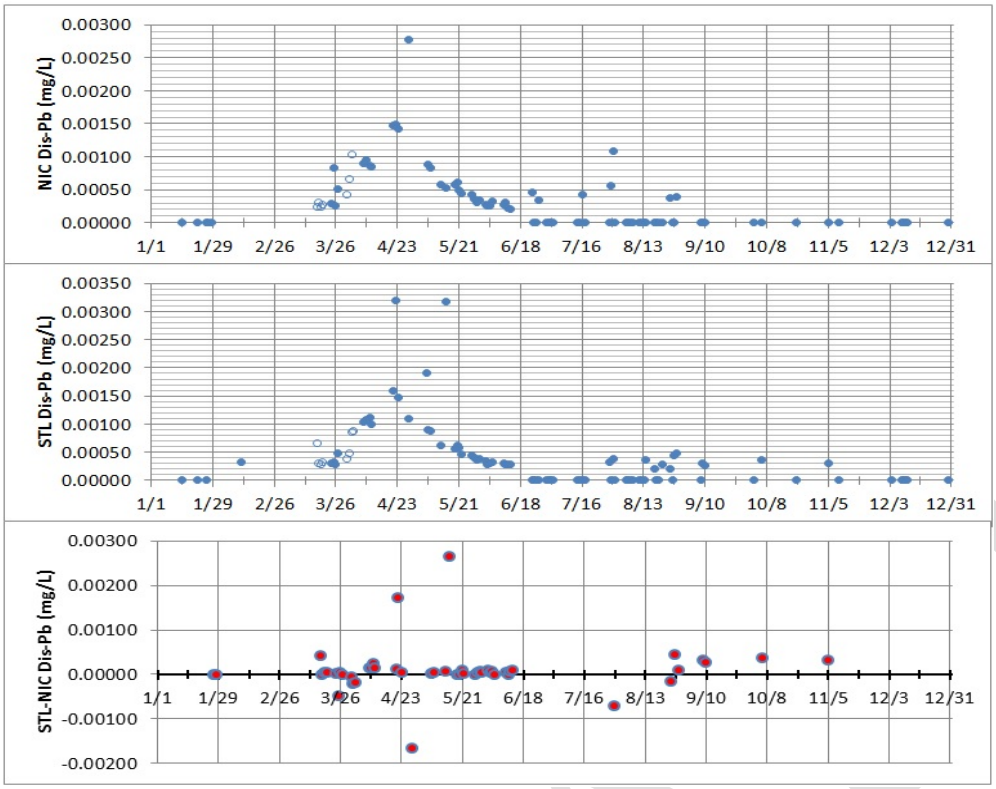


Figure 7. Dissolved lead concentrations at upstream (NIC) and downstream (STL) stations on the Spokane River, 2014. (Below detect concentrations are graphed at zero). Numbers on the bottom graph above zero indicate an increase in lead from upstream to downstream locations. Numbers on the bottom graph below zero indicate a decrease in lead from upstream to downstream locations.

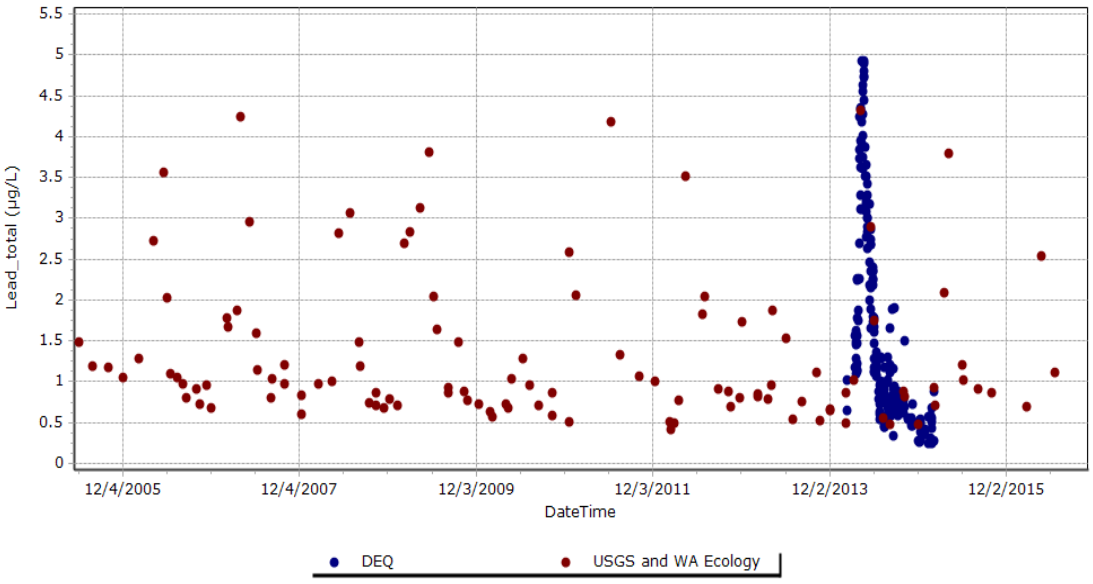


Figure 8. Comparison of DEQ, USGS, and WA Ecology Spokane River total lead data collected between 2005 and 2015.

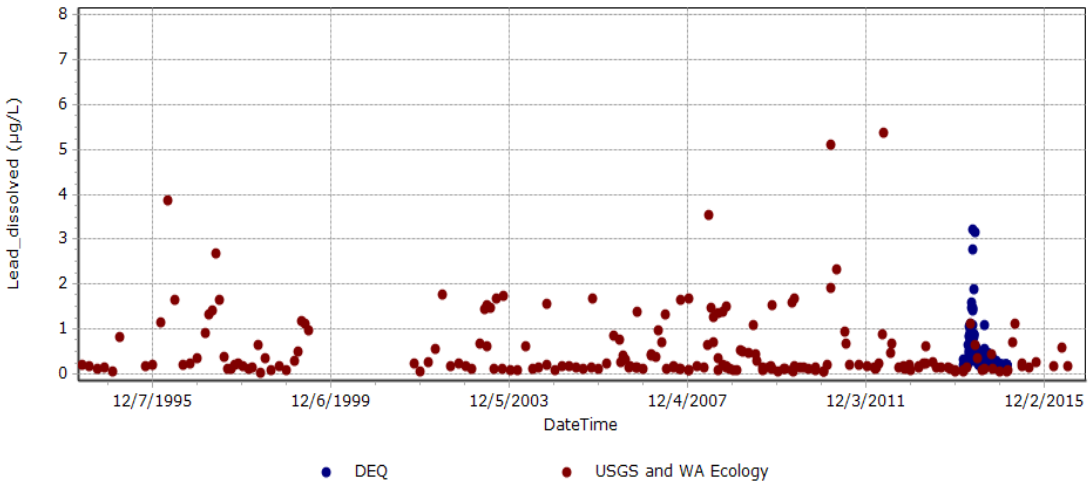


Figure 9. Comparison of DEQ, USGS, and WA Ecology Spokane River dissolved lead data collected between 1995 and 2015.

2.4.1.4 Zinc

General statistics for ambient concentrations of total and dissolved lead in the Spokane River are included in Table 6. Analysis of 2014 total and dissolved zinc (Zn) monitoring data collected from the upstream (NIC) and downstream (STL) stations indicate that both species of zinc are at the highest concentrations during spring runoff, lowest during base flow, and rise again in November and December (Figure 10-Figure 11). Between mid-June and mid-August total and dissolved zinc concentrations are higher at the upstream (NIC) site (as indicated in the bottom graph in Figure 10-Figure 11). When comparing total and dissolved zinc data from all stations on or near the Spokane River assessment units since 1995, the DEQ samples fall within the same range of results reported by U.S. Geologic Survey and WA Ecology (Figure 12-Figure 13). Total and dissolved zinc concentrations have decreased since monitoring began in 1995.

Table 6. Ambient zinc general statistics at NIC and STL locations.

		Concentration (µg/L)					
		Min	**Max**	**Mean**	**Median**	**Upper 95% CI**	**SD**
NIC	Dissolved Zinc	17.1	60.4	39.88	38.05	41.82	12.12
	Total Zinc	21.9	59.1	39.39	36.4	41.15	10.75
STL	Dissolved Zinc	15.5	72	38.92	38.25	41.14	13.87
	Total Zinc	18.4	61.9	38.61	38.5	40.74	13.01

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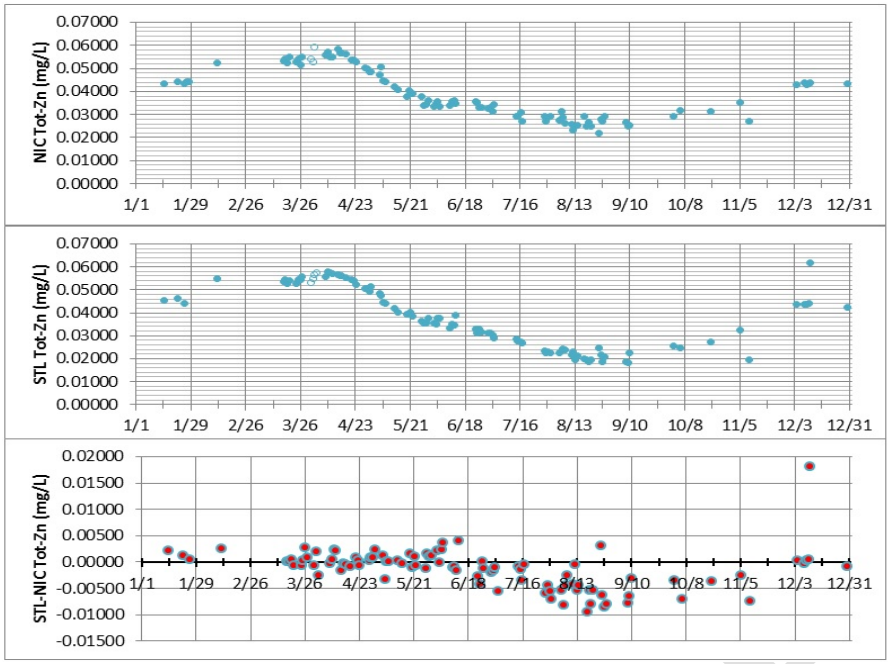


Figure 10. Total zinc concentrations at upstream (NIC) and downstream (STL) stations on the Spokane River, 2014. (Below detect concentrations are graphed at zero). Numbers on the bottom graph above zero indicate a increase in zinc from upstream to downstream locations. Numbers on the bottom graph below zero indicate an decrease in zinc from upstream to downstream locations.

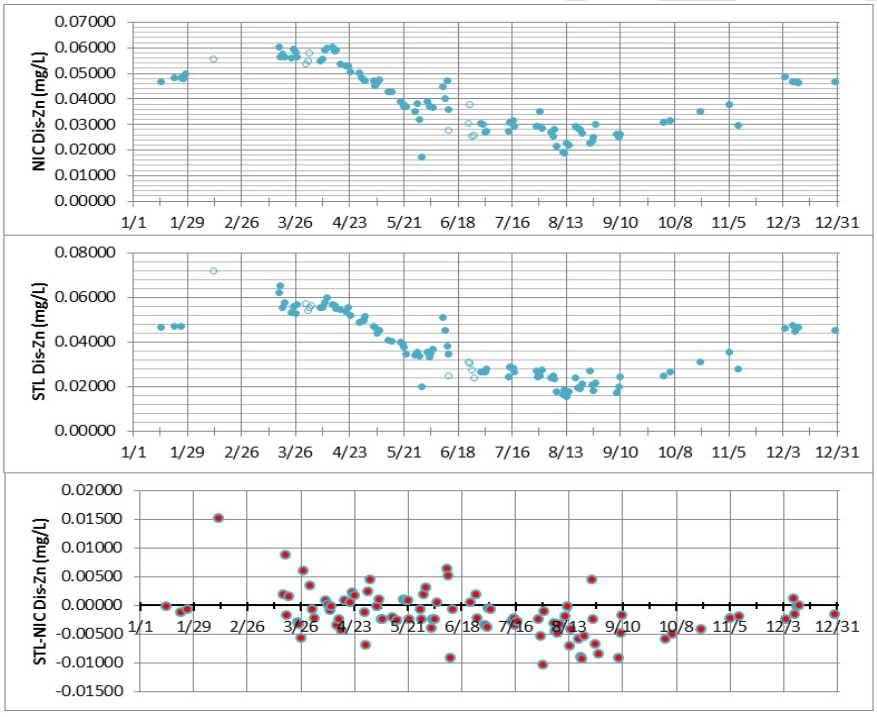


Figure 11. Dissolved zinc concentrations at upstream (NIC) and downstream (STL) stations on the Spokane River, 2014. (Below detect concentrations are graphed at zero). Numbers on the bottom graph above zero indicate a increase in zinc from upstream to downstream locations. Numbers on the bottom graph below zero indicate an decrease in zinc from upstream to downstream locations.

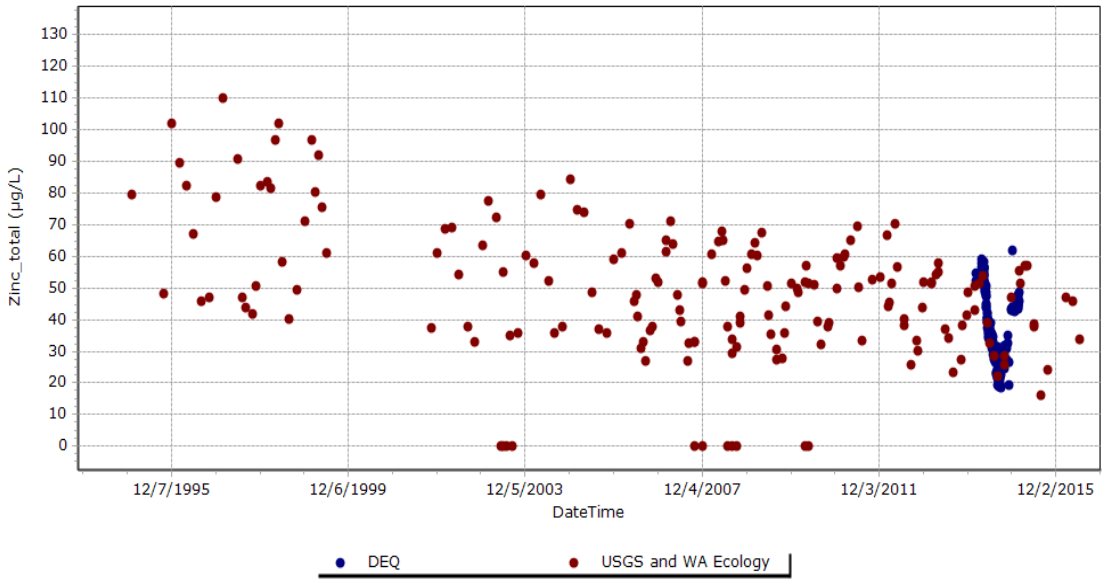


Figure 12. Comparison of DEQ, USGS, and WA Ecology Spokane River total zinc data collected between 1995 and 2015.

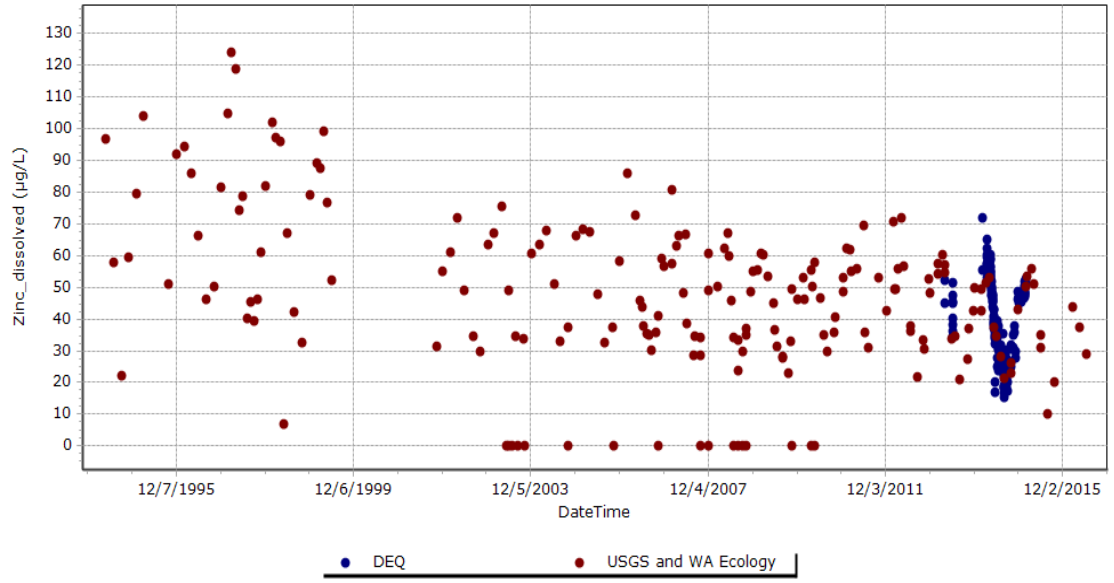


Figure 13. Comparison of DEQ, USGS, and WA Ecology Spokane River dissolved zinc data collected between 1995 and 2015.

2.4.2 Wastewater Discharge from Municipal Treatment Plants

Section 308 of the Clean Water Act and federal regulation 40 CFR 122.44(i) require monitoring in National Pollutant Discharge Elimination System (NPDES) permits to determine compliance with effluent limitations. Monitoring may also be required to determine effluent impacts on receiving water quality and whether additional effluent limitations are required in future permits. There are three wastewater treatment facilities with authorization under an NPDES/IPDES permit to discharge into the Spokane River in Idaho:

- City of Coeur d'Alene Advanced Wastewater Treatment Plant (NPDES/IPDES Permit No. ID0022853)
- Hayden Area Regional Sewer Board Publicly-owned Treatment Works (NPDES/IPDES Permit No. ID0026590)
- City of Post Falls Publicly-owned Treatment Works (NPDES/IPDES Permit No. ID0025852)

On June 5, 2018, EPA approved the Idaho Pollutant Discharge Elimination System (IPDES) program and authorized the transfer of permitting authority to the state beginning on July 1, 2018. The goal of IPDES, like NPDES, is to address water pollution by regulating point sources that discharge pollutants to waters of the United States. The IPDES program has assumed authority over the above permits and is in the process of renewing these permits.

The Hayden Area Regional Sewer Board Publicly-owned Treatment Works and the City of Post Falls Publicly-owned Treatment Works have 2014-permitted effluent limits for lead and zinc. City of Coeur d'Alene Advanced Wastewater Treatment Plant has 2014-permitted effluent limits for zinc. There are currently no 2014-permitted effluent limits for lead. Monitoring methodology is defined in their individual Quality Assurance Project Plans (QAPPs). Concentrations and flow data from the WWTP sources, and copies of QAPPs were acquired and evaluated against the Data Quality Objectives of the DEQ ambient water quality monitoring QAPP prior to inclusion in the TMDL development. Currently, all three entities are in compliance with their NPDES/IPDES permits (personal communication, Wes Green, Compliance Officer IPDES). Additional details about individual wastewater treatment plants are summarized in Section 3.1.1.

While Idaho Water Quality Standards for metals are based on dissolved metal concentrations, 2014-permitted effluent limits for wastewater dischargers are in total recoverable metals not dissolved metals. When effluent limits are developed, a translator is used to estimate how much of the total is expected to be in the dissolved form in the receiving water. Receiving water chemistry determines what the dissolved to particulate ratio will be in the receiving water. When adequate receiving water data is collected, a site specific translator is developed. When data is not available the metal conversion factor as defined in Idaho Water Quality Standards is used as a conservative assumption of the translator. For the Spokane River, enough data was available so a site-specific translator was developed.

2.4.2.1 City of Coeur d'Alene

End-of-pipe discharge data from the City of Coeur d'Alene Advanced Wastewater Treatment Plant were collected during 2010-2016. The daily average discharge ranged from 2.6-4.4 mgd. Hardness data was available only during 2015. Hardness of the effluent ranged between 128-141 mg/L, which was greater than upstream ambient hardness in the river (Figure 14).

End-of-pipe discharge monitoring data for total lead and zinc was collected from the City of Coeur d'Alene for the dates of 1/1/2010 – 12/02/2015. Effluent total lead concentrations were variable between May 2010 and December 2012 with concentrations ranging between 0.2 to 6.7 µg/L. However, after 2012 total effluent lead concentrations remained below 2 µg/L and below upstream ambient concentrations in the Spokane River.

Effluent total zinc concentrations were variable between May 2010 and December 2012 ranging from 32 to 65.9 µg/L. However, after 2012 total effluent zinc concentrations were higher than upstream Spokane River ambient concentrations after the beginning of May (Figure 15-Figure 16).

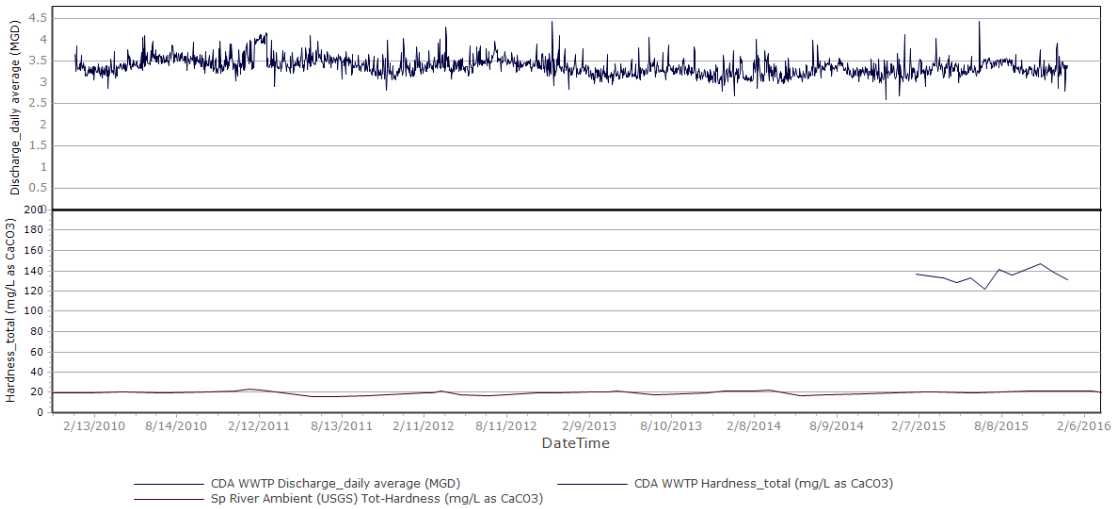


Figure 14. City of Coeur d'Alene wastewater discharge end-of-pipe flow and hardness (2010-2016).

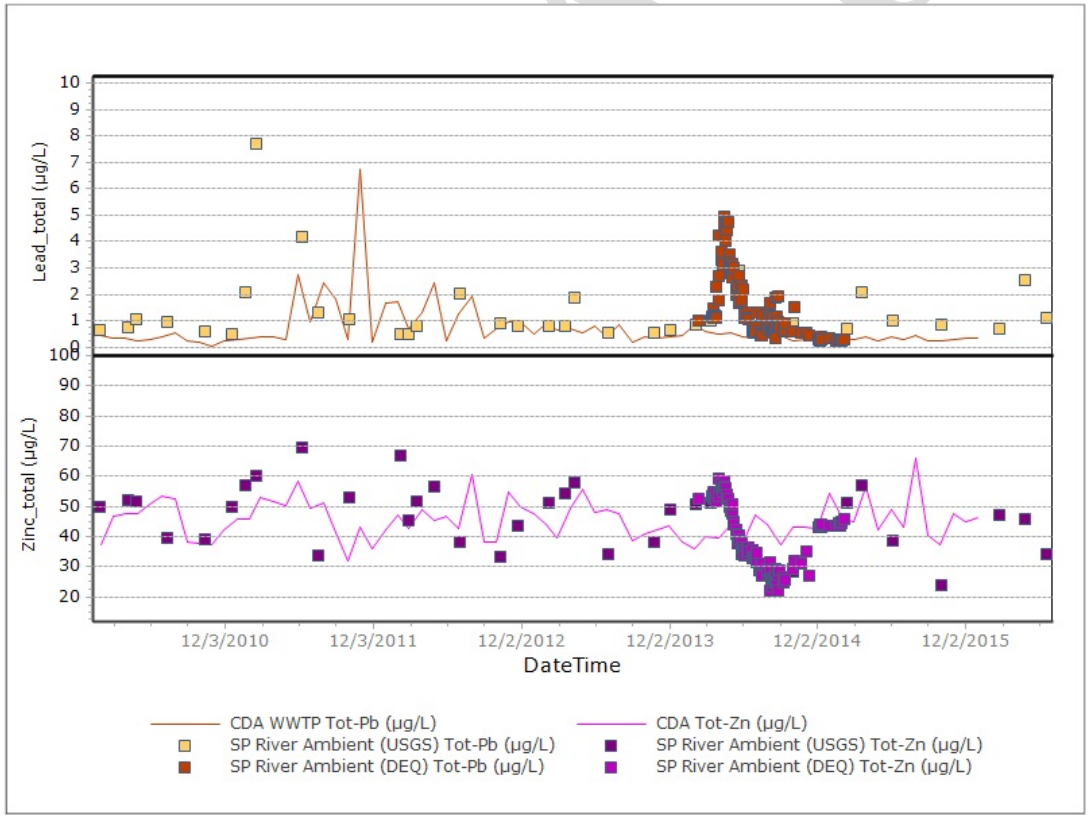


Figure 15. Comparison of concentrations of total lead and zinc in City of Coeur d'Alene wastewater discharge and ambient samples collected from the Spokane River (2010-2015).

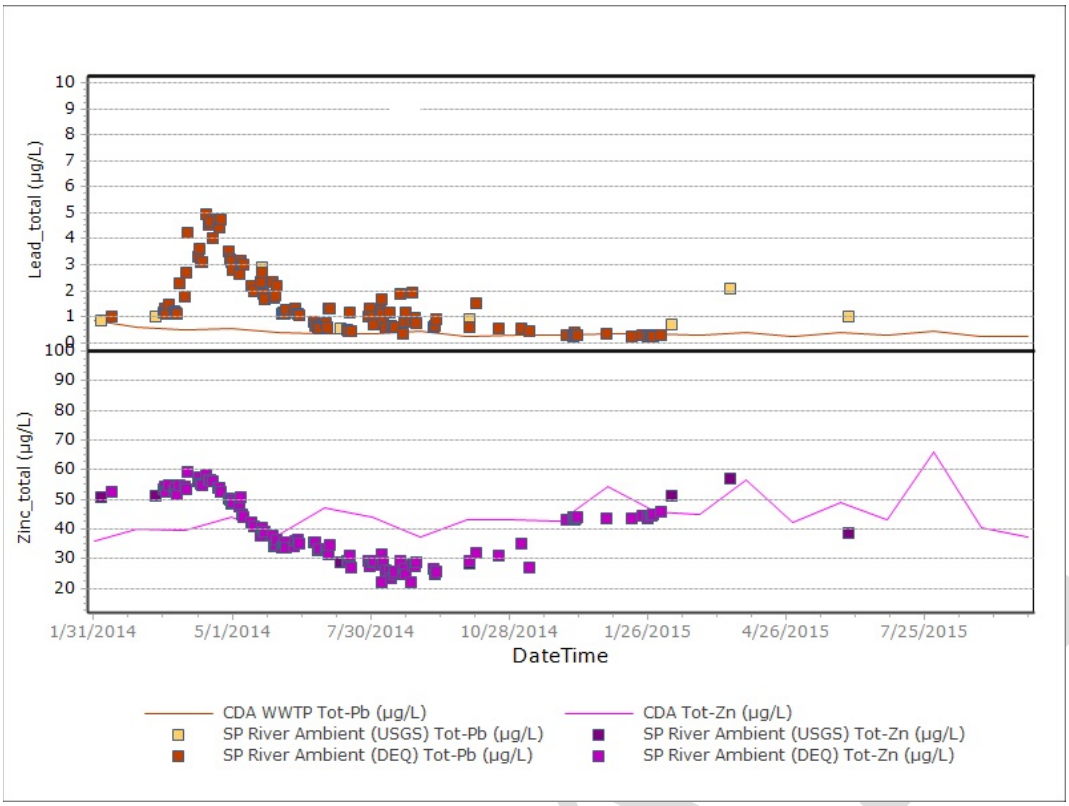


Figure 16. Comparison of concentrations of total lead and zinc in City of Coeur d'Alene wastewater discharge and ambient samples collected from the Spokane River (2014-2016).

2.4.2.2 Hayden Area Regional Sewer Board

End-of-pipe discharge and hardness data is not available from the Hayden Area Regional Sewer Board Publicly-owned Treatment Works (HARSB). End-of-pipe discharge monitoring data for total lead and zinc was collected from the HARSB for the dates of 1/1/2010 – 12/31/2015. Effluent total lead concentrations remained stable at concentrations below 1µg/L, which was near ambient concentrations during low flow in the Spokane River, and well below upstream ambient concentrations during runoff. Effluent total zinc concentrations were variable between May 2010 and January 2016 ranging between 14 to 4 µg/L. Total effluent zinc concentrations remained less than upstream total ambient zinc concentrations in the Spokane River during runoff and more than ambient concentrations during low flow (Figure 17-Figure 18).

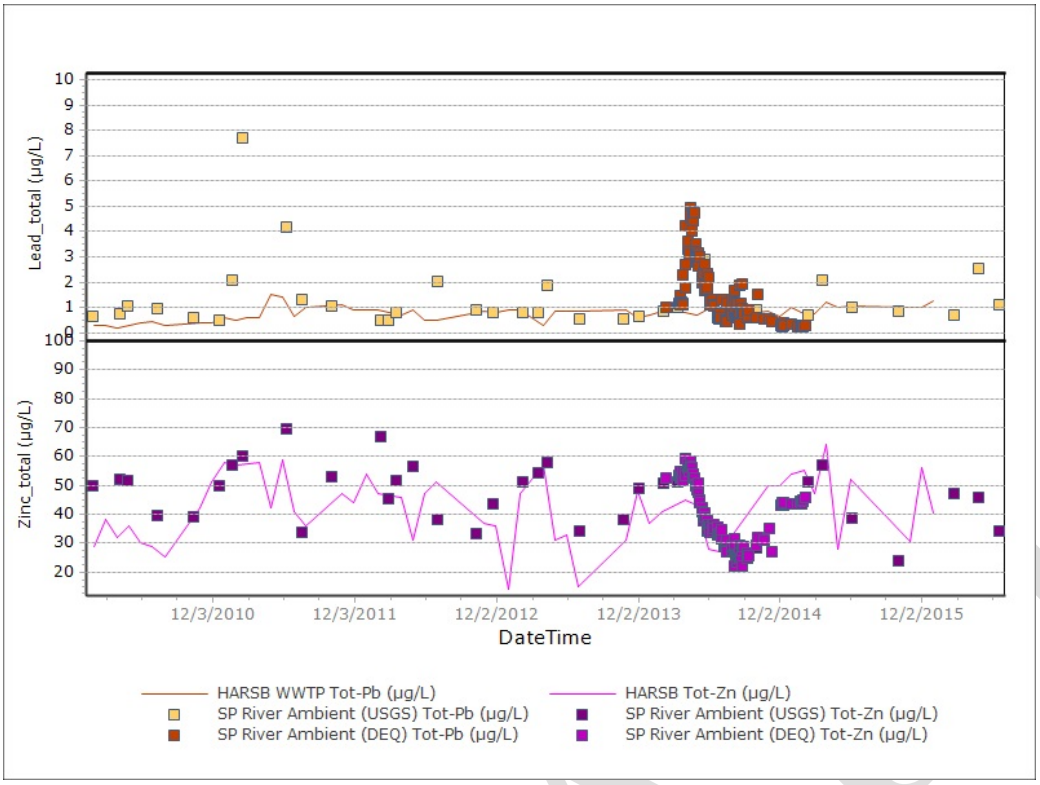


Figure 17. Comparison of concentrations of total lead and zinc in HARSB wastewater discharge and ambient samples collected from the Spokane River (2010-2016).

