State of Oregon Department of Environmental Quality

Attachment E

Powder River Basin TMDL

This document contains copies of the Total Maximum Daily Load, Water Quality Management Plan, and Technical Support Document with changes that have been made to the versions that went out on notice highlighted.

Redline versions of the following documents are attached:

Attachment E.1 – Total Maximum Daily Load

Attachment E.2 – Water Quality Management Plan

Attachment E.3 – Technical Support Document

Total Maximum Daily Load ~~Rule~~draft rule

Powder River Basin TMDL for *E. coli*~~Powder River Basin - Bacteria~~

May 2024

State of Oregon
DEQ Department of Environmental Quality

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Table of Contents

List of Tables

List of Figures

1. Introduction

The Oregon Department of Environmental Quality (DEQ) has developed a This draft Total Maximum Daily Load (TMDL) rule for the Powder River Basin that addresses a type of fecal indicatora type of bacteria (*Escherichia coli*; hereafter *E. coli*) that indicates contaminationpollution of surface waterss by human and animal human and animal feces from humans or other warm-blooded animals (*Escherichia coli*; hereafter *E. coli*) was developed forin the Middle Snake-Powder River River Basin to address water quality impairments of bacteria. The TMDLrule focuses on a specific A type of fecal indicator bacteria (*Escherichia coli*; hereafter *E. coliE. coli*) that indicates waterfecalfecal fecal contaminationa sources originating from humans orand other warm-blooded animals. The The A TMDL describesoutlines a science-basedstructured approach for water quality restoration plan to is a science-based approach to cleaning upclean upcleaning up polluted waters in the basin so that it meets state water quality standards. The tTarget numerical values presented in a A TMDLthe rule is a numerical value that representsdescribes the highest maximum amount of amount of a pollutantpollution a a surface water body of water can receive and still meet state water quality the standards for *E. coliE. coli* designed to protect beneficial usesmeet. The TMDL may be referred to as either the Powder River Basin Bacteria TMDL or the Powder River Basin TMDL for *E. coli*For brevity, the rule ismay be referred to as the Powder River Basin Bacteria TMDL.

1.1 TMDL history

The Middle-Snake Powder River Basin occupies is locatedlies in eastern Oregon on the border with Idaho. The basin is also known as the Middle-Snake Powder within tThe US Geological Survey (USGS) Hydrologic Unit Code classification system refers to the basin as a six-digit (3rd field) Hydrologic Unit Code (HUC) classification systemnumbered 170502 and as the Middle-Snake Powder Basin and .- Subbasins (eight-digit HUCs) includes the the Oregon portion of the Brownlee sSubbasin (17050201), Burnt River sSubbasin (17050202), and Powder River sSubbasins (17050203) US Geological Survey (USGS) 4th Field HUC subbasins in eastern Oregon. The basin is also known as the Middle-Snake Powder within the US. All streams in the these subbasinsbasin drain ultimately to into Brownlee Reservoir the Snake River along on the border of Oregon and Idaho.

The TMDL described here represents the first one fecal indicatoris fecal in bacteria TMDL is the first to be issued for the Middle-Snake Powder River Basin individuallyPowder River Basin. The Water Quality Management Plan (WQMP) developed for this TMDL will be updated as additional water quality concerns are addressed in As fFfuture TMDLs for other water quality concerns in the basin are written to address additional water quality impairments within the Powder River Basin, the WQMP will be updated accordingly. Issuance of this the Middle-Snake Powder River Basin Bacteria fecal indicator bacteria TMDL for *E. coli* does not impact or represent a revision to any existing Snake River Basin TMDLs that encompass the Powder River Basin.

1.2 TMDL administrative and public participation processes

Following completion of Oregon Department of Environmental Quality'sDEQthe drafting TMDL development process, including which includesdincluding the engagement of a rule advisory committee on the fiscal impacts statement and other aspects of the rule, DEQ will propose this the Middle-Snake Powder River Basin TMDL on bacteriafor *E. coli* will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule as OAR 340-042-0090(2)(a). Any subsequently amended or renumbered rules cited in this document are intended to apply.

In addition to to seeking input on TMDL development of these the TMDLs throughworking with a the rule advisory committee during TMDL development, DEQ provided updates and solicited sought local input on interpretations of data analyses prior to TMDL development from to the Powder Basin Watershed Council, Powder Valley Water Control District, Burnt and Powder-Brownlee Agriculture Local Advisory Groups, and Oregon Department of Agriculture, and other stakeholders interested parties and people who live, work, and recreate invisit the basin. DEQ provided draft TMDL documents for review by rule advisory committee members in early April 2023, followed by two opportunities for public review and submission of comments. The assistance of theseInput from these groups, and along comments submitted during aThe initial with a 91-day public comment opportunity period was open from (June 2, 2023 through August 31, 2023),), and was followed by and a second 3878-day public comment period that was open from (January 3, 2024 through Feb 9Mar 22, 2024.), and comments aDEQ also held a public hearing in Baker City on (August 15, 2023.), Assistance from the above-mentioned groups, along with the public comment periods and public hearing, fulfills the publiccompleted the public participation requirements specified in OAR 340-042-0050. DEQ considered all input received during these public participation opportunities, used input to guide the analyses, and preparation, and revision of documentsthe TMDL, and provided response to comments (available onat https://www.oregon.gov/deq/rulemaking/Pages/PowderTMDL.aspxDEQ's website)., which are available on DEQ's website.

2. TMDL name and location

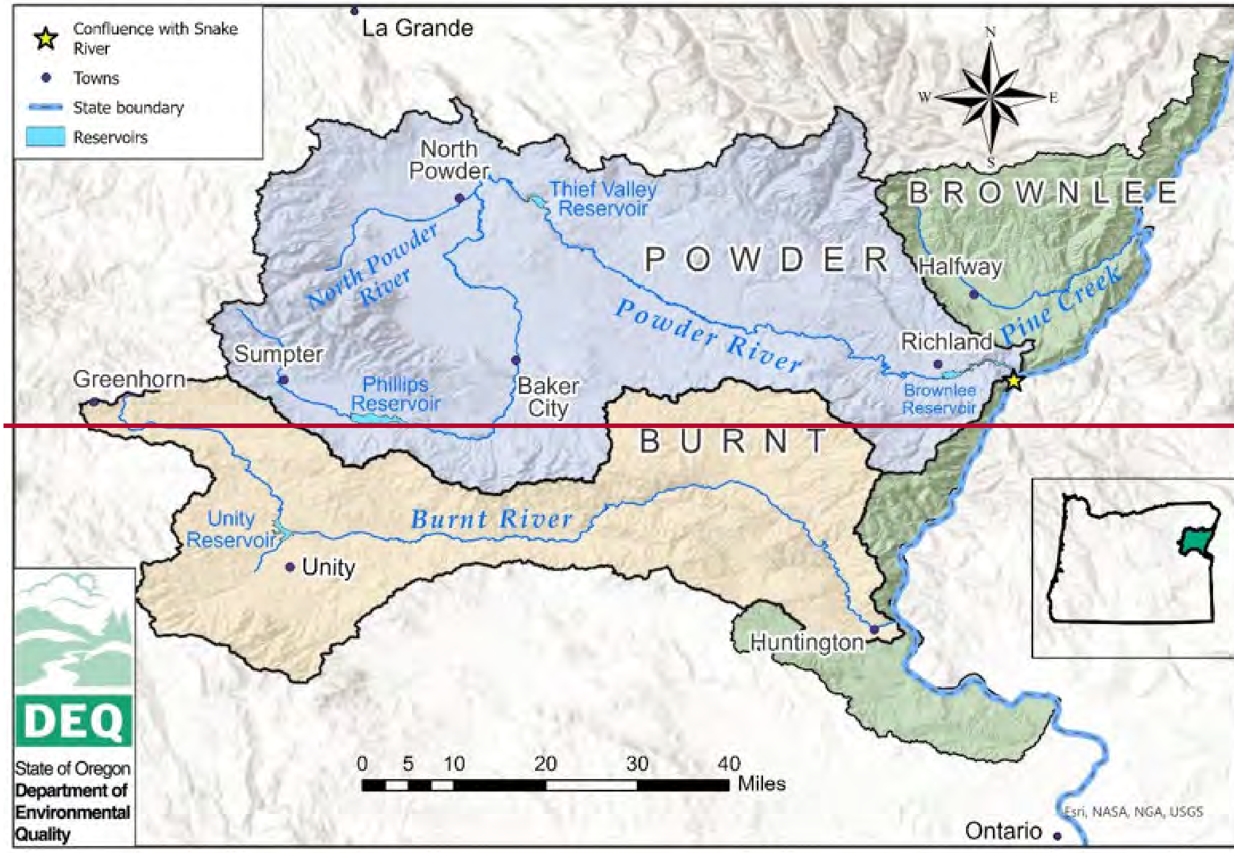
Per Oregon Administrative Rule 340-042-0040(a), this element describes the geographic area for which thewhere the TMDL is developedapplies. This Powder River Basin TMDL covers all freshwater perennial and intermittent streams in the Powder River Basin. (further described below) and a small portion of the Malheur Basin, referred to as the (Moore's Hollow assessment unit).

TAs designated by Oregon's Water Resources Department, the Powder River Basin is comprisesmakes up one of 20 drainage basins in Oregon with basin-specific water quality standards described in OAR 340-041-0260 (originally described as the Powder/Burnt Basins) and mapped in that rule on Figure 260A. Within tThe US Geological Survey (USGS) refers to the basin as a six-digit Hydrologic Unit Code (HUC) numbered 170502 and as the Middle-Snake Powder Basin. Subbasins (eight-digit HUCs) include the Oregon portion of the Brownlee sSubbasin (17050201), Burnt River sSubbasin (17050202), and Powder River Ssubbasins (17050203) (The United States Geologic Survey 's Hydrologic Unit Code (HUC) classification system refersd esignates basin as a 6six-digit to the , the basin is referred to as the Middle-Snake Powder River SubbBasin via a 6-digit HUC code (170502) and is comprised of three smaller 8-digit HUC code subbasins as listed in Table 1Table)2.0).

Table 1: Powder River Basin subbasins~~Table 2.0: Powder River Basin Subbasins~~

HUC8 Code	Subbasin Name
17050201	Brownlee Subbasin
17050202	Burnt River Subbasin
17050203	Powder River Subbasin

The basin forms a portion of the border of Oregon with Idaho and lies mostly within Baker County, with small portions in Union, Wallowa, and Malheur Counties. A portion of the Brownlee S~~s~~ubbasin also lies in ~~, as well as in~~ Idaho and is not covered by the TMDL. The Oregon portion of the basin ~~in Oregon~~ drains 3,444 square miles (8,925 square kilometers). Elevation ranges from 1,640 feet (500 meters) above sea level at the junction with ~~the Brownlee Reservoir, an impoundment on~~ the Snake River~~,~~ to 9,563 feet (2,914 meters) above sea level in the Wallowa ~~and Elkhorn~~ Mountains~~ ranges in the northeastern portion of the watershed~~basin. The average elevation is 4,237 feet (1,291 meters) above sea level (~~Figure 2.0~~Figure 1). ~~As shown in Figure 2.0, t~~T~~he Powder River Basin is comprised of three smaller subbasins that drain to Brownlee Reservoir, which sits on the Oregon-Idaho border and is an impoundment of the Snake River (Figure 2.0).~~ In 1988, two river reaches ~~within~~in the basin were designated ~~by the U.S. Congress~~ as Scenic under the federal Wild and Scenic Rivers Act of 1968. These reaches include ~~:~~ a ~~6.4 mile~~6.4-mile reach~~s~~ of the North Powder River from it~~'~~s headwaters in the Elkhorn Mountains to the Wallowa-Whitman National Forest boundary~~;~~ and an 11.7-~~-~~mile reach~~s~~ of the Powder River from Thief Valley Dam to the Highway 203 bridge (National Wild and Scenic River System~~,~~ 2024).


Confluence with Snake River
Towns
State boundary
Reservoirs
La Grande
North Powder
Thief Valley Reservoir
POWDER
BROWNLEE
Halfway
North Powder River
Powder River
Pine Creek
Richland
Sumpter
Greenhorn
Phillips Reservoir
Baker City
Brownlee Reservoir
BURNT
Unity Reservoir
Burnt River
Unity
Huntington
DEQ
State of Oregon
Department of Environmental Quality
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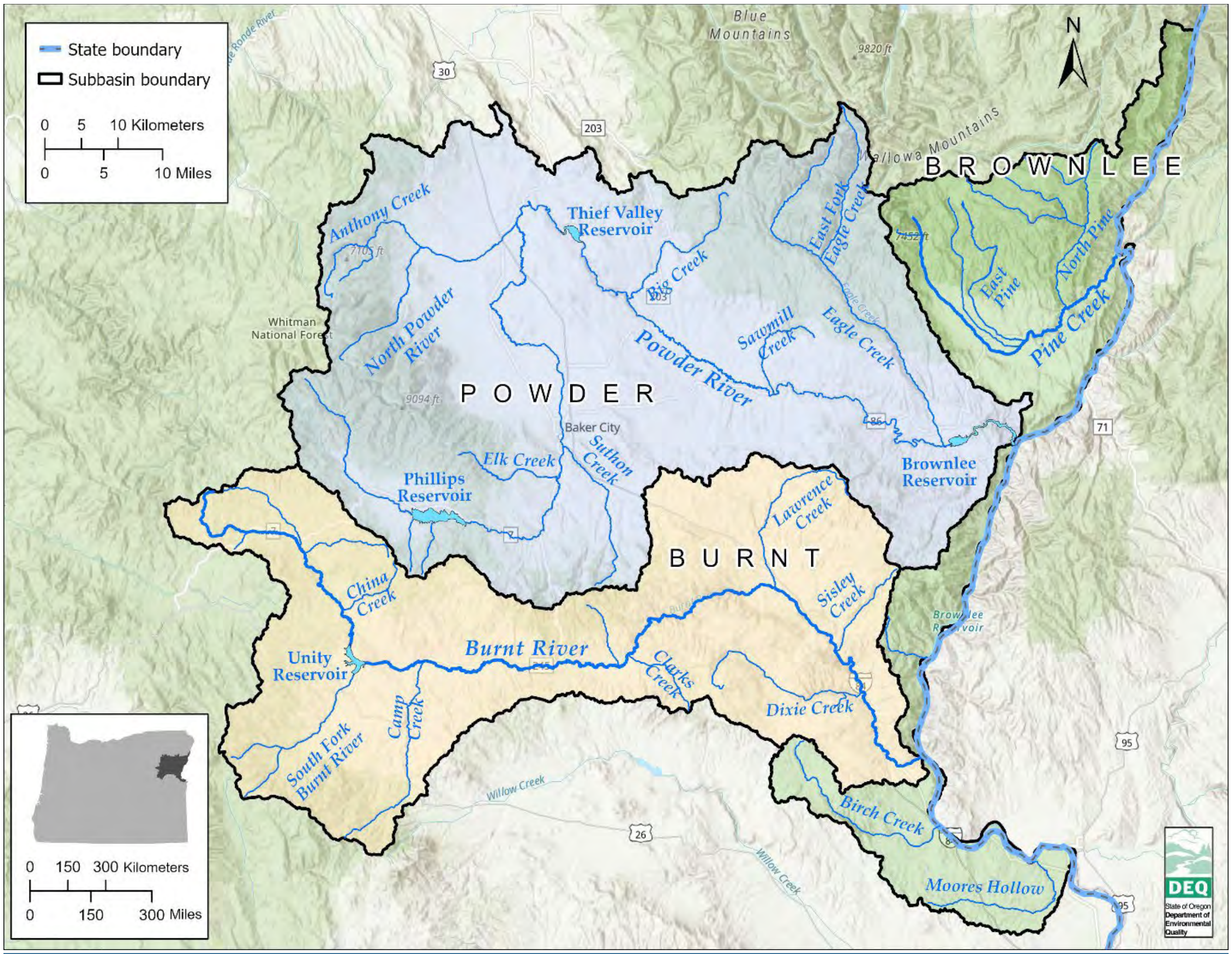
Miles
Esri, NASA, NGA, USGS
Ontario

Figure 1: Brownlee, Burnt, and Powder subbasins within the Powder River Basin


State boundary
Subbasin boundary
0 5 10 Kilometers
0 5 10 Miles
Blue Mountains
BROWNLEE
POWDER
BURNT
Anthony Creek
Thief Valley Reservoir
Big Creek
East Fork Eagle Creek
North Pine
East Pine
Pine Creek
North Powder River
Powder River
Sawmill Creek
Eagle Creek
Baker City
Sutton Creek
Elk Creek
Phillips Reservoir
Brownlee Reservoir
Lawrence Creek
Sisley Creek
China Creek
Burnt River
Clarks Creek
Dixie Creek
Unity Reservoir
Camp Creek
South Fork Burnt River
Birch Creek
Moores Hollow
Willow Creek
Whitman National Forest
0 150 300 Kilometers
0 150 300 Miles
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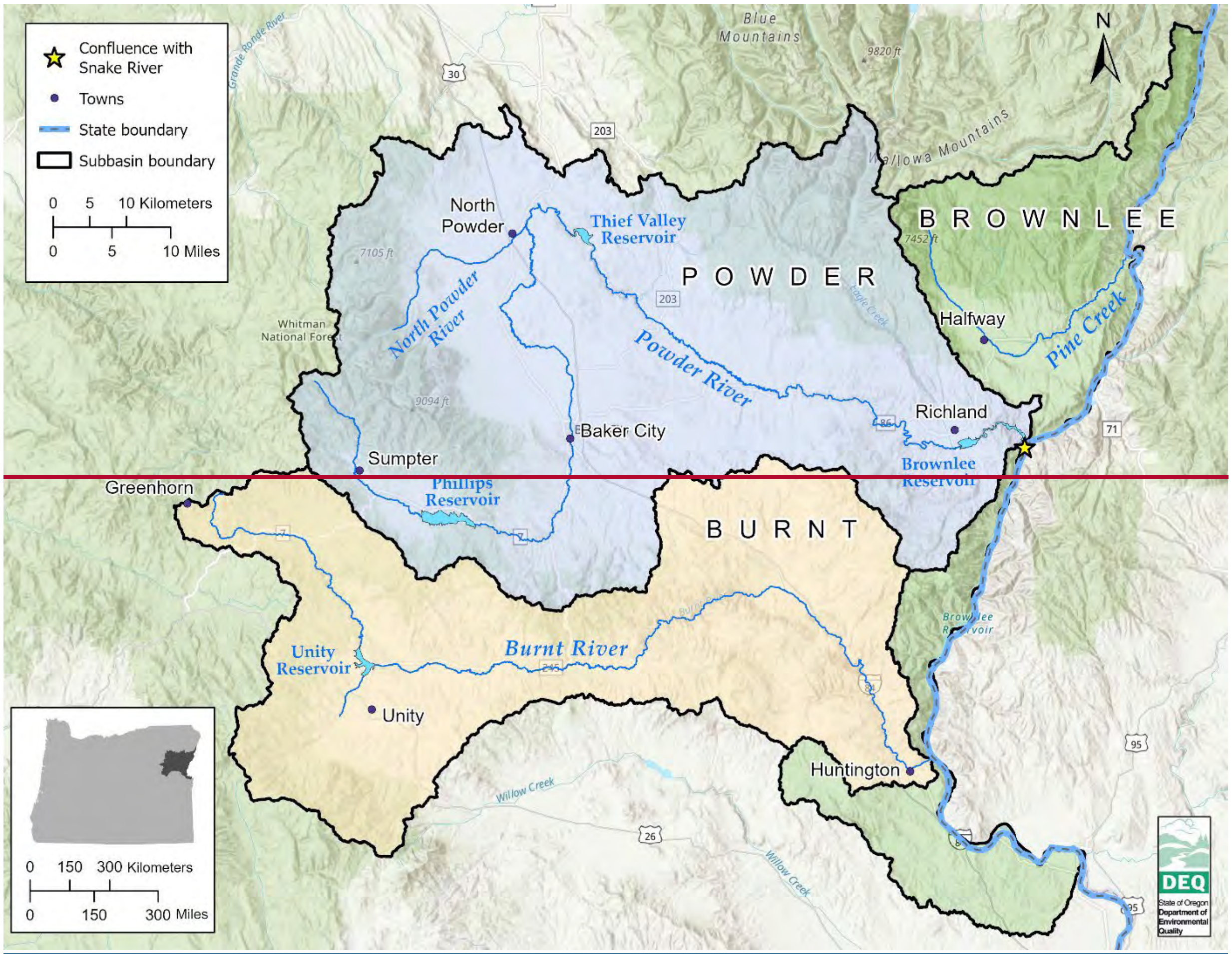


~~Figure 2.0: Brownlee, Burnt~~, ~~and Powder Subbasins within the Powder River Basin~~

2.1 Climate

~~The climate of the Powder Basin is influenced by the Cascade Mountains located approximately 200 miles to the west. This mountain range forms a barrier against the modifying effects of warm, moist fronts from the Pacific Ocean. As a result, th~~The ~~overall~~ climate of the Powder River Basin falls under the ~~is classified as~~ Temperate Continental-~~cool~~ Cool ~~summer~~ Summer ~~phase~~ Phase in the Köppen-Geiger Climate ~~c~~Classification System (Kottek et al, 2006). Light precipitation, low relative humidity, rapid evaporation, abundant sunshine, and ~~wide~~ large fluctuations of temperature and precipitation ~~fluctuations are characteristics~~characterize ~~of~~ this climate. Over the past 30 years (1991 – 2020), ~~the~~ mean annual temperature ~~for~~ in the ~~Powder Basin~~basin was 45.3°F (7.4°C), with a mean annual minimum temperature of 33.3°F (0.8°C) and a mean annual maximum temperature of 64.9°F (18.3°C) (PRISM Climate Group~~,~~ 2022).

~~The majority of~~Most annual precipitation falls as snow during winter. Over the past 30 years (1991 – 2020), annual precipitation has averaged 22.0 inches (56.0 cm) across the Powder Basin, with an average of 10.2 inches (25.9 cm) in the valleys and foothills an average of 78.2 inches (198.6 cm) at the highest elevations of the Elkhorn, Wallowa, and Blue Mountains ~~(Daly, et al., 2008)~~ (PRISM Climate Group~~,~~ 2022). Portions of the basin commonly experience rain-on snow events, which reduce the ~~snow pack~~snowpack and ~~may~~ can cause ~~brief~~ localized flooding.

2.2 Hydrology

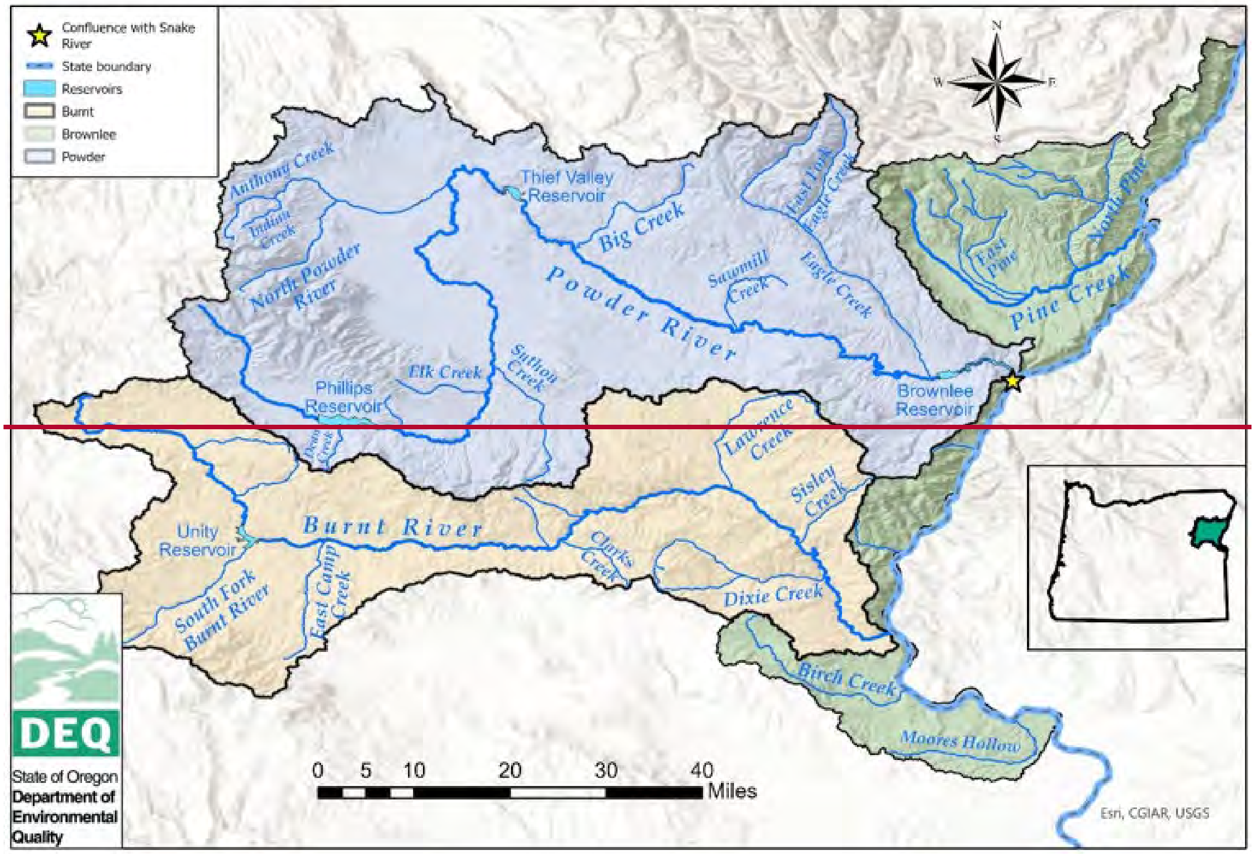
Major drainages in the Powder River Basin originate in mountainous areas in the western portion of the basin and flow east into Brownlee, or Oxbow, or Hells Canyon Reservoirs Reservoir on the Snake River (Figure 12.20). The two major rivers in the basin, the Powder and Burnt Rivers, begin in the Blue Mountains and flow for 144 and 100 miles, respectively, until the confluence with Brownlee Reservoir on ethe Snake River. Southern and middle drainages in the Brownlee Subbasin also drain to Brownlee Reservoir while ones north of Brownlee dam, including Pine Creek, drain into Oxbow or Hells Canyon Reservoirs on the Snake River.

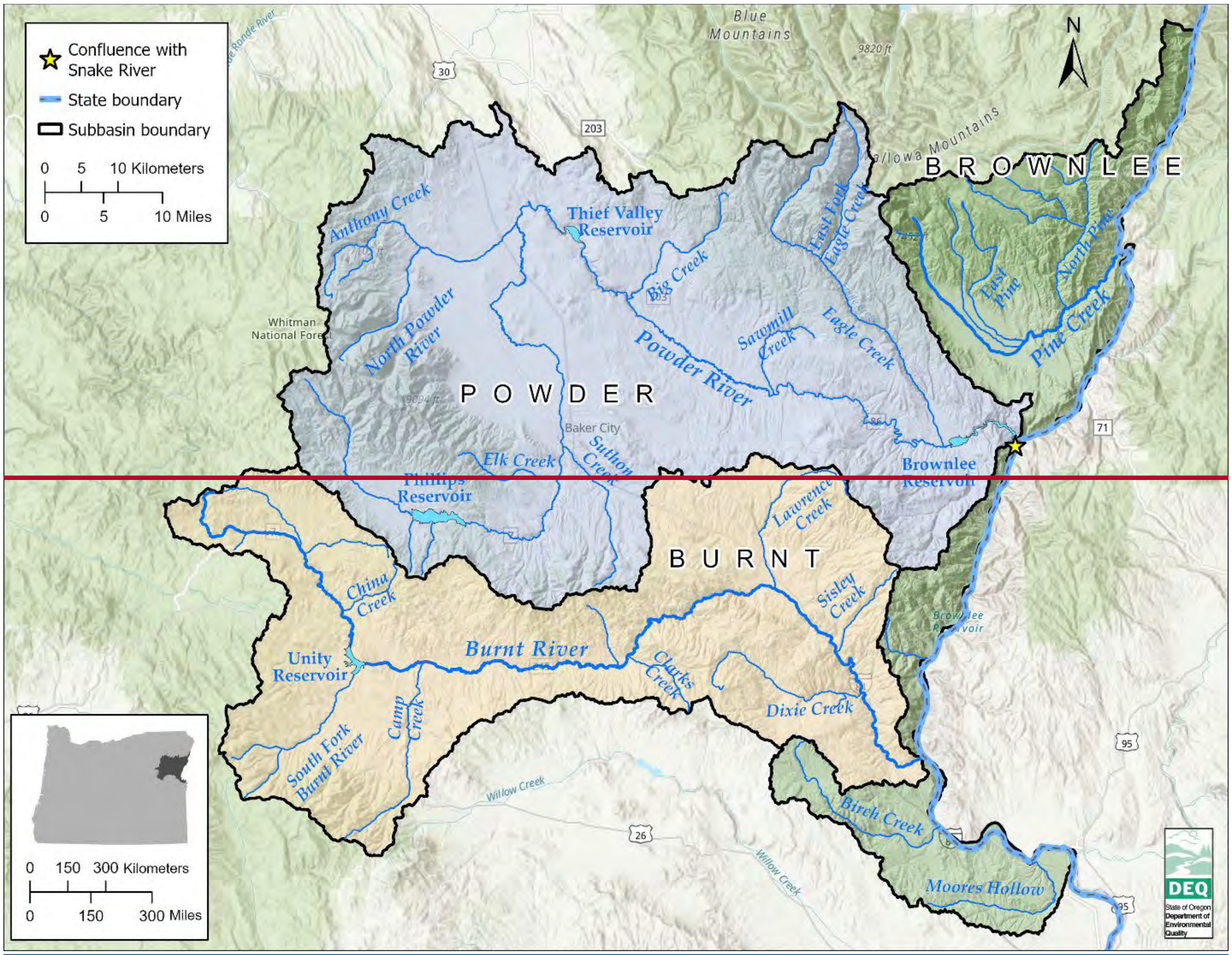
The Powder River has headwaters originate areas in the Blue Mountains (Elkhorn MountainsRange) west of Baker City near the town of Sumpter. Cracker Creek and McCully Fork join to form the Powder River. The river flows southwest before entering Phillips Reservoir, where Cracker Creek and McCully Fork join to form the Powder River. Downstream of the reservoir, Tthe river flowsturns north through the Baker Valley, and enters Thief Valley Reservoir to the east of the town of North Powder. Downstream of Thief Valley, the river and thenturns southeast throughand flows the Keating Valley, eventually entering and reaches Brownlee Reservoir on the Snake River near the town of Richland. Major tributaries include the North Powder River and Eagle Creek (Figure 12.20).

to the west of the The headwaters of the Burnt River headwaters beginsinclude the North, West, Middle, and South Forks of the Burnt River that headwater are located in the southern Blue Mountains (Figure 2.201). The forks flow into Unity Reservoir; the mainstem Burnt River begins immediately downstream of the Reservoir. The Burnt River flows near the town of Unity where the and flows east/southeast to and joins the Snake River downstream of the , from there it flows approximately 100 miles east to the Snake River near the town of Huntington. Major tributaries include Clarks Creek, Lawrence Creek, and Dixie Creek (Figure 2.201). d

The Powder River has headwater areas in the Elkhorn Mountains west of Baker City near the town of Sumpter, where Cracker Creek and McCully Fork join to form the Powder River. The river flows north through the Baker Valley, and then southeast through the Keating Valley and reaches Brownlee Reservoir on the Snake River near the town of Richland. The total length of the Powder River is approximately 144 miles. Major tributaries include the North Powder River and Eagle Creek. The Brownlee Subbasin includes all the streams that drain directly to the Snake River from an area just north of Ontario to the Hells Canyon area just north of the Wallowa County-Baker County line south to the town of Ontario. The largest stream in the Brownlee Subbasin is Pine Creek, which is located in the northern portion of the subbasin near the town of Halfway (Figure 2.201). The major streams and several reservoirs in the basin are shown on Figure 2.2.

Operation of the multiple rReservoir operations and irrigation conveyance systems in the basin influence the timing, amount, and duration of flows described below significantly defines hydrologic patterns in the Powder River Basin. DEQ's analyses found that increased bacteria loads are delivered to waterways during irrigation season higher flows, even in areas where livestock access occurs only during non-irrigation season (DEQ 2024a). DEQ considered seasonal hydrological patterns in determining bacteria load capacities, excess loads and allocations.


Confluence with Snake River
State boundary
Reservoirs
Burnt
Brownlee
Powder
N
W
E
S
Anthony Creek
Indian Creek
North Powder River
Thief Valley Reservoir
Big Creek
Powder River
East Fork Eagle Creek
Sawmill Creek
Eagle Creek
Elk Creek
Sutton Creek
Phillips Reservoir
Dean Creek
Brownlee Reservoir
East Pine
North Pine
Pine Creek
Lawrence Creek
Sisley Creek
Burnt River
Unity Reservoir
Clarks Creek
Dixie Creek
South Fork Burnt River
East Camp Creek
Birch Creek
Moores Hollow
0 5 10 20 30 40
Miles
DEQ
State of Oregon
Department of Environmental Quality
Esri, CGIAR, USGS


Confluence with Snake River
State boundary
Subbasin boundary
0 5 10 Kilometers
0 5 10 Miles
Blue Mountains
Wallowa Mountains
POWDER
BURNT
BROWNLEE
Anthony Creek
Thief Valley Reservoir
Big Creek
East Fork Eagle Creek
North Powder River
Powder River
Sawmill Creek
Eagle Creek
East Pine
North Pine
Pine Creek
Baker City
Sutton Creek
Elk Creek
Phillips Reservoir
Brownlee Reservoir
Lawrence Creek
China Creek
Sisley Creek
Unity Reservoir
Burnt River
Clarks Creek
Dixie Creek
Camp Creek
South Fork Burnt River
Willow Creek
Birch Creek
Moores Hollow
Whitman National Forest
0 150 300 Kilometers
0 150 300 Miles
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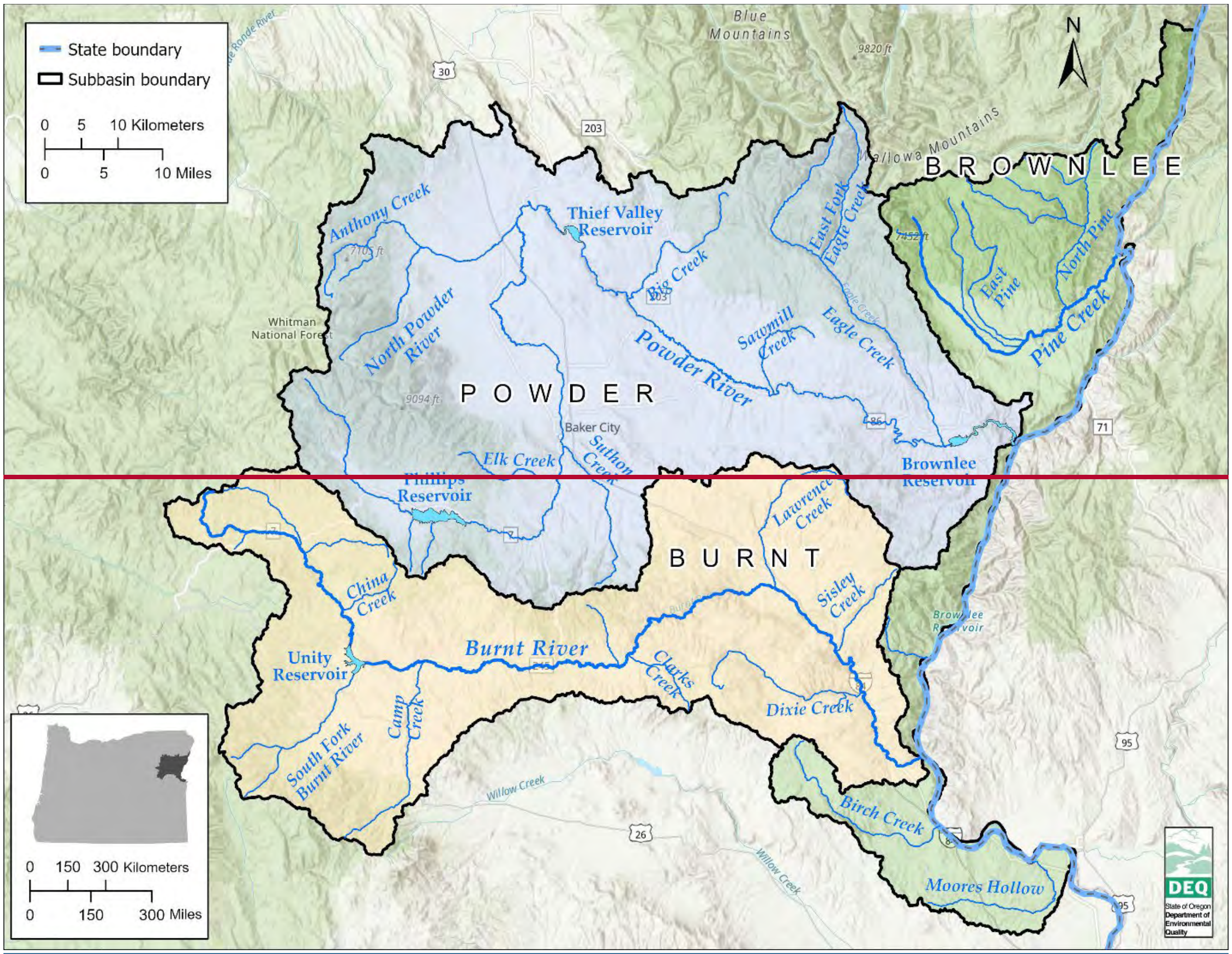


Figure 2.2: Major streams and reservoirs in the Powder River Basin

The timing and magnitude of stream flows in the Powder River Basin depend on seasonal patterns of temperature and precipitation. Generally, most precipitation occurs from late fall through early spring in the basin as snow- (November-Apriland rain (mostly in the valley floors), although monsoonal thunderstorms with intense, localized rainfall can occur during the summer months. With the exception ofExcept for periodic summertime storms, dry and warm conditions persist from late spring through early fall in the basin (May-October). Stream flows typically peak in late spring for rivers in the basin with significant winter snowpacks and decline throughout the summer through late fall. From late spring through early fall, a portion of stream flow and water stored in reservoirs enters the irrigation conveyance system within the basin.

Reservoir operations and irrigation systems in the basin further influence the timing, amount, and duration of flows in the Powder River Basin. According to the records Oregon Water Resources Department (OWRD) records, there are 69 dams with a height overgreater than 10 feet in height exist in the Powder River Basin. OWRD documents that and most of the water impounded stored in by these reservoirs is used forenters irrigation conveyance systems. There are tThree irrigation or water control districts manage irrigation water in the Powder Subbasin: the Baker Valley Irrigation District, the Lower Powder Irrigation District, and the Powder Valley Water Control District (divided into the Wolf Creek and Pilcher Creek sub-districts). The Burnt River Irrigation District manages irrigation water Irrigation in the Burnt River Subbasin is managed by the Burnt River Irrigation District. There are no fFormal irrigation or water control districts do not exist in the Brownlee ~~Reservoir~~ Subbasin; i~~. I, irrigation is managed by i~~ndividuals or informal user groups manage irrigation water ~~in that subbasin~~there. Available water ~~in the Powder Basin~~ is fully appropriated in the Powder River Basin. In low water years, all users may not receive adequate water supplies despite managers ~~will~~ drawing ~~-~~reservoirs ~~are often drawn~~ down to minimum levels. ~~— and there is not enough water to supply all users.~~

The Powder River Basin contains ~~There are~~ five reservoirs ~~in the Powder Basin~~ with ~~a~~ storage ~~capacity~~ capacities greater than 5,000 acre-feet. These include one (~~Unity Dam (~~Unity ~~Reservoir)~~) in ~~on~~ the Burnt Subbasin~~River,~~ and four (~~Thief Valley Dam (~~Thief Valley ~~Reservoir~~, Phillips ~~Reservoir~~, Pilcher Creek, and Wolf Creek) in the Powder Subbasin. ~~the and Mason Dam (Phillips Reservoir) on the Powder River, were constructed by t~~The U.S. Bureau of Reclamation constructed Unity, Thief Valley, and Phillips Reservoirs; all ~~and~~ are now operated by local irrigation districts. Pilcher Creek ~~Dam~~ and Wolf Creek ~~Dam~~ Dams ~~(not shown on Figure 2.2)~~ are owned and operated by the Powder Valley Water Control District. ~~These projects are discussed in more detail in following subsections.~~

2.2.1 Burnt River Irrigation Project

~~As shown on Figure 2.2,~~ Unity ~~Dam and~~ Reservoir ~~are~~ is located on the ~~upper~~ Burnt River about 40 miles southwest of Baker City (Figure 1~~2.2~~). Lands served by the irrigation project are scattered along the Burnt River downstream from Unity Reservoir near the towns of Hereford, Bridgeport, Durkee, Weatherby, Dixie, Lime, and Huntington. In addition, some lands upstream from the reservoir are included in the project. ~~Based on 1992 data, 15,070 acres received project water for growing forage crops (approximately 13,670 acres) and cereal crops such as corn and barley.~~

~~The Bureau of Reclamation reports that~~ Unity Dam is a zoned ~~earthfill~~earth fill dam 82 feet high and 694 feet long. ~~and t~~The maximum reservoir capacity is 25,800 acre-feet with a surface area of 926 acres. Unity Dam was completed in 1937 ~~to take advantage of the existing distribution system~~ and the ~~dam and~~ reservoir ~~have~~ has since been operated and maintained by the Burnt River Irrigation District. ~~and offer no flood control benefits.~~

~~Along with irrigation, Unity Reservoir provides area residents with recreation benefits such as camping, fishing, and boating administered by the Oregon State Parks Department.~~

2.2.2 Baker Irrigation Project

The Upper Division of the Baker Project furnishes irrigation water from Phillips Reservoir to 18,500 acres of land along both sides of the Powder River just north of Baker City. The Lower Division provides a supplemental water supply from Thief Valley Reservoir to about 7,300 acres of land along the Powder River in the Keating Valley about 10 miles northeast of Baker City.

Mason Dam on the Powder River near Sumpter, Ore.~~OR~~, is a zone earth and rockfill embankment dam measuring 173 feet high and 895 feet long. Mason dam creates Phillips Reservoir, which has a maximum capacity of 95,500 acre-feet and a surface area of 2,235 acres. Stored water is released into the Powder River for diversion downstream into existing distribution canals and laterals. Operation and maintenance of Upper Division facilities was transferred to the Baker Valley Irrigation District on August 23, 1968.

~~The Bureau of Reclamation reports that~~ Thief Valley Dam is a concrete slab and buttress dam 390 feet long and 73 feet high with a maximum reservoir capacity of 17,600 acre-feet and a surface area of 740 acres. Water stored in Thief Valley Reservoir is released for diversion downstream into existing distribution canals and laterals. The operation of Thief Valley Dam and facilities of the Lower Division were taken over by the Lower Powder River Irrigation District on June 1, 1932.

~~Mason Dam on the Powder River near Sumpter, OR, is a zone earth and rockfill embankment dam, measuring 173 feet high and 895 feet long. The re and impounds the Powder River near Sumpter, OR. Mason dam Phillips Reservoir has a maximum capacity of 95,500 acre-feet and a surface area of 2,235 acres and stored water is released into the Powder River for diversion downstream into existing distribution canals and laterals. Operation and maintenance of Upper Division facilities was transferred to the Baker Valley Irrigation District on August 23, 1968.~~

2.2.3 Powder Valley Water Control District

The Powder Valley Water Control District owns and operates Wolf Creek and Pilcher Creek Reservoirs. These systems ~~, which~~ provide irrigation water to land located in the North Powder and ~~northern~~ Baker valleys in the vicinity of the City of North Powder (~~see~~ Figure ~~2.0~~ 21 for general location). Completed in 1974, the reservoir behind Wolf Creek dam is approximately 220 acres in area and stores approximately 12,000 acre-feet. Pilcher Creek Reservoir was completed in 1984 and is approximately 222 acres in area and stores approximately 5,900 acre-feet. Operated as one pool, Wolf Creek Reservoir usually draws down quicker than Pilcher Creek Reservoir, so to balance out the system, water is transferred via a canal between the two sites. Additional water from Pilcher Creek Reservoir is also put instream via the North Powder River for irrigation both to the north and south of the river. Due to the connectivity of the system, the project is often referred to as the Wolf Creek Reservoir Complex.

2.3 Land use/land cover

~~As summarized in Table 2.3 and shown in Figure 2.3, t~~The largest percentage of land use/land cover in ~~the~~ Powder River Ba~~ba~~sin ~~is~~ consists of scrub-shrub, followed by forest and grasslands~~;~~ (Table 2~~.3~~). ~~d~~Developed urban areas are minimal, with the largest being Baker City (population approximately 9,700). Land ownership is divided equally between ~~, located near the center of the basin; and pP~~private and federal ~~ownership are about equal and dominant~~. Areas of irrigated agriculture are found along~~:~~ the Burnt River~~;~~, the North Powder River~~;~~, the Powder River ~~in Baker Valley~~ north of Baker City, in the Keating Valley, and near Richland~~;~~, and along~~and in the~~ Pine ~~Valley~~ Creek near Halfway (~~see~~ Figure 2~~.03~~). Grassland/shrub areas ~~are located in the~~ occur in the valley plains and foothill areas ~~and~~ while forested areas are concentrated in the mountains.

Table 2: 2019 Land cover classes and percentages in the Powder River Basin (Dewitz, J., and U.S. Geological Survey, 2021)~~Table 2.3: 2019 Land cover classes and percentages in the Powder River Basin~~

NLCD Land Cover Class	Acres	Percent of the basin
Shrub/Scrub	1016650	46.1
Evergreen Forest	593939	26.9
Herbaceous	366166	16.6
Hay/Pasture	78513	3.6
Cultivated Crops	65532	3.0

NLCD Land Cover Class	Acres	Percent of the basin
Developed, Open Space	24548	1.1
Emergent Herbaceous Wetlands	20737	0.9
Open Water	13869	0.6
Barren Land	7770	0.4
Developed, Low Intensity	6675	0.3
Woody Wetlands	5871	0.3
Developed, Medium Intensity	3527	0.2
Developed, High Intensity	215	<0.1
Deciduous Forest	103	<0.1
Mixed Forest	45	<0.1
Total:	2204160	100.0

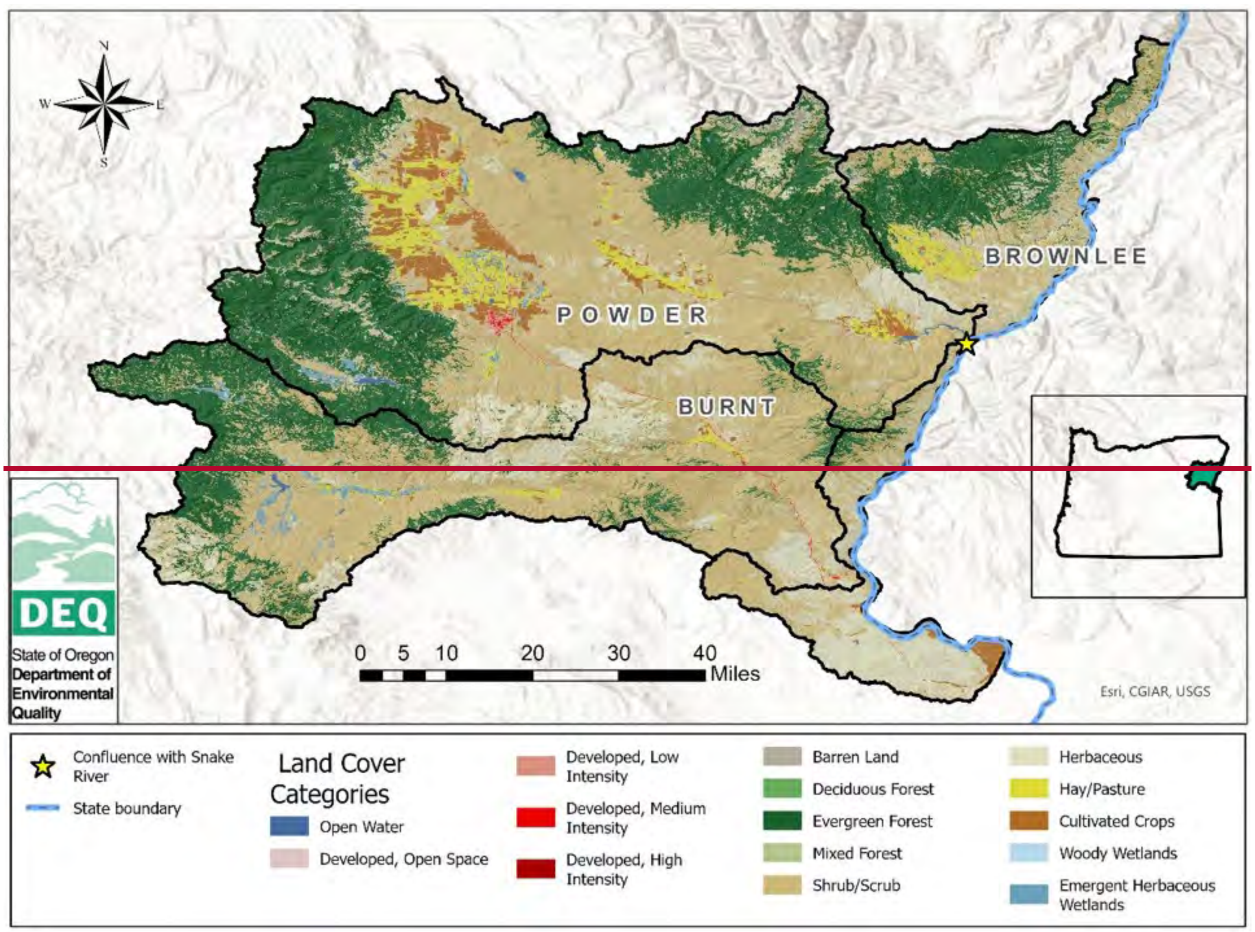
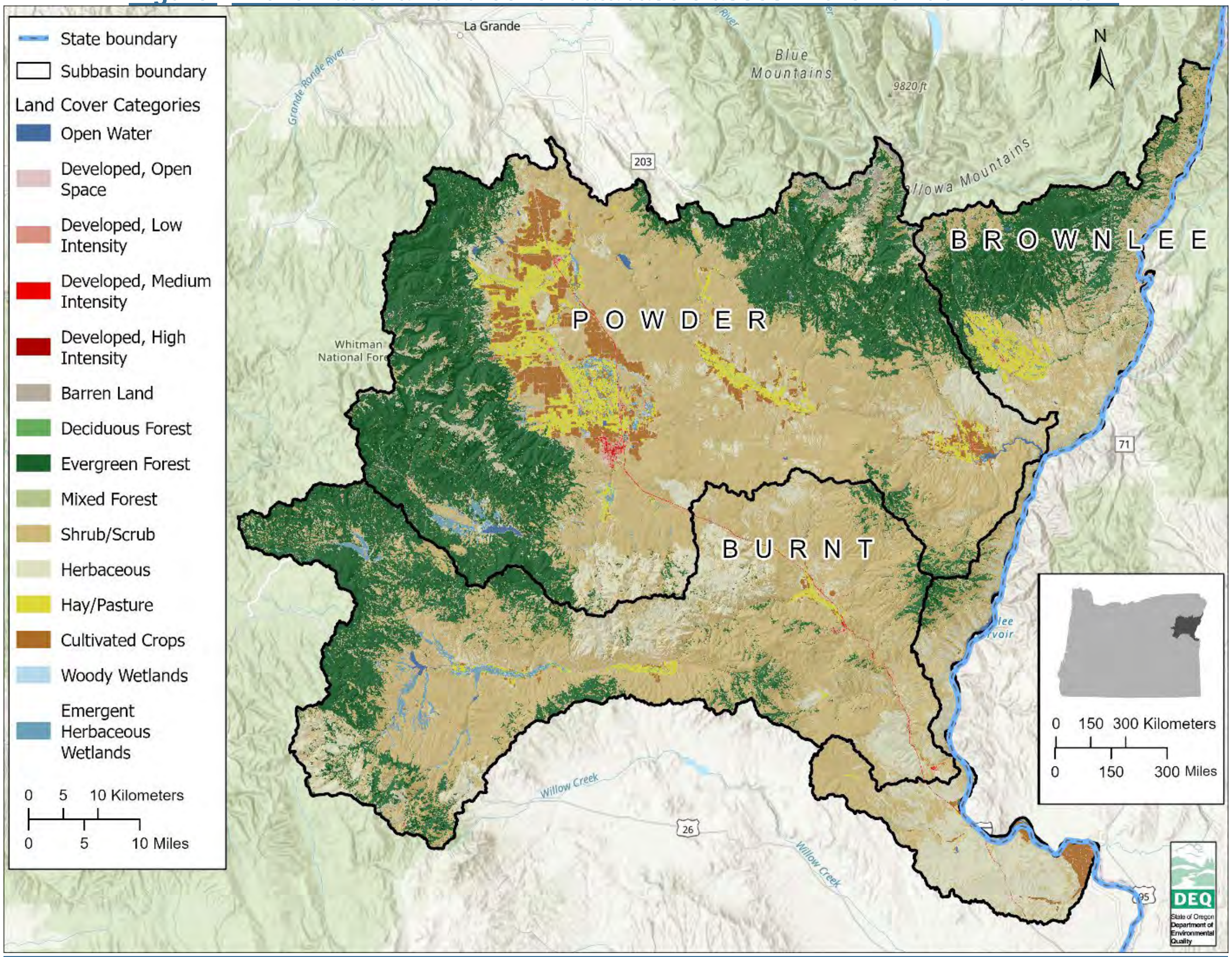


Figure 2: 2019 National land cover database classes in the Powder River Basin



~~Figure 2.3: 2019 National land cover database classes in Powder River Basin~~

3. Pollutant identification

As stated in OAR 340-042-0040(4)(b), this element identifies the pollutants causing impairment of water quality that are addressed by this TMDL. The associated water quality standards and beneficial uses are identified in Chapter 4.

~~The table~~Table 3~~.0~~ and ~~figure~~ Figure 3~~.0~~ ~~in this section~~ present~~s~~ stream and watershed assessment units ~~within~~ in the Powder River Basin that were listed as impaired for ~~bacteria *E. coli*~~*E. coli* and fecal coliform on DEQ's 2022 Clean Water Act Section 303(d) List (as part of DEQ's Integrated Report), which was approved by EPA on September 1, 2022 (DEQ 2022a). One assessment unit within the Powder River Basin is listed as impaired for fecal coliform (Table 3). This assessment unit was added to the 303(d) list in 1998 and is based on a previously applicable criterion. Additional information about the fecal coliform listing is included in Section 3 of the TMDL Technical Support Document. ~~Status categoriesy designations are prescribed assigned by~~ Sections 305(b) and 303(d) of the Clean Water Act assigns status categories. ~~and are summarized in~~ Section 3 of the TMDL Technical Support Document summarizes the assigned categories in the Powder River Basin. Assessment units listed ~~in~~ as Category 5 (data indicate a designated use is not supported or a water quality standard is not attained~~designated use is not supported or a water quality standard is not attained~~) require ~~development of~~ a TMDL.

DEQ's evaluations include data and information collected within the basin ~~spanning decades~~from 1990 to 2024 and includes consideration of past EPA-approved Integrated Reports, specifically the 2012 and 2018-20 impairment listings and categories. Comparisons between these and the 2022 impairments indicate some ~~divergences~~differences. Tabulated comparisons and explanations are provided in the TMDL Technical Support Document (DEQ~~,~~ 2024a). DEQ developed this TMDL to be implemented to achieve attainment of the applicable water quality criteria to support the ~~associated~~ designated beneficial uses, as specified in Section 4 of this document.

DEQ developed ~~this~~ the Powder River Basin Bacteria TMDL to address Category 5 listed assessment units and to serve as a protection plan for all other assessment categories in the basin, including unimpaired and unassessed. The allocations and implementation framework apply year-round to all freshwater perennial and intermittent streams in the basin (Sections 5, 8, and 9)~~, as described in Sections 5, 8 and 9 of this document~~. The implementation framework ~~is~~ presented in the ~~Powder River Basin Bacteria TMDL Water Quality Management Plan~~WQMP (DEQ~~,~~ 2024b) ~~and includes~~describes ~~possible~~potential implementation activities, ~~and~~ timeframes to ~~improve water quality~~achieve water quality targets, ~~as well as~~and measures of success (Section 12). ~~These and other protection plan elements are further explained in Section 12, below.~~

Table 3~~.0~~ ~~presents~~ describes the relevant *E. coli* ~~bacteria~~303(d) listings and the assessment units where the proposed TMDL applies~~for which DEQ developed this TMDL~~. ~~The extent of~~Figure 3~~.0~~ displays the locations of assessment units listed as Category ~~5 assessment units (for both stream segment and watershed assessment types) are mapped in Figure 3~~5 in the 2022 EPA-approved Integrated Report (DEQ 2022a)~~.0~~. ~~Further information is available in~~ ~~S~~Section 3 of the ~~TMDL~~ Technical Support Document provides ~~detailed~~ information on these listings (DEQ~~,~~ 2024a).

Table 3: Powder River Basin *E. coli* and fecal coliform assessment units and status on Oregon's 2022 Integrated Report~~Table 3.0: Powder River Basin bacteria*E. coli* and fecal coliform assessment units and status on Oregon's 2022 Integrated Report~~

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
Brownlee Subbasin				
OR_LK_1705020102_05_100576	Love Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020102_05_100577	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020103_05_100578	Brownlee Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100579	Clear Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100580	Fish Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100581	Crow Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020107_05_100582	Hells Canyon Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020107_05_100583	Oxbow Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020101_02_103229	Snake River	River and stream	*E. coli*	Unassessed
OR_SR_1705020102_05_102789	Birch Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102790	Pine Creek	River and stream	*E. coli*	2
OR_SR_1705020106_05_102791	Lake Fork Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102792	North Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102793	Pine Creek	River and stream	*E. coli*	2
OR_SR_1705020106_05_102794	Dry Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102795	Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102796	North Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020107_05_102797	McGraw Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020107_05_102798	Spring Creek	River and stream	*E. coli*	Unassessed
OR_WS_170502010101_05_103097	HUC12 Name: Moores Hollow	Watershed Unit (1st through 4th order streams)	*E. coli*	4A[1]
OR_WS_170502010106_05_103227	HUC12 Name: Bridge Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010201_05_103226	HUC12 Name: Road Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010202_05_103098	HUC12 Name: Upper Birch Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010203_05_103099	HUC12 Name: Love Reservoir	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010204_05_103100	HUC12 Name: Lower Birch Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010205_05_103101	HUC12 Name: Benson Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010206_05_103225	HUC12 Name: Grouse Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502010301_05_103224	HUC12 Name: Ryan Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010303_05_103223	HUC12 Name: Morgan Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010304_05_103222	HUC12 Name: Dennett Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010306_05_103221	HUC12 Name: Raft Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010307_05_103220	HUC12 Name: Jackson Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010401_05_103219	HUC12 Name: Cottonwood Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010403_05_103218	HUC12 Name: Dukes Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010601_05_103102	HUC12 Name: Headwaters Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010602_05_103103	HUC12 Name: McMullen Slough	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010603_05_103104	HUC12 Name: Clear Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010604_05_103105	HUC12 Name: Deer Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010605_05_103106	HUC12 Name: East Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010606_05_103107	HUC12 Name: Fish Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010607_05_103108	HUC12 Name: Upper North Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010608_05_103109	HUC12 Name: Lake Fork Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010609_05_103110	HUC12 Name: Lower North Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010610_05_103111	HUC12 Name: Sheep Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010701_05_103228	HUC12 Name: Oxbow Dam-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010703_05_103217	HUC12 Name: Herman Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010704_05_103216	HUC12 Name: McGraw Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010705_05_103215	HUC12 Name: Hells Canyon Dam-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Powder Subbasin				
OR_LK_1705020301_05_100588	Phillips Lake	Lake/Reservoir	*E. coli*	2
OR_LK_1705020303_05_100589	Smith Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020303_05_100590	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020303_05_100591	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020304_05_100592	Rock Creek Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020305_05_100593	Pilcher Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100594	Wolf Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_LK_1705020306_05_100595	Shaw Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100596	Jimmy Creek	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100597	Thief Valley Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020307_05_100598	Fisk Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100599	Balm Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100600	Love Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100601	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100602	Echo Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100603	Lookingglass Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100604	Eagle Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020311_05_100605	Brownlee Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020303_02_107258	Highway 203 Pond	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020301_05_102812	Cracker Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020301_05_102813	McCully Fork	River and stream	*E. coli*	Unassessed
OR_SR_1705020301_05_102814	Powder River	River and stream	*E. coli*	2
OR_SR_1705020302_05_102815	Powder River	River and stream	Fecal coliform	5
OR_SR_1705020302_05_102815	Powder River	River and stream	*E. coli*	2
OR_SR_1705020303_05_102816	Powder River	River and stream	*E. coli*	2
OR_SR_1705020305_05_102817	North Powder River	River and stream	*E. coli*	5
OR_SR_1705020304_05_102818	Powder River	River and stream	*E. coli*	2
OR_SR_1705020306_05_102819	Powder River	River and stream	*E. coli*	Unassessed
OR_SR_1705020306_05_102820	Antelope Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020306_05_102821	Powder River	River and stream	*E. coli*	3
OR_SR_1705020307_05_102822	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020307_05_102823	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020307_05_102824	Beagle Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020308_02_102825	Clover Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020308_05_102826	Powder River	River and stream	*E. coli*	2
OR_SR_1705020308_05_102827	Clover Creek	River and stream	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_SR_1705020308_05_102828	Goose Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020309_05_102829	Powder River	River and stream	*E. coli*	5
OR_SR_1705020310_05_102830	Eagle Creek	River and stream	*E. coli*	5
OR_SR_1705020311_05_102831	Powder River	River and stream	*E. coli*	Unassessed
OR_WS_170502030101_05_103151	HUC12 Name: Cracker Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030102_05_103152	HUC12 Name: McCully Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030103_05_103153	HUC12 Name: Hawley Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030104_05_103154	HUC12 Name: Clear Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030105_05_103155	HUC12 Name: Deer Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030106_05_103156	HUC12 Name: Union Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030201_05_103157	HUC12 Name: Lake Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030202_05_103158	HUC12 Name: Stices Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030203_05_103159	HUC12 Name: Beaver Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030204_05_103160	HUC12 Name: Elk Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030205_05_103161	HUC12 Name: Ebell Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030206_05_103162	HUC12 Name: Sutton Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030207_05_103163	HUC12 Name: Blue Canyon-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030301_05_103164	HUC12 Name: Upper Baldock Slough	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030302_05_103165	HUC12 Name: Lower Baldock Slough	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030303_05_103166	HUC12 Name: Old Settlers Slough	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030304_05_103167	HUC12 Name: Estes Slough-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030401_05_103168	HUC12 Name: Upper Salmon Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030402_05_103169	HUC12 Name: Lower Salmon Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030403_05_103170	HUC12 Name: Willow Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030404_05_103171	HUC12 Name: Rock Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030405_05_103172	HUC12 Name: Big Muddy Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030406_05_103173	HUC12 Name: Sand Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030407_05_103174	HUC12 Name: Warm Springs Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030408_05_103175	HUC12 Name: Gentry Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502030501_05_103176	HUC12 Name: Upper North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030502_05_103177	HUC12 Name: Middle North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030503_05_103178	HUC12 Name: Upper Anthony Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030504_05_103179	HUC12 Name: Lower Anthony Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030505_05_103180	HUC12 Name: Lower North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030601_05_103181	HUC12 Name: Upper Wolf Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030602_05_103182	HUC12 Name: Lower Wolf Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030603_05_103183	HUC12 Name: Jimmy Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030604_05_103184	HUC12 Name: Antelope Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030605_05_103185	HUC12 Name: Thief Valley Reservoir-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030606_05_103186	HUC12 Name: Magpie Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030701_05_103187	HUC12 Name: Upper Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030702_05_103188	HUC12 Name: Middle Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030703_05_103189	HUC12 Name: Beagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030704_05_103190	HUC12 Name: Lower Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030801_05_103191	HUC12 Name: Salt Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030802_05_103192	HUC12 Name: Crews Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030803_05_103193	HUC12 Name: Tucker Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030804_05_103194	HUC12 Name: Ruckles Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030805_05_103195	HUC12 Name: Balm Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030806_05_103196	HUC12 Name: Clover Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030807_05_103197	HUC12 Name: Goose Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030808_05_103198	HUC12 Name: Ritter Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030901_05_103199	HUC12 Name: Love Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030902_05_103200	HUC12 Name: Fivemile Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030903_05_103201	HUC12 Name: Maiden Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030904_05_103202	HUC12 Name: Hyall Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030905_05_103203	HUC12 Name: Chalk Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031001_05_103204	HUC12 Name: Headwaters Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502031002_05_103205	HUC12 Name: West Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031003_05_103206	HUC12 Name: Bennett Creek-Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031004_05_103207	HUC12 Name: East Fork Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031005_05_103208	HUC12 Name: Paddy Creek-Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031006_05_103209	HUC12 Name: Little Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031007_05_103210	HUC12 Name: Lower Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031101_05_103211	HUC12 Name: Daly Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031102_05_103212	HUC12 Name: Immigrant Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031103_05_103213	HUC12 Name: Foster Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Burnt Subbasin				
OR_LK_1705020201_05_100584	Unity Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020202_05_100585	Whited Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020202_05_100586	Elms Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020203_05_100587	Higgins Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020201_05_102799	tributary to Trout Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102800	North Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102801	Trout Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102802	North Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020202_05_103265	South Fork Burnt River	River and stream	*E. coli*	5
OR_SR_1705020202_05_103266	South Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020203_05_103267	Camp Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020203_05_103268	Camp Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020204_05_102803	Burnt River	River and stream	*E. coli*	2
OR_SR_1705020204_05_102804	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020205_05_102805	Burnt River	River and stream	*E. coli*	5
OR_SR_1705020205_05_102806	Clarks Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020205_05_102807	Auburn Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020207_05_102808	Durkee Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020206_05_102809	Burnt River	River and stream	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_SR_1705020208_05_102810	Burnt River	River and stream	E. coli	2
OR_SR_1705020208_05_102811	Dixie Creek	River and stream	E. coli	2
OR_WS_170502020101_05_103112	HUC12 Name: Headwaters North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020102_05_103113	HUC12 Name: Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020103_05_103114	HUC12 Name: Patrick Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020104_05_103115	HUC12 Name: Trout Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020105_05_103116	HUC12 Name: Petticoat Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020106_05_103117	HUC12 Name: West Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	2
OR_WS_170502020107_05_103118	HUC12 Name: Middle Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	5
OR_WS_170502020108_05_103119	HUC12 Name: Antelope Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020201_05_103120	HUC12 Name: Upper South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020202_05_103121	HUC12 Name: Middle South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020203_05_103262	HUC12 Name: Lower South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020204_05_103122	HUC12 Name: Job Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020301_05_103123	HUC12 Name: West Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020302_05_103124	HUC12 Name: East Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020303_05_103125	HUC12 Name: Higgins Reservoir-Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020401_05_103126	HUC12 Name: Pine Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020402_05_103127	HUC12 Name: Rock Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020403_05_103128	HUC12 Name: Upper Big Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020404_05_103129	HUC12 Name: Lower Big Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020405_05_103130	HUC12 Name: Independence Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020501_05_103131	HUC12 Name: Mill Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020502_05_103132	HUC12 Name: Clarks Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020503_05_103133	HUC12 Name: Auburn Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020601_05_103134	HUC12 Name: Dark Canyon-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020602_05_103135	HUC12 Name: Cave Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020603_05_103136	HUC12 Name: Powell Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020701_05_103137	HUC12 Name: Lawrence Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502020702_05_103138	HUC12 Name: Upper Alder Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020703_05_103139	HUC12 Name: Lower Alder Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020704_05_103140	HUC12 Name: Durkee Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020705_05_103141	HUC12 Name: Pritchard Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020801_05_103142	HUC12 Name: Manning Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020802_05_103143	HUC12 Name: Swayze Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020803_05_103144	HUC12 Name: Shirttail Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020804_05_103145	HUC12 Name: Sisley Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020805_05_103146	HUC12 Name: North Fork Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020806_05_103147	HUC12 Name: South Fork Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020807_05_103148	HUC12 Name: Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020808_05_103149	HUC12 Name: Jett Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020809_05_103150	HUC12 Name: Durbin Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Note: [1]Listed as Category 4A under the Malheur Basin TMDL. It will be reassigned to the Powder River Basin Bacteria TMDL.				

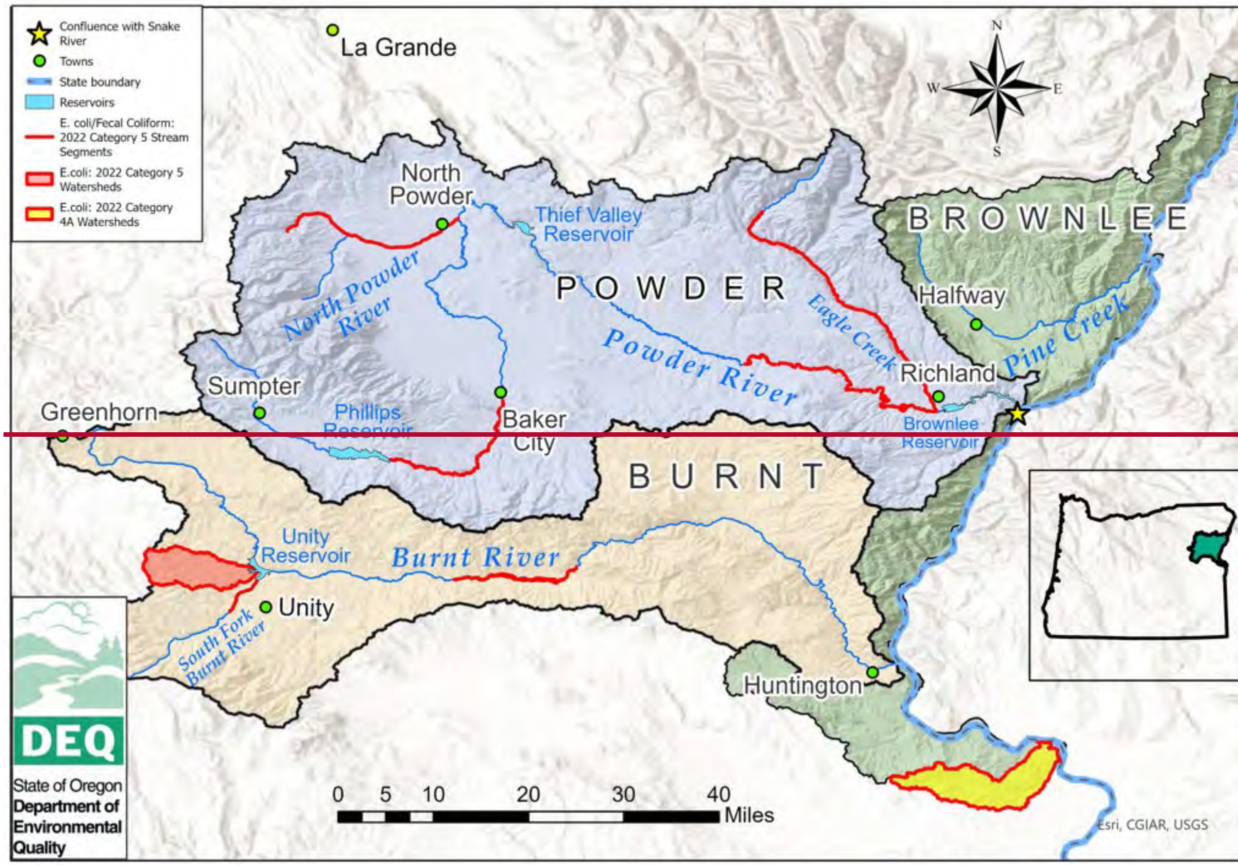
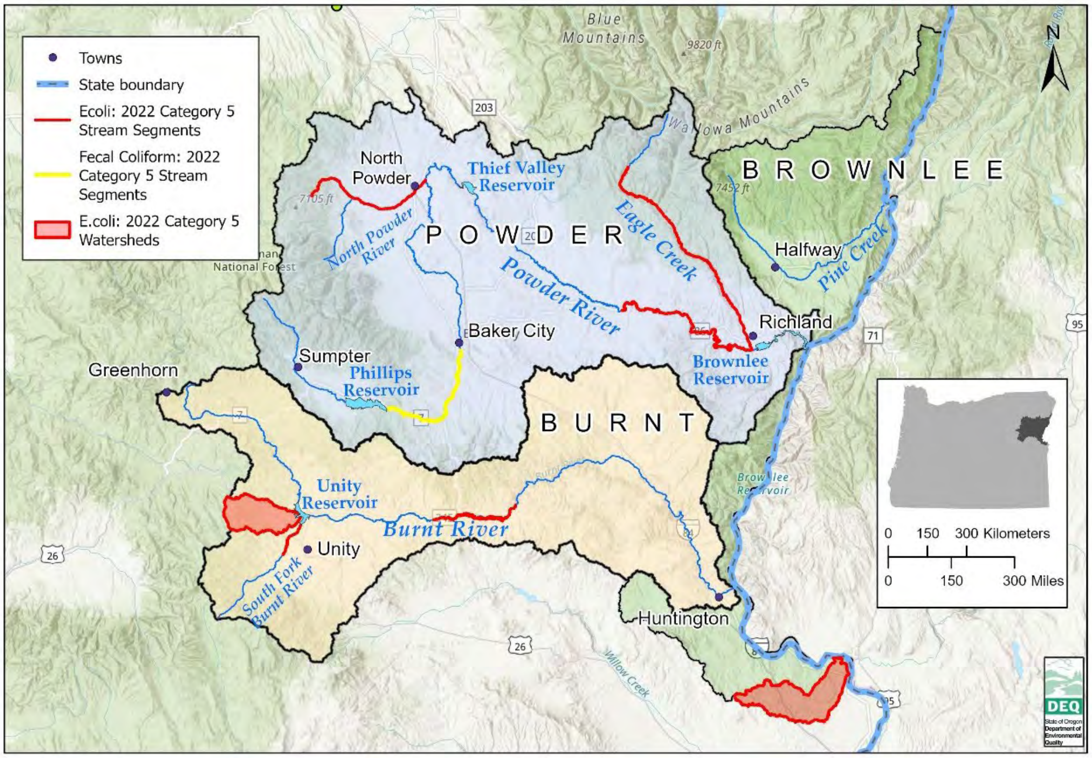

Confluence with Snake River
Towns
State boundary
Reservoirs
E. coli/Fecal Coliform: 2022 Category 5 Stream Segments
E.coli: 2022 Category 5 Watersheds
E.coli: 2022 Category 4A Watersheds
La Grande
North Powder
Thief Valley Reservoir
POWDER
North Powder River
Powder River
Eagle Creek
BROWNLEE
Halfway
Pine Creek
Richland
Sumpter
Greenhorn
Phillips Reservoir
Baker City
Brownlee Reservoir
BURNT
Unity Reservoir
Burnt River
Unity
South Fork Burnt River
Huntington
0 5 10 20 30 40 Miles
DEQ
State of Oregon Department of Environmental Quality
Esri, CGIAR, USGS

Figure 3: Powder River Basin *E. coli* and fecal coliform Category 5 assessment units (2022)



~~Figure 3.0: Powder River Basin bacteria~~*E. coli* and fecal coliform ~~impaired~~ Category 5 ~~assessment units~~ (2022)

4. Water quality standards and beneficial uses

As stated in OAR 340-042-0040(4)(c), this element identifies the beneficial uses in the basin, specifying the most sensitive beneficial use, and the relevant water quality standards established in OAR 340-041-0202 through 340-041-0975. Achieving water quality standards for a pollutant that protects the ~~most sensitive~~ beneficial use in the basin most sensitive to impairment by that pollutant ~~in the basin~~ ensures that all ~~By design, achievement of Oregon's water quality criteria protective of the most sensitive beneficial use protects all~~ beneficial uses are also protected. Table 4~~.0a~~ describes beneficial uses in the Powder River Basin.

~~As noted in Table 4.0b, fe~~Fecal contamination can affect multiple beneficial uses, including water contact recreation and fish and aquatic life (Table ~~4.0b~~5)~~-~~. In the Powder River Basin, ~~W~~water contact recreation is ~~the~~designated the most sensitive ~~The most sensitive~~ beneficial use affected by fecal contamination~~ in the Powder River Basin~~. Exposure to waters ~~fecal~~ contaminated ~~waters~~by fecal material ~~to fecal material~~ during ~~water contact recreation, including~~ swimming, boating, fishing, other water sports, or recreating on beaches/river banks~~,~~ increases the risk of contracting mild to severe illnesses~~ diseases found in fecal materialtof which is human contact of waters for recreational purposes with respect to potential exposure by~~

pathogens found with bacteria in fecal material. E. coliE. coli is an indicator of fecal contamination from human or other warm-blooded animals in Oregon's freshwatersThe E. coli criterionstandards is established to protect the beneficial use of human contact of waters for recreational purposes (water contact recreation) with respect to potential exposure to pathogens found with bacteria in fecal material. Recreational use not only includes swimming but any activity that could result in ingestion of water, such as: fishing, through contact of hands with water; any water sports; children playing along the banks or shores; and others. Recreational use of fecal contaminated waters can lead to mild to severe illnesses in humans.

Water with high levels of fecal contamination can also pose a disease risk to livestock and wildlife. -Infections likesuch as Johne's disease are caused byresult from ingestion of fecal material from sick animals bacteria in manure of infected animals, which serves as an ongoing reservoir of the bacteria. This potentially fatale disease reducesdecreases weight gain in cattle, can be fatal and leads tocauses wasting symptoms in deer. Fecal contamination of water used for irrigation water also raises the increases the risk of pathogen -produce crop contamination of food crops. Although the TMDL addresses water quality standards designed to protect water recreational contact, beneficial uses of -water contact recreation not the most sensitive beneficial use, irrigation and livestock watering are prevalent beneficial uses in the Powder River Basin and will also be protected through implementation of this TMDL.

Tables 4.0a and Table 4.0b5 specify identify designated beneficial uses of Powder River Basin surface waterof surface waters in the Powder River Basin specified in OAR 340-041-0260. Table 260A, -and the applicable numeric and narrative water quality standards addressed by this the TMDL, as well as indicateand the most sensitive beneficial uses related to each standard.

As explained in Section 3 of the TMDL Technical Support Document and Section 4 of this document, eDElevated E. coliE. coli bacteria loads impairconcentrations in surface waters indicate impairments of water contact recreation (and loa the most sensitive beneficial use) in the basin (Section 43 and Section 34 of the Technical Support Document). (water contact recreation) in freshwaters. The TMDL sets acceptable loadslevels of E. coliE. coli in surface waters that do not impairthat allow bacteria impairments are addressed by this TMDL to support water contact recreation use to be supported. Therefore, the TMDL protects all hus and ; thus and, hence, protectings all beneficial uses in the basin related to fecal contaminationon.

TaTable 4: Powder River Basin designated beneficial uses (from OAR 340-041-0260 Table 260A)ble 4.0a: Powder River Basin designated beneficial uses

All streams and tributaries theretoAll Basin Waters
Public Domestic Water Supply
Private Domestic Water Supply
Industrial Water Supply
Irrigation
Livestock Watering
Fish and Aquatic Life

~~All streams and tributaries thereto~~**All Basin Waters**
Wildlife and Hunting
Fishing
Boating
Water Contact Recreation
Aesthetic Quality

Table 5: Applicable water quality standards and most sensitive beneficial uses~~Table 4.0b: Applicable water quality standards and most sensitive beneficial uses~~

Parameter	Citation	Summary of applicable standards	Applicable water	Most sensitive beneficial use
Bacteria	OAR 340-041-009(1)(a)	(A) 90-day geometric mean (of 5 or more samples) of 126 ~~*E. coli*~~*E. coli* organisms per 100 mL (B) No single sample may exceed 406 ~~*E. coli*~~*E. coli* organisms per 100 mL	Fresh water	Water contact recreation
Statewide Narrative Criteria	OAR 340-041-0007(1)	The highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided ~~so as~~ to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest possible levels.	All waters of the state	Fish and aquatic life

From 2000-2024~~—2019~~, ~~E~~exceedances of the water contact recreation criteria for *E.coli*, including both ~~*E. coli* log~~ geometric mean ~~criterion~~ (126 ~~*E. coli*~~*E. coli* organisms/100 mL) and single sample criterion (406 ~~*E. coli*~~*E. coli* organisms/100 mL) have both been observed (see the Technical Support Document) ~~year-round, although exceedances are more common during the irrigation season~~. DEQ used both criteria to identify and ~~develop~~set the percent reduction~~s~~ needed to achieve water quality standards across all flow conditions (Section 4.5 of the Technical Support Document) ~~As explained in Section 4.5.2 of the TMDL Technical Support Document, DEQ used the single sample maximum criterion as the maximum daily concentration for the TMDL and specified that this concentration will not be exceeded over the 90-day period, so that the geometric mean criterion is also met~~.

~~As noted in Table 4.0b, fecal contamination threatens or impairs~~can affect ~~multiple beneficial uses~~. The most ~~, the most sensitive~~ beneficial use ~~of which is human contact of waters for recreational purposes with respect to potential exposure by pathogens found with bacteria in fecal material. The *E. coli* criterion is established to protect the beneficial use of human contact of waters for recreational purposes (water contact recreation) with respect to potential exposure to pathogens found with bacteria in fecal material. Recreational use not only includes swimming but any activity that could result in ingestion of water, such as: fishing, through contact of hands with water; any water sports; children playing along the banks or shores; and others. Recreational use of fecal contaminated waters can lead to mild to severe illnesses in humans.~~

Water with high levels of fecal contamination can also pose a disease risk to livestock and wildlife. Infections like Johne's disease are caused by ingestion of bacteria in manure of infected animals, which serves as an ongoing reservoir of the bacteria. The disease reduces weight gain in cattle, can be fatal and leads to wasting symptoms in deer. Fecal contamination of irrigation water also raises the risk of produce crop contamination. Although not the most sensitive beneficial use, irrigation and livestock watering are prevalent beneficial uses in the Powder River Basin and will also be protected through implementation of this TMDL.

Because waters of tThe Powder River, Burnt River, and streams in the Brownlee Subbasins drain to reservoirs oin the Snake River, which formings the border between the northeast portion of Oregon and Idaho. Therefore, DEQ considered downstream water quality standards, identified impairments, and effects of implementation implementing theof this TMDL. The mainstem Snake River does not currently have Category 5 listing for *E. coliE. coli* fecal indicator bacteria listings by in either Oregon or Idaho at or downstream of discharges from the Powder River Basin in Oregon or Idaho. The flow volumes of the Powder, Burnt and Brownlee Subbasins are very small, relative to the Snake River flows. These smaller flows at multiple discharge points are unlikely to measurably improve or degrade bacteria conditions in the Snake River. However, because Oregon and Idaho share comparable similar criteria for *E. coliE. coli* criteria (IDEQ, 2023). Thus, , DEQ concluded that implementation of the TMDL allocations in Powder, Burnt, and Brownlee Ssubbasins will result in attainment of both state's *bacteria E. coliE. coli* water quality criteria at the points of discharge into reservoirs on the to the Snake River.

5. Seasonal variation and critical conditions for *bacteriaE. coliE. coli*

Per OAR 340-042-0040(4)(j) and 40 Code of Federal Regulation130.7(c)(1), TMDLs must also identify any seasonal variation and the critical condition or period of for each pollutant, if applicable.

The timing and magnitude of stream flows in the Powder River Basin depend on seasonal patterns of temperature and precipitation. Generally, most precipitation occurs from late fall through early spring in the basin as a mixture of snow and rain (mostly in the valley floors), although monsoonal thunderstorms with intense, localized rainfall can occur during the summer months. With the exception toof periodic summertime storms, dry and warm conditions persist from late spring through early fall in the basintfalls from , magSeasonal variations are observed in the hydrologic conditions of the Powder River Basin due to alternating dryer conditions in late spring through early fall and wetter conditions in late fall through early spring. Stream flows typically peak in late spring for systemsrivers in the basin with significant winter snowpacks and decline throughout the summer through late fall. From late spring through early fall, a portion of stream flow and water stored in reservoirs enters the irrigation conveyance system inwithin the basin.During the

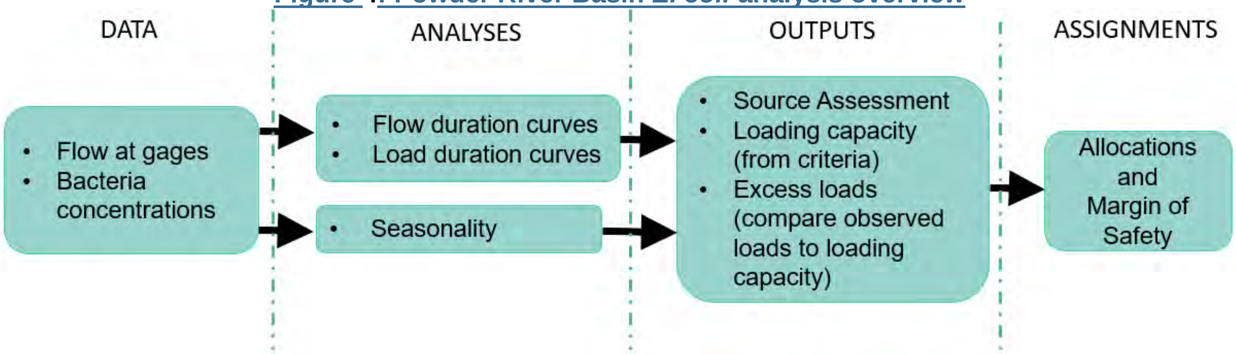
Stream flows during winter months DEQ evaluated *E. coliE. coli* concentrations and loads during these two hydrologic periods as defined as late spring through early fall (“irrigation season” (April – October)May-October) and late fall through early spring (“non-irrigation season,” (November – March)November-April) respectively. These periods are based on differences in climate, hydrology, and water management practices, including irrigation (Section 2)., which Dividing the analysis into these periods allowed an assessment of the potential role of irrigation return water in contributed to excess instream *bacteria E. coliE. coli* loads into streams and rivers. As detailed in the Powder River Basin TMDLdescribed in the Technical Support Document, DEQ captured describedcalculated the differences in *these variations in E. coliE. coli* the load duration curves and time-series plots analysesconcentrations betweenfor each of the two periods. The analysis found exceedances of *E. coliE. coli* concentration criteria year roundcriteria year-round. However, more frequent exceedances occurred during the irrigation seasonfrom late spring through early fallMay-October and found that bacteria criteria are exceeded year-round, but generally with reduced impacts during the non-irrigation season.

Although DEQ’s analyses suggest that critical conditions for E. coli*E. coli* loads occur from late spring through early fallMay-October in the basin. However, due to potential differences in the timing of when deposition of nonpoint source -fecal material is depositedoccurs on land and when it is transferredtransport to surface waters occurs, DEQ determinedapplied that is Although critical conditions could be considered to occur during irrigation season, late spring through early fall (approximately May through October), stream flow-based nonpoint source load allocations and the associatedrecommended management actions needed to support them must be appliedapply year-round.

6. Bacteria *E. coliE. coli* water quality data evaluation overview

DEQ used EPA’s flow-basedthe load duration curve method recommended by the EPA to determine pollutant loading capacityloading capacity, assess current conditions, and calculate the necessary pollutant reductions needed to comply with Oregon’s bacteria *E. coliE. coli* water quality criteria (Figure 6.04; , as summarized in Figure 6.0 and detailed in Sections 4.4 and 4.5 of the Technical Support document Document (DEQ, 2024a). The approach method allows comparison ofcomparesquantifies observed *bacteria E. coliE. coli* loads to and water quality criteria under various flow categories and seasonal conditions.- These comparisonsComparisons between observations and criteria and can be used to help target identify appropriate water quality restoration effortsactivities for different areas.

Figure 4: Powder River Basin *E. coli* analysis overview



~~**Figure 6.0: Powder River Basin bacteria*E. coli* analysis overview**~~

Flow duration ~~intervals~~curves describe ~~the range of flows that fall within defined intervals describing that full~~ the probability that a ~~specific~~measured flow will be equal to or greater than ~~or equal to~~ that flow over the period of record for a specific stream or river gage.

DEQ used the categories to defin~~de~~ ~~following simplified flow categories intervalscategories~~flow duration intervals to define ~~to describe inter~~~~the range of potential flow conditions with common intervals of~~~~based on~~~~the percent of time that of flows that flows~~ ~~exceedance cert~~~~probability~~~~flow duration intervals~~ in basin streams and rivers: High Flows (flows equal or greater 0% to 10% of the time~~);~~), Medium-High Flows (flows equal or greater 10% to 40% of the time~~);~~), Medium Flows (flows equal or greater 40% to 60% of the time~~);~~), Medium-Low Flows (flows equal or greater 60% to 90% of the time~~);~~), and Low Flows (flows equal or greater 90% to 100% of the time)~~, as defined in~~ ~~Table 4.4 of the TMDL Technical Support Document~~ (DEQ~~,~~ 2024a). ~~Flow duration intervals describe the~~

Load duration curves ~~are~~were calculated by multiplying paired water quality concentrations ~~(data with~~and flows across a flow duration curve. ~~s with a~~~~to paired~~~~uration~~ DEQ developed load duration curves for specific reaches in the Powder River basin that describe ~~- for various reaches within the watershed basin by multiplying estimated stream flows by:~~ 1) ~~the~~ water quality standards for ~~*E. coli*~~*E. coli* ~~water quality criterion concentration to determine loading capacity~~(geometric mean and single sample criteria)~~;~~ and~~,~~ 2) ~~measured *E. coli*~~*E. coli* ~~concentrations~~ loads calculated from ~~the most recently available data for the reach~~DEQ TMDL project described in the Technical Support document (DEQ 2024a) ~~to determine observed loads~~. Comparisons of ~~acceptable~~ loads based on water quality standards and observed loads allowed DEQ to calculate the amount of ~~E. coli~~*E. coli* load reduction, expressed as a percent, needed to meet water quality standards~~, expressed as a percent reduction~~ (DEQ~~,~~ 2024a). Load duration curves for ~~*E. coli*~~*E. coli* and calculations of the percent reductions in ~~*E. coli*~~*E. coli* loads needed ~~to meet water quality~~ ~~Excess loads are indicated by the differences between loading capacities and observed loads and are expressed as reductions needed at various reaches. DEQ~~ provided the basis for ~~linked linking~~calculating contributions of ~~potential~~ point and nonpoint sources ~~of bacteria E~~in the basin ~~that could influence stream bacteria concentrations during differing hydrologic conditions using area land use information and specific local knowledge~~. ~~Additional i~~Information on ~~bacteria~~*E. coli* analyses is provided in Section 4 of the TMDL Technical Support Document (DEQ~~,~~ 2024a).

7.~~0~~ Pollutant sources or source categories

As noted in OAR 340-042-0040(4)(f) and OAR 340-042-030(12), a source ~~is~~ consists of any process, practice, activity, or resulting condition that causes or may cause pollution or the introduction of pollutants to a waterbody. This section identifies ~~the various~~ pollutant sources and ~~estimates~~contributions, to the extent existing data allow estimates, of the significance of pollutant loading from existing sources.

~~Specific sources are described below and are subsequently assigned allocations.~~ Sources of pollutants to streams include point and nonpoint sources. OAR 340-045-0010(17) defines point source as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." OAR 340-41-0002(42) defines nonpoint sources as "diffuse or unconfined sources of pollution where wastes can either enter, or be conveyed by the movement of water, into waters of the state."

By definition (OAR 340-042-0030(1)), background sources include all sources of pollution or pollutants not originating from human activities. Background sources may also include anthropogenic sources of a pollutant that the DEQ or another Oregon state agency does not have authority to regulate, such as pollutants emanating from another state, tribal lands, or sources otherwise beyond the jurisdiction of the state.

There are several potential ~~a variety of potential anthropogenic~~human or human-influenced sources of fecal contamination to surface waters of the Powder River Basin ~~surface waters~~. Each source varies in ~~significance of fecal contributions,~~magnitude based on ~~prevalence of the activities~~~~activity~~ type, ~~size of the land area on which the activities occur~~extent ~~of activities~~, ~~locations~~ proximity ~~of~~~~of activities in relation~~ to surface waters, and mechanism of transport to surface waters~~transport mechanisms~~. ~~By mass~~Based on permit limits set for point sources ~~of *E. coli* in the basin~~~~of~~ , DEQ concluded that nonpoint sources ~~are far greater contributors of bacteria in the Powder River Basin than point sources~~contribute the majority of ~~*E. coli*~~*E. coli* observed in surface waters. Further information on source assessment is available in Section 5 of the TMDL Technical Support Document (DEQ ~~,~~ 2024a).

7.1 ~~*Bacteria*~~ ~~*E. coli*~~*E. coli* nonpoint and background sources

~~Nonpoint~~The combined category of nonpoint and ~~/~~background sources of ~~*bacteria*~~ ~~*E. coli*~~*E. coli* in the Powder River Basin includes wildlife, leaching from failing residential or business septic systems, stormwater runoff from roads not managed by the Oregon Department of Transportation, and runoff (including ~~runoff~~ stormwater and irrigation ~~runoff~~water) ~~in contact with activities associated~~from agricultural and forest lands with annual or seasonal livestock populations. ~~withareas with livestock on reservoir, agricultural and forest lands, ; roadways; residential septic systems and wildlife.~~

DEQ's analyses suggest that runoff from agricultural areas constitute a source of ~~*E. coli*~~*E. coli* in the Powder River Basin. Concentrations of ~~*E. coli*~~*E. coli* exceeded both geometric mean and single sample criteria in ~~areas of~~areas of the Powder and Burnt River s~~S~~ubbasins downstream of ~~areas with~~ irrigated pastures and areas ~~used~~occupied annually or seasonally by livestock ~~for annual or seasonal grazing~~. ~~hayfields. , and and~~

~~DEQ's analyses identified runoff from grazed and irrigated areas, including reservoirs grazed during draw down and irrigation return water, as primary sources of the bacteria load to streams in the basin. High bacteria concentrations were most common in areas where land use includes irrigated pastures and hayfields, seasonal livestock use and livestock feeding areas. DEQ found higher concentrations of bacteria in the Powder River: downstream of Phillips Reservoir; along the Keating Valley; downstream of Richland near the discharge into the Brownlee Reservoir; and above the Eagle Creek-Powder confluence. Bacteria was also higher along the south fork of the Burnt River and from Unity Reservoir to Bridgeport.~~ Further details can be found in the source assessment provided in Section 5 of the Technical Support Document.

DEQ concluded that transfer of ~~*bacteriaE. coli*~~*E. coli* from a variety of land uses to surface waters ~~are conveyed to waters in the basin as overland flows, along roadways or other conveyances, and can~~could be addressed using nonpoint source management strategies. DEQ concluded potential loading of ~~*E. coli*~~*E. coli* from failing septic systems in rural residential areas could be addressed with DEQ's Onsite Septic~~-~~ Program~~Program that the low small and dispersed population on septic systems and small percentage of systems that could be failing at the same time constitutes a possible, but likely insignificant source of bacteria to Powder River Basin waterways~~. Input of *E. coli* from pet waste ~~could~~can be addressed through existing ordinances.~~s~~ Further information is available in Section 5.2.2 of the TMDL Technical Support Document.

DEQ concluded that wildlife, including resident ungulates such as elk and mule deer, beavers, and resident and migratory waterfowl, constitute a source of ~~*E. coli*~~*E. coli* to surface waters in the basin. Wildlife management practices, such as the ~~elk feeding area Human~~Oregon Department of Fish and Wildlife ~~E~~elk ~~F~~feeding ~~S~~station in the Elkhorn Wildlife Area, could be ~~*E. coli*~~*E. coli* sources as well.

There are 12 registrants under the NPDES and Water Pollution Control Facility (WPCF) Confined Animal Feedlot Operation (CAFO) general permits in the Powder River Basin. CAFO permittees are prohibited from discharging manure, litter, or process wastewater to surface waters and ground waters of the state, except as allowed under conditions of an extreme rainfall event, defined in the permit as greater than the 25-year, 24-hour rainfall. The CAFO extreme weather event definition is similar to, but applied differently, then an "upset" and "overflow" events identified for NPDES permitted wastewater treatment plants.

DEQ administers WPCF Domestic Permits in the Powder River Basin that are issued for land irrigation of wastewater, wastewater lagoons, onsite sewage disposal systems, and underground injection control systems (i.e., dry wells, sumps, etc.). Discharge to surface water is not allowed under a WPCF permit. Current WPCF domestic permits in the basin are listed in Table 56 of the Technical Support Document.

Permit conditions and TMDL requirements for appropriate management measures of CAFO and domestic WPCF sources of *E. coli* are included in sections 5.2.1.2 and 5.2.3.3 of the Technical Support Document (DEQ 2024a).

~~While wildlife contributions are considered background, DEQ considered human practices that enhance delivery of bacteria from wildlife, such as elk congregating at artificial feeding areas in the Elkhorn Wildlife Area. DEQ concluded that wildlife, including migrating waterfowl, may make minor seasonal contributions, but are not a significant source of bacteria loading to surface waters in the Powder River Basin. Further i~~Information is available in Section 5.2.4 of the TMDL Technical Support Document. DEQ did not ~~attempt to~~ separate background from ~~anthropogenic~~ human and human-influenced sources in the load duration curve analyses. ~~Rather~~Instead, background sources were ~~included~~ grouped with ~~with~~ all nonpoint sources of ~~*bacteria E. coli*~~*E. coli* in the analyses ~~and load allocations~~. ~~Thus background sources are included , such that they are components of surface water runoff transported to streams from land uses including forests, pastures and rural residential.~~

7.2 ~~*Bacteria E. coli*~~*E. coli* point sources

Table ~~7.2~~6 lists the Nonpoint Discharge Elimination System (~~S~~ NPDES) permitted point sources with potential to ~~contribute~~ discharge ~~*bacteria E. coli*~~*E. coli* directly to surface waters in the basin. These include three permitted point source domestic wastewater discharges and Oregon Department of Transportation’s statewide MS4 permit, which regulates stormwater discharges from highways following collection, treatment, and conveyance. Information is available in Section 5.2.3 of the TMDL Technical Support Document to support DEQ’s conclusion that ~~these~~ point sources contribute ~~minimal~~ lesser amounts of ~~*E. coli*~~*E. coli* ~~bacterial~~ loads to surface waters than nonpoint sources in the basin.

Table 6: Point sources with *E. coli* contributions in the Powder River Basin~~Table 7.2: Point sources with bacteria*E. coli* contributions in the Powder River Basin~~

DEQ file number	EPA number	Permittee	Facility type	Permit type	Receiving water	River Mile
40981	OR0020052	City of Huntington	~~sewage~~ Sewage treatment	DOM-Db	Burnt River	2
61600	OR0022403	City of North Powder	~~sewage~~ Sewage treatment	DOM-Db	Powder River	82.4
5324	OR0020699	City of Baker City	~~sewage~~ Sewage treatment	DOM-C1b	Powder River	116.3
101822	ORS110870	Oregon Department of Transportation	~~highway~~ Highway stormwater	MS4 - Phase I	various	NA

8.0 Bacteria E. coliE. coli loadinginging capacity and excess load

Summarizing OAR 340-042-0040(4)(d) and 40 CFR 130.2(f), loading capacity is the amount of a pollutant or pollutants that a waterbody can receive and still meet water quality standards. In accordance with OAR 340-042-0040(4)(e), the excess load calculation evaluates, to the extent existing data allow, the difference between the actual pollutant load in a waterbody and the loading capacityloading capacity of that waterbody.

