Upper Salmon River Subbasin Temperature Total Maximum Daily Load

2026 TMDL and Five-Year Review

Hydrologic Unit Code 17060201



State of Idaho

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Abbreviations, Acronyms, and Symbols

§ 303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
§	section (usually a section of federal or state rules or statutes)
AU	assessment unit
BAG	basin advisory group
BLM	United States Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
CSWCD	Custer Soil and Water Conservation District
CW	cold water
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
DWS	domestic water supply
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
FSBI	Fine Sediment Biota Index
GIS	geographic information system
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
ISWCC	Idaho Soil and Water Conservation Commission
L	liter
LA	load allocation
LC	load capacity
m	meter
m^2	square meter
MDAT	maximum daily average temperature
MDMT	maximum daily maximum temperature
MMI	multimetric indices
mg	milligram
mL	milliliter

mm	millimeter
MOS	margin of safety
MSGP	multisector general permits
MWMT	maximum weekly maximum temperature
NB	natural background
NPS	nonpoint source pollution
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NTU	nephelometric turbidity unit
PCR	primary contact recreation
PNV	potential natural vegetation
QA	quality assurance
QC	quality control
RMRS	Rocky Mountain Research Station
SCNF	Salmon-Challis National Forest
SCR	secondary contact recreation
SECI	Streambank Erosion Condition Inventory
SEI	Streambank Erosion Inventory
SFI	DEQ's Stream Fish Index
SHI	DEQ's Stream Habitat Index
SMI	DEQ's Stream Macroinvertebrate Index
SS	Salmonid spawning
TMDL	total maximum daily load
USC	United States Code
USFS	United States Forest Service
USGS	United States Geological Survey
WAG	watershed advisory group
WBAG	*Water Body Assessment Guidance*
WLA	wasteload allocation

Executive Summary

The Upper Salmon River subbasin has 27 impaired assessment units (AUs) on the most recent § 303(d) list (DEQ 2024). This priority list (§ 303(d)) summarizes water quality throughout the state. After reviewing up-to-date monitoring data from the subbasin, DEQ developed one total maximum daily load (TMDL) for temperature. DEQ has not developed TMDLs for the other impaired water bodies due to unclear impairments, unclear pollutant targets, or for AUs that are recommended for delisting. In addition, up-to-date data has been reviewed as part of the 5-year review for current water quality status, pollutant sources, and recent pollution control efforts of previously developed and approved TMDLs in the Upper Salmon River subbasin.

Key Findings

Most of the water bodies in the Upper Salmon River subbasin are fully supporting all beneficial uses. For those AUs listed as impaired, the most common associated pollutant is temperature, due to stream temperatures exceeding applicable temperature criteria. The other known impairments for § 303(d)-listed waters are sediment/siltation and combined biota/habitat bioassessments.

To investigate these impairments, DEQ collected water quality data and evaluated data from external agencies. External data was submitted from the Bureau of Land Management (BLM), the United States Geological Survey (USGS), and the United States Forest Service's Rocky Mountain Research Station (RMRS). After analysis of the available data, DEQ developed one temperature TMDL for Pole Creek (Table A).

Pole Creek Temperature TMDL

This AU had a failing Beneficial Use Reconnaissance Program (BURP) score and had temperature exceedances in 2021. A TMDL was developed using the Potential Natural Vegetation (PNV) methodology. The details of the temperature TMDL development are described in section 5. The available data are not sufficient to justify additional TMDL development for the other temperature impaired water bodies at this time.

Table A. Summary of the Pole Creek temperature TMDL components.

Water Body	Assessment Unit Number	Load Allocations	Total Existing Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)			
Pole Creek - source to mouth	ID17060201SL085_03	590,000	810,000	220,000 (27%)	-26%

Summary of § 303(d)-listed Assessment Units

For the remaining AUs listed as impaired in the § 303(d) list, DEQ evaluated sediment and temperature data and made several recommendations to collect additional data and modify

existing assessments (Table B), including one delisting recommendation (Basin Creek, ID17060201SL048_03). DEQ did not evaluate many of the temperature listings, because these were added to the § 303(d) list while DEQ was finalizing this document (Table B). These AUs will be evaluated in the next TMDL review cycle.

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

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Morgan Creek - West Creek to mouth	ID17060201SL002_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Morgan Creek - source to West Creek	ID17060201SL003_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
West Creek - Blowfly Creek to mouth	ID17060201SL004_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Eddy Creek - source to mouth	ID17060201SL010_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bear Creek - source to mouth	ID17060201SL011_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Challis Creek - source to Bear Creek	ID17060201SL012_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Mill Creek - 3rd order	ID17060201SL013_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bayhorse Creek - source to mouth	ID17060201SL017_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Salmon River – Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Kinnikinic Creek - source to mouth	ID17060201SL020_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bruno Creek - source to mouth	ID17060201SL026_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Thompson Creek - source to mouth	ID17060201SL028_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Yankee Fork Creek – Jordan Creek to mouth	ID17060201SL032_04	Temperature	No	No change – retain in Category 5	PNV analysis was completed for temperature; however, results indicate no shade deficiencies.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Jordan Creek - source to Unnamed Tributary	ID17060201SL042_03	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Basin Creek – East Basin Creek to mouth (5, 4c)	ID17060201SL048_03	Sedimentation/ Siltation	No	Remove from Category 5 and retain in Category 4c	BURP assessments and McNeil results indicate sediment is not impairing beneficial uses. Retain in Category 4c for Physical Substrate Habitat Alterations since sources of sediment were from natural causes.
Salmon River	ID17060201SL068_05	Temperature	No	No change – retain in Category 5	AU is a large river and appropriate methods for developing load allocations are needed.
Pole Creek – source to mouth	ID17060201SL085_03	Combined Biota/Habitat Bioassessments	Yes	Retain in Category 5 for Combined Biota and add to Category 4a	Temperature criteria exceedances were documented, and PNV analysis was used to develop the TMDL.
Williams Creek – source to mouth	ID17060201SL089_02	Combined Biota/Habitat Bioassessments	No	No change – retain in Category 5	Additional BURP assessment was completed in 2023. Results will help determine if changes to grazing allotments have benefited the AU.
Big Casino Creek - source to mouth	ID17060201SL092_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
East Fork Salmon River – Herd Creek to mouth	ID17060201SL102_05	Temperature	No	No change – retain in Category 5	AU is a large river and appropriate methods for developing load allocations are needed.
East Fork Salmon River – Germania Creek to Herd Creek	ID17060201SL103_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5 for Combined Biota and add Temperature as a pollutant	PNV was completed for temperature; however, results indicate no shade deficiencies.
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Big Boulder Creek - source to mouth	ID17060201SL105_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Herd Creek- confluence of West Fork Herd Creek and East Pass	ID17060201SL118_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Road Creek - Corral Basin Creek to mouth	ID17060201SL124_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Road Creek - source to Corral Basin Creek	ID17060201SL125_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Corral Basin Creek - source to mouth	ID17060201SL127_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle

Upper Pole Creek

As part of the development of the temperature TMDL, DEQ collected and evaluated data associated with the 2nd-order segment of Pole Creek (ID17060201SL085_02), which is not currently on the § 303(d) list. DEQ collected BURP, continuous stream temperature data, and estimated shade from PNV data for this AU. Given the available water quality data and adjacent land use, DEQ did not develop a TMDL for this AU (sections 4.2.5 and 5).

Five-Year Review

DEQ reviewed the status of the 23 previously developed TMDLs in the Upper Salmon River subbasin (Table C). DEQ produced 3 sediment TMDLs in the *2003 Upper Salmon River Subbasin Assessment and TMDL*, 4 sediment TMDLs, and 16 temperature TMDLs in the *Upper Salmon River Subbasin Assessment and TMDL - 2016 Addendum and Five-Year Review*. DEQ does not recommend changes to many of these water bodies, as there is little or no evidence for recovery from the listed impairments (section 4). There are six AUs with existing TMDLs that DEQ will recommend delisting.

Challis Creek (ID17060201SL009_03) has shown significant recovery from sediment impairments, and the surveys completed by DEQ illustrated that this AU has achieved its sediment target goals.

Aspen Creek (ID17060201SL024_02) was listed in error. This water body did not have stream temperature data to show impairments or provide justification for the PNV analysis; therefore, DEQ will categorize this water body as unassessed until monitoring data are available for assessment.

Based on the current available data, DEQ determined that the four Warm Springs water bodies (ID17060201SL131_04; ID17060201SL132_02; ID17060201SL132_03; ID17060201SL132_04) are primarily impaired by flow regime modification and not in addition to sedimentation (Table C). See section 4 for a more detailed discussion.

Note for updates to the next Integrated Report: Two Challis Creek AUs will have updates in the 2026 Integrated Report. The AU ID17060201SL007_04, Challis Creek - Darling Creek to mouth will be merged with ID17060201SL007_04, and the combined AUs will be renamed Challis Creek

- Mill Creek to mouth. The AU ID17060201SL009_03, Challis Creek - Bear Creek to Darling Creek will be renamed Challis Creek - Bear Creek to Mill Creek.

Table C. Five-year review recommendations for existing TMDLs.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	Temperature	Retain in Category 4a	New temperature data indicates continued exceedances
Challis Creek - Darling Creek to mouth (2 TMDLs)	ID17060201SL007_04	Sedimentation/Siltation	Retain in Category 4a	No new data
		Temperature	Retain in Category 4a	No new data
Challis Creek - Bear Creek to Darling Creek (2 TMDLs)	ID17060201SL009_03	Sedimentation/Siltation	Delist from Category 4a for sediment; retain in Category 4a for temperature	Sediment target goals are achieved
		Temperature	Retain in Category 4a	No new data
Challis Creek - Bear Creek to Darling Creek (2 TMDLs)	ID17060201SL009_04	Sedimentation/Siltation	Retain in Category 4a	No new data
		Temperature	Retain in Category 4a	No new data
Salmon River - Garden Creek to Pennal Gulch	ID17060201SL014_06	Temperature	Retain in Category 4a	No new data
Salmon River - East Fork Salmon River to Garden Creek	ID17060201SL016_06	Temperature	Retain in Category 4a	New temperature data indicates continued exceedances
Salmon River - Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_05	Temperature	Retain in Category 4a	New temperature data indicates continued exceedances
Paasasikwana Naokwaide - Cash Creek to mouth	ID17060201SL021_04	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide Tributaries	ID17060201SL023_02	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide- Willow Creek to Martin Creek	ID17060201SL023_03	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide - Martin Creek to Cash Creek	ID17060201SL023_04	Temperature	Retain in Category 4a	No new data
Aspen Creek - source to mouth	ID17060201SL024_02	Temperature	Delist from Category 4a and move into Category 3	No temperature data for AU; listed in error

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Salmon River - Thompson Creek to Paasasikwana Naokwaide	ID17060201SL027_05	Temperature	Retain in Category 4a	No new data
Salmon River - Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	Temperature	Retain in Category 4a	No new data
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05	Temperature	Retain in Category 4a	New temperature data indicates continued exceedances
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05	Temperature	Retain in Category 4a	No new data
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant

Public Participation

The Salmon River Basin Advisory Group (BAG) also serves as the Upper Salmon River WAG. The BAG was given an opportunity to review and comment on this document at each of their biannual meetings. The general public was provided an opportunity to comment on this document during the public comment period that took place March 16 through April 15, 2026.

Introduction

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. The CWA § 303(d) establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited. This priority list § 303(d) is published as the list of impaired (Category 5) water bodies in Idaho's Integrated Report, which summarizes water quality throughout the state. For waters identified on the § 303(d) list, DEQ must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards.

A TMDL determines the maximum pollutant amount that can be present in a water body and while still meeting water quality standards (40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

To date, DEQ has developed two subbasin-wide TMDL documents for the Upper Salmon River subbasin; the *2003 Upper Salmon River Subbasin Assessment and TMDL* and the *Upper Salmon River Subbasin Assessment and TMDL - 2016 Addendum and Five-Year Review* (DEQ 2003 and DEQ 2016a). In these previous efforts, DEQ developed TMDLs for temperature, *Escherichia coli* (*E. coli*), and sediment. Since the last TMDL, DEQ has collected monitoring data, conducted water body assessments, and collected data from partner agencies. This document presents an updated description of pollutant loads and water quality issues in the Upper Salmon River subbasin. This objective is detailed in the following sections: (1) an updated description of key characteristics or updated information for the subbasin characterization; (2) current water quality concerns; (3) pollutant source inventory; (4) a 5-year review of existing United States Environmental Protection Agency (EPA) approved TMDLs; and (5) development of new TMDLs for impaired water bodies.

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. DEQ reviewed 23 existing EPA-approved TMDLs (section 4) and developed one new TMDL (section 5).

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. DEQ implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, or CWA, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC § 1251). The act and programs it generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was

protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

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

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

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

1 Subbasin Characterization

The Upper Salmon River subbasin (hydrologic unit code 17060201) is in central Idaho (Figure 1). The headwaters of the Salmon River originate in the Boulder Mountains, north of Ketchum. The western border is delineated by the Sawtooth Mountains, and the northern extent is adjacent to the Frank Church-River of No Return Wilderness. The eastern boundary follows the Pahsimeroi Mountains of the Lost River Range. This subbasin contains 2,425 square miles of land area with 5,711 miles of stream (DEQ 2003).

Elevation above sea level ranges from 11,815 feet at Castle Peak to 4,640 feet at the confluence of the Salmon and Pahsimeroi Rivers. The mean elevation of the basin is 7,570 feet. Climate in most of the basin is semiarid and annual precipitation averages 24 inches per year. Precipitation primarily is snow, and peak flows in streams generally result from spring snowmelt (USGS 2006).

A comprehensive discussion of the Upper Salmon River subbasin geology, topography, economics, vegetation, and fish types is found in the *Upper Salmon River Subbasin Assessment*

and TMDL (DEQ 2003) and the *Upper Salmon River Subbasin Assessment and TMDL 2016 Addendum and Five-Year Review* (DEQ 2016).

1.1 Climate and Precipitation

Custer and Blaine Counties are home to the Upper Salmon River subbasin and vary in elevation, precipitation, and bioregions, providing a diverse range of climate and hydrologic conditions. For Custer County, the 30-year average for maximum air temperature was 51.1°F, with an overall +0.5 increase per decade. Minimum air temperatures averaged 26.2°F with a +0.4 increase per decade (NOAA 2022). Precipitation in this region was 21.85 inches from 1991–2021 with a slight decrease of -0.02 inches per decade.

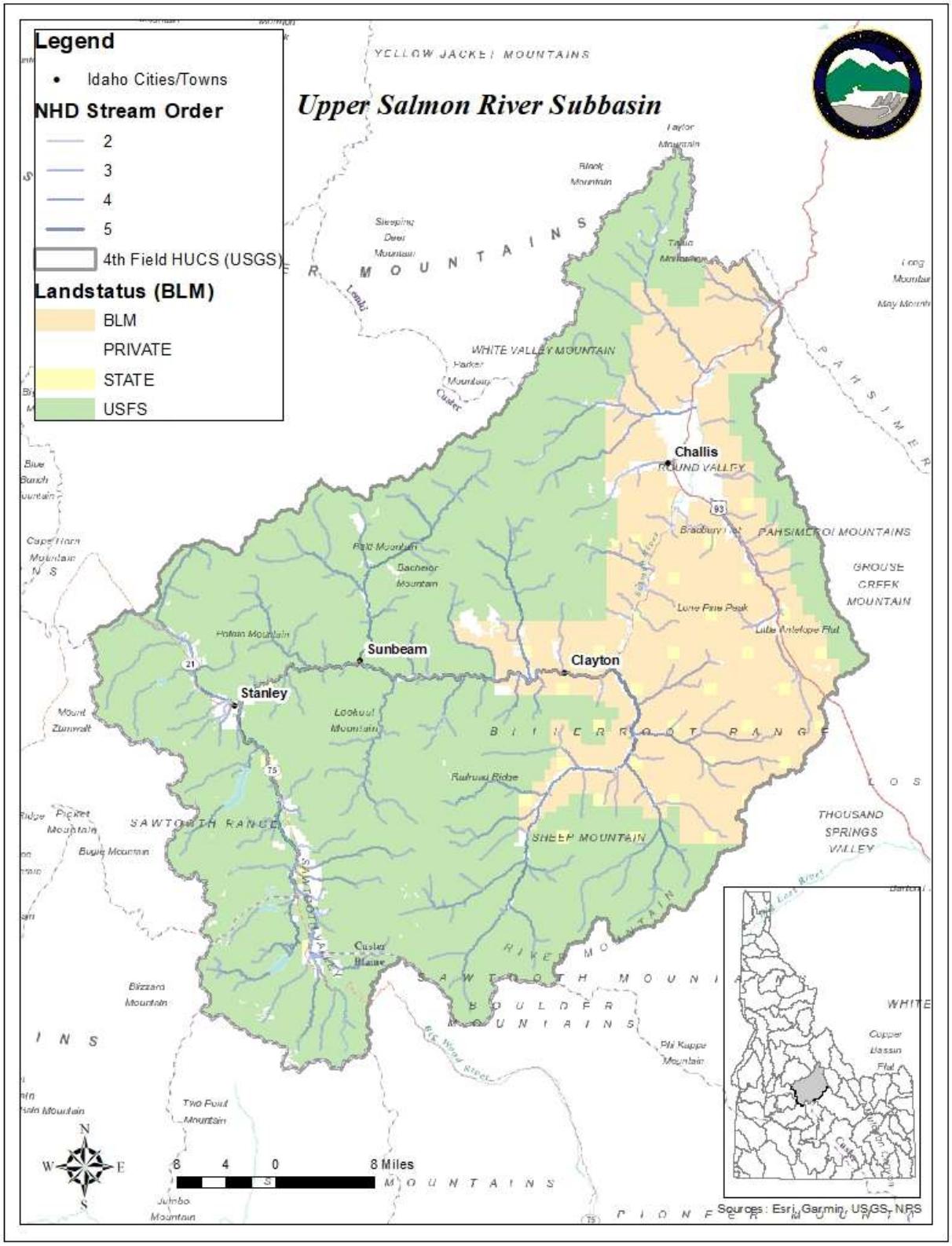


Figure 1. Upper Salmon River subbasin.

1.2 Hydrologic Conditions

The United States Geological Survey (USGS) currently maintains five stream gaging stations in the Upper Salmon River subbasin. These gaging stations measure discharge in cubic feet per second and gage height in feet. The mean, minimum, and maximum average annual flow illustrates the difference in size and volume of the streams based on water year (Table 1). Full data records are found on the USGS National Water Dashboard (USGS 2024).

Table 1.Summary of discharge data at historic USGS stream gaging stations.

USGS Gaging Station	Assessment Unit Name	Assessment Unit Number	Observation Dates	Drainage Area (square miles)	Annual Flow (cfs)		
					Mean	Minimum	Maximum
13295000	Valley Creek - Trap Creek to mouth	ID17060201SL051_04	1911–2024	147	200	101	372
13296000	Yankee Fork Creek - Jordan Creek to mouth	ID17060201SL032_04	1922–2024	189	205	102	423
13296500	Salmon River - Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	1922–2024	807	981	467	1856
13297330	Thompson Creek - source to mouth	ID17060201SL028_03	1973–2024	29.1	16	4.7	38
13297355	Paasasikwana Naokwaide Cash Creek to mouth	ID17060201SL021_04	1973–2024	71.6	33	11	80

1.3 Landownership and Population

Landownership in the Upper Salmon River subbasin is comprised of approximately 95% public and 5% private lands. The public lands are managed by the United States Forest Service (USFS) Sawtooth National Recreation Area, Salmon-Challis National Forest (SCNF), Bureau of Land Management (BLM), and Idaho Department of Lands (IDL). These lands are primarily managed for recreation, forestry, livestock grazing, and mining. The private lands include the areas of Challis and Stanley and are predominantly agricultural and residential.

The general breakdown of landownership has not changed significantly since the 2016 TMDL was published (Table 2). The resident population of the Upper Salmon River subbasin has increased slightly overall according to the 2010 and 2020 census. Custer county's census indicated an increase from 4,368 residents in 2010 to 4,428 residents in 2020. Challis is the county seat in Custer County and showed a slight decline in population from 1,081 residents in 2010 to 902 residents in 2020.

Table 2. Current landownership in the Upper Salmon River subbasin.

Owner/Land Manager	Acreage 2022	Percent of Subbasin 2022
Bureau of Land Management	379,015	24.44%
Private	69,431	4.48%
State	22,690	1.46%
Surveyed water	6,405	0.41%
US Forest Service	1,072,989	69.20%
Total	1,550,530	100.00%

2 Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

In DEQ's Integrated Report, all state waters are placed into at least one of five categories based on the amount of information known about their water quality, whether or not their beneficial uses are supported (Figure 2).

There are 27 Category 5 AUs from the 2022 and 2024 Integrated Reports addressed in Table 3, which describes the water quality concerns and status. These AUs do not meet applicable water quality standards for one or more beneficial uses and make up the § 303(d)-list.

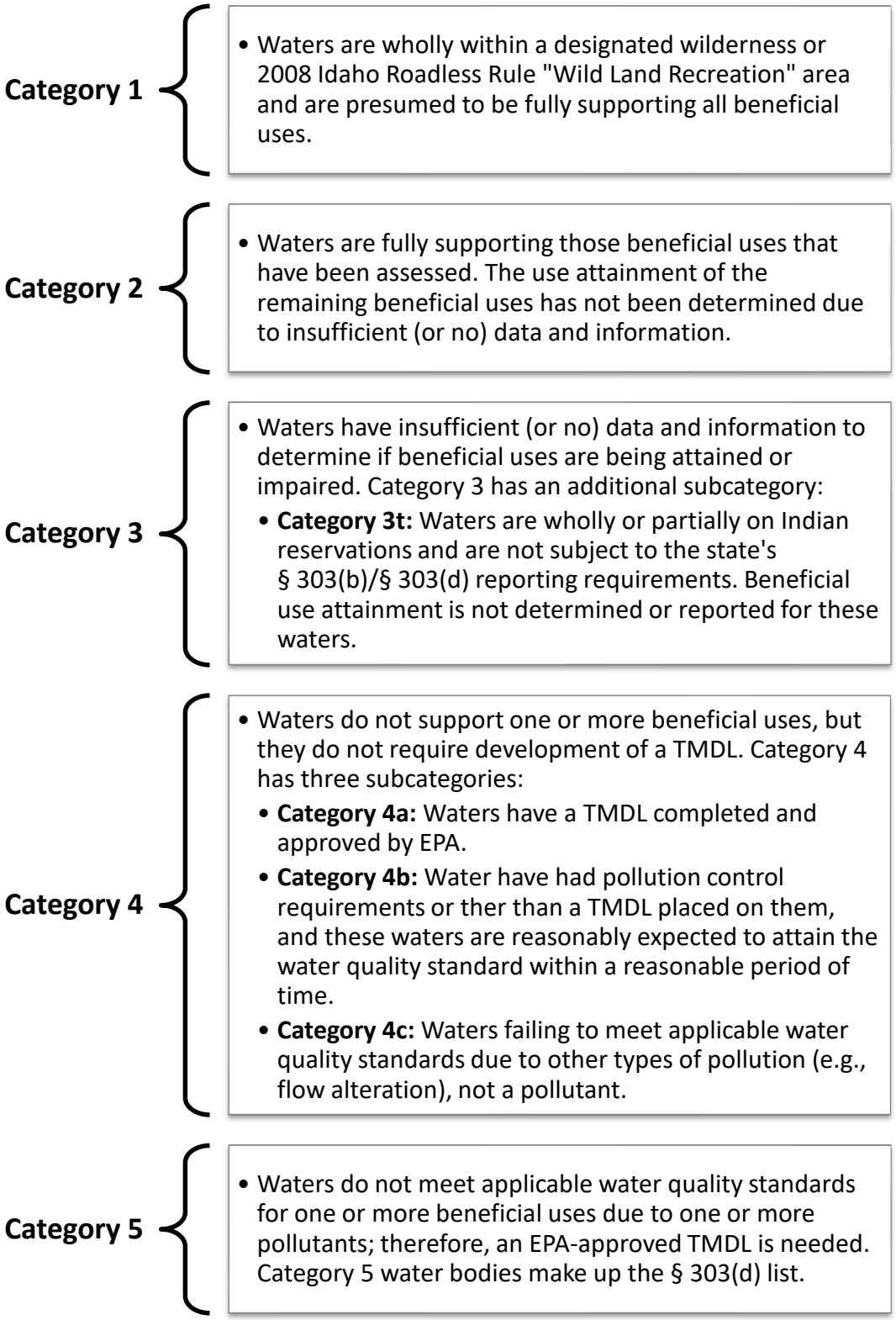


Figure 2. Five categories of the Integrated Report.

Category 5 Assessment Units

The Upper Salmon River subbasin has 27 AUs with impairments, including temperature, sediment/siltation, or combined biota/habitat bioassessments. The impaired AUs of the § 303(d)-list are in Category 5 of DEQ's 2024 Integrated Report (Table 3). The pollutants are determined by internal data collection by DEQ's Beneficial Reconnaissance Program (BURP) and external data submissions that qualify as Tier 1 (i.e., undergoing standard operating, quality control, and quality assurance procedures). The newest additions to Category 5 (i.e., listing basis 2024 § 303(d) list) will be examined during the next subbasin assessment cycle. These additions are provided here as a reference only and are not addressed further in this document.

Table 3. Upper Salmon River subbasin § 303(d)-listed assessment units in the subbasin. The listing basis reflects the year the impairment was first listed in DEQ's Integrated Report.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Morgan Creek - West Creek to mouth	ID17060201SL002_03	Temperature	2024 § 303(d) list
Morgan Creek - source to West Creek	ID17060201SL003_03	Temperature	2024 § 303(d) list
West Creek - Blowfly Creek to mouth	ID17060201SL004_02	Temperature	2024 § 303(d) list
Eddy Creek - source to mouth	ID17060201SL010_02	Temperature	2024 § 303(d) list
Bear Creek - source to mouth	ID17060201SL011_02	Combined Biota/Habitat Bioassessments	2024 § 303(d) list
Challis Creek - source to Bear Creek	ID17060201SL012_02	Combined Biota/Habitat Bioassessments	2024 § 303(d) list
Mill Creek - 3rd order	ID17060201SL013_03	Temperature	2024 § 303(d) list
Bayhorse Creek - source to mouth	ID17060201SL017_03	Temperature	2024 § 303(d) list
Salmon River – Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_02	Temperature	2024 § 303(d) list
Kinnikinic Creek - source to mouth	ID17060201SL020_02	Temperature	2024 § 303(d) list
Bruno Creek - source to mouth	ID17060201SL026_02	Temperature	2024 § 303(d) list
Thompson Creek - source to mouth	ID17060201SL028_03	Temperature	2024 § 303(d) list
Yankee Fork Creek – Jordan Creek to mouth	ID17060201SL032_04	Temperature	2022 § 303(d) list
Jordan Creek - source to Unnamed Tributary	ID17060201SL042_03	Combined Biota/Habitat Bioassessments	2024 § 303(d) list
Basin Creek – East Basin Creek to mouth (Category 5, 4c)	ID17060201SL048_03	Sedimentation/Siltation	2018/2020 § 303(d) list
Salmon River	ID17060201SL068_05	Temperature	2022 § 303(d) list
Pole Creek – source to mouth	ID17060201SL085_03	Combined Biota/Habitat Bioassessments	2016 § 303(d) list

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Williams Creek – source to mouth	ID17060201SL089_02	Combined Biota/Habitat Bioassessments	2010 §303(d) list
Big Casino Creek - source to mouth	ID17060201SL092_02	Combined Biota/Habitat Bioassessments	2024 § 303(d) list
East Fork Salmon River – Herd Creek to mouth	ID17060201SL102_05	Temperature	2022 § 303(d) list
East Fork Salmon River – Germania Creek to Herd Creek	ID17060201SL103_02	Combined Biota/Habitat Bioassessments	2002 §303(d) list
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_04	Temperature	2024 § 303(d) list
Big Boulder Creek - source to mouth	ID17060201SL105_03	Temperature	2024 § 303(d) list
Herd Creek-confluence of West Fork Herd Creek and East Pass	ID17060201SL118_04	Temperature	2024 § 303(d) list
Road Creek - Corral Basin Creek to mouth	ID17060201SL124_04	Temperature	2024 § 303(d) list
Road Creek - source to Corral Basin Creek	ID17060201SL125_02	Temperature	2024 § 303(d) list
Corral Basin Creek - source to mouth	ID17060201SL127_03	Temperature	2024 § 303(d) list

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described in Appendix A. DEQ presumes the beneficial use of cold water aquatic life for all waters of the state and many of the waters of the Upper Salmon River subbasin have salmonid spawning, primary/secondary contact recreation, and domestic water supply designated or as existing uses. In addition, all waters within the state are protected for agricultural and industrial water supply, wildlife habitat, and aesthetics (IDAPA 58.01.02.100). DEQ's Water Body Assessment Guidance (WBAG) (DEQ 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

2.2.1 Beneficial Uses in the Subbasin

To determine the applicable water quality standards to evaluate impaired streams, DEQ must first look at the applicable beneficial uses of the impaired AUs (Table 4).

Table 4. Beneficial uses[a] in the Upper Salmon River subbasin.

Assessment Unit Name	Assessment Unit Number	2024 Integrated Report Category	Bull Trout Waters	Type of Use	
				Existing	Designated
Yankee Fork Creek – Jordan Creek to mouth	ID17060201SL032_04	Category 5	Yes		CW[b], SS, PCR, DWS
Basin Creek – East Basin Creek to mouth (Category 5, 4c)	ID17060201SL048_03	Category 5 and 4c	Yes	CW, SS, SCR	
Salmon River	ID17060201SL068_05	Category 5	Yes		CW, SS, PCR, DWS
Pole Creek – source to mouth	ID17060201SL085_03	Category 5	Yes	CW, SS, SCR	
Williams Creek – source to mouth	ID17060201SL089_02	Category 5	Yes	CW, SS	
East Fork Salmon River – Herd Creek to mouth	ID17060201SL102_05	Category 5	Yes		CW, SS, PCR, DSW
East Fork Salmon River – Germania Creek to Herd Creek	ID17060201SL103_02	Category 5	Yes		CW, SS, PCR, DSW

a. Beneficial uses include cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS).
b. Cold water aquatic life beneficial use is presumed in all waters of the state.

2.2.2 Protection of Downstream Uses

Idaho's water quality standards require that all waters "shall maintain a level of water quality at their pour point into downstream waters that provides for the attainment and maintenance of the water quality standards of those downstream waters, including waters of another state or tribe" (IDAPA 58.01.02.070.08).

This provision requires states to consider and ensure the attainment and maintenance of downstream water quality standards by adopting either narrative or numeric criteria (EPA 2014). In the case of temperature impairments, DEQ has numeric criteria to ensure the protection of all sensitive species (e.g., state and federally listed and threatened and endangered species), as well as species with economic and social importance. The aquatic species of concern in the Upper Salmon River subbasin include the following under the Federal Endangered Species Act (ESA):

- Endangered species and designated critical habitat: Spring/Summer – Run Chinook Salmon *(Oncorhynchus tshawytscha)*
- Threatened species and designated critical habitat: Bull Trout *(Salvelinus confluentus)* and Steelhead Trout *(Oncorhynchus mykiss)*
- Candidate species: Western Ridged Mussel *(Gonidea angulate)*

DEQ developed one new temperature TMDL following the work described in this document (section 5). The load allocation from this TMDL supports the enhancement, protection, and restoration of lower order streams. This, in turn, supports the protection of downstream uses in the higher order streams of the Upper Salmon River subbasin.

2.2.3 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251). By meeting the requirements of these criteria, the AUs will fully support cold water aquatic life, salmonid spawning, and Bull Trout spawning and rearing (Table 5).

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the WBAG (DEQ 2016b). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations.