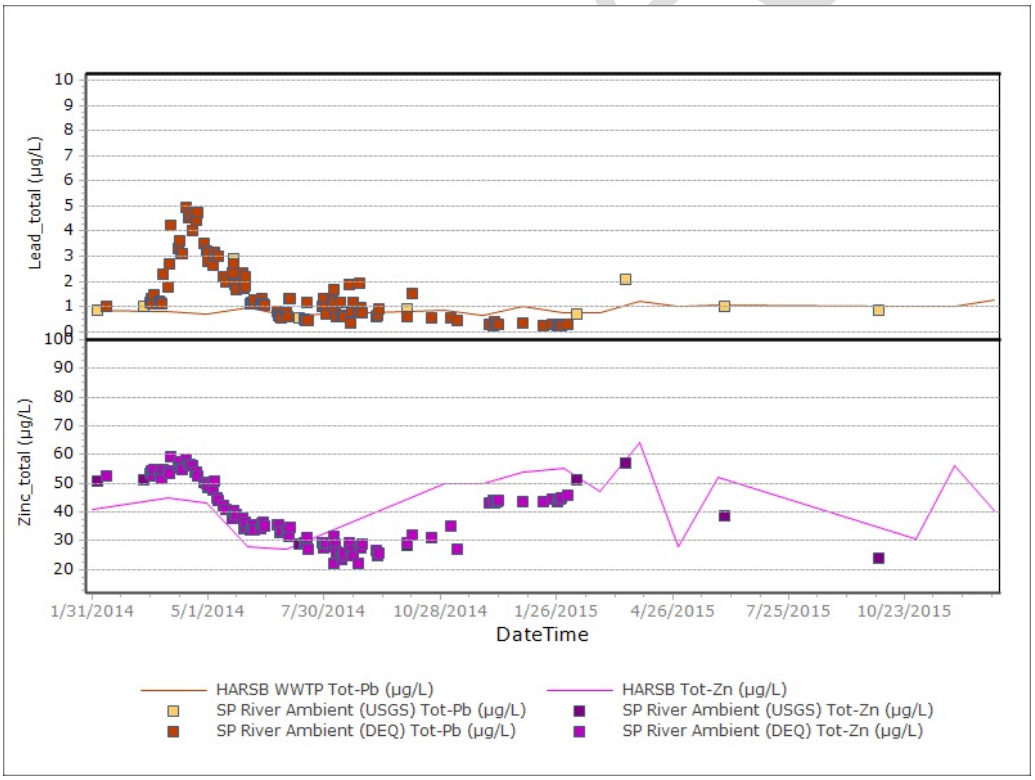


Figure 18. Comparison of concentrations of total lead and zinc in HARSB wastewater discharge and ambient samples collected from the Spokane River (2014-2016).

2.4.2.3 City of Post Falls

End-of-pipe discharge data were collected by the City of Post Falls Publicly-owned Treatment Works during 2010-2016. The daily average discharge ranged from 1.5-3.2 mgd. Hardness data was available only during 2015. Hardness of the effluent ranged between 164-200 mg/L, which was greater than upstream ambient hardness in the river (Figure 19).

End-of-pipe discharge monitoring data for total lead and zinc was collected from the City of Post Falls for the dates of 1/1/2010 – 12/02/2015. Effluent total lead concentrations remained stable at concentrations below 1µg/L, which was near ambient concentrations during low flow in the Spokane River and well below upstream ambient concentrations during runoff. Effluent total zinc concentrations were variable between May 2010 and January 2016 ranging from 22.7 to 96.2 µg/L. Total effluent zinc concentrations remained less than total upstream ambient zinc concentrations in the Spokane River during runoff, and more than ambient concentrations during low flow (Figure 20-Figure 21).

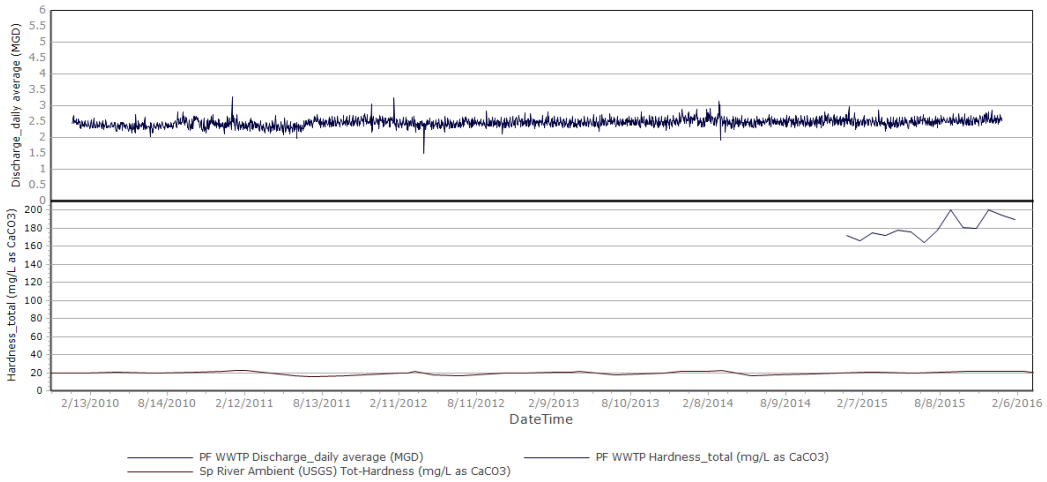


Figure 19. City of Post Falls wastewater discharge, end-of-pipe flow and hardness (2010-2016).

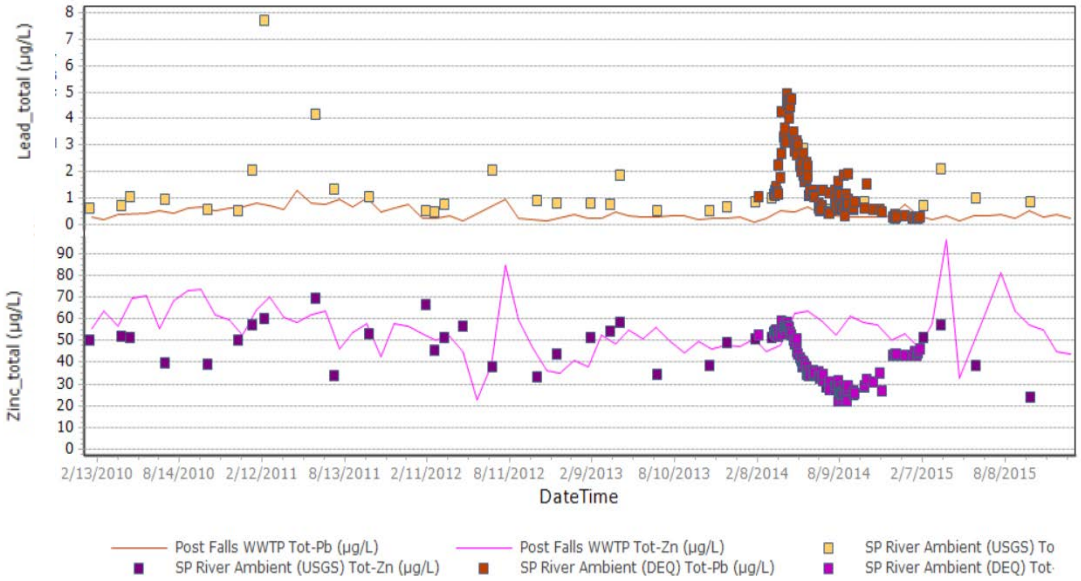


Figure 20. Comparison of concentrations of total lead and zinc in City of Post Falls wastewater discharge and ambient samples collected from the Spokane River (2010-2015).

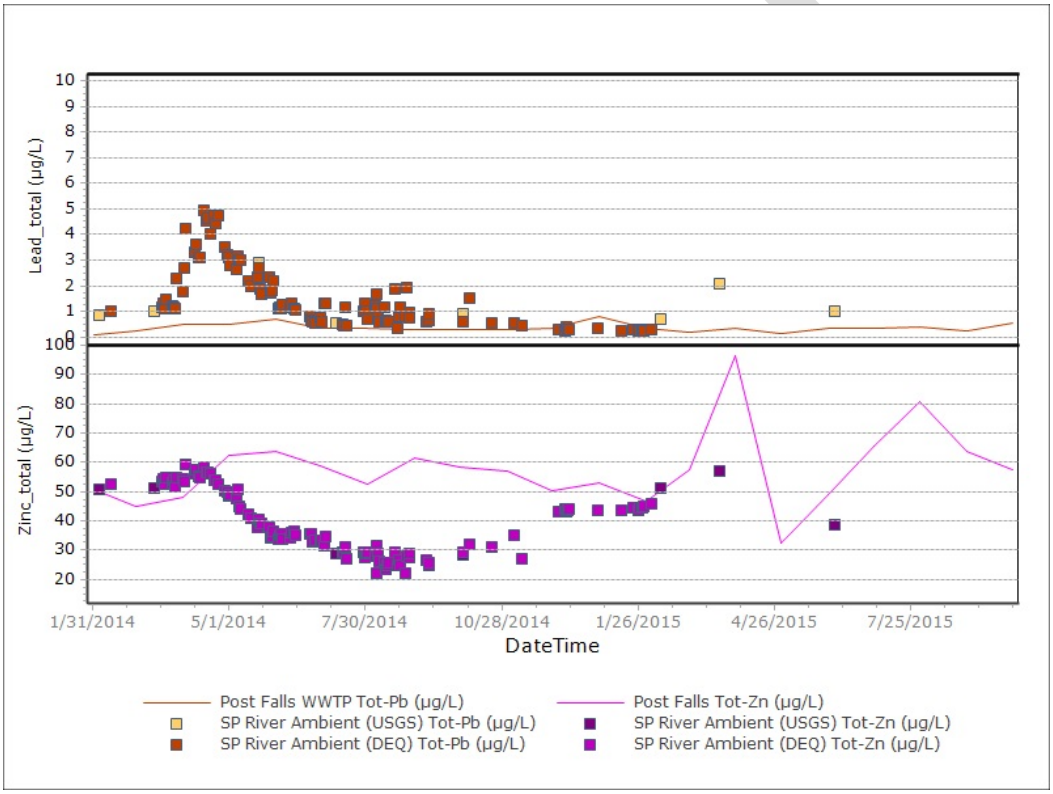


Figure 21. Comparison of concentrations of total lead and zinc in City of Post Falls wastewater discharge and ambient samples collected from the Spokane River (2014-2015).

2.4.3 Stormwater Discharge from Municipal Separate Storm Sewer Systems (MS4s)

Certain types of stormwater runoff are considered point source discharges that are regulated under the EPA's National Pollutant Elimination System (NPDES) program. Specifically, stormwater discharged from municipal separate storm sewer systems (MS4s) within U.S. Bureau of Census-delineated Urbanized Areas. The NPDES/IPDES program directs operators of the MS4s to develop a Storm Water Management Program. The program is designed to reduce the discharge of pollutants from the MS4 *to the maximum extent practicable*, and to protect water quality in the receiving water body. One requirement of their program is to conduct monitoring to determine whether storm water discharges from any part of the MS4 contribute pollutants of concern, either directly or indirectly, to receiving waters of the U.S. The MS4s within the Coeur d'Alene Urbanized Area that are authorized to discharge pollutants into the Spokane River are the City of Coeur d'Alene (NPDES/IPDES Permit No. IDS028215), the City of Post Falls (NPDES/IPDES permit IDS028231), Idaho Transportation Department District #1 (NPDES/IPDES Permit No. IDS028223), and the Post Falls Highway District (NPDES/IPDES Permit No. IDS028207. The IPDES program will take over primacy for stormwater from MS4s on July 1, 2021. For details on these MS4s and the Coeur d'Alene Urbanized Area refer to Section 3.1.2.

2.4.3.1 City of Coeur d'Alene

The City of Coeur d'Alene has four MS4 storm water outfalls that discharge into the Spokane River. Under the City's MS4 NPDES/IPDES permit (IDS028215), they are required to collect from one outfall into the Spokane River, a minimum of 4 samples; one during each of 4 monitoring time periods: March – April, May – June, August, and September – October. Among the parameters for lab analysis are total lead and total zinc. Storm events eligible for monitoring must be greater than 0.1 inch in accumulation with at least 72 hours of dry weather preceding the event. Water quality samples are collected from an Isco 4250 or equivalent within the first 30 to 60 minutes of the storm event. The unit also monitors open-channel flow with a sensor mounted in the influent pipe to a manhole. The manhole is upstream of the stormwater outfall within the MS4 system because the outfall is located below the high water elevation. Sample collection is remotely initiated once storm event conditions are met. Details of sample collection and data analysis are documented in the City's Stormwater Management Plan and their Quality Assurance Project Plan (CH2MHill 2010). For more information on the City of Coeur d'Alene MS4, refer to Section 3.1.2.1. Monitoring data for the City's MS4 outfalls are provided in Appendix C. Due to deficiencies in data quality with the City's flow data, flow data was excluded from the data analysis.

2.4.3.2 City of Post Falls

There are two outfalls used for Post Falls' MS4 monitoring. The outfalls are located off Centennial Trail and 4th Avenue. Under the City's MS4 NPDES/IPDES permit (IDS028231), they are required to collect a minimum of 4 samples from each of the outfall pipes, one during each of 4 monitoring time periods: March – April, May – June, August, and September – October. Among the parameters for lab analysis are total lead and zinc. Storm events eligible for monitoring must be greater than 0.1 inch in accumulation with at least 72 hours of dry weather preceding the event. Water quality samples are collected by taking a grab sample within the first

30 to 60 minutes of the storm event. Flow rate from the outfall pipe is determined by measuring depth of flow in the outfall pipe, then calculating the flow. Monitoring methodology is defined in their individual Quality Assurance Plan contained in their Stormwater Management Plan. For more information on the City of Post Falls MS4, refer to Section 3.1.2.2. Monitoring data for the City's MS4 outfalls are provided in Appendix C.

2.4.3.3 Stormwater Water Quality Data Summary

Because stormwater outfall data was collected on a quarterly basis, data from Post Falls and Coeur d'Alene MS4s were combined to have a more robust data source for statistical analysis and TMDL loading calculations. Statistical analyses were performed using data from the 4th Avenue and Centennial Trail outfalls in Post Falls, and the Bellerive outfall in Coeur d'Alene. Data points that were below the laboratory reporting limit were run as ½ the highest reporting limit (reporting limits were different for the two data sources). Results of this analysis are listed in Table 7.

Table 7. Post Falls, Coeur d'Alene MS4 outfall data (combined), combined statistics. Rounded to 3 significant figures.

	Mean	Median	Max	Min	upper 95th CI on Median
Tot-Lead (µg/L)	12.9	9.50	79.0	0.010	17.9
[1]Dis-Lead (µg/L)	3.40	2.50	20.9	0.002	4.70
Tot-Zinc (µg/L)	341	230	3050	27.0	504
[1]Dis-Zinc (µg/L)	344	232	3080	27.3	509

[1]Dissolved lead and zinc were calculated using a regression equation developed using Spokane River data. The regression is in Appendix C

Status of Beneficial Uses

The following is an evaluation of beneficial use support with a look at data collected in the Spokane River against Idaho's evaluated acute (CMC) and chronic (CCC) aquatic life criteria as defined in Subsection 210.02 of Idaho's Water Quality Standards.

2.4.4 Metals Toxicity Criteria Evaluation

To evaluate beneficial use support of the Spokane River, concentrations of dissolved lead and zinc in the Spokane River were compared against Idaho's acute (CMC) and chronic (CCC) aquatic criteria as defined in Subsection 210.02 of Idaho's Water Quality Standards. Both criteria are based on ambient hardness in the river at the time of sample collection.

In comparing samples to Idaho's acute criteria, data collected at the state line by DEQ, and WA Ecology were analyzed using the minimum hardness of 25 µg/L. In comparing samples against chronic criteria, it is necessary to determine four-day average concentrations from samples taken over four consecutive days. The analysis was done on data collected by DEQ in 2014-2015 from the Stateline (STL) station which represents the ambient conditions of the Spokane River assessment units (as described in section 2.4.1.1.3). The North Idaho College (NIC) station was not included in this analysis because it represents the upstream border conditions and concentrations of Coeur d'Alene Lake.

A discussion of concentrations of dissolved lead and zinc in the Spokane River compared to Washington's metal criteria is provided in Appendix C.

2.4.4.1 Lead

Ambient dissolved lead concentrations in the Spokane River at the state line were compared to Idaho's acute (CMC) and chronic (CCC) aquatic life criteria based on ambient hardness in the river at the time of sample collection. Hardness in the Spokane River at the state line was consistently below the minimum hardness value of 25 µg/L for Idaho's acute (CMC) and chronic (CCC) aquatic life criteria. Therefore, the acute and chronic criteria remained at 13.882 µg/L and 0.541 µg/L, respectively. The results of this investigation demonstrated that dissolved lead concentrations did not exceed Idaho's acute (CMC) minimum hardness-based criteria, but the 4-day average did exceed Idaho's chronic (CCC) minimum hardness-based criteria (Figure 22).

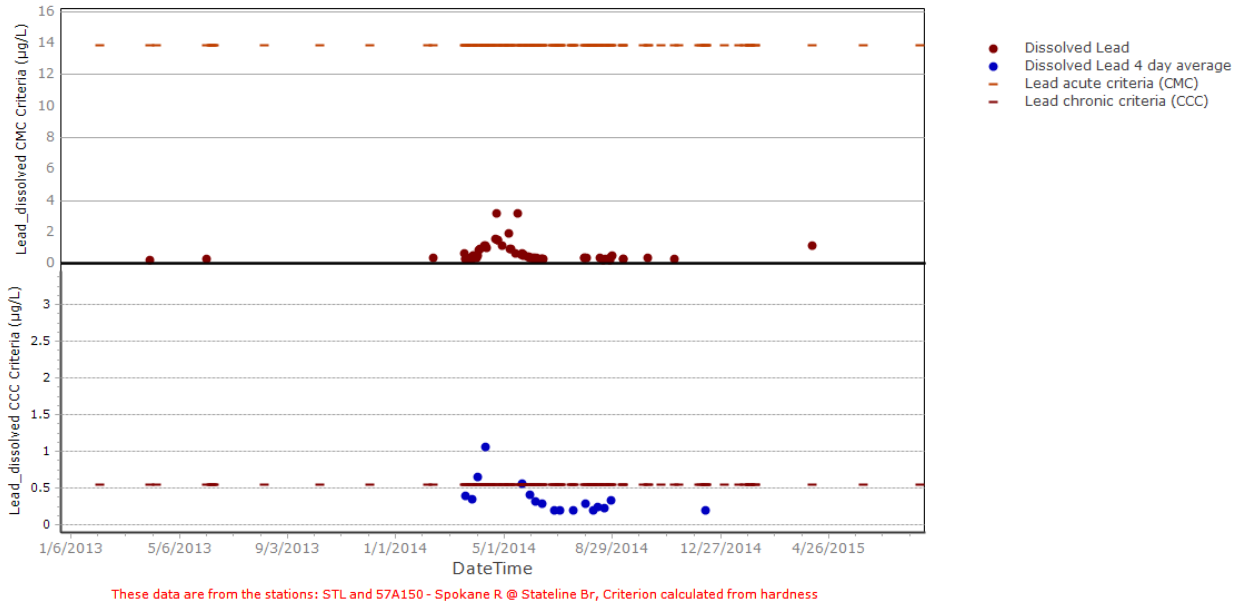


Figure 22. Dissolved lead concentrations at STL compared to Idaho's acute (CMC) and chronic (CCC) criteria (2014-2015).

2.4.4.2 Zinc

Ambient dissolved zinc concentrations in the Spokane River at the state line were compared to Idaho's acute (CMC) and chronic (CCC) aquatic life criteria based on ambient hardness in the river at the time of sample collection. Hardness in the Spokane River at the state line was consistently below the minimum hardness value of 25 µg/L for both the acute and chronic zinc criteria; therefore the acute and chronic criteria remained at 36 µg/L. The results of this investigation demonstrated that dissolved zinc concentrations exceeded both Idaho's acute (CMC) and chronic (CCC) minimum hardness-based criteria (Figure 23).

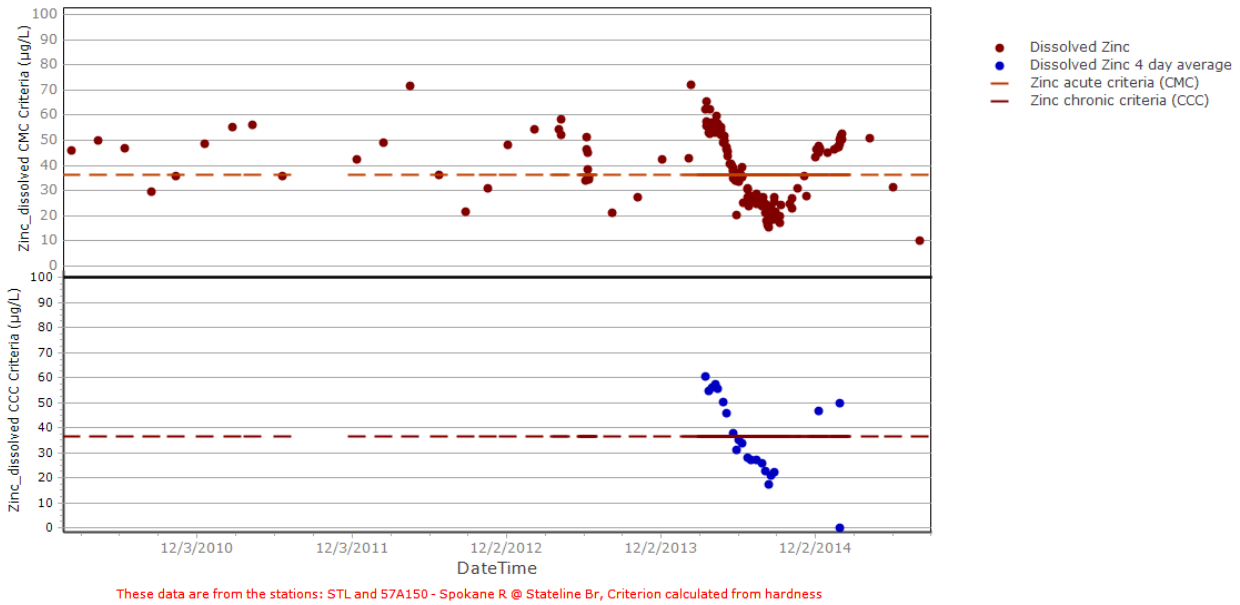


Figure 23. Dissolved zinc concentrations at STL compared to Idaho's acute (CMC) and chronic (CCC) criteria (2014-2015).

2.5 Assessment Unit Summary

A summary of the data analysis, literature review, and field investigations and a list of conclusions for AUs included in Category 5 of the 2014 Integrated Report follows. This section includes changes that will be documented in the next Integrated Report once the TMDLs in this document have been approved by EPA.

2.5.1 Assessment Units Addressed in TMDLs

17010305PN004_04, Spokane River – Coeur d'Alene Lake to Post Falls Dam
17010305PN003_04, Post Falls Dam to Idaho/Washington Border

- Listed for lead and zinc in Idaho's 2018/2020 Integrated Report.
- Dissolved lead concentrations did not exceed Idaho's acute (CMC) hardness-based criteria, but the 4-day average did exceed Idaho's chronic (CCC) hardness-based criteria. Idaho's Integrated Report listing for lead as a cause of impairment will remain the same.
- Dissolved zinc concentrations exceeded both Idaho acute (CMC) and chronic (CCC) hardness-based criteria. Idaho's Integrated Report listing for zinc as a cause of impairment will remain the same.

3 Pollutant Source Inventory

This section summarizes point and nonpoint pollutant sources of lead and zinc within the upper Spokane River sub-basin.

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3.1 Point Sources

The federal Clean Water Act authorizes discharge of pollutants from point sources into the waters of the United States with a permit under the National Pollutant Discharge Elimination System. On June 5, 2018, EPA approved the Idaho Pollutant Discharge Elimination System (IPDES) program and authorized the transfer of permitting authority to the state beginning on July 1, 2018. The goal of IPDES, like NPDES, is to address water pollution by regulating point sources that discharge pollutants to waters of the United States.

Table 8 lists the point source entities authorized to discharge pollutants into the Spokane River.

Table 8. NPDES/IPDES-authorized point source discharger into the Spokane River

Permittee	Type of Discharge	Permit Number
City of Coeur d'Alene	City of Coeur d'Alene Advanced Wastewater Treatment Plant (AWTP)	ID0022853
City of Coeur d'Alene	Municipal Separate Storm Sewer Systems (MS4s)	IDS028215
City of Post Falls	City of Post Falls Publicly-owned Treatment Works	ID0025852
City of Post Falls	Municipal Separate Storm Sewer Systems (MS4s)	IDS028231
City of Hayden	Hayden Area Regional Sewer Board Publicly-Owned Treatment Works	ID0026590
Post Falls Highway District	Municipal Separate Storm Sewer Systems (MS4s)	IDS028207
Idaho Transportation District	Municipal Separate Storm Sewer Systems (MS4s)	IDS028223

3.1.1 Wastewater Treatment Plants

The federal Clean Water Act authorizes discharge of pollutants from point sources into the waters of the United States with a permit under the National Pollutant Discharge Elimination System. There are three wastewater treatment facilities with authorization under an NPDES/IPDES permit to discharge into the Spokane River in Idaho:

- City of Coeur d'Alene Advanced Wastewater Treatment Plant (AWTP)
- Hayden Area Regional Sewer Board Publicly-owned Treatment Works (POTW)
- City of Post Falls POTW

The Idaho Pollutant Discharge Elimination System (IPDES) program has permitting authority over these entities in Idaho and is In the process of renewing these permits.

3.1.1.1 City of Coeur d'Alene Wastewater Facility

Effective December, 2014, the City of Coeur d'Alene is authorized under permit number ID0022853 to discharge pollutants in wastewater from their facility processes, waste streams, and operations from Outfall 001 on the Spokane River. The outfall is located between the outlet of Lake Coeur d'Alene and the Post Falls Dam, about one-half mile upstream of the US Highway 95 bridge (47° 40' 56", -116° 47' 47"). The permit expired November 30, 2019, has been administratively continued, and is in the process of being renewed under the IPDES program. 2014-permitted effluent limits and monitoring requirements for pollutants of concern are detailed in Table 7 and Table 1 in the permit (City of Coeur d'Alene 2014).

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3.1.1.2 City of Post Falls Water Reclamation Facility

Effective December, 2014, the City of Post Falls is authorized under permit number ID0025852 to discharge pollutants in wastewater from their facility processes, waste streams, and operations from Outfall 001 the Spokane River. The outfall is located about 0.2 miles downstream of the Post Falls Dam (47° 42' 30" -116° 58' 10"). The permit expired November 30, 2019, has been administratively continued, and is in the process of being renewed under the IPDES program. 2014-permitted effluent limits and monitoring requirements for pollutants of concern are detailed in Table 7 and Table 1 in the permit (City of Post Falls 2014).

3.1.1.3 Hayden Area Regional Sewer Board

Effective December, 2014, the Hayden Area Regional Sewer Board is authorized under permit number ID0026590 to discharge pollutants in wastewater from their facility processes, waste streams, and operations from Outfall 001 the Spokane River. The outfall is located approximately river mile 108.7 (47° 41' 54"; -116° 50' 03"). The permit expired November 30, 2019, has been administratively continued, and is in the process of being renewed under the IPDES program. 2014-permitted effluent limits and monitoring requirements for pollutants of concern are detailed in Table 9 and Table 1 in the permit (Hayden Area Regional Sewer Board (2014).

Table 9. 2014 NPDES/IPDES-permitted effluent limits for wastewater treatment plant point source discharges into the Spokane River .

Permittee	2014-permitted effluent limits (Average Monthly)		2014-permitted effluent limits (Maximum Daily)	
	Tot-Lead	Tot-Zinc	Tot-Lead	Tot-Zinc
Coeur d'Alene ID0022853	No limits specified	135 µg/L 6.76 lb/day	No limits specified	168 µg/L 8.42 lb/day
Post Falls ID0025852	2.05 µg/L 0.0855 lb/day	84.3 µg/L 3.52 lb/day	3.79 µg/L 0.158 lb/day	115 µg/L 4.80 lb/day
HARSB ID0026590	2.0 µg/L 0.040 lb/day	88.2 µg/L 1.77 lb/day	3.76 µg/L 0.075 lb/day	112 µg/L 2.24 lb/day

3.1.2 Stormwater within the Coeur d'Alene Urbanized Area

Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, and are regulated under the EPA's National Pollutant Elimination System (NPDES) program. Specifically, stormwater discharges from certain types of industries (as defined in federal regulations at 40 CFR 122.26(b)(14)); stormwater discharges from construction sites disturbing one or more acres; and stormwater discharged from municipal separate storm sewer systems (MS4s) within U.S. Bureau of Census-delineated Urbanized Areas (UAs).

The latest (Year 2010) Census by the U.S. Bureau of the Census delineated the boundary of Coeur d'Alene UA (Figure 24). An urbanized area (UA) **"***is a land area comprising one or more places — central place(s) — and the adjacent densely settled surrounding area — urban fringe — that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile"* (US Federal Register 1990). Any and all

operators of small municipal separate storm sewer systems (MS4s) located within the boundaries of the UA are covered under the US EPA Storm Water Phase II Final Rule (US EPA 2005). MS4s are not part of a combined sewer system. To prevent harmful pollutants from being discharged from an MS4 to receiving waters of the U.S., the Rule directs operators to obtain a NPDES permit from the US EPA. IPDES will take over MS4 stormwater program in July 2021. Under the current permit, all requirements will stay the same, but Idaho will communicate with stakeholders about extra measures/monitoring requirements as it relates to this TMDL

Operators of small municipal separate storm sewer systems (MS4s) located within the boundaries of the Coeur d'Alene Urbanized Area who are authorized to discharge pollutants into the Spokane River are the City of Coeur d'Alene, the City of Post Falls, the Idaho Transportation Department, and the Post Falls Highway District. As a requirement in their pollutant reduction activities, the entities must submit a monitoring and assessment plan to EPA. After July 2021, conditions under the current permit will remain the same, and permitees will be required to submit future monitoring and assessment plans to DEQ.

Currently, the Idaho Transportation Department does not discharge into the Spokane River. Instead, it drains into adjacent roadside ditch areas and infiltrated through vegetated areas into groundwater. ITD does not currently discharge into the Spokane River; however the waste load allocation developed in this TMDL allows them to discharge in the future. Results of stormwater monitoring are summarized in section 2.4.3.3.

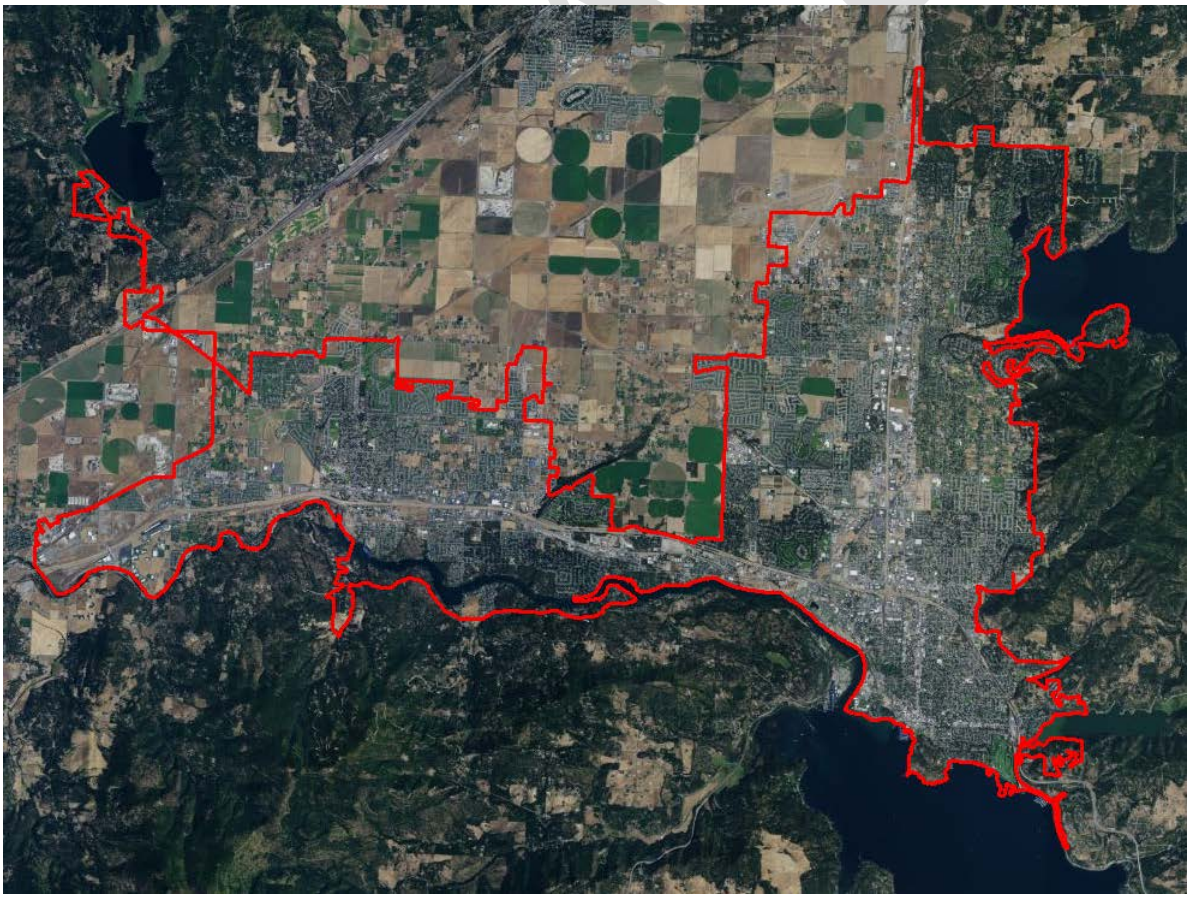


Figure 24. Coeur d'Alene Urbanized Area. Source: U.S. Bureau of the Census (2010).