Table 8.07 presents a summary of estimated *E. coliE. coli* loading capacities and excess loads calculated at monitoredfor monitoring locations and named stream reaches based on. at the flow categories category with the of the greatesthighest observed exceedance of thes applicable *E. coliE. coli* criteria. Excess loads are presented as the highest largest largest percent reduction needed from the of current loads (calculated with the most recently available data)calculated from needed to achieve the applicable *E. coliE. coli* criteria at each monitoredin each stream reach for the identified flow category. DEQ applied the percent reduction needed for each reach across all flow categories and seasons to ensure that both geometric mean and single sample criteria would be met throughout the year (DEQ, 2024a).To ensure As , Loading capacities, based on the geometric mean criterion to ensure the single sample criterion is also met, for each flow category and each of the named stream reaches are present in Tables 910-134.

across a range of flow categories, during both irrigation and non-irrigation seasonal times and based on a mix of single sample maximum and geomean criterion exceedances. Estimated loading capacities for all otherindividual assessment units within the basin (DEQ 2022a) flows can be calculated for either criterion using the following equations and are presented for each flow category and location in Tables 9.1b-9.1f13:

(1) Geometric Mmean Loading loading Capacity capacity (organisms/day) = 126 organisms/100 mL x Flow x CFconversion factor to org/day (geometric mean)

(2) Single Sample Loading loading Ccapacity (organisms/day) = 406 organismsorg/100 mL x Flow x conversion factor to org/day (single sample)CF

Where CF is the appropriate conversion factor for units of volume and time needed to convert units of flow for calculations of loading capacities in terms of organisms/day.

Section 4.5 of the TMDL Technical Support Document presents modeled estimations and calculation details of the calculationsed for the amounts of *E. coliE. coli* loading bacteria that the Powder River Basin stream reaches can receive and still meet water quality standards.

~~Estimated loading capacities apply to all streams tributary to each stream reach described in association with each downstream monitoring station. Year-round implementation of the highest relative percent reduction indicated at any flow and for either criterion is protective of all flows and both criteria (DEQ, 2024a).~~

Table 7: *E. coli* loadinging capacities and excess loads as highest percent reductions needed Table 8.0: *Bacteria E. coli* loading capacities and excess loads as highest percent reductions needed

Downstream station	Stream reach description	Measured Load (orgs/day)	Loading CapacityLoading capacity (orgs/day)	Excess Load (percent reduction)	Flow Category (for highest reduction)	Criterion (for highest reduction)
Brownlee Subbasin						
36382-ORDEQ: Pine Creek at Hwy 71	Brownlee Subbasin streams confluence with Snake RiverPine Creek upstream of Highway 71	1.17E+13	1.30E+13	0%	All	bothBoth
Powder Subbasin						
34250-ORDEQ: Powder River above Phillips Reservoir Dam Dam	Powder River upstream of Philips Reservoir	1.18E+11	4.58E+11	0%	All	bothBoth
11490-ORDEQ: Powder River at Hwy 7 (in Baker City)	Powder River from Phillips Reservoir to Baker City	4.20E+12	7.05E+11	83%*	Medium	single Single sample max
36192-ORDEQ: North Powder River at Miller Rd. Bridge	North Powder River from USFS Boundary to Miller Rd	3.26E+12	5.46E+11	83%	Medium-High and Medium-Low	single Single sample max
36191-ORDEQ: North Powder River at Hwy 30 Bridge	North Powder River from Miller Road to Confluence with Powder River	2.48E+11	1.25E+10	95%	Low	Geometric mean
36193-ORDEQ: Eagle Creek at Snake River Rd	Eagle Creek from New Bridge to Brownlee Reservoir	2.97E+10	1.08E+10	64%	Low	Geometric mean
11857-ORDEQ: Powder River at Snake River Rd. (Richland)36191-ORDEQ: North Powder River at Hwy 30 Bridge	Powder River from Baker City to confluence with Snake RiverNorth Powder River from Miller Road to Confluence with Powder River	4.34E+112.48E+11	1.07E+11 1.25E+10	75%95%	Medium-LowLow	Geometric meanGeometric meangeomean
34256-ORDEQ: Burnt River at Clarks Cr. Bridge	Burnt River from Unity Reservoir to Clarks Creek Rd	4.61E+12	7.74E+11	83%	Medium-High	single Single sample max

Burnt Subbasin						
36195-ORDEQ: Burnt River at Unity Reservoir Dam	Burnt River at upstream of Unity Reservoir Dam	3.83E+11	2.63E+12	0%	All	both
34256-ORDEQ: Burnt River at Clarks Cr. Bridge11857-ORDEQ: Powder River at Snake River Rd. (Richland)	Burnt River from Unity Reservoir to Clarks Creek RdPowder River from Baker City to confluence with Snake RiverPowder River from Thief Valley Reservoir to confluence with Eagle Creek near Richland	4.61E+12 4.34E+11	7.74E+11 1.07E+11	83%75%	Medium-HighMedium-Low	Single sampleGeometric meangeomean
11494-ORDEQ: Burnt River at Snake River Rd (Huntington)	Burnt River from Clarks Creek Rd to confluence with Snake RiverBurnt River from Clarks Creek Rd to Snake River near Huntington	5.12E+12	3.10E+12	40%	High	Geometric meangeomean
Notes: * Indicates the only location where the highest percent reduction is during non-irrigationNovember-April season.						

9.~~0~~ Allocations, reserve capacity, and margin of safety

OAR 340-042-0040(4)(g), (h), (i), and (k) [and 40 CFR 130.2(h) and (g) and 130.7(c)(2)] ~~respectively~~ define the required TMDL elements of apportionment of the allowable pollutant load: point source wasteload allocations (WLAs)~~;~~ , nonpoint source load allocations (LAs),~~;~~ margin of safety (MOS),~~;~~ and~~,~~ reserve capacity (RC). Collectively, these elements add up to the maximum pollutant load ~~of a pollutant~~ that ~~still~~ allows a waterbody to meet water quality standards. OAR 304-042-0040(5) and (6) describe the potential ~~factors~~ considerations ~~of consideration~~ for determining and distributing ~~these~~ allocations of the allowable pollutant loading capacities. Water quality data analysis must be conducted to determine allocations, potentially including statistical analysis and mathematical modeling.

9.1 ~~Bacteria~~ ~~*E. coli*~~*E. coli* allocations

~~Bacteria a~~Allocations are the amount of ~~*E. coli*~~*E. coli* allowed in discharges from each source. Table ~~9.1a~~8 presents ~~*E. coli*~~*E. coli* allocations as a relative percentage of the maximum ~~*E. coli*~~*E. coli* load that Powder River Basin streams can receive and still meet the ~~*bacteria*~~ *E. coli* criteria, distributed among the known point and nonpoint sources in the ~~watershed~~basin~~,~~ and after ~~accounting for~~taking into account a ~~margin of safety~~MOS with both implicit and explicit components.

~~Total Aallocations (combinedAllocationsCombinedAllocations)~~Allocations for individual assessment units (DEQ 2022b) may be calculated using the ~~outputs from the loading capacity equations~~following equations ~~presented in Section 8 and the allocation schemes presented in Table 9~~:~~.~~

(3) Geometric mean ~~load total allocationLAallocation~~allocation (organisms/day) = 126 organisms/100 mL ~~-~~x Flow x CF x 0.9 ~~x LF~~

~~(1) Geometric mean load allocation (organisms/day) = 126 organisms/100 mL x Flow x CF x 0.9 x LF~~

(4) Single sample ~~allocation~~allocation (organisms/day) = 406 organisms/100 mL x Flow x CF x 0.9

Where CF is the appropriate conversion factor for units of volume and time needed to convert units of flow for calculations of ~~loading capacities~~allocations in terms of organisms/day and the ~~and~~ multiplier of 0.9 reflects the 10% explicit ~~margin of safety~~MOS ~~10%~~ and 0~~%~~% ~~reserve capacity~~RC. The scheme for distributing the calculated allocation among ~~loads~~LAs and ~~wasteloads~~WLAs is presented ~~Individual load and wasteload allocations for calculations described above may be determined from the scheme presented~~ in Table 9.

It is anticipated that any futurefFuture *E. coli* water quality impairments detected in for assessment units -2022b) identified in Table 3 will receive an allocations consistent with loading capacitiesthe calculations determined from the equations in Section 8abovefrom equations 3 and 4 and the allocation scheme set forth in Tables 9.

Tables 910.1b- through 9.1f1314 present the daily loads allowable from sources to each named stream reach relative to the daily flow ranges measured for each flow category. Background sources were not able to be separated from other human or human-influencecaused nonpoint sources. However, in keeping with the definition of background sources in OAR 340-042-0030(1), actions to implement the load allocationLAs will be focused on sources arising from human activities.

Bacteria E. coliE. coli load allocationLAs in Tables 10-14 correspond to the loading capacities based on a maximum *E. coliE. coli* concentration of 126 organisms/100 mL and apply to all streams tributary to each stream reach described in association with each downstream monitoring station. Using the geometric mean criterion ensures that single sample load capacityloading capacity will also be met.

Bacteria E. coliE. coli waste-load allocations apply at the point of discharge.

As noted in Sections 5.2.3 and 6.1 of the TMDL Technical Support Document, tThe three industrial wastewater permits and the NPDES 1200Z industrial stormwater general permit registrants are not sources of *bacteriaE. coli* and are not assigned numeric wasteload allocationWLAs (Sections 5.2.3 and 6.1 of the Technical Support Document). Instead, the permittees and 1200Z registrants must follow comply with their permit conditions to meet the narrative wasteload allocation of their current *bacteriaE. coli* loads, if any meet permit conditions to show compliance with *E. coli* allocations and requirements of the TMDL.

Wastewater treatment plants are allocated permitted effluent limits at the bacteria (*E. coliE. coli*) standard (Table 4.0b5) and maximum permitted discharge (1 MGD for North Powder and Huntington and 2 MGD for Baker City), to ensure that recreation-based criteria are attained. Individual NPDES permits issued to the cities of Huntington, Baker City and North Powder for treatment of domestic wastewater do not require further modification at renewal as they currently implement the *E. coliE. coli* criteria as permit limits.

Registrants of general wastewater permits (NPDES and WPCF CAFO) must meet permit conditions to show compliance with *E. coli* allocations and requirements of the TMDL.mfollowfollow their permit conditions to meet the narrative wasteload allocation of current *E. coliE. coli* loads, if any..

Table 8: *E. coli* allocations by sources and areas as a relative percentage of loading capacity~~Table 9.1a: *Bacteria* allocations by sources and areas as a relative percentage of loading capacity~~

Stream reach description	Allocations (percent)			RC (percent) ~~Reserve capacity~~	MOS (percent) ~~Margin of safety~~	Total (percent)
	Nonpoint source and background LA	ODOT MS4 WLA	Wastewater treatment WLA			
Brownlee Subbasin						
Confluence of Brownlee Subbasin streams with Snake River	89.0	1.0	0.0	0.0	10.0	100.0
Powder Subbasin						
Powder River upstream of Philips Reservoir	89.0	1.0	0.0	0.0	10.0	100.0
Powder River from Phillips Reservoir to Baker City	89.0	1.0	0.0	0.0	10.0	100.0
North Powder River from USFS Boundary to Miller Rd	89.0	1.0	0.0	0.0	10.0	100.0
North Powder River from Miller Rd to Confluence with Powder River	89.0	1.0	0.0	0.0	10.0	100.0
Eagle Creek from New Bridge to Brownlee Reservoir	89.0	1.0	0.0	0.0	10.0	100.0
Powder River from Baker City to confluence with Snake River	42.9-88.7	1.0	0.3-46.1	0.0	10.0	100.0
Burnt Subbasin						
Burnt River from Unity Reservoir to Clarks Creek Rd	89.0	1.0	0.0	0.0	10.0	100.0
Burnt River upstream of Unity Reservoir Dam	89.0	1.0	0.0	0.0	10.0	100.0
Burnt River from Clarks Creek Rd to confluence with Snake River	80.3-88.8	1.0	0.2-8.7	0.0	10.0	100.0
Notes: Ranges of values represent the range of relative allocations from Low to High flow categories. LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety.						

Table 9: Distribution of *E. coli* allocations among loads and wasteloads for individual assessment units

State highway MS4 Phase I Permit present	NPDES permit for sewage treatment discharge present	Percent of allocation		
		Nonpoint source and background load	ODOT MS4 wasteload	Wastewater treatment wasteload
No	No	~~90.~~100.0	0.0	0.0
Yes	No	~~89~~98.9~~.0~~	1.~~0~~1	0.0
No	Yes	Difference between ~~90.0% of loading capacity~~100.0% and the percent of permitted ~~effluent load~~wasteload that contributes to allocation[1]	0.0	Percent ~~that~~of permitted waste~~effluent~~ load that contributes to the ~~loading capacity~~alloctation[1]
Yes	Yes	Difference between 98.9% and the percent of permitted wasteload that contributes to allocation[2] ~~Difference between 89.0% of loading capacity and percent of permitted effluent load~~	~~1.0~~1.1	Percent ~~that~~of permitted ~~effluent load~~wasteload that contributes to the ~~loading capacity~~allocation[2]

Notes: Assessment units are described in Methodology for Oregon's 2022 Water Quality Report and List of Water Quality Limited Waters (DEQ 2022b) and include watersheds, rivers and streams, and lakes/~~ and~~ reservoirs.

~~The relate allocations may be applied to outputs from the loading capacity equations presented in Section 8.~~Percents may be used to determine individual load and wasteload allocations from the calculated allocations in Equations 3 and 4

Presence of a state highway MS4 Phase I or sewage treatment discharge NPDES permit includes those intersecting and upstream of the assessment unit.

[1]Percent of permitted wasteload ~~effluent load~~ that contributes to ~~loading capacity~~allocation must be ≤ ~~9~~100.0% ~~to preserve a 10.0% margin of safety.~~

[2]Percent of permitted wasteload ~~effluent load~~ that contributes to ~~loading capacity~~allocation must be ≤ ~~89.0~~98.9%~~ to preserve a 10.0% margin of safety.~~

Table 10: High flow *E. coli* allocations by source and named stream reach

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms/ day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		RC (organisms/ day)	MOS (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	1,010.00 to 7,000.00	8.26E+12	0	7.36E+12	8.26E+10	0	0	8.26E+11
Powder Subbasin								
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0	1.36E+12	1.53E+10	0	0	1.53E+11
Powder River from Phillips Reservoir to Baker City	226.0 to 669.00	1.31E+12	83	1.17E+12	1.31E+10	0	0	1.31E+11
North Powder River from USFS Boundary to Miller Rd	83.50 to 904.00	1.23E+12	83	1.10E+12	1.23E+10	0	0	1.23E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95	1.10E+12	1.23E+10	0	0	1.23E+11
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64	4.73E+12	5.32E+10	0	0	5.32E+11
Powder River from Baker City to confluence with Snake River	592.00 to 3,300.00	4.65E+12	75	4.12E+12	4.65E+10	1.43E+10	0	4.65E+11
Burnt Subbasin								
Burnt River upstream of Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0	1.77E+12	1.99E+10	0	0	1.99E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83	2.12E+12	2.39E+10	0	0	2.39E+11
Burnt River from Clarks Creek Rd to confluence with Snake River	249.00 to 2,130.0	3.10E+12	40	2.75E+12	2.79E+10	4.77E+09	0	3.10E+11
Note: LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety								

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms/ day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		Reserve capacity (organisms/ day)	Margin of safety (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	1,010.00 to 7,000.00	8.26E+12	0	7.36E+12	8.26E+10	0	0	8.26E+11
Powder Subbasin								
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0	1.36E+12	1.53E+10	0	0	1.53E+11
~~Powder River from Phillips Reservoir to Baker City~~	~~226.0 to 669.00~~	~~1.31E+12~~	~~83~~	~~1.17E+12~~	~~1.31E+10~~	~~0~~	~~0~~	~~1.31E+11~~
North Powder River from USFS Boundary to Miller Rd	83.50 to 904.00	1.23E+12	83	1.10E+12	1.23E+10	0	0	1.23E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95	1.10E+12	1.23E+10	0	0	1.23E+11
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64	4.73E+12	5.32E+10	0	0	5.32E+11
Powder River from Baker City to confluence with Snake River	592.00 to 3,300.00	4.65E+12	75	4.12E+12	4.65E+10	1.43E+10	0	4.65E+11
Burnt Subbasin								
Burnt River upstream of Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0	1.77E+12	1.99E+10	0	0	1.99E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83	2.12E+12	2.39E+10	0	0	2.39E+11
Burnt River from Clarks Creek Rd to confluence with Snake River	249.00 to 2,130.0	3.10E+12	40	2.75E+12	2.79E+10	4.77E+09	0	3.10E+11
Note: LA = Load allocation; WLA = Wasteload Allocation								

~~**Table 9.1b: High flow *bacteria E. coli* allocations by source and stream reach**~~

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	1,010.00 to 7,000.00	8.26E+12	0%	7.36E+12	8.26E+10	0	0	8.26E+11
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0%	1.36E+12	1.53E+10	0	0	1.53E+11
Powder River from Phillips Reservoir to Baker City	226.0 to 669.00	1.31E+12	83%	1.17E+12	1.31E+10	0	0	1.31E+11
~~North Powder River from USFS Boundary to Miller Rd~~	~~83.50 to 904.00~~	~~1.23E+12~~	~~83%~~	~~1.10E+12~~	~~1.23E+10~~	~~0~~	~~0~~	~~1.23E+11~~
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64%	4.73E+12	5.32E+10	0	0	5.32E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95%	1.10E+12	1.23E+10	0	0	1.23E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83%	2.12E+12	2.39E+10	0	0	2.39E+11
Burnt River at Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0%	1.77E+12	1.99E+10	0	0	1.99E+11
Powder River from Thief Valley Reservoir to near Richland	592.00 to 3,300.00	4.65E+12	75%	4.14E+12	4.18E+10	4.77E+09	0	4.65E+11
Burnt River from Clarks Creek Rd to Snake River near Huntington	249.00 to 2,130.0	3.10E+12	40%	2.75E+12	2.79E+10	4.77E+09	0	3.10E+11

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)		Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
				Irrigation return and stormwater	Improper septic systems	ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	1,010.00 to 7,000.00	8.26E+12	0%	7.36E+12	0	8.26E+10	0	0	8.26E+11
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0%	1.36E+12	0	1.53E+10	0	0	1.53E+11
Powder River from Phillips Reservoir to Baker City	226.0 to 669.00	1.31E+12	83%	1.17E+12	0	1.31E+10	0	0	1.31E+11
North Powder River from USFS Boundary to Miller Rd	83.50 to 904.00	1.23E+12	83%	1.10E+12	0	1.23E+10	0	0	1.23E+11
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64%	4.73E+12	0	5.32E+10	0	0	5.32E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95%	1.10E+12	0	1.23E+10	0	0	1.23E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83%	2.12E+12	0	2.39E+10	0	0	2.39E+11
Burnt River at Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0%	1.77E+12	0	1.99E+10	0	0	1.99E+11
Powder River from Thief Valley Reservoir to near Richland	592.00 to 3,300.00	4.65E+12	75%	4.12E+12	0	4.65E+10	1.43E+10	0	4.65E+11
Burnt River from Clarks Creek Rd to Snake River near Huntington	249.00 to 2,130.0	3.10E+12	40%	2.75E+12	0	3.10E+10	4.77E+09	0	3.10E+11

Notes: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Confluence of Brownlee Subbasin streams with Snake River	1,010.00 to 7,000.00	8.26E+12	0%	7.36E+12	8.26E+10	0	0	8.26E+11
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0%	1.36E+12	1.53E+10	0	0	1.53E+11
Powder River from Phillips Reservoir to Baker City	226.0 to 669.00	1.31E+12	83%	1.17E+12	1.31E+10	0	0	1.31E+11
~~North Powder River from USFS Boundary to Miller Rd~~	~~83.50 to 904.00~~	~~1.23E+12~~	~~83%~~	~~1.10E+12~~	~~1.23E+10~~	~~0~~	~~0~~	~~1.23E+11~~
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64%	4.73E+12	5.32E+10	0	0	5.32E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95%	1.10E+12	1.23E+10	0	0	1.23E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83%	2.12E+12	2.39E+10	0	0	2.39E+11
Burnt River upstream of Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0%	1.77E+12	1.99E+10	0	0	1.99E+11
Powder River from Baker City to confluence with Snake River	592.00 to 3,300.00	4.65E+12	75%	4.12E+12	4.65E+10	1.43E+10	0	4.65E+11
Burnt River from Clarks Creek Rd to confluence with Snake River	249.00 to 2,130.0	3.10E+12	40%	2.75E+12	2.79E+10	4.77E+09	0	3.10E+11

Note: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	1,010.00 to 7,000.00	8.26E+12	0%	7.36E+12	8.26E+10	0	0	8.26E+11
Powder River upstream of Philips Reservoir	191.35 to 906.00	1.53E+12	0%	1.36E+12	1.53E+10	0	0	1.53E+11
Powder River from Phillips Reservoir to Baker City	226.0 to 669.00	1.31E+12	83%	1.17E+12	1.31E+10	0	0	1.31E+11
~~North Powder River from USFS Boundary to Miller Rd~~	~~83.50 to 904.00~~	~~1.23E+12~~	~~83%~~	~~1.10E+12~~	~~1.23E+10~~	~~0~~	~~0~~	~~1.23E+11~~
Eagle Creek from New Bridge to Brownlee Reservoir	754.40 to 3,000.00	5.32E+12	64%	4.73E+12	5.32E+10	0	0	5.32E+11
North Powder River from Miller Rd to Confluence with Powder River	83.50 to 904.00	1.23E+12	95%	1.10E+12	1.23E+10	0	0	1.23E+11
Burnt River from Unity Reservoir to Clarks Creek Rd	155.00 to 1,840.00	2.39E+12	83%	2.12E+12	2.39E+10	0	0	2.39E+11
Burnt River at Unity Reservoir Dam	160.00 to 1,390.00	1.99E+12	0%	1.77E+12	1.99E+10	0	0	1.99E+11
Powder River from Thief Valley Reservoir to near Richland	592.00 to 3,300.00	4.65E+12	75%	4.12E+12	4.65E+10	1.43E+10	0	4.65E+11
Burnt River from Clarks Creek Rd to Snake River near Huntington	249.00 to 2,130.0	3.10E+12	40%	2.75E+12	2.79E+10	4.77E+09	0	3.10E+11

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Table 11: Medium-High flow *E. coli* allocations by source and named stream reach~~**Table 9.1c: Medium-High flow bacteria**~~***E. coli*** ~~**allocations by source and stream reach**~~

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms/ day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		RC (organisms /day)	MOS (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	262.00 to 1,009.99	1.81E+12	0	1.61E+12	1.81E+10	0	0	1.81E+11
Powder Subbasin								
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0	2.35E+11	2.64E+09	0	0	2.64E+10
Powder River from Phillips Reservoir to Baker City	80.25 to 225.99	4.66E+11	83	4.15E+11	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	19.00 to 83.49	1.19E+11	83	1.06E+11	1.19E+09	0	0	1.19E+10
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95	1.06E+11	1.19E+09	0	0	1.19E+10
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64	1.05E+12	1.18E+10	0	0	1.18E+11
Powder River from Baker City to confluence with Snake River	110.00 to 591.99	8.83E+11	75	7.72E+11	8.83E+09	1.43E+10	0	8.83E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	0	2.13E+11	2.40E+09	0	0	2.40E+10
Burnt River upstream of Unity Reservoir Dam	80.00 to 159.99	3.59E+11	83	3.20E+11	3.59E+09	0	0	3.59E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	71.70 to 248.99	3.63E+11	40	3.19E+11	3.27E+09	4.77E+09	0	3.63E+10
Note: LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety								

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms/ day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		Reserve capacity (organisms /day)	Margin of safety (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	262.00 to 1,009.99	1.81E+12	0	1.61E+12	1.81E+10	0	0	1.81E+11
Powder Subbasin								
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0	2.35E+11	2.64E+09	0	0	2.64E+10
~~Powder River from Phillips Reservoir to Baker City~~	~~80.25 to 225.99~~	~~4.66E+11~~	~~83~~	~~4.15E+11~~	~~4.66E+09~~	~~0~~	~~0~~	~~4.66E+10~~
North Powder River from USFS Boundary to Miller Rd	19.00 to 83.49	1.19E+11	83	1.06E+11	1.19E+09	0	0	1.19E+10
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95	1.06E+11	1.19E+09	0	0	1.19E+10
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64	1.05E+12	1.18E+10	0	0	1.18E+11
Powder River from Baker City to confluence with Snake River	110.00 to 591.99	8.83E+11	75	7.72E+11	8.83E+09	1.43E+10	0	8.83E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	0	2.13E+11	2.40E+09	0	0	2.40E+10
Burnt River upstream of Unity Reservoir Dam	80.00 to 159.99	3.59E+11	83	3.20E+11	3.59E+09	0	0	3.59E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	71.70 to 248.99	3.63E+11	40	3.19E+11	3.27E+09	4.77E+09	0	3.63E+10
Note: LA = Load allocation; WLA = Wasteload Allocation								

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	262.00 to 1,009.99	1.81E+12	0%	1.61E+12	1.81E+10	0	0	1.81E+11
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0%	2.35E+11	2.64E+09	0	0	2.64E+10
Powder River from Phillips Reservoir to Baker City	80.25 to 225.99	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~19.00 to 83.49~~	~~1.19E+11~~	~~83%~~	~~1.06E+11~~	~~1.19E+09~~	~~0~~	~~0~~	~~1.19E+10~~
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64%	1.05E+12	1.18E+10	0	0	1.18E+11
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95%	1.06E+11	1.19E+09	0	0	1.19E+10
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	83%	2.13E+11	2.40E+09	0	0	2.40E+10
Burnt River at Unity Reservoir Dam	80.00 to 159.99	3.59E+11	0%	3.20E+11	3.59E+09	0	0	3.59E+10
Powder River from Thief Valley Reservoir to near Richland	110.00 to 591.99	8.83E+11	75%	7.82E+11	7.95E+09	4.77E+09	0	8.83E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	71.70 to 248.99	3.63E+11	40%	3.19E+11	3.27E+09	4.77E+09	0	3.63E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)		Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
				Irrigation return and stormwater	Improper septic systems	ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	262.00 to 1,009.99	1.81E+12	0%	1.61E+12	0	1.81E+10	0	0	1.81E+11
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0%	2.35E+11	0	2.64E+09	0	0	2.64E+10
~~Powder River from Phillips Reservoir to Baker City~~	~~80.25 to 225.99~~	~~4.66E+11~~	~~83%~~	~~4.15E+11~~	~~0~~	~~4.66E+09~~	~~0~~	~~0~~	~~4.66E+10~~
North Powder River from USFS Boundary to Miller Rd	19.00 to 83.49	1.19E+11	83%	1.06E+11	0	1.19E+09	0	0	1.19E+10
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64%	1.05E+12	0	1.18E+10	0	0	1.18E+11
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95%	1.06E+11	0	1.19E+09	0	0	1.19E+10
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	83%	2.13E+11	0	2.40E+09	0	0	2.40E+10
Burnt River at Unity Reservoir Dam	80.00 to 159.99	3.59E+11	0%	3.20E+11	0	3.59E+09	0	0	3.59E+10
Powder River from Thief Valley Reservoir to near Richland	110.00 to 591.99	8.83E+11	75%	7.72E+11	0	8.83E+09	1.43E+10	0	8.83E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	71.70 to 248.99	3.63E+11	40%	3.19E+11	0	3.63E+09	4.77E+09	0	3.63E+10

Notes: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Confluence of Brownlee Subbasin streams with Snake River	262.00 to 1,009.99	1.81E+12	0%	1.61E+12	1.81E+10	0	0	1.81E+11
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0%	2.35E+11	2.64E+09	0	0	2.64E+10
Powder River from Phillips Reservoir to Baker City	80.25 to 225.99	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	19.00 to 83.49	1.19E+11	83%	1.06E+11	1.19E+09	0	0	1.19E+10
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64%	1.05E+12	1.18E+10	0	0	1.18E+11
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95%	1.06E+11	1.19E+09	0	0	1.19E+10
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	83%	2.13E+11	2.40E+09	0	0	2.40E+10
Burnt River upstream of Unity Reservoir Dam	80.00 to 159.99	3.59E+11	0%	3.20E+11	3.59E+09	0	0	3.59E+10
Powder River from Baker City to confluence with Snake River	110.00 to 591.99	8.83E+11	75%	7.72E+11	8.83E+09	1.43E+10	0	8.83E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	71.70 to 248.99	3.63E+11	40%	3.19E+11	3.27E+09	4.77E+09	0	3.63E+10

Note: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	262.00 to 1,009.99	1.81E+12	0%	1.61E+12	1.81E+10	0	0	1.81E+11
Powder River upstream of Philips Reservoir	27.03 to 191.34	2.64E+11	0%	2.35E+11	2.64E+09	0	0	2.64E+10
Powder River from Phillips Reservoir to Baker City	80.25 to 225.99	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~19.00 to 83.49~~	~~1.19E+11~~	~~83%~~	~~1.06E+11~~	~~1.19E+09~~	~~0~~	~~0~~	~~1.19E+10~~
Eagle Creek from New Bridge to Brownlee Reservoir	157.00 to 754.39	1.18E+12	64%	1.05E+12	1.18E+10	0	0	1.18E+11
North Powder River from Miller Rd to Confluence with Powder River	19.00 to 83.49	1.19E+11	95%	1.06E+11	1.19E+09	0	0	1.19E+10
Burnt River from Unity Reservoir to Clarks Creek Rd	49.80 to 154.99	2.40E+11	83%	2.13E+11	2.40E+09	0	0	2.40E+10
Burnt River at Unity Reservoir Dam	80.00 to 159.99	3.59E+11	0%	3.20E+11	3.59E+09	0	0	3.59E+10
Powder River from Thief Valley Reservoir to near Richland	110.00 to 591.99	8.83E+11	75%	7.72E+11	8.83E+09	1.43E+10	0	8.83E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	71.70 to 248.99	3.63E+11	40%	3.19E+11	3.27E+09	4.77E+09	0	3.63E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Table 12: Medium flow *E. coli* allocations by source and named stream reach~~Table 9.1d: Medium flow bacteria~~***E. coli*** ~~allocations by source and stream reach~~

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		RC (organisms /day)	MOS (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	100.00 to 261.99	5.41E+11	0	4.82E+11	5.41E+09	0	0	5.41E+10
Powder Subbasin								
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0	5.22E+10	5.86E+08	0	0	5.86E+09
Powder River from Phillips Reservoir to Baker City	30.00 to 80.24	4.66E+11	83	4.15E+11	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	14.00 to 18.99	5.22E+10	83	4.64E+10	5.22E+08	0	0	5.22E+09
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95	4.64E+10	5.22E+08	0	0	5.22E+09
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64	3.42E+11	3.84E+09	0	0	3.84E+10
Powder River from Baker City to confluence with Snake River	48.00 to 109.99	2.31E+11	75	1.91E+11	2.31E+09	1.43E+10	0	2.31E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	0	1.19E+11	1.33E+09	0	0	1.33E+10
Burnt River upstream of Unity Reservoir Dam	13.00 to 79.99	1.28E+11	83	1.14E+11	1.28E+09	0	0	1.28E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	52.50 to 71.69	1.98E+11	40	1.71E+11	1.78E+09	4.77E+09	0	1.98E+10
Note: LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety								

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		Reserve capacity (organisms /day)	Margin of safety (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	100.00 to 261.99	5.41E+11	0	4.82E+11	5.41E+09	0	0	5.41E+10
Powder Subbasin								
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0	5.22E+10	5.86E+08	0	0	5.86E+09
~~Powder River from Phillips Reservoir to Baker City~~	~~30.00 to 80.24~~	~~4.66E+11~~	~~83~~	~~4.15E+11~~	~~4.66E+09~~	~~0~~	~~0~~	~~4.66E+10~~
North Powder River from USFS Boundary to Miller Rd	14.00 to 18.99	5.22E+10	83	4.64E+10	5.22E+08	0	0	5.22E+09
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95	4.64E+10	5.22E+08	0	0	5.22E+09
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64	3.42E+11	3.84E+09	0	0	3.84E+10
Powder River from Baker City to confluence with Snake River	48.00 to 109.99	2.31E+11	75	1.91E+11	2.31E+09	1.43E+10	0	2.31E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	0	1.19E+11	1.33E+09	0	0	1.33E+10
Burnt River upstream of Unity Reservoir Dam	13.00 to 79.99	1.28E+11	83	1.14E+11	1.28E+09	0	0	1.28E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	52.50 to 71.69	1.98E+11	40	1.71E+11	1.78E+09	4.77E+09	0	1.98E+10
Note: LA = Load allocation; WLA = Wasteload Allocation								

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	100.00 to 261.99	5.41E+11	0%	4.82E+11	5.41E+09	0	0	5.41E+10
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0%	5.22E+10	5.86E+08	0	0	5.86E+09
Powder River from Phillips Reservoir to Baker City	30.00 to 80.24	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~14.00 to 18.99~~	~~5.22E+10~~	~~83%~~	~~4.64E+10~~	~~5.22E+08~~	~~0~~	~~0~~	~~5.22E+09~~
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64%	3.42E+11	3.84E+09	0	0	3.84E+10
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95%	4.64E+10	5.22E+08	0	0	5.22E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	83%	1.19E+11	1.33E+09	0	0	1.33E+10
Burnt River at Unity Reservoir Dam	13.00 to 79.99	1.28E+11	0%	1.14E+11	1.28E+09	0	0	1.28E+10
Powder River from Thief Valley Reservoir to near Richland	48.00 to 109.99	2.31E+11	75%	2.01E+11	2.08E+09	4.77E+09	0	2.31E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	52.50 to 71.69	1.98E+11	40%	1.71E+11	1.78E+09	4.77E+09	0	1.98E+10
Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation								

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)		Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
				Irrigation return and stormwater	Improper septic systems	ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	100.00 to 261.99	5.41E+11	0%	4.82E+11	0	5.41E+09	0	0	5.41E+10
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0%	5.22E+10	0	5.86E+08	0	0	5.86E+09
Powder River from Phillips Reservoir to Baker City	30.00 to 80.24	4.66E+11	83%	4.15E+11	0	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	14.00 to 18.99	5.22E+10	83%	4.64E+10	0	5.22E+08	0	0	5.22E+09
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64%	3.42E+11	0	3.84E+09	0	0	3.84E+10
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95%	4.64E+10	0	5.22E+08	0	0	5.22E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	83%	1.19E+11	0	1.33E+09	0	0	1.33E+10
Burnt River at Unity Reservoir Dam	13.00 to 79.99	1.28E+11	0%	1.14E+11	0	1.28E+09	0	0	1.28E+10
Powder River from Thief Valley Reservoir to near Richland	48.00 to 109.99	2.31E+11	75%	1.91E+11	0	2.31E+09	1.43E+10	0	2.31E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	52.50 to 71.69	1.98E+11	40%	1.71E+11	0	1.98E+09	4.77E+09	0	1.98E+10
Notes: LA = Load allocation; WLA = Wasteload Allocation									

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Confluence of Brownlee Subbasin streams with Snake River	100.00 to 261.99	5.41E+11	0%	4.82E+11	5.41E+09	0	0	5.41E+10
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0%	5.22E+10	5.86E+08	0	0	5.86E+09
Powder River from Phillips Reservoir to Baker City	30.00 to 80.24	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	14.00 to 18.99	5.22E+10	83%	4.64E+10	5.22E+08	0	0	5.22E+09
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64%	3.42E+11	3.84E+09	0	0	3.84E+10
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95%	4.64E+10	5.22E+08	0	0	5.22E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	83%	1.19E+11	1.33E+09	0	0	1.33E+10
Burnt River upstream of Unity Reservoir Dam	13.00 to 79.99	1.28E+11	0%	1.14E+11	1.28E+09	0	0	1.28E+10
Powder River from Baker City to confluence with Snake River	48.00 to 109.99	2.31E+11	75%	1.91E+11	2.31E+09	1.43E+10	0	2.31E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	52.50 to 71.69	1.98E+11	40%	1.71E+11	1.78E+09	4.77E+09	0	1.98E+10

Note: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	100.00 to 261.99	5.41E+11	0%	4.82E+11	5.41E+09	0	0	5.41E+10
Powder River upstream of Philips Reservoir	12.00 to 27.02	5.86E+10	0%	5.22E+10	5.86E+08	0	0	5.86E+09
Powder River from Phillips Reservoir to Baker City	30.00 to 80.24	4.66E+11	83%	4.15E+11	4.66E+09	0	0	4.66E+10
North Powder River from USFS Boundary to Miller Rd	14.00 to 18.99	5.22E+10	83%	4.64E+10	5.22E+08	0	0	5.22E+09
Eagle Creek from New Bridge to Brownlee Reservoir	88.30 to 156.99	3.84E+11	64%	3.42E+11	3.84E+09	0	0	3.84E+10
North Powder River from Miller Rd to Confluence with Powder River	14.00 to 18.99	5.22E+10	95%	4.64E+10	5.22E+08	0	0	5.22E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	34.10 to 49.79	1.33E+11	83%	1.19E+11	1.33E+09	0	0	1.33E+10
Burnt River at Unity Reservoir Dam	13.00 to 79.99	1.28E+11	0%	1.14E+11	1.28E+09	0	0	1.28E+10
Powder River from Thief Valley Reservoir to near Richland	48.00 to 109.99	2.31E+11	75%	1.91E+11	2.31E+09	1.43E+10	0	2.31E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	52.50 to 71.69	1.98E+11	40%	1.71E+11	1.78E+09	4.77E+09	0	1.98E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Table 13: Medium-Low flow *E. coli* allocations by source and named stream reach~~Table 9.1e: Medium-Low flow bacteria~~*E. coli* ~~allocations by source and stream reach~~

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms/ day)	Point source WLAs (organisms/day)		RC (organisms /day)	MOS (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	33.00 to 99.99	2.06E+11	0	1.83E+11	2.06E+09	0	0	2.06E+10
Powder Subbasin								
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0	1.76E+10	1.98E+08	0	0	1.98E+09
Powder River from Phillips Reservoir to Baker City	12.81 to 29.99	1.64E+11	83	1.46E+11	1.64E+09	0	0	1.64E+10
North Powder River from USFS Boundary to Miller Rd	5.40 to 13.99	3.00E+10	83	2.67E+10	3.00E+08	0	0	3.00E+09
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95	2.67E+10	3.00E+08	0	0	3.00E+09
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64	1.10E+11	1.24E+09	0	0	1.24E+10
Powder River from Baker City to confluence with Snake River	18.80 to 47.99	1.07E+11	75	8.07E+10	1.07E+09	1.43E+10	0	1.07E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	0	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River upstream of Unity Reservoir Dam	4.10 to 12.99	2.54E+10	83	2.26E+10	2.54E+08	0	0	2.54E+09
Burnt River from Clarks Creek Rd to confluence with Snake River	28.00 to 52.49	1.29E+11	40	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10
Note: LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety								

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms /day)	Point source WLAs (organisms/day)		Reserve capacity (organisms /day)	Margin of safety (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	33.00 to 99.99	2.06E+11	0	1.83E+11	2.06E+09	0	0	2.06E+10
Powder Subbasin								
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0	1.76E+10	1.98E+08	0	0	1.98E+09
~~Powder River from Phillips Reservoir to Baker City~~	~~12.81 to 29.99~~	~~1.64E+11~~	~~83~~	~~1.46E+11~~	~~1.64E+09~~	~~0~~	~~0~~	~~1.64E+10~~
North Powder River from USFS Boundary to Miller Rd	5.40 to 13.99	3.00E+10	83	2.67E+10	3.00E+08	0	0	3.00E+09
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95	2.67E+10	3.00E+08	0	0	3.00E+09
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64	1.10E+11	1.24E+09	0	0	1.24E+10
Powder River from Baker City to confluence with Snake River	18.80 to 47.99	1.07E+11	75	8.07E+10	1.07E+09	1.43E+10	0	1.07E+10
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	0	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River upstream of Unity Reservoir Dam	4.10 to 12.99	2.54E+10	83	2.26E+10	2.54E+08	0	0	2.54E+09
Burnt River from Clarks Creek Rd to confluence with Snake River	28.00 to 52.49	1.29E+11	40	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10
Note: LA = Load allocation; WLA = Wasteload Allocation								

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	33.00 to 99.99	2.06E+11	0%	1.83E+11	2.06E+09	0	0	2.06E+10
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0%	1.76E+10	1.98E+08	0	0	1.98E+09
Powder River from Phillips Reservoir to Baker City	12.81 to 29.99	1.64E+11	83%	1.46E+11	1.64E+09	0	0	1.64E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~5.40 to 13.99~~	~~3.00E+10~~	~~83%~~	~~2.67E+10~~	~~3.00E+08~~	~~0~~	~~0~~	~~3.00E+09~~
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64%	1.10E+11	1.24E+09	0	0	1.24E+10
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95%	2.67E+10	3.00E+08	0	0	3.00E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	83%	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River at Unity Reservoir Dam	4.10 to 12.99	2.54E+10	0%	2.26E+10	2.54E+08	0	0	2.54E+09
Powder River from Thief Valley Reservoir to near Richland	18.80 to 47.99	1.07E+11	75%	9.03E+10	9.61E+08	4.77E+09	0	1.07E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	28.00 to 52.49	1.29E+11	40%	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)		Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
				Irrigation return and stormwater	Improper septic systems	ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	33.00 to 99.99	2.06E+11	0%	1.83E+11	0	2.06E+09	0	0	2.06E+10
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0%	1.76E+10	0	1.98E+08	0	0	1.98E+09
~~Powder River from Phillips Reservoir to Baker City~~	~~12.81 to 29.99~~	~~1.64E+11~~	~~83%~~	~~1.46E+11~~	~~0~~	~~1.64E+09~~	~~0~~	~~0~~	~~1.64E+10~~
North Powder River from USFS Boundary to Miller Rd	5.40 to 13.99	3.00E+10	83%	2.67E+10	0	3.00E+08	0	0	3.00E+09
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64%	1.10E+11	0	1.24E+09	0	0	1.24E+10
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95%	2.67E+10	0	3.00E+08	0	0	3.00E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	83%	7.34E+10	0	8.25E+08	0	0	8.25E+09
Burnt River at Unity Reservoir Dam	4.10 to 12.99	2.54E+10	0%	2.26E+10	0	2.54E+08	0	0	2.54E+09
Powder River from Thief Valley Reservoir to near Richland	18.80 to 47.99	1.07E+11	75%	8.07E+10	0	1.07E+09	1.43E+10	0	1.07E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	28.00 to 52.49	1.29E+11	40%	1.10E+11	0	1.29E+09	4.77E+09	0	1.29E+10

Notes: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Confluence of Brownlee Subbasin streams with Snake River	33.00 to 99.99	2.06E+11	0%	1.83E+11	2.06E+09	0	0	2.06E+10
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0%	1.76E+10	1.98E+08	0	0	1.98E+09
Powder River from Phillips Reservoir to Baker City	12.81 to 29.99	1.64E+11	83%	1.46E+11	1.64E+09	0	0	1.64E+10
North Powder River from USFS Boundary to Miller Rd	5.40 to 13.99	3.00E+10	83%	2.67E+10	3.00E+08	0	0	3.00E+09
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64%	1.10E+11	1.24E+09	0	0	1.24E+10
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95%	2.67E+10	3.00E+08	0	0	3.00E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	83%	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River upstream of Unity Reservoir Dam	4.10 to 12.99	2.54E+10	0%	2.26E+10	2.54E+08	0	0	2.54E+09
Powder River from Baker City to confluence with Snake River	18.80 to 47.99	1.07E+11	75%	8.07E+10	1.07E+09	1.43E+10	0	1.07E+10
Burnt River from Clarks Creek Rd to confluence with Snake River	28.00 to 52.49	1.29E+11	40%	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10

Note: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	33.00 to 99.99	2.06E+11	0%	1.83E+11	2.06E+09	0	0	2.06E+10
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0%	1.76E+10	1.98E+08	0	0	1.98E+09
Powder River from Phillips Reservoir to Baker City	12.81 to 29.99	1.64E+11	83%	1.46E+11	1.64E+09	0	0	1.64E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~5.40 to 13.99~~	~~3.00E+10~~	~~83%~~	~~2.67E+10~~	~~3.00E+08~~	~~0~~	~~0~~	~~3.00E+09~~
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64%	1.10E+11	1.24E+09	0	0	1.24E+10
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95%	2.67E+10	3.00E+08	0	0	3.00E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	83%	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River at Unity Reservoir Dam	4.10 to 12.99	2.54E+10	0%	2.26E+10	2.54E+08	0	0	2.54E+09
Powder River from Thief Valley Reservoir to near Richland	18.80 to 47.99	1.07E+11	75%	8.07E+10	1.07E+09	1.43E+10	0	1.07E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	28.00 to 52.49	1.29E+11	40%	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Table 14: Low flow *E. coli* allocations by source and named stream reach~~Table 9.1f: Low flow bacteria*E. coli* allocations by source and stream reach~~

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms /day)	Point source WLAs (organisms/day)		RC (organisms/ day)	MOS (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	0.01 to 32.99	8.02E+10	0	7.13E+10	8.02E+08	0	0	8.02E+09
Powder Subbasin								
Powder River upstream of Philips Reservoir	0.03 to 1.69	2.38E+09	0	2.12E+09	2.38E+07	0	0	2.38E+08
Powder River from Phillips Reservoir to Baker City	3.20 to 12.80	3.02E+10	83	2.68E+10	3.02E+08	0	0	3.02E+09
North Powder River from USFS Boundary to Miller Rd	0.01 to 5.39	1.25E+10	83	1.12E+10	1.25E+08	0	0	1.25E+09
North Powder River from Miller Rd to Confluence with Powder River	0.01 to 5.39	1.25E+10	95	1.12E+10	1.25E+08	0	0	1.25E+09
Eagle Creek from New Bridge to Brownlee Reservoir	0.00 to 5.59	1.08E+10	64	9.62E+09	1.08E+08	0	0	1.08E+09
Powder River from Baker City to confluence with Snake River	0.00 to 18.79	3.11E+10	75	1.33E+10	3.11E+08	1.43E+10	0	3.11E+09
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	5.90 to 17.79	4.30E+10	0	3.83E+10	4.30E+08	0	0	4.30E+09
Burnt River upstream of Unity Reservoir Dam	0.00 to 4.09	4.98E+09	83	4.43E+09	4.98E+07	0	0	4.98E+08
Burnt River from Clarks Creek Rd to confluence with Snake River	0.00 to 27.99	5.51E+10	40	4.43E+10	4.96E+08	4.77E+09	0	5.51E+09
Note: LA = load allocation; WLA = wasteload allocation; RC = reserve capacity; MOS = margin of safety								

Stream reach description	Mean daily flow ranges (cubic feet/ second)	Loading capacity (organisms /day)	Excess load (maximum percent reduction needed)	Nonpoint source and background LAs (organisms /day)	Point source WLAs (organisms/day)		Reserve capacity (organisms/ day)	Margin of safety (organisms/ day)
					ODOT MS4	Wastewater treatment		
Brownlee Subbasin								
Confluence of Brownlee Subbasin streams with Snake River	0.01 to 32.99	8.02E+10	0	7.13E+10	8.02E+08	0	0	8.02E+09
Powder Subbasin								
Powder River upstream of Philips Reservoir	0.03 to 1.69	2.38E+09	0	2.12E+09	2.38E+07	0	0	2.38E+08
~~Powder River from Phillips Reservoir to Baker City~~	~~3.20 to 12.80~~	~~3.02E+10~~	~~83~~	~~2.68E+10~~	~~3.02E+08~~	~~0~~	~~0~~	~~3.02E+09~~
North Powder River from USFS Boundary to Miller Rd	0.01 to 5.39	1.25E+10	83	1.12E+10	1.25E+08	0	0	1.25E+09
North Powder River from Miller Rd to Confluence with Powder River	0.01 to 5.39	1.25E+10	95	1.12E+10	1.25E+08	0	0	1.25E+09
Eagle Creek from New Bridge to Brownlee Reservoir	0.00 to 5.59	1.08E+10	64	9.62E+09	1.08E+08	0	0	1.08E+09
Powder River from Baker City to confluence with Snake River	0.00 to 18.79	3.11E+10	75	1.33E+10	3.11E+08	1.43E+10	0	3.11E+09
Burnt Subbasin								
Burnt River from Unity Reservoir to Clarks Creek Rd	5.90 to 17.79	4.30E+10	0	3.83E+10	4.30E+08	0	0	4.30E+09
Burnt River upstream of Unity Reservoir Dam	0.00 to 4.09	4.98E+09	83	4.43E+09	4.98E+07	0	0	4.98E+08
Burnt River from Clarks Creek Rd to confluence with Snake River	0.00 to 27.99	5.51E+10	40	4.43E+10	4.96E+08	4.77E+09	0	5.51E+09
Note: LA = Load allocation; WLA = Wasteload Allocation								

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	0.01 to 32.99	8.02E+10	0%	7.13E+10	8.02E+08	0	0	8.02E+09
Powder River upstream of Philips Reservoir	0.03 to 1.69	2.38E+09	0%	2.12E+09	2.38E+07	0	0	2.38E+08
Powder River from Phillips Reservoir to Baker City	3.20 to 12.80	3.02E+10	83%	2.68E+10	3.02E+08	0	0	3.02E+09
~~North Powder River from USFS Boundary to Miller Rd~~	~~0.01 to 5.39~~	~~1.25E+10~~	~~83%~~	~~1.12E+10~~	~~1.25E+08~~	~~0~~	~~0~~	~~1.25E+09~~
Eagle Creek from New Bridge to Brownlee Reservoir	0.00 to 5.59	1.08E+10	64%	9.62E+09	1.08E+08	0	0	1.08E+09
North Powder River from Miller Rd to Confluence with Powder River	0.01 to 5.39	1.25E+10	95%	1.12E+10	1.25E+08	0	0	1.25E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	5.90 to 17.79	4.30E+10	83%	3.83E+10	4.30E+08	0	0	4.30E+09
Burnt River at Unity Reservoir Dam	0.00 to 4.09	4.98E+09	0%	4.43E+09	4.98E+07	0	0	4.98E+08
Powder River from Thief Valley Reservoir to near Richland	0.00 to 18.79	3.11E+10	75%	2.29E+10	2.80E+08	4.77E+09	0	3.11E+09
Burnt River from Clarks Creek Rd to Snake River near Huntington	0.00 to 27.99	5.51E+10	40%	4.43E+10	4.96E+08	4.77E+09	0	5.51E+09

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)		Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
				Irrigation return and stormwater	Improper septic systems	ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	0.01 to 32.99	8.02E+10	0%	7.13E+10	0	8.02E+08	0	0	8.02E+09
Powder River upstream of Philips Reservoir	0.03 to 1.69	2.38E+09	0%	2.12E+09	0	2.38E+07	0	0	2.38E+08
~~Powder River from Phillips Reservoir to Baker City~~	~~3.20 to 12.80~~	~~3.02E+10~~	~~83%~~	~~2.68E+10~~	~~0~~	~~3.02E+08~~	~~0~~	~~0~~	~~3.02E+09~~
North Powder River from USFS Boundary to Miller Rd	0.01 to 5.39	1.25E+10	83%	1.12E+10	0	1.25E+08	0	0	1.25E+09
Eagle Creek from New Bridge to Brownlee Reservoir	0.00 to 5.59	1.08E+10	64%	9.62E+09	0	1.08E+08	0	0	1.08E+09
North Powder River from Miller Rd to Confluence with Powder River	0.01 to 5.39	1.25E+10	95%	1.12E+10	0	1.25E+08	0	0	1.25E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	5.90 to 17.79	4.30E+10	83%	3.83E+10	0	4.30E+08	0	0	4.30E+09
Burnt River at Unity Reservoir Dam	0.00 to 4.09	4.98E+09	0%	4.43E+09	0	4.98E+07	0	0	4.98E+08
Powder River from Thief Valley Reservoir to near Richland	0.00 to 18.79	3.11E+10	75%	1.33E+10	0	3.11E+08	1.43E+10	0	3.11E+09
Burnt River from Clarks Creek Rd to Snake River near Huntington	0.00 to 27.99	5.51E+10	40%	4.43E+10	0	5.51E+08	4.77E+09	0	5.51E+09

Notes: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Confluence of Brownlee Subbasin streams with Snake River	0.01 to 32.99	8.02E+10	0%	7.13E+10	8.02E+08	0	0	8.02E+09
Powder River upstream of Philips Reservoir	0.03 to 1.69	2.38E+09	0%	2.12E+09	2.38E+07	0	0	2.38E+08
Powder River from Phillips Reservoir to Baker City	3.20 to 12.80	3.02E+10	83%	2.68E+10	3.02E+08	0	0	3.02E+09
North Powder River from USFS Boundary to Miller Rd	0.01 to 5.39	1.25E+10	83%	1.12E+10	1.25E+08	0	0	1.25E+09
Eagle Creek from New Bridge to Brownlee Reservoir	0.00 to 5.59	1.08E+10	64%	9.62E+09	1.08E+08	0	0	1.08E+09
North Powder River from Miller Rd to Confluence with Powder River	0.01 to 5.39	1.25E+10	95%	1.12E+10	1.25E+08	0	0	1.25E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	5.90 to 17.79	4.30E+10	83%	3.83E+10	4.30E+08	0	0	4.30E+09
Burnt River upstream of Unity Reservoir Dam	0.00 to 4.09	4.98E+09	0%	4.43E+09	4.98E+07	0	0	4.98E+08
Powder River from Baker City to confluence with Snake River	0.00 to 18.79	3.11E+10	75%	1.33E+10	3.11E+08	1.43E+10	0	3.11E+09
Burnt River from Clarks Creek Rd to confluence with Snake River	0.00 to 27.99	5.51E+10	40%	4.43E+10	4.96E+08	4.77E+09	0	5.51E+09

Note: LA = Load allocation; WLA = Wasteload Allocation

Stream reach description	Mean daily flow ranges (cubic feet per second)	Loading capacity (orgs/day)	Excess load (maximum reduction needed)	Nonpoint source and background LAs (orgs/day)	Point source WLAs (org /day)		Reserve capacity (orgs/day)	Margin of safety (orgs/day)
					ODOT MS4	Wastewater treatment		
Pine Creek upstream of Highway 71	33.00 to 99.99	2.06E+11	0%	1.83E+11	2.06E+09	0	0	2.06E+10
Powder River upstream of Philips Reservoir	1.70 to 11.99	1.98E+10	0%	1.76E+10	1.98E+08	0	0	1.98E+09
Powder River from Phillips Reservoir to Baker City	12.81 to 29.99	1.64E+11	83%	1.46E+11	1.64E+09	0	0	1.64E+10
~~North Powder River from USFS Boundary to Miller Rd~~	~~5.40 to 13.99~~	~~3.00E+10~~	~~83%~~	~~2.67E+10~~	~~3.00E+08~~	~~0~~	~~0~~	~~3.00E+09~~
Eagle Creek from New Bridge to Brownlee Reservoir	5.59 to 88.29	1.24E+11	64%	1.10E+11	1.24E+09	0	0	1.24E+10
North Powder River from Miller Rd to Confluence with Powder River	5.40 to 13.99	3.00E+10	95%	2.67E+10	3.00E+08	0	0	3.00E+09
Burnt River from Unity Reservoir to Clarks Creek Rd	17.80 to 34.09	8.25E+10	83%	7.34E+10	8.25E+08	0	0	8.25E+09
Burnt River at Unity Reservoir Dam	4.10 to 12.99	2.54E+10	0%	2.26E+10	2.54E+08	0	0	2.54E+09
Powder River from Thief Valley Reservoir to near Richland	18.80 to 47.99	1.07E+11	75%	8.07E+10	1.07E+09	1.43E+10	0	1.07E+10
Burnt River from Clarks Creek Rd to Snake River near Huntington	28.00 to 52.49	1.29E+11	40%	1.10E+11	1.16E+09	4.77E+09	0	1.29E+10

Notes: Load allocations correspond to the loading capacities based on a maximum E. coli concentration of 126 organisms/100 mL; Wasteload allocations were calculated using a maximum discharge of 1 MGD and maximum E. coli concentration of 126 organisms/100 mL to ensure the recreation-based criteria were attained. LA = Load allocation; WLA = Wasteload Allocation

9.2 Reserve capacity

DEQ did not identify any projected needsspecify a for reserve capacityRC of *bacteria E. coliE. coli* due to account for to future growth and new or expanded sources. DEQ reserved zero percent of the bacteria*E. coli* loading capacityloading capacity. Future permitted sources may discharge effluent containing *fecal bacteriaE. coliE. coli* at concentrations in compliance with water quality standard criteria (see Table 4.0b5), which is consistentaligns with the requirements in this the TMDL for currently permitted sources and does not constitute a lowering of bacterialdegradation of water quality.

9.3 Margin of safety

As required by OAR 340-042-0040(4)(i), this element explains how a margin of safetyMOS was derived and incorporated into the TMDL to account for uncertainty in available data or in the actual effect controls will have on loading reductions and receiving water quality. For bacteria*E. coli* in the Powder River Basin, DEQ used an both explicit and implicit margins of safety. The TMDL calculation included an explicit margin of safetyMOS of As shown in Tables 9.1a8 through 9.1f13, a value of 10% percent was explicitly applied in the TMDL calculation(Tables 8-13). A detailed description of the margin of safetyMOS calculations can be foundappears in Section 6.4 of the Powder River Basin TMDL Technical Support Document.

In addition, the following conservative analytical assumptions provided an were included to incorporate an additional, implicit margin of safetyMOS. DEQ used reasonable maximum scenarios for each part of the analysis to ensure that estimated calculated loadsing would be the maximum potential loadings from sources. Die-off of *E. coli* during transport from land based sources to surface waters and establishment of naturally-reproducing *E. coli* populations in surface waters from a fecal source were not modeled. loads would be the highest actual loads that may be encountered. For instance, death and decay of *E. coliE. coli* in nonpoint sources is likely during the time spent on land and in runoff and stream/river transportbetween deposition and transport into waterways, particularly for reaches with long distances between monitoring stations.l, given the long distances to downstream monitoring sites and the presence of reservoirs in some reaches. Naturally reproducing populations of fecal-derived *E. coliE. coli* originating from fecal material may also contribute to observed concentrations at some locations (IDEQ, 2020). ly TemporHowever, DEQ assumed that all measured *E. coliE. coli* concentrations source bacteria reachoriginated from point or nonpoint sources the streams, because optimal growth conditions for *E. coli* exist in animal intestines. ; tThus, elevated *E. coli* concentrations in surface water suggest a direct input or land based source of fecal contamination (IDEQ, 2020)rather than modeling accounting for die-off of bacteriagrowth and death of *E. coliE. coli* populations. In calculating wasteload allocationWLAs for wastewater treatment facilities, DEQ used permitted discharge limits for *E. coliE. coli* without considering the bacteria*E. coli* reduction from chlorination or other treatments usedapplied to remove all pathogens from effluent prior to discharge. Because differingTo account for the potential disconnect between the land surface deposition and transport through runoff into surface waters, sources contribute differing magnitudes of bacteria*E. coli* during differing different flow conditions, DEQ also chose to apply reductions needed asapplied the maximum percent reduction needed to meet either from among those calculated based on geometric mean or single sample criteria for in an individual flow category-season combination across all flow categories and both seasons. This approach ensures additional that source reductions will be accomplished are applied to sources contributing during flows other than those associated with the maximum observed concentration.

10.~~0~~ Water quality management plan

As described in OAR 340-042-0040(4)(l)(A)-(O), an associated WQMP is an required element of a TMDL and must include the following components: (A) Condition assessment and problem description; (B) Goals and objectives; (C) Proposed management strategies design to meet the TMDL allocations; (D) Timeline for implementing management strategies; (E) Explanation of how TMDL implementation will attain water quality standards; (F) Timeline for attaining water quality standards; (G) Identification of persons, including Designated Management Agencies, responsible for TMDL implementation; (H) Identification of existing implementation plans; (I) Schedule for submittal of implementation plans and revision triggers; (J) Description of reasonable assurance of TMDL implementation; (K) Plan to monitor and evaluate progress toward achieving TMDL allocations and water quality standards; (L) Plan for public involvement in TMDL implementation; (M) Description of planned efforts to maintain management strategies over time; (N) General discussion of costs and funding for TMDL implementation; and, (O) citation of legal authorities relating to TMDL implementation.

DEQ sought and considered input from various persons, including DMAs responsible for TMDL implementation and other interested public, and prepared the Powder River Basin WQMP as a stand-alone document. DEQ intends to propose the draft WQMP as an element of the Powder River Basin TMDL for adoption as rule by the Oregon Environmental Quality Commission [OAR 340-042-0090(2)(b)].

11.~~0~~ Reasonable assurance

OAR 340-042-0030(9) defines Reasonable Assurance as “a demonstration that a TMDL will be implemented by federal, state or local governments or individuals through regulatory or voluntary actions including management strategies or other controls.” EPA’s TMDL guidance describes that when a TMDL is developed for waters impaired by both point and nonpoint sources and WLAs ~~are based on an assumption~~assume that NPS load reductions will occur, the TMDL must provide “reasonable assurances” that NPS control measures will achieve expected load reductions (USEPA 1991). Comprehensive explanations of reasonable assurances of implementation are provide in Section 7 of the Powder River Basin TMDL Water Quality Management Plan.

12.~~0~~ Protection plan

The scope of ~~this bacteria~~the ~~*E. coli*~~*E. coli* TMDL includes all perennial and intermittent streams in the Powder River Basin. As such, ~~these TMDLs~~this TMDL also serves as a “protection plan” to prevent impairment in waters currently attaining the applicable water quality standards,

~~whether~~whether those waters are assessed or not, and waters that have not been assessed yet ~~or unassessed~~. The protection of these unimpaired waters has ~~watershed~~basin-wide benefits such as:

- Clarity and consistency for implementation of management strategies throughout the ~~watershed~~basin.~~;~~
- Proactive~~ly~~ ~~applying~~ application of management strategies and protections to waters where data is not available for establishing listing status~~;~~ .
- Improvement of~~ing~~ TMDL outcomes by maintaining or improving water quality in streams that are tributary to listed streams~~;~~ .
- ~~Creating~~ Creation of ~~efficiencies~~ efficient transfers between TMDL and protection plan implementation (including monitoring, evaluating progress, adaptive management, enforcement, and leveraging partner ~~entities'~~ efforts)~~; and,~~ .
- Assisting with funding opportunities for implementation when grants require projects to be part of a larger watershed plan.

Protection plan core elements, as described in materials available ~~on~~ from the EPA~~'s webpage~~ (EPA 2023a and 2023b), are fulfilled by the statements and references to specific sections of the TMDLs, WQMP, and ~~TMDL~~ Technical Support Document in the subsections that follow.

12.1 Identification of specific waters to be protected and risks to their condition

Table 3~~.0~~ lists ~~all the assessments units within the watershed with~~ the 2022 Integrated Report assessment status for all the assessments units in the basin. ~~Those a~~Assessment units with the status of Category 2, Category 3, or unassessed are included in the protection plan. Therefore, ~~,~~ ~~along with other unassessed~~ the plan includes all waters in the basin that may have impairments for ~~waters that may be found to be unimpaired for bacteria~~*E. coli* ~~in the future~~identified in the future. The same sources and processes described in Section 7 that have caused ~~bacteria~~*E. coli* impairments to some reaches in the basin also pose a risk to unimpaired and unassessed waters.

12.2 Quantification of loads and activities expected to resist degradation

The implementation of management practices specified in Sections 2 and 5 of the WQMP also protect against risks to unimpaired and unassessed waters.

Monitoring stations ~~that provided~~ where ~~*bacteria E. coli*~~*E. coli* data ~~used~~ were collected ~~in~~ for the TMDLs analyses and associated flow data are ~~shown in TSD Tables 4.3a and 4.3b~~ 6 ~~and on figures and text throughout TSD Section 5.1~~described in Section 5.1 of the Technical Support Document. ~~The associate flow gaging stations used are listed in TSD Tables~~ 6~~4.3a and 4.3b and in text of TSD Section 5.1.~~ These -data and flow measurements were used to calculate loading ~~capacities~~ duration curves and loading capacities of ~~*E. coli*~~*E. coli* ~~within~~ in the basin ~~as shown in the load durations curves, presented as TSD Figures 4.5.1a – 4.5.1j16-25~~(Section 4.5 of the Technical Support Document). Applicable loading capacities for ~~any~~ unimpaired stream reaches that fall within the studied reaches are shown in Table~~s~~ ~~8.0~~7~~,~~ and Tables 10-14~~9.1b through 9.1f~~13. ~~Instructions~~ Methods for calculating loading capacities for ~~any~~ unimpaired stream reaches outside the studied reaches are provided in Section 8.~~0. Applicable loading capacities for bacteria*E. coli* for any unimpaired stream reaches at the varying flow categories are shown in TSD Table 4.5.2pp~~51~~.~~

~~Similar to~~As with loading capacities, relative percentages of the ~~*bacteria E. coli*~~*E. coli* ~~loading capacity~~loading capacity are allocated to sources to any stream reach within the ~~watershed~~ basin in Table ~~9.1a8~~9. ~~Relevant a~~Allocations for ~~anthropogenic~~ all sources of ~~*bacteria E. coli*~~*E. coli* loads are shown by studied reach in Tables ~~9.1.b9 through 9.1f13~~10-14.

12.3 Timeframes for protection

Timelines for ~~watershed~~basin-wide implementation of the TMDLs are described in Section 5 of the WQMP and estimated timelines for attainment of water quality standards in the impaired stream reaches are provided in Section 4 of the WQMP. DEQ's ~~watershed~~basin-wide approach ensures that the TMDLs and the protection plan will be implemented in a prioritized manner over the same timeframe that will be required to demonstrate effectiveness of management strategies in reducing excess pollutant loads.

12.4 Measures of success

The WQMP describes ~~in detail~~ DEQ's approach to quantitative and qualitative measures of progress in attaining and maintaining water quality standards~~, which is applied~~ ~~watershed~~basin-wide. Section 6 of the WQMP discusses quantitative and qualitative evaluation of implementation of management strategies, development of a plan for periodic monitoring, and an approach to adaptive management. Section 7 of the WQMP ~~details the interconnected~~describes the framework for accountability of implementation, including: engaging with sources~~;~~, setting measurable objectives~~;~~, evaluating progress~~;~~, conducting enforcement~~;~~, and tracking status and trends.

13.~~0~~ References

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Water Quality Management Plan

Powder River Basin - Total Maximum Daily Load for ~~Bacteria~~*E. coli*

May 2024

State of Oregon
DEQ Department of Environmental Quality

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Table of Contents

List of Tables and Figures

List of Figures

1. Introduction

In Oregon, Water Quality Management Plans (WQMPs) guide implementation of Total Maximum Daily Loads (TMDLs) that have been developed to restore and maintain water quality standards in surface waters (OAR 340-042-0040(4)(l)). WQMPs provide the framework for monitoring and management needed to achieve implementation timelines and gage success in meeting TMDL targets. This document presents the This draft Water Quality Management Plan (WQMP developed to facilitate) was developed to guide implementation of the Powder River Basin bacteria*E. coli* Total Maximum Daily Load (TMDL)TMDL for *E. coli* (also referred to as the Powder River Basin Bacteria TMDL). A WQMP is an element of a TMDL, as described by OAR 340-042-0040(4)(l) that , which provides the framework for management strategies to attain and maintain water quality standards and is designed to work in conjunction with detailed implementation plans prepared by persons responsible for TMDL implementation. The WQMP provides identifies tools, resources, and approaches that Designated Management Agencies (DMAs) and other Responsible Persons s(RPs) for TMDL implementation can use to formulate monitoring and management strategies.

This The WQMP for the Powder River Basin Bacteria TMDL WQMP will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule as OAR 340-042-0090(2)(b) and . This WQMP is intended to provide comprehensive information for implementation of all relevant TMDLs. It , so will be amended, as needed, upon for issuance of any future developed or revisednew or amended TMDLs for the Powder River Basin.

[ALTERNATIVE]: Oregon's administrative rules, (OAR 340-042-0030 and OAR 340-042-0040(4)(l)) identify the Water Quality Management Plan (WQMP) as the element of a Total Maximum Daily Load (TMDL) that provides the framework of management strategies to attain and maintain water quality standards. The framework is designed to work in conjunction with detailed plans and analyses provided in sector-specific or source-specific implementation plans.

This WQMP serves to guide implementation of the Powder River Basin TMDL for *E. coli* (also referred to as the Powder River Basin Bacteria TMDL). The WQMP identifies the entities responsible for nonpoint source implementing pollution reduction strategies, timelines for implementing those strategies, and approaches to gage progress in meeting TMDL targets, including periodic reporting and monitoring. The WQMP also identifies tools, resources, and approaches that Designated Management Agencies (DMAs) and other persons responsible for TMDL implementation can use to formulate monitoring and WQ protection and restoration strategies.

The WQMP for the Powder River Basin Bacteria TMDL will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule asin OAR 340-042-0090 (2)(b) and will be amended as needed for issuance of any new or amended TMDLs for the Powder River Basin.

1.1 Condition assessment and problem description

The firstAn element of the WQMP, per provided in OAR 340-042-0040(4)(l)(A), is an assessment of water quality conditions and problem description. in the Powder River Basin with

~~a problem description.~~ Oregon's 2022 Integrated Report, approved by US Environmental Protection Agency on September 1, 2022, ~~lists~~provides ~~There are a~~assessment units in the Powder River Basin that are listed as Category 5 (impaired) for ~~bacteria~~*E. coli* or fecal coliform, dissolved oxygen, pH, ~~chlorophyll *a*,~~ temperature, and phosphorus (DEQ~~,~~ 2022a) ~~in Oregon's 2022 Integrated Report, which was approved by US Environmental Protection Agency on September 1, 2022~~.

As required by Section 303(d) of the federal Clean Water Act, DEQ developed a ~~Total Maximum Daily Loads~~TMDL~~s~~ for ~~pollutants causing bacteria~~*E. coli* water quality impairments ~~of waters with~~in the Powder River Basin. ~~This~~ The TMDL addresses *E. coli* ~~and fecal coliform bacteria~~ and applies to all perennial and intermittent streams ~~within~~ in the Powder River Basin. TMDLs ~~to address~~addressing ~~dissolved oxygen, pH, chlorophyll *a*, and phosphorus are scheduled for future development and are not discussed further in this document~~additional water quality impairments will be developed in the future.

The public policy of the State of Oregon is to protect, maintain, and improve the quality of waters of the state for beneficial uses and to provide for prevention, abatement, and control of water pollution. ~~***Bacteria***~~*E. coli* impairment of streams poses risk of illness for people, pets, livestock, and wildlife that use the ~~beneficially using the~~ waters within the basin for recreational contact, ~~ingestion~~consumption, and irrigation. ~~Section 3 of the Powder River Basin Bacteria TMDL Further i~~Information ~~on~~about the risks associated with *E. coli* and fecal contamination is ~~available~~ described in Section 3 of the Powder River Basin Bacteria TMDL document and Section 3 of the ~~TMDL~~ associated Technical Support Document.

1.2 Goals and objectives

OAR 340-042-0040(4)(l)(B) requires identification of the goals and objectives of the WQMP.

The goal of ~~this~~ the WQMP is to provide the framework for implementing this TMDL to ~~provide the framework for TMDL implementation to~~ achieve and maintain ~~the E. coli~~ fecal bacteria (*E. coli*) water quality standards ~~with~~in the Powder River Basin.

The ~~primary~~ objectives of ~~this~~ the WQMP are to~~:~~ describe responsibilities for implementing TMDL management strategies and actions necessary to reduce excess pollutant loads to meet TMDL allocations, and to provide
~~dDescribe: a framework for TMDL implementation.~~
~~Outline DMA and RP responsibilities for implementing the TMDL; ,.~~
~~Provide possible management strategies and actions necessary that could to reduce excess *pollutant E. coli* loads in order to meet the TMDL allocations,; , and,~~
~~Develop~~ a strategy to evaluate progress towards attaining water quality standards in surface waters of~~throughout~~ the Powder River Basin.

2. Proposed management strategies

As required by OAR 340-042-0040(4)(l)(C), the following section presents management strategies~~,~~ by pollutant source~~,~~ that can be ~~designed~~ used to meet the load and wasteload allocations required by the Powder River Basin ~~bacteria~~~~*E. coli*~~Bacteria TMDL.

OAR 340-042-0030(6) defines management strategies as “measures to control the addition of pollutants to waters of the state and includes application of pollutant control practices, technologies, processes, siting criteria, operating methods, best management practices or other alternatives.”

Table ~~2.0a~~1 includes ~~proven~~ water protection and pollutant reduction strategies ~~(and practices within the strategies)~~ summarized by possible sources of *E. coli* ~~pollutant source~~. ~~The majority of~~Strategies and practices are adapted from published sources, including US Department of Agriculture Natural Resources Conservation Service ~~,~~ Field Office Technical Guide ~~(NRCS 2022)~~ , the Oregon Department of Agriculture, Oregon State University Extension Service, and the State Index of Conservation Practice Standards for Oregon (NRCS~~,~~ 2022). DEQ used the categories and language from the Oregon Watershed Enhancement Board (OWEB)~~'s~~ Oregon Aquatic Habitat Restoration and Enhancement Guide, and Oregon Watershed Restoration Inventory Online List of Treatments. ~~Additional sStrategies included in Table 2.0a1 are supported by the Oregon Department of Agriculture, Oregon State University Extension Service, and others.~~

~~**Table 2.0a: Management strategies by sources**~~

Table 1: ~~Possible~~Priority ~~M~~management strategies by sources of *E. coli*

	Sources	Percent Reductions Needed	Water Protection and Reduction Management Strategies (and practices)
Nonpoint and background	Stormwater ~~R~~runoff from non-agricultural lands, agricultural stormwater, snowmelt runoff, and ~~I~~irrigation return water in ~~and stormwater runoff in~~ contact with fecal matter ~~livestock grazing (management) areas (heavy use and confined feeding) and roadways~~	40% - 95%~~[2]~~[1]	Irrigation system improvement to reduce runoff (irrigation pipeline, microirrigation, sprinkler irrigation, irrigation tailwater recovery); improved irrigation efficiency ~~Runoff~~ runoff management; road/collection system cleaning/maintenance; surface drainage improvement
	Animals, including ~~L~~livestock, pets, and wildlife~~[1]~~ in and around streams ~~(including reservoirs during dry draw down)~~		~~Livestock~~ Agricultural management; upland erosion control techniques; riparian fencing (or other ~~livestock~~ animal exclusion or management methods); crossing improvements (culverts, structures, fords removed or replaced with bridge or ford); water gap development; livestock stream access/crossing (creation or improvement); livestock off channel watering/shade; riparian area restoration or enhancement; city ordinances for pet waste cleanup
	Failing or improper septic systems	unknown~~, but minimal~~	Identify any needed septic system repairs or upgrades, eliminate illicit discharges
Point~~t~~	Permitted Wastewater Treatment Systems	none, must meet standard	Compliance with NPDES permits; Plan, fund and implement system upgrades
	ODOT MS4 permit	unknown~~, but minimal~~~~[3]~~[2]	Compliance with MS4 permit; maintain road/collection system

Note: ~~[1]Minor, seasonal wildlife bacteria~~~~*E. coli*~~ ~~contributions are considered background sources and were not separated from other nonpoint sources in the TMDL analyses.~~ ~~[2]~~[1]For individual ~~By~~ stream reaches identified Table 9 of the TMDL ~~in TMDL Table 8.09~~; note that~~, some~~ not all reaches ~~do not~~ require reductions. ~~[3]ODOT~~ [2]ODOT roadway runoff ~~was not separated from all nonpoint and background sources, but is~~has a wasteload allocation of ~~allocated~~ 1% of the loading capacity.

Practices applied in the Malheur River Basin ~~demonstrated~~ to reduce ~~bacteria~~*E. coli*~~l~~ inputs from flood irrigated lands are listed in Table ~~2.0b~~2~~;~~. ~~and f~~Further information ~~on them~~ is available by contacting the Oregon State University Malheur Experiment Station, the Oregon Department of Agriculture ~~and~~, the Malheur Soil Water Conservation District, and the USDA Natural Resources Conservation Service. These types of projects can be~~y~~ funded through ~~G~~grants from the Oregon Watershed Enhancement Board, ~~(~~with match provided by land ~~ownders~~owners, ~~)along with significant matching from landowners, National~~ USDA Natural Resource~~s~~s Conservation Service, irrigation districts, watershed councils and other partners~~;~~, and Clean Water State Revolving Fund loans for public entities (~~,~~ which can include ~~principle~~principal forgiveness)~~, may be available and can be leveraged to make these types of projects possible~~. ~~More i~~Information on potential funding options is available in Section 5.3.6 and ~~its~~ the associated resources.

~~Table 2.0b: Applicable proven bacteria~~*E. coli* ~~reduction practices for nonpoint sources~~

Table 2: Applicable *E. coli* reduction practices for nonpoint sources

~~Malheur River Basin Proven Practices~~Best Management Practices for Flood Irrigated Lands
Irrigation Schedule Optimization
Sediment Basin and Tail Water Recovery (Pump-Back Systems)
Polyacrylamide (PAM)
Mechanical Straw Mulching
Water Conservation Methods
Filter Strips
Gated Pipe
Surge Irrigation
Laser Leveling
Turbulent Fountain Weed Screens
Underground Outlets for Field Tail Water
Nutrient Management
Improved Confined Animal Feeding Operation Practices
Constructed wetlands

~~With input from local land owners~~~~landowners/operators and conservation practioners, DEQ's source assessment identified the strategies in Table 2.0a1 and 2.0b2, as appropriate for the conditions and sources within the basin. Therefore, tThese are considered priority strategies and practices that should may receive special focus during implementation plan development.~~

DEQ's source assessment~~, detailed in Section 7 of the Powder River Basin TMDL Report Rule and Section 5 of the TMDL Technical Support Document~~ suggests that runoff from areas contaminated by fecal material can contribute to ~~, concluded that the primary pathways for~~a ~~pathway for~~excess *E* ~~fecal bacteria~~*E.* *coli* loading to surface waters (DEQ 2024a; DEQ 2024b)~~to enter waters of the state is from runoff in areas contaminated by fecal material. are through erosion and runoff from irrigated farmlands and pastures; direct deposition of livestock manure; and transport and delivery of sediment and organic matter containing bacteria~~*~~E. coli~~*~~. Therefore, the primary m~~Management strategies for reducing ~~bacteria~~*E. coli* ~~inputs~~ loads ~~from this process~~~~into streams~~ include:

- Irrigation ~~improvements~~ modernization practices and erosion control techniques ~~that have been widely applied in eastern Oregon~~: ~~with success in reducing bacteria~~*~~E. coli~~* ~~concentrations, as well as reducing nutrient and sediment pollution:~~
  - ~~Conversion of f~~Flood irrigation to sprinkler or drip irrigation.~~;~~
  - ~~Installation of c~~Concrete-lined irrigation ditches and piped water delivery systems.~~;~~
  - ~~Construction of w~~Wetlands, ponds, or other sediment trapping systems.
- ~~Implement additional b~~Best management practices for livestock manure ~~and~~ management and management of ~~of~~ grazed areas ~~and~~ to~~reduce livestock access to streams to~~ reduce land surface runoff and direct deposition of manure to surface waters.~~organic matter mobilization in runoff and direct deposition into surface waters.;~~
- Enhancement and protection of riparian zones to provide adequate filtration capacity for organic matter and nutrients.

- ~~Improve pastures and riparian zones to reduce surface erosion and provide adequate filtration capacity for organic matter and nutrients.~~;
- ~~Assess~~Inspection of onsite septic systems to identify those currently or at~~at the~~ highest risk of malfunction~~-~~ing~~or failure~~.

DEQ expects ~~that~~ entities identified in Section 4.1 ~~will~~ to develop implementation plans that include, but are not limited to, strategies and practices ~~from~~ listed in Tables ~~2.0a~~1, ~~and~~ ~~2.0b~~2, and ~~in the tables, if any, within entity-specific sections that follow~~ ~~with specificother entities~~tables within section 5, as needed. At a minimum, ~~I~~implementation plans ~~must~~ must~~need to~~ include:

- Location and timing of strategies.
- Measurable objectives.
- Milestones for gaging implementation progress.
- Interim and final implementation targets for evaluating effectiveness.
- ~~specifics details on where and when priority and other strategies will be appliedapply, along, with measurable objectives and milestones for ensuring their implementation and gaging their implementation and effectiveness.~~

Based on the analysis of available water quality data (DEQ 2024b), DEQ has identified ~~determined the~~ areas ~~within the Powder River Basin shown~~ in Table ~~2.0c~~3 ~~should be prioritized for~~as ones of initial focus for implementation projects to reduce ~~bacteria~~*E. coli* loads~~, particularly from irrigated farmlands and pastures (including rangelands) with the potential for overland flows to reach waterbodieswaters of the state.~~. Table ~~2.0c~~3 also shows the ~~primary~~ DMAs and ~~RPs~~persons responsible for managing ~~jurisdictional responsibility for land use~~lands and practices in these areas. ~~DEQ prioritized these locations based on land use, /land cover and water quality monitoring data withthat demonstrate criteria exceedances~~However, water quality data and other information acquired during TMDL implementation may shift or expand the focus to other areas in the basin ~~to~~.

~~Further Additional information is available in Section 7 of the Powder River Basin TMDL Report and Section 5 of the TMDL Technical Support Document.~~

~~**Table 2.0c: Priority locations for implementation of bacteria*E. coli* reduction strategies**~~

Table 3: ~~Priority~~Initial focus areas for ~~locations for~~ implementation of ~~E. coli~~*E. coli* reduction strategies

~~River reaches~~Focus area	Designated Management Agency
North Powder River from USFS Boundary to confluence with Powder River	Oregon Department of Agriculture
Burnt River from Unity Reservoir to Clarks Creek Rd	Oregon Department of Agriculture, U.S. Bureau of Land Management
South Fork Burnt River	Oregon Department of Agriculture, U.S. Bureau of Land Management
Powder River from ~~Thief Valley Reservoir to near Richland~~Baker City to confluence with the Snake River	Oregon Department of Agriculture, U.S. Bureau of Land Management
Eagle Creek from New Bridge to Brownlee Reservoir	Oregon Department of Agriculture, U.S. Bureau of Land Management, U.S. Forest Service
Thief Valley Reservoir~~, due to trespass cattle during the dry season~~	U.S. Bureau of Reclamation, Oregon Department of Agriculture, U.S. Bureau of Land Management

3. Timelines for implementing strategies

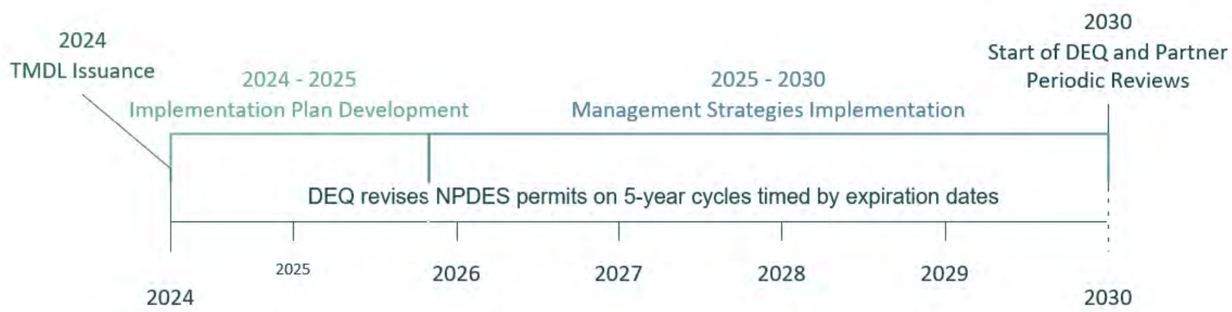
OAR 340-042-0040(4)(l)(D) requires schedules for implementing management strategies including permit revisions, achieving appropriate incremental and measurable water quality targets, implementing control actions and completing measurable milestones.~~OAR 340-042-0040(l)(D) requires schedules for implementation ofing management strategies. Schedules need to include timelines for:~~

- ~~including pPermit revisions, .~~
- ~~Expected achievement of achieving appropriate incremental and measurableincremental and final water quality targets.~~
- ~~, implementing Implementation of control actions.~~
- ~~C and completion ofng measurable milestones.~~

The DEQ~~'s water~~ Water ~~quality~~ Quality ~~permitting~~ Permit ~~p~~Program has responsibility for revising permits to comply with TMDLs. Other ~~DMAs and RPs~~responsible persons (RPs) and DMAs have responsibilities for developing ~~T~~timelines for implementation of management strategies ~~by responsible persons is discussed separately~~to address nonpoint sources of pollution. ~~DEQ will begin the incremental review of the Powder River Basin Bacteria TMDL in~~

~~2030 (~~Figure ~~3~~1~~)~~ represents an anticipated timeline for TMDL implementation in five-year increments. ~~presents a typified timeline for TMDL implementation in a five-year increment.~~

Figure 1: Powder River Basin ~~*E. coli*~~ Bacteria TMDL implementation timelines



~~**Figure 1: Powder River Basin E. coli*E. coli* TMDL implementation timelines**~~
~~**Figure 3: Powder River Basin Bacteria*E. coli* TMDL implementation timelines**~~

3.1 DEQ ~~Permit~~ permit revision cycle~~s~~

NPDES permits ~~are typically~~ undergo re-~~evaluated~~ evaluation on five-year cycles. ODOT ~~received~~was issued a ~~'s~~ statewide MS4 stormwater NPDES permit ~~was last issued~~ in 2020 ~~and is anticipated to~~ will ~~be renewed in 2025~~. The Powder River Basin ~~Bacteria~~~~*E. coli*~~Bacteria TMDL allocation will be implemented in ~~ODOT's~~ the ~~renewed~~ permit upon renewal ~~at renewal~~. NPDES permits issued to Baker City, ~~the cities of~~ Huntington, and North Powder do not require further modification ~~at renewal as~~ because ~~they~~ these facilities currently implement ~~the *E. coli* criteria (OAR 340-0041) as~~ permit limits that ~~, which are~~ meet the ~~bacteria~~*E. coli* wasteload allocations required ~~assigned by~~ in ~~this~~ the TMDL. ~~DEQ~~

3.2 Management strategies implemented by responsible persons

~~DEQ's~~ Based on analyses (DEQ~~,~~ 2024a), DEQ estimated timelines to attain excess pollutant load reductions. These are presented in Section 4.2 as the schedule for achieving appropriate incremental and measurable water quality targets. DEQ also estimated reasonable timelines for implementation of ~~some~~ several priority management strategies specific to ~~certain~~ DMAs and RPs, ~~as~~ shown in tables in subsections of Section 5.1. DEQ expects ~~responsible persons~~these entities to consider the~~se~~ timelines presented in Section 5.1 when~~in~~ establishing commitments for management strategies and actions in TMDL implementation plans. ~~as they that specify the management strategies and practices, along with~~and ~~schedules with measurable milestones, in implementation plans, as required in Section 5.3.~~

As discussed in Section 6, DEQ evaluates completion of implementation schedules and measurable milestones during review of annual reports. ~~The annual reports~~DEQ periodically ~~and gages~~evaluates progress toward TMDL goals, typically ~~set on~~in five-year increments,~~,~~ ~~during periodic evaluationin~~by evaluating~~ons of~~ all available monitoring data and other relevant information~~, typically in five-year increments~~.

4. Attaining water quality standards

Based on the DEQ analyses analysiscompleted for this TMDL (DEQ 2024a), achieving the excess load reductions identified (in Table 78.0 of the TMDL Rule)allocations presented in Tables 10-14 in the TMDL document will result in attainment of the Oregon's water quality standards for bacteria (*E. coli*). Management strategies identified in this the WQMP and included in implementation plans represent provide a system of measures and practices that willintended to collectively reduce bacteria*E. coli* pollutant loads and improve water quality in the Powder River Basin.

4.1 How priority management strategies support attainment of bacteria*E. coli* water quality criteria

OAR 340-042-0040(4)(l)(E) requires an explanation of how implementing the proposed management strategies will result in attainment of water quality standards.

As detailed inIn Section —4.5 of the TMDL Technical Support Document identifies , reductions in excess loads of fecal bacteria*E. coli* are needed to attain Oregon's bacteria*E. coli* water quality criteriastandards for *E. coli*. Recommended management strategies for reduction of *E. coli* loads are included in Section 2. The priority management strategies identified in Section 2 for implementation by responsible personRPs are proven to be effective in bacteria*E. coli* and are supported by the available literature.

Landowners, and land managers, producers, conservation professionals, RPs and designated management agenciesDMAs have the individual and collective expertise and experience needed to developfor managing site-specific management strategiesconditions and practices to meet water quality standards and best management practices responsible persons of areas within their jurisdictions. In Sections 2 and 5, DEQ used existingavailable data and information to prioritizeidentify focal -areas within the watershedbasin to help focusfor expanded *E. coli* monitoring and initial -TMDL implementation by DMAs and RPs of bacteria*E. coli* reduction strategies, as well as providing entity-specific strategies throughout Section 5.1. As more information on current practices, strategies, and monitoring becomes available, focal areas may be expanded or shifted.

4.2 Timelines for attaining bacteria*E. coli* water quality criteria

OAR 340-042-0040(4)(l)(F) requires an estimated timeline for attaining water quality standards through implementation of the TMDL, WQMP, and associated required TMDL implementation plans.

Based on DEQ's source assessment andthe TMDLs analysis (DEQ, 2024a), nonpoint sources contribute nearly all ofmost the of *pollutant E. coli* loading to surface waters in associated with water quality impairments in the Powder River Basin. Therefore, management should focus on it is critical for nonpoint sources to meet s to make timely progress toward reducing anthropogenic pollutant loads in order toto meet the TMDL load allocations.

The timeline for water quality standard attainment will is expected towill probably vary substantially across the basin, . with some pPortions of the basin already at or near the attainment ofattain *E. coli* water quality standards and whereas in while other areas may need additional management practicesefforts are needed to reduce loads. portions severely degraded. Currently DEQ determined that there is a fair amount of local support for irrigation system improvements that will enhance control of water application, reduce bacteria*E. coli* loading to streams, and improve crop yields. Local irrigation system improvements and other conservation projects have been funded by OWEB with contributions from NRCS and landowners. Additional More fFinancial and technical support from state and federal programs can support through grants and staff time will be is needed for continued future implementation of similar related projects and best management practices. Several resources are available through state and federal programs (see (-Section 25).

In the nearby neighboring Malheur River and Owyhee Basins, the rate of irrigation system improvement and piping projects has accelerated over the last 10- to 15 years and significant improvements in water quality have been measured and documented (DEQ, 2022b). Anecdotally, Aas landowners see neighbors achieve better crop yields and environmental benefits, more of them are encouraged to participate join in the process. Best Management Practices for irrigated agriculture have been developed and implemented on a wide scalein those basins (see Examples of Best Management Practices for flood irrigated lands that have been used in the Malheur and Owyhee River basins- are listed in Table s 2.0a1 and 2.0b2). For example, irrigation systems have been improved modified by installing concrete-lined irrigation ditches and piped water delivery systems. Wetlands and sediment ponds have been constructed to trap sediment and reduce nutrient and bacteria*E. coli* concentrations. These actions have resulted measurable reductions in sediment and bacteria*E. coli* concentrations in surface waters.

DEQ recognizes that irrigation projects have been completed recently or are currently under way in the Powder River Basin. These projects will be considered part of implementation of the TMDL. DEQ expects iIt is reasonable to assume conclude that sSimilar gains improvements in to water quality improvement could happen be achieved in the Powder River Basin through continued and expanded implementation of similar these management strategiestypes of projects over the next 10- to 15 years, with a possible 50% decline in bacteria*E. coli* loading over 10-15 years and attainment of water quality standards in 20-30 years.. For substantial and timelymeasurable improvements to water quality, projects should be focused on areas listed in Table 2.0c3 provides a list of areas that can be initially scoped for implementation; others may be identified through continued monitoring or community feedback.

5. Implementation responsibilities and schedule

5.1 Identification of implementation responsibilities

OARs 340-042-0040(4)(I)(G) and 340-042-0080(1) require identification of persons, including Designated Management AgenciesDMAs, responsible for planning, implementing, and revising management strategies- for a TMDLand preparing and revising implementation plansand preparing and revising implementation plans.

OAR 340-042-0030(2) defines Designated Management AgencyDMA as a federal, state, or local governmental agency that haswiththat has legal authority over a sector or source of contributing contributing pollutants possibly contributing to water quality impairment and is and is identified as such as such by DEQ in a TMDL.

The TMDL rule provides numerous mentions of the term "'responsible person' person" (abbreviated throughout this document as RP) with associated requirements. OAR 340-042-0025(2) indicates that responsible sources must meet TMDL load and wasteload load allocations through compliance with discharge permits or other strategies developed in implementation plans. OAR 340-042-0030(9) defines "'reasonable assurance"' as a demonstration of TMDL implementation by governments or individuals. OARs 340-042-0040(4)(l)(G) requires identification of persons, including DMAs, responsible for developing and revising implementation plans. OAR 340-042-0040(4)(l)(I) requires a schedule for submittal and revision of implementation plans by responsible personsRPs, including DMAs. And OAR 340-042-0080(4) reiterates the requirement for of responsible personsRPs, including DMAs, responsible forto development, submittal, and revision revise of implementation plans, along withand the required elements of those plans.

Therefore, for For tThe purposes of this the WQMP guiding implementation of the Powder River Basin WQMP, for implementation of the bacteria*E. coli* Bacteria TMDL, 'responsible person'RP is definedrefers to as any an entity responsible for any a possible source of *pollution addressed by the TMDLE. coli* to surface waters in the basin.. Unless otherwise specified, all responsible personsRPs, including DMAs, are requiredneedare required to must develop, submit, implement, and revise, as needed,, as needed, an implementation plan specific to the Powder River Basin Bacteria TMDL. These plans need to that must include, but are not limited to,s: management strategies;, timelines for implementation;, a schedule for achieving milestones;, and a performance monitoring component, and a with a schedule for review and plan revision, as detailed in Section 5.3. Submittal of each plan must follow the schedule described in Section 5.4.plan for periodic review and plan revision. Table 45.1 contains the list of these responsible persons.

~~**Table 5.1: Entities responsible for implementing bacteria*E. coli* management strategies and developing implementation plans for the Powder River Basin**~~

Table 4: Entities responsible for ~~implementing E. coli management strategies and~~ development and implementation of management strategies ~~ing implementation plans and implementing~~ for *E. coli* ~~management strategies~~in the Powder River Basin ~~for the Powder River Basin~~

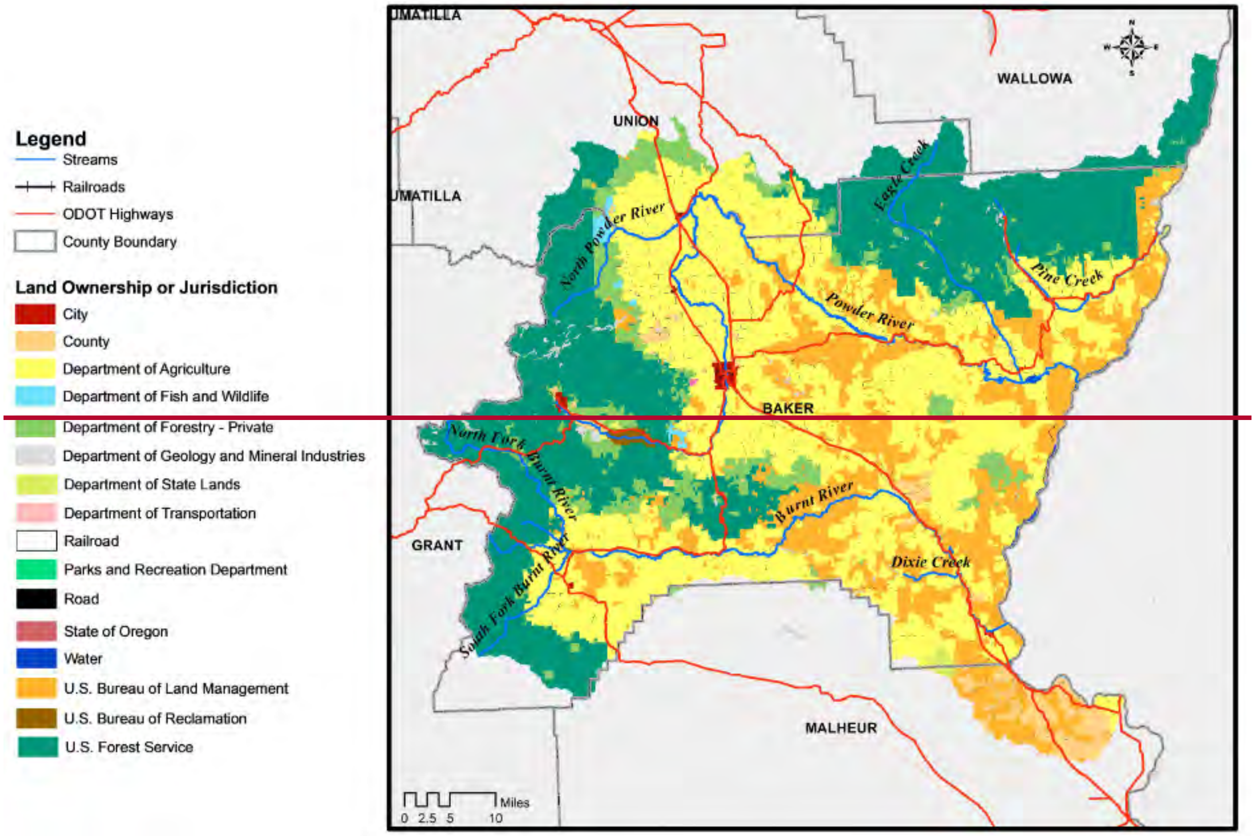
Designated Management Agency or responsible person	~~Area of~~ Jurisdiction
Oregon Department of Agriculture	Agricultural lands and activities
Oregon Department of Fish and Wildlife	ODFW managed lands and activities~~including the Elkhorn Wildlife Area~~
Oregon Department of Forestry*	Non-federal forest lands
US Forest Service	Wallowa-Whitman National Forest managed lands
US Dept of Interior, Bureau of Land Management	BLM Vale District managed lands
Baker County	Planning and Development (~~Z~~zoning and rural land use), Building permits and inspections, County-owned lands and roads and rights-of-way along subbasin perennial tributaries, drainage ditches within county service districts, Sumpter Valley lands (Baker), Environmental Health~~; and improperly functioning septic systems, when encountered~~
Union County	
US Bureau of Reclamation Columbia-Pacific Northwest Regional Office	Management of reservoir lands
Baker Valley Irrigation District	Water management ~~and~~ , conveyance and ~~I~~irrigation systems operated by water management district
Powder Valley Water Control District	
Lower Powder Irrigation District	
Burnt River Irrigation District	
Baker City	Municipal stormwater control, city-owned and/or managed property and facilities, maintenance, and enhancement of riparian areas within city land use jurisdiction~~.~~
Oregon Department of Environmental Quality*	NPDES and WPCF permits implementation and enforcement. Statewide Onsite Wastewater Program.
Oregon Department of Transportation	Stormwater and other nonpoint sources from highways, rights-of-way, and facilities
NOTE: *~~-~~DEQ and ODF will not prepare implementation plans. DEQ will incorporate waste load allocations into NPDES permit requirements and ODF will implement the Forest Practices Act.	

