Potlatch River Watershed Assessment and Total Maximum Daily Loads

2017 Temperature TMDL

Hydrologic Unit Code 17060306

Final

State of Idaho
Department of Environmental Quality

April 2018

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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
Ag plan	*Idaho Agricultural Pollution Abatement Plan*
AU	assessment unit
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGP	Construction General Permit
COLD	cold water aquatic life
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DWS	domestic water supply
EPA	United States Environmental Protection Agency
GIS	geographic information systems
ICIS	Integrated Compliance Information System
IDAPA	refers to citations of Idaho administrative rules
kWh	kilowatt-hour
LA	load allocation
LC	load capacity
m	meter
MOS	margin of safety
MS4s	municipal separate storm sewer systems
MSGP	multisector general permit
NB	natural background
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
PCR	primary contact recreation
PNV	potential natural vegetation
POTW	publicly owned treatment works
SCR	secondary contact recreation
SS	salmonid spawning
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
USGS	United States Geological Survey
WAG	watershed advisory group
WLA	wasteload allocation
WWTP	wastewater treatment plant

Executive Summary

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

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses 11 water bodies (21 assessment units) in the Potlatch River watershed (within the Clearwater River subbasin) that are in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2014).

This TMDL describes the key physical and biological characteristics of the watershed; water quality concerns and status; pollutant sources; and recent pollution control actions in the Potlatch River watershed, located in north central Idaho. For more detailed information about the watershed and previous TMDLs, see the *Potlatch River Subbasin Assessment and TMDLs* (DEQ 2008).

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. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

Temperature TMDLs within this document were developed using an updated methodology; as such, those portions of this document represent a revision to the original *Potlatch River Subbasin Assessment and TMDL* (DEQ 2008). TMDLs for other pollutants within the Potlatch River watershed are being produced in separate documents. Additionally, the 2008 assessment and TMDL analyzed only the main stem segments of assessment units (AUs) listed in Table A. This TMDL establishes heat loads for all tributary streams within an AU as well as the main stem segments. The 2008 analysis included portions of the Potlatch River within the Nez Perce Reservation boundary, this analysis excludes those portions of the Potlatch River found within the Nez Perce Reservation boundary. This document serves to establish heat loads for entire AUs, excluding portions within the Nez Perce Reservation boundary, noted for temperature pollution in the 2014 Integrated Report using updated methodology.

Watershed at a Glance

The Potlatch River watershed is a part of the Clearwater River subbasin (hydrologic unit code 17060306). The watershed encompasses approximately 380,400 acres (594 square miles),

draining into the Clearwater River between Myrtle and Spalding. The upper reaches of the Potlatch River are divided into two main tributaries: the East Fork and West Fork Potlatch Rivers. The East Fork originates in the northwest corner of Clearwater County and flows southwest to its confluence with the main stem. The West Fork originates in the northeast corner of Latah County and flows southeast to its confluence with the Potlatch River. The Potlatch River drains the eastern two-thirds of Latah County, running from northeast to southwest (Figure A).

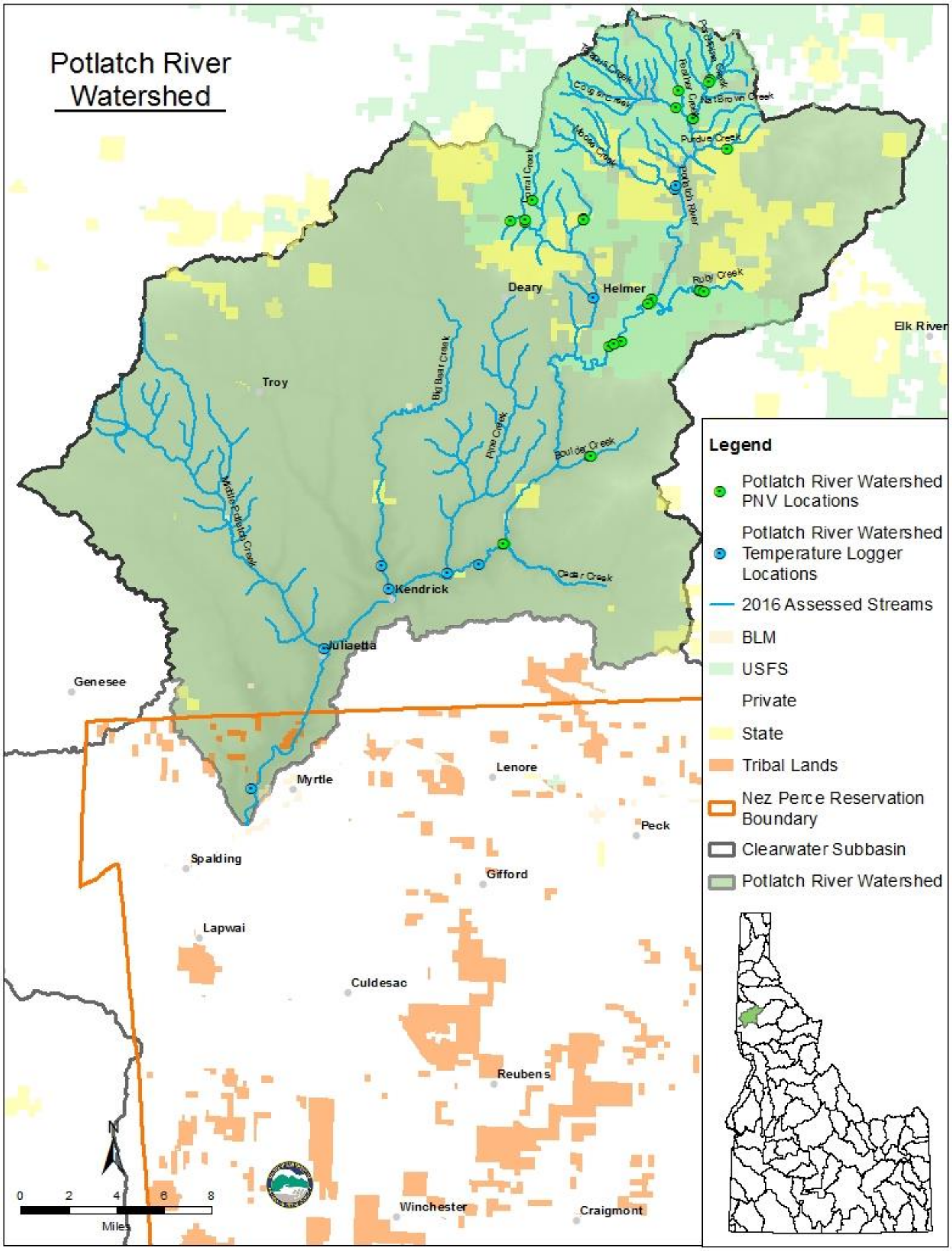

Figure A. Potlatch River watershed.

Land uses in the upper watershed include forestry, livestock, and agriculture. The river flows onto the Nez Perce Reservation approximately 7 miles upstream from its confluence with the Clearwater River. Stream and river flows in the Potlatch River watershed reflect weather patterns. Most of the precipitation occurs during winter and early spring with very little precipitation during the summer months. This pattern tends to cause high peak flows in early spring and extremely low flows in late summer.

The upper Potlatch River drains rolling hills and meadows of the eastern edge of the Columbia River basalt plateau and the adjacent Clearwater Mountains. Elevations range from approximately 2,500 feet on the plateau to near 5,000 feet in the mountains surrounding the watershed.

Potlatch River AUs on the 2014 §303(d) list were identified as being impaired by sedimentation/siltation, bacteria, nutrient loading, and water temperature. Listings for these pollutants may be impacting the beneficial uses of the watershed, which include cold water aquatic life, salmonid spawning, contact recreation, and domestic water supply.

Key Findings

The Potlatch River and tributary streams were placed on the 1998 §303(d) list of impaired waters, or subsequent lists, for reasons associated with temperature criteria violations, and the Idaho Department of Environmental Quality (DEQ) has developed temperature TMDLs for these waters (Table A).

Table A. Water bodies and pollutants for which 2016 temperature TMDLs were developed.

Water Body	Assessment Unit	Pollutant
Potlatch River - Headwaters	ID17060306CL049_02	Temperature
Potlatch River - 3rd Order	ID17060306CL049_03	Temperature
Potlatch River - 4th Order	ID17060306CL049_04	Temperature
Potlatch River - 4th Order	ID17060306CL048_04	Temperature
Potlatch River - 5th Order	ID17060306CL048_05	Temperature
Potlatch River - 5th Order	ID17060306CL045_05	Temperature
Potlatch River - 6th Order	ID17060306CL044_06	Temperature
Cedar Creek - 4th Order	ID17060306CL046_04	Temperature
Boulder Creek - 3rd Order	ID17060306CL047_03	Temperature
East Fork Potlatch River - 4th Order	ID17060306CL051_04	Temperature
Ruby Creek - 3rd Order	ID17060306CL052_03	Temperature
Moose Creek - Headwaters	ID17060306CL053_02	Temperature
Moose Creek – 3rd Order	ID17060306CL053_03	Temperature
Corral Creek - Headwaters	ID17060306CL054_02	Temperature

Water Body	Assessment Unit	Pollutant
Corral Creek - 3rd Order	ID17060306CL054_03	Temperature
Pine Creek - Headwaters	ID17060306CL055_02	Temperature
Pine Creek - 3rd Order	ID17060306CL055_03	Temperature
Big Bear Creek - 4th Order	ID17060306CL056_04	Temperature
Big Bear Creek - 5th Order	ID17060306CL056_05	Temperature
Middle Potlatch Creek - Headwaters	ID17060306CL062_02	Temperature
Middle Potlatch Creek - 3rd Order	ID17060306CL062_03	Temperature

Biological and water chemistry data were originally used to determine if beneficial uses of the AUs were fully supported. Temperature data loggers were deployed at nine different locations within the watershed from March through October 2016 to determine if any temperature exceedances were measured in surface water. Analysis of the temperature data will also provide insight into the severity and duration of any discovered exceedances. A number of activities can contribute to elevated temperatures in surface waters. These may include canopy cover deficiencies resulting from land uses and valley bottom morphology resulting from hydrologic flow regimes.

Temperature water quality standards differ for cold water aquatic life and salmonid spawning. Maximum and average daily temperatures are not to exceed numeric criteria, except when allowed during a time period when the atmospheric temperature is within the 90th percentile for a given year. Maximum and daily averages for cold water aquatic life are 22 °C and 19 °C, respectively. Maximum and daily averages for salmonid spawning are 13 °C and 9 °C, respectively. If water temperatures exceed these values, excluding the warmest days of the year, water temperatures may be impacting beneficial uses.

Effective target shade levels were established for 21 AUs based on the concept of maximum shading under potential natural vegetation resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation that was partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho’s water quality standards (IDAPA 58.01.02). A summary of assessment outcomes is presented in Table B.

Table B. Summary of assessment outcomes for assessment units.

Water Body	Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Potlatch River - Headwaters	ID17060306CL049_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 3rd Order	ID17060306CL049_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 4th Order	ID17060306CL049_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 4th Order	ID17060306CL048_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 5th Order	ID17060306CL048_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 5th Order	ID17060306CL045_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 6th Order	ID17060306CL044_06	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Cedar Creek - 4th Order	ID17060306CL046_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Boulder Creek - 3rd Order	ID17060306CL047_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
East Fork Potlatch River - 4th Order	ID17060306CL051_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Ruby Creek - 3rd Order	ID17060306CL052_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Moose Creek - Headwaters	ID17060306CL053_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Moose Creek - 3rd Order	ID17060306CL053_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Corral Creek - Headwaters	ID17060306CL054_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Corral Creek - 3rd Order	ID17060306CL054_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Pine Creek - Headwaters	ID17060306CL055_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Pine Creek - 3rd Order	ID17060306CL055_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Big Bear Creek - 4th Order	ID17060306CL056_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Big Bear Creek - 5th Order	ID17060306CL056_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Middle Potlatch Creek - Headwaters	ID17060306CL062_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Middle Potlatch Creek - 3rd Order	ID17060306CL062_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade

Table C presents solar loads for AUs assessed for this temperature TMDL.

Table C. Total solar loads and average lack of shade for assessment units (2016).

Water Body/Assessment Unit	Total Existing Load (kWh/day)	Total Target Load (kWh/day)	Excess Load (% Reduction) (kWh/day)	Average Lack of Shade (%)
Potlatch River - Headwaters (ID17060306CL049_02)	430,000	250,000	180,000 (42%)	-22
Potlatch River - 3rd Order (ID17060306CL049_03)	150,000	130,000	18,000 (12%)	-12
Potlatch River - 4th Order (ID17060306CL049_04)	290,000	270,000	20,000 (7%)	-9
Potlatch River - 4th Order (ID17060306CL048_04)	380,000	340,000	39,000 (10%)	-10
Potlatch River - 5th Order (ID17060306CL048_05)	710,000	630,000	80,000 (11%)	-10
Potlatch River - 5th Order (ID17060306CL045_05)	4,100,000	4,600,000	0 (0%)	0
Potlatch River - 6th Order (ID17060306CL044_06)	2,100,000	2,400,000	0 (0%)	0
Cedar Creek - 4th Order (ID17060306CL046_04)	98,000	88,000	10,000 (10%)	-15
Boulder Creek - 3rd Order (ID17060306CL047_03)	31,000	12,000	20,000 (65%)	-19
East Fork Potlatch River - 4th Order (ID17060306CL051_04)	200,000	210,000	0 (0%)	0
Ruby Creek - 3rd Order (ID17060306CL052_03)	22,000	15,000	7,000 (32%)	-14
Moose Creek - Headwaters (ID17060306CL053_02)	140,000	42,000	92,000 (66%)	-32
Moose Creek - 3rd Order (ID17060306CL053_03)	110,000	85,000	28,000 (25%)	-16
Corral Creek - Headwaters (ID17060306CL054_02)	180,000	120,000	65,000 (36%)	-20
Corral Creek - 3rd Order (ID17060306CL054_03)	240,000	330,000	0 (0%)	0
Pine Creek - Headwaters (ID17060306CL055_02)	380,000	320,000	62,000 (16%)	-27
Pine Creek - 3rd Order (ID17060306CL055_03)	150,000	220,000	0 (0%)	0
Big Bear Creek - 4th Order (ID17060306CL056_04)	520,000	550,000	0 (0%)	0
Big Bear Creek - 5th Order	76,000	66,000	10,000	-13

Water Body/Assessment Unit	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
	(kWh/day)			
(ID17060306CL056_05)			(13%)	
Middle Potlatch Creek - Headwaters (ID17060306CL062_02)	670,000	300,000	390,000 (58%)	-41
Middle Potlatch Creek - 3rd Order (ID17060306CL062_03)	620,000	540,000	80,000 (13%)	-3

Note: Load data are rounded to two significant figures, which may present rounding errors.

Most AUs assessed have existing solar loads that exceed target solar loads. Those with the greatest discrepancies between existing and target solar loads include the headwater segments of Moose Creek (AU ID17060306CL053_02) with an average lack of shade of 32% and of Middle Potlatch Creek (AU ID17060306CL062_02) with an average lack of shade of 41%. Six AUs assessed in this temperature TMDL are meeting solar load targets: the lower reaches of the Potlatch River, 3rd-order segments of Corral and Pine Creeks, and 4th-order segments of the East Fork Potlatch River and Big Bear Creek.

Public Participation

The general public was able to comment on this draft document during the public comment period. This document was on public comment from August 29, 2017 to September 17, 2017 and from February 16, 2018 to March 19th, 2018.

Introduction

This document addresses 21 assessment units (AUs) in the Potlatch River watershed that are in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2014) for temperature. The purpose of this total maximum daily load (TMDL) is to characterize and document temperature pollutant loads within the Potlatch River watershed. The first portion of this document presents key characteristics or updated information for the watershed assessment, which is divided into four major sections: watershed characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the watershed assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The watershed assessment is used to develop a TMDL for each pollutant of concern for the Potlatch River watershed. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). 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. Effective shade targets were established for 21 AUs based on the concept of maximum shading under potential natural vegetation (PNV) resulting in natural background temperatures.