3.1.2.1 City of Coeur d'Alene

The City of Coeur d'Alene owns/operates a municipal separate storm sewer system (MS4) within the Coeur d'Alene Urbanized Area under NPDES Permit No. IDS028215 (City of Coeur d'Alene 2020). The City of Coeur d'Alene incorporates 10,367 acres of land. Of those acres, approximately 1000 have the potential to contribute runoff directly to the Spokane River (Personal Communication City of Coeur d'Alene). The percent impervious surface of the acreage that delivers water to the City's MS4 and discharges into the Spokane River has not yet been determined by the City. The City of Coeur d'Alene has four MS4 storm water outfalls that discharge into the Spokane River. The storm-watersheds draining to these outfalls are illustrated in Figure 25. Storm watershed labeled as "groundwater" collects stormwater into drywells.

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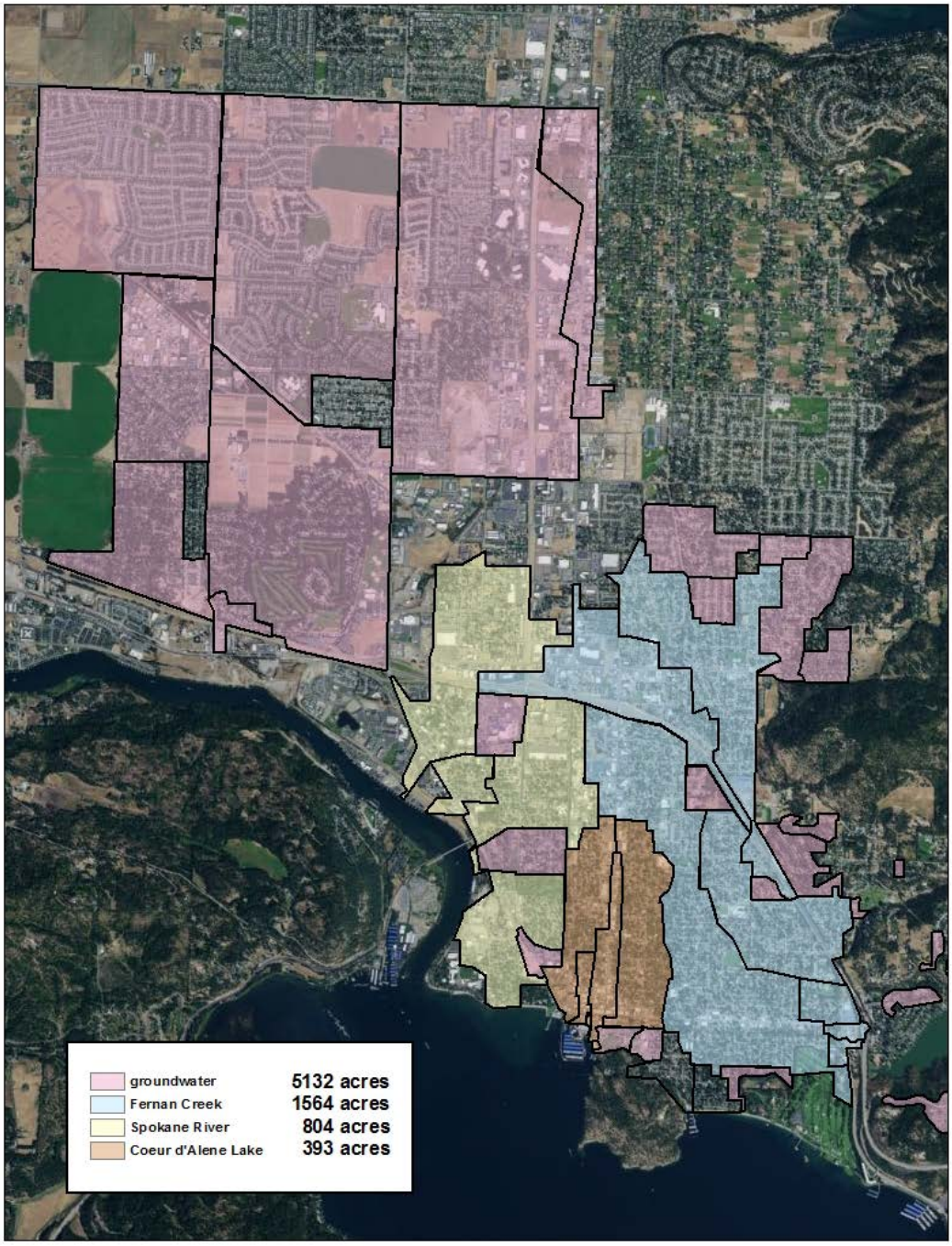


Figure 25. Locations of City of Coeur d'Alene stormwater outfalls that discharge into the Spokane River. Map provided by the City of Coeur d'Alene. 2019.

3.1.2.2 City of Post Falls

The City of Post Falls city limits incorporate 9,314.5 acres of land, of which 30 percent is impervious surface area (pavement and roofs) that has the potential to contribute to runoff (City of Post Falls, 2010). The City's MS4 storm sewer area is 184.8 acres. However, only 38.6 acres (1 percent) of impervious surface contributes to runoff into the Spokane River and is not captured by the City's zero-discharge storm water management system of swales and drywells

(City of Post Falls 2010). There are two outfalls used for Post Falls' MS4 monitoring. The outfalls are located off Centennial Trail and 4th Avenue. The storm-watersheds draining to these outfalls are illustrated in Figure 26.

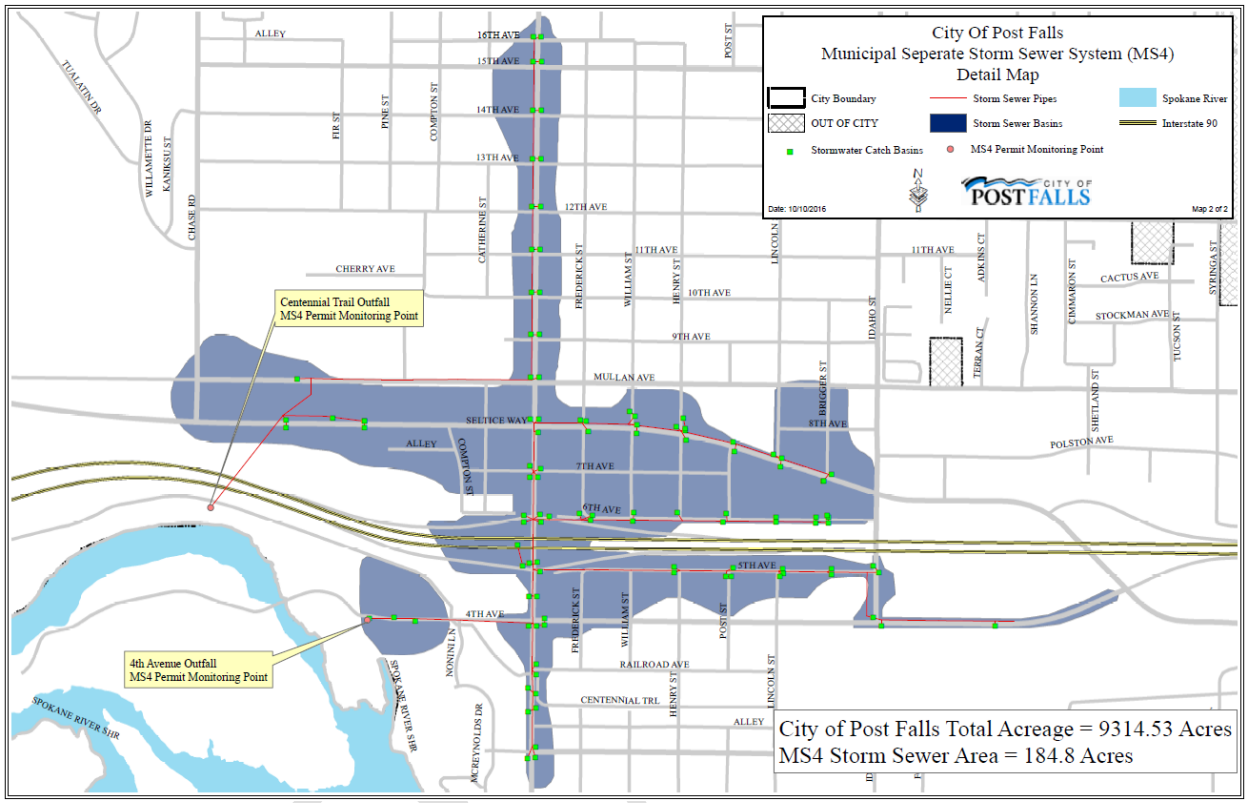


Figure 26. Location of the City of Post Falls stormwater outfalls that discharge (indirectly) into the Spokane River. Map provided by the City of Post Falls. 2019.

3.1.2.3 Post Falls Highway District

The MS4 is managed and operated by the Post Falls Highway District (NPDES Permit No. IDS028207) consists of natural drainage channels, culverts, and ditches along the approximately 194 miles of roadway. A portion of those roadways are within the Coeur d'Alene Urbanized Area (Figure 27). The Post Falls Highway District has 17 MS4 storm water outfalls that discharge into the Spokane River. The MS4 permit also regulates discharge from Lakes Highway District and East Side Highway District. According to the District, drainage canals and ditches slow water flow prior to discharge into the Spokane River.

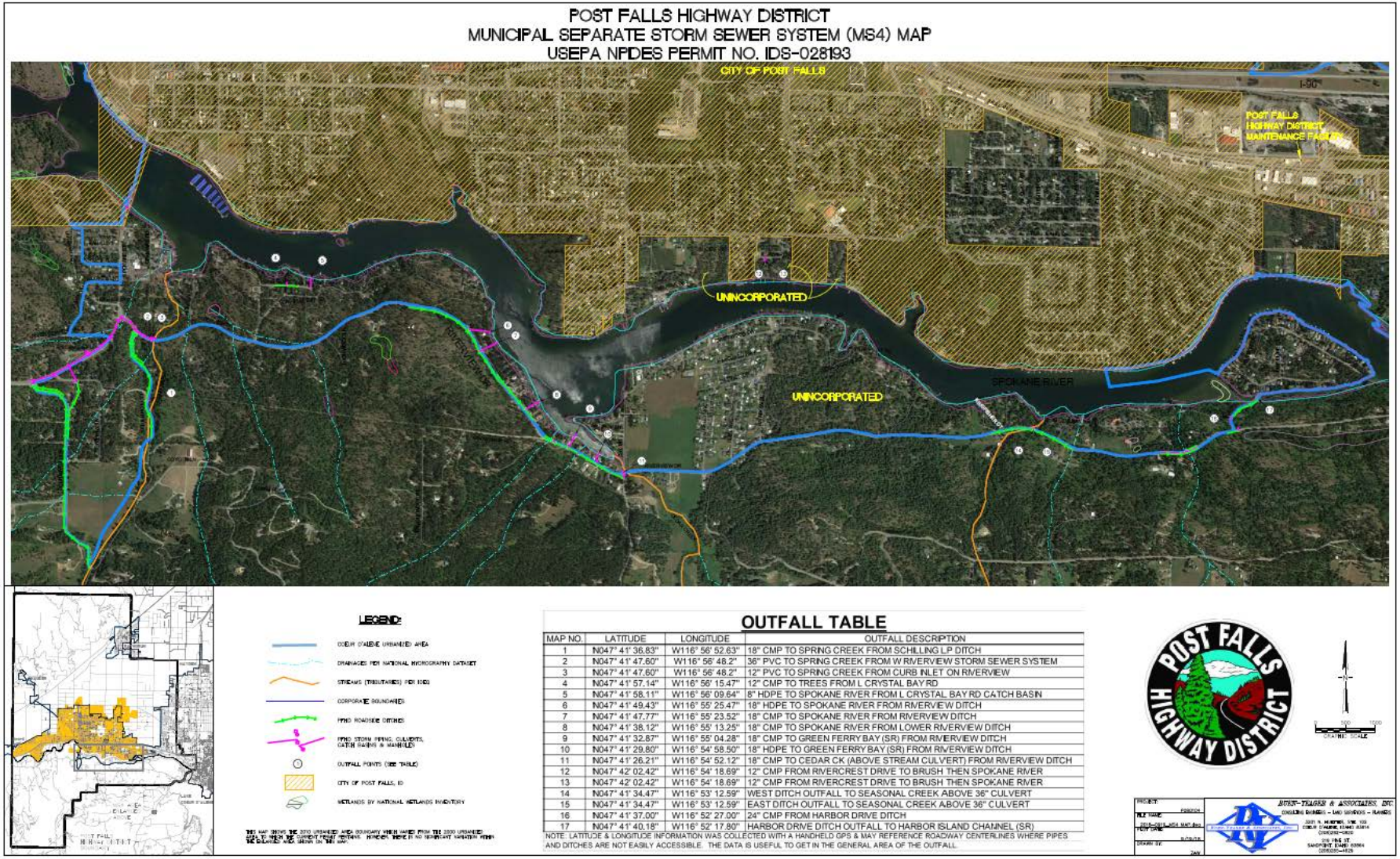


Figure 27. Post Falls Highway District MS4 Map (provided by Post Falls Highway District). 2019.

3.1.2.4 Idaho Transportation Department District #1

The MS4 managed and operated by the Idaho Department of Transportation District #1 (ITD) consists of natural drainage channels, culverts, and ditches associated with I-90, US-95, and a portion of Coeur d'Alene Lake Drive, east of Coeur d'Alene within the Coeur d'Alene Urbanized Area. Much of the storm water from the ITD MS4 highway system drains into adjacent roadside ditch areas and infiltrates through vegetated areas into groundwater. Although currently their permit authorizes discharge into the Spokane River, all MS4 outfalls drain into Coeur d'Alene Lake at Fernan Creek (Figure 28). Currently, there is no stormwater from the ITD road network discharged into the Spokane River.

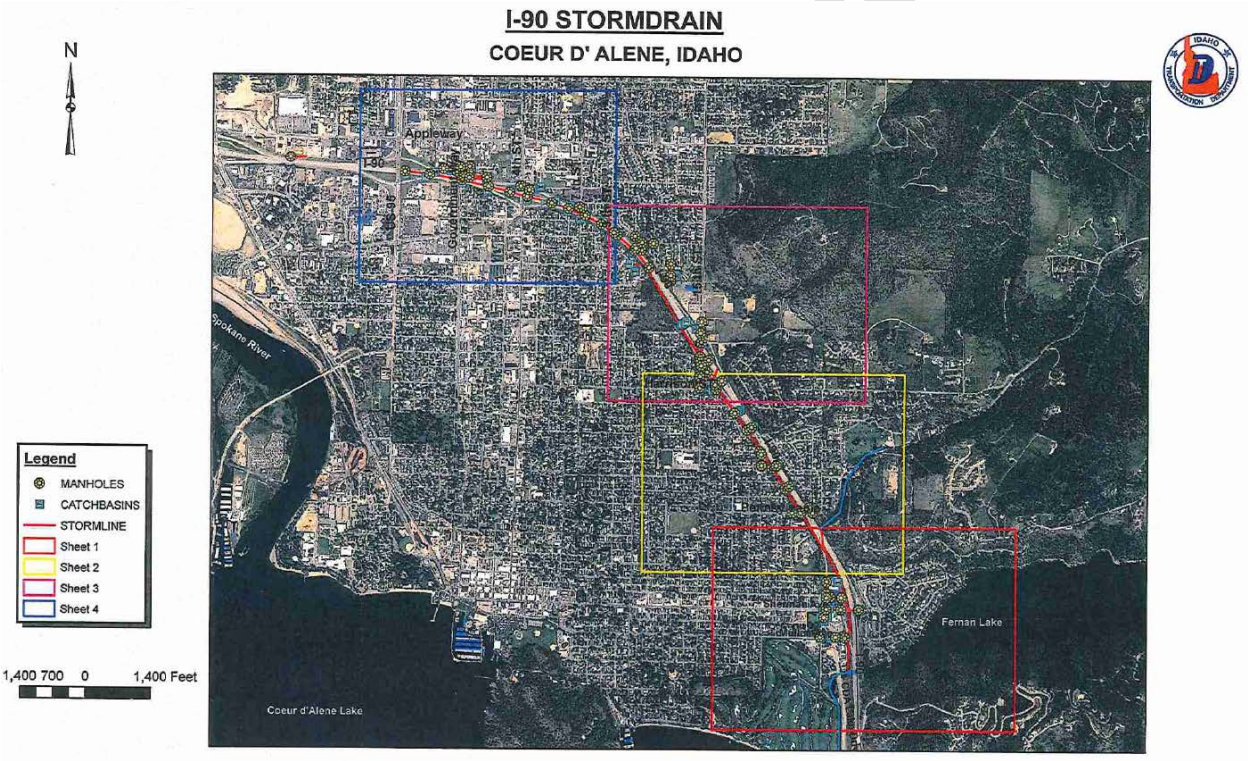


Figure 28. Storm watershed of Idaho Transportation Department. Figure provided by Idaho Transportation Department 2019.

3.1.3 Other Point Sources in the Upper Spokane Watershed

Other non-construction point sources in the upper Spokane River watershed are listed in Table 10. All three sources are accounted for in the TMDL because they discharge to a POTW or an MS4. All construction activities under the EPA Construction General Permit and discharges into an existing MS4 are accounted for in the Stormwater analysis in Section 4.1.2.

Table 10. Other permitted discharges to the Spokane River.

Permitted Discharger	Discharge Type	Latitude	Longitude	Discharge To
Buck Knives	NPDES Minor	47.70303259	-117.0010071	Post Falls POTW
Quality Coatings	NPDES Minor	47.69677818	-117.0151604	Post Falls POTW
Zanetti Brothers, Inc.	Industrial Stormwater	47.69433816	-116.8160943	Coeur d'Alene MS4

3.2 Nonpoint Sources

3.2.1 Environmental Transport of Legacy Mining Waste

Historic lead and silver mining began in the South Fork Coeur d'Alene River basin in 1885, when lead-bearing rock was discovered in the drainage. Mining subsurface ore resulted in waste rock that was milled before smelting. The first mill began operations in 1886 to process ore from the Bunker Hill Mine. At least 44 mills operated in the South Fork Coeur d'Alene River basin between 1886 and 1997. Initially, ores were processed by pulverizing the material and separating ore material from the parent rock through agitation of the pulverized material with water and settling the heavier, more valuable ore material (a process called "jigging"). The waste material, or Jig tailings, containing as much as 10 % lead and zinc, were either sluiced to waste dumps, or discharged directly into a nearby stream. In 1912, the efficiency of recovery of minerals from tailings was increased through a process called flotation milling. Flotation milling further pulverized the material which was then subjected to chemical and physical processes that allowed for better recovery of the desired minerals. The waste material were either sluiced to waste dumps or discharged directly into a nearby stream (Stratus 2000).

In the early 1900s, in response to complaints by downstream landowners, the mine association built a series of dams in the South Fork Coeur d'Alene River to impound tailings. In each incident, the impoundments filled up, tailings washed over the spillway, then the dam breached, sending the impounded tailings into the South Fork Coeur d'Alene River and downstream (Stratus 2000)

Although direct discharge of tailings into streams ended in 1968, this practice resulted in an estimated 64.5 million tons of tailings discharged to the Coeur d'Alene River or tributaries (Stratus 2000). These deposits of metals-contaminated sediments (containing primarily lead, cadmium, and zinc) were subsequently transported and deposited along the bed, banks, floodplain, and riparian areas of the North and South Forks of the Coeur d'Alene River, the mainstem, the 11 lateral lakes, numerous wetlands along the lower Coeur d'Alene River, the lakebed of Coeur d'Alene Lake, and into the Spokane River. Despite considerable effort to remediate environmental impacts of past mining in the basin, natural river flow, chemical processes, and food-chain interactions continue to redistribute metals-contaminated sediments throughout the entire system — including the Spokane River to the Idaho/Washington border (Stratus 2000).

Smelting operations at the Bunker Hill smelter began in 1917. Smelter emissions from the stacks contained particulates with metals and other hazardous compounds that were transported in the air throughout the Coeur d'Alene River valley. Soils, particularly near the former Bunker Hill

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smelter now contain elevated concentrations of lead, cadmium, and zinc. Erosion of these soils to surface waters is an ongoing source of metals-contaminated sediment to surface water (Stratus 2000).

3.2.2 Stormwater outside the Coeur d'Alene Urbanized Area

The sloping riverbank along the Spokane River and its tributaries is another area with stormwater impacts to the Spokane River, as a nonpoint source. The riverbank ranges in distance, slope, and composition throughout the length of the Spokane River in Idaho. For this TMDL purposes, a general riverbank width of 25 feet adjacent to the Spokane River water's edge has a slope toward the river to deliver surface water runoff to the Spokane River. Nonpoint stormwater from the general riverbank slope to stream tributaries was assumed to be from a distance up to 12.5 feet on each streambank. This area was mapped for loading analysis as described in Section 5.3.3.

3.2.3 Other Non-Point Sources

Analysis of loads between CDA outlet and the Stateline indicated loads were not statistically different. This indicates that pollutant loading between the two monitoring points is insignificant. The insignificant difference in pollutant loading between the two locations also makes quantifying other sources on non-point sources difficult given that temporal and spatial resolution of monitoring data. Based on the source assessment and metals loads at the CDA lake outlet being statistically similar to those at the Washington state line, major sources of lead and zinc pollution do not originate from the Upper Spokane subbasin and non-point source controls and reductions must originate from sources upstream of the subbasin.

4 Pollution Control Efforts and Monitoring

This section includes an assessment of pollution control efforts from both point and nonpoint sources of lead and zinc in the Upper Spokane River Sub-basin.

4.1 Point Sources

4.1.1 Wastewater Treatment Plants

Pollution control efforts from the City of Coeur d'Alene, the City of Post Falls, and the Hayden Area Regional Sewer Board are in compliance with effluent limitations and monitoring to determine effluent impacts on receiving water quality. Monitoring is performed to determine whether additional effluent limitations are required in future permits.

4.1.2 Stormwater from Municipal Separate Storm Sewer Systems (MS4s)

The NPDES program directs operators of the City of Coeur d'Alene, the City of Post Falls, and the Post Falls Highway District MS4s to develop a Storm Water Management Program. The program defines minimum control measures designed to reduce the discharge of pollutants from the MS4 *to the maximum extent practicable*, and to protect water quality in the receiving water body. The plan must define water quality monitoring and control measures with BMPs, system

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design, engineering methods, and other provisions to limit discharges of pollutants from the MS4. Control measures required under the NPDES permits include:

- A prohibition on snow disposal directly into surface waters;
- Specific prohibitions for non-stormwater discharges;
- A requirement to develop/revise a stormwater management plan that includes five control measures:
  - Public education and outreach,
  - Illicit discharge detection and elimination,
  - Construction site stormwater runoff control,
  - Post-construction stormwater management for new development and redevelopment,
  - Pollution prevention/good housekeeping for MS4 operations;
- Quantitative monitoring/assessment of pollutants removed by BMPs in conjunction with their required maintenance in all impaired AUs;
- Requirements for the MS4 to implement pollutant reduction activities; and
- The stipulation that if either EPA or DEQ determine that an MS4 causes or contributes to an excursion above the water quality standards, the permittee must take a series of actions to remedy the situation.

4.1.2.1 City of Coeur d'Alene

The City of Coeur d'Alene MS4 program is always looking for opportunity to reduce discharge to both the Spokane River and upstream of the Spokane River. For example, the City got permission from ITD to create a swale in the area between US-95 and the southbound exit to Northwest Boulevard which will capture the entire drainage area going to the Spokane River 2 outfall except for a few catch basins on Northwest Boulevard that are beyond that swale area. This project in the will take place in the spring 2021.The City is assessing the feasibility to remove/reduce the Spokane River 3 outfall as part of the larger Lacrosse Avenue project be completed in 2021.

In 2018, stormwater discharge at the Spokane River 1 outfall was reduced by creating a swale at the University of Idaho Outdoor Classroom. Only very large rainfall events reach the overflow in the swale.

The City is looking at removing stormwater discharge from a Sanders Beach outfall (discharge to Coeur d'Alene Lake) during smaller storm events by storing rainfall in underground chambers and then releasing the water through a sand/compost filter. In addition, preliminary discussions with a developer are underway to create a swale to remove the discharge to the Fernan Creek outfall (tributary to Coeur d'Alene Lake).

4.2 Nonpoint Sources

4.2.1 Environmental Transport of Legacy Mine Waste

Nonpoint sources in the Upper Spokane River are primarily from upstream sources. Reduction of those sources will be addressed through pollutant reduction programs/plans such as CERCLA, TMDLs and the Coeur d'Alene Lake Management Plan. See Section 5.6.2 for an in-depth discussion of nonpoint source pollution control efforts in the Coeur d'Alene Basin.

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4.2.2 Stormwater outside the Coeur d'Alene Urbanized Area

There are no known pollution control efforts that transports stormwater to the Spokane River and its tributaries outside the Coeur d'Alene Urbanized Area.

4.3 Water Quality Monitoring Points

There currently is one active water quality monitoring site under BEMP, which is at the Washington State Line (USGS station #12419500). Implementation of BEMP is done by the US Geological Survey. Included in the water quality monitoring under BEMP is monitoring for annual total and dissolved lead and zinc. This station captures the fate of metal transport to the ID/WA state line.

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = waste load allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and waste load allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source

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loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, and considers equities in load reduction responsibility. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Instream Water Quality Targets

Instream water quality targets for TMDL development were set for the most stringent conditions — protection of sensitive aquatic organisms from chronic toxicity. Idaho's aquatic life criteria for metals are expressed as dissolved fraction of the metal and as a function of total hardness (mg/L as calcium carbonate). A minimum hardness value of 25 mg/L was chosen for calculation of chronic instream water quality targets. The minimum hardness represents the most stringent conditions in the TMDL. For a full explanation of these criteria, refer to section 2.2.2 of this document.

5.1.1 Design Conditions

Idaho's metals criteria to protect aquatic life from chronic toxicity effects are a 4-day average concentration of a toxic substance to ensure adequate protection of sensitive species of aquatic organisms from **chronic** toxicity. Chronic criteria are expected to adequately protect the designated aquatic life use if not exceeded more than once every three (3) years.

5.1.2 Target Selection

The target load or load capacity for dissolved lead and zinc is based on Idaho's hardness-dependent metals Criteria Continuous Concentration (chronic). Idaho's aquatic life criteria for lead and zinc are expressed as a function of total hardness (mg/L as calcium carbonate), the metal's water effect ratio (WER), and multiplied by an appropriate dissolved conversion factor. The target hardness-dependent metals Criteria Continuous Concentration (chronic) was calculated using the following equation (see IDAPA 58.01.02.210.02):

$$CCC = WER \times e^{(mc \times \ln(hardness) + bc)} \times Chronic\ Conversion\ Factor$$

The target chronic criteria for dissolved lead and zinc were determined with a minimum hardness of 25 mg/L and a water-effect ratio of 1.0 (as defined in Subsection 210.01 of Idaho's Water Quality Standards).

The conversion factors for dissolved lead and zinc are defined in Subsection 210.02 of Idaho's Water Quality Standards. The conversion factor for lead is also dependent on hardness. The conversion factor for lead was calculated using the minimum hardness of 25 mg/L using the following equation:

$$\text{Conversion Factor} = 1.46203 - [(\ln \text{hardness}) * (0.145712)]$$

The conversion factor for zinc is not hardness dependent. Conversion factors and the Criteria Continuous Concentration (chronic) for both lead and zinc are listed in Table 11.

Table 11. Conversion factors and CCC Target Concentration for lead and zinc

Metal	CCC Conversion Factor	CCC (µg/L)
Lead	0.993	0.5
Zinc	0.986	36

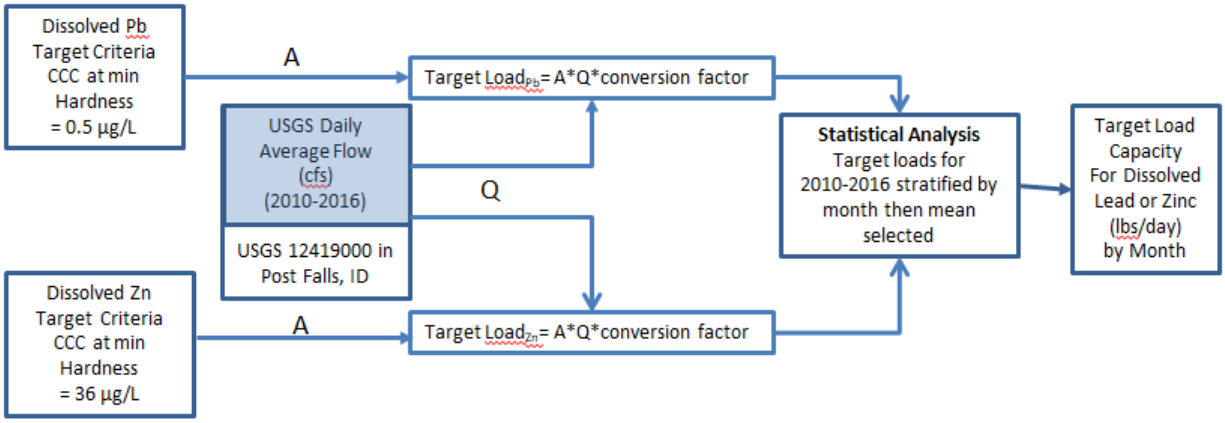
5.2 Load Capacity

Load capacity is the maximum load each water body can accommodate and still meet the water quality standard. This must be a level to meet "...water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge..." (Clean Water Act § 303(d)(C)). The time period for which loading is calculated needs to be appropriate to the nature of the pollutant and use impairment. Load capacity for the Spokane River was set to meet the target metals Criteria Continuous Concentration (chronic) on a monthly basis based on 2010-2016 flow conditions in the river as observed by the US Geological Survey at Post Falls (continuous discharge gaging station #1241900). Using the Criteria Continuous Concentration (chronic) condition at the minimum hardness as defined by Idaho Water Quality Standards is a margin of safety in the TMDL. The US Geological Survey gaging station at Post Falls was chosen because flow at this site is representative flows in the Spokane River in Idaho, and at this gaging stations flows are not restricted as they are upstream at the natural outflow sill at Coeur d'Alene Lake or the dams currently are operated by AVISTA Corporation under the Post Falls Hydroelectric Project.

5.2.1 Daily Load Capacity

Daily load capacity of the Spokane River for dissolved lead and zinc were calculated by stratifying the target loads by month using the steps defined in Figure 29. Because the most stringent (CCC) criteria were selected loading calculations, it was appropriate to select the mean target load capacity for each month. Daily load capacity (target loads) for each month of dissolved lead and zinc in the Spokane River are listed in Table 12.