Table 5. Selected narrative and numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Pollutant	IDAPA	Water Quality Criteria
Temperature	IDAPA 58.01.02.250.02	**Cold Water Aquatic Life:** Water temperatures of 22 degrees C or less with a maximum daily average of no greater than 19 degrees C.
	IDAPA 58.01.02.250.02.f	**Salmonid Spawning:** Water temperatures of 13 degrees C or less with a maximum daily average no greater than 9 degrees C.
	IDAPA 58.01.02.250.02.g	**Idaho Bull Trout Temperature Criteria:** Water temperatures for the waters identified under Subsection 250.02.g.i. shall not exceed thirteen degrees Celsius (13C) maximum weekly maximum temperature (MWMT) during June, July and August for juvenile bull trout rearing, and nine degrees Celsius (9C) daily average during September and October for bull trout spawning. For measuring these criteria, the values shall be generated from a recording device with a minimum of six (6) evenly spaced measurements in a twenty-four (24) hour period. The MWMT is the mean of daily maximum water temperatures measured over the annual warmest consecutive seven (7) day period occurring during a given year.
		EPA Bull Trout Temperature Criterion: The 1997 federally promulgated temperature criterion of 10 ºC for 7-day average maximum daily temperatures from June through September continues to be effective for CWA purposes for waters specified in the federal rule until EPA withdraws the federal rule (40 CFR 131.33).
Sediment	IDAPA 58.01.02.200.08	**Sediment** shall not exceed quantities specified in Sections 250 or 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.

DEQ found it very common for water temperatures to exceed one or more applicable numeric temperature criteria. As mentioned above, temperature is the most common impairment in the

subbasin and has been the leading pollutant cause associated with impaired waters statewide in the last three Integrated Report cycles (DEQ 2020, 2022, 2024).

Specifically, the stream temperatures observed in many AUs of the Upper Salmon River subbasin do not meet the EPA Bull Trout 1997 federally promulgated temperature criterion. This is the most stringent criterion for the Bull Trout (*Salvelinus confluentus*), a threatened species under the ESA. However, this criterion is in the process of being withdrawn from the federal rule and once finalized, the temperature impairments in Bull Trout streams will be determined by Idaho Bull Trout criteria.

Regardless of the criterion, temperature exceedances can often occur in waters that otherwise show full support of beneficial uses and lack clear sources of pollution. This situation has made it difficult to prioritize TMDL development and identify true temperature impairments. DEQ is currently in the process of developing better methods to determine natural background conditions for temperature criteria.

2.3 Summary and Analysis of Existing Water Quality Data

The existing water quality data for the Upper Salmon River subbasin includes water temperature data, biological samples (e.g., macroinvertebrates, fish, and bacteria), and habitat data from Idaho's surface waters. These data have been collected by DEQ's BURP, USGS, and the USFS Rocky Mountain Research Station (RMRS). Data sources are provided in Appendix B.

2.3.1 Beneficial Use Reconnaissance Program

In 1994, DEQ implemented BURP, a statewide ambient monitoring program aimed at integrating biological and chemical monitoring with physical habitat assessment (DEQ 2017). BURP conducts annual monitoring at selected sites, as outlined in the BURP Field Manual for Streams, emphasizing sampling and analysis to support assessment of biological assemblages and physical habitat structure of streams (DEQ 2017). From 2016–2023, DEQ collected BURP monitoring data at 58 sites in the Upper Salmon River subbasin (Table 6).

After the BURP monitoring data was obtained, the assessment process followed the WBAG (DEQ 2016b). This guidance document describes DEQ's methods for assessment and determination of beneficial uses of a stream, as well as the evaluation of impaired waters to determine causes and sources of pollutants. DEQ developed stream multimetric indices (MMIs) as a numeric representation of the biological and habitat condition data collected by BURP. MMI scores are calculated from the stream's macroinvertebrate index (SMI2), fish index (SFI2), and habitat index (SHI2). Each index rating has an associated score (1–100) and average rating. The results of these indices are assigned index ratings and used to evaluate support of cold water aquatic life. They must have an average index score of greater than or equal to 2 to be considered fully supporting. If the average index score is less than 2, this is an indication the AU does not fully support cold water aquatic life.

DEQ collected BURP monitoring data in several sites in the Upper Salmon River subbasin from 2016–2023 (Table 6). The data from 2024 and 2025 are still being processed and will be

available once finalized. Of the available data, the Upper Salmon River subbasin had a total of 36 passing and 14 failing ratings.

Table 6. Upper Salmon River subbasin BURP monitoring sites (2016–2023) and ratings. The average ratings in green show AUs that are fully supporting, while the average ratings in red are not supporting. Eight AUs were not sampled due to flow or accessibly constraints.

BURP ID	Assessment Unit Name	Assessment Unit Number	SMI2 Score	SMI2 Rating	SFI2 Score	SFI2 Rating	SHI2 Score	SHI2 Rating	Avg Rating
2016SIDFA036	Birch Creek	ID17060201SL016_02	—	—	—	—	—	—	No Flow
2016SIDFA037	Spud Creek	ID17060201SL019_02	55	2	—	—	51	1	1.50
2016SIDFA038	Bayhorse Creek	ID17060201SL017_03	72	3	70	1	76	2	2.00
2016SIDFA039	Juliette Creek	ID17060201SL017_02	84	3	79	2	74	2	2.33
2017SDEQA0346	Williams Creek	ID17060201SL089_02	65	2	67	1	59	1	1.33
2017SDEQA0368	Morgan Creek	ID17060201SL003_03	65	3	100	3	67	2	2.67
2017SIDFA036	Yankee Fork	ID17060201SL034_03	83	3	97	3	86	3	3.00
2017SIDFA037	Champion Creek	ID17060201SL086_03	64	2	94	3	67	2	2.33
2017SIDFA038	Herd Creek	ID17060201SL118_04	50	1	100	3	67	2	2.00
2017SIDFA039	Holman Creek	ID17060201SL100_02	38	1	81	2	82	3	2.00
2018SIDFA040	Jordan Creek	ID17060201SL041_03	70	3	95	3	63	1	2.33
2018SIDFA041	Valley Creek	ID17060201SL053_03	60	2	81	2	76	2	2.00
2018SIDFA042	Stanley Lake Creek	ID17060201SL058_02	53	2	—	—	66	2	2.00
2018SIDFA043	Boundary Creek	ID17060201SL068_02	61	2	—	—	81	3	2.50
2018SIDFA044	Smiley Creek	ID17060201SL083_03	70	3	77	2	71	2	2.33
2018SIDFA045	Alturas Lake Creek	ID17060201SL079_03	58	2	66	1	81	3	2.00
2018SIDFA046	Gold Creek	ID17060201SL090_02	58	2	79	2	69	2	2.00
2018SIDFA047	Williams Creek	ID17060201SL089_03	—	—	—	—	—	—	Inaccessible
2018SIDFA052	West Fork Morgan Creek	ID17060201SL004_02	82	3	100	3	74	2	2.67
2019SIDFA029	Kinnikinic Creek	ID17060201SL020_02	59	2	68	1	78	3	2.00
2019SIDFA030	Paasasikwana Naokwaide	ID17060201SL021_04	61	2	82	2	74	2	2.00
2019SIDFA031	Copper Creek	ID17060201SL047_02	—	—	—	—	—	—	No Flow
2019SIDFA032	Beaver Creek	ID17060201SL082_02	80	3	95	3	79	3	3.00
2019SIDFA033	Slate Creek	ID17060201SL099_03	—	—	—	—	—	—	Inaccessible

BURP ID	Assessment Unit Name	Assessment Unit Number	SMI2 Score	SMI2 Rating	SFI2 Score	SFI2 Rating	SHI2 Score	SHI2 Rating	Avg Rating
2019SIDFA034	Slate Creek	ID17060201SL099_03	75	3	98	3	66	2	2.67
2019SIDFA051	East Basin Creek	ID17060201SL049_02	78	3	96	3	80	3	3.00
2021SIDFA038	Garden Creek	ID17060201SL015_02	72	3	96	3	74	2	2.67
2021SIDFA039	Challis Creek	ID17060201SL009_03	64	3	100	3	73	3	3.00
2021SIDFA040	Challis Creek	ID17060201SL012_02	87	3	77	2	78	3	2.67
2021SIDFA041	Challis Creek	ID17060201SL012_03	44	1	84	2	73	2	1.67
2021SIDFA042	White Valley Creek	ID17060201SL009_02	60	2	81	2	78	3	2.33
2021SIDFA043	Bear Creek	ID17060201SL011_02	68	2	99	3	69	2	2.33
2021SIDFA044	Little Casino Creek	ID17060201SL091_02	39	1	99	3	60	1	1.67
2021SIDFA045	Big Casino Creek	ID17060201SL092_02	68	2	—	—	76	2	2.00
2021SIDFA046	Rough Creek	ID17060201SL093_02	71	3	75	2	77	2	2.33
2021SSTOA020	Fourth of July Creek	ID17060201SL087_02	61	2	90	3	83	3	2.67
2021SSTOA021	Crooked Creek	ID17060201SL059_02	—	—	—	—	—	—	Denied Access
2021SSTOA022	Salmon River	ID17060201SL081_03	52	2	62	1	71	2	1.67
2021SSTOA023	Pole Creek	ID17060201SL085_03	59	2	62	1	75	2	1.67
2021SSTOA024	Pole Creek	ID17060201SL085_02	46	1	69	1	76	2	1.33
2021SSTOA025	Smiley Creek	ID17060201SL083_02	—	—	—	—	—	—	No Flow
2021SSTOA026	UNT to Smiley Creek	ID17060201SL083_02	67	2	65	1	72	2	1.67
2021SSTOA027	Basin Creek	ID17060201SL048_03	42	1	95	3	64	2	2.00
2021SSTOA034	Fourth of July Creek	ID17060201SL034_02	56	2	97	3	77	2	2.33
2021SSTOA035	Jordan Creek	ID17060201SL042_03	69	2	—	—	70	2	2.00
2021SSTOA036	McKay Creek	ID17060201SL037_02	70	3	86	2	67	2	2.33
2021SSTOA037	Twelvemile Creek	ID17060201SL038_02	27	1	—	—	68	2	1.50
2021SSTOA038	Tenmile Creek	ID17060201SL039_02	65	2	94	3	85	3	2.67
2022SIDFA046	Elk Creek	ID17060201SL057_02	39	1	73	2	73	2	1.67
2022SIDFA047	Fishhook Creek	ID17060201SL065_02	58	2	78	2	88	3	2.33
2022SIDFA048	Muley Creek	ID17060201SL031_02	—	—	—	—	—	—	Flow < 1 cfs

BURP ID	Assessment Unit Name	Assessment Unit Number	SMI2 Score	SMI2 Rating	SFI2 Score	SFI2 Rating	SHI2 Score	SHI2 Rating	Avg Rating
2022SIDFA049	Slate Creek	ID17060201SL099_02	30	1	70	1	59	1	1.00
2023SIDFA029	Stanley Creek	ID17060201SL052_03	41	1	78	2	65	2	1.67
2023SIDFA031	Iron Creek	ID17060201SL060_02	39	1	69	1	76	2	1.33
2023SIDFA032	Cabin Creek	ID17060201SL075_03	—	—	—	—	—-	—	No flow
2023SIDFA033	Yankee Fork	ID17060201SL034_03	81	3	83	2	82	3	2.67
2023SIDFA034	Greylock Creek	ID17060201SL034_02	71	3	90	3	82	3	3.00
2023SIDFA035	Camp Creek	ID17060201SL089_02	61	2	69	1	76	2	1.67

2.3.2 Stream Temperature Monitoring

Stream temperatures have direct and profound effects on organisms that live or reproduce in the water (DEQ 2013). Streams may exceed tolerable thresholds for aquatic species through anthropogenic heat sources such as point-source discharges, or may be influenced by water source, groundwater, precipitation runoff, solar radiation (including shading), air temperature, climate, and geologic setting (DEQ 2013). For these reasons, the state has numeric criteria in the Idaho Administrative Code (IDAPA 58.01.02) for the protection of cold water aquatic life, salmonid spawning, and Bull Trout (Table 5), which are applicable to many of the AUs in the Upper Salmon River subbasin.

The numeric temperature criteria stated in Idaho's water quality standards take the form of four reduced metrics:

- *Maximum temperature (max):* the highest temperature in the quality assurance (QA)/ quality control (QC) validated data set.
- *Maximum daily average temperature (MDAT)*: the mean temperature calculated over a period of 1 day.
- *Maximum weekly maximum temperature (MWMT)*: the highest weekly maximum temperature in the QA/QC validated data set. The weekly maximum temperature is the mean of daily maximum temperatures measured over a consecutive 7-day period ending on the day of calculation.
- *Maximum weekly average temperature (MWAT)*: the highest weekly average temperature in the QA/QC validated data set. The weekly average temperature is the mean temperature calculated over a 1-week period.

Acceptable departures from the numeric criteria for temperature include those that are infrequent, brief, and small. Infrequent means less than 10% of valid, applicable, representative measurements (IDAPA 58.01.02.054.03). Percentages of exceedances are compared in Table 7, and those less than the 10% for the most protective criteria were considered fully supporting beneficial uses.

DEQ deployed HOBO Water Temperature Pro v2 Data Loggers in Pole Creek (ID17060201SL085_02 and ID17060201SL085_03) and Wickiup Creek (ID17060201SL103_02). The loggers for ID17060201SL085_02 and ID17060201SL103_02 were deployed from June through October in 2021, and the logger in ID17060201SL085_03 was deployed from August through November in 2022 to capture hourly stream temperatures (Figure 3).

In addition to DEQ's data collection, the RMRS and USGS provided continuous stream temperature data (Appendix C). DEQ examined all temperature data for cold water aquatic life, salmonid spawning, Idaho Bull Trout, and EPA Bull Trout criteria for exceedances (Table 7). The salmonid spawning dates were referenced from the WBAG (DEQ 2016a) and *Geography and Timing of Salmonid Spawning in Idaho* (BioAnalysts, Inc. 2014) for specific species' spawning and egg incubation periods. Once data collection was completed, DEQ analyzed the temperatures for applicable criteria exceedances using R version 4.1.2.

Table 7. Summary of Upper Salmon River subbasin temperature criteria exceedances from data collected by DEQ, USGS, and RMRS.

Assessment Unit Name/Number	Data Collector	Total Days Evaluated	Data Years	Temperature Criteria									
				Salmonid Spawning				Idaho Bull Trout				EPA Bull Trout	
				13 °C Instantaneous		9 °C Average		Rearing: MWMT > 13 °C (Jun–Aug)		Spawning: Daily Average > 9 °C (Sep–Oct)		MWMT > 10 °C (Jun–Sep)	
				Temperature Exceedances									
				Days	Percent	Days	Percent	7-Day Periods	Percent	Days	Percent	7-Day Periods	Percent
Yankee Fork Creek ID17060201SL032_04	USGS	1425	2016–2019	289	20%	345	24%	243	74%	71	29%	418	93%
Salmon River ID17060201SL068_05	RMRS 123	241	2016	93	39%	97	40%	89	100%	no data	no data	89	100%
Pole Creek ID17060201SL085_02	DEQ	114	2021	7	6%	3	3%	0	0%	0	0%	53	56%
Pole Creek ID17060201SL085_03	DEQ	62	2022	0	0%	1	2%	no data	no data	0	0%	3	12%
East Fork Salmon River ID17060201SL102_05	RMRS 112	271	2016	105	39%	125	46%	71	77%	30	100%	122	100%
East Fork Salmon River ID17060201SL103_02	DEQ	114	2021	51	44%	78	68%	53	83%	8	18%	81	86%

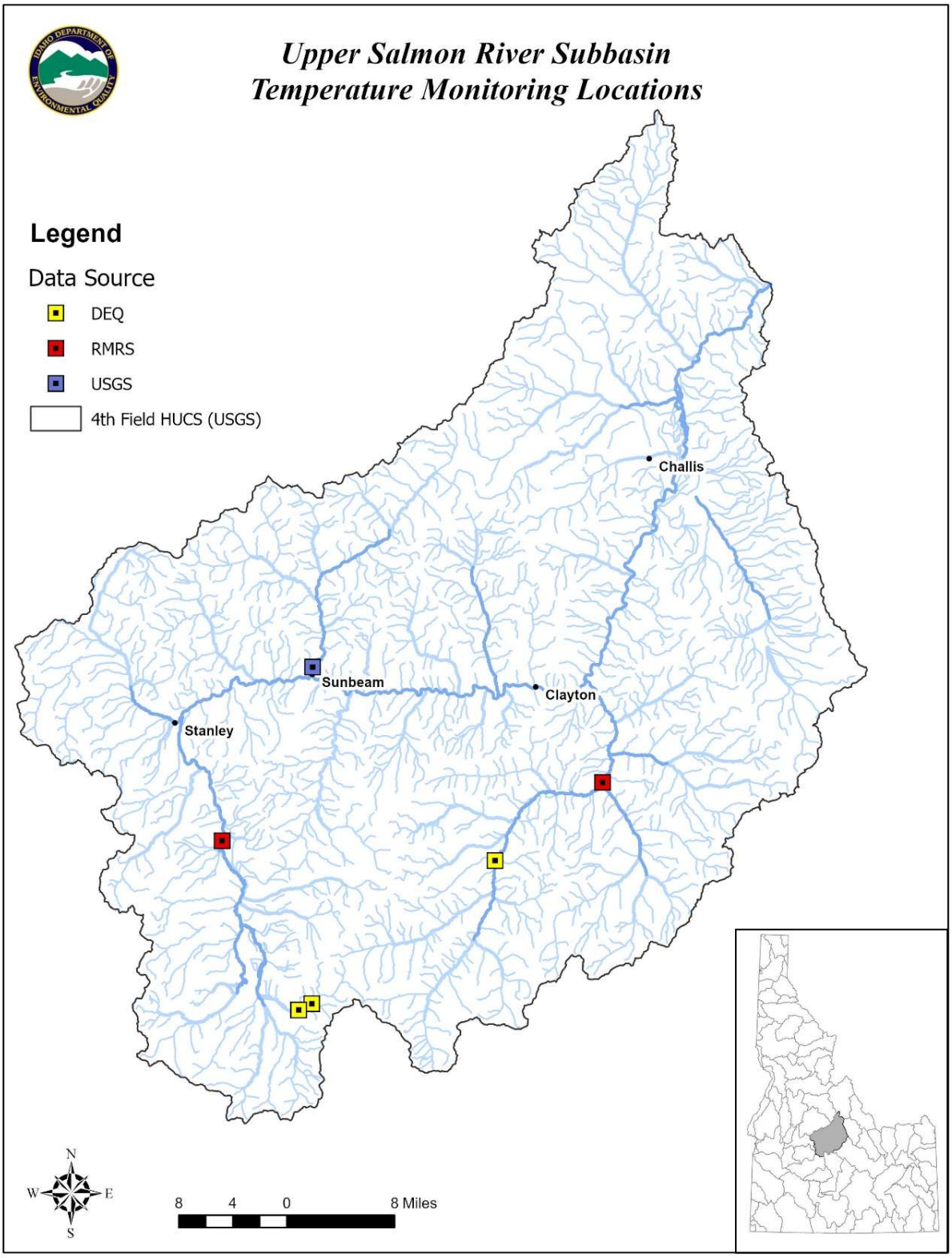


Figure 3. Locations of temperature logger deployments from 2016–2022.

2.3.3 Sediment Monitoring

Sediment is the fourth leading cause of impairments by AU in Idaho, according to DEQ's 2024 Integrated Report (DEQ 2024). To better understand sedimentation issues in the Upper Salmon River subbasin, DEQ collected McNeil core samples (Appendix D), performed Streambank Erosion Inventories (SEI) (Appendix E), and reviewed sediment-related metrics from BURP monitoring. Three AUs were examined with these methods:

- Basin Creek (ID17060201SL048_03)—Category 5 sediment impaired AU
- Williams Creek (ID17060201SL089_02)—Category 5 impaired AU without a specific pollutant (Combined Biota/Habitat Assessment)
- Challis Creek (ID17060201SL009_03)—Category 4a, 4c AU with a 5-year review (section 4)

2.3.3.1 McNeil Core Sampling

One methods used by DEQ to assess the suitability of stream substrates for salmonid spawning is McNeil core samples. This method estimates the particle-size distribution from potential spawning sites. Excessive sediments in the streambed can reduce the oxygenation of spawning gravels, essentially choking the spawning areas that can lead to reduced survival and growth rates. DEQ's *Standard Operating Procedure for the Collection of McNeil Core Samples* outlines field procedures and highlights reference values from literature sources (DEQ 2014a).

The McNeil core samples are taken within the streambed at suitable spawning locations to measure the percentage subsurface fines (<6.3 millimeters), which is a direct measure of conditions supportive of salmonid spawning and egg survival within the substrate (Figure 4). If the percent fines are less than 28%, that is an indication that salmonid spawning is not being affected by fine sediments. If the percent fines are greater than 28% and if streambank erosion is an apparent stressor to water quality, then an SEI is completed.



Figure 4. DEQ staff collecting McNeil core samples at Basin Creek (ID17060201SL048_03).

2.3.3.2 Streambank Erosion Inventories

DEQ use the data collected from SEIs to develop load allocations for sediment impaired AUs. The SEI is a field-based methodology that estimates long-term streambank lateral recession rates from an evaluation of the following six streambank characteristics:

- Bank Erosion Evidence
- Bank Stability Condition
- Bank Cover/Vegetation
- Lateral Channel Stability
- Channel Bottom Stability
- In-Channel Deposition

Each category is assigned a field stability score, along with erosion measurements taken throughout the reach, and then compared to target erosion rates. The data provides a sediment loading rate, or mass per unit time (tons per year). Load capacity is met when streambank stability is 80% or greater, which is protective of stream habitat (DEQ 2014b). If the stability score is less than 80%, then load allocations are developed from the estimated current loads and load capacities.

2.3.3.3 BURP Habitat Data

BURP data was used to compare sediment impaired AUs over time. The habitat data collected includes percent fines for bankfull widths, instream cover, riffle embeddedness, channel shape, disruptive pressures, zone of influence, pool substrate characteristic, and pool variability. The streambank conditions are inventoried as covered and stable, or uncovered and unstable. The large organic debris is counted throughout the assessment reach and Wolman pebble counts are conducted at three transects.

2.3.4 Assessment Unit Summary

The following summaries are of the data analyses, literature reviews, field investigations, and conclusions for the seven AUs in Category 5 addressed in this document. Within these groups, one AU has a temperature TMDL developed, six AUs are recommended for further monitoring, and one AU is proposed for delisting.

Note: The 2024 Integrated Report was published while finalizing this document. There are 20 additional AUs that were added to the 2024 Integrated Report that are not addressed in this document. These AUs will be addressed during the next subbasin assessment and TMDL review.

This section includes changes that will be included in the next Integrated Report once the TMDL in this document has been approved by EPA. The proposed changes in this section are not considered official until reviewed and approved by EPA during the next Integrated Report submittal process.

2.3.4.1 Assessment Units Addressed in TMDLs

ID17060201SL085_03, Pole Creek – Source to Mouth

- 2024 Integrated Report listing status: Category 5 – Combined Biota/Habitat Bioassessments.
- The most recent BURP assessment in this AU (2021SSTOA023) received a failing condition rating of 1.67, indicating the stream does not fully support cold water aquatic life. This failing score was driven by low fish metric scores.
- In 2022, DEQ collected continuous stream temperature data in this AU. The recorded water temperatures met the salmonid spawning instantaneous criterion and exceeded the average criterion at a frequency of 2% (which is less than the 10% exceedances required for temperature impairment consideration). These same data exceeded EPA Bull Trout criterion at a frequency of 12%.
- A PNV analysis was conducted for this AU. The solar loads were estimated to be 810,000 kilowatt hours per day (kWh/day) throughout the AU, which is 27% higher than the target load of 590,000 kWh/day. DEQ developed a PNV temperature TMDL for this AU (section 5).
- Assessment recommendation: This AU should be listed as Category 4a for temperature upon approval of the TMDL.

2.3.4.2 Assessment Units for Further Monitoring

ID17060201SL032_04, Yankee Fork Creek – Jordan Creek to Mouth

- 2024 Integrated Report listing status: Category 5 – Temperature.
- The most recent BURP assessment completed in this AU (1995SIDFA093) received a failing condition rating of 1.67, indicating the stream does not fully support cold water aquatic life. This failing score was driven by low fish and habitat metric scores.
- From 2016 to 2020, the USGS monitoring station 13296000 recorded water temperatures that exceeded the salmonid spawning instantaneous criterion at a frequency of 20% and the average criterion at a frequency of 24%. These same data exceeded the EPA Bull Trout criterion at a frequency of 93%.
- A PNV analysis was conducted for this AU. The solar loads were estimated to be 1,400,000 kWh/day throughout the AU, which equals the target load, indicating the shade conditions are met. DEQ did not develop a temperature TMDL for this reason.
- Assessment recommendation: This AU should remain in Category 5. Future analysis of temperature exceedances may include the examination of groundwater/surface water interactions, geothermal activity, width/depth ratios, or temperature modeling.

ID17060201SL068_05, Salmon River

- 2024 Integrated Report listing status: Category 5 – Temperature.
- There have not been any BURP assessments completed in this AU. There were three attempts, and each commented on the inaccessibility due to high flows.
- In 2016, RMRS collected continuous stream temperature data in this AU. The recorded water temperatures exceeded the salmonid spawning instantaneous criterion at a

frequency 39% and the average criterion at a frequency of 40%. These same data exceeded the EPA Bull Trout criterion at a frequency of 100%.

- This AU is considered a large river, not a wadeable stream. Currently, there are no appropriate analyses to determine the cause of temperature impairments in large rivers.
- Assessment recommendation: this AU should remain in Category 5 until appropriate analysis methods become available for large rivers.

ID17060201SL085_02, Pole Creek – Source to Mouth

- 2024 Integrated Report listing status: Category 2 – Fully supporting.
- The most recent BURP site in this AU (2021SSTOA024) received a failing condition rating of 1.33, indicating the stream does not fully support cold water aquatic life. This failing score was driven by low macroinvertebrate and fish index scores. As previously mentioned, the presence of non-native brook trout is the metric that caused the fish index score to fail.
- The stressor analysis report indicated the sample contained several intolerant and cold water obligate taxa (EcoAnalysts Inc. 2023) (Appendix F).
- In 2021, DEQ collected continuous stream temperature data in this AU. The recorded water temperatures did not exceed the allowable exceedance rate for the salmonid spawning criteria (10% or greater exceedances required for temperature impairment consideration) and did not exceed the Idaho Bull Trout criteria (Table 7). These same data exceeded the 1997 MWMT EPA temperature criterion at a frequency of 56%.
- DEQ erroneously included this AU in the PNV analysis along with AUs with existing impairments. Although the PNV analysis did estimate higher existing solar load than target, these estimates were collected from an AU lacking a temperature impairment and are not needed to develop a TMDL.
- The entirety of the land use adjacent to this AU is undeveloped and forested.
- Assessment recommendation: This AU should remain in Category 2. Based on the ambiguous BURP data, DEQ will collect additional data to verify the impairment status of this AU for the next Integrated Report.

ID17060201SL089_02, Williams Creek – Source to Mouth

- 2024 Integrated Report listing status: Category 5 – Combined Biota/Habitat Bioassessments.
- The most recent BURP assessment completed in this AU (2017SDEQA0346) received a failing condition rating of 1.33, indicating the stream does not to support cold water aquatic life. This failing score was driven by low fish and habitat metric scores. Another BURP assessment was completed in 2023 (2023SIDFA035), with results achieving a slightly better score of 1.67. The fish score was still low, driven down by several Brook Trout captured during electrofishing.
- DEQ wrote comments in the 2016 TMDL recommending continued monitoring after changes in grazing management, stating they would have positive impacts, but would need time for recovery.

- In 2011, 2013, and 2022, DEQ conducted site visits to this AU and found good vegetation and a cobble bed with willow dominating the vegetation. Excessive sediment loads were not visibly present.
- A SEI was conducted for this AU in 2021. The field stability score and the calculations for the load capacity indicated no load reduction was required.
- Assessment recommendation: This AU should remain in Category 5 until causes of the Combined Biota/Habitat Bioassessment can be determined.

ID17060201SL102_05, East Fork Salmon River – Herd Creek to Mouth

- 2024 Integrated Report listing status: Category 5 – Temperature.
- There have not been any BURP assessments completed in this AU. One assessment was attempted in 2006, and DEQ commented that this is a nonwadeable reach.
- In 2016, RMRS collected continuous stream temperature data in this AU. The recorded water temperatures exceeded the salmonid spawning instantaneous criterion at a frequency of 39% and the average criterion at a frequency of 46%. These same data exceeded the EPA Bull Trout criterion at a frequency of 100%.
- This AU is considered a large river, not a wadeable stream. Currently, there are no appropriate analyses to determine the cause of temperature impairments in large rivers.
- Assessment recommendation: This AU should remain in Category 5 until appropriate analysis methods become available for large rivers.

ID17060201SL103_02, East Fork Salmon River – Germania Creek to Herd Creek

- 2024 Integrated Report listing status: Category 5 – Combined Biota/Habitat Bioassessments.
- The most recent BURP assessment completed in this AU (1997SIDFL049) received a passing score of 3.00, indicating the stream does support cold water aquatic life.
- In 2021, DEQ collected continuous stream temperature data in this AU. The recorded water temperatures exceeded the salmonid spawning instantaneous criterion at a frequency of 44% and the average criterion at a frequency of 68%. These same data exceeded the EPA Bull Trout criterion at a frequency of 86%.
- A PNV analysis was conducted for this AU. The solar loads were estimated to be 670,000 kWh/day throughout the AU, which equals the target load, indicating the shade conditions are met. DEQ did not develop a temperature TMDL for this reason.
- Assessment recommendation: This AU should remain in Category 5, and temperature should be added as an impairment. The AU should have further analysis of the temperature exceedances that may include the examination of groundwater/surface water interactions, geothermal activity, width/depth ratios, or temperature modeling.

2.3.4.3 Category 5 Assessment Units Proposed for Delisting

For the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Delistings must be supported by a detailed rationale. The following AU is proposed for delisting in the next Integrated Report:

ID17060201SL048_03, Basin Creek – East Basin Creek to Mouth

- 2024 Integrated Report listing status: Category 5 – Sedimentation/Siltation and Category 4c – Physical Substrate Habitat Alteration.
- The Halstead fire scorched nearly 181,800 acres from late July to late October of 2012, which significantly reduced the forest density in this AU.
- There have been four BURP assessments completed in this AU. Two were completed before the Halstead fire in 2012 (2001SIDFA144; 2002SIDFA083) and two after the fire to monitor recovery (2014SIDFA051; 2021SSTOA027).
- The most recent 2021 BURP assessment completed in this AU (2021SSTOA027) received a passing condition rating of 2.00, indicating the stream fully supports cold water aquatic life. The high fish and habitat scores were important components of the site rating. The fish collected during the electrofishing surveys included 5 Rainbow Trout (60 millimeter (mm)–140 mm), 2 Chinook Salmon (40 mm–80 mm) and 23 Shorthead Sculpin. The habitat scores from 2014 to 2021 saw an increase from 47 to 64 with the highest recovery seen in the Instream Cover category.
- Additional monitoring for the postfire recovery continued. In 2021, DEQ conducted a McNeil core sample to evaluate subsurface fines. The McNeil results were 39% fines, which is above the target amount of 28% fines. This may be indicative of residue fines from the Halstead fire. An SEI was planned; however, assessors documented that the banks throughout the AU were stabilized by vegetation, and bank erosion did not appear to be a main source of sediment.
- Based on the results of the 2021 BURP assessment and site visits completed, this AU should be removed from Category 5 for Sediment/Siltation and remain in Category 4c for Physical Substrate Habitat Alterations since the source of sediment is from natural causes.

3 Pollutant Source Inventory

Pollutant sources fall into two broad classes: point sources and nonpoint sources. The CWA defines point sources as discernable, confide, and discrete conveyances, including but not limited to pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operations, or vessel or other floating craft, from which pollutants are or may be discharged (CWA § 502(14)). Some examples of common point sources include discharges from municipal wastewater treatment facilities, mines, and industrial operations. The Idaho Pollutant Discharge Elimination System (IPDES) program sets requirements and issues permits for discharges of pollutants to waters of the United States in Idaho.