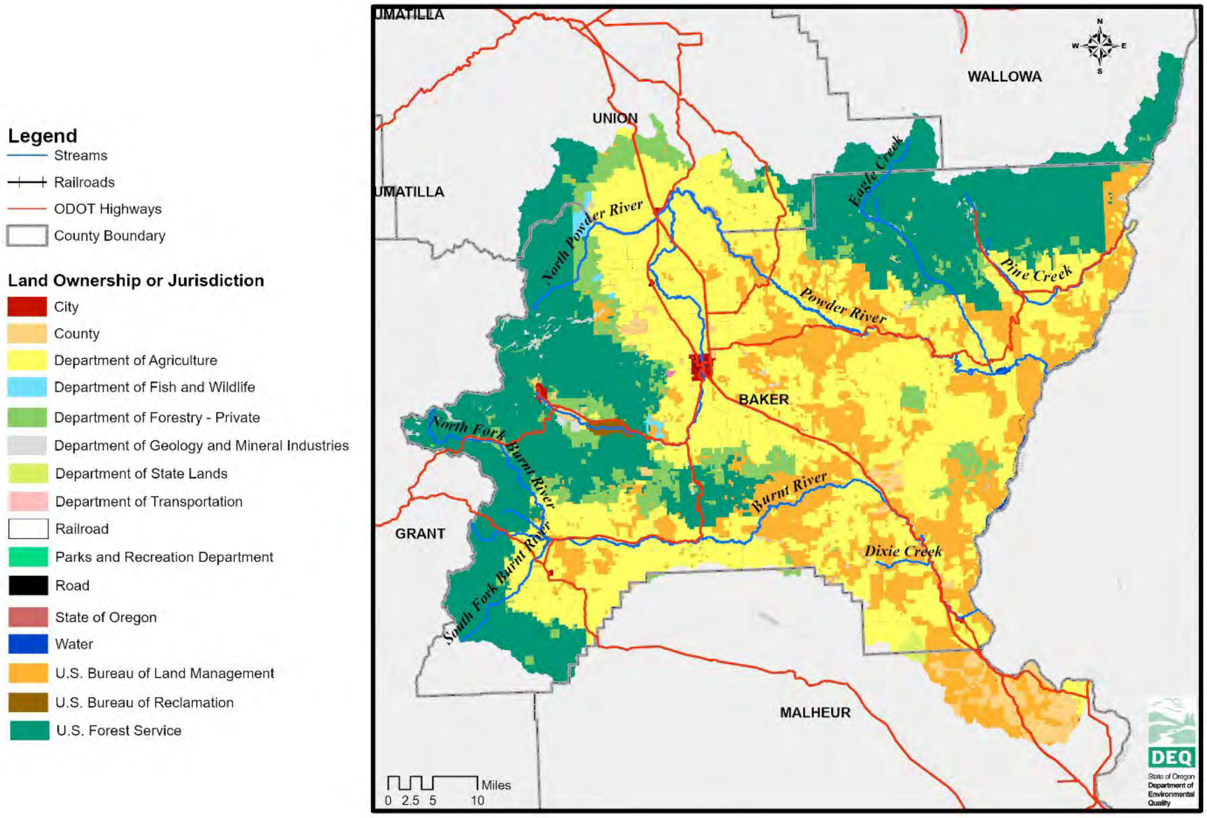
~~Table 45.1 is not an exhaustive list of every individual that bears responsibility for improving water quality in the Powder River Basin.~~In addition to the DMAs and RPs listed in Table 4, ~~A~~ all people ~~that~~ who live, work, and ~~recreate in the watershed~~visit the basin can take steps to ~~reduce pollution and~~ protect ~~or~~ and restore water quality ~~to attain standards and protect designated beneficial uses~~. Achievement of long-term water quality improvements in the basin will only be accomplished with leadership from ~~Active participation by~~ local communities ~~may be needed to achieve long-term water quality improvements throughout the watershed~~.

Figure 2~~5.1~~ ~~is a map of the watershed showing~~displays areas ~~by~~ of land use, ownership, ~~or~~ and jurisdiction ~~with responsibility for implementation of management strategies by the entities indicated~~in the Powder River Basin. The Oregon Department of Agriculture has jurisdiction ~~on~~for

~~about~~ 38% ~~percent~~ of the land area in the basin. Jurisdictional areas of the US Forest Service and Bureau of Land Management are ~~approximately~~ 32% ~~percent~~ and 18 %~~percent~~, respectively. DEQ calculated Oregon Department of Transportation jurisdictional area in the basin to be ~~approximately~~ <0.1% ~~percent~~. Other ~~mapped~~ entities ~~also~~ have ~~less than one percent~~<1% of the area under their jurisdiction or ownership. DEQ determined ~~in its source assessment~~ that these entities have existing permit requirements or lack authorization to discharge *E. coli* ~~most of these small jurisdiction entities are adequately regulated under existing permit programs, and/or do not have authority for activities contributing to excess *E. coli*, or do not conduct activities that are nonpoint sources of excess bacteria*E. coli* and therefore did not assign identify them as DMAs or responsible persons in Table 5.1.Table 4~~.

Figure 2: Powder River Basin land ownership ~~or~~and jurisdiction





~~**Figure 2: Powder River Basin land ownership or jurisdiction**~~

~~**Figure 5.1: Powder River Basin land ownership or jurisdiction**~~

5.1.1 Land management and land use agencies

5.1.1.1 Oregon Department of Agriculture

The Oregon Department of Agriculture (ODA) ~~is responsible for regulating~~regulates agricultural activities on private lands that can affect water quality in Oregon surface waters. ~~Approximately~~ ODA supervises 38% ~~percent~~ of lands in the Powder River Basin~~ are under ODA jurisdiction~~. In addition to ODA's implementation of the Oregon Agricultural Water Quality program (Area Rules and Powder-Brownlee and the Burnt River Area Plans), DEQ ~~determined in Section 5.2.2 that~~ expects ODA ~~must develop a~~ to submit a TMDL implementation plan~~, in order to meet~~ for the Powder River Basin~~ agricultural sector load allocations for bacteria~~*E. coli*~~. ODA's~~. The implementation plan ~~must should~~must include the required elements described in Section 5.3 and ~~be~~ be submitted according to the schedule in Section 5.4. The plan ~~must shouldshould~~may include ~~priority~~ management strategies from Tables ~~2.0a~~1, ~~2.0b~~2, and 5,~~, 1.1.1~~ and others selected by ODA ~~or other strategies that ODA documents are appropriate~~ for TMDL implementation~~to agricultural land and activity-related conditions in the subbasin, to address gaps between the current bacteria~~*E. coli*~~ loading under existing Area Rules and Area Plans~~, ~~and~~

the TMDL allocations applicable to agriculturerequirements of the TMDL. Any aAlternative sStrategies or timelines selected as alternative to those presented in Table 5.1.2a95 must shouldmust be documented in the implementation plan.

ODA's implementation plan must identify a combination of protection strategies to maintain conditions where agricultural sector load allocations are being met and ways to promote and assist with active restoration strategies in areas where agricultural sector allocations are not being met. Specific mManagement strategies and controls practices to address gaps in pollution controls or prevention should may be documented in revisions to the Area Rules or Area Plan, as appropriate as needed.

DEQ expects As part of developing the implementation plan, ODA must to include an effective methodologymethods and schedules for to conducting assessment of land conditions and current management practices within ODA's its jurisdictional areas of the Powder River Basinin the implementation plan. DEQ expects ODA's land assessment methodology methods must to address factors described in Section 5.3.1 in determining the details of the implementation plan, and include a process for determining locations for implementation of priority management strategies, from Tables 2.0a1, 2.0b2, and 5,.1.1.1 and in considerration of the priority focus areas identified in Table 2.0c3.

ODA administers the Confined Animal Feeding Operation (CAFO) Program and conducts inspections of permitted CAFOs within the Powder River Basin. Inspections include permit evaluation and evaluation of animal waste collection, treatment, handling, disposal, and management procedures for compliance with the Clean Water Act, Oregon water quality law, and permit conditions. ODA may include timelines for CAFO inspections in a TMDL implementation plan.

ODA has conducted land condition assessments to address identified Area Rule violations and included monitoring as part of the Lower Powder and South Fork Burnt River, Strategic Implementation Areas (SIA). ODA's assessment methodologys couldmay build on existing SIA evaluation methods and Focus Areas, to identify and address land conditions or practices that mayareas with inadequate lack sufficient management practices to controlmanage *E. coli* loading to surface waters. The implementation plan may include descriptions of any of these processes for evaluation of compliance with ODA's area rules outside any SIA evaluation areas. To date, ODA has conducted land condition assessments, has or will address identified Area Rule violations, and included monitoring as part of the Lower Powder and South Fork Burnt River Strategic Implementation Areas. ODA's implementation plan must describe how ongoing or completed work has already addressed, aligns with, or can be built upon to will advance the goals and requirements of this TMDL and WQMP. ODA's assessment methodology could build on existing Strategic Implementation Area SIA evaluation methods and ODA's Agricultural Focus Area process to identify and address land conditions or practices, including those that may be in compliance with Area Rules, but individually or collectively prevent attainment of agricultural sector load allocations that lack sufficient management or practices to control *E. coli* loading to surface waters. This strategy should also include evaluation of compliance with Area Rules in areas of the watershed basin outside any SIA evaluation areas.

ODA is responsible to administers the Confined Animal Feeding Operation (CAFO) Program and conducts inspections of permitted CAFOs within the Powder River Basin. This information can be included in ODA's TMDL implementation plan. DEQ recognizes ODA's existing collaborative process with the Powder-Brownlee and Burnt Local Advisory Committees to encourage landowners to implement voluntary practices identified in the Area Plans. ~~This~~This collaboration, along with subbasin area specific collaboration with other DMAs, ~~should~~ may be described in ODA's implementation plan ~~to fulfill the education and outreach component described in Section 5.3.4~~.

~~**Table 5.1.1.1: ODA-specific management strategies and timelines that would be effective in achieving load allocations for bacteria*E. coli***~~

Table 5: ODA~~-specific~~ management strategies and timelines ~~designed to achieve load allocations for *E. coli*~~for TMDL Implementation

Source or activity	Management Strategy	Timeline
Agricultural land condition	Work collaboratively with DMA~~'~~s and local and regional partners to develop a schedule of grant proposals to fund ~~the~~ assessment, prioritization, outreach, and implementation of ~~bacteria~~*E. coli* management measures. Prioritize assessment and planned implementation for ~~high bacteria*E. coli* loading~~priority areas noted in Section 2	Submit with TMDL implementation plan
	Describe plan to assess land condition for surface and bank erosion; ensure that roads and livestock access to streams include BMPs to minimize erosion and sediment delivery to waters of the state	
	Describe plan to assess manure management (storage, distribution) and ~~make a plan~~plan to ensure BMPs to prevent runoff are in place	
	Describe plan to identify locations and assess patterns of livestock access to streams ~~in the watershed~~across the basin	
	Complete assessment of agricultural land conditions and domestic livestock land use	Years 1 – 3 after ~~TMDL issuance~~EQC adoption of the TMDL rule
Domestic livestock - grazing and manure management	Alter animal stocking rate or timing if necessary to reduce manure near streams	Years 1–~~-~~10 after EQC adoption of the TMDL rule~~TMDL issuance~~
	Utilize rotational grazing and other techniques to minimize overgrazing	
	Provide off-channel livestock water	
	Conduct livestock management training	
	Minimize direct livestock stream access (livestock exclusion through fencing or other practices)	
	Ensure adequate riparian vegetated filter strip and buffer zone	
Agricultural runoff	Implement irrigation system improvements and modernize water conservation practices to reduce or prevent runoff. ~~Evaluate Ensure~~ Encourage agricultural ~~operators~~ producers to coordinate with irrigation districts and other agricultural water suppliers to develop and implement ~~utilizing~~ Agricultural Water Management and Conservation Plans (WMCPs)~~:~~ Online: https://www.oregon.gov/owrd/programs/planning/wmcp/pages/agriculturalwatermanagement.aspx	

5.1.1.2 Oregon Department of Forestry

The Oregon Department of Forestry (ODF) has jurisdiction over forest operations on private forested lands in the Powder River Basin. ~~,~~ODF ~~including~~ ensur~~ing~~es water protection ~~under~~ through the Forest Practices Act. DEQ's analysis does not suggest that ~~P~~private forestry activities ~~are not a~~are source of excess ~~bacteria~~*E. coli* loading to surface waters in the Powder River Basin. ~~and~~ ODA has jurisdiction over ~~grazing~~ agricultural activities~~y~~ on non-federal forestlands in Oregon. ODF must meet the waterway protection measures identified in the Oregon Forest Practices Act, the associated administrative rules, and any amendments (see Section 5.2.1). DEQ considers ODF to be meeting the requirements of a TMDL implementation plan for ~~bacteria~~*E. coli* by following the Oregon Forest Practices Act and any amendments.

5.1.1.3 Oregon Department of Fish and Wildlife

ODFW ~~has jurisdiction~~ manages ~~over approximately~~ 8,836 acres ~~of land along the east slope of the Elkhorn Mountains, known as~~ in the Elkhorn Wildlife Area under the ~~, currently managed under an existing~~ Elkhorn Wildlife Area Management Plan (~~see Section 5.2.5~~ODFW 2017). The wildlife area is managed to provide winter range for elk and deer, with limited livestock grazing and timber harvest (~~see also section 5.2.5~~ODFW 2017). Wildlife ~~represent~~may be a ~~a natural background~~ source of ~~fecal bacteria~~*E. coli* loading to waterbodies ~~with the potential to be particularly problematic where larger~~in congregation areas ~~groups accumulate~~, such as ~~at~~ winter feeding stations in ~~in~~ the Elkhorn Wildlife Area.~~artificial feeding locations. At the time of Based on information available for the TMDL source assessment, DEQ concludedfound that the wildlife area elk feeding stations were were not found to be significantlikely contributing excess sources of bacteriaE. coli loads to surface waterbodies during the winter season through , but the Wwildlife Aarea may be contributing to criteria exceedances from during the period when livestock grazing period is allowed (from May through through October). To ensure that the elk feeding stations do not become an increased source of bacteriaE. coli and to reduce the impact from livestock grazing,~~ ODFW must develop a TMDL implementation plan for the Elkhorn Wildlife Area~~.~~

~~ODFW's implementation plan must~~ that includes ~~include~~ the required elements described in Section 5.3 and ~~be~~ is submitted according to the schedule in Section 5.4. The implementation plan ~~must should~~may include strategies listed in Tables ~~2.0a~~1, ~~2.0b~~2, and 6~~5.1.1.3~~, or other strategies ~~that~~ selected by ODFW ~~documents are appropriate to wildlife area land and activity-related conditions in the basin, to address gaps between current bacteriato manage E. colil loading under the existingfrom~~ for the Elkhorn Wildlife Area ~~Management Plan (additional details in Section 5.2.5) and the applicable TMDL load allocations~~. ~~Any A~~Alternative strategies or timelines in Table 6~~5.1.1.3~~ must be documented in the implementation plan. Revisions to ~~Specific m~~management strategies ~~and controls to address gaps in pollution controls or prevention shouldmayshould~~may be documented in ~~revisions to~~future updates to the existing wildlife area management plan ~~during the next update,~~ as ~~appropriate~~needed.

~~Table 5.1.1.3: ODFW-specific management strategies and timelines that would be effective in achieving load allocations for bacteriaE. coli~~

Table 6: ODFW-specific management strategies and timelines designed to achieve load allocations for *E. coli*for TMDL implementation

Source or activity	Management Strategy	Timeline
Assessment - elk, deer and livestock grazing	Assess livestock/wildlife use patterns and manure management (storage, distribution)	Years 1-2 after EQC adoption of the TMDL ruleTMDL issuance
Assessment – land condition	Assess manure management (storage, distribution); identify locations and assess patterns of livestock access to streams in the Elkhorn Wildlife Area	
Manure and runoff management	Implement BMPs to prevent and/or filter runoff in high use grazing areas	Years 3-5 after EQC adoption of the TMDL ruleTMDL issuance
	Ensure adequate riparian vegetated filter strip and buffer zone	
	Minimize direct livestock stream access (livestock exclusion through fencing or other practices)	

5.1.1.4 Oregon Department of Transportation

The Oregon Department of Transportation is responsible for managing runoff from highways under a statewide Phase I Municipal Separate Storm Sewer System (or MS4) permit. According to calculations made for this TMDL, ODOT has jurisdiction over ~~approximately~~ 3,350-acres as roadway rights-of-way in the Powder River Basin (0.1% ~~percent~~ of the total basin area). ODOT is required to include Powder River Basin ~~bacteria~~*E. coli* TMDL in their statewide TMDL implementation plan. However, DEQ expects that maintaining compliance with ODOT's MS4 permit will be adequate to meet ODOT's waste~~-~~load allocation for ~~bacteria~~*E. coli*. DEQ also expects that ~~and~~ the need for and additional ~~bacteria~~*E. coli* nonpoint source controls associated with ODOT facilities will be minimal. Amendment of ODOT's statewide TMDL implementation plan must follow the schedule for submittal in Section 5.4.

5.1.1.5 US Bureau of Land Management and US Forest Service

The US Department of the Interior Bureau of Land Management (BLM) and US Department of Agriculture Forest Service (USFS) are responsible for management and regulation of certain forest and range lands owned by the federal government. ~~Approximately~~ BLM supervises 18% ~~percent~~ of lands in the Powder River Basin ~~are under jurisdiction of the BLM~~from the Vale District Office. Forest comprises ~~Approximately~~ 33% (740,400 acres) of the ~~total~~ land area in the Powder River Basin ~~is forested~~, ~~the majority of which is publicly owned and~~ most of which falls under the management of the Wallowa-Whitman National Forest by ~~the US Forest Service (USFS)~~USFS. Livestock ~~are known~~ ~~(permitted?) to~~ graze on BLM and USFS lands ~~(~~through a fee-based permit system ~~with minimal fees), which has the potential to~~ that may impact riparian conditions and cause fecal ~~(*E. coli*)~~ contamination of surface waters. As of May 2024, ~~At the time this WQMP was prepared, the Forest Service website contained the following information: On the Wallowa-Whitman National Forest~~ there ~~a~~were 93 term grazing permits issued on 110 grazing allotments on the Wallowa-Whitman National Forest and provided~~. The Forest is currently providing~~ forage for approximately 23,800 head of cattle and 3,300 head of sheep (USFS 2024).
~~https://www.fs.usda.gov/detail/wallowa-whitman/landmanagement/resourcemanagement/?cid=stelprdb5259516~~

BLM and USFS must develop ~~and implement Powder River Basin bacteria~~~~*E. coli*~~ ~~TMDL implementation plans. Each~~ implementation plans ~~must~~ that include the required elements described in Section 5.3 and be submitted according to the schedule in Section 5.4. The plans ~~must~~ ~~shouldmustshould~~may include management strategies from Tables ~~2.0a~~1, 2 ~~2.0 b~~ and 7~~5.1.1.5~~, or ~~other appropriate~~ practices selected by the respective agency. Plans ~~should~~may also ~~and with focus on~~consider the ~~priority locations~~focus areas for implementation ~~of bacteria~~~~*E. coli*~~ ~~reductions~~ listed in Table ~~2.0c~~3. The plan ~~should mustshould~~may reference any relevant ~~Resource~~ resource ~~Management~~ management and ~~Water~~ water ~~Quality~~ quality ~~Restoration~~ restoration ~~Plans~~plans~~,~~ as discussed in Sections 5.2.3 and 5.2~~3~~.4. If additional assessment of land conditions or current practices is needed to determine details of the plan~~these details~~, the process to ~~obtain that information~~complete the assessment will be identified in the implementation plan, ~~and~~ the annual report, or other agreed-upon mechanism.

~~**Table 5.1.1.5: BLM and USFS-specific management strategies and timelines that would be effective in achieving load allocations for bacteria*E. coli***~~

Table 7: BLM and USFS~~-specific~~ management strategies ~~and timelines designed to achieve load allocations for *E. coli*~~for TMDL implementation

Source or activity	Management Strategy	Timeline
Pasture use – livestock grazing and manure management	Assess land condition for surface and bank erosion; ensure that roads in grazed areas (current or past) include BMPs to minimize erosion and sediment/manure delivery to waters of the state	Years 1-3 after EQC adoption of the TMDL rule~~TMDL issuance~~
	Identify locations and assess patterns of livestock access to streams in the ~~watershed~~ basin and ensure BMPs to prevent erosion and runoff are in place	
	Evaluate current grazing permits for animal stocking rate and timing. Alter animal stocking rate or timing if necessary to reduce manure near streams. Enforce permit requirements.	Years 1-10 after EQC adoption of the TMDL rule~~TMDL issuance~~
	Utilize rotational grazing and other techniques to minimize overgrazing	
	Provide off-channel livestock water	
	Conduct livestock management training	
	Minimize direct livestock stream access (livestock exclusion through fencing or other practices)	
	Ensure adequate riparian vegetated filter strip and buffer zone	

5.1.1.6 US Bureau of Reclamation

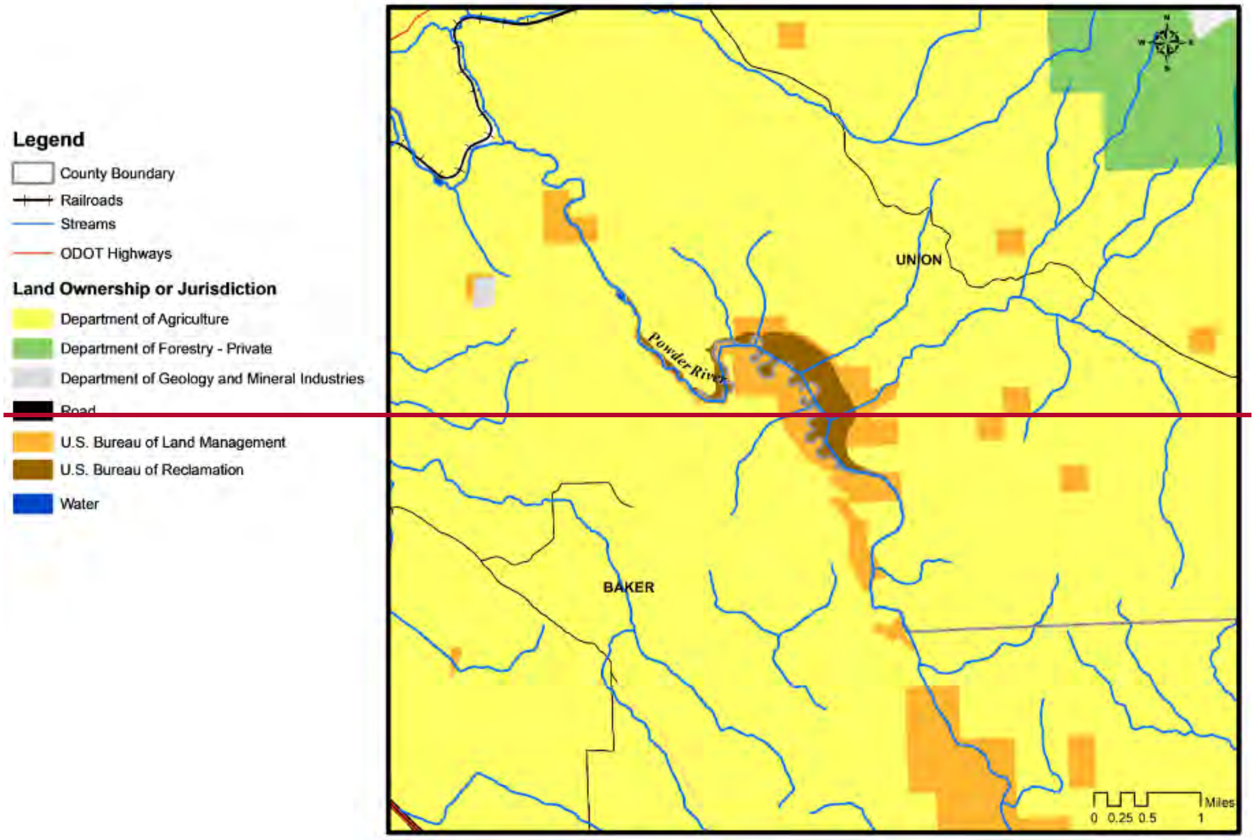
The US Bureau of Reclamation is responsible for the federally owned and~~/or~~ operated water delivery and drainage facilities in the Powder River Basin. These facilities include Mason Dam/Phillips Reservoir (Powder River), Thief Valley Dam/Reservoir ~~on the~~(~~-~~Powder River), ~~-~~and Unity Dam/Reservoir (Burnt River) ~~on the Burnt River, as shown in~~ (Figures 3~~5.1.1.6a~~, ~~5.1.1.6b~~4 and 5)~~.1.1.6c~~.

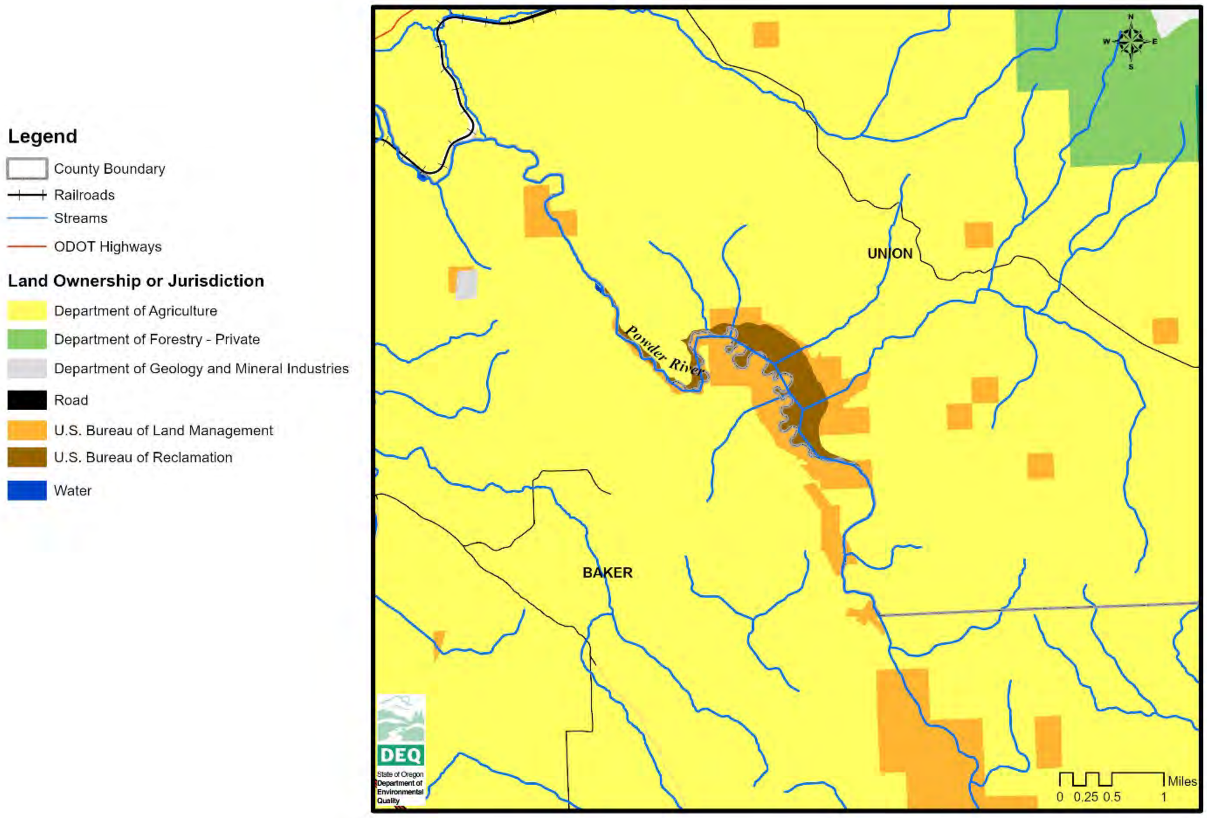
Although there are no grazing allotments within these reservoir lands, trespass cattle have been observed within the dewatered footprint of Thief Valley Reservoir on ~~several occasions during the last decade and as recently as August 2022. Cattle manure is a source of *E. coli* which contribute to exceedances of water quality standards within the Powder River Basin. Accumulated manure from summer cattle grazing is flooded over and discharged downstream when Thief Valley Reservoir fills during the winter and spring.~~ multiple occasions in recent years.

~~The~~ USBR must develop an ~~Powder River Basin bacteria~~*E. coli* ~~TMDL~~ implementation plan to address sources of *E. coli* at the ~~above mentioned~~ federal dam and reservoirs ~~projects in the Powder Basin~~in the Powder River Basin.~~. The implementation plan must~~ The implementation plan must include the required elements described in Section 5.3 and be submitted according to the schedule in Section 5.4. The plan ~~shouldmayshould~~ may include ~~M~~management strategies ~~that must be addressed in the TMDL implementation plan are included~~listed in Tables 1, 2, and 8, or other appropriate practices~~5.1.1.6; additional strategies may be found in Tables 2.0a~~1 ~~and 2.0b~~2.

~~Within six months of TMDL issuance,~~ USBR ~~must should~~must conduct and submit the results of an assessment of livestock use, landscape conditions, and current practices at the federal dam and reservoir project areas, with focus on the ~~priority~~ locations ~~for implementation of bacteria~~*E. coli* ~~protection and reductions strategies~~listed in Table ~~2.0c~~3. The assessment ~~should~~ must be conducted as described in Section 5.3.1 and used in determining theto determine details, including locations, for of the implementation plan, as well as identifying locations for immediate implementation of effective priority strategies, such as restricting livestock trespass and managing manureimplementation of management strategies. The results of this assessment and any management strategies implemented within 18 months of TMDL issuance mustshouldmust be included in USBR's implementation plan submittedal to DEQ within 18 months of TMDL adoption by the Environmental Quality Commission.

Figure 3: Thief Valley Reservoir Land Ownership or Jurisdiction

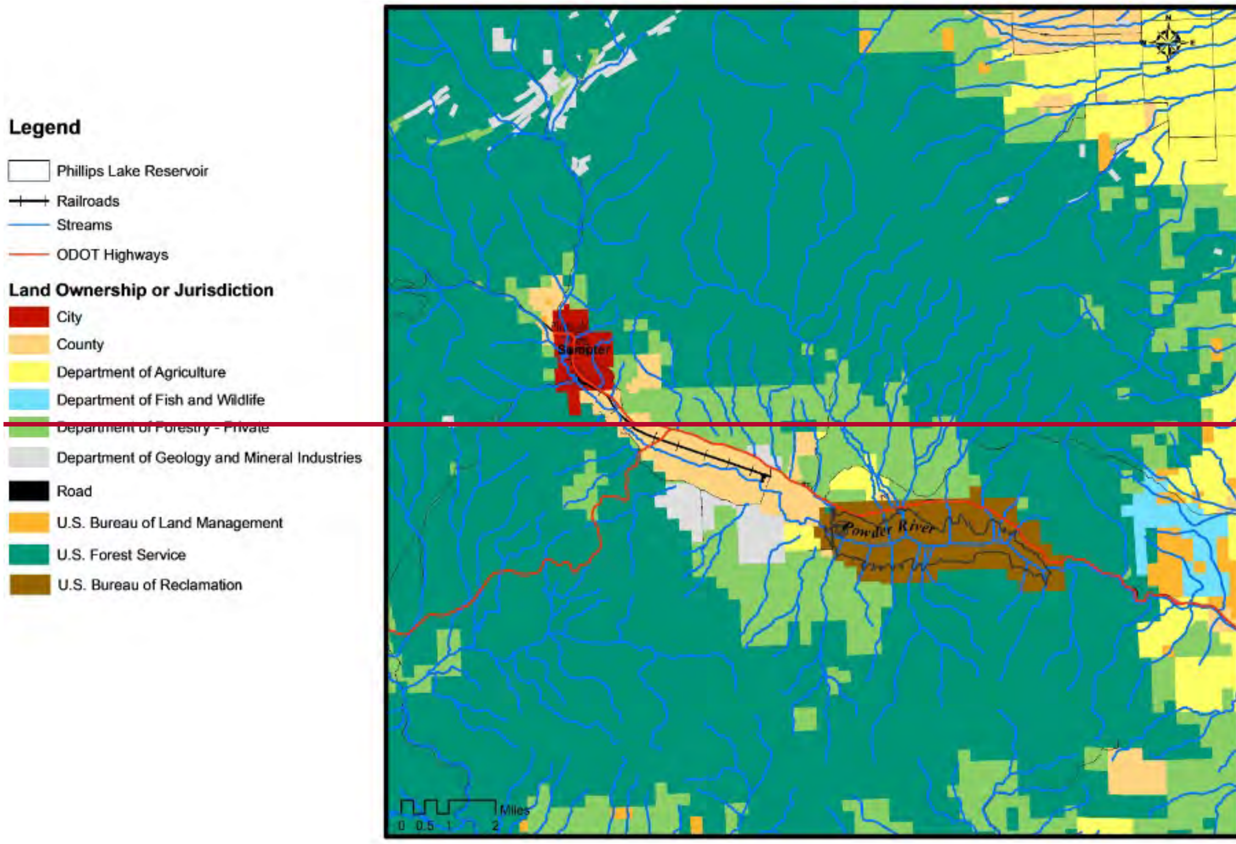


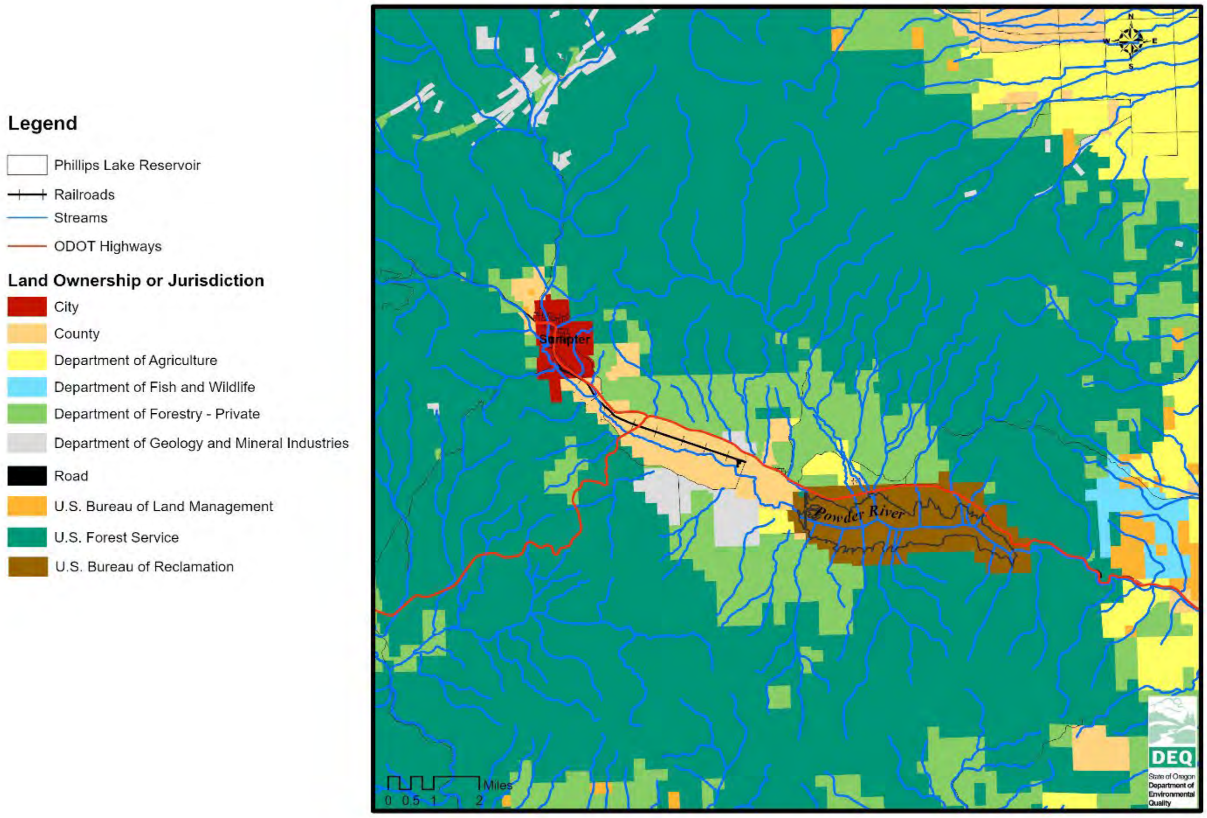


~~Figure 3: Thief Valley Reservoir Land Ownership or Jurisdiction~~

Figure 4: Phillips Lake Land Ownership or Jurisdiction

~~**Figure 5.1.1.6a: Thief Valley Reservoir Land Ownership or Jurisdiction**~~

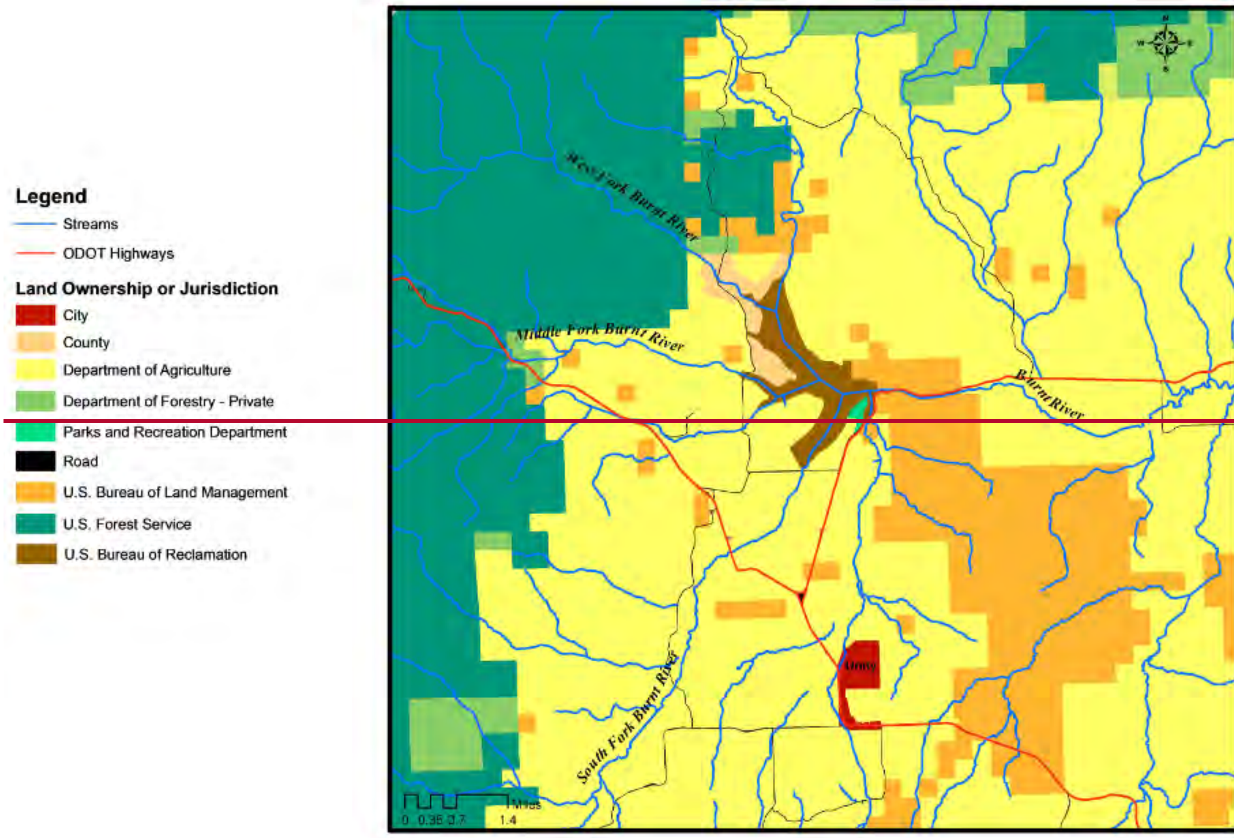


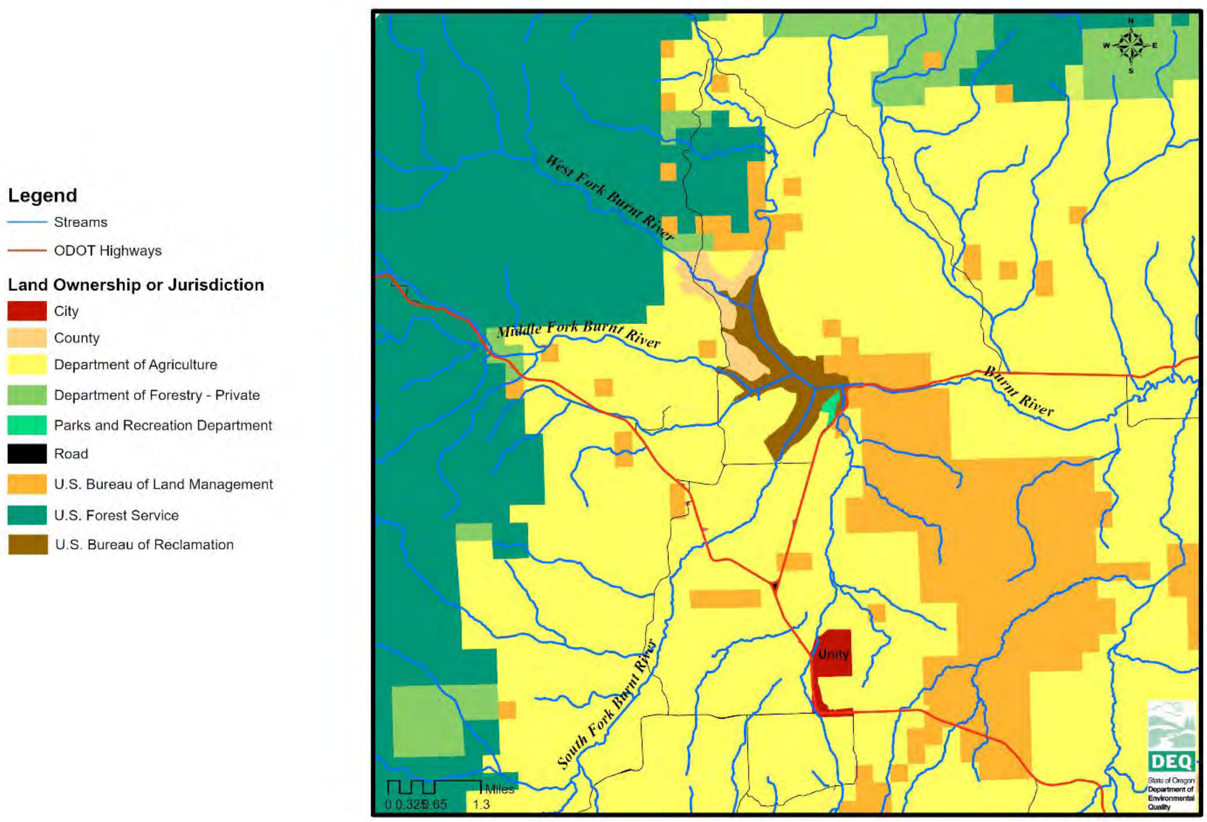


~~Figure 4: Phillips Lake Land Ownership or Jurisdiction~~

Figure 5: Unity Reservoir Land Ownership or Jurisdiction

~~Figure 5.1.1.6b: Phillips Lake Land Ownership or Jurisdiction~~





~~**Figure 5: Unity Reservoir Land Ownership or Jurisdiction**~~

~~**Figure 5.1.1.6c: Unity Reservoir Land Ownership or Jurisdiction**~~

~~**Table 5.1.1.6: USBR-specific management strategies and timelines that would be effective in achieving load allocations for bacteria*E. coli***~~

Table 8: USBR~~-specific~~ management strategies ~~and timelines designed to achieve load allocations for *E. coli*~~for TMDL implementation

Source or activity	Management Strategy	Timeline
Livestock use of reservoir footprint and/or adjacent lands	~~Implement a protocol to a~~Assess and monitor livestock use and manure on reservoir lands	Within ~~6~~18 months of ~~TMDL issuance~~~~adoption~~ EQC adoption of the TMDL rule
	Coordinate with other land~~-~~owners/operators to exclude trespassing livestock from Thief Valley Reservoir	Years 1-5 after EQC adoption of the TMDL rule~~TMDL issuance~~
	Manage potential livestock impacts at Phillips and Unity Reservoirs	

	Develop a manure management strategy to meet ~~bacteria~~*E. coli* TMDL load allocations ~~and plan for future nutrient TMDLs~~	

5.1.2 Irrigation districts

Irrigation and drainage districts are ~~responsible persons~~RPs ~~and are~~ required to develop ~~either a~~ unified or district-specific TMDL implementation plans to ~~address load allocations~~manage *E. coli* loading associated with non-federal water storage, delivery, and drainage systems in the Powder River Basin. Irrigation and water control districts with jurisdiction in the Powder River Basin are described below.

The implementation plan(s) must include the required elements described in Section 5.3 and be submitted according to the schedule in Section 5.4. Implementation plan(s) ~~should~~ may include management strategies found in Tables ~~2.0a~~1, ~~2.0b~~2, and 9~~5.1.2~~. DEQ will assist the districts in preparing a plan that complies with OAR 340-042-0080(3). The implementation plan(s) must include specifics on where and when priority and other strategies will be applied~~, along with~~ and measurable objectives and milestones for ensuring ~~their~~ implementation and gaging ~~their~~ effectiveness.

5.1.2.1 Baker Valley Irrigation District

The Upper Division of the Baker Project supplies irrigation water sourced from Phillips Reservoir to land along the Powder River north of Baker City. Phillips Reservoir is impounded by Mason Dam~~;~~. ~~m~~Maintenance and operation of these facilities is managed by the Baker Valley Irrigation District.

5.1.2.2 Powder Valley Water Control District

Wolf Creek and Pilcher Creek Reservoirs~~, often referred to as the Wolf Creek Reservoir Complex,~~ are owned and operated by the Powder Valley Water Control District. The projects are a source of irrigation water for lands in the North Powder and northern Baker Valleys near the City of North Powder.

5.1.2.3 Lower Powder River Irrigation District

Operation of the Thief Valley Dam and Lower Division facilities of the Baker Project ~~is~~ are managed by the Lower Powder River Irrigation District. Water is released as a supplemental water supply to land along the Powder River in the Keating Valley.

5.1.2.4 Burnt River Irrigation District

Irrigation in the Burnt River Subbasin is managed by the Burnt River Irrigation District. This includes operation of Unity Dam and Reservoir, located on the upper Burnt River. The project primarily provides irrigation water to lands downstream of the reservoir, near Hereford, Bridgeport, Durkee, Weatherby, Dixie, Lime, and Huntington, but also serves some land upstream of Unity Reservoir.

~~**Table 5.1.2: Irrigation district-specific management strategies and timelines that would be effective in achieving load allocations for bacteria*E. coli***~~

Table 9: Irrigation district~~-specific~~ management strategies ~~and timelines~~for TMDL implementation ~~designed to achieve load allocations for *E. coli*~~

Source or activity	Management Strategy	Timeline
Irrigation system management; return water in	Inventory and map system and assess and prioritize locations where irrigation	Years 1-5 after EQC adoption of

contact with livestock and wildlife grazing areas	improvements and optimization are most needed to improve water quality. Develop and maintain GIS-based spatial data of systems that can be periodically updated.	the TMDL rule~~TMDL issuance~~
	Implement irrigation system improvements	Years 2-10 after EQC adoption of the TMDL rule~~TMDL issuance~~
	Implement irrigation schedule optimization	
	Implement water conservation methods	
	Implement sediment basin and tail water recovery	
	Prepare a water management and conservation plan (WMCP) if one is not required by OWRD in existing water rights permit.	

5.1.3 Counties and municipalities

Baker County, Union County, and Baker City are identified ~~in this TMDL/WQMP~~ as ~~designated management agencies~~DMAs that each must ~~each~~ develop a Powder River Basin ~~bacteria~~*E. coli* TMDL Implementation Plan~~s~~. These plans ~~should~~ may~~must~~ ~~that~~ include~~s priority~~ management strategies listed in Tables 1~~2a~~, 2~~b~~, and ~~and Table~~ 10~~5.1.3~~ or selected by the county or municipality. ~~below that are applicable to each jurisdictional entity.~~ Each implementation plan must include the required elements described in Section 5.3 and be submitted according to the schedule in Section 5.4.

5.1.3.1 Baker County

Baker County comprises ~~approximately~~ 87% ~~percent~~ of the land area in the Powder River Basin. Baker County has authority for planning and development through ~~its~~ zoning, ~~and~~ land use requirements, and ~~for~~ building permits~~ting~~ and inspections. These programs have requirements that are intended to prevent public health and safety risks through respective codes and ordinances. Baker County has jurisdiction over county-owned and maintained roads and rights- of-way as well as lands in the Sumpter dredge area, adjacent to surface waters.

The County is expected to ensure that its roads and facilities programs have best management practices in place to detect or prevent wastes from human activities from entering waters of the state ~~via~~through county-maintained properties and stormwater conveyances.

~~The A large majorityMost (68%)~~Sixty-eight percent ~~percent)~~ of Baker County residents live in areas serviced by municipal sewage systems. ~~Old or impaired Based on DEQ's source assessment,~~ In ~~unserviced~~ areas not serviced, a~~A~~ging or poorly maintained septic systems are a potential source of ~~pollutants to surface water, including~~ *E. coli* and other pathogens (Hoghoogh et al~~,~~ 2021, Verhougstraete et al~~,~~ 2015). DEQ concluded in the source assessment for bacteria and *E. coli* (TSD, Section 5.2.2 Residential septic systems) that septic systems were ~~unlikely~~ a ~~potential to but minor~~ possible ~~be a significant~~ source of *E. coli* contamination to surface waters of the Powder River Basin ~~at this time,~~. ~~but~~ Since periodic system failures occur~~.~~ due to a variety of factors~~Therefore~~, further ~~characterization~~ evaluation of the systems that pose higher risk of failure is warranted.

Since Because theAs -rural housing stock across the state and in the Basin is agingages, DEQ concluded that it is likely that a significant number of many onsite wastewater treatment systems have reachedreach or are nearing their the end of service. , but tThe number and location of the at-risk systems cannot be determined without a more thorough evaluation based on the factors identified in the source assessment, including system age, materials of construction, repair, and maintenance history.

Under OAR 340-071-0120, the Oregon DEQ has entered into agreements with relevant some Oregon counties authorizing those counties to become the department'sDEQ's agents for permitting onsite systems, including receiving and processing applications, issuing permits, enforcing, and performing required inspections. As a County Onsite program agent, Baker County has jurisdiction for implementation of the residential septic system program and must ensure management strategies are in place to maintain the integrity of onsite wastewater treatment systems. Currently, DEQ administers the On-Ssite Program in Baker County. The county couldmay enter into an agreement with DEQ to be the Onsite Program agent in the future. In administering the program, DEQ is responsible for regulating the siting, design, installation, and ongoing operation and maintenance of onsite septic systems. The regulatory programs in place at DEQ are intended ensure onsite systems are properly sited, installed, and maintained in order toto prevent causing or contributing to water quality violations, and onsite systems are designed to produce no bacteria loads to surface waters. For systems that may be at the end of service life, several septic system funding options are identified in Table 115.3.6 (below) including the State of Oregon, Craft3, and national financing programs available through U.S. EPA, the U.S. Department of Agriculture (USDA), as well as other agencies.

Baker County is expected to coordinate with DEQ on developing an assessment process to identify Onsite systems at higher-risk of failure and in assisting lower-income property owners in the identification of funding strategies for system that need repairs or replacement.

5.1.3.2 Union County

Union County comprises approximately 8 eight percent8% of the land area in the Powder River Basin. Union County has authority for planning and development through zoning, land use requirements, and building permits and inspectionshas authority for planning and development through zoning and land use requirements, and for building permitting and inspections. These programs have requirements that are intended to prevent public health and safety risks through respective codes and ordinances.

Union County has jurisdiction over county-owned and maintained roads and rights of way adjacent to waters of the state and manages the park located at Thief Valley Reservoir. The County is expected to ensure that its roads and facilities programs have best management practices in place to detect and prevent wastes from human activities from entering the surface waters viathrough county-maintained properties and stormwater conveyances.

Based on DEQ's source assessment, septic systems are a potential but minora possible -source of pollutants to surface water, including *E. coli* and other pathogens for the reasons described into surface waters (-Section 5.1.3.1) above. Union County is authorized by Oregon DEQ as the department's residential onsite septic agent for permitting onsite systems, including receiving and processing applications, issuing permit, enforcing, and performing required inspections. Based on DEQ's source assessment, septic systems are a potential source of pollutants to surface water, including *E. coli* and other pathogens. Therefore, further characterization of the systems that pose higher risk of failure and pollution of surface water is warranted. Currently, DEQ administers the Ons-Site Program in BakerUnion County and is responsible for regulating the siting, design, installation, and ongoing operation and maintenance of onsite septic systems. The ~~c~~county ~~could~~may enter into an agreement with DEQ to be the Onsite Program agent in the future. The regulatory programs in place at DEQ are intended ensure onsite systems are properly sited, installed, and maintained ~~in order to~~to prevent ~~causing or contributing to~~ water quality violations. ~~, and o~~Onsite systems are designed to produce no bacteria loads to surface waters.

Union County is expected to coordinate with DEQ on developing an assessment process to identify Onsite systems at higher-risk of failure and in assisting lower-income property owners in the identification of funding strategies for system that need repairs or replacement.

5.1.3.3 Baker City

Baker City's jurisdictional area makes up less than ~~1 one percent~~1% of the land area within the Powder River Basin. Baker City operates a non-permitted municipal separate stormwater sewerage system (MS4) within the City limits and manages parks and other property along riparian areas including the Powder River. Activities on city-owned or managed property and facilities (e.g., parks, roads, rights-of-way) represent a possible source of *E. coli* and other pathogens to surface waters. Therefore, DEQ has identified the city as a municipal (urban) DMA and identified basic strategies to ensure that its municipal programs have best management practices in place to prevent wastes from entering the surface waters via city-maintained facilities and stormwater conveyances.

~~**Table 5.1.3: County and municipality-specific management strategies and timelines that would be effective in achieving load allocations for bacteria*E. coli***~~

Table 10: County and municipality-~~specific~~ management strategies for TMDL implementation~~and timelines designed to achieve load allocations for *E. coli*~~

Source or activity	Management Strategy	Timeline
Onsite Wastewater Treatment Systems and septic systems	Coordinate with DEQ on developing an assessment of near-stream septic systems (age, tank type, condition) to evaluate potential failure risk and rank systems for review based on risk of failure	~~Years 1-3 after EQC adoption of the TMDL rule~~~~TMDL issuance: Evaluation and rank systems~~ Years 3-5 after EQC adoption of the TMDL rule~~TMDL issuance~~ and annually thereafter: Evaluation and rank systems; Conduct outreach on inspection and repair and replacement funding
	Identify onsite system data sources and tools, including County records (such as year-built), spatial data, and other available information	
	Coordinate with DEQ to prioritize tax lots for education and outreach, inspection and/or repair assistance based on results of analyses Offer free or subsidized septic system inspections to highest priority properties	
	Participate in developing and facilitating financial assistance mechanisms (e.g., Craft3, community low interest loan program)	
Land use/ development and land management	Fully enforce local land use, development, and building codes and plans that require best management practices to ensure setbacks and riparian protections are in place to filter fecal matter and minimize erosion and sediment delivery to waters of the state from land development and building activities.	Independent of approval of TMDL implementation plan; on-going

Source or activity	Management Strategy	Timeline
Local codes and ordinances; municipal operations	Develop or revise codes or voluntary programs as needed to prevent fecal contamination. Enforce pet waste clean-up ordinances. Evaluate activities in city-owned and managed parks, roads, and rights-of-way for potential sources of fecal contamination and identify strategies and actions to mitigate water pollution from these sources through compliance with local codes.	Submit list of relevant codes with Implementation plan. Identify dates for code revisions, if needed; Years 3-5 after EQC adoption of the TMDL rule

5.2 Existing implementation plans

OAR 340-042-0040(4)(l)(H) requires identification of any source or sector-specific implementation plans available at the time of TMDL issuanceadoption by the Environmental Quality Commission. No iImplementation plans were not developed prior to adoption by the Environmental Quality Commissionissuance of the Powder River Basin TMDL. However, some statewide or federal rules and programs related to forestry, agriculture, or other sectors are in place and are intended, in part, to reduce or control nonpoint sources of pollution,, e.g., like a sector-specific implementation plan.

5.2.1 Adequacy of Forest Practices Act to meet TMDL load allocationsfor TMDL implementation

Waterway protection measures were established in 1994 for state and private forest practices in Oregon, as codified in Oregon Revised Statutes 527.610 through 527.992, Oregon's Forest Practices Act, (OAR 629-600 through 629-665,) and Oregon's Plan for Salmon and Watersheds (Executive Order 99-01). As provided in ORS 527.770, forest operations conducted in accordance with the Forest Practices Act and administrative rules along with other voluntary measures, are generally considered to be in compliance withcompliant with water quality standards. Private forestry activities are not a likely source of have not been identified as a source of an bacteria*E. coli* excess *E. coli* or *pathogen* loading to surface waters in the Powder River Basin. and . and tThe ODA has jurisdiction over grazing activity agricultural activities including grazing on non-federal forestlands in Oregon.

5.2.2 Adequacy of Agricultural Water Quality Management Area Rules and Plans to meet TMDL load allocationsfor TMDL implementation

The Agricultural Water Quality Management Program was established in 1993 under ORS 568.900 to through 568.933, and ORS 561.191, and OAR chapter Chapter 603, divisions Divisions 90 and 95. Oregon Department of Agriculture led development of 38 watershed-based Agricultural Water Quality Area Rules and Area Plans intended to implement the rules. There are two agricultural water quality areas in the Powder River Basin: the Powder-Brownlee and the Burnt River. ODA established the Powder-Brownlee rules and plan in 2004. The plan was most rrecently updated in 2018 and a light biennial review that resulted in no changes to the plan was completed in March 2021. The Burnt River rules and plan were established in 2005; the plan was last updated in 2018 and received a light biennial review in 2021. ODA signed a MOU with DEQ that defines how water quality rules and regulations regarding TMDLs will be met. Despite implementation and biennial review of the area plans, periodic revision of the area rules and implementation of other voluntary agricultural initiatives and funding programs, significant water quality impairments continue in the Powder River Basin. Powder River Basin streams continue to be identified as impaired on Oregon's Section 303(d) list for *E. coli* in part due to contributions of fecal bacteria from agricultural lands.

ODA, through coordination with agency and local partners, identified two Strategic Implementation Areas in the Powder River Basin, located on the Lower Powder and South Fork Burnt Rivers. The SIA process includes an assessment and compliance evaluation of agricultural lands, outreach to landowners, technical assistance, monitoring of water quality and land conditions, and landowner follow up as needed. The Lower Powder SIA was establishedinitiated several years agoin 2018 and the and review of monitoring data is forthcoming is not available at the time this TMDL rule was developed. The South Fork Burnt SIA was more recently establishedinitiated in 2021, and landowner outreach began in fall 2022. Outcomes from both SIAs will contribute to the goals of the Powder River Basin bacteria*E. coli* TMDL in the areas covered by the SIAs.

Based on DEQ's analysessource assessment for this TMDL,, livestock, and specifically cattle, agricultural areas were identified as the primarya source of *E. colie**E. coli* contamination loading in river stream reaches that with excess loadsexceeded the loading capacity. Exceedances of water quality criteria for *E. coli* occurred most frequently during the irrigation seasonfrom May-October and in areas where with surrounding land use was dominated by irrigated pastures and fields. Powder River Basin streams continue to be identified as impaired for *E. coli* inon Oregon's Integrated Report 303(d) list (DEQ 2022a). for *E. coli*, in part due to fFecal contamination of waters draining agricultural lands may be contributing to these ongoing impairments.directly or through irrigation return water and stormwater runoff from agricultural lands. Based on the source assessment, water quality impairments for bacteria*E. coli* continue due to uncontrolled livestock manure deposition in contact withfecal contamination of waters directly or through reservoir filling, irrigation return water, and stormwater runoff.. Livestock land use areas dominate the basin and bacteria*E. coli* impairments are caused by insufficient implementation of AgWQMP requirements for livestock exclusion from waterways and control and treatment of irrigation return water.

DEQ concluded that the ODAAgWQ Water Quality program area rules combined with the area plan voluntary measures domay not sufficiently controlreduce *E. coli* loading are either not fully implemented throughout the basin or are not adequateinat all locations to meet bacteriathe *E. coli* support attainment of nonpoint source load allocations, and achieve achieve the *E.coli* water quality criteriastandards in all areas of the Powder River Basin. Powder River Basin streams continue to be identified as impaired onin Oregon's SectionIntegrated Report 303(d) list for *E. coli*, in part due to contributions of fecal bacteria from agricultural lands and activities. Therefore, ODA is required expected to develop a TMDL implementation plan to be submitted to DEQ for review and approval within 18 months of TMDL adoption by the Environmental Quality Commission. .

5.2.3 BLM Resource Management and Water Quality Restoration Plans

US Bureau of Land Management develops geographically ~~-~~specific Resource Management Plans (RMPs) and amendments, project-level plans, and Water Quality Restoration Plans (WQRPs) to meet applicable water quality standards. ~~Per~~ In previous Memorandums of Understanding (MOUs) between BLM and DEQ, RMPs and WQRPs served as BLM's implementation plan to meet TMDL requirements for specific geographic areas. Previous MOUs also required monitoring to ensure that practices ~~are~~ were ~~properly designed and applied to determine the~~ effective~~ness of practices~~ in meeting water quality standards and ~~to provide for adjustment of best management practices when it is~~could be adjusted if ~~found that~~ water quality standards ~~are~~ were not ~~being protected~~achieved. As MOUs are updated, DEQ anticipates that BLM will develop statewide TMDL implementation plans that cover all effective TMDLs in Oregon.

Currently ~~there are no~~ WQRPs for BLM managed lands in the Powder River Basin do not exist. BLM must develop and implement a TMDL implementation plan to ~~support attainment~~attain ~~of the~~ ~~bacteria~~*E. coli* ~~load allocation~~water quality criteria. This plan ~~can~~ may be incorporated into a statewide TMDL implementation plan and a Powder River Basin WQRP.

5.2.4 USFS Resource Management and Water Quality Restoration Plans

USFS signed a~~n~~ MOU with DEQ that defines how water quality rules and regulations regarding TMDLs will be met. USFS generally responds to TMDLs by developing and implementing WQRPs, which have served as the equivalent of TMDL implementation plans. As MOUs are updated, DEQ anticipates that USFS will develop statewide TMDL implementation plans that cover all effective TMDLs in Oregon.

Currently ~~there are no~~ WQRPs for USFS managed lands in the Powder River Basin do not exist. USFS must develop and implement a TMDL implementation plan to attain *E. coli* water quality criteria~~to support attainment of the bacteria~~~~*E. coli*~~ ~~load allocation~~. This plan ~~can~~ may be incorporated into a statewide TMDL implementation plan and a Powder River Basin WQRP.

5.2.5 ODFW Elkhorn Wildlife Area Management Plan

~~The~~ ODFW is responsible for management of the Elkhorn Wildlife Area, which consists of ~~approximately~~ 8,836 acres ~~located along~~on the east slope of the Elkhorn Mountains. ~~The wildlife area is a mix of lands owned by ODFW, USFS, BLM and leased private land.~~ ODFW manages wildlife grazing, livestock grazing, and timber harvest on these lands by means of an existing Elkhorn Wildlife Area Management Plan~~, completed in October 2006 and updated in October 2017~~ (ODFW~~,~~ 2017). Ten winter ~~(December 1 through approximately mid-March or April)~~ feeding locations are maintained ~~in order to~~to ~~keep up to 1,400 elk and 800 deer~~the numbers of elk and deer from ~~wintering and~~ feeding on agricultural lands in the Baker Valley. ~~Two of the stations are located adjacent to perennial waterways (i.e., Anthony Creek and North Powder River). Both feeding sites are located on a contiguous tract of property owned by ODFW. The feeding sites on this property are located along Anthony Creek (Anthony Creek Site) on the north side of the tract and the North Powder River (North Powder Site) on the south end of the tract.~~ Rotational livestock grazing (May 1~~—~~-October 1) is used to manage and condition forage for winter use by wildlife. ~~Small-scale timber harvests are used to manage tree stands.~~ A small area of~~Small irrigated fields are~~ is fields ~~maintained to provide forage. All riparian areas used for livestock grazing are fenced to protect and maintain woody vegetation.~~

The ODFW's Elkhorn Wildlife Management Area Plan (ODFW~~,~~ 2017) includes strategies to protect riparian areas, maintain habitat, and manage elk and livestock. ~~The management plan is updated every 10 years, with the last update in 2017.~~ Because the existing management plan does not ~~specifically~~ address the requirements of the Powder River Basin ~~bacteria~~*E. coli* TMDL and WQMP, ODFW must ~~develop~~ submit an ~~TMDL~~ implementation plan to ~~be submitted to~~ DEQ for review and approval within 18 months of TMDL adoption by the EQC.

5.3 Implementation plan requirements

As required in OAR 340-042-0080~~(4)(a)(A)-(E)~~, implementation plans must include:

- Management strategies that the entity will use to achieve load allocations and reduce pollutant loading~~;~~.
- Timeline for strategy implementation and a schedule for completing measurable milestones~~;~~.
- Performance monitoring and a plan for periodic review and revision of implementation plan.~~; and,~~
- Any other analyses or information specified in the WQMP.

The following subsections ~~provide detail on each~~outline components required by ~~this~~ the WQMP to be included in implementation plans. DEQ ~~will~~ expects to work with each entity required to develop a TMDL implementation plan to ensure that ~~all~~ required elements are included with sufficient detail for the plan to be approved on the schedule required in Section 5.4 below. To enhance eligibility for grant-funded restoration opportunities, DEQ ~~will also~~expects to work with entities to ensure that implementation plans align with the nine key elements for watershed-based plans, as described in EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters (USEPA~~,~~ 2008).

5.3.1 Management strategies

Each entity required to develop a TMDL implementation plan is expected to include applicable priority management strategies from Tables ~~2.0a~~1 and ~~2.0b~~2, strategies listed in entity specific subsections of Section 5.1, and ~~potentially~~ other practices and actions appropriate for operations and landscape conditions specific to the entities' ~~pollutant sources or source sectors~~jurisdictions.

DEQ expects implementation plans to identify all areas ~~with~~in an entity's jurisdiction, priority implementation areas, and low priority ~~or responsibility and discuss where management strategy implementation should be targeted, as well as~~ areas ~~that might not need action~~. ~~In some cases, c~~Completion of ~~a comprehensive~~an inventory of the jurisdiction area ~~of responsibility~~ may be needed ~~as an initial step for understanding~~to identify areas in need of ~~where~~ management actions and timing of implementation~~are needed and when they can be implemented~~. Selection of management strategies that differ from those identified by DEQ ~~to be effective in achieving load allocations should~~must include an explanation of the ~~their effectiveness~~strategy. ~~For s~~Sources associated with ~~agricultural~~agriculture, forest~~-~~land, or transportation activities~~, this the inventory should~~ may focus on assessment of land conditions in an inventory. Land condition assessment includes evaluation of infrastructure condition (pastures, roads, and drainage networks), ~~significant~~ changes in amount of ~~exposed or~~ bare earth and disturbed soils, mass wasting events, and other factors that ~~are indicators of~~indicate erosion~~ and sources of fine sediment~~.

5.3.2 Timeline and schedule

Each implementation plan must include commitments to enact specific management strategies on a reasonable timeline~~,~~ with a schedule specified for meeting measurable milestones~~ to demonstrate progress~~. To meet the intent of this requirement and be useful for the requirement to track and report progress, entities ~~should~~ may develop management strategies using the SMART elements: Specific, Measurable, Achievable, Relevant, Time-bound (Doran~~,~~ 1981).

Timelines and milestones ~~schedules should~~may be informed by the ~~comprehensive~~ inventory of the area of jurisdiction~~-~~ (Section ~~and control, as described in Section~~ 5.3.1). ~~above and con~~Each entity must consider~~ation~~ of all relevant factors~~ of the entity's specific situation~~. ~~Identification~~ Selection of management strategy implementation timelines that differ from those ~~estimated by~~put forth by DEQ ~~to be effective in achieving load allocations~~ must include an explanation ~~of why the revised timelines are reasonable and how the timelines will be me~~justifying the choice.~~t.~~

5.3.3 Reporting on performance monitoring and plan review and revision

5.3.3.1 Reporting on performance monitoring

~~Each i~~Implementation plans must include a commitment to prepare annual reports on performance monitoring and ~~a~~ submission dates ~~date by which they will be submitted~~ to DEQ. These reports must include implementation tracking for each of the identified management strategies, progress toward timelines and measurable milestones specified in the implementation plan, and evaluation of ~~the~~ effectiveness~~ of the strategies~~.

~~Implementation actions should be tracked by accounting for t~~The numbers, types, and locations of projects, best management practices, education activities, and ~~or~~ other actions must be tracked to assess implementation actions~~taken to improve or protect water quality~~. Implementation of conservation practices that are listed in the OWEB's OWRI Online List of Treatments must be reported to the OWRI database and noted in annual reports to DEQ. Because DEQ utilizes OWRI's database to track implementation of ~~many~~ voluntary management practices, unreported actions ~~may not be able to~~may not count toward evaluation of ~~be credited in evaluating progress on~~ TMDL implementation progress.

Implementation plans must include periodic assessment of ~~whether~~ the effectiveness of implementation activities in improving management practices, land condition, or community actions. ~~, which may include structural and non-structural best management practices or BMPs, are effective in improving management practices, land condition or sector community behaviors.~~ Annual reports ~~should~~ must summarize the status and results of these evaluations~~ on the relevant time scale~~. Reports on year five must summarize implementation and effectiveness over the proceeding four years.

5.3.3.2 Implementation plan review and revision

Implementation plans must be reviewed, revised as ~~appropriate~~needed, and approved by DEQ every five years. DEQ will use the annual reports of actions tracked and effectiveness evaluations for ~~this~~ reviews. If implementation plan revisions are needed ~~to correct deficiencies or otherwise ensure the plan is effective~~ following the year five review, DEQ will identify a date for submission of the revised plan for DEQ approval.

5.3.4 Implementation public involvement

As required in OAR 340-042-0040(4)(l)(L), implementation plans prepared by ~~designated management agencies~~DMAs must include a plan to involve the public in implementation of management strategies. Public engagement and education must be included to align this component with the nine key elements for watershed-based plans~~, as~~ described in EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters (USEPA~~,~~ 2008). Implementation plans and ~~future~~ amended versions must be posted to a publicly accessible website or made available in hard copy upon request.

5.3.5 Maintenance of strategies over time

As required in OAR 340-042-0040(4)(l)(M), implementation plans prepared by ~~responsible persons, including designated management agencies,~~RPs and DMAs ~~should~~ may include discussion of planned efforts to maintain management strategies over time.

5.3.6 Implementation costs and funding

As required in OAR 340-042-0040(4)(l)(N), this section provides a general discussion of costs and funding for implementing management strategies. Implementation of management strategies to reduce ~~or~~ and prevent pollution into waters of the state may incur financial capital or operating costs. These costs vary in relation to pollutant sources and loading, proximity to waterways, and type or extent of preventative controls already in place. ~~Certain m~~Management practices, such as preventative infrastructure maintenance, may result in long-term cost savings to DMAs or landowners.

OAR 340-042-0040(4)(l)(N) also indicates that~~,~~ sector-specific or source-specific implementation plans may provide more detailed analyses of costs and funding for specific management strategies in the plan. DEQ requires each DMA to provide a fiscal analysis of the resources needed to develop, execute, and maintain the programs and projects described in implementation plans to the extent that these costs can be accounted for or estimated. DEQ recommends that all ~~responsible person~~RPs prepare the following level of economic analysis. ~~This~~ The analysis ~~should~~ may be in five-year increments to estimate costs, demonstrate sufficient funding is available to begin implementation, and identify potential future funding sources to sustain management strategy implementation. ~~Factors, as relevant, to consid~~Considerations ~~er~~ include, but are not limited to:

- Staff salaries, supplies, volunteer coordination, regulatory fees.
- Installation, operation, and maintenance of management measures.
- Monitoring, data analysis and plan revisions.
- Public education and outreach efforts.
- Ordinance development.

There are multiple sources of local, state, and federal funds available for implementation of pollutant management strategies and control practices. Table 5.3.6 provides a partial list of financial incentives, technical assistance programs, grant funding and low interest loans for public entities and with principal forgiveness available in Oregon that may be used to support implementation of assessment, pollution controls and watershed restoration actions or land condition improvements that improve water quality in the Powder River Basin.

~~Table 5.3.6: Partial list of funding programs available in the Powder River Basin~~

Table 11: Partial list of funding programs available in the Powder River Basin

Program	General Description	Contact
Clean Water State Revolving Fund	Loan program for below-market rate loans for planning, design, and construction of various water pollution control activities, depending on eligibility to receive CWSRF assistance	Oregon DEQ Clean Water State Revolving Fund https://www.oregon.gov/deq/wq/cwsrf/Pages/CWSRF-Contacts.aspx
DEQ Onsite Septic Financial Aid Program and Craft3 Statewide Project	Several types of financial resources are available depending on eligibility	Oregon DEQ Onsite Septic Program onsiteseptic.info@deq.oregon.gov.
Conservation Reserve Enhancement Program (CREP)	Provides annual rent to landowners who enroll eligible agricultural lands along streams. Also cost-shares conservation practices such as riparian tree planting, livestock watering facilities, and riparian fencing.	NRCS-Farm Services Agency, SWCDs, ODF
Conservation Reserve Program (CRP)	Competitive CRP provides annual rent to landowners who enroll highly erodible lands. Continuous CRP provides annual rent to landowners who enroll agricultural lands along seasonal or perennial streams. Also cost-shares conservation practices such as riparian plantings.	NRCS, SWCDs
Conservation Stewardship Program (CSP)	Provides cost-share and incentive payments to landowners who have attained a certain level of stewardship and are willing to implement additional conservation practices.	NRCS, SWCDs
Drinking Water Source Protection Fund	These funds allow states to provide loans for certain source water assessment implementation	Oregon Health Authority

Program	General Description	Contact
	activities, including source water protection land acquisition and other types of incentive-based source water quality protection measures.	
Emergency Watershed Protection Program (EWP)	Available through the USDA-Natural Resources Conservation Service. Provides federal funds for emergency protection measures to safeguard lives and property from floods and the products of erosion created by natural disasters that cause a sudden impairment to a watershed.	NRCS, SWCDs
Emergency Forest Restoration Program (EFRP)	Available through the USDA-Natural Resources Conservation Service. Helps owners of non-industrial private forests restore forest health damaged by natural disasters.	USDA, ODF
Environmental Protection Agency Section 319 Grants	Fund projects that improve watershed functions and protect the quality of surface and groundwater, including restoration and education projects.	DEQ, SWCDs, Watershed Councils
Environmental Quality Incentives Program (EQIP)	Cost-shares water quality and wildlife habitat improvement activities, including conservation tillage, nutrient and manure management, fish habitat improvements, and riparian plantings.	NRCS, SWCDs
Agriculture Water Quality Support Grant	Provides capacity to support voluntary agricultural water quality work in small watersheds and to meet the goals of the Agricultural Water Quality Management	ODA

Program	General Description	Contact
	Area Plans and the SIA initiative.	
Farm and Ranchland Protection Program (FRPP)	Cost-shares purchases of agricultural conservation easements to protect agricultural land from development.	NRCS, SWCDs, ODF
Federal Reforestation Tax Credit	Provides federal tax credit as incentive to plant trees.	Internal Revenue Service
Grassland Reserve Program (GRP)	Provides incentives to landowners to protect and restore pastureland, rangeland, and certain other grasslands.	NRCS, Farm Service Agency, SWCDs
Landowner Incentive Program (LIP)	Provides funds to enhance existing incentive programs for fish and wildlife habitat improvements.	U.S. Fish and Wildlife Service, ODFW
Oregon Watershed Enhancement Board (OWEB)	Provides grants for a variety of restoration, assessment, monitoring, and education projects, as well as watershed council staff support. 25 percent local match requirement on all grants.	SWCDs, Watershed Councils, OWEB
Oregon Watershed Enhancement Board Small Grant Program	Provides grants up to $10,000 for priority watershed enhancement projects identified by local focus group.	SWCDs, Watershed Councils, OWEB
OWEB – Oregon Agricultural Heritage Program (OAHP)	Program provides voluntary incentives to farmers and ranchers to support practices that maintain or enhance both agriculture and natural resources such as fish and wildlife on agricultural lands.	OWEB (Program Coordinator) https://www.oregon.gov/oweb/grants/oahp/Pages/oahp.aspx
Partners for Wildlife Program	Provides financial and technical assistance to private and non-federal landowners to restore and improve wetlands, riparian areas, and upland habitats in partnership with the U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service, NRCS, SWCDs

Program	General Description	Contact
	and other cooperating groups.	
Public Law 566 Watershed Program	Program available to state agencies and other eligible organizations for planning and implementing watershed improvement and management projects. Projects ~~should~~ may reduce erosion, siltation, and flooding; provide for agricultural water management; or improve fish and wildlife resources.	NRCS, SWCDs
Resource Conservation & Development (RC & D) Grants	Provides assistance to organizations within RC & D areas in accessing and managing grants.	Resource Conservation and Development https://narcdc.org/find-your-local-rcd/
ODF Small Forestland Investment in Stream Habitat (SFISH) Grants	Provides funding for Small Forestland Owners (SFO's) to improve road conditions and stream crossings as part of forest operations.	ODF, ODFW
State Forestation Tax Credit	Provides for reforestation of under-productive forestland not covered under the Oregon Forest Practices Act. Situations include brush and pasture conversions, fire damage areas, and insect and disease areas.	ODF
Forestry Stewardship Program	Provides cost share dollars through USFS funds to family forest landowners to have management plans developed.	ODF
Western Bark Beetle Mitigation	ODF administers a cost share program for forest management practices pertaining to bark beetle mitigation for forest health and is funded through the USFS.	ODF, USFS

Program	General Description	Contact
State Tax Credit for Fish Habitat Improvements	Provides tax credit for part of the costs of voluntary fish habitat improvements and required fish screening devices.	ODFW
Wetlands Reserve Program (WRP)	Provides cost-sharing to landowners who restore wetlands on agricultural lands.	NRCS, SWCDs
Wildlife Habitat Tax Deferral Program	Maintains farm or forestry deferral for landowners who develop a wildlife management plan with the approval of the Oregon Department of Fish and Wildlife.	ODFW, SWCDs, NRCS
ODFW Riparian Lands Tax Incentive Program	offers a property tax incentive to property owners for improving or maintaining qualifying riparian lands which can include up to 100 feet from a waterway.	ODFW: https://www.dfw.state.or.us/lands/tax_overview.asp
Funding Resources for Watershed Protection and Restoration	EPA's Funding Resources for Watershed Protection and Restoration (USEPA, 2023) contains numerous links to funding sources	variousUS EPA 2023
Septic System Funding	Links to various septic system grant or loan programs	DEQ: https://www.oregon.gov/deq/Residential/Pages/Onsite.aspx EPA: https://www.epa.gov/septic/frequent-questions-septic-systems#maintaining

5.4 Schedule for implementation plan submittal

OAR 340-042-0040(4)(l)(I) specifies that the WQMP contain a schedule for submittal of implementation plans. As stated in OAR 340-042-0080(4)(a), entities identified in the WQMP with responsibility for developing implementation plans are required to prepare and submit an implementation plan for DEQ approval according to the schedule in the WQMP.

Within 18 months of issuance adoption of the Powder River Basin Bacteria TMDL and WQMP by the Environmental Quality CommissionEQC, of the Powder River Basin Bacteria*E. coli* TMDL and WQMP, persons, includingRPs and DMAs, responsible for developing implementation plans must submit implementation plans to DEQ for review and approval.

OAR-340-012-0055(1)(e) identifies failure to timely submit or implement a TMDL implementation plan, as required by DEQ order or rule, as a Class II violation. OAR 340-012-0053~~(1)~~ identifies failure to report by the reporting deadline, as required by DEQ order or rule, as a Class I violation.

~~Should a sector or sector-wide~~If a DMA or RP fails to submit an ~~approvable~~ TMDL implementation plan for approval, DEQ may pursue enforcement under OAR 340-012-0055(1)(e) or identify individual sources (landowners/operators) as persons responsible for developing and implementing TMDL implementation plans ~~to address the load allocations relevant for the sector~~. DEQ may revise the WQMP or issue individual orders to identify additional ~~responsible persons~~RPs and notify them of the required schedule for submitting ~~source-specific~~ implementation plans.

Following the ~~issuance~~ adoption of the TMDL and ~~this~~ WQMP, DEQ may determine that ~~nonpoint source~~ implementation plans are not necessary for certain entities identified in the WQMP based on available information or new information provided by those entities. For these entities, DEQ will provide a written determination of why a plan is not necessary. ~~This~~ The determination ~~could~~ may be based on a variety of factors~~,~~ such as inaccurate identification within the geographic scope of the TMDL, ~~or~~ documentation that an entity is not a source of pollution, or the entity does not discharge pollutants to a waterbody within the scope of this ~~particular~~ TMDL.

Once approved, DEQ expects implementation plans to be ~~fully implemented~~ executed according to the timelines and schedules for achieving measurable milestones specified ~~within~~ in the plans. As required in Section 5.3 above, reports on tracking and evaluation of implementation progress must be submitted annually~~,~~ on the date specified in the approved implementation plan. ~~And i~~Implementation plans must be reviewed and revised as appropriate for DEQ approval every five years~~,~~ submitted on the date specified in the approved implementation plan.

6. Monitoring and evaluation of progress

OAR 340-042-0040(4)(l)(K) requires that the WQMP include a plan to monitor and evaluate progress toward achieving the TMDL allocations and associated water quality standards for the impairments addressed in the TMDL. Additional objectives of monitoring efforts are to assess progress towards reducing excess pollutant loads and to better understand variability associated with environmental or anthropogenic factors. This section summarizes DEQ’s approach, including the required elements of identification of monitoring responsibilities and the plan and schedule for reviewing monitoring information to make TMDL revisions, as appropriate.

There are two fundamental components to DEQ’s approach to monitoring and evaluating TMDL progress: 1) tracking the implementation and effectiveness of activities committed to by responsible persons in DEQ-approved implementation plans, and 2) periodically monitoring the physical, chemical, and biological parameters necessary to assess water quality status and trends for the impairments that constitute the basis for these TMDLs.

DEQ will engage with DMAs, RPs, and local partners to encourage coordination of monitoring activities in the Powder River Basin and participation in development of a Monitoring Strategy for the TMDL. With input from partnersthese parties, DEQ will create overarching coordinateddevelop overarching water column sampling and analysis plan(s) to finalize the first iteration of the Powder River Basin Monitoring Strategy, after the issuance adoption of the TMDLs and WQMP. DEQ will continue to work with partners to implement the sampling and analysis plan(s), periodically review the results and iteratively refine the strategy, as appropriate.

6.1 Persons responsible for monitoring

Section 5.1 identifies the Designated Management Agencies and other persons responsible for developing TMDL implementation plans and implementing the management strategies described on the timelines committed to in approved plans. Section 5.3 details the content required in implementation plans and annual reports, as well as the schedules for their the submittal. This required reporting from each responsible entity on tracking of management actions implemented, milestones met and periodic evaluation of performance monitoring, fulfills the first fundamental component of DEQ's approach and makes up the primary monitoring information DEQ reviews in gaging progress toward meeting TMDL goals.

DEQ also expects ODA, BLM, and USFS to undertakeconduct monitoring actions in areas within their their respective jurisdictional areas or and ownerships to help determine the status of instream water quality and landscape conditions associated with water quality. DEQ expects This efforts will to be progressiveincremental, starting with review of existing data and monitoring locations, then adjusted as needed to improve understanding of current water quality status and develop a trend monitoring network.

As guidance for developing a monitoring program in individual implementation plans, the objectives of the monitoring and assessment portion of the implementation plan include, but are not limited to:

1. Provide information necessary to determine locations for applying management strategies or to assess the effectiveness of those strategies.
2. Refine information on source-specific or sector-specific pollutant loading.
3. Provide information necessary to demonstrate progress towards meeting load allocations.
4. Provide information used to identify roles and participate in collaborative effort among responsible persons to characterize water quality status and trends.
5. Provide information integral to an adaptive management approach to inform and adjust management strategies over time.

Some A DMAs may also perform certain types of monitoring formonitor administration of its its regulatory or voluntary program, separately from activities conducted under elements of a TMDL implementation plan. These DMAs should may provide include information from those the activities in their the annual reporting to DEQ that are relevant to the above objectives listed above.

Environmental media and water column monitoring activities conducted by DMAs to meet TMDL objectives, and the collection and management of data collection and management must be performed in adherenceneed to adhere to Quality Control procedures and Quality Assurance protocols established by U.S.US EPA or other appropriate organizations likesuch as DEQ's

Volunteer Monitoring Program. This requirement will be met through developing or adapting Quality Assurance Project Plans and/or project-specific Sampling and Analysis Plans.

For water column monitoring, QA/QC documentation must be submitted to DEQ for review and approval based on a schedule in the approved TMDL implementation plan. Existing QAPPs or SAPs may be revised as needed. Alternatively, responsible persons can agree to participate in a collaborative monitoring plan under an umbrella QAPP. DEQ staff will coordinate QAPP development with responsible persons upon request in advance of submission. Resources for developing quality assurance project plans and sampling and analysis plans are available on DEQ's water quality monitoring website (DEQ~~,~~ 2023).

The use of bacterial/DNA source tracking (BST) methods can also ~~help to~~ facilitate TMDL implementation by clarifying ~~the dominant~~the presence and relative importance of sources of fecal bacteria (such as human vs. animal) and refine selection of appropriate management strategies~~ for implementation~~. BST methods are particularly helpful when used as supplemental to traditional methods of water quality monitoring for *E. coli*. DEQ supports the use of EPA-endorsed BST methods (USEPA 2011) in implementation of the Powder River Basin *E. coli* TMDL.

DEQ anticipates that monitoring and reporting ~~efforts~~ may consist of the following activities:

- Reports on the numbers, types and locations of projects, management strategies and practices and educational activities completed.~~;~~
- Monitoring of ~~bacteria~~*E. coli* concentrations in surface water.~~;~~
- Monitoring riparian vegetation communities that function as pollutant buffers for streams.~~; and,~~
- Monitoring for compliance with ODA Agricultural Water Quality Rules and to assess Strategic Implementation Areas.

6.1.1 Powder River Basin Long Term Monitoring Plan

In 2021, the Powder River Basin Watershed Council (PBWC) received a monitoring grant from the Oregon Watershed Enhancement Board. Interested parties in the Powder River Basin, ~~stakeholders~~ including community members and agency partners, collaborated on development of the monitoring plan, which ~~serves as an excellent example of~~ represents a basin-wide approach to water quality monitoring. ~~This effort is an extension of previous monitoring conducted over several previous years with active participation of the PBWC, along with community volunteers, schools, local agricultural organizations and state and federal agencies. PBWC initiated the monitoring plan in Spring 2022 and plan to complete it in 2024.~~ Plan objectives will contribute to future TMDL development and implementation for dissolved oxygen, pH, and phosphorus, and will provide direct support for implementation of the ~~bacteria~~*E. coli* TMDL.

~~As stated in the plan objectives, the PBWC intends to monitor surface waters for a suite of parameters, including temperature, dissolved oxygen, pH, conductivity, turbidity and streamflow. The plan provides additional details about selected locations for specific parameters and measurement methods. For example, select sites will be monitored continuously for dissolve oxygen during the redband and bull trout spawning seasons.~~

~~*E. coli*~~~~*E. coli* and total phosphorus will be monitored twice a month throughout the irrigation season (May-October) from 2022-2024 to establish current concentrations of these parameters~~

~~in the Burnt River. Monitoring sites for *E. coli* and total phosphorus were selected collaboratively by the Burnt River Local Advisory Committee, Burnt River Irrigation District, DEQ, ODA, Burnt River SWCD and the PBWC, and resultant~~Resultant data will be shared with DEQ~~. This data will be particularly helpful useful to DEQ for its~~ and will be useful for the statewide water quality status and trends analysis project, assessment of ~~bacteria~~*E. coli* TMDL implementation effectiveness, and for analysis in determining ~~the forthcoming~~ phosphorus conditions in surface waters across the Basin ~~TMDL~~.

The plan also ~~has the potential~~ represents opportunities for significant ~~stakeholder~~agency and community engagement, as the PBWC intends to assemble a ~~stakeholder~~ group of representatives from Ag. Water Quality LAC, BRID, BLM, USFS, ODA, DEQ, WRD, ODFW and the local SWCDs to meet annually for review of data and to provide input on the past years sampling. Monitoring data and results are intended to be shared with the community and ~~stakeholders~~ interested parties via a final report after conclusion of the monitoring program.

6.1.2 DEQ Recommendations for Additional Monitoring

DEQ ~~is supportive~~ supports~~of~~ the local monitoring plans that have been implemented ~~as well as those~~and ~~that are~~ planned for ~~2023-2024~~the future. DEQ recommends that local partners continue to coordinate with DEQ during the implementation of the ~~bacteria~~*E. coli* TMDL and participate in future development and implementation of TMDLs for dissolved oxygen, nutrients, and temperature.

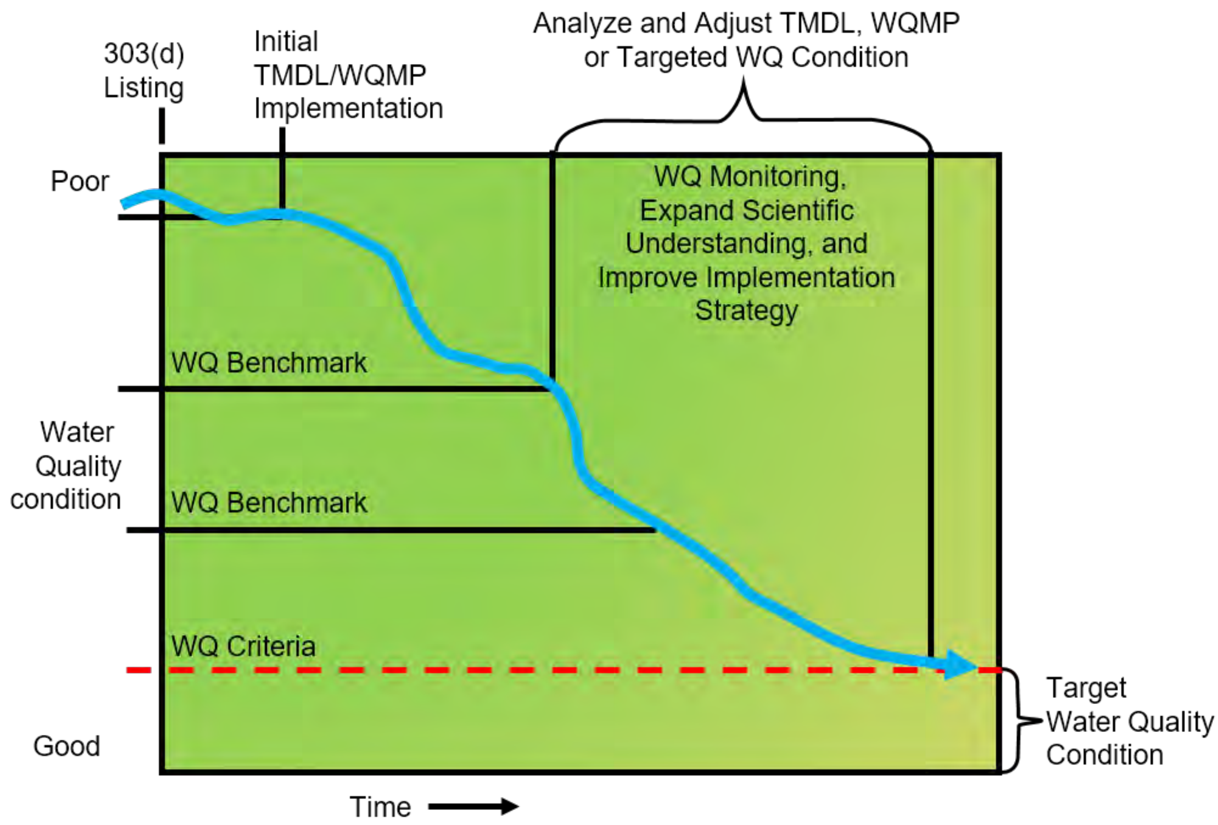
DEQ recommends the consideration of ~~an~~ additional monitoring site(s) for ~~bacteria~~*E. coli* and phosphorus in the Powder River between Baker City and Haines~~,~~ and ~~also~~ at Bidwell Road, ~~which is~~ located above the confluence with the North Powder River. DEQ recommends that sites in the lower Powder River include the DEQ ambient monitoring site below Keating (sampled by DEQ every other month), at the OWRD flow gage above Richland, and the Snake River Road crossing below Richland. DEQ also recommends a monitoring site in lower Eagle Creek at the Snake River Road crossing.

6.2 Plan and schedule for reviewing monitoring information and revising the TMDL

DEQ recognizes that it will take time before monitoring and management strategies ~~practices~~ identified in a WQMP and the approved implementation plans are fully implemented and effective in reducing and controlling pollution. DEQ also recognizes that despite best efforts, natural disturbances ~~events beyond the control of humans~~ may interfere with or delay attainment of the TMDL. Such events include, but are not limited to, floods, large fires, insect infestations, and drought. In addition, DEQ recognizes that technology and practices for controlling nonpoint source pollution will continue to develop and improve over time. As implementation, technology, and knowledge about these approaches progress, DEQ will use adaptive management to refine implementation.

Adaptive management is a process that acknowledges and incorporates improved technologies and practices over time ~~in order to~~to refine ~~implementation~~plans and actions. A conceptual representation of the TMDL adaptive management process is presented in Figure 6~~.2~~.

Figure 6: Conceptual representation of adaptive management



~~**Figure 6.2: Conceptual representation of adaptive management**~~

DEQ considers entities ~~complying with~~ that are executing their DEQ ~~-~~approved TMDL implementation plans to be in compliance with ~~the~~ TMDL~~s~~ and WQMP ~~R~~rules or ~~O~~orders. The annual reports and Year Five Reviews submitted to DEQ by each of the ~~responsible persons~~RPs, including DMAs, in the Powder River Basin will be evaluated individually and collectively.~~The information generated by each of the DMAs or other entities compiling annual reports and gathering data in the Powder River Basin will be evaluated individually and collectively~~ DEQ will use this information to determine whether management actions are supporting progress towards TMDL objectives, or if changes in management actions and/or TMDLs are needed.

~~Annually,~~ DEQ will review annual reports, participate with DMAs and other ~~responsible persons~~RPs in review of monitoring information and participate in implementing the Powder River Basin Monitoring Strategy.

Every five years, DEQ will collectively evaluate annual reports and all available monitoring data and information to assess progress on meeting the goals of the TMDLs and WQMP. Monitoring data that is submitted to DEQ by ~~Responsible Persons~~RPs or other monitoring groups and meets DEQ's quality control standards will be included in these evaluations.

- ~~Where~~ If DEQ determines that implementation plans or effectiveness of management strategies are inadequate, DEQ will require DMAs and responsible persons to revise the components of their implementation plans to address these deficiencies.
- ~~Where~~ If progress toward meeting Monitoring Strategy objectives is not being made, DEQ and partners will revise sampling and analysis plans or other aspects of the Monitoring Strategy.
- If DEQ's evaluation of water monitoring data and supporting information indicate that the TMDL load allocations for a given pollutant-impairment combination are insufficient to meet state numeric or narrative criteria or protect the designated beneficial uses, DEQ will consider whether revisions to the TMDL ~~revisions~~are warranted. Per OAR 340-042-0040(7), DEQ will follow all public participation requirements, including convening a local technical or rulemaking advisory committee to provide input on proposed TMDL revisions.
- If DEQ collects or receives additional data and analyses show that substantive changes ~~should~~may be made to the *E. coli* TMDL point source and/or nonpoint source allocations, DEQ will schedule a date for revisions to the Powder River Basin *E. coli* TMDL in the statewide TMDL workplan.

7. Reasonable assurance of implementation

OAR 340-042-0030(9) defines Reasonable Assurance as "a demonstration that a TMDL will be implemented by federal, state or local governments or individuals through regulatory or voluntary actions including management strategies or other controls." OAR 340-042-0040(4)(l)(J) requires a description of reasonable assurance that management strategies and sector-specific or source-specific implementation plans will be carried out through regulatory or voluntary actions. And, as a factor in consideration of allocation distribution among sources, OAR 340-042-0040(6)(g) states that "to establish reasonable assurance that the TMDL's load allocations will be achieved requires determination that practices capable of reducing the specified pollutant load: (1) exist; (2) are technically feasible at a level required to meet allocations; and (3) have a high likelihood of implementation," which is also consistent with EPA past practice.

The Clean Water Act section 303(d) requires that a TMDL be "established at a level necessary to implement the applicable water quality standard." Federal regulations define a TMDL as "the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background" in ~~[~~40 CFR 130.2(i)~~]~~. For TMDL approval, EPA guidance on the TMDL process requires determinations that allocations are appropriate to implement water quality standards and reasonable assurance that nonpoint source controls will achieve load reductions~~,~~ ~~when~~ whereas WLAs are based on an assumption that nonpoint source load reductions will occur (USEPA~~,~~ 1991, 2002a and 2012).

When a TMDL is developed for waters impaired by point sources only, the existence of the NPDES regulatory program and the issuance of NPDES permits provide the reasonable assurance that the wasteload allocations in the TMDL will be achieved. That is because federal regulations implementing the Clean Water Act require that water quality-based effluent limits in permits be consistent with "the assumptions and requirements of any available [wasteload allocation]" in an approved TMDL, ~~(~~40 CFR 122.44(d)(1)(vii)(B)~~)~~.

Where a TMDL is developed for waters impaired by both point and nonpoint sources, ~~it is the state's best professional judgment~~ ~~as to the three point test in~~ OAR 340-042-0040(6)(g) provides ~~on~~ for reasonable assurance that the TMDL's load allocations will be achieved.

Where there is a demonstration that nonpoint source load reductions can and will be achieved, a determination that reasonable assurance exists; and allocation of greater loads to point sources is appropriate. Without a demonstration of reasonable assurance that relied ~~-~~upon nonpoint source reductions will occur, reductions to point sources wasteload allocations are needed.

The Powder River Basin ~~Bacteria~~*E. coli* TMDL was developed to address both point and nonpoint sources with load reduction allocations proportional to estimated source contributions and in consideration of opportunities for effective measures to reduce those contributions. There are several elements that combine to provide the reasonable assurance to meet federal and state requirements. Education, outreach, technical and financial assistance, permit administration, permit enforcement, responsible person's implementation and DEQ enforcement of TMDL implementation plans will all be used to ensure that the goals of this TMDL are met.

7.1 Accountability Framework

Reasonable assurance that the needed ~~needed load~~ reductions ~~will be achieved for~~in nonpoint sources will be achieved relies on the ~~is based primarily on an~~ accountability framework ~~incorporated into the~~ in the WQMP~~, together with the~~ and implementation plans ~~of persons responsible for implementation~~developed by RPs and DMAs. ~~This~~ The approach ~~is similar to~~like ~~the accountability framework~~ mimics the one adopted by EPA for the Chesapeake Bay TMDL in ~~, which was adopted in~~ 2010. Figure 7~~.1~~ presents the accountability framework elements, which are intended to work in concert to demonstrate reasonable assurance of implementation.

Figure 7: Representation of the Reasonable Assurance Accountability Framework Led by DEQ

~~**Figure 7.1 Representation of the Reasonable Assurance Accountability Framework Led by DEQ**~~

Pollutant reduction strategies are identified in Section 2 and more specific strategies will be detailed in each required implementation plan~~,~~ to be submitted ~~per the~~according to the timelines in Section 5.4. These strategies and actions are comprehensively implemented through a variety of regulatory and non-regulatory programs. Many of these are existing strategies and actions ~~that are~~ already being implemented within the basin and demonstrate reduced pollutant loading. These strategies are technically feasible at an appropriate scale ~~in order to~~to meet the allocations. A high likelihood of implementation is demonstrated because DEQ reviews the individual implementation plans and proposed actions for adequacy and establishes a monitoring and reporting system to track implementation and respond to any inadequacies.

The ~~Designated Management Agencies~~DMAs~~,~~ responsible for implementation of pollutant reduction strategies are identified in Section 5.1. General timelines for implementing management strategies and attaining the *E. coli* water quality criterion are provided in Sections 3 and 4, respectively. ~~More s~~Specific timelines, milestones, and measurable objectives will be specified in each required implementation plan. These elements support timely action by ~~both~~ DEQ and other ~~agencies~~ DMAs responsible for implementation. ~~so that enforcement and adaptive management actions can be triggered and evaluation of attainment of TMDL goals occurs.~~

DEQ periodically reviews reporting by persons and agencies responsible for ~~implementatating~~implementing pollutant reduction strategies to track the management strategies being implemented and evaluate achievements against established timelines and milestones.

Following ~~up on reviews to track progress of~~ implementation plan reviews~~s~~, DEQ will take appropriate action if ~~-~~the DMAs or ~~responsible persons~~RPs fail to develop or effectively implement their implementation plan or fulfill milestones. DEQ's actions can take two tracks, 1) enforcement or 2) engagement in voluntary initiatives. DEQ uses both tracks, as appropriate within the process, to achieve optimal pollutant reductions. In some ~~cases~~cases, DEQ can assist in facilitating the availability of incentives for meeting voluntary initiatives or providing education. DEQ will also take enforcement actions where necessary based on authorities listed in Section 10 or raise issues to the Environmental Quality Commission, as provided in OAR 340-042-0080.