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Conversion Factor = unit conversion factor (0.00539377)

Figure 29. Calculation of load capacity of dissolved lead and zinc in the Spokane River (in lbs/day).

Table 12. Daily load capacity (target loads) in lbs/day of dissolved lead and zinc in the Spokane River (rounded to 3 significant figures).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pb	13.8	18.8	27.6	39.8	38.2	26.5	6.84	2.20	2.79	4.95	8.80	13.6
Zn	990	1350	1990	2870	2750	1910	492	158	201	357	634	982

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)).

5.3.1 Ambient Conditions in the Spokane River

Existing loads of dissolved lead and zinc in the Spokane River were calculated using 2010-2016 flow conditions in the river as observed by the US Geological Survey at Post Falls (continuous gaging station # 1241900) and 2010-2016 ambient dissolved lead and zinc concentrations combined from 5 monitoring stations on the river. Flows and concentrations were matched by date, then multiplied by each other and multiplied by a conversion factor to get a load (Figure 34). The US Geological Survey site at Post Falls was selected because there is no statistical difference between lead and zinc loads at NIC and STL (see below):

1. Idaho Department of Environmental Quality at the Coeur d'Alene Lake outlet (station NIC)
2. USGS continuous gaging station at the Coeur d'Alene Lake outlet (station #s 12417610 & 12417650)
3. Idaho Department of Environmental Quality at the ID/WA state line (station STL)
4. Washington Ecology at the ID/WA state line (station # 57A150).

General statistics for ambient existing metals load in the river at NIC and STL are provided in Table 13.

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Table 13. General statistics for ambient existing metals load in the river at NIC and STL

		Concentration (µg/L)							
		Min	**Max**	**Mean**	**Median**	**Upper 95% CI**	**SD**	**SE**	**n**
NIC	Dissolved Lead Load	0.684	282.4	26.12	8.004	45.41	42.21	4.425	91
STL	Dissolved Lead Load	0.684	307.8	32.2	5.89	57.15	55.2	5.724	93
NIC	Dissolved Zinc Load	65.24	7786	2333	1425	3238	2148	207.6	107
STL	Dissolved Zinc Load	53.01	8136	2346	1598	3259	2175	209.3	108

Dissolved lead loads exceed the target load during the runoff period, and are below the target the rest of the year (Figure 30). A Mann-Whitney test concluded there is no significant difference between dissolved lead at NIC and the STL stations (p=0.652) (Figure 31). Dissolved zinc loads exceed the target load for most of the year, except during low flow (Figure 32). A Mann-Whitney test concluded there is no significant difference between dissolved zinc at NIC and the STL stations (p=0.603) (Figure 33).

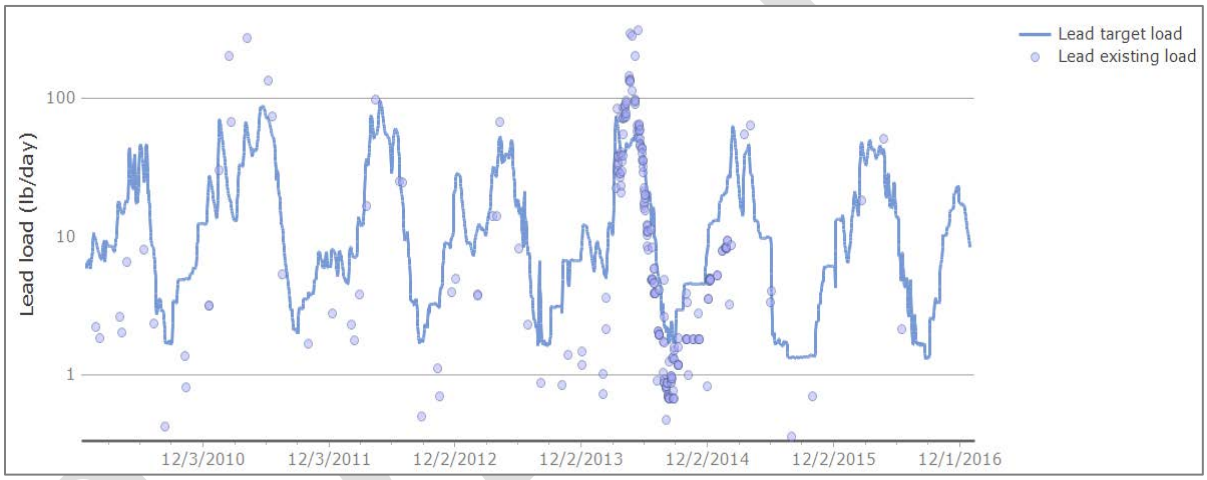


Figure 30. Existing dissolved lead load compared to target load, lead (2010-2016).

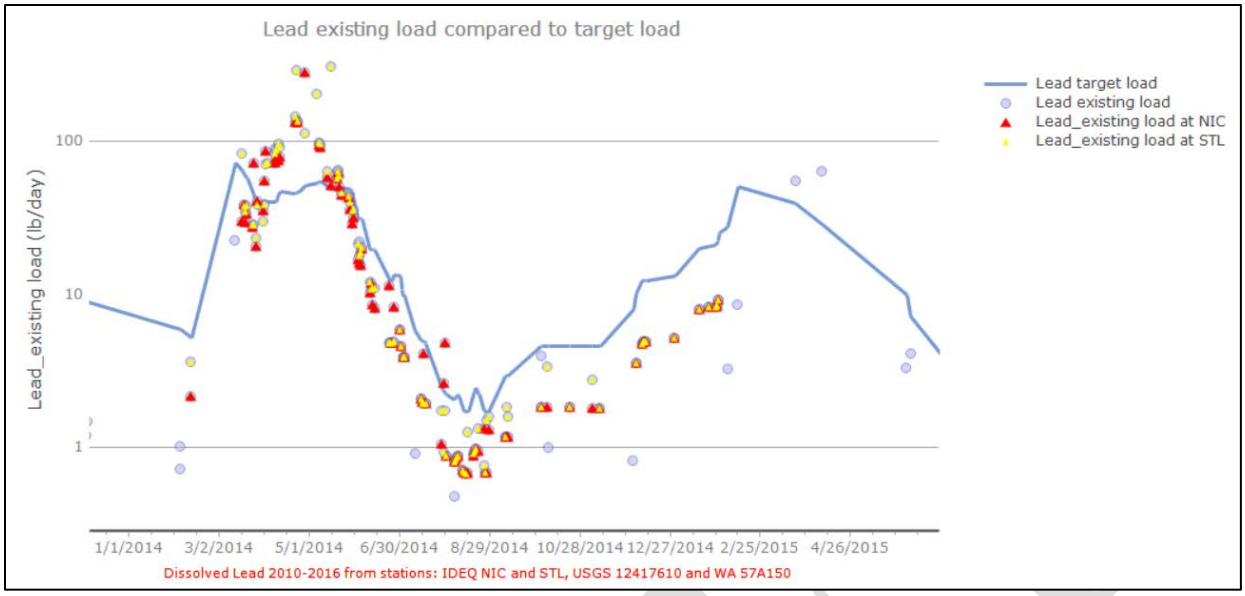


Figure 31. Existing dissolved lead load compared to target load, lead at NIC and STL stations (2014).

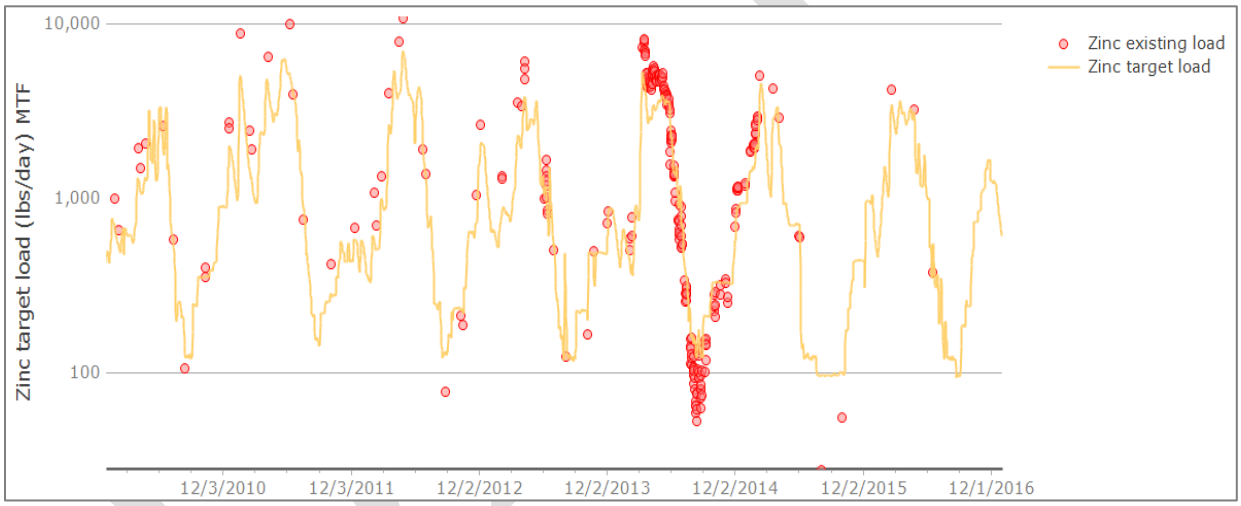


Figure 32. Existing dissolved zinc load compared to target load, zinc (2010-2016).

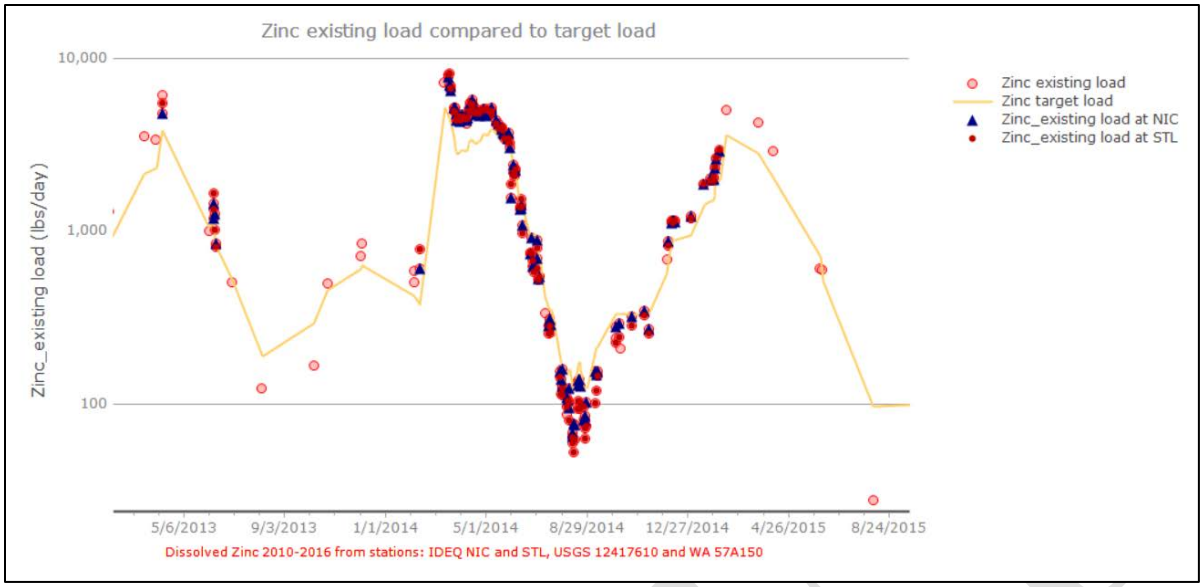
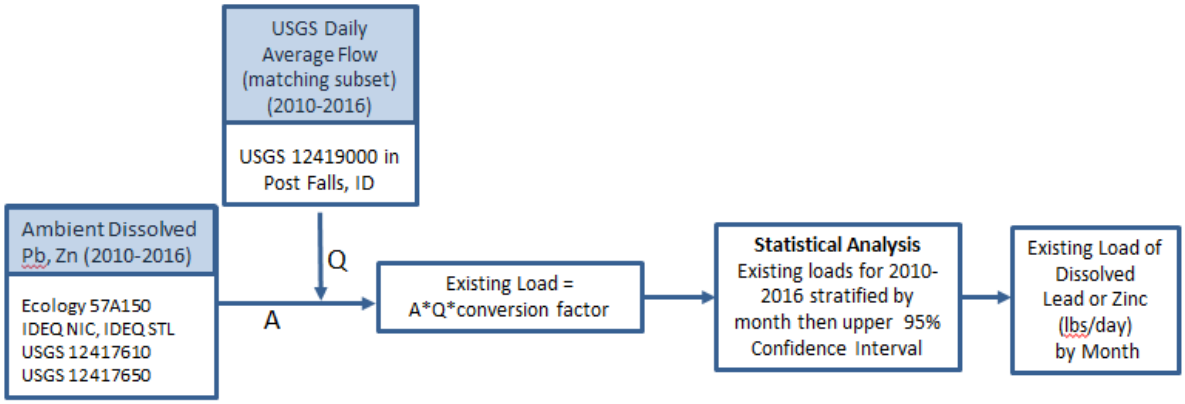


Figure 33. Existing dissolved zinc load compared to target load, zinc – at NIC and STL stations (2014)

5.3.1.1 Daily Existing Loads by Month

Daily existing loads of dissolved lead and zinc in the Spokane River were determined by stratifying existing loads (in section 5.3.1) by month then calculating the 95% upper confidence interval with best fit distribution using the steps defined in Figure 34. The 95% confidence interval shows that there is 95% certainty that the range contains the true mean of the population. Selecting the upper confidence limit provides a margin of a safety. Existing ambient loading conditions of dissolved lead and zinc are listed in Table 14.



Conversion factor = unit conversion factor (0.005393377).

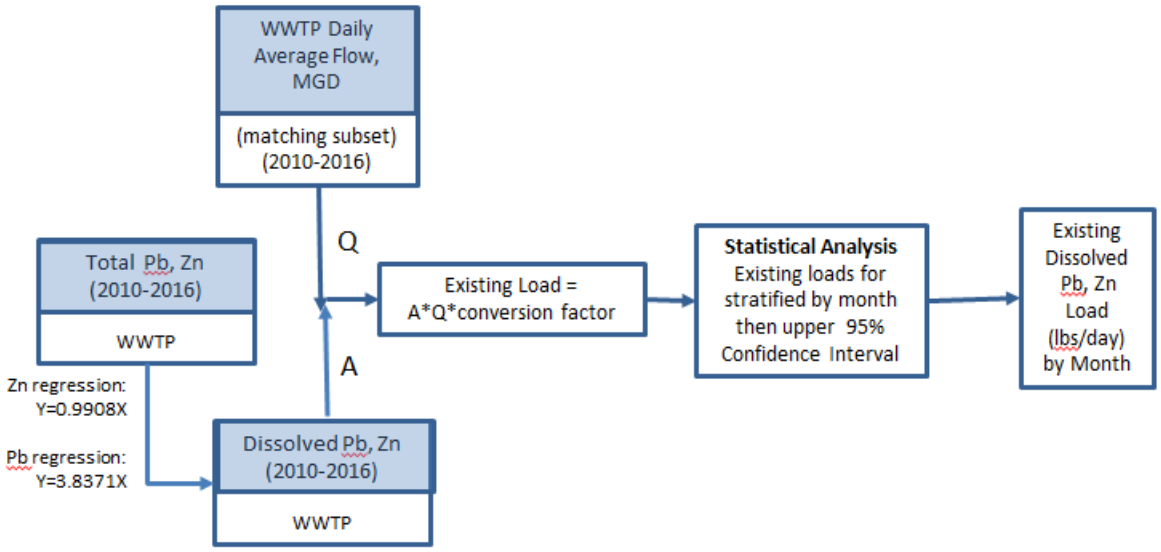
Figure 34. Calculation of existing loads of dissolved lead and zinc in the Spokane River (in lbs/day).

Table 14. Existing load in lbs/day of dissolved lead and zinc in the Spokane River (rounded to 3 significant figures).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pb	18.2	157	42.1	262	123	20.6	4.42	0.950	1.61	2.14	3.36	5.37
Zn	3400	2640	6260	5200	4260	1910	491	97.5	156	323	1100	1510

5.3.2 Wastewater Treatment Plants

Lead and zinc loading from the City of Coeur d'Alene Advanced Wastewater Treatment Plant (AWTP), Hayden Area Regional Sewer Board Publicly-owned Treatment Works (POTW) and the City of Post Falls POTW were provided by the facilities. Monthly values were a result of a 24-hour composite sample taken once a month (Appendix C). Existing loads were calculated using the steps defined in Figure 35. Because the treatment plants are not required to monitor for dissolved metals, total metals concentrations were converted to dissolved metals using a regression equation generated from a graph of total versus dissolved metals data from the DEQ STL site in the Spokane River (data from 2010-2016). Regression analysis results are in Appendix C. This regression analysis is considered a site-specific translator as defined in Idaho Water Quality Standards. The purpose of a translator is to determine how the constituents of the effluent act in the receiving water. Using this site-specific regression is a conservative approach as ambient water chemistry in the Spokane River favors the dissolved metal fraction even if there is more particulate metals in the effluent. Daily loads were determined by stratifying the existing loads by month and using the upper 95% confidence interval by month. Taking the upper 95% confidence interval was an additional margin of safety. Daily lead and zinc loads by month are provided in Table 15-Table 16.



Conversion factor = unit conversion factor (0.008345412).

Figure 35. Calculation of existing loads of dissolved lead and zinc for WWTPs (in lbs/day).

Table 15. Daily dissolved lead load (lb/day) to the Spokane River from Wastewater Treatment Plants (rounded to 3 significant figures).

[1]Dis-Pb (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CDA WWTP	0.00903	0.00463	0.00657	0.00110	0.0121	0.00719	0.0140	0.00818	0.00366	0.0245	0.00459	0.00748
PF WWTP	0.00266	0.00251	0.00295	0.00517	0.00395	0.00345	0.00427	0.00313	0.00375	0.00274	0.00300	0.00425
HARSB	0.000234	0.000247	0.000242	0.000314	0.000304	0.000202	0.000261	[2]Land Application-		0.000276	0.000235	0.000286

[1]Dissolved lead concentration was calculated from a regression of Spokane River ambient dissolved lead versus total lead (y=3.7831x);Appendix E).
[2]Land application of treated effluent is transported, via underground pipeline to a storage lagoon and land applied under a permit issued by the State of Idaho Department of Environmental quality (Permit #WRU M-0109-04).

Table 16. Daily dissolved zinc load (lb/day) to the Spokane River from Wastewater Treatment Plants (rounded to 3 significant figures).

[1]Dis-Zinc (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CDA WWTP	1.29	1.50	1.44	1.44	1.61	1.45	1.76	1.16	1.13	1.40	1.30	1.37
PF WWTP	1.39	1.34	1.43	1.29	1.43	1.37	1.65	1.43	1.30	1.21	1.19	1.18
HARSB	0.055	0.048	0.061	0.041	0.053	0.046	0.364	[2]Land Application		0.047	0.054	0.057

[1]Dissolved zinc calculated from regression of Spokane River ambient dissolved zinc versus total zinc (y=0.9908x; Appendix E).
[2]Land application of treated effluent is transported, via underground pipeline to a storage lagoon and land applied under a permit issued by the State of Idaho Department of Environmental quality (Permit #WRU M-0109-04).

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5.3.3 Stormwater

Dissolved lead and zinc loading from point source stormwater discharged to the Spokane River from the Coeur d'Alene Urbanized Area (NPDES-MS4 stormwater, see section 3.1.2) and nonpoint source stormwater from outside the Urbanized Area (see section 3.2.2) was estimated using Geographic Information System (GIS) to determine impervious surface area. Runoff was then calculated using the Schueler's Simple Method equation (Schueler 1987). The method for determining variables for the Schueler's Simple Method is described below and diagramed in Figure 36. Loading estimates using these methods are listed in Table 17-Table 18.

Schueler's Simple Method equation for Runoff:

$L = 0.226 * R * C * A$

Where:
L = Annual pollutant load (lbs)
R = Annual runoff (in)
C = Pollutant concentration (mg/L)
A = Total drainage area (acres)
0.226 = Unit conversion factor

$R = P * Pj * Rv$
Where:
R = Annual runoff (in)
P = Annual rainfall (in)- 95% upper CI was used on data
Pj = Fraction of annual rainfall events that produce Runoff = 0.9 (standard assumption)
Rv = Runoff coefficient (Rv = 0.05 + 0.9(Ia))
Ia = Impervious fraction

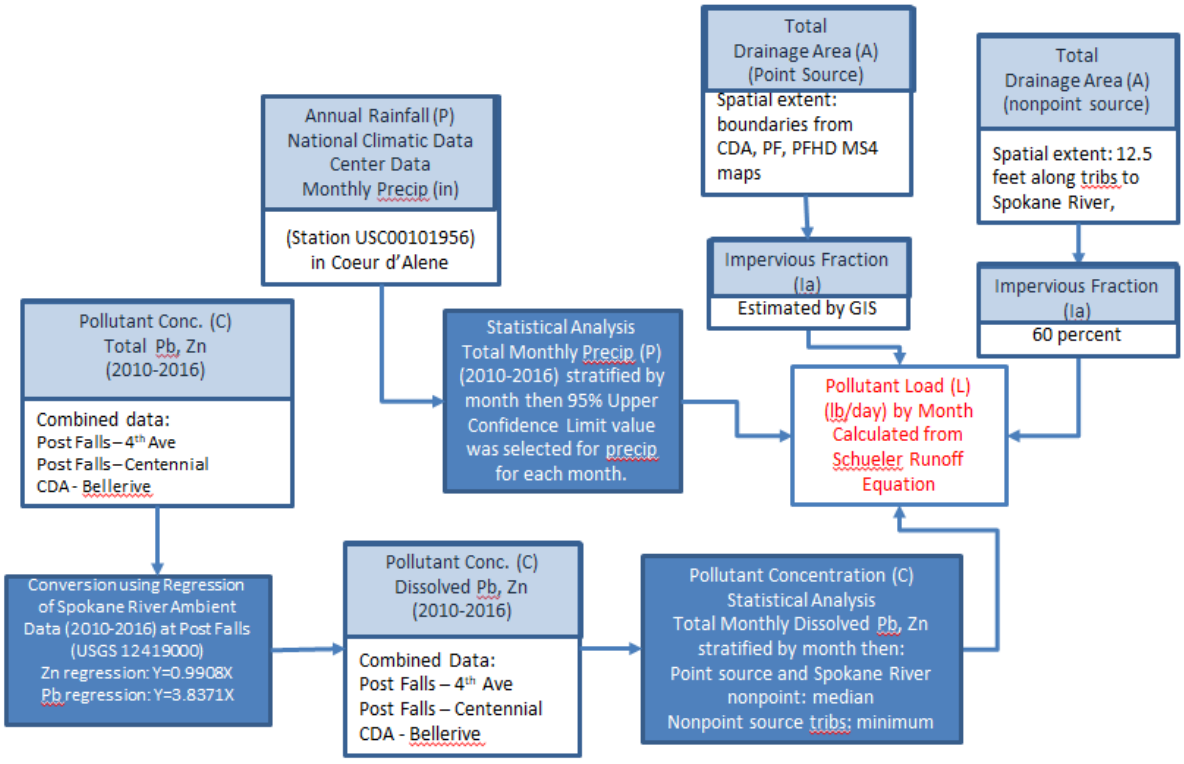


Figure 36. Steps for stormwater loading estimates using the Schueler's Simple Method for runoff.

Annual Rainfall (P):

Annual runoff (P) was calculated using the steps below.

1. Annual runoff was calculated using daily rainfall data (2000-2016) from the National Climatic Data Center at the Coeur d'Alene precipitation station located at the mouth of Coeur d'Alene Lake (station number USC00101956).
2. Total monthly rainfall was stratified by month for each month across the years (2000-2016) then stratified to determine the 95th Confidence Interval for each month.
3. Annual rainfall was calculated by summing the 95th Confidence Interval – best fit - for each month. This summation was the best estimate for annual rainfall for the area of interest with a margin of safety. A summary of monthly rainfall statistics are provided in Appendix C.

Pollutant Concentration (C):

Pollutant concentration (dissolved lead and zinc) was calculated by combining total lead and total zinc stormwater outfall data from the City of Post Falls and the City of Coeur d'Alene (Post Falls Highway District have not collected lead and zinc data from outfalls in their MS4 system). Because lead and zinc data was only collected with quarterly grab samples from individual MS4 outfalls, the data were combined to have a more robust dataset from which to run statistics. The median pollutant concentration was used in the Schueler's Simple Method equation. The median concentration was appropriate due to the decrease in pollutant concentration with time during a rainfall event — the highest concentrations are in the first flush. The City of Post Falls and the City of Coeur d'Alene's stormwater outfall monitoring data for zinc and lead and statistical analysis are provided in Appendix C. The minimum pollutant concentration was used for the 12-foot shoreline areas on Skalan Creek that contribute stormwater to the Spokane River (as defined in section 3.2.2).

Total Drainage Area (A):

A point source (MS4) storm watershed boundary was delineated from MS4 storm watershed boundary maps provided by the City of Coeur d'Alene, the City of Post Falls, and the Post Falls Highway District (see Section 2.4.2).

The Idaho Transportation Department (Interstate 90 stormwater from Northwest Boulevard to Sherman Avenue) discharges to French Gulch, Fernan Creek, and Coeur d'Alene Lake. Because they do not discharge into the Spokane River, the section of Interstate 90 along the Spokane River was excluded from the spatial extent.

For the spatial extent that addresses nonpoint source stormwater along the Spokane River, a 25 foot buffer was delineated along the shoreline of the Spokane River and the tributaries.

Fraction of Annual Rainfall Events that Produce Runoff (Pj):

It was assumed that 90 percent of rainfall events produce runoff that discharges into the Spokane River. Therefore, a value of 0.9 was used for this variable. Assuming 90 percent of rainfall events produce runoff is a margin of safety as soils and alluvium are very permeable in this area.

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Impervious Fraction (Ia)

To determine the pollutant loading from stormwater impacting the Idaho portion of the Spokane River, a percentage of impervious surfaces for a given spatial extent were calculated using GIS software. The boundaries were defined by referencing MS4 permits for the City of Coeur d'Alene, City of Post Falls, and the Post Falls Highway District, (shown in section 3.1.2). The boundaries of four spatial extents were classified with stormwater impacts entering the Spokane River.

All of the spatial extents were utilized as boundary areas in GIS to determine a percentage estimate of impervious area. The 2015 one meter color infrared orthorectified aerial imagery from the National Agriculture Imagery Program (NAIP) was use to generate a Normalized Difference Vegetation Index (NDVI). Surface area by pollutant source is provided Figures 37-Figure 39. The total impervious surface area delivering stormwater from the City of Coeur d'Alene, City of Post Falls, and Post Falls Highway District MS4 areas are 611, 138, and 146 acres, respectively.

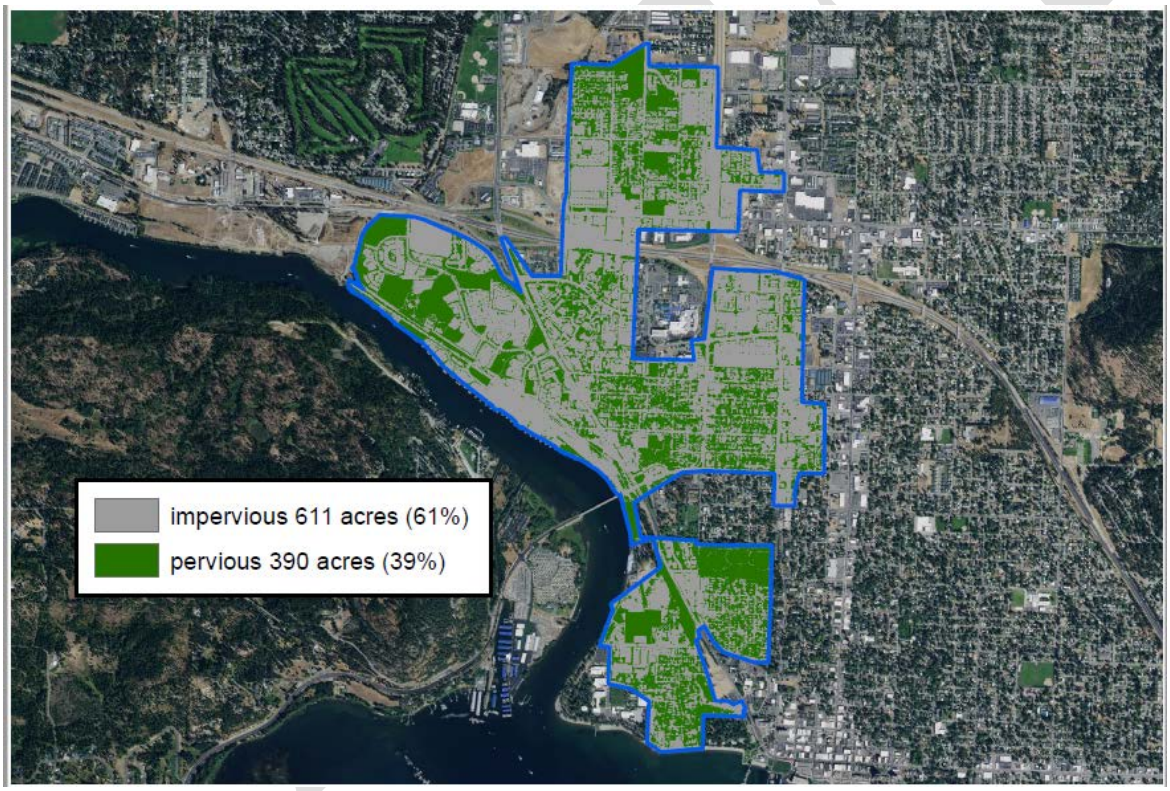


Figure 37. Impervious surface area within the City of Coeur d'Alene MS4 discharging into the Spokane River (estimated using GIS).



Figure 38. Impervious surface area within the City of Post Falls MS4 discharging into the Spokane River (estimated using GIS).

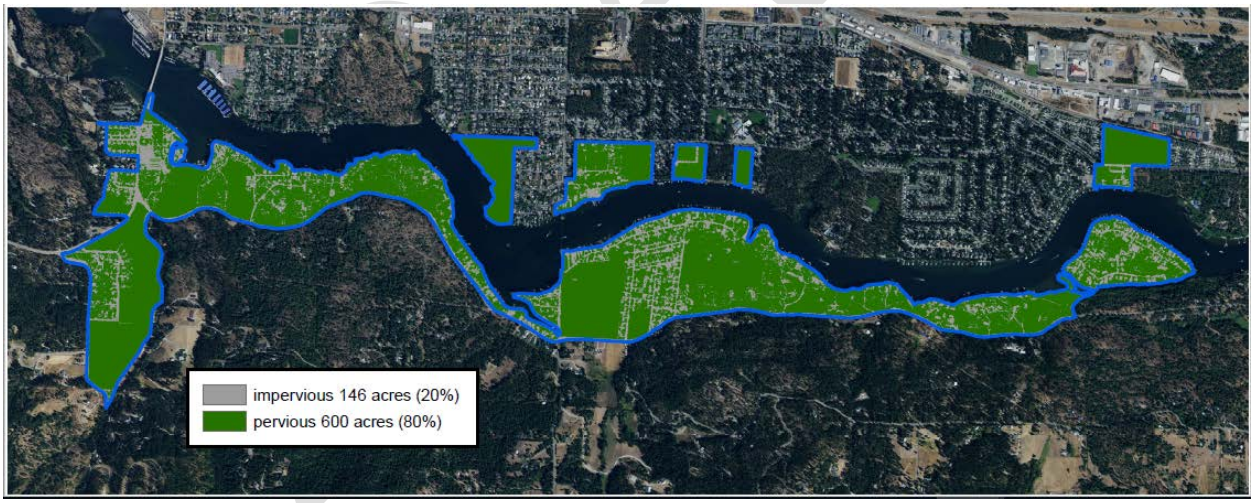


Figure 39. Impervious surface area within the Post Falls Highway District MS4 discharging into the Spokane River (estimated using GIS).