Nonpoint source pollution (NPS) is defined to mean any source of water pollution that does not meet the legal definition of point source as defined by the CWA. Nonpoint sources of pollution generally result from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. NPS, unlike point sources, comes from many diffuse sources. NPS can include excess fertilizers applied to agricultural or residential areas; sediment from constructions sites, crop and forested lands, and eroding streambanks; bacteria from livestock and pet waste; and atmospheric deposition (EPA 2020a).

3.1 Point Sources

In its entirety, the Upper Salmon River subbasin has four active IPDES permits (Figure 5). Permittees are required to operate under the IPDES rules (IDAPA 58.01.25) and water quality requirements in their permits. In addition, they must follow National Marine Fisheries Service guidelines to meet the EPA-approved Idaho Mixing Zone Rules and the United States Fish and Wildlife Service conservation measures for ESA-listed species or critical habitat (DEQ 2023).

Entities that operate with an IPDES permit in the Upper Salmon River subbasin include the Idaho Department of Fish and Game (IDFG) Sawtooth Fish Hatchery, Garden Creek Farms Fish Hatchery, Hecla Mining Company, and Thompson Creek Mining. There are also facilities in the subbasin with stormwater permits (i.e., multisector general permits [MSGPs] and construction general permits), but these do not have continuous discharge and are generally temporary in nature. Challis Mine (44.486, -114.3333) is an inactive and unmanned phosphate mine with an MSGP. No facility discharges into waters on the § 303(d) list or waters with an EPA-approved TMDL.

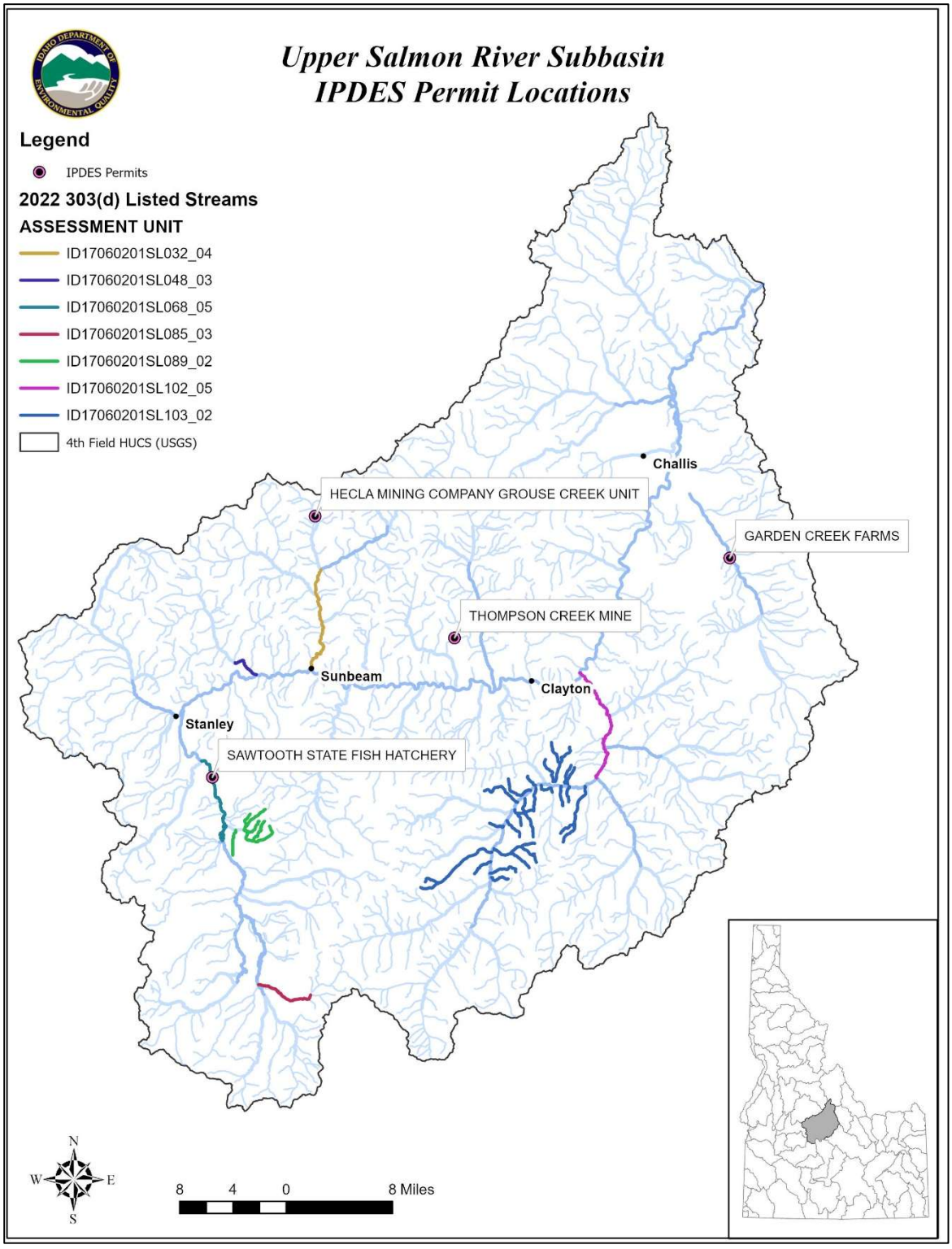


Figure 5. Active IPDES-permitted discharger locations in comparison to 2022 Integrated Report Category 5 streams in the Upper Salmon River subbasin.

3.2 Nonpoint Sources

DEQ's strategy for addressing NPS is through the *Idaho Nonpoint Source Management Plan* (NPS Plan) (DEQ 2025). The NPS Plan was developed in 1989, and it is updated every 5 years. It provides strategies for agencies to identify and mitigate pollutant sources, it addresses the key components of EPA's § 319 guidance, and it implements DEQ's strategic plan component of making recognizable and measurable environment improvements.

The CWA § 319 funding is a significant way to help mitigate NPS. The CWA § 319 established a grant program under which states, territories, and tribes may receive funds to support a wide variety of NPS management activities. A successful grant must focus on improving the water quality of lakes, streams, rivers, and aquifers. Funds may be used to address a variety of NPS management and prevention activities in agriculture, urban storm water runoff, transportation, silviculture/forestry, mining, groundwater, and hydrologic and habitat modification (DEQ 2025).

NPS originates from a multitude of sources that can only be addressed through the combined efforts of multiple Idaho agencies, federal agencies, and the Idaho public (DEQ 2025). The primary objective to improve impaired streams in the Upper Salmon River subbasin is to reduce NPS pollutants for such activities as agriculture, grazing, natural resource extraction, timber/silviculture management, urban and suburban development, and transportation.

3.3 Pollutant Transport

Pollutant transport refers to the pathway by which pollutants move from the pollutant source to cause a problem or water quality violation in the receiving water body. NPS pollution occurs when rainfall, snowmelt, or irrigation runs over the land or through the ground, picks up pollutants, and deposits them into rivers and lakes (EPA 1996).

Temperature is a common pollutant in Idaho streams. There are multiple ways human interaction and modification of streams have contributed to warming temperatures. Research is ongoing for best management practices to reduce stream temperature and mitigate for the criteria exceedances so that streams may achieve support for beneficial uses. DEQ's current guidance for examining how excessive stream temperatures move from pollutant source to a receiving body is to quantify the amount of shade the stream receives. This can be evaluated by comparing expected to actual riparian shade densities. If the densities of shade-producing vegetation in lower order and headwater streams are less than what was historically or expected to be available, then streams can warm faster and transport the warmer temperatures throughout the watershed. Other ways streams may transport warmer temperatures are when the water quantity is less than historically available or there is less groundwater to surface water interactions. Stream modifications such as overwidening or straightening of streams can also influence a stream's ability to retain and transport cooler water.

4 TMDL Five-Year Review and Status

The objective of this effort is to review the current water quality status, pollutant sources, and recent pollution control efforts in the subbasin and provide assessment recommendations of the AUs with existing EPA-approved TMDLs, if applicable. The appropriateness of beneficial uses, water quality criteria, TMDL targets, pollutant allocations, assumptions and analysis are summarized in the key TMDL review elements (Table 8).

The TMDLs under review include 3 TMDLs from the *2003 Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003) and 20 TMDLs from the *Upper Salmon River Subbasin Assessment and TMDL - 2016 Addendum and Five-Year Review* (DEQ 2016a). One 2003 sediment TMDL, four 2016 sediment TMDLs, and one 2016 temperature TMDL are proposed for delisting, based on newer data and additional monitoring.

AUs Proposed for Delisting

- 2003 Sediment TMDL – Challis Creek, ID17060201SL009_03
- 2016 Sediment TMDL – Warm Spring Creek, ID17060201SL131_04
- 2016 Sediment TMDL – Warm Spring Creek, ID17060201SL132_02
- 2016 Sediment TMDL – Warm Spring Creek, ID17060201SL132_03
- 2016 Sediment TMDL – Warm Spring Creek, ID17060201SL132_04
- 2016 Temperature TMDL – Aspen Creek, ID17060201SL024_02

There are several AUs with temperature TMDLs from 2016 that are from the main stem Salmon River and will require further examination once appropriate methods are available to evaluate temperature impairments in large rivers (5th order and larger) (section 4.2.2). Currently, these will remain in Category 4a with the existing load allocations assigned to them.

Large River AUs

- Salmon River - Pennal Gulch to Pahsimeroi River, ID17060201SL001_06
- Salmon River - Garden Creek to Pennal Gulch, ID17060201SL014_06
- Salmon River - East Fork Salmon River to Garden Creek, ID17060201SL016_06
- Salmon River - Paasasikwana Naokwaide to East Fork Salmon River, ID17060201SL019_05
- Salmon River - Thompson Creek to Paasasikwana Naokwaide, ID17060201SL027_05
- Salmon River - Yankee Fork Creek to Thompson Creek, ID17060201SL031_05
- Salmon River - Valley Creek to Yankee Fork Creek, ID17060201SL047_05
- Salmon River - Redfish Lake Creek to Valley Creek, ID17060201SL063_05

The pollutant targets, load capacity, and load allocations were reviewed for appropriateness for all TMDLs, and Table 9 references the percent reductions specified in the 2003 and 2016 subbasin assessments and provided general outcomes from the review. The specific changes and recommendations for all 5-year reviews are detailed in section 4.2.5.

Table 8. TMDL review element summaries for the Upper Salmon River subbasin sediment and temperature TMDLs.

TMDL Review Elements	2003 Sediment TMDLs	2016 Temperature TMDLs	2016 Sediment TMDLs
Are the TMDL targets appropriate?	Yes, the SEI methodology used to develop the sediment targets were appropriate.	The PNV methodology used to develop the temperature TMDLs is generally appropriate for lower stream orders, however shade targets for 5th order and larger AUs are less susceptible to riparian shade therefore less appropriate (DEQ 2009).[a]	No, the TMDL targets are not appropriate. The AUs have not had BURP assessments completed and the SEI data collected indicate the Warm Creek AUs may be ephemeral.[c]
Are the pollutant allocations appropriate?	Yes, if allocations are met, the AUs should eventually support beneficial uses.	For the 5th order and larger AUs, if allocations were met, the stream temperature would likely not meet the temperature criteria.[a]	No, the pollutant allocations are not appropriate for the 2016 sediment TMDLs. The Warm Creek AUs should be reassigned to Category 3 as unassessed.[c]
Are assumptions and analysis appropriate?	Yes, assumptions and analysis of excessive sediment limiting support for beneficial uses is appropriate.	The assumptions and analysis of the 5th order and larger streams using the PNV methodology are not appropriate.[a]	No, the assumptions and analysis are not appropriate for the 2016 sediment TMDLs.[c]
Do all available data confirm and support data used in existing TMDLs?	Yes, data collected by DEQ and external agencies support the existing TMDLs.	No, the Aspen Creek AU does not have instream temperature data to provide the justification for PNV analysis.[b]	No, there have not been BURP assessments or other appropriate data collected for the Warm Creek AUs contained in the 2016 sediment TMDLs.[c]
Are water quality criteria identified in the subbasin assessment/TMDLs consistent with current water quality standards?	Yes, the narrative sediment criteria identified in the 2003 TMDLs are consistent with current water quality standards.	Yes, the numeric temperature criteria identified in the 2016 TMDLs are consistent with current water quality standards.	Yes, the narrative sediment criteria addressed is consistent with current water quality standards, however not appropriate for the 2016 sediment TMDLs that were developed.

a. See section 4.2.2 for information about how DEQ plans to address stream temperature monitoring in large rivers.
b. See section 4.2.5.2 for further information about the Aspen Creek AU.
c. See section 4.2.4 for further information about the Warm Creek AUs.

Table 9. Percent load reductions for past TMDLs in the Upper Salmon River subbasin.

Assessment Unit Name	Assessment Unit Number	Pollutants	TMDL Approval Year	TMDL Load Reductions Required	Review Outcomes
Challis Creek - Darling Creek to mouth	ID17060201SL007_04	Sedimentation/ Siltation	2003	26%	Retain in Category 4a
		Temperature	2016	25%	Retain in Category 4a
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_03	Sedimentation/ Siltation	2003	36%	Delist from Category 4a for sediment
		Temperature	2016	43%	Retain in Category 4a
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_04	Sedimentation/ Siltation	2003	0%	Retain in Category 4a
		Temperature	2016	29%	Retain in Category 4a
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	Temperature	2016	3% for the combined four AUs	Retain in Category 4a
Salmon River - Garden Creek to Pennal Gulch	ID17060201SL014_06	Temperature	2016		
Salmon River - East Fork Salmon River to Garden Creek	ID17060201SL016_06	Temperature	2016		
Salmon River - Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_05	Temperature	2016		
Paasasikwana Naokwaide - Cash Creek to mouth	ID17060201SL021_04	Temperature	2016	16%	Retain in Category 4a
Paasasikwana Naokwaide Tributaries	ID17060201SL023_02	Temperature	2016	17%	Retain in Category 4a
Paasasikwana Naokwaide - Willow Creek to Martin Creek	ID17060201SL023_03	Temperature	2016	0%	Retain in Category 4a
Paasasikwana Naokwaide- Martin Creek to Cash Creek	ID17060201SL023_04	Temperature	2016	11%	Retain in Category 4a
Aspen Creek - source to mouth	ID17060201SL024_02	Temperature	2016	50%	Delist from Category and move into Category 3
Salmon River - Thompson Creek to Paasasikwana Naokwaide	ID17060201SL027_05	Temperature	2016	0%	Retain in Category 4a

Assessment Unit Name	Assessment Unit Number	Pollutants	TMDL Approval Year	TMDL Load Reductions Required	Review Outcomes
Salmon River - Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	Temperature	2016	4%	Retain in Category 4a
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05	Temperature	2016	8%	Retain in Category 4a
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05	Temperature	2016	2%	Retain in Category 4a
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	Sedimentation/ Siltation	2016	94%	Delist from Category 4a; retain in Category 4c for Flow Regime Modification
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	Sedimentation/ Siltation	2016	77%	Delist from Category 4a; retain in Category 4c for Flow Regime Modification
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03	Sedimentation/ Siltation	2016	0%	Delist from Category 4a; retain in Category 4c for Flow Regime Modification
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04	Sedimentation/ Siltation	2016	80%	Delist from Category 4a; retain in Category 4c for Flow Regime Modification

4.1 Beneficial Use Status

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses and are described in more detail at *Beneficial Uses Idaho Department of Environmental Quality*. The WBAG (DEQ 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

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

- Wildlife habitats
- Aesthetics

The existing, designated, and presumed beneficial uses of the Category 4a AUs in the Upper Salmon River subbasin are shown in Table 10. Cold water aquatic life beneficial use is presumed for all waters of the state, and some may also be existing or designated.

Table 10. Beneficial uses of water bodies with existing EPA-approved TMDLs (Category 4a).

Assessment Unit Name	Assessment Unit Number	Type of Use		
		Existing	Designated	Presumed
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_02		CW, SS, PCR, DWS	
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_06		CW, SS, PCR, DWS	
Challis Creek - Darling Creek to mouth	ID17060201SL007_04	CW, SS		
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_03	CW, SS		
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_04	SS		CW
Salmon River - Garden Creek to Pennal Gulch	ID17060201SL014_06		CW, SS, PCR, DWS	
Salmon River - East Fork Salmon River to Garden Creek	ID17060201SL016_06		CW, SS, PCR, DWS	
Salmon River - Paasasikwana Naokwaideto East Fork Salmon River	ID17060201SL019_05		CW, SS, PCR, DWS	
Paasasikwana Naokwaide - Cash Creek to mouth	ID17060201SL021_04		CW, SS, SCR	
Paasasikwana NaokwaideTributaries	ID17060201SL023_02		CW, SS, SCR	
Paasasikwana Naokwaide - Willow Creek to Martin Creek	ID17060201SL023_03		CW, SS, SCR	
Paasasikwana Naokwaide - Martin Creek to Cash Creek	ID17060201SL023_04		CW, SS, SCR	
Aspen Creek - source to mouth	ID17060201SL024_02	CW, SS, SCR		
Salmon River - Thompson Creek to Paasasikwana Naokwaide	ID17060201SL027_05		CW, SS, PCR, DWS	
Salmon River - Yankee Fork Creek to Thompson Creek	ID17060201SL031_05		CW, SS, PCR, DWS	
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05		CW, SS, PCR, DWS	
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05		CW, SS, PCR, DWS	
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04			CW, SCR
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02			CW, SCR

Assessment Unit Name	Assessment Unit Number	Type of Use		
		Existing	Designated	Presumed
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03			CW, SCR
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04			CW, SCR

a. Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)

4.2 Summary and Analysis of Current Water Quality Data

All AUs discussed in this section are in Category 4a and have had a TMDL developed in 2003 or in 2016. Monitoring data was collected and reviewed as part of the 5-year review to determine if the AU is meeting the required load reductions assigned through the TMDL. DEQ examined all data associated with impaired AUs and included relevant BURP, temperature, and sediment data for the AUs in the Upper Salmon River subbasin.

4.2.1 Beneficial Use Reconnaissance Program

DEQ examined BURP assessment data as part of the 5-year review process to understand trends in macroinvertebrate, fish, and habitat metrics. The Challis Creek AU (ID17060201SL009_03) and the Paasasikwana Naokwaide AU (ID17060201SL021_04) both had BURP assessments completed since the most recent TMDL published in 2016.

The Challis Creek AU (ID17060201SL009_03) had a sediment TMDL developed in 2003 and a temperature TMDL developed in 2016 (Table 11). The comparison of the 2014 and 2021 BURP assessments has shown an improvement in both the habitat and macroinvertebrate metrics. The habitat metrics that saw the most improvement between 2014 and 2021 include instream cover with a score of 3 in 2014 and 14 in 2021, an embeddedness score improvement from 6 in 2014 to 12 in 2021, and a large organic debris count from a 0 in 2014 to 13 in 2021, The macroinvertebrate metrics saw increases in the Fine Sediment Biota Index (FSBI) and the Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa, both indications of improving stream conditions for sediment intolerant species. The FSBI increased from 120 to 145 and the EPT taxa score increased from 41 to 88 out of a total of 100.

The Paasasikwana Naokwaide AU (ID17060201SL021_04) received a passing BURP metrics score in 2013 and 2019, which indicated cold water aquatic life is supported (Table 11). However, the 2016 TMDL was developed from data that indicated this AU had exceedances for temperature criteria (DEQ 2016). More recently, the BLM collected stream temperature data that show temperatures continue to exceed salmonid spawning and EPA Bull Trout criteria for 2018–2022. Continued monitoring of this AU is recommended. The results of these data have been reflected in the 2024 Integrated Report.

Table 11. BURP assessments for Category 4a AUs from 2013–2021.

Name	Assessment Unit	BURP ID	SMI2 Score	SMI2 Rating	SFI2 Score	SFI2 Rating	SHI2 Score	SHI2 Rating	Avg Rating
Challis Creek	ID17060201SL009_03	2021SIDFA039	64	3	100	3	73	3	3
		2014SIDFA050	58	2	NM	NM	52	1	1.5
Paasasikwana Naokwaide	ID17060201SL021_04	2019SIDFA030	61	2	82	2	74	2	2
		2013SIDFA022	76	3	77	2	60	1	2

4.2.2 Stream Temperature Monitoring

The Salmon River AUs in Category 4a consists of 5th- and 6th-order streams and are all large river reaches that are nonwadeable. Four of these reaches continue to be monitored for temperature by RMRS (Table 12). In 2016, DEQ received updated temperature from RMRS for these AUs (Appendix C), and these data continue to record exceedances to salmonid spawning and EPA Bull Trout criterion.

Significant features such as Highway 75 and geothermal springs are near these AUs and should be taken into consideration for any type of stream temperature and shade analysis. The highway is a prominent feature near the entire impairment area that restricts how much shade is available in this section of river. Geothermal springs are a natural feature of this area and can influence ambient temperatures.

Based on the size of the impaired AUs of the Salmon River, the future recommendations are to continue to analyze temperature data collected from partner agencies, research the effects of geothermal activity to the region, and develop appropriate methods for assessing large, unwadeable rivers. The methods for developing load allocations for large unwadeable rivers are currently being researched in collaboration with other regions of the state, as well as other states in EPA Region 10. As modeling methods are approved, DEQ will use these models to reassess the AUs that are not meeting the TMDL review elements from Table 8.

Table 12. Temperature monitoring for Category 4a AUs since 2016.

Assessment Unit Name	Assessment Unit Number	Site Name
Salmon River – Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	141
Salmon River – East Fork Salmon River to Garden Creek	ID17060201SL016_06	181
Salmon River – Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_05	140
Salmon River – Valley Creek to Yankee Fork Creek	ID17060201SL047_05	174

4.2.3 Sediment Monitoring

DEQ conducted sediment monitoring for this 5-year review for Challis Creek (ID17060201SL009_03). This AU had a sediment TMDL developed in 2003 with an overall recommended load reduction of 36%. The 2003 TMDL stated that sampling conducted by Environmental Science and Research Foundation in the 1990s showed McNeil core sediment sampling of depth fines at 41% at an upper site and 44% at a lower site in Challis Creek. The

primary sources of sediment had been identified as streambank erosion, road erosion, historic overgrazing, and periodic heavy releases of water from Mosquito Flat Reservoir.

The site visits by DEQ in early 2013 documented improved conditions, evidenced by limited fine sediment particles and the stable banks. The Lodgepole fire burned great portions of the watershed in late 2013, and the damage was compounded by heavy monsoon rains in the watershed in August 2014. This led to flooding, debris flows, and washouts in Challis Creek (DEQ 2016a).

The Challis Creek watershed was revisited in 2021 to examine the recovery from the fire and floods. DEQ performed a BURP assessment, McNeil core samples (Appendix D), and an SEI in accessible and representative locations of the AU ID17060201SL009_03. The 2021, McNeil core samples collected in this AU measured subsurface fines at 14% with the 2.5-inch particles and 20% without the 2.5-inch particles, indicating that recovery is being made towards support of beneficial uses. DEQ also conducted an SEI that incorporated 4.94 miles of the stream, and the results indicated that there is no load reduction required (Appendix EAppendix E).

4.2.4 Photo Monitoring

The Warm Spring Creek AUs have been dry through several BURP monitoring seasons. This suggests these streams may be impaired due to a lack of flow; however, flow (or lack of flow) is not considered a pollutant as defined by CWA § 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution but not pollutants, the prescribed TMDL from 2016 should be revisited.

Along with the BURP site visits to document conditions, DEQ conducted additional site visits in 2021 and 2022 along with photo documentation (Figure 6–Figure 8) to the following AUs:

- ID17060201SL131_04, Warm Spring Creek - Hole-in-Rock Creek to mouth
- ID17060201SL132_02, Warm Spring Creek - source to Hole-in-Rock Creek
- ID17060201SL132_03, Warm Spring Creek - source to Hole-in-Rock Creek
- ID17060201SL132_04, Warm Spring Creek - source to Hole-in-Rock Creek

In 2003, discussions with respect to the expected function of the streams were debated and at that time, there were no TMDLs developed (DEQ 2003). The four SEIs completed in June 2013, were the basis for the load allocations documented in the 2016 TMDL. They were based solely on the field stability scoring even if the AU was dry. The field sheet for the AU ID17060201SL132_02 noted that the stream was dry with no indication of flow in recent months. The 2016 TMDL contains further details about the SEIs completed for the TMDL development.





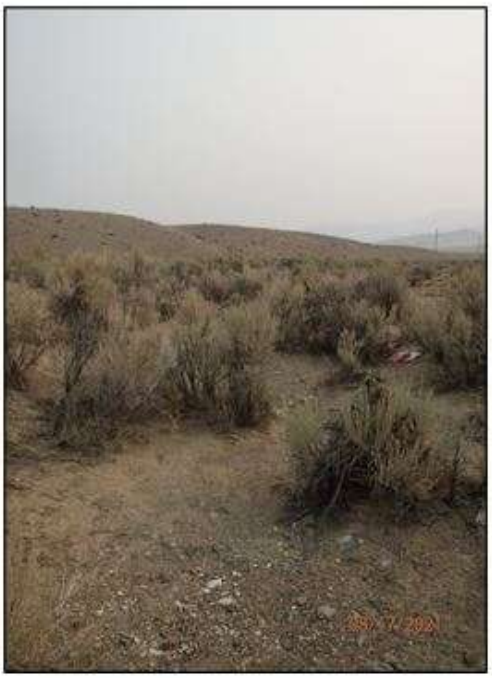


"Looked like the stream was diverted into pond at the upstream end of the AU. The downstream end of the AU was completely dry. As we walked upstream, there was more evidence of wetting. Eventually the stream turned into more of a wetland, then a stream in a wetland, then dry again." (DEQ 2021 Field Notes)



Figure 6. Survey photos of Warm Spring Creek - Hole-in-Rock Creek to mouth, ID17060201SL131_04 in 2021.







"Dry Lime Creek Culvert that is almost full of sediment." (DEQ 2021 Field Notes)

Figure 7. Survey photos of Warm Spring Creek – source to Hole-in-Rock Creek; ID17060201SL132_02 in 2021.







"Document that this stream is intermittent/dry. Should not have been assessed. Remove 4a sediment/siltation listing and retain 4c Flow Regime Modification as only listing." (2021 Field Notes)

Figure 8. Survey photos of Warm Spring Creek – source to Hole-in-Rock Creek; ID17060201SL132_04 in 2021 and 2022.

4.2.5 Assessment Unit Summary

All 5-year TMDL review elements have been verified, and the following summaries are of the data analyses, field investigations, and conclusions for the 20 individual AUs, of which 23 TMDLs have been developed. There are 14 AUs with existing TMDLs that are still impaired and 6 AUs that are proposed for delisting. The proposed changes in this section are not considered official until reviewed and approved by EPA during the next Integrated Report submittal process.

4.2.5.1 Assessment Units in TMDLs That Are Still Impaired

ID17060201SL001_06, Salmon River - Pennal Gulch to Pahsimeroi River

- 2024 Integrated Report listing status: Category 4a for Temperature.
- In 2016, RMRS (site 141) collected continuous stream temperature data that showed exceedances for the EPA Bull Trout criterion at a frequency of 100%.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL007_04, Challis Creek - Darling Creek to mouth

- 2024 Integrated Report listing status: Category 4a for Sedimentation/Siltation and Temperature.
- No recent data collection in this AU.
- Recommendation: This AU should remain in Category 4a for temperature and sediment impairments.

ID17060201SL009_04, Challis Creek - Bear Creek to Darling Creek

- 2024 Integrated Report listing status: Category 4a for Sedimentation/Siltation and Temperature.
- The AUs in Challis Creek was split differently in 2003 and the sediment TMDL that was developed showed a 0% load reduction required for this corresponding AU; however, the 2003 TMDL combined all Challis Creek reaches for the resulting load reduction of 36%.
- No recent data collection in this AU.
- Recommendations: This AU should remain in Category 4a for temperature and sediment impairments and receive additional monitoring.

ID17060201SL014_06, Salmon River - Garden Creek to Pennal Gulch

- 2024 Integrated Report listing status: Category 4a for Temperature.
- The 2016 Temperature TMDL required a 3% load reduction for four combined Salmon River AUs (i.e., ID17060201SL001_06, ID17060201SL014_06, ID17060201SL016_06, and ID17060201SL019_05). The RMRS did not collect stream temperature data for this AU; however, data was collected for the three other AUs in the 2016 TMDL and all showed exceedances for the EPA Bull Trout criterion at a frequency of 100%.

- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL016_06, Salmon River - East Fork Salmon River to Garden Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- In 2016, RMRS (site 181) collected continuous stream temperature data that showed exceedances for the EPA Bull Trout criterion at a frequency of 100%.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL019_05, Salmon River - Paasasikwana Naokwaide to East Fork Salmon River

- 2024 Integrated Report listing status: Category 4a for Temperature.
- In 2016, RMRS (site 140) collected continuous stream temperature data that showed exceedances for the EPA Bull Trout criterion at a frequency of 100%.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL021_04, Paasasikwana Naokwaide - Cash Creek to mouth

- 2024 Integrated Report listing status: Category 4a for Temperature.
- No recent data collection in this AU.
- Recommendation: This AU should remain in Category 4a for temperature impairments.

ID17060201SL023_02, Paasasikwana Naokwaide Tributaries

- 2024 Integrated Report listing status: Category 4a for Temperature.
- No recent data collection in this AU.
- Recommendation: This AU should remain in Category 4a for temperature impairments.

ID17060201SL023_03, Paasasikwana Naokwaide - Willow Creek to Martin Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- The PNV conducted for this AU for the 2016 TMDL resulted in a 0% load reduction. The existing solar load was well below the target load; however, the TMDL was developed due to temperature exceedances.
- Recommendations: There should be further investigation into causes of temperature impairments since no shade deficiencies were reported.

ID17060201SL023_04, Paasasikwana Naokwaide - Martin Creek to Cash Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- No recent data collection in this AU.
- Recommendation: This AU should remain in Category 4a for temperature impairments.

ID17060201SL027_05, Salmon River - Thompson Creek to Paasasikwana Naokwaide

- 2024 Integrated Report listing status: Category 4a for Temperature.
- Although there were temperature exceedances from the continuous stream temperature collected by DEQ in 2013, shade does not appear to be a factor for these exceedances.
- The PNV conducted for this AU for the 2016 TMDL resulted in a 0% load reduction. The existing solar load was well below the target load; however, the TMDL was developed due to temperature exceedances.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL031_05, Salmon River - Yankee Fork Creek to Thompson Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- The 2016 temperature TMDL required a 4% load reduction.
- No recent data collection in this AU.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL047_05, Salmon River - Valley Creek to Yankee Fork Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- In 2016, RMRS (site 140) collected continuous stream temperature data that showed exceedances for the EPA Bull Trout criterion at a frequency of 100%.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

ID17060201SL063_05, Salmon River - Redfish Lake Creek to Valley Creek

- 2024 Integrated Report listing status: Category 4a for Temperature.
- The 2016 temperature TMDL required a 2% load reduction.
- No recent data collection in this AU.
- Recommendations: Continue to analyze temperature data until such time that appropriate methods for assessing large rivers are available. This AU should remain in Category 4a for temperature impairments.

4.2.5.2 Assessment Units in TMDLs Proposed for Delisting

For the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Delistings are supported by a detailed rationale. The following AUs are proposed for delisting in the next Integrated Report.

ID17060201SL009_03, Challis Creek – Bear Creek to Darling Creek

- 2024 Integrated Report listing status: Category 4a for Temperature and Sediment/Siltation**;** Category 4c for Flow Regime Modification.
- Recent monitoring data indicates that this AU is meeting the load targets for sediment. The BURP assessment in 2021 returned a passing site condition rating of 3.00. Compared to the 2014 BURP assessment, this AU saw the greatest improvements in the following categories:
  - SHI2: The instream cover score increased from 3 to14 out of 20.
  - SHI2: The embeddedness score improved from a score of 6 to 12 out of 20.
  - SHI2: The large organic debris increased from a 0 count in 2014 to a 13 count in 2021.
  - SMI2: FSBI increased from 120 to 145.
  - SMI2: EPT Taxa score increased from 41 to 88 out of 100.
- In 2021, McNeil core samples collected in this AU measured subsurface fines at 14% with 2.5-inch particles and 20% without the 2.5-inch particles. These results are well below the target of 28% fines.
- The SEI in 2021 found the total bank erosion was 26.2 tons per year. A reduction of approximately 20 tons in annual streambank erosion, which meets the 2003 target reduction of 17.5 tons/year.
- Recommendations: this AU should be removed from Category 4a for Sediment/Siltation and should remain in Category 4a for Temperature and 4c for Flow Regime Modification.