DEQ ~~tracks~~ periodically evaluates water quality status and trends ~~concurrently~~ as management strategies are implemented. DEQ relies on a system of interconnected evaluations~~, which~~ that include DMAs and ~~responsible persons~~RPs meeting measurable objectives,~~ effectiveness~~ demonstration of effective pollutant management strategies, accountability of implementation, periodically assessing progress on Oregon's Nonpoint Source Program Five-Year Plan Goals (approved by EPA), discharge monitoring, and instream monitoring. DEQ also periodically evaluates water quality data collected through its ambient and project-specific monitoring programs, including monitoring plans developed specifically for the Powder River Basin~~, as presented~~ described in Section 6. DEQ ~~regularly~~ periodically prepares Status and Trends reports and conducts water quality assessments on status of all waterways in Oregon approximately every two years, as required ~~by the Clean Water Act~~ for submittal to EPA for approval as ~~DEQ's~~ Oregon's Integrated Report, ~~/~~Section 303(d) List of Category 5 Water Quality Limited Waters. Together, these data and evaluations allow refinement of focus on specific geographic areas or ~~discharges~~ pollutants and appropriate implementation of adaptive management actions to attain, over time, the objectives of the TMDL.

7.2 Reasonable Assurance Conclusions

DEQ's implementation approach is multi-faceted and requires many targeted management practices across the entire basin to reduce anthropogenic pollutants, regardless of source origination.

Because the nonpoint sources of ~~bacteria~~*E. coli* in the basin include a ~~less significant~~ portion of background sources and the management practices that can be employed are distributed over a wide area and among many DMAs, there is some uncertainty about the pace of achieving ~~adequate~~ calculated reductions in ~~bacteria~~*E. coli* loading to basin waters. DEQ's WQMP addresses this uncertainty by including an extensive monitoring, reporting and adaptive component that is designed to match the accountability framework used by EPA in its Chesapeake Bay TMDL (2010).

The rationale described in this document stems from robust evaluations, implements an accountability framework, and provides opportunities for adaptive management to maximize pollutant reductions. Together this approach provides reasonable assurance to meet state and federal requirements and attain the goals of the TMDL.

8. Legal Authorities

~~As required in~~ Oregon Administrative Rule 340-042-0040(4)(l)(O), provides for citation of ~~this section cites~~ legal authorities relating to implementation of management strategies.

Clean Water Act, Section 303(d)

The DEQ is the Oregon state agency responsible for implementing the Clean Water Act in Oregon. Section 303(d) of the 1972 Federal Clean Water Act as amended requires states to develop a list of rivers, streams and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. These waters are referred to as "water quality limited." Water quality limited waterbodies must be identified by the EPA or by a state agency which has this authority. In Oregon, the responsibility to delegate water quality limited waterbodies rests with DEQ and DEQ's list of water quality limited waters is updated every two years. The list is referred to as the 303(d) list. Section 303 of the Clean Water Act further requires that TMDLs be developed for all waters on the 303(d) list. The Oregon Environmental Quality Commission granted DEQ authority to implement TMDLs through OAR 340-042, with special provisions for agricultural lands and nonfederal forestland as governed by the Agriculture Water Quality Management Act and the Forest Practices Act, respectively. The EPA has the authority under the Clean Water Act to approve or disapprove TMDLs that states submit. When a TMDL is officially submitted by a state to EPA, EPA has 30 days to take action on the TMDL to approve or disapprove the TMDL. In the case where EPA disapproves a TMDL, EPA must issue a TMDL within 30 days. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL~~, which~~ that is designed to restore the water quality, and

~~result in~~ to be in compliance with the water quality standards. In this way, the designated beneficial uses of the water will be protected for all users.

Endangered Species Act, Section 6

Section 6 of the 1973 federal Endangered Species Act, as amended, encourages states to develop and maintain conservation programs for federally listed threatened and endangered species. In addition, Section 4(d) of the ESA requires the National Marine Fisheries Service to list the activities that could result in a "take" of species they are charged with protecting. ~~With regard to~~Regarding this TMDL, NMFS' protected species are salmonid fish. NMFS also described certain precautions that, if followed, would preclude prosecution for take even if a listed species were harmed inadvertently. Such a provision is called a limit on the take prohibition. The intent is to provide local governments and other entities greater certainty regarding their liability for take.

NMFS published ~~their~~ a rule in response to Section 4(d) in July of 2000 (~~see~~ 65 FR 42421, July 10, 2000). The NMFS 4(d) rule lists 12 criteria that will be used to determine whether a local program incorporates sufficient precautionary measures to adequately conserve fish. The rule provides for local jurisdictions to submit development ordinances for review by NMFS under one, several or all ~~of~~ the criteria. The criteria for the Municipal, Residential, Commercial, and Industrial Development and Redevelopment limit are listed below:

1. Avoid inappropriate areas such as unstable slopes, wetlands, and areas of high habitat value.~~;~~
2. Prevent stormwater discharge impacts on water quality.~~;~~
3. Protect riparian areas.~~;~~
4. Avoid stream crossings – whether by roads, utilities, or other linear development.~~;~~
5. Protect historic stream meander patterns.~~;~~
6. Protect wetlands, wetland buffers, and wetland function.~~;~~
7. Preserve the ability of permanent and intermittent streams to pass peak flows (hydrologic capacity).~~;~~
8. Stress landscaping with native vegetation.~~;~~
9. Prevent erosion and sediment run-off during and after construction.~~;~~
10. Ensure water supply demand can be met without affecting salmon needs.~~;~~
11. Provide mechanisms for monitoring, enforcing, funding, and implementing.~~; and~~
12. Comply with all other state and federal environmental laws and permits.

Oregon Revised Statute Chapter 468B

DEQ is authorized by law to prevent and abate water pollution within the State of Oregon. Particularly relevant provisions of this chapter include:

ORS 468B.020 Prevention of pollution

(A) Pollution of any of the waters of the state is declared to be not a reasonable or natural use of such waters and to be contrary to the public policy of the State or Oregon, as set forth in ORS 468B.015.

(B) ~~In order to~~To carry out the public policy set forth in ORS 468B.015, the Department of Environmental Quality shall take such action as is necessary for the prevention of new pollution and the abatement of existing pollution by:

a) Fostering and encouraging the cooperation of the people, industry, cities, and counties, ~~in order~~ to prevent, control and reduce pollution of the waters of the state; and

b) Requiring the use of all available and reasonable methods necessary to achieve the purposes of ORS 468B.015 and to conform to the standards of water quality and purity established under ORS 468B.048.

ORS 468B.110 provides DEQ and the EQC with authority to take actions necessary to achieve and maintain water quality standards, including issuing TMDLs and establishing wasteload allocations and load allocations.

NPDES and WPCF Permits

DEQ administers two different types of wastewater permits in implementing provided in ~~Oregon Revised Statute (~~ORS ~~)~~ 468B.050, ~~. These are:~~ that are: ~~the~~ 1) NPDES permits for waste discharge into waters of the United States,~~;~~ and 2) Water Pollution Control Facilities permits for waste disposal on land. The NPDES permit is also a federal permit and is required under the Clean Water Act. The WPCF permit is a state program.

401 Water Quality Certification

Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the state must provide the licensing or permitting agency a certificate from DEQ that the activity complies with water quality requirements and standards. These include certifications for hydroelectric projects and for 'dredge and fill' projects. The legal citations are: 33 U.S.C. 1341; ORS 468B.035 ~~–~~through 468B.047; and OAR 340-048~~-0005 – 340-048-0040.~~.

USACE Dam Operation and Management

In association with other federal statues, including House Document No. 531 Volume V, the River and Harbor Act, the Flood Control Act, and the Water Resources Development Act, the USACE is charged with operating its projects in compliance with the federal Clean Water Act, and in accordance with all federal, State, interstate and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water quality pollution as per Title 1 Section 313 (33 U.S.C. 1323).

Oregon Forest Practices Act

The Oregon Department of Forestry is the ~~designated management agency~~DMA for regulating land management actions on non-federal forestry lands that impact water quality (ORS 527.610 to 527.992, and OAR 629 Divisions 600 through 665). The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 625, 630, and 635~~-~~through 660 that ~~, which~~ describe best management practices for forest operations. The Oregon Environmental Quality Commission, Board of Forestry, DEQ, and ODF have agreed that these pollution control measures will primarily be relied upon to result in achievement of state water quality standards. Statutes and rules also include provisions for adaptive management that provide for revisions to FPA practices where necessary to meet water quality standards. These provisions are described in ORS 527.710, ORS 527.765, OAR 629-035-0100, and OAR 340-042-0080.

Agricultural Water Quality Management Act

The Oregon Department of Agriculture is responsible for the prevention and control of water pollution from agricultural activities as directed and authorized through the Agricultural Water Quality Management Act, adopted by the Oregon legislature in 1993 in ~~(~~ORS 568.900 to ORS 568.933~~)~~. It is the lead state agency for regulating agriculture for water quality (ORS 561.191). The Agricultural Water Quality Management Plan Act directs the ODA to work with local communities to develop water quality management plans for specific watersheds that have been identified as violating water quality standards and have agriculture water pollution contributions. The agriculture water quality management plans are expected to identify problems in the ~~watershed~~ basin that need to be addressed and outline ways to correct the problems. Agricultural Water Quality area rules for areas within the Powder Basin ~~Willamette Basin~~ include Powder-Brownlee in ~~(~~OAR 603-095-3600 to 3660~~),~~ and the Burnt River in ~~(~~OAR 603-095-3200 to 3260.~~). 603-095-2100 to 1160, OAR 603-095-2300 to 2360, OAR 603-095-2600 to 2660, and OAR 603-095-3700 to 3760.~~

Municipal Local Ordinances

Local governments are expected to describe in their implementation plans ~~their~~ specific legal authorities to carry out the management strategies chosen to meet the TMDL allocations. If new or modified local codes or ordinances are required to implement the plan, the DMA will identify code development as a management strategy. Legal authority to enforce the provisions of a city's NPDES permit would be a specific example of legal authority to carry out management strategies.

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Technical Support Document

Powder River Basin ~~Bacteria~~ TMDL

for *E. coli*

May 2024

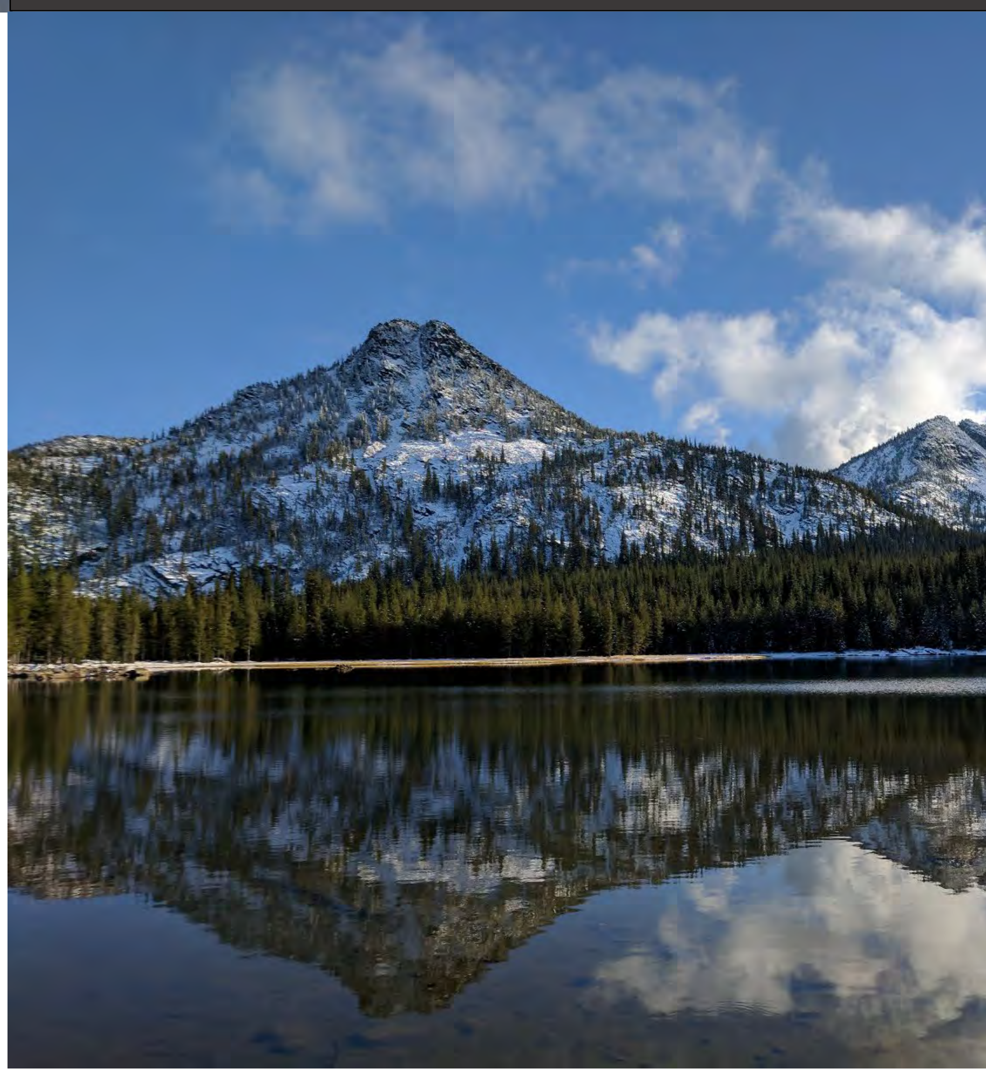

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Table of contents

List of Ttables and figures

List of Figures

1. Introduction

1.1 Document purpose and organization

This draft document provides ~~comprehensive~~ supporting information on technical analyses completed for the Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) ~~for~~ addressing ~~bacteria~~ fecal contamination of surface waters in the ~~impairments in the waters of the~~ Powder River Basin documented in DEQ’s approved 303(d) list of impaired waters needing a TMDL. Included here are ~~This document provides explanation of the~~ TMDL concepts and ~~analysis~~ analyses, ~~are described and describes the~~ results used to support TMDL ~~for~~ conclusions, and requirements ~~included~~ for~~in~~ the Powder River Basin TMDL and WQMP, which will be proposed for adoption by Oregon’s Environmental Quality Commission, by reference, into rule [OAR 340-042-0090(2) (a) and (b)].

This document is organized into sections with titles reflective of the TMDL elements required by OAR 340-042-0040(4) in the Powder River Basin TMDL for *Escherichia coli (~~E. coli~~E. coli)~~bacteria~~*, which is a bacteria that indicates fecal contamination from human~~s~~ or other warm-blooded animal sources~~which is the designated indicator for fecal contamination of surface waters used for~~. ~~For brevity, the~~The TMDL ~~is~~may be referred to as either the Powder River Basin Bacteria ~~(or *E. coli* ?)~~ TMDL or the Powder River Basin TMDL for *E. coli*. This organization is intended to assist readers to readily access the information relied on for TMDL element-specific determinations.

1.2 Overview of TMDL elements

According to OAR 340-042-0030(15)~~:~~, ~~Total Maximum Daily Load~~TMDL means a written quantitative plan and analysis for attaining and maintaining water quality standards and includes the elements described in OAR 340-042-0040(4). Determinations on each element are presented in the Powder River Basin Bacteria TMDL ~~for Bacteria*E. coli*~~. Technical and policy information supporting those determinations are presented in this report at the section headings that correspond to the TMDL elements for which complex analysis was undertaken.

In plain language, a TMDL is a water quality ~~budget~~ restoration plan to ensure that the receiving water body can attain water quality standards that protect designated beneficial uses ~~of the water~~. ~~This~~ The budget assigns pollutant loads for discharges of point (effluent discharge requiring a permit) and non-point (land surface and non-permitted inputs) sources into surface waters, in consideration of natural background levels, along with determination of a margin of safety (MOS) and reserve capacity (RC).

A MOS considers the uncertainty in predicting how well pollutant reductions will result in meeting water quality standards and can be expressed either explicitly, as a portion of the loading capacity, or implicitly, by incorporating conservative assumptions in the analyses. RC sets aside some portion of the loading capacity for use for pollutant discharges that may result from future growth and new or expanded sources.
~~The budget calculates and assigns pollutant loads for discharges of point (end of pipe effluent withrequiring a permits) and non-point (diffuse landscape inputs without a permits) sources, in consideration of natural background levels, along with determination of a margin of safety and reserve capacity.~~

A margin Margin of safetySafety (MOS) takes into account the uncertainty in predicting how well pollutant reductions will result in meeting water quality standards and can be expressed either explicitly, as a portion of the allocations, or implicitly, by incorporating conservative assumptions in the analyses. Reserve capacity Capacity (RC) sets aside some portion of the loading capacity for use for pollutant discharges that may result from future growth and new or expanded sources.

A key element of analysis is the "loading capacity", which refers to the amount of pollutant that a waterbody can receive and still meet the applicable water quality standard is referred to as the "loading capacity" of a waterbody. Because the loading capacity must not be exceeded by pollutant loads from all existing sources plus the margin of safetyMOS and reserve capacityRC, it can be considered the maximum allowable load. Hence, the loading capacity is often referred to as the TMDL.

Another key element of the TMDL analysis is allocating portions of the loading capacity to known sources. Allocations are quantified measures that assure water quality standards will be met and may distribute the pollutant loads between nonpoint and point sources. Load allocations (LAs) are portions of the loading capacity that are attributed to: 1) non-point source sectors such as urban areas, agriculture, rural residential or forestry activities; and 2) background sources such as soils or wildlife. Wasteload allocations (WLAs) are portions of the total load that are allotted to point sources of pollution, such as permitted discharges from sewage treatment plants, industrial wastewater, or stormwater. As noted above, allocations can also be reserved for future uses in the RC.

This general TMDL concept is represented by the following equation:

(1) $TMDL = \sum WLAs + \sum LAs + RC + MOS$

Together, these elements establish the pollutant loads necessary to meet the applicable water quality standards for impaired pollutants and protect beneficial uses.

Another key element of the TMDL analysis is allocating portions of the loading capacity (or TTMDL) to known sources. Allocations are quantified measures that assure water quality standards will be met and may distribute the pollutant loads between nonpoint and point sources. "Load allocations" are portions of the loading capacity that are attributed to: 1) non-point sources sectors such as urban areas, agriculture, rural residential or forestry activities; and 2) natural background sources such as soils or wildlife. "Wasteload allocations" are portions of the total load that are allotted to point sources of pollution, such as permitted discharges from sewage treatment plants, industrial wastewater or stormwater. As noted above, allocations can also be reserved for future uses, termed "reserve capacity." in the RC.

This general TMDL concept is represented by the following equation:

TMDL = ∑Wasteload Allocations + ∑Load Allocations + Reserve Capacity + Margin of Safety

Together, these elements establish the pollutant loads necessary to meet the applicable water quality standards for impaired pollutants and protect beneficial uses.

2. Location

Per Oregon Administrative Rule 340-042-0040(a), this element describes the geographic area where the TMDL applies. This Powder River Basin TMDL covers all freshwater perennial and intermittent streams in the Powder River Basin and a small portion of the Malheur Basin (Moore’s Hollow assessment unit).

The Powder River Basin makes up one of 20 drainage basins in Oregon with basin-specific water quality standards described in OAR 340-041-0260 (originally described as the Powder/Burnt Basins) and mapped in Figure 260A. The US Geological Survey (USGS) refers to the basin as a six-digit Hydrologic Unit Code (HUC) numbered 170502 and as the Middle-Snake Powder Basin. Subbasins (eight-digit HUCs) include the Oregon portion of the Brownlee Subbasin (17050201), Burnt River Subbasin (17050202), and Powder River Subbasin (17050203) (Table ~~2.0~~1; Figure ~~2.0~~1).

Table 1: Powder River Basin subbasins

HUC8 Code	Subbasin Name
17050201	Brownlee Subbasin
17050202	Burnt River Subbasin
17050203	Powder River Subbasin

The basin forms a portion of the border of Oregon with Idaho and lies mostly within Baker County, with small portions in Union, Wallowa, and Malheur Counties. A portion of the Brownlee S~~s~~ubbasin also lies in Idaho and is not covered by the TMDL. The Oregon portion of the basin drains 3,444 square miles (8,925 square kilometers). Elevation ranges from 1,640 feet (500 meters) above sea level at the junction with the Snake River to 9,563 feet (2,914 meters) above sea level in the Wallowa Mountains. The average elevation is 4,237 feet (1,291 meters) above sea level (Figure ~~2.0~~1). The entire Powder River Basin falls within the Blue Mountains Level III Ecoregion (Omernik, 1987).

In 1988, two river reaches in the basin were designated as Scenic under the federal Wild and Scenic Rivers Act of 1968. These reaches include a 6.4-mile reach of the North Powder River from its headwaters in the Elkhorn Mountains to the Wallowa-Whitman National Forest boundary and an 11.7-mile reach of the Powder River from Thief Valley Dam to the Highway 203 bridge (National Wild and Scenic River System, 2024).

~~Per Oregon Administrative Rule 340-042-0040(a), this element describes the geographic area for which the TMDL is developed. This Powder River Basin TMDL covers all freshwater perennial and intermittent streams in the Powder River Basin (HUC6 170502).~~

~~The Powder River Basin is one of 20 designated drainage basins in Oregon, with basin-specific water quality standards described in OAR 340-041-0260. The basin forms a portion of the border of Oregon with Idaho and lies mostly within Baker County, with small portions in Union, Wallowa, and Malheur Counties, as well as Idaho. The portion of the basin in Oregon drains 3,444 square miles (8,925 km^2). Elevation ranges from 1,640 feet (500 m) above sea level at~~

~~the junction with the Snake River to 9,563 feet (2,914 m) above sea level in the Wallowa and Elkhorn Mountain ranges in the northeastern portion of the watershed. The average elevation is 4,237 feet (1,291 m) above sea level. As shown in Figure 2.0, the Powder River Basin is comprised of three smaller subbasins that drain to Brownlee Reservoir, which sits on the Oregon-Idaho border and is an impoundment of the Snake River. The entire Powder River Basin falls within the Blue Mountains Level III Ecoregion (Omernik, 1987).~~ A summary of basin characteristics relevant for water quality assessment is compiled in DEQ's November 2013 Powder Basin Status Report and Action Plan (DEQ 2013), available on DEQ's website.

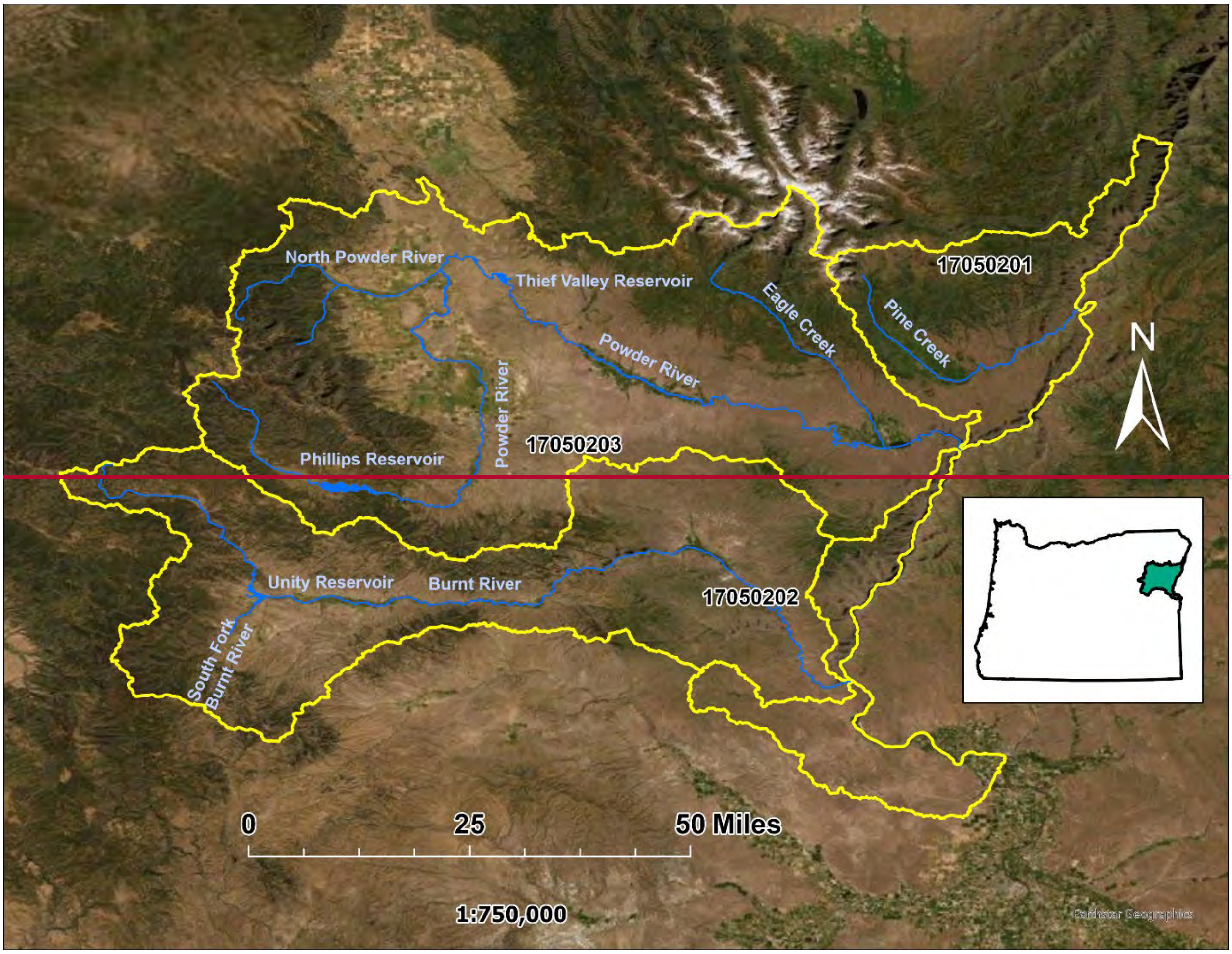
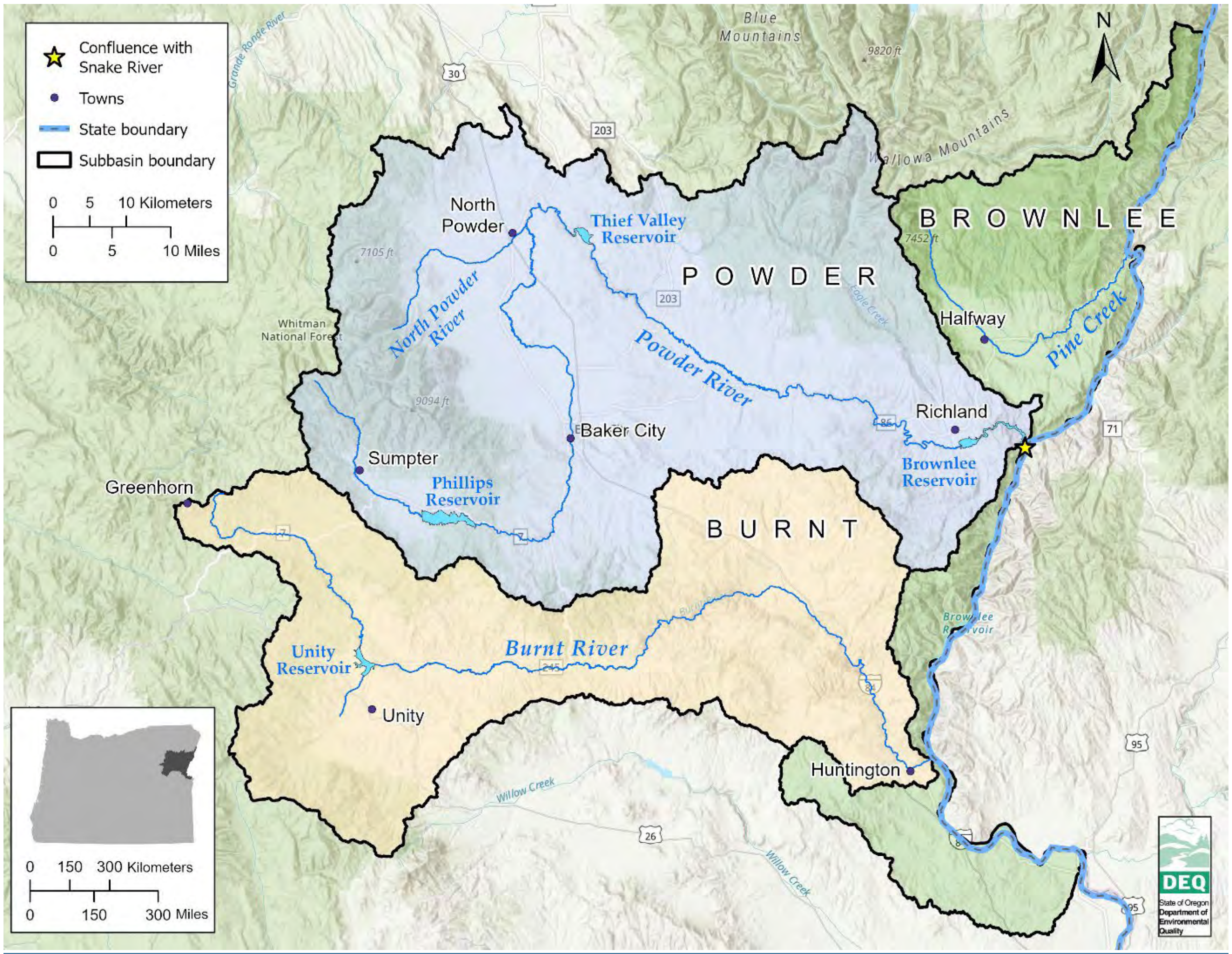


Figure 1: The Powder River Basin (HUC6 170502) Oregon



~~**Figure 2.0: The Powder River Basin (HUC6 170502), Oregon.**~~

~~Within the United States Geologic Survey's Hydrologic Unit Code classification system, the Powder River Subbasin is a 6-digit HUC code (170502) comprised of three smaller 8-digit HUC code subbasins as listed in Table 2.0.~~

~~**Table 2.0: Powder River Subbasins**~~

~~HUC8 Code~~	~~Subbasin Name~~
~~17050201~~	~~Brownlee Subbasin~~
~~17050202~~	~~Burnt River Subbasin~~
~~17050203~~	~~Powder River Subbasin~~

2.1 Climate

The climate of the Powder Basin is influenced by the Cascade Mountains located approximately 200 miles to the west. This mountain range forms a barrier against the modifying effects of warm, moist fronts from the Pacific Ocean. As a result, the climate of the Powder River Basin falls under the Temperate Continental-Cool Summer Phase in the Köppen-Geiger Climate Classification System (Kottek et al, 2006). Light precipitation, low relative humidity, rapid evaporation, abundant sunshine, and large fluctuations of temperature and precipitation characterize this climate. Over the past 30 years (1991 – 2020), mean annual temperature in the basin was 45.3°F (7.4°C), with a mean annual minimum temperature of 33.3°F (0.8°C) and a mean annual maximum temperature of 64.9°F (18.3°C) (PRISM Climate Group, 2022). , the overall climate is classified as Temperate Continental-cool summer phase. Light precipitation, low relative humidity, rapid evaporation, abundant sunshine and wide temperature and precipitation fluctuations are characteristics of this climate. Over the past 30 years (1991 – 2020), the mean annual temperature for the Powder Basin was 45.3°F (7.4°C), with a mean annual minimum temperature of 33.3°F (0.8°C) and a mean annual maximum temperature of 64.9°F (18.3°C).

The majority ofMost annual precipitation falls as snow during winter. Over the past 30 years (1991 – 2020), annual precipitation has averaged 22.0 inches (56.0 cm) across the Powder Basin, with an average of 10.2 inches (25.9 cm) in the valleys and foothills an average of 78.2 inches (198.6 cm) at the highest elevations of the Elkhorn, Wallowa, and Blue Mountains (PRISM Climate Group, 2022) (Daly, et al., 2008). Portions of the basin commonly can experience rain-on snow events, which reduce the snow-pack and may cause brief localized flooding.

2.2 Hydrology

Major drainages in the Powder River Basin originate in mountainous areas in the western portion of the basin and flow east into Brownlee or, Oxbow, or Hells Canyon Reservoirs on the Snake River (Figure 2.01). The two major rivers in the basin, the Powder and Burnt Rivers, begin in the Blue Mountains and flow for 144 and 100 miles, respectively, until the confluence with Brownlee Reservoir on the Snake River. Southern and middle drainages in the Brownlee Subbasin also drain to Brownlee Reservoir while ones north of Brownlee dam, including Pine Creek, drain into Oxbow or Hells Canyon Reservoirs on the Snake River.

The Powder River headwaters originate in the Blue Mountains (Elkhorn Range) west of Baker City near the town of Sumpter. Cracker Creek and McCully Fork join to form the Powder River. The Powder River headwaters originate in the Blue Mountains (Elkhorn Range) west of Baker City near the town of Sumpter. The river flows southwest before entering Phillips Reservoir. Downstream of the reservoir, the river turns north through the Baker Valley and enters Thief Valley Reservoir to the east of the town of North Powder. Downstream of Thief Valley, the river turns southeast and flows the Keating Valley, eventually entering Brownlee Reservoir on the Snake River near the town of Richland. Major tributaries include the North Powder River and Eagle Creek (Figure 2.01).

The headwaters of the Burnt River include the North, West, Middle, and South Forks of the Burnt River that headwater in the southern Blue Mountains (Figure 2.21). The forks flow into Unity Reservoir; the mainstem Burnt River begins immediately downstream. The Burnt River flows east/southeast to join the Snake River downstream of the town of Huntington. Major tributaries include Clarks Creek, Lawrence Creek, and Dixie Creek (Figure 2.01).

The Brownlee Subbasin includes all the streams that drain directly to the Snake River from just north of the Wallowa County-Baker County line south to the town of Ontario. The largest stream in the Brownlee Subbasin, is Pine Creek, is located in the northern portion of the subbasin near the town of Halfway and was used to set loading capacity and allocations for the subbasin (Figure 2.01).

The timing and magnitude of stream flows in the Powder River Basin depend on seasonal patterns of temperature and precipitation. Generally, most precipitation occurs from late fall through early spring (November-April) in the basin as snow and rain (mostly in the valley floors), although monsoonal thunderstorms with intense, localized rainfall can occur during the summer monthsmonths. With the exception ofExcept for periodic summertime storms, dry and warm conditions persist from late spring through early fall (May-October) in the basin. Stream flows typically peak in late spring for rivers in the basin with significant winter snowpacks and decline throughout the summer through late fall. From late spring through early fall, a portion of stream flow and water stored in reservoirs enters the irrigation conveyance system within the basin.

Plots of flow over time, monthly summaries for the period of record, and
The major rivers/streams in the Powder River Basin include the Powder River, North Powder River, Burnt River and Pine Creek, as shown in Figure 2. The Burnt River headwaters are located in the southern Blue Mountains near the town of Unity, from there it flows approximately 100 miles east to the Snake River near the town of Huntington. The Powder River has headwater areas in the Elkhorn Mountains west of Baker City near the town of Sumpter, where Cracker Creek and McCully Fork join to form the Powder River. It flows north through the Baker Valley, and then southeast through the Keating Valley and reaches Brownlee Reservoir on the Snake River near the town of Richland. The total length of the Powder River is approximately 144 miles. Major tributaries include the North Powder River and Eagle Creek. The Brownlee Subbasin includes all the streams that drain directly to the Snake River from an area just north of Ontario to the Hells Canyon area just north of the Wallowa County/Baker County line. The largest stream in the Brownlee Subbasin is Pine Creek, which is located in the northern portion of the subbasin near the town of Halfway.

Fflow duration intervals based on available flow data from 1990 to 2017 for the largest rivers/streams draining each watershed subbasin within the Powder River Basin are shown in Figures 2-10.2a-i, 2.2b, and 2.2c. Flow duration curves describe the probability that a measured flow will be equal to or greater than that flow over the period of record for a specific stream or river. The exceedance probability (EP) for each flow was computed by:

(1) $EP = rank/(n+1)$

where *n* is the number of flow measurements and rank is the ranking of the flow measurement in the period of recorded ordered from highest to lowest. The flow duration interval is EP multiplied by 100 (Figures 4, 7, and 10).
Flow duration curves describe the probability that a measured flow will be equal to or greater than that flow over the period of record for a specific stream or river. 4, 7, and 10
DEQ used the categories to define flow duration intervals to define in basin streams and rivers: High Flows (flows equal or greater 0% to 10% of the time); Medium-High Flows (flows equal or greater 10% to 40% of the time); Medium Flows (flows equal or greater 40% to 60% of the time); Medium-Low Flows (flows equal or greater 60% to 90% of the time); and Low Flows (flows equal or greater 90% to 100% of the time) (Section 4.4). DEQ's categories names for flow intervals are explained in Section 4.4. Flow duration intervals in all three watersheds subbasins show flows typical of winter rain and a snowmelt driven hydrologic regime with peak flows in the spring and low flows typically in late summer and through fall/winterearly fall. However, the highest flows during the periods of record reflect rain on snow events occurring during winter months.

Figure 2: Flow over time for Pine Creek, Oregon from 1990-2017

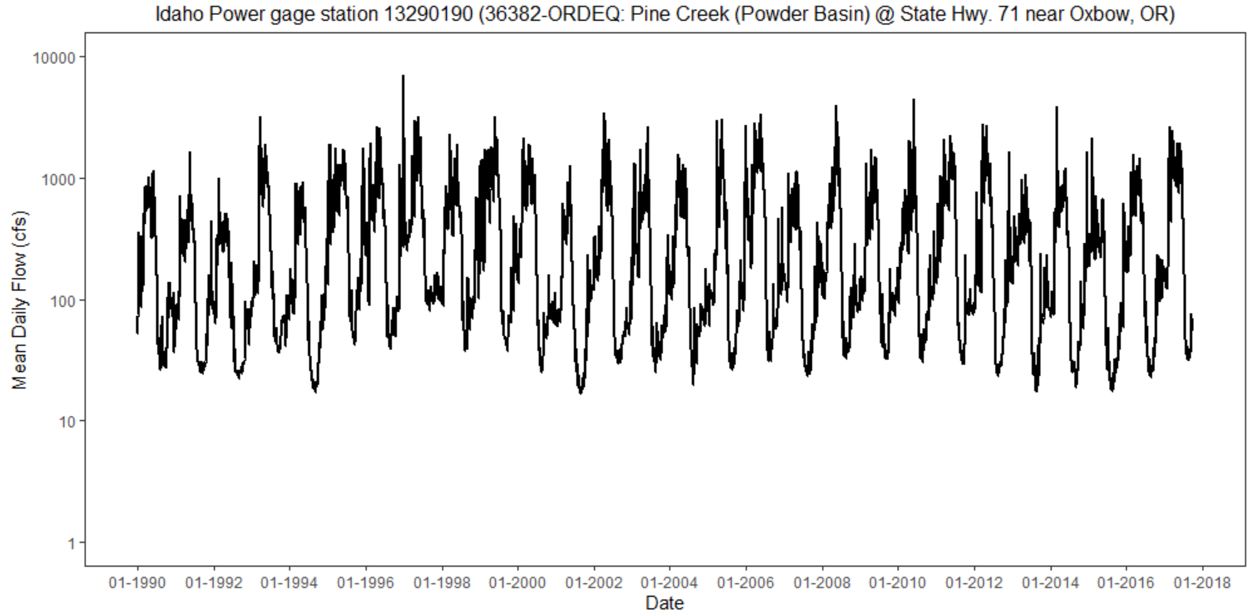


Figure 3: Monthly mean flow (± minimum or maximum) for Pine Creek, Oregon from 1990-2017

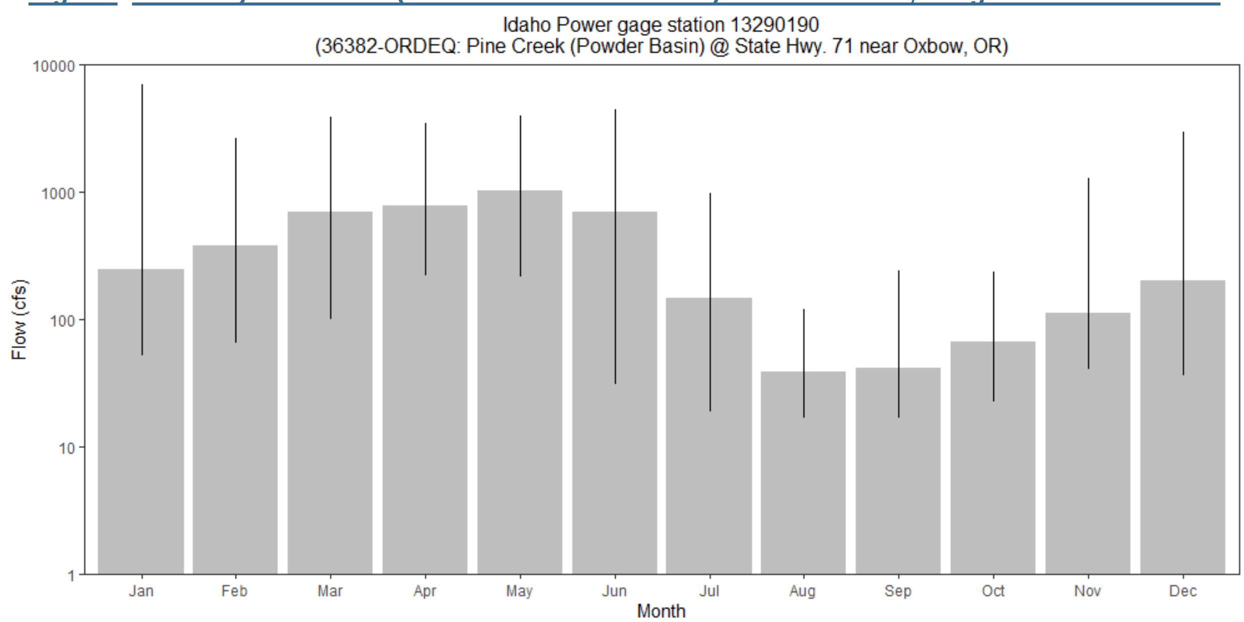
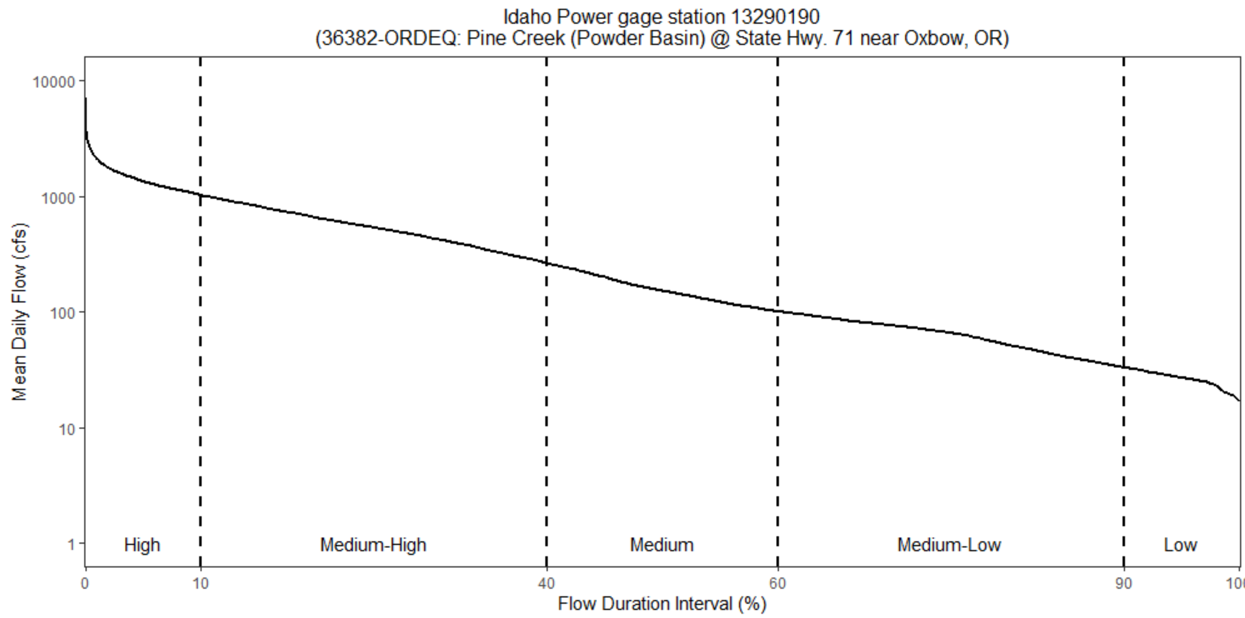
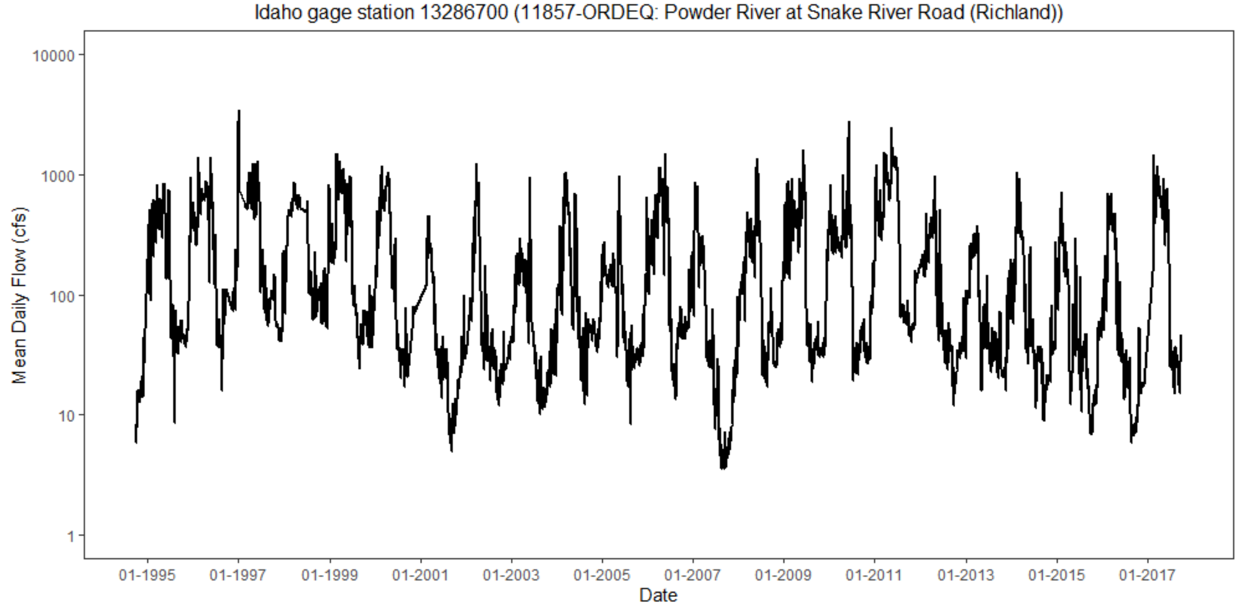


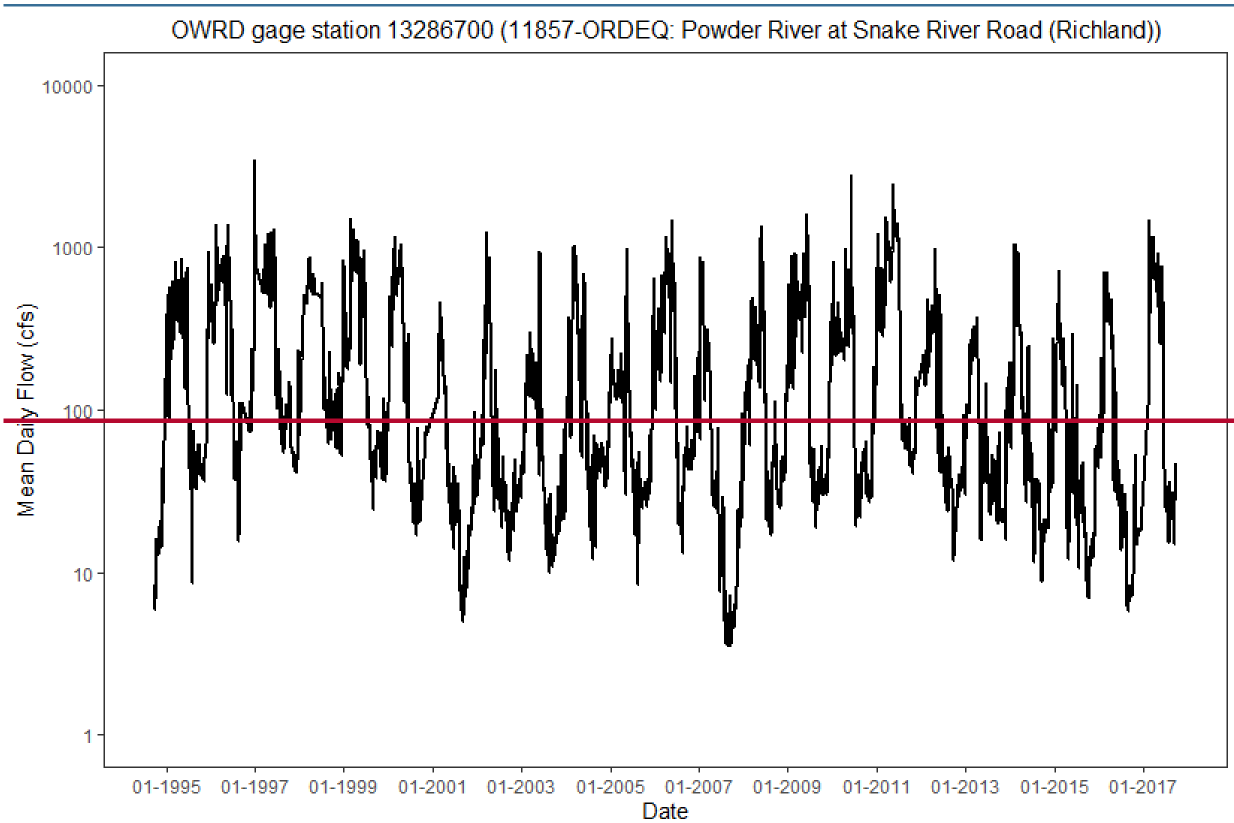
Figure 4: Flow duration intervals for Pine Creek, Oregon from 1990-2017



Figures ~~8~~2-4 represent flows in Pine Creek (Brownlee Subbasin) just upstream from the confluence with Hells Canyon Reservoir based on data from 1/1/1990 to 9/30/2017. Low flows in Pine Creek ranged from 10.0 to 34.6 cfs, medium-low flows ranged from 34.7 to 100.0 cfs, medium flows ranged from 101.0 to 250.0 cfs, medium-high flow ranged from 251.0 to 977.0 cfs, and high flows ranged from 978.0 to 7000.0 cfs from 1990-2017.

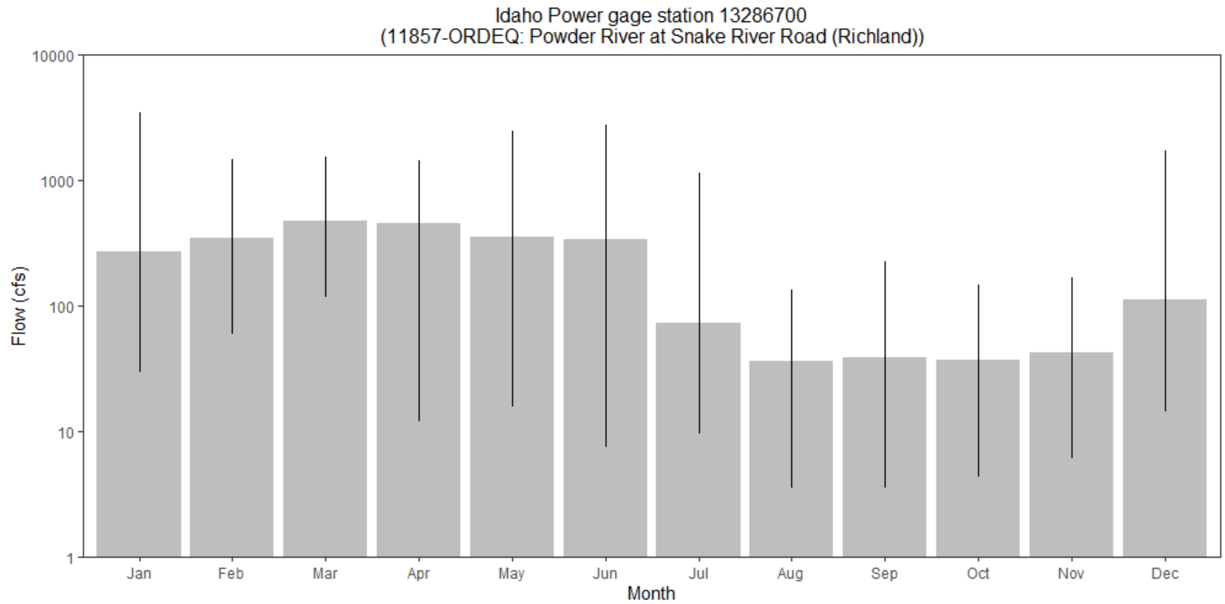
Figure 5: Flow over time for the Powder River, Oregon from 1994-2017

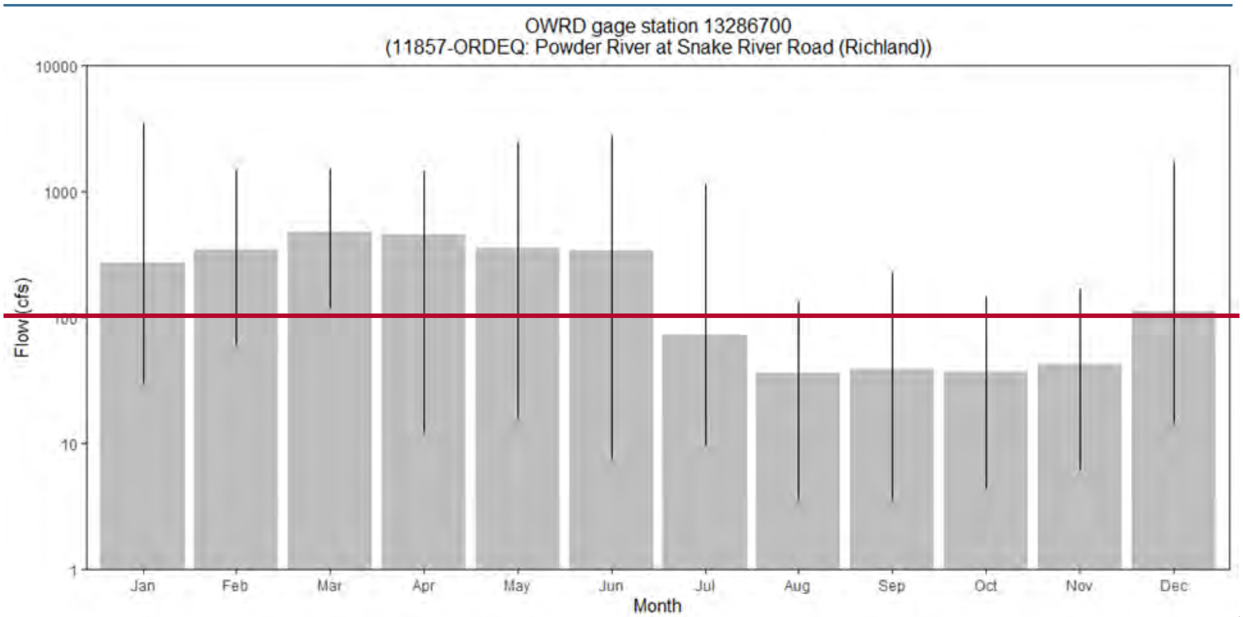




~~Figure 2.2a: Flow over time for the Powder River, Oregon, 1994-2017~~

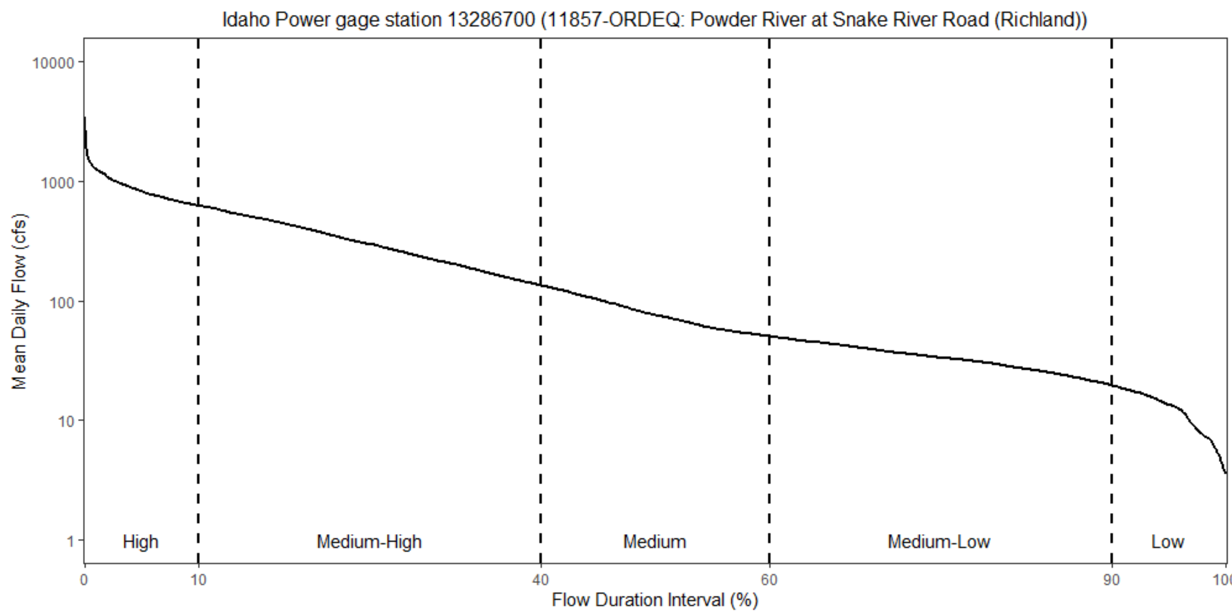
Figure 6: Monthly mean flow (± minimum or maximum) for the Powder River, Oregon from 1994-2017

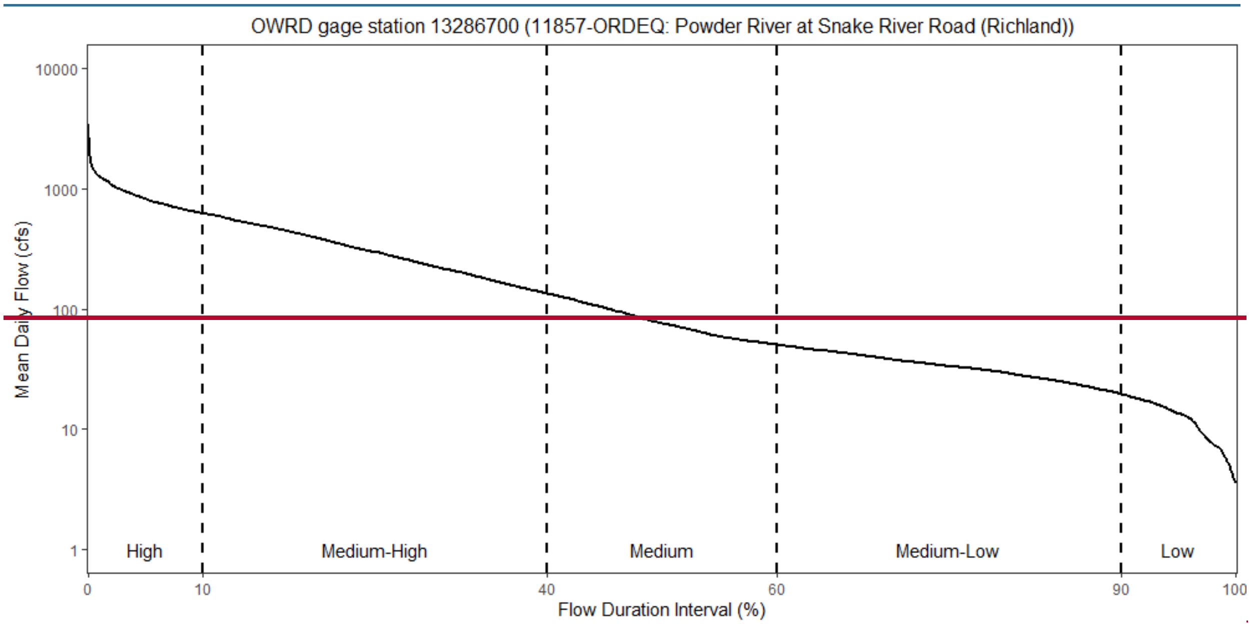


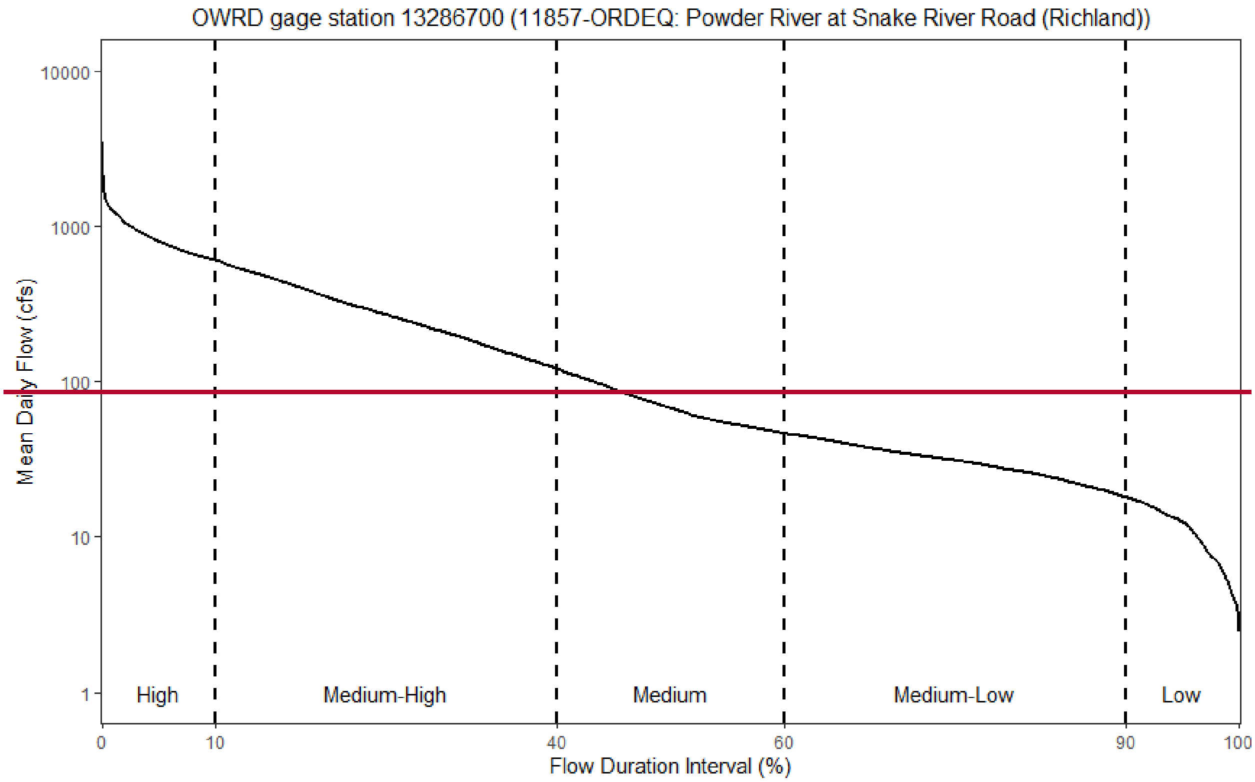


~~Figure 2.2b: Monthly mean flow (± minimum or maximum) for the Powder River, Oregon, 1994-2017~~

Figure 7: Flow duration intervals for the Powder River, Oregon from 1994-2017


Idaho Power gage station 13286700 (11857-ORDEQ: Powder River at Snake River Road (Richland))
Mean Daily Flow (cfs)
10000
1000
100
10
1
High
Medium-High
Medium
Medium-Low
Low
0
10
40
60
90
100
Flow Duration Interval (%)

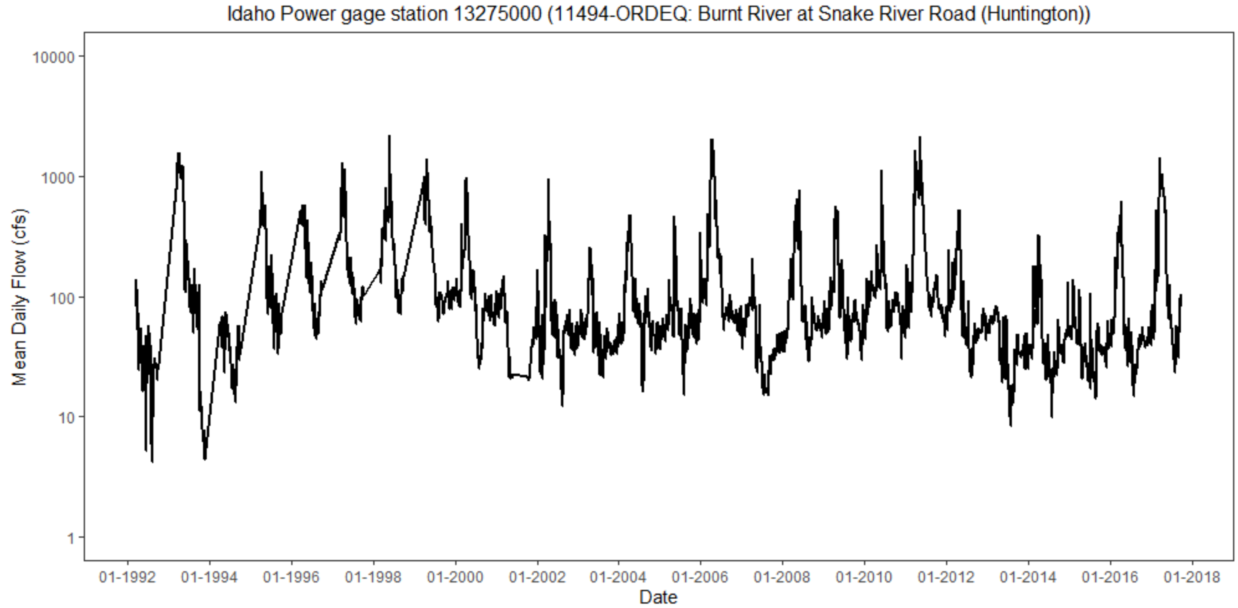

OWRD gage station 13286700 (11857-ORDEQ: Powder River at Snake River Road (Richland))
Mean Daily Flow (cfs)
10000
1000
100
10
1
High
Medium-High
Medium
Medium-Low
Low
0
10
40
60
90
100
Flow Duration Interval (%)

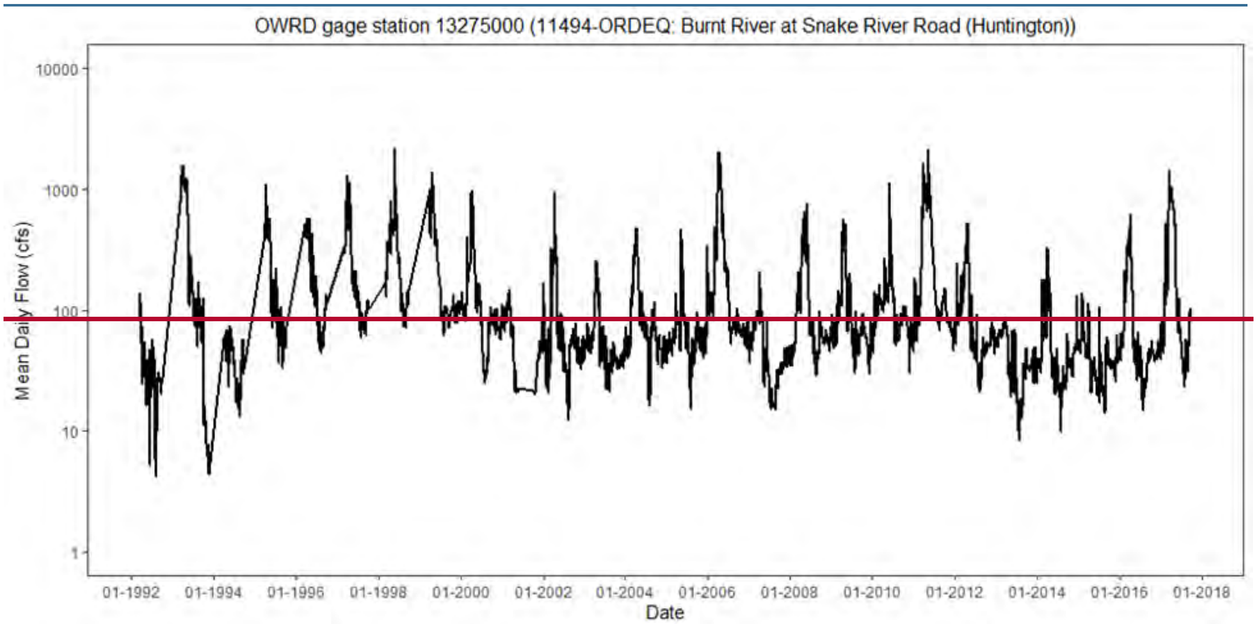


~~Figure 2.2a~~2~~c~~: ~~Flow duration intervals for the Powder River~~, Oregon, 1994~~0 -2017~~

Figures ~~2~~5~~.2a-c~~47 represent~~s~~ flows in the Powder Watershed just upstream from the confluence with Brownlee Reservoir based on data from 10/1/1994 to 9/30/2017. Based on DEQ flow categories, low flows in the Powder River just before entering Brownlee Reservoir on the Snake River ranged from 2.5 to 17.8 cfs, medium-low flows ranged from 17.9 to 46.1 cfs, medium flows ranged from 46.2 to 120.0 cfs, medium-high flow ranged from 121.0 to 563.0 cfs, and high flows ranged from 564.0 to 9255.0 cfs from 1994-2017.

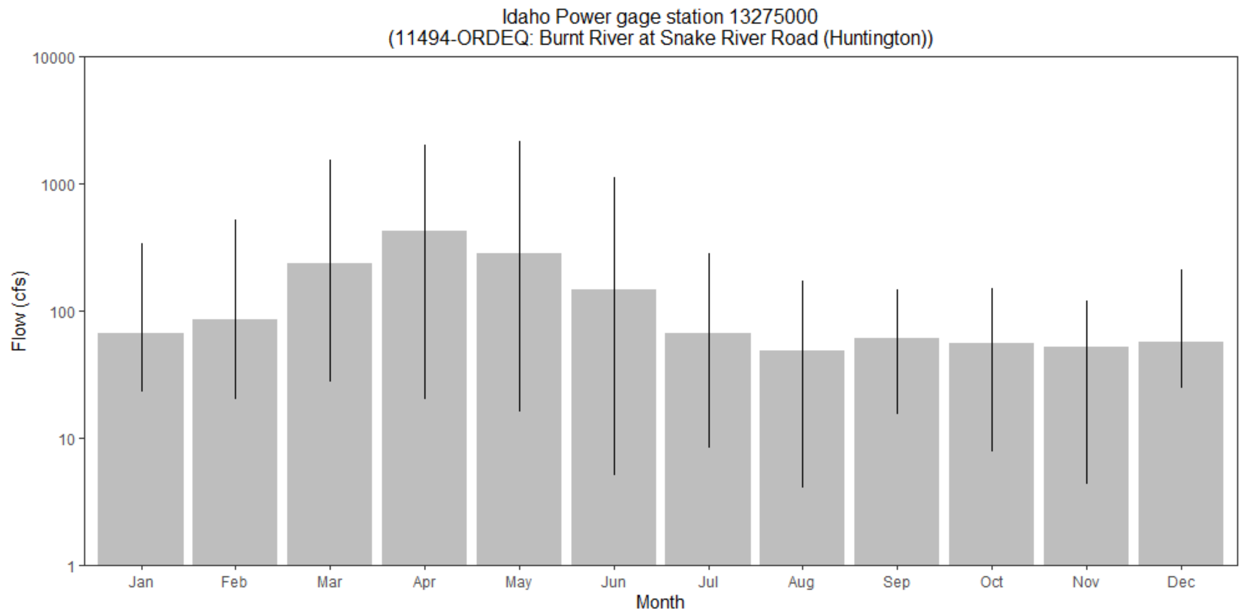
Figure 8: Flow over time for the Burnt River, Oregon from 1990-2017

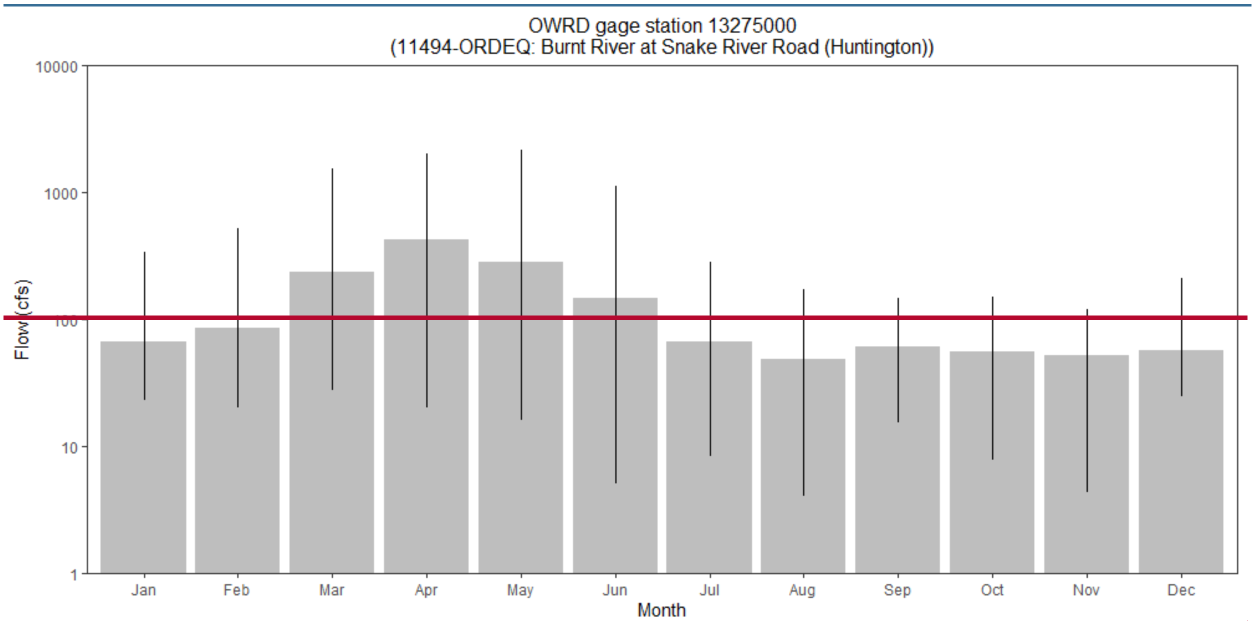




~~**Figure 2.2d: Flow over time for the Burnt River, Oregon, 1990-2017**~~

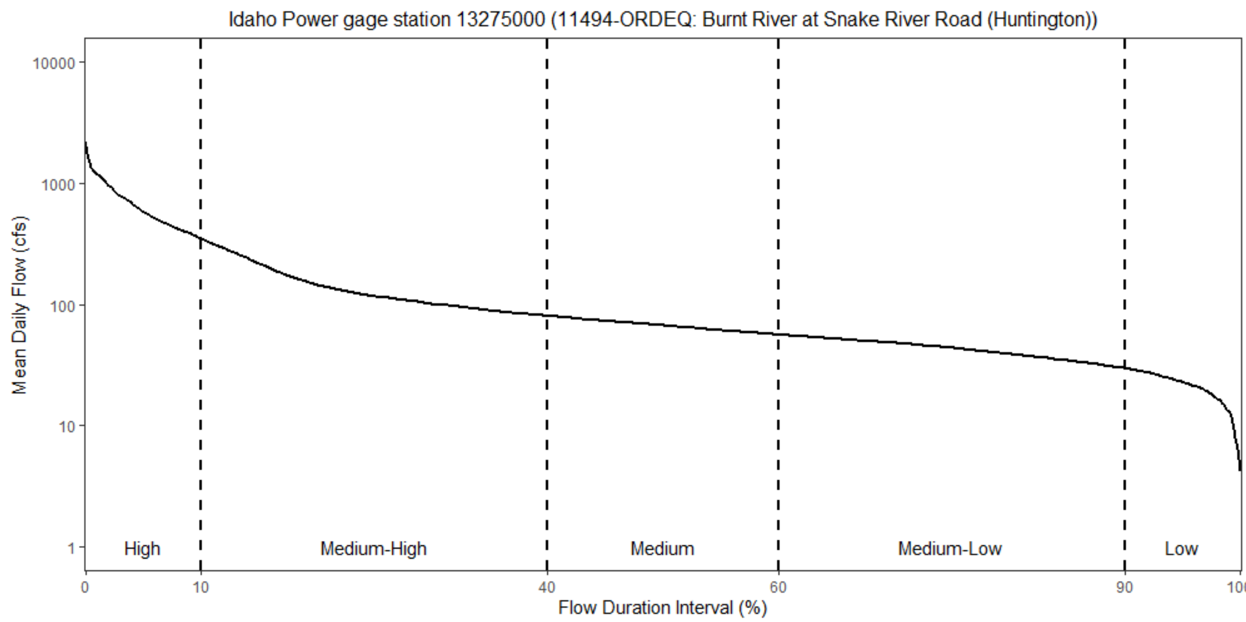
Figure 9: Monthly mean flow (± minimum or maximum) for the Burnt River, Oregon from 1990-2017

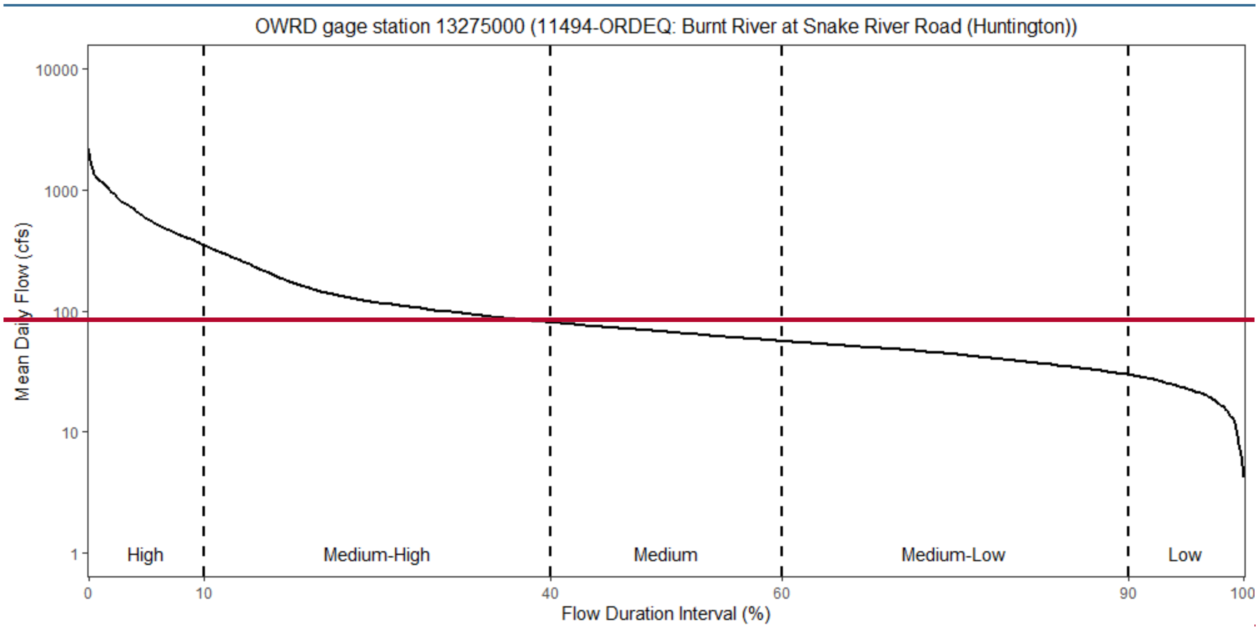




~~Figure 2.2e: Monthly mean flow (± minimum or maximum) for the Burnt River, Oregon, 1990-2017~~

Figure 10: Flow duration intervals for the Burnt River, Oregon from 1990-2017


Idaho Power gage station 13275000 (11494-ORDEQ: Burnt River at Snake River Road (Huntington))
Mean Daily Flow (cfs)
10000
1000
100
10
1
High
Medium-High
Medium
Medium-Low
Low
0
10
40
60
90
100
Flow Duration Interval (%)


OWRD gage station 13275000 (11494-ORDEQ: Burnt River at Snake River Road (Huntington))
Mean Daily Flow (cfs)
10000
1000
100
10
1
High
Medium-High
Medium
Medium-Low
Low
0
10
40
60
90
100
Flow Duration Interval (%)

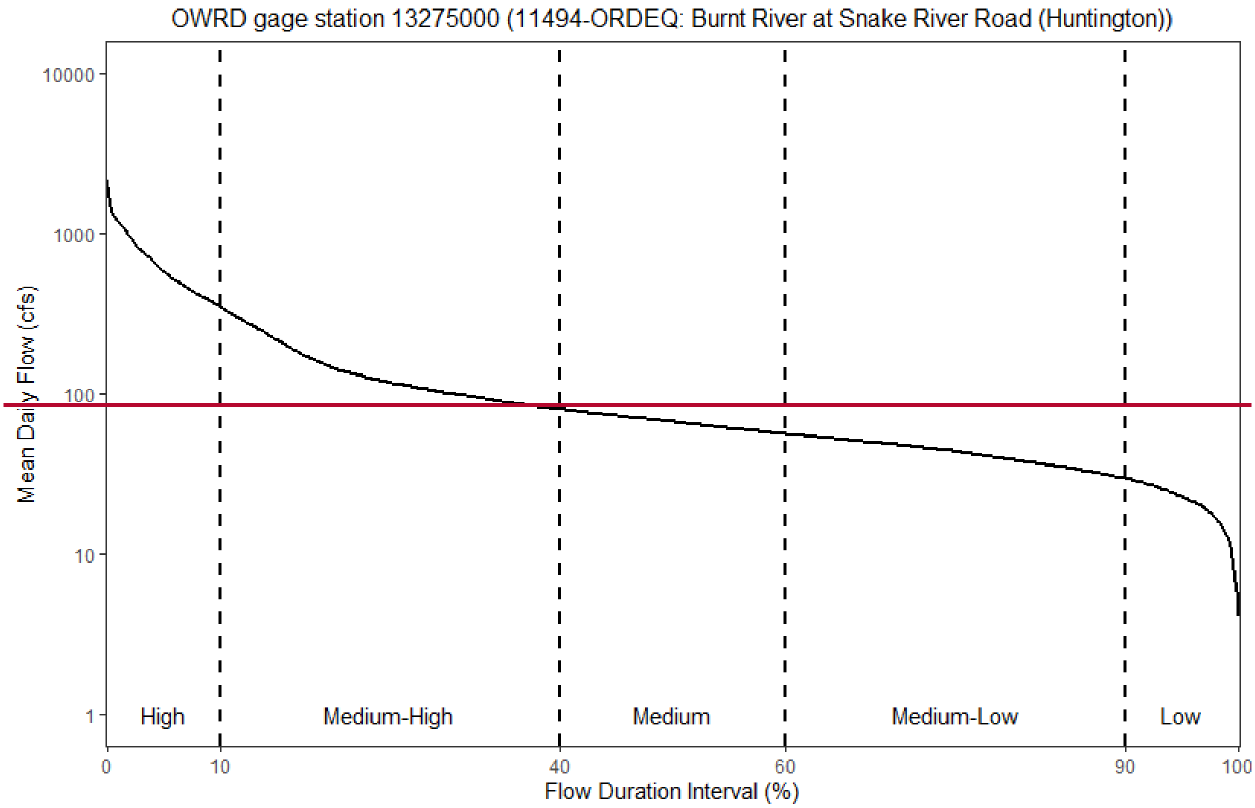


Figure 2.2b2f: Flow duration intervals for the Burnt River, Oregon, 1990-2017

Figures 58-710fb represents flows in the Burnt Watershed Subbasin just upstream from the confluence with Brownlee Reservoir based on data from 1/1/1990 to 9/30/202017. Low flows in the Burnt River just before entering Brownlee Reservoir on the Snake River ranged from 4.0 to 31.0 cfs, medium-low flows ranged from 31.1 to 58.0 cfs, medium flows ranged from 58.1 to 82.0 cfs, medium-high flow ranged from 82.1 to 304.0 cfs, and high flows ranged from 305.0 to 2180.0 cfs from 1990-2017. Low flows and medium-low flows in the Burnt River are modulated below the City of Huntington by effluent released by the wastewater treatment plant. Upstream of Huntington reflects a similar hydrologic regime to that of the Powder River and Pine Creek.

Figure 8: Flow over time for Pine Creek, Oregon from 1990-2017

Figure 9: Monthly mean flow (± minimum or maximum) for Pine Creek, Oregon from 1990-2017

Figure 10: Flow duration intervals for Pine Creek, Oregon from 1990-2017

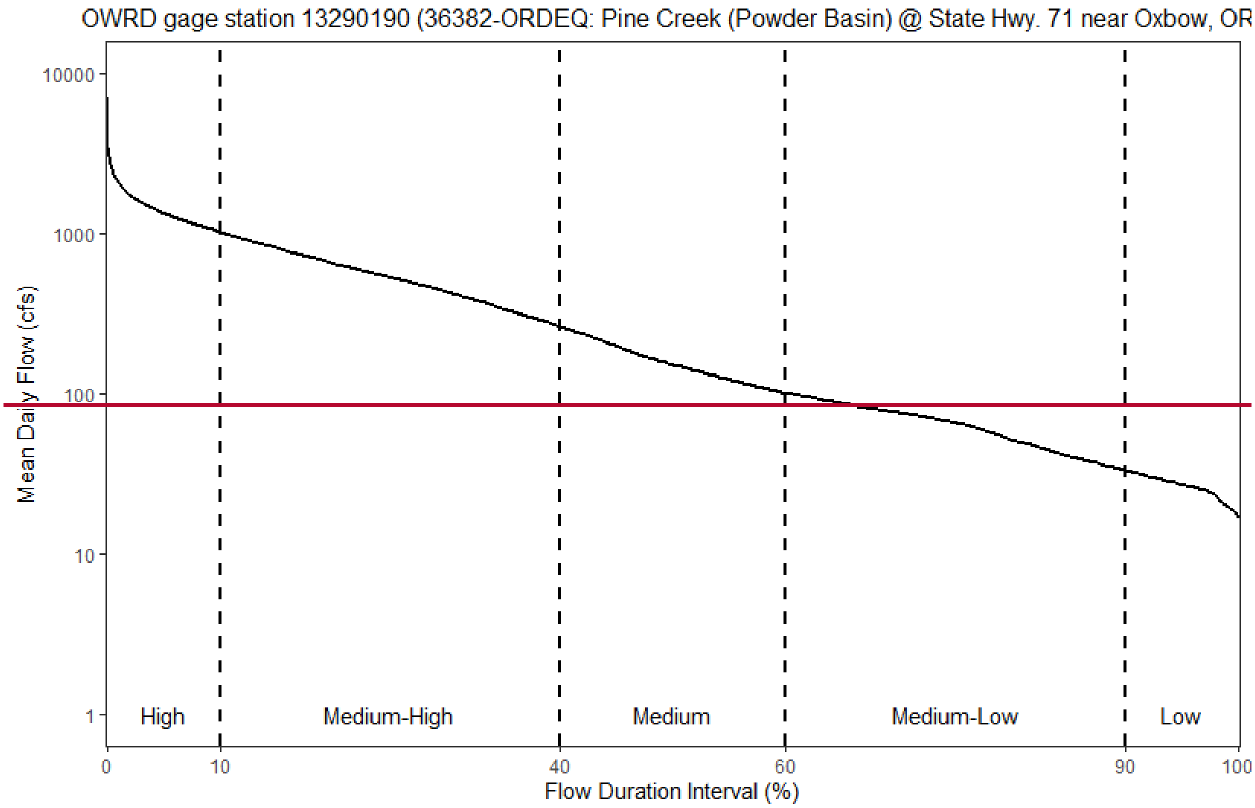


Figure 2.2c: Flow duration intervals for Pine Creek

Figure 82.2c10 represents flows in the Pine Creek (Brownlee Watershed Subbasin) just upstream from the confluence with Brownlee Oxbow Reservoir based on data from 1/1/1/1/1990 to 9/30/9//2017. Low flows in Pine Creek just before entering Brownlee Reservoir on the Snake River ranged from 10.0 to 34.6 cfs, medium-low flows ranged from 34.7 to 100.0 cfs, medium flows ranged from 101.0 to 250.0 cfs, medium-high flow ranged from 251.0 to 977.0 cfs, and high flows ranged from 978.0 to 7000.0 cfs from 1990-2017.

Reservoir operations and irrigation systems in the basin further influence the timing, amount/rate, and duration of flows in the Powder River Basin. According to the Oregon Water Resources Department (OWRD), 69 dams greater than 10 feet in height exist in the Powder River Basin. OWRD documents that most of the water stored in reservoirs enters irrigation conveyance systems. Three districts manage irrigation water in the Powder Subbasin: the Baker Valley Irrigation District, the Lower Powder Irrigation District, and the Powder Valley Water Control District (divided into the Wolf Creek and Pilcher Creek sub-districts). The Burnt River Irrigation District manages irrigation water in the Burnt River Subbasin. Formal irrigation or water control districts do not exist in the Brownlee Reservoir Subbasin; individuals or informal user groups manage irrigation water there. Available water is fully appropriated in the Powder River Basin. In During droughtlow water years, all some users may not receive adequate water supplies identified in water rights despite managers drawing reservoirs down to minimum levels.

The Powder River Basin contains five reservoirs with storage capacities greater than 5,000 acre-feet. These include one (Unity) in the Burnt Subbasin and four (Thief Valley, Phillips, Pilcher Creek, and Wolf Creek) in the Powder Subbasin. The U.S. Bureau of Reclamation constructed Unity, Thief Valley, and Phillips Reservoirs; all are now operated by local irrigation districts. Pilcher Creek and Wolf Creek Dams are owned and operated by the Powder Valley Water Control District.

~~According to Oregon Water Resources Department records, there are 69 dams with a height over 10 feet in the Powder Basin and most of the water impounded by these reservoirs is used for irrigation. There are three irrigation or water control districts in the Powder Subbasin: Baker Valley Irrigation District, Lower Powder Irrigation District, and Powder Valley Water Control District (divided into the Wolf Creek and Pilcher Creek sub-districts). Irrigation in the Burnt River Subbasin is managed by the Burnt River Irrigation District. There are no formal irrigation or water control districts in the Brownlee Reservoir Subbasin, irrigation is managed by individuals or informal user groups. Available water in the Powder Basin is fully appropriated. In low water years, reservoirs are often drawn down to minimum levels and there is not enough water to supply all users.~~

~~There are five reservoirs in the Powder Basin with a storage capacity greater than 5,000 acre-feet. Unity Dam on the Burnt River, and Thief Valley Dam and Mason Dam on the Powder River, were constructed by the U.S. Bureau of Reclamation and are operated by local irrigation districts. Pilcher Creek Dam and Wolf Creek Dam are owned and operated by the Powder Valley Water Control District. These projects are discussed in more detail in following subsections.~~

2.2.1 Burnt River Irrigation Project

Unity Reservoir is located on the Burnt River about 40 miles southwest of Baker City (Figure 1~~2.0~~). Lands served by the irrigation project are scattered along the Burnt River downstream from Unity Reservoir near the towns of Hereford, Bridgeport, Durkee, Weatherby, Dixie, Lime, and Huntington. In addition, some lands upstream from the reservoir are included in the project.

Unity Dam is a zoned earth fill dam 82 feet high and 694 feet long. The maximum reservoir capacity is 25,800 acre-feet with a surface area of 926 acres. Unity Dam was completed in 1937 and the reservoir has since been operated and maintained by the Burnt River Irrigation District.

2.2.2 Baker Irrigation Project

The Upper Division of the Baker Project furnishes irrigation water from Phillips Reservoir to 18,500 acres of land along both sides of the Powder River just north of Baker City. The Lower Division provides a supplemental water supply from Thief Valley Reservoir to about 7,300 acres of land along the Powder River in the Keating Valley about 10 miles northeast of Baker City.

Mason Dam on the Powder River near Sumpter, OR, is a zone earth and rockfill embankment dam measuring 173 feet high and 895 feet long. Mason dam creates Phillips Reservoir, which has a maximum capacity of 95,500 acre-feet and a surface area of 2,235 acres. Stored water is released into the Powder River for diversion downstream into existing distribution canals and laterals. Operation and maintenance of Upper Division facilities was transferred to the Baker Valley Irrigation District on August 23, 1968.

Thief Valley Dam is a concrete slab and buttress dam 390 feet long and 73 feet high with a maximum reservoir capacity of 17,600 acre-feet and a surface area of 740 acres. Water stored in Thief Valley Reservoir is released for diversion downstream into existing distribution canals and laterals. The operation of Thief Valley Dam and facilities of the Lower Division were taken over by the Lower Powder River Irrigation District on June 1, 1932.

2.2.3 Powder Valley Water Control District

The Powder Valley Water Control District owns and operates Wolf Creek and Pilcher Creek Reservoirs. These systems provide irrigation water to land located in the North Powder and Baker valleys in the vicinity of the City of North Powder (Figure 2.01 for general location). Completed in 1974, the reservoir behind Wolf Creek dam is approximately 220 acres in area and stores approximately 12,000 acre-feet. Pilcher Creek Reservoir was completed in 1984 and is approximately 222 acres in area and stores approximately 5,900 acre-feet. Operated as one pool, Wolf Creek Reservoir usually draws down quicker than Pilcher Creek Reservoir, so to balance out the system, water is transferred via a canal between the two sites. Additional water from Pilcher Creek Reservoir is also put instream via the North Powder River for irrigation both to the north and south of the river. Due to the connectivity of the system, the project is often referred to as the Wolf Creek Reservoir Complex.

2.2.1 Burnt River Irrigation Project

As shown on Figure 2.0, Unity Dam and Reservoir are located on the upper Burnt River about 40 miles southwest of Baker City. Lands served by the irrigation project are scattered along the Burnt River downstream from Unity Reservoir near the towns of Hereford, Bridgeport, Durkee, Weatherby, Dixie, Lime, and Huntington. In addition, some lands upstream from the reservoir are included in the project. Based on 1992 data, 15,070 acres received project water for growing forage crops (approximately 13,670 acres) and cereal crops such as corn and barley.

The Bureau of Reclamation reports that Unity Dam is a zoned earthfill dam 82 feet high and 694 feet long and the maximum reservoir capacity is 25,800 acre-feet with a surface area of 926 acres. Unity Dam was completed in 1937 to take advantage of the existing distribution system and the dam and reservoir have since been operated and maintained by the Burnt River Irrigation District and offer no flood control benefits.

Along with irrigation, Unity Reservoir provides area residents with recreation benefits such as camping, fishing and boating administered by the Oregon State Parks Department.

2.2.2 Baker Irrigation Project

The Upper Division of the Baker Project provides irrigation water from Phillips Reservoir to 18,500 acres of land along both sides of the Powder River just north of Baker City. The Lower Division provides a supplemental water supply from Thief Valley Reservoir to about 7,300 acres of land along the Powder River in the Keating Valley about 10 miles northeast of Baker City. The Bureau of Reclamation reports that Thief Valley Dam is a concrete slab and buttress dam 390 feet long and 73 feet high with a maximum reservoir capacity of 17,600 acre-feet and a surface area of 740 acres. Water stored in Thief Valley Reservoir is released for diversion downstream into existing distribution canals and laterals. The operation of Thief Valley Dam and facilities of the Lower Division were taken over by the Lower Powder River Irrigation District on June 1, 1932.

Mason Dam is a zone earth and rockfill embankment dam, 173 feet high and 895 feet long and impounds the Powder River near Sumpter, OR. Phillips Reservoir has a maximum capacity of 95,500 af and a surface area of 2,235 acres and stored water is released into the Powder River for diversion downstream into existing distribution canals and laterals. Operation and maintenance of Upper Division facilities was transferred to the Baker Valley Irrigation District on August 23, 1968.