Regulatory Requirements

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

Congress passed the Federal Water Pollution Control Act, more commonly called the 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 the programs it has 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 §303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or

uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

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

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

1 Watershed Assessment—Subbasin Characterization

The Potlatch River watershed (Figure 1) is in the Clearwater River subbasin (hydrologic unit code 17060306). The watershed encompasses approximately 380,400 acres, draining into the Clearwater River between Myrtle and Spalding. The upper reaches of the Potlatch River are divided into two main tributaries: the East Fork and the West Fork Potlatch Rivers. The East Fork originates in the northwest corner of Clearwater County and flows in a southwest direction to its confluence with the main stem. The West Fork originates in the northeast corner of Latah County and flows southeast to its confluence with the Potlatch River. The Potlatch River drains the eastern two-thirds of Latah County, running from northeast to southwest. The river flows onto the Nez Perce Reservation approximately 7 miles upstream from its confluence with the Clearwater River (DEQ 2008). The location of water bodies in the watershed analyzed as part of this TMDL that are included in Category 4a of Idaho's 2014 integrated report (DEQ 2014) are shown in Figure 1.

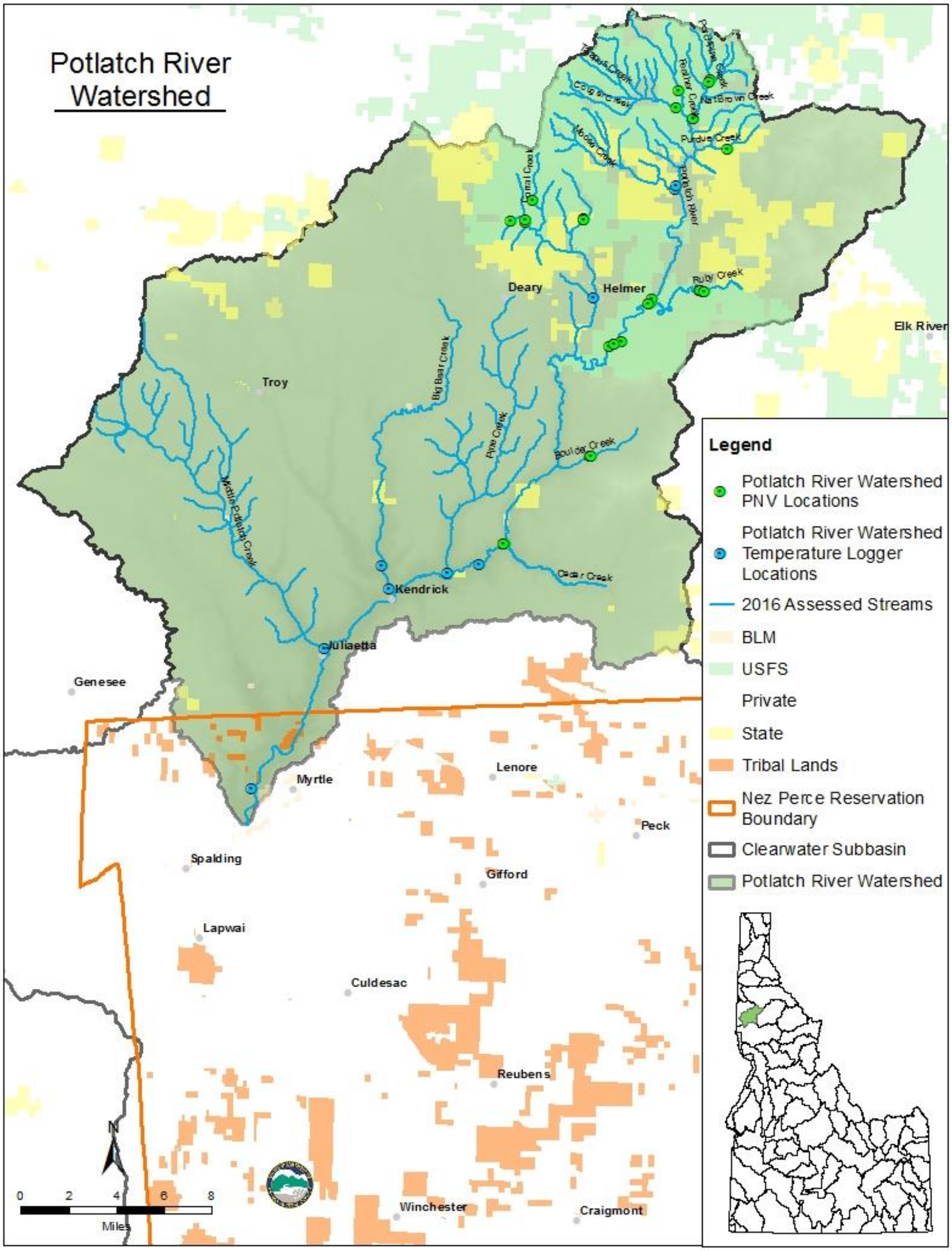

Figure 1. Potlatch River watershed.

The landownership, population, and economic status of the area have remained largely unchanged since the 2008 assessment. Further discussion of the physical, biological, and cultural characteristics is provided in the *Potlatch River Subbasin Assessment and TMDLs* (DEQ 2008).

2 Watershed Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Watershed

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards. This TMDL is updating the methodology used on previously developed temperature TMDLs.

Headwater AUs (denoted with an _02 in the AU number) of the Potlatch River are typically low relief channels with numerous meanders and high sinuosity within broad, silty alluvium meadows with established floodplains.

Ruby Creek originates southeast of the town of Bovill and runs northwest to its confluence with the East Fork Potlatch River. The East Fork then flows into the Potlatch River between Moose Creek and Corral Creek. Moose Creek drains the forested hills, meadows, and grasslands north of Bovill. Corral Creek, from its headwaters to its mouth, drains the forested hills, meadows, and grasslands surrounding the town of Helmer.

From Corral Creek to Big Bear Creek, the Potlatch River flows through a relatively inaccessible canyon to Cedar Creek, then opens up to a wider canyon. Boulder Creek, Cedar Creek, and Pine Creek flow into the Potlatch River between Corral Creek and Big Bear Creek. Boulder Creek, from Pig Creek to its mouth, drains the forested hills east of the community of Park. Cedar Creek, from Leopold Creek to its mouth, drains the forested hills and grasslands north and east of the community of Southwick. Pine Creek drains the forested hills and agriculture lands south of Deary, flowing into a steep canyon and entering the Potlatch River above the town of Kendrick.

From Big Bear Creek to its mouth, the Potlatch River flows through a flat-bottomed canyon. Big Bear Creek from the west fork of Big Bear Creek to its mouth drains the forested hills and grasslands west of the town of Deary, carving a steep canyon as it leaves the grassy potlatch ridges on its way to its confluence with Little Bear Creek. The canyon broadens as the stream approaches the Potlatch River.

Below Big Bear Creek, Middle Potlatch Creek enters the Potlatch River. The Middle Potlatch Creek headwaters originate near the town of Joel in agricultural lands of the grassy potlatch ridges. The creek carves a bedrock canyon as it leaves the plateau, widening as it descends toward the mouth, and enters the Potlatch River just upstream of Juliaetta. At its lower end, the Potlatch River enters the Clearwater River as it travels through the Nez Perce Reservation.

2.1.1 Assessment Units

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

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

Table 1 shows the pollutants addressed by this TMDL.

Table 1. Potlatch River watershed temperature-impaired assessment units addressed in this TMDL.

Water Body	Assessment Unit	Pollutant
Potlatch River - Headwaters	ID17060306CL049_02	Temperature
Potlatch River - 3rd Order	ID17060306CL049_03	Temperature
Potlatch River - 4th Order	ID17060306CL049_04	Temperature
Potlatch River - 4th Order	ID17060306CL048_04	Temperature
Potlatch River - 5th Order	ID17060306CL048_05	Temperature
Potlatch River - 5th Order	ID17060306CL045_05	Temperature
Potlatch River - 6th Order	ID17060306CL044_06	Temperature
Cedar Creek - 4th Order	ID17060306CL046_04	Temperature
Boulder Creek - 3rd Order	ID17060306CL047_03	Temperature
East Fork Potlatch River - 4th Order	ID17060306CL051_04	Temperature
Ruby Creek - 3rd Order	ID17060306CL052_03	Temperature
Moose Creek - Headwaters	ID17060306CL053_02	Temperature
Moose Creek - 3rd Order	ID17060306CL053_03	Temperature
Corral Creek - Headwaters	ID17060306CL054_02	Temperature
Corral Creek - 3rd Order	ID17060306CL054_03	Temperature
Pine Creek - Headwaters	ID17060306CL055_02	Temperature
Pine Creek - 3rd Order	ID17060306CL055_03	Temperature
Big Bear Creek - 4th Order	ID17060306CL056_04	Temperature
Big Bear Creek - 5th Order	ID17060306CL056_05	Temperature
Middle Potlatch Creek - Headwaters	ID17060306CL062_02	Temperature
Middle Potlatch Creek - 3rd Order	ID17060306CL062_03	Temperature

2.2 Applicable Water Quality Standards and Beneficial Uses

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

2.2.1 Beneficial Uses in the Watershed

See section 2.2 of the 2008 TMDL for detailed information on the watershed's beneficial uses (DEQ 2008). Table 2 lists the beneficial uses within the AUs assessed for this TMDL.

Table 2. Potlatch River watershed beneficial uses of assessed streams.

Water Body	Assessment Unit	Beneficial Uses	Type of Use
Potlatch River - Headwaters	ID17060306CL049_02	COLD, SS, PCR, DWS	Designated
Potlatch River - 3rd Order	ID17060306CL049_03	COLD, SS, PCR, DWS	Designated
Potlatch River - 4th Order	ID17060306CL049_04	COLD, SS, PCR, DWS	Designated
Potlatch River - 4th Order	ID17060306CL048_04	COLD, SS, PCR, DWS	Designated
Potlatch River - 5th Order	ID17060306CL048_05	COLD, SS, PCR, DWS	Designated
Potlatch River - 5th Order	ID17060306CL045_05	COLD, SS, PCR, DWS	Designated
Potlatch River - 6th Order	ID17060306CL044_06	COLD, SS, PCR, DWS	Designated
Cedar Creek - 4th Order	ID17060306CL046_04	COLD, SS, SCR	Existing
Boulder Creek - 3rd Order	ID17060306CL047_03	COLD, SS, SCR	Existing
East Fork Potlatch River - 4th Order	ID17060306CL051_04	COLD, SS, SCR	Existing
Ruby Creek - 3rd Order	ID17060306CL052_03	COLD, SS, SCR	Existing

Water Body	Assessment Unit	Beneficial Uses	Type of Use
Moose Creek - Headwaters	ID17060306CL053_02	COLD, SS, PCR	Existing
Moose Creek - 3rd Order	ID17060306CL053_03	COLD, SS, PCR	Existing
Corral Creek - Headwaters	ID17060306CL054_02	COLD, SS, SCR	Existing
Corral Creek - 3rd Order	ID17060306CL054_03	COLD, SS, SCR	Existing
Pine Creek - Headwaters	ID17060306CL055_02	COLD, SS, SCR	Existing
Pine Creek - 3rd Order	ID17060306CL055_03	COLD, SS, SCR	Existing
Big Bear Creek - 4th Order	ID17060306CL056_04	COLD, SS, SCR	Existing
Big Bear Creek - 5th Order	ID17060306CL056_05	COLD, SS, SCR	Existing
Middle Potlatch Creek - Headwaters	ID17060306CL062_02	COLD, SCR / SS	Designated / Existing
Middle Potlatch Creek - 3rd Order	ID17060306CL062_03	COLD, SCR / SS	Designated / Existing

Cold water aquatic life (COLD), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)

2.2.2 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) (Table 3). For more about temperature criteria and natural background provisions relevant to the PNV approach, see Appendix B.

Table 3. Numeric temperature criteria supportive of beneficial uses in Idaho water quality standards.

Parameter	Cold Water Aquatic Life	Salmonid Spawning[a]
Temperature[b]	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
Temperature	—	7-day moving average of 10 °C or less maximum daily temperature for June–September

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

2.3 Summary and Analysis of Existing Water Quality Data

No new data have been collected for these streams since the *Potlatch River Subbasin Assessment and TMDL* (DEQ 2008) other than the data necessary for conversion to PNV-style temperature TMDLs with shade curves developed for plant communities found in Idaho. Data sources are provided in Appendix C. The 2008 analysis examined main stem segments of streams included for temperature pollution. The 2016 analysis presented here expanded on that effort and included all tributary streams within the headwater segments of AUs with previously developed TMDLs (specifically, those AUs with an _02 designation). Higher-order AUs were generally similar between the analysis years with the only differences occurring in the bankfull width, which does have some impact on calculations of solar loads. Often, the differences in bankfull width were marginal and would not drastically change solar loads. The 2008 analysis examined main stem reaches of several streams such as the East Fork Potlatch River, Ruby Creek, Cedar Creek, and Boulder Creek, whereas the 2016 analysis only examined main stem reaches based on AU designation. Table 4 compares the 2008 and 2016 existing and target solar loads, as well as a percentage of load reduction required to meet target.

Table 4. 2008 and 2016 comparison of existing and target solar loads.

Water Body Segment	Assessment Unit	2008 Total Existing Load (kWh/day)	2008 Total Target Load (kWh/day)	2008 Excess Load (kWh/day)	2008 Load Reduction (%)	2016 Total Existing Load (kWh/day)	2016 Total Target Load (kWh/day)	2016 Excess Load (kWh/day)	2016 Load Reduction (%)
Potlatch River - Big Bear Creek to Clearwater River[a]	ID17060306CL044_06	6,488,593	4,146,979	2,341,614	36	2,100,000	2,400,000	0	0
Potlatch River - Corral Creek to Big Bear Creek	ID17060306CL045_05	3,392,534	2,946,251	446,283	13	4,100,000	4,600,000	0	0
Potlatch River - Moose Creek to Corral Creek	ID17060306CL048_04 ID17060306CL048_05	1,394,385	872,988	521,396	37	1,100,000	970,000	120,000	11
Cedar Creek - Leopold Creek to Potlatch River	ID17060306CL046_04	207,693	140,398	67,295	32	98,000	88,000	10,000	10
Boulder Creek - Pig Creek to Potlatch River	ID17060306CL047_03	57,081	39,332	17,750	31	31,000	12,000	20,000	65
Potlatch River - Headwaters to Moose Creek	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	78,472	38,834	39,637	51	400,000	340,000	57,000	14
East Fork Potlatch River - Ruby Creek to Potlatch River	ID17060306CL051_04	336,983	222,994	113,989	34	200,000	210,000	0	0
Ruby Creek - Unnamed tributary 3.4 km upstream to E.F. Potlatch River	ID17060306CL052_03	54,335	23,651	30,683	56	22,000	15,000	7,000	32
Moose Creek - Headwaters to Potlatch River	ID17060306CL053_02 ID17060306CL053_03	184,043	44,232	139,811	76	150,000	97,000	55,000	37
Corral Creek - Headwaters to Potlatch River	ID17060306CL054_02 ID17060306CL054_03	327,049	164,059	162,990	50	260,000	350,000	0	0
Pine Creek - Headwaters to Potlatch River	ID17060306CL055_02 ID17060306CL055_03	394,850	183,663	211,187	53	320,000	410,000	0	0
Big Bear Creek - WF Big Bear Creek to Potlatch River	ID17060306CL056_04 ID17060306CL056_05	1,994,634	1,421,586	573,047	29	600,000	620,000	0	0
Middle Potlatch Creek	ID17060306CL062_02 ID17060306CL062_03	497,979	272,681	225,298	45	630,000	550,000	80,000	13

[a]The 2016 analysis excludes portions of the Potlatch River found within the Nez Perce Reservation boundary. The 2008 analysis includes portions of the Potlatch River within the Nez Perce Reservation boundary.

Cedar Creek showed a large decrease in existing and target load; however, the 2008 analysis examined nearly 16 kilometers of stream where the 2016 analysis examined just over 8 kilometers. The 2008 existing load is approximately double that of the 2016 load, as could be expected given the differences in assessment length. Similar differences are observed in the East Fork Potlatch River, Ruby Creek, and Boulder Creek where the 2008 assessment length was greater than the 2016 assessment length.