The sloping land along the Spokane River and its tributaries outside the Coeur d'Alene Municipal Area is another area with stormwater runoff impacts to the Spokane River, as a nonpoint source. The sloping land ranges in distance, slope, and composition throughout the length of the Spokane River in Idaho. A general width of 25 ft was used to obtain an area measurement adjacent to the Spokane River with potential for stormwater runoff to the Spokane River. The 25 ft distance to the Spokane River water's edge has a slope toward the river. The

stream tributaries were also included in the analysis with a distance of 12.5 ft. The total area for nonpoint source stormwater is 263 acres (Figure 40). For calculations using the Schueler equations, 60 percent of this area was considered impervious toward runoff into the Spokane River. After reviewing aerial imagery and using knowledge from site visits, sixty percent was selected using best professional judgement. This number likely overestimates the impervious area in this corridor.

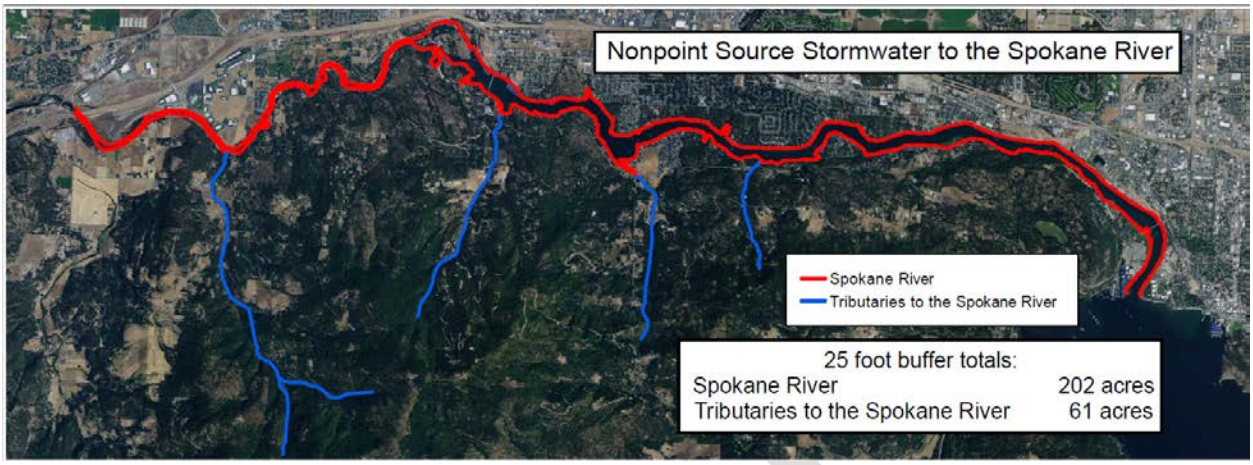


Figure 40. Impervious surface area discharging nonpoint stormwater discharging into the Spokane River (estimated using GIS).

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Table 17. Dissolved lead load estimates to the Spokane River from point and nonpoint stormwater sources (rounded to 3 significant figures).

Dis-Pb (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coeur d'Alene MS4	0.0380	0.0190	0.0340	0.0210	0.0230	0.0260	0.00900	0.00900	0.0120	0.0270	0.0370	0.0410
Post Falls MS4	0.00840	0.00422	0.00748	0.00460	0.00513	0.00586	0.00203	0.00201	0.00260	0.00593	0.00834	0.00914
Post Falls Highway District	0.0106	0.00533	0.00946	0.00582	0.00648	0.00741	0.00257	0.00255	0.00329	0.00750	0.0105	0.0116
Idaho Transportation Department	0	0	0	0	0	0	0	0	0	0	0	0
Nonpoint Source	0.00770	0.00390	0.00690	0.00420	0.00470	0.00540	0.00190	0.00190	0.00240	0.00550	0.00770	0.00840

Table 18. Dissolved zinc load estimates to the Spokane River from point and nonpoint stormwater sources (rounded to 3 significant figures).

Dis-Zc (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coeur d'Alene MS4	3.50	1.76	3.12	1.92	2.14	2.45	0.845	0.839	1.08	2.47	3.47	3.81
Post Falls MS4	0.778	0.391	0.693	0.427	0.475	0.543	0.188	0.187	0.241	0.550	0.773	0.847
Post Falls Highway District	0.983	0.494	0.876	0.539	0.600	0.687	0.238	0.236	0.304	0.695	0.977	1.07
Idaho Transportation Department	0	0	0	0	0	0	0	0	0	0	0	0
Nonpoint Source	0.718	0.361	0.640	0.394	0.439	0.502	0.174	0.172	0.222	0.508	0.714	0.782

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5.4 Meeting Washington Toxics Substances Criteria for Lead and Zinc at the Idaho/Washington Border

5.4.1 Comparison of Idaho and Washington Criteria for lead and zinc

Provided in Appendix C is a comparison of Idaho and Washington's lead and zinc criteria. While similar, there are differences in the rules regulating water quality for each state. The Spokane River flows from the outlet of Coeur d'Alene Lake in the State of Idaho into the State of Washington. Idaho Water Quality Standards (IDAPA 58.01.02) and Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC) are applicable to the Spokane River for each state. The purpose of the following is to ensure that loads and allocations in this TMDL meet Washington toxics substances criteria for lead and zinc at the Idaho/Washington border by developing a factor for use in allocation development.

Pursuant to sections 303 and 101(a) of the Clean Water Act ("CWA" or "the Act"), the federal regulation at 40 CFR 131.10(b) requires that "In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." Section 707.08 of Idaho Water Quality Standards requires that "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."

Both chronic and acute lead criteria for Idaho and Washington are the same for hardness concentrations of 25.0 mg/L or greater. Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA lead criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

Acute zinc criteria for Idaho and Washington are almost identical for hardness concentrations of 25.0 mg/L or greater. Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA acute zinc criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

Washington's chronic zinc criteria are slightly more stringent than Idaho's for all hardness concentrations. Again, Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA chronic zinc criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

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5.4.2 Load Capacity Determination

The monthly load capacity was calculated in order to be protective of Washington's portion of the Spokane River due to Washington's more stringent criteria for lead and zinc. For this purpose a new term has been added to the load capacity equation. This term is the change in target load in order to meet more stringent downstream state criterion at the state line.

Equation 3:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = waste load allocation

Load capacity for a pollutant with numeric criteria is based a state's water quality criteria. When a downstream state's water quality criteria is more stringent, as is the case for lead and zinc in the Spokane River, load capacity needs to ensure that downstream state criteria are met. For the TMDLs that load capacities need to be decreased it has been determined that the amount decrease required to meet more stringent downstream criteria be shown, rather than adopting another state's criteria in calculations. The equation below shows that load capacity (LC) is sum of the load capacity using Idaho criteria (LC_{ID}) and the change in load capacity using Washington criteria (ΔLC_{WA}). The change in load capacity using Washington criteria (ΔLC_{WA}) is always negative and results from subtracting the load capacity using Idaho criteria from the load capacity using Washington criteria (Table 19). This process is equivalent to calculating load capacity with Washington criteria, but allows for tracking the portion of the load capacity that is required to meet more stringent downstream criteria at the state line.

Equation 4:

$$LC = LC_{ID} + \Delta LC_{WA}$$

Where:

LC = load capacity
LC_{ID} = load capacity based on Idaho criteria
LC_{WA} = load capacity based on Washington criteria

$$LC_{ID} + \Delta LC_{WA} = MOS + NB + LA + WLA = TMDL$$

The purpose of calculating the difference in load capacity to meet more stringent Washington criteria [ΔLC_{WA}] is to have an accounting for how much downstate criteria is driving the target loads and affecting required reductions. To calculate the more stringent target load:

$$\Delta LC_{WA} = \Delta Criteria_{WA} \times Q \times K$$

Where:

ΔLC_{WA} = difference between loads to meet more stringent Washington criteria (lbs/day, 2 significant figures)

$\Delta Criteria_{WA}$ = difference between concentrations to meet more stringent Washington criteria

Q = discharge (cfs) for month (2 significant figures)

K = conversion Factor for calculating load given (cfs) and (µg/L) resulting in (lbs/day)

K= 0.00539377

Table 19. Calculation of difference between ID and WA loads to meet more stringent Washington criteria

	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CCC	Hardness (mg/L as $CaCO_3$)	20.6	21.8	22.0	20.6	18.2	16.7	17.0	18.4	19.5	19.6	20.3	19.5
	Discharge (cfs)	3300	4200	7600	15000	16000	8600	2000	680	1100	1700	2500	4600
Dis-Pb	$\Delta Criteria_{WA}$ (µg/L)	0.11	0.08	0.07	0.11	0.16	0.20	0.19	0.16	0.13	0.13	0.11	0.13
	ΔLC_{WA}(lb/day)	2.0	1.8	2.9	8.90	14	9.3	2.0	0.59	0.77	1.2	1.5	3.2
Dis-Zn	$\Delta Criteria_{WA}$ (µg/L)	9.10	7.75	7.53	9.10	11.83	13.56	13.21	11.60	10.34	10.23	9.43	10.34
	ΔLC_{WA}(lb/day)	160	170	310	740	1000	630	140	43	61	94	130	260

5.5 Load and Waste Load Allocation

Stakeholders, specifically NPDES permittees, in the Watershed Advisory Group (WAG) have expressed support for concentration-based limits when determining total daily load limits. This support is due, in a large part, to the fact that metals loading to the river is dominated by upstream sources and is only minimally affected by the individual discharges when viewed in comparison to upstream sources (explained below). A concern has been expressed by members of the WAG that given the substantial load contribution from upstream sources, relative to contributions by local dischargers, attempting to achieve water quality standards within this stretch of the Spokane River through mass reductions of point source discharges alone would be technologically difficult, extremely cost-prohibitive, and ineffective. To address this concern and to still meet the requirements of loading limits, TMDL allocations are written so WWTPs follow IPDES-permitted water quality based effluent limits (WQBELs) that meet Idaho Water Quality Standards which have been shown in the NPDES permitting process not to contribute or cause an exceedance of Washington criterion for lead and zinc.

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5.5.1 Spokane River – Ambient Conditions

After a thorough review of the ambient water quality data from the Upper Spokane River and of the point source discharge data, all river data (2010-2016) were segregated by corresponding month and compared to the existing load in the river to the TMDL target. In this case, there are two TMDL targets: the target based on Idaho water quality criteria for lead and zinc, and the target to meet WA water quality criteria for lead and zinc at the state line. The targets are based on the water quality standards for chronic toxicity effects (or Criteria for Continuous Concentrations) (Table 20-Table 21). Rational for additional load reduction requirements to meet WA criteria at the state line are described in Section 5.4.2.

WA TMDL targets (and water quality standards) are met during the low flow, summer months (or the dry season) for lead. During periods in which river flow is dominated by runoff from upstream sources (wet season) lead and zinc WA TMDL targets are not met. Only during August, WA TMDL targets for zinc are met. When TMDL targets are not met, load reductions are required. Percent load reduction requirements to meet ID lead and zinc criteria under this TMDL are in Table 22. Additional load reductions are required to meet WA standards at the state line as described in Section 5.4. The load reduction requirements needed to meet WA criteria are listed in Table 23.

Table 20. Ambient dissolved lead loads in the Spokane River (rounded to 3 significant figures).

Dis-Pb Load (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
[1]Existing	18.2	157	42.1	262	123	20.6	4.42	0.95	1.61	2.14	3.36	5.37
[2]IDTarget	13.8	18.8	27.6	39.8	38.2	26.5	6.84	2.20	2.79	4.95	8.8	13.6
[3]Delta	↓4.40	↓138	↓14.5	↓222	↓84.8	↑-5.90	↑-2.42	↑-1.25	↑-1.18	↑-2.81	↑-5.44	↑-8.23

[1]95% Upper Confidence Limit – best fit. [2]Based on chronic toxicity effects (or criteria for continuous concentrations, or CCC) and mean loads calculated on criteria [3]Existing minus target.
Cells shaded in grey are months wherein water quality targets are not met. Negative values are months where targets are met and no reductions are needed

Table 21. Ambient dissolved zinc loads in the Spokane River (rounded to 3 significant figures)

Zn Load (lb/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
[1]Existing	3400	2640	6260	5200	4260	1910	491	97.5	156	323	1100	1510
2IDTarget	990	1350	1990	2870	2750	1910	492	158	201	357	634	982
Delta	↓2410	↓1290	↓4270	↓2330	↓1510	0	↑-1.0	↑-60.5	↑-45.0	↑-34.0	↓466	↓528

[1]95% Upper Confidence Limit – best fit. [2]Based on chronic toxicity effects (or criteria for continuous concentrations, or CCC) and mean loads calculated on criteria.
Cells shaded in grey are months wherein water quality targets are not met. Negative values are months where targets are met and no reductions are needed

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Table 22. TMDL load reduction requirements to meet ID criteria for dissolved lead and zinc. Cells shaded in grey are months where pollutant load reductions are required.

Analyte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dis-Lead	24%	88%	34%	85%	69%	[1]NRR	NRR	NRR	NRR	NRR	NRR	NRR
Dis-Zinc	↓ 71%	↓ 49%	↓ 68%	↓ 45%	↓ 35%	NRR	NRR	NRR	NRR	NRR	↓ 42%	↓ 35%

[1]No Reduction Required

Table 23. TMDL load reduction requirements to meet WA criteria for dissolved lead and zinc. Cells shaded in grey are months where pollutant load reductions are required.

Analyte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dis-Lead	↓ 35.8%	↓ 89.0%	↓ 41.6%	↓ 88.1%	↓ 80.4%	↓ 16.5%	NRR	NRR	NRR	NRR	NRR	NRR
Dis-Zinc	↓ 76.2%	↓ 55.7%	↓ 73.3%	↓ 59.2%	↓ 59.2%	↓ 33.7%	↓ 30.6%	NRR	↓ 10.3%	↓ 18.6%	↓ 55.5%	↓ 53.2%

5.5.2 Point Source Contribution

The data were evaluated by looking at loading to the upper Spokane River by individual calendar month and calculating the percentage contributed by the point source dischargers. Data from wastewater treatment plants and stormwater from both point (MS4) and nonpoint sources are in tables provided in Appendix C. During the months where load reductions are required, combined contributions from the point source discharges — from wastewater treatment plants and stormwater MS4 areas within the immediate watershed of the upper Spokane River — are diminutive (less than 1.0% of monthly loading) when compared to the overall system loading (Table 24-Table 25). This means when the upstream load within the river is reduced, the existing permittees discharging at their current rates would neither cause nor contribute to an exceedance of water quality standards.

During months where the targets are met (i.e. June - December) the combined point sources of lead are less than 4% of the total contribution. When targets are not met (i.e., January - May), the combined lead point sources do not exceed 1% of the total existing load. During months where the targets are met (i.e. June - October) the combined point sources of zinc are less than 4% of the total contribution. When targets are not met (i.e., November - May), the combined zinc point sources do not exceed 1% of the total existing load.

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Table 24. Percent contribution from point sources to existing dissolved lead load in the Spokane River.

Point Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coeur d'Alene WWTP	0.050%	0.003%	0.016%	0.000%	0.010%	0.035%	0.317%	0.861%	0.227%	1.145%	0.137%	0.139%
PF WWTP	0.015%	0.004%	0.020%	0.004%	0.009%	0.045%	0.265%	0.877%	0.611%	0.319%	0.280%	0.209%
HARSB WWTP	0.001%	0.000%	0.001%	0.000%	0.000%	0.001%	0.006%	0.000%	0.000%	0.013%	0.007%	0.005%
Coeur d'Alene MS4	0.207%	0.012%	0.080%	0.008%	0.019%	0.128%	0.206%	0.953%	0.727%	1.248%	1.116%	0.765%
Post Falls MS4	0.046%	0.003%	0.018%	0.002%	0.004%	0.028%	0.046%	0.212%	0.161%	0.277%	0.248%	0.170%
Post Falls Highway District MS4	0.058%	0.003%	0.022%	0.002%	0.005%	0.036%	0.058%	0.268%	0.204%	0.350%	0.313%	0.216%
Idaho Transportation Department MS4	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Total Contribution	0.377%	0.025%	0.156%	0.016%	0.047%	0.273%	0.898%	3.171%	1.930%	3.352%	2.100%	1.505%

0.000% indicates no discharge to the Spokane River.
Gray-shaded cells are months when ambient conditions are above the TMDL target.

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Table 25. Percent contribution from point sources to existing dissolved zinc load in the Spokane River.

Point Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coeur d'Alene WWTP	0.038%	0.057%	0.023%	0.028%	0.038%	0.076%	0.358%	1.190%	0.724%	0.433%	0.118%	0.091%
PF WWTP	0.041%	0.051%	0.023%	0.025%	0.034%	0.072%	0.336%	1.467%	0.833%	0.375%	0.108%	0.078%
HARSB WWTP	0.002%	0.002%	0.001%	0.001%	0.001%	0.002%	0.074%	0.000%	0.000%	0.014%	0.005%	0.004%
Coeur d'Alene MS4	0.103%	0.067%	0.050%	0.037%	0.050%	0.128%	0.172%	0.861%	0.692%	0.765%	0.315%	0.252%
Post Falls MS4	0.023%	0.015%	0.011%	0.008%	0.011%	0.028%	0.038%	0.192%	0.154%	0.170%	0.070%	0.056%
Post Falls Hwy District MS4	0.029%	0.019%	0.014%	0.010%	0.014%	0.036%	0.048%	0.242%	0.195%	0.215%	0.089%	0.071%
Idaho Transportation District MS4	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Total Contribution	0.235%	0.210%	0.122%	0.109%	0.148%	0.342%	1.027%	3.951%	2.599%	1.973%	0.706%	0.552%

0.000% indicates no discharge to the Spokane River.
Gray-shaded cells are months when ambient conditions are above the TMDL target.

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5.5.3 Rationale for Point Source Waste Load Allocation Development:

The waste load allocation (WLA) recommendations of the TMDL have been developed for all point source dischargers who discharge to the Spokane River.

5.5.4 Point Source Dischargers

During the months where load reductions are required, combined contributions from the point source discharges — from wastewater treatment plants, stormwater MS4 areas, — and nonpoint sources (excluding all sources upstream of the outlet of Coeur d'Alene Lake) are diminutive (less than 1.0% of monthly loading) when compared to the overall system loading. This means when the upstream load within the river is reduced to the upstream allocation, permitted and nonpoint discharges to the Spokane River would neither cause nor contribute to an exceedance of water quality standards. Assigning maximum daily load limits more stringent than individual permit limits when point source loading is insignificant would be ineffective in meeting water quality standards in the Spokane River. To address this concern and to still meet the requirements of loading limits, TMDL allocations are written so WWTPs follow IPDES-permitted water quality based effluent limits (WQBELs). WQBELs are based on Idaho Water Quality Standards, but were evaluated to ensure they are not causing or contributing to exceedances of Washington Water Quality Standards (US EPA 2013 a,b,c). Limits for the wastewater discharges are listed in Table 26. More information on implementation of WWTP WLAs is discussed in Section 5.6.3

Waste load allocations for MS4 stormwater entities are based on current loads, and there are no effluent limits for MS4 stormwater discharges. Rather, MS4-permitted entities must reduce the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP) using Best Management Practices and monitoring.

Table 26. 2014 IPDES/NPDES-permitted effluent limits for point source discharges into the Spokane River.

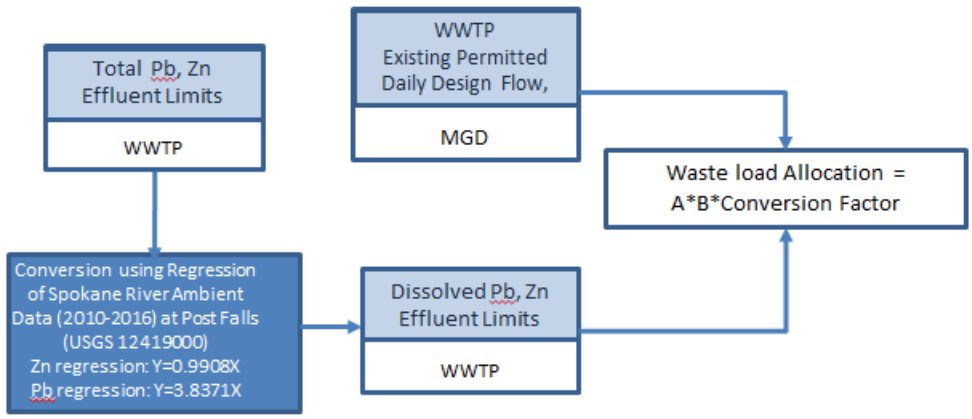
Discharger	Permit Number	2014-permitted effluent limits (Average Monthly in µg/L)		2014-permitted effluent limits (Average Monthly lb/day)	
		Tot-Lead	Tot-Zinc	Tot-Lead	Tot-Zinc
Coeur d'Alene WWTP	ID0022853	No limits specified	135	No limits specified	6.76
Post Falls WWTP	ID0025852	2.05	84.3	0.0855	3.52
HARSB WWTP	ID0026590	2.0	88.2	0.040	1.77

The wastewater treatment plant 2014 NPDES/IPDES permits allow an average monthly loading limit in pounds/day (Table 26). The loading limits are based on the design flow of the individual treatment plants Waste load allocations were calculated for wastewater treatment plants from the existing 2014 EPA-permitted effluent limits at the effluent design flow (Table 27), using the steps defined in Figure 41. These effluent limits were calculated using standard NPDES protocol to meet Idaho Water Quality Criteria for lead and zinc. It was determined through this process there was no reasonable potential to cause or contribute to an exceedance of Washington criterion for lead and zinc (US EPA 2013a, 2013b, 2013c). Waste load allocations (in lbs/day) for the wastewater treatment plants are listed in Tables 28-29. The waste load allocation for point source stormwater (MS4) dischargers were equal to the existing loads calculated using GIS and the Schueler runoff equation (defined in Section 5.3.3). Waste load Allocations for MS4

permittees are not intended to be implemented as numeric effluent limits. More information on implementation of stormwater WLAs is discussed in Section 5.6.3. Waste load allocations (in lbs/day) for the MS4 dischargers are listed in Tables 28-29.

Table 27. 2014 NPDES/IPDES-permitted design flows for wastewater treatment plants

Discharger	Permit Number	Design Flow (MGD)
Coeur d'Alene WWTP	ID0022853	6.0
Post Falls WWTP	ID0025852	5.0
HARSB WWTP	ID0026590	3.2



Conversion Factor = unit conversion factor (0.008345412)
Calculations are based on 2014 EPA-derived effluent limits based on Idaho Water Quality Criteria for metals.

Figure 41. 2014 EPA-permitted effluent limits at effluent design flow used to calculate effluent load limits for wastewater treatment plants.

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5.5.4.1 Reserve for Future Capacity

Reserve for future capacity is designed for future growth and development for existing point source dischargers. Growth in the Coeur d'Alene/Post Falls region is predicted to continue to increase. The Cities of Coeur d'Alene, Post Falls and Hayden Area Region Sewer Board are currently working on long term (> 20 year plans) planning for growth. Therefore, currently-permitted design flow for WWTPs will need to be increased. While a reserve for future capacity is not calculated into the WWTP waste load allocations, permits can consider reserve for future growth beyond discharges above the WWTP design flow allocated in this TMDL if the permitted facility meets end-of-pipe water quality based effluent limits (WQBELs) that are calculated based on Idaho Water Quality Standards and a reasonable potential analysis. Should a reasonable potential analysis show WQBEL is not required; this is consistent with the TMDL. Implementation of WWTP WLAs is discussed further in Section 5.6.2.1.

A reserve for future capacity was calculated for Idaho Transportation Department as part of their waste load allocation. Dissolved lead and zinc loading from the I90 corridor was estimated for future capacity to discharge to the Spokane River. Geographic Information System (GIS) was used to determine impervious surface area (Error! Reference source not found.). Runoff was then calculated using the Schueler's Simple Method equation (Schueler 1987). The method for determining variables for the Schueler's Simple Method is described in Section 5.3.3. A total of 63 acres of impermeable surface area was estimated.

Given the growth of the region, it is likely the impervious area within the MS4 area will continue to increase. Given the source assessment indicating almost all of the lead and zinc loading is coming from upstream sources, additional impervious within the Upper Spokane subbasin is unlikely to significantly increase lead and zinc loads. A numeric reserve allocation for MS4 was not made in this TMDL; however, expanding impervious areas within the MS4 boundaries will be considered consistent with the WLAs developed in this TMDL as long as the MS4 permitees maintain permit coverage and are compliant with the conditions of the MS4 permit. This includes the permit requirement to reduce pollutants to the Maximum Extent Practical (MEP) and implementation of at least one pollutant reduction activity designed to reduce lead, and zinc loadings from the MS4 into the Spokane River (Permit numbers in Table 8 of this document). Implementation of MS4 WLA's is discussed further in Section 5.6.3.



Figure 42. Impervious surface area within the I90 corridor for future growth for ITD to discharge into the Spokane River (estimated using GIS).

5.5.5 Nonpoint Source Contribution

As discussed in section 3.2.3, lead and zinc loading between the Spokane River at outlet of Coeur d'Alene Lake and the Spokane River at the State Line is insignificant. Therefore, major sources of lead and zinc pollution do not originate from the Upper Spokane subbasin and non-point source controls and reductions must originate from sources upstream of the subbasin. During months when the existing load of lead and zinc is greater than the load capacity of the river (TMDL target) a load allocation of lead and zinc to sources upstream of the outlet of Coeur d'Alene Lake is provided in Table 28 and Table 29. During the months of June through December, existing dissolved lead loads are less than the load capacity of the river (ID TMDL target); therefore, load allocations to sources upstream of the outlet of Coeur d'Alene Lake were set to the existing load at the outlet of the lake. This load allocation is represented in Table 28. During the months of June through October, existing dissolved zinc loads are less than the load capacity of the river (ID TMDL target); therefore, load allocations to sources upstream of the outlet of Coeur d'Alene Lake were set to the existing load at the outlet of the lake. This load allocation is represented in Table 29.

Although it is considered a minor source of lead and zinc to the subbasin, stormwater runoff from the sloping riverbank along the Spokane River and its tributaries outside the Coeur d'Alene Urbanized Area were considered nonpoint source in this TMDL (See section 3.2.2). During months when the existing load of lead and zinc is greater than the load capacity of the river (ID TMDL target), this stormwater source was also given a load allocation and a load reduction requirement in Table 28 and Table 29.

Load capacity for a pollutant with numeric criteria is based a state's water quality criteria. When a downstream state's water quality criteria is more stringent, as is the case for lead and zinc in the Spokane River, load capacity needs to ensure that downstream state criteria are met at the state line. An additional load allocation and nonpoint source load reduction was written into the load allocation tables to assure WA criteria are met at the state line.

5.5.6 Natural Background

Quantifying natural background levels of lead and zinc within the Spokane River basin is challenging and loads have been accounted for as a portion of upstream sources load allocations. The primary source of lead and zinc are the metal rich veins associated with the Osborn fault network in the Precambrian meta-sediments in the now Silver Valley. This fault network does not extend into Coeur d'Alene or the Spokane River. Tributaries in this downstream area would not appropriately be used to estimate natural background conditions. The amount of anthropogenic perturbation in the Silver Valley streams have resulted in higher than natural background conditions. There are no non-impacted streams upon which to measure natural background. Another method for estimating natural background is to use ground water attributes to project surface water loads. The Spokane River is a losing reach (to ground water) within Idaho; therefore ground water would not be used to estimate natural background. Natural background load allocations have been accounted for, and are a component of sources upstream of the mouth of Coeur d'Alene Lake.

The tributary to the Spokane River, Skalan Creek, is an intermittent creek, with predominant flows from stormwater runoff. Stormwater runoff in the Skalan Creek watershed loading has been accounted for in the non-MS4 stormwater calculations.

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5.5.7 Load and Waste Load Allocation Summary

Load allocations and waste load allocations are listed in Table 28 and 29. Allocations are written to meet both Idaho Water Quality Standards and Washington Water Quality Standards at the state line. Values are dissolved lead and dissolved zinc. Translators for converting dissolved lead to total lead which are used for permitting purposes are provided in the footnote of the tables and in Appendix C. During the months where load reductions are required, combined contributions from the point source discharges are diminutive (less than 1.0% of monthly loading) when compared to the overall system loading. Therefore, the majority of lead and zinc to the Spokane River is from nonpoint sources upstream of the outlet of Coeur d'Alene Lake.

During the months when existing dissolved lead and zinc loads are greater than the load capacity of the river (TMDL target) the majority of the load reduction requirement is from nonpoint sources of lead and zinc upstream of the mouth of Coeur d'Alene Lake. Stormwater runoff from the sloping riverbank along the Spokane River and its tributaries outside the Coeur d'Alene Urbanized Area was also given a load reduction. During the months when existing dissolved lead and zinc loads are less than the load capacity of the river (ID TMDL target), load allocations to sources upstream of the outlet of Coeur d'Alene Lake were set to the existing load at the outlet of the lake. These load allocations are provided in Tables 28 and 29. An additional load allocation was written into the load allocation tables to assure WA criteria are met at the state line.

Because of their minimal influence on the lead and zinc concentrations and loads in the Spokane River, the WWTPs are considered an insignificant source of lead and zinc compared to the overall loading from upstream sources. While a reserve for future capacity is not calculated into the WWTP waste load allocations, permits can consider reserve for future growth beyond discharges above the WWTP design flow allocated in this TMDL if the permitted facility meets end-of-pipe water quality based effluent limits (WQBELs) that are calculated based on Idaho Water Quality Standards and a reasonable potential analysis. Should a reasonable potential analysis show WQBEL is not required; this is consistent with the TMDL.

Federal Regulations require Municipal Separate Storm Sewer Systems (MS4) permits to include conditions to reduce the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP). This includes management practices, control techniques and system, design, and engineering methods. Expanding impervious areas within the MS4 boundaries will be considered consistent with the WLAs developed in this TMDL provided the MS4 permittees address their stormwater WLA through implementation of BMPs consistent with the permit requirement to reduce pollutants by the MEP.

Although they currently do not discharge into the Spokane River, Idaho Transportation Department has a reserve for future capacity calculated into their waste load allocation.

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Table 28. Waste load/load allocation for dissolved lead (in lbs/day), Spokane River.

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Existing Condition	18.2	157	42.1	262	123	20.6	4.42	0.95	1.61	2.14	3.36	5.37
TMDL (ID)	13.8	18.8	27.6	39.8	38.2	26.5	6.84	2.20	2.79	4.95	8.80	13.6
Additional Load Reduction to meet WA Criteria at state line	2.0	1.8	2.9	8.9	14	9.3	NRR	NRR	NRR	NRR	NRR	NRR
TMDL (WA)	11.8	17.0	24.7	30.9	24.2	17.2	4.42	0.95	1.61	2.14	3.36	5.37
Waste Load Allocations												
City of Coeur d'Alene AWTP	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271
City of Post Falls POTW	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226
Hayden Area Regional Sewer Board POTW	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141
City of Coeur d'Alene MS4	0.0377	0.0190	0.0336	0.0207	0.0230	0.0264	0.00912	0.00905	0.0117	0.0267	0.0375	0.0411
City of Post Falls MS4	0.0084	0.00422	0.00748	0.0046	0.00513	0.00586	0.00203	0.00201	0.0026	0.00593	0.00834	0.00914
Post Falls Highway District MS4	0.0106	0.00533	0.00946	0.00582	0.00648	0.00741	0.00257	0.00255	0.00329	0.00750	0.0105	0.0116
Idaho Transportation Department Reserve	0.0008	0.0004	0.0007	0.0004	0.0005	0.0005	0.0002	0.0002	0.0002	0.0005	0.0008	0.0008
Load Allocations												
Non-MS4 Stormwater	0.0077	0.0039	0.0069	0.0042	0.0047	0.0054	0.0019	0.0019	0.0024	0.0055	0.0077	0.0084
Sources Upstream from CDA Lake Outlet	11.7	16.9	24.6	30.8	24.1	17.1	4.42	0.95	1.61	2.14	3.36	5.37
% Load Reduction from Sources Upstream from CDA Lake Outlet to meet WA TMDL at state line	35.9%	89.0%	41.6%	88.1%	80.4%	17.0%	NRR	NRR	NRR	NRR	NRR	NRR

[1]NRR = No Reduction Required. During the months of July-Dec when no load reductions are required, TMDL at the WA state line is set at existing conditions. Discharges and waste load allocations above the WWTP design flow identified in this TMDL are consistent with this TMDL if the permitted facility follows IPDES-permitted water quality based effluent limits (WQBELs) that meet Idaho Water Quality Standards end of pipe. Allocations are shown as dissolved metals and may be compared to total using a translator of 3.7831x for lead; refer to Appendix E."