2.2.3 Powder Valley Water Control District

~~The Powder Valley Water Control District owns and operates Wolf Creek and Pilcher Creek Reservoirs, which provide irrigation water to land located in the North Powder and northern Baker valleys in the vicinity of the City of North Powder. Completed in 1974, the reservoir behind Wolf Creek dam is approximately 220 acres in surface area and stores approximately 12,000 acre-feet. Pilcher Creek Reservoir was completed in 1984 and is approximately 222 acres in surface area and stores approximately 5,900 acre-feet. Operated as one pool, Wolf Creek Reservoir usually draws down quicker than Pilcher Creek Reservoir, so to balance out the system, water is transferred via a canal between the Wolf Creek and Pilcher Creek reservoirs. Additional water from Pilcher Creek Reservoir is also put instream via the North Powder River for irrigation both to the north and south of the river. Due to the connectivity of the system, the project is often referred to as the Wolf Creek Reservoir Complex.~~

2.3 Land use/land cover ~~Land Use~~

The largest percentage of land use/land cover in Powder River Basin consists of scrub-shrub, followed by forest and grasslands (Table 2~~.3~~). Developed urban areas are minimal, with the largest being Baker City (population approximately 9,700). Land ownership is divided almost equally between private and federal. Areas of irrigated agriculture are found along the Burnt River; the North Powder River; the Powder River north of Baker City, in the Keating Valley, and near Richland, and along Pine Creek near Halfway (Figure ~~2.3~~11). Grassland/shrub areas occur in the valley plains and foothill areas while forested areas are concentrated in the mountains. ~~As shown in Figure 2.3a and summarized in Table 2.3, the largest percentage of land use/land cover in the basin as of 2019 (Dewitz & USGS, 2021) is scrub-shrub, followed by forest and grasslands; developed urban areas are minimal, with the largest being Baker City (population approximately 9,700), located near the center of the basin; and private and federal ownership are about equal and dominant. Areas of irrigated agriculture are found in the along the Burnt River, the Baker Valley north of Baker City, the Keating Valley, near Richland and in the Pine Valley near Halfway. Grassland/shrub areas are located in the plains and foothill areas, and forested areas are concentrated in the mountains.~~

Table 2: 2019 Land cover classes and percentages in the Powder River Basin (Dewitz, J., and U.S. Geological Survey, 2021)~~Table 2.3: 2019 Land cover classes and percentages in the Powder River Basin (Dewitz, J., and U.S. Geological Survey, 2021)~~
~~National Land Cover Database classes and percentages in the Powder River Basin in 2019~~

NLCD Land Cover Class	Acres	Percent of the basin
Shrub/Scrub	1016650	46.1
Evergreen Forest	593939	26.9
Herbaceous	366166	16.6
Hay/Pasture	78513	3.6
Cultivated Crops	65532	3.0
Developed, Open Space	24548	1.1
Emergent Herbaceous Wetlands	20737	0.9
Open Water	13869	0.6
Barren Land	7770	0.4
Developed, Low Intensity	6675	0.3
Woody Wetlands	5871	0.3
Developed, Medium Intensity	3527	0.2
Developed, High Intensity	215	<0.1

Deciduous Forest	103	<0.1
Mixed Forest	45	<0.1
Total:	**2204160**	**100.0**

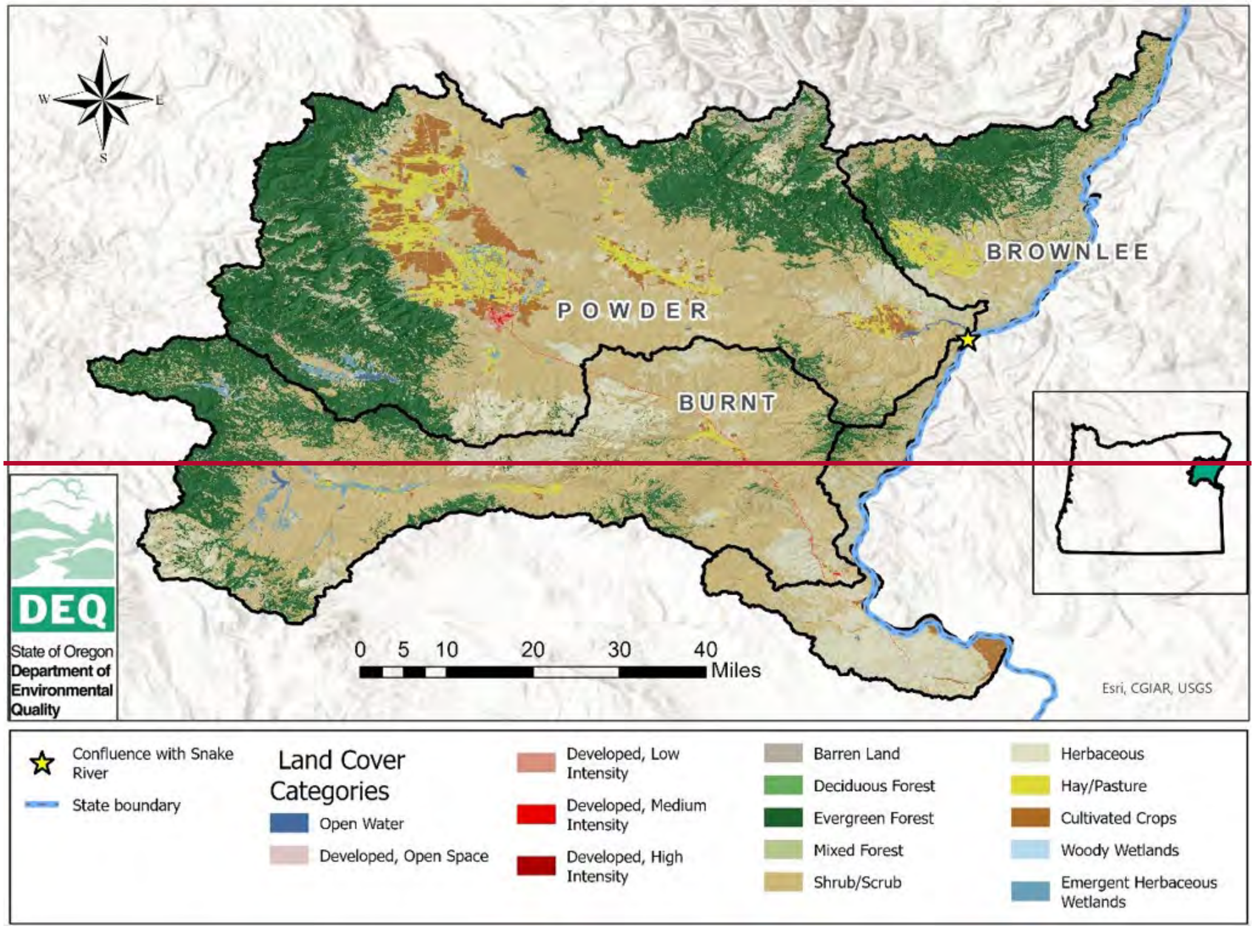


Figure 11: 2019 National Land Cover Database Land Cover Classes in the Powder River Basin

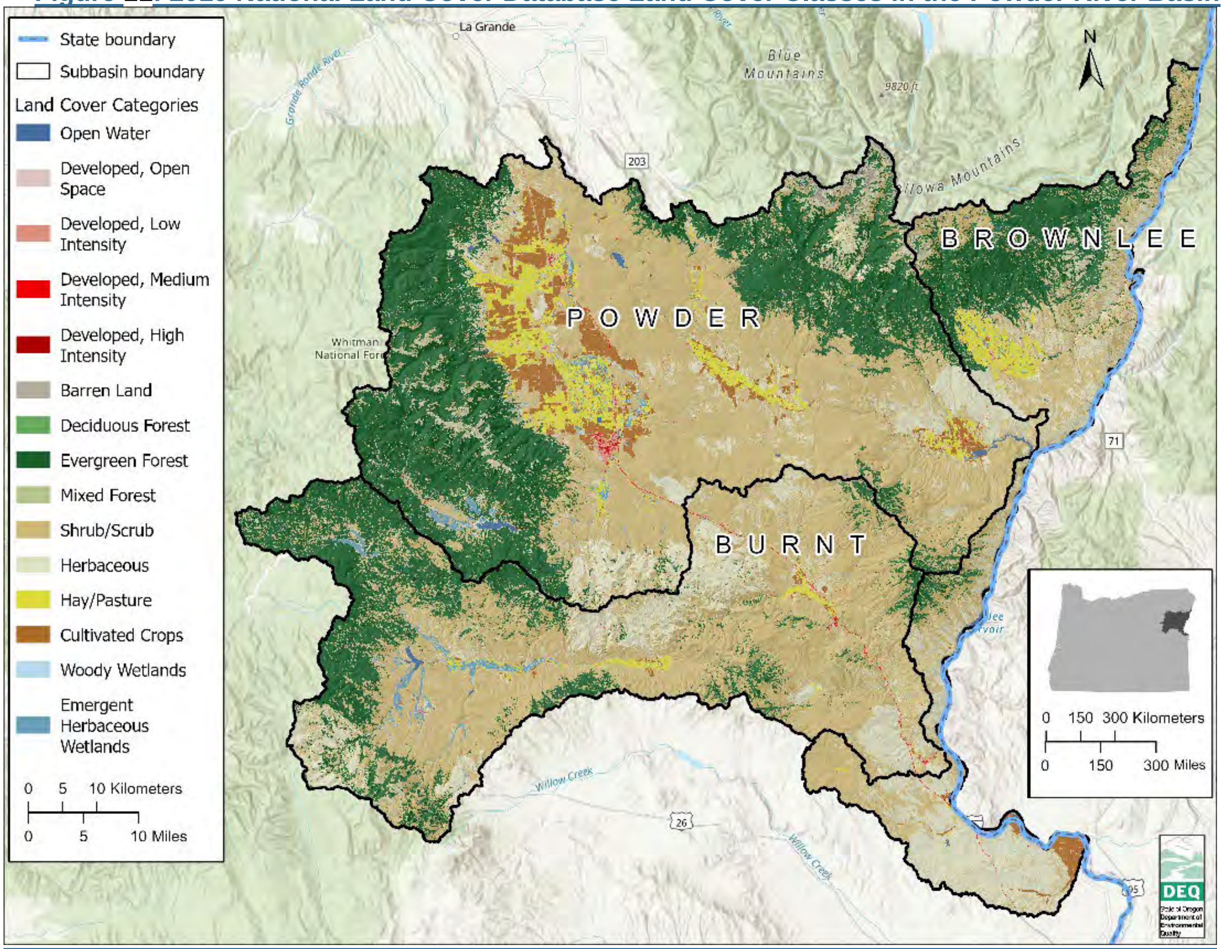


Figure 2.3a: 2019 National Land Cover Database Land Cover Classes in the Powder River Basin.

2.4 Geology and Soilssoils

The soils and geology of the Powder River Basin represent a complex history of basalt flows, uplift of continental material, sedimentary formations, glaciation, and deposition of alluvium (Walker & MacLeod, 1991). As shown in Figure 2.4a12, mountain ranges and upland areas consist of various igneous and metamorphic formations and lowland valleys largely consist of sedimentary and unconsolidated rocks. Agriculture, urban and rural residential development largely occurs in the low-relief areas underlain by sedimentary and unconsolidated formations (Figures 2.3a11 -and 2.4a12).

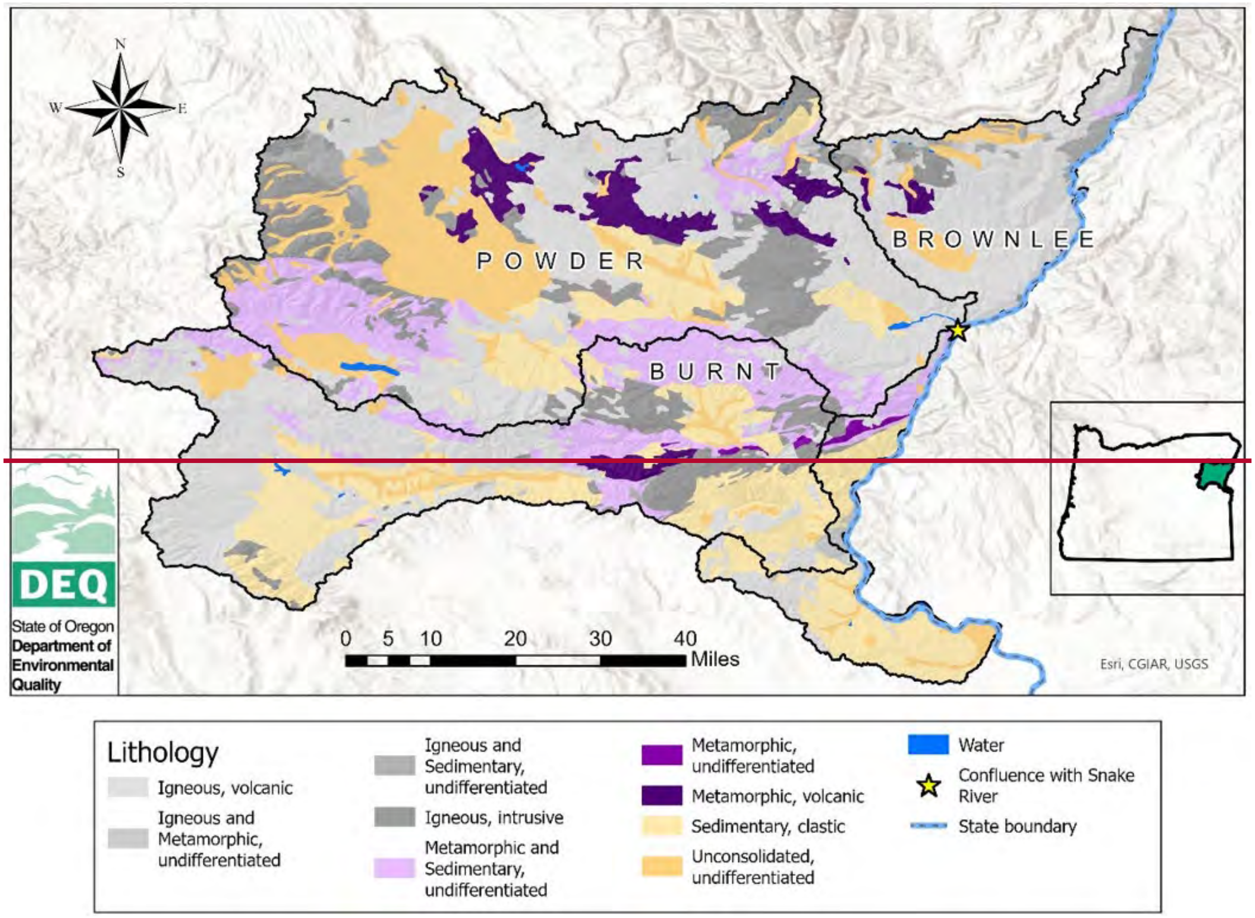
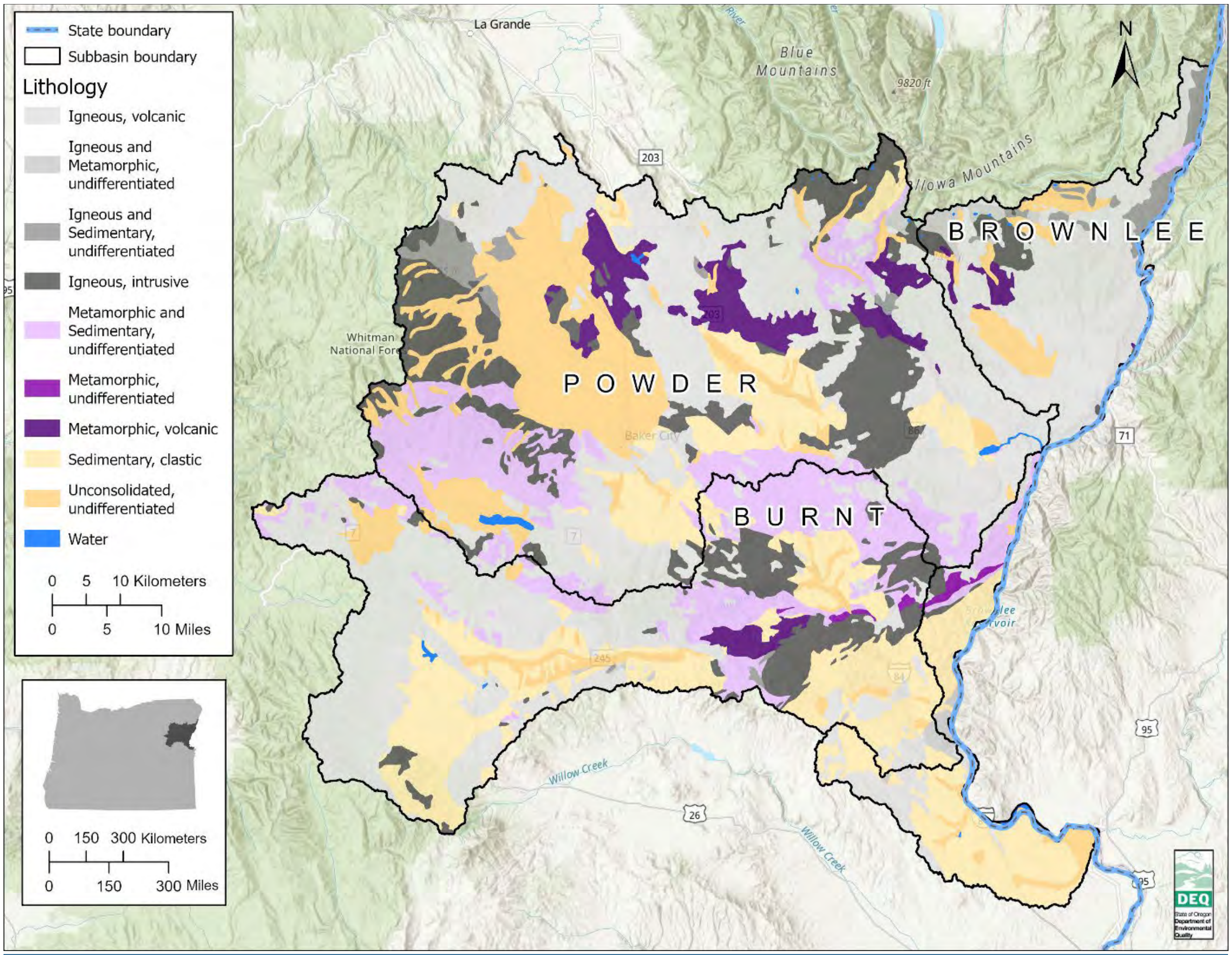


Figure 12: Lithology of the Powder River Basin



~~**Figure 2.4a: Lithology of the Powder River Basin**~~

Surface and shallow subsurface runoff can transport fecal ~~bacteria~~ material into surface waters in these subbasins. Flow over the soil surface occurs when the precipitation rate is higher than the infiltration rate of the underlying soil; subsurface flow occurs when the reverse occurs. Moisture, temperature, and organic matter content all can influence ~~bacteria~~~~*E. coli*~~fecal material transport in overland and subsurface flow.

The Powder River Basin contains 767 soil series, according to the 2017 SSURGO/STATSGO2 database from the USDA NRCS (NRCS, 2022). Translating these soils into USDA NRCS Hydrologic Groups shows the portions of the basin susceptible to overland runoff versus portions where water infiltration dominates (Figure ~~2.4b~~13). Much of the basin is characterized by soils with moderately high to high runoff potential. ~~-~~Soils with the highest runoff potentials tend to be found in the lower portions of the Powder ~~watershed~~ River Basin and in the divide between the Powder and Burnt ~~watersheds~~ s~~S~~ubbasins (Figure ~~2.4b~~13).~~-~~ Soils with the lowest runoff potentials (and hence highest infiltration rates) tend to be found north of Baker City in the Baker Valley (Figure ~~2.4b~~13).

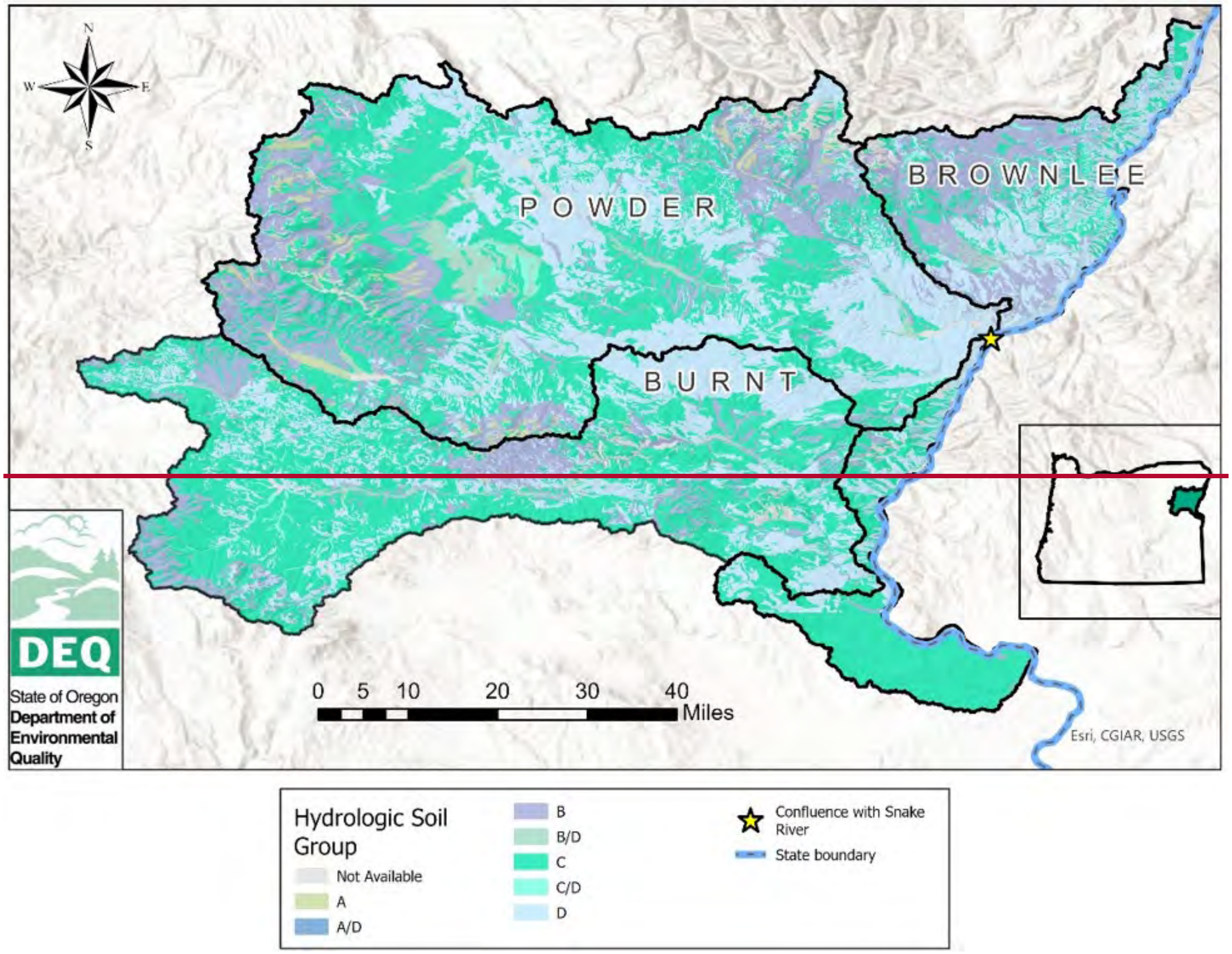

POWDER
BROWNLEE
BURNT
DEQ
State of Oregon
Department of
Environmental
Quality
0 5 10 20 30 40
Miles
Esri, CGIAR, USGS
Hydrologic Soil Group
Not Available
A
A/D
B
B/D
C
C/D
D
Confluence with Snake River
State boundary

Figure 13: Hydrologic Soils Groups in the Powder River Basin

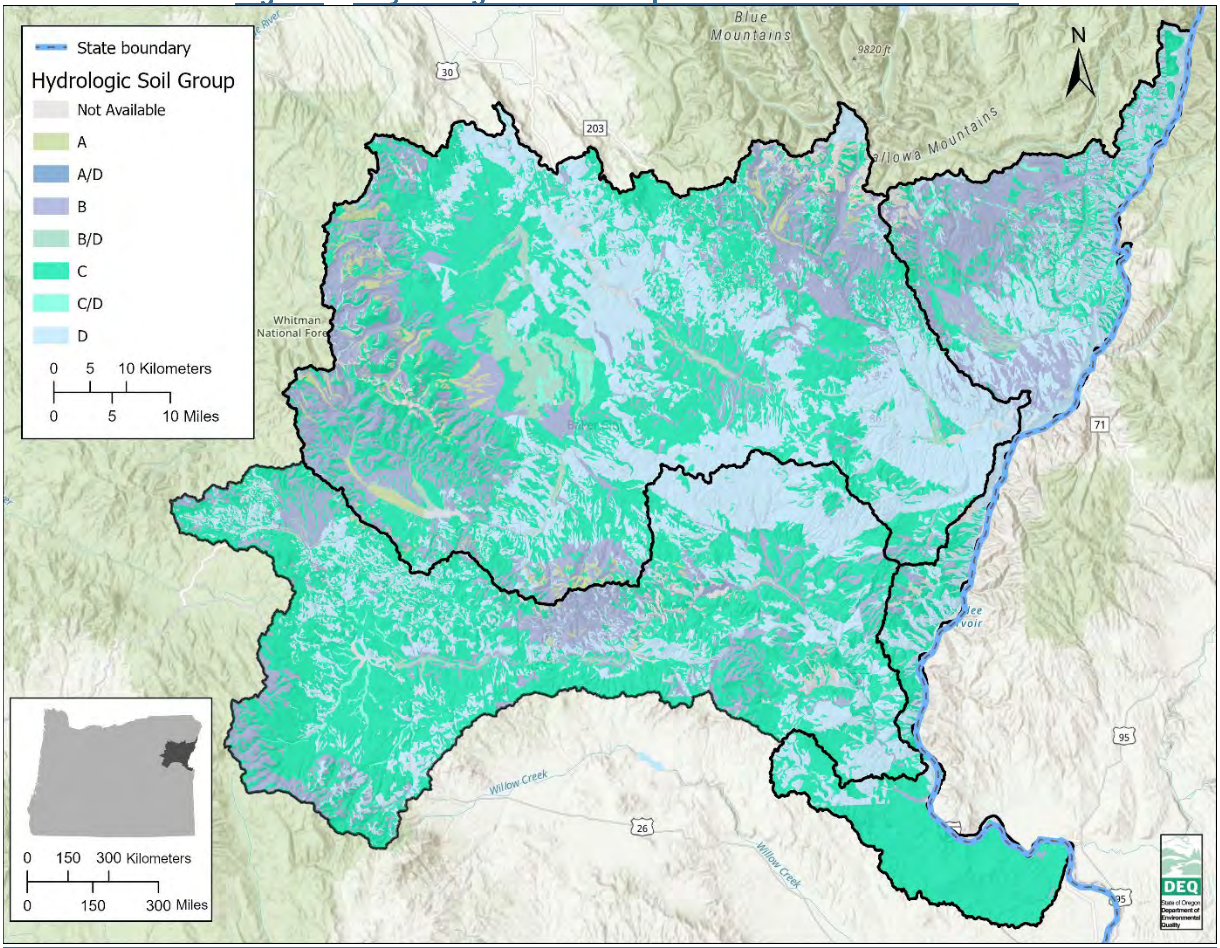


Figure 2.4b: Hydrologic Soils Groups in the Powder River Basin

3. ~~Bacteria~~~~*E. coli*~~*E. coli* water quality standards and beneficial uses

Fecal indicator bacteria are used as a surrogate for potential fecal pathogen contamination in waterbodies. In Oregon freshwaters, the primary fecal indicator bacteria is *Escherichia coli* (~~abbreviated as *E. coli*~~*E. coli*). Fecal contamination of waterbodies originates from both point and nonpoint sources containing feces from humans and other warm-blooded animals, including ~~, domesticated ones and animals and w~~wildlife, pets, and livestock. Examples of point sources include~~:~~ wastewater treatment plants (WWTPs), stormwater conveyance systems, and combined sewer overflows. Nonpoint sources of fecal contamination include~~:~~ direct deposition of ~~livestock or wildlife~~animal fecal matter into ~~streams or reservoirs;~~waterbodies, ~~and~~ transport of ~~animal feces~~fecal material in runoff from the watershed, ~~e~~ ~~surface runoff that contacts pastures used by livestock and/or wildlife oror~~and leaching from failing on-site septic systems.

Recreational use of ~~fecal contaminated~~ waters contaminated by fecal material ~~could~~ can lead to mild to severe illnesses in humans. Recreational uses include~~s~~ swimming and ~~, but also any~~other activit~~y~~ies that could result in ingestion of water through incidental contact, such as fishing ~~through contact of hands with water~~, ~~any~~ water sports, or ~~children playing along the banks or shores~~recreating on banks and beaches. Water with high levels of fecal bacteria can also pose a disease risk to livestock and wildlife, such as Johne's disease (caused by the ingestion of *Mycobacterium avium spp*.). Fecal contamination of irrigation water ~~can~~ also raises the contamination risk of *Listeria monocytogenese* in fresh produce crops (Weller, Wiedmann, & Strawn, 2015).

Tables 3~~.0a~~ and ~~3.0b~~4 identify designated beneficial uses of surface waters in the Powder River Basin specified in OAR 340-041-0260. Table 260A, applicable numeric and narrative water quality standards addressed by the TMDL, and the most sensitive beneficial use related to each standard. Elevated *E. coli* concentrations in surface waters indicate impairments of water contact recreation (the most sensitive beneficial use) in the basin. The TMDL sets acceptable levels of *E. coli* in surface waters that allow water contact recreation use to be supported. Therefore, the TMDL protects all beneficial uses in the basin related to fecal contamination.

Table 3: Powder River Basin designated beneficial uses (from OAR 340-041-0260 Table 260A)

All streams and tributaries thereto
Public Domestic Water Supply
Private Domestic Water Supply
Industrial Water Supply
Irrigation
Livestock Watering
Fish and Aquatic Life
Wildlife and Hunting
Fishing
Boating
Water Contact Recreation

All streams and tributaries thereto
Aesthetic Quality

Table 4: Applicable water quality standards and most sensitive beneficial uses

Parameter	**Citation**	**Summary of applicable standards**	**Applicable water**	**Most sensitive beneficial use**
Bacteria	OAR 340-041-0009(1)(a)	(A) 90-day geometric mean (of 5 or more samples) of 126 *E. coli* organisms per 100 mL (B) No single sample may exceed 406 *E. coli* organisms per 100 mL	Fresh water	Water contact recreation
Statewide Narrative Criteria	OAR 340-041-0007(1)	The highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest possible levels.	All waters of the state	Fish and aquatic life

DEQ has also designated ~~I~~irrigation and livestock watering as beneficial uses in the Powder River Basin. However,~~ sources are designated beneficial uses, but are not the main ones addressed in this TMDL. I n~~ meeting water quality standards for the ~~The~~ most sensitive beneficial use in the basin-~~,~~ water contact recreation-will ensure achievement of these uses as well.~~, achievement of th addressed directly in this TMDL is water contact recreation with respect to potential pathogenic exposure from fecal material.~~

DEQ uses the Integrated Report to document condition and quality of Oregon's surface waters by assigning a status category. Oregon uses four of EPA's recommended reporting categories to classify water quality status for a particular pollutant or parameter. Table ~~3.0c~~5 and Figure ~~3.0~~14 presents stream and watershed assessment units ~~within~~ in the Powder River Basin ~~that were~~ listed as impaired and needing a TMDL for ~~bacteria~~~~*E. coli*~~*E. coli* on DEQ's 2022 Clean Water Act Section 303(d) List (as part of DEQ's Integrated Report; DEQ, 2022), ~~which was~~ approved by the EPA on September 1, 2022. Status category designations are prescribed by Sections 305(b) and 303(d) of the Clean Water Act and ~~are summarized as follows~~include:

- Category 1 – all designated uses are supported, no use is threatened (USEPA, 2023). DEQ does not use the Category 1 designation~~s~~.
- Category 2 – available data indicate that some designated uses are supported.
- Category 3 – there is insufficient data to make a designated use support determination.
- Category 4 – available data indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed. Category 4 includes the following subcategories:
    - ~~(~~4~~a~~A – an EPA approved TMDL is in place.~~,~~
    - 4~~b~~B – other required control measures are expected to result in attainment.~~,~~
    - 4~~c~~C – non-attainment is not caused by a pollutant~~)~~.~~;~~

- Category 5 – available data indicate that at least one designated use is not being supported or is threatened and a TMDL is needed~~;~~. ~~Category 4 – available data indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed (4a – a TMDL is in place, 4b – other required control measures are expected to result in attainment, 4c – non-attainment is not caused by a pollutant); Category 3 – there is insufficient data to make a designated use support determination; Category 2 – available data indicate that some, but not all designated uses are supported; Category 1 – all designated uses are support, no use is threatened (USEPA, 2023). DEQ does not use Category 1 designations.~~
-

~~For In regards to~~Regarding the freshwater AU identified as impaired for fecal coliform (OR_SR_1705020302_05_102815) in Table ~~3.0c~~5~~1~~, DEQ reviewed the applicability of the Section 303(d) status for fecal coliform. Based on the 2018/2020 Integrated Report assessment methodology and the 2016 revisions to Oregon's Bacteria Standards – OAR 340-041-0009, DEQ concluded that identifying this AU as impaired for fecal coliform is a legacy of the prior bacteria standard combined with EPA's additions to Oregon's Section 303(d) list in 2010. DEQ's Standards and Assessment Program confirmed that (~~a~~1) fecal coliform is not currently the applicable criterion for the designated freshwater water contact recreation beneficial use (*A. Borok, personal communication*) and (~~b~~2) ~~since~~ because sufficient ~~*E. coli*~~*E. coli* data is available for assessment ~~in these freshwater Aus~~which show attainment of the applicable criterion, ~~that the data~~information supersedes the data for the legacy fecal coliform Section 303d listings. ~~The~~ the legacy fecal coliform listing for this AU will be ~~for fecal coliform and these will be removed~~ recommended for removal from the 303(d) list in the 2024 Integrated Report ~~cycle~~ (*L. Merrick, personal communication*). ~~Since~~ Because ~~*E. coli*~~*E. coli* data ~~was~~ were used in the 2018-2020 and 2022 assessments and Integrated Reports to determine ~~water quality~~category status for ~~bacteria~~*E. coli* ~~thi~~the~~s~~ AU, the Section 303(d) listings for fecal coliform (Table ~~3.0c~~5~~1~~) is not addressed in the Powder River Basin ~~bacteria~~ Bacteria TMDL.

For ~~the watershed AU~~assessment unit~~unit~~ OR_WS_170502010101_05_103097 (Moores Hollow), identified as Category 4A for ~~*E. coli*~~*E. coli* in Table ~~3.10c~~5, DEQ determined that ~~this~~ the ~~Moores Hollow AU~~ assessment unit was ~~improperly~~ incorrectly associated with the Malheur Basin B~~b~~acteria TMDL for the 2022 Integrated Report ~~listing~~. Because ~~this unit~~the assessment unit ~~AU~~ is ~~was~~ not addressed by the Malheur TMDL, it should ~~have been~~be listed as Categor~~g~~y 5. As such, DEQ included this unit in the Powder River Basin ~~bacteria~~ Bacteria TMDL. Although ~~data limitations~~lack of observed flow data ~~prevented~~ did allow the development of ~~flow~~ load duration curves for ~~this unit~~ assessment unit~~AU~~, ~~it is reasonable~~DEQ concluded that allocations made for the Powder Basin Bacteria TMDL apply there. ~~to apply the results of nearby analyses, such that the allocations will also apply to the Moores Hollow unit.~~ Thus, DEQ will correct the TMDL associated with this assessment unit in the 2024 Integrated Report.
~~Thus, DEQ will correct the TMDL associated with this unit in the 2024 Integrated Report, and it will remain as Category 4A.~~

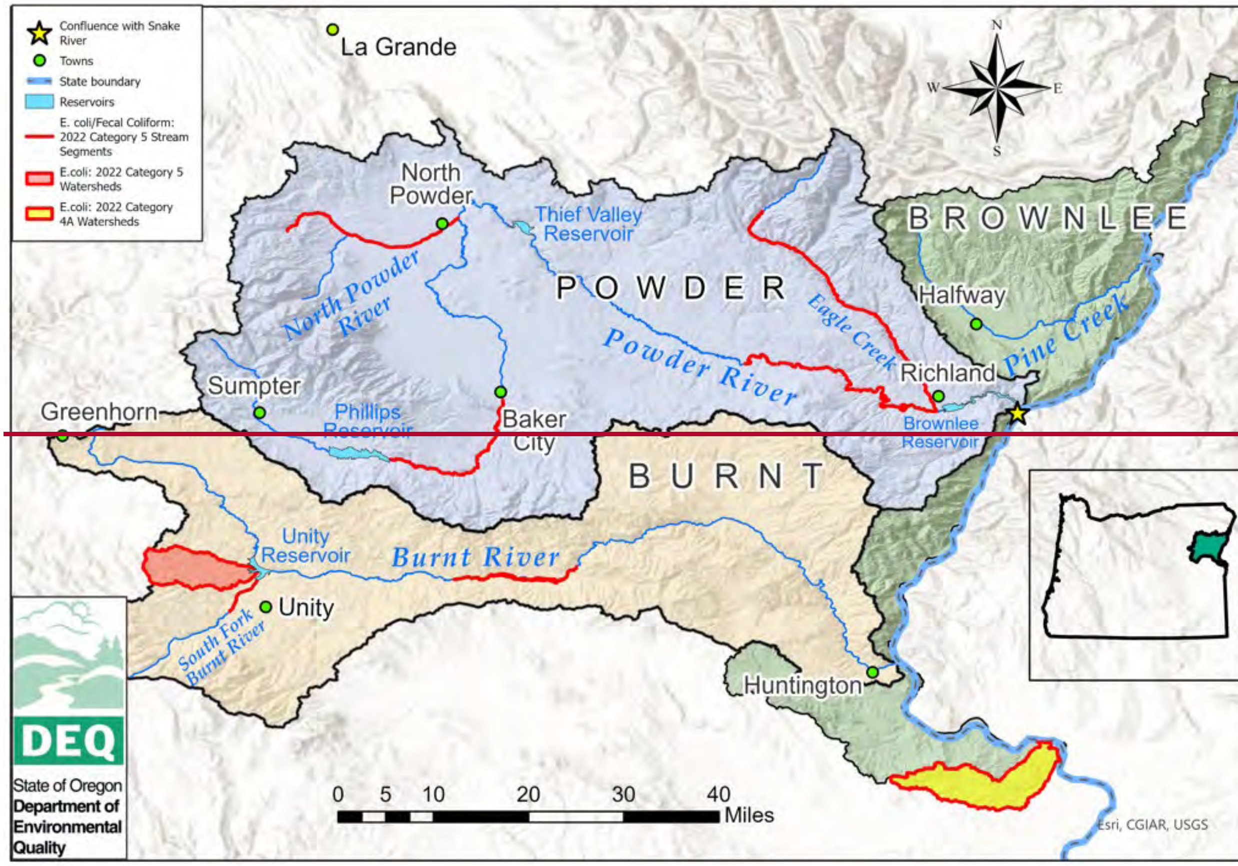


Figure 14: Bacteria (~~*E. coli*~~*E. coli*/fecal coliform) listings in the Powder River Basin

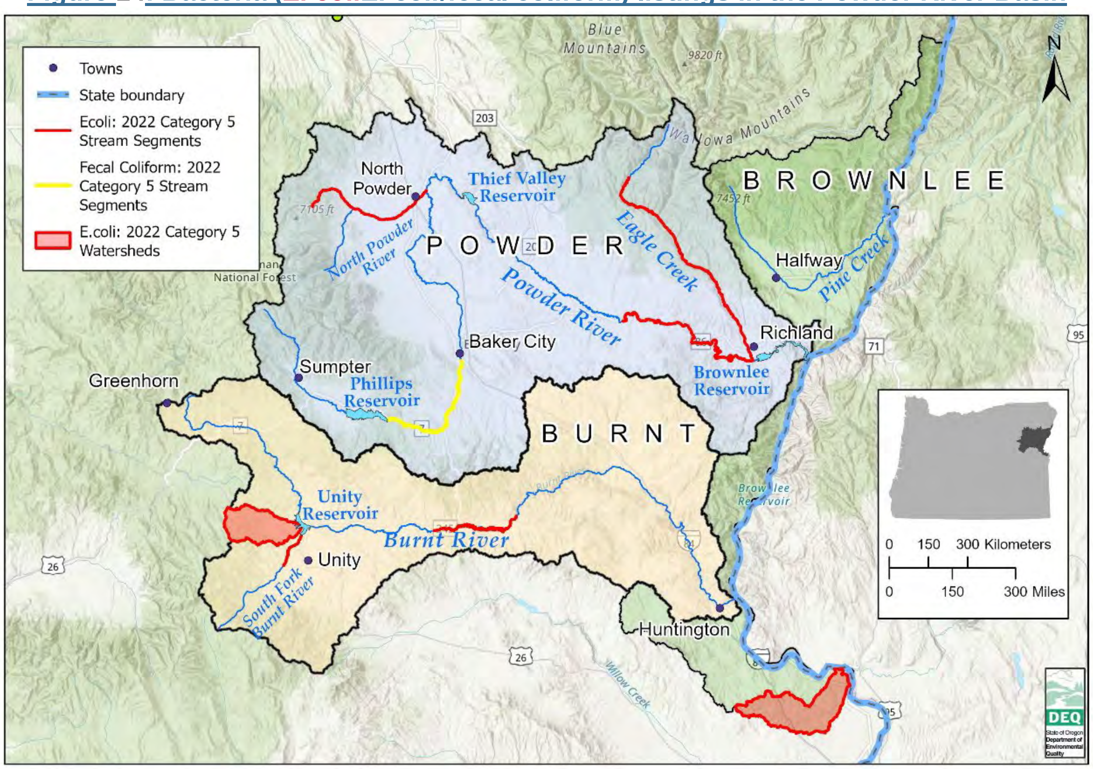


Figure 3.0: Bacteria (*E. coli*/fecal coliform) Category 5 303(d) listings in the Powder River Basin.

Table 5: Powder River Basin fecal indicator bacteria assessment units and status on Oregon's 2022 Integrated Report

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
Brownlee Subbasin				
OR_LK_1705020102_05_100576	Love Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020102_05_100577	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020103_05_100578	Brownlee Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100579	Clear Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100580	Fish Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020106_05_100581	Crow Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020107_05_100582	Hells Canyon Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020107_05_100583	Oxbow Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020101_02_103229	Snake River	River and stream	*E. coli*	Unassessed
OR_SR_1705020102_05_102789	Birch Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102790	Pine Creek	River and stream	*E. coli*	2
OR_SR_1705020106_05_102791	Lake Fork Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102792	North Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102793	Pine Creek	River and stream	*E. coli*	2
OR_SR_1705020106_05_102794	Dry Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102795	Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020106_05_102796	North Pine Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020107_05_102797	McGraw Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020107_05_102798	Spring Creek	River and stream	*E. coli*	Unassessed
OR_WS_170502010101_05_103097	HUC12 Name: Moores Hollow	Watershed Unit (1st through 4th order streams)	*E. coli*	4A[1]
OR_WS_170502010106_05_103227	HUC12 Name: Bridge Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010201_05_103226	HUC12 Name: Road Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010202_05_103098	HUC12 Name: Upper Birch Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010203_05_103099	HUC12 Name: Love Reservoir	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010204_05_103100	HUC12 Name: Lower Birch Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010205_05_103101	HUC12 Name: Benson Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010206_05_103225	HUC12 Name: Grouse Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502010301_05_103224	HUC12 Name: Ryan Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010303_05_103223	HUC12 Name: Morgan Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010304_05_103222	HUC12 Name: Dennett Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010306_05_103221	HUC12 Name: Raft Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010307_05_103220	HUC12 Name: Jackson Gulch-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010401_05_103219	HUC12 Name: Cottonwood Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010403_05_103218	HUC12 Name: Dukes Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010601_05_103102	HUC12 Name: Headwaters Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010602_05_103103	HUC12 Name: McMullen Slough	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010603_05_103104	HUC12 Name: Clear Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010604_05_103105	HUC12 Name: Deer Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010605_05_103106	HUC12 Name: East Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010606_05_103107	HUC12 Name: Fish Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010607_05_103108	HUC12 Name: Upper North Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010608_05_103109	HUC12 Name: Lake Fork Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010609_05_103110	HUC12 Name: Lower North Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010610_05_103111	HUC12 Name: Sheep Creek-Pine Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010701_05_103228	HUC12 Name: Oxbow Dam-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010703_05_103217	HUC12 Name: Herman Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010704_05_103216	HUC12 Name: McGraw Creek-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502010705_05_103215	HUC12 Name: Hells Canyon Dam-Snake River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Powder Subbasin				
OR_LK_1705020301_05_100588	Phillips Lake	Lake/Reservoir	*E. coli*	2
OR_LK_1705020303_05_100589	Smith Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020303_05_100590	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020303_05_100591	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020304_05_100592	Rock Creek Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020305_05_100593	Pilcher Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100594	Wolf Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_LK_1705020306_05_100595	Shaw Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100596	Jimmy Creek	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020306_05_100597	Thief Valley Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020307_05_100598	Fisk Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100599	Balm Creek Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100600	Love Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020308_05_100601	---	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100602	Echo Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100603	Lookingglass Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020310_05_100604	Eagle Lake	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020311_05_100605	Brownlee Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020303_02_107258	Highway 203 Pond	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020301_05_102812	Cracker Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020301_05_102813	McCully Fork	River and stream	*E. coli*	Unassessed
OR_SR_1705020301_05_102814	Powder River	River and stream	*E. coli*	2
OR_SR_1705020302_05_102815	Powder River	River and stream	Fecal coliform	5
OR_SR_1705020302_05_102815	Powder River	River and stream	*E. coli*	2
OR_SR_1705020303_05_102816	Powder River	River and stream	*E. coli*	2
OR_SR_1705020305_05_102817	North Powder River	River and stream	*E. coli*	5
OR_SR_1705020304_05_102818	Powder River	River and stream	*E. coli*	2
OR_SR_1705020306_05_102819	Powder River	River and stream	*E. coli*	Unassessed
OR_SR_1705020306_05_102820	Antelope Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020306_05_102821	Powder River	River and stream	*E. coli*	3
OR_SR_1705020307_05_102822	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020307_05_102823	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020307_05_102824	Beagle Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020308_02_102825	Clover Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020308_05_102826	Powder River	River and stream	*E. coli*	2
OR_SR_1705020308_05_102827	Clover Creek	River and stream	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_SR_1705020308_05_102828	Goose Creek	River and stream	E. coli	Unassessed
OR_SR_1705020309_05_102829	Powder River	River and stream	E. coli	5
OR_SR_1705020310_05_102830	Eagle Creek	River and stream	E. coli	5
OR_SR_1705020311_05_102831	Powder River	River and stream	E. coli	Unassessed
OR_WS_170502030101_05_103151	HUC12 Name: Cracker Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030102_05_103152	HUC12 Name: McCully Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030103_05_103153	HUC12 Name: Hawley Gulch-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030104_05_103154	HUC12 Name: Clear Creek-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030105_05_103155	HUC12 Name: Deer Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030106_05_103156	HUC12 Name: Union Creek-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030201_05_103157	HUC12 Name: Lake Creek-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030202_05_103158	HUC12 Name: Stices Gulch-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030203_05_103159	HUC12 Name: Beaver Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030204_05_103160	HUC12 Name: Elk Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030205_05_103161	HUC12 Name: Ebell Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030206_05_103162	HUC12 Name: Sutton Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030207_05_103163	HUC12 Name: Blue Canyon-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030301_05_103164	HUC12 Name: Upper Baldock Slough	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030302_05_103165	HUC12 Name: Lower Baldock Slough	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030303_05_103166	HUC12 Name: Old Settlers Slough	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030304_05_103167	HUC12 Name: Estes Slough-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030401_05_103168	HUC12 Name: Upper Salmon Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030402_05_103169	HUC12 Name: Lower Salmon Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030403_05_103170	HUC12 Name: Willow Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030404_05_103171	HUC12 Name: Rock Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030405_05_103172	HUC12 Name: Big Muddy Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030406_05_103173	HUC12 Name: Sand Creek-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030407_05_103174	HUC12 Name: Warm Springs Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502030408_05_103175	HUC12 Name: Gentry Creek-Powder River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502030501_05_103176	HUC12 Name: Upper North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030502_05_103177	HUC12 Name: Middle North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030503_05_103178	HUC12 Name: Upper Anthony Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030504_05_103179	HUC12 Name: Lower Anthony Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030505_05_103180	HUC12 Name: Lower North Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030601_05_103181	HUC12 Name: Upper Wolf Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030602_05_103182	HUC12 Name: Lower Wolf Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030603_05_103183	HUC12 Name: Jimmy Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030604_05_103184	HUC12 Name: Antelope Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030605_05_103185	HUC12 Name: Thief Valley Reservoir-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030606_05_103186	HUC12 Name: Magpie Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030701_05_103187	HUC12 Name: Upper Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030702_05_103188	HUC12 Name: Middle Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030703_05_103189	HUC12 Name: Beagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030704_05_103190	HUC12 Name: Lower Big Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030801_05_103191	HUC12 Name: Salt Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030802_05_103192	HUC12 Name: Crews Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030803_05_103193	HUC12 Name: Tucker Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030804_05_103194	HUC12 Name: Ruckles Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030805_05_103195	HUC12 Name: Balm Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030806_05_103196	HUC12 Name: Clover Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030807_05_103197	HUC12 Name: Goose Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030808_05_103198	HUC12 Name: Ritter Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030901_05_103199	HUC12 Name: Love Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030902_05_103200	HUC12 Name: Fivemile Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030903_05_103201	HUC12 Name: Maiden Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030904_05_103202	HUC12 Name: Hyall Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502030905_05_103203	HUC12 Name: Chalk Creek-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031001_05_103204	HUC12 Name: Headwaters Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502031002_05_103205	HUC12 Name: West Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031003_05_103206	HUC12 Name: Bennett Creek-Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031004_05_103207	HUC12 Name: East Fork Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031005_05_103208	HUC12 Name: Paddy Creek-Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031006_05_103209	HUC12 Name: Little Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031007_05_103210	HUC12 Name: Lower Eagle Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031101_05_103211	HUC12 Name: Daly Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031102_05_103212	HUC12 Name: Immigrant Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502031103_05_103213	HUC12 Name: Foster Gulch-Powder River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Burnt Subbasin				
OR_LK_1705020201_05_100584	Unity Reservoir	Lake/Reservoir	*E. coli*	2
OR_LK_1705020202_05_100585	Whited Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020202_05_100586	Elms Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_LK_1705020203_05_100587	Higgins Reservoir	Lake/Reservoir	*E. coli*	Unassessed
OR_SR_1705020201_05_102799	tributary to Trout Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102800	North Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102801	Trout Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020201_05_102802	North Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020202_05_103265	South Fork Burnt River	River and stream	*E. coli*	5
OR_SR_1705020202_05_103266	South Fork Burnt River	River and stream	*E. coli*	Unassessed
OR_SR_1705020203_05_103267	Camp Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020203_05_103268	Camp Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020204_05_102803	Burnt River	River and stream	*E. coli*	2
OR_SR_1705020204_05_102804	Big Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020205_05_102805	Burnt River	River and stream	*E. coli*	5
OR_SR_1705020205_05_102806	Clarks Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020205_05_102807	Auburn Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020207_05_102808	Durkee Creek	River and stream	*E. coli*	Unassessed
OR_SR_1705020206_05_102809	Burnt River	River and stream	*E. coli*	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_SR_1705020208_05_102810	Burnt River	River and stream	E. coli	2
OR_SR_1705020208_05_102811	Dixie Creek	River and stream	E. coli	2
OR_WS_170502020101_05_103112	HUC12 Name: Headwaters North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020102_05_103113	HUC12 Name: Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020103_05_103114	HUC12 Name: Patrick Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020104_05_103115	HUC12 Name: Trout Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020105_05_103116	HUC12 Name: Petticoat Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020106_05_103117	HUC12 Name: West Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	2
OR_WS_170502020107_05_103118	HUC12 Name: Middle Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	5
OR_WS_170502020108_05_103119	HUC12 Name: Antelope Creek-North Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020201_05_103120	HUC12 Name: Upper South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020202_05_103121	HUC12 Name: Middle South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020203_05_103262	HUC12 Name: Lower South Fork Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020204_05_103122	HUC12 Name: Job Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020301_05_103123	HUC12 Name: West Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020302_05_103124	HUC12 Name: East Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020303_05_103125	HUC12 Name: Higgins Reservoir-Camp Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020401_05_103126	HUC12 Name: Pine Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020402_05_103127	HUC12 Name: Rock Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020403_05_103128	HUC12 Name: Upper Big Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020404_05_103129	HUC12 Name: Lower Big Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020405_05_103130	HUC12 Name: Independence Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020501_05_103131	HUC12 Name: Mill Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020502_05_103132	HUC12 Name: Clarks Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020503_05_103133	HUC12 Name: Auburn Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020601_05_103134	HUC12 Name: Dark Canyon-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020602_05_103135	HUC12 Name: Cave Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020603_05_103136	HUC12 Name: Powell Creek-Burnt River	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed
OR_WS_170502020701_05_103137	HUC12 Name: Lawrence Creek	Watershed Unit (1st through 4th order streams)	E. coli	Unassessed

Assessment Unit	Assessment Unit Name	Assessment Unit Type	Pollutant	Listing Category
OR_WS_170502020702_05_103138	HUC12 Name: Upper Alder Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020703_05_103139	HUC12 Name: Lower Alder Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020704_05_103140	HUC12 Name: Durkee Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020705_05_103141	HUC12 Name: Pritchard Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020801_05_103142	HUC12 Name: Manning Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020802_05_103143	HUC12 Name: Swayze Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020803_05_103144	HUC12 Name: Shirttail Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020804_05_103145	HUC12 Name: Sisley Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020805_05_103146	HUC12 Name: North Fork Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020806_05_103147	HUC12 Name: South Fork Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020807_05_103148	HUC12 Name: Dixie Creek	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020808_05_103149	HUC12 Name: Jett Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
OR_WS_170502020809_05_103150	HUC12 Name: Durbin Creek-Burnt River	Watershed Unit (1st through 4th order streams)	*E. coli*	Unassessed
Note: [1]Listed as Category 4A under the Malheur Basin TMDL. It will be reassigned to the Powder River Basin Bacteria TMDL.				

~~Waterbody~~	~~Assessment Unit~~	~~AU Description~~	~~Pollutant~~	~~Listing Category~~
~~Powder River~~	~~OR_SR_1705020302_05_102815~~	~~Phillips Res. To Sutton Cr.~~	~~Fecal Coliform~~	~~5~~
~~North Powder River~~	~~OR_SR_1705020305_05_102817~~	~~Anthony Cr. to Powder R.~~	~~*E. coli*~~	~~5~~
~~Powder River~~	~~OR_SR_1705020309_05_102829~~	~~Goose Cr. to Eagle Cr.~~	~~*E. coli*~~	~~5~~
~~Eagle Creek~~	~~OR_SR_1705020310_05_102830~~	~~Two Color Cr. to Powder R.~~	~~*E. coli*~~	~~5~~
~~South Fork Burnt River~~	~~OR_SR_1705020202_05_103265~~	~~Whited Res. To Unity Res.~~	~~*E. coli*~~	~~5~~
~~Burnt River~~	~~OR_SR_1705020205_05_102805~~	~~Indian Cr. to Marble Cr.~~	~~*E. coli*~~	~~5~~
~~HUC 12: Middle Fork Burnt River~~	~~OR_WS_170502020107_05_103118~~	~~1st through 4th order streams~~	~~*E. coli*~~	~~5~~
~~HUC 12: Moores Hollow~~	~~OR_WS_170502010101_05_103097~~	~~1st through 4th order streams~~	~~*E. coli*~~	~~4A~~

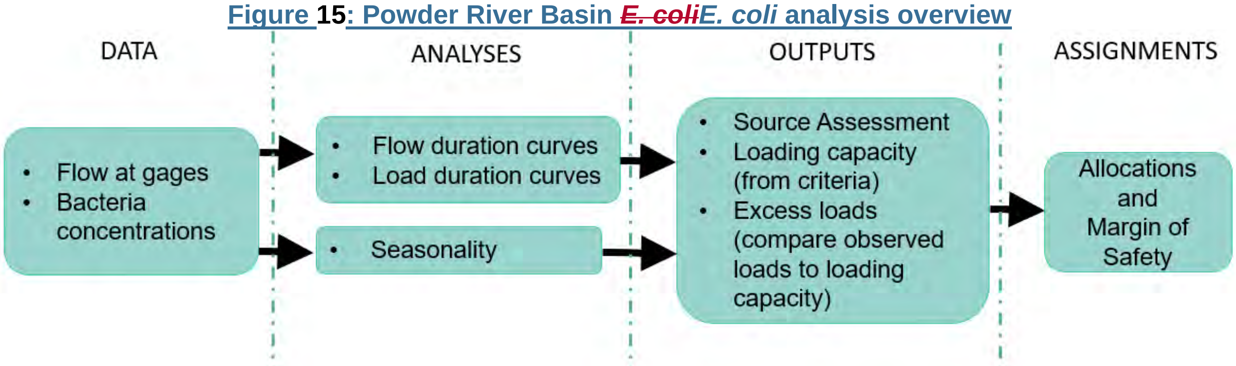
Waterbody	Assessment Unit	AU Description	Pollutant	Listing Category
Powder River	OR_SR_1705020306_05_102821	Thief Valley Reservoir to Big Creek	*E. coli*	3
Unity Reservoir	OR_LK_1705020201_05_100584	Lake/Reservoir Unit	*E. coli*	2
Phillips Lake	OR_LK_1705020301_05_100588	Lake/Reservoir Unit	*E. coli*	2
Thief Valley Reservoir	OR_LK_1705020306_05_100597	Lake/Reservoir Unit	*E. coli*	2
Brownlee Reservoir	OR_LK_1705020311_05_100605	Lake/Reservoir Unit	*E. coli*	2
Pine Creek	OR_SR_1705020106_05_102790	West Fork Pine Creek to Dry Creek	*E. coli*	2
Pine Creek	OR_SR_1705020106_05_102793	North Pine Creek to confluence with Snake River	*E. coli*	2
Burnt River	OR_SR_1705020204_05_102803	Unity Reservoir to Indian Creek	*E. coli*	2
Burnt River	OR_SR_1705020208_05_102810	Durkee Creek to confluence with Snake River	*E. coli*	2
Dixie Creek	OR_SR_1705020208_05_102811	Thornton Gulch to confluence with Burnt River	*E. coli*	2
Powder River	OR_SR_1705020301_05_102814	McCully Fork to Phillips Lake	*E. coli*	2
Powder River	OR_SR_1705020302_05_102815	Phillips Lake to Sutton Creek	*E. coli*	2
Powder River	OR_SR_1705020303_05_102816	Sutton Cr. to Old Settlers Slough	*E. coli*	2
Powder River	OR_SR_1705020304_05_102818	Old Settlers Slough to North Powder River	*E. coli*	2
Powder River	OR_SR_1705020308_05_102826	Big Creek to Goose Creek	*E. coli*	2
HUC12 Name: West Fork Burnt River	OR_WS_170502020106_05_103117	Watershed Unit (1st through 4th order streams)	*E. coli*	2

4. Water ~~Quality~~ quality d~~D~~ata e~~E~~valuation and a~~A~~nalyses

4.1 Analysis ~~Overview~~overview

An overview of the analyses undertaken is presented in Figure ~~4.~~15 and detailed information is presented in sections that follow in the order of flow noted in the schematic.

Figure 15: Powder River Basin ~~*E. coli*~~*E. coli* analysis overview



~~**Figure 4.1: Powder River Basin bacteria*E. coli* analysis overview**~~

DEQ and the EPA used ~~the~~ data collected ~~as part of the DEQ ambient monitoring network and~~ from a specialized DEQ TMDL monitoring project conducted from 2007-2013~~s data collected by DEQ from sources described below~~ to develop load duration curves for stream reaches in the basin. The load duration curves were used to ~~provide information on current~~calculate ~~bacteria*E. coli*~~*E. coli* loads and loading capacities ~~within the basin~~for the stream reaches, ~~for DEQ to develop the TMDL,~~ assign allocations between point and nonpoint sources, and ~~determine the needed~~identify potential management approaches (EPA 2019).

4.2 ~~Description of waterway reaches~~Stream reaches analyzed ~~evaluated~~

EPA Region 10 and DEQ worked together to develop load duration curves for ~~river and~~ stream reaches with paired *E. coli* concentrations and flow data (EPA 2019). *E. coli* concentration data were collected as part of a TMDL specific study conducted from 2007-2013 ~~(EPA 2019)~~ (DEQ 2013). Reaches for the project originally corresponded to a previous stream segments listed by EPA ~~-~~in integrated reports (2010 and 2012). The reaches now cover assessment units described in the 2022 Integrated Report (Figure ~~4.2~~14~~3.0~~; DEQ, 2022). ~~DEQ directly excerptedrefers directlydirectly refers to EPA's the description of stream reaches for load duration curve analysis from EPA's technical memorandum (EPA 2019).~~

In the Brownlee Subbasin, one load duration curve was developed that applies to the streams in the subbasin. The specific area with the associated downstream monitoring station was:

- Confluence of Brownlee Subbasin streams with Snake River.

- o 36382-ORDEQ: Pine Creek at Hwy 71 (Figure 25).

In the Powder Subbasin, The Powder River is also a tributary to Snake River (Figure 3.2). It joins Snake River north of Burnt River. Three lload duration curves have beenwere developed for three pointsreaches along on Powder River, one reach on Eagle Creek, and two reaches of the , which is listed as impaired from RM 0 to 130. Load duration The tributaries to Powder River for this project are Eagle Creek and North Powder River (EPA 2019). The specific reaches with the associated downstream monitoring stations include:Eagle Creek is listed as impaired from RM 0 to 21.1 and one load duration curve has been developed for it. Two load duration curves have been developed for North Powder River, which is listed as impaired from RM 1 to 24.3.

- Powder River upstream of Philips Reservoir.
  - o 34250-ORDEQ: Powder River above Phillips Reservoir Dam Powder River (RM 130) – above Phillips Reservoir (34250-ORDEQ; Figure 5.1.1a16).
- Powder River from Phillips Reservoir to Baker City.
  - o 11490-ORDEQ: Powder River at Hwy 7 (in Baker City) Powder River – at Baker City, OR(11490-ORDEQ; Figure 5.1.1a17).
- North Powder River from USFS Boundary to Miller Rd.Powder River (RM 22) – near Richland, OR
- Eagle Creek – near confluence with the Powder River; near Richland, OR
- N
  - o 36192-ORDEQ: North Powder River at Miller Rd. Bridge orth Powder River – intersection with Miller Road(36192-ORDEQ; Figure 5.1.218).
- North Powder River from Miller Road to Confluence with Powder River.
  - o 36191-ORDEQ: North Powder River at Hwy 30 Bridge North Powder River – intersection with Hwy 30(36191-ORDEQ; Figure 195.1.2).
- 11857-ORDEQ; 205.1.3Eagle Creek from New Bridge to Brownlee Reservoir.
  - o 36193-ORDEQ: Eagle Creek at Snake River Rd (36193-ORDEQ; Figure 215.1.3).
- Powder River from Baker City to the confluence with Snake River.
  - o 11857-ORDEQ: Powder River at Snake River Rd. (Richland) (Figure 20).

In the Burnt Subbasin, As shown in Figure 4.2, the Burnt River is a tributary to Snake River. It is fed by the North, Middle Fork Burnt River and South Fork Burnt River just upstream of Unity Lake. Three load duration curves have beenwere developed for points three reaches along Burnt River, which is listed as impaired from RM 0 to 45.1. Although AUs in the Segments of Middle Fork Burnt River (RM 0 to 11) and and South Fork Burnt Rivers (RM 0 to 11.5) are also listed as impairedhave been listed as impaired on the 2022 Integrated Report based on *E. coli* concentration data, paired concentration and flow data were not available to develop load duration curves.. There are ODEQ monitoring stations for both of those segments, but no flow data.The specific Burnt Subbasin reaches with the associated downstream monitoring stations include:

- Burnt River upstream of Unity Reservoir Dam.
  - o 36195-ORDEQ: Burnt River at Unity Reservoir Dam (Figure 5.1.422).
- Burnt River from Unity Reservoir to Clarks Creek Rd.

- o 34256-ORDEQ: Burnt River at Clarks Cr. Bridge (Figure 5.1.423).
- Burnt River from Clarks Creek Rd to confluence with Snake River.Burnt River (RM 0) – confluence with the Snake River; Huntington, OR
    - o 11494-ORDEQ: Burnt River at Snake River Rd (Huntington) (Figure 5.1.424).

25

- Burnt River (RM 45) – intersection with Clark Creek Rd.; near Bridgeport, OR
- Burnt River (RM 77) – Unity Dam
- Middle Fork and South Fork Burnt River (*Load duration curves were not developed for these, as there was not enough flow data.)

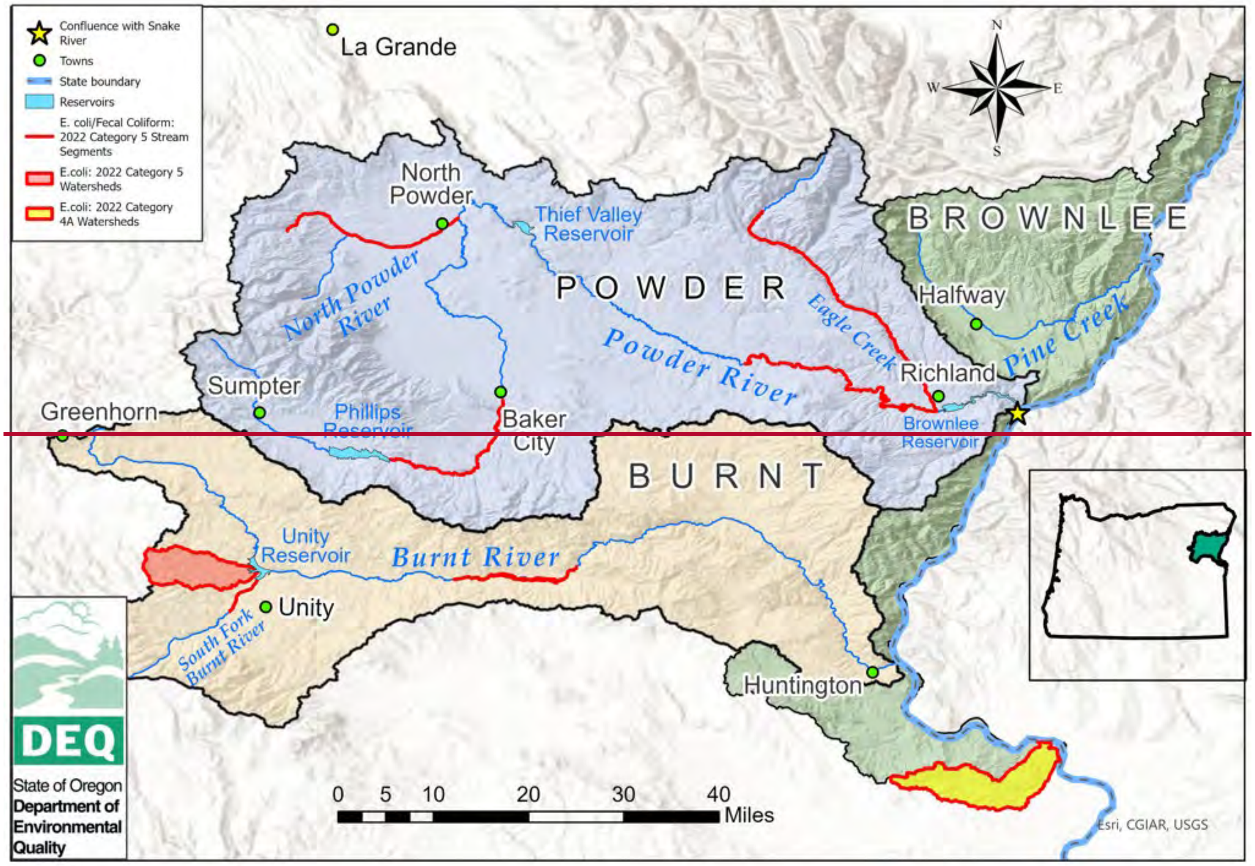
The Powder River is also a tributary to Snake River (Figure 3.2). It joins Snake River north of Burnt River. Three load duration curves have been developed for points along Powder River, which is listed as impaired from RM 0 to 130. The tributaries to Powder River for this project are Eagle Creek and North Powder River. Eagle Creek is listed as impaired from RM 0 to 21.1 and one load duration curve has been developed for it. Two load duration curves have been developed for North Powder River, which is listed as impaired from RM 1 to 24.3.

- Powder River (RM 130) – above Phillips Reservoir
- Powder River – at Baker City, OR
- Powder River (RM 22) – near Richland, OR
- Eagle Creek – near confluence with the Powder River; near Richland, OR
- North Powder River – intersection with Miller Road
- North Powder River – intersection with Hwy 30

Pine Creek is a tributary to Snake River north of Powder River's confluence with Snake River. A load duration curve was developed for this water to demonstrate what the measurements look like for a non-impaired waterbody. It is a good example of an area with significant cattle use that has low levels of bacteria*E. coli*.

- Pine Creek – intersection with Hwy 71

As noted in Section 3.1, the Catergory 4A listing shown on Figure 4.2 for the Moores Hollow watershed assessment should be Category 5 and is being addressed by this TMDL.



~~**Figure 4.2: Bacteria (*E. coli*/fecal coliform) impairments in the Powder River Basin.**~~

4.3 Data

~~The water quality m~~Monitoring stations ~~where~~ for ~~bacteria~~~~*E. coli*~~*E. coli* data collected in the 2007-2013 TMDL study (DEQ 2013) and streamflow gages paired with *E. coli* data ~~were collected and the associated flow monitoring stations~~ are presented in Tables ~~4.3a, 4.3b and 4.3c~~6-8. In general, monitoring stations were located at ~~publicly-accessible~~publicly accessible points of entry. DEQ data ~~collection~~ collected data according to protocols outlined in~~followed the protocols documented in~~ the Sampling and Analysis Plan governing Oregon's Ambient Monitoring program (DEQ 2016) and the Powder/Burnt Quality Assurance Project Plan and amendments (DEQ ~~2007~~-2013). ~~that were filed with and approved by DEQ's Laboroatory and are available on DEQ's website. Details~~Descriptions of ~~below about~~ the ~~bacteria~~~~*E. coli*~~*E. coli* and flow data are ~~excerpted directly~~adapted from EPA's technical memorandum (EPA 2019) and appear below:~~.~~

~~Bacteria~~~~*E. coli*~~*E. coli* Data~~:~~

The source of ~~*E. coli*~~*E. coli* data came ~~entering~~ from DEQ ~~Water~~ water ~~Quality~~ quality ~~Monitoring~~ monitoring ~~Stations~~ stations and consisted of:

- Data collected 2007 to 2013 (~~start of TMDL monitoring) and later~~DEQ TMDL Project).
- Analytical methods, detailed in DEQ (2013), included:
    - o 9223 B: Enzyme substrate assay for measuring total coliforms and *E. coli* (ONPG-MUG test or CPRG-MUG test)

- Coliform/*E. coli* Enzyme substrate test; ONPG-MUG test (COLILERT)

- Data were analyzed by the DEQ Laboratory and Environmental Assessment Division or the Oregon Public Health Laboratory.
- Only data graded as "A" (approved QAPP) or "B" (minimum data acceptance criteria met) were used for the analysis (see DEQ (2013) and DEQ (2016) for details):
    - 915 of 933 samples (98%) graded as "A"; 18 of 933 graded as "B" (all from April 8-10, 2008).
- Data ~~collected~~ are reported as Most Probable Number ~~in~~ (MPN ~~(most probable number~~) per 100 mL. OAR 340-041-0009(1)(a)~~Oregon's Water Quality Standards (WQS)~~ define the ~~bacteria~~~~*E. coli*~~*E. coli* criteria in terms of organisms/ ~~per~~ 100 mL. Because MPN represents a probabilistic estimate for number of organisms, comparing sampled data to the criteria is appropriate.~~It is appropriate to use data collected in terms of MPN in comparison to these criteria because MPN is a probabilistic estimate of the number of organisms.~~

Measured Stream Flow Data~~Flow:~~

Sources of flow monitoring data in the Powder River Basin include:
- Idaho Power (2023)
- Oregon Water Resources Department (2023)
- U~~.~~S~~.~~ Bureau of Reclamation (2023)

- All available data from January 1, 1990 thru Sept 30, 2017 ~~was~~ were used.
    - ~~*Note:*~~ An exception to this was for the flow gage for Burnt River at Huntington (13275000). The record from 1990 to 2000 had several long periods of zero flow, and it was difficult to discern if this was meant to be marked as 'no measurement' or if it truly was zero for those periods. Thus, only data from the year 2000 and onward ~~was~~ were used for the load duration curve developed using data from this gage.
    - The period of record for each gage consisted of at least 10 years of data; thus, the flow data used to develop the load duration curves sufficiently ~~should~~ captured interannual ~~the~~ variability present for each location.
- Flow units are the stream daily average discharge in ~~cfs~~cubic feet per second (cfs).
- Period of record for each US Bureau of Reclamation gage:
    - ~~Burnt River below Unity Dam (UNY) - 1/1/1990 – 9/30/2017~~Powder River above Phillips Reservoir (PRHO): January 1, 1990-September 30, 2017
    - Powder River at Baker City (PWDO): January 1, 1990-September 30, 2017
    - Powder River near Richland (PRRO): January 1, 1990-August 29, 2017
    - Burnt River below Unity Dam (UNY): January 1, 1990-September 30, 2017
- Period of record for each Idaho Power Company gage:
    - Pine Creek near Oxbow (13290190): January 1, 1990-September 30, 2017
    - Burnt River above Clarks Creek (13274020): March 14, 2007-September 30, 2017
    - Burnt River at Huntington (13275000): October 2, 2000-September 30, 2017
- Period of record for each Oregon Water Resources Division gage:

    - ~~Burnt River above Clarks Creek (13274020): - 3/14/2007 – 9/30/2017~~
    - ~~Burnt River at Huntington (13275000): - 10/2/, 2000- – 9/30/2017~~
    - Eagle Creek near Richland (13288300): ~~- 4/16/~~April 16, 1999-~~–~~September 30, 2017~~9/30/2017~~
    - North Powder River at Miller Road (13282550): ~~–~~May 22, ~~5/22/~~1999-~~–~~September 30, 2017~~9/30/2017~~
    - ~~Powder River above Phillips Reservoir (PRHO): - 1/1/1990 – 9/30/2017~~

~~Mason Dam and Phillips Lake near Sumpter (PHL): - 1/1/1990-9/30-2017~~
- o ~~Powder River at Baker City (PWDO): - 1/1/1990- – 9/30/2017~~
- ~~o Powder River near Richland (PRRO): - 1/1/1990- – 8/29/2017~~
- ~~o Pine Creek near Oxbow (13290190): - 1/1/1990 -– 9/30/2017~~

~~Assumptions~~Method Considerations

- Irrigation~~Irrigation~~ diversions and return flows were not directly factored into flow duration interval~~s~~ or load duration curve calculations.
- ~~•~~ For censored data, the value following the qualifier (< or >) was ~~Where present, estimated values were used for bacteria*E. coli* data (Burnt R. @ Huntington (11494) & Powder R. @ Baker (11490)).~~
- ~~Where present, approximate values were used for bacteria*E. coli* data. For "<1," "1" was used in calculations. For ">#," the number value was~~ used in calculations.
- Duplicate samples were ~~collected for some of the bacteria*E. coli* data~~periodically collected as a quality assurance field check. To eliminate samples taken on the same date, one value was randomly selected to be eliminated. ~~In some cases,~~This procedure did not result in excluding measurements that ~~this random selection may have eliminated~~ indicated exceedances of the water quality criteria.
- ~~Some days did not have any f~~Occasionally, daily flows were not reported.~~low reported, so~~ When this occurred, those dates were removed ~~those flow data were removed~~ from calculations~~, under the assumption that flow was not collected on those days~~.
- The ~~The North Powder River at Hwy 30 m~~monitoring station for ~~36191-ORDEQ (~~North Powder River at Hwy 30 (36191-ORDEQ) is approximately ~~6~~ six miles downstream of the North Powder River at Miller Road flow gage (13282550) that was~~, which was~~ used for ~~that~~ the calculation of the load duration curve.
- ~~One~~ The flow gage for the ~~(13282550,~~ North Powder River at Miller Road flow gage (OWRD ~~(~~13282550)~~N. Powder River @ Miller Rd.)~~ , ~~presented a sharp drop off nearing~~ recorded a zero flow between the 99-100th percentile. ~~The point isn't captured on the load duration chart because it is way below the next lowest point. Because of this~~Consequently, the 100th percentile was excluded from the calculation of the TMDL loading capacity for the low flow interval on the load duration curve. When the 100th percentile was included in the calculations, the resulting ~~log~~ geometric mean was skewed ~~disproportionally~~ low~~er~~. Load reductions would have been required although~~, even though~~ ~~*the monitored values*~~*E. coli* concentration samples never exceeded the loading capacity ~~on the particular day they were collected~~for days with recorded flow. With the 100th percentile included, the loading capacity (as a ~~log~~ geometric mean ~~of~~ in the flow interval) ~~would be~~ was 2.79E09 ~~billion~~ organisms/~~per~~ day and~~,~~ ~~requiring~~ required a 64% reduction. With the 100th percentile excluded, the loading capacity ~~would be~~was 12.54E09 ~~billion~~ organisms/~~per~~ day and ~~,~~ requir*e*~~ing~~ ~~zero~~ 0% reduction~~ from existing conditions~~. ~~For this flow gage, the 90-99th percentile is much more representative of loading capacity of the low flow interval most of the time.~~

Table 6: Paired DEQ water quality monitoring stations, flow gages, and load duration curve reach description in the Brownlee Subbasin (4th Field HUC 17050201) (IPC = Idaho Power Company)~~Table 4.3a: Paired DEQ water quality monitoring stations, flow gages, and load duration curve reach description in Brownlee Subbasin (4th Field HUC 17050201). IPC = Idaho Power Company.~~

DEQ monitoring station	DEQ monitoring station description	Flow gage	Flow gage description	Load duration curve reach description
36382-ORDEQ	Pine Creek at Hwy 71	13290190 (IPC)	Pine Cr. near Oxbow (mouth)	Brownlee Subbasin streams confluence with Snake River

DEQ monitoring station	DEQ monitoring station description	Flow gage	Flow gage description	Load duration curve reach description

Table 7: Paired DEQ water quality monitoring stations, flow gages, and load duration curve reach description in the Powder Subbasin (4th Field HUC 17050203) (USBR = U.S. Bureau of Reclamation; IPC = Idaho Power Company; OWRD = Oregon Water Resources Division)

DEQ monitoring station	DEQ monitoring station description	Flow gage	Flow gage description	Load duration curve reach description
34250-ORDEQ	Powder River above Phillips Reservoir Dam	PRHO (USBR)	Powder River above Phillips Reservoir	Powder River upstream of Philips Reservoir
11490-ORDEQ	Powder River at Hwy 7 (in Baker City)	PWDO (USBR)	Powder River @ Baker City	Powder River from Phillips Reservoir to Baker City
36192-ORDEQ	North Powder River at Miller Rd. Bridge	13282550 (OWRD)	North Powder R. @ Miller Rd.	North Powder River from USFS Boundary to Miller Rd
36191-ORDEQ	North Powder River at Hwy 30 Bridge	13282550 (OWRD)	North Powder R. @ Miller Rd.	North Powder River from Miller Road to Confluence with Powder River
36193-ORDEQ	Eagle Creek at Snake River Rd	13288300 (IPC)	Eagle Cr. near Richland (mouth)	Eagle Creek from New Bridge to Brownlee Reservoir
11857-ORDEQ	Powder River at Snake River Rd. (Richland)	PRRO (USBR)	Powder River at Snake River Rd (Richland)	Powder River from Baker City to confluence with Snake River

Table 8: Paired DEQ water quality monitoring stations, flow gages, and load duration curve reach description in the Burnt Subbasin (4th Field HUC 17050202) (USBR = U.S. Bureau of Reclamation; IPC = Idaho Power Company)

~~**Table 4.3a3b: Paired DEQ water quality monitoring stations and flow gages in Burnt River Subbasin (4th Field HUC 17050202). USBR = US Bureau of Reclamation; IPC = Idaho Power Company.water quality monitoring stations and associated flow data**~~

~~**Water Quality**~~**DEQ** ~~**Monitoring**~~ **monitoring** ~~**Station**~~**station**	**DEQ monitoring station description**	**Flow** ~~**Gage**~~**gage**	**Flow gage description**	**Load duration curve reach description**
36195-ORDEQ	Burnt River at Unity Reservoir Dam	UNY (USBR)	Burnt R. below Unity Dam	Burnt River upstream of Unity Reservoir Dam
~~Burnt River at Unity Reservoir Dam~~~~Burnt @ Unity Dam~~		~~Burnt R. below Unity Dam; RM 77~~		
34256-ORDEQ	Burnt River at Clarks Cr. Bridge	13274020 (IPC)	Burnt River above Clarks Cr. near Bridgeport, OR	Burnt River from Unity Reservoir to Clarks Creek Rd
~~Burnt River @ Clark Cr. Road~~		~~Burnt River above Clarks Cr. Near Bridgeport, OR; RM 45~~		
11494-ORDEQ	Burnt River at Snake River Rd (Huntington)	13275000 (IPC)	Burnt River @ Huntington (mouth)	Burnt River from Clarks Creek Rd to confluence with Snake River
~~Burnt River @ Huntington~~		~~Burnt River @ Huntington (mouth); RM 0~~		
~~**36197**~~		~~*no flow gage*~~		
-		-		
~~**36196**~~		~~*no flow gage*~~		
	~~Notes: USBR = US Bureau of Reclamation, IPC = Idaho Power Company~~			

Table 8: Paired DEQ water quality monitoring stations, flow gages, and load duration curve reach description in the Powder Subbasin (4th Field HUC 17050203) (USBR = U.S. Bureau of Reclamation; IPC = Idaho Power Company; OWRD = Oregon Water Resources Division) Table 4.3b: Eagle Creek and Powder River water quality monitoring stations and associated flow data		

Waterbody Information		**Water Quality Monitoring Station**	**Flow Gage**
Water Body	**Eagle Creek**		
Basin Name	Middle Snake-Powder		
Subbasin	Powder		
4th Field HUC	17050203	**36193**	**13288300** (IPC)
Record ID	24355	Eagle Creek near Richland	Eagle Cr. near Richland (mouth)
LLID	1171699447463		
River Miles	0 to 21.1		
Segment Miles	21.1	-	-

Waterbody Information		Water Quality Monitoring Station	Flow Gage
Water Body	North Powder River		
Basin Name	Middle Snake-Powder	36192	13282550 (OWRD)
Subbasin	Powder	North Powder @ Miller Rd.	North Powder R. @ Miller Rd.
4th Field HUC	17050203		
Record ID	24365 & 24366	36191	13282550 (OWRD)
LLID	1178956450385	North Powder @ Hwy 30	North Powder R. @ Miller Rd.
River Miles	0 to 24.3		
Segment Miles	24.3	-	-
-		34250	PRHO (USBR)
Water Body	Powder River	Powder River above Phillips Reservoir	Powder River above Phillips Reservoir
Basin Name	Middle Snake-Powder		
Subbasin	Powder	26601	PHL (USBR)
4th Field HUC	17050203	Powder River at Mason Dam	Mason Dam and Phillips Lake near Sumpter, OR
Record ID	24346 & 24347		
LLID	1170508447455	11490	PWDO (USBR)
River Miles	0 to 130	Powder River @ Baker City	Powder River @ Baker City
Segment Miles	130		
	-	11857	PRRO (USBR)
-	-	Powder River at Snake River Rd (Richland)	Powder River at Snake River Rd (Richland)
Notes: USBR = US Bureau of Reclamation, OWRD = OR Water Resources Department			

Table 4.3b3c: Pine Creek water quality monitoring stations and associated flow data

Waterbody Information		Water Quality Monitoring Station	Flow Gage
Water Body	Pine Creek	36382	13290190 (IPC)
		Pine Creek @ Hwy 71	Pine Cr. near Oxbow (mouth); RM 0
Notes: IPC = Idaho Power Company			

4.4 Flow Categoriescategories

DEQ uses the flow categories describedy names represented in Table 4.49 to be consistent in all TMDLs beginning in 2022 and for clarity in communicating with the TMDL implementers and the public. The exceedance probability numeric ranges describe flow duration intervals and are consistent with groupings flow categories in EPA's Load Duration Curve Guidance referred to respectively as: Low Flows; Dry Conditions; Mid-Range Flows; Moist Conditions; and High Flows (EPA 2007). DEQ's flow categories were also informed by flow regimes described in the

~~US Geological Survey report on a regression-based method for predicting flow-duration curves, and roughly coincide with USGS' nonexceedance probability ranges: Low Flow (0.02%-10%); Medium Flow (20%-90%); and High Flow (95%-99.98%) (Russell et al. 2018).~~ Table ~~4.4~~9 crosswalks DEQ's and EPA flow categories and includes numeric and narrative descriptions of the categories.~~includes a column of flow categories EPA used in the Powder River Basin analyses and the DEQ flow categories they correspond to. DEQ converted all flow duration curves evaluated in the DEQ categories.~~

Table 9: Flow Categories based on flow duration intervals

~~**Table 4.4: Flow Categories based on flow duration intervals**~~

DEQ Flow Category	EPA Flow Category	Exceedance Probability	Hydrologic Description
Low	Low	90~~%~~-100%	Watershed soils dry, may be drought conditions, storage empty, channel levels near or below lowest (7Q10) flow, long dry and warm periods between weather events, entirely groundwater return flow as source to stream flow
Medium-Low	Dry	60~~%~~-90%	Watershed soils much below saturated, storage empty, channels much less than bank-full, extended dry periods between weather events, some shallow subsurface, but mainly groundwater return flow as source to stream flow
Medium	Typical	40~~%~~-60%	~~watershed~~ Watershed soils partially saturated, storage almost empty, channels less than bank-full, typical size storms or snow melt events, surface, shallow subsurface and groundwater return flow as source to stream flow
Medium-High	Transitional	10~~0%~~-40%	~~watershed~~ Watershed soils partially saturated, storage partially full, channels near bank-full, moderate size storms or snow melt events, mainly surface or shallow subsurface flow as source to stream flow
High	High	0~~%~~-10%	~~watershed~~ Watershed soils completely saturated, storage near capacity, channels at or near flood stages, large storms or snow melt events, mainly surface or shallow subsurface flow as source to stream flow

4.5 ~~Bacteria~~*E. coli* load duration curves

4.5.1 Calculation of load duration curves

DEQ ~~excerpted~~ adapted the ~~EPA's explanation~~ description of methods used for~~of how~~ calculating load duration curves ~~were calculated directly~~ from the EPA ~~'s~~ technical memorandum (EPA 2019). Load duration curves for the Powder River Basin are presented below as Figures ~~4.5.1a~~16 through ~~4.5.1j~~25.

All load duration curves were calculated using Microsoft™ Excel. The analysis steps included: ~~to do so are listed below.~~

- Calculation of~~e~~ the flow for ~~at~~ each flow percentile. This was done by using the PERCENTILE function in Excel for the entire flow period of record to calculate the flow at each percentile interval. The intervals are 0, 1, 5, 10 … [~~continue every~~increments of 5] … 95, 99, 100.

- Calculate the acceptable load for each flow percentile interval. Combining these intervals produced ~~This becomes~~ the load duration curve. The equation for calculating the load ~~is~~was:

  (3) LOAD = (86,400*28,316.85*FLOW [cfs] * CRITERION [org/100 mL])/100

- Two water quality criteria, from Oregon's Administrative Rule 340-041-0009, ~~are~~ were used to develop ~~two~~ individual curves for:
  - 90-day geometric mean criterion of 126 organisms/100 mL.
  - Single sample criterion of 406 organisms/100 mL.

- The load duration curves were divided into the five flow categories (Table 9):
  - High Flows (0th-10th percentile).
  - Medium-High Flows (10th-40th percentile).
  - Medium Flows (40th-60th percentile).
  - Medium-Low Flows (60th-90th percentile).
  - Low Flows (90th-100th percentile).

~~90-day log mean criterion of 126 organisms/100 mL~~

~~The load duration curve is divided into five flow regimes:~~
~~High flows (0th – 9th percentile)~~
~~Transitional flows (10th – 39th percentile)~~
~~Typical flows (40th – 59th percentile)~~
~~Dry flows (60th – 89th percentile)~~
~~Low flows (90th – 100th percentile)~~

- For each measured ~~*data point*~~*E. coli* concentration, ~~calculate the~~ an observed load was calculate using ~~. This is done by~~ using the measured daily flow ~~for the day~~when the ~~bacteria~~~~*E. coli*~~*E. coli* sample was collected. The equation for calculating the load is:

(4) LOAD = (86,400*28,316.85*FLOW [cfs] * ~~BACTERIA~~~~*E. COLI*~~*E. COLI* CONC. [organisms/100 mL])/100

- Measured *E. coli* loads were displayed by seasonal category describing differences in hydrology, climate, and management:
    - o Late spring through early fall (May-October).
    - o Late fall through early spring (November-April).

Measured ~~bacteria~~~~*E. coli*~~*E. coli* loads are ~~shown~~ displayed by seasonal category describing differences in hydrology, climate, and management:~~in two ways:~~
Late spring through early fall (~~By season:~~
~~Spring (Mar – May)~~
~~Summer (Jun – Aug)~~
~~Fall (Sep – Nov)~~
~~Winter (Dec – Feb)~~
~~By irrigation season:~~
~~Irrigation (May – Oct)~~May-October)
Late fall through early spring ~~Non-irrigation~~ (November~~—~~-April~~Apr~~)

- Calculated TMDL components:
    - o TMDL load capacity (to meet the 126 organisms/100 mL geometric mean criterion) = geometric mean of each flow group.
    - o RC = 0% of the load capacity.
    - o MOS = 10% of the load capacity.
    - o WLA:
        - MS4 stormwater from the Oregon Department of Transportation: 1% of the load capacity (see Section 6.1).
        - Effluent from NPDES Wastewater Treatment Plants: geometric mean criterion (126 organisms/100 mL) times the permitted effluent volume to produce a calculation in terms of organisms/day.
    - o LA = TMDL-RC-MOS-WLA
- ~~Calculate TMDL components:~~
    ~~TMDL loading capacity (to meet the 126 org/100 mL log mean criterion) = log mean of each flow group~~
        - ~~Margin of Safety (MOS) = 10% of the loading capacity~~
    ~~The Wasteload Allocation (WLA) is equal to zero.~~
    ~~o Load Allocation (LA) = TMDL – MOS – WLA~~

- Calculat~~e~~ed the percent reductions:
    - o For the ~~log~~ geometric mean criterion, 126 org~~.~~anism/100 mL:
    Calculated the ~~log~~ geometric mean of the measured load of each flow group ~~('Log Mean of Observed Data')~~for each seasonal category. ~~Then, subtract the 10% MOS from the TMDL loading capacity. Since the WLA is zero, it is equal to the Load Allocation in this case.~~ The percent reduction ~~is~~ wss calculated as the reduction needed from the ~~Log Mean of Observed Data~~geometric mean of observed data to meet the ~~Load Allocation~~LA. Specifically, the calculation was: Percent Reduction = (Measured Load - Load Capacity) / (Measured Load) * 100.

    - o For the single sample criterion, 406 org~~./~~anism/100 mL:

Calculated the acceptable load for the day with the highest measured value in each flow group~~, by~~ using the flow measured on that day. The percent reduction wa~~i~~s calculated as the reduction needed from the highest measured value to meet the acceptable load for that day.

Figure 16: ~~*E. coli*~~*E. coli* load duration curve for Confluence of Brownlee Subbasin streams with Snake River

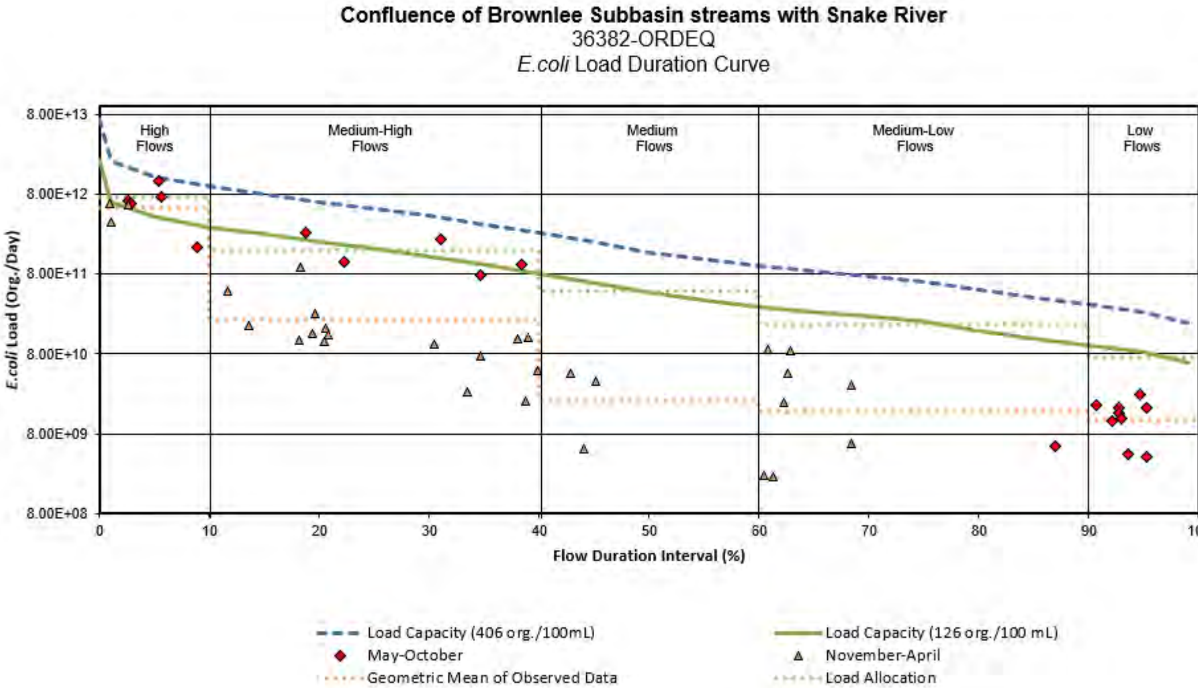
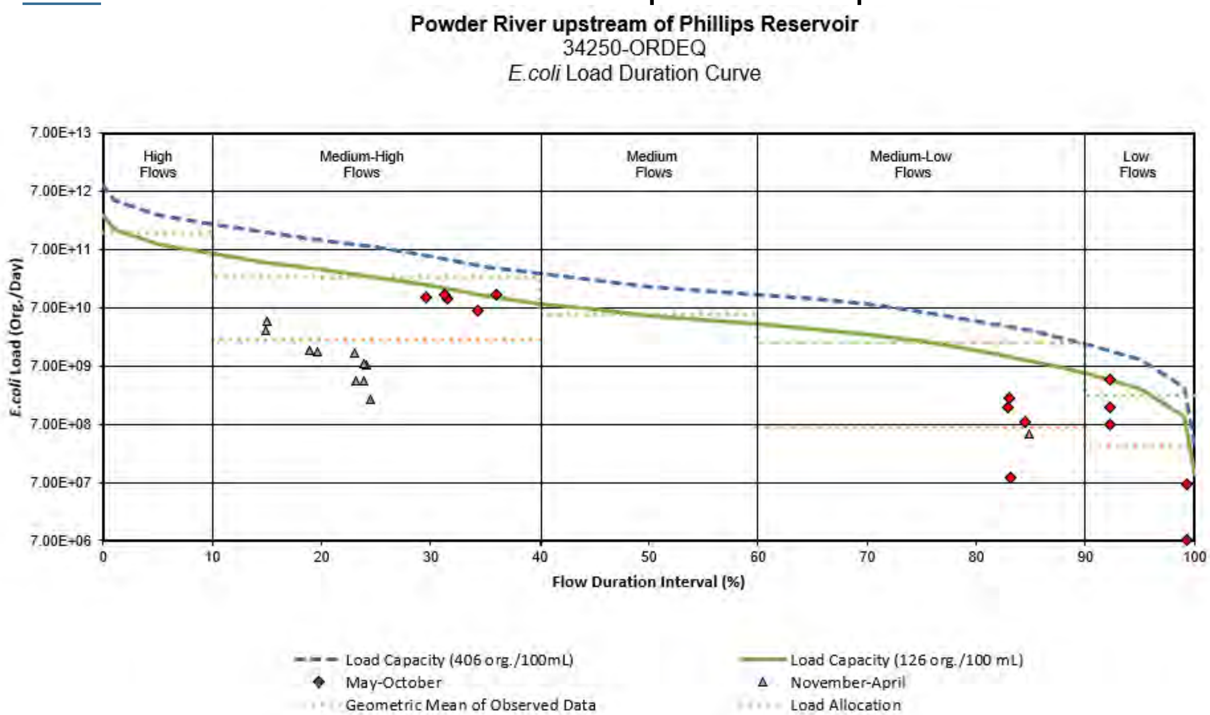


Figure 17: ~~*E. coli*~~*E. coli* load duration curve for the Powder River upstream of Phillips Reservoir



~~o~~

~~In addition to the overall percent reductions, the reductions for irrigation versus non-irrigation season to meet the log mean criterion were calculated. Within each~~

flow group, the same method was applied to obtain the required percent reduction, except instead of calculating the log mean of all observed data within a flow group, the log mean of observed data for only the irrigation months was taken for one set of percent reduction calculations, and the log mean of observed data for only the non-irrigation months was taken for the other set of percent reduction calculations.