Notable departures from presented conditions include the headwater segments of the Potlatch River and Middle Potlatch Creek. The 2016 solar loads are much greater than those calculated in 2008, even when analyzing the same total stream length. Within the Potlatch River headwaters, some of the difference between the analysis years can be attributed to the bankfull width examined. The 2016 estimated bankfull width was double the figure used in 2008. However, that alone does not account for the remainder of the difference observed. It is also unlikely that such a large difference would result from the different shade curves used between analysis years. Despite the large increase in solar load in headwater segments of the Potlatch River and Middle Potlatch Creek calculated in 2016, existing solar loads are much closer to target levels when compared to 2008.

3 Watershed Assessment—Pollutant Source Inventory

Pollution within the Potlatch River watershed is primarily from bacteria, sedimentation/siltation, and water temperature. Load allocations and wasteload allocations were established in the *Potlatch River Subbasin Assessment and TMDLs* approved by EPA in 2009 (DEQ 2008).

3.1 Point Sources

Point sources of pollution are affiliated with known discrete discharges and are regulated through the National Pollutant Discharge Elimination System (NPDES). Eight NPDES point sources exist within the Potlatch River watershed (Table 5, Figure 2), three of which are construction general permit (CGP) types. Two other listed point sources discharge to streams not in the 2014 Integrated Report for temperature. The three remaining dischargers are the Juliaetta wastewater treatment plant (WWTP), Kendrick WWTP, and Bovill WWTP. The Juliaetta and Kendrick WWTPs are year-round dischargers that discharge to an AU in the 2014 Integrated Report for temperature pollution. The Bovill WWTP is listed as a wintertime discharger to an AU in the 2014 Integrated Report for temperature pollution, but that period overlaps with several spring and fall spawning fish species found within the Potlatch River sensitive to water temperature. Wasteload allocations have been considered for the three facilities with the potential to discharge water with elevated temperatures to a stream with temperature impairments. Wasteload allocations are discussed in section 5.

Table 5. NPDES-permitted point sources in the Potlatch River watershed.

ID#	Facility Name	NPDES Type	Affected Drainage	Comments
IDR00A231	The McGregor Company	CGP	Middle Potlatch Creek (Category 4a for Bacteria, Sediments, and Temperature)	BMP regulated and state certified. No effects anticipated.
ID0023604	Troy WWTP	POTW	West Fork Little Bear Creek	Not a TMDL water.
ID0024554	Kendrick WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature.
ID0020788	Deary WWTP	POTW	Mount Deary Creek	Not a TMDL water.
ID0022861	Bovill WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature. No discharge to Potlatch River from May 1 to October 31.
IDR053100	I-Minerals Bovill Kaolin Project	CGP	Moose Creek	BMP regulated and state certified. No effects anticipated.
ID0023761	Juliaetta WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature.
IDR053101	Bovill Mine	CGP	Moose Creek	BMP regulated and state certified. No effects anticipated.

Notes: BMP = best management practice, POTW = publicly owned treatment works

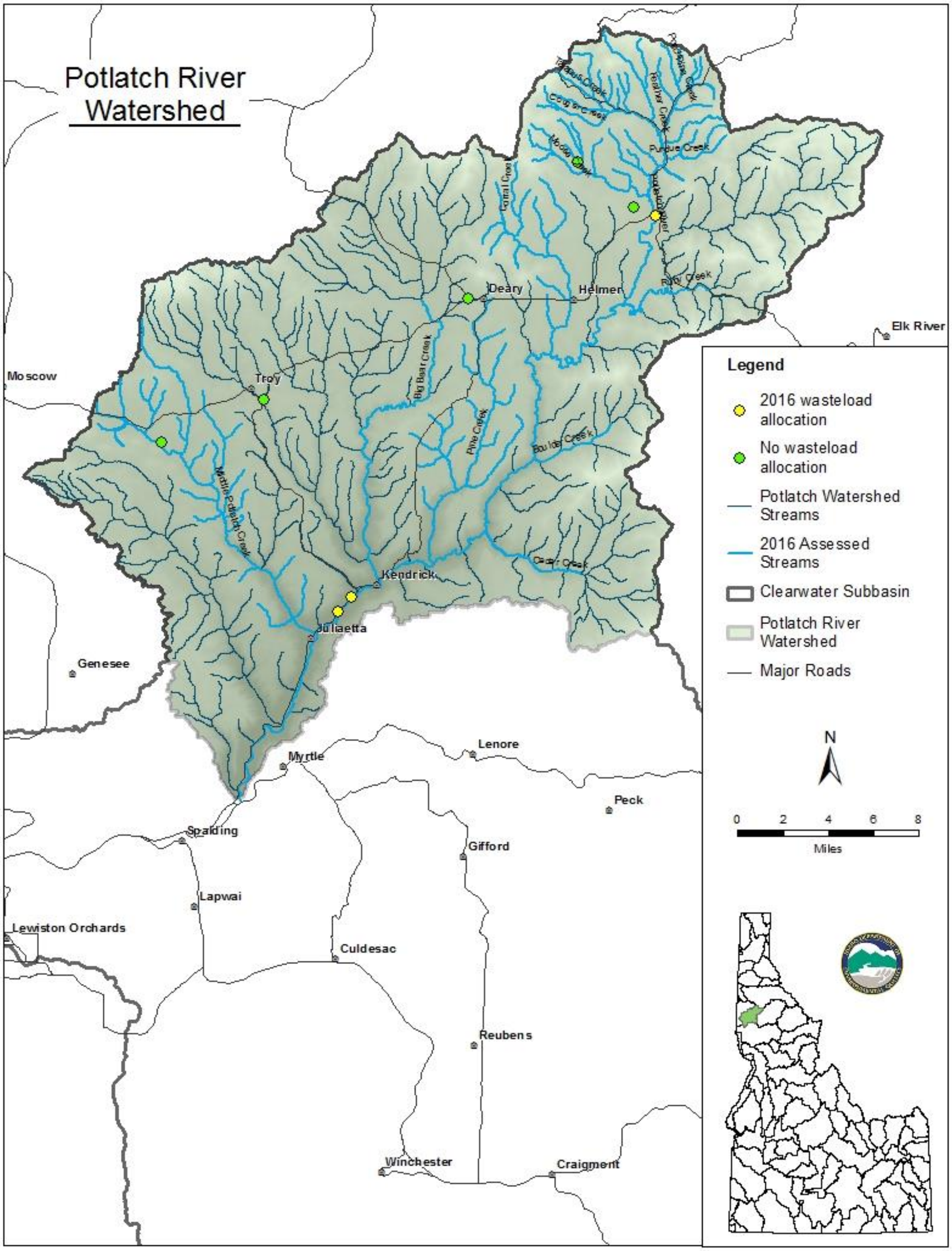

Figure 2. NPDES-permitted point sources in the Potlatch River watershed.

3.2 Nonpoint Sources

Nonpoint sources of pollution within the Potlatch River watershed include agriculture, forestry, roads, and septic systems. Approximately 36% of the watershed is considered agricultural, which includes cropped fields, conservation reserve program lands, pasture, and hay production areas. Approximately 42% of the watershed is considered forested. The major public roads in the watershed are State Highways 3, 8, and 9. Numerous graveled county, forest, and Potlatch Corporation roads allow access to the more remote areas of the watershed.

4 Watershed Assessment—Summary of Past and Present Pollution Control Efforts

Section 4 of the 2008 assessment and TMDL lists water quality improvement projects throughout the watershed (DEQ 2008).

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, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

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

Where:

LC = load capacity

MOS = margin of safety

NB = natural background

LA = load allocation

WLA = 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. After the necessary margin of safety and natural background, if

relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

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

5.1 Instream Water Quality Targets

For the Potlatch River watershed temperature TMDLs, we used 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 B 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

There are several important contributors of heat to a stream, including ground water temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the source of heat that is most controllable. 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 along a stream is that riparian plant community that could grow to an overall mature state, although some level of natural disturbance is usually included in the development and use of shade targets. Vegetation can be removed by disturbance either naturally (e.g., wildfire, disease/old age, wind damage, wildlife grazing) or anthropogenically (e.g., domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar loading to the stream without any anthropogenic removal of shade-producing vegetation. Vegetation levels less than PNV (with the exception of natural levels of disturbance and age distribution) result in the stream heating up from anthropogenically created additional solar inputs.

We can estimate PNV (and therefore target shade) from models of plant community structure (shade curves for specific riparian plant communities), and we can measure or estimate existing canopy cover or shade. Comparing the two (target and existing shade) tells us how much excess solar load the stream is receiving and what potential exists to decrease solar gain. Streams disturbed by wildfire, flood, or some other natural disturbance will be at less than PNV and require time to recover. Streams that have been disturbed by human activity may require additional restoration above and beyond natural recovery.

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 collecting these data. In this case, we used the station in Pendleton, Oregon. 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 (see Appendix B).

PNV shade and the associated solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (so long as no point sources or

other anthropogenic sources of heat exist in the watershed) and are considered to be consistent with the Idaho water quality standards, even if they exceed numeric criteria by more than 0.3 °C.

5.1.2.1 Existing Shade Estimates

Existing shade was estimated for 21 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 taking into account 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). For example, if shade for a particular stream segment was estimated somewhere between 50% and 59%, we assigned a 50% shade class to that segment. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and stream width. Streams where the banks and water are clearly visible are usually in low shade classes (10%, 20%, or 30%). Streams with dense forest or heavy brush where no portion of the stream is visible are usually in high shade classes (70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (40%, 50%, or 60%).

Visual estimates made from aerial photos are strongly influenced by canopy cover and do not always take into account topography or any shading that may occur from physical features other than vegetation. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. However, research has shown that shade and canopy cover measurements are remarkably similar (OWEB 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade. The visual estimates of shade in this TMDL were partially field verified with a Solar Pathfinder, which measures effective shade and takes into consideration other physical features that block the sun from hitting the stream surface (e.g., hillsides, canyon walls, terraces, and human-made structures).

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at 23 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, ten 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. Ten traces were taken following the manufacturer's instructions (i.e., orient to 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 50 to 100 meters (m) from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 50 m, 50 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances.

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. 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.

Nearly half of the aerial photo estimates of stream shade were within the same shade classification as the Solar Pathfinder measurements (Table 6). A majority of the remaining estimates were within one to two shade classifications of field measurements. The largest difference between the aerial estimate and the on-the-ground measurement was observed at Feather Creek, where only two Solar Pathfinder measurements were made due to difficulty in the field of finding the main channel in a highly braided system.

Verifying aerial interpretations allows for a check on accuracy and further refinement of the assessment techniques involved. Solar Pathfinder data were used to correct the stream segments with the largest over and under estimations. Adjacent stream segments that showed similar characteristics were also corrected. Allowing for this correction gives a more accurate estimate of solar load for the water body segment.

Table 6. Solar Pathfinder field verification results for the Potlatch River watershed.

Pathfinder Site	Aerial Classification	Pathfinder Measurement	Pathfinder Classification	Classification Difference[a]
Boulder Cr_01	80	83	80	0
Cedar Cr_01	60	67	60	0
Corral Cr_01	60	71	70	-1
EF Corral Cr_01	50	48	40	1
EF Corral Cr_02	90	90	90	0
EF Potlatch R_01	60	36	30	3
EF Potlatch R_02	30	40	40	-1
Feather Cr_01	60	24	20	4
Porcupine Cr_01	70	72	70	0
Potlatch R_01	50	61	60	-1
Potlatch R_02	10	35	30	-2
Potlatch R_03	10	36	30	-2
Potlatch R_04	30	16	10	2
Potlatch R_05	40	47	40	0
Potlatch R_06	40	12	10	3
Potlatch R_07	20	47	40	-2
Potlatch R_08	20	26	20	0
Purdue Cr_01	60	65	60	0
Ruby Cr_01	50	53	50	0
WF Corral Cr_01	50	53	50	0
WF Corral Cr_01 T	90	92	90	0
WF Corral Cr_02	80	81	80	0
WF Potlatch R_01	60	67	60	0

[a] Mean = 0.17, Standard Deviation = 1.56, Confidence Level (95%) = 0.67

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 (see Shumar and De Varona 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 3).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Clearwater curve from Figure 3. Although estimates from other curves were examined (i.e., Spokane, Salmon), the Clearwater curve was ultimately chosen because of its proximity to the Potlatch River watershed and since the Potlatch River is a tributary to the Clearwater River. Existing width data should also be evaluated and compared to these curve estimates if such data are available. However, for the Potlatch River watershed, only a few Beneficial Use Reconnaissance Program (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.

In general, we found BURP bankfull width data to agree with natural bankfull width estimates from the Clearwater curve and chose not to make natural widths any smaller than these Clearwater basin estimates. Natural bankfull width estimates for each stream in this analysis are presented in Appendix C. The load analysis tables contain a natural bankfull width and an existing bankfull width for every stream segment in the analysis based on the bankfull width results presented in Tables C2–C11. Existing widths and natural widths are the same in load tables when no data support making them different.

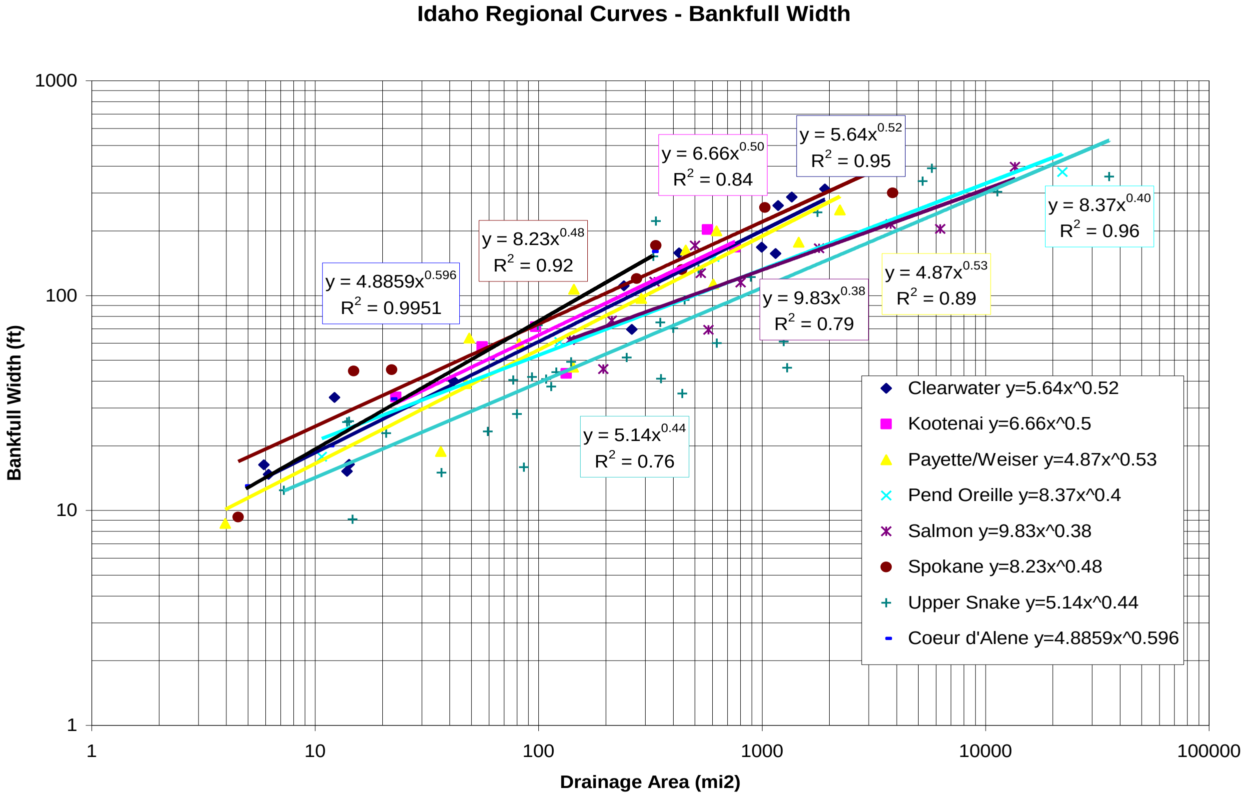

Figure 3. Bankfull width as a function of drainage area.