ID17060201SL024_02, Aspen Creek - Source to Mouth

- 2024 Integrated Report listing status: Category 4a for Temperature.
- There are no BURP assessments to determine beneficial uses of this AU, and there is no historical evidence that this AU has supported salmonid spawning. Until this AU has been properly assessed with protocols from the WBAG, there should be no determination for salmonid spawning as an existing use.
- This AU has not had continuous instream temperature collected to confirm any criteria exceedances. It was only identified as shade deficient while calculating adjacent AU existing and target loads using the PNV method.
- Recommendations: Aspen Creek was included with the Paasasikwana Naokwaide AUs in the 2016 TMDL in error. This AU had not been assessed with BURP methodology and did not have documented temperature data to indicate there was any impairment. The beneficial uses are presumed due to the amount of shade present; however, it was noted as being in good condition overall. This AU should be removed from Category 4a for an approved temperature TMDL and be reassigned into Category 3 – Unassessed until such time data is available to make that determination. This AU is proposed for a BURP assessment within the next 5- year review cycle.

ID17060201SL131_04, Warm Spring Creek - Hole-in-Rock Creek to mouth

- 2024 Integrated Report listing status: Category 4a for Sediment/Siltation**;** Category 4c for Flow Regime Modification.
- In 2021, DEQ performed photo monitoring to document conditions.
- Data collected indicate this AU may be ephemeral.
- Recommendations: This AU should be removed from Category 4a for sediment impairments and reassigned to Category 3 – Unassessed since a BURP assessment has not been made to determine if beneficial uses are attained or impaired. The AU should remain in Category 4c for Flow Regime Modification as the only listing.

ID17060201SL132_02, Warm Spring Creek - source to Hole-in-Rock Creek

- 2024 Integrated Report listing status: Category 4a for Sediment/Siltation**;** Category 4c for Flow Regime Modification.
- In 2008 dry conditions were observed when BURP assessors visited the AU and in 2021, photo monitoring documented dry conditions.
- Data collected indicate this AU may be ephemeral.
- Recommendations: This AU should be removed from Category 4a for sediment impairments and reassigned to Category 3 – Unassessed since a BURP assessment has not been made to determine if beneficial uses are attained or impaired. The AU should remain in Category 4c for Flow Regime Modification as the only listing.

ID17060201SL132_03, Warm Spring Creek - source to Hole-in-Rock Creek

- 2024 Integrated Report listing status: Category 4a for Sediment/Siltation**;** Category 4c for Flow Regime Modification.
- In 2008 dry conditions were observed when BURP assessors visited the AU.
- Data collected indicate this AU may be ephemeral.
- Recommendations: This AU should be removed from Category 4a for sediment impairments and reassigned to Category 3 – Unassessed since a BURP assessment has not been made to determine if beneficial uses are attained or impaired. The AU should remain in Category 4c for Flow Regime Modification as the only listing.

ID17060201SL132_04, Warm Spring Creek - source to Hole-in-Rock Creek

- 2024 Integrated Report listing status: Category 4a for Sediment/Siltation**;** Category 4c for Flow Regime Modification.
- In 2021 and 2022, photo monitoring documented dry conditions.
- Data collected indicate this AU may be ephemeral.
- Recommendations: This AU should be removed from Category 4a for sediment impairments and be reassigned to Category 3 – Unassessed since a BURP assessment has not been made to determine if beneficial uses are attained or impaired. The AU should remain in Category 4c for Flow Regime Modification as the only listing.

4.3 Review of Past Implementation Plan and Activities

The most recent implementation plan for the Upper Salmon River subbasin was the *Total Maximum Daily Load Agricultural Implementation Plan* (ISWCC 2007) by the Idaho Soil and Water Conservation Commission (ISWCC) and in cooperation with the Custer Soil and Water Conservation District (CSWCD). This implementation plan provides best management practices (BMPs) that will improve or restore physical, chemical, and biological functions of Challis Creek.

The CSWCD and Upper Salmon Basin Watershed Project used the Stream Visual Assessment Protocol and their Streambank Erosion Condition Inventory (SECI) to assess conditions for 2.3 miles of Challis Creek (Figure 9). There were four reaches that had good aquatic habitat, and all five reach surveys indicated only slight erosion. The SECI surveys show three reaches (CC2, CC4, and CC6) that contribute approximately two-thirds of the streambank erosion to Challis Creek. The implementation plan recommended that all reaches could improve water quality and increase aquatic habitat with minor changes and appropriate BMPs and any work on CC16 should be considered on a site-specific basis (ISWCC 2007).

The flow alterations have been addressed extensively by improving irrigation practices and decreasing in-stream barriers where feasible. Fencing has been installed in voluntary cooperation with landowners and numerous animal feedlot operations have been removed or addressed to meet water quality standards (Table 13).

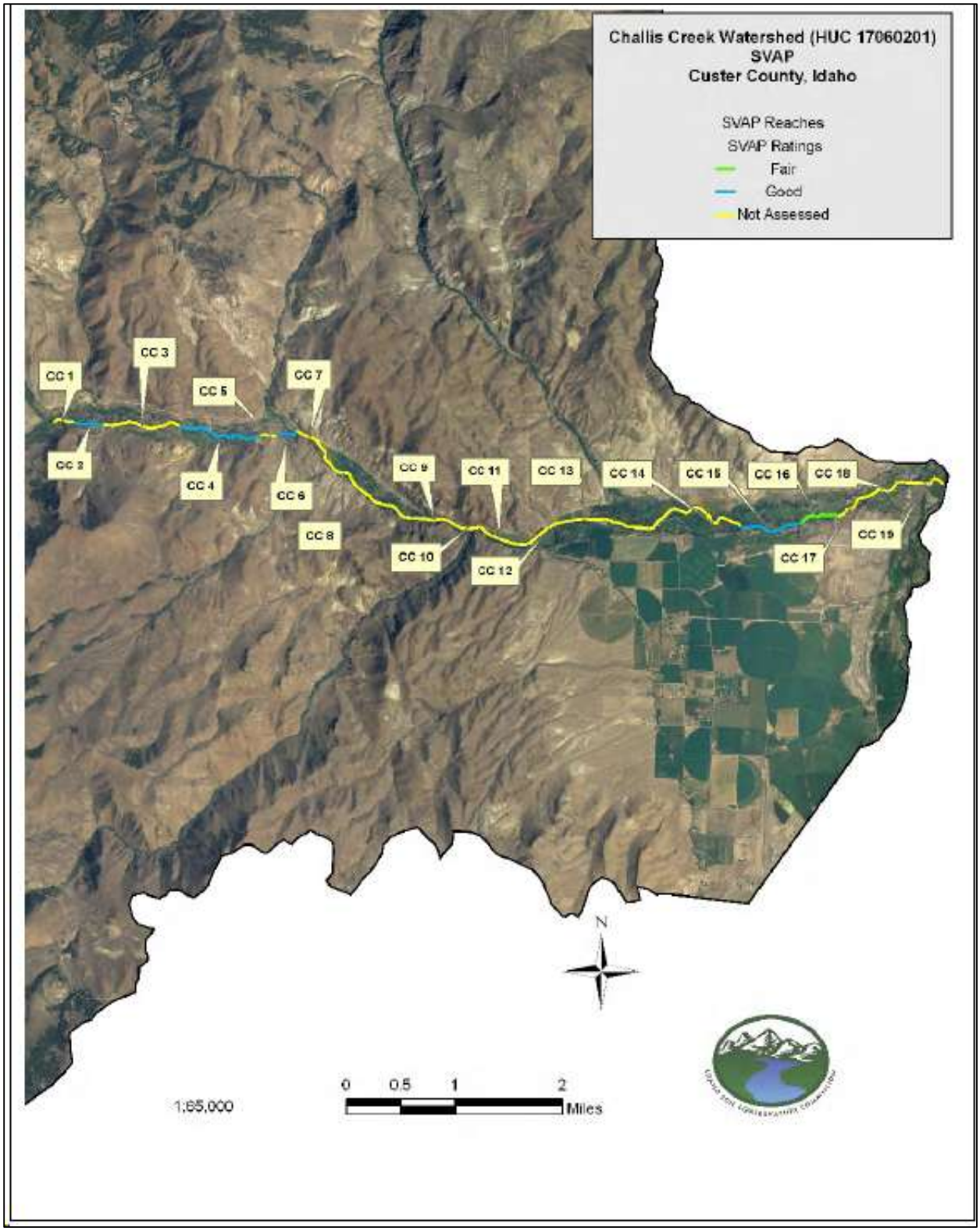


Figure 9. Map from the 2007 Agricultural Implementation Plan.

Table 13. Challis Creek Implementation Plan recommended BMPs.

Site	Identified Problems	Recommended BMPs
CC4	Past channelization, lack of trees/shrubs, eroding banks, dewatering and lack of deep pools	Riparian buffer, tree/shrub planting, structure for water control, and stream habitat improvement
CC6	Eroding banks, past channelization, livestock access	Use exclusion, watering facilities, streambank protection, riparian buffer, tree/shrub planting, stream habitat improvement
CC15	Livestock access	Use exclusion, watering facilities, stream habitat improvement
CC16	Past channelization, eroding banks, dewatering, lack of instream cover, lack of deep pools, fish barriers, livestock access, and urbanization	Riparian buffer, tree/shrub planting, use exclusion, watering facilities, irrigation system, structures for water control, stream stabilization, fish passage, and stream habitat improvement

4.3.1 Responsible Parties

Various entities have been involved in or responsible for implementing TMDLs in the Upper Salmon River subbasin (Table 14). Detailed agency roles are described in DEQs Nonpoint Source Management Plan (DEQ 2025).

Table 14. Designated management agencies and their responsibility for implementing the Upper Salmon River subbasin TMDLs.

Designated Management Agency	Resource Responsibility
Idaho Soil and Water Conservation Commission	Agriculture
Bureau of Land Management	BLM Land
Salmon-Challis National Forest	USFS Land
Idaho Department of Lands	State endowment lands, timber harvest, and mining
Idaho Department of Transportation	Roads

4.3.2 Activities Planned and Implemented

Multiple agencies and districts planned and implemented the following projects in several areas of the Upper Salmon River subbasin (Table 15Table 15). Additional projects and full details are found on each entity's web page.

4.3.3 Planned Time Frame

The implementation plan developed for the Upper Salmon River subbasin addressed the sediment impaired AUs in Challis Creek from DEQ's 2003 TMDL. The projected time frame for sediment TMDLs to attain full recovery will vary due to land use, pollution effects, and funding sources. DEQ will continue to monitor sediment loads under the 5-year review program.

Table 15. Implementation activities in the Upper Salmon River subbasin.

Project Name	Lead Agency	Activity	Schedule
Morgan Creek Passage Project	CSWCD	Installation of a rock ramp for fish passage at low flows.	Morgan Creek Passage Project - 2021 Morgan Creek Modifications on S-22 - 2023
Garden Creek Rehabilitation Project	CSWCD	Removal of full and partial passage barriers in six locations on Garden Creek.	Garden Creek Gini Flume – Full Barrier Removal– 2004 City of Challis Full Passage Barrier Removal – 2013 Garden Creek Syphon – Full Passage Barrier Removal – 2017 Garden Creek – Chipmunk Culvert to Bridge – partial barrier removal/reduction of sedimentation - 2018/2019 Garden Creek - County Culvert Removal – 2019 Garden Creek – Piva Culvert Removal – partial barrier/sedimentation – 2020 Garden Creek - 1,200 feet of exclusion fencing, willow and tree planting, stock water system - 2023
Pole Creek Rehabilitation Project (Section 5.5.5 highlights)	CSWCD	Installation of fish screens, culvert replacement, irrigation project, off stream stock-water system, vegetation restoration.	Pole Creek Project - 2014-2016 Pole Meadows Project - 2018 Pole Creek Stream Complexity Project Phase 1
Road Creek Passage Barrier Removal and Bridge Installation project	CSWCD	Removal of an undersized culvert and installing a new bridge in the historic channel of Road Creek.	Road Creek Culvert to Bridge phase 1 – 2021–2026 Road Creek Culvert to Bridge phase 2 - ongoing
Riparian Fence Projects	CSWCD	Exclusion fencing installed.	East Fork Riparian Fence - 2014 Williams Creek Fence - 2017 Stanley Lake Creek Fence - 2020
Kelly Creek Bridge (68885)	SCNF	At the intersection of Kelly Creek Trail (No. 4323) and Lower Basin (No. 4349), approximately 6 miles northeast of Stanley, ID.	Decision 04/2026; Implementation 06/2026
Challis Backyard Trails (68598)	SCNF	Project proposes 32 miles of new motorized and nonmotorized trail construction 7 miles west of Challis, ID.	Decision 11/2025; Implementation 07/2026

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources which receive load allocations. Wasteload allocations may be composited for certain types of point sources, such as general permits, but typically each point source is given a wasteload allocation. Each nonpoint source load may receive a load allocation, or the sources may be aggregated with a single load allocation for all nonpoint source loads. Natural background contributions, when present, are considered part of the load allocation but may be treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to anthropogenic pollutant sources.

Load capacity can be summarized by the following equation:

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

Where:

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

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. If the MOS is explicit (i.e., a specific amount or proportion of the load capacity) and the natural background is separated from other nonpoint sources, those loads are subtracted from the overall load capacity, and the remaining load is allocated among pollutant sources (i.e., the load allocation and WLA). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load

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

5.1 Instream Water Quality Targets

TMDL water quality targets are a translation of the applicable numeric or narrative water quality standard(s) for each pollutant. For pollutants with established numeric water quality standards, the numeric value(s) are used as the TMDL targets. For pollutants with narrative water quality standard(s), the targets provide a water body-specific interpretation of the narrative standard(s). Water quality targets are typically developed for multiple parameters that link directly to the impaired beneficial use(s) and applicable water quality standard(s). Therefore, the targets provide a benchmark by which to evaluate attainment of water quality standards. Furthermore, comparing existing stream conditions to target values allows for a better understanding of the extent and severity of the problem.

For the Upper Salmon River subbasin temperature TMDL, DEQ utilized a PNV approach. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLs, the natural level of shade and channel width become the TMDL target. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria. See Appendix G for further discussion of water quality standards and natural background provisions.

The PNV approach is described briefly below. The procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in detail in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona 2009). The manual also provides a more complete discussion of shade and its effects on stream water temperature.

5.1.1 Factors Controlling Water Temperature in Streams

Temperatures in streams fluctuate over the day and throughout the year in response to changes in groundwater temperature, air temperature, river flow and direct solar radiation (Poole 2001). Flow and solar radiation are the factors that can be most influenced by BMPs, but because water quantity is outside of the scope of TMDLs (section 5.4.1), the focus of allocations

in Idaho temperature TMDLs, and of the PNV approach, is on solar radiation. The parameters that affect the amount of solar radiation hitting a stream throughout its length are shade and stream morphology. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Stream morphology (i.e., structure) affects riparian vegetation density and water storage in the alluvial aquifer. Riparian vegetation and channel morphology are the factors influencing shade that are most likely to have been influenced by anthropogenic activities and can be most readily corrected and addressed by a TMDL.

Riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. However, depending on how much vertical elevation surrounds the stream, vegetation further away from the riparian corridor can also provide shade. We can measure the amount of shade that a stream receives in a number of ways. Effective shade (i.e., that shade provided by all objects that intercept the sun as it makes its way across the sky) can be measured in a given location with a Solar Pathfinder or with other optical equipment similar to a fish-eye lens on a camera. Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and stream aspect.

In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream and can be measured using a densiometer or estimated visually either on-site or using aerial photography. All of these methods provide information about how much of the stream is covered and how much is exposed to direct solar radiation.

5.1.2 Potential Natural Vegetation for Temperature TMDLs

PNV is the mature state of a stream's riparian plant community absent human disturbance. The amount of stream shade resulting from this community is expected to be natural, and these shade levels are used as TMDL targets. We can estimate PNV (and therefore target shade) from models of plant community. Curves from this modeling relate the amount of stream shade produced from long-term average vegetation conditions to the width and aspect (north, south, east, west) of the stream. Vegetation levels can be reduced by natural processes, such as disease/old age, wind damage, and wildlife grazing. Some level of ongoing natural disturbance is accounted for in the development and use of these shade curves and targets because the curves are based on existing vegetation communities across the state, which are affected by these disturbances. A detailed description of this methodology is provided in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona 2009).

In this TMDL, existing and PNV shade was converted to solar loads from data collected on flat-plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather stations. In this case, we used the Boise, Idaho and Missoula, Montana stations. The difference between existing and target solar loads, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (Appendix G).

5.1.2.1 Existing Shade Estimates

Existing shade was estimated for four AUs from visual interpretation of aerial photos. Estimates of existing shade based on plant type and density were marked out as stream segments on a 1:100,000 or 1:250,000 hydrography considering natural breaks in vegetation density. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. Each segment was assigned a single value representing the bottom of a 10% shade class (adapted from the cumulative watershed effects process [IDL 2000]).

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at eight sites. The Solar Pathfinder is a device that allows one to trace the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a stream segment, 20 traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Twenty traces were taken following the manufacturer's instructions (i.e., orient to the south and level). Systematic sampling was used because it is easiest to accomplish without biasing the sampling location. For each sampled segment, the sampler started at a unique location, such as 25 to 50 meters (m) from a bridge or fence line and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 25 m, 25 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances, consistent with the PNV methodology (DEQ 2009).

When possible, the sampler also measured bankfull widths, took notes, and photographed the landscape of the stream at several unique locations while taking traces. Special attention was given to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) were present. Observations of localized natural disturbance are noted while at each sampling location and any observations of disturbance are noted while travelling to and from the sampling areas. If possible, photographs that can clearly depict the scale of the disturbance should be taken. One can also take densiometer readings at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream.

5.1.2.2 Target Shade Determination

PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in Idaho (DEQ 2009). A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, shade decreases as vegetation has less ability to shade the center of wide

streams. As the vegetation gets taller, the more shade the plant community is able to provide at any given channel width.

Natural Bankfull Widths

Stream width must be known to calculate target shade since the width of a stream affects the amount of shade the stream receives. Bankfull width is used because it best approximates the width between the points on either side of the stream where riparian vegetation starts. Measures of current bankfull width may not reflect widths present under PNV (i.e., natural widths). As impacts to streams and riparian areas occur, width-to-depth ratios tend to increase such that streams become wider and shallower. Shade produced by vegetation covers a lower percentage of the water surface in wider streams, and widened streams can also have less vegetative cover if shoreline vegetation has eroded away.

Since existing bankfull width may not be discernible from aerial photo interpretation and may not reflect natural bankfull widths, this parameter must be estimated from available information. We used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bankfull width (Figure 10).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Salmon Basin curve. The Salmon Basin curve was chosen because of its proximity to the Yankee Fork Creek, Pole Creek, and East Fork Salmon River watersheds. Existing width data should also be evaluated and compared to these curve estimates when data are available. Within the listed watersheds, only a few BURP sites exist, and bankfull width data from those sites represent only spot data (e.g., only three measured widths in a reach just several hundred meters long) that are not always representative of the stream as a whole.

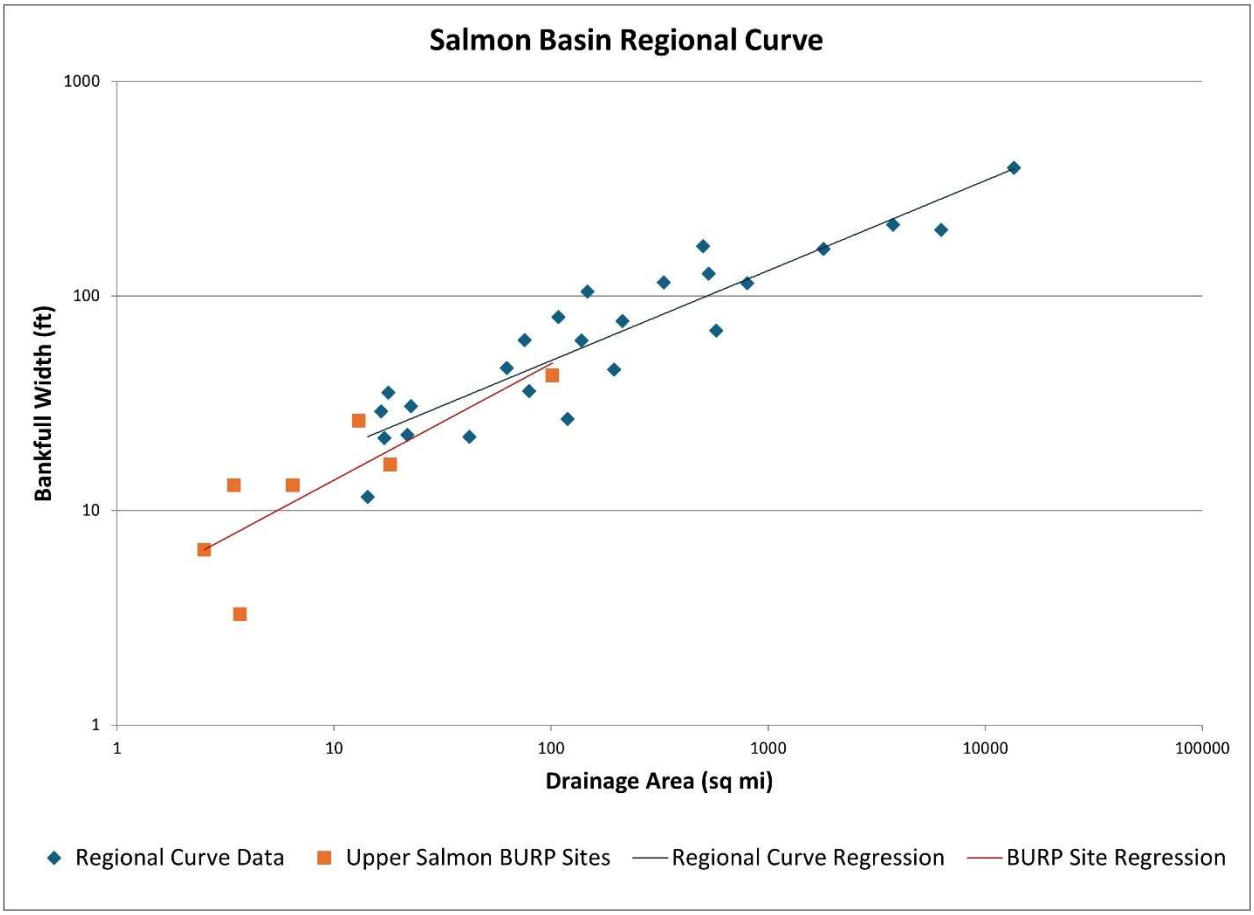


Figure 10. Bankfull width as a function of drainage area.

5.1.3 Critical Conditions, Seasonal Variation, and Other Design Conditions

This TMDL is based on average seasonal loads. All loads have been calculated to be inclusive of the 6-month period from April through September. This time period is when the combination of increasing air and water temperatures coincide with increasing solar inputs and vegetative shade. The critical time periods are April through June when spring salmonid spawning occurs, July and August when maximum temperatures may exceed cold water aquatic life criteria, and September when fall salmonid spawning is most likely to be affected by higher temperatures (DEQ 2016b). Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angle. Because the TMDL focuses on the months where effective shade is most important to protecting the beneficial uses, improving effective shade and reducing the solar load during that time frame will address sources that contribute excess solar loading the rest of the year as well.

DEQ's WBAG (DEQ 2016b), *Geography and Timing of Salmonid Spawning in Idaho,* and associated GIS layer (BioAnalysts, Inc. 2014) identify the core spawning and rearing times for select native and introduced salmonid species in Idaho that must be considered when assessing the temperature requirements for AUs (Table 16). In addition, federal and state regulations identify specific water bodies where Bull Trout spawning must be protected. Criteria are

intended to protect indigenous species; however, the state may also choose to protect introduced species if the state considers them desirable. If an introduced salmonid species is present in a water body and IDFG considers that species desirable for that drainage, then salmonid spawning criteria could be applied for that species. The management objectives of IDFG's Fisheries Management Plan (IDFG 2013) specify, by drainage, which species are considered desirable and are managed for propagation and sustainable populations (DEQ 2016b).

Table 16. Spawning and egg incubation period for select native and introduced salmonid species in Idaho.

Fish Species	WBAG[a] Time Frame	Geography and Timing Report[b]	
		Spawn Start Date	Emergence End Date
Chinook Salmon (spring/summer run)	August 15–June 1	August 15–31	April 22–30
Chinook Salmon (fall run)	October 1–April 15	Not applicable to this subbasin	
Sockeye Salmon	October 1–June 1	Not applicable to this subbasin	
Steelhead Trout	April 1–July 15	March 15–21	July 22–31
Redband/Rainbow Trout	March 15–July 15	Not applicable to this subbasin	
Cutthroat Trout (Westslope)	April 1–July 1	May 1–7	July 22–31
Bull Trout	September 1–April 1	No data	No data
Kokanee Salmon	September 1–May 1	No data	No data
Mountain Whitefish	October 15–March 15	No data	No data
Brown Trout	October 1–April 1	No data	No data
Brook Trout	October 1–June 1	No data	No data

a. DEQ 2016b
b. BioAnalysts, Inc. 2014

5.1.4 Shade Curve Selection

To determine PNV shade targets for AUs in the Upper Salmon River subbasin, effective shade curves from the Salmon-Challis National Forest and the Southern Idaho Non-Forest (DEQ 2009) were examined (Table 17). These curves were produced using vegetation community modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Yankee Fork Creek, Pole Creek, and East Fork Salmon River tributaries, curves for the most similar vegetation type were selected for shade target determinations.

Table 17. Shade curves used in Upper Salmon River subbasin analysis.

Salmon-Challis Forest Types	Non-Forest Shade Curves
Douglas fir/Lodgepole pine - gentle	Quaking aspen with Douglas fir
Douglas fir/Lodgepole pine - steep	Black cottonwood
Dry Douglas fir without ponderosa pine	Grassland
Subalpine fir with lodgepole pine	Mountain big sagebrush
Subalpine fir - moist	Mountain big sagebrush with Douglas fir
Subalpine fir - dry/gentle	Riparian shrub
Subalpine fir - dry/steep	Three-tip sagebrush
Subalpine fir with whitebark pine	Wyoming big sagebrush

5.2 Load Capacity

The load capacity for a stream under PNV is essentially the solar loading allowed under the shade targets specified for the segments within that stream. These loads are determined by multiplying the solar load measured by a flat-plate collector (under full sun) for a given period of time by the fraction of the solar radiation that is not blocked by shade (i.e., the percent open or 100% minus percent shade). In other words, if a shade target is 60% (or 0.6), the solar load hitting the stream under that target is 40% of the load hitting the flat-plate collector under full sun. The target solar load can be summarized with the following equation:

$$\sum seg = seg_1 + seg_2 + seg_3 + \cdots + seg_n + WLA$$

Where:

seg = $NREL\ Collector\ kWh/m^2/day \times (1 - Target\ Shade\ Percentage)$

WLA = 0.3 °C Allowance for Point Source Discharges. This background allowance is equivalent to 851 kWh/day per one cubic foot per second of stream flow (IDAPA 58.01.02.401).

DEQ obtained solar load data from flat-plate collectors at the NREL weather stations in Boise, Idaho, and Missoula, Montana. The solar load data used in this TMDL analysis are spring/summer averages (i.e., an average load for the 6-month period from April through September). As such, load capacity calculations are also based on this 6-month period, which coincides with the time of year when stream temperatures are increasing, deciduous vegetation is in leaf, and fall spawning is occurring. Instead of focusing on maximum summer water temperatures, DEQ's approach spans the 6-month period because it includes multiple time frames that are critical for beneficial use support. Since the PNV TMDLs targets are based on natural conditions, achieving shade targets equivalent to natural conditions will achieve stream temperatures that are also equivalent to natural conditions during the critical 6-month, which include months with the lowest flows and highest ambient air temperatures. During this period, temperatures may affect beneficial uses such as spring and fall salmonid spawning and

cold water aquatic life criteria may be exceeded during summer months. Late July and early August typically represent the period of highest stream temperatures. However, solar gains can begin early in the spring and affect not only the highest temperatures reached later in the summer but also salmonid spawning temperatures in spring and fall.

It should be noted that the load capacity does not include the thermal load within each water body. Because DEQ uses effective shade from PNV as a surrogate, the load capacity is the thermal load that is associated with the attainment of target PNV conditions. Therefore, the load capacity represents the maximum solar thermal load that the stream can receive and still be consistent with natural stream temperatures.

In Appendix H, Tables H1–H4 show corresponding target summer loads (in kilowatt-hours per square meter per day [kWh/m^2/day] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segment's channel width, which typically only has one or two significant figures, dictates the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce rounding errors.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)). The existing solar load for nonpoint sources can be summarized with the following equation:

$$\sum seg = seg_1 + seg_2 + seg_3 + \cdots + seg_n$$

Where:

$$\text{seg} = NREL\ Collector\ kWh/m^2/day \times\ (1\ -\ Existing\ Shade\ Percentage)$$

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather Boise, Idaho and Missoula, Montana. Like load capacities (target loads), existing loads in Tables H1–H4 in Appendix H are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are summed for the entire stream or portion of stream and presented in a single load analysis table. The difference between target and existing load was then determined for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade).

For AUs where PNV analyses show no excess solar load (i.e., no shade deficit), additional assessments are needed to demonstrate beneficial uses are supported and stream temperatures are not exceeding numeric criteria due to human activities. Alternatively, AUs meeting shade targets may be candidates for future site specific temperature criteria.

The Upper Salmon River subbasin PNV analysis resulted in one AU requiring development of a TMDL (Pole Creek – source to mouth ID17060201SL085_03). This AU exhibited excess solar loads with the average lack of shade at 26% (Table 18). The Yankee Fork – Jordan Creek to Mouth (ID17060201SL032_04) and the East Fork Salmon River – Germania Creek to Herd Creek (ID17060201SL103_02) show 0% solar load reduction required and will not have a TMDL developed and remain in Category 5 for further monitoring. The Pole Creek ID17060201SL085_02 was included in the PNV analysis in error, as previously mentioned. Although the analysis estimated a shade deficit of -22% for Pole Creek (Table 18), DEQ does not make impairment decisions based off PNV estimates and the temperature logger data associated with this AU do not indicate temperature impairment. This conclusion was based on a full season of temperature data and compared to the Idaho Bull Trour criterion. DEQ did not develop a TMDL for this AU and the PNV output is included for informational purposes only.

Table 18. Upper Salmon River subbasin existing solar loads, target solar load and lack of shade.

Water Body	Assessment Unit Number	Total Target Load	Total Existing Load	Excess Load (% Reduction)	Average Lack of Shade (%)	TMDL Required?
		(kWh/day)				
Yankee Fork - Jordan Creek to mouth	ID17060201SL032_04	1,400,000	1,400,000	0 (0%)	0%	No
Pole Creek - source to mouth	ID17060201SL085_02	38,000	140,000	110,000 (79%)	-22%	No
Pole Creek - source to mouth	ID17060201SL085_03	590,000	810,000	220,000 (27%)	-26%	Yes
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_02	670,000	670,000	0 (0%)	0%	No

Target shade classifications (Figure 11) are percentages of riparian shade percentages expected to be present given the vegetation cover. The existing shade classifications (Figure 12) are percentages of riparian shade cover observed in the landscape.

The shade deficiencies (Figure 13) are calculated as the differences between target and existing shade estimates. Shade deficiencies are the poorest at -90% to -99% indicating the difference between expected shade and observed shade is severe. Although temperature exceedances have been recorded in these AUs, many stream segments meet or are near the target shade levels.