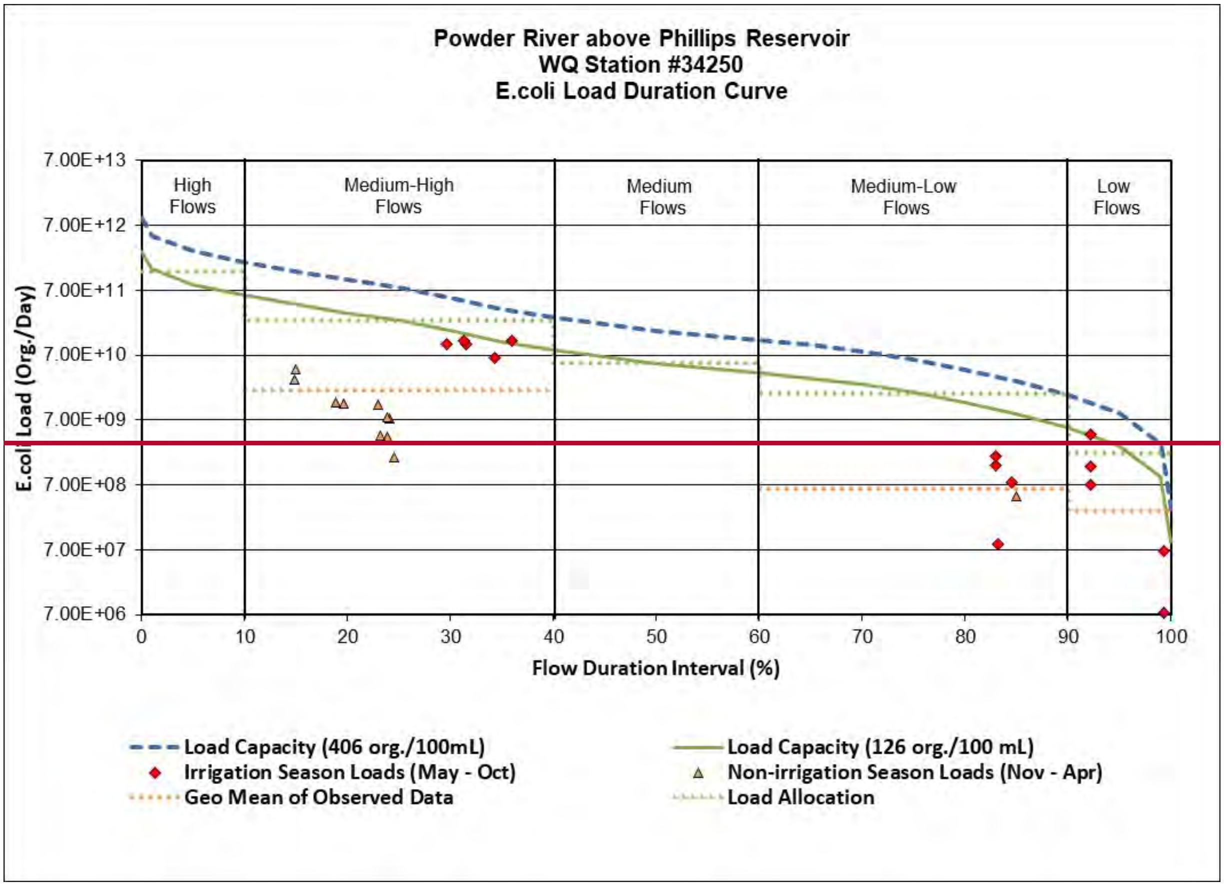
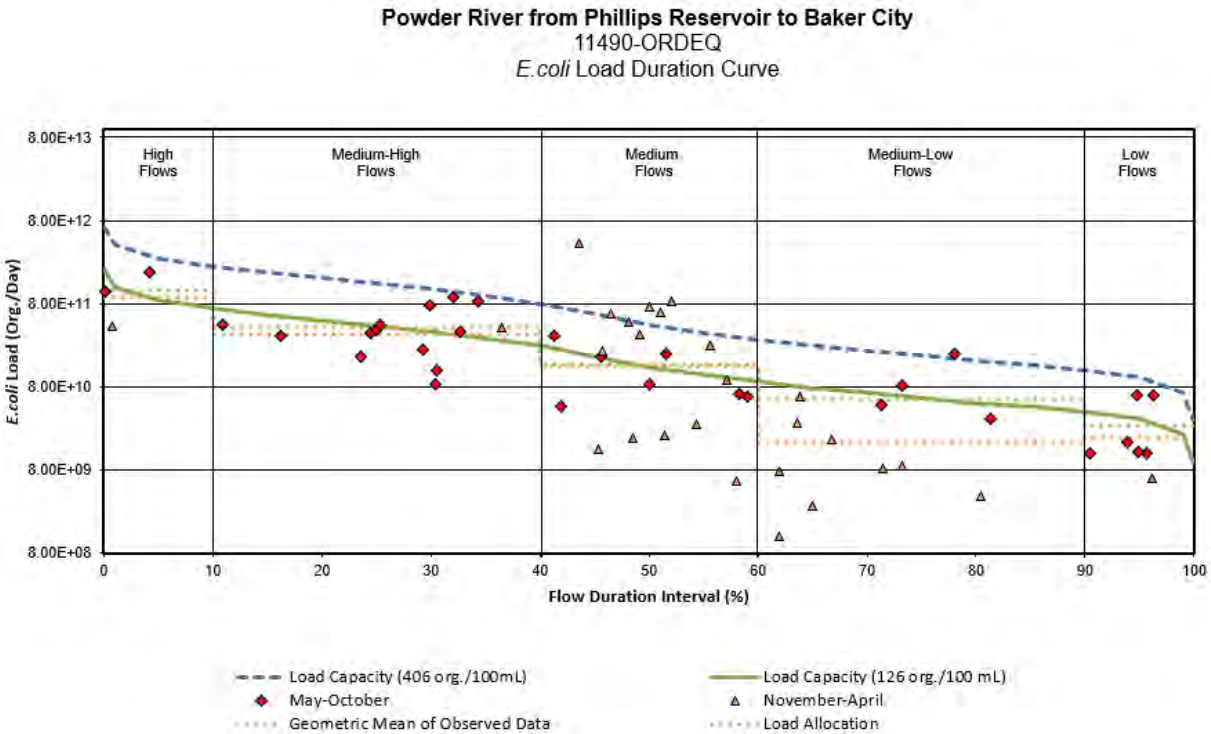


Figure 4.5.1a: *E. coli* load duration curve for the Powder River above upstream of Phillips Reservoir

Figure 18: ~~*E. coli*~~*E. coli* load duration curve for the Powder River from Phillips Reservoir to Baker City



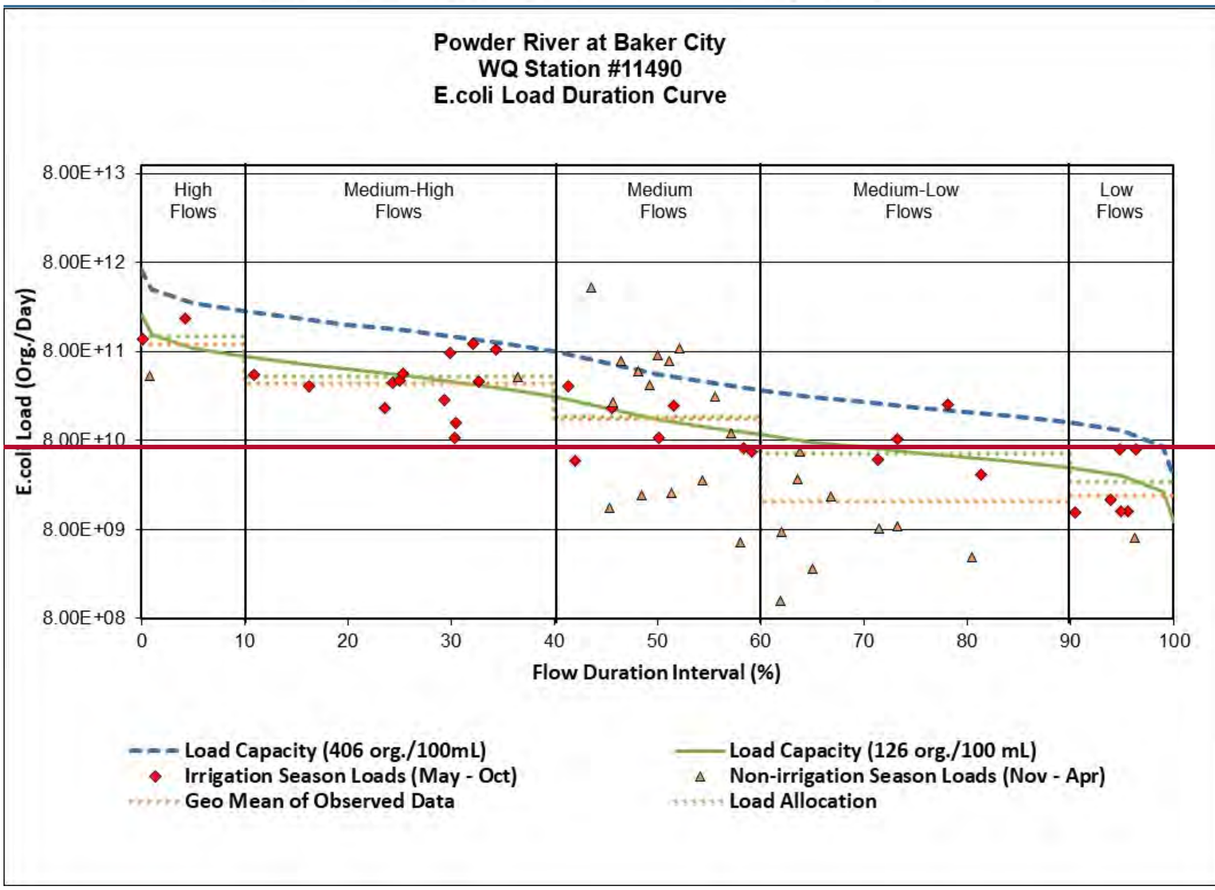
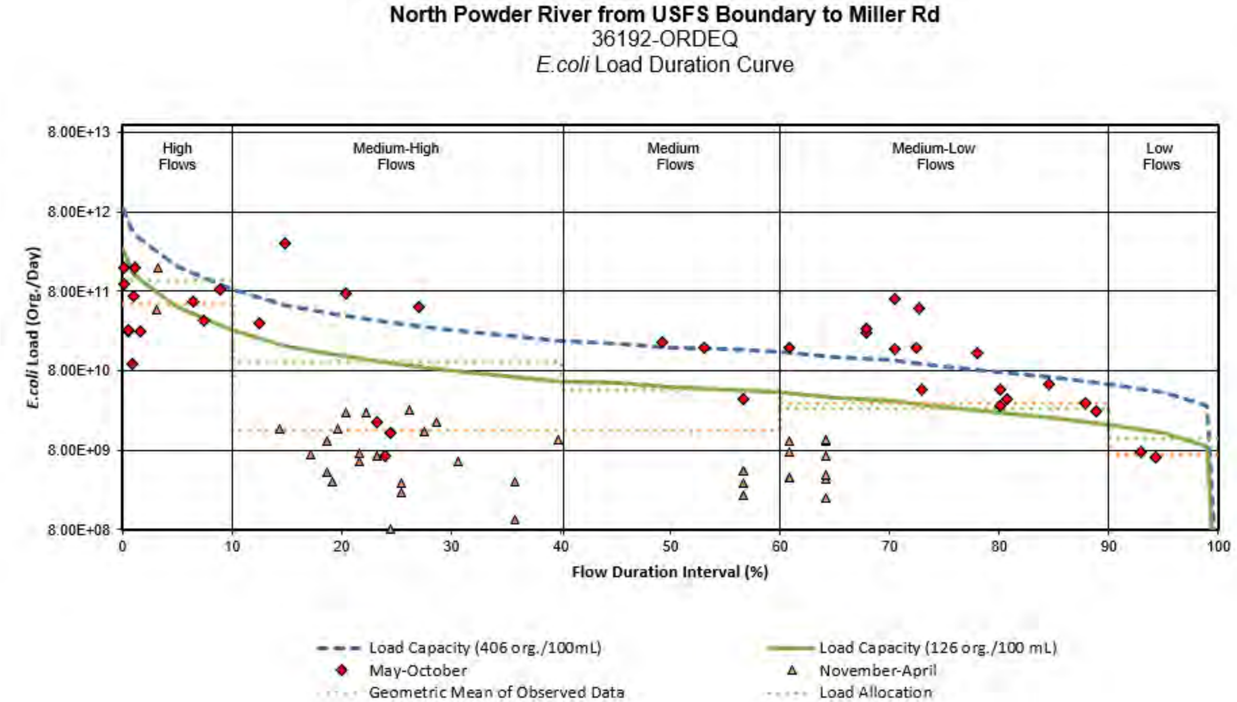


Figure 4.5.1b: *E. coli* load duration curve for the Powder River from Phillips Reservoir to Baker CityPowder River at Baker City

Figure 19: ~~E. coli~~E. coli load duration curve for the North Powder River from USFS Boundary to Miller Rd.



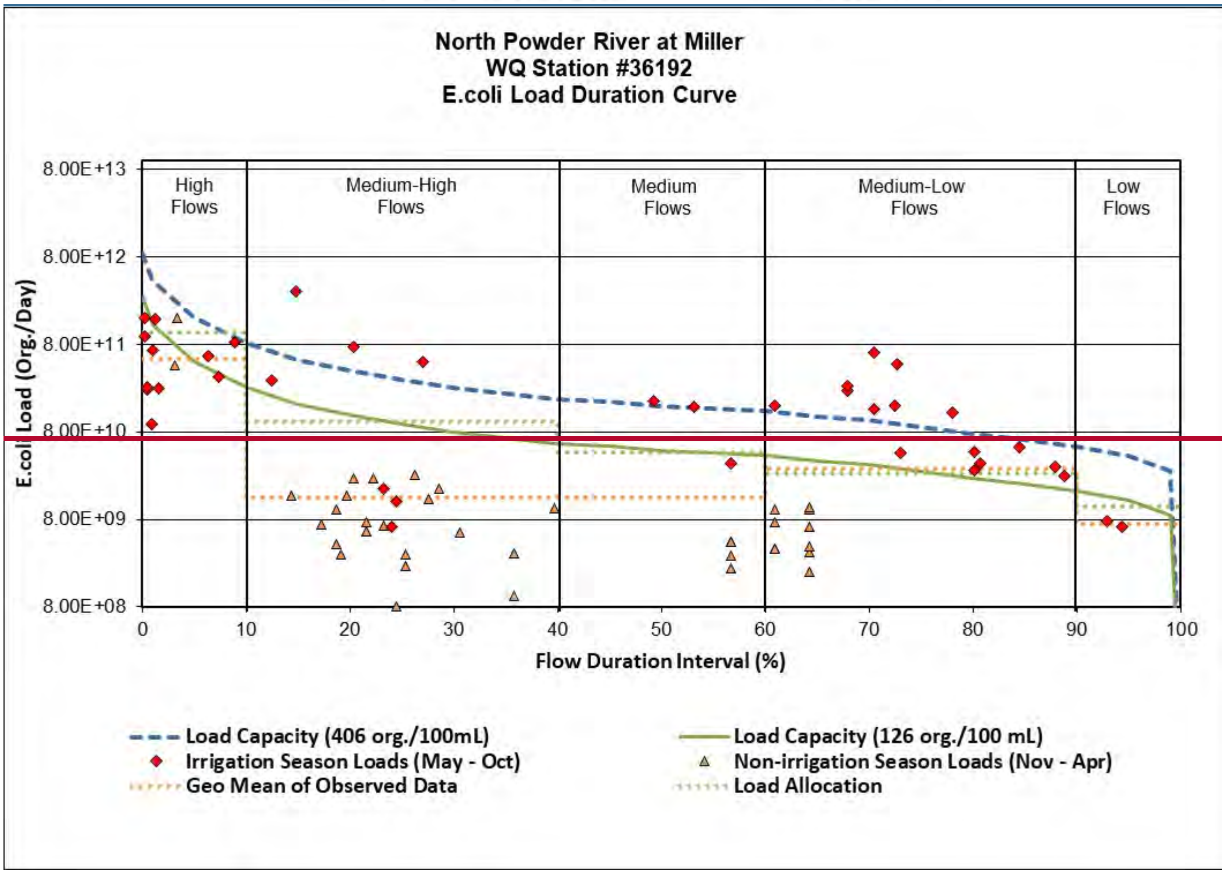
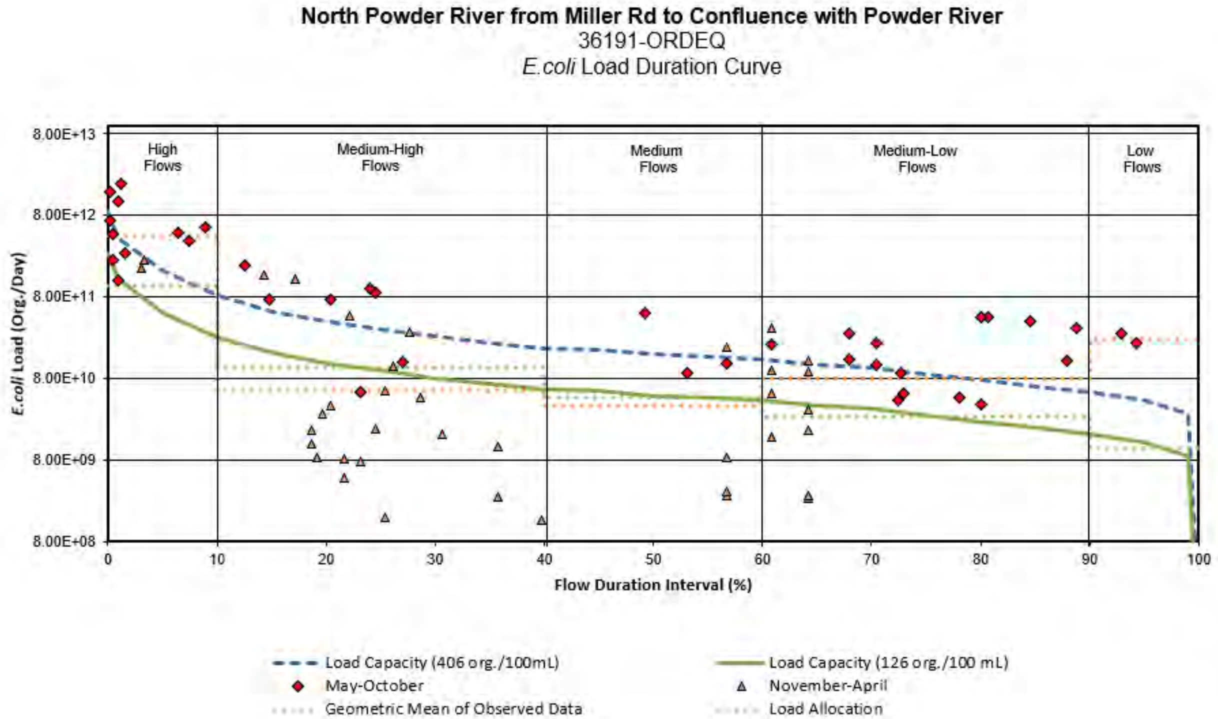
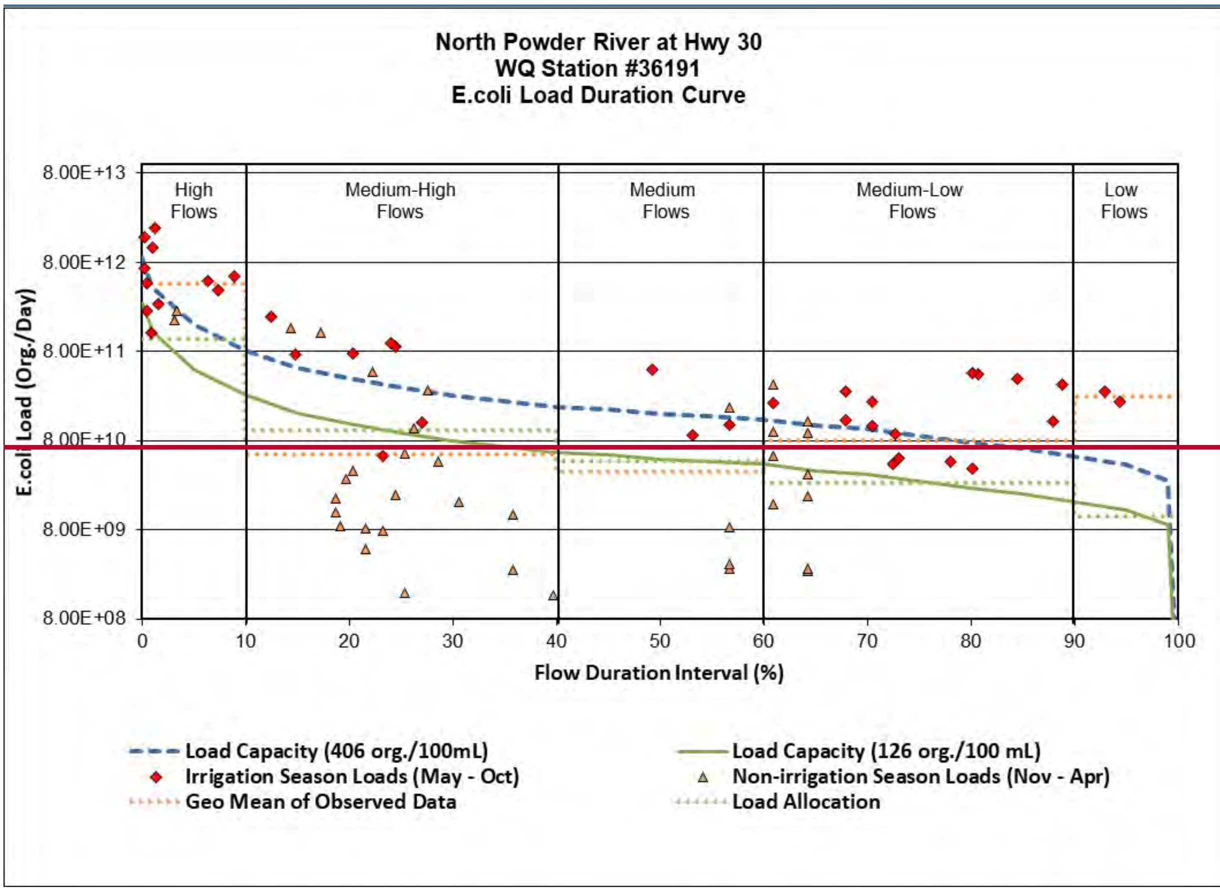


Figure 4.5.1c: *E. coli* load duration curve for the North Powder River from USFS Boundary to Miller RdNorth Powder River at Miller Road

Figure 20: ~~*E. coli*~~*E. coli* load duration curve for the North Powder River from Miller Rd. to confluence with Powder River





~~**Figure 4.5.1d: *E. coli* load duration curve**~~ **for the** ~~**North Powder River from Miller Rd to Confluence with Powder River**~~ ~~**North Powder River at Highway 30**~~

Figure 21: ~~*E. coli*~~*E. coli* load duration curve for Eagle Creek from New Bridge to Brownlee Reservoir

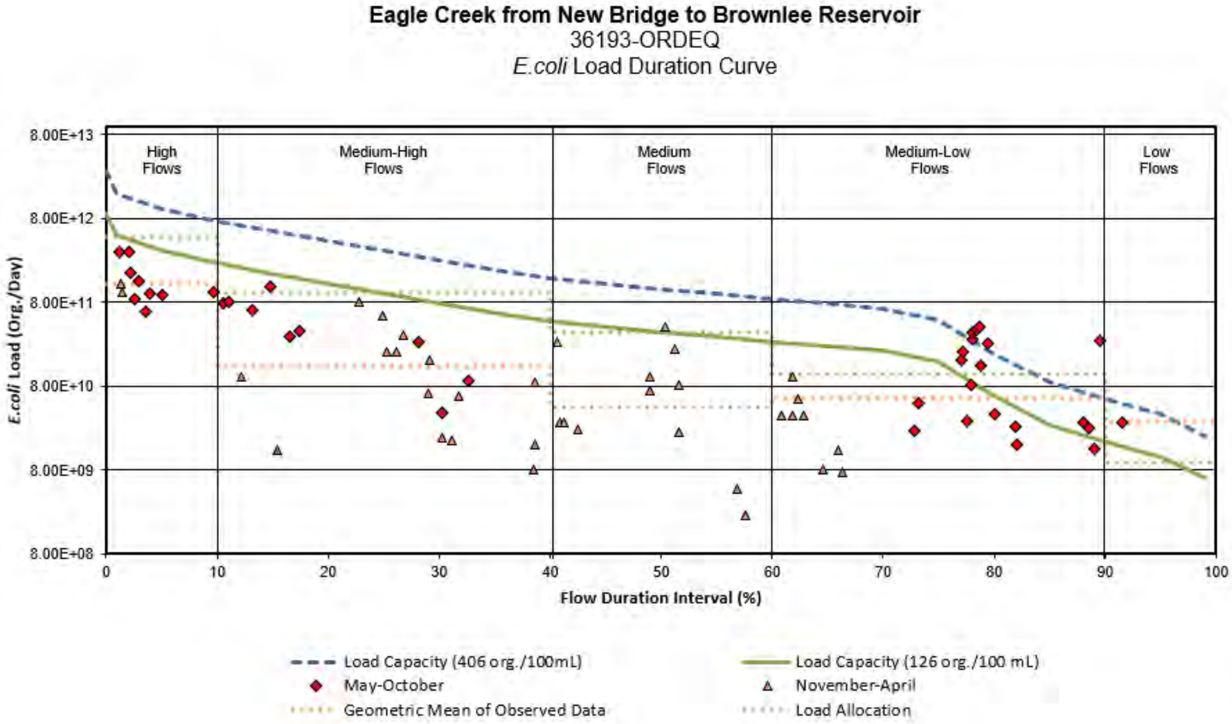
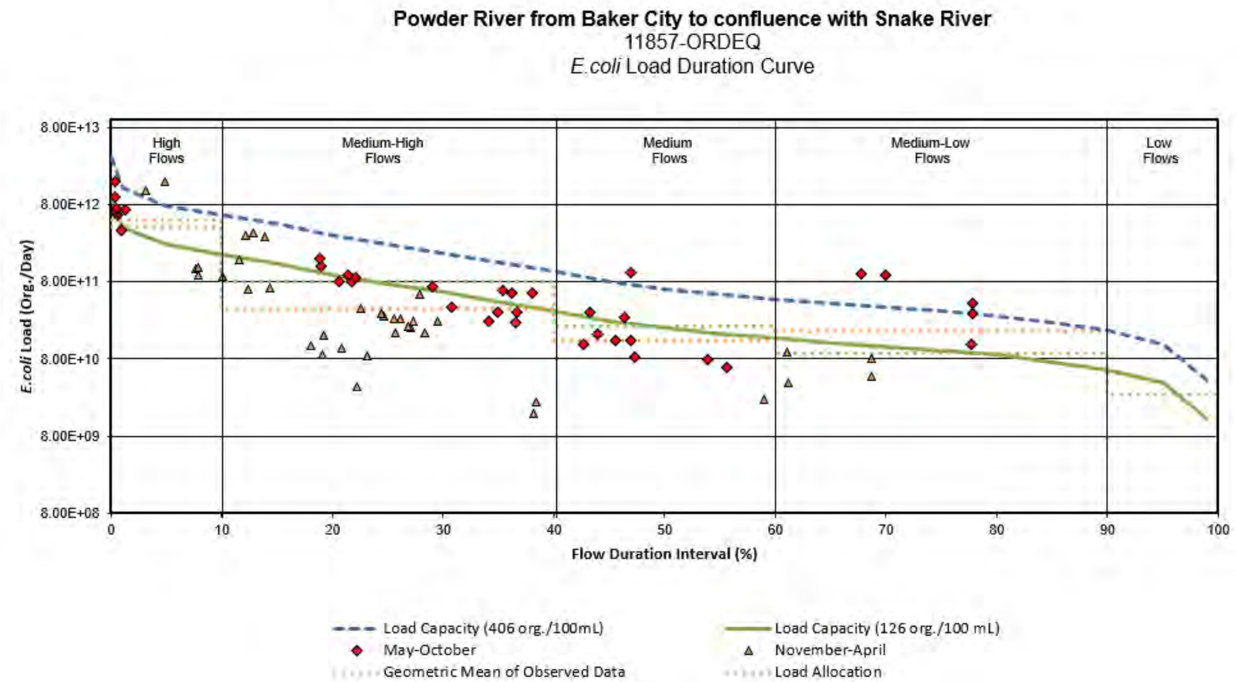
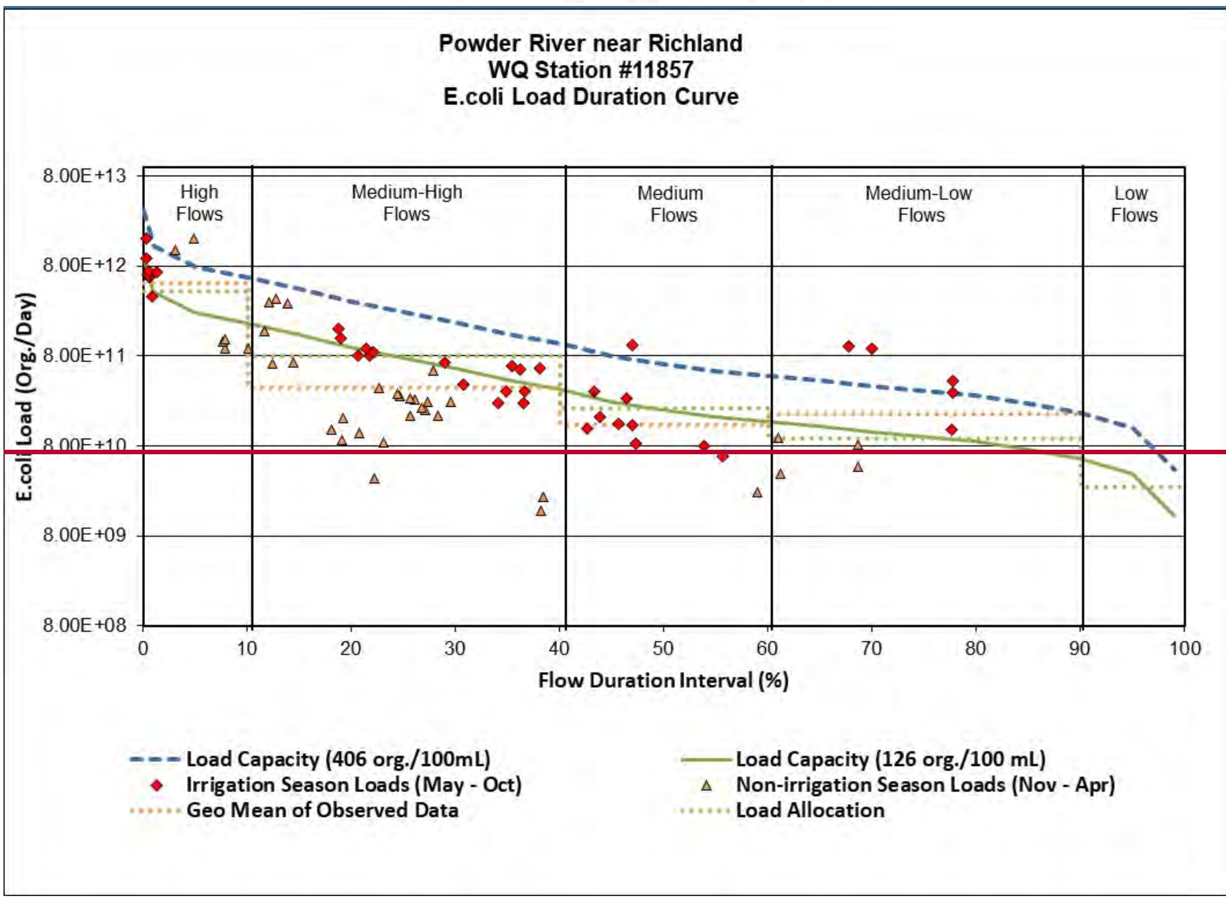


Figure 22: ~~*E. coli*~~*E. coli* load duration curve for the Powder River from ~~Thief Valley Reservoir to near Richland~~Baker City to confluence with Snake River





~~**Figure 4.5.1e: *E. coli* load duration curve for the Powder River from Thief Valley Reservoir to near Richland Powder River near Richland**~~

Figure 21: *E. coli* load duration curve for Eagle Creek from New Bridge to Brownlee Reservoir

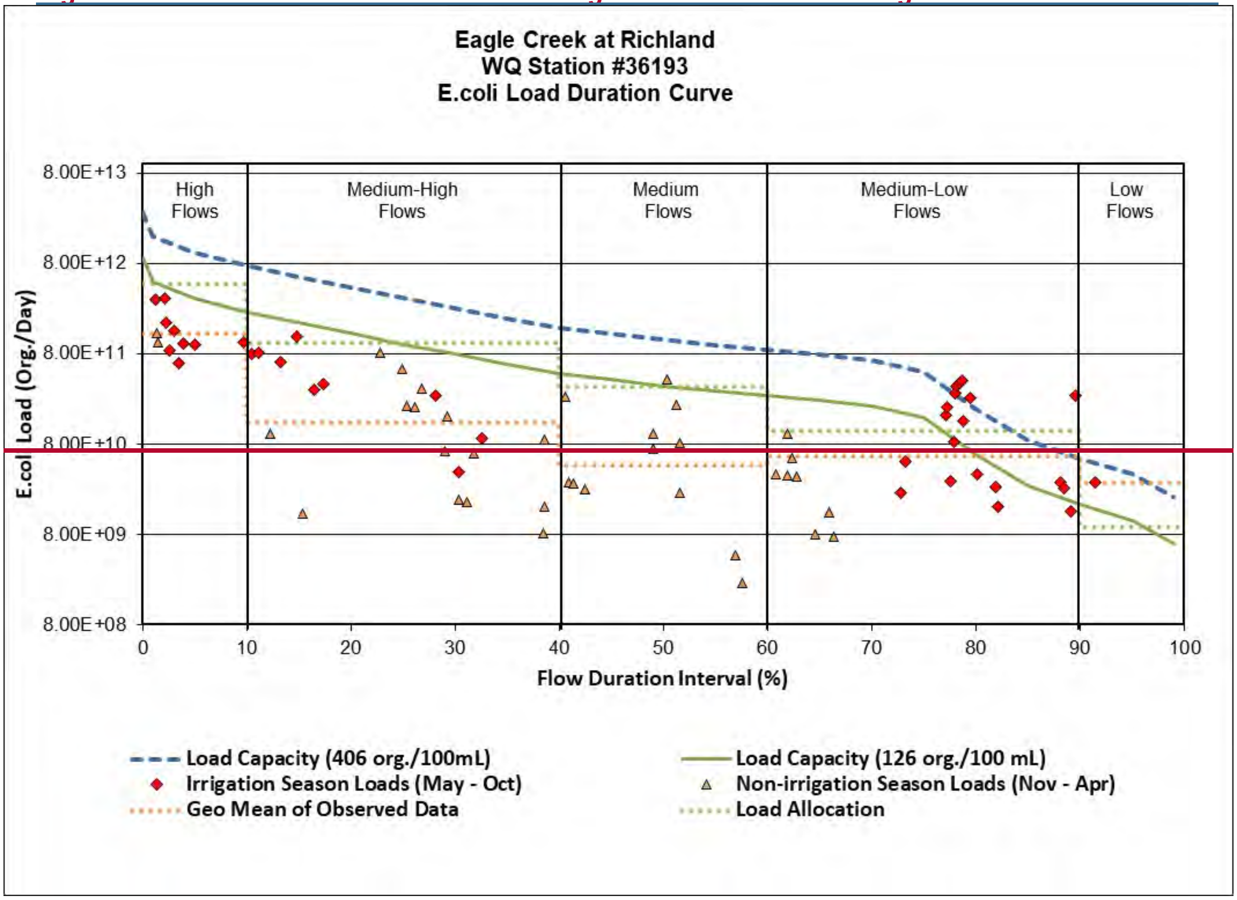
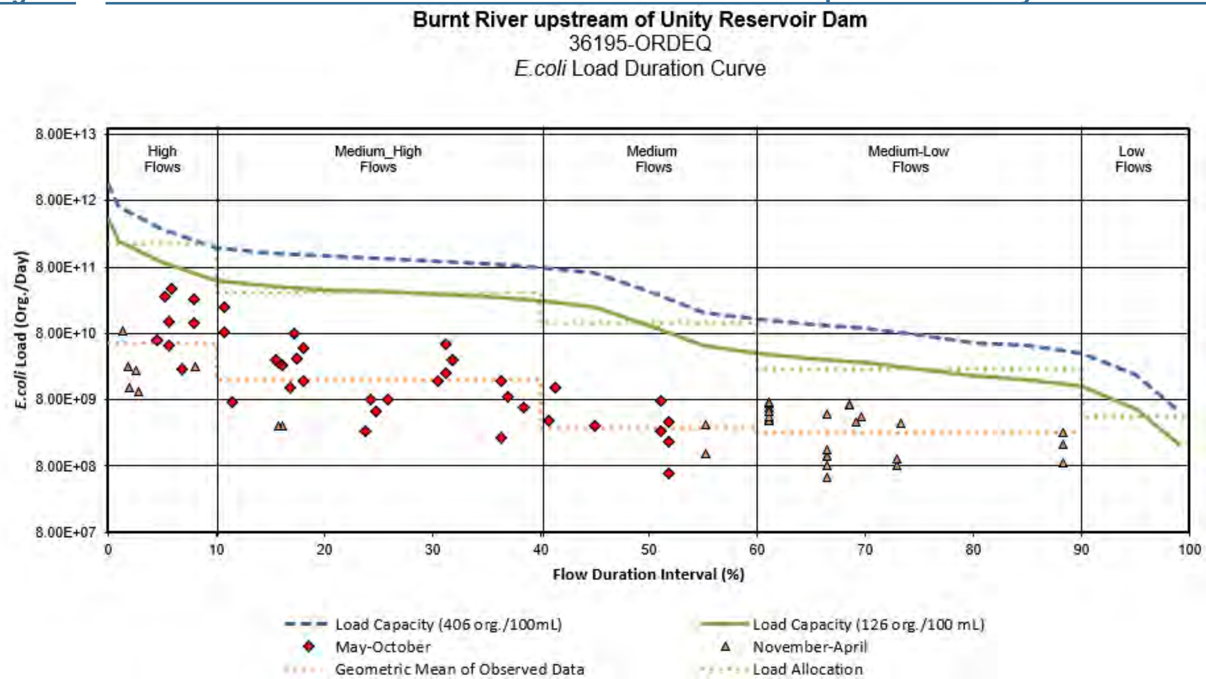
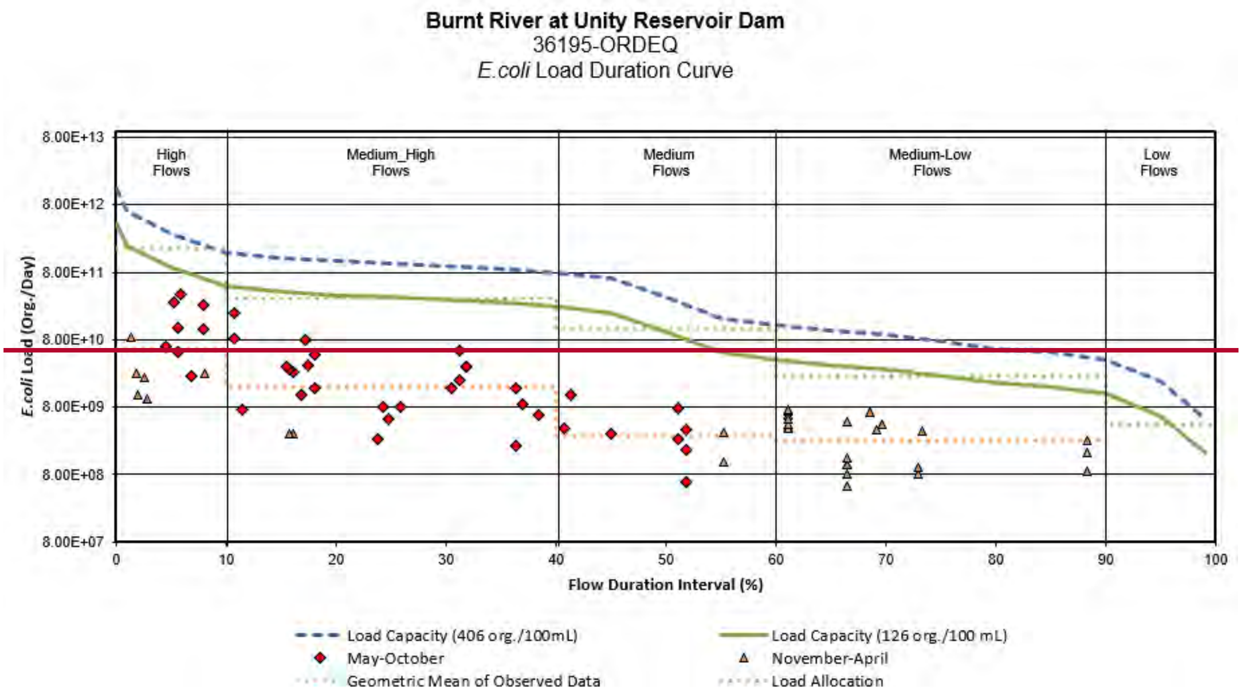
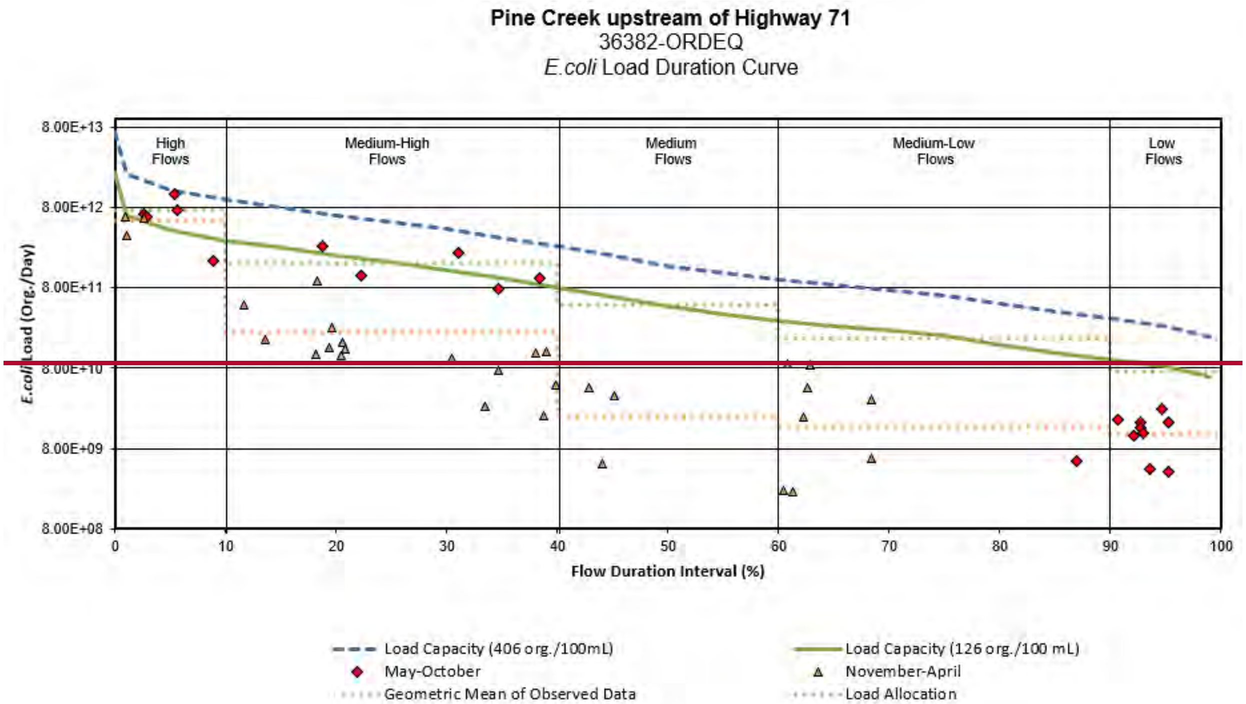


Figure 4.5.1f: *E. coli* load duration curve Eagle Creek near Richland

Figure 23: ~~*E. coli*~~*E. coli* load duration curve for the Burnt River ~~at~~upstream of Unity Reservoir Dam







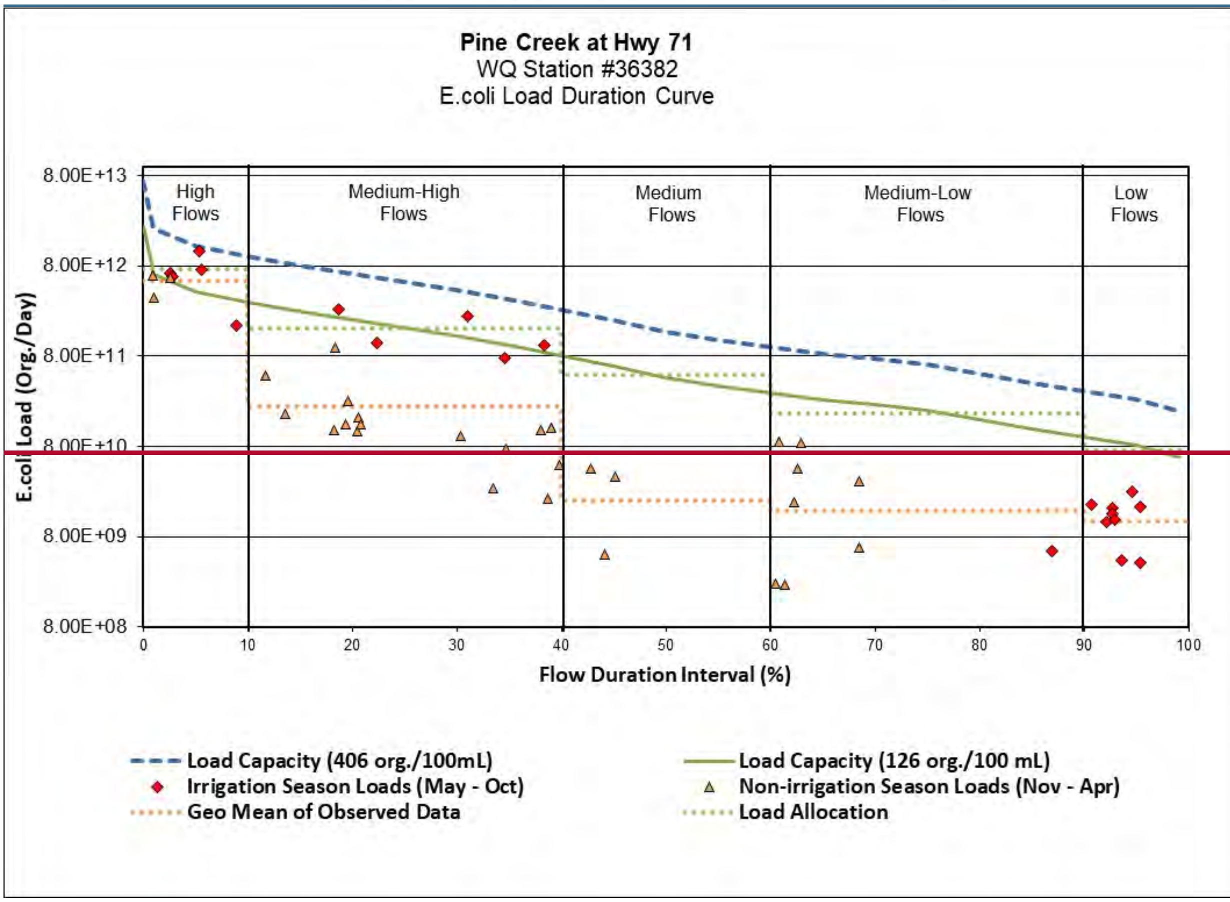
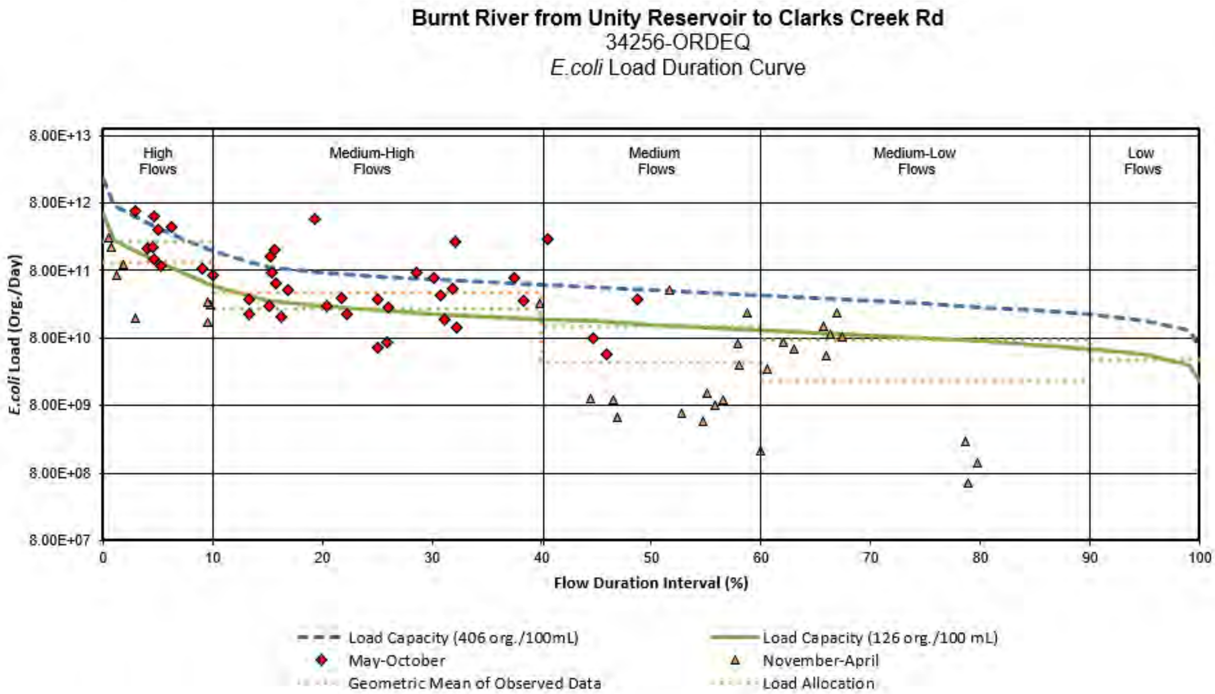
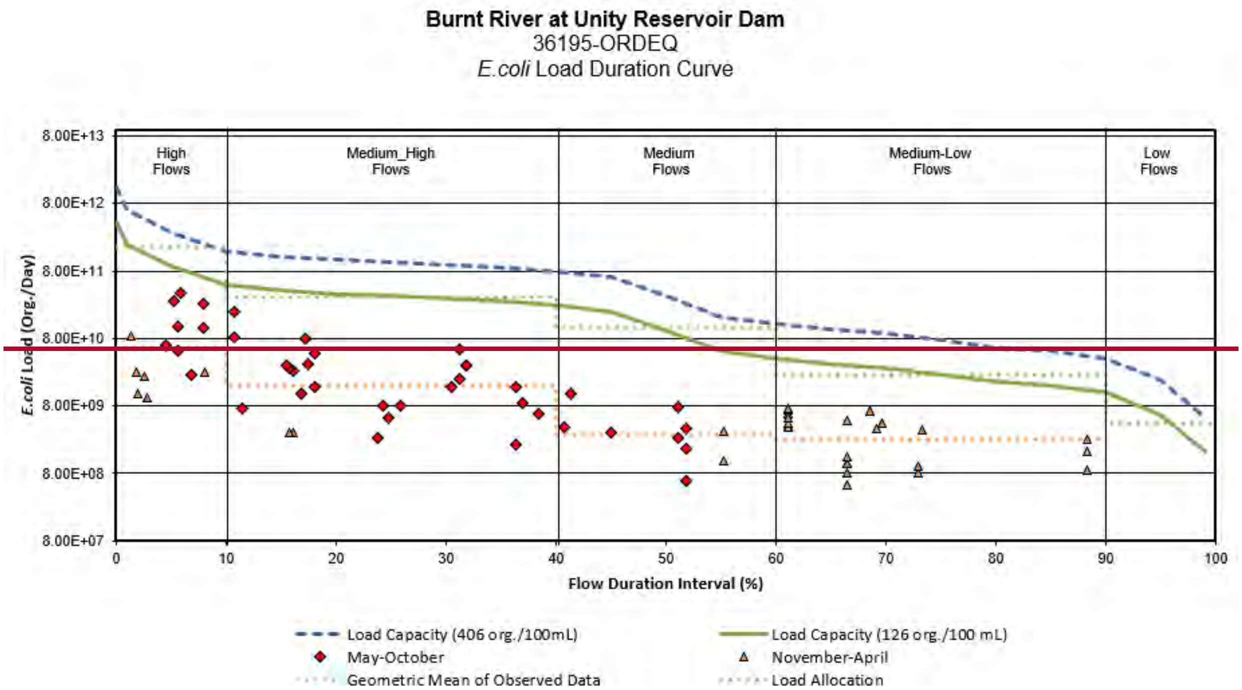


Figure 4.5.1g: *E. coli* load duration curve Pine Creek at upstream of Highway 71

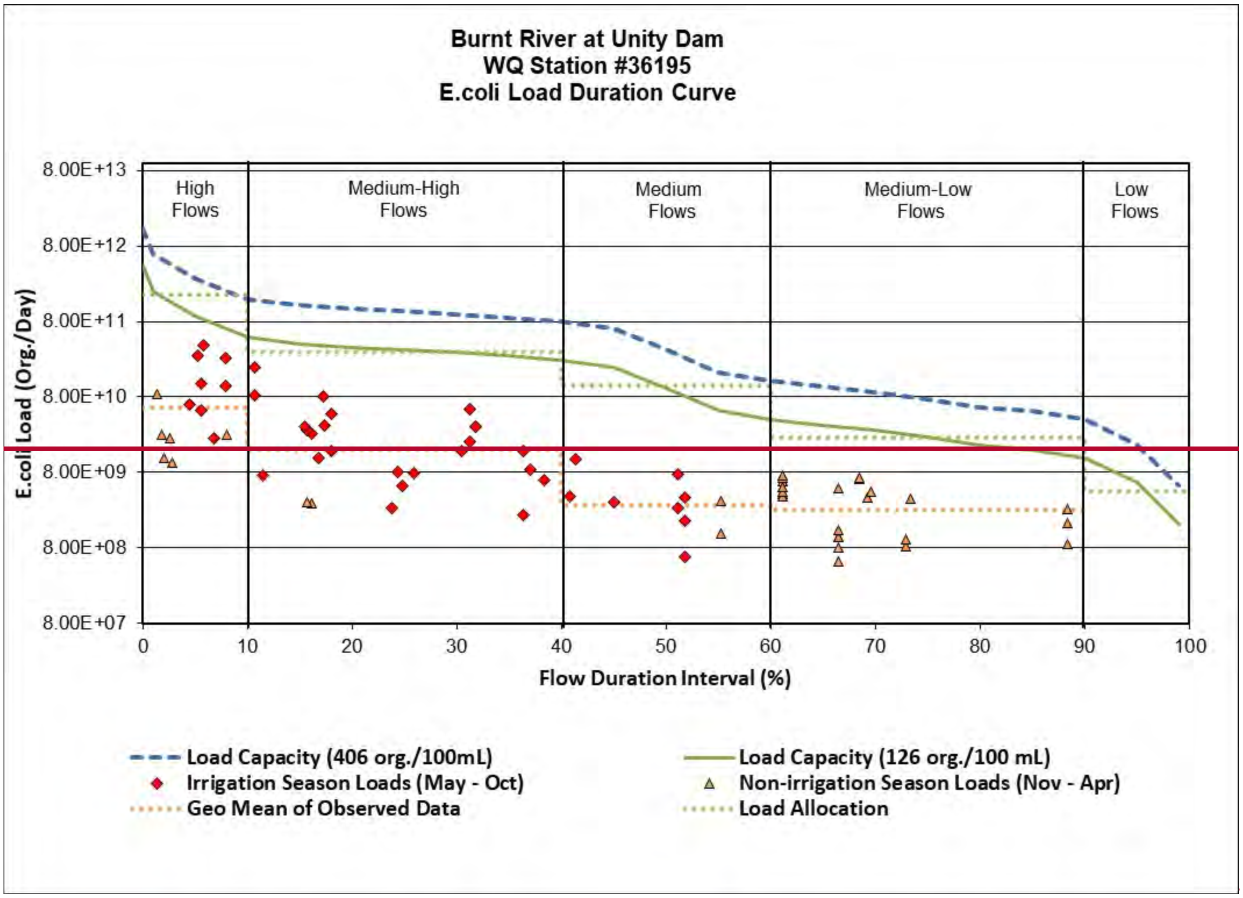
Figure 24: ~~*E. coli*~~*E. coli* load duration curve for the Burnt River from Unity Reservoir to Clarks Creek Rd.



Burnt River from Unity Reservoir to Clarks Creek Rd
34256-ORDEQ
E.coli Load Duration Curve
High Flows
Medium-High Flows
Medium Flows
Medium-Low Flows
Low Flows
8.00E+13
8.00E+12
8.00E+11
8.00E+10
8.00E+09
8.00E+08
8.00E+07
E.coli Load (Org./Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Load Capacity (406 org./100mL)
May-October
Geometric Mean of Observed Data
Load Capacity (126 org./100 mL)
November-April
Load Allocation

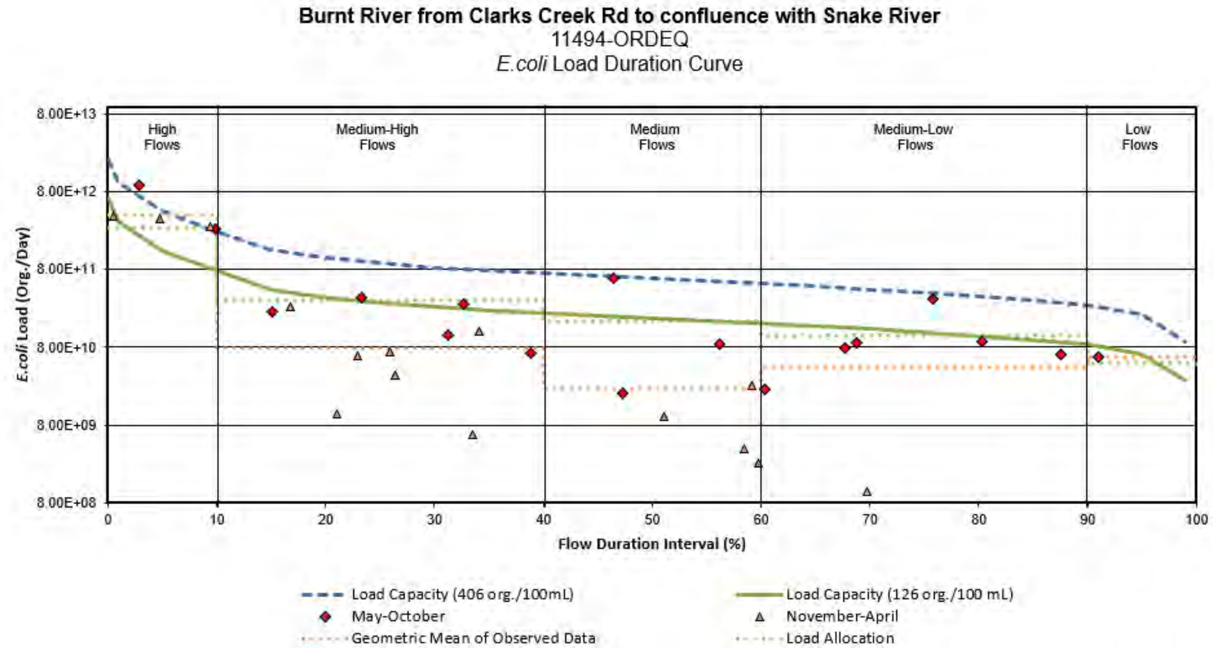


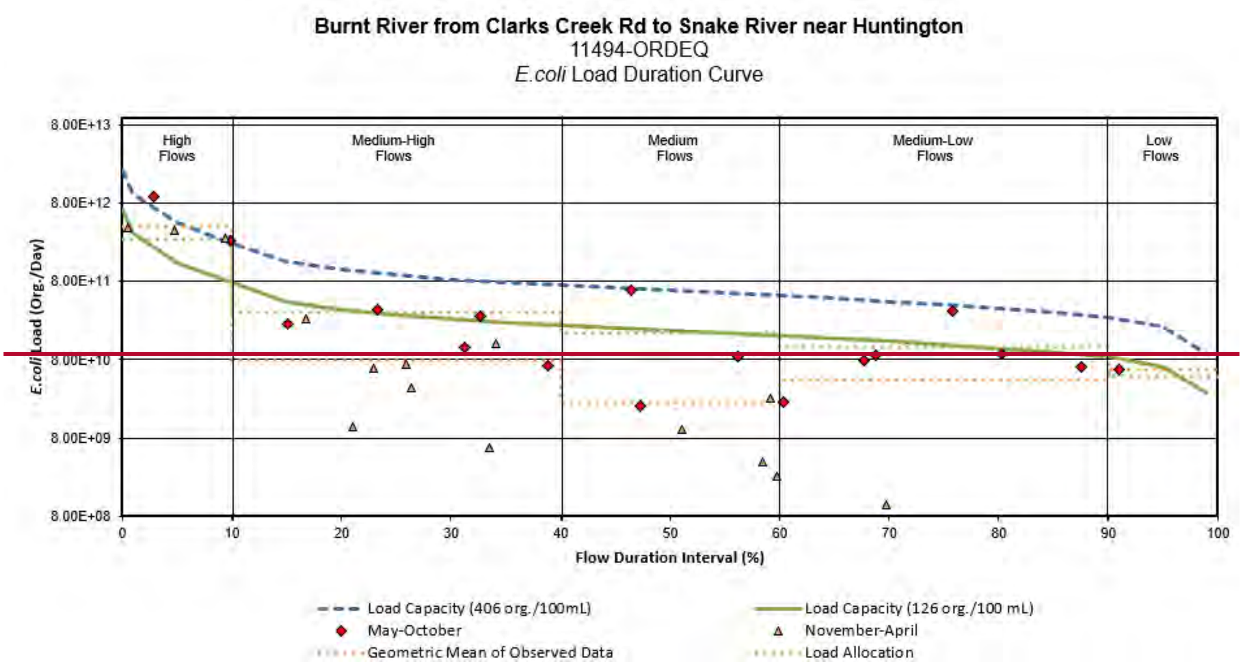
Burnt River at Unity Reservoir Dam
36195-ORDEQ
E.coli Load Duration Curve
High Flows
Medium_High Flows
Medium Flows
Medium-Low Flows
Low Flows
8.00E+13
8.00E+12
8.00E+11
8.00E+10
8.00E+09
8.00E+08
8.00E+07
E.coli Load (Org./Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Load Capacity (406 org./100mL)
May-October
Geometric Mean of Observed Data
Load Capacity (126 org./100 mL)
November-April
Load Allocation

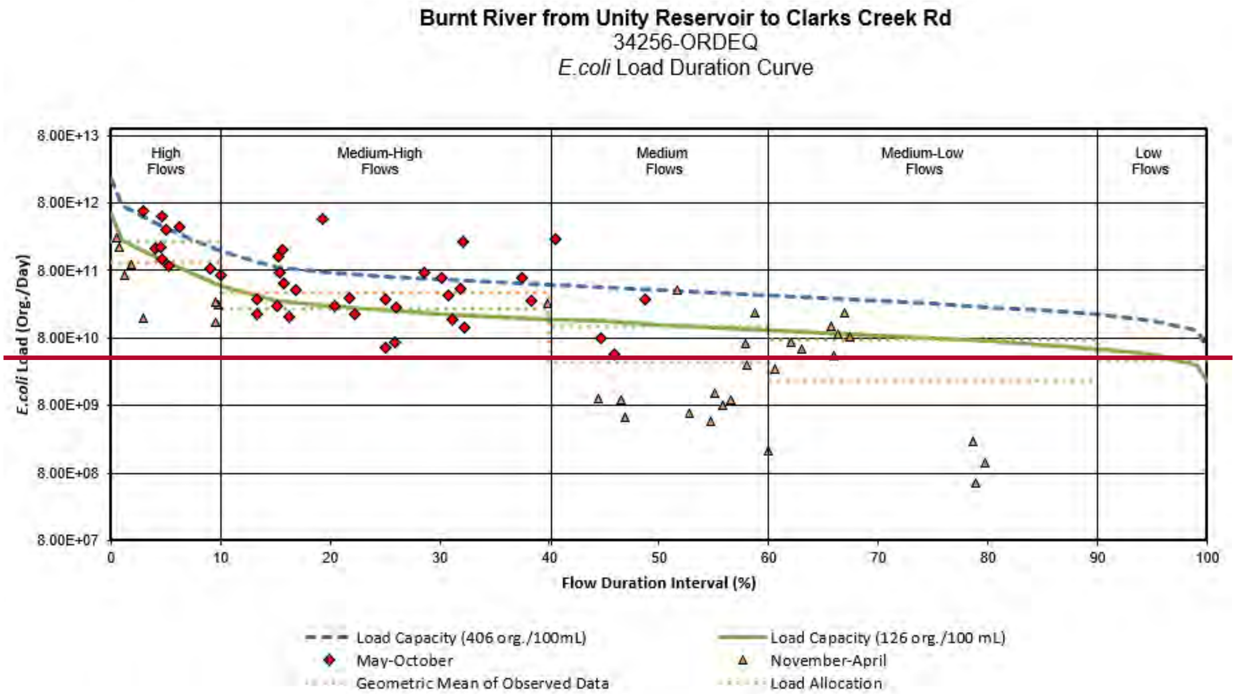


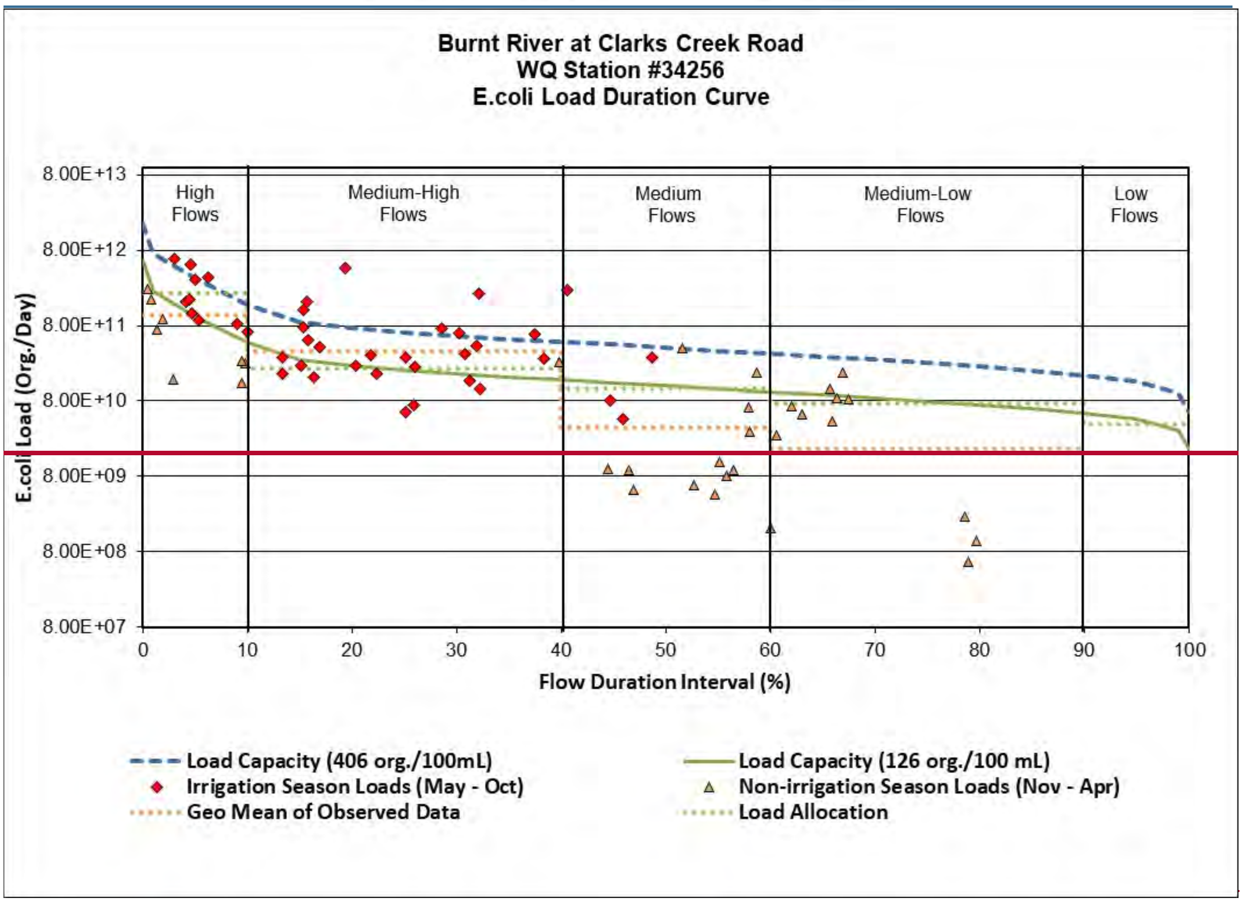
~~Figure 4.5.1h: *E. coli* load duration curve Burnt River at Unity Reservoir~~ Dam

Figure 25: ~~*E. coli*~~*E. coli* load duration curve for the Burnt River from Clarks Creek Rd. to ~~Snake River near Huntington~~confluence with Snake River



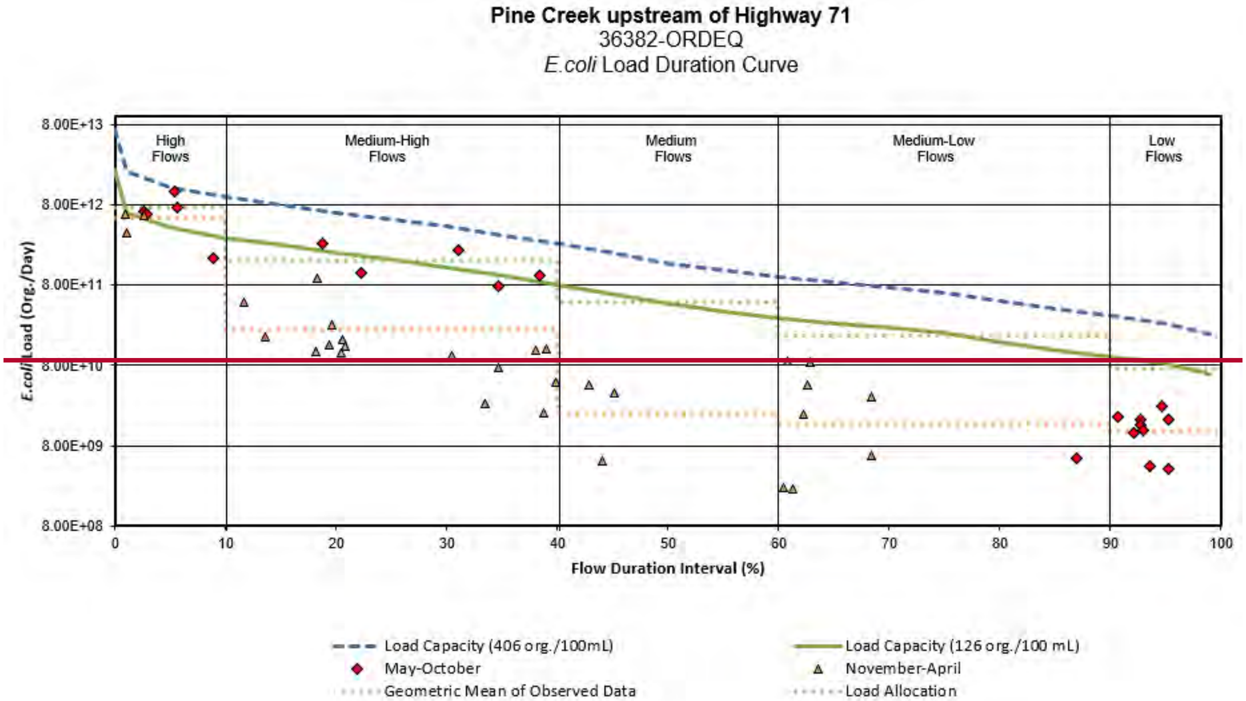






~~**Figure 4.5.1i: *E. coli* load duration curve Burnt River at Clarks Creek Road**~~

Figure 25: *E. coli* load duration curve for Pine Creek upstream of Highway 71



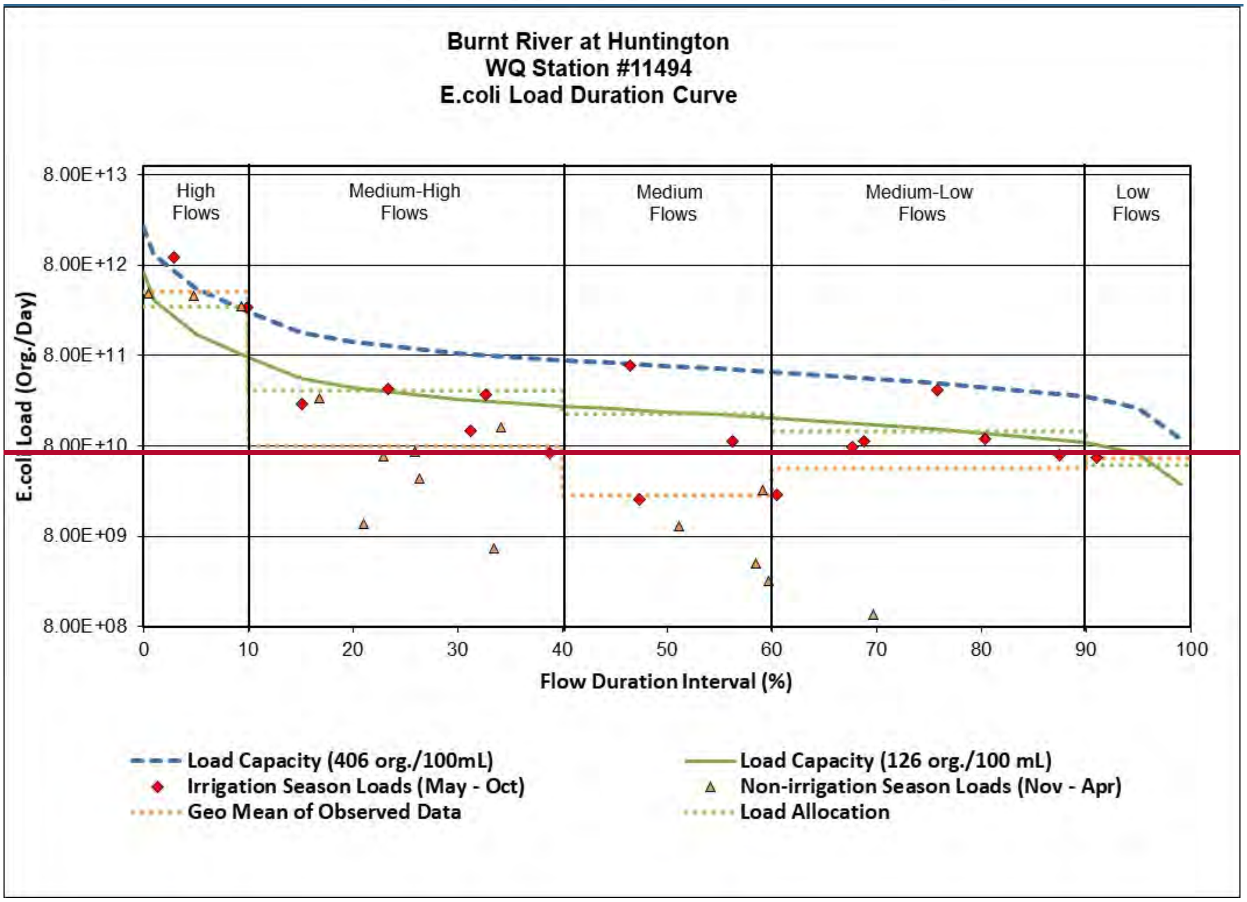


Figure 4.5.1j: *E. coli* load duration curve for the Burnt River from Clarks Creek Rd to Snake River near HuntingtonBurnt River at Huntington

4.5.2 Load duration curves ~~calculated outputs~~

DEQ used the ~~evaluated the outputs and~~load duration curves ~~calculated by EPA and selected paired sets of calculations for the geometric mean and single sample maximum criteria from 10 locations representing the range of flows~~described in Section 4.5.1 to determine the percent reductions needed to meet loading capacity for both geometric mean and single sample criteria and allocate the loading capacity into LA, WLAs, and a MOS (RC was 0) for all flow categories in each of the 10 named stream reaches ~~during irrigation season and non-irrigation season~~for the November-April and May-October seasonal periods (Section 4.5.1). Dividing the analysis between these two ~~water management-based~~ periods provides ~~insight~~ information ~~onto~~ on potential *E. coli* ~~the~~ sources and ~~transport~~ surface water delivery mechanisms ~~for *E. coli* to receiving waters~~. Load duration curves were calculated for reaches where percent reductions could be calculated for both geometric mean and single sample criteria for at least three of the five flow categories in November-April and May-October.~~For example, if the highest percent reductions need to occur during the irrigation season in areas where livestock only have access during the non-irrigation period, then reducing livestock access or removing manure deposits before irrigation season and/or changes to irrigation practices may be needed to achieve reductions year-round.~~

DEQ ~~used the approach to apply~~set the excess load reduction required for achieving water quality standards to the maximum percent reduction needed to meet either geometric mean or single sample criteria within individual flow categories and seasons to all criteria, flow categories, and seasons for each of the 10 stream reaches. Using this approach ensures that both criteria will be met during all flow conditions and across seasons. ~~-~~This approach ~~is appropriate because of the potential for disconnect~~ can also help identify sources and practices that lead to disconnect between ~~when and where~~the input of fecal bacteria to ~~are deposited on the~~ landscapes ~~in manure~~ and ~~the~~ flow ~~mechanisms~~ processes that can mobilize ~~responsible for delivering fecal bacteria~~it to surface waters ~~(runoff and irrigation practices)~~.

~~Load duration curves were calculated for reaches in which enough data were collected to allow for calculations of percent reductions for both geometric mean criteria and single sample criteria for at least three of the five flow categories for non-irrigation and irrigation seasons. For the flow category/season combinations in which data were not available to calculate percent reductions for both geometric mean and single sample criteria, the maximum percent reduction identified for the reach applied.~~

~~Except for converting to DEQ's flow categories and simplifying titles,~~ Tables ~~4.5.2a through 4.5.2nn~~10-49 ~~are excerpted directly from EPA's technical memorandum~~display the load duration curve calculations and the allocations for *E. coli* in the Powder River Basin (EPA, 2019). ~~In each of these tables, potential allocations are highlighted with orange shading.~~ The ~~potential load~~ allocations ~~presented are the determined loading capacity needed~~include the MOS, RC, WLAs (point sources), and LAs (nonpoint source) needed to meet ~~to meet that~~the applicable ~~bacteria~~~~*E. coli*~~*E. coli* criterion ~~minus explicit calculations of margin of safety (explicitly calculated as 10% of the loading capacity, See Section 6.4) and reserve capacity (calculated as 0% of the load capacity see Section 6.3)~~. ~~When adequate data were available, percent reductions are were calculated as: Percent Reduction = (Measured Load - Load Capacity) / (Measured Load) * 100; and are highlighted in yellow.~~

The percent reduction represents the amount of the current load that needs to be reduced for the applicable water quality standardcriteria for *E. coliE. coli* to be met. Tables 4.5.2oo50 and 4.5.2pp51 summarize measured loads, load capacities, and, where applicable, percent reductions needed to meet load capacities for all flow categories and irrigation/non-irrigation seasonal categoriess. Table 4.5.2qq52 summarizes the maximum percent reductions across all flow categories and seasonsseason categories. These maximum percent reductions apply across all flow categories and seasons as a layer of insurance that water quality standards to ensure that criteria are met.

DEQ presents fFinal allocations for each of the 10 stream reaches can be found in Tables 910-134.1b-f in the TMDL document. For allocations by stream reach and flow category (inclusive of both November-April and May-Octobernon-irrigation and irrigation season), DEQ calculated loading capacities using the geometric mean criterion for *E. coliE. coli* (126 organisms/100 mL). Using this allocation approach ensures that both single sample and geometric mean criteria for *E. coliE. coli* will be met. Maximum percent reductions needed based on geometric mean or single sample criteria across flow categories and seasons provide an additional margin of safetyMOS to ensure that *E. coliE. coli* criteria are met with pollution reduction activities.

Table 34: Load duration calculations for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geometric mean of loading capacity in each flow group)				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
Margin of Safety (10% of LC)		-	-	-
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
Load Allocation			-	-
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured Load (geometric mean of observed values in each flow group)				
5.65E+12	1.40E+12	N/A	5.53E+09	1.20E+10
Percent Reduction (all seasons)		-	-	-
0	0	N/A	0	0

Table 35: Load duration calculations for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geometric mean of loading capacity in each flow group)				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
Margin of Safety (10% of LC)		-	-	-
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
Reserve Capacity (5% of LC)		-	-	-
4.13E+11	9.05E+10	2.70E+10	1.03E+10	4.01E+09
Wasteload Allocation				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
Load Allocation: TMDL LC - MOS			-	-
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured Load (geometric mean of observed values in each flow group)				
5.07E+12	1.25E+11	2.04E+10	1.73E+10	N/A
Percent Reduction (all seasons)		-	-	-
0	0	0	0	N/A

Table 36: Load duration calculations for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.17E+13	2.65E+12	N/A	5.53E+09	2.53E+10
Flow (on day with highest measured value)				-
1310	692	N/A	38	27
Load Capacity (on day with highest measured value)				
1.30E+13	6.87E+12	N/A	3.74E+11	2.71E+11
Margin of Safety (10% of LC)		-	-	-
1.30E+12	6.87E+11	N/A	3.74E+10	2.71E+10
Reserve Capacity (0% of LC)				
0	0	N/A	0	0
Wasteload Allocation				
1.30E+11	6.87E+10	N/A	3.74E+09	2.71E+09
Load Allocation				
1.16E+13	6.12E+12	N/A	3.33E+11	2.41E+11
Percent Reduction		-	-	-
0	0	N/A	0	0

Table 37: Load duration calculations for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
6.18E+12	9.79E+11	4.52E+10	8.95E+10	N/A
Flow (on day with highest measured value)				-
2190	702	228	98	N/A
Load Capacity (on day with highest measured value)				
2.18E+13	6.97E+12	2.26E+12	9.74E+11	N/A
Margin of Safety (10% of LC)		-	-	-
2.18E+12	6.97E+11	2.26E+11	9.74E+10	N/A
Reserve Capacity (0% of LC)				
0	0	0	0	N/A
Wasteload Allocation				
2.18E+11	6.97E+10	2.26E+10	9.74E+09	N/A
Load Allocation				
1.94E+13	6.21E+12	2.02E+12	8.67E+11	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 10: Load duration calculation for the Powder River above Phillips Reservoir (34250-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2a: Load duration calculations Powder River above Phillips Reservoir (34250-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group)				-
1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
Margin of Safety (10% of LC)		-	-	-
1.53E+11	2.64E+10	5.86E+09	1.98E+09	2.38E+08
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation			-	-
1.53E+10	2.64E+09	5.86E+08	1.98E+08	2.38E+07
Load Allocation	-	-		
1.36E+12	2.35E+11	5.22E+10	1.76E+10	2.12E+09
Measured Load (geo mean of observed values in each flow group) -				
N/A	9.86E+10	N/A	6.44E+08	2.86E+08
Percent Reduction		-	-	-
N/A	0	N/A	0	0

Table 11: Load duration calculations for the Powder River above Phillips Reservoir (34250-ORDEQ) - geometric mean criteria from November to April

Table 4.5.2b: Load duration calculations Powder River above Phillips Reservoir (34250-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group)				-
1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
Margin of Safety (10% of LC)		-	-	-
1.53E+11	2.64E+10	5.86E+09	1.98E+09	2.38E+08
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation			-	-
1.53E+10	2.64E+09	5.86E+08	1.98E+08	2.38E+07
Load Allocation	-	-		
1.36E+12	2.35E+11	5.22E+10	1.76E+10	2.12E+09
Measured Load (geo mean of observed values in each flow group) -				
N/A	9.05E+09	N/A	4.76E+08	N/A
Percent Reduction		-	-	-
N/A	0	N/A	0	0

Table 12: Load duration calculations for the Powder River above Phillips Reservoir (34250-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2c: Load duration calculations Powder River above Phillips Reservoir (34250-ORDEQ) – single sample criteria – irrigation season

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Measured Load (highest value)~~			-	-
~~N/A~~	~~1.18E+11~~	~~N/A~~	~~1.97E+09~~	~~4.15E+09~~
~~Flow (cfs on day with highest measured value)~~				-
~~N/A~~	~~46~~	~~N/A~~	~~4~~	~~1~~
~~Load Capacity (on day with highest measured value)~~				
~~N/A~~	~~4.58E+11~~	~~N/A~~	~~3.48E+10~~	~~1.31E+10~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~N/A~~	~~4.58E+10~~	~~N/A~~	~~3.48E+09~~	~~1.31E+09~~
~~Reserve Capacity (0% of LC)~~				-
~~N/A~~	~~0~~	~~N/A~~	~~0~~	~~0~~
~~Wasteload Allocation~~				
~~N/A~~	~~4.58E+09~~	~~N/A~~	~~3.48E+08~~	~~1.31E+08~~
~~Load Allocation~~				-
~~N/A~~	~~4.07E+11~~	~~N/A~~	~~3.09E+10~~	~~1.17E+10~~
~~Percent Reduction~~		-	-	-
~~N/A~~	~~0~~	~~N/A~~	~~0~~	~~0~~

~~Table 13: Load duration calculations for the Powder River above Phillips Reservoir (34250-ORDEQ) - single sample criteria from November to AprilTable 4.5.2d: Load duration calculations Powder River above Phillips Reservoir (34250-ORDEQ) – single sample criteria – non-irrigation season~~

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Measured Load (highest value)~~			-	-
~~N/A~~	~~4.14E+10~~	~~N/A~~	~~4.76E+08~~	~~N/A~~
~~Flow (cfs on day with highest measured value)~~				-
~~N/A~~	~~130~~	~~N/A~~	~~3~~	~~N/A~~
~~Load Capacity (on day with highest measured value)~~				
~~N/A~~	~~1.29E+12~~	~~N/A~~	~~3.07E+10~~	~~N/A~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~N/A~~	~~1.29E+11~~	~~N/A~~	~~3.07E+09~~	~~N/A~~
~~Reserve Capacity (0% of LC)~~				-
~~N/A~~	~~0~~	~~N/A~~	~~0~~	~~N/A~~
~~Wasteload Allocation~~				
~~N/A~~	~~1.29E+10~~	~~N/A~~	~~3.07E+08~~	~~N/A~~
~~Load Allocation~~				-
~~N/A~~	~~1.15E+12~~	~~N/A~~	~~2.73E+10~~	~~N/A~~

Percent Reduction		-	-	-
N/A	0	N/A	0	N/A

Table 14: Load duration calculations for the Powder River at Baker City (11490-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2e: Load duration calculations Powder River at Baker City (11490-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group)				-
1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
Margin of Safety (10% of LC)	-	-	-	
1.31E+11	4.66E+10	1.64E+10	6.37E+09	3.02E+09
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
1.31E+10	4.66E+09	1.64E+09	6.37E+08	3.02E+08
Load Allocation		-	-	
1.17E+12	4.15E+11	1.46E+11	5.67E+10	2.68E+10
Measured Load (geo mean of observed values in each flow group) -				
1.44E+12	3.43E+11	1.10E+11	7.22E+10	2.30E+10
Percent Reduction	-	-	-	
9%	0%	0%	12%	0%

Table 15: Load duration calculations for the Powder River at Baker City (11490-ORDEQ) - geometric mean criteria from November to AprilTable 4.5.2f: Load duration calculations Powder River at Baker City (11490-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group)				-
1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
Margin of Safety (10% of LC)	-	-	-	
1.31E+11	4.66E+10	1.64E+10	6.37E+09	3.02E+09
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
1.31E+10	4.66E+09	1.64E+09	6.37E+08	3.02E+08
Load Allocation		-	-	
1.17E+12	4.15E+11	1.46E+11	5.67E+10	2.68E+10
Measured Load (geo mean of observed values in each flow group) -				

4.25E+11	4.12E+11	1.56E+11	8.65E+09	6.44E+09
Percent Reduction		-	-	-
0%	0%	0%	0%	0%

Table 16: Load duration calculations for the Powder River at Baker City (11490-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2g: Load duration calculations Powder River at Baker City (11490-ORDEQ) – single sample criteria –irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.88E+12	9.76E+11	3.25E+11	2.03E+11	6.40E+10
Flow (on day with highest measured value)				-
295	116	80	17	9
Load Capacity (on day with highest measured value)				
2.93E+12	1.15E+12	7.91E+11	1.69E+11	9.12E+10
Margin of Safety (10% of LC)		-	-	-
2.93E+11	1.15E+11	7.91E+10	1.69E+10	9.12E+09
Reserve Capacity (0% of LC)				-
0	0	0	0	0
Wasteload Allocation				
2.93E+10	1.15E+10	7.05E+09	1.69E+09	9.12E+08
Load Allocation (LC-RC)				-
2.60E+12	1.02E+12	6.28E+11	1.50E+11	8.12E+10
Percent Reduction		-	-	-
0	0	0	17%	0

Table 17: Load duration calculations for the Powder River at Baker City (11490-ORDEQ) - single sample criteria from November to AprilTable 4.5.2h: Load duration calculations Powder River at Baker City (11490-ORDEQ) – single sample criteria –non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
4.25E+11	4.12E+11	4.20E+12	6.05E+10	6.44E+09
Flow (on day with highest measured value)				-
370	97	71	24	9
Load Capacity (on day with highest measured value)				
3.68E+12	9.66E+11	7.05E+11	2.42E+11	9.17E+10
Margin of Safety (10% of LC)		-	-	-
3.68E+11	9.66E+10	7.05E+10	2.42E+10	9.17E+09
Reserve Capacity (0% of LC)				-

~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Wasteload Allocation~~				
~~3.68E+10~~	~~9.66E+09~~	~~7.05E+09~~	~~2.42E+09~~	~~9.17E+08~~
~~Load Allocation (LC-RC)~~				-
~~3.27E+12~~	~~8.60E+11~~	~~6.28E+11~~	~~2.16E+11~~	~~8.16E+10~~
~~Percent Reduction~~		-	-	-
~~0~~	~~0~~	~~83%~~	~~0~~	~~0~~

~~Table 18: Load duration calculations for the North Powder River at Highway 30 (36191-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2i: Load duration calculations North Powder River at Highway 30 (36191-ORDEQ) – geometric mean criteria – irrigation season~~

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Load Capacity (geo mean of loading capacity in each flow group)~~ -				
~~1.23E+12~~	~~1.19E+11~~	~~5.22E+10~~	~~3.00E+10~~	~~1.25E+10~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~1.23E+11~~	~~1.19E+10~~	~~5.22E+09~~	~~3.00E+09~~	~~1.25E+09~~
~~Reserve Capacity (0% of LC)~~		-	-	-
~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Wasteload Allocation~~				
~~1.23E+10~~	~~1.19E+09~~	~~5.22E+08~~	~~3.00E+08~~	~~1.25E+08~~
~~Load Allocation~~			-	-
~~1.10E+12~~	~~1.06E+11~~	~~4.64E+10~~	~~2.67E+10~~	~~1.12E+10~~
~~Measured Load (geo mean of observed values in each flow group)~~ -				
~~5.34E+12~~	~~4.90E+11~~	~~1.78E+11~~	~~1.46E+11~~	~~2.48E+11~~
~~Percent Reduction During Irrigation Season~~				-
~~77%~~	~~76%~~	~~71%~~	~~79%~~	~~95%~~

~~Table 19: Load duration calculations for the North Powder River at Highway 30 (36191-ORDEQ) - geometric mean criteria from November to AprilTable 4.5.2j: Load duration calculations North Powder River at Highway 30 (36191-ORDEQ) – geometric mean criteria – non-irrigation season~~

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Load Capacity (geo mean of loading capacity in each flow group)~~ -				
~~1.23E+12~~	~~1.19E+11~~	~~5.22E+10~~	~~3.00E+10~~	~~1.25E+10~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~1.23E+11~~	~~1.19E+10~~	~~5.22E+09~~	~~3.00E+09~~	~~1.25E+09~~
~~Reserve Capacity (0% of LC)~~		-	-	-

0	0	0	0	0
Wasteload Allocation				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
Load Allocation: TMDL LC- MOS-RC			-	-
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured Load (geo mean of observed values in each flow group) -				
2.01E+12	2.72E+10	1.12E+10	3.34E+10	N/A
Percent Reduction During Non-Irrigation Season				-
39%	0%	0%	10%	N/A

Table 20: Load duration calculations for the North Powder River at Highway 30 (36191-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2k: Load duration calculations North Powder River at Highway 30 (36191-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.96E+13	1.97E+12	5.00E+11	4.56E+11	2.84E+11
Flow (on day with highest measured value)				-
403	67	17	8	5
Load Capacity (on day with highest measured value)				
4.00E+12	6.66E+11	1.69E+11	7.65E+10	4.77E+10
Margin of Safety (10% of LC)		-	-	-
4.00E+11	6.66E+10	1.69E+10	7.65E+09	4.77E+09
Reserve Capacity (0% of LC)		-		
0	0	0	0	0
Wasteload Allocation				
4.00E+10	6.66E+09	1.69E+09	7.65E+08	4.77E+08
Load Allocation		-		
3.56E+12	5.92E+11	1.50E+11	6.81E+10	4.24E+10
Percent Reduction		-	-	-
80%	66%	66%	83%	83%

Table 21: Load duration calculations for the North Powder River at Highway 30 (36191-ORDEQ) - single sample criteria from November to AprilTable 4.5.2l: Load duration calculations North Powder River at Highway 30 (36191-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
2.26E+12	1.46E+12	1.90E+11	3.36E+11	N/A

Flow (on day with highest measured value)				-
238	57	15	14	N/A
Load Capacity (on day with highest measured value)				
2.36E+12	5.66E+11	1.49E+11	1.39E+11	N/A
Margin of Safety (10% of LC)		-	-	-
2.36E+11	5.66E+10	1.49E+10	1.39E+10	N/A
Reserve Capacity (0% of LC)				-
0	0	0	0	N/A
Wasteload Allocation				
2.36E+10	5.66E+09	1.49E+09	1.39E+09	N/A
Load Allocation				-
2.10E+12	5.04E+11	1.33E+11	1.24E+11	N/A
Percent Reduction		-	-	-
0%	61%	22%	59%	N/A

Table 22: Load duration calculations for the North Powder River at Miller Road (36192-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2m: Load duration calculations North Powder River at Miller Road (36192-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
Margin of Safety (10% of LC)		-	-	-
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
Load Allocation			-	-
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured Load (geo mean of observed values in each flow group) -				
4.97E+11	1.29E+11	9.96E+10	9.91E+10	7.05E+09
Percent Reduction		-	-	-
0	8%	48%	70%	0

Table 23: Load duration calculations for the North Powder River at Miller Road (36192-ORDEQ) - geometric mean criteria from November to AprilTable 4.5.2n: Load duration calculations North Powder River at Miller Road (36192-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
Margin of Safety (10%)		-	-	-
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
Load Allocation			-	-
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured Load (log mean of observed values in each flow group)				-
8.64E+11	6.78E+09	3.40E+09	5.38E+09	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 24: Load duration calculations for the North Powder River at Miller Road (36192-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2o: Load duration calculations North Powder River at Miller Road (36192-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.60E+12	3.26E+12	1.81E+11	6.50E+11	7.63E+09
Flow (on day with highest measured value)				-
645	55	17	11	5
Load Capacity (on day with highest measured value)				
6.41E+12	5.46E+11	1.69E+11	1.09E+11	4.77E+10
Margin of Safety (10%)		-	-	-
6.41E+11	5.46E+10	1.69E+10	1.09E+10	4.77E+09
Reserve Capacity (0% of LC)				-
0	0	0	0	0
Wasteload Allocation				
6.41E+10	5.46E+09	1.69E+09	1.09E+09	4.77E+08
Load Allocation				-
5.70E+12	4.86E+11	1.50E+11	9.72E+10	4.24E+10
Percent Reduction		-	-	-
0	83%	7%	83%	0

Table 25: Load duration calculations for the North Powder River at Miller Road (36192-ORDEQ) - single sample criteria from November to AprilTable 4.5.2p: Load duration calculations North Powder River at Miller Road (36192-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)				
1.60E+12	2.59E+10	4.40E+09	1.10E+10	N/A
Flow (on day with highest measured value)				
238	31	15	13	N/A
Load Capacity (on day with highest measured value)				
2.36E+12	3.08E+11	1.49E+11	1.29E+11	N/A
Margin of Safety (10%)				
2.36E+11	3.08E+10	1.49E+10	1.29E+10	N/A
Reserve Capacity (0% of LC)				
0	0	0	0	0
Wasteload Allocation				
2.36E+10	3.08E+09	1.49E+09	1.29E+09	N/A
Load Allocation				
2.10E+12	2.74E+11	1.33E+11	1.15E+11	N/A
Percent Reduction				
0	0	0	0	N/A

Table 30: Load duration calculations for Eagle Creek near Richland (36193-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geometric mean of loading capacity in each flow group)				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
Margin of Safety (10% of LC)		-	-	-
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
9.32E+10	6.41E+10	1.92E+10	1.90E+10	9.32E+10
Load Allocation: TMDL LC – MOS-RC			-	-
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured Load (geometric mean of observed values in each flow group)				
1.35E+12	3.38E+11	N/A	8.30E+10	2.97E+10
Percent Reduction		-	-	-
0	0	N/A	0	64%

Table 31: Load duration calculations for Eagle Creek near Richland (36193-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geometric mean of loading capacity in each flow group)				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
Margin of Safety (10% of LC)		-	-	-
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
5.32E+10	1.18E+10	3.84E+09	1.24E+09	1.08E+08
Load Allocation: TMDL LC- MOS-RC			-	-
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured Load (geometric mean of observed values in each flow group)				
1.20E+12	7.82E+10	4.55E+10	2.62E+10	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

~~Table 32: Load duration calculations for Eagle Creek near Richland (36193-ORDEQ) - single sample criteria from May to October~~

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Measured Load (highest value)~~			-	-
~~3.22E+12~~	~~1.24E+12~~	~~N/A~~	~~4.08E+11~~	~~2.97E+10~~
~~Flow (on day with highest measured value)~~				-
~~1410~~	~~575~~	~~N/A~~	~~24~~	~~5~~
~~Load Capacity (on day with highest measured value)~~				
~~1.40E+13~~	~~5.71E+12~~	~~N/A~~	~~2.41E+11~~	~~5.02E+10~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~1.40E+12~~	~~5.71E+11~~	~~N/A~~	~~2.41E+10~~	~~5.02E+09~~
~~Reserve Capacity (0% of LC)~~				-
~~0~~	~~0~~	~~N/A~~	~~0~~	~~0~~
~~Wasteload Allocation~~				
~~1.40E+11~~	~~5.71E+10~~	~~N/A~~	~~2.41E+09~~	~~5.02E+08~~
~~Load Allocation (LC-RC)~~				-
~~1.25E+13~~	~~5.08E+12~~	~~N/A~~	~~2.15E+11~~	~~4.46E+10~~
~~Percent Reduction~~		-	-	-
~~0~~	~~0~~	~~N/A~~	~~41%~~	~~0~~

~~Table 33: Load duration calculations for Eagle Creek near Richland (36193-ORDEQ) - single sample criteria from November to April~~

~~High~~	~~Medium-High~~	~~Medium~~	~~Medium-Low~~	~~Low~~
~~Measured Load (highest value)~~			-	-
~~1.35E+12~~	~~8.13E+11~~	~~4.13E+11~~	~~1.03E+11~~	~~N/A~~
~~Flow (on day with highest measured value)~~				-
~~1550~~	~~367~~	~~114~~	~~85~~	~~N/A~~
~~Load Capacity (on day with highest measured value)~~				
~~1.54E+13~~	~~3.65E+12~~	~~1.13E+12~~	~~8.47E+11~~	~~N/A~~
~~Margin of Safety (10% of LC)~~		-	-	-
~~1.54E+12~~	~~3.65E+11~~	~~1.13E+11~~	~~8.47E+10~~	~~N/A~~
~~Reserve Capacity (5% of LC)~~				-
~~7.70E+11~~	~~1.82E+11~~	~~5.65E+10~~	~~4.24E+10~~	~~N/A~~
~~Wasteload Allocation~~				
~~1.54E+11~~	~~3.65E+10~~	~~1.13E+10~~	~~8.47E+09~~	~~N/A~~
~~Load Allocation (LC-RC)~~				-
~~1.37E+13~~	~~3.24E+12~~	~~1.01E+12~~	~~7.54E+11~~	~~N/A~~
~~Percent Reduction~~		-	-	-
~~0~~	~~0~~	~~0~~	~~0~~	~~N/A~~

Table 26: Load duration calculations for the Powder River at Snake River Rd (Richland) Table 4.5.2q: Load duration calculations Powder River at Snake River Rd (Richland) (11857-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
Margin of Safety (10% of LC)		-	-	-
4.65E+11	8.83E+10	2.31E+10	1.07E+10	3.11E+09
Reserve Capacity (5% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
5.12E+10	1.36E+10	7.08E+09	5.84E+09	5.08E+09
Load Allocation			-	-
4.13E+12	7.81E+11	2.01E+11	9.02E+10	2.29E+10
Measured Load (geo mean of observed values in each flow group) -				
7.10E+12	5.87E+11	1.65E+11	4.34E+11	N/A
Percent Reduction		-	-	-
35%	0	0	75%	N/A

Table 4.5.2r: Table 27: Load duration calculations for the Powder River at Snake River Rd (Richland) Load duration calculations Powder River at Snake River Rd (Richland) (11857-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
Margin of Safety (10% of LC)		-	-	-
4.65E+11	8.83E+10	2.31E+10	1.07E+10	3.11E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
5.12E+10	1.36E+10	7.08E+09	5.84E+09	5.08E+09
Load Allocation			-	-
4.13E+12	7.81E+11	2.01E+11	9.02E+10	2.29E+10
Measured Load (geo mean of observed values in each flow group) -				
3.05E+12	2.68E+11	2.44E+10	6.21E+10	N/A

Percent Reduction		-	-	-
0	0	0	0	N/A

Table 28: Load duration calculations for the Powder River at Snake River Rd (Richland) Table 4.5.2s: Load duration calculations Powder River at Snake River Rd (Richland) (11857-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)		-		-
1.59E+13	1.58E+12	1.04E+12	1.02E+12	N/A
Flow (on day with highest measured value)				-
2110	348	74	40	N/A
Load Capacity (on day with highest measured value)				
2.10E+13	3.46E+12	7.32E+11	3.96E+11	N/A
Margin of Safety (10% of LC)		-	-	-
2.10E+12	3.46E+11	7.32E+10	3.96E+10	N/A
Reserve Capacity (0% of LC)				-
0	0	0	0	N/A
Wasteload Allocation				
Wasteload Allocation				
2.14E+11	3.93E+10	1.21E+10	8.73E+09	N/A
Load Allocation				-
1.86E+13	3.07E+12	6.47E+11	3.48E+11	N/A
Percent Reduction		-	-	-
0	0	30%	61%	N/A

Table 29: Load duration calculations for the Powder River at Snake River Rd (Richland) Table 4.5.2t: Load duration calculations Powder River at Snake River Rd (Richland) (11857-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.59E+13	3.41E+12	2.44E+10	9.78E+10	N/A
Flow (on day with highest measured value)				-
795	502	50	47	N/A
Load Capacity (on day with highest measured value)				
7.89E+12	4.98E+12	4.92E+11	4.65E+11	N/A
Margin of Safety (10% of LC)		-	-	-
7.89E+11	4.98E+11	4.92E+10	4.65E+10	N/A
Reserve Capacity (0% of LC)				-

0	0	0	0	N/A
Wasteload Allocation				
8.37E+10	5.46E+10	9.69E+09	9.42E+09	N/A
Load Allocation			-	
7.02E+12	4.43E+12	4.33E+11	4.09E+11	N/A
Percent Reduction	-	-	-	
50%	0	0	0	N/A

Table 4.5.2u: Load duration calculations Eagle Creek near Richland (36193-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (log mean of loading capacity in each flow group) -				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
Margin of Safety (10% of LC)	-	-	-	
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
5.32E+10	1.18E+10	3.84E+09	1.24E+09	1.08E+08
Load Allocation: TMDL LC – MOS-RC		-	-	
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured Load (geo mean of observed values in each flow group) -				
1.35E+12	3.38E+11	N/A	8.30E+10	2.97E+10
Percent Reduction	-	-	-	
0	0	N/A	0	64%

Table 4.5.2v: Load duration calculations Eagle Creek near Richland (36193-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
Margin of Safety (10% of LC)	-	-	-	
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
5.32E+10	1.18E+10	3.84E+09	1.24E+09	1.08E+08
Load Allocation: TMDL LC- MOS-RC		-	-	
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured Load (geo mean of observed values in each flow group) -				
1.20E+12	7.82E+10	4.55E+10	2.62E+10	N/A
Percent Reduction	-	-	-	
0	0	0	0	N/A