Design Conditions

The Potlatch River watershed is found in two different Level III ecoregions (McGrath et al. 2001). The mouth of the Potlatch River is within the Columbia Plateau ecoregion, and the upper portions of the river and tributary systems are found within the Northern Rockies ecoregion. Most valley bottoms in the Level IV ecoregion classification have been identified as the Lower Clearwater Canyons ecoregion with upland areas described as Grassy Potlatch Ridges transitioning to Northern Idaho Hills and Low Relief Mountains near the headwaters (McGrath et al. 2001). The Level IV ecoregion classification places the mouth of the river in the Lower Snake and Clearwater Canyons ecoregion. The remainder of the watershed is found in Level IV ecoregions such as the Lower Clearwater Canyons in the valley bottoms with upland areas described as Grassy Potlatch Ridges transitioning to Northern Idaho Hills and Low Relief Mountains near the headwaters (McGrath et al. 2001). The Lower Clearwater Canyons are typically more developed than the Lochsa and Selway River bottoms. Outside of the riparian zone, the vegetation is comprised of a mixed grassland and open woodland where the trees are sufficiently spaced as to not create a closed canopy. Other woodland types within this ecoregion include Douglas-fir–ponderosa pine forests. Valley bottoms tend to have greater densities of forest when compared to the surrounding hill sides.

In the Grassy Potlatch Ridges ecoregion, the landscape is made up of grasses and some shrubs. In cooler, moister areas, ponderosa pine forests are present. This ecoregion type contrasts with the forests and savannas of the Lower Clearwater Canyons and the upland forests of the Northern Idaho Hills and Low Relief Mountains. The Northern Idaho Hills and Low Relief Mountains are

not as high or rugged as other nearby forested ecoregions. A mix of forest types including western red cedar, grand fir, Douglas-fir, and ponderosa pine are normally present. Logging is a common practice in these easily accessible forests.

Shade Curve Selection

To determine PNV shade targets for the Potlatch River watershed, effective shade curves from the Clearwater National Forest and non-forest types were examined (Table 7) (Shumar and De Varona 2009). 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 Potlatch River watershed, curves for the most similar vegetation type were selected for shade target determinations. Shade curves presented in Shumar and De Varona (2009) generally correspond with ecoregion types described in the previous section. Upland areas align with the Northern Idaho Hills and Low Relief Mountains and are described as areas that are generally above the breaklands in elevation and have more rolling topography. The upland areas within the Clearwater National Forest typically are cooler and more mesic than the breaklands. The breaklands correspond to the Grassy Potlatch Ridges and are described as mostly steep slopes at lower elevations that have warmer climatic regimes. Other shade curves used for this analysis include a mix of forest and shrubs, alder, hawthorn, western cottonwood, and grass-dominated riparian areas.

Table 7. Shade curves for target selection for the various vegetation types in the analysis.

Clearwater National Forest Types	Idaho Non-Forest Types
Mesic Uplands	Western Cottonwood
Upland / Mountain Alder Mix	Mountain Alder
Warm/Dry Breaklands	Palouse Hawthorn
Warm/Dry Breaklands / Mountain Alder Mix	Gramminoid (grasses)

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.

We obtained solar load data from flat-plate collectors at the NREL weather station in Pendleton, OR. 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. 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.

Tables C12–C32 and Figures C10–C42 show the existing shade, target shade, and shade deficit levels. The tables also 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 apparent rounding errors.

The AU with the largest target load (i.e., load capacity) was the 5th-order segment of the Potlatch River (AU ID17060306CL045_05) with 4,600,000 kWh/day (Table C17). The smallest target load was in the 3rd-order segment of Boulder Creek (AU ID17060306CL047_03) with 12,000 kWh/day (Table C20).

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” (Water Quality Planning and Management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed) but may be aggregated by type of source or area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. There are currently eight permitted point sources in the affected AUs. 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 station. Existing shade data are presented in Tables C12–C32. Like load capacities (target loads), existing loads in Tables C12–C32 are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade) to be discussed next in the load allocation section and as depicted in the lack-of-shade figures (Figures C10–C42).

The AU with the largest existing load was the Potlatch River 5th-order segment (AU ID17060306CL045_05) with 4,100,000 kWh/day (Table C17). The smallest existing load

was in the Ruby Creek 3rd-order segment AU (AU ID17060306CL052_03) with 22,000 kWh/day (Table C21).

5.4 Load and Wasteload Allocation

Because this TMDL is based on PNV, which is equivalent to background loading, the load allocation is essentially the desire to achieve background conditions. However, in order to reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Therefore, load allocations are stream segment specific and dependent upon the target load for a given segment. Tables C12–C32 show the target shade and corresponding target summer load. This target load (i.e., load capacity) is necessary to achieve background conditions. There is no opportunity to further remove shade from the stream by any activity without exceeding its load capacity. Additionally, because this TMDL is dependent upon background conditions for achieving water quality standards, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system.

Table 8 shows the total existing, target, and excess loads and the average lack of shade for each water body examined. The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of their larger channel widths.

Although this TMDL analysis focuses on total solar loads, it is important to note that differences between existing and target shade, as depicted in the shade deficit figures (Figures C10–C42), are the key to successfully restoring these waters to achieving water quality standards. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each load analysis table contains a column that lists the lack of shade on the stream segment. This value is derived from subtracting target shade from existing shade for each segment. Thus, stream segments with the largest lack of shade are in the worst shape. The average lack of shade derived from the last column in each load analysis table is listed in Table 8 and provides a general level of comparison among streams.

Table 8. Total solar loads and average lack of shade for all waters.

Water Body/Assessment Unit	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)		
Potlatch River - Headwaters (ID17060306CL049_02)	430,000	250,000	180,000 (42%)	-22
Potlatch River - 3rd Order (ID17060306CL049_03)	150,000	130,000	18,000 (12%)	-12
Potlatch River - 4th Order (ID17060306CL049_04)	290,000	270,000	20,000 (7%)	-9
Potlatch River - 4th Order (ID17060306CL048_04)	380,000	340,000	39,000 (10%)	-10
Potlatch River - 5th Order (ID17060306CL048_05)	710,000	630,000	80,000 (11%)	-10
Potlatch River - 5th Order (ID17060306CL045_05)	4,100,000	4,600,000	0 (0%)	0
Potlatch River - 6th Order (ID17060306CL044_06)	2,100,000	2,400,000	0 (0%)	0
Cedar Creek - 4th Order (ID17060306CL046_04)	98,000	88,000	10,000 (10%)	-15
Boulder Creek - 3rd Order (ID17060306CL047_03)	31,000	12,000	20,000 (65%)	-19
East Fork Potlatch River - 4th Order (ID17060306CL051_04)	200,000	210,000	0 (0%)	0
Ruby Creek - 3rd Order (ID17060306CL052_03)	22,000	15,000	7,000 (32%)	-14
Moose Creek - Headwaters (ID17060306CL053_02)	140,000	42,000	92,000 (66%)	-32
Moose Creek - 3rd Order (ID17060306CL053_03)	110,000	85,000	28,000 (25%)	-16
Corral Creek - Headwaters (ID17060306CL054_02)	180,000	120,000	65,000 (36%)	-20
Corral Creek - 3rd Order (ID17060306CL054_03)	240,000	330,000	0 (0%)	0
Pine Creek - Headwaters (ID17060306CL055_02)	380,000	320,000	62,000 (16%)	-27
Pine Creek - 3rd Order (ID17060306CL055_03)	150,000	220,000	0 (0%)	0
Big Bear Creek - 4th Order (ID17060306CL056_04)	520,000	550,000	0 (0%)	0
Big Bear Creek - 5th Order (ID17060306CL056_05)	76,000	66,000	10,000 (13%)	-13

Water Body/Assessment Unit	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)		
Middle Potlatch Creek - Headwaters (ID17060306CL062_02)	670,000	300,000	390,000 (58%)	-41
Middle Potlatch Creek - 3rd Order (ID17060306CL062_03)	620,000	540,000	80,000 (13%)	-3

Note: Load data are rounded to two significant figures, which may present rounding errors.

Excess solar loads were observed in a majority of AUs assessed as part of this analysis. For those AUs with an excess load, the percentage of solar load required to meet target loads ranged from 7% at the Potlatch River – 4th-order segment (ID17060306CL049_04) to 66% at the Moose Creek – Headwaters 1st- and 2nd-order segments (ID17060306CL053_02). Six other AUs were found to be meeting solar load targets, including 5th- and 6th-order segments of the Potlatch River near the confluence with the Clearwater River.

The largest existing and target solar loads were observed in large-order segments of the Potlatch River. The river in these segments is wide, with bankfull widths estimated at 24–48 meters. It is expected that solar loads in a river system this large would have correspondingly large solar loads. In the smaller headwater segments of the AUs analyzed, the Middle Potlatch Creek – Headwaters 1st- and 2nd-order segments had the largest existing solar load, but the Pine Creek – Headwaters had a higher target solar load. The observed difference in existing solar loads between Middle Potlatch Creek and Pine Creek could be attributed to the length of stream present in each AU, but it is more likely that the amount and type of streamside vegetation present play larger roles. The type of streamside vegetation expected within each drainage is sufficiently different to produce the calculated solar loads; the headwater segments of the Pine Creek drainage are likely made up of more forested areas, whereas the headwaters of Middle Potlatch Creek likely have a larger concentration of shrubs or forest/shrub communities.

A certain amount of excess load is potentially created by the existing shade/target shade difference inherent in the load analysis. Because existing shade is reported as a 10% shade class and target shade a unique integer between 0 and 100%, there is usually a difference between the two. For example, say a particular stream segment has a target shade of 86% based on its vegetation type and natural bankfull width. If existing shade on that segment were at target level, it would be recorded as 80% in the load analysis because it falls into the 80% existing shade class. There is an automatic difference of 6%, which could be attributed to the margin of safety.

5.4.1 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 reads as follows:

> 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, we have not quantified what impact, if any, diversions are having on stream temperature. Water diversions are allowed for in 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.

5.4.2 Margin of Safety

The margin of safety 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 load analysis. Although the load analysis used in this TMDL involves gross estimations that are likely to have large variances, load allocations are applied to the stream and its riparian vegetation rather than specific nonpoint source activities and can be adjusted as more information is gathered from the stream environment.

5.4.3 Seasonal Variation

This TMDL is based on average summer 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. 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.

5.4.4 Reasonable Assurance

CWA §319 requires each state to develop and submit a nonpoint source management plan. The *Idaho Nonpoint Source Management Plan* was approved by EPA in March 2015 (DEQ 1999). 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 nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups and watershed advisory groups (WAGs). The Potlatch River WAG is the designated WAG for the Potlatch River watershed.

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 9.

Table 9. State of Idaho's regulatory authority for nonpoint pollution sources.

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

Idaho uses a voluntary approach to address agricultural nonpoint sources; however, regulatory authority is found in the water quality standards (IDAPA 58.01.02.350.01–03). IDAPA 58.01.02.055.07 refers to the *Idaho Agricultural Pollution Abatement Plan* (Ag Plan) (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 and wastewater treatment requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; Idaho Soil and Water Conservation Commission for grazing and agricultural activities; Idaho Transportation Department for public road construction; Idaho State Department of Agriculture for aquaculture; and DEQ for all other activities (IDAPA 58.01.02.010.24).

5.4.5 TMDL Wasteload Allocation

There are eight NPDES-permitted point sources in the Potlatch River watershed (Table 5). Of those, three are CGP-type permits, two discharge to waters without a TMDL, and three are POTW-type permits. The POTW permits consist of the WWTP of Juliaetta, Kendrick, and Bovill. The Bovill WWTP discharges during the winter months of November through April; however, resident fish spawning seasons in both the spring and fall overlap with that discharge window. Due to this overlap, the Bovill WWTP has been included in the wasteload allocation. The *Potlatch River Subbasin Assessment and TMDLs* (DEQ 2008) calculated wasteload allocations for the Juliaetta and Kendrick WWTP. Temperature monitoring is a permitted requirement for the point sources in Table 10; however, no temperature data was available within the discharge monitoring reports in EPA's Permit Compliance System and Integrated Compliance Information System (ICIS). The ICIS database contains information regarding facilities holding NPDES permits.

There is one unpermitted discharge to the Potlatch River from the Juliaetta drinking water facility. The estimated design flow from the Juliaetta drinking water facility is 0.0069 mgd. The unpermitted Juliaetta drinking water facility was included in the wasteload allocation.

Table 10. NPDES-permitted point sources in the Potlatch River watershed with wasteload allocations.

Facility Name	NPDES Type	Affected Drainage	Comments
Kendrick WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature.
Bovill WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature. No discharge to Potlatch River from May 1 to October 31.
Juliaetta WWTP	POTW	Potlatch River	Facility discharges to impaired water for temperature.

Wasteload allocations in the previous TMDL (DEQ 2008) calculated allowable effluent temperatures based on a relation between the discharge flow and flow of the receiving water body when compared against a temperature standard. This TMDL follows the methods used in 2008 and presents a range of allowable effluent temperatures at different flow rates. The effluent temperatures presented in the wasteload allocation tables are for illustrative purposes only and do not represent temperature limits. Wasteload allocations are designed to meet the designated temperature limits applied to all facilities that discharge to a water body listed for temperature

impairment. Design flow rates for each facility were found in that facility's NPDES permit application and were used to create a range of discharge flows that could be expected. A range of Potlatch River flows were created from average monthly flow data available from a United States Geological Survey (USGS) gaging station 13341570 near the mouth of the Potlatch River near Spalding, ID. Figure 4 shows monthly average flow values from this USGS gaging station. The minimum average monthly flow is 0.131 cubic feet per second (cfs) calculated in August 2015, and the maximum average monthly flow is 2,560 cfs calculated in March 2012. Average annual flow from 2003 to 2016 was calculated at 391 cfs.

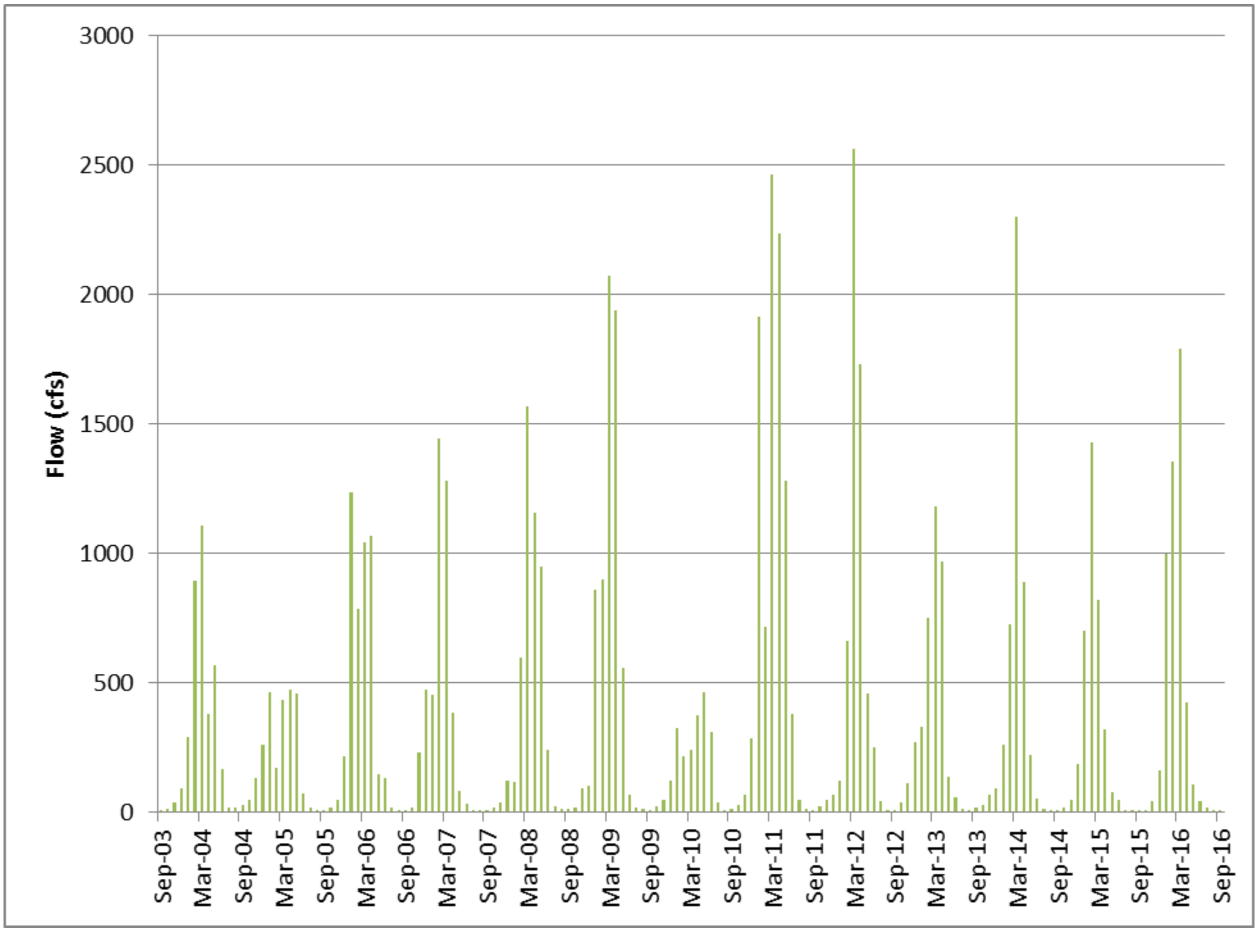

Figure 4. Average monthly flow rates for the Potlatch River from USGS gaging station 13341570 near Spalding, Idaho.