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Table 29. Waste load/load allocation (LA) for dissolved zinc (in lbs/day), Spokane River.

	Jan	Feb	Mar	Apr	May	June -	July	Aug	Sept	Oct	Nov	Dec
Existing Condition	3400	2640	6260	5200	4260	1910	491	97.5	156	323	1100	1510
TMDL (ID)	990	1350	1990	2870	2750	1910	492	158	201	357	634	982
Additional Load Reduction to meet WA Criteria at state line	160	170	310	740	1000	630	140	NRR	61	94	130	260
TMDL (WA)	830	1180	1680	2130	1750	1280	352	97.5	140	263	504	722
Waste Load Allocations												
City of Coeur d'Alene AWTP	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82
City of Post Falls POTW	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
Hayden Area Regional Sewer Board POTW	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38
City of Coeur d'Alene MS4	3.50	1.76	3.12	1.92	2.13	2.44	0.845	0.839	1.08	2.47	3.47	3.81
City of Post Falls MS4	0.778	0.391	0.693	0.427	0.475	0.543	0.188	0.187	0.241	0.550	0.773	0.847
Post Falls Highway District MS4	0.983	0.494	0.876	0.539	0.600	0.686	0.238	0.236	0.304	0.695	0.977	1.070
Idaho Transportation Department MS4 Reserve	0.0714	0.0359	0.0636	0.0391	0.0436	0.0498	0.0173	0.0171	0.0221	0.0504	0.0709	0.0777
Load Allocations												
Non-MS4 Stormwater	0.718	0.361	0.640	0.394	0.439	0.502	0.174	0.172	0.222	0.508	0.714	0.782
Sources Upstream from CDA Lake Outlet	811	1160	1660	2110	1730	1260	338	97.5	125	246	485	703
% Load Reduction from Sources Upstream from CDA Lake Outlet to meet WA TMDL at state line	76.2%	56.1%	73.5%	59.4%	59.4%	33.9%	31.2%	NRR	29.5%	23.8%	55.9%	53.4%

[1]NRR = No Reduction Required. During the month of August when no load reductions are required, TMDL at the WA state line is set at existing conditions. Discharges and waste load allocations above the WWTP design flow identified in this TMDL are consistent with this TMDL if the IPDES-permitted facility follows permitted water quality based effluent limits (WQBELs) that meet Idaho water quality standards end of pipe. Allocations are shown as dissolved metals and may be compared to total using a translator of 0.9908x for zinc; refer to Appendix E."

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5.5.8 Margin of Safety

Implicit margins of safety were used for conservative assumptions in the development of the TMDL. Implicit margins of safety are described below:

1. For calculation of monthly existing loads for lead and zinc in the Spokane River, the 95 % upper confidence limit was used. This is a higher estimate than the mean, which was used for the target load.
2. Assuming 90 percent of rainfall events produce runoff is a margin of safety when calculating runoff using the Schueler Simple Method runoff equations. In a region with seasonal rainfall and permeable soils/alluvium this is an over-estimate of runoff.
3. Total monthly rainfall used in the Schueler Simple Method runoff equations for stormwater were based on the 95th Confidence Interval for rainfall in each month. This is a higher estimate than the mean.
4. Daily loads from wastewater treatment plants were determined by stratifying the existing loads by month and using the upper 95% confidence interval by month. This is a higher estimate than the mean.

No explicit margin of safety was used.

5.5.9 Seasonal Variation

Seasonal variation is addressed in the daily loading tables (Tables 28-29) stratified by month.

5.5.10 Reasonable Assurance

When TMDLs are developed for waters impaired by point sources only, the issuance of IPDES or NPDES permits provides reasonable assurance that waste load allocations will be met. The permitting programs require that effluent limits in permits are consistent with "the assumptions and requirements of any available waste load allocation" in an approved TMDL according to 40 C.F.R. 122.44(d)(1)(vii)(B).

When a TMDL is developed for water impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint sources load reductions will occur, the TMDL is required to provide reasonable assurances that nonpoint sources controls will achieve expected load reductions. Due to the nonpoint load allocations and point source waste load allocations in this TMDL, a demonstration of reasonable assurance is required.

Wasteload allocations in this TMDL are already being met by following state and federal point source permitting requirements including Rules Regulating the Idaho Pollutant Discharge Elimination System Program (IDAPA 58.01.25). In addition, NPDES/IPDES permits require WWTP dischargers to meet Idaho Water Quality Criteria for metals.

Federal Regulations require Municipal Separate Storm Sewer Systems (MS4) permits to include conditions to reduce the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP). This included management practices, control techniques and system, design, and engineering methods, and such other provisions of the Administrator or State Determine appropriate for the control of pollutants (33 U.S.C §1342(p)).

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Waste load allocations in this TMDL are already met, and it is reasonable to expect nonpoint source reductions within the Upper Spokane Subbasin are de minimis. Therefore the major source of metal loads that are the cause of non-attainment of water quality standards are upstream of the Upper Spokane subbasin, this TMDL bases reasonable assurance on upstream sources outside the geographic extent of the Upper Spokane subbasin. Due to Idaho's requirement to protect downstream water quality (IDAPA 58.01.02.070.08) a future TMDL(s) is necessary to address upstream sources of metals. Future upstream TMDL development along with actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), known also as Superfund, will help achieve the goals of Upper Spokane Metals TMDLs. Efforts under CERCLA are described in Section 5.6 below.

Extra emphasis should be noted that the success of this TMDL is predicated on load reductions from upstream sources. This TMDL estimated that less than 1% of the total pollutant load in the Spokane River is generated from sources within the Upper Spokane Subbasin. This means attaining metals criteria cannot be achieved by reducing or even eliminating sources of pollution within the Upper Spokane subbasin. During future reviews of this TMDL, focus should be placed on evaluating upstream load reductions because those reductions will be necessary to attain water quality standards within the Upper Spokane River. DEQ will not recommend further reductions in waste load allocations developed in this TMDL because waste load allocations ensure water quality standards are met at the end of pipe; therefore, WLAs are not dependent on nonpoint source reductions.

While the nonpoint source reductions are not required in the Upper Spokane (downstream of the outlet of Coeur d'Alene Lake), DEQ typically relies on the nonpoint source management plan and other programs to achieve nonpoint reductions. A description of reasonable assurance follows.

Clean Water Act §319 requires each state to develop and submit a nonpoint source management plan. The Idaho Nonpoint Source Management Plan was approved by EPA in March 2015 (DEQ 2015). The plan identifies programs to achieve implementation of nonpoint source best management practices (BMPs), includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's Nonpoint Source Management Program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups and WAGs. The Spokane River Watershed Advisory Group is the designated WAG for the Upper Spokane River Subbasin.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 30.

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Table 30. State of Idaho's regulatory authority for nonpoint pollution sources.

Authority	Water Quality Standard	Responsible Agency
Rules Pertaining to the Idaho Forest Practices Act (IDAPA 20.02.01)	58.01.02.350.03(a)	Idaho Department of Lands
Solid Waste Management Rules and Standards (IDAPA 58.01.06)	58.01.02.350.03(b)	Idaho Department of Environmental Quality
Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03)	58.01.02.350.03(c)	Idaho Department of Environmental Quality
Stream Channel Alteration Rules (IDAPA 37.03.07)	58.01.02.350.03(d)	Idaho Department of Water Resources
Rathdrum Prairie Sewage Disposal Regulations (Panhandle District Health Department)	58.01.02.350.03(e)	Idaho Department of Environmental Quality/Panhandle District Health Department
Rules Governing Exploration, Surface Mining and Closure of Cyanidation Facilities (IDAPA 20.03.02)	58.01.02.350.03(f)	Idaho Department of Lands
Dredge and Placer Mining Operations in Idaho (IDAPA 20.03.01)	58.01.02.350.03(g)	Idaho Department of Lands
Rules Governing Dairy Waste (IDAPA 02.04.14)	58.01.02.350.03(h)	Idaho State Department of Agriculture

Idaho uses a voluntary approach to address agricultural nonpoint sources; however, regulatory authority is found in the Water Quality Standards (IDAPA 58.01.02.350.01–03). IDAPA 58.01.02.055.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan) (SCC and DEQ 2003), which provides direction to the agricultural community regarding approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (soil conservation districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, the Ag Plan assigns the local soil conservation districts to assist the landowner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The Idaho water quality standards and wastewater treatment requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; Idaho Soil and Water Conservation Commission for grazing and agricultural activities, Idaho Transportation Department for public road construction, Idaho State Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.010.24).

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5.5.11 Construction Stormwater and TMDL Waste Load Allocations

Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP). For more information about these permits and managing stormwater, see Appendix E.

5.6 Implementation Strategies

Cleanup of upstream sources continue under the focus of CERCLA activities within the Coeur d'Alene Basin and the Basin Environmental Improvement Program Commission, the Coeur d'Alene Lake Management Plan and by cooperation among federal, state, tribe, industries, and local communities. See section 5.6.2 for details on cleanup efforts of legacy mine wastes.

IPDES permits requiring WWTP dischargers to reduce the discharge of pollutants based on water quality based effluent limits (WQBELs) assure these point source discharges meet water quality standards in the receiving water body. In future permit cycles, discharges above the WWTP design flow allocated in this TMDL are consistent with this TMDL (and meet Idaho Water Quality Standards) if the permitted facility meets water quality based effluent limits (WQBELs) end of pipe based on a reasonable potential analysis. Should an analysis show WQBEL is not required, this is consistent with the TMDL.

DEQ does not intend for stormwater waste load allocations to be implemented as numeric limits in MS4 Permits. The waste load allocations will be implemented through reducing the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP) using Best Management Practices and monitoring.

5.6.1 Time Frame

The targets established reduction of sources of lead and zinc from upstream of the outlet of Lake Coeur d'Alene may take decades to be achieved. The Spokane River Metals TMDL relies on CERCLA and Coeur d'Alene Lake Management Plan efforts to decrease those sources as described in Section 5.6.2 below. This TMDL does not define an implementation time frame for nonpoint sources; rather, implementation is ongoing and will continue until the load allocation targets are met. This acknowledges that successfully achieving the TMDL target and allocations will depend in part on CERCLA and Lake Management Plan measures and be influenced by available funding, cost-sharing and willing partners.

5.6.2 Approach

5.6.2.1 Waste Water Treatment Plants

The waste load allocations developed in this TMDL are based off of current permitted conditions. Allocations are shown as dissolved metals and may be compared to total using a translator of 3.7831x for lead and 0.9908x for zinc as described in Appendix E." Waste load allocations are already implemented for WWTPs that currently have effluent limits for total recoverable lead and total zinc at end of pipe. The City of Post Falls and the Hayden Regional

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Sewer WWTPs currently have total recoverable lead and zinc effluent limits in the NPDES permits (Permit Numbers ID0025852 and ID0026590) The City of Coeur d'Alene AWTP currently has effluent limits for total recoverable zinc and monitoring requirements for lead (Permit Number ID0022853).

In future permit cycles, DEQ considers the waste load allocations are implemented consistent with the assumptions of this TMDL, if the WWTP's NPDES or IPDES permit include Water Quality Based Effluent Limits for lead and zinc at end of pipe based on Idaho Water Quality Standards. No mixing zone is allowed unless upstream source reduction has occurred and/or it is proven assimilative capacity for lead or zinc in the river exists.

Since the City of Post Falls and Hayden Regional Sewer Board NPDES permits current contain effluent limits for lead and zinc that meet Idaho Water Quality Standards with no mixing zone, DEQ considers those waste load allocations to already be implemented. The City of Coeur d'Alene currently has effluent limits for zinc and monitoring requirements for lead. DEQ considers the zinc waste load allocations for the City of Coeur d'Alene to already be implemented in the current NPDES permit. In future permit cycles, DEQ recommends a Reasonable Potential Analysis (RPA) to determine if the City of Coeur d'Alene's AWTP has the potential to cause exceedances of the lead criteria. Should the RPA indicate there is not a reasonable potential, the City of Coeur d'Alene's AWTP does not require a lead effluent limits to be consistent with the assumptions of this TMDL. Should the RPA indicate lead effluent limits are required for the City of Coeur d'Alene's AWTP, future effluent limits should be developed to be consistent with the TMDL.

If the current NPDES permit effluent limits for lead and zinc are carried forward into future permit cycles, those limits are considered consistent with the assumptions of this TMDL. If a facilities design flow increases, updated WQBELs based on the new design flow and Idaho's numeric criteria for lead and zinc are considered consistent with the assumptions of this TMDLs provided that a reasonable potential analysis is done to determine reasonable potential to cause exceedance of Idaho water quality criteria. No mixing zone is allowed unless upstream reductions have occurred and/or assimilative capacity in the Spokane River exists.

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5.6.3 Stormwater MS4

Federal Regulations require Municipal Separate Storm Sewer Systems (MS4) permits to include conditions to reduce the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP). This includes management practices, control techniques and system, design, and engineering methods, and such other provisions of the Administrator or State Determine appropriate for the control of pollutants (33 U.S.C §1342(p)). MS4 permits generally rely on developing and implementing a suite of BMPS that are designed to reduce pollutants to the MEP. MS4 permittees are required to develop Stormwater Management Plans (SWMP) in order to implement permit requirements including BMPs. Additionally, MS4 permits contain requirements to submit summaries of monitoring results.

DEQ assumes the MS4 permittees address their stormwater WLA through implementation of BMPs consistent with the requirement to reduce pollutants by the MEP. In future permit cycles, DEQ recommends permit writers review applicable monitoring data to evaluate MS4 discharges consistency with the WLA of this TMDL. If available data suggest inconsistency with the WLAs in the TMDL, it is recommended future permits require additional BMP implementation. Additional BMP requirements should focus on reducing pollutants addressed in this TMDL.

Given the growth of the region, it is likely the impervious area within the MS4 area will continue to increase. Given the source assessment indicating almost all of the metal loading is coming from upstream sources, additional impervious within the Upper Spokane subbasin is unlikely to significantly increase lead and zinc loads. A numeric reserve allocation for MS4 was not made in this TMDL; however, expanding impervious areas within the MS4 boundaries will be considered consistent with the WLAs developed in this TMDL as long as the MS4 permitees maintain permit coverage and are compliant with the conditions of the MS4 permit, including the requirement to reduce pollutants to the Maximum Extent Practical (MEP) and implementation of at least one pollutant reduction activity designed to reduce lead, and zinc loadings from the MS4 into the Spokane River (Permit numbers in Table 8 of this document). MS4 permittees are also required to develop Stormwater Management Plans (SWMP) in order to implement permit requirements including BMPs. In addition, MS4 permits should contain requirements to submit summaries of monitoring results.

5.6.4 Non-Point Source

Nonpoint sources in the Upper Spokane River are primarily from upstream sources. Reduction of those sources will be addressed through pollutant reduction programs/plans such as CERCLA, TMDLs and the Coeur d'Alene Lake Management Plan.

The U.S. Environmental Protection Agency (EPA) established the Bunker Hill Mining and Metallurgical Superfund Site in 1983 to facilitate cleanup of contamination from historic mine wastes under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (National Priorities List 1983). Prior to this designation, mining companies performed mitigation activities and improved waste disposal practices, which continue to improve. The Site includes mine, mill, and smelter sites in the Silver Valley along the South Fork Coeur d'Alene River and many of its tributaries. It also includes waste disposal sites,

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contaminated fill materials, areas of metals deposition by air, and downstream areas where metals contaminants have been deposited by floodwaters.

EPA divided the Site into 3 Operable Units for cleanup (EPA 2015). Operable Unit 1 (OU1) is the populated areas in the 21-square-mile Bunker Hill "Box" surrounding historic smelter operations in the Silver Valley. Operable Unit 2 (OU2) is the non-populated areas of the Box. Operable Unit 3 (OU3) is the broader area in the Coeur d'Alene Basin where mining-related contamination is located.

The focus of CERCLA activities within the Coeur d'Alene Basin is to reduce human and ecological exposures to metals contamination, primarily from lead and zinc (National Research Council 2005). Cleanup under CERCLA began in the 1990s within the Box in OU1 and OU2 where human health risks were the greatest (EPA 1991, EPA 1992). This continued with the 2002 interim Record of Decision (ROD) for cleanup of mine waste contamination of the broader Basin in OU3 (EPA 2002). EPA issued a ROD Amendment in 2012 for the Upper Basin, the eastern portion of the Site primarily located in the South Fork Coeur d'Alene River Subbasin (EPA 2012).

The State of Idaho established the Basin Environmental Improvement Program Commission (Basin Commission) with the Basin Environmental Improvement Act in 2001 (Idaho Code Title 39 Chapter 81). The Basin Commission includes representatives from the State of Idaho, each of the three affected counties in Idaho, the Coeur d'Alene Tribe, the State of Washington, and the EPA. The Basin Commission provides a forum for coordination and local involvement in the planning and implementation of cleanup and related activities. The Institutional Controls Program is a set of locally enforced rules and regulations administered by the Panhandle Health District helps manage contaminated soils and ensure remediated properties remain clean (IDAPA 41.01.01).

Cleanup has been accomplished by cooperation among federal, state, tribe, industries, and local communities. Cleanup to reduce human health risks has been a major priority. More than 6,500 residential yards, parks, commercial properties, and other public areas have been remediated by placing healthy soil and surface cover. Other human health projects included protection of remedies through stormwater management, the Paved Roads program to provide protective barriers on roadways, dust control, drinking water protection, and other activities (EPA 2015). Cleanup actions have also included source removals, surface capping, demolition of buildings at mine sites, revegetation, stream channel reconstruction, and water treatment. EPA recently completed significant expansion and upgrades at the Central Treatment Plant, a large water treatment system at the western edge of Kellogg. The work includes interception of contaminated groundwater under the Central Impoundment Area for pumping and treatment, preventing this contamination from reaching the South Fork Coeur d'Alene River and substantially reducing metals loading. Source control in South Fork Coeur d'Alene River tributaries is ongoing with emphasis on large mill sites in the Canyon Creek and Ninemile Creek drainages (BEIPC 2019, Coeur d'Alene Trust 2019).

In the Lower Basin, the Coeur d'Alene River and floodplain corridor, cleanup is proceeding with priority wetlands areas such as the Grays Meadow Project near Black Lake (EPA 2018, BEIPC 2019). EPA has also conducted extensive characterizations of the Lower Basin to identify and prioritize source control actions in the Coeur d'Alene River (CH2MHILL 2010). With this

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information, EPA identified the Dudley Reach of the Coeur d'Alene River upstream of Rose Lake as a significant source of metals loading to downstream areas in the floodplain, Coeur d'Alene Lake, and beyond. Pilot projects will be implemented to explore techniques such as dredging and subaqueous capping for the river bottom to reduce metals loading from contaminants in this reach of the Coeur d'Alene River (EPA 2018, BEIPC 2019, Coeur d'Alene Trust 2019).

For Coeur d'Alene Lake, the 2002 ROD for the Coeur d'Alene Basin deferred remediation for the lake when prescribing remedial activities for most of OU3. Instead, the State of Idaho and Coeur d'Alene Tribe developed the Coeur d'Alene Lake Management Plan (LMP) to protect and improve conditions in Coeur d'Alene Lake using non-CERCLA authorities such as the Clean Water Act (DEQ and Coeur d'Alene Tribe 2009). The LMP was approved in 2009, with the goal: "*to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments"*

Objectives identified in the LMP include the following:

1. Improve scientific understanding of lake conditions through monitoring, modeling, and special studies
2. Establish and strengthen partnerships to maximize benefits of actions under existing regulatory frameworks
3. Develop and implement a nutrient reduction action plan
4. Increase public awareness of lake conditions and influences on water quality
5. Establish funding mechanisms to support the LMP goal, objectives, and strategies.

Implementation of the LMP has been ongoing since 2009. In 2018, the Coeur d'Alene Tribe determined the LMP alone is not enough to protect the lake from metals release, and discussions between the Tribe, State of Idaho, and EPA are ongoing. The State of Idaho is currently in the process of securing a contract with the National Academy of Sciences to perform a review of lake data to inform future management actions, while implementation of lake management efforts continue.

The City of Coeur d'Alene, the City of Post Falls, and the Post Falls Highway District MS4 programs are always looking for opportunities to reduce discharge to both the Spokane River and upstream of the Spokane River. They are looking at removing stormwater discharge from Spokane River outfalls during smaller storm events by diverting stormwater to swales and/or storing rainfall in underground chambers and then releasing the water through a sand/compost filter.

5.6.5 Responsible Parties

DEQ and the designated management agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. In Idaho, these agencies, and their federal and state partners, are charged by the Clean Water Act to lend available technical assistance and other appropriate support to local efforts for water quality improvements. Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those resources for which they have regulatory authority or programmatic responsibilities:

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- Idaho Department of Lands for timber harvest, oil and gas exploration and development, and mining
- Idaho Soil and Water Conservation Commission for grazing and agricultural activities
- Idaho Transportation Department for public road construction
- Idaho State Department of Agriculture for aquaculture
- DEQ for all other activities

5.6.6 Implementation Monitoring Strategy

Long-term routine water quality monitoring continues in streams and rivers of the Coeur d'Alene basin is conducted under the Basin Environmental Monitoring Plan (BEMP). There currently is only one active annual water quality monitoring site in the Spokane River under BEMP, which is at the Washington state line (USGS station #12419500). The schedule for annual surface water monitoring at this site includes (US EPA 2004):

- Mid-Fall drawdown of PFHP dam (mid-October)
- Post-Fall Drawdown PFHP dam (late December)
- Low Pool in Coeur d'Alene Lake (mid-Winter)
- Rain-on-Snow (late Winter or early Spring)
- Coeur d'Alene Lake Filling (late April or early May)
- Snowmelt Runoff Peak (late May)
- Full Pool in Coeur d'Alene Lake (mid-July)
- Full Pool, Maximum Productivity in Coeur d'Alene Lake (late August)

Also under the BEMP program, fish tissue metals concentrations are monitored every 5 years. For details on BEMP monitoring see EPA (2004).

Long-term monitoring is also conducted at the Washington/Idaho state line by the Washington Department of Ecology. This data can be used to help demonstrate long-term recovery, better understand natural variability, track project and BMP implementation, and track the effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the reasonable assurance component of the TMDL implementation plan.

Monitoring will provide information on progress being made toward achieving TMDL allocations and water quality standards and will help in the interim evaluation of progress, including in the development of 5-year reviews and future TMDLs.

6 Conclusions

The results of analyses for this TMDL development demonstrate dissolved cadmium concentrations did not exceed both Idaho's acute (CMC) and chronic (CCC) hardness-based criteria over the past 5 years. Based upon the results of this investigation, the EPA approved a delisting of cadmium from the list of causes of impairment for the Spokane River assessment units (Table 31). For purposes of the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Detailed delisting rationale is provided in Appendix M in Idaho's 2016 Integrated Report. Dissolved lead concentrations did not exceed Idaho's acute criteria, but did exceed Idaho's chronic criteria. Dissolved zinc

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concentrations exceeded both Idaho acute and chronic criteria. Therefore, TMDLs for these pollutants were developed (Table 28-29).

Table 31. Summary of assessment outcomes for §303(d)-listed assessment units.

Water Body	Assessment Unit Number	TMDL Developed	Delisted In 2016 IR
Spokane River – Coeur d'Alene Lake to Post Falls dam	17010305PN003_04	Lead, Zinc	Cadmium
Spokane River – Post Falls dam to Idaho/Washington Border	17010305PN004_04	Lead, Zinc	Cadmium

After a thorough review of the 2010-2015 ambient water quality data from the Upper Spokane River and of the point source discharge data, Idaho TMDL targets (based on chronic water quality standards) are met during the low flow, summer months (or the dry season) for both lead and zinc. During periods in which river flow is dominated by runoff from upstream sources (wet season) lead and zinc TMDL targets (ID targets) are not met. During November and December, TMDL targets (ID targets) for zinc are also not met. When ID TMDL targets are not met, load reductions are required. Percent load reduction requirements for lead and zinc under this TMDL are provided in Table 32.

Table 32. Percent load reductions for lead and zinc required under this TMDL.

Analyte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dis-Lead	↓ 24%	↓ 88%	↓ 34%	↓ 85%	↓ 69%	[1]NRR	NRR	NRR	NRR	NRR	NRR	NRR
Dis-Zinc	↓ 71%	↓ 49%	↓ 68%	↓ 45%	↓ 35%	NRR	NRR	NRR	NRR	NRR	↓ 42%	↓ 35%

[1]NR = No reduction required

Loading analysis showed dissolved lead and zinc loads at the outlet of Coeur d'Alene Lake are not significantly different that loads at the state line.

During the months where load reductions are required, combined contributions from the point source discharges — from wastewater treatment plants, stormwater MS4 areas, — and nonpoint sources (excluding all sources upstream of the outlet of Coeur d'Alene Lake) are diminutive (less than 1% of monthly loading) when compared to the overall system loading. This means when the upstream load within the river is reduced, permitted and nonpoint discharges to the Spokane River would neither cause nor contribute to an exceedance of water quality standards.

Because combined point source contributions are negligible during months where TMDL targets are met, waste load allocations for wastewater treatment facilities are based on EPA 2014 NPDES-permitted effluent limits. These effluent limits were calculated to meet Idaho Water Quality Criteria for lead and zinc and they were determined in the permitting process to neither cause or contribute to exceedences of Washington water quality criterion for lead and zinc. It was determined through the NPDES permitting process there was no reasonable potential to cause or contribute to an exceedance of Washington criterion for lead and zinc. Waste load allocations for MS4 stormwater entities are based on current loads. Assigning maximum daily load limits beyond individual permit limits when point source loading is insignificant would be ineffective at reducing lead and zinc load in the river when the primary source of these metals is

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from the outlet of Lake Coeur d'Alene. Maintaining concentration-based limits will ensure existing treatment remains in place and water quality standards are met. There currently are no effluent limits written into permits for MS4 stormwater discharges from the City of Post Falls and the City of Coeur d'Alene because requirements are BMP based.

IPDES permits requiring WWTP dischargers to reduce the discharge of pollutants based on water quality based effluent limits (WQBELs) assure point source discharges meet water quality standards in the receiving water body. In future permit cycles, discharges above the WWTP reserve capacity design flow allocated in this TMDL are consistent with this TMDL if the IPDES-permitted facility meets water quality based effluent limits (WQBELs) that meet Idaho Water Quality Standards end-of-pipe. Should an analysis show WQBEL is not required, this is consistent with the TMDL. No mixing zone is allowed unless reduction of upstream sources has occurred and/or it has been shown there is assimilative capacity in the Spokane River.

Federal Regulations require Municipal Separate Storm Sewer Systems (MS4) permits to include conditions to reduce the discharge of pollutants from MS4 to the Maximum Extent Practical (MEP). This includes management practices, control techniques and system, design, and engineering methods, and such other provisions of the Administrator or State Determine appropriate for the control of pollutants. MS4 permits generally rely on developing and implementing a suite of BMPS that are designed to reduce pollutants to the MEP. MS4 permittees are required to develop Stormwater Management Plans (SWMP) in order to implement permit requirements including BMPs. In addition, MS4 permits contain requirements to submit summaries of monitoring results.

DEQ assumes the MS4 permittees address their stormwater WLA through implementation of BMPs consistent with the requirement to reduce pollutants by the MEP. In future permit cycles, DEQ recommends permit writers review applicable monitoring data to evaluate MS4 discharges consistency with the WLA of this TMDL. If available data suggest inconsistency with the WLAs in the TMDL, it is recommended future permits require additional BMP implementation. Additional BMP requirements should focus on reducing pollutant addressed in this TMDL.

The success of this TMDL is predicated on load reductions from upstream sources. Attaining metals criteria cannot be achieved by reducing or even eliminating sources of pollution within the Upper Spokane subbasin. During future reviews of this TMDL, focus should be placed on evaluating upstream load reductions because those reductions will be necessary to attain water quality standards within the Upper Spokane River. DEQ will not recommend further reductions in waste load allocations developed in this TMDL because waste load allocations ensure water quality standards are met at the end of pipe.

Load capacity for a pollutant with numeric criteria is based a state's water quality criteria. When a downstream state's water quality criteria is more stringent, as is the case for lead and zinc in the Spokane River, load capacity needs to ensure that downstream state criteria are met. An additional nonpoint load reduction was written into the load allocation tables to assure WA criteria are met at the state line.

This document was prepared with input from the public, as described in Appendix F. Following the public comment period, comments and DEQ responses will also be included in this appendix, and a distribution list will be included in Appendix G.

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GIS Coverages

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Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Load is the product of flow (discharge) and concentration.

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

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Nonpoint Source	A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + waste load allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Waste load Allocation (WLA)	The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a water body.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

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Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.
Water Quality Standards	State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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Appendix A. Beneficial Uses

Idaho Water Quality Standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho Water Quality Standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses.

Existing Uses

Existing uses under the Clean Water Act are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards" (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

Designated Uses

Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

Undesignated Surface Waters and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address nondesignated waters. Sections 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. Man-made waterways and private waters have no presumed use protections. Man-made waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most Idaho waters will support cold water

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aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called presumed uses, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to presumed uses, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

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Appendix B. Comparison of Idaho and Washington Toxics Substances Criteria for lead and zinc.

The following is a comparison of Idaho and Washington's lead and zinc criteria. While similar, there are differences in the rules regulating water quality for each state. The Spokane River flows from the outlet of Coeur d'Alene Lake in the State of Idaho into the State of Washington. Idaho Water Quality Standards (IDAPA 58.01.02) and Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC) are applicable to the Spokane River for each state. The purpose of the following is to ensure that loads and allocations in this TMDL meet Washington toxics substances criteria for lead and zinc at the Idaho/Washington border by developing a factor for use in allocation development.

Pursuant to sections 303 and 101(a) of the Clean Water Act ("CWA" or "the Act"), the federal regulation at 40 CFR 131.10(b) requires that "In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." Section 707.08 of Idaho Water Quality Standards requires that "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."

Idaho Criteria

Idaho's numeric criteria for lead and zinc are listed in Table B-1.

Table B-1.

Section 210 Numeric Criteria for Toxic Substances for Waters Designated for Aquatic Life, Recreation, or Domestic Water Supply Use (cadmium, lead and zinc) (11/21/2017) IDAPA 58.01.02.210 WATER QUALITY STANDARDS					
Compound/Chemical	**Chemical Abstracts Service (CAS)#**	**Aquatic Life Criteria - Freshwater**		**Human Health Criteria for Consumption of:**	
		Acute	**Chronic**	**Water & Organisms**	**Organisms Only**
Lead	7439921	65 i	2.5 i	-	-
Zinc	7440666	120 i	120 i	7,400	26,000

Applicable footnotes to Section 210: i. Aquatic life criteria for these metals are a function of total hardness (mg/L as calcium carbonate), the pollutant's water effect ratio (WER) as defined in Subsection 210.03.c.iii. and multiplied by an appropriate dissolved conversion factor as defined in Subsection 210.02. For comparative purposes only, the example values displayed in this table are shown as dissolved metal and correspond to a total hardness of one hundred (100) mg/L and a water effect ratio of one (1.0).

Idaho §58.01.02.210.02 Factors for Calculating Hardness Dependent Metals Criteria

Hardness dependent metals criteria are calculated using values from the Table B-2 and the equations:

$$CMC = WER \times exp^{\{mA[\ln(hardness)]+bA\}} \times Acute\ Conversion\ Factor$$

$$CCC = WER \times exp^{mc[\ln(hardness)]+bc\}} \times Chronic\ Conversion\ Factor$$

Table B-2. Factors for calculating hardness dependent metals criteria

Section 210.02 Factors for Calculating Hardness Dependent Metals Criteria (11/21/2017) IDAPA 58.01.02.210.02 WATER QUALITY STANDARDS						
Metal	**mA**	**bA**	**mc**	**bc**	**Acute Conversion Factor**	**Chronic Conversion Factor**
Lead	1.273	-1.460	1.273	-4.705	0.791	0.791
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Applicable footnotes to section 210.02: a. Conversion factors (CF) are from "Stephan, C. E. 1995. Derivation of conversion factors for the calculation of dissolved freshwater aquatic life criteria for metals. U.S. Environmental Protection Agency, Environmental Research Laboratory – Duluth." The conversion factors for lead is hardness-dependent and can be calculated for any hardness (see limitations in Subsection 210.03.b.i.) using the following equations. For comparative purposes, the conversion factors for a total hardness of one hundred (100) mg/L are shown in the table. The conversion factor shall not exceed one (1).