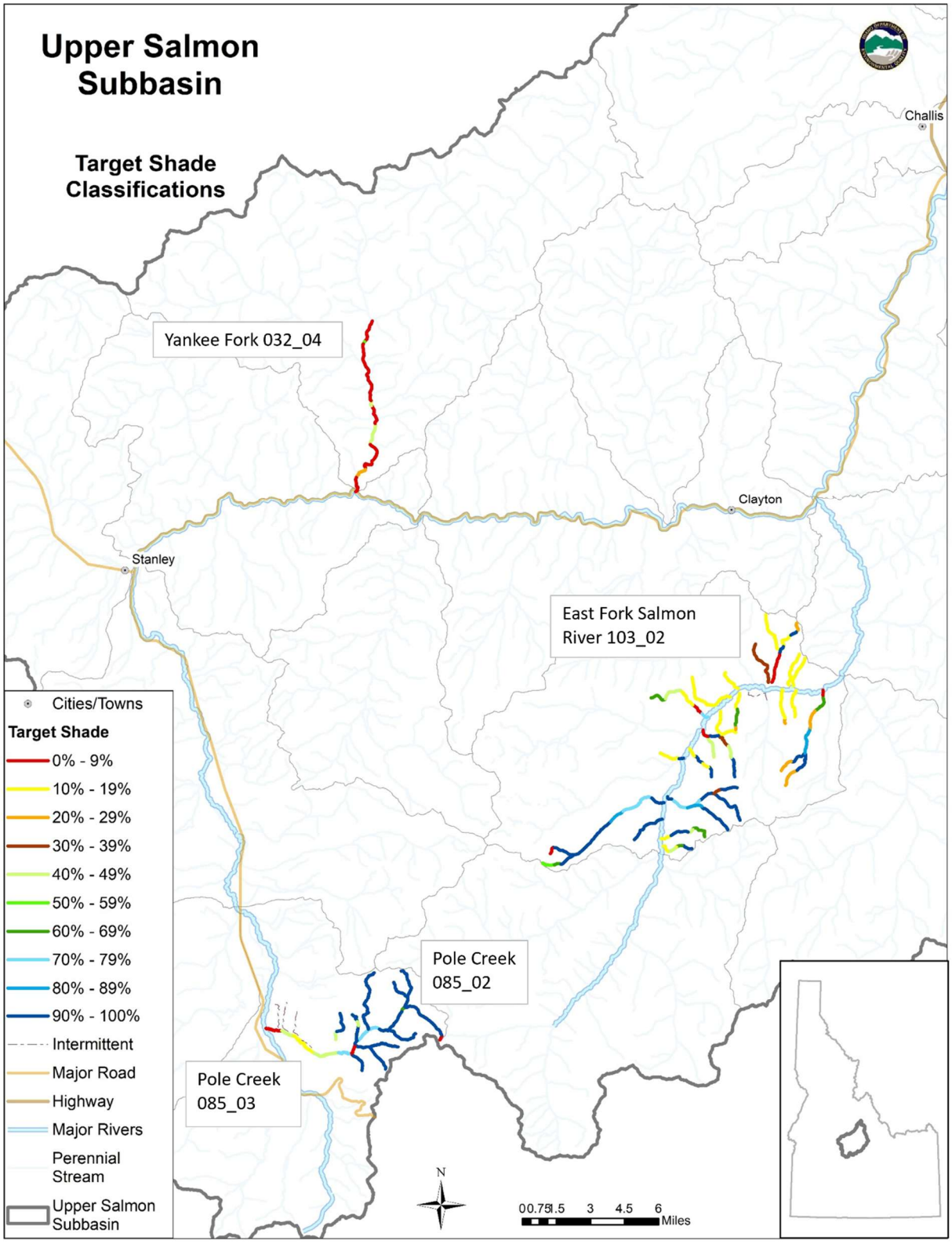


Figure 11. Target shade estimates for Yankee Fork Creek (ID17060201SL032_04), East Fork Salmon River tributaries (ID17060201SL103_02), and Pole Creek and tributaries (ID17060201SL085_02 and ID17060201SL085_03).

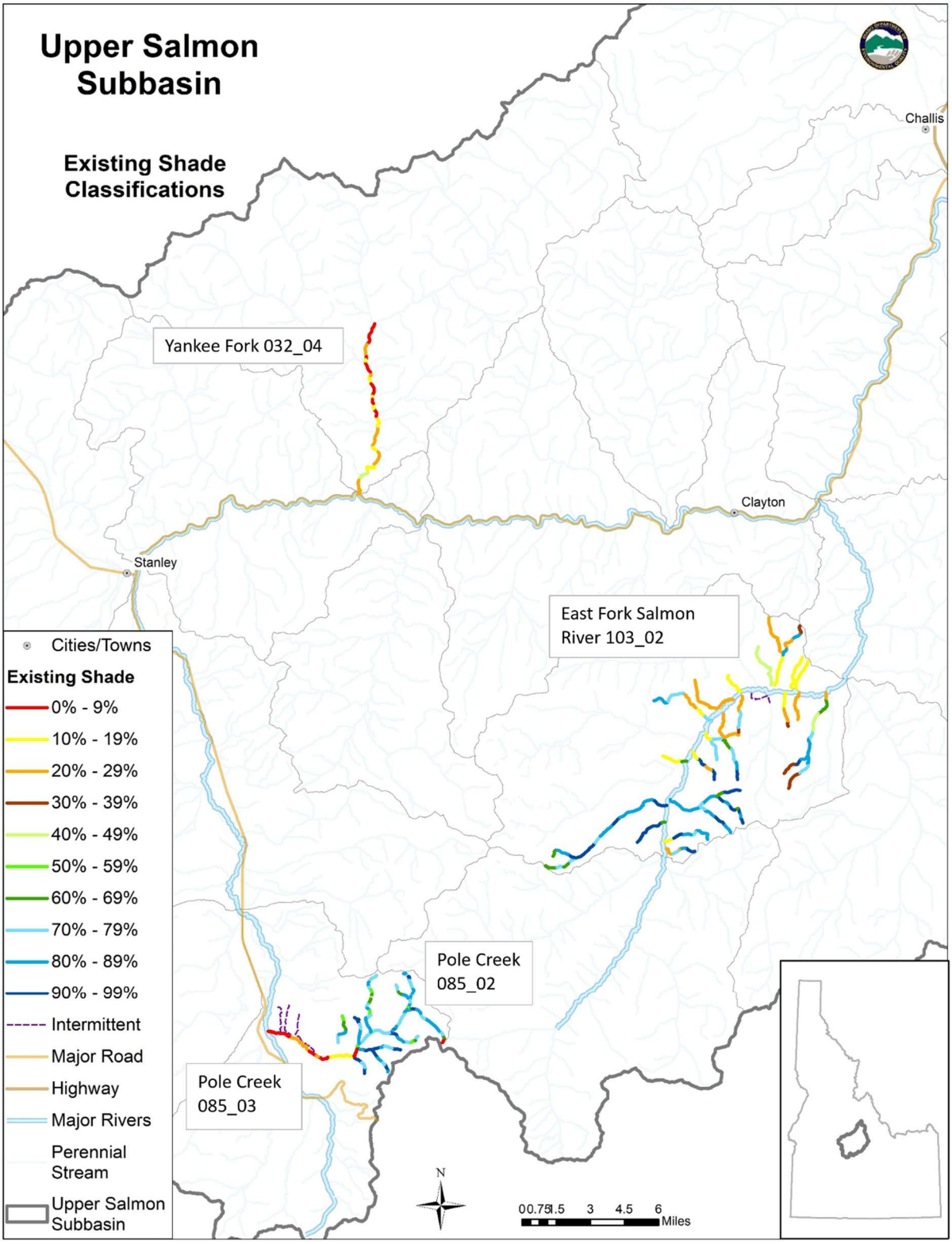


Figure 12. Existing shade estimates for Yankee Fork Creek (ID17060201SL032_04), East Fork Salmon River tributaries (ID17060201SL103_02), and Pole Creek and tributaries (ID17060201SL085_02 and ID17060201SL085_03).

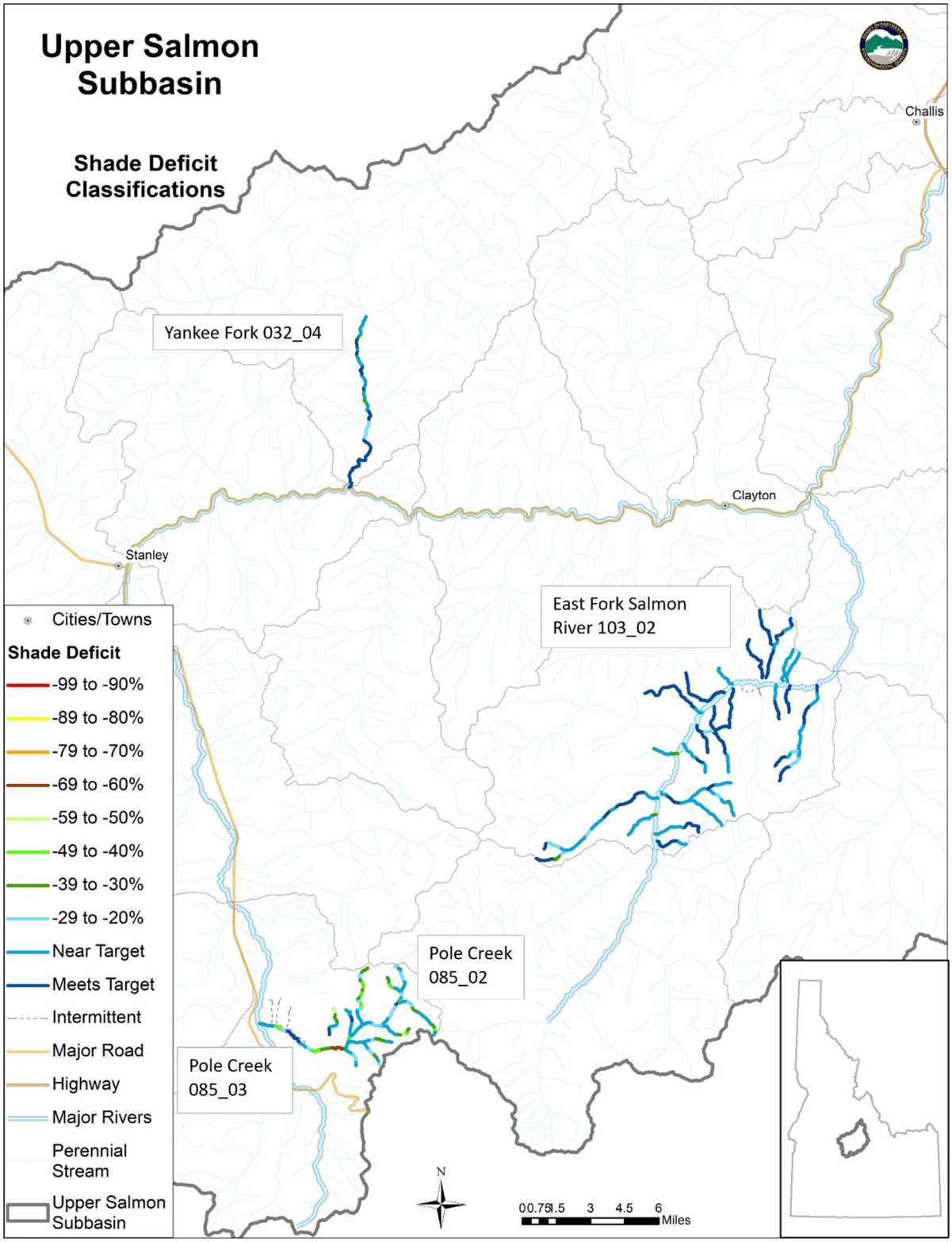


Figure 13. Shade deficiencies (difference between target and existing estimates) for Yankee Fork Creek (ID17060201SL032_04), East Fork Salmon River tributaries (ID17060201SL103_02), and Pole Creek and tributaries (ID17060201SL085_02 and ID17060201SL085_03).

5.4 TMDL Allocations

5.4.1 Load Allocations

Load allocations represent the portion of the load capacity allocated to nonpoint sources. They may be presented by single source type, or the load allocation may include all sources together (DEQ 2009). The nonpoint sources may originate from different land uses or activities, and both current and historical. Considering Pole Creek AU, ID17060201SL085_03, the land surrounding the impaired AU are evenly divided between USFS and private land. The load allocations are aggregated for all nonpoint sources that may affect these streams.

When a temperature TMDL is based on a PNV analysis, the goal is to achieve the same loading as would exist under background conditions. Loading, in this case, refers to the excess solar loading that streams with shade deficiencies receive. Table 19 presents the load allocations for the Pole Creek AU (ID17060201SL085_03) found to exhibit shade deficiencies and temperature exceedances for the salmonid spawning and EPA Bull Trout criterion. The load allocations are assigned to nonpoint source activities as one group that have affected or may affect riparian vegetation and shade.

Table 19. Load allocations based on the total target loads.

Water Body	Assessment Unit Number	Load Allocations (kWh/day)	Excess Load (kWh/day)	Percent Load Reduction Required
Pole Creek - source to mouth	ID17060201SL085_03	590,000	220,000	27%

5.4.2 Wasteload Allocations

The Upper Salmon River subbasin does not have any point sources, or IPDES permits that discharge to a temperature impaired AU, and no wasteload allocations are required.

5.4.3 Storm Water Point Sources

In the Upper Salmon River subbasin, there are two facilities with active IPDES Multi-Sector General Permit coverage: Hecla Mining Company Grouse Creek Unit (IDR053105) and Challis Mine (IDR053102). These entities do not impact the current impaired water bodies in this TMDL, and no wasteload allocations are applicable for storm water activities.

5.4.4 Reserve for Growth

There is no nonpoint reserve for growth in a temperature TMDL. The allocations are based on meeting a natural background riparian canopy condition.

A numeric allocation was not made in this TMDL for future point sources; however, future point sources may discharge to water bodies addressed in this TMDL if the discharge does not have a reasonable potential to cause exceedances of the applicable numeric temperature criteria or the discharger receives a water quality-based effluent limit for temperature.

5.4.5 Margin of Safety

TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load, WLAs, and water quality. EPA guidance states a MOS can be implicit (i.e., incorporated through conservative assumptions) or explicit (i.e., a portion of the load capacity is set aside for a MOS).

The MOS in this TMDL is considered implicit in the design. Because the target is essentially background conditions, loads (shade levels) are allocated to lands adjacent to these streams at natural background levels. Because shade levels are established at natural background or system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the loading analysis. For example, if a particular stream segment has a target shade of 86% based on its vegetation type and natural bankfull width, even if existing shade on that segment were at target level, it would be recorded as 80% in the loading analysis because it falls into the 80% existing shade class. There is an automatic difference of 6%, which could be attributed to the MOS.

5.4.6 Water Diversion

Stream temperature may be affected by diversions of water for water rights purposes. Diversion of flow reduces the amount of water exposed to a given level of solar radiation in the stream channel, which can result in increased water temperature in that channel. Loss of flow in the channel also affects the ability of the near-stream environment to support shade-producing vegetation, resulting in an increase in solar load to the channel.

Although these water temperature effects may occur, nothing in this TMDL supersedes any water appropriation in the affected watershed. Section 101(g), the Wallop Amendment, was added to the CWA as part of the 1977 amendments to address water rights.

It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated, or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

Additionally, Idaho water quality standards indicate the following:

> The adoption of water quality standards and the enforcement of such standards is not intended to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure… (IDAPA 58.01.02.050.01).

In this TMDL, DEQ has not quantified what impact, if any, diversions are having on stream temperature. Water diversions are allowed by state statute, and it is possible for a water body

to be 100% allocated. Diversions notwithstanding, reaching shade targets as discussed in the TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature. This TMDL will lead to cooler water by achieving shade that would be expected under natural conditions and water temperatures resulting from that shade. DEQ encourages local landowners and holders of water rights to voluntarily do whatever they can to help instream flow for the purpose of keeping channel water cooler for aquatic life.

5.4.7 Reasonable Assurance

When TMDLs are developed for water bodies that are impaired by point sources only, the issuance of an IPDES or National Pollutant Discharge Elimination System permit(s) provided reasonable assurance that the wasteload allocation in the TMDL will be achieved. When a TMDL is developed for water bodies impaired by both point and nonpoint sources, the TMDL must provide reasonable assurance that the load allocation will be achieved through nonpoint source controls for the TMDL to be approvable. For water bodies impaired only by nonpoint sources, a demonstration of reasonable assurance is not required (EPA 2002).

While a demonstration of reasonable assurance is not required in this TMDL, the State of Idaho relies on the *Idaho Nonpoint Source Management Plan*, TMDL implementation plans, § 319 grants, and agency partners to promote voluntary implementation of nonpoint source controls that may be needed to meet the reductions required by a TMDL's load allocations. A discussion about these groups is provided in this section, and TMDL implementation strategies are discussed in section 5.5.

The CWA § 319 requires each state to develop and submit a nonpoint source management plan. The *Idaho Nonpoint Source Management Plan 2025-2029* was approved by EPA in February 2025 (DEQ 2025). The plan identifies programs to achieve implementation of nonpoint source BMPs, includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's NPS management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups and watershed advisory groups (WAGs) (Idaho Code § 39-3615). The Salmon Basin Advisory Group (BAG) is the designated WAG for the Upper Salmon River subbasin.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 20.

Table 20. State of Idaho's regulatory authority for nonpoint pollution sources.

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

Idaho uses a voluntary approach to address agricultural nonpoint sources; however, regulatory authority is found in the water quality standards (IDAPA 58.01.02.350.01–03). IDAPA 58.01.02.055.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan) (ISWCC 2015), which provides direction to the agricultural community regarding approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (soil conservation districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, the Ag Plan assigns the local soil conservation districts to assist the landowner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

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

5.5 Implementation Strategies

In accordance with the CWA, DEQ developed one temperature TMDL for the Upper Salmon River subbasin using PNV methodology. The BURP assessments initially confirmed impairments in Pole Creek – source to mouth (ID17060201SL085_03) and temperature data indicated that impairments were due to temperature criteria exceedances. The goal of the TMDL implementation strategy is to provide methods that have an ability to show progress towards reduction of the solar loads affecting Pole Creek AUs and bring about improvement to water quality. Section 5.5.4 outlines an implementation strategy that focuses on vegetation restoration on the most shade deficient segments of Pole Creek – source to mouth (ID17060201SL085_03).

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (section 5.4.7) for the TMDL to meet water quality standards is based on the implementation strategy.

5.5.1 Time Frame

Implementing the temperature TMDL relies on riparian area management practices that will provide a mature canopy cover to shade the stream and prevent excess solar loading. Because implementation depends on mature riparian communities to substantially improve stream temperatures, DEQ believes 10–20 years may be a reasonable amount time for achieving water quality standards. Shade targets will not be achieved all at once. Given their smaller bankfull widths, smaller streams may reach targets sooner than larger streams.

This TMDL does not define an implementation time frame for nonpoint sources; rather, implementation would begin as quickly as possible and continue until the load allocation targets are met. This acknowledges that successfully achieving the TMDL target and allocations will depend in part on voluntary measures and be influenced by available funding, cost-sharing, willing partners, and opportunities for water quality trading.

5.5.2 Approach to Meeting Allocations

There are multiple agencies currently working to acquire the necessary funding for several Pole Creek restoration projects. These implementation projects can show shade progress over time with riparian plantings in strategic areas. The PNV analysis can be repeated to monitor shade trends. This provides valuable feedback for the treatment areas and allows the measurement of progress towards beneficial use attainment.

Since Pole Creek and tributaries are a stronghold for Chinook and Bull Trout, the Governor's Office of Species Conservation have a technical team working to obtain funds through the Bonneville Power Administration for restoration, removals of fish barriers, riparian plantings, and fish monitoring. These projects are in progress and ongoing.

5.5.3 Responsible Parties

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

- Idaho Department of Lands for timber harvest, oil and gas exploration and development, and mining
- ISWCC for grazing and agricultural activities
- Idaho Transportation Department for public road construction
- Idaho State Department of Agriculture for aquaculture
- United States Forest Service for forest resource conservation and management
- DEQ for all other activities

In addition to the designated management agencies, the public—through the WAG or other equivalent organizations or processes—will have opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (e.g., landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those developed with substantial public cooperation and involvement.

5.5.4 Implementation Monitoring Strategy

The objectives of a monitoring strategy are to demonstrate long-term recovery, better understand natural variability, track project and BMP implementation, and track the effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the reasonable assurance component of the TMDL implementation plan. In the Upper Salmon River subbasin, the lead agency for developing the implementation strategy is the ISWCC.

DEQ will collaborate with the ISWCC in developing the implementation plan. The monitoring will provide information on the progress made toward achieving TMDL allocations and water quality standards and will help in the interim evaluation of progress, including developing 5-year reviews and future TMDLs.

The implementation plan will be tracked by accounting for the numbers, types, and locations of projects, BMPs, educational activities, or other actions taken to improve or protect water quality. Implementation plan monitoring will include watershed monitoring and BMP monitoring.

DEQ examined the lack of shade locations in the Pole Creek AU (ID17060201SL085_03). Table 21 provides monitoring locations with percentage deficiencies greater than 30% in the AU and the associated dominant vegetation type. The full existing and target solar load tables are found in Appendix H. Future water quality monitoring should take place after implementation efforts to determine compliance with TMDL targets. By prioritizing implementation efforts at locations with lack of shade at or greater than 30%, streams can have a better overall chance to meet the criteria needed to support beneficial uses. This is recommended since the average lack of shade values that are less than 10% are functioning within the margin of safety and lack of shade values at 10% and 20% are considered near target (DEQ 2009).

Table 21. Water quality monitoring points, segment length in meters, and dominant natural vegetation type provided for implementation planning.

Stream Name/AU Number	Dominant Vegetation Type	Percent Lack of Shade	Latitude	Longitude	Segment Length (m)
Pole Creek ID17060201SL085_03	Aspen/Conifer	64%	43.911199	-114.739208	1716
	Riparian Shrub	35%	43.910653	-114.751071	996
	Riparian Shrub	45%	43.91013	-114.764919	1059
	Riparian Shrub	42%	43.924708	-114.795575	1817

5.5.5 Project Spotlight – Pole Creek Watershed

This section acknowledges the years of restoration projects that have improved the Pole Creek watershed from its historically altered state. The Pole Creek Rehabilitation Project is an ongoing multiagency and landowner effort that shows how collaboration can provide better water quality, quantity, support native fish, and improve the overall watershed health.

The full story with photos and video is found at *Pole Creek Conservation Success Story – Idaho Rangeland Resource Commission* (idrange.org).

Pole Creek Rehabilitation Project



CSWCD - The Pole Creek Project was a multi-year, multi-agency project that took place in 2014 through 2016. The project goal was to facilitate a restored hydrologic cycle within Pole Creek with near-natural peak and base flows. During the late-summer irrigation period, this project reduced the trend from 75 percent of flows being removed from Pole Creek to 75 percent of flows remaining within Pole Creek. Long-term agreements were developed with landowners and the Idaho Water Board to secure and maintain at least 15 cubic feet per second (cfs) instream and ensure resiliency and sustainability of the system. CSWCD installed infrastructure to accommodate smaller screen sizes and water transaction on this “source switch” project.

The completion of the Pole Creek Project included a conversion from hydropower to electric power for the sprinkler irrigation system, which resulted in an immediate reduction of 6 cfs that would no longer be withdrawn from Pole Creek. This was tested for several years prior to the project with a gas generator at the hydro plant.

Reconfiguring other existing irrigation systems was the next step in reducing irrigation withdrawals from Pole Creek. Two wells were drilled to supplement surface water with groundwater to provide additional instream flows during the late season. As a result, an additional 8 cfs will not be withdrawn from the creek. The outcome for this project resulted in a total of at least 15 cfs that will remain in Pole Creek. This is a considerable flow that extends down the length of Pole Creek 4.5 miles through the private property and added another 8 miles of this flow into the headwaters of the Salmon River. Pole Creek is one of the major tributaries to the Salmon River and would naturally contribute the majority of the flow at the confluence of Pole Creek to the Salmon River during a typical summer day.

This project showcased the cooperation and collaboration that leveraged additional components toward the restoration of this 4.5-mile stretch of Pole Creek. Additional leveraged components included:

- The installation of a fish screen by IDFG Screen Shop

- Instream with IDWR water transaction program 102g-17 on water rights for up to 22 cfs in contract with landowners from 2017 until 2035.
- Test wells were funded via a Custer SWCD contract with BOR
- BOR also provided design assistance to the Shoshone-Bannock Tribes for the bridge that replaced a passage barrier culvert.
- Pacific Coast Salmon Recovery funds and NRCS funds were used in combination with Bonneville Power Administration to implement the irrigation component.
- NRCS provided design and funding for the irrigation project and the stock-water system
- Off-stream stock water was installed to allow full exclusion of Pole Creek through the private property.
- CSWCD is currently in the design phase of a stream complexity project on 1.8 miles of Pole Creek and intends to implement the Phase I in 2024.

Additional actions taken on private property by other partners, independently but in cooperation with this project, included a riparian fence that excluded livestock in an effort to allow native plants to regenerate along the stream bank. The Shoshone-Bannock Tribes removed a passage barrier culvert with a fish-passable bridge and reinstated a historic meander improving stream sinuosity. Landowners provided more than $350,000 in cash and in-kind contributions. IDFG and the Shoshone-Bannock Tribes conduct ongoing fish monitoring, IDWR conducts flow monitoring, and CSWCD conducts annual compliance monitoring.

Adjustments: Existing Pole Creek project flow will help encourage adult spawners to move higher in the system to spawn. The new strategy of releasing smolts at the County Line Bridge and adults at the County Line Bridge or potentially to the bridge on Pole Creek will increase the importance of both the flow improvements and the proposed habitat project on Pole Creek. Redds were found in Pole Creek during the 2023 monitoring season.

Pole Meadows - 2018: This work, completed on the Sawtooth National Recreation Area, implemented passage and stream restoration from the private property to the headwaters of Pole Creek. The Pole Meadows project, which returned streamflow directly to the quality habitat of the historic channel while restoring vegetative potential to the meadow area, was implemented to reverse the historic resource impact of sheep grazing. The project significantly reduced the sediment contributing to the stream every spring as the soft soil from the meadow washed into the creek. The channel had relocated in high water and due to beaver activity, and flows were reintroduced back to the historic channel that had established vegetative cover to prevent and reduce sedimentation. The Pole Meadows project was the last remaining component to complete the full restoration of the upper reach of Pole Creek.

Pole Creek Summary: The efforts made on this full reach of Pole Creek is an excellent example of how all partners work together towards a common goal. The participation of the private landowners involved in this project helped set a standard for future opportunities to complete this type of conservation and fish recovery projects. In summary, this project added 4.5 miles of stream that will have sufficient water for anadromous Salmonid and increased flows in Pole Creek by 15 cfs. This included culvert removal, trail modifications, and other land use impacts. Additional projects were implemented on the federal land to address the full Pole Creek

drainage. The completion of the Pole Creek projects, in addition to full reach planning, was a unique opportunity to accomplish improvements on the full length of Pole Creek to the Salmon River.



Credit: Life on the Range. Full story can be found here:

Pole Creek Conservation Success Story – Idaho Rangeland Resource Commission (idrange.org).

6 Conclusions

In this Upper Salmon River subbasin assessment and TMDL, DEQ evaluated the most recent water quality data related to 7 AUs on the § 303(d)-list (Category 5), 1 fully supporting AU (Category 2), and 20 AUs with EPA-approved TMDLs (Category 4a). This resulted in one temperature TMDL, and seven delisting recommendations.

DEQ developed one temperature TMDL in the Upper Salmon River subbasin for Pole Creek – source to mouth, AU ID17060201SL085_03 (Table 22). This assessment unit had temperature exceedances for the EPA Bull Trout criterion from instream temperature data collected during 2021 (Appendix C). The TMDL was developed from the PNV methodology described in section 5.

Table 22. Water body for which a temperature TMDL was developed.

Water Body	Assessment Unit Number	Load Allocations	Total Existing Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)			
Pole Creek - source to mouth	ID17060201SL085_03	590,000	810,000	220,000 (27%)	-26%

Table 23 reflects DEQ's BURP assessments, continuous stream temperature monitoring, sediment monitoring, along with external RMRS and USGS data that were used to summarize and justify the assessment outcomes for the § 303(d)-listed AUs. There is one delisting recommendation for Basin Creek – East Basin Creek to mouth ID17060201SL048_03. The 20 new listings reported in the 2024 Integrated Report will be fully addressed during the next subbasin assessment cycle.

Table 23.Summary of assessment outcomes for § 303(d)-listed assessment units.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Morgan Creek - West Creek to mouth	ID17060201SL002_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Morgan Creek - source to West Creek	ID17060201SL003_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
West Creek - Blowfly Creek to mouth	ID17060201SL004_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Eddy Creek - source to mouth	ID17060201SL010_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bear Creek - source to mouth	ID17060201SL011_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Challis Creek - source to Bear Creek	ID17060201SL012_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Mill Creek - 3rd order	ID17060201SL013_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bayhorse Creek - source to mouth	ID17060201SL017_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Salmon River – Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Kinnikinic Creek - source to mouth	ID17060201SL020_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Bruno Creek - source to mouth	ID17060201SL026_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Thompson Creek - source to mouth	ID17060201SL028_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Yankee Fork Creek – Jordan Creek to mouth	ID17060201SL032_04	Temperature	No	No change – retain in Category 5	PNV analysis was completed for temperature; however, results indicate no shade deficiencies.
Jordan Creek - source to Unnamed Tributary	ID17060201SL042_03	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Basin Creek – East Basin Creek to mouth (5, 4c)	ID17060201SL048_03	Sedimentation/ Siltation	No	Remove from Category 5 and retain in Category 4c	BURP assessments and McNeil results indicate sediment is not impairing beneficial uses. Retain in Category 4c for Physical Substrate Habitat Alterations since sources of sediment were from natural causes.
Salmon River	ID17060201SL068_05	Temperature	No	No change – retain in Category 5	AU is a large river and appropriate methods for developing load allocations are needed.
Pole Creek – source to mouth	ID17060201SL085_03	Combined Biota/Habitat Bioassessments	Yes	Retain in Category 5 for Combined Biota and add to Category 4a for Temperature	Temperature criteria exceedances were documented and PNV analysis was used to develop the TMDL.
Williams Creek – source to mouth	ID17060201SL089_02	Combined Biota/Habitat Bioassessments	No	No change – retain in Category 5	Additional BURP assessment was completed in 2023. Results will help determine if changes to grazing allotments have benefited the AU.
Big Casino Creek - source to mouth	ID17060201SL092_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
East Fork Salmon River – Herd Creek to mouth	ID17060201SL102_05	Temperature	No	No change – retain in Category 5	AU is a large river and appropriate methods for developing load allocations are needed.
East Fork Salmon River – Germania Creek to Herd Creek	ID17060201SL103_02	Combined Biota/Habitat Bioassessments	No	Retain in Category 5 for Combined Biota and add Temperature as pollutant	PNV was completed for temperature; however, results indicate no shade deficiencies.
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Big Boulder Creek - source to mouth	ID17060201SL105_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Herd Creek-confluence of West Fork Herd Creek and East Pass	ID17060201SL118_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Road Creek - Corral Basin Creek to mouth	ID17060201SL124_04	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Road Creek - source to Corral Basin Creek	ID17060201SL125_02	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle
Corral Basin Creek - source to mouth	ID17060201SL127_03	Temperature	No	Retain in Category 5	New listings as of 2024 Integrated Reporting cycle

TMDLs developed in 2003 and 2016 were reviewed as a part of DEQ's 5-year review strategy (Table 24). Each AU was evaluated for any recent data, land use change, BMPs, and restoration projects. This resulted in five delisting recommendations from the 5-year review.