Tables 11 and 12 present effluent discharge temperatures that would not exceed the salmonid spawning average daily temperature criterion by more than 0.3 °C. Based on the fish species present within the subbasin and presented in the Potlatch River subbasin assessment and TMDL (DEQ 2008), the spring salmonid spawning time period would extend from March 15 to July 15 (DEQ 2016a). The fall salmonid spawning time period would extend from October 1 to June 1 (DEQ 2016a, BioAnalysts et al. 2014). For the remaining portions of the summer season, the cold water aquatic life criteria would be applicable and cover the time period of July 16–September 30. Tables 11–14 present effluent discharge temperatures that would not exceed the salmonid spawning criterion, and Tables 15–18 present effluent discharge temperatures that would not exceed the cold water aquatic life criterion.

Designed discharge for the Juliaetta and Kendrick WWTPs considered in this wasteload allocation is 0.12 cfs. Designed discharge for the Bovill WWTP is 0.08 cfs. Because the receiving water flow and the facility design flow are the same for the Juliaetta and Kendrick WWTPs, those wasteload allocations are presented in a shared table (Table 11). The salmonid spawning temperature criteria used for the calculations presented in Table 11–Table 14 are based on the 9 °C or less daily average.

Table 11. Juliaetta and Kendrick WWTPs allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the salmonid spawning temperature criteria (9 °C).

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.07	0.15	0.23	0.3
	Effluent Temperature (°C)				
1	16.8	10.4	9.8	9.6	9.6
2	24.3	11.4	10.3	10.0	9.8
5	46.8	14.7	11.8	10.9	10.6
10	84.3	20.0	14.3	12.6	11.8
25		36.1	21.8	17.5	15.6
50		62.9	34.3	25.6	21.8
100			59.3	41.9	34.3

Table 12. Bovill WWTP allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the salmonid spawning temperature criteria (9 °C).

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.05	0.1	0.15	0.2
	Effluent Temperature (°C)				
1	16.8	10.8	10.1	9.8	9.7
2	24.3	12.3	10.8	10.3	10.1
5	46.8	16.8	13.1	11.8	11.2
10	84.3	24.3	16.8	14.3	13.1
25		46.8	28.1	21.8	18.7
50		84.3	46.8	34.3	28.1
100			84.3	59.3	46.8

Temperature values presented in Table 11 and Table 12 were transformed to kWh/day to more accurately describe the heat load each facility contributes to the receiving water body, as shown in Table 13 and Table 14. Similar to the temperature values presented, the heat loads represent values that would not contribute additional heat beyond criteria limits.

Table 13. Potlatch River heat load (kWh/day) added by Juliaetta and Kendrick WWTPs effluent, based on effluent and receiving water temperature.

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.07	0.15	0.23	0.3
	Heat Load (kWh/day)				
1	222	273	341	410	469
2	435	486	555	623	683
5	1,075	1,126	1,195	1,263	1,323
10	2,142	2,193	2,261	2,329	2,389
25		5,392	5,461	5,529	5,589
50		10,725	10,793	10,862	10,921
100			21,459	21,527	21,587

Table 14. Potlatch River heat load (kWh/day) added by Bovill WWTP effluent, based on effluent and receiving water temperature.

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.05	0.1	0.15	0.2
	Heat Load (kWh/day)				
1	222	256	299	341	384
2	435	469	512	555	597
5	1,075	1,109	1,152	1,195	1,237
10	2,142	2,176	2,218	2,261	2,304
25		5,375	5,418	5,461	5,503
50		10,708	10,751	10,793	10,836
100			21,416	21,459	21,501

Table 15 and Table 16 present allowable effluent discharge temperatures that would not exceed the cold water aquatic life average daily temperature criterion by more than 0.3 °C. Because the receiving water flow and the facility design flow are the same for the Juliaetta and Kendrick WWTPs, those wasteload allocations are presented in a shared table (Table 15). The cold water aquatic life temperature criteria used for the calculations presented in Table 15–Table 18 are based on the 19 °C or less daily average.

Table 15. Juliaetta and Kendrick WWTPs allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the cold water aquatic life temperature criteria (19 °C).

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.07	0.15	0.23	0.3
	Effluent Temperature (°C)				
1	26.8	20.4	19.8	19.6	19.6
2	34.3	21.4	20.3	20.0	19.8
5	56.8	24.7	21.8	20.9	20.6
10	94.3	30.0	24.3	22.6	21.8
25		46.1	31.8	27.5	25.6
50		72.9	44.3	35.6	31.8
100			69.3	51.9	44.3

Table 16. Bovill WWTP allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the cold water aquatic life temperature criteria (19 °C).

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.05	0.1	0.15	0.2
	Effluent Temperature (°C)				
1	26.8	20.8	20.1	19.8	19.7
2	34.3	22.3	20.8	20.3	20.1
5	56.8	26.8	23.1	21.8	21.2
10	94.3	34.3	26.8	24.3	23.1
25		56.8	38.0	31.8	28.7
50		94.3	56.8	44.3	38.0
100			94.3	69.3	56.8

Temperature values presented in Table 15 and Table 16 were transformed to kWh/day to more accurately describe the heat load each facility contributes to the receiving water body, as shown in Table 17 and Table 18. Similar to the temperature values presented, the heat loads represent values that would not contribute additional heat beyond criteria limits.

Table 17. Potlatch River heat load (kWh/day) added by Juliaetta and Kendrick WWTPs effluent, based on effluent and receiving water temperature.

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.07	0.15	0.23	0.3
	Heat Load (kWh/day)				
1	506	2,264	4,607	6,951	9,002
2	720	2,477	4,821	7,164	9,215
5	1,359	3,117	5,461	7,804	9,855
10	2,426	4,184	6,527	8,871	10,921
25		7,383	9,727	12,070	14,121
50		12,716	15,059	17,403	19,454
100			25,725	28,068	30,119

Table 18. Potlatch River heat load (kWh/day) added by Bovill WWTP effluent, based on effluent and receiving water temperature.

Potlatch River flow below WWTP outfall (cfs)	WWTP Effluent Discharge (cfs)				
	0.01	0.05	0.1	0.15	0.2
	Heat Load (kWh/day)				
1	506	1,678	3,143	4,607	6,072
2	720	1,891	3,356	4,821	6,285
5	1,359	2,531	3,996	5,461	6,925
10	2,426	3,598	5,062	6,527	7,992
25		6,797	8,262	9,727	11,192
50		12,130	13,595	15,059	16,524
100			24,260	25,725	27,190

The Juliaetta drinking water facility receives a wasteload allocation which requires effluent temperatures to meet 9° C plus 0.3° C after mixing for the salmonid spawning period (October through June) and 19° C plus 0.3° C after mixing during the remaining months (July through September). The estimated flow for the Juliaetta drinking water facility considered in this wasteload allocation is 0.0069 mgd. The salmonid spawning temperature criteria used for the calculations presented in Table 19 and Table 20 are based on the 9 °C or less daily average.

Table 19. Juliaetta drinking water facility allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the salmonid spawning temperature criteria (9 °C).

Potlatch River flow below DWF outfall (cfs)	DWF Effluent Discharge (cfs)				
	0.001	0.004	0.007	0.011	0.014
	Effluent Temperature (°C)				
1	84.3	28.1	20.0	16.1	14.7
2		46.8	30.7	22.9	20.0
5			62.9	43.4	36.1
10				77.5	62.9
15					89.7
20					
25					

Table 20. Potlatch River heat load (kWh/day) added by Juliaetta drinking water facility effluent, based on effluent and receiving water temperature based on salmonid spawning temperature criteria (9 °C).

Potlatch River flow below DWF outfall (cfs)	DWF Effluent Discharge (cfs)				
	0.001	0.004	0.007	0.011	0.014
	Heat Load (kWh/day)				
1	214	217	219	223	225
2		430	433	436	439
5			1,073	1,076	1,078
10				2,142	2,145
15					3,212
20					
25					

Table 21 and Table 22 present allowable effluent discharge temperatures that would not exceed the cold water aquatic life average daily temperature criterion by more than 0.3 °C. The cold water aquatic life temperature criteria used for the calculations presented in Table 21 and Table 22 are based on the 19 °C or less daily average.

Table 21. Juliaetta drinking water facility allowable maximum effluent temperature (°C) which would increase receiving water temperature by 0.3 °C when the receiving water meets the cold water aquatic life temperature criteria (19 °C).

Potlatch River flow below DWF outfall (cfs)	DWF Effluent Discharge (cfs)				
	0.001	0.004	0.007	0.011	0.014
	Effluent Temperature (°C)				
1	94.3	38.1	30.0	26.1	24.7
2		56.8	40.7	32.9	30.0
5			72.9	53.4	46.1
10				87.5	72.9
15					99.7
20					
25					

Table 22. Potlatch River heat load (kWh/day) added by Juliaetta drinking water facility effluent, based on effluent and receiving water temperature based cold water aquatic life temperature criteria (19 °C).

Potlatch River flow below DWF outfall (cfs)	DWF Effluent Discharge (cfs)				
	0.001	0.004	0.007	0.011	0.014
	Heat Load (kWh/day)				
1	243	330	418	536	623
2		544	632	749	837
5			1,272	1,389	1,477
10				2,455	2,543
15					3,610
20					
25					

The wasteload allocation assigned to the Juliaetta drinking water facility is based on best estimates from the facility and may be updated in the future to reflect the most up-to-date information.

5.4.6 Construction Stormwater and TMDL Wasteload Allocation

There are eight known NPDES-permitted point sources in the affected watersheds; of those, three are stormwater construction permit types (Table 5). As those permits are EPA-regulated and require BMPs to limit the effects of stormwater runoff, they are not anticipated to affect the waters analyzed in this TMDL. Should a point source be proposed that would have thermal consequences on these waters, background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09; IDAPA 58.01.02.401.01) should be involved (see Appendix B).

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or human-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for CWA purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the MSGP, and construction stormwater covered under the Construction General Permit (CGP). For more information about these permits and managing stormwater, see Appendix D.

5.4.7 Reserve for Growth

An explicit growth reserve has not been included in this TMDL addendum. The load capacity has been allocated to the existing sources in the watershed. Any new sources will need to obtain an allocation from the existing load allocation. The TMDL is based on numeric temperature criteria. Therefore, growth can occur provided the following are true:

- The receiving stream channel can transport the extra effluent.
- The effluent discharge temperature would not exceed the applicable temperature criteria by more than 0.3°C after mixing.

DEQ via this addendum makes no statement about water rights or availability.

5.5 Implementation Strategies

Implementation strategies for TMDLs produced using PNV-based shade and solar loads should incorporate the load analysis tables presented in this TMDL (Tables C12–C32). These tables need to be updated, first to field verify the remaining existing shade levels and second to monitor progress toward achieving reductions and TMDL goals. Using the Solar Pathfinder to measure existing shade levels in the field is important to achieving both objectives. It is likely that further field verification will find discrepancies with reported existing shade levels in the load analysis tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include Solar Pathfinder monitoring to simultaneously field verify the TMDL and mark progress toward achieving desired load reductions.

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 (addressed in section 5.4.4) for the TMDL to meet water quality standards is based on the implementation strategy. There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land-use activities (e.g., logging, grazing, and mining). It is important that existing shade for each stream segment be field verified to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

5.5.1 Time Frame

Implementation of this 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 is dependent on mature riparian communities to substantially improve stream temperatures, DEQ believes 10–20 years may be a reasonable amount of time for achieving water quality standards. Shade targets will not be achieved all at once. Given their smaller bankfull widths, targets for smaller streams may be reached sooner than those for larger streams.

DEQ and the designated WAG will continue to re-evaluate TMDLs on a 5-year cycle. During the 5-year review, implementation actions completed, in progress, and planned will be reviewed, and pollutant load allocations will be reassessed accordingly.

5.5.2 Approach and Responsible Parties

Development of the implementation plan for the Potlatch River watershed TMDL will proceed under the existing practice established for the state of Idaho. DEQ, the Potlatch River WAG, federal land management agencies, affected private landowners, and other watershed stakeholders with input through the established public process will cooperatively develop and implement the plan. Other individuals may be identified to assist in the development of site-specific implementation plans if their areas of expertise are identified as beneficial to the process.

In addition to the designated agencies, the public (through the WAG's process and other equivalent processes) will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation significantly affects public acceptance of the document and the proposed control actions. Stakeholders (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 that are developed with substantial public cooperation and involvement.

5.5.3 Implementation Monitoring Strategy

Effective shade monitoring can take place on any segment throughout the 21 AUs and be compared to existing shade estimate figures in Appendix C and described in Tables C12–C32. Those areas with the largest disparity between existing and target shade should be monitored with Solar Pathfinders to verify existing shade levels and determine progress toward meeting shade targets. Since many existing shade estimates have not been field verified, they may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Ten equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

5.5.4 Pollutant Trading

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed. For additional information, see Appendix E.

6 Conclusions

Effective shade targets were established for those water bodies and AUs listed in Table 1 based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation and partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02). A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table 23.

Table 23. Summary of assessment outcomes for assessment units.

Water Body	Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Potlatch River - Headwaters	ID17060306CL049_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 3rd Order	ID17060306CL049_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 4th Order	ID17060306CL049_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 4th Order	ID17060306CL048_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 5th Order	ID17060306CL048_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 5th Order	ID17060306CL045_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Potlatch River - 6th Order	ID17060306CL044_06	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Cedar Creek - 4th Order	ID17060306CL046_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Boulder Creek - 3rd Order	ID17060306CL047_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
East Fork Potlatch River - 4th Order	ID17060306CL051_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Ruby Creek - 3rd Order	ID17060306CL052_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Moose Creek - Headwaters	ID17060306CL053_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Moose Creek - 3rd Order	ID17060306CL053_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade

Water Body	Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Corral Creek - Headwaters	ID17060306CL054_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Corral Creek - 3rd Order	ID17060306CL054_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Pine Creek - Headwaters	ID17060306CL055_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Pine Creek - 3rd Order	ID17060306CL055_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Big Bear Creek - 4th Order	ID17060306CL056_04	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Big Bear Creek - 5th Order	ID17060306CL056_05	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Middle Potlatch Creek - Headwaters	ID17060306CL062_02	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade
Middle Potlatch Creek - 3rd Order	ID17060306CL062_03	Temperature	Yes	Remain in Category 4a	Excess solar load from a lack of existing shade

The 2016 analysis based on data collected in 2015 revisits a shade analysis completed for the 2008 TMDL. The 2008 TMDL used surrogate shade curve values to estimate solar loads on streams. The 2016 analysis updates those methods and incorporates shade curves developed from riparian communities found within the state of Idaho. The 2016 analysis was completed for all segments of the AUs; it represents an expansion of the 2008 analysis, which considered only main stem segments of streams in the AUs.