Table 4.5.2w: Load duration calculations Eagle Creek near Richland (36193-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-

3.22E+12	1.24E+12	N/A	4.08E+11	2.97E+10
Flow (on day with highest measured value)				-
1410	575	N/A	24	5
Load Capacity (on day with highest measured value)				
1.40E+13	5.71E+12	N/A	2.41E+11	5.02E+10
Margin of Safety (10% of LC)		-	-	-
1.40E+12	5.71E+11	N/A	2.41E+10	5.02E+09
Reserve Capacity (0% of LC)				-
0	0	N/A	0	0
Wasteload Allocation				
1.40E+11	5.71E+10	N/A	2.41E+09	5.02E+08
Load Allocation (LC-RC)				-
1.25E+13	5.08E+12	N/A	2.15E+11	4.46E+10
Percent Reduction		-	-	-
0	0	N/A	41%	0

Table 4.5.2x: Load duration calculations Eagle Creek near Richland (36193-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.35E+12	8.13E+11	4.13E+11	1.03E+11	N/A
Flow (on day with highest measured value)				-
1550	367	114	85	N/A
Load Capacity (on day with highest measured value)				
1.54E+13	3.65E+12	1.13E+12	8.47E+11	N/A
Margin of Safety (10% of LC)		-	-	-
1.54E+12	3.65E+11	1.13E+11	8.47E+10	N/A
Reserve Capacity (5% of LC)				-
7.70E+11	1.82E+11	5.65E+10	4.24E+10	N/A
Wasteload Allocation				
1.54E+11	3.65E+10	1.13E+10	8.47E+09	N/A
Load Allocation (LC-RC)				-
1.37E+13	3.24E+12	1.01E+12	7.54E+11	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 4.5.2y: Load duration calculations Pine Creek at Highway 71 near mouth (to Snake River) (36382-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
Margin of Safety (10% of LC)		-	-	-
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
Load Allocation			-	-
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured Load (geo mean of observed values in each flow group) -				

5.65E+12	1.40E+12	N/A	5.53E+09	1.20E+10
Percent Reduction (all seasons)		-	-	-
0	0	N/A	0	0

Table 4.5.2z: Load duration calculations Pine Creek at Highway 71 near mouth (to Snake River) (36382-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
Margin of Safety (10% of LC)		-	-	-
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
Reserve Capacity (5% of LC)		-	-	-
4.13E+11	9.05E+10	2.70E+10	1.03E+10	4.01E+09
Wasteload Allocation				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
Load Allocation: TMDL LC - MOS			-	-
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured Load (geo mean of observed values in each flow group) -				
5.07E+12	1.25E+11	2.04E+10	1.73E+10	N/A
Percent Reduction (all seasons)		-	-	-
0	0	0	0	N/A

Table 4.5.2aa: Load duration calculations Pine Creek at Highway 71 near mouth (to Snake River) (36382-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
1.17E+13	2.65E+12	N/A	5.53E+09	2.53E+10
Flow (on day with highest measured value)				-
1310	692	N/A	38	27
Load Capacity (on day with highest measured value)				
1.30E+13	6.87E+12	N/A	3.74E+11	2.71E+11
Margin of Safety (10% of LC)		-	-	-
1.30E+12	6.87E+11	N/A	3.74E+10	2.71E+10
Reserve Capacity (0% of LC)				
0	0	N/A	0	0
Wasteload Allocation				
1.30E+11	6.87E+10	N/A	3.74E+09	2.71E+09
Load Allocation				
1.16E+13	6.12E+12	N/A	3.33E+11	2.41E+11
Percent Reduction		-	-	-
0	0	N/A	0	0

Table 4.5.2bb: Load duration calculations Pine Creek at Highway 71 near mouth (to Snake River) (36382-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
6.18E+12	9.79E+11	4.52E+10	8.95E+10	N/A
Flow (on day with highest measured value)				-
2190	702	228	98	N/A
Load Capacity (on day with highest measured value)				

2.18E+13	6.97E+12	2.26E+12	9.74E+11	N/A
Margin of Safety (10% of LC)	-	-	-	
2.18E+12	6.97E+11	2.26E+11	9.74E+10	N/A
Reserve Capacity (0% of LC)				
0	0	0	0	N/A
Wasteload Allocation				
2.18E+11	6.97E+10	2.26E+10	9.74E+09	N/A
Load Allocation				
1.94E+13	6.21E+12	2.02E+12	8.67E+11	N/A
Percent Reduction	-	-	-	
0	0	0	0	N/A

Table 38: Load duration calculations for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2cc: Load duration calculations Burnt River at Unity Reservoir discharge (36195-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of load capacity in each flow group) -				
1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
Margin of Safety (10% of LC)	-	-	-	
1.99E+11	3.59E+10	1.28E+10	2.54E+09	4.98E+08
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
1.99E+10	3.59E+09	1.28E+09	2.54E+08	4.98E+07
Load Allocation: TMDL LC – MOS-RC		-	-	
1.77E+12	3.20E+11	1.14E+11	2.26E+10	4.43E+09
Measured Load (geo mean of observed values in each flow group) -				
1.15E+11	1.84E+10	3.25E+09	N/A	N/A
Percent Reduction	-	-	-	
0	0	0	N/A	N/A

Table 39: Load duration calculations for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - geometric mean criteria from November to AprilTable 4.5.2dd: Load duration calculations Burnt River at Unity Reservoir discharge (36195-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of load capacity in each flow group) -				
1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
Margin of Safety (10% of LC)	-	-	-	
1.99E+11	3.59E+10	1.28E+10	2.54E+09	4.98E+08
Reserve Capacity (0% of LC)	-	-	-	
0	0	0	0	0
Wasteload Allocation				
1.99E+10	3.59E+09	1.28E+09	2.54E+08	4.98E+07
Load Allocation		-	-	
1.77E+12	3.20E+11	1.14E+11	2.26E+10	4.43E+09
Measured Load (log mean of observed values in each flow group) -				

2.35E+10	3.17E+09	2.04E+09	2.61E+09	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 40: Load duration calculations for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2ee: Load duration calculations Burnt River at Unity Reservoir discharge (36195-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
3.83E+11	1.97E+11	1.20E+10	0.00E+00	N/A
Flow (on day with highest measured value)				-
265	155	78	N/A	N/A
Load Capacity (on day with highest measured value)				
2.63E+12	1.54E+12	7.75E+11	N/A	N/A
Margin of Safety (10% of LC)		-	-	-
2.63E+11	1.54E+11	7.75E+10	N/A	N/A
Reserve Capacity (0% of LC)				
0	0	0	N/A	N/A
Wasteload Allocation				
2.63E+10	1.54E+10	7.75E+09	N/A	N/A
Load Allocation				
2.34E+12	1.37E+12	6.90E+11	N/A	N/A
Percent Reduction		-	-	-
0	0	0	N/A	N/A

Table 4.5.2ff: Load duration calculations Burnt River at Unity Reservoir discharge (36195-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
8.75E+10	3.18E+09	3.33E+09	7.25E+09	N/A
Flow (on day with highest measured value)				-
596	65	17	13	N/A
Load Capacity (on day with highest measured value)				
5.92E+12	6.46E+11	1.69E+11	1.29E+11	N/A
Margin of Safety (10% of LC)		-	-	-
5.92E+11	6.46E+10	1.69E+10	1.29E+10	N/A
Reserve Capacity (0% of LC)				
0	0	0	0	N/A
Wasteload Allocation				
5.92E+10	6.46E+09	1.69E+09	1.29E+09	N/A
Load Allocation				
5.27E+12	5.75E+11	1.50E+11	1.15E+11	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 4.5.2gg: Load duration calculations Burnt River at Clarks Creek Road (34256-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group)				

-				
2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
Margin of Safety (10% of LC)		-	-	-
2.39E+11	2.40E+10	1.33E+10	8.25E+09	4.30E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
2.39E+10	2.40E+09	1.33E+09	8.25E+08	4.30E+08
Load Allocation			-	-
2.12E+12	2.13E+11	1.19E+11	7.34E+10	3.83E+10
Measured Load (geo mean of observed values in each flow group) -				
2.15E+12	3.77E+11	2.27E+11	N/A	N/A
Percent Reduction		-	-	-
N/A	36%	41%	N/A	N/A

Table 4.5.2hh: Load duration calculations Burnt River at Clarks Creek Road (34256-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of loading capacity in each flow group) -				
2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
Margin of Safety (10% of LC)		-	-	-
2.39E+11	2.40E+10	1.33E+10	8.25E+09	4.30E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
2.39E+10	2.40E+09	1.33E+09	8.25E+08	4.30E+08
Load Allocation: TMDL LC- MOS-RC			-	-
2.12E+12	2.13E+11	1.19E+11	7.34E+10	3.83E+10
Measured Load (geo mean of observed values in each flow group) -				
5.03E+11	2.62E+11	1.90E+10	1.88E+10	N/A
Percent Reduction		-	-	-
0	8%	0	0	N/A

Table 44: Load duration calculations for the Burnt River at Clarks Creek Road (34256-ORDEQ) - single sample criteria from May to OctoberTable 4.5.2ii: Load duration calculations Burnt River at Clarks Creek Road (34256-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
6.11E+12	4.61E+12	2.38E+12	N/A	N/A
Flow (on day with highest measured value)				-
483	78	49	N/A	N/A
Load Capacity (on day with highest measured value)				
4.80E+12	7.74E+11	4.91E+11	N/A	N/A
Margin of Safety (10% of LC)		-	-	-
4.80E+11	7.74E+10	4.91E+10	N/A	N/A
Reserve Capacity (0% of LC)				
0	0	0	N/A	N/A
Wasteload Allocation				
4.80E+10	7.74E+09	4.91E+09	N/A	N/A

Load Allocation				
4.27E+12	6.89E+11	4.37E+11	N/A	N/A
Percent Reduction		-	-	-
21%	83%	79%	N/A	N/A

Table 4.5.2jj: Load duration calculations Burnt River at Clarks Creek Road (34256-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
2.41E+12	2.62E+11	4.02E+11	1.93E+11	N/A
Flow (on day with highest measured value)				-
857	50	40	30	N/A
Load Capacity (on day with highest measured value)				
8.51E+12	4.97E+11	3.97E+11	3.00E+11	N/A
Margin of Safety (10% of LC)		-	-	-
8.51E+11	4.97E+10	3.97E+10	3.00E+10	N/A
Reserve Capacity (5% of LC)				
4.26E+11	2.48E+10	1.98E+10	1.50E+10	N/A
Wasteload Allocation				
8.51E+10	4.97E+09	3.97E+09	3.00E+09	N/A
Load Allocation (LC-RC)				
7.58E+12	4.42E+11	3.54E+11	2.67E+11	N/A
Percent Reduction		-	-	-
0	0	1%	0	N/A

Table 46: Load duration calculations for the Burnt River at Huntington (11494-ORDEQ) - geometric mean criteria from May to OctoberTable 4.5.2kk: Load duration calculations for Burnt River at Huntington (11494-ORDEQ) – geometric mean criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of load capacity in each flow group) -				
3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
Margin of Safety (10% of LC)		-	-	-
3.10E+11	3.63E+10	1.98E+10	1.29E+10	5.51E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
3.57E+10	8.40E+09	6.75E+09	6.06E+09	5.32E+09
Load Allocation: LC -RC			-	-
2.75E+12	3.19E+11	1.71E+11	1.10E+11	4.43E+10
Measured Load (geo mean of observed values in each flow group) -				
5.12E+12	1.78E+11	1.04E+11	8.31E+10	5.88E+10
Percent Reduction		-	-	-
40%	0	0	0	6%

Table 4.5.2ll: Load duration calculations for Burnt River at Huntington (11494-ORDEQ) – geometric mean criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geo mean of load capacity in each flow group) -				
3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
Margin of Safety (10% of LC)		-	-	-

3.10E+11	3.63E+10	1.98E+10	1.29E+10	5.51E+09
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
3.57E+10	8.40E+09	6.75E+09	6.06E+09	5.32E+09
Load Allocation: LC -RC			-	-
2.75E+12	3.19E+11	1.71E+11	1.10E+11	4.43E+10
Measured Load (geo mean of observed values in each flow group) -				
3.41E+12	4.42E+10	7.24E+09	1.10E+09	N/A
Percent Reduction		-	-	-
9%	0	0	0	N/A

Table 4.5.2mm: Load duration calculations for Burnt River at Huntington (11494-ORDEQ) – single sample criteria – irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
9.79E+12	3.45E+11	6.16E+11	3.35E+11	5.88E+10
Flow (on day with highest measured value)				-
691	103	65	40	27
Load Capacity (on day with highest measured value)				
6.86E+12	1.02E+12	6.47E+11	3.94E+11	2.68E+11
Margin of Safety (10% of LC)		-	-	-
6.86E+11	1.02E+11	6.47E+10	3.94E+10	2.68E+10
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	0
Wasteload Allocation				
7.34E+10	1.50E+10	1.12E+10	8.71E+09	7.45E+09
Load Allocation: LC-RC			-	-
6.10E+12	9.06E+11	5.71E+11	3.46E+11	2.34E+11
Percent Reduction		-	-	-
30%	0	0	0	0

Table 4.5.2nn: Load duration calculations for Burnt River at Huntington (11494-ORDEQ) – single sample criteria – non-irrigation season

High	Medium-High	Medium	Medium-Low	Low
Measured Load (highest value)			-	-
3.90E+12	2.70E+11	2.59E+10	1.10E+09	N/A
Flow (on day with highest measured value)				-
1340	133	53	45	N/A
Load Capacity (on day with highest measured value)				
1.33E+13	1.32E+12	5.26E+11	4.47E+11	N/A
Margin of Safety (10% of LC)		-	-	-
1.33E+12	1.32E+11	5.26E+10	4.47E+10	N/A
Reserve Capacity (0% of LC)		-	-	-
0	0	0	0	N/A
Wasteload Allocation				
1.38E+11	1.80E+10	1.00E+10	9.24E+09	N/A
Load Allocation: LC-RC			-	-
1.18E+13	1.17E+12	4.64E+11	3.93E+11	N/A
Percent Reduction		-	-	-
0	0	0	0	N/A

Table 10: Load duration curve calculations (organism/day) for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load Capacity (geometric mean of load capacity in each flow group)				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
MOS (10% of load capacity)				
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
LA				
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured load (geometric mean of observed values in each flow group)				
5.65E+12	1.40E+12	N/A	5.53E+09	1.20E+10
Percent reduction				
0	0	N/A	0	0

Table 11: Load duration curve calculations (organism/day) for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
MOS (10% of load capacity)				
8.26E+11	1.81E+11	5.41E+10	2.06E+10	8.02E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
8.26E+10	1.81E+10	5.41E+09	2.06E+09	8.02E+08
LA				
7.36E+12	1.61E+12	4.82E+11	1.83E+11	7.13E+10
Measured load (geometric mean of observed values in each flow group)				
5.07E+12	1.25E+11	2.04E+10	1.73E+10	N/A
Percent reduction				
0	0	0	0	N/A

Table 12: Load duration curve calculations (organism/day) for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.17E+13	2.65E+12	N/A	5.53E+09	2.53E+10
Flow (cfs on day with highest measured value)				
1310	692	N/A	38	27
Load capacity (on day with highest measured value)				
1.30E+13	6.87E+12	N/A	3.74E+11	2.71E+11
MOS (10% of load capacity)				
1.30E+12	6.87E+11	N/A	3.74E+10	2.71E+10
RC (0% of load capacity)				
0	0	N/A	0	0
WLA				
1.30E+11	6.87E+10	N/A	3.74E+09	2.71E+09
LA				
1.16E+13	6.12E+12	N/A	3.33E+11	2.41E+11
Percent reduction				
0	0	N/A	0	0

Table 13: Load duration curve calculations (organism/day) for Confluence of Brownlee Subbasin streams with Snake River (36382-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
6.18E+12	9.79E+11	4.52E+10	8.95E+10	N/A
Flow (cfs on day with highest measured value)				
2190	702	228	98	N/A
Load capacity (on day with highest measured value)				
2.18E+13	6.97E+12	2.26E+12	9.74E+11	N/A
MOS (10% of load capacity)				
2.18E+12	6.97E+11	2.26E+11	9.74E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
2.18E+11	6.97E+10	2.26E+10	9.74E+09	N/A
LA				
1.94E+13	6.21E+12	2.02E+12	8.67E+11	N/A
Percent reduction				
0	0	0	0	N/A

Table 14: Load duration curve calculation for the Powder River above Phillips Reservoir (34250-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
MOS (10% of load capacity)				
1.53E+11	2.64E+10	5.86E+09	1.98E+09	2.38E+08
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.53E+10	2.64E+09	5.86E+08	1.98E+08	2.38E+07
LA				
1.36E+12	2.35E+11	5.22E+10	1.76E+10	2.12E+09
Measured load (geometric mean of observed values in each flow group)				
N/A	9.86E+10	N/A	6.44E+08	2.86E+08
Percent reduction				
N/A	0	N/A	0	0

Table 15: Load duration curve calculations (organism/day) for the Powder River above Phillips Reservoir (34250-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
MOS (10% of load capacity)				
1.53E+11	2.64E+10	5.86E+09	1.98E+09	2.38E+08
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.53E+10	2.64E+09	5.86E+08	1.98E+08	2.38E+07
LA				
1.36E+12	2.35E+11	5.22E+10	1.76E+10	2.12E+09
Measured load (geometric mean of observed values in each flow group)				
N/A	9.05E+09	N/A	4.76E+08	N/A
Percent reduction				
N/A	0	N/A	0	0

Table 16: Load duration curve calculations (organism/day) for the Powder River above Phillips Reservoir (34250-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
N/A	1.18E+11	N/A	1.97E+09	4.15E+09
Flow (cfs on day with highest measured value)				
N/A	46	N/A	4	1
Load capacity (on day with highest measured value)				
N/A	4.58E+11	N/A	3.48E+10	1.31E+10
MOS (10% of load capacity)				
N/A	4.58E+10	N/A	3.48E+09	1.31E+09
RC (0% of load capacity)				
N/A	0	N/A	0	0
WLA				
N/A	4.58E+09	N/A	3.48E+08	1.31E+08
LA				
N/A	4.07E+11	N/A	3.09E+10	1.17E+10
Percent reduction				
N/A	0	N/A	0	0

Table 17: Load duration curve calculations (organism/day) for the Powder River above Phillips Reservoir (34250-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
N/A	4.14E+10	N/A	4.76E+08	N/A
Flow (cfs on day with highest measured value)				
N/A	130	N/A	3	N/A
Load capacity (on day with highest measured value)				
N/A	1.29E+12	N/A	3.07E+10	N/A
MOS (10% of load capacity)				
N/A	1.29E+11	N/A	3.07E+09	N/A
RC (0% of load capacity)				
N/A	0	N/A	0	N/A
WLA				
N/A	1.29E+10	N/A	3.07E+08	N/A
LA				
N/A	1.15E+12	N/A	2.73E+10	N/A
Percent reduction				
N/A	0	N/A	0	N/A

Table 18: Load duration curve calculations (organism/day) for the Powder River at Baker City (11490-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
MOS (10% of load capacity)				
1.31E+11	4.66E+10	1.64E+10	6.37E+09	3.02E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.31E+10	4.66E+09	1.64E+09	6.37E+08	3.02E+08
LA				
1.17E+12	4.15E+11	1.46E+11	5.67E+10	2.68E+10
Measured load (geometric mean of observed values in each flow group)				
1.44E+12	3.43E+11	1.10E+11	7.22E+10	2.30E+10
Percent reduction				
9%	0%	0%	12%	0%

Table 19: Load duration curve calculations (organism/day) for the Powder River at Baker City (11490-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
MOS (10% of load capacity)				
1.31E+11	4.66E+10	1.64E+10	6.37E+09	3.02E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.31E+10	4.66E+09	1.64E+09	6.37E+08	3.02E+08
LA				
1.17E+12	4.15E+11	1.46E+11	5.67E+10	2.68E+10
Measured load (geometric mean of observed values in each flow group)				
4.25E+11	4.12E+11	1.56E+11	8.65E+09	6.44E+09
Percent reduction				
0%	0%	0%	0%	0%

Table 20: Load duration curve calculations (organism/day) for the Powder River at Baker City (11490-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.88E+12	9.76E+11	3.25E+11	2.03E+11	6.40E+10
Flow (cfs on day with highest measured value)				
295	116	80	17	9
Load capacity (on day with highest measured value)				
2.93E+12	1.15E+12	7.91E+11	1.69E+11	9.12E+10
MOS (10% of load capacity)				
2.93E+11	1.15E+11	7.91E+10	1.69E+10	9.12E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
2.93E+10	1.15E+10	7.05E+09	1.69E+09	9.12E+08
LA				
2.60E+12	1.02E+12	6.28E+11	1.50E+11	8.12E+10
Percent reduction				
0	0	0	17%	0

Table 21: Load duration curve calculations (organism/day) for the Powder River at Baker City (11490-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
4.25E+11	4.12E+11	4.20E+12	6.05E+10	6.44E+09
Flow (cfs on day with highest measured value)				
370	97	71	24	9
Load capacity (on day with highest measured value)				
3.68E+12	9.66E+11	7.05E+11	2.42E+11	9.17E+10
MOS (10% of load capacity)				
3.68E+11	9.66E+10	7.05E+10	2.42E+10	9.17E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
3.68E+10	9.66E+09	7.05E+09	2.42E+09	9.17E+08
LA				
3.27E+12	8.60E+11	6.28E+11	2.16E+11	8.16E+10
Percent reduction				
0	0	83%	0	0

Table 22: Load duration curve calculations (organism/day) for the North Powder River at Highway 30 (36191-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
MOS (10% of load capacity)				
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
LA				
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured load (geometric mean of observed values in each flow group)				
5.34E+12	4.90E+11	1.78E+11	1.46E+11	2.48E+11
Percent reduction				
77%	76%	71%	79%	95%

Table 23: Load duration curve calculations (organism/day) for the North Powder River at Highway 30 (36191-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
MOS (10% of load capacity)				
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
LA				
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured load (geometric mean of observed values in each flow group)				
2.01E+12	2.72E+10	1.12E+10	3.34E+10	N/A
Percent reduction				
39%	0%	0%	10%	N/A

Table 24: Load duration curve calculations (organism/day) for the North Powder River at Highway 30 (36191-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.96E+13	1.97E+12	5.00E+11	4.56E+11	2.84E+11
Flow (cfs on day with highest measured value)				
403	67	17	8	5
Load capacity (on day with highest measured value)				
4.00E+12	6.66E+11	1.69E+11	7.65E+10	4.77E+10
MOS (10% of load capacity)				
4.00E+11	6.66E+10	1.69E+10	7.65E+09	4.77E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
4.00E+10	6.66E+09	1.69E+09	7.65E+08	4.77E+08
LA				
3.56E+12	5.92E+11	1.50E+11	6.81E+10	4.24E+10
Percent reduction				
80%	66%	66%	83%	83%

Table 25: Load duration curve calculations (organism/day) for the North Powder River at Highway 30 (36191-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
2.26E+12	1.46E+12	1.90E+11	3.36E+11	N/A
Flow (cfs on day with highest measured value)				
238	57	15	14	N/A
Load capacity (on day with highest measured value)				
2.36E+12	5.66E+11	1.49E+11	1.39E+11	N/A
MOS (10% of load capacity)				
2.36E+11	5.66E+10	1.49E+10	1.39E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
2.36E+10	5.66E+09	1.49E+09	1.39E+09	N/A
LA				
2.10E+12	5.04E+11	1.33E+11	1.24E+11	N/A
Percent reduction				
0%	61%	22%	59%	N/A

Table 26: Load duration curve calculations (organism/day) for the North Powder River at Miller Road (36192-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
MOS (10% of load capacity)				
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
LA				
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured load (geometric mean of observed values in each flow group)				
4.97E+11	1.29E+11	9.96E+10	9.91E+10	7.05E+09
Percent reduction				
0	8%	48%	70%	0

Table 27: Load duration curve calculations (organism/day) for the North Powder River at Miller Road (36192-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
MOS (10% of load capacity)				
1.23E+11	1.19E+10	5.22E+09	3.00E+09	1.25E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.23E+10	1.19E+09	5.22E+08	3.00E+08	1.25E+08
LA				
1.10E+12	1.06E+11	4.64E+10	2.67E+10	1.12E+10
Measured load (log mean of observed values in each flow group)				
8.64E+11	6.78E+09	3.40E+09	5.38E+09	N/A
Percent reduction				
0	0	0	0	N /A

Table 28: Load duration curve calculations (organism/day) for the North Powder River at Miller Road (36192-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.60E+12	3.26E+12	1.81E+11	6.50E+11	7.63E+09
Flow (cfs on day with highest measured value)				
645	55	17	11	5
Load capacity (on day with highest measured value)				
6.41E+12	5.46E+11	1.69E+11	1.09E+11	4.77E+10
MOS (10% of load capacity)				
6.41E+11	5.46E+10	1.69E+10	1.09E+10	4.77E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
6.41E+10	5.46E+09	1.69E+09	1.09E+09	4.77E+08
LA				
5.70E+12	4.86E+11	1.50E+11	9.72E+10	4.24E+10
Percent reduction				
0	83%	7%	83%	0

Table 29: Load duration curve calculations (organism/day) for the North Powder River at Miller Road (36192-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.60E+12	2.59E+10	4.40E+09	1.10E+10	N/A
Flow (cfs on day with highest measured value)				
238	31	15	13	N/A
Load capacity (on day with highest measured value)				
2.36E+12	3.08E+11	1.49E+11	1.29E+11	N/A
MOS (10% of load capacity)				
2.36E+11	3.08E+10	1.49E+10	1.29E+10	N/A
RC (0% of load capacity)				
0	0	0	0	0
WLA				
2.36E+10	3.08E+09	1.49E+09	1.29E+09	N/A
LA				
2.10E+12	2.74E+11	1.33E+11	1.15E+11	N/A
Percent reduction				
0	0	0	0	N/A

Table 30: Load duration curve calculations (organism/day) for Eagle Creek near Richland (36193-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
MOS (10% of load capacity)				
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
9.32E+10	6.41E+10	1.92E+10	1.90E+10	9.32E+10
LA				
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured load (geometric mean of observed values in each flow group)				
1.35E+12	3.38E+11	N/A	8.30E+10	2.97E+10
Percent reduction				
0	0	N/A	0	64%

Table 31: Load duration curve calculations (organism/day) for Eagle Creek near Richland (36193-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
MOS (10% of load capacity)				
5.32E+11	1.18E+11	3.84E+10	1.24E+10	1.08E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
5.32E+10	1.18E+10	3.84E+09	1.24E+09	1.08E+08
LA				
4.73E+12	1.05E+12	3.42E+11	1.10E+11	9.62E+09
Measured load (geometric mean of observed values in each flow group)				
1.20E+12	7.82E+10	4.55E+10	2.62E+10	N/A
Percent reduction				
0	0	0	0	N/A

Table 32: Load duration curve calculations (organism/day) for Eagle Creek near Richland (36193-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
3.22E+12	1.24E+12	N/A	4.08E+11	2.97E+10
Flow (cfs on day with highest measured value)				
1410	575	N/A	24	5
Load capacity (on day with highest measured value)				
1.40E+13	5.71E+12	N/A	2.41E+11	5.02E+10
MOS (10% of load capacity)				
1.40E+12	5.71E+11	N/A	2.41E+10	5.02E+09
RC (0% of load capacity)				
0	0	N/A	0	0
WLA				
1.40E+11	5.71E+10	N/A	2.41E+09	5.02E+08
LA				
1.25E+13	5.08E+12	N/A	2.15E+11	4.46E+10
Percent reduction				
0	0	N/A	41%	0

Table 33: Load duration curve calculations (organism/day) for Eagle Creek near Richland (36193-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.35E+12	8.13E+11	4.13E+11	1.03E+11	N/A
Flow (cfs on day with highest measured value)				
1550	367	114	85	N/A
Load capacity (on day with highest measured value)				
1.54E+13	3.65E+12	1.13E+12	8.47E+11	N/A
MOS (10% of load capacity)				
1.54E+12	3.65E+11	1.13E+11	8.47E+10	N/A
RC (0% of LC)				
0	0	0	0	N/A
WLA				
1.54E+11	3.65E+10	1.13E+10	8.47E+09	N/A
LA				
1.37E+13	3.24E+12	1.01E+12	7.54E+11	N/A
Percent reduction				
0	0	0	0	N/A

Table 34: Load duration curve calculations (organism/day) for the Powder River from Baker City to confluence with Snake River (11857-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
MOS (10% of load capacity)				
4.65E+11	8.83E+10	2.31E+10	1.07E+10	3.11E+09
RC (0% of LC)				
0	0	0	0	0
WLA				
6.08E+10	2.31E+10	1.66E+10	1.54E+10	1.46E+10
LA				
4.12E+12	7.72E+11	1.91E+11	8.07E+10	1.33E+10
Measured load (geometric mean of observed values in each flow group)				
7.10E+12	5.87E+11	1.65E+11	4.34E+11	N/A
Percent reduction				
35%	0	0	75%	N/A

Table 35: Load duration curve calculations (organism/day) for the Powder River from Baker City to confluence with Snake River (11857-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
MOS (10% of load capacity)				
4.65E+11	8.83E+10	2.31E+10	1.07E+10	3.11E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
6.08E+10	2.31E+10	1.66E+10	1.54E+10	1.46E+10
LA				
4.12E+12	7.72E+11	1.91E+11	8.07E+10	1.33E+10
Measured load (geometric mean of observed values in each flow group)				
3.05E+12	2.68E+11	2.44E+10	6.21E+10	N/A
Percent reduction				
0	0	0	0	N/A

Table 36: Load duration curve calculations (organism/day) for the Powder River from Baker City to confluence with Snake River (11857-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.59E+13	1.58E+12	1.04E+12	1.02E+12	N/A
Flow (cfs on day with highest measured value)				
2110	348	74	40	N/A
Load capacity (on day with highest measured value)				
2.10E+13	3.46E+12	7.32E+11	3.96E+11	N/A
MOS (10% of load capacity)				
2.10E+12	3.46E+11	7.32E+10	3.96E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
2.24E+11	4.89E+10	2.16E+10	1.83E+10	N/A
LA				
1.86E+13	3.06E+12	6.37E+11	3.38E+11	N/A
Percent reduction				
0	0	30%	61%	N/A

Table 37: Load duration curve calculations (organism/day) for the Powder River from Baker City to confluence with Snake River (11857-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
1.59E+13	3.41E+12	2.44E+10	9.78E+10	N/A
Flow (cfs on day with highest measured value)				
795	502	50	47	N/A
Load capacity (on day with highest measured value)				
7.89E+12	4.98E+12	4.92E+11	4.65E+11	N/A
MOS (10% of load capacity)				
7.89E+11	4.98E+11	4.92E+10	4.65E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
9.32E+10	6.41E+10	1.92E+10	1.90E+10	N/A
LA				
7.01E+12	4.42E+12	4.23E+11	3.99E+11	N/A
Percent reduction				
50%	0	0	0	N/A

Table 38: Load duration curve calculations (organism/day) for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of Load capacity in each flow group)				
1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
MOS (10% of load capacity)				
1.99E+11	3.59E+10	1.28E+10	2.54E+09	4.98E+08
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.99E+10	3.59E+09	1.28E+09	2.54E+08	4.98E+07
LA				
1.77E+12	3.20E+11	1.14E+11	2.26E+10	4.43E+09
Measured load (geometric mean of observed values in each flow group)				
1.15E+11	1.84E+10	3.25E+09	N/A	N/A
Percent reduction				
0	0	0	N/A	N/A

Table 39: Load duration curve calculations (organism/day) for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of Load capacity in each flow group)				
1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
MOS (10% of load capacity)				
1.99E+11	3.59E+10	1.28E+10	2.54E+09	4.98E+08
RC (0% of load capacity)				
0	0	0	0	0
WLA				
1.99E+10	3.59E+09	1.28E+09	2.54E+08	4.98E+07
LA				
1.77E+12	3.20E+11	1.14E+11	2.26E+10	4.43E+09
Measured load (geometric mean of observed values in each flow group)				
2.35E+10	3.17E+09	2.04E+09	2.61E+09	N/A
Percent reduction				
0	0	0	0	N/A

Table 40: Load duration curve calculations (organism/day) for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
3.83E+11	1.97E+11	1.20E+10	0.00E+00	N/A
Flow (cfs on day with highest measured value)				
265	155	78	N/A	N/A
Load capacity (on day with highest measured value)				
2.63E+12	1.54E+12	7.75E+11	N/A	N/A
MOS (10% of load capacity)				
2.63E+11	1.54E+11	7.75E+10	N/A	N/A
RC (0% of load capacity)				
0	0	0	N/A	N/A
WLA				
2.63E+10	1.54E+10	7.75E+09	N/A	N/A
LA				
2.34E+12	1.37E+12	6.90E+11	N/A	N/A
Percent reduction				
0	0	0	N/A	N/A

Table 41: Load duration curve calculations (organism/day) for the Burnt River at Unity Reservoir discharge (36195-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
8.75E+10	3.18E+09	3.33E+09	7.25E+09	N/A
Flow (cfs on day with highest measured value)				
596	65	17	13	N/A
Load capacity (on day with highest measured value)				
5.92E+12	6.46E+11	1.69E+11	1.29E+11	N/A
MOS (10% of load capacity)				
5.92E+11	6.46E+10	1.69E+10	1.29E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
5.92E+10	6.46E+09	1.69E+09	1.29E+09	N/A
LA				
5.27E+12	5.75E+11	1.50E+11	1.15E+11	N/A
Percent reduction				
0	0	0	0	N/A

Table 42: Load duration curve calculations (organism/day) for the Burnt River at Clarks Creek Road (34256-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
MOS (10% of load capacity)				
2.39E+11	2.40E+10	1.33E+10	8.25E+09	4.30E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
2.39E+10	2.40E+09	1.33E+09	8.25E+08	4.30E+08
LA				
2.12E+12	2.13E+11	1.19E+11	7.34E+10	3.83E+10
Measured load (geometric mean of observed values in each flow group)				
2.15E+12	3.77E+11	2.27E+11	N/A	N/A
Percent reduction				
N/A	36%	41%	N/A	N/A

Table 43: Load duration curve calculations (organism/day) for the Burnt River at Clarks Creek Road (34256-ORDEQ) -geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
MOS (10% of load capacity)				
2.39E+11	2.40E+10	1.33E+10	8.25E+09	4.30E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
2.39E+10	2.40E+09	1.33E+09	8.25E+08	4.30E+08
LA				
2.12E+12	2.13E+11	1.19E+11	7.34E+10	3.83E+10
Measured load (geometric mean of observed values in each flow group)				
5.03E+11	2.62E+11	1.90E+10	1.88E+10	N/A
Percent reduction				
0	8%	0	0	N/A

Table 44: Load duration curve calculations (organism/day) for the Burnt River at Clarks Creek Road (34256-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
6.11E+12	4.61E+12	2.38E+12	N/A	N/A
Flow (cfs on day with highest measured value)				
483	78	49	N/A	N/A
Load capacity (on day with highest measured value)				
4.80E+12	7.74E+11	4.91E+11	N/A	N/A
MOS (10% of load capacity)				
4.80E+11	7.74E+10	4.91E+10	N/A	N/A
RC (0% of load capacity)				
0	0	0	N/A	N/A
WLA				
4.80E+10	7.74E+09	4.91E+09	N/A	N/A
LA				
4.27E+12	6.89E+11	4.37E+11	N/A	N/A
Percent reduction				
21%	83%	79%	N/A	N/A

Table 45: Load duration curve calculations (organism/day) for the Burnt River at Clarks Creek Road (34256-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
2.41E+12	2.62E+11	4.02E+11	1.93E+11	N/A
Flow (cfs on day with highest measured value)				
857	50	40	30	N/A
Load capacity (on day with highest measured value)				
8.51E+12	4.97E+11	3.97E+11	3.00E+11	N/A
MOS (10% of load capacity)				
8.51E+11	4.97E+10	3.97E+10	3.00E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
8.51E+10	4.97E+09	3.97E+09	3.00E+09	N/A
LA				
7.58E+12	4.42E+11	3.54E+11	2.67E+11	N/A
Percent reduction				
0	0	1%	0	N/A

Table 46: Load duration curve calculations (organism/day) for the Burnt River at Huntington (11494-ORDEQ) - geometric mean criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of load capacity in each flow group)				
3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
MOS (10% of load capacity)				
3.10E+11	3.63E+10	1.98E+10	1.29E+10	5.51E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
3.57E+10	8.40E+09	6.75E+09	6.06E+09	5.32E+09
LA				
2.75E+12	3.19E+11	1.71E+11	1.10E+11	4.43E+10
Measured load (geometric mean of observed values in each flow group)				
5.12E+12	1.78E+11	1.04E+11	8.31E+10	5.88E+10
Percent reduction				
40%	0	0	0	6%

Table 47: Load duration curve calculations (organism/day) for the Burnt River at Huntington (11494-ORDEQ) - geometric mean criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Load capacity (geometric mean of Load capacity in each flow group)				
3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
MOS (10% of load capacity)				
3.10E+11	3.63E+10	1.98E+10	1.29E+10	5.51E+09
RC (0% of load capacity)				
0	0	0	0	0
WLA				
3.57E+10	8.40E+09	6.75E+09	6.06E+09	5.32E+09
LA				
2.75E+12	3.19E+11	1.71E+11	1.10E+11	4.43E+10
Measured load (geometric mean of observed values in each flow group)				
3.41E+12	4.42E+10	7.24E+09	1.10E+09	N/A
Percent reduction				
9%	0	0	0	N/A

Table 48: Load duration curve calculations (organism/day) for the Burnt River at Huntington (11494-ORDEQ) - single sample criteria from May to October

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
9.79E+12	3.45E+11	6.16E+11	3.35E+11	5.88E+10
Flow (cfs on day with highest measured value)				
691	103	65	40	27
Load capacity (on day with highest measured value)				
6.86E+12	1.02E+12	6.47E+11	3.94E+11	2.68E+11
MOS (10% of load capacity)				
6.86E+11	1.02E+11	6.47E+10	3.94E+10	2.68E+10
RC (0% of load capacity)				
0	0	0	0	0
WLA				
7.34E+10	1.50E+10	1.12E+10	8.71E+09	7.45E+09
LA				
6.10E+12	9.06E+11	5.71E+11	3.46E+11	2.34E+11
Percent reduction				
30%	0	0	0	0

Table 49: Load duration curve calculations (organism/day) for the Burnt River at Huntington (11494-ORDEQ) - single sample criteria from November to April

High	Medium-High	Medium	Medium-Low	Low
Measured load (highest value)				
3.90E+12	2.70E+11	2.59E+10	1.10E+09	N/A
Flow (cfs on day with highest measured value)				
1340	133	53	45	N/A
Load capacity (on day with highest measured value)				
1.33E+13	1.32E+12	5.26E+11	4.47E+11	N/A
MOS (10% of load capacity)				
1.33E+12	1.32E+11	5.26E+10	4.47E+10	N/A
RC (0% of load capacity)				
0	0	0	0	N/A
WLA				
1.38E+11	1.80E+10	1.00E+10	9.24E+09	N/A
LA				
1.18E+13	1.17E+12	4.64E+11	3.93E+11	N/A
Percent reduction				
0	0	0	0	N/A

Table 50: Compiled *E. coliE. coli* loading capacity and excess load by stationstream reach - geometric mean criterionTable 4.5.2oo: Compiled *E.coli* loading capacity and excess load by station - geometric mean criterion

Station	Caclulation	Flow category by seasonal period									
		May-October					November-April				
		High	Medium-High	Medium	Medium-Low	Low	High	Medium-High	Medium	Medium-Low	Low
Confluence of Brownlee Subbasin streams with Snake River	Measured Load (organisms/day)	5.65E+12	1.40E+12	N/A	5.53E+09	1.20E+10	5.07E+12	1.25E+11	2.04E+10	1.73E+10	N/A
	Load Capacity (organsims/day)	8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10	8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
	Excess Load (% reduction)	0	0	N/A	0	0	0	0	0	0	N/A
Powder River upstream of Philips Reservoir	Measured Load (organisms/day)	N/A	9.86E+10	N/A	6.44E+08	2.86E+08	N/A	9.05E+09	N/A	4.76E+08	N/A
	Load Capacity (organsims/day)	1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09	1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
	Excess Load (% reduction)	N/A	0	N/A	0	0	N/A	0	N/A	0	N/A
Powder River from Phillips Reservoir to Baker City	Measured Load (organisms/day)	1.44E+12	3.43E+11	1.10E+11	7.22E+10	2.30E+10	4.25E+11	4.12E+11	1.56E+11	8.65E+09	6.44E+09
	Load Capacity (organsims/day)	1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10	1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
	Excess Load (% reduction)	9	0	0	12	0	0	0	0	0	0
North Powder River from USFS Boundary to Miller Rd	Measured Load (organisms/day)	4.97E+11	1.29E+11	9.96E+10	9.91E+10	7.05E+09	8.64E+11	6.78E+09	3.40E+09	5.38E+09	N/A
	Load Capacity (organsims/day)	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
	Excess Load (% reduction)	0	8	48	70	0	0	0	0	0	N/A
North Powder River from Miller Rd to Confluence with Powder River	Measured Load (organisms/day)	5.34E+12	4.90E+11	1.78E+11	1.46E+11	2.48E+11	2.01E+12	2.72E+10	1.12E+10	3.34E+10	N/A
	Load Capacity (organsims/day)	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
	Excess Load (% reduction)	77	76	71	79	95	39	0	0	10	N/A
Eagle Creek from New Bridge to Brownlee Reservoir	Measured Load (organisms/day)	1.35E+12	3.38E+11	N/A	8.30E+10	2.97E+10	1.20E+12	7.82E+10	4.55E+10	2.62E+10	N/A
	Load Capacity (organsims/day)	5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10	5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
	Excess Load (% reduction)	0	0	N/A	0	64	0	0	0	0	N/A
Powder River from Baker City to confluence with Snake River	Measured Load (organisms/day)	7.10E+12	5.87E+11	1.65E+11	4.34E+11	N/A	3.05E+12	2.68E+11	2.44E+10	6.21E+10	N/A
	Load Capacity (organsims/day)	4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10	4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
	Excess Load (% reduction)	35	0	0	75	N/A	0	0	0	0	N/A
Burnt River upstream of Unity Reservoir Dam	Measured Load (organisms/day)	1.15E+11	1.84E+10	3.25E+09	N/A	N/A	2.35E+10	3.17E+09	2.04E+09	2.61E+09	N/A
	Load Capacity (organsims/day)	1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09	1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
	Excess Load (% reduction)	0	0	0	N/A	N/A	0	0	0	0	N/A
Burnt River from Unity Reservoir to Clarks Creek Rd	Measured Load (organisms/day)	2.15E+12	3.77E+11	2.27E+11	N/A	N/A	5.03E+11	2.62E+11	1.90E+10	1.88E+10	N/A
	Load Capacity (organsims/day)	2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10	2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
	Excess Load (% reduction)	0	36	41	N/A	N/A	0	8	0	0	N/A
Burnt River from Clarks Creek Rd to confluence with Snake River	Measured Load (organisms/day)	5.12E+12	1.78E+11	1.04E+11	8.31E+10	5.88E+10	3.41E+12	4.42E+10	7.24E+09	1.10E+09	N/A
	Load Capacity (organsims/day)	3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10	3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
	Excess Load (% reduction)	39	0	0	0	6	9	0	0	0	N/A

Station		Geometric Mean Criterion									
		Irrigation Season					Non-irrigation season				
	Flow Category	High	Medium-High	Medium	Medium-Low	Low	High	Medium-High	Medium	Medium-Low	Low
36382-ORDEQ: Pine Creek at Hwy 71	Measured Load (organisms/day)	5.65E+12	1.40E+12	N/A	5.53E+09	1.20E+10	5.07E+12	1.25E+11	2.04E+10	1.73E+10	N/A
	Load Capacity (organsims/day)	8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10	8.26E+12	1.81E+12	5.41E+11	2.06E+11	8.02E+10
	Excess Load (% reduction)	0%	0%	N/A	0%	0%	0%	0%	0%	0%	N/A
34250-ORDEQ: Powder River above Phillips	Measured Load (organisms/day)	N/A	9.86E+10	N/A	6.44E+08	2.86E+08	N/A	9.05E+09	N/A	4.76E+08	N/A
	Load Capacity (organsims/day)	1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09	1.53E+12	2.64E+11	5.86E+10	1.98E+10	2.38E+09
	Excess Load (% reduction)	N/A	0%	N/A	0%	0%	N/A	0%	N/A	0%	N/A
11490-ORDEQ: Powder River at Baker City	Measured Load (organisms/day)	1.44E+12	3.43E+11	1.10E+11	7.22E+10	2.30E+10	4.25E+11	4.12E+11	1.56E+11	8.65E+09	6.44E+09
	Load Capacity (organsims/day)	1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10	1.31E+12	4.66E+11	1.64E+11	6.37E+10	3.02E+10
	Excess Load (% reduction)	9%	0%	0%	12%	0%	0%	0%	0%	0%	0%
36192-ORDEQ: North Powder River at Miller Rd	Measured Load (organisms/day)	4.97E+11	1.29E+11	9.96E+10	9.91E+10	7.05E+09	8.64E+11	6.78E+09	3.40E+09	5.38E+09	N/A
	Load Capacity (organsims/day)	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
	Excess Load (% reduction)	0%	8%	48%	70%	0%	0%	0%	0%	0%	N/A
36191-ORDEQ: North Powder River at Hwy 30	Measured Load (organisms/day)	5.34E+12	4.90E+11	1.78E+11	1.46E+11	2.48E+11	2.01E+12	2.72E+10	1.12E+10	3.34E+10	N/A
	Load Capacity (organsims/day)	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10	1.23E+12	1.19E+11	5.22E+10	3.00E+10	1.25E+10
	Excess Load (% reduction)	77%	76%	71%	79%	95%	39%	0%	0%	10%	N/A
36193-ORDEQ: Eagle Creek near Richland	Measured Load (organisms/day)	1.35E+12	3.38E+11	N/A	8.30E+10	2.97E+10	1.20E+12	7.82E+10	4.55E+10	2.62E+10	N/A
	Load Capacity (organsims/day)	5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10	5.32E+12	1.18E+12	3.84E+11	1.24E+11	1.08E+10
	Excess Load (% reduction)	0%	0%	N/A	0%	64%	0%	0%	0%	0%	N/A
11857-ORDEQ: Powder River near Richland	Measured Load (organisms/day)	7.10E+12	5.87E+11	1.65E+11	4.34E+11	N/A	3.05E+12	2.68E+11	2.44E+10	6.21E+10	N/A
	Load Capacity (organsims/day)	4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10	4.65E+12	8.83E+11	2.31E+11	1.07E+11	3.11E+10
	Excess Load (% reduction)	35%	0%	0%	75%	N/A	0%	0%	0%	0%	N/A
36195-ORDEQ: Burnt River at Unity Reservoir	Measured Load (organisms/day)	1.15E+11	1.84E+10	3.25E+09	N/A	N/A	2.35E+10	3.17E+09	2.04E+09	2.61E+09	N/A
	Load Capacity (organsims/day)	1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09	1.99E+12	3.59E+11	1.28E+11	2.54E+10	4.98E+09
	Excess Load (% reduction)	0%	0%	0%	N/A	N/A	0%	0%	0%	0%	N/A
34256-ORDEQ: Burnt River at Clarks Creek Rd	Measured Load (organisms/day)	2.15E+12	3.77E+11	2.27E+11	N/A	N/A	5.03E+11	2.62E+11	1.90E+10	1.88E+10	N/A
	Load Capacity (organsims/day)	2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10	2.39E+12	2.40E+11	1.33E+11	8.25E+10	4.30E+10
	Excess Load (% reduction)	0%	36%	41%	N/A	N/A	0%	8%	0%	0%	N/A
11494-ORDEQ: Burnt River at Huntington	Measured Load (organisms/day)	5.12E+12	1.78E+11	1.04E+11	8.31E+10	5.88E+10	3.41E+12	4.42E+10	7.24E+09	1.10E+09	N/A
	Load Capacity (organsims/day)	3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10	3.10E+12	3.63E+11	1.98E+11	1.29E+11	5.51E+10
	Excess Load (% reduction)	40%	0%	0%	0%	6%	9%	0%	0%	0%	N/A

~~Notes: N/A indicates no data. Highest reductions needed are highlighted in pale orange. Year-round implementation of highest reduction indicated at any flow is protective of all flows and both criteria.~~

Table 51: Compiled ~~*E. coli*~~*E. coli* loading capacity and excess load by ~~station~~stream reach - single sample criterion~~Table 4.5.2pp: Compiled *E.coli* loading capacity and excess load by station – single sample criterion~~

Station	Caclulation	Flow category by seasonal period									
		May-October					November-April				
		High	Medium-High	Medium	Medium-Low	Low	High	Medium-High	Medium	Medium-Low	Low
Confluence of Brownlee Subbasin streams with Snake River	Measured Load (organisms/day)	1.17E+13	2.65E+12	N/A	5.53E+09	2.53E+10	6.18E+12	9.79E+11	4.52E+10	8.95E+10	N/A
	Load Capacity (organsims/day)	1.30E+13	6.87E+12	N/A	3.74E+11	2.71E+11	2.18E+13	6.97E+12	2.26E+12	9.74E+11	N/A
	Excess Load (% reduction)	0	0	N/A	0	0	0	0	0	0	N/A
Powder River upstream of Philips Reservoir	Measured Load (organisms/day)	N/A	1.18E+11	N/A	1.97E+09	4.15E+09	N/A	4.14E+10	N/A	4.76E+08	N/A
	Load Capacity (organsims/day)	N/A	4.58E+11	N/A	3.48E+10	1.31E+10	N/A	1.29E+12	N/A	3.07E+10	N/A
	Excess Load (% reduction)	N/A	0	N/A	0	0	N/A	0	N/A	0	N/A
Powder River from Phillips Reservoir to Baker City	Measured Load (organisms/day)	1.88E+12	9.76E+11	3.25E+11	2.03E+11	6.40E+10	4.25E+11	4.12E+11	4.20E+12	6.05E+10	6.44E+09
	Load Capacity (organsims/day)	2.93E+12	1.15E+12	7.91E+11	1.69E+11	9.12E+10	3.68E+12	9.66E+11	7.05E+11	2.42E+11	9.17E+10
	Excess Load (% reduction)	0	0	0	17	0	0	0	83	0	0
North Powder River from USFS Boundary to Miller Rd	Measured Load (organisms/day)	1.60E+12	3.26E+12	1.81E+11	6.50E+11	7.63E+09	1.60E+12	2.59E+10	4.40E+09	1.10E+10	N/A
	Load Capacity (organsims/day)	6.41E+12	5.46E+11	1.69E+11	1.09E+11	4.77E+10	2.36E+12	3.08E+11	1.49E+11	1.29E+11	N/A
	Excess Load (% reduction)	0	83	7	83	0	0	0	0	0	N/A
North Powder River from Miller Rd to Confluence with Powder River	Measured Load (organisms/day)	1.96E+13	1.97E+12	5.00E+11	4.56E+11	2.84E+11	2.26E+12	1.46E+12	1.90E+11	3.36E+11	N/A
	Load Capacity (organsims/day)	4.00E+12	6.66E+11	1.69E+11	7.65E+10	4.77E+10	2.36E+12	5.66E+11	1.49E+11	1.39E+11	N/A
	Excess Load (% reduction)	80	66	66	83	83	0	61	22	59	N/A
Eagle Creek from New Bridge to Brownlee Reservoir	Measured Load (organisms/day)	3.22E+12	1.24E+12	N/A	4.08E+11	2.97E+10	1.35E+12	8.13E+11	4.13E+11	1.03E+11	N/A
	Load Capacity (organsims/day)	1.40E+13	5.71E+12	N/A	2.41E+11	5.02E+10	1.54E+13	3.65E+12	1.13E+12	8.47E+11	N/A
	Excess Load (% reduction)	0	0	N/A	41	0	0	0	0	0	N/A
Powder River from Baker City to confluence with Snake River	Measured Load (organisms/day)	1.59E+13	1.58E+12	1.04E+12	1.02E+12	N/A	1.59E+13	3.41E+12	2.44E+10	9.78E+10	N/A
	Load Capacity (organsims/day)	2.10E+13	3.46E+12	7.32E+11	3.96E+11	N/A	7.89E+12	4.98E+12	4.92E+11	4.65E+11	N/A
	Excess Load (% reduction)	0	0	30	61	N/A	50	0	0	0	N/A
Burnt River upstream of Unity Reservoir Dam	Measured Load (organisms/day)	3.83E+11	1.97E+11	1.20E+10	0.00E+00	N/A	8.75E+10	3.18E+09	3.33E+09	7.25E+09	N/A
	Load Capacity (organsims/day)	2.63E+12	1.54E+12	7.75E+11	N/A	N/A	5.92E+12	6.46E+11	1.69E+11	1.29E+11	N/A
	Excess Load (% reduction)	0	0	0	N/A	N/A	0	0	0	0	N/A
Burnt River from Unity Reservoir to Clarks Creek Rd	Measured Load (organisms/day)	6.11E+12	4.61E+12	2.38E+12	N/A	N/A	2.41E+12	2.62E+11	4.02E+11	1.93E+11	N/A
	Load Capacity (organsims/day)	4.80E+12	7.74E+11	4.91E+11	N/A	N/A	8.51E+12	4.97E+11	3.97E+11	3.00E+11	N/A
	Excess Load (% reduction)	21	83	79	N/A	N/A	0	0	1	0	N/A
Burnt River from Clarks Creek Rd to confluence with Snake River	Measured Load (organisms/day)	9.79E+12	3.45E+11	6.16E+11	3.35E+11	5.88E+10	3.90E+12	2.70E+11	2.59E+10	1.10E+09	N/A
	Load Capacity (organsims/day)	6.86E+12	1.02E+12	6.47E+11	3.94E+11	2.68E+11	1.33E+13	1.32E+12	5.26E+11	4.47E+11	N/A
	Excess Load (% reduction)	30	0	0	0	0	0	0	0	0	N/A

Station	Flow Category	Single Sample Maximum Criterion									
		Irrigation Season					Non-irrigation season				
		High	Medium-High	Medium	Medium-Low	Low	High	Medium-High	Medium	Medium-Low	Low
36382-ORDEQ: Pine Creek at Hwy 71	Measured Load (organisms/day)	1.17E+13	2.65E+12	N/A	5.53E+09	2.53E+10	6.18E+12	9.79E+11	4.52E+10	8.95E+10	N/A
	Load Capacity (organsims/day)	1.30E+13	6.87E+12	N/A	3.74E+11	2.71E+11	2.18E+13	6.97E+12	2.26E+12	9.74E+11	N/A
	Excess Load (% reduction)	0%	0%	N/A	0%	0%	0%	0%	0%	0%	N/A
34250-ORDEQ: Powder River above Phillips	Measured Load (organisms/day)	N/A	1.18E+11	N/A	1.97E+09	4.15E+09	N/A	4.14E+10	N/A	4.76E+08	N/A
	Load Capacity (organsims/day)	N/A	4.58E+11	N/A	3.48E+10	1.31E+10	N/A	1.29E+12	N/A	3.07E+10	N/A
	Excess Load (% reduction)	N/A	0%	N/A	0%	0%	N/A	0%	N/A	0%	N/A
11490-ORDEQ: Powder River at Baker City	Measured Load (organisms/day)	1.88E+12	9.76E+11	3.25E+11	2.03E+11	6.40E+10	4.25E+11	4.12E+11	4.20E+12	6.05E+10	6.44E+09
	Load Capacity (organsims/day)	2.93E+12	1.15E+12	7.91E+11	1.69E+11	9.12E+10	3.68E+12	9.66E+11	7.05E+11	2.42E+11	9.17E+10
	Excess Load (% reduction)	0%	0%	0%	17%	0%	0%	0%	83%	0%	0%
36192-ORDEQ: North Powder River at Miller Rd	Measured Load (organisms/day)	1.60E+12	3.26E+12	1.81E+11	6.50E+11	7.63E+09	1.60E+12	2.59E+10	4.40E+09	1.10E+10	N/A
	Load Capacity (organsims/day)	6.41E+12	5.46E+11	1.69E+11	1.09E+11	4.77E+10	2.36E+12	3.08E+11	1.49E+11	1.29E+11	N/A
	Excess Load (% reduction)	0%	83%	7%	83%	0%	0%	0%	0%	0%	N/A
36191-ORDEQ: North Powder River at Hwy 30	Measured Load (organisms/day)	1.96E+13	1.97E+12	5.00E+11	4.56E+11	2.84E+11	2.26E+12	1.46E+12	1.90E+11	3.36E+11	N/A
	Load Capacity (organsims/day)	4.00E+12	6.66E+11	1.69E+11	7.65E+10	4.77E+10	2.36E+12	5.66E+11	1.49E+11	1.39E+11	N/A
	Excess Load (% reduction)	80%	66%	66%	83%	83%	0%	61%	22%	59%	N/A
36193-ORDEQ: Eagle Creek near Richland	Measured Load (organisms/day)	3.22E+12	1.24E+12	N/A	4.08E+11	2.97E+10	1.35E+12	8.13E+11	4.13E+11	1.03E+11	N/A
	Load Capacity (organsims/day)	1.40E+13	5.71E+12	N/A	2.41E+11	5.02E+10	1.54E+13	3.65E+12	1.13E+12	8.47E+11	N/A
	Excess Load (% reduction)	0%	0%	N/A	41%	0%	0%	0%	0%	0%	N/A
11857-ORDEQ: Powder River near Richland	Measured Load (organisms/day)	1.59E+13	1.58E+12	1.04E+12	1.02E+12	N/A	1.59E+13	3.41E+12	2.44E+10	9.78E+10	N/A
	Load Capacity (organsims/day)	2.10E+13	3.46E+12	7.32E+11	3.96E+11	N/A	7.89E+12	4.98E+12	4.92E+11	4.65E+11	N/A
	Excess Load (% reduction)	0%	0%	30%	61%	N/A	50%	0%	0%	0%	N/A
36195-ORDEQ: Burnt River at Unity Reservoir	Measured Load (organisms/day)	3.83E+11	1.97E+11	1.20E+10	0.00E+00	N/A	8.75E+10	3.18E+09	3.33E+09	7.25E+09	N/A
	Load Capacity (organsims/day)	2.63E+12	1.54E+12	7.75E+11	N/A	N/A	5.92E+12	6.46E+11	1.69E+11	1.29E+11	N/A
	Excess Load (% reduction)	0%	0%	0%	N/A	N/A	0%	0%	0%	0%	N/A
34256-ORDEQ: Burnt River at Clarks Creek Rd	Measured Load (organisms/day)	6.11E+12	4.61E+12	2.38E+12	N/A	N/A	2.41E+12	2.62E+11	4.02E+11	1.93E+11	N/A
	Load Capacity (organsims/day)	4.80E+12	7.74E+11	4.91E+11	N/A	N/A	8.51E+12	4.97E+11	3.97E+11	3.00E+11	N/A
	Excess Load (% reduction)	21%	83%	79%	N/A	N/A	0%	0%	1%	0%	N/A
11494-ORDEQ: Burnt River at Huntington	Measured Load (organisms/day)	9.79E+12	3.45E+11	6.16E+11	3.35E+11	5.88E+10	3.90E+12	2.70E+11	2.59E+10	1.10E+09	N/A
	Load Capacity (organsims/day)	6.86E+12	1.02E+12	6.47E+11	3.94E+11	2.68E+11	1.33E+13	1.32E+12	5.26E+11	4.47E+11	N/A
	Excess Load (% reduction)	30%	0%	0%	0%	0%	0%	0%	0%	0%	N/A

~~Notes: N/A indicates no data. Highest reductions needed are highlighted in pale orange. Year-round implementation of highest reduction indicated at any flow is protective of all flows and both criteria.~~

Table 52: Compiled percent reduction needed for reaches in the Powder BasinTable 4.5.2qq: Compiled percent reductions needed for reaches in the Powder Basin

Station and stream reach	Percent reduction	Criterion based upon	Season based upon	Flow category based upon
11490-ORDEQ: Powder River at Baker City	83%	Single Sample	Non-Irrigation	Medium
11857-ORDEQ: Powder River at Snake River Rd (Richland)	75%	Geometric Mean	Irrigation	Medium-Low
36193-ORDEQ: Eagle Creek near Richland	64%	Geometric Mean	Irrigation	Low
36191-ORDEQ: North Powder River at Hwy 30	95%	Geometric Mean	Irrigation	Low
36192-ORDEQ: North Powder River at Miller Rd	83%	Single Sample	Irrigation	Medium-High & Medium-Low
34256-ORDEQ: Burnt River at Clarks Creek Rd	83%	Single Sample	Irrigation	Medium High
11494-ORDEQ: Burnt River at Huntington	40%	Geometric Mean	Irrigation	High
34250-ORDEQ: Powder River above Phillips Reservoir	0%	Geometric Mean & Single Sample	Irrigation & Non-Irrigation	All
36382-ORDEQ: Pine Creek at Hwy 71	0%	Geometric Mean & Single Sample	Irrigation & Non-Irrigation	All
36195-ORDEQ: Burnt River at Unity Reservoir Discharge	0%	Geometric Mean & Single Sample	Irrigation & Non-Irrigation	All
Stream reach	**Percent reduction**	**Criterion based upon**	**Season based upon**	**Flow category based upon**
Brownlee Subbasin				
Brownlee Subbasin streams confluence with Snake River	0	Geometric Mean & Single Sample	May-October & November-April	All
Powder Subbasin				
34250-ORDEQ: Powder River above Phillips Reservoir	0	Geometric Mean & Single Sample	May-October & November-April	All
Powder River from Phillips Reservoir to Baker City	83	Single Sample	November-April	Medium
North Powder River from USFS	83	Single Sample	May-October	Medium-High & Medium-Low

Boundary to Miller Rd				
North Powder River from Miller Road to Confluence with Powder River	95	Geometric Mean	May-October	Low
Eagle Creek from New Bridge to Brownlee Reservoir	64	Geometric Mean	May-October	Low
Powder River from Baker City to confluence with Snake River	75	Geometric Mean	May-October	Medium-Low
Burnt Subbasin				
Burnt River upstream of Unity Reservoir Dam	0	Geometric Mean & Single Sample	May-October & November-April	All
Burnt River from Unity Reservoir to Clarks Creek Rd	83	Single Sample	May-October	Medium High
Burnt River from Clarks Creek Rd to confluence with Snake River	40	Geometric Mean	May-October	High

5. Source ~~Assessment~~ assessment and ~~Load~~ load Contributions

Fecal indicator bacteria, such as ~~*E. coli*~~ *E. coli*, and associated pathogens originate from human~~, livestock and wildlife~~ and other warm-blooded animal ~~waste~~ feces. The pathways by which ~~*E. coli*~~ *E. coli* and associated fecal pathogens enter waterbodies depends on the specific sources, ~~locations of origin,~~ transport mechanisms, and landscape management practices.

5.1 Summary of DEQ ~~source assessment bacteria~~ *E.* ~~*coli*~~ *E. coli* monitoring data

~~Water in the Powder River Basin is highly managed for irrigation. Thus, water storage and release affect *E. coli* concentrations in surface waters at different times of the year. Low flows typically occur in the winter months and high flows occur during spring and summer as snowmelt and water stored in reservoirs is released for irrigation. A large proportion of the basin experiences flood irrigation with significant irrigation return flows to streams. Irrigation induced erosion is generally highest in spring and early summer.~~ Return water and ~~This erosion can carry sediment, nutrients and *E. coli* to local waterbodies.~~

~~The sections that follow~~ This section presents ~~tabulated *E. coli*~~ *E. coli* ~~data~~ sample data collected ~~, collected on a quarterly basis~~ by DEQ in the ~~Powder River, Brownlee Reservoir and Burnt River Subbasins~~ River between ~~2007-2013~~ 2000 and 2024, including data collected approximately every two months as part of the statewide DEQ ambient monitoring program ~~along with discussion of evaluation of the data~~ and data from the ~~Basin specific~~ DEQ TMDL project from 2007-2013 (DEQ 2013; DEQ 2016). ~~For TMDL project data, s~~ Samples are ~~organized~~ grouped according to ~~irrigation (~~ May-October~~)~~ and ~~non-irrigation (~~ November-April~~)~~ seasonal periods. ~~The data are grouped as irrigation season (May through October) and non-irrigation season (November through April).~~

~~Bacteria~~ ~~*E. coli*~~ *E. coli* data for the Brownlee, Powder, ~~-~~ and Brownlee subbasins are summarized in Table~~s~~ ~~5.1a~~ 53 and sample locations are shown on Figures ~~5.1.1a~~ 26~~, 5.1.2 and 5.1.3a~~, 28, ~~and~~ 29, and 31. ~~Bacteria~~ ~~*E. coli*~~ ~~data for the Burnt~~ S~~subbasin is summarized in Table 5.1b~~ 54 ~~and sample locations are shown in Figure 5.1.4a~~ 31~~.~~

Table 53: Brownlee, Powder River, and Burnt and Brownlee sSubbasins E. coli*E. coli* data and percent of samples exceeding the single sample criterion (406 organisms/day) from 2007-2013 (DEQ TMDL Project; DEQ 2013)Table 5.1a: Powder River and Brownlee Reservoir Subbasins bacteria*E. coli* data from 2007-2013 (DEQ TMDL Project; DEQ 2013)

Station Number and NameDEQ Monitoring Station	Sample dates years	May-October			Non-irrigation Season November-April11/1-4/30		
		Number of Samples n	Log Geometric Mmean (organisms/day)	%>%> 406 organisms/ 100 mL	Number of Samples n	Log GeometricM mean (organisms/day)	%> 406 organisms/ 100 mL%> 406
Brownlee Subbasin							
36382-ORDEQ: Pine Creek (Powder Basin) @ State Hwy. 71 near Oxbow, OR	2011-13	30	33	0	21	9	0
Powder Subbasin							
34249-ORDEQ: Cracker Creek above Wind Creek confluence at bridge crossing-Cracker Cr. above Wind Cr. confluence	072007	19	4	0	5	1	0
34250-ORDEQ: -Powder R.above Phillips Reservoir DamPowder River at Dredge Loop Road above Phillips Reservoir Dam	2007-08	25	14	0	8	6	0
26601-ORDEQ: -Powder River at RM 131.1 (Snake), 0.25 miles d/s of Mason Dam, at WRD gauging station-Powder R. at RM 131.1, d/s Of Mason Dam	2007-08	28	1	0	22	1	0
10725-ORDEQ: Powder River 3 miles south of Baker-Powder R. 3 miles south of Baker	2007-08	22	138	14	5	135	20
11490-ORDEQ: Powder River at Hwy 7 (in Baker City)-Powder R. at Hwy 7 (in Baker City)*	2007-13	38	72	10	21	51	10
34252-ORDEQ: -Powder River upstream of North Powder confluence-Powder R. upstream of N. Powder confluence	2007-08	21	224	38	24	54	8

		May-October			Non-irrigation Season November-April11/1-4/30		
Station Number and NameDEQ Monitoring Station	Sample dates years	Number of Samples n	Log Geometric Mmean (organisms/day)	%>%> 406 organisms/ 100 mL	Number of Samples n	Log GeometricM mean (organisms/day)	%> 406 organisms/ 100 mL%> 406
12624-ORDEQ: -Powder River at Deane Bidwell Road- Powder R. at Deane Bidwell Rd.	2011-12	1	N/A	0	10	39	0
36191-ORDEQ: North Powder River at Hwy. 30 Bridge - N. Powder R. at Hwy. 30 bridge	2010-13	45	372	47	30	61	27
36192-ORDEQ: North Powder River at Miller Rd. Bridge - N. Powder R. at Miller Rd. bridge	2010-13	45	84	16	32	20	12
10724-ORDEQ: Powder River at Hwy 86 (east of Baker City) -Powder R. at Hwy 86 (east of Baker City)*	2007-13	18	107	11	13	61	8
36193-ORDEQ: Eagle Creek at Snake River Road11857 -Powder R. at Snake R. Rd.(Richland)	2010-1310-13	45 45	34148	1118	30 30	1736	00
11857-ORDEQ: Powder River at Snake River Road (Richland)36193 -Eagle Cr. at Snake R. Rd. near Richland	2010-1310-13	45 45	14834	1811	30 30	3617	00
36194 -Powder R. Arm of Brownlee Res.	10	25	19	4	8	110	0
36194-ORDEQ: - Powder River Arm of Brownlee Reservoir @ Hewitt Pk. Boat Ramp36382 - Pine Cr. at Hwy 71	201011-13	25 30	1933	40	82 1	1109	00
Burnt Subbasin							
36198-ORDEQ: West Fork Burnt River at Rice Road Bridge	2010-13	43	24	2	19	33	0
36197-ORDEQ: Middle Fork Burnt River at Rice Road Bridge	2010-13	43	97	14	32	17	0

Station Number and NameDEQ Monitoring Station	Sample dates years	May-October			Non-irrigation Season November-April11/1-4/30		
		Number of Samples n	Log Geometric Mmean (organisms/day)	%>%> 406 organisms/ 100 mL	Number of Samples n	Log GeometricM mean (organisms/day)	%> 406 organisms/ 100 mL%> 406
36196-ORDEQ: So. Fork Burnt River at Rouse Lane Bridge	2010-13	43	410	56	31	40	16
36195-ORDEQ: Burnt River at Unity Reservoir Dam	2010-13	43	6	0	35	9	0
34256-ORDEQ: Burnt River at Clarks Creek bridge	2010-13	43	193	26	32	29	3
36384-ORDEQ: Dixie Creek (Burnt Basin) near mouth at Hwy. 30.	2011-12	3	150	33	4	14	0
36385-ORDEQ: Burnt River @ Hwy. 30 upstream of Huntington, OR	2011-12	4	63	0	4	22	0
11494-ORDEQ: Burnt River at Snake River Road (Huntington)	2011-12	18	85	17	15	20	0
Notes: Blue shaded results exceed WQ Criteria (geometric mean 126 organisms/100 mL; single sample maximum of 406 organisms/100 mL)							

Table 54: Burnt River Subbasin *E. coli* data from 2010-2013 (DEQ TMDL Project; DEQ 2013)Table 5.1b: Burnt River Subbasin *E. coli* data from 2010-2013 (DEQ TMDL Project; DEQ 2013)

Table 5.1b: Burnt River Subbasin bacteriaE. coli data 2010-2013

Station Number and name	Sample Dates years	River Mile	Irrigation Season 5/1-10/31				Non-irrigation Season 11/1-4/30			
			Number of Samples	Log Mean	Max.	%> 406	Number of Samples	Log Mean	Max.	%>406
36198 - WF Burnt R. at Rice Rd.	10-13	2.5	43	24	1733	2	19	33	101	0
36197 - MF Burnt R. at Rice Rd.	10-13	1.5	43	97	1533	14	32	17	148	0
36196 - SF Burnt R. at Rouse Ln.	10-13	1	43	410	2420	56	31	40	1553	16
36195 - Burnt R. at Unity Res. Dam	10-13	77	43	6	59	0	35	9	28	0
34256 - Burnt R. at Clarks Cr.	10-13	46	43	193	2420	26	32	29	411	3
36384 -Dixie Cr. near mouth at Hwy 30	11-12	0.25	3	150	866	33	4	14	33	0
36385 - Burnt R. at Hwy 30 upstream of Huntington	11-12	3.5	4	63	118	0	4	22	108	0
11494 - Burnt R. at Snake R. Rd. Huntington*	11-12	1	18	85	579	17	15	20	137	0

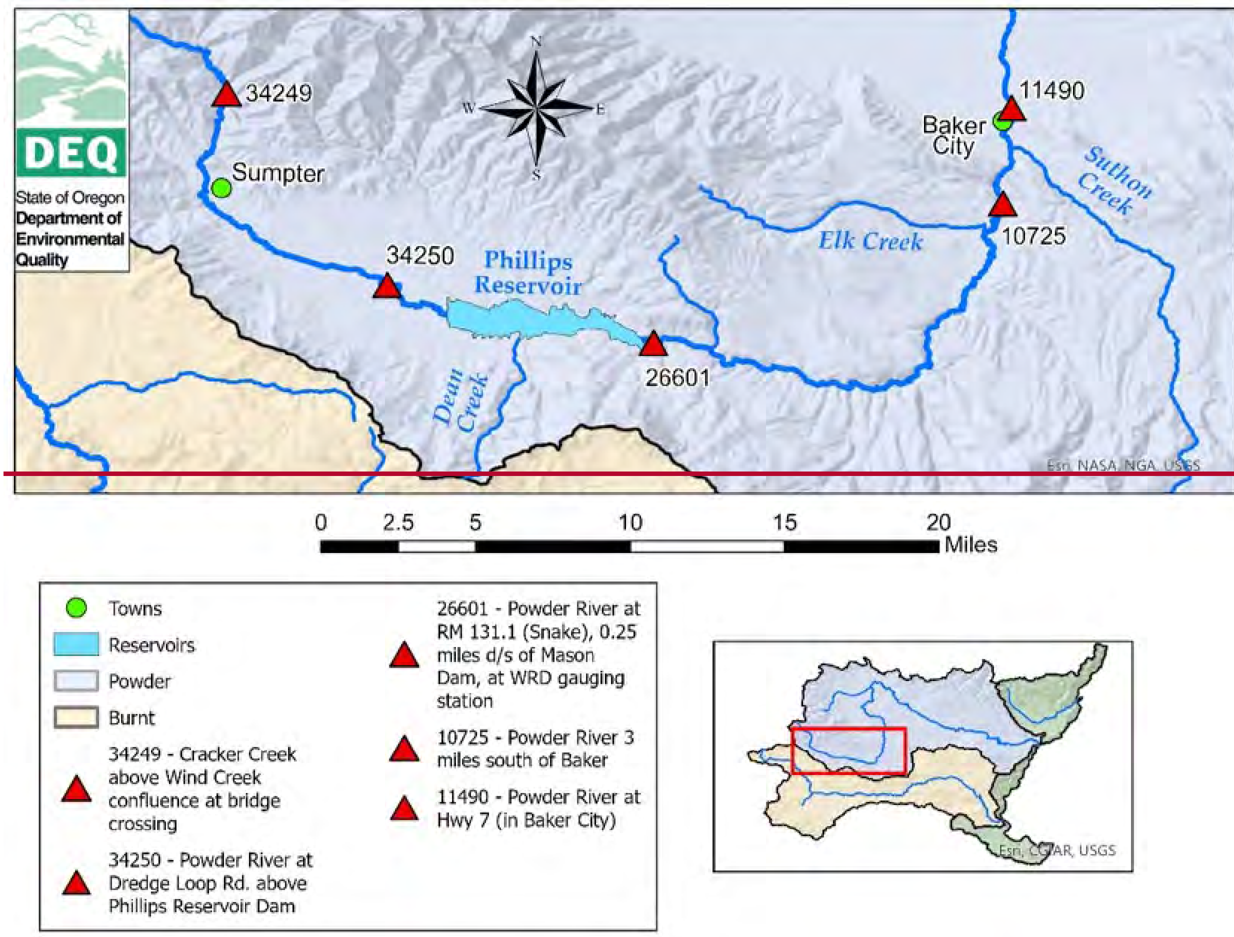
Notes: * DEQ ambient water quality site
Blue shaded results exceed WQ Criteria (log mean 126 org/100ml, single sample maximum of 406 org/100ml)

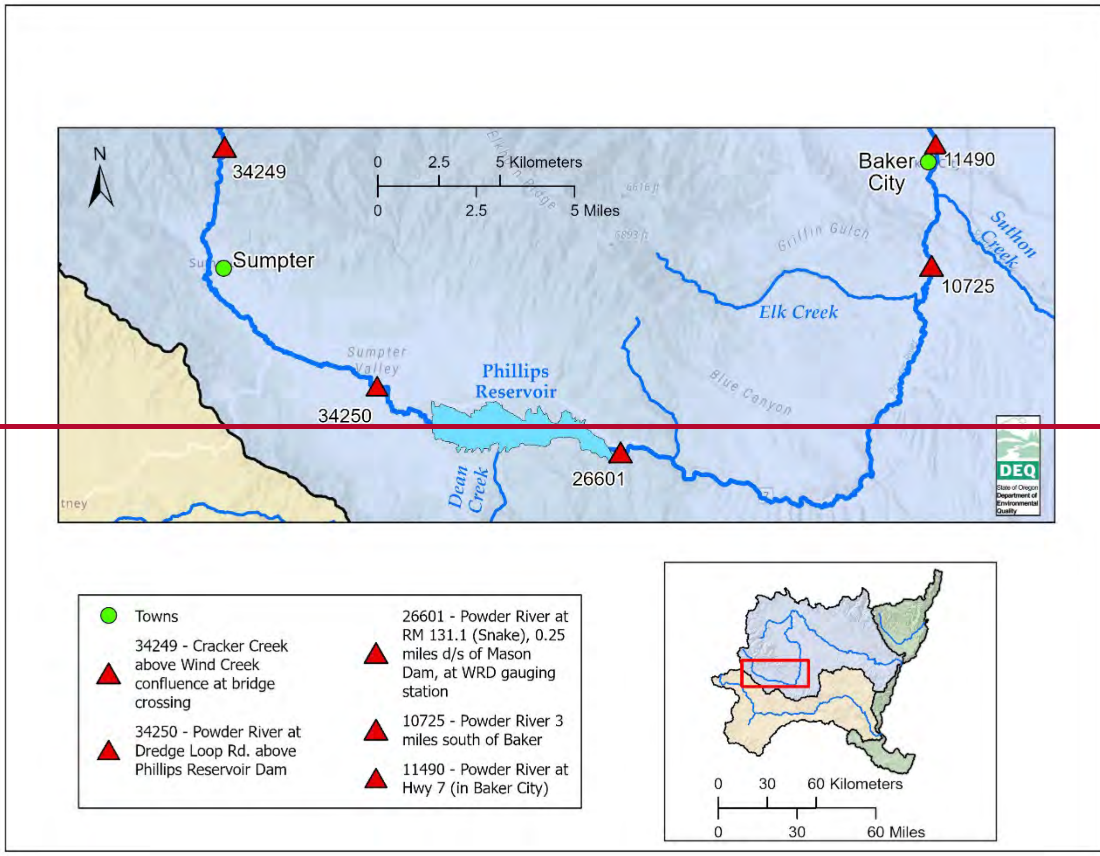
5.1.1 Upper Powder River to Baker City

BacteriaE. coliE. coli monitoring locations in the Powder River Subbasins and tributaries from the its headwaters to Baker City are shown in Figure 5.1.1a26. Land cover/land uses in this areareach consists of forest interspersed with pastures used for livestock grazing. Based on monitoring data, bacteriaE. coliE. coli loading concentrations above Phillips Reservoir (34249-ORDEQ Cracker Creek and 34250-ORDEQPowder River sample locations) appears to be minimalhad, with no exceedances of geometric mean or single sample criteria during the DEQ TMDL project from 2007-13. Irrigated pastures and hay fields that are often seasonally grazed by livestock become more frequent and extensiveare present downstream of Phillips Reservoir. The DEQ monitoring station on the Powder River South of Baker City (10725-ORDEQ), located approximately 14 miles downstream of Phillips Reservoir (10725-ORDEQ), had exhibitedhad exceedances of both geometric mean and single sample criteria year round during the DEQ TMDL Pproject Study of from 2007-13 (Table 5.1a53).

Based on monitoring data, eExceedances of criteria become were less frequent at the monitoring station 11490-ORDEQ (-Powder River at Hwy 7 (in Baker City)in Baker City (; Table 5.1a53). Using a Seasonal Mann-Kendall tTest (Meals et al., 2011) to examine interannual trends of *E. coli* concentratioin DEQ ambient monitoring datan, -Bacteria*E. coliE. coli* concentrations declined at 11490-ORDEQ between 2000 and 2019, with only one exceedance of the single sample criteria between 2015 and 2019 significantly increased (*p* = 0.028; slope = 1.31) between 2000 and 2024 after accounting for seasonal differences (irrigationNovember-April vs. non-irrigationMay-October) (Figure 5.1.1b27). Two exceedances of the *E. coli* single sample criterion have been observed between 2020 and 2024.

Based on data collected in the DEQ TMDL project from 2007-13, the highest percent reduction needed to meet criteria at monitoring station 11490-ORDEQ occurred during theAccording to Based on the loading capacity and excess load calculated for station 11490, this is the only location non-irrigation seasonNovember-April with a greater percent reduction required to meet criteria during the non-irrigation season rather than the irrigation season (Table 4.5.2qq523). Station 11490This station is located within Baker City at highway 7 and just downstream of several public parks and residential areas in Baker City and upstream of the discharge point for the Baker City Wastewater Treatment Plant. Unlike other monitoring locations, water quality at this site includes influence f In additional to nonpoint source inputs from rural areas upstream of the city boundary, inputs from sources such as pet waste, waterfowl and other urban wildlife, and romfailing septic systems urban activities and *E. coli* sources such as potential contamination from wildlife and pet waste and roadway and stormwater conveyance runoffmay be contributing to excess *E. coli* loading in this reach and potential contamination from wildlife and pet waste. These additional influences are not limited to the irrigation season and may be greater when land surface runoff is naturally higher. Based on monitoring data and information on land use/land cover and zoning, the primary area of concern for bacteria*E. coli* loading in this reach, due to livestock and irrigation practices, occurs immediately upstream of Baker City and downstream of Phillips Reservoir.


DEQ
State of Oregon Department of Environmental Quality
34249
Sumpter
34250
Phillips Reservoir
Dean Creek
26601
Elk Creek
11490
Baker City
10725
Suthon Creek
N
E
W
S
Esri, NASA, NGA, USGS
0 2.5 5 10 15 20 Miles
Towns
Reservoirs
Powder
Burnt
34249 - Cracker Creek above Wind Creek confluence at bridge crossing
34250 - Powder River at Dredge Loop Rd. above Phillips Reservoir Dam
26601 - Powder River at RM 131.1 (Snake), 0.25 miles d/s of Mason Dam, at WRD gauging station
10725 - Powder River 3 miles south of Baker
11490 - Powder River at Hwy 7 (in Baker City)
Esri, CGIAR, USGS


N
34249
Sumpter
34250
26601
Baker City
11490
10725
Elk Creek
Phillips Reservoir
Dean Creek
Sumpter Valley
Griffin Gulch
Blue Canyon
Suthon Creek
0 2.5 5 Kilometers
0 2.5 5 Miles
DEQ
Towns
34249 - Cracker Creek above Wind Creek confluence at bridge crossing
34250 - Powder River at Dredge Loop Rd. above Phillips Reservoir Dam
26601 - Powder River at RM 131.1 (Snake), 0.25 miles d/s of Mason Dam, at WRD gauging station
10725 - Powder River 3 miles south of Baker
11490 - Powder River at Hwy 7 (in Baker City)
0 30 60 Kilometers
0 30 60 Miles

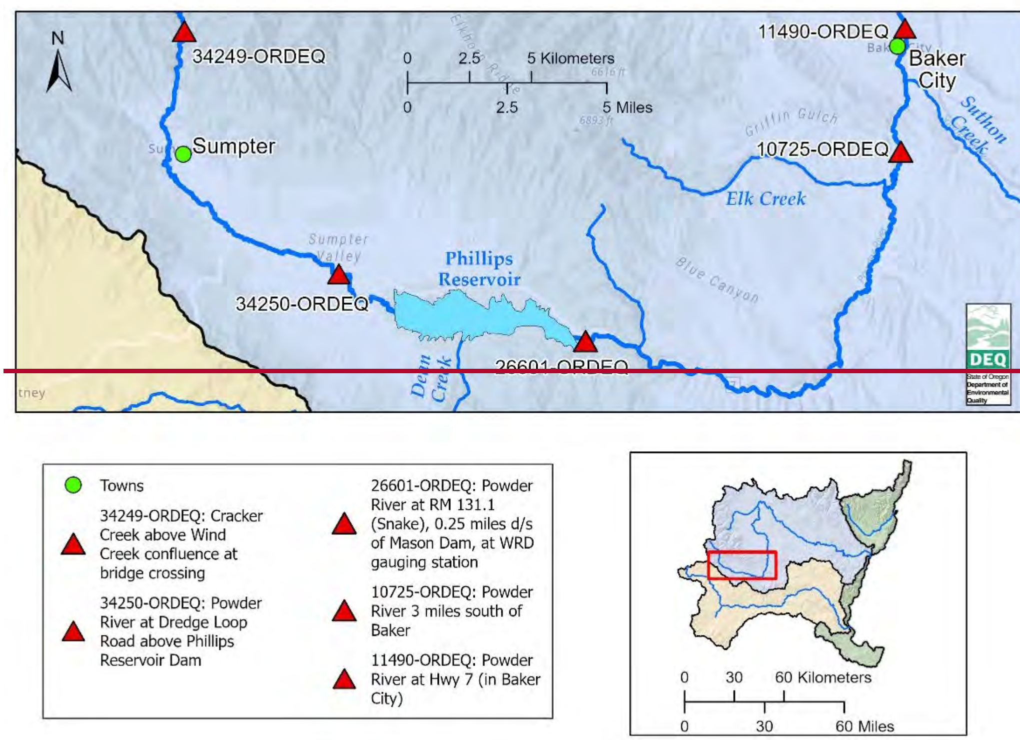
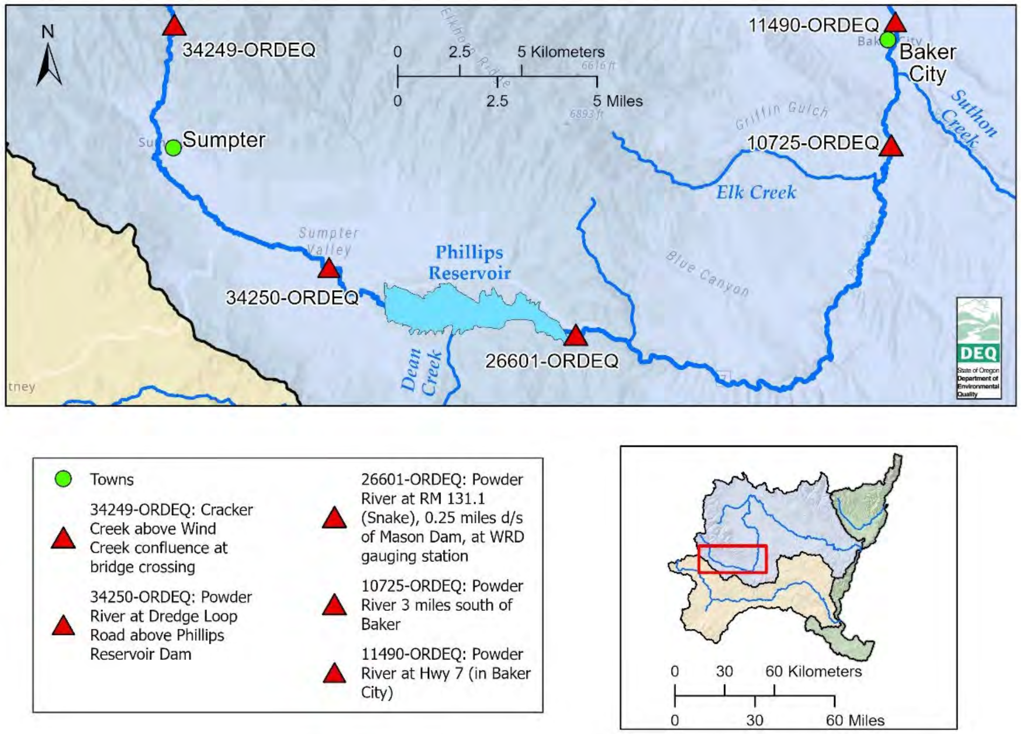
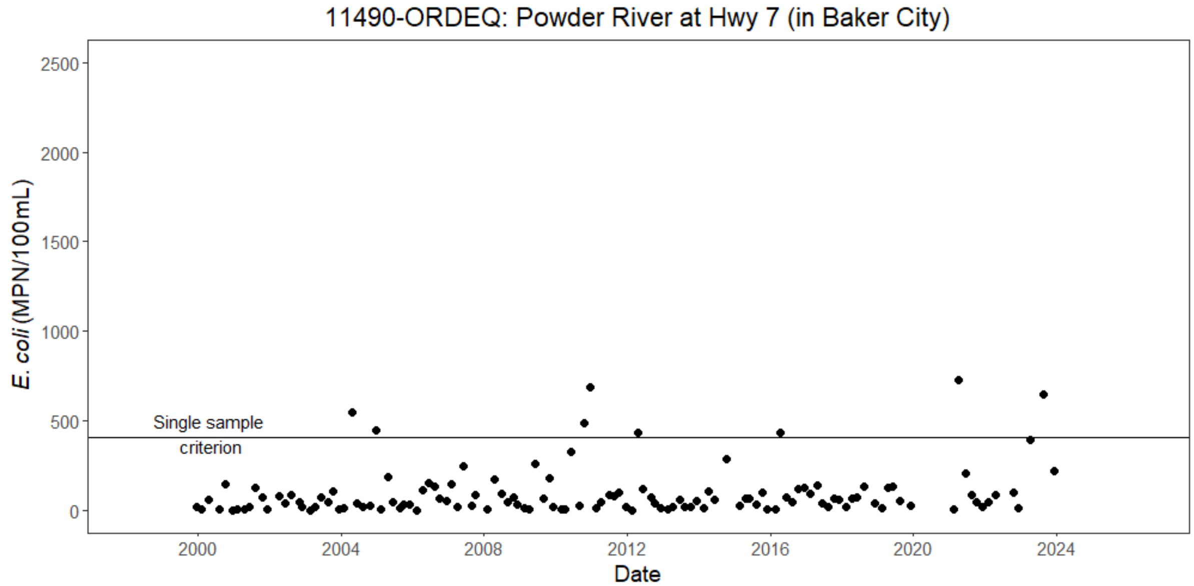

N
34249-ORDEQ
Sumpter
34250-ORDEQ
26601-ORDEQ
11490-ORDEQ
Baker City
10725-ORDEQ
Elk Creek
Phillips Reservoir
Dean Creek
Sumpter Valley
Griffin Gulch
Blue Canyon
Suthon Creek
0 2.5 5 Kilometers
0 2.5 5 Miles
DEQ
Towns
34249-ORDEQ: Cracker Creek above Wind Creek confluence at bridge crossing
34250-ORDEQ: Powder River at Dredge Loop Road above Phillips Reservoir Dam
26601-ORDEQ: Powder River at RM 131.1 (Snake), 0.25 miles d/s of Mason Dam, at WRD gauging station
10725-ORDEQ: Powder River 3 miles south of Baker
11490-ORDEQ: Powder River at Hwy 7 (in Baker City)
0 30 60 Kilometers
0 30 60 Miles

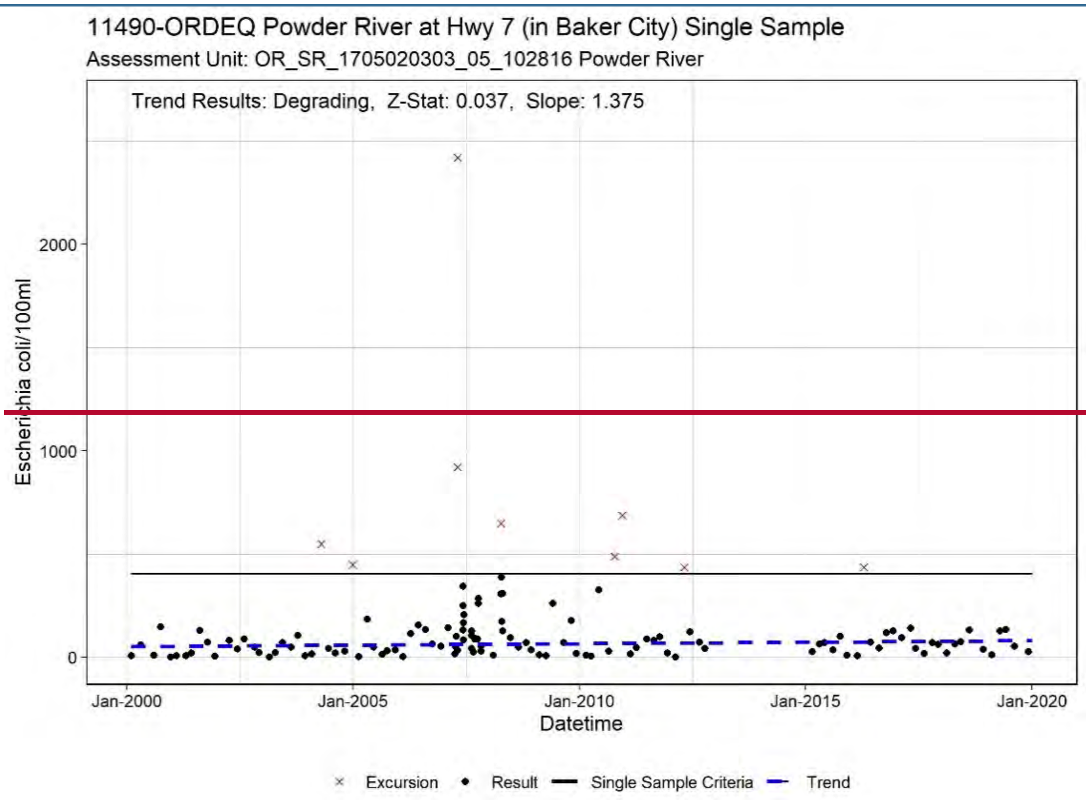
Figure 26**: DEQ** ~~*E. coli*~~***E. coli* monitoring location in the upper portion of the Powder Subbasin**~~**Figure 5.1.1a: Bacteria *DEQ E. coli*** monitoring locations E. coli **sampling locations and DEQ station numbers in the upper portion of the Powder River Subbasin.and tributaries from headwaters to Baker City**~~



34250 Powder River abv Phillips Reservoir	**26601 Powder River blw Phillips**

Figure 27: ~~E. coli~~*E. coli* data for Powder River at Highway 7 (11490-ORDEQ; AU ID: OR_SR_1705020303_05_102816) from the DEQ Ambient Monitoring Program, 2000-2024

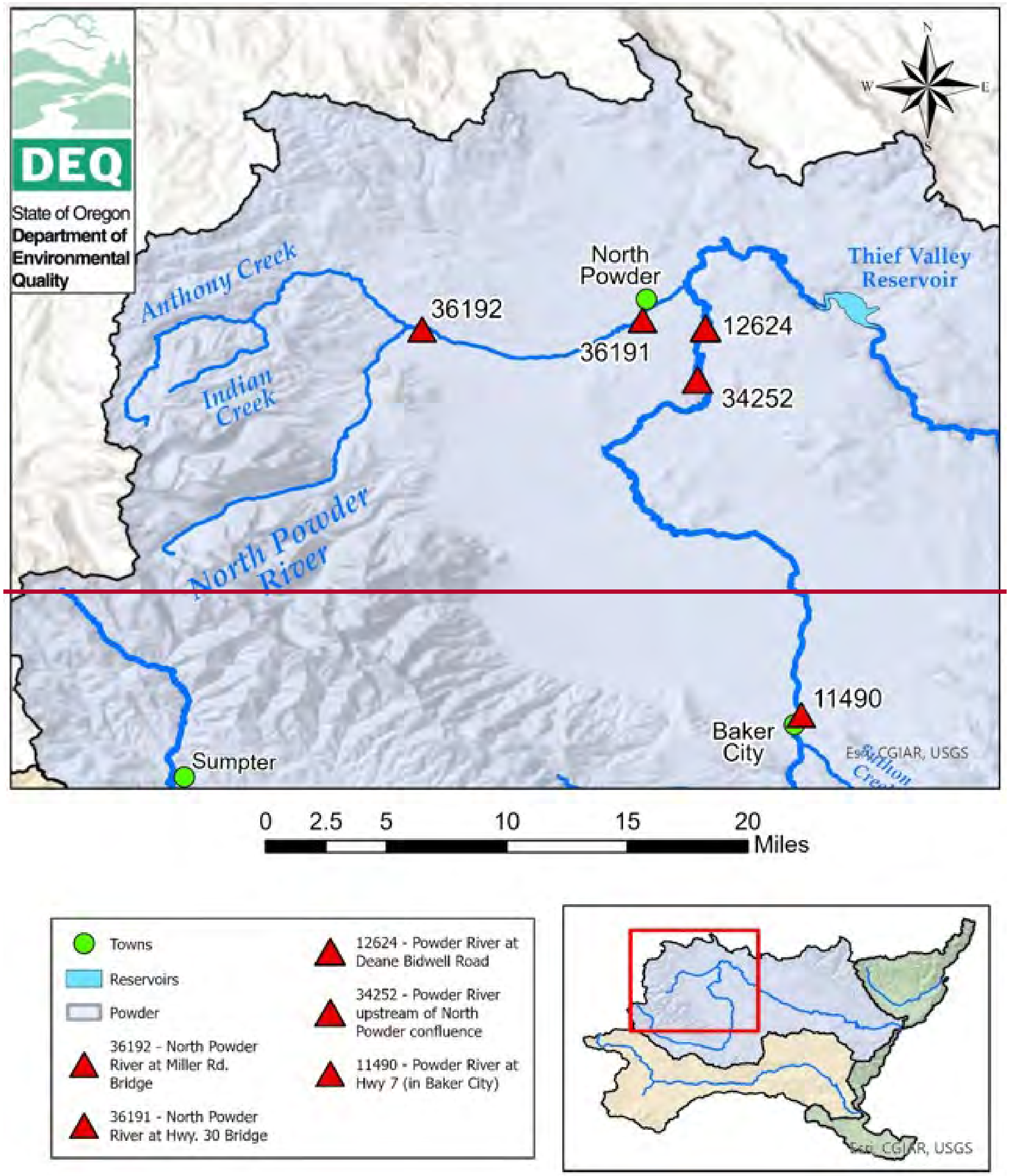




~~Figure 5.1.1b: Bacteria~~*E. coli* data f~~or~~rom 11490-ORDEQ (Powder River at Highway 7 (in Baker City (11490)) from the DEQ Ambient Monitoring Program, 2000-202419. MPN: most probable number of organisms. Values for p and slope refer to Seasonal Mann-Kendall test statistics for monotonic a trends over time blockingafter accounting for by irrigation (May-October) and non-irrigation (NNovember-April) seasonal categoriess (AU_ID OR_SR_1705020303_05_102816 XXXXX).DEQ 2020 Water Quality Status and Trends Report

5.1.2 Powder River from Baker City to Thief Valley Reservoir~~, including~~ and ~~lower~~ North Powder River

Data collected in the TMDL project from 2007-13 and as part of the DEQ ambient monitoring network suggest that ~~Downstream of Baker City, bacteria~~~~*E. coli*~~*E. coli* concentrations ~~generally~~ increase in the Powder River downstream of Baker City as it flows through ~~a lowland valley area~~the Baker Valley ~~dominated by irrigated pastures and livestock~~ (Table ~~5.1a~~53 and Figure ~~5.1.2~~28). ~~Bacteria~~~~*E. coli*~~*E. coli* concentrations at the Powder River at I-84 (34252-ORDEQ) and the North Powder River at the Hwy 30 (36191-ORDEQ) exceeded both the ~~log~~ geometric mean and single sample criteria during ~~the irrigation season~~May-October and the single sample ~~criteria~~ criterion in ~~the non-irrigation season~~November-April based ~~on monitoring data~~data collected from the TMDL project during ~~from~~ 2007-~~20~~13. ~~Due to the high populations of livestock and predominance of flood irrigation practices, bacteria~~~~*E. coli*~~*E. coli* load reductions to this reach of the Powder River and lower North Powder River should be a high priority for restoration activities.