Table 24.Summary of assessment outcomes for 5-year review assessment units.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	Temperature	Retain in Category 4a	New temperature data indicates continues exceedances
Challis Creek - Darling Creek to mouth (2 TMDLs)	ID17060201SL007_04	Sedimentation/Siltation	Retain in Category 4a	No new data
		Temperature	Retain in Category 4a	No new data
Challis Creek - Bear Creek to Darling Creek (2 TMDLs)	ID17060201SL009_03	Sedimentation/Siltation	Delist from Category 4a for sediment; retain in Category 4a for temperature	Sediment target goals are achieved
		Temperature	Retain in Category 4a	No new data
Challis Creek - Bear Creek to Darling Creek (2 TMDLs)	ID17060201SL009_04	Sedimentation/Siltation	Retain in Category 4a	No new data
		Temperature	Retain in Category 4a	No new data
Salmon River - Garden Creek to Pennal Gulch	ID17060201SL014_06	Temperature	Retain in Category 4a	No new data
Salmon River - East Fork Salmon River to Garden Creek	ID17060201SL016_06	Temperature	Retain in Category 4a	New temperature data indicates continues exceedances
Salmon River - Paasasikwana Naokwaide to East Fork Salmon River	ID17060201SL019_05	Temperature	Retain in Category 4a	New temperature data indicates continues exceedances

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Paasasikwana Naokwaide - Cash Creek to mouth	ID17060201SL021_04	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide Tributaries	ID17060201SL023_02	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide- Willow Creek to Martin Creek	ID17060201SL023_03	Temperature	Retain in Category 4a	No new data
Paasasikwana Naokwaide - Martin Creek to Cash Creek	ID17060201SL023_04	Temperature	Retain in Category 4a	No new data
Aspen Creek - source to mouth	ID17060201SL024_02	Temperature	Delist from Category 4a and move into Category 3	No temperature data for AU; listed in error
Salmon River - Thompson Creek to Paasasikwana Naokwaide	ID17060201SL027_05	Temperature	Retain in Category 4a	No new data
Salmon River - Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	Temperature	Retain in Category 4a	No new data
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05	Temperature	Retain in Category 4a	New temperature data indicates continues exceedances
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05	Temperature	Retain in Category 4a	No new data
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04	Sedimentation/Siltation	Delist from Category 4a; retain in Category 4c for Flow Regime Modification	Cause of impairment due to pollution, not a pollutant

Following the public comment period, comments and DEQ responses will be included in Appendix I, and a distribution list will be included in **Error! Reference source not found.**.

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GIS Coverages

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EPA (US Environmental Protection Agency). 2006. National Hydrography Dataset 1:100,000 flowlines, streams, rivers, canals, connectors, artificial paths. Spatial geometry, water flow model, and linear referencing measures for locating the network.

Esri, Garmin, USGS, NPS. World Terrain Reference Map was compiled from a variety of best available sources, including the US Geological Survey, National Park Service, Garmin, and ESRI. Data Source: Basemaps "Terrain with Labels".

IDWR (Idaho Department of Water Resources). 2023. "Licensed or Decreed Points of Diversion (IDWR Water Rights)." Developed 5/31/2023 by IDWR Water Rights or Adjudication Section. Categories summarized by DEQ for this TMDL analysis.

USGS (United States Geological Survey). 2022. "Idaho Watershed Boundary Dataset." Polygons are attributed with hydrologic unit codes for 4th-level subbasins, 5th-level watersheds, 6th-level watershed, name, and size with other attributes.

Glossary

§ 303(d)

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

Assessment Unit (AU)

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Exceedance

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

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (DEQ 2016a).

Load Allocation (LA)

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

Load

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

Load Capacity (LC)

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

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the

	calculations and/or models). The margin of safety is not allocated to any sources of pollution.
Nonpoint Source	A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (DEQ 2016a).
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)	The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.
Water Quality Standards	State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Appendix A. Beneficial Uses

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

Existing Uses

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

Designated Uses

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

Undesignated Surface Waters and Presumed Use Protection

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

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

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

Appendix B. Data Sources

Table B1. Data sources for Upper Salmon River subbasin assessment.

Water Body/Area	Data Source	Type of Data	Collection Date
Valley Creek, Yankee Fork Creek, Salmon River, Thompson Creek, Paasasikwana Naokwaide Creek	USGS Water Data for the Nation	Flow and Temperature	1911–present
Upper Salmon River subbasin	DEQ Beneficial Use Reconnaissance Program	Bioassessments	1995–2021
Challis Creek, Warm Spring Creek	DEQ – Idaho Falls Regional Office	Sediment – SEIs and McNeil Core Samples	2001–2021
Challis Creek	Idaho Soil and Water Conservation Commission	Implementation BMPs	2007
Upper Salmon River subbasin	Custer Soil and Water Conservation District	BMPs and Restoration Projects	2007–present
Upper Salmon River subbasin	DEQ – Idaho Falls Regional Office and Technical Services State Office	Temperature and PNV Analyses	2014–present
Upper Salmon River subbasin	USFS – Rocky Mountain Research Station	Temperature	2016–2022
Upper Salmon River subbasin	US Census	Population and Land Ownership	2016–present
Pole Creek	DEQ – Idaho Falls Regional Office	Temperature	2021–2022

Appendix C. Stream Temperature Data

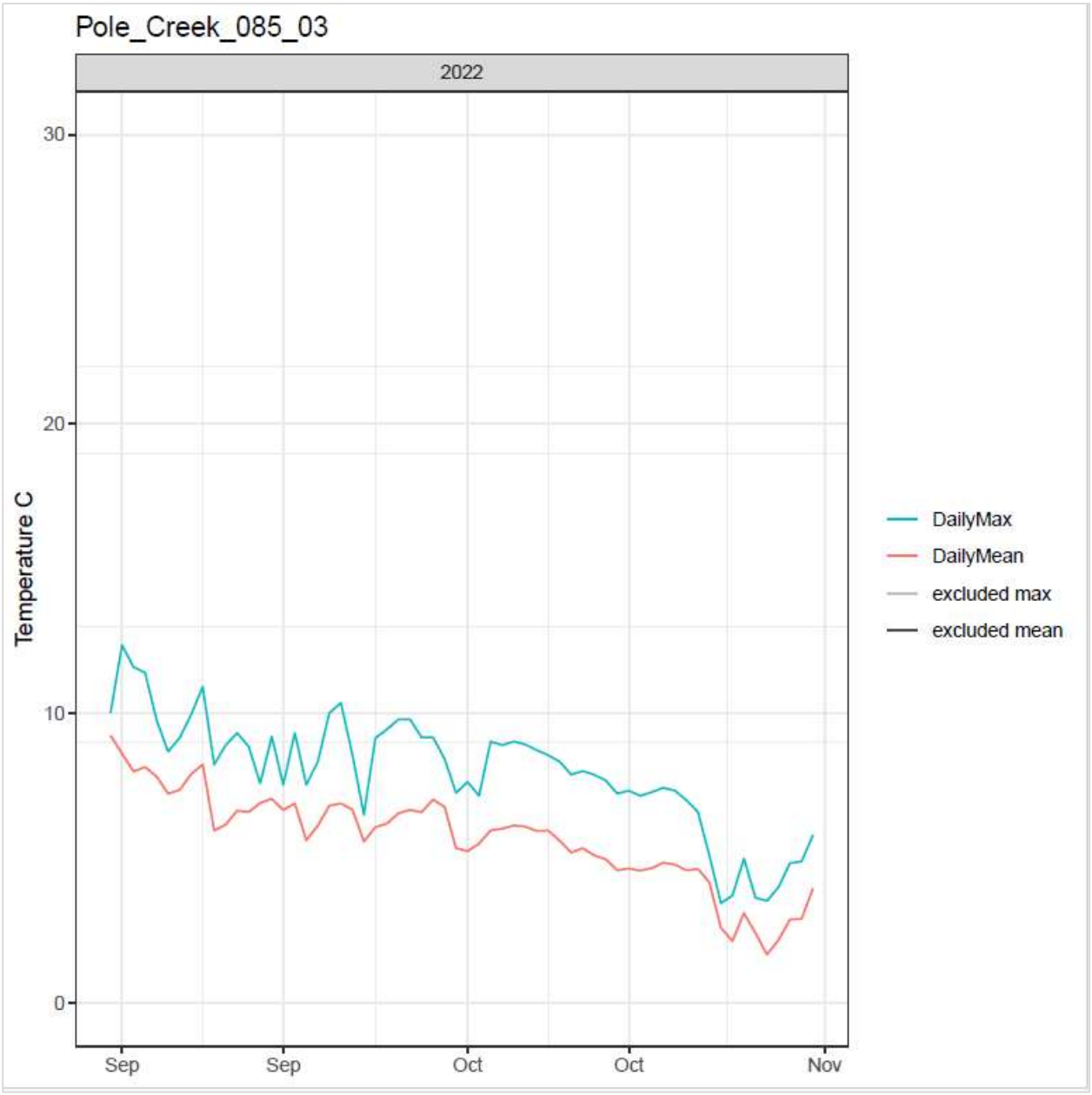


Figure C1. Temperature data for Pole Creek – source to mouth (ID17060201SL085_03) – Category 5 for Combined Biota/Habitat Bioassessments.

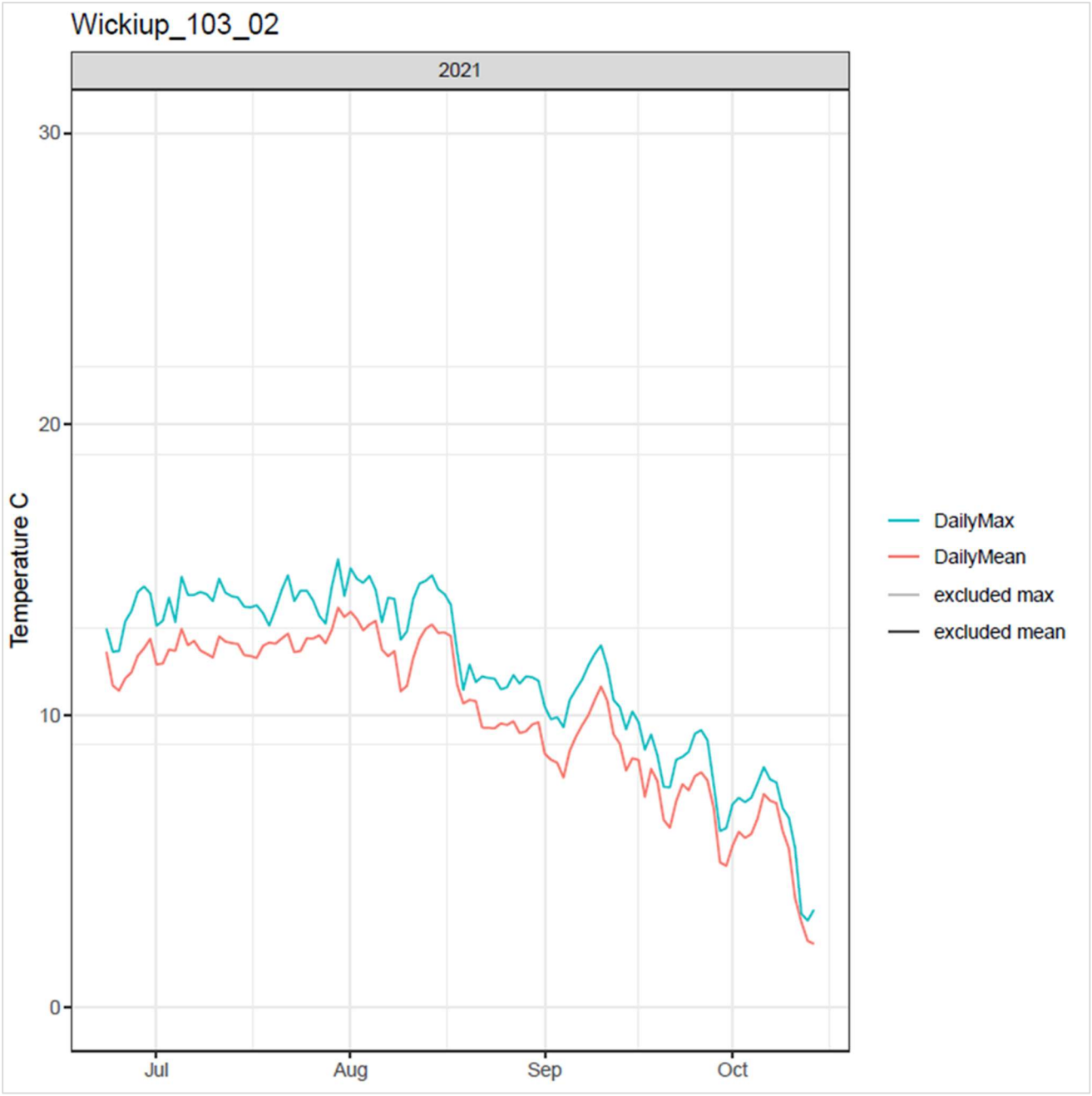


Figure C2. Temperature data for East Fork Salmon River - Germania Creek to Herd Creek (ID17060201SL103_02) – Category 5 for Combined Biota/Habitat Bioassessments

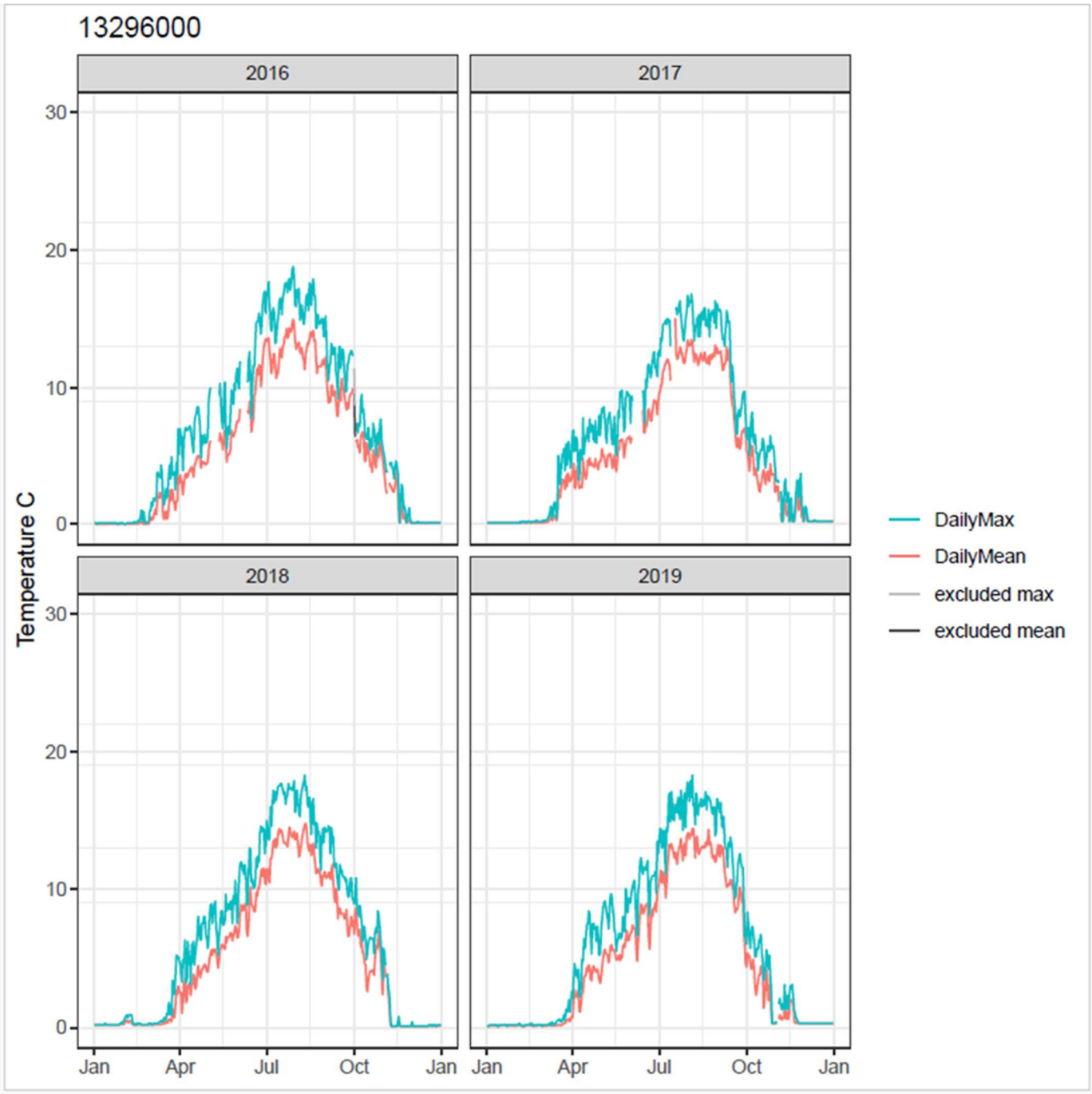


Figure C3. Temperature data for Yankee Fork Creek temperature data from USGS for 2016-2019 (gage station 13269000).

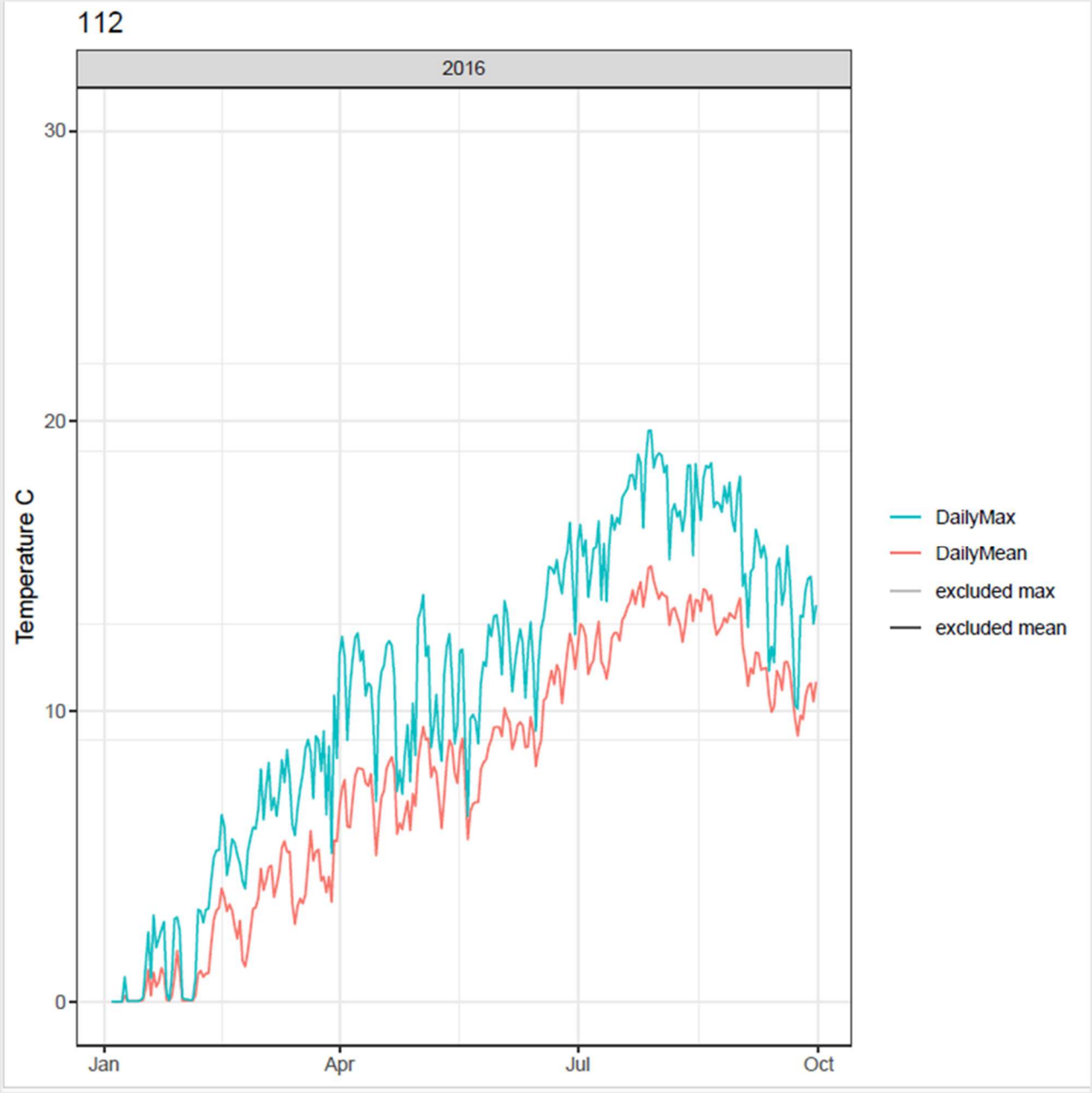


Figure C4. Temperature data from RMRS for 2016 (station 112).

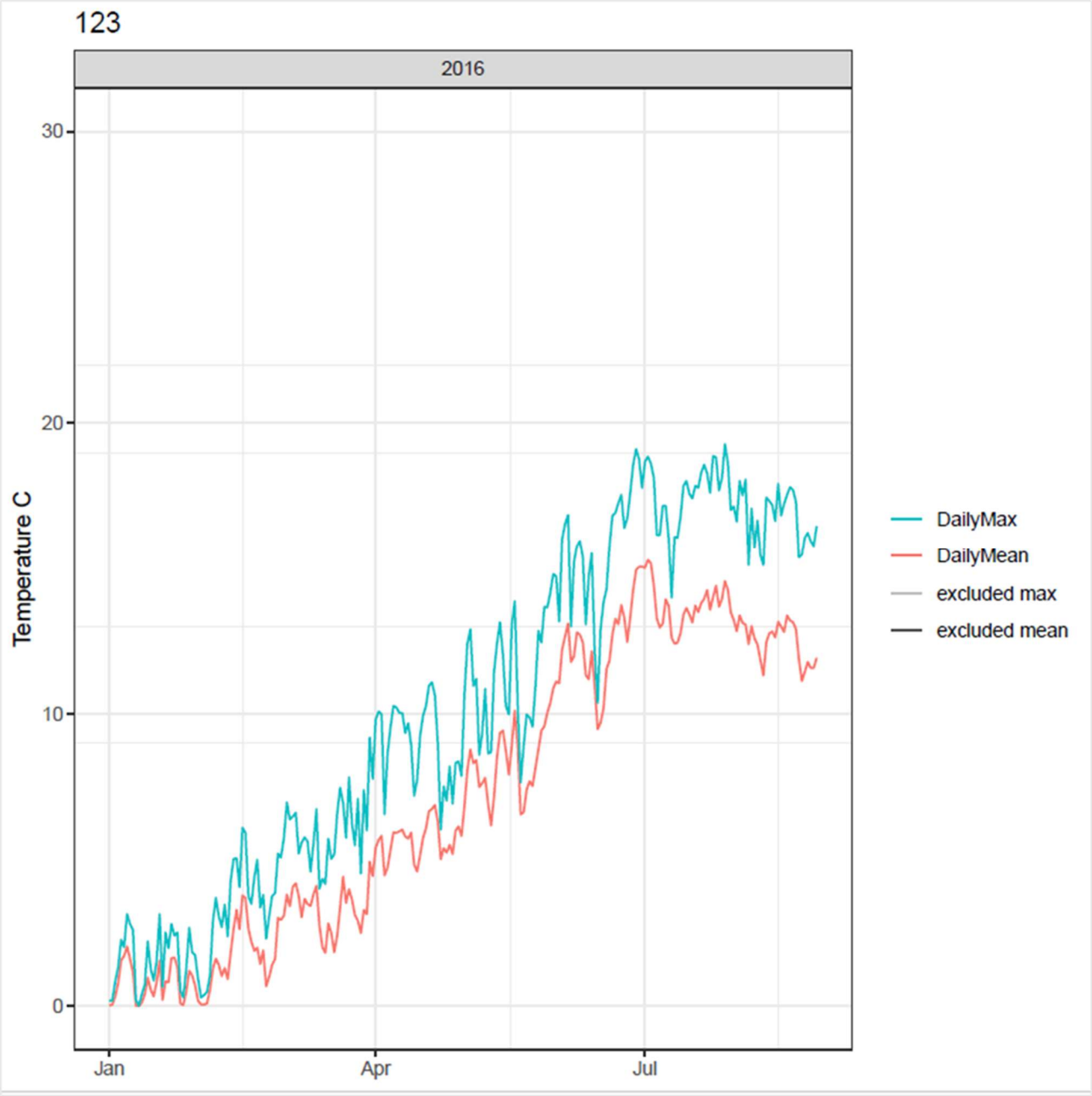


Figure C5. Temperature data from RMRS for 2016 (station 123).

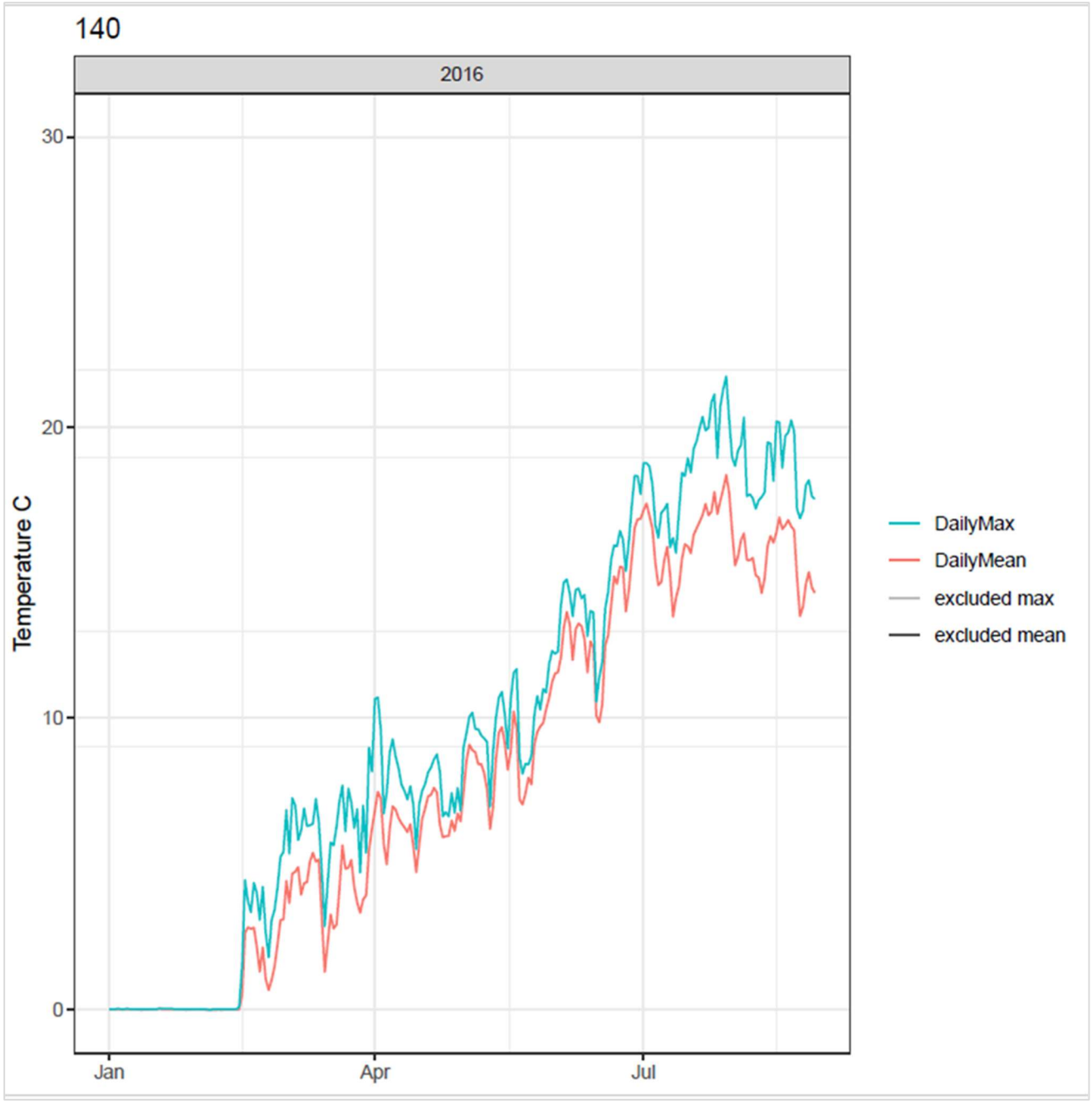


Figure C6. Temperature data from RMRS for 2016 (station 140).

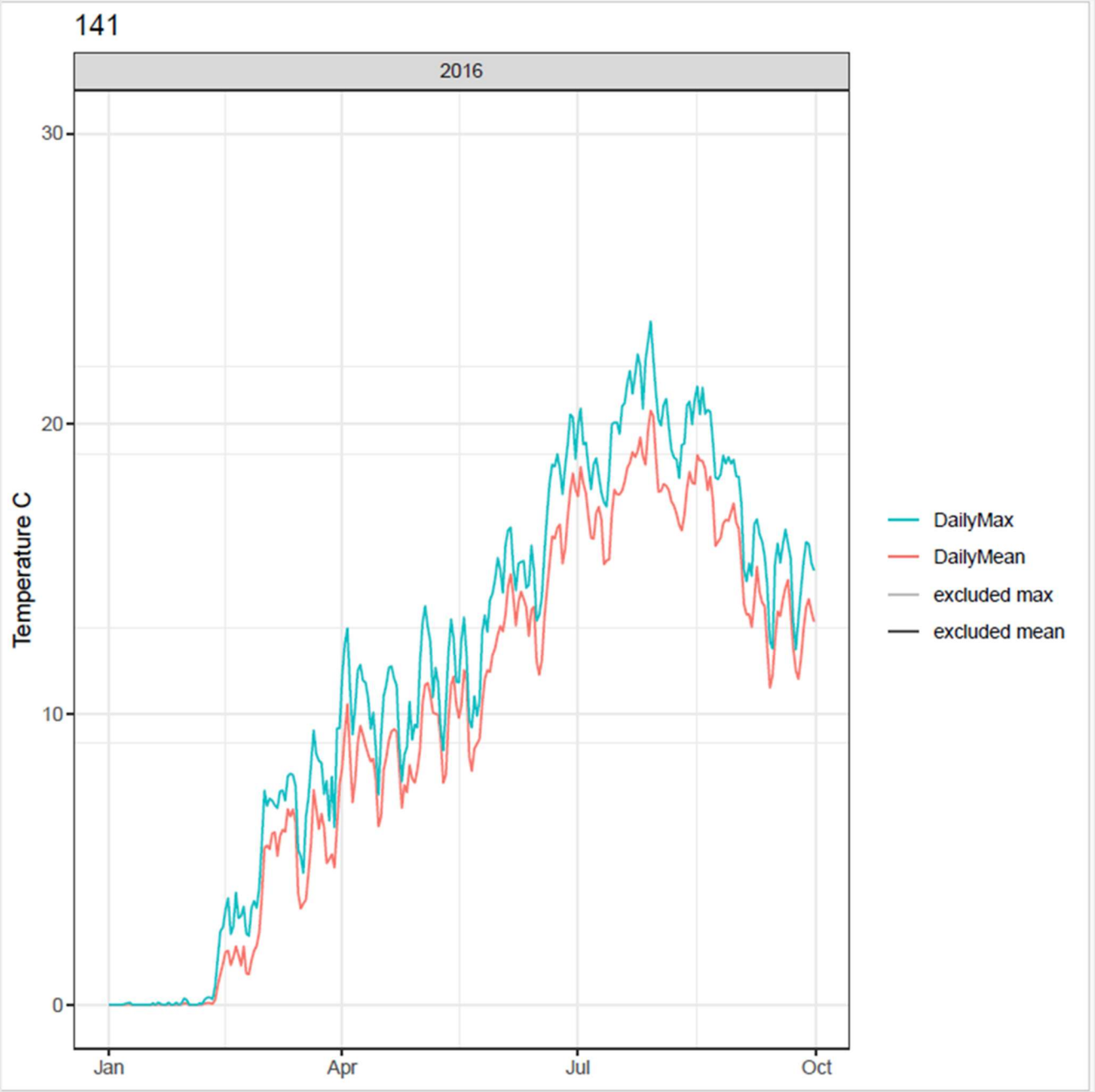


Figure C7. Temperature data from RMRS for 2016 (station 141).