A comparison of solar loads calculated in 2008 and 2016 show few similarities between the years. Efforts were made to match as closely as possible the segments of stream analyzed, but discrepancies still exist. In streams such as Cedar Creek and Boulder Creek, the 2008 analysis was completed on the entire main stem. The 2016 analysis was completed only on the AUs that were shorter in length.

The 1st- and 2nd-order tributaries found in headwater segments of the Potlatch River, Moose Creek, Pine Creek, and Middle Potlatch Creek represent some of the largest percentages of excess solar loads. Stream segments of this size make up a proportionately large amount of the stream miles analyzed and have an opportunity to contribute a relatively large portion of the total heat load. As a benefit to the watershed and rehabilitation, these streams are usually small, and it is feasible that they can be treated or enhanced more easily than a large stream. Rehabilitation efforts in small streams have the potential to create a more pronounced effect and can provide a greater benefit when compared to a similar length of rehabilitated large stream or river.

High-order segments of the Potlatch River are currently meeting shade targets and carry no excess solar load. Although the solar loads present in these river segments are many times greater than other AUs assessed, they have been found to meet shade targets. Cottonwood forests and relatively dense stands of shrubs have shown to be sufficient in creating adequate shade in these river segments. All AUs found meeting shade targets were 3rd-order or larger stream segments. Those include segments of the East Fork of the Potlatch River, Corral Creek, Pine Creek, and Big Bear Creek.

Managers should strive to meet target shade levels for individual stream segments with future implementation plans and should prioritize implementation efforts regarding the largest differences between existing and target shade.

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

References Cited

Armantrout, N.B., compiler. 1998. *Glossary of Aquatic Habitat Inventory Terminology*. Bethesda, MD: American Fisheries Society.

BioAnalysts, Inc., Anchor QEA, and D. Essig. 2014. Geography and Timing of Salmonid Spawning in Idaho.

CFR (Code of Federal Regulation). 1977. "Guidelines Establishing Test Procedures for the Analysis of Pollutants." 40 CFR 136.

CFR (Code of Federal Regulation). 1983. "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." 40 CFR 122.

CFR (Code of Federal Regulation). 1983. "Water Quality Standards." 40 CFR 131.

CFR (Code of Federal Regulation). 1995. "Water Quality Planning and Management." 40 CFR 130.

Clean Water Act (Federal water pollution control act), 33 United States Code § 1251-1387. 1972.

DEQ (Idaho Department of Environmental Quality). 1999. *Idaho Nonpoint Source Management Plan*. State of Idaho. Division of Environmental Quality.

DEQ (Idaho Department of Environmental Quality). 2005. *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties*. Boise, ID: DEQ. Available at: *www.deq.idaho.gov/water-quality/wastewater/stormwater*.

DEQ (Idaho Department of Environmental Quality). 2008. *Potlatch River Subbasin Assessment and TMDLs.* Lewiston, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2010. *Water Quality Pollutant Trading Guidance.* Boise, ID: DEQ. Available at: *www.deq.idaho.gov/water-quality/surface-water/pollutant-trading*.

DEQ (Idaho Department of Environmental Quality). 2014. *Idaho's 2014 Integrated Report*. Boise, ID: DEQ. Available at: *www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report*.

DEQ (Idaho Department of Environmental Quality). 2016a. *Water Body Assessment Guidance*. Boise, ID: DEQ. *www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/*

DEQ (Idaho Department of Environmental Quality). 2016b. *Water Quality Trading Guidance*. Boise, ID: DEQ. Available at: *https://www.deq.idaho.gov/media/60179211/water-quality-trading-guidance-1016.pdf*

EPA (US Environmental Protection Agency). 1996. *Biological Criteria: Technical Guidance for Streams and Small Rivers*. Washington DC: EPA, Office of Water. EPA 822-B-96-001.

Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, and D.T. Mosier. 2002. *Water Body Assessment Guidance.* 2nd ed. Boise, ID: Department of Environmental Quality. 114 p.

Idaho Code. 2012. "Creation of Watershed Advisory Groups." Idaho Code 39-3615.

Idaho Code. 2012. "Development and Implementation of Total Maximum Daily Load or Equivalent Processes." Idaho Code 39-3611.

IDAPA. 2012. "Idaho Water Quality Standards." Idaho Administrative Code. IDAPA 58.01.02.

IDL (Idaho Department of Lands). 2000. *Forest Practices Cumulative Watershed Effects Process for Idaho*. Boise, ID: IDL.

ISWCC (Idaho Soil and Water Conservation Commission) 2015. *Idaho Agricultural Pollution Abatement Plan*. Boise, ID: Resource Planning Unlimited, Inc.

Küchler, A.U. 1964. "Potential Natural Vegetation of the Conterminous United States." American Geographical Society Special Publication 36.

McGrath, C.L., A.J. Woods, J.M. Omernik, S.A. Bryce, M. Edmondson, J.A. Nesser, J. Shelden, R.C. Crawford, J.A. Comstock, and M.D. Plocher. 2001. "Ecoregions of Idaho." Reston, VA: US Geological Survey.

OWEB (Oregon Watershed Enhancement Board). 2001. "Stream Shade and Canopy Cover Monitoring Methods." In *Water Quality Monitoring Technical Guide Book*, chap. 14. Salem, OR: OWEB.

Poole, G.C. and C.H. Berman. 2001. "An Ecological Perspective on In-Stream Temperature: Natural Heat Dynamics and Mechanisms of Human-Caused Thermal Degradation." *Environmental Management* 27(6): 787–802.

Shumar, M.L. and J. De Varona. 2009. *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual*. Boise, ID: Idaho Department of Environmental Quality.

Strahler, A.N. 1957. "Quantitative Analysis of Watershed Geomorphology." *Transactions American Geophysical Union* 38: 913–920.

US Congress. 1972. Clean Water Act (Federal Water Pollution Control Act). 33 United States Code §1251–1387.

GIS Coverages

Restriction of liability: Neither the State of Idaho, nor the Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information or data provided. Metadata is provided for all data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical

errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice.

USDA–FSA Aerial Photography Field Office—2013 National Agricultural Imagery Program 0.5m imagery

USDA–FSA Aerial Photography Field Office—2015 National Agricultural Imagery Program 1.0m imagery

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 US Environmental Protection Agency approval.

Ambient
General conditions in the environment (Armantrout 1998). In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations or specific disturbances such as a wastewater outfall (EPA 1996).

Anthropogenic
Relating to, or resulting from, the influence of human beings on nature.

Assessment Unit (AU)
A segment of a water body that is treated as a homogenous unit, meaning that any designated uses, the rating of these uses, and any associated causes and sources must be applied to the entirety of the unit.

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

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, 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 exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

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

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading 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 loading capacity set aside to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. This 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 MOS is not allocated to any sources of pollution.

Natural Condition

The condition that exists with little or no anthropogenic influence.

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 of origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete a use support assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

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. These changes include human-induced alterations of the physical, biological, chemical, and radiological integrity of water and other media.

Potential Natural Vegetation (PNV)

A.U. Küchler (1964) defined potential natural vegetation as vegetation that would exist without human interference and if the resulting plant succession were projected to its climax condition while allowing for natural disturbance processes such as fire. Our use of the term reflects Küchler's definition in that riparian vegetation at PNV would produce a system potential level of shade on streams and includes recognition of some level of natural disturbance.

Riparian

Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.

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 water body 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, or industrial processes.

Water Quality Standards

State-adopted and US Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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Appendix A. Beneficial Uses

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

Existing Uses

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

Designated Uses

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

Undesignated Surface Waters and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address nondesignated waters. Sections 101.02 and 101.03 specifically address nondesignated human-made waterways and private waters. Human-made waterways and private waters have no presumed use protections. Human-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. State and Site-Specific Water Quality Standards and Criteria

Water Quality Standards Applicable to Salmonid Spawning Temperature

Water quality standards for temperature are specific numeric values not to be exceeded during the salmonid spawning and egg incubation period, which varies by species. For spring-spawning salmonids, the default spawning and incubation period recognized by the Idaho Department of Environmental Quality (DEQ) is generally March 15 to July 15 (Grafe et al. 2002). Fall spawning can occur as early as September 1 and continue with incubation into the following spring up to June 1. Per IDAPA 58.01.02.250.02.f.ii., the following water quality criteria need to be met during spawning and incubation periods:

- 13 °C as a daily maximum water temperature
- 9 °C as a daily average maximum water temperature

For the purposes of a temperature TMDL, the highest recorded water temperature in a recorded data set (excluding any high water temperatures that may occur on days when air temperatures exceed the 90th percentile of the highest annual maximum weekly maximum air temperatures) is compared to the daily maximum criterion of 13 °C. The difference between the two water temperatures represents the temperature reduction necessary to achieve compliance with temperature standards. Additionally, if exceedances to temperature criteria are infrequent, brief, and small such that aquatic life beneficial uses are still supported DEQ may give less weight to those departures from the criteria. Infrequent is defined in IDAPA 58.01.02.054.03 as less than ten percent of valid, applicable, representative measurements when continuous data are available (DEQ 2016a).

Natural Background Provisions

For potential natural vegetation temperature TMDLs, it is assumed that natural temperatures may exceed these criteria during certain time periods. If potential natural vegetation targets are achieved yet stream temperatures are warmer than these criteria, it is assumed that the stream's temperature is natural (provided there are no point sources or human-induced ground water sources of heat) and natural background provisions of Idaho water quality standards apply:

> When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions. Provided, however, that temperature may be increased above natural background conditions when allowed under Section 401. (IDAPA 58.01.02.200.09)

Section 401 relates to point source wastewater treatment requirements. In this case, if temperature criteria for any aquatic life use are exceeded due to natural conditions, then a point source discharge cannot raise the water temperature by more than 0.3 °C (IDAPA 58.01.02.401.01.c).

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Appendix C. Data Sources and Other Data

Table C1. Data sources for Potlatch River watershed assessment.

Data Source	Type of Data
DEQ Lewiston Regional Office	Solar Pathfinder effective shade and stream width
DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation
DEQ IDASA Database	Temperature

Figure C1. Cedar Creek temperature data.

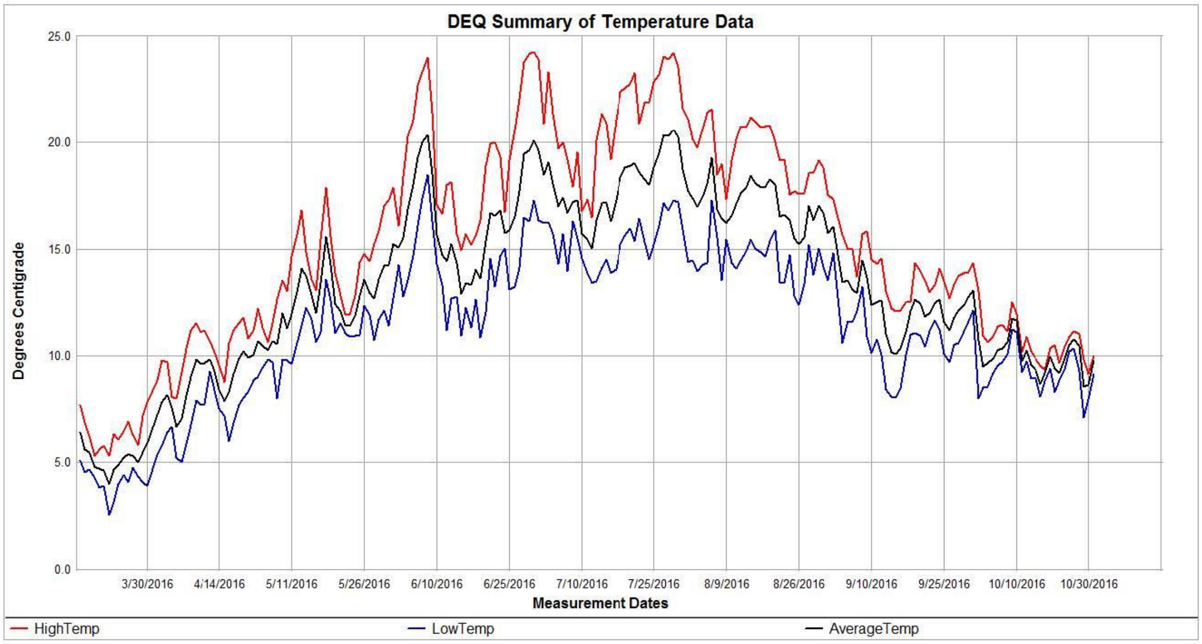
Data Source Name: DEQ-Lewiston
Water Body Name: Cedar Creek_046_04
Data Collection Site:

Date Period: 3/12/2016 **to** 10/31/2016

MDMT:	24.29	6/30/2016
MWMT:	23.4	7/30/2016
MDAT:	20.59	7/29/2016
MWAT:	19.79	7/31/2016
Overall Mean:	13.29	

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	Waterbody Name		Serial Number
	Cedar Creek_046_04		10862364
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	92	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	16	17%	
19 C Average	12	13%	
Days Evaluated & Date Range	92	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	50	76%	
9 C Average Spring	64	97%	
Spring Days Eval'd w/in Dates	66	4/15/2016	7/1/2016
13 C Instantaneous Fall	54	78%	
9 C Average Total	69	100%	
Fall Days Eval'd w/in Dates	69	8/1/2016	10/15/2016
13 C Instantaneous Total	104	77%	
9 C Average Total	133	99%	
Days Eval'd w/in Both Dates	135		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	120	100%	
Num of 7-Day Avg's w/in Dates	120	6/1/2016	9/30/2016

Figure C2. Boulder Creek temperature data.

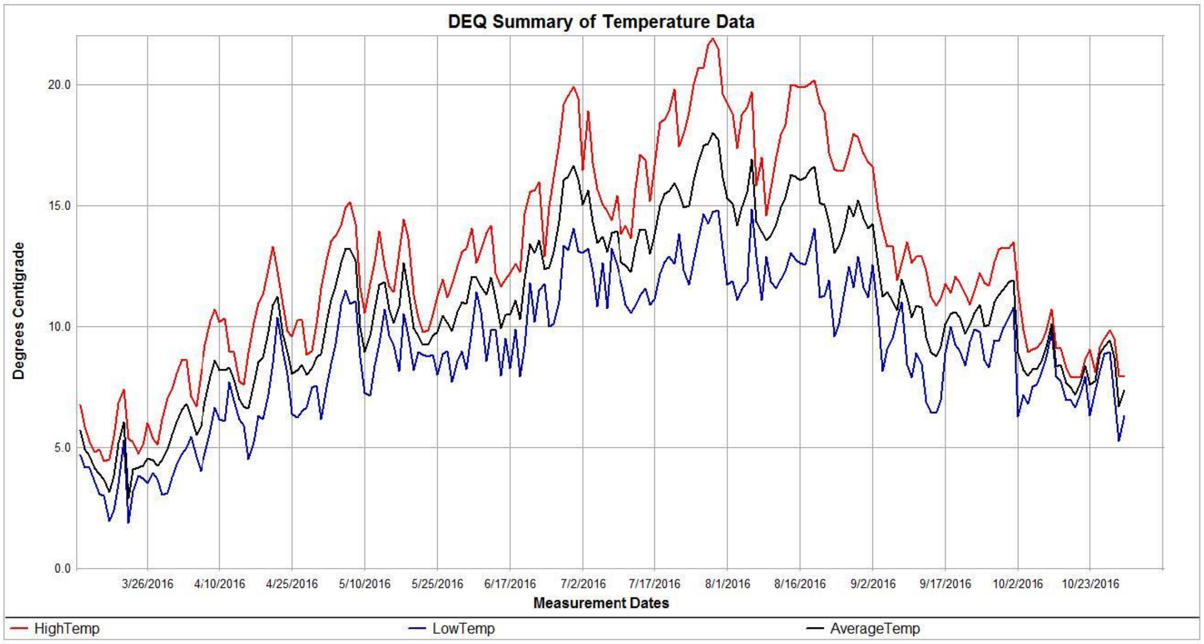
Data Source Name: DEQ-Lewiston
Water Body Name: Boulder Creek_047_03
Data Collection Site:

Date Period: 3/12/2016 **to** 10/30/2016

MDMT:	21.94	7/29/2016
MWMT:	20.89	7/31/2016
MDAT:	17.97	7/29/2016
MWAT:	17.09	7/31/2016
Overall Mean:	10.86	

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation: 0
Water Body ID:



EXCEEDANCE SUMMARY	**Waterbody Name**		**Serial Number**
	Boulder Creek_047_03		10862365
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	92	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	0	0%	
19 C Average	0	0%	
Days Evaluated & Date Range	92	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	28	40%	
9 C Average Spring	56	80%	
Spring Days Eval'd w/in Dates	70	4/15/2016	7/1/2016
13 C Instantaneous Fall	40	59%	
9 C Average Total	60	88%	
Fall Days Eval'd w/in Dates	68	8/1/2016	10/15/2016
13 C Instantaneous Total	68	49%	
9 C Average Total	116	84%	
Days Eval'd w/in Both Dates	138		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	106	95%	
Num of 7-Day Avg's w/in Dates	112	6/1/2016	9/30/2016

Figure C3. Potlatch River (048_04) temperature data.