Lead (Acute and Chronic): CF=1.46203–[(ln hardness)(0.145712)

Idaho §58.01.02.210.03.c Applicability of metals criteria

Footnote i. For metals other than cadmium, for purposes of calculating hardness dependent aquatic life criteria from the equations in Subsection 210.02, the minimum hardness allowed for use in those equations shall not be less than twenty-five (25) mg/l, as calcium carbonate, even if the actual ambient hardness is less than twenty-five (25) mg/l as calcium carbonate. The maximum hardness allowed for use in those equations shall not be greater than four hundred (400) mg/l, as calcium carbonate, except as specified in Subsections 210.03.c.ii. and 210.03.c.iii., even if the actual ambient hardness is greater than four hundred (400) mg/l as calcium carbonate. (3-29-10)

Washington Criteria

Washington's numeric criteria for lead and zinc are listed in Table B-3.

Table B-3.

Table 240 Toxics Substances Criteria (lead and zinc) (11/16/2017) Chapter 173-201A WAC: WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON						
Compound/Chemical	**Chemical Abstracts Service (CAS)#**	**Category**	**Aquatic Life Criteria - Freshwater**		**Human Health Criteria for Consumption of:**	
			Acute	**Chronic**	**Water & Organisms**	**Organisms Only**
Lead	7439921	Metals, cyanide, and total phenols	(q,c,dd)	(r,d,dd)	-	-
Zinc	7440666	Metals, cyanide, and total phenols	(aa,c,dd)	(bb,d,dd)	2,300	2,900

Applicable footnotes to Table 240
c. A 1-hour average concentration not to be exceeded more than once every three years on the average.

d. A 4-day average concentration not to be exceeded more than once every three years on the average.

i. ≤ (0.944)(e(1.128[ln(hardness)]-3.828)) at hardness = 100. Conversion factor (CF) of 0.944 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.136672 - [(ln hardness)(0.041838)].

j. ≤ (0.909)(e(0.7852[ln(hardness)]-3.490)) at hardness = 100. Conversions factor (CF) of 0.909 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.101672 - [(ln hardness)(0.041838)].

q. ≤ (0.791)(e(1.273[ln(hardness)]-1.460)) at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

r. ≤ (0.791)(e (1.273[ln(hardness)]-4.705)) at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

aa. ≤ $(0.978)(e^{(0.8473[\ln(\text{hardness})] + 0.8604)})$

bb. ≤ $(0.986)(e^{(0.8473[\ln(\text{hardness})] + 0.7614)})$

dd. These ambient criteria in the table are for the dissolved fraction. The cyanide criteria are based on the weak acid dissociable method. The metals criteria may not be used to calculate total recoverable effluent limits unless the seasonal partitioning of the dissolved to total metals in the ambient water are known. When this information is absent, these metals criteria shall be applied as total recoverable values, determined by back-calculation, using the conversion factors incorporated in the criterion equations. Metals criteria may be adjusted on a site-specific basis when data are made available to the department clearly demonstrating the effective use of the water effects ratio approach established by USEPA, as generally guided by the procedures in USEPA Water Quality Standards Handbook, December 1983, as supplemented or replaced by USEPA or ecology. Information which is used to develop effluent limits based on applying metals partitioning studies or the water effects ratio approach shall be identified in the permit fact sheet developed pursuant to WAC 173-220-060 or 173-226-110 , as appropriate, and shall be made available for the public comment period required pursuant to WAC 173-220-050 or 173-226-130 (3), as appropriate. Ecology has developed supplemental guidance for conducting water effect ratio studies.

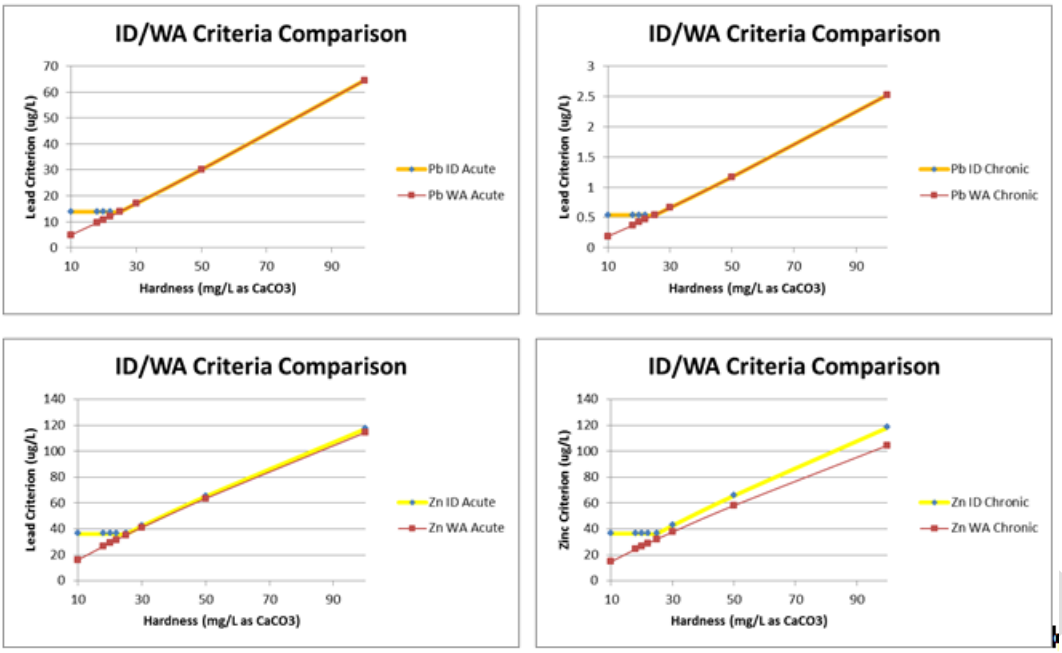
Comparison of Idaho to Washington Criteria at different hardness concentrations.

Both Idaho and Washington provide spread sheet calculators to determine criteria at different hardness concentrations (Table B-4). These spread sheet calculators have been used at a range of hardness concentrations in order to compare criteria.

Table B-4. Comparison of Idaho to Washington selected criteria based on hardness (results µg/L)

Hardness (mg/L as $CaCO_3$)	Pb ID Acute	Pb ID Chronic	Pb WA Acute	Pb WA Chronic	Zn ID Acute	Zn ID Chronic	Zn WA Acute	Zn WA Chronic
100	64.58	2.52	64.58	2.52	117.18	118.14	114.45	104.51
50	30.14	1.17	30.14	1.17	65.13	65.66	63.61	58.09
30	17.04	0.66	17.04	0.66	42.25	42.59	41.26	37.68
25	13.88	0.54	13.88	0.54	36.2	36.5	35.36	32.29
22	13.88	0.54	12.02	0.47	36.2	36.5	31.73	28.97
20	13.88	0.54	10.79	0.42	36.2	36.5	29.27	26.72
18	13.88	0.54	9.58	0.37	36.2	36.5	26.77	24.44
10	13.88	0.54	4.91	0.19	36.2	36.5	16.27	14.85

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Both chronic and acute lead criteria for Idaho and Washington are the same for hardness concentrations of 25.0 mg/L or greater. Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA lead criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

Acute zinc criteria for Idaho and Washington are almost identical for hardness concentrations of 25.0 mg/L or greater. Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA acute zinc criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

Washington's chronic zinc criteria are slightly more stringent than Idaho's for all hardness concentrations. Again, Idaho Water Quality Standards (§58.01.02.210.03.c) directs a minimum hardness of 25.0 mg/L to be used for calculating criteria. Washington does not have a minimum hardness. An increase in stringency to meet WA chronic zinc criteria factor needs to be developed for conditions when ambient hardness is less than 25.0 mg/L. Spokane River ambient hardness concentrations are for the most part less than 25.0 mg/L.

Comparing Idaho and Washington equation factors

Idaho and Washington lead and zinc criterion calculation equations are the same math even though they are written differently in each states water quality standards. Table B-5 shows the exponent coefficients and constants for both Idaho and Washington. These are for the most part the same, or very similar, with the exception of exponent constant for chronic zinc.

Table B-5. Exponent Coefficients and Constants for both Idaho and Washington					
Metal	**State**	**mA**	**bA**	**mc**	**bc**
Lead	ID	1.273	-1.460	1.273	-4.705
	WA	1.273	-1.460	1.273	-4.705
Zinc	ID	0.8473	0.884	0.8473	**0.884**
	WA	0.8473	0.8604	0.8473	**0.7614**

Equation 1:

$$CMC = WER \times exp^{\{mA[\ln(hardness)]+bA\}} \times ACF$$

Where:

CMC = Criterion Maximum Concentration or acute criterion
WER = water effects ratio, in all Spokane River cases = 1.0
mA = constant from table above
bA = constant from table above
ACF = acute conversion factor, depends on toxic substance and hardness

Equation 2:

$$CCC = WER \times exp^{mc[\ln(hardness)]+bc\}} \times Chronic\ Conversion\ Factor$$

Where:

CCC = Criterion Continuous Concentration or chronic criterion
WER = water effects ratio, in all Spokane River cases = 1.0
mc = constant from table above
bc = constant from table above
ACF = acute conversion factor, depends on toxic substance and hardness

Load Capacity in Spokane River

The purpose of this section is to develop a load amount that it would take each month in order to be protective of Washington's portion of the Spokane River due to Washington's more stringent criteria for lead and zinc. For this purpose a new term has been added to the load capacity equation. This term is the change in target load in order to meet more stringent downstream state criterion.

Equation 3:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation

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WLA = waste load allocation

Load capacity for a pollutant with narrative criteria is based a state's water quality criteria. When a downstream state's water quality criteria is more stringent, as is the case for lead and zinc in the Spokane River, load capacity needs to ensure that downstream state criteria are met. For the TMDLs that load capacities need to be decreased it has been determined that the amount decrease required to meet more stringent downstream criteria be shown, rather than adopting another state's criteria in calculations. The equation below shows that load capacity (LC) is sum of the load capacity using Idaho criteria (LC_{ID}) and the change in load capacity using Washington criteria (ΔLC_{WA}). The change in load capacity using Washington criteria (ΔLC_{WA}) is always negative and results from subtracting the load capacity using Idaho criteria from the load capacity using Washington criteria. This process is equivalent to calculating load capacity with Washington criteria, but allows for tracking the portion of the load capacity that is required to meet more stringent downstream criteria.
Equation 4:

$$LC = LC_{ID} + \Delta LC_{WA}$$

Where:

LC = load capacity
LC_{ID} = load capacity based on Idaho criteria
LC_{WA} = load capacity based on Washington criteria

Equation 5:

$$\Delta LC_{WA} = LC_{ID} - LC_{WA}$$

Where:

LC_{ID} = load capacity based on Idaho criteria
ΔLC_{WA} = difference in load capacity to meet more stringent Washington criteria
LC_{WA} = load capacity based on Washington criteria

$$LC_{ID} + \Delta LC_{WA} = MOS + NB + LA + WLA = TMDL$$

The purpose of calculating the difference in load capacity to meet more stringent Washington criteria [ΔLC_{WA}] is to having an accounting for how much downstate criteria is driving the target loads and affecting required reductions.

Hardness

Spokane River has relatively low hardness concentrations that range from 16.0 to 23.0 mg/L based on all laboratory analyzed samples collected between 2010 and 2015. Idaho Department of Environmental Quality submits the dissolved fraction of a sample for calcium and magnesium and calculates hardness from these concentrations. It is not abundantly clear if USGS or Ecology submits filtered or unfiltered samples, but hardness should be comparable because of the high solubility of calcium and magnesium. Figure A-1 depicts ambient hardness concentrations collected in 2014 by Idaho DEQ as a model for how hardness changes throughout the year.

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Figure A-1. Hardness concentrations at the state line (2014).

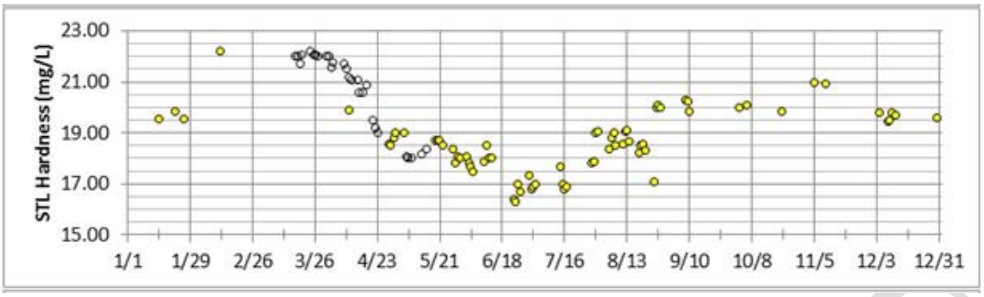


Table B-6 shows the 50th percentile hardness concentrations for each month. The following table also shows the chronic Idaho and Washington Criteria as well as the difference between these criteria. Chronic (CCC) criteria is more stringent than acute criteria; it is what the target loads were calculated from; and it contributes to the implicit margin of safety for these TMDLs.

Equation 6:

$$Criteria_{ID} - Criteria_{WA} = \Delta Criteria_{WA}$$

Where:

$Criteria_{ID}$ = Idaho's water quality criteria concentration calculated using Equation 2.
$Criteria_{WA}$ = Washington's water quality criteria concentration calculated using Equation 2.
$\Delta Criteria_{WA}$ = difference between concentrations to meet more stringent Washington criteria.

Table B-6. Monthly hardness and difference between concentrations to meet more stringent (CCC) Washington criteria (µg/L)

	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Hardness (mg/L as $CaCO_3$)	20.6	21.8	22.0	20.6	18.2	16.7	17.0	18.4	19.5	19.6	20.3	19.5
Dis-Pb	$Criteria_{ID}$	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
	$Criteria_{WA}$	0.43	0.46	0.47	0.43	0.38	0.34	0.35	0.38	0.41	0.41	0.43	0.41
	$\Delta Criteria_{WA}$	0.11	0.08	0.07	0.11	0.16	0.20	0.19	0.16	0.13	0.13	0.11	0.13
Dis-Zn	$Criteria_{ID}$	36.50	36.50	36.50	36.50	36.50	36.50	36.50	36.50	36.50	36.50	36.50	36.50
	$Criteria_{WA}$	27.40	28.75	28.97	27.40	24.67	22.94	23.29	24.90	26.16	26.27	27.06	26.16
	$\Delta Criteria_{WA}$	9.10	7.75	7.53	9.10	11.83	13.56	13.21	11.60	10.34	10.23	9.43	10.34

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Discharge

For the period between 2010 and 2015, Spokane River daily average flows ranged from 500 to 35,800 cubic feet per second. The highest flows during that period were during April and May of 2011 and 2012, and the lowest flows were in July, August and September of 2015. Table B-7 lists the 50th percentile discharge in the Spokane River at the state line by month.

Table B-7. Spokane River 50th %tile ambient discharge 2010-2015 (cfs)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Discharge	3300	4200	7600	15000	16000	8600	2000	680	1100	1700	2500	4600

Difference in load capacity to meet more stringent Washington criteria

Equation 7:

$$\Delta LC_{WA} = \Delta Criteria_{WA} \times Q \times K$$

Where:

ΔLC_{WA} = difference between loads to meet more stringent Washington criteria (lbs/day, 2 significant figures)

$\Delta Criteria_{WA}$ = difference between concentrations to meet more stringent Washington criteria

Q = discharge (cfs) for month (2 significant figures)

K = conversion Factor for calculating load given (cfs) and (µg/L) resulting in (lbs/day)

K= 0.00539377

Calculation of difference between ID and WA loads to meet more stringent Washington criteria													
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CCC	Hardness (mg/L as $CaCO_3$)	20.6	21.8	22.0	20.6	18.2	16.7	17.0	18.4	19.5	19.6	20.3	19.5
	Discharge (cfs)	3300	4200	7600	15000	16000	8600	2000	680	1100	1700	2500	4600
Dis-Pb	$\Delta Criteria_{WA}$ (µg/L)	0.11	0.08	0.07	0.11	0.16	0.20	0.19	0.16	0.13	0.13	0.11	0.13
	ΔLC_{WA}(lb/day)	2.0	1.8	2.9	8.90	14	9.3	2.0	0.59	0.77	1.2	1.5	3.2
Dis-Zn	$\Delta Criteria_{WA}$ (µg/L)	9.10	7.75	7.53	9.10	11.83	13.56	13.21	11.60	10.34	10.23	9.43	10.34
	ΔLC_{WA}(lb/day)	160	170	310	740	1000	630	140	43	61	94	130	260

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Appendix C. Data Sources

Table 33 Monthly precipitation (inches) statistics. Data source: National Climatic Data Center - Coeur d'Alene Station USC00101956 (2000-2016).

Month	Min	Max	Median	95 Confidence Interval (median)
Jan	1.21	6.47	3.05	3.83
Feb	0.02	3.19	1.42	1.86
Mar	1.25	6.14	2.39	3.35
Apr	0.86	3.01	1.53	2.33
May	0.9	3.74	1.95	2.59
Jun	0.66	4.95	1.64	2.45
Jul	0.12	2.86	0.42	0.68
Aug	0	2.02	0.47	0.96
Sep	0	2.4	0.69	1.42
Oct	0.37	6.86	1.62	2.55
Nov	1.43	7.47	2.85	3.38
Dec	1.13	6.05	3.23	5.21
Sum	7.95	55.16	21.26	30.61

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Table 34. MS4 outfall monitoring data – City of Post Falls.

	4th Ave Outfall			Centennial Outfall		
Sample Date	**Lead (mg/L)**	**Zinc (mg/L)**	**Hardness (mg/L)**	**Lead (mg/L)**	**Zinc (mg/L)**	**Hardness (mg/L)**
3/17/2010	0.018	0.21	34.7	0.03	0.79	85.7
5/19/2010	0.02	0.39	97.80	0.019	0.289	49.6
8/11/2010	<.01	0.193	67.8	0.079	3.05	290
9/16/2010	0.011	0.191	51.3	0.009	0.284	38.9
3/10/2011	0.011	0.13	36.5	0.018	0.29	55.2
5/7/2011	<.01	0.033	20.1	<.01	0.11	24.6
5/15/2011	0.011	0.23	72.40	0.013	0.37	90.50
7/13/2011	0.014	0.21	1.36	0.02	0.37	2.55
9/27/2011	<.01	0.15	41.1	<.01	0.33	45.2
3/12/2012	0.016	0.23	65.60	0.020	0.56	135.00
4/4/2012	<.01	0.13	36.60	<.01	0.15	26.00
5/2/2012	<.01	0.05	19.80	<.01	0.25	20.20
7/15/2012	<.01	0.08	15.70	0.021	1.23	34.20
10/15/2012	<.01	0.34	18.80	<.01	0.34	18.80
3/6/2013	0.016	0.23	66	0.020	0.56	135
5/13/2013	0.029	0.55	82	0.037	1.04	190
7/8/2013	0.049	0.05	54	0.070	2.20	122
9/4/2013	0.009	0.12	24	0.023	0.49	71
3/8/2014	0.009	0.17	60	0.031	0.38	66
5/4/2014	0.019	0.24	41	0.014	0.25	43
7/22/2014	0.010	0.33	93	0.010	0.82	129
9/3/2014	0.008	0.18	43	0.004	0.35	66
3/14/2015	0.014	0.25	46	0.016	0.52	60
5/13/2015	0.005	0.12	33	0.007	0.40	41
7/11/2015	0.005	0.27	88	0.006	0.98	112
9/5/2015	0.001	0.03	26	0.001	0.28	21

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Table 35. MS4 outfall monitoring data – City of Coeur d'Alene Bellerive Outfall.

Date	Total Lead (mg/L)	Total Zinc (mg/L)
3/12/2013	0.014	0.233
5/22/2013	<0.0075	0.0361
7/17/2013	<0.0075	0.0467
8/2/2013	<0.0075	0.0273
9/5/2013	<0.0075	0.0337
2/12/2014	<0.0075	0.134
3/10/2014	<0.0075	0.0602
4/24/2014	0.0092	0.119
6/3/2014	<0.0075	0.0485
7/22/2014	0.0101	0.255
9/3/2014	<0.0075	0.0894
2/9/2015	0.0221	0.319
3/23/2015	<0.0075	0.074
7/11/2015	<0.0075	0.102
9/5/2015	<0.0075	0.135
2/18/2016	<0.0075	0.074
4/12/2016	0.0113	0.294
6/24/2016	0.0106	0.155
9/2/2016	0.0152	0.187

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Table 36. City of Coeur d'Alene Wastewater Treatment Plant monthly data. Monthly values were a result of a 24-hour composite sample taken once a month

	Total Lead (ug/L)											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2010	0.43	0.32	0.32	0.25	0.27	0.4	0.54	0.22	0.2	0.03	0.22	0.31
2011	0.35	0.38	0.38	0.31	2.73	0.96	2.44	1.82	0.27	6.71	0.20	1.65
2012	1.7	0.69	1.29	2.43	0.24	1.27	1.94	0.34	0.69	0.94	0.96	0.50
2013	0.9	0.63	0.69	0.52	0.80	0.41	0.87	0.2	0.38	0.33	0.40	0.46
2014	0.84	0.60	0.5	0.554	0.387	0.32	0.34	0.42	0.23	0.30	0.29	0.32
2015	0.316	0.306	0.416	0.257	0.39	0.273	0.422	0.259	0.257	0.291	0.337	0.354
Mean	0.76	0.49	0.60	0.72	0.80	0.61	1.09	0.54	0.34	1.43	0.40	0.60
Mean dis-Pb	0.20	0.13	0.16	0.19	0.21	0.16	0.29	0.14	0.089	0.38	0.11	0.16
	Total Zinc (ug/L)											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2010	37.1	46.7	47.8	47.8	50.9	53.4	52.7	38.3	37.8	37.3	42.3	45.8
2011	45.8	52.8	51.7	50.2	58.5	49.4	51.3	41.1	32.0	43.1	35.8	42.4
2012	47.1	42.6	48.9	45.2	46.6	42.7	60.4	38.2	38.2	54.8	49.8	47.6
2013	44.1	39.7	49.3	55.7	48.1	49.0	47.4	38.7	40.9	42.1	43.4	38.4
2014	35.8	40.1	39.6	43.9	38.2	47.0	44.2	37.5	42.9	43.3	42.6	54.1
2015	45.9	44.8	56.5	42.3	48.8	42.9	65.9	40.5	37.2	47.7	45.0	46.4
Mean	42.6	44.5	49.0	47.5	48.5	47.4	53.7	39.1	38.2	44.7	43.2	45.83
Mean dis-Zn	42.2	44.0	48.5	47.1	48.1	47.0	53.2	38.7	37.8	44.3	42.8	45.4

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Table 37. City of Post Falls Wastewater Treatment Plant monthly data. Monthly values were a result of a 24-hour composite sample taken once a month

	Total Lead (ug/L)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	0.27	0.19	0.38	1.27	0.45	0.53	0.411	0.61	0.67	0.55	0.6	0.67
2011	0.80	0.72	0.59	0.15	0.83	0.77	0.976	0.65	1.0	0.49	0.622	0.75
2012	0.25	0.22	0.35	0.35	0.29	0.29	0.94	0.24	0.20	0.12	0.26	0.39
2013	0.22	0.26	0.49	0.49	0.68	0.36	0.34	0.34	0.18	0.24	0.34	0.27
2014	0.11	0.26	0.51	0.15	0.35	0.34	0.32	0.31	0.28	0.31	0.38	0.79
2015	0.32	0.21	0.33				0.40	0.23	0.55	0.29		0.24
Mean	0.349	0.310	0.442	0.482	0.520	0.458	0.565	0.397	0.480	0.333	0.440	0.518
Mean dis-Pb	0.092	0.082	0.117	0.127	0.137	0.121	0.149	0.105	0.127	0.088	0.116	0.137
	Total Zinc (ug/L)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	55.3	63.7	56.4	69.1	70.4	55.3	68.3	72.8	73.3	61.9	59.2	52.7
2011	64.3	69.8	60.9	58.2	61.9	63.5	45.9	53.9	57.7	42.3	57.7	56.5
2012	53.0	50.1	51.8	44.7	22.7	38.2	84.7	59.5	46.8	36.0	35.1	41.0
2013	37.8	52.2	48.2	54.7	50.8	55.9	49.4	44.5	49.5	46.1	47.6	47.2
2014	50.8	44.8	48.0	62.3	63.6	58.9	52.6	61.3	58.2	57.1	50.1	53.0
2015	46.6	57.6	96.2	32.4	48.9	65.4	80.9	63.8	57.3	54.9	44.9	44.0
Mean	51.3	56.5	60.3	53.6	53.1	56.2	63.6	59.3	57.1	49.7	49.1	49.1
Mean dis-Zn	50.8	55.8	59.7	53.1	52.6	55.7	63.0	58.8	56.6	49.3	48.6	48.6

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Table 38. Hayden Area Regional Sewer Board (HARSB) Wastewater Treatment Plant monthly data. Monthly values were a result of a 24-hour composite sample taken once a month

	Total Lead (ug/L)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	0.295	0.297	0.187	0.28	0.402	0.419	0.307	Land Application		0.392	0.4	0.579
2011	0.486	0.601	0.575	1.5	1.4	0.66	1			1.11	0.881	0.914
2012	0.902	0.757	0.707	0.92	0.516	0.515				0.835	0.79	0.89
2013	0.893		0.29	0.865	0.847	0.86				0.911	0.618	0.696
2014	0.836		0.804	0.707	0.966	0.622				0.854	0.669	1.02
2015	0.734		1.19	0.984	1.06					1.02	0.999	1.27
Mean	0.691	0.552	0.626	0.876	0.865	0.615	0.654			0.854	0.726	0.895
Mean dis-Pb	0.183	0.146	0.165	0.232	0.229	0.163	0.173			0.226	0.192	0.237
	Total Zinc (ug/L)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	29	38	32	36	30	29	25	Land Application		42	51	58
2011	57	47	58	42	59	41	36			47	44	54
2012	47		46	31	47	51				37	36.1	14
2013	47		57	31	33	15				31	48	37
2014	41		45	43	28	27				50	50	54
2015	55		64	28	52					30.5	56.2	40.6
Mean	46	43	50	35	42	33	31			40	48	43
Mean dis-Zn	46	43	51	35.	42	33	31			40	48	43

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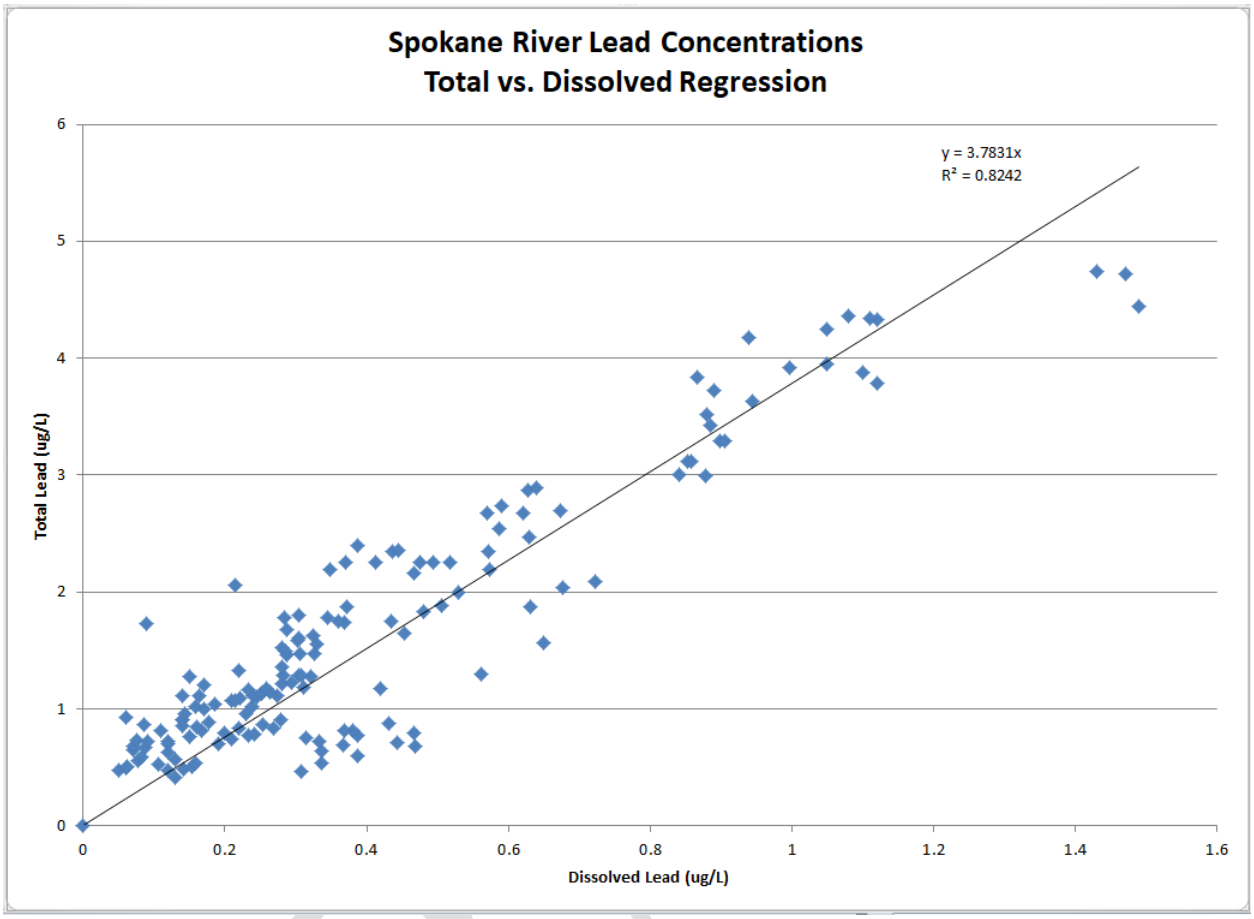


Table 39. Regression between total and dissolved lead from ambient concentrations in the Spokane River (2010-2016).