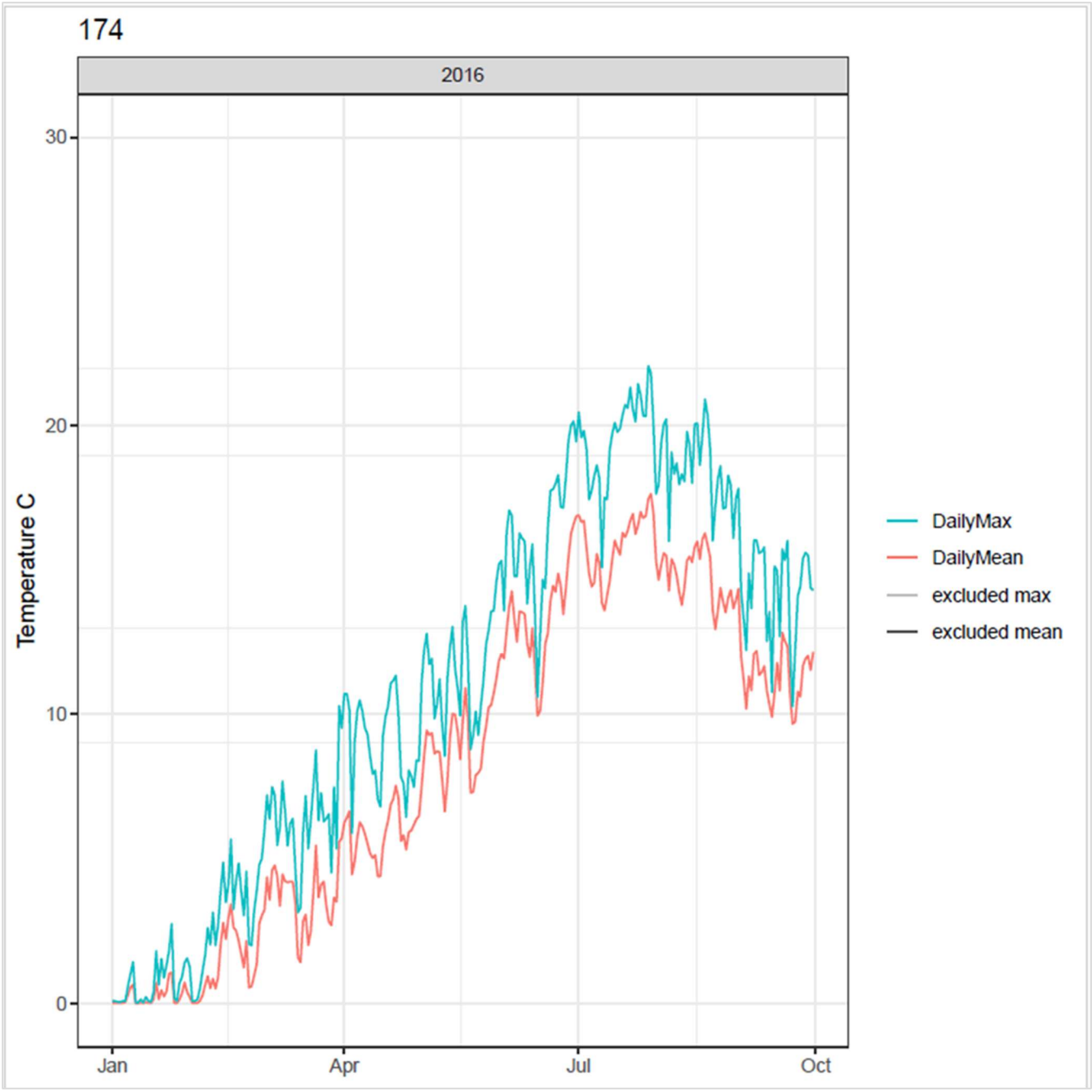


Figure C8. Temperature data from RMRS for 2016 (station 174).

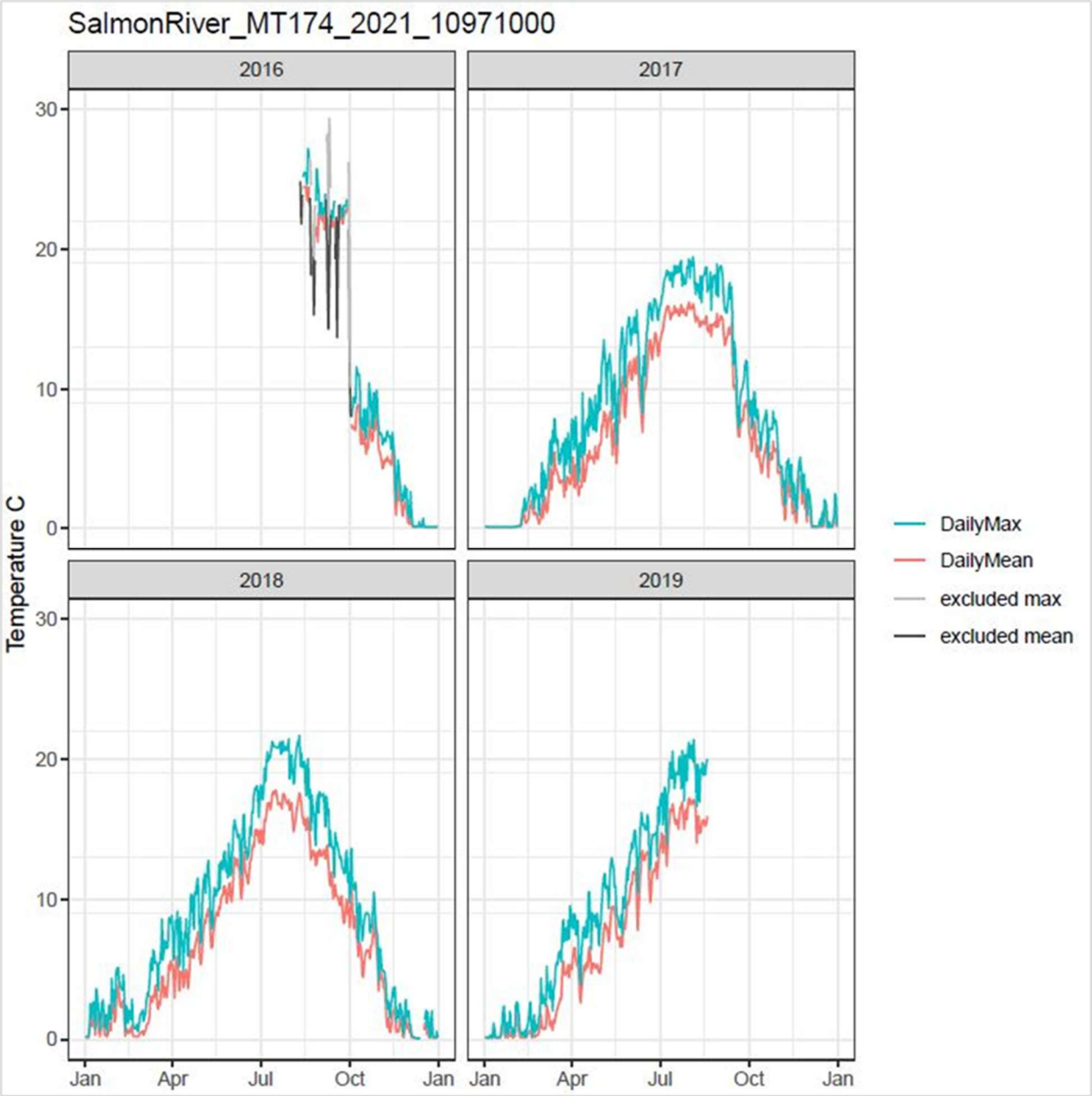


Figure C9. Temperature data from RMRS for 2016-2019 (station 174).

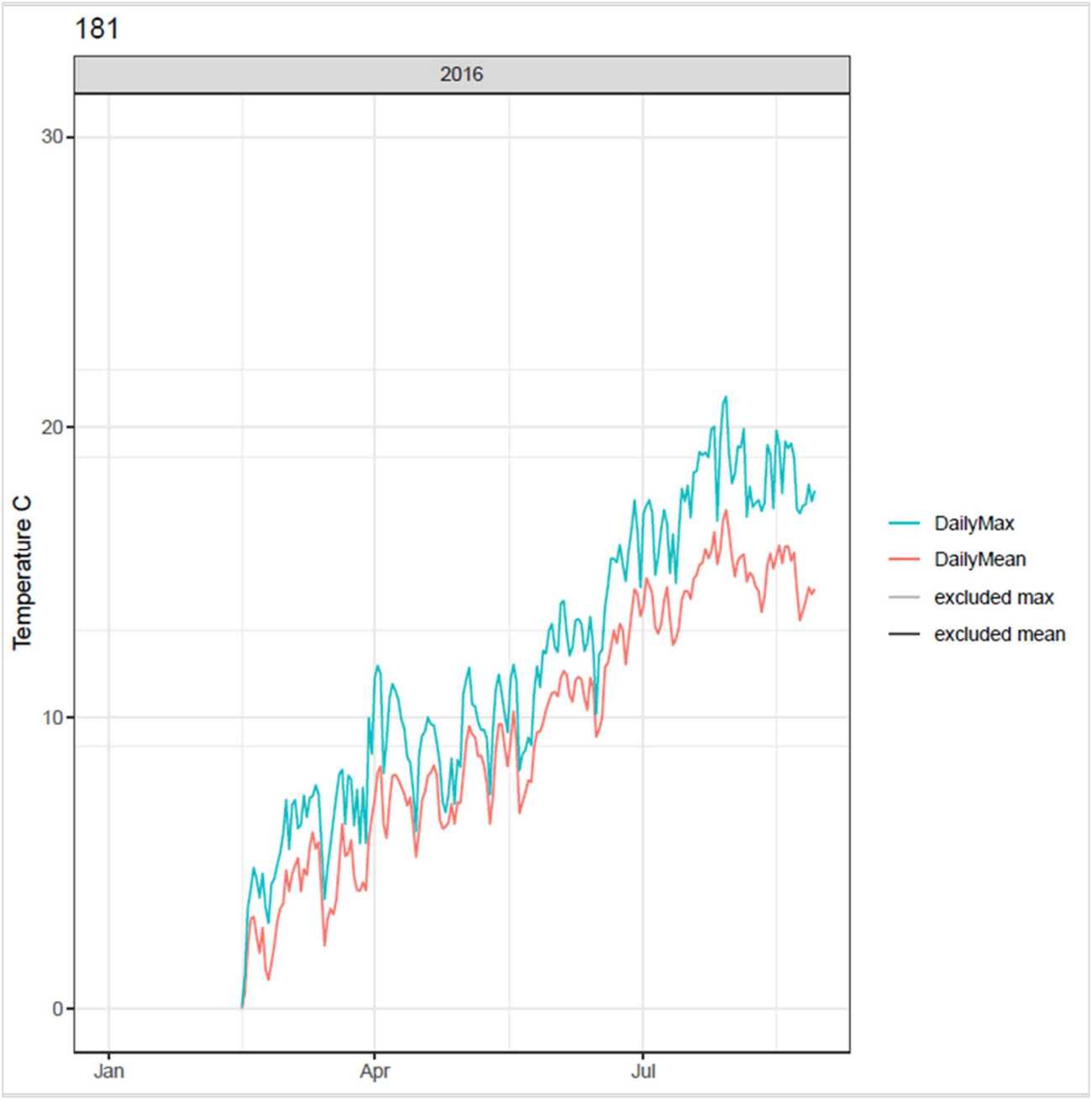


Figure C10. Temperature data from RMRS for 2016 (station 181).

Appendix D. McNeil Core Samples Field Sheets

Stream:	Basin Creek - ID17060201SL048_03					
Date (mm/dd/yyyy):	8/18/2021					
Site Description:						
Lat/Lon:	44.26988 / - 113.83078					
Lat/Lon accuracy:		meters				
Datum:	WGS84					
Samping Event ID	2021 TMDL					
Personnel:	D. Shore, C. Sandow, A. Laib, D. Locke, M. Barnes					
Rosgen Channel:						
Habitat Unit						
Reach Gradient (%):						
Geology (Q, G, V, or S):						
Target Species:						
Flow (cfs):						
Surrounding Land Use:						
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		650	0	860		
25 mm (1.0")		2135	1420	1160		
12.5 mm (0.5")		710	1360	540		
6.34 mm (0.25")		530	830	390		
1.0 - 0.25" Subtotal		3375	3610	2090		
4.75 mm (0.187")		285	205	190		
2.36 mm (0.0937")		260	620	400		
850 µm (0.0331")		1040	1240	690		
212 µm (0.0083")		510	740	570		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		41	24	34		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		2136	2829	1884		
Sample total w/o 2.5" particles		5511	6439	3974	Mean	STDDEV
% fines w/o 2.5" particles		0.387588459	0.439353937	0.47408153	0.433675	0.035538
Sample total w/ 2.5" particles		6161	6439	4834	Mean	STDDEV
% fines w/ 2.5" particles		0.346696965	0.439353937	0.389739346	0.39193	0.037859

Figure D1. McNeil Core sampling field data for Basin Creek (ID17060201SL048_03).

Stream:	Challis Creek ID17060201SL009_03					
Date (mm/dd/yyyy):	8/16/2021					
Site Description:	BLM access along Challis Creek Rd					
Lat/Lon:	44.57335 / 114.306233					
Lat/Lon accuracy:		meters				
Datum:	WGS84					
Samping Event ID	2021 TMDL					
Personnel:	D. Shore, C. Sandow, A. Laib, A. Bell, D. Locke, M. Barnes					
Rosgen Channel:						
Habitat Unit						
Reach Gradient (%):						
Geology (Q, G, V, or S):						
Target Species:						
Flow (cfs):						
Surrounding Land Use:						
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		2620	1690	2510		
25 mm (1.0")		2970	2055	3280		
12.5 mm (0.5")		490	640	480		
6.34 mm (0.25")		170	280	490		
1.0 - 0.25" Subtotal		3630	2975	4250		
4.75 mm (0.187")		5	130	140		
2.36 mm (0.0937")		0	200	335		
850 µm (0.0331")		150	480	860		
212 µm (0.0083")		97	240	210		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		49	20	25		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		301	1070	1570		
Sample total w/o 2.5" particles		3931	4045	5820	Mean	STDDEV
% fines w/o 2.5" particles		0.076570847	0.264524104	0.26975945	0.203618	0.089861
Sample total w/ 2.5" particles		6551	5735	8330	Mean	STDDEV
% fines w/ 2.5" particles		0.045947184	0.18657367	0.18847539	0.140332	0.066745

Figure D2. McNeil Core sampling field data for Challis Creek (ID17060201SL009_03).

Appendix E. Streambank Erosion Inventories

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Challis Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL009_03	***Upstream N***	44.569400
Segment Inventoried:	Bear Creek to Darling Creek	***W***	-114.362070
Total Reach:	4.94 miles	***Downstream N***	44.572830
Date Collected:	16-Aug-21	***W***	-114.354260
Field Crew:	D. Shore, A. Laib, C. Sandow , A. Bell	**Notes:**	
Data Reduced By:	C. Windsor		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flow path distance)	2883.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	26083	ft	Total Reach
Estimated Distance inventoried	5766.00	ft	"
Total Erosive Bank Length	215.72	ft	"
Percent Erosive Bank	3.7	%	"
Eroding Area (AE)	534.49	ft^2	"
Lateral Recession Rate (RLR)	0.1275		"
Bank Erosion (E)	2.90	tons/year	"
Total Bank Erosion Rate (ER)	5.30	tons/mile/year	Reach and Segment
Total Bank Erosion	26.20	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1.5	0.5
Bank Stability Condition (0 to 3)	1.5	0.5
Bank Cover/Vegetation(0 to 3)	1	0.5
Lateral Channel Stability (0 to 3)	2	0.5
Channel Bottom Stability (0 to 2)	1	0.5
In-Channel Deposition (-1 to 1)	0.25	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	7.25	2.5
Lateral Recession Rate (RLR) (ft/yr)	**0.1275**	**0.035**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	2857.31	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	4.25	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	7.78	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	38.45	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
5.3	**26.2**	**7.8**	**38.5**	**No**	**4**

Percent Erosion Reduction (%)	**-28**
Total Erosion Reduction (tons/yr)	**-8**

Figure E1. SEI worksheet for Challis Creek (ID17060201SL009_03).

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Williams Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL089_02	***Upstream N***	44.083890
Segment Inventoried:	source to mouth	***W***	-114.828670
Total Reach:	3.78 miles = 19958 ft	***Downstream N***	44.085930
Date Collected:	19-Aug-21	***W***	-114.830930
Field Crew:	D. Shore, C. Sandow , D. Locke, Miria	**Notes:**	Channel slope: 0.03m Ave Bankfull Width: 1m
Data Reduced By:	C. Windsor		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flow path distance)	1016.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	19958	ft	Total Reach
Estimated Distance inventoried	2032.00	ft	"
Total Erosive Bank Length	323.17	ft	"
Percent Erosive Bank	15.9	%	"
Eroding Area (AE)	253.64	ft^2	"
Lateral Recession Rate (RLR)	0.0425		"
Bank Erosion (E)	0.46	tons/year	"
Total Bank Erosion Rate (ER)	2.38	tons/mile/year	Reach and Segment
Total Bank Erosion	9.00	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	0.25	0.25
Bank Cover/Vegetation(0 to 3)	0.25	0.25
Lateral Channel Stability (0 to 3)	0.5	0.5
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	0.25	0.25
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3.25	3.25
Lateral Recession Rate (RLR) (ft/yr)	**0.0425**	**0.0425**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	318.97	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.58	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	2.99	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	11.32	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
2.4	**9.0**	**3.0**	**11.3**	**No**	**1**

Percent Erosion Reduction (%)	**-12**
Total Erosion Reduction (tons/yr)	**-1**

Figure E2. SEI worksheet for Williams Creek (ID17060201SL089_02).

Appendix F. BURP Macroinvertebrate Pollutant Tolerance/Stressor Indicators

The following summaries were referenced from the EcoAnalysts report, 2023 *BURP Macroinvertebrate Pollutant Tolerance/Stressor Indicator Narrative* (EcoAnalysts, Inc. 2023) for AUs surveyed in 2021 by the DEQ's State Office BURP staff.

Twelvemile Creek (ID17060201SL038_02) – BURP site 2021SSTOA037

- A Stressor Analysis report completed by EcoAnalysts concluded that the poor SMI score was due to the limited amount of taxa present in the sample. The low SMI was not backed up by the benthic community which, although depauperate, contained intolerant taxa normally associated with good quality streams.
- In addition to the EcoAnalysts report, comments from the crew noted a recent blowout and evidence of scouring. This stream 'fails' the BURP multi-metric index because it is atypical in comparison to the types of streams used to develop the index. As a higher gradient 1st order stream that endures flashy flows, it is existing in a natural condition and will remain Fully Supporting for Cold Water Aquatic Life.

Salmon River (ID17060201SL081_03) – BURP site 2021SSTOA022

- received a failing BURP score (1.67). However, the Cold Water Aquatic Life use will remain Fully Supporting.
- Sculpin were not vouchered for identification to species, bringing down the SFI2 and changing the overall score from a potential passing score of 2 to a 1.67. Employees will return to voucher sculpin or resample the site entirely.
- A Stressor Analysis report completed by EcoAnalysts on BURP data from site 2021SSTOA022 gave it an index score of 52, placing it in the partially impaired condition rating for the Mountain site class. The benthic community, while somewhat limited in taxa, showed a high intolerance to several stressors including organic enrichment, metals, and temperature. Sediment did appear to be affecting the benthic community, with highly fine sediment sensitive taxa lacking. If the site fails again after vouchering or full resampling, sediment should be evaluated as the known stressor.

Smiley Creek (ID17060201SL083_02) – BURP site 2021SSTOA026

- Cold Water Aquatic Life is an existing use based on 2021 BURP data. The BURP site received a failing BURP score (1.67). However, the Cold Water Aquatic Life use will remain Fully Supporting.
- Sculpin were not vouchered for identification to species, bringing down the SFI2 and changing the overall score from a potential passing score of 2 to a 1.67. Employees will return to voucher sculpin or resample the site entirely.
- A Stressor Analysis report completed by EcoAnalysts on BURP data from site 2021SSTOA026 placed it in the upper range of the partially impaired stream condition with an overall SMI index score of 67. Midges and worms dominated the benthic community, accounting for 74% of the total abundance, and even though these groups

are often associated with generalist tolerances, most of the taxa present were intolerant of pollution and warm temperatures with low tolerance values. Stressors such as nutrient enrichment and fine sediment did not appear to be a factor in the low Ephemeroptera/Plecoptera/Trichoptera numbers, so habitat heterogeneity may be a limiting factor at the site.

Pole Creek (ID17060201SL085_02) – BURP site 2021SSTOA024

- Received a failing BURP score (1.33) in 2021.
- Considering conflicting information in a Stressor Analysis report performed by EcoAnalysts on site 2021SSTOA024, this assessment unit will be revisited and evaluated for impacts from nutrients and sediment.
- The report indicated that Upper Pole Creek had an overall condition rating of 1 (impaired). Of the six metrics in the mountain SMI, only two had individual index scores in the supporting category. However, non-insect taxa made up a large percentage of the abundance (49%), and this large percentage negatively affected many metric results at the site. Of the non-insects found, high numbers of a worm (Enchytraeidae) drove down several metrics. This worm is assigned a very high tolerance value of 9, but the taxa is classified as a cold water obligate and is normally found in large numbers at unimpaired sites. Some effects from organic enrichment and fine sediment were noted on the benthic community, but these appeared to be minor.
- Although the Upper Pole Creek site scored poorly in the SMI, the site contained several intolerant and cold water obligate taxa - more information is needed.

Pole Creek – source to mouth (AU ID17060201SL085_03) – BURP site 2021SSTOA023

- Received a failing BURP score (1.67) in 2021.
- The failing scores have been caused by low fish index scores, which are the direct result of crews documenting Brook Trout (invasive, but cold water taxa), and sculpin which have not been vouchered and identified to species.
- A Stressor Analysis report performed by EcoAnalysts found a benthic macroinvertebrate community that was intolerant to a range of stressors, suggesting that water quality did not appear to be a limiting factor. No clear pollutants were identified as potential stressors, instead, poor scores for the percent clinger and semi-volatile measures indicated that instream habitat stability may be affecting the benthic community.
- Effects from many of the common stressors were not noted in the benthic community. The percentage of intolerant taxa at the site was also fairly high, with those taxa with an HBI value of 3 or less making up 31% of the total abundance. Some fine sediment effects may be present at the Pole Creek site, but these effects were minor. Fine sediment sensitive taxa were present, with extremely and very fine sediment taxa present, including *Oligophlebodes sp, Rhithrogena sp, Caudatella hystrix,* Drunella doddsii, and *Drunella grandis*. The Metals Tolerance Index score for the site was 1.75, indicating a benthic community that is highly intolerant of metals. At least five empirically derived cold water taxa were present at the site (*Polycelis sp., Enchytraeidae, Oligophlebodes sp, Paraleuctra sp, Epeorus deceptivus*), indicating this site supports cold water biota.

Salmon River - source to Alturas Lake Creek (ID17060201SL081_03) – BURP site 2021SSTOA022

- AU site rating scored low due to Brook Trout captured during electrofishing.
- Received a failing BURP score (1.67). However, the Cold Water Aquatic Life use will remain Fully Supporting. Sculpin were not vouchered for identification to species, bringing down the SFI2 and changing the overall score from a potential passing score of 2 to a 1.67. Employees will return to voucher sculpin or resample the site entirely.
- A Stressor Analysis report completed by EcoAnalysts on BURP data from site 2021SSTOA022 gave it an index score of 52, placing it in the partially impaired condition rating for the Mountain site class. The benthic community, while somewhat limited in taxa, showed a high intolerance to several stressors including organic enrichment, metals, and temperature. Sediment did appear to be affecting the benthic community, with highly fine sediment sensitive taxa lacking. If the site fails again after vouchering or full resampling, sediment should be evaluated as the known stressor.

UNT to Smiley Creek - source to mouth (ID17060201SL083_02) – BURP site 2021SSTOA026

- The results indicate the stream is supportive of Chinook spawning and rearing.
- Cold Water Aquatic Life is an existing use based on 2021 BURP data. The BURP site received a failing BURP score (1.67). However, the Cold Water Aquatic Life use will remain Fully Supporting. Sculpin were not vouchered for identification to species, bringing down the SFI2 and changing the overall score from a potential passing score of 2 to a 1.67. Employees will return to voucher sculpin or resample the site entirely. A Stressor Analysis report completed by EcoAnalysts on BURP data from site 2021SSTOA026 placed it in the upper range of the partially impaired stream condition with an overall SMI index score of 67. Midges and worms dominated the benthic community, accounting for 74% of the total abundance, and even though these groups are often associated with generalist tolerances, most of the taxa present were intolerant of pollution and warm temperatures with low tolerance values. Stressors such as nutrient enrichment and fine sediment did not appear to be a factor in the low Ephemeroptera/Plecoptera/Trichoptera numbers, so habitat heterogeneity may a limiting factor at the site.

Appendix G. State and Site-Specific Water Quality Standards and Criteria

Table G1. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Water Quality Standards: IDAPA 58.01.02.250–251				
Bacteria				
• Geometric mean	<126 *E. coli*/100 mL[b]	<126 *E. coli*/100 mL	—	—
• Single sample	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	—	—
pH	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
Dissolved oxygen (DO)	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	**Water Column DO**: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater **Intergravel DO**: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
Temperature[c]	—	—	22 °C or less daily maximum; 19 °C or less daily average **Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average **Bull Trout**: Not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June–August; not to exceed 9 °C daily average in September and October
Turbidity	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR 131				
Temperature	—	—	—	7-day moving average of 10 °C or less maximum daily temperature for June–September

a. During spawning and incubation periods for inhabiting species
b. *Escherichia coli* per 100 milliliters
c. Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

Appendix H. PNV Solar Load Tables

The calculations in these tables take into consideration significant figures and results are presented with two significant figures to reduce apparent rounding errors that may occur when existing and target loads are subtracted.

Table H1. Existing and target solar loads for Yankee Fork – Jordan Creek to mouth (ID17060201SL032_04).

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL032_04	Yankee Fork	1	Mountain Big Sage	324	17	2%	5.82	5,500	32,000	0%	5.94	5,500	33,000	-2%	1,000
SL032_04	Yankee Fork	2	Mountain Big Sage	172	17	2%	5.82	2,900	17,000	0%	5.94	2,900	17,000	-2%	0
SL032_04	Yankee Fork	3	Rock/Barren	327	17	0%	5.94	5,600	33,000	0%	5.94	5,600	33,000	0%	0
SL032_04	Yankee Fork	4	Rock/Barren	459	17	0%	5.94	7,800	46,000	0%	5.94	7,800	46,000	0%	0
SL032_04	Yankee Fork	5	Rock/Barren	369	17	0%	5.94	6,300	37,000	0%	5.94	6,300	37,000	0%	0
SL032_04	Yankee Fork	6	Cottonwood	192	17	51%	2.91	3,300	9,600	20%	4.75	3,300	16,000	-31%	6,400
SL032_04	Yankee Fork	7	Mtn. Big Sage w/conifer	710	17	8%	5.46	12,000	66,000	20%	4.75	12,000	57,000	12%	(9,000)
SL032_04	Yankee Fork	8	Mountain Big Sage	227	17	2%	5.82	3,900	23,000	10%	5.35	3,900	21,000	8%	(2,000)
SL032_04	Yankee Fork	9	Mountain Big Sage	129	18	2%	5.82	2,300	13,000	0%	5.94	2,300	14,000	-2%	1,000
SL032_04	Yankee Fork	10	Mountain Big Sage	221	18	2%	5.82	4,000	23,000	10%	5.35	4,000	21,000	8%	(2,000)
SL032_04	Yankee Fork	11	Mountain Big Sage	408	18	2%	5.82	7,300	42,000	0%	5.94	7,300	43,000	-2%	1,000
SL032_04	Yankee Fork	12	Mtn. Big Sage w/conifer	215	18	8%	5.46	3,900	21,000	0%	5.94	3,900	23,000	-8%	2,000
SL032_04	Yankee Fork	13	Mtn. Big Sage w/conifer	299	18	8%	5.46	5,400	30,000	20%	4.75	5,400	26,000	12%	(4,000)
SL032_04	Yankee Fork	14	Mtn. Big Sage w/conifer	649	18	8%	5.46	12,000	66,000	10%	5.35	12,000	64,000	2%	(2,000)
SL032_04	Yankee Fork	15	Rock/Barren	971	18	0%	5.94	17,000	100,000	0%	5.94	17,000	100,000	0%	0
SL032_04	Yankee Fork	16	Mountain Big Sage	261	19	2%	5.82	5,000	29,000	0%	5.94	5,000	30,000	-2%	1,000
SL032_04	Yankee Fork	17	Mountain Big Sage	306	19	2%	5.82	5,800	34,000	10%	5.35	5,800	31,000	8%	(3,000)
SL032_04	Yankee Fork	18	Cottonwood	402	19	46%	3.21	7,600	24,000	10%	5.35	7,600	41,000	-36%	17,000
SL032_04	Yankee Fork	19	Rock/Barren	608	19	0%	5.94	12,000	71,000	10%	5.35	12,000	64,000	10%	(7,000)
SL032_04	Yankee Fork	20	Mtn. Big Sage w/conifer	851	19	8%	5.46	16,000	87,000	10%	5.35	16,000	86,000	2%	(1,000)

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL032_04	Yankee Fork	21	Aspen/Conifer	952	20	42%	3.45	19,000	65,000	20%	4.75	19,000	90,000	-22%	25,000
SL032_04	Yankee Fork	22	Aspen/Conifer	628	20	42%	3.45	13,000	45,000	20%	4.75	13,000	62,000	-22%	17,000
SL032_04	Yankee Fork	23	Mtn. Big Sage w/conifer	504	20	7%	5.52	10,000	55,000	10%	5.35	10,000	53,000	3%	(2,000)
SL032_04	Yankee Fork	24	Mtn. Big Sage w/conifer	1004	20	7%	5.52	20,000	110,000	20%	4.75	20,000	95,000	13%	(15,000)
SL032_04	Yankee Fork	25	Mtn. Big Sage w/conifer	1161	21	7%	5.52	24,000	130,000	10%	5.35	24,000	130,000	3%	0
SL032_04	Yankee Fork	26	Dry DF w/o PPine	933	21	28%	4.28	20,000	86,000	40%	3.56	20,000	71,000	12%	(15,000)
SL032_04	Yankee Fork	27	Mtn. Big Sage w/conifer	1169	21	7%	5.52	25,000	140,000	20%	4.75	25,000	120,000	13%	(20,000)
					Total Solar Loading				*1,400,000*				*1,400,000*		*-11,000*

-1% -1%

Table H2. Existing and target solar loads for Pole Creek – source to mouth (ID17060201SL085_02).