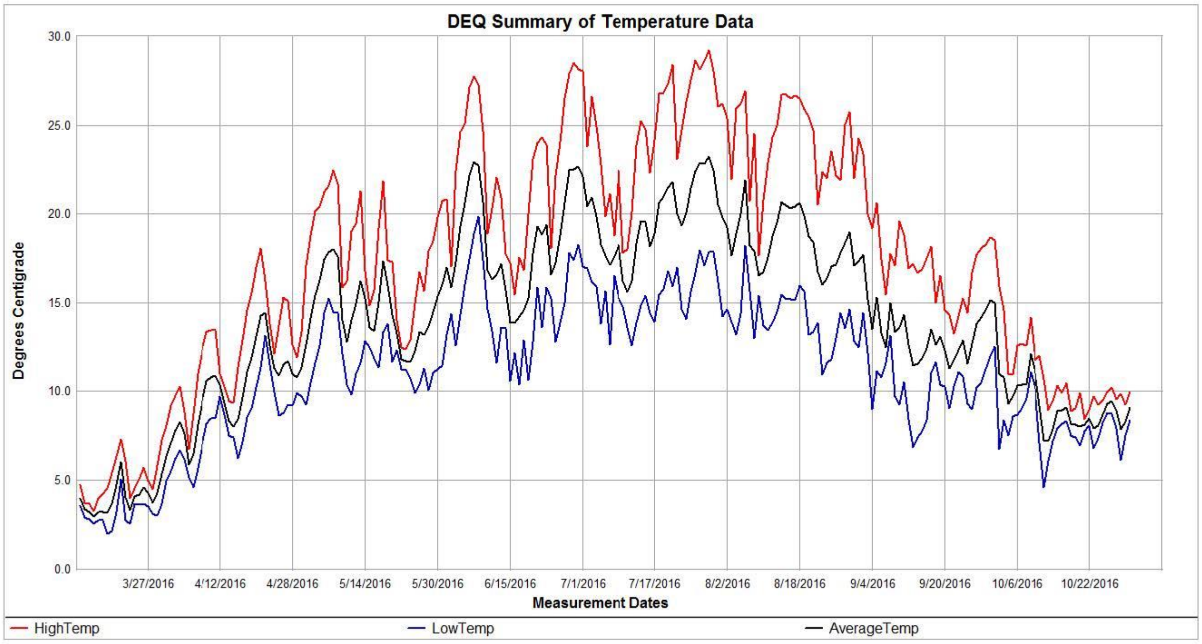
Data Source Name: DEQ-Lewiston
Water Body Name: Potlatch_River_048_04
Data Collection Site:

Date Period: 3/12/2016 **to** 10/31/2016

MDMT:	29.24	7/29/2016
MWMT:	28.09	7/30/2016
MDAT:	23.18	7/29/2016
MWAT:	22.22	7/31/2016
Overall Mean:	13.94	

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	**Waterbody Name**		**Serial Number**
	Potlatch_River_048_04		10862367
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	26	28%	
23 C Average	1	1%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	58	62%	
19 C Average	37	40%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	69	88%	
9 C Average Spring	76	97%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	64	85%	
9 C Average Total	71	95%	
Fall Days Eval'd w/in Dates	75	8/1/2016	10/15/2016
13 C Instantaneous Total	133	87%	
9 C Average Total	147	96%	
Days Eval'd w/in Both Dates	153		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	121	100%	
Num of 7-Day Avg's w/in Dates	121	6/1/2016	9/30/2016

Figure C4. Potlatch River (048_05) temperature data.

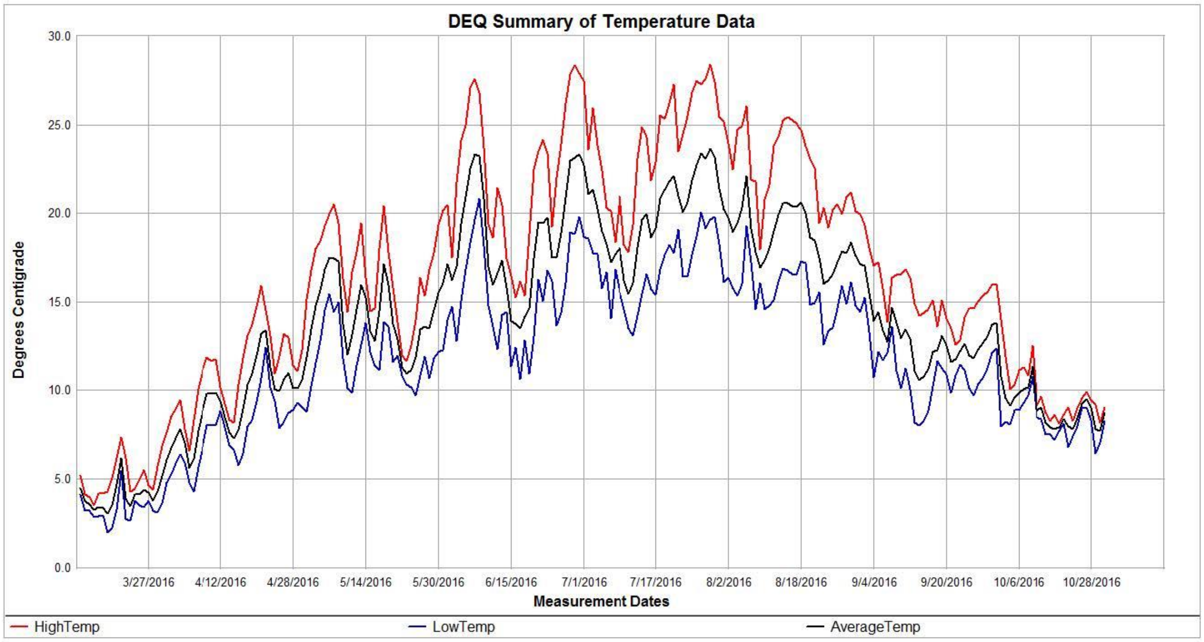
Data Source Name: DEQ-Lewiston
Water Body Name: Potlatch Fiver_048_05
Data Collection Site:

Date Period: 3/12/2016 **to** 10/31/2016

MDMT:	28.44	7/29/2016
MWMT:	27.23	7/30/2016
MDAT:	23.63	7/29/2016
MWAT:	22.72	7/31/2016
Overall Mean:		13.94

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	Waterbody Name		Serial Number
	Potlatch River_048_05		10862366
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	14	15%	
23 C Average	6	6%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	47	51%	
19 C Average	41	44%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	66	85%	
9 C Average Spring	75	96%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	60	87%	
9 C Average Total	69	100%	
Fall Days Eval'd w/in Dates	69	8/1/2016	10/15/2016
13 C Instantaneous Total	126	86%	
9 C Average Total	144	98%	
Days Eval'd w/in Both Dates	147		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	121	100%	
Num of 7-Day Avg's w/in Dates	121	6/1/2016	9/30/2016

Figure C5. Ruby River temperature data.

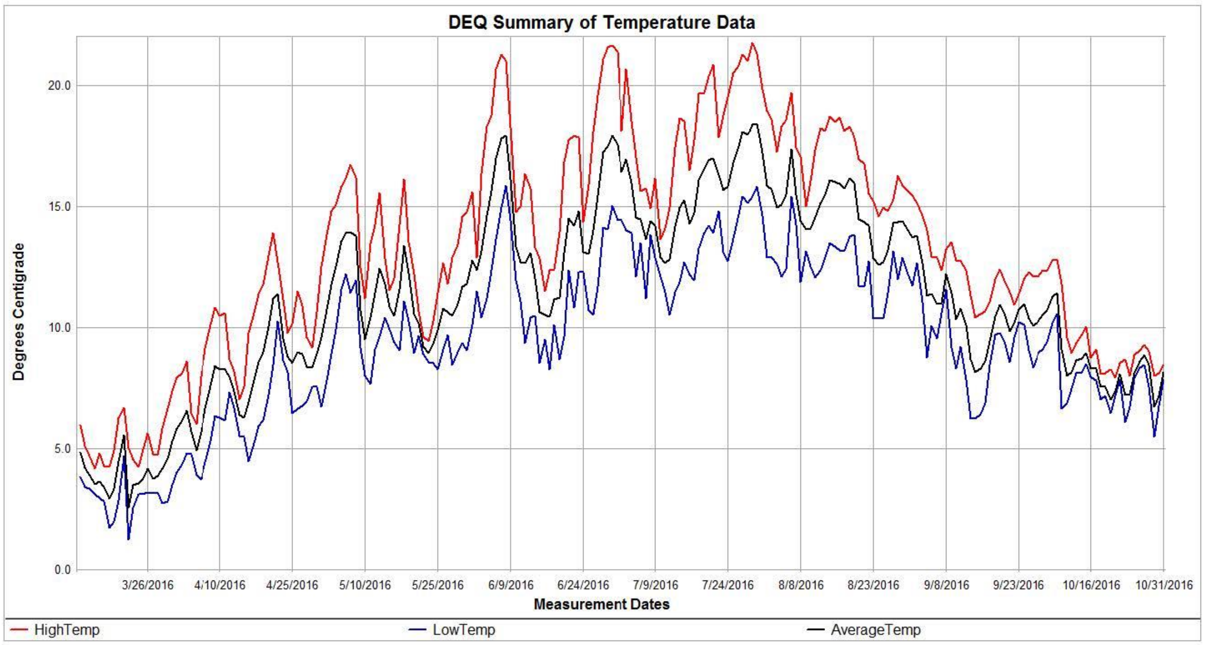
Data Source Name: DEQ-Lewiston
Water Body Name: Ruby_River_052_03
Data Collection Site:

Date Period: 3/12/2016 to 10/31/2016

MDMT:	21.77	7/29/2016
MWMT:	20.94	7/31/2016
MDAT:	18.42	7/30/2016
MWAT:	17.73	7/31/2016
Overall Mean:	11.22	

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

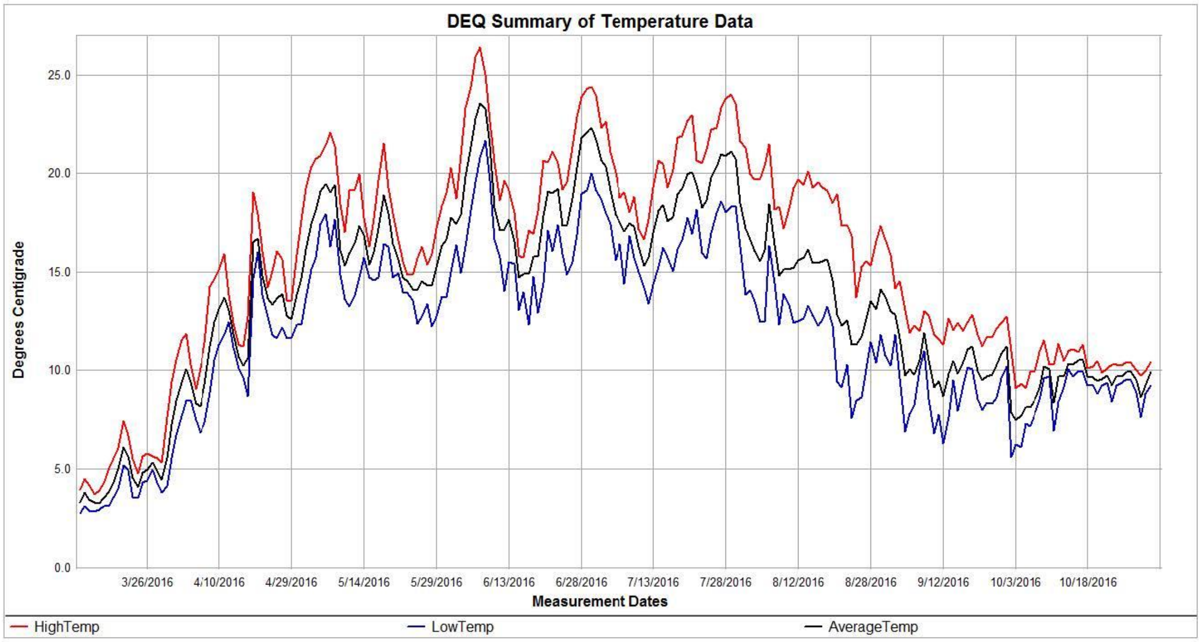
Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	Waterbody Name		Serial Number
	Ruby_River_052_03		10862368
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	0	0%	
19 C Average	0	0%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	43	55%	
9 C Average Spring	65	83%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	36	54%	
9 C Average Total	58	87%	
Fall Days Eval'd w/in Dates	67	8/1/2016	10/15/2016
13 C Instantaneous Total	79	54%	
9 C Average Total	123	85%	
Days Eval'd w/in Both Dates	145		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	113	93%	
Num of 7-Day Avg's w/in Dates	121	6/1/2016	9/30/2016

Figure C6. Moose Creek temperature data.

Data Source Name:	DEQ-Lewiston	**MDMT:** 26.45	6/7/2016	**HUC Number:**	17060306
Water Body Name:	Moose Creek_053_03	**MWMT:** 24.13	6/9/2016	**HUC Name:**	CLEARWATER
Data Collection Site:		**MDAT:** 23.6	6/7/2016	**Site Description:**	
		MWAT: 21.51	6/10/2016		
Date Period:	3/12/2016 **to** 10/31/2016	**Overall Mean:** 13.62		**Elevation:**	
				Water Body ID:	



EXCEEDANCE SUMMARY	**Waterbody Name**		**Serial Number**
	Moose Creek_053_03		10862370
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	87	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	15	17%	
19 C Average	20	23%	
Days Evaluated & Date Range	87	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	72	97%	
9 C Average Spring	74	100%	
Spring Days Eval'd w/in Dates	74	4/15/2016	7/1/2016
13 C Instantaneous Fall	34	49%	
9 C Average Total	61	88%	
Fall Days Eval'd w/in Dates	69	8/1/2016	10/15/2016
13 C Instantaneous Total	106	74%	
9 C Average Total	135	94%	
Days Eval'd w/in Both Dates	143		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	111	97%	
Num of 7-Day Avg's w/in Dates	115	6/1/2016	9/30/2016

Figure C7. Corral Creek temperature data.