DEQ
State of Oregon Department of Environmental Quality
Anthony Creek
Indian Creek
North Powder River
36192
North Powder
36191
12624
34252
Thief Valley Reservoir
11490
Baker City
Sumpter
Esri, CGIAR, USGS
0 2.5 5 10 15 20 Miles
Towns
Reservoirs
Powder
36192 - North Powder River at Miller Rd. Bridge
36191 - North Powder River at Hwy. 30 Bridge
12624 - Powder River at Deane Bidwell Road
34252 - Powder River upstream of North Powder confluence
11490 - Powder River at Hwy 7 (in Baker City)
Esri, CGIAR, USGS

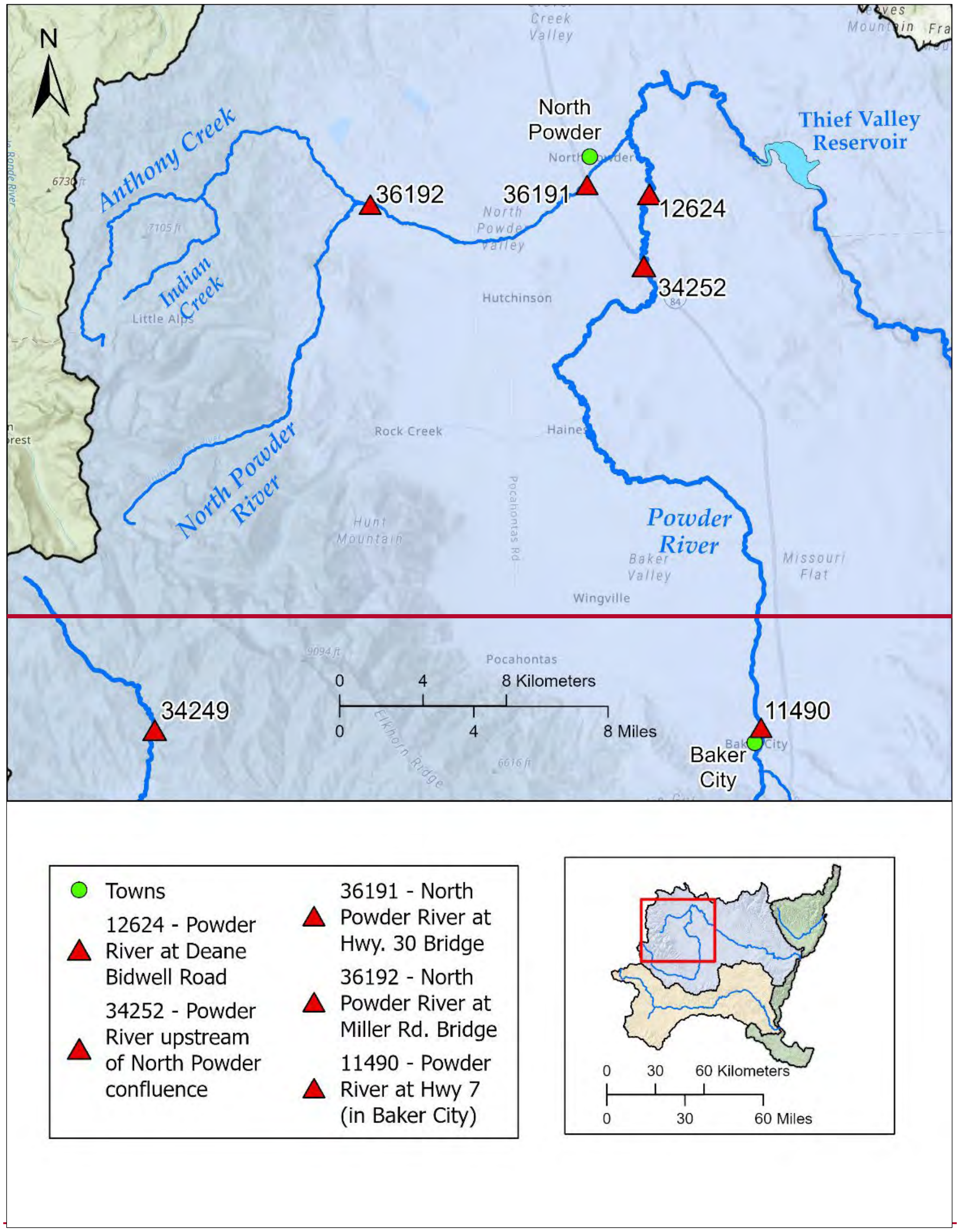
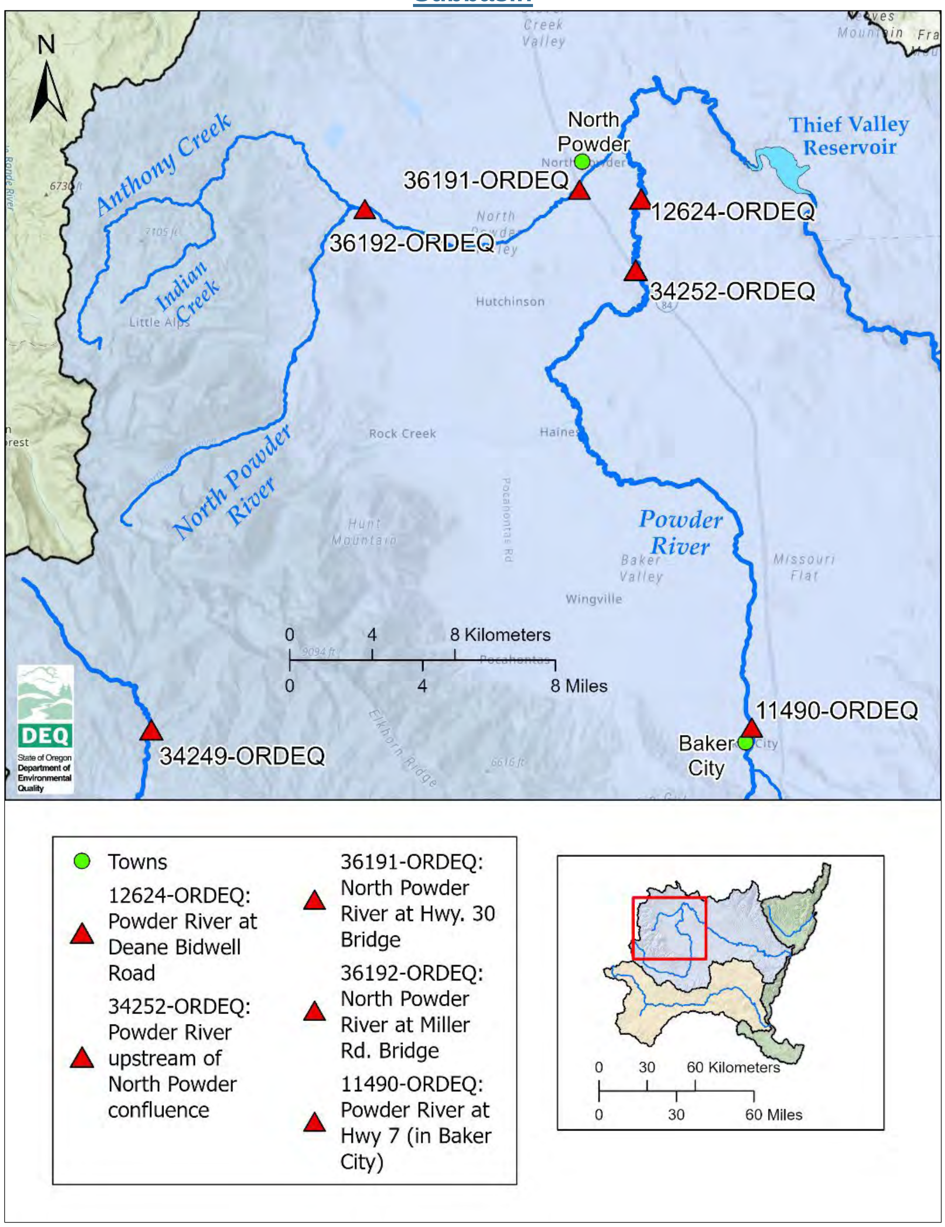

N
Anthony Creek
Indian Creek
North Powder River
North Powder
36192
36191
12624
34252
Thief Valley Reservoir
Hutchinson
Rock Creek
Haines
Powder River
Baker Valley
Missouri Flat
Wingville
Pocahontas
34249
11490
Baker City
0 4 8 Kilometers
0 4 8 Miles
Towns
12624 - Powder River at Deane Bidwell Road
34252 - Powder River upstream of North Powder confluence
36191 - North Powder River at Hwy. 30 Bridge
36192 - North Powder River at Miller Rd. Bridge
11490 - Powder River at Hwy 7 (in Baker City)
0 30 60 Kilometers
0 30 60 Miles

Figure 28: DEQ ~~*E. coli*~~*E. coli* monitoring locations in the middle portion of the Powder River Subbasin



~~**Figure 5.1.2: Bacteria**~~ **DEQ *E. coli* monitoring locations** ~~***E. coli* sampling locations**~~ **in the middle portion of the** ~~**Powder River**~~ **Subbasin.** ~~**and tributaries from Baker City to Thief Valley Reservoir**~~

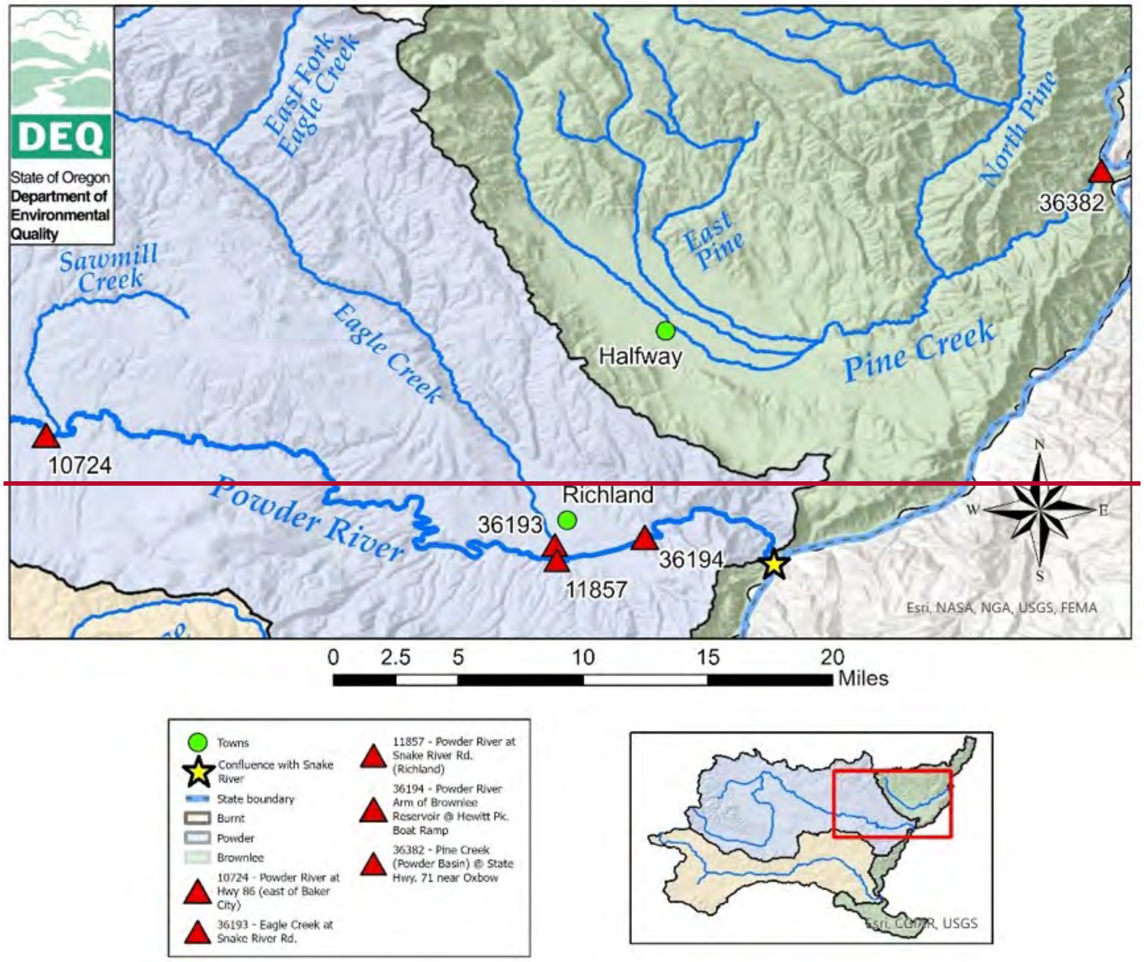
5.1.3 Lower Powder River Subbasin and the Brownlee Subbasin~~from Thief Valley Reservoir to Brownlee Reservoir and Pine Creek~~

~~DEQ has observed cattle within the footprint of the dewatered portions of Thief Valley Reservoir during the last decade. During discussions with DEQ, US Bureau of Reclamation staff have stated that there are no grazing allotments within the reservoir lands. However, cattle deposit observable amounts of manure in the reservoir footprint during the summer months.~~

The Powder River below Thief Valley Reservoir transitions intoflows through an area with high topographic relief interspersed with agricultural areas in valley bottoms (Figure 5.1.3a29). -The most prominent of these is the Keating Valley midway between Thief Valley Reservoir and the city of near Richland. , which contains iIrrigated hay fields and seasonal livestock usage of cattle characterize these agricultural areas along the river (Figure 5.1.3b). DEQ ambient monitoring Bacteria*E. coli* monitoring data from 2000-2019 at the Powder River near Keating (10724-ORDEQ) indicatesORDEQ (Powder River at Hwy 86 (east of Baker City)) indicatessuggests consisistentconsistent, and possibly increasing (p = 0.0793; slope = 2.82), bacteria*E. coliE. coli* concentrations loading from agricultural (livestock) sources in this area from 2000-2024 based on a seasonal Mann-Kendall test during irrigation and non-irrigation seasons (Table 5.1aFigure 5.1.3b30).

Near Richland and the confluence with Eagle Creek, the Powder River flows through river enters a broad valley with extensive irrigated pastures and hay fields before joining the Snake River in Brownlee Reservoir on the Snake River (Figure 5.1.3a29). Exceedances of both the log mean and single sample criteria occuredoccurred during the irrigation seasonMay-October in at 11857-ORDEQ (Powder River at Snake River Rd (Richland))) (11857-ORDEQ) during the DEQ TMDL project of 2010-13 from 2000-2019 (Table 5.1a53). However, tThere were no exceedances of criteria in the non-irrigation seasonNovember-April during this period. Monitoring Bacteria*E. coli* concentrations data at 36193-ORDEQ (Eagle Creek at Snake River Road) the monitoring station for Eagle Creek near Richland (36193-ORDEQ) forfrom the DEQ TMDL project 2007-2013 indicate that bacteria*E. coliE. coli* loading contributes contributed to periodic single sample criteriona exceedances during the irrigation seasonMay-October from 2010-13 (Table 5.1a3).

Pine Creek drains a portion of the Brownlee watershed Subbasin that enters directly into Hells Canyon Reservoir on thethe Snake River below below Oxbow Dam (Figure 5.1.3a29). -The upper portion of the watershed catchment near Halfway contains extensive irrigated pastures and hay fields. -The lower portion flows through an area of high topographic relief with minimal development. -Monitoring data for 36382-ORDEQ (-Pine Creek (Powder Basin) @ State Hwy. 71 near Oxbow, ORPine Creek at Hwy 71 (36382-ORDEQ) from 20072011-2013 do not indicate exceedances of bacteria*E. coli* geometric mean or single sample criteria during irrigation or non-irrigation seasonsthroughout the year (Table 5.13a).



DEQ
State of Oregon
Department of Environmental Quality
East Fork Eagle Creek
Sawmill Creek
Eagle Creek
East Pine
North Pine
Halfway
Pine Creek
36382
10724
Powder River
Richland
36193
11857
36194
Esri, NASA, NGA, USGS, FEMA
0 2.5 5 10 15 20 Miles
Towns
Confluence with Snake River
State boundary
Burnt
Powder
Brownlee
10724 - Powder River at Hwy 86 (east of Baker City)
36193 - Eagle Creek at Snake River Rd.
11857 - Powder River at Snake River Rd. (Richland)
36194 - Powder River Arm of Brownlee Reservoir @ Hewitt Pk. Boat Ramp
36382 - Pine Creek (Powder Basin) @ State Hwy. 71 near Oxbow

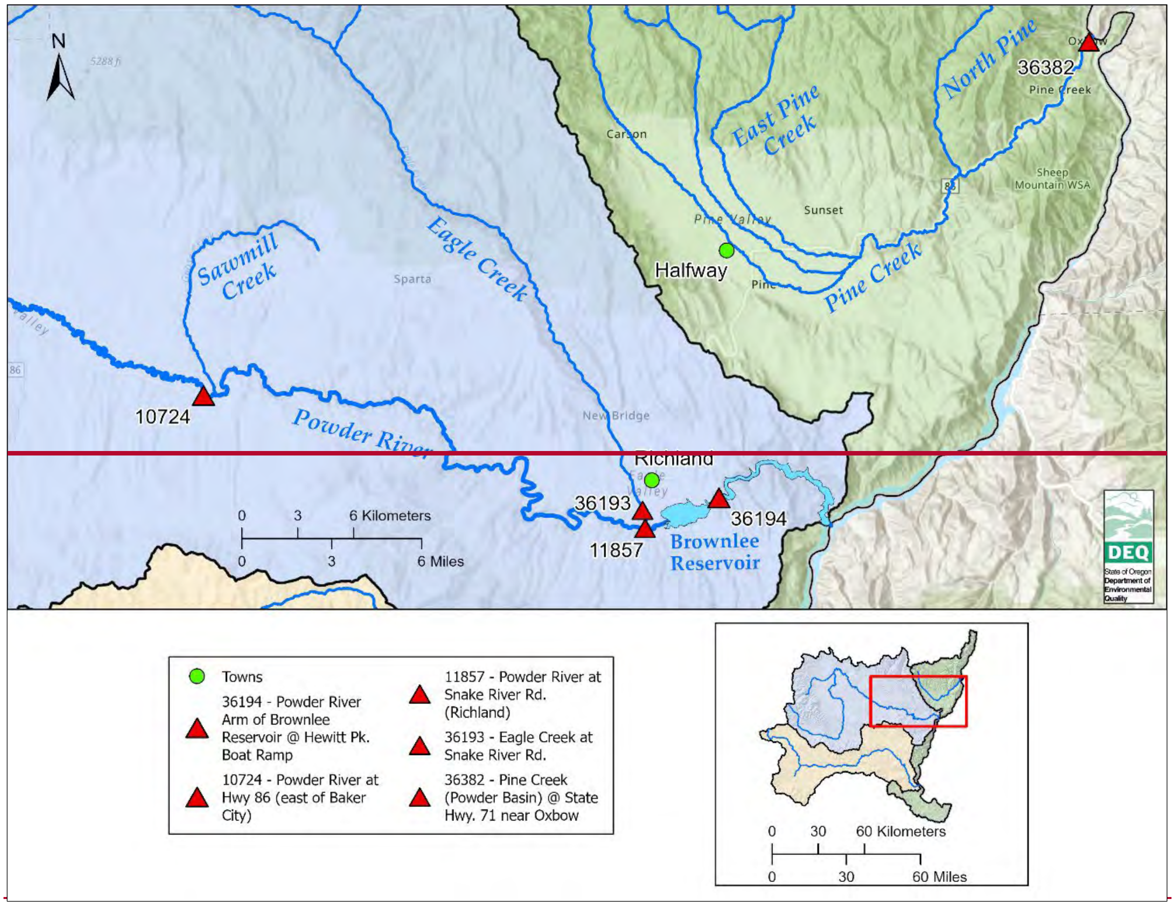
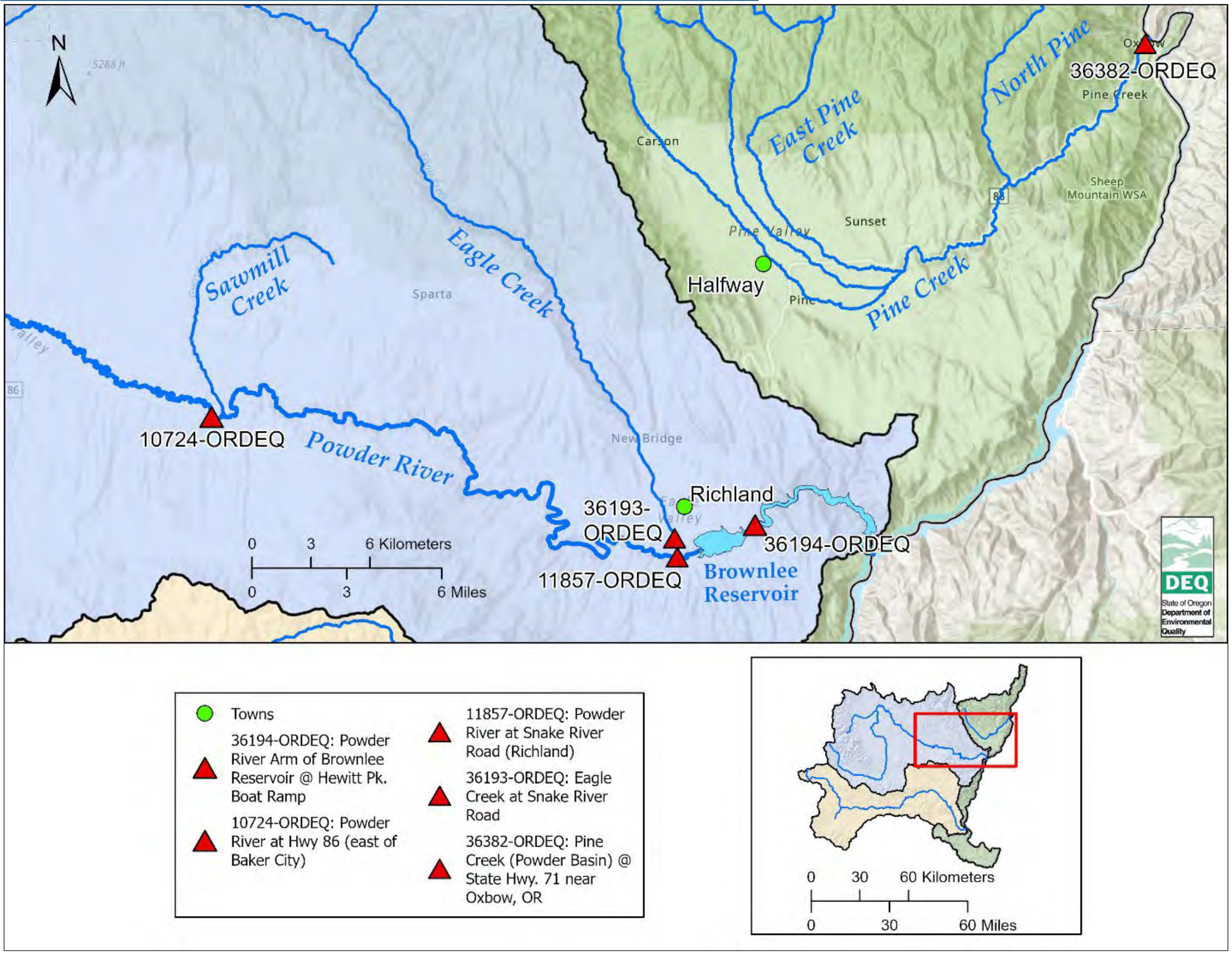
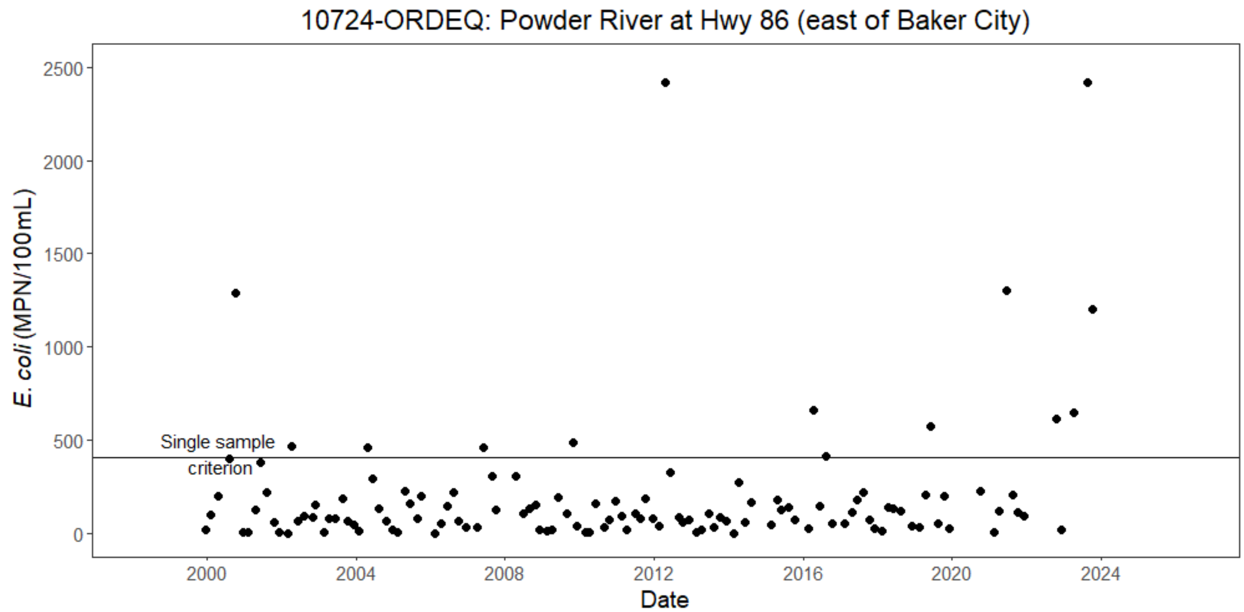

N
Sawmill Creek
Eagle Creek
Powder River
10724
Sparta
New Bridge
Richland
36193
11857
36194
Brownlee Reservoir
Halfway
Carson
East Pine Creek
North Pine
Pine Creek
36382
Sunset
Sheep Mountain WSA
0 3 6 Kilometers
0 3 6 Miles
DEQ
State of Oregon Department of Environmental Quality
Towns
36194 - Powder River Arm of Brownlee Reservoir @ Hewitt Pk. Boat Ramp
10724 - Powder River at Hwy 86 (east of Baker City)
11857 - Powder River at Snake River Rd. (Richland)
36193 - Eagle Creek at Snake River Rd.
36382 - Pine Creek (Powder Basin) @ State Hwy. 71 near Oxbow
0 30 60 Kilometers
0 30 60 Miles

Figure 29: DEQ ~~E. coli~~E. coli monitoring locations in the lower portion of the Powder River Subbasin and the northern portion of the Brownlee Subbasin



~~**Figure 5.1.3a: Bacteria DEQ E. coli monitoring locations E. coli sampling locations in the lower portion of the Powder River Subbasin and the northern portion of the Brownlee Subbasin.and tributaries from Thief Valley Reservoir to Brownlee Reservoir and Pine Creek**~~

Figure 30: *E. coliE. coli* for the Powder River at Hwy 86 (10724-ORDEQ; AU ID: OR_SR_1705020308_05_102826) from the DEQ Ambient Monitoring Program from 2000 to 2024



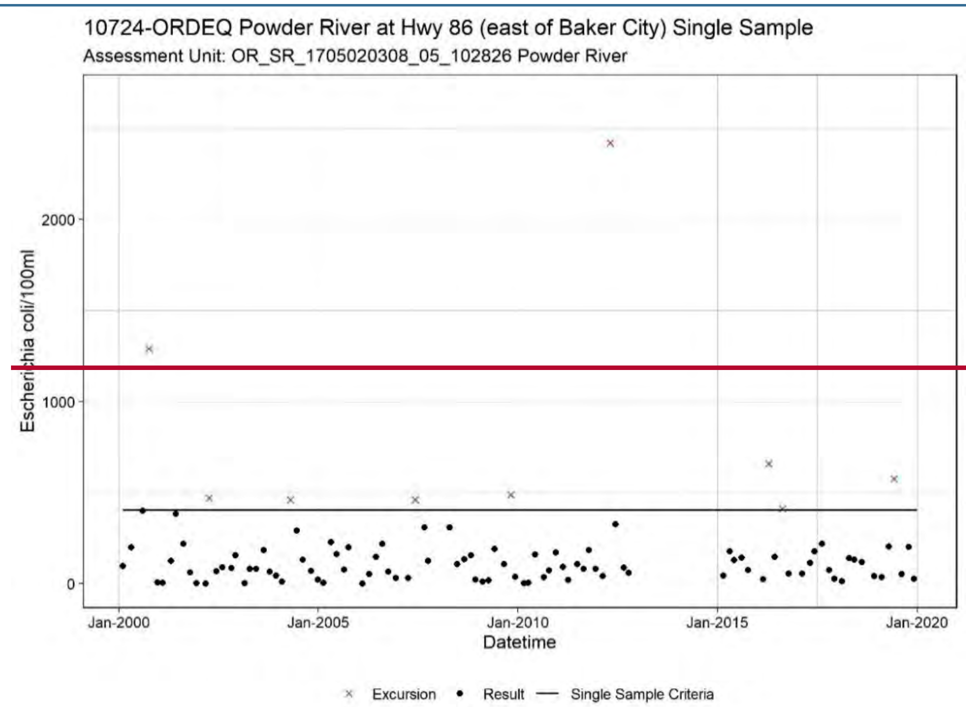


Figure 5.1.3b: Bacteria*E. coli* data fromfor 10724-ORDEQ (Powder River at Highwawy 86 (east of Baker City)/ near Keating (10724) from the DEQ Ambient Monitoring Program, 2000-20192024. MPN: most probable number of organisms. Values for p and slope refer to Seasonal Mann-Kendall test statistics for a trend over time after accounting for May-October and November-April seasonal categories irrigation (May-October) and non-irrigation (November-April) seasons (AU ID OR_SR_1705020308_05_102826).

~~**Values for p and slope refer to Seasonal Mann-Kendall test statistics for monotonic trends over time blocking by irrigation (May-October) and non-irrigation (November-April) seasons.DEQ 2020 Water Quality Status and Trends Report**~~

5.1.4 Upper Burnt ~~River~~ Subbasin above Unity Reservoir

The upper Burnt ~~River~~ Subbasin ~~Watershed~~ above Unity Reservoir contains a mixture of managed and unmanaged land uses/land covers. The upper portions of the forks are mostly forested. ~~-~~The North and West Forks of Burnt River contains ~~limited~~ pasturelands along a portion of the rivers ~~channel~~ just upstream of ~~the~~ Unity Reservoir. ~~-~~The Middle and South Forks contain irrigated ~~more~~ pastures and hayfields ~~areas~~ near the reservoir~~, with the South Fork having the largest areas of irrigated pastures and hayfields~~.

~~Bacteria~~~~*E. coli*~~*E. coli* data ~~have~~ were~~been~~ collected ~~from~~ in the West, Middle, and South Forks of the Burnt River from 2010-13 as part of the DEQ TMDL project (Table 5~~.1.1b~~4). The North Fork ~~has~~ was not ~~been~~ sampled due to lack of public access ~~to the river~~ in the vicinity of the reservoir (Figure ~~5.1.4a~~31). ~~Of the~~Based on available ~~monitoring~~ data ~~available for the forks~~, the South Fork had frequent exceedances of both the ~~log~~ geometric mean and single sample criteria ~~in~~ during ~~the irrigation season~~May-October and several single sample criterion exceedances in ~~the non-irrigation season~~November-April from ~~2007~~2010-2013 (Table ~~5.1b~~54). The Middle and West Forks had several exceedances of the single sample criterion during ~~the irrigation season~~May-October ~~only~~ during ~~2007~~2010-~~20~~13 (Table ~~5.1b~~54). Percent reductions were not ~~Because there was no measured flow data available~~calculated for monitoring stations on the ~~for the North,~~ Middle, West and South Forks of the Burnt River because measure flow data were not available.~~, it was not possible to calculate percent load reductions needed in these reaches.~~ The nearest ~~nearest~~ location ~~reach~~ with ~~load duration curve was calculated using~~ flow data occurs ~~measured below~~ below Unity Dam~~, where the downstream reservoir dynamics influence biological processes and bacteria~~~~*E. coli*~~ ~~levels~~. ~~As noted above and based on observed criteria exceedances~~Despite the lack of flow data, concentration data suggest that ~~,~~ the South Fork Burnt River should be the highest priority for ~~bacteria~~~~*E. coli*~~*E. coli* load reductions in the tributaries upstream of ~~the Burnt River~~Unity Reservoir.

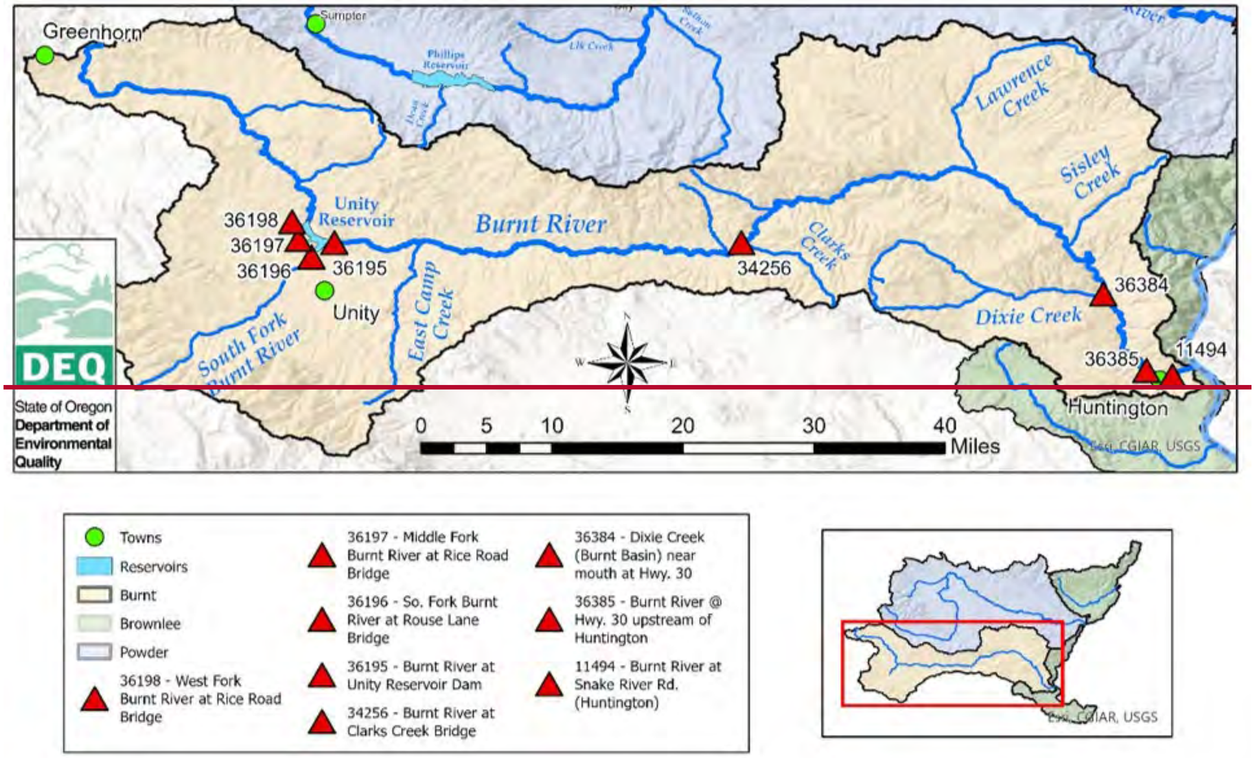
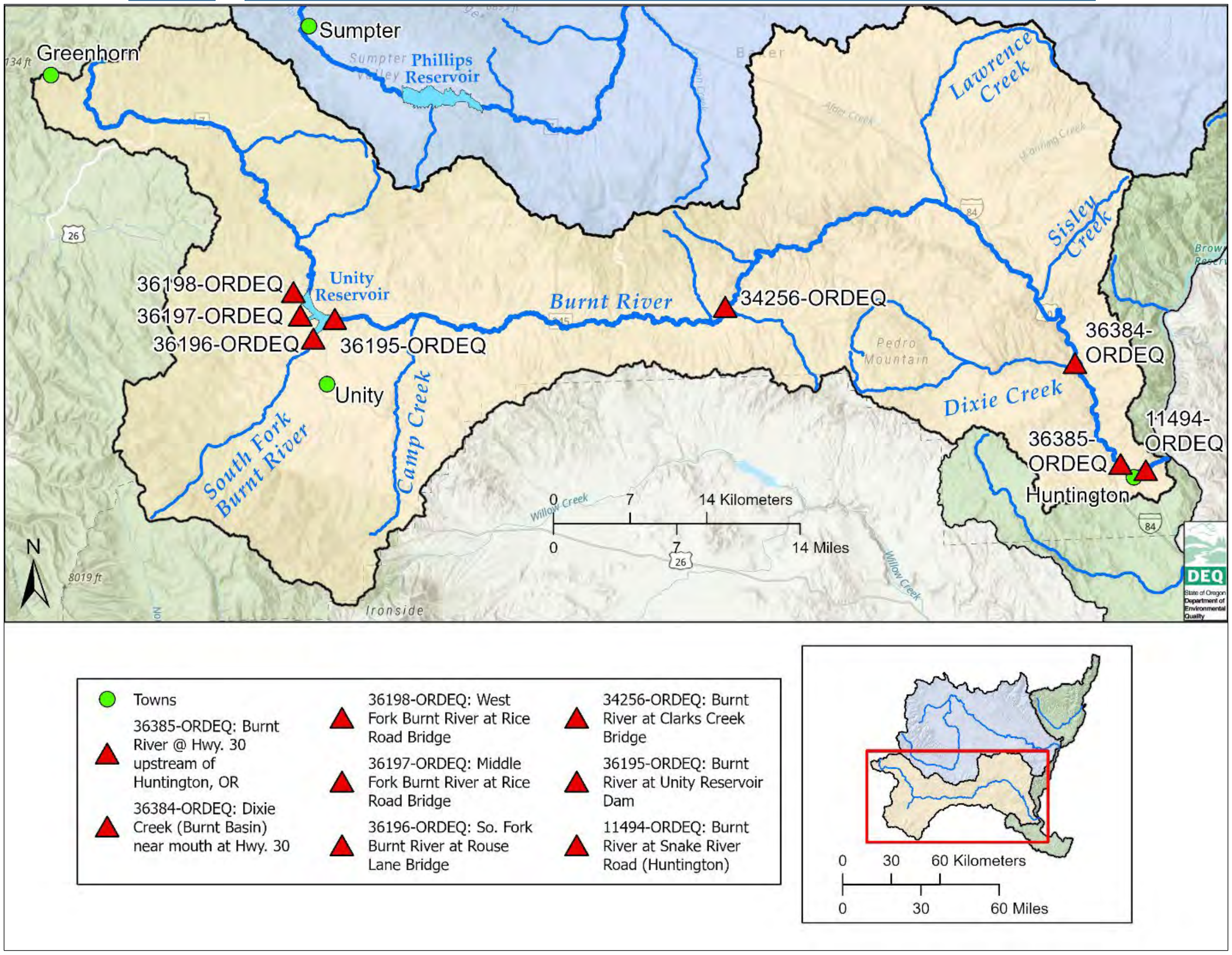

Greenhorn
Sumpter
Phillips Reservoir
Lawrence Creek
Sisley Creek
36198
36197
36196
36195
Unity Reservoir
Burnt River
Unity
South Fork Burnt River
East Camp Creek
34256
Clarks Creek
36384
Dixie Creek
36385
11494
Huntington
DEQ
State of Oregon Department of Environmental Quality
0 5 10 20 30 40 Miles
Towns
Reservoirs
Burnt
Brownlee
Powder
36198 - West Fork Burnt River at Rice Road Bridge
36197 - Middle Fork Burnt River at Rice Road Bridge
36196 - So. Fork Burnt River at Rouse Lane Bridge
36195 - Burnt River at Unity Reservoir Dam
34256 - Burnt River at Clarks Creek Bridge
36384 - Dixie Creek (Burnt Basin) near mouth at Hwy. 30
36385 - Burnt River @ Hwy. 30 upstream of Huntington
11494 - Burnt River at Snake River Rd. (Huntington)

Figure 31: DEQ ~~E. coli~~*E. coli* monitoring locations in the Burnt River Subbasin



~~Figure 5.1.4a:~~ DEQ ~~Bacteria~~*E. coli* ~~sampling~~ monitoring ~~locations and DEQ station numbers in the Burnt River~~ Subbasin~~.and tributaries~~

5.1.5 Burnt River from Unity Reservoir to Huntington

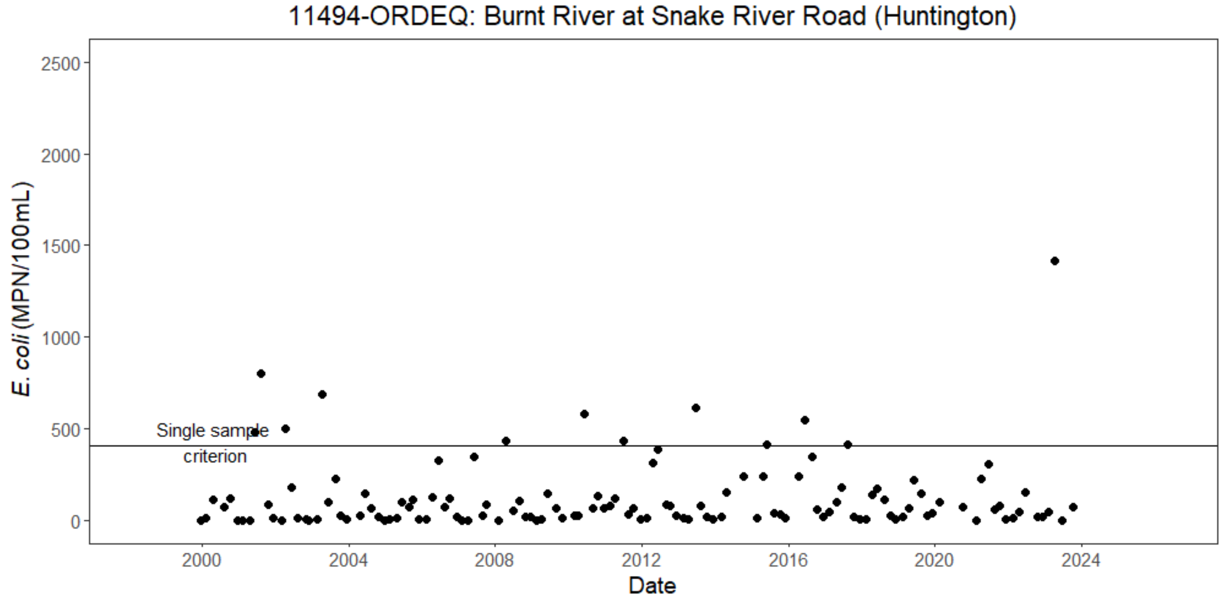
The Burnt River below Unity Reservoir flows through a ~~30-mile long~~30-mile-long valley with irrigated pastures and cultivated hay~~, along with~~ and through the communities of Hereford and Bridgeport. Below the DEQ monitoring station ~~Bridgeport (~~34256-ORDEQ (~~;~~ Burnt River at Clark Creek bridge), the Burnt River enters a steep, 15-mile-long canyon~~ for 15 miles~~. Most of the ~~land~~ area is managed by the Bureau of Land Management~~ with minimal agriculture and grazing~~. Below the canyon, the Burnt River flows through ~~the~~ fields and scattered cottonwood gallery forests in the Durkee Valley followed by another canyon reach before flowing into ~~the~~ Brownlee Reservoir on the Snake River~~ (Brownlee Reservoir)~~ below the ~~community~~ City of Huntington (Figure ~~5.1.4a~~31). Dixie Creek enters the Burnt River upstream of Huntington. The Huntington ~~WWTP~~ waste-water treatment plant (DEQ# 40981, EPA# OR0020052) discharges into the Burnt River below Huntington and is reflected in samples collected at 11494-ORDEQ.

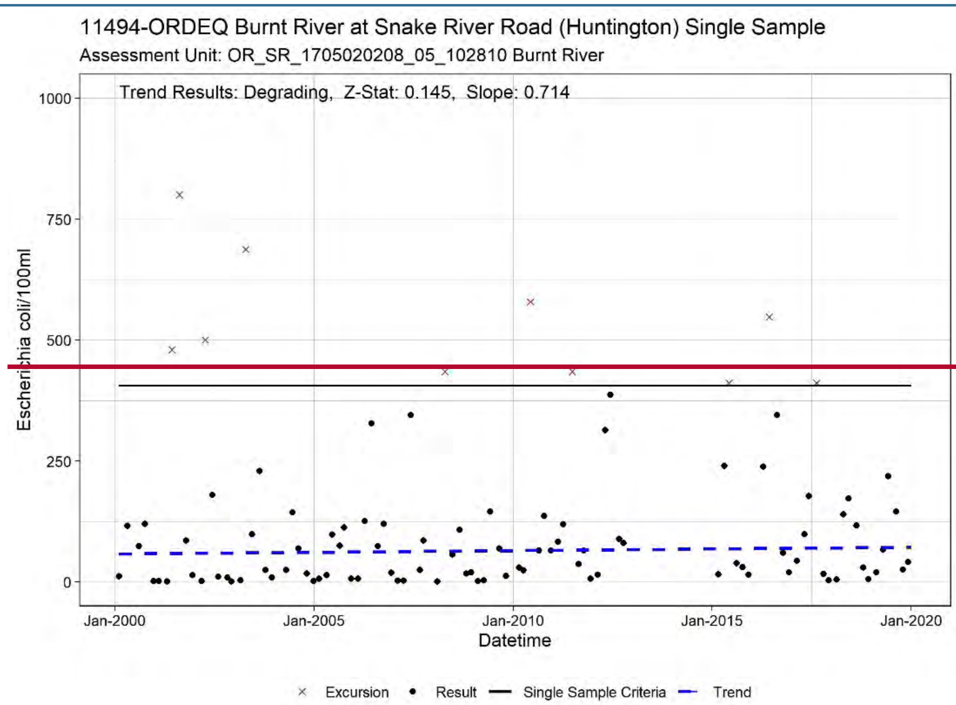
~~Quarterly m~~Monitoring for ~~the Burnt River at Unity (~~36195-ORDEQ (Burnt River at Unity Reservoir Dam) from 2010-2013 suggest ~~extremely~~ no criteria exceedances of ~~low bacteria~~ ~~*E. coli*~~*E. coli* ~~levels~~ concentrations~~(no criteria exceedances)~~ entering the river from the outlet of the dam (Table 5~~.1b~~4). ~~Bacteria~~ ~~*E. coli* entering from sources upstream likely die off in the reservoir.~~

~~Bacteria~~ ~~*E. coli*~~*E. coli* monitoring for 34256-ORDEQ (~~the~~ Burnt River at Clarks Creek ~~Road (~~bridge~~34256-ORDEQ~~) from 2010-2013 ~~indicate~~ suggest exceedances of geometric mean and single sample criteria during ~~the irrigation season~~May-October and of the single sample criterion during ~~the non-irrigation season~~November-April (Table 5~~.1b~~4). ~~This sampling location reflects the influence of agricultural activities downstream of Unity Reservoir.~~

Monitoring data from 36384-ORDEQ (Dixie Creek (Burnt Basin) near mouth at Hwy. 30~~Dixie Creek at Hwy 30 (36384-ORDEQ~~) indicate exceedances of geometric mean and single sample criteria during ~~the irrigation season~~May-October of 2011-12. ~~However, t~~There were no exceedances of criteria during ~~non-irrigation season~~November-April. ~~On~~ At ~~the Burnt River upstream of Huntington (~~36385-ORDEQ (Burnt River @ Hwy. 30 upstream of Huntington, OR), no exceedances of ~~bacteria~~ ~~*E. coli*~~*E. coli* were observed during all seasons from 2010-2013. ~~However, e~~ Exceedances of the single sample criterion were observed during irrigation season downstream of ~~Huntington (~~11494-ORDEQ (Burnt River at Snake River Road (Huntington)) over the same time period (Table 5~~.1b~~4). Significantly increasing (p = 0.0236; slope 1.23) *E. coli* concentrations ~~Single sample exceedances~~ were also observed at this ~~site~~ station from 2000-~~2019~~ 2024 (Figure ~~5.1.4b~~32). Although this site is located downstream of the ~~WWTP~~ wastewater treatment plant outfall, calculations based on permitted limits suggest that nonpoint sources still ~~compose~~ contribute most of the ~~bacteria~~ ~~*E. coli*~~*E. coli* present in water samples (Tables 4~~.5.2kk-nn~~6-49).

Figure 32: ~~E. coli~~*E. coli* data for the Burnt River at Snake River Road (11494-ORDEQ; AU ID: OR_SR_1705020208_05_102810) from the DEQ Ambient Monitoring Program from 2000 to 2024





~~**Figure 5.1.4.b: Bacteria*E. coli* data fromfor 11494-ORDEQ (Burnt River at Snake River Road (Huntington)) from the DEQ Ambient Monitoring Program (11494), 2000-20192024. MPN: most probable number of organisms. Values for p and slope refer to Seasonal Mann-Kendall test statistics for a trend over time after accounting for irrigation (May-October) and non-irrigation (November-April) seasons (AU ID OR_SR_1705020208_05_102810).Values for p and slope refer to Seasonal Mann-Kendall test statistics for monotonic trends over time blocking by irrigation (May-October) and non-irrigation (November-April) seasons.DEQ 2020 Water Quality Status and Trends Report.**~~

5.2 ~~Bacteria~~ ~~*E. coli*~~*E. coli* sources

In this section, DEQ describes potential sources and transport mechanisms of *E. coli* to surface waters. Based on the analysis of monitoring data presented in Section 5.1 and information presented ~~described~~ below, DEQ ~~identified waterbodies (rivers and streams) downstream of irrigated pastures, hay fields and livestock grazing as prone to exhibit higher number and rate exceedances~~ concludes that nonpoint sources contribute the largest share of excess loads causing violations of ~~of~~ Oregon's ~~criteria~~ water quality standards for ~~*E. coli*~~*E. coli*~~fecal bacteria~~ in the Power River Basin. ~~Only t~~~~Two~~Two of the monitoring locations ~~may be influenced~~receive potential influences from wastewater treatment plant discharges ~~by discharges from WWTPs~~. ~~However, b~~Based on permit effluent limits for these facilities, the potential contributions to ~~riverine~~ instream loads are ~~minimal except under upset or bypass conditions~~less than contributions from nonpoint sources (Section 4.5.2).

~~.~~DEQ did not have access to Bacteria Source Tracking (BST) or DNA data for identifying the presence or absence of specific sources or estimating the relative proportion of sources to specific areas of the basin. DEQ instead relied on publicly available information land use/land cover, agricultural statistics, population statistics, permit limits and conditions, and available information on wildlife in the basin to identify source categories. The lack of BST information does not affect the calculation of percent reductions in loads needed to meet criteria or the allocation of sources between point and nonpoint source categories (section 6). Collection of BST information could be useful for TMDL implementation and adaptive management in the basin (USEPA, 2011). ~~Thus, DEQ contends concluded that nonpoint source input of fecal contamination bacteria*E. coli* is the largest source of *E. coli* loads fecal contamination to surface waters in the Powder Basin. In this section, DEQ considers various potential sources of bacteria*E. coli* and discusses different agricultural and water management practices that may facilitate the delivery of bacteria*E. coli* to surface waters.~~

5.2.1 ~~Livestock grazing and pasture irrigation~~Agricultural practices

Stream reaches downstream of areas with agricultural practices, including areas used ~~by~~ for livestock production, tended to have exceedances of *E. coli* criteria in the Powder River Basin~~The locations (and timing?) of bacteria*E. coli* criteria exceedances and associated upstream land use/land cover and zoning strongly suggests that livestock, specifically cattle with access to irrigated farmland, pastures and surface water, as represent the primary source of *E. coli* contamination in river reaches that exceeded loading capacity in the Powder River Basin~~. Surface ~~and shallow surface~~ runoff from these areas ~~contaminated~~ may contribute ~~significant~~ *E. coli* loads to surface waters through agricultural stormwater discharge (USEPA, 2023b), irrigation return water, and stormwater originating from mixed land uses/land covers ~~to recieving waters~~.

Agricultural statistics from ~~D~~data from Baker County (representing the majority of the ~~which occupies most of the~~ Powder and Burnt ~~S~~subbasins ~~Basin and generally reflects conditions in adjacent counties~~) shows that cattle/calves make up the majority of livestock ~~compared to hogs, sheep, horses, and chickens~~~~for these irrigated lands~~present on an annual basis. Based on the 2017 USDA Census of Agriculture for Baker County, ~~-~~71,187 cattle/calves were recorded in 2012 and 75,187 were recorded in in 2017 ~~cattle/calf animal units~~~~cow-calf operations were recorded in Baker County during 2012 and 2017, respectively~~ (USDA-NASS 2019), ~~(USDA-NASS 2019)~~. ~~During the same time periods, combined hogs, sheep, horses, and chickens~~

never did not exceeded 8,343 animal unitss. It is important to note that the census records inventories as of December 31st of the census year (USDA-NASS 2019). Thus, the actual number of livestock of a particular type present in the basin at any one time throughout the year may be less than that recorded on the census due to birthing, sales, or other factors. As a comparison, different types and age classes of cattle produce on average 26-136 pounds manure per day versus <1-8 pounds per day for other livestock types listed above (Statistics Canada 2006). According to the USDA Agricultural Census data (USDA-NASS 2019), most of the cattle had access to pasture or rangeland at some point during the year, allowing resulting in waste manure and fecal pathogensindicators including *E. coli* to be deposited to the landscape.

The lof these cow-calf operationsCattle/calves may occupy pastures, free range areas, or confined animal feeding operations (CAFOs),-or leave the basin entirely throughoutduring the year. CAFOs require a permint and are point sources and not included in the nonpoint source loadsfor waste management and are discussed in the next section.are defined in Oregon by the number of animals present, how long animals are present in a prepared area, and how the manure and wastewater generated by the farm is stored (ODA 2024). Section 5.2.1.2 discusses permitting requirement for CAFOs.

5.2.1.2 Confined Animal Feeding Operations (CAFOs)

CAFOs are generally defined as the concentrated confined feeding or holding of animals in buildings, pens, or lots where the surface is prepared to support animals in wet weather or where there are wastewater treatment facilities for livestock (e.g., manure lagoons). CAFO wastes include but are not limited to manure, silage pit drainage, wash down waters, contaminated runoff, milk wastewater, and bulk tank wastewater.

The CAFO permit program began in the early 1980s to prevent CAFO wastes from contaminating groundwater and surface water. There are 12 CAFOs operating in the Powder River Basin, (see Table 5.2.3b54), which are permitted under general permits in either Oregon's federally delegated NPDES or state Water Pollution Control Facility (WPCF) programs. CAFO permits are administered by the Oregon Department of Agriculture (ODA), guided by a Memorandum of Understanding with DEQ. Neither the NPDES or WPCF CAFO permits allow point source discharge of wastewater or wastes from regulated activities to surface water or groundwater, except during a 25-year, 24-hour rainfall event. Therefore, no numeric point source WLAs are appropriate. However, a permittee's failure to fully comply with all permit conditions could allow contribution of excess *E. coli* to the nonpoint source general loads, thus a narrative requirement for appropriate management measures to be applied is required, which also supports implementation of nonpoint source LAs throughout the basin.

Table ~~55~~54: Permits for Confined Animal Feeding Operations (CAFOs) in the Powder River Basin (as of April 2024)

ODA permit number	Permit type	City	Designation
62653	NPDES	BAKER CITY	Medium Concentrated
173037	NPDES	BAKER CITY	Medium Concentrated
180694	NPDES	BAKER CITY	Medium Concentrated
180848	NPDES	BAKER CITY	Medium Concentrated
180868	NPDES	HAINES	Medium Concentrated
181161	NPDES	RICHLAND	Medium Concentrated
181194	NPDES	BAKER CITY	Large Tier 1 Concentrated
181215	WPCF	BAKER CITY	Medium Confined
182744	NPDES	BAKER CITY	Medium Concentrated
186190	NPDES	BAKER CITY	Medium Concentrated
186660	NPDES	BAKER CITY	Medium Concentrated
1000275	NPDES	BAKER CITY	Large Tier 2 Concentrated

CAFO permittees are prohibited from discharging manure, litter, or process wastewater to surface waters and ground waters of the state, except as allowed under conditions of an extreme rainfall event, defined in the permit as greater than the 25-year, 24-hour rainfall. The CAFO extreme weather event is similar to, but applied differently than, an “upset” and “overflow” event identified for NPDES permitted WWTPs.

Each permitted CAFO receives a routine inspection from their ODA area Livestock Water Quality Inspector once a year, on average. During this inspection, the operator and inspector discuss the operation, and the inspector reviews the entire operation and recordkeeping to ensure compliance with permit terms and water quality rules and laws. Inspection reports detail permit compliance in the following areas: permitted number of animals, animal confinement requirements, manure and silage containment requirements, manure application requirements, Animal Waste Management Plan, and record keeping. Problems in any of these areas can result in the issuance of a water quality advisory or a notice of noncompliance. In the event a violation is found, the ODA requires the operator to develop a solution to the problem and a schedule to complete the corrective actions. Surface water quality samples are taken when visual or anecdotal evidence of discharge is present.

CAFO permits also regulate land applications of animal and other waste and require that these discharges do not exceed a designated *E. coli* effluent limit. Types of discharge that are prohibited include, but are not limited to:

- contaminated runoff from confinement or waste accumulation areas,
- overflow or discharges from waste storage facilities,
- discharges due to improper land application activities from seepage below the root zone,
- surface drainages or field tile outlets,
- dry-weather discharges,
- discharges due to equipment failure,
- leakage or seepage from facilities in the production area in excess of approved designs, and
- discharges to underground injection control systems.

All land application of manure and process wastewater must be done in accordance with an ODA approved Animal Waste Management Plan.

Having adequate manure storage can be challengingdifficult, particularly during periods of heavy precipitation or snowmelt. This predicamentdifficulty can beis further exacerbated by the location of some CAFO facilities with streams and drainages near limited acceptable land application areas. CAFO facilities may not have the capability to store manure through extended wet weather periods and the lack of capacity can result in the land application of manure when conditions are not agronomically favorable (saturated soils and/or potential for surface runoff). The permit does allow application when it is a desired alternative to allowing waste storage or wastewater control facilities to overflow (e.g., land application to saturated soils to pond wastewater onsite provides for greater protection of surface waters than a direct overflow of a waste storage tank to surface waters). The land application in these circumstances will be considered an upset condition according to their permti. The general permit stipulates that, during such a discharge, effluent cannot cause or contribute to a violation of state water quality criteria.

DEQ thus concludes concluded that reductions of *E. coli* from lands occupied seasonally or annually year-round by cattle will be are needed to achieve Oregon's recreational-based water quality criteria for fecal indicator bacteria*E. coli*. Lands where livestock are managed that are also irrigated have a higher rate of exceedance of the *E. coli* criteria.

5.2.2 2 Residential septic systems

The population of Baker County, which represents most of the population within the Powder River Basin, as of 2020 was 16,668 (US Census Bureau 2021). Approximately 68% of the county's population lived within areas serviced by centralized sewage systems (US Census Bureau 2021) with permits to limit bacteria*E. coli* discharge to surface waters. The remaining population likely uses some form of onsite septic treatment system. These systems are designed to minimize the leaching of fecal wastes to adjacent waterways. Over time, these systems may become compromised and fail to provide removal functions. However, given the low population on septic systems, the dispersed nature of this population, and the likelihood that only a small percentage of systems are failing at any given time, DEQ concludes, therefore, that leaching of *E. coli* from failing septic systems constitutes a possible but likely insignificant relatively small source load to listed impaired waters in the Powder River Basin.

The Powder, and Burnt subbasins along with the and Brownlee Reservoir Ssubbasins in Baker County and Union County are predominately rural. Even though urban areas make up a small percentage of the land use area in the subbasins, approximately 68% of the county's population lived within these Urban centers areas (US Census Bureau 2021). These urban centers are served by publicpermited wastewater treatment systems make up a small percentage of the land use area while and approximately 68% of the county's population lived within areas serviced by centralized sewage systems (US Census Bureau 2021) with state-issued wastewater permits to limit *E. coli* *E. coli* bacteria discharge to surface waters to protect public health and beneficial uses of water.

A septic system is the predominate method of sewage treatment for homes and businesses that are not connected to a centralized wastewater treatment system. Rural residences and businesses that utilize onsite or subsurface wastewater management (septic systems) are not evenly distributed throughout the subbasin.

Septic systems consist of a tank and a subsurface distribution system, or drainfield. Wastewater flows into the tank where solid material settles to the bottom and the remaining effluent flows out of the tank into a drainfield where it leaches into the ground. The initial treatment occurs in a septic tank, where most of the settleable and floatable materials are removed and partial digestion of organic matter occurs under anaerobic conditions. Microbes in the soil and other biological processes further breakdown the remaining contaminants to yield treated effluent that is often delivered to groundwater, and in some cases, surface waters (USU.S. EPA, 2002). For properly functioning on-site systems, bBacteria dies off during the treatment process and if the system is functioning properly, discharge impacts to groundwater are negligible. However, there are factors described below that affect whether a system is functioning properly.

Oregon Administrative Rule 340-071-0100 governs the rules and permit conditions for onsite wastewater treatment systems. OAR 340-071-0100(65) defines a "Failing System" as any system that discharges untreated or incompletely treated sewage or septic tank effluent directly or indirectly onto the ground surface or into public waters or that creates a public health hazard. Many of Oregon's older onsite systems may fall under this definition. These systems have a higher potential tobe adversely impacting water quality without surfacing sewage to the groundrelative to systems installed after the establishment of OAR 340-071-0100.

Onsite septic systems indirectly discharge to local groundwater and not to surface waters; theoretically, bacteria dies off during the treatment process and if functioning correctly, discharge impacts to groundwater would be negligible.

These rules specify that "A person may not discharge untreated or partially treated wastewater or septic tank effluent directly or indirectly onto the ground surface or into public waters. Such discharge constitutes a public health hazard and is prohibited" (OAR 340-07-0130(3).

The onsite program is directly managed by the Department of Environmental Quality in Coos and Curry Counties whereas Douglas County has entered into agreement with Oregon DEQ to become the department's agent for permitting onsite systems, including receiving and processing applications, issuing permits, enforcing, and performing required inspections.

The regulatory programs in place at DEQ and county agents are intended ensure onsite systems are properly sited, installed and maintained in order to prevent causing or contributing to water quality violations, and onsite systems are designed to produce no bacteria loads to surface waters. However, failing and/or poorly situated onsite sewage systems can produce significant bacterial loads.

Certain areas that frequently require onsite system repair are ones utilized for incompatible activities such as building a driveway, placement of a garage, or for confining livestock. These types of activities can adversely impact the suitability of repair areas and complicate repairs.

Information on onsite system failure rates suggests high variability and inconsistent evaluation and tracking of information (Hoghoogh et al, 2021). Estimates are that approximately 10 to 25 percent of septic systems fail during their operational life (Jeong et al., 2010). System failure can result in untreated wastewater entering surface and ground water supplies (U.S. EPA 2003). Contaminants in untreated wastewater include pathogens, nitrates, phosphates, metals and toxics including emerging contaminants.

Septic system service life and risk of OSDS failure varies significantly with system age, materials of construction (e.g., steel tank), system loading rate, maintenance history and operation. Combined with siting factors including soils, and hydrologic properties of the site, these factors determine the risk of OSDS failure (Joubert et al., 2003; Jeong et al., 2010). Observed service life ranges from 11 to 30 years (Siegrist et al., 2001). For design purposes, the U.S.US EPA recommends 20 years or less (assuming most household systems are not well maintained). Based on general system failure risks, DEQ concluded that there may be a contribution to *E. coli* loading from failing or improperly functioning onsite systems serving rural populations.
For example, steel septic tanks installed in the 1970's have likely rusted through and are no longer watertight. In addition, solids from poorly maintained onsite systems can clog drain-fields and soils prematurely and result in the leachfield failing and sewage surfacing.

The risk of surface water pollution from failing systems is a function of multiple factors including housing (system) density, groundwater hydrology and proximity to surface waters. The watershed scale risks can be generally classified using a GIS Septic System Risk Analysis (Hoghoogh et al 2021, The Clackamas River Water Providers, 2012). Risks or impacts to a specific waterbody involves site-specific assessment information, including sanitary surveys or inspections by a licensed Maintenance Provider.

Since the rural housing stock in the subbasin is aging, DEQ concluded that it is likely that a significant number of onsite wastewater treatment systems have reached or are nearing their end of service life, but more information is needed to classify the number of at-risk systems.

A resource to address these potential sources are Tthe DEQ Onsite Wastewater Management Program is partner in the Oregon Septic Smart Initiative (https://www.oregon.gov/deq/Residential/Pages/Septic-Smart.aspx) that provides access to information about their septic systems including a voluntary approach to existing system evaluation during property transactions or when failing systems are identified. Ongoing education and outreach as well as regulatory programs are in place to help ensure onsite disposal systems do not cause or contribute to water quality violations.

Based on the general system failure risks identified above, DEQ concluded that there a small but unquantified contribution from failing or improperly functioning onsite system serving low density rural populations. However, DEQ does not have sufficient information to determine the proportion of *E. coli* loading to surface waters in specific areas of the subbasin. Based on the low density of rural housing, DEQ concluded that septic systems are unlikely to be a major source of bacteria in the subbasins but represent a potential source of fecal contamination and nutrient pollution that should be further evaluated using conventional approaches (system age, distance to streams, inspections) or more advanced techniques.

~~Microbial source tracking (MST) a class of methods that, when used appropriately, can assess fecal sources in finer detail and are intended to discriminate between human and nonhuman sources of fecal contamination. Certain MST methods are designed to differentiate between fecal contamination originating from different animal species, such as ruminants, canids and birds (Rock et al 2015). MST could be useful to characterize the extent of onsite sources within specific areas of the subbasin using human markers.~~

5.2.3 Permitted wastewater and stormwater discharges

Table 5~~.2.36~~5 lists all National Pollutant Discharge Elimination System permits for discharge of wastewater and stormwater within the Powder River Basin.

5.2.3.1 Wastewater discharges

As shown in Table 55, there are three active industrial wastewater discharge permits within the Powder River Basin. DEQ determined that the processes involved in these sugar and power facilities do not have a reasonable potential for *E. coli* in discharges.

Table 55 also lists four permitted municipal wastewater facilities that regulated *E. coli* discharges. As detailed in the table and its notes, the active sewage treatment plants discharging in the Powder River Basin are at Baker City (≤2 MGD to the Powder River; Figure 28), North Powder (≤1 MGD to the North Powder River; Figure 28) and Huntington (≤1 MGD to the Burnt River; Figure 31). *E. coli* concentrations in effluents from these facilities are not permitted to be above the criteria in OAR 340-041-0009(6)(b)(A) and (B). Based on available data on wastewater treatment infrastructure, DEQ concluded that point source discharge of treated sewage wastewater contributes less *E. coli* to surface waters than nonpoint sources in the basin.

Table 5.2.3a: Powder River Basin wasterwater and stormwater discharge permitsTable 55: Powder River Basin wastewater and stormwater discharge permits

Discharge type	DEQ file number	EPA number	Permittee	Facility type	NPDES Permit type	Receiving water	River Mile
Municipal wastewater	5324	OR0020699	City of Baker City*	sewage treatment	DOM-C1b	Powder River	116.3
	36156	OR0023329	City of Halfway**	sewage treatment	DOM-Db	Pine Creek	19.5
	40981	OR0020052	City of Huntington	sewage treatment	DOM-Db	Burnt River	2
	61600	OR0022403	City of North Powder	sewage treatment	DOM-Db	Powder River	82.4
Industrial wastewater	2142	OR0002526	Amalgamated Sugar Co, Inc	food preparation	IW-B04	Snake River	252
	41297	OR0027278	Idaho Power Co - Hells Canyon Plant	electric power	IW-O	Snake River	247
	41299	OR0027286	Idaho Power Co - Oxbow Plant	electric power	IW-O	Snake River	273
Stormwater	125054	ORR303528	Rare Earth Resources, LLC - Bonnanza Mine	gold ore	GEN12Z	Pine Creek	26.43
	126933	ORR303529	Bayhorse Silver (USA) Inc.	silver ore	GEN12Z	Snake River	317
	102507	ORR211070	Ash Grove Cement Co	limestone	GEN12Z	Burnt River	27
	108030	ORR211613	Ash Grove Cement Co - Lime Plant	concrete products	GEN12Z	Burnt River	8.5
	101822	ORS110870	Oregon Department of Transportation	highway	MS4 - Phase I	various	NA

Notes:
* Baker City ceased discharge to the Powder River in summer 2022. Water Pollution Control Facility (no discharge) permit application in process. However, discharge resumed in summer of 2023 under the NPDES permit.
**Halfway ceased discharge to Pine Creek in 2018. NPDES permit terminated and WPCF permit issued in 2019.
NA = Not applicable because outfalls are located along the road system throughout the basin

5.2.3.1 Wastewater discharges

As shown in Table 5.2.3a6, there are three active industrial wastewater discharge permits within the Powder River Basin. DEQ determined that the processes involved in these sugar and power facilities do not have a reasonable potential for bacteria*E. coli* in discharges.

Table 5.2.3a6 also lists four permitted municipal wastewater facilities that regulated bacteria*E. coli* discharges. As detailed in the table and its notes, the active sewage treatment plants discharging in the Powder River Basin are at Baker City (≤2 MGD to the Powder River28), North Powder (≤1 MGD to the North Powder River28) and Huntington (≤1 MGD to the Burnt River31). *E. coli* concentrations in effluents from these facilities are not permitted to be above the recreation-based criteria according to OAR 340-041-0009. Based on available data on wastewater treatment infrastructure, DEQ concluded that point source discharge of treated sewage wastewater does not contribute a significant amount of *E. coli* to most of the listed waterbodies in the Powder River Basin with the possible exception of the Burnt River

~~downstream of Huntington and the Powder River downstream of Baker City and below the confluence with the North Powder River.~~

5.2.3.2 Stormwater discharges

Stormwater running off from lands ~~following exposure to manure from livestock, wildlife, pets or poorly functioning septic systems~~ contaminated by fecal material ~~is a~~ potentially ~~significant~~ contributes nonpoint sources of ~~bacteria~~*~~E. coli~~**E. coli* to waterways in the basin. ~~This source~~Stormwater originates from a variety of land uses within the basin and may be conveyed to waters as overland flows, along roadways, or other conveyances and can be addressed using nonpoint source management strategies.

DEQ determined that the handful of ore operations in the basin registered under the NPDES 1200Z Industrial Stormwater general permit do not have reasonable potential to contribute ~~bacteria~~*~~E. coli~~**E. coli* in discharges ~~and cumulative flow volumes would be miniscule~~. The only permitted point source of ~~bacteria~~*~~E. coli~~**E. coli* in stormwater discharge in the basin is through the Oregon Department of Transportation management of stormwater from highways statewide under a Phase I Municipal Separate Storm Sewer System (or MS4) permit. Although ODOT's MS4 permit does not specify an effluent limit for *~~fecal indicator bacteria~~**E. coli* ~~and highway stormwater runoff is not anticipated to be a significant source of bacteria~~*~~E. coli~~*, ~~manure and background sources of bacteria~~*~~E. coli~~**E. coli* ~~are likely to~~may be present at times in highway stormwater conveyances within the Powder River Basin. Therefore, DEQ opted to assign a ~~wasteload allocation~~WLA of at least 1% of the loading capacity for ODOT's MS4 permit. EPA's draft TMDLs to Stormwater Permits Handbook (USEPA, 2016) offers several methods for calculating ~~wasteload allocation~~WLAs for NPDES stormwater permits, including MS4 permits. DEQ chose the ratio of jurisdictional boundary method, which calculates the ratio of ODOT jurisdictional area to the total watershed area to determine a percentage of the ~~bacteria~~*~~E. coli~~**E. coli* loading capacity to be given as the ~~wasteload allocation~~WLA for ODOT's MS4 permit discharges within the watershed.

~~Because a readily available source of the extents of the ODOT jurisdictional boundary within the watershed does not exist,~~ DEQ ~~estimated~~ calculated right-of-way area using road centerlines from 2019 Oregon Transportation Network spatial data (Oregon Explorer 2022). Roads designated as owned by ODOT were clipped to the HUC6 boundary of the Powder Basin. A 30-ft planar buffer around the ODOT roads was used to calculate the area of the right-of-way using the Buffer tool in ArcGIS Pro 3.0. This resulted in a MS4 jurisdictional area of 3,350 acres assigned to ODOT. Based on the Powder Basin area (2,630,554 acres), the proportion of the basin that fell within the jurisdictional boundary of the ODOT MS4 was 0.1%.

There is uncertainty in the estimation of jurisdictional area and resultant potential ~~bacteria~~*~~E. coli~~**E. coli* loads due to the following factors:

- Roads tend to be near the valley bottoms and adjacent to streams~~;~~.
- The episodic nature of pollutant loads from roads makes it difficult to capture only using jurisdictional boundary area to watershed area ratio. ~~and;~~
- The mixture of impervious and pervious contributing areas results in variations in loads from different locations within the estimated jurisdictional boundaries, even for the same events.

5.2.3.3 Water Pollution Control Facility (WPCF) Permits

DEQ administers Water Pollution Control Facility (WPCF) Individual Domestic ~~p~~Permits that do not allow discharge of treated wastewater to surface waters. The WPCF permit is a state requirement for the discharge of wastewater to the ground; discharge to surface water is not allowed. WPCF permits are issued for land irrigation of wastewater, wastewater lagoons, onsite sewage disposal systems, and underground injection control systems (i.e., dry wells, sumps, etc.). The primary purpose of a WPCF permit is to prevent discharges to surface waters and to protect groundwater from contamination. This permit is also used to prevent nuisance conditions such as odors and mosquitoes.

Permit applications and operational requirements are based on the type of proposed facility, type of wastewater involved (industrial, domestic sewage or both) and design capacity, along with a number of siting requirements. The applicable rules are found in OAR Chapter 340, Division 071.

WPCF Individual Domestic Permits apply to larger wastewater volumes than single residential onsite (septic) systems and may employ advanced onsite wastewater treatment systems.

DEQ identified the WPCF permits for Baker County in Table (below)5.2.3.376 in the source assessment for this TMDL because a WPCF system could contribute pollutants to surface water if it fails or is not properly maintained. DEQ is responsible for all phases of regulatory oversight for WPCF permits and does not delegate this program to County agents.

Table 5.2.3.3. Water Pollution Control Facility (WPCF) permits issued in the Powder River Basin. **Table 56: Water Pollution Control Facility (WPCF) permits issued in the Powder River Basin**

DEQ File Number/ Facility ID	Legal Name	City	County	Permit Type
114814	BAKER COUNTY PARKS AND RECREATION DEPARTMENT	RICHLAND	BAKER	WPCFOS-Bii
105305	CHRISTANSEN, JOHN	PINE	BAKER	WPCFOS-BiiiSF>
112743	CORNUCOPIA WILDERNESS LODGE, LLC	HALFWAY	BAKER	WPCFOS-Bii
36005	HAINES, CITY OF	HAINES	BAKER	WPCF-DOM-E
36156	HALFWAY, CITY OF	HALFWAY	BAKER	WPCF-DOM-E
111911	IDAHO POWER COMPANY	OXBOW	BAKER	WPCFOS-Bii
111553	OREGON PARKS & RECREATION DEPARTMENT	HUNTINGTON	BAKER	WPCFOS-Bii
109353	Oregon Travel Information Council	BAKER CITY	BAKER	WPCFOS-Bii
75135	RICHLAND, CITY OF	RICHLAND	BAKER	WPCF-DOM-E
5450	SUMPTER VALLEY RAILROAD RESTORATION, INC.	SUMPTER	BAKER	WPCF-DOM-E
103793	SUMPTER, CITY OF	SUMPTER	BAKER	WPCF-DOM-E
91445	UNITY, CITY OF	UNITY	BAKER	WPCF-DOM-E
106196	USDOI; BUREAU OF LAND MANAGEMENT	BAKER CITY	BAKER	WPCF-DOM-E

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114814	BAKER COUNTY PARKS AND RECREATION DEPARTMENT	RICHLAND	BAKER	WPCFOS-Bii
105305	CHRISTANSEN, JOHN	PINE	BAKER	WPCFOS-BiiiSF>
112743	CORNUCOPIA WILDERNESS LODGE, LLC	HALFWAY	BAKER	WPCFOS-Bii
36005	HAINES, CITY OF	HAINES	BAKER	WPCF-DOM-E
36156	HALFWAY, CITY OF	HALFWAY	BAKER	WPCF-DOM-E
111911	IDAHO POWER COMPANY	OXBOW	BAKER	WPCFOS-Bii
111553	OREGON PARKS & RECREATION DEPARTMENT	HUNTINGTON	BAKER	WPCFOS-Bii

109353	Oregon Travel Information Council	BAKER CITY	BAKER	WPCFOS-Bii
75135	RICHLAND, CITY OF	RICHLAND	BAKER	WPCF-DOM-E
5450	SUMPTER VALLEY RAILROAD RESTORATION, INC.	SUMPTER	BAKER	WPCF-DOM-E
103793	SUMPTER, CITY OF	SUMPTER	BAKER	WPCF-DOM-E
91445	UNITY, CITY OF	UNITY	BAKER	WPCF-DOM-E
106196	USDOI; BUREAU OF LAND MANAGEMENT	BAKER CITY	BAKER	WPCF-DOM-E
127643	Oasis on the Snake	HUNTINGTON	MALHEUR	WPCF-IW-B13
103287	Baker City WWTP	BAKER CITY	BAKER	WPCF-DOM-E
103297	City of North Powder	NORTH POWDER	UNION	WPCF-DOM-E

5.2.3.3 Confined Animal Feeding Operations (CAFOs)

Confined animal feeding operations (CAFOs) are generally defined as the concentrated confined feeding or holding of animals in buildings, pens, or lots where the surface is prepared to support animals in wet weather or where there are wastewater treatment facilities for livestock (e.g., manure lagoons). CAFO wastes include but are not limited to manure, silage pit drainage, wash down waters, contaminated runoff, milk wastewater, and bulk tank wastewater.

The CAFO permit program began in the early 1980s to prevent CAFO wastes from contaminating groundwater and surface water. There are twelve12 CAFOs operating in the Powder River Basin, (see Table XX5.2.3b), which are permitted under general permits in either Oregon's federally-delegated NPDES or state Water Pollution Control Facility (WPCF) programs. CAFO permits are administered by the Oregon Department of Agriculture (ODA) , guided by a Memorandum of Understanding with DEQ. As explained in Section XX below, n Neither the NPDES or WPCF CAFO permits allow point source discharge of wastewater or wastes from regulated activities to surface water or groundwater, except during a 25-year, 24-hour rainfall event. Therefore, no numeric point source wasteload allocations are appropriate. However, a permittee's failure to fully comply with all permit conditions could allow contribution of excess *bacteriaE. coli and organic matter* to the nonpoint source general loads, sothus a narrative requirement for appropriate management measures to be applied is required, which also supports implementation of nonpoint source load allocations throughout the basin.

Table 5.2.3bX.X. Permits for Confined Animal Feeding Operations (CAFOs) in the Powder River Basin (as of April 2024).

ODA Ppermit # number	Permit type	City	Designation
62653	NPDES	BAKER CITY	Medium Concentrated

173037	NPDES	BAKER CITY	Medium Concentrated
180694	NPDES	BAKER CITY	Medium Concentrated
180848	NPDES	BAKER CITY	Medium Concentrated
180868	NPDES	HAINES	Medium Concentrated
181161	NPDES	RICHLAND	Medium Concentrated
181194	NPDES	BAKER CITY	Large Tier 1 Concentrated
181215	WPCF	BAKER CITY	Medium Confined
182744	NPDES	BAKER CITY	Medium Concentrated
186190	NPDES	BAKER CITY	Medium Concentrated
186660	NPDES	BAKER CITY	Medium Concentrated
1000275	NPDES	BAKER CITY	Large Tier 2 Concentrated

CAFO permittees are prohibited from discharging manure, litter, or process wastewater to surface waters and ground waters of the state, except as allowed under conditions of an extreme rainfall event, defined in the permit as greater than the 25-year, 24-hour rainfall. The CAFO extreme weather event is similar to, but applied differently, than an “upset” and “overflow” event identified for NPDES permitted WWTPs.

Each permitted CAFO receives a routine inspection from their area Livestock Water Quality Inspector once a year, on average. During this inspection, the operator and inspector discuss the operation, and the inspector reviews the entire operation and recordkeeping to ensure compliance with permit terms and water quality rules and laws. Inspection reports detail permit compliance in the following areas: permitted number of animals, animal confinement requirements, manure and silage containment requirements, manure application requirements, Animal Waste Management Plan, and record keeping. Problems in any of these areas can result in the issuance of a water quality advisory or a notice of noncompliance. In the event a violation is found, the ODA requires the operator to develop a solution to the problem and a schedule to complete the corrective actions. Surface water quality samples are taken when visual or anecdotal evidence of discharge is present.

CAFO permits also regulate land applications of animal and other waste and require that these discharges do not exceed a designated *E. coli* effluent limit. Types of discharge that are prohibited include, but are not limited to::

- contaminated runoff from confinement or waste accumulation areas;,
- overflow or discharges from waste storage facilities;,
- discharges due to improper land application activities from seepage below the root zone,
- surface drainages or field tile outlets;,
- dry-weather discharges,
- ; discharges due to equipment failure,

; or leakage or seepage from facilities in the production area in excess of approved designs;, and

and discharges to underground injection control systems.

All land application of manure and process wastewater must be done in accordance with an ODA approved Animal Waste Management Plan.

Having adequate manure storage can be challenging, particularly during periods of heavy precipitation or snowmelt. This predicament can be further exacerbated by the location of some CAFO facilities with streams and drainages in close proximity to limited acceptable land application areas. CAFO facilities may not have the capability to store manure through extended wet weather periods and thisthe lack of capacity can result in the land application of manure when conditions are not agronomically favorable (saturated soils and/or potential for surface runoff). The permit does provide for such anallow application when it is a desired alternative to allowing waste storage or wastewater control facilities to overflow (e.g., land application to saturated soils to pond wastewater onsite provides for greater protection of surface waters than a direct overflow of a waste storage tank to surface waters). The land application in these circumstances will be considered an upset condition. The general permit stipulates that, during such a discharge, effluent cannot cause or contribute to a violation of state water quality criteria.

5.2.4 Wildlife

Wildlife werewas considered to be amay contribute potential source of bacteria*E. coli**E. coli* pollution loading to surface waters in the Powder River Basin, particularly in areas where they congregate at artificial feeding areas. In 2019 and 2020, the Powder Basin Watershed Council conducted a bacteria*E. coli**E. coli* and total phosphorus water quality study at two elk feeding areas managed by the Oregon Department of Fish and Wildlife (Powder Basin Watershed Council 2021). The feeding sites are located on the east side of the Elkhorn Mountains along Anthony Creek and the North Powder River. Results showed that *E. coli* were detected in surface waters downstream of the feeding sites, particularly during the summer months after animals had dispersed.

Both elk feeding sites have irrigated livestock pastures with fenced riparian areas and water gaps. Riparian condition is considered to be good and cattle graze the pastures in rotations between May 1 and October 1 each year. Elk are generally present during the winter months when deep snow drives them out of the mountains and into the Baker Valley. Water quality samples were collected upstream and downstream of each feeding area during January (elk feeding), April-May (runoff), and August (base flows during livestock grazing period). An additional site was located on the North Powder River approximately 2 miles downstream of the North Powder Feeding area near North Powder Pond 1.

All bacteria*E. coli* water sample results from the feeding sites had less than 10% of the single sample criteria for *E. coli* (406 organisms/100 ml) except for the downstream samples during the baseflow period in August. Maximum *E. coli* concentrations during the baseflow period ranged from 348 MPN per 100 mL at Anthony Creek to 1600 MPN per 100 mLat the North Powder site. The baseflow results from the monitoring site near North Powder Pond 1 site were also above 300 MPN per 100 mL.

The results of this studyThis suggests that the elk feeding areas are not a significant sourcewhilealthough elk may not contribute to excess of bacteria*E. coli**E. coli* contamination loads during the time of year when feeding sites are active, they may contribute to excess loads during the spring and summer months due to transport of fecal material during runoff and irrigation. However, these areas may also be used by livestock at different time of the year as well (ODFW 2017).to nearby waterbodies during the elk feeding season, but may be a source of bacteria*E. coli* during the livestock grazing period. Additional studies may be necessary to assess wildlife bacteria*E. coli* contributions in other areas of the basin.

In high densities, In regions other than the Powder River Basin, resident and migratory waterfowl in high densities haved been demonstrated tocan contribute to elevated *E. coliE. coli* in waterbodies (Meerburg et al. 2011; Weyant 2021). However, Thus, resident and migratory waterfowl, common throughout the Powder River Basin (Holthuijzen, 2003), may contribute to observed *E. coli* loads. Similarly, other wildlife present in the basin, including mule deer, bighorn sheep, mountain goats, and beavers, may contribute to observed *E. coli* loads. Additional monitoring during TMDL implementation, possibly including the use of MicrobialBacteria Source Tracking (MBST), is needed to assess wildlife contributions to *E. coli* loads in specific areas of the basin.the transitory nature of waterfowl and lower overall densities compared to livestock indicates that waterfowl as an *E. coli* source is minor in the Powder River Basin. Based on a report produced by the Idaho Power Company (Holthuijzen 2003), the density of wintering waterfowl in the Powder River arm of Brownlee Reservoir was 120.3±68.5 birds per river mile (mean±standard deviation). DEQ used the Idaho Power study to do a rough, conservative calculation of bird density in Powder River Basin areas originally listed as impaired for *E. coli* in the 2010 DEQ Integrated Report, which encompasses a larger area than the current listings. Applying the approximate upper 95% confidence interval boundary density of 258 birds per river mile (mean + two standard deviations) to the 221.8 river miles of the Powder River, North Powder River, Burnt River, South Fork Burnt River amounts to 57,225 overwintering waterfowl in areas with past or current *E. coli* impairments. The amount of manure produced by waterfowl varies widely according to species. Farmed ducks are reported to produce 0.33 pounds/day (Woynarovich 1979) and Canadian geese produce 1.75 pounds per day (Weyant 2021). The report from Holthuijzen (2003) suggested that only 6.1% of the surveyed populations were Canadian geese, with mallard ducks, goldeneye, and common merganser making up the majority. DEQ conservatively assumed that the 57,225 overwintering waterfowl were all Canadian geese and that populations have remained similar since the original survey period (which is supported by recent ODFW hunting forecasts for the area (ODFW 2018)). This suggests an upper amount of 100,143 pounds of manure potentially produced per day (258 birds/mile x 221.8 miles x 1.75 pounds per day) in the area during the overwintering season. In comparison, based on the recent agricultural census (USDA-NASS 2019), using the low end of potential manure produced by cattle animal units (26 pounds per day; Statistics Canada 2006), a lower end amount of 1,850,862 pounds of manure per day could potentially be produced just in Baker County. This conservatively suggests that the upper potential amount of waterfowl produced manure across the Powder Basin is 5% of the lower potential amount of manure produced by cattle in Baker County. The comparable amount of waterfowl versus cattle manure is probably much lower due to the species composition of waterfowl, the migratory nature of waterfowl, and the potential for larger amounts of manure to be produced daily by cattle. Nonetheless, waterfowl produced manure in the basin is small compared to livestock produced manure in the basin.

In summary, wildlife sources, although ubiquitous throughout the area, are likely not a major source of *E. coli* to listed waterbodies in the Powder River Basin. A study examining elk in the North Powder Subbasin did not suggest that this common wildlife species in the basin was a significant sources of *E. coli* contamination in adjacent waterbodies (Powder Basin Watershed Council 2021). By extension, DEQ concludes that mule deer, bighorn sheep and mountain goats also do not contribute substantive *E. coli* contamination to the basin's listed waterbodies.

6. Allocation ~~Approach~~ approach

As indicated by ~~the data analysis to identify and assess~~the assessment of ~~bacteria*E. coli*~~*E. coli* sources, permitted point source contributions are limited in location and contribution. Due to the overlap of wildlife, residential, and agricultural land uses, nonpoint and background sources are not ~~separable~~distinguishable. These land use types make up ~~the majority of~~most of the basin area. Thus the ~~, so this~~ mixed category of nonpoint and background sources ~~is the main driver of~~make up the largest contribution to ~~bacteria*E. coli*~~*E. coli* loads in rivers and streams of the Powder River Basin. ~~In line with these proportional contributions,~~ Permitted point sources ~~point source waste load allocations~~ make up ~~the smallest fraction~~a smaller fraction of the allocation. ~~distribution, followed by the margin of safety and substantial load allocations for nonpoint sources, inclusive of background sources.~~ The allocation distribution among sources reflects proportional contributions, as well as allowing for uncertainty and any subsequent change to permitted discharges. Proportionality and conservative ~~margin of safety~~MOS support reasonable assurance of implementation.

6.1 ~~Impacts from~~ Wasteload allocation methods~~WLAs~~

As noted in Table 5~~.2.3~~*7*, four facilities within the basin are permitted to discharge industrial stormwater and three facilities are permitted to discharge industrial wastewater. DEQ determined that stormwater exposed to the activities at these ore and concrete processing facilities and wastewater associated with sugar and power operations do not have reasonable potential to increase ~~bacteria*E. coli*~~*E. coli* in streams. This is because ~~bacteria*E. coli*~~*E. coli* is unlikely to be associated with these activities~~,~~ and ~~is~~ not monitored under the permits ~~and cumulative discharge flows are anticipated to be minor~~. Therefore, no ~~bacteria*E. coli*~~*E. coli* reductions are needed and the ~~wasteload allocation~~WLAs for the NPDES 1200Z Industrial Stormwater general permit and the three industrial wastewater permits are set at current, unquantified loads, with the narrative requirement of implementing the permits.

DEQ developed ~~wasteload allocation~~WLAs for the wastewater treatment plants serving the cities of Baker City, North Powder, and Huntington. Based on the permit limits for these facilities, DEQ used a maximum discharge of 2 MDG at Baker City and 1 MGD at North Powder and Huntington with the maximum ~~*E. coli*~~*E. coli* concentration allowed by the geometric mean criterion, 126 organisms/100 mL, to ensure the recreation-based criteria were attained. For the Huntington facility, the calculated ~~wasteload allocation~~WLA is 4.77E+09 organisms/day. This amounts to 0.2 to 8.7% of the loading capacity for 11494-ORDEQ: Burnt River at Snake River Road (Huntington) ~~Burnt River at Huntington~~ based on the geometric mean criterion across the gradient of high to low flow categories. For the Baker City and North Powder facilities' combined 3 MGD, the calculated ~~wasteload allocation~~WLA is 1.43E+10 organisms/day. This amounts to 0.3 to 46.1% of the loading capacity for 11857-ORDEQ: Powder River at Snake River Road (Richland) ~~Powder River near Richland~~ based on the geometric mean criterion across the gradient of high to low flow categories. Discharges typically operate well within their permit limits and discharge smaller loads than those presented above, especially in consideration of chlorination treatment. When operating properly, they will not cause or contribute to water quality violations. Because the facilities have existing permits, no additional reductions are required.

Although the calculated ratio of jurisdiction area assigned to ODOT to the area of the Powder Basin was 0.1%, DEQ assigned 1% of the loading capacity as the ODOT MS4 (Phase I permit) ~~wasteload allocation~~WLA following recommendations by the EPA's draft TMDLs to Stormwater Permits Handbook (EPA 2008). Implementation of the ODOT MS4 permit conditions and control measures is anticipated to keep ~~bacteria~~~~*E. coli*~~*E. coli* loads in highway stormwater discharges within the watershed below the ~~wasteload allocation~~WLA of 1% of the loading capacity. These conditions and measures include:

- Public education and outreach – including information specifically on ~~bacteria~~~~*E. coli*~~*E. coli*
- Public involvement and participation – including facilitation of a public website with ~~bacteria~~~~*E. coli*~~*E. coli* information and illicit discharge reporting
- Illicit discharge detection and elimination – including procedures for addressing potential illicit dumping of wastes
- Construction site runoff control – requiring use and maintenance of controls for erosion, sediment and waste materials management at all ground disturbing projects, from initial clearing through final stabilization, to reduce all potential pollutants in stormwater
- Post-construction site runoff control – including inventorying and maintaining all water quality facilities, which reduce loads of ~~bacteria~~~~*E. coli*~~*E. coli* and other pollutants
- Pollution prevention and good housekeeping – including inspection and cleanout of catch basins and litter control, both of which contribute to reducing loads of ~~bacteria~~~~*E. coli*~~*E. coli* and other pollutants.

6.2 Nonpoint ~~Source~~ source and ~~Background~~ background ~~Load~~ load ~~Allocation~~ allocation ~~Methodology~~methods

DEQ used a ~~two step~~two-step process for determining ~~load allocation~~LAs for each reach and identifying reaches where reductions in fecal indicator bacteria loading were needed. First, DEQ calculated the loading capacity, ~~margin of safety~~MOS, ~~wasteload allocation~~WLAs, and ~~load allocation~~LAs for each flow category. Basing these calculations on the 90-day geometric mean criterion of 126 organisms/100 mL, ensured that both geometric mean and single sample criteria are met~~, in both irrigation and non-irrigation seasons~~ throughout the year. Second, for each flow category and season, DEQ compared observed data based on seasonal period (~~irrigation~~ November-April vs. ~~non-irrigation~~May-October) against both geometric mean and single sample criteria. This allowed identification of the maximum ~~potential~~ percent reduction in loads needed to meet the applicable criteria. DEQ calculated percent reductions according to methods described in Section 4.5.1. As an additional layer for ~~margin of safety~~MOS, DEQ applied the maximum percent reduction identified ~~for an individual criterion-flow category-season combination~~ to all criteria, flow categories, and seasons. This ensures that both ~~gemeometric~~geometric mean and single sample criteria will be met annually under all flow scenarios.

Based on the source assessment presented in Section 5.2, nonpoint and background sources constitute the dominant contribution of ~~fecal indicator bacteria (~~~~*E. coli*~~*E. coli* ~~)~~ to the Powder

Basin. DEQ assigned nonpoint/background source load allocationLAs to all areas of the basin on an annual basis. Thus, load allocationLAs calculated from the percent reduction and margin of safetyMOS calculations for each reach apply to all contributing land areas with agricultural land uses (including areas occupied by livestock or influenced by livestock waste) and nonagricultural areas occupied by wildlife and rural residences (Tables 4.5.2a – 4.5.2qq10-52). The reductions apply only to nonpoint sources only in the contributing land area and irrigation return water withinin the contributing area of the reachh. If another designated reach for reductions occurs upstream, only the loads from the contributing area downstream of the upstream station apply. Load allocationLAs apply year-round, including both irrigation and non-irrigation seasons.

As described in section 5.2.2, failing septic systems constitute a possible but probably insignificant *E. coli* source to listed waters in the Powder River Basin. Based on the information presented in section 5.2.4, wildlife sources were considered as a background source of bacteria*E. coli* (OAR 340-042-0030(1)). Both are included in the mixed category of nonpoint and background sources.

6.3 Allocations to assessment units

Allocations for individual assessment units (DEQ 2022b) may be calculated using the following equations:

(3) Geometric mean allocation (organisms/day) = 126 organisms/100 mL x Flow x CF x 0.9
(4) Single sample allocation (organisms/day) = 406 organisms/100 mL x Flow x CF x 0.9

Where CF is the appropriate conversion factor for units of volume and time needed to convert units of flow for calculations of allocations in terms of organisms/day and the multiplier of 0.9 reflects the 10% explicit margin of safetyMOS and 0% reserve capacity. The scheme for distributing the calculated allocation among loads and wasteloads is presented in Table 957.

Future *E. coli* water quality impairments detected in assessment units identified in Table 3 will receive allocations consistent with the calculations determined from equations 3 and 4 and the scheme in Table 957.

Table 57: Distribution of *E. coli* allocations among loads and wasteloads for individual assessment units

State highway MS4 Phase I Permit present	NPDES permit for sewage treatment discharge present	Percent of allocation		
		Nonpoint source and background load	ODOT MS4 wasteload	Wastewater treatment wasteload
No	No	100.0	0.0	0.0
Yes	No	98.9	1.1	0.0
No	Yes	Difference between 100.0% and the percent of permitted wasteload that contributes to allocation[1]	0.0	Percent of permitted wasteload that contributes to the alloctation[1]
Yes	Yes	Difference between 98.9% and the percent of permitted wasteload that contributes to allocation[2]	1.1	Percent of permitted wasteload that contributes to the allocation[2]

Notes: Assessment units are described in Methodology for Oregon's 2022 Water Quality Report and List of Water Quality Limited Waters (DEQ 2022b) and include watersheds, rivers and streams, and lakes and reservoirs.
Percents may be used to determine individual load and wasteload allocations from the calculated allocations in Equations 3 and 4
Presence of a state highway MS4 Phase I or sewage treatment discharge NPDES permit includes those intersecting and upstream of the assessment unit.
[1]Percent of permitted wasteload that contributes to allocation must be ≤ 100.0%
[2]Percent of permitted wasteload that contributes to allocation must be ≤ 98.9%

6.4 Reserve ~~Capacity~~capacity

As indicated in OAR 340-042-0040(k), ~~reserve capacity~~RC is an element of the TMDL which is an allocation for increases in specific pollutant loads from future growth and new or expanded sources. Alternatively, a TMDL may allocate no ~~reserve capacity~~RC. For this TMDL, DEQ assumed minimal growth and development in the Powder River Basin and ~~explicitly~~ reserved zero percent of the load capacity. New sources or increased discharges from existing sources will be allowed however they will be required to meet ~~bacteria~~~~*E. coli*~~*E. coli* standards prior to discharge. This ensures these additions of load will not cause violations of water quality standards. Allocation of any available capacity may be considered on a case-by-case basis by DEQ for NPDES permitted point sources, should the need arise in the future.

6.5 Margin of ~~Safety~~safety

As indicated in OAR 340-042-0040(4)(i), ~~margin of safety~~MOS can be calculated either explicitly or implicitly. Implicit margins of safety incorporate conservative assumptions in water quality targets, sources or restoration effectiveness and uncertainty ranges (Minnesota Pollution Control Agency 2017). In comparison, explicit margins of safety set conservative water quality targets, add a specific safety factor to pollutant load estimates or reserve a portion of the load capacity. For this TMDL, DEQ adopted an explicit ~~margin of safety~~MOS that specifically reserves a 10 percent portion of the loading capacity.

~~An explicit 10 percent margin of safety was used in the calculation of percent reductions needed to meet load allocations based on the log-mean *E.coli* criterion of 126 organisms/100 mL and the single sample maximum criterion of 406 organisms/100 mL.~~

In addition, the following conservative analytical assumptions were included to incorporate an additional, implicit ~~margin of safety~~MOS. DEQ used reasonable maximum scenarios for each part of the analysis to ensure that ~~estimated~~ calculated loads would be the highest ~~actual~~ potential loads~~ that may be encountered. For instance~~~~example, death and decay of *E. coli* is likely during the time spent on land runoff and stream/river transport, given the long distances to downstream monitoring sites and the presence of reservoirs in some reaches. However, DEQ assumed that all source bacteria~~~~*E. coli*~~ ~~reach the streams, rather than accounting for die-off of bacteria~~~~*E. coli*~~~~. Similarly, *E. coli* from fecal sources may establish naturally reproducing populations in some areas during certain times of the year.~~ . Naturally reproducing populations of *E. coli* originating from fecal material may also contribute to observed concentrations at some locations (IDEQ, 2020). However, DEQ assumed that all measured *E. coli* concentrations originate from point or nonpoint sources because optimal growth conditions for *E. coli* exist in animal intestines; thus, elevated *E. coli* concentrations in surface water suggest relatively recent surface water fecal contamination (IDEQ, 2020). By assuming that all *E. coli* originate from land base sources, the highest potential loads and load reductions are calculated. In calculating ~~wasteload allocation~~WLAs for wastewater treatment facilities, DEQ used permitted discharge limits for ~~*E. coli*~~*E. coli* without considering the ~~bacteria~~~~*E. coli*~~*E. coli* reduction from chlorination applied to remove all pathogens from effluent prior to discharge. DEQ also chose to apply reductions needed as the maximum from among those calculated based on geometric mean or single sample criteria across all flow categories and both seasons. This approach ensures additional reductions are applied to sources contributing during flows other than those associated with the maximum observed concentration.

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