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL085_02	Dry Canyon	1	Subalpine Fir/WBP	239	1	100%	0.00	200	0	70%	1.78	200	400	-30%	400
SL085_02	Dry Canyon	2	Subalpine Fir/WBP	147	1	100%	0.00	100	0	70%	1.78	100	200	-30%	200
SL085_02	Dry Canyon	3	Subalpine Fir/WBP	216	1	100%	0.00	200	0	60%	2.38	200	500	-40%	500
SL085_02	Dry Canyon	4	Subalpine Fir/WBP	273	1	100%	0.00	300	0	50%	2.97	300	900	-50%	900
SL085_02	Dry Canyon	5	SubalpineFir Dry-Gentle	383	2	100%	0.00	800	0	70%	1.78	800	1,000	-30%	1,000
SL085_02	Dry Canyon	6	SubalpineFir Dry-Steep	552	2	99%	0.06	1,000	60	80%	1.19	1,000	1,000	-19%	900
SL085_02	Dry Canyon	7	SubalpineFir Dry-Gentle	629	3	100%	0.00	2,000	0	90%	0.59	2,000	1,000	-10%	1,000
SL085_02	Grand Prize Gulch	1	Rock/Barren	115	1	0%	5.94	100	600	0%	5.94	100	600	0%	0
SL085_02	Grand Prize Gulch	2	Rock/Barren	285	1	0%	5.94	300	2,000	0%	5.94	300	2,000	0%	0
SL085_02	Grand Prize Gulch	3	Subalpine Fir/WBP	221	1	100%	0.00	200	0	60%	2.38	200	500	-40%	500
SL085_02	Grand Prize Gulch	4	Subalpine Fir/WBP	390	1	100%	0.00	400	0	70%	1.78	400	700	-30%	700
SL085_02	Grand Prize Gulch	5	Subalpine Fir/WBP	1382	2	99%	0.06	3,000	200	80%	1.19	3,000	4,000	-19%	4,000
SL085_02	Grand Prize Gulch	6	SubalpineFir Dry-Gentle	499	3	100%	0.00	1,000	0	70%	1.78	1,000	2,000	-30%	2,000
SL085_02	Grand Prize Gulch	7	SubalpineFir Dry-Gentle	414	3	100%	0.00	1,000	0	80%	1.19	1,000	1,000	-20%	1,000
SL085_02	Grand Prize Gulch	8	SubalpineFir Dry-Gentle	527	4	99%	0.06	2,000	100	90%	0.59	2,000	1,000	-9%	900
SL085_02	Grand Prize Gulch	9	SubalpineFir Dry-Gentle	185	4	99%	0.06	700	40	80%	1.19	700	800	-19%	800
SL085_02	Pole Creek	1	SubalpineFir Dry-Gentle	340	1	100%	0.00	300	0	80%	1.19	300	400	-20%	400
SL085_02	Pole Creek	2	SubalpineFir Dry-Gentle	121	1	100%	0.00	100	0	70%	1.78	100	200	-30%	200
SL085_02	Pole Creek	3	SubalpineFir Dry-Steep	314	1	99%	0.06	300	20	90%	0.59	300	200	-9%	200
SL085_02	Pole Creek	4	SubalpineFir Dry-Steep	700	2	99%	0.06	1,000	60	70%	1.78	1,000	2,000	-29%	2,000

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL085_02	Pole Creek	5	SubalpineFir Dry-Steep	384	3	97%	0.18	1,000	200	80%	1.19	1,000	1,000	-17%	800
SL085_02	Pole Creek	6	SubalpineFir Dry-Gentle	248	3	100%	0.00	700	0	70%	1.78	700	1,000	-30%	1,000
SL085_02	Pole Creek	7	SubalpineFir Dry-Gentle	190	4	99%	0.06	800	50	80%	1.19	800	1,000	-19%	1,000
SL085_02	Pole Creek	8	SubalpineFir Dry-Gentle	101	4	99%	0.06	400	20	80%	1.19	400	500	-19%	500
SL085_02	Pole Creek	9	SubalpineFir Dry-Gentle	133	4	99%	0.06	500	30	70%	1.78	500	900	-29%	900
SL085_02	Pole Creek	10	SubalpineFir Dry-Gentle	403	5	98%	0.12	2,000	200	80%	1.19	2,000	2,000	-18%	2,000
SL085_02	Pole Creek	11	SubalpineFir Dry-Gentle	178	5	98%	0.12	900	100	50%	2.97	900	3,000	-48%	3,000
SL085_02	Pole Creek	12	SubalpineFir Dry-Gentle	51	6	97%	0.18	300	50	80%	1.19	300	400	-17%	400
SL085_02	Pole Creek	13	SubalpineFir Dry-Gentle	44	6	97%	0.18	300	50	80%	1.19	300	400	-17%	400
SL085_02	Pole Creek	14	SubalpineFir Dry-Gentle	107	6	97%	0.18	600	100	80%	1.19	600	700	-17%	600
SL085_02	Pole Creek	15	Riparian Shrub	225	6	61%	2.32	1,000	2,000	70%	1.78	1,000	2,000	9%	0
SL085_02	Pole Creek	16	SubalpineFir Dry-Gentle	345	6	97%	0.18	2,000	400	50%	2.97	2,000	6,000	-47%	6,000
SL085_02	Pole Creek	17	SubalpineFir Dry-Gentle	694	6	97%	0.18	4,000	700	80%	1.19	4,000	5,000	-17%	4,000
SL085_02	Pole Creek	18	SubalpineFir Dry-Gentle	117	6	97%	0.18	700	100	80%	1.19	700	800	-17%	700
SL085_02	Pole Creek	19	SubalpineFir Dry-Gentle	285	6	97%	0.18	2,000	400	80%	1.19	2,000	2,000	-17%	2,000
SL085_02	Pole Creek	20	SubalpineFir Dry-Gentle	240	6	97%	0.18	1,000	200	70%	1.78	1,000	2,000	-27%	2,000
SL085_02	Pole Creek	21	SubalpineFir Dry-Gentle	118	7	95%	0.30	800	200	70%	1.78	800	1,000	-25%	800
SL085_02	Pole Creek	22	SubalpineFir Dry-Gentle	619	7	95%	0.30	4,000	1,000	80%	1.19	4,000	5,000	-15%	4,000
SL085_02	Pole Creek	23	Subalpine Fir Moist	870	7	75%	1.49	6,000	9,000	70%	1.78	6,000	10,000	-5%	1,000
SL085_02	Pole Creek	24	SubalpineFir Dry-Steep	1207	8	79%	1.25	10,000	10,000	70%	1.78	10,000	20,000	-9%	10,000
SL085_02	Pole Creek	25	Subalpine Fir/LPP	436	8	90%	0.59	3,000	2,000	50%	2.97	3,000	9,000	-40%	7,000

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL085_02	Pole Creek_Trib 01	1	Subalpine Fir/WBP	547	1	100%	0.00	500	0	70%	1.78	500	900	-30%	900
SL085_02	Pole Creek_Trib 01	2	Subalpine Fir/WBP	282	1	100%	0.00	300	0	60%	2.38	300	700	-40%	700
SL085_02	Pole Creek_Trib 01	3	Subalpine Fir/WBP	774	2	99%	0.06	2,000	100	80%	1.19	2,000	2,000	-19%	2,000
SL085_02	Pole Creek_Trib 02	1	SubalpineFir Dry-Steep	751	1	99%	0.06	800	50	90%	0.59	800	500	-9%	500
SL085_02	Pole Creek_Trib 02	2	Mtn. Big Sage w/conifer	327	2	45%	3.27	700	2,000	70%	1.78	700	1,000	25%	(1,000)
SL085_02	Pole Creek_Trib 02	3	SubalpineFir Dry-Steep	1089	3	97%	0.18	3,000	500	80%	1.19	3,000	4,000	-17%	4,000
SL085_02	Pole Creek_Trib 03	1	Subalpine Fir/WBP	413	1	100%	0.00	400	0	90%	0.59	400	200	-10%	200
SL085_02	Pole Creek_Trib 03	2	SubalpineFir Dry-Steep	443	1	99%	0.06	400	20	70%	1.78	400	700	-29%	700
SL085_02	Pole Creek_Trib 03	3	SubalpineFir Dry-Gentle	749	2	100%	0.00	1,000	0	90%	0.59	1,000	600	-10%	600
SL085_02	Pole Creek_Trib 04	1	Subalpine Fir/WBP	463	1	100%	0.00	500	0	50%	2.97	500	1,000	-50%	1,000
SL085_02	Pole Creek_Trib 04	2	SubalpineFir Dry-Steep	703	1	99%	0.06	700	40	60%	2.38	700	2,000	-39%	2,000
SL085_02	Pole Creek_Trib 04	3	SubalpineFir Dry-Steep	550	2	99%	0.06	1,000	60	80%	1.19	1,000	1,000	-19%	900
SL085_02	Pole Creek_Trib 04	4	Mtn. Big Sage w/conifer	598	2	45%	3.27	1,000	3,000	70%	1.78	1,000	2,000	25%	(1,000)
SL085_02	Rainbow Creek	1	SubalpineFir Dry-Gentle	267	1	100%	0.00	300	0	80%	1.19	300	400	-20%	400
SL085_02	Rainbow Creek	2	SubalpineFir Dry-Gentle	330	1	100%	0.00	300	0	90%	0.59	300	200	-10%	200
SL085_02	Rainbow Creek	3	SubalpineFir Dry-Gentle	388	2	100%	0.00	800	0	70%	1.78	800	1,000	-30%	1,000
SL085_02	Rainbow Creek	4	SubalpineFir Dry-Gentle	301	2	100%	0.00	600	0	80%	1.19	600	700	-20%	700
SL085_02	Rainbow Creek	5	SubalpineFir Dry-Steep	697	3	97%	0.18	2,000	400	90%	0.59	2,000	1,000	-7%	600
SL085_02	Rainbow Creek	6	SubalpineFir Dry-Gentle	683	3	100%	0.00	2,000	0	90%	0.59	2,000	1,000	-10%	1,000
SL085_02	Rainbow Creek	7	SubalpineFir Dry-Steep	471	4	94%	0.36	2,000	700	80%	1.19	2,000	2,000	-14%	1,000

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL085_02	Rainbow Creek_Trib 01	1	Subalpine Fir/WBP	626	1	100%	0.00	600	0	90%	0.59	600	400	-10%	400
SL085_02	Rainbow Creek_Trib 01	2	SubalpineFir Dry-Gentle	561	2	100%	0.00	1,000	0	70%	1.78	1,000	2,000	-30%	2,000
SL085_02	Rainbow Creek_Trib 01	3	SubalpineFir Dry-Gentle	531	2	100%	0.00	1,000	0	80%	1.19	1,000	1,000	-20%	1,000
SL085_02	Rainbow Creek_Trib 01	4	SubalpineFir Dry-Gentle	411	3	100%	0.00	1,000	0	90%	0.59	1,000	600	-10%	600
SL085_02	Twin Creek	1	Subalpine Fir/WBP	767	1	100%	0.00	800	0	70%	1.78	800	1,000	-30%	1,000
SL085_02	Twin Creek	2	Subalpine Fir/WBP	385	1	100%	0.00	400	0	80%	1.19	400	500	-20%	500
SL085_02	Twin Creek	3	SubalpineFir Dry-Gentle	254	2	100%	0.00	500	0	70%	1.78	500	900	-30%	900
SL085_02	Twin Creek	4	Subalpine Fir/WBP	400	2	99%	0.06	800	50	50%	2.97	800	2,000	-49%	2,000
SL085_02	Twin Creek	5	SubalpineFir Dry-Gentle	212	2	100%	0.00	400	0	60%	2.38	400	1,000	-40%	1,000
SL085_02	Twin Creek	6	SubalpineFir Dry-Gentle	112	2	100%	0.00	200	0	40%	3.56	200	700	-60%	700
SL085_02	Twin Creek	7	SubalpineFir Dry-Gentle	431	3	100%	0.00	1,000	0	60%	2.38	1,000	2,000	-40%	2,000
SL085_02	Twin Creek	8	SubalpineFir Dry-Gentle	337	3	100%	0.00	1,000	0	70%	1.78	1,000	2,000	-30%	2,000
SL085_02	Twin Creek	9	SubalpineFir Dry-Gentle	255	3	100%	0.00	800	0	80%	1.19	800	1,000	-20%	1,000
SL085_02	Twin Creek	10	SubalpineFir Dry-Gentle	362	4	99%	0.06	1,000	60	50%	2.97	1,000	3,000	-49%	3,000
SL085_02	Twin Creek	11	SubalpineFir Dry-Gentle	207	4	99%	0.06	800	50	70%	1.78	800	1,000	-29%	1,000
SL085_02	Twin Creek	12	SubalpineFir Dry-Gentle	1285	5	98%	0.12	6,000	700	80%	1.19	6,000	7,000	-18%	6,000
					Total Solar Loading				*38,000*				*140,000*		*110,000*
														-22%	79%

Table H3. Existing and target solar loads for Pole Creek – source to mouth (ID17060201SL085_03).

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL085_03	Pole Creek	1	Grassland	1716	9	7%	5.52	20,000	100,000	0%	5.94	20,000	100,000	-7%	0
SL085_03	Pole Creek	2	Aspen/Conifer	1716	9	74%	1.54	20,000	30,000	10%	5.35	20,000	100,000	-64%	70,000
SL085_03	Pole Creek	3	Riparian Shrub	996	9	45%	3.27	9,000	30,000	10%	5.35	9,000	50,000	-35%	20,000
SL085_03	Pole Creek	4	Riparian Shrub	1059	9	45%	3.27	10,000	30,000	0%	5.94	10,000	60,000	-45%	30,000
SL085_03	Pole Creek	5	Riparian Shrub	1059	9	45%	3.27	10,000	30,000	20%	4.75	10,000	50,000	-25%	20,000
SL085_03	Pole Creek	6	Mtn. Big Sage w/conifer	608	9	15%	5.05	5,000	30,000	0%	5.94	5,000	30,000	-15%	0
SL085_03	Pole Creek	7	Mtn. Big Sage w/conifer	2099	10	14%	5.11	21,000	110,000	20%	4.75	21,000	100,000	6%	(10,000)
SL085_03	Pole Creek	8	Riparian Shrub	2099	10	42%	3.45	21,000	72,000	20%	4.75	21,000	100,000	-22%	28,000
SL085_03	Pole Creek	9	Riparian Shrub	1817	10	42%	3.45	18,000	62,000	0%	5.94	18,000	110,000	-42%	48,000
SL085_03	Pole Creek	10	Grassland	1817	10	6%	5.58	18,000	100,000	0%	5.94	18,000	110,000	-6%	10,000
					Total Solar Loading				*590,000*				*810,000*		*220,000*
														-26%	27%

Table H4. Existing and target solar loads for East Fork Salmon River – Germania Creek to Herd Creek (ID17060201SL103_02).

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	Baker Creek	1	Dry DF w/o PPine	789	1	94%	0.36	800	300	90%	0.59	800	500	-4%	200
SL103_02	Baker Creek	2	Subalpine Fir Moist	647	1	96%	0.24	600	100	80%	1.19	600	700	-16%	600
SL103_02	Baker Creek	3	Mtn. Big Sage w/conifer	875	2	45%	3.27	2,000	7,000	70%	1.78	2,000	4,000	25%	(3,000)
SL103_02	Baker Creek	4	Mtn. Big Sage w/conifer	1125	3	35%	3.86	3,000	10,000	60%	2.38	3,000	7,000	25%	(3,000)
SL103_02	Baker Creek	5	Aspen/Conifer	775	4	97%	0.18	3,000	500	70%	1.78	3,000	5,000	-27%	5,000
SL103_02	Baker Creek	6	Mountain Big Sage	217	4	8%	5.46	900	5,000	10%	5.35	900	5,000	2%	0
SL103_02	Baker Creek	7	Wyoming Big Sage	416	4	7%	5.52	2,000	10,000	10%	5.35	2,000	10,000	3%	0
SL103_02	Baker Creek_Trib 01	1	Mtn. Big Sage w/conifer	1632	2	45%	3.27	3,000	10,000	70%	1.78	3,000	5,000	25%	(5,000)
SL103_02	Bluett Creek	1	Mtn. Big Sage w/conifer	1226	1	67%	1.96	1,000	2,000	80%	1.19	1,000	1,000	13%	(1,000)
SL103_02	Bluett Creek	2	Mtn. Big Sage w/conifer	444	2	45%	3.27	900	3,000	70%	1.78	900	2,000	25%	(1,000)
SL103_02	Bluett Creek	3	Mtn. Big Sage w/conifer	504	2	45%	3.27	1,000	3,000	70%	1.78	1,000	2,000	25%	(1,000)
SL103_02	Bluett Creek	4	Mtn. Big Sage w/conifer	583	2	45%	3.27	1,000	3,000	70%	1.78	1,000	2,000	25%	(1,000)
SL103_02	Bluett Creek	5	Mountain Big Sage	393	3	11%	5.29	1,000	5,000	20%	4.75	1,000	5,000	9%	0
SL103_02	Bluett Creek	6	Mountain Big Sage	891	3	11%	5.29	3,000	20,000	20%	4.75	3,000	10,000	9%	(10,000)
SL103_02	Bluett Creek	7	Wyoming Big Sage	957	4	7%	5.52	4,000	20,000	10%	5.35	4,000	20,000	3%	0
SL103_02	Bluett Creek	8	Riparian Shrub	523	4	77%	1.37	2,000	3,000	70%	1.78	2,000	4,000	-7%	1,000
SL103_02	Deer Creek	1	Mtn. Big Sage w/conifer	1397	1	67%	1.96	1,000	2,000	80%	1.19	1,000	1,000	13%	(1,000)
SL103_02	Deer Creek	2	Mtn. Big Sage w/conifer	411	2	45%	3.27	800	3,000	70%	1.78	800	1,000	25%	(2,000)
SL103_02	Deer Creek	3	Dry DF w/o PPine	718	2	93%	0.42	1,000	400	80%	1.19	1,000	1,000	-13%	600
SL103_02	Deer Creek	4	Dry DF w/o PPine	599	3	91%	0.53	2,000	1,000	90%	0.59	2,000	1,000	-1%	0

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	Deer Creek	5	Wyoming Big Sage	765	3	10%	5.35	2,000	10,000	10%	5.35	2,000	10,000	0%	0
SL103_02	Dry Gulch	1	Wyoming Big Sage	2958	2	14%	5.11	6,000	30,000	20%	4.75	6,000	30,000	6%	0
SL103_02	Dry Gulch	2	Pasture/Agricultural	1533	4	16%	4.99	6,000	30,000	20%	4.75	6,000	30,000	4%	0
SL103_02	EF Salmon River_Trib 01	1	Dry DF w/o PPine	782	1	94%	0.36	800	300	90%	0.59	800	500	-4%	200
SL103_02	EF Salmon River_Trib 01	2	Mtn. Big Sage w/conifer	416	1	67%	1.96	400	800	80%	1.19	400	500	13%	(300)
SL103_02	EF Salmon River_Trib 01	3	Threetip Sage	136	2	17%	4.93	300	1,000	20%	4.75	300	1,000	3%	0
SL103_02	EF Salmon River_Trib 01	4	Mtn. Big Sage w/conifer	434	2	45%	3.27	900	3,000	70%	1.78	900	2,000	25%	(1,000)
SL103_02	EF Salmon River_Trib 01	5	Threetip Sage	703	2	17%	4.93	1,000	5,000	20%	4.75	1,000	5,000	3%	0
SL103_02	EF Salmon River_Trib 02	1	Wyoming Big Sage	1501	2	14%	5.11	3,000	20,000	10%	5.35	3,000	20,000	-4%	0
SL103_02	EF Salmon River_Trib 02	2	Aspen/Conifer	345	3	99%	0.06	1,000	60	60%	2.38	1,000	2,000	-39%	2,000
SL103_02	EF Salmon River_Trib 03	1	DF/Lodgepole-Gentle	817	1	100%	0.00	800	0	90%	0.59	800	500	-10%	500
SL103_02	EF Salmon River_Trib 03	2	Mountain Big Sage	450	2	14%	5.11	900	5,000	20%	4.75	900	4,000	6%	(1,000)
SL103_02	EF Salmon River_Trib 03	3	Dry DF w/o PPine	883	2	93%	0.42	2,000	800	90%	0.59	2,000	1,000	-3%	200
SL103_02	EF Salmon River_Trib 03	4	Wyoming Big Sage	630	3	10%	5.35	2,000	10,000	10%	5.35	2,000	10,000	0%	0
SL103_02	EF Salmon River_Trib 04	1	Wyoming Big Sage	2990	2	14%	5.11	6,000	30,000	20%	4.75	6,000	30,000	6%	0
SL103_02	EF Salmon River_Trib 05	1	Mountain Big Sage	341	1	23%	4.57	300	1,000	30%	4.16	300	1,000	7%	0
SL103_02	EF Salmon River_Trib 05	2	Mtn. Big Sage w/conifer	1139	1	67%	1.96	1,000	2,000	70%	1.78	1,000	2,000	3%	0
SL103_02	EF Salmon River_Trib 05	3	Wyoming Big Sage	1261	2	14%	5.11	3,000	20,000	20%	4.75	3,000	10,000	6%	(10,000)
SL103_02	EF Salmon River_Trib 06	1	Wyoming Big Sage	1664	2	14%	5.11	3,000	20,000	10%	5.35	3,000	20,000	-4%	0
SL103_02	EF Salmon River_Trib 08	1	Mountain Big Sage	402	1	23%	4.57	400	2,000	30%	4.16	400	2,000	7%	0
SL103_02	EF Salmon River_Trib 08	2	Wyoming Big Sage	926	2	14%	5.11	2,000	10,000	20%	4.75	2,000	10,000	6%	0

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	EF Salmon River_Trib 08	3	Wyoming Big Sage	1227	3	10%	5.35	4,000	20,000	10%	5.35	4,000	20,000	0%	0
SL103_02	EF Salmon River_Trib 09	1	Wyoming Big Sage	2580	2	14%	5.11	5,000	30,000	10%	5.35	5,000	30,000	-4%	0
SL103_02	EF Salmon River_Trib 10	1	Wyoming Big Sage	2246	2	14%	5.11	4,000	20,000	10%	5.35	4,000	20,000	-4%	0
SL103_02	EF Salmon River_Trib 11	1	Wyoming Big Sage	2086	2	14%	5.11	4,000	20,000	20%	4.75	4,000	20,000	6%	0
SL103_02	Fox Creek	1	Wyoming Big Sage	432	1	25%	4.46	400	2,000	30%	4.16	400	2,000	5%	0
SL103_02	Fox Creek	2	Wyoming Big Sage	1036	1	25%	4.46	1,000	4,000	30%	4.16	1,000	4,000	5%	0
SL103_02	Fox Creek	3	SubalpineFir Dry-Steep	779	2	99%	0.06	2,000	100	70%	1.78	2,000	4,000	-29%	4,000
SL103_02	Fox Creek	4	DF/Lodgepole-Steep	782	2	98%	0.12	2,000	200	80%	1.19	2,000	2,000	-18%	2,000
SL103_02	Fox Creek	5	Riparian Shrub	1370	3	88%	0.71	4,000	3,000	80%	1.19	4,000	5,000	-8%	2,000
SL103_02	Fox Creek	6	Riparian Shrub	599	3	88%	0.71	2,000	1,000	70%	1.78	2,000	4,000	-18%	3,000
SL103_02	Fox Creek	7	Mtn. Big Sage w/conifer	1284	4	29%	4.22	5,000	20,000	40%	3.56	5,000	20,000	11%	0
SL103_02	Fox Creek	8	Riparian Shrub	1424	5	68%	1.90	7,000	10,000	60%	2.38	7,000	20,000	-8%	10,000
SL103_02	Fox Creek	9	Wyoming Big Sage	373	5	6%	5.58	2,000	10,000	20%	4.75	2,000	10,000	14%	0
SL103_02	Fox Creek_Trib 01	1	Wyoming Big Sage	732	1	25%	4.46	700	3,000	30%	4.16	700	3,000	5%	0
SL103_02	Fox Creek_Trib 01	2	Wyoming Big Sage	268	1	25%	4.46	300	1,000	30%	4.16	300	1,000	5%	0
SL103_02	Fox Creek_Trib 01	3	SubalpineFir Dry-Steep	698	2	99%	0.06	1,000	60	90%	0.59	1,000	600	-9%	500
SL103_02	Fox Creek_Trib 01	4	DF/Lodgepole-Gentle	587	2	100%	0.00	1,000	0	80%	1.19	1,000	1,000	-20%	1,000
SL103_02	Little Wickiup Creek	1	Dry DF w/o PPine	446	1	94%	0.36	400	100	90%	0.59	400	200	-4%	100
SL103_02	Little Wickiup Creek	2	Dry DF w/o PPine	1122	2	93%	0.42	2,000	800	90%	0.59	2,000	1,000	-3%	200
SL103_02	Little Wickiup Creek	3	Dry DF w/o PPine	883	3	91%	0.53	3,000	2,000	90%	0.59	3,000	2,000	-1%	0
SL103_02	Little Wickiup Creek	4	Dry DF w/o PPine	204	3	91%	0.53	600	300	60%	2.38	600	1,000	-31%	700

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	Marco Creek	1	Mountain Big Sage	732	1	23%	4.57	700	3,000	30%	4.16	700	3,000	7%	0
SL103_02	Marco Creek	2	Riparian Shrub	456	1	95%	0.30	500	100	80%	1.19	500	600	-15%	500
SL103_02	Marco Creek	3	Mountain Big Sage	1210	2	14%	5.11	2,000	10,000	20%	4.75	2,000	10,000	6%	0
SL103_02	Marco Creek	4	Aspen/Conifer	426	3	99%	0.06	1,000	60	80%	1.19	1,000	1,000	-19%	900
SL103_02	Marco Creek	5	Aspen/Conifer	67	3	99%	0.06	200	10	80%	1.19	200	200	-19%	200
SL103_02	Marco Creek	6	Mountain Big Sage	1217	4	8%	5.46	5,000	30,000	10%	5.35	5,000	30,000	2%	0
SL103_02	Marco Creek	7	Wyoming Big Sage	728	5	6%	5.58	4,000	20,000	10%	5.35	4,000	20,000	4%	0
SL103_02	Marco Creek	8	Wyoming Big Sage	312	5	6%	5.58	2,000	10,000	10%	5.35	2,000	10,000	4%	0
SL103_02	Marco Creek_Trib 01	1	Wyoming Big Sage	2491	2	14%	5.11	5,000	30,000	20%	4.75	5,000	20,000	6%	(10,000)
SL103_02	Marco Creek_Trib 01	2	Wyoming Big Sage	544	3	10%	5.35	2,000	10,000	20%	4.75	2,000	10,000	10%	0
SL103_02	Marco Spring	1	Mtn. Big Sage w/conifer	3374	3	35%	3.86	10,000	40,000	40%	3.56	10,000	40,000	5%	0
SL103_02	Sheep Creek	1	SubalpineFir Dry-Steep	449	1	99%	0.06	400	20	90%	0.59	400	200	-9%	200
SL103_02	Sheep Creek	2	SubalpineFir Dry-Steep	380	1	99%	0.06	400	20	80%	1.19	400	500	-19%	500
SL103_02	Sheep Creek	3	Subalpine Fir Moist	289	1	96%	0.24	300	70	90%	0.59	300	200	-6%	100
SL103_02	Sheep Creek	4	DF/Lodgepole-Steep	236	1	98%	0.12	200	20	60%	2.38	200	500	-38%	500
SL103_02	Sheep Creek	5	DF/Lodgepole-Gentle	394	2	100%	0.00	800	0	90%	0.59	800	500	-10%	500
SL103_02	Sheep Creek	6	DF/Lodgepole-Gentle	722	2	100%	0.00	1,000	0	80%	1.19	1,000	1,000	-20%	1,000
SL103_02	Sheep Creek	7	DF/Lodgepole-Steep	234	2	98%	0.12	500	60	90%	0.59	500	300	-8%	200
SL103_02	Sheep Creek	8	DF/Lodgepole-Steep	284	3	97%	0.18	900	200	90%	0.59	900	500	-7%	300
SL103_02	Sheep Creek	9	Aspen/Conifer	1236	3	99%	0.06	4,000	200	80%	1.19	4,000	5,000	-19%	5,000
SL103_02	Sheep Creek	10	Riparian Shrub	466	4	77%	1.37	2,000	3,000	70%	1.78	2,000	4,000	-7%	1,000
SL103_02	Sheep Creek	11	Dry DF w/o PPine	132	4	83%	1.01	500	500	80%	1.19	500	600	-3%	100

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	Sheep Creek	12	Dry DF w/o PPine	418	4	83%	1.01	2,000	2,000	80%	1.19	2,000	2,000	-3%	0
SL103_02	Sheep Creek	13	Dry DF w/o PPine	1358	5	74%	1.54	7,000	10,000	80%	1.19	7,000	8,000	6%	(2,000)
SL103_02	Sheep Creek	14	Aspen/Conifer	404	6	90%	0.59	2,000	1,000	80%	1.19	2,000	2,000	-10%	1,000
SL103_02	Sheep Creek_Trib 01	1	DF/Lodgepole-Steep	853	1	98%	0.12	900	100	90%	0.59	900	500	-8%	400
SL103_02	Sheep Creek_Trib 01	2	Subalpine Fir Moist	451	2	95%	0.30	900	300	90%	0.59	900	500	-5%	200
SL103_02	Sheep Creek_Trib 01	3	Mtn. Big Sage w/conifer	463	3	35%	3.86	1,000	4,000	60%	2.38	1,000	2,000	25%	(2,000)
SL103_02	Sheep Creek_Trib 02	1	Dry DF w/o PPine	640	1	94%	0.36	600	200	80%	1.19	600	700	-14%	500
SL103_02	Sheep Creek_Trib 02	2	Dry DF w/o PPine	1096	2	93%	0.42	2,000	800	90%	0.59	2,000	1,000	-3%	200
SL103_02	Sheep Creek_Trib 02	3	Dry DF w/o PPine	826	3	91%	0.53	2,000	1,000	80%	1.19	2,000	2,000	-11%	1,000
SL103_02	Sheep Creek_Trib 02	4	Riparian Shrub	509	3	88%	0.71	2,000	1,000	70%	1.78	2,000	4,000	-18%	3,000
SL103_02	Wickiup Creek	1	Bunchgrass/Fescue	891	1	53%	2.79	900	3,000	60%	2.38	900	2,000	7%	(1,000)
SL103_02	Wickiup Creek	2	Subalpine Fir/WBP	499	1	60%	2.38	500	1,000	70%	1.78	500	900	10%	(100)
SL103_02	Wickiup Creek	3	Subalpine Fir Moist	402	1	96%	0.24	400	100	60%	2.38	400	1,000	-36%	900
SL103_02	Wickiup Creek	4	Subalpine Fir Moist	764	1	96%	0.24	800	200	70%	1.78	800	1,000	-26%	800
SL103_02	Wickiup Creek	5	Subalpine Fir Moist	1712	2	95%	0.30	3,000	900	90%	0.59	3,000	2,000	-5%	1,000
SL103_02	Wickiup Creek	6	Dry DF w/o PPine	601	3	91%	0.53	2,000	1,000	70%	1.78	2,000	4,000	-21%	3,000
SL103_02	Wickiup Creek	7	Dry DF w/o PPine	1266	3	91%	0.53	4,000	2,000	80%	1.19	4,000	5,000	-11%	3,000
SL103_02	Wickiup Creek	8	Dry DF w/o PPine	674	4	83%	1.01	3,000	3,000	90%	0.59	3,000	2,000	7%	(1,000)
SL103_02	Wickiup Creek	9	Dry DF w/o PPine	477	4	83%	1.01	2,000	2,000	80%	1.19	2,000	2,000	-3%	0
SL103_02	Wickiup Creek	10	Dry DF w/o PPine	1449	5	74%	1.54	7,000	10,000	80%	1.19	7,000	8,000	6%	(2,000)
SL103_02	Wickiup Creek	11	Dry DF w/o PPine	1021	5	74%	1.54	5,000	8,000	80%	1.19	5,000	6,000	6%	(2,000)

	Stream Segment Details					Target Shade				Existing Shade				Solar Load Summary	
AU	Stream Name	Segment Number	Vegetation Type	Length (m)	Segment Width (m)	Shade Value	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Shade Level	Solar Radiation (kWh/m²/day)	Segment Area (m²)	Solar Load (kWh/day)	Lack of Shade	Excess Load (kWh/day)
SL103_02	Wickiup Creek	12	Aspen/Conifer	1015	6	90%	0.59	6,000	4,000	90%	0.59	6,000	4,000	0%	0
SL103_02	Wickiup Creek_Trib 01	1	Rock/Barren	433	1	0%	5.94	400	2,000	0%	5.94	400	2,000	0%	0
SL103_02	Wickiup Creek_Trib 01	2	SubalpineFir Dry-Gentle	1229	2	100%	0.00	2,000	0	80%	1.19	2,000	2,000	-20%	2,000
SL103_02	Wickiup Creek_Trib 01	3	DF/Lodgepole-Gentle	491	3	99%	0.06	1,000	60	90%	0.59	1,000	600	-9%	500
					Total Solar Loading				*670,000*				*670,000*		*1,900*

-2% 0%

Appendix I. Public Participation and Public Comments

This TMDL was developed with participation from the Salmon BAG.

Salmon Basin Advisory Group and their interest represented

Bruce Mulkey (Agriculture)

Theresa Hughes (At-large Position)

Betsy Rieffenberger (Environmental)

Will Nailon (Mining)

Ryan Stebbins (Non-Municipal IPDES)

Stephen Pfeiffer (Recreation)

Hunter Osborne (Tribal)

Updates were given to BAG members on:

- October 23, 2024
- April 24, 2024
- May 7, 2025

The public comment period was from March 16 through April 15, 2026. There were no public comments submitted during the comment period.