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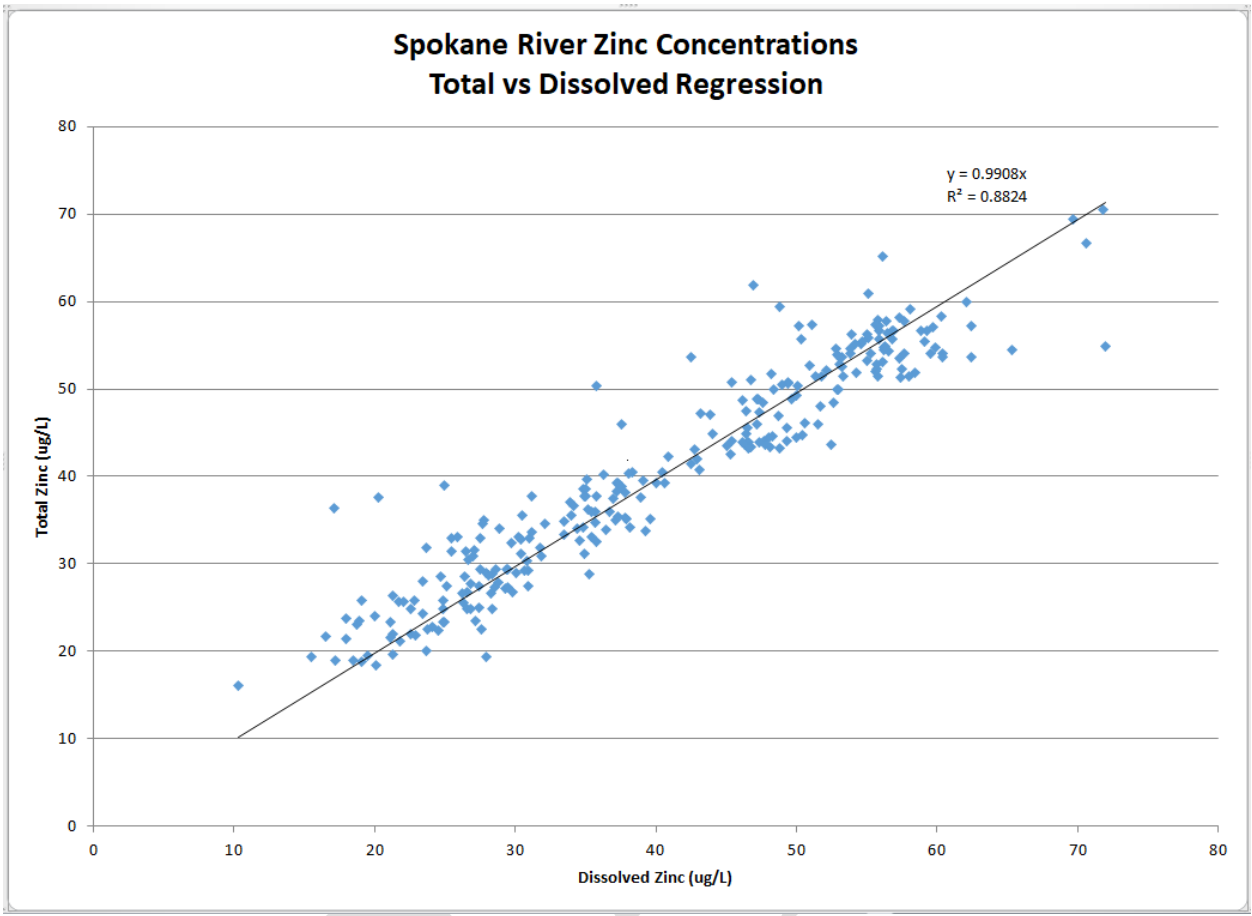


Table 40. Regression between total and dissolved lead from ambient concentrations in the Spokane River (2010-2016).

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Appendix D. Stormwater Impervious Surface Area Determination

To determine the pollutant loading from stormwater impacting the Idaho portion of the Spokane River, a percentage of impervious surfaces for a given spatial extent were calculated using geographic information system software.

Defining areas of stormwater impacting the Spokane River

The boundaries were defined by referencing municipal separate storm sewer system (MS4) permits for the City of Coeur d'Alene, City of Post Falls, Post Falls Highway District, and Idaho Transportation Department.

The boundaries of five spatial extents were classified with stormwater impacts entering the Spokane River. The spatial extent for the MS4 stormwater drainage into the Spokane River for the City of Coeur d'Alene the City of Post Falls, and the Post Falls Highway District were defined using this municipal separate storm sewer system maps illustrated in Figures 41-43.

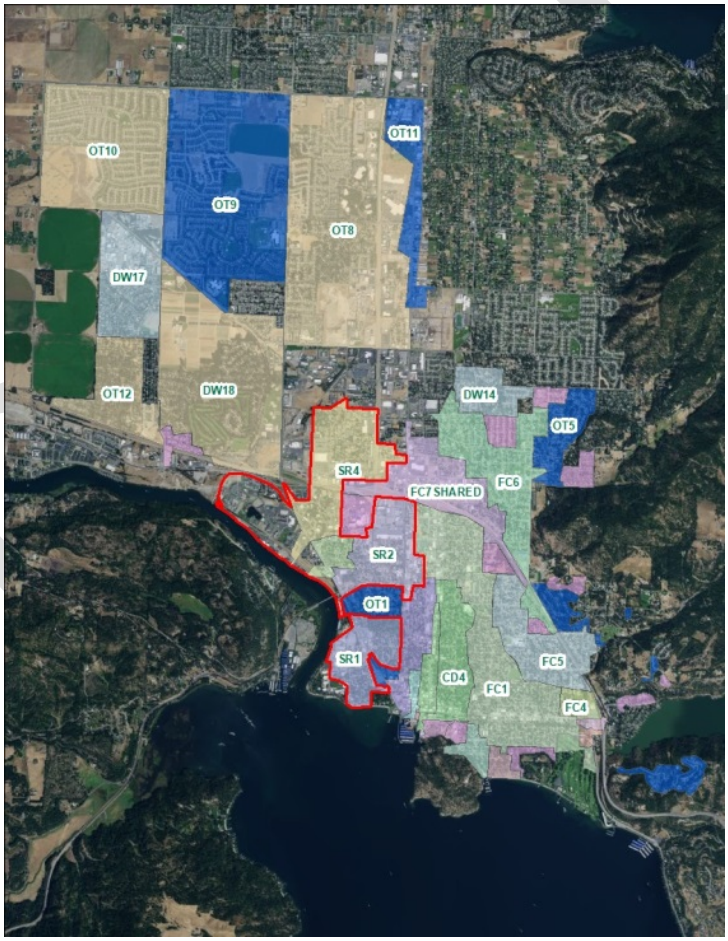


Figure 43 City of Coeur d'Alene MS4 map. Boundary in red is stormwater discharged directly into the Spokane River.

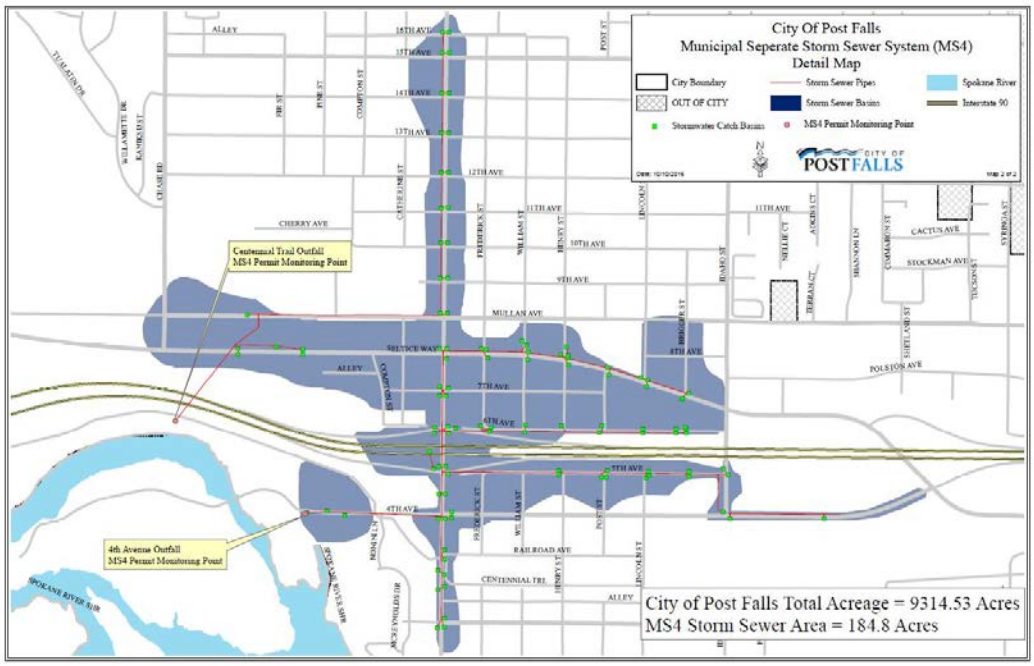


Figure 44. City of Post Falls MS4 map for water discharging into the Spokane River.

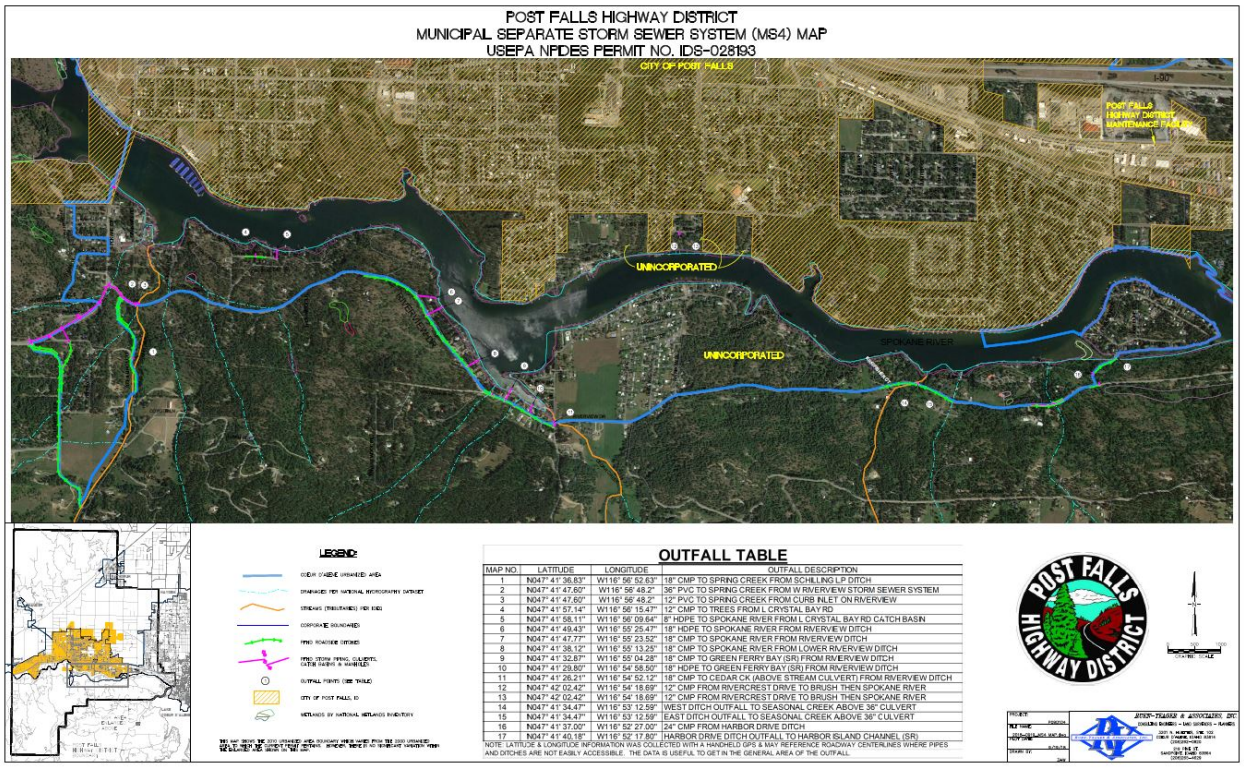


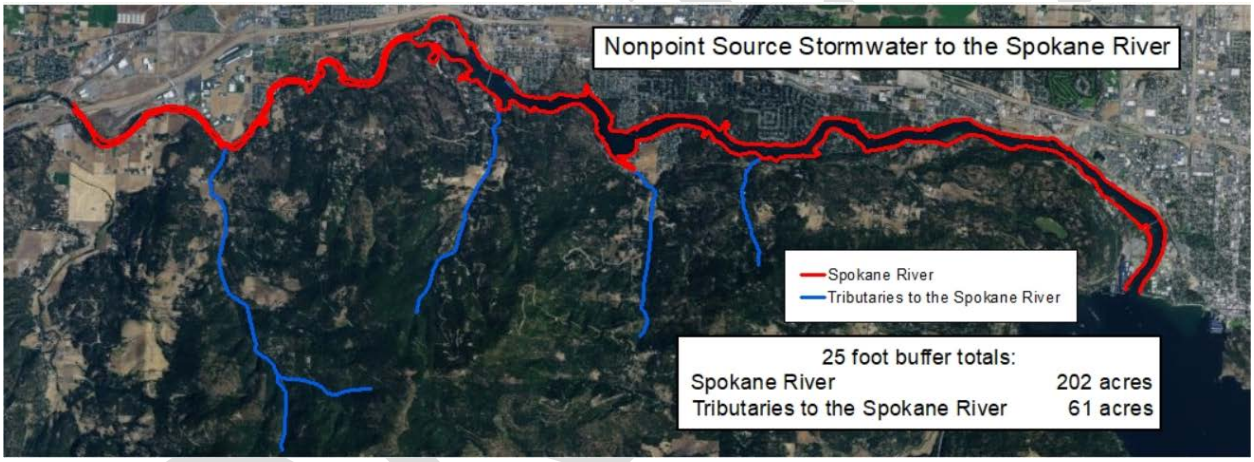
Figure 45. Post Falls Highway District MS4 map for water discharging into the Spokane River.

The Idaho Transportation Department Interstate 90 stormwater from Northwest Boulevard to Sherman Avenue discharges to French Gulch, Fernan Creek, and Coeur d'Alene Lake. The spatial extent included area for future growth along I90..

The last spatial extent addresses nonpoint source stormwater along the Spokane River, which was split between the area adjacent to the Spokane River and tributaries to the Spokane River.



Figure 46. Impervious surface estimated for future growth for Idaho Transportation Department.



Imagery process and impervious area calculations

All of the spatial extents were utilized as boundary areas in GIS software to determine a percentage estimate of impervious area. The 2015 one meter color infrared orthorectified aerial imagery from the National Agriculture Imagery Program (NAIP) was used to generate a Normalized Difference Vegetation Index (NDVI). These images, like a photograph or our vision, see color based off how objects reflect or absorb wavelengths of light. The cell structure in plants strongly reflects near-infrared light. The chlorophyll in plant photosynthesis strongly absorbs visible light. NDVI can be calculated from the visible and near-infrared light reflected by vegetation. The calculation is near-infrared minus visible red divided by near-infrared plus visible red:

$$NDVI = (NIR-VIS)/(NIR+VIS)$$

This index is a ratio from the returns of near-infrared and visible light. Since the NDVI is a ratio, the processing will minimize shadow effects. A high NDVI ratio indicates healthy, growing vegetation. A low NDVI ratio identifies something that is not living, pavement or rooftops. The range for the index is from -1.0 to +1.0. Positive values are typically areas of vegetation. The

cut-off value of 0.1 was used to define the two classifications. Non-vegetated areas had a value less than 0.1 and vegetated areas had a value equal to or greater than 0.1. Since there is a very high correlation between areas of non-vegetation and impervious surfaces, this was used to determine impervious surfaces.

Bare soil, dormant vegetation, and water were classified as non-vegetation, or impervious surfaces in the previous processing. To increase the accuracy of the impervious classification and show bare soil, dormant vegetation, and water as pervious, these areas were addressed using a parcel layer scale and visual observation. Kootenai County parcels were selected if it was classified as impervious but the majority of the surface was bare soil or dormant vegetation in the NAIP imagery, or if it was a water body. These areas were then reclassified as pervious surfaces in the results. The red outlined parcels in this image illustrate an example of those areas selected for correction within the City of Post Falls MS4 spatial extent.

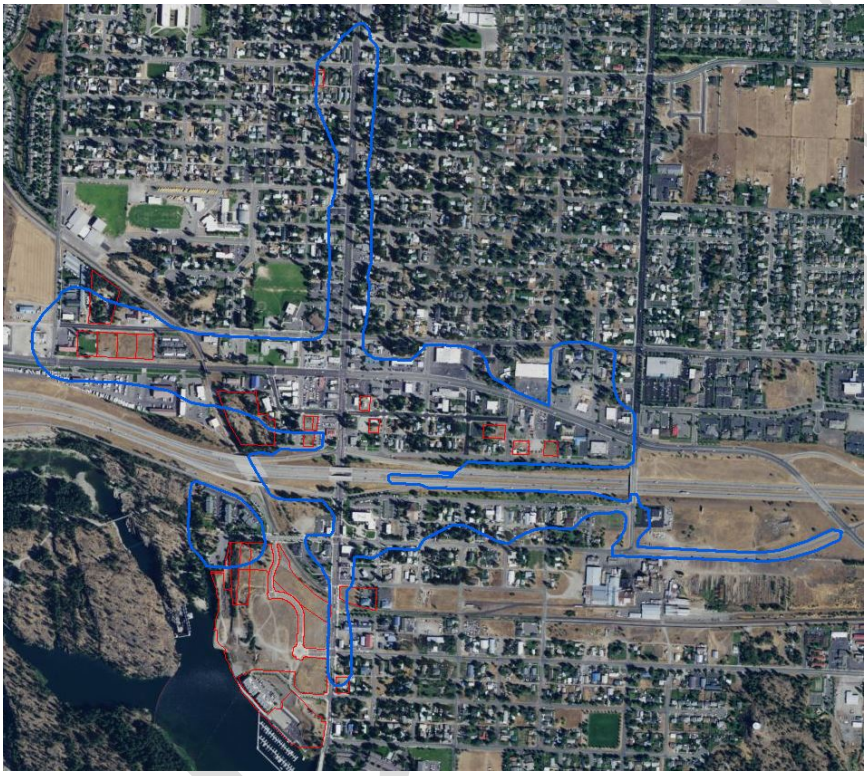


Figure 47. Areas selected in the Post Falls MS4 for pervious surface correction.

Rooftops on residential homes were classified as impervious. Most of these impervious surfaces drain into pervious yards. These impervious surfaces were not excluded and remained as a margin of safety in the TMDL.

The results of this process identified the impervious and pervious areas within the defined stormwater boundaries for the City of Coeur d'Alene, City of Post Falls, and Post Falls Highway District (Figures 45-47). The total impervious surface area delivering stormwater to the City of Coeur d'Alene, City of Post Falls, and Post Falls Highway District are 611, 138, and 146 acres respectively.

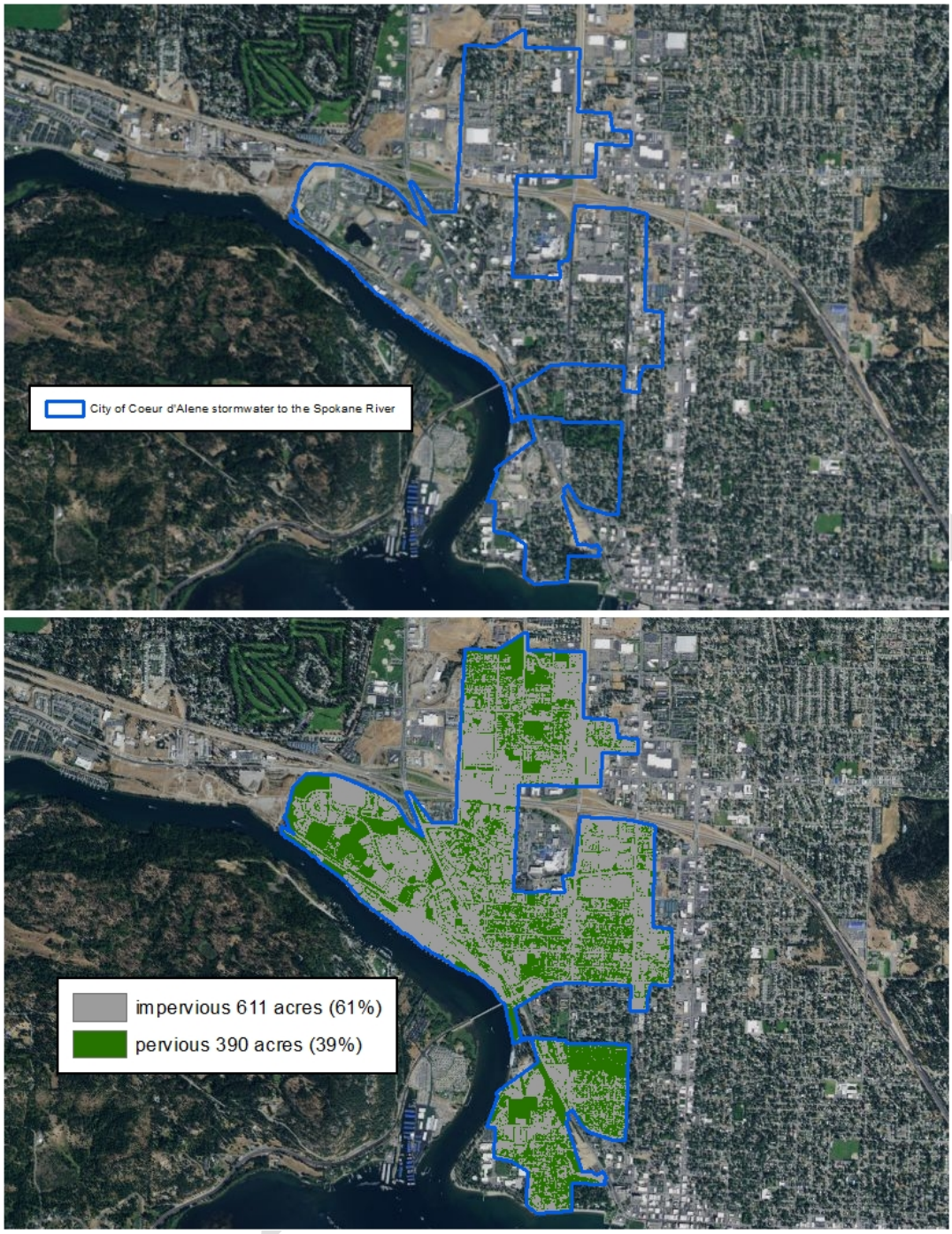


Figure 48. Impervious/pervious surface area in the City of Coeur d'Alene MS4 area that drain to the Spokane River.

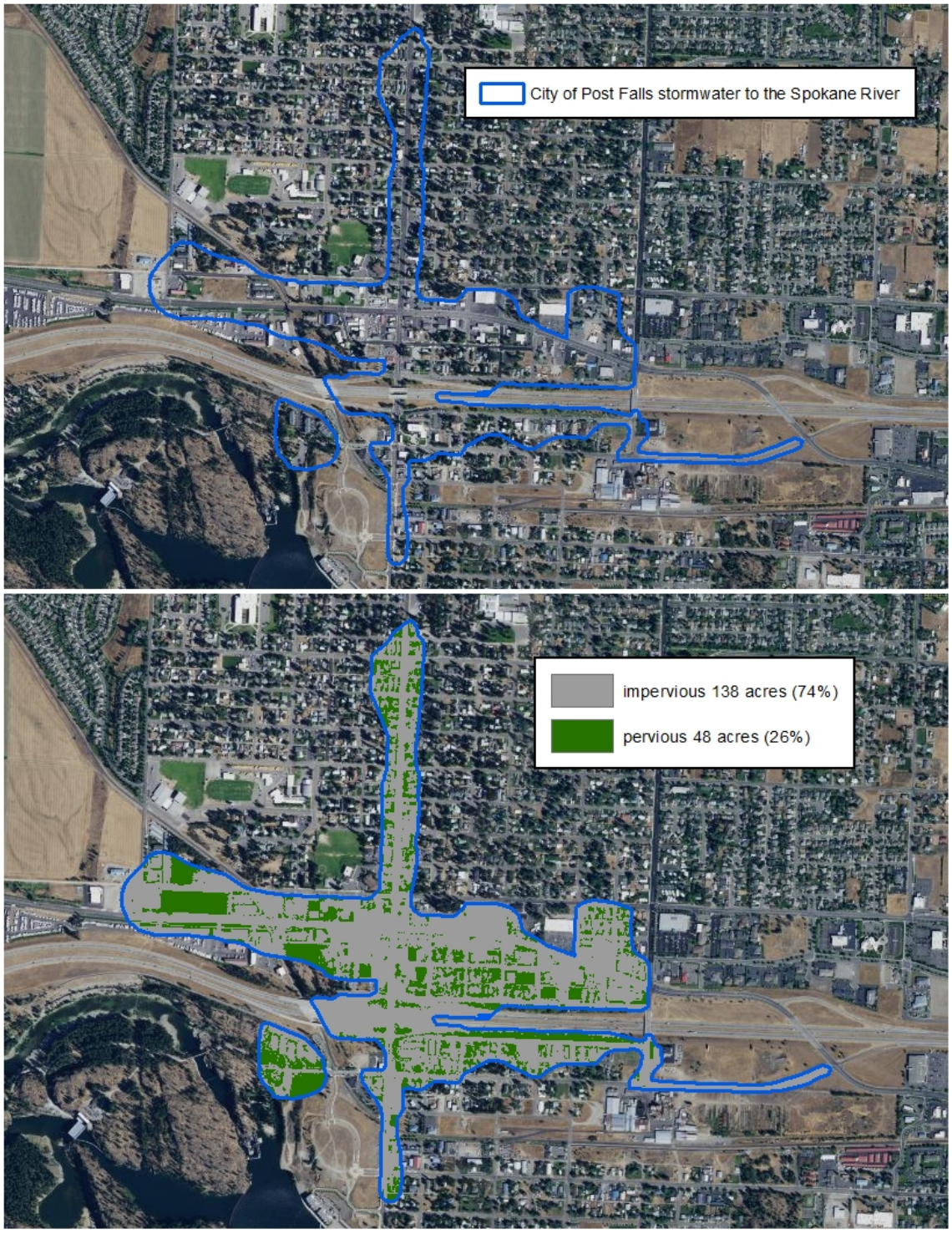


Figure 49. Impervious/pervious surface area in the City of Post Falls MS4 area that drain to the Spokane River.

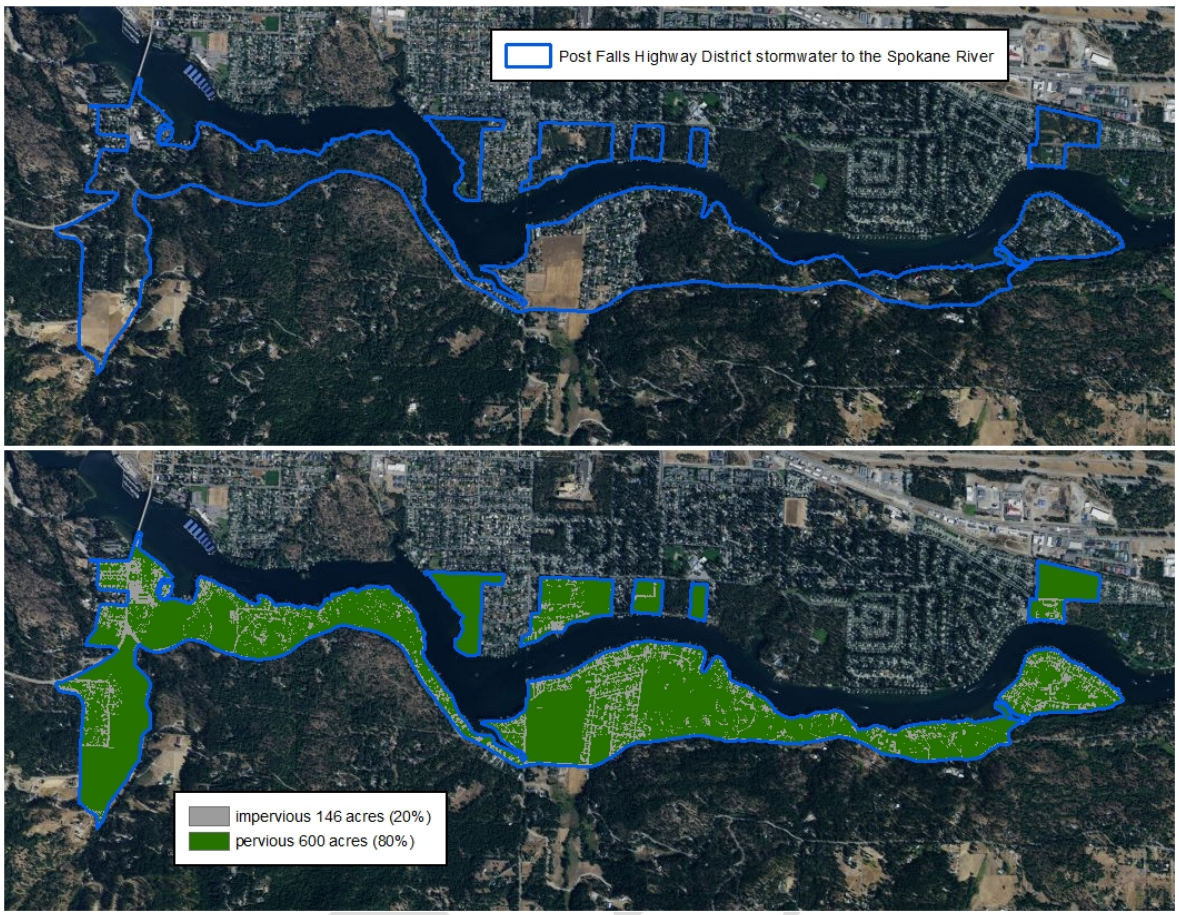


Figure 50. Impervious/pervious surface area in the Post Falls Highway District MS4 area that drain to the Spokane River.

The sloping land along the Spokane River is another area with stormwater impacts to the Spokane River, as a nonpoint source. The sloping land ranges in distance, slope, and composition throughout the length of the Spokane River in Idaho. A general width of 25 ft was used to obtain an area measurement. The 25 ft distance to the Spokane River water's edge has a slope toward the river. The stream tributaries were also included with a distance of 12.5 ft on each bank. The total area for nonpoint source stormwater was 263 acres (Figure 48).

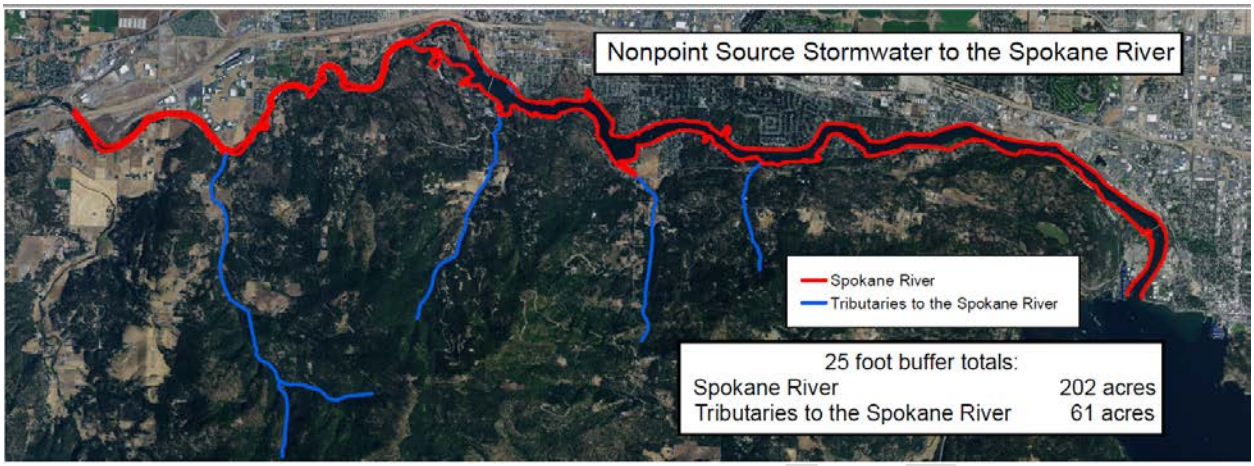


Figure 51. Pervious surface area draining nonpoint source pollution to the Spokane River.

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Appendix E. Managing Stormwater

Municipal Separate Storm Sewer Systems

Polluted stormwater runoff is commonly transported through municipal separate storm sewer systems (MS4s), from which it is often discharged untreated into local water bodies. An MS4, according to 40 CFR 122.26(b)(8), is a conveyance or system of conveyances that meets the following criteria:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the US
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
- Not a combined sewer
- Not part of a publicly owned treatment works (sewage treatment plant)

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the US Environmental Protection Agency (EPA), implement a comprehensive municipal stormwater management program (SWMP), and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

Industrial Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body.

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an industrial facility discharges industrial stormwater into waters of the US, the facility must be permitted under EPA's most recent Multi-Sector General Permit (MSGP). To obtain an MSGP, the facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

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Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 water quality certification. The MSGP will detail the specific monitoring requirements.

TMDL Industrial Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a waste load allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric waste load allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The next MSGP will have specific monitoring requirements that must be followed.

Construction Stormwater

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

Construction General Permit (CGP) and Stormwater Pollution Prevention Plans

If a construction project disturbs more than 1 acre of land (or is part of a larger common development that will disturb more than 1 acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

TMDL Construction Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a gross waste load allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric waste load allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

Post-construction Stormwater Management

Many communities throughout Idaho are currently developing rules for post-construction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and*

Counties (DEQ 2005b) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing in order to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

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Appendix F. Public Participation and Public Comments

This TMDL was developed with participation from the upper Spokane River Watershed Advisory Group.

[Public comments and DEQ responses to be inserted following public comment period.]

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Appendix G. Distribution List

[To be inserted following public comment period.]

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