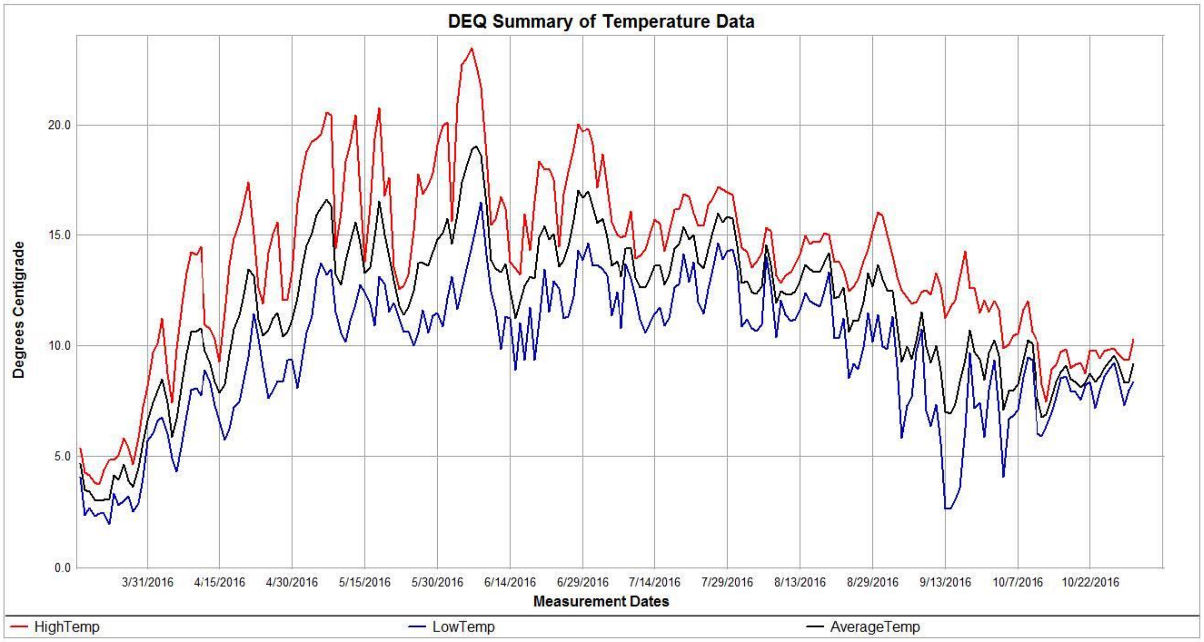
Data Source Name: DEQ-Lewiston
Water Body Name: Corral Creek_054_03
Data Collection Site:

Date Period: 3/12/2016 **to** 10/31/2016

MDMT:	23.45	6/6/2016
MWMT:	21.87	6/9/2016
MDAT:	18.99	6/7/2016
MWAT:	17.73	6/9/2016
Overall Mean:	11.6	

HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	**Waterbody Name**		**Serial Number**
	Corral Creek_054_03		10862372
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	0	0%	
19 C Average	0	0%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	70	90%	
9 C Average Spring	76	97%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	32	48%	
9 C Average Total	51	77%	
Fall Days Eval'd w/in Dates	66	8/1/2016	10/15/2016
13 C Instantaneous Total	102	71%	
9 C Average Total	127	88%	
Days Eval'd w/in Both Dates	144		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	101	88%	
Num of 7-Day Avg's w/in Dates	115	6/1/2016	9/30/2016

Figure C8. Pine Creek temperature data.

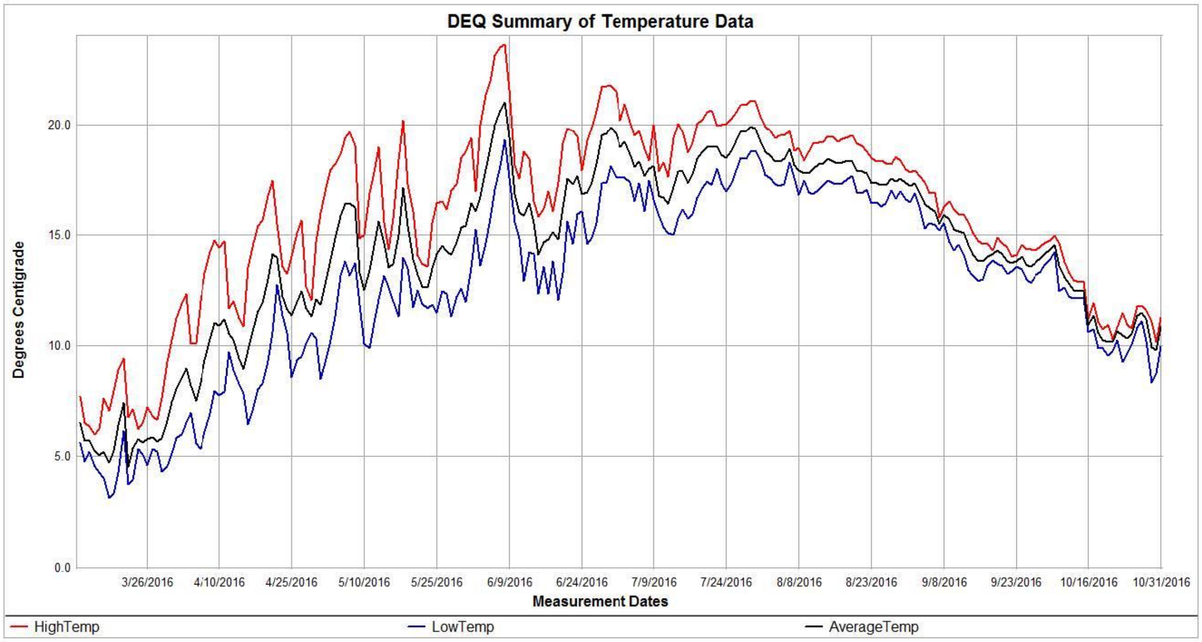
Data Source Name: DEQ-Lewiston
Water Body Name: Pine Creek_055_03
Data Collection Site:

Date Period: 3/12/2016 **to** 10/31/2016

MDMT:	23.64	6/8/2016
MWMT:	22.16	6/9/2016
MDAT:	21.03	6/8/2016
MWAT:	19.48	7/31/2016
Overall Mean:	14.3	

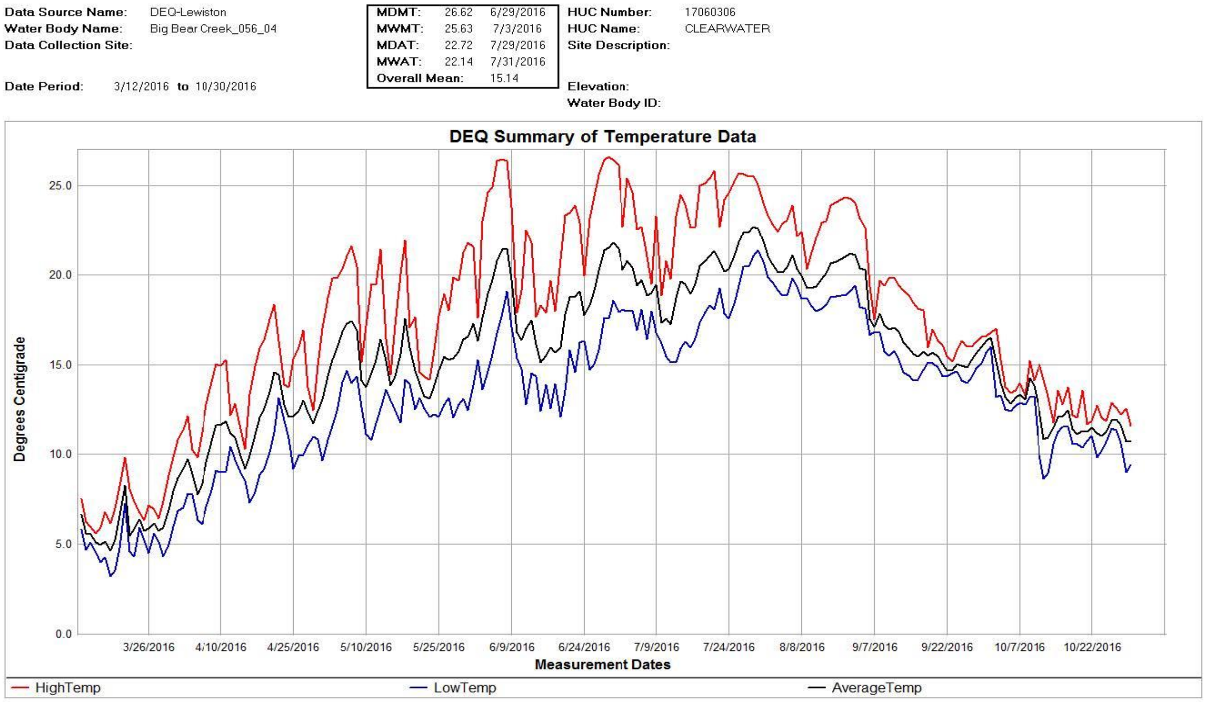
HUC Number: 17060306
HUC Name: CLEARWATER
Site Description:

Elevation:
Water Body ID:



EXCEEDANCE SUMMARY	**Waterbody Name**		**Serial Number**
	Pine Creek_055_03		10862363
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	0	0%	
23 C Average	0	0%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	0	0%	
19 C Average	11	12%	
Days Evaluated & Date Range	93	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	75	96%	
9 C Average Spring	77	99%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	64	96%	
9 C Average Total	67	100%	
Fall Days Eval'd w/in Dates	67	8/1/2016	10/15/2016
13 C Instantaneous Total	139	96%	
9 C Average Total	144	99%	
Days Eval'd w/in Both Dates	145		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	121	100%	
Num of 7-Day Avg's w/in Dates	121	6/1/2016	9/30/2016

Figure C9. Big Bear Creek temperature data.



EXCEEDANCE SUMMARY	Waterbody Name		Serial Number
	Big Bear Creek_056_04		10862361
Seasonal Cold Water	**Number**	**Percentage**	
26 C Instantaneous	4	5%	
23 C Average	0	0%	
Days Evaluated & Date Range	79	6/21/2016	9/22/2016
Idaho Cold Water Biota	**Number**	**Percentage**	
22 C Instantaneous	54	68%	
19 C Average	51	65%	
Days Evaluated & Date Range	79	6/21/2016	9/22/2016
Idaho Salmonid Spawning	**Number**	**Percentage**	
13 C Instantaneous Spring	76	97%	
9 C Average Spring	78	100%	
Spring Days Eval'd w/in Dates	78	4/15/2016	7/1/2016
13 C Instantaneous Fall	60	98%	
9 C Average Total	61	100%	
Fall Days Eval'd w/in Dates	61	8/1/2016	10/15/2016
13 C Instantaneous Total	136	98%	
9 C Average Total	139	100%	
Days Eval'd w/in Both Dates	139		
IDAHO BULL TROUT			
Site Location	NORTH		
Site Elevation	N/A		
	N/A		
EPA BULL TROUT	**Number**	**Percentage**	
10 C 7-Day Avg of Daily Max	107	100%	
Num of 7-Day Avg's w/in Dates	107	6/1/2016	9/30/2016

Table C2. Bankfull width estimates in Potlatch River for streams in load analysis.

Location	Stream Segment (AU)	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)
Potlatch River	Moose Creek to Corral Creek (048_04, 048_05)	144.1	27	24	19	23
Potlatch River	Corral Creek to Big Bear Creek (045_05)	296.2	39	35	25	33
Potlatch River	Big Bear Creek to Clearwater River (044_06)	594.1	54	49	33	48

Table C3. Bankfull width estimates in Potlatch River headwater segments (049_02, 049_03, 049_04) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)
01st Trib to Moose Creek	1.2	3	2	3	2
01st Trib to Potlatch River	1.2	3	2	3	2
01st Trib to Purdue Creek	0.9	2	2	2	2
01st Trib to WF Potlatch River	0.5	2	2	2	1
02nd Trib to Moose Creek	0.3	1	1	2	1
02nd Trib to Potlatch River	0.8	2	2	2	2
02nd Trib to Purdue Creek	0.6	2	2	2	1
02nd Trib to WF Potlatch River	1.6	3	3	3	2
03rd Trib to Moose Creek	2.5	4	3	4	3
03rd Trib to Moose Creek_Trib1	0.6	2	2	2	1
03rd Trib to Moose Creek_Trib2	0.6	2	2	2	1
03rd Trib to Potlatch River	1.4	3	2	3	2
03rd Trib to WF Potlatch River	1.3	3	2	3	2
03rd Trib to WF Potlatch River_Trib	0.5	2	1	2	1
04th Trib to Moose Creek	1.1	3	2	3	2
04th Trib to Potlatch River	2.4	4	3	4	3
04th Trib to Potlatch River_Trib	0.4	2	1	2	1
04th Trib to WF Potlatch River	0.3	1	1	2	1
05th Trib to Moose Creek	0.6	2	2	2	1
05th Trib to WF Potlatch River	1.4	3	2	3	2
05th Trib to WF Potlatch River_Trib	0.4	2	1	2	1
Cougar Creek	3.7	5	4	4	3
Cougar Creek Trib	0.7	2	2	2	1
Feather Creek	5.4	6	5	5	4
Head Creek	0.5	2	1	2	1
Laguna Creek	1.7	3	3	3	2
Moose Creek	11.9	8	7	7	6
Nat Brown Creek	1.6	3	3	3	2
Pasture Creek	0.6	2	2	2	1
Porcupine creek	1.8	3	3	3	2
Potlatch River	52.6	17	15	12	13
Purdue Creek	4.0	5	4	4	4
Sheep Creek	1.5	3	2	3	2
Talapus Creek	1.0	3	2	3	2
WF Potlatch River	16.2	10	8	8	7
Wolf Creek	0.7	2	2	2	1

Table C4. Bankfull width estimates in Cedar Creek for streams in load analysis.

Location	Stream Segment (AU)	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
Cedar Creek	Leopold Creek to Potlatch River (046_04)	39.3	14.6	13	11	12	9

Table C5. Bankfull width estimates in Boulder Creek for streams in load analysis.

Location	Stream Segment (AU)	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
Boulder Creek	Pig Creek to Potlatch River (047_03)	18.0	10	9	8	8	6

Table C6. Bankfull width estimates in Ruby Creek and EF Potlatch River for streams in load analysis.

Location	Stream Segment (AU)	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
Ruby Creek	Unamed tributary 3.4 km upstream to EF Potlatch River (052_03)	12.6	8	7	7	6	2
EF Potlatch River	Ruby Creek to Potlatch River (051_04)	62.1	18	16	13	15	10

Table C7. Bankfull width estimates in Moose Creek (053_02, 053_03) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
01st Trib to Moose Creek	1.2	3	2	3	2	
02nd Trib to Moose Creek	0.3	1	1	2	1	
03rd Trib to Moose Creek_Trib1	0.6	2	2	2	1	
03rd Trib to Moose Creek_Trib2	0.6	2	2	2	1	
03rd Trib to Moose Creek	2.5	4	3	4	3	
04th Trib to Moose Creek	1.1	3	2	3	2	
05th Trib to Moose Creek	0.6	2	2	2	1	
Moose Creek	11.9	8	7	7	6	3

Table C8. Bankfull width estimates in Corral Creek (054_02, 054_03) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
01st Trib to Corral Creek	0.8	2.3	2	2	2	
01st Trib to WF Corral Creek	1.1	2.6	2	3	2	
02nd Trib to Corral Creek	0.6	2.0	2	2	1	
02nd Trib to WF Corral Creek	0.8	2.2	2	2	2	
03rd Trib to Corral Creek	1.2	2.7	2	3	2	
04th Trib to Corral Creek	1.4	2.9	2	3	2	
Corral Creek	22.4	11.2	10	9	9	
EF Corral Creek	4.1	4.9	4	4	4	4
Tee Meadow Creek	1.6	3.1	3	3	2	
WF Corral Creek	1.4	2.9	2	3	2	1

Table C9. Bankfull width estimates in Pine Creek (055_02, 055_03) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)
01st Trib to Big Bear Gulch	0.9	2	2	2	2
01st Trib to Pine Creek	1.1	3	2	3	2
02nd Trib to Big Bear Gulch	1.3	3	2	3	2
02nd Trib to Pine Creek	1.5	3	2	3	2
03rd Trib to Big Bear Gulch	1.1	3	2	3	2
03rd Trib to Pine Creek	1.6	3	3	3	2
04th Trib to Big Bear Gulch	0.7	2	2	2	1
04th Trib to Pine Creek	1.3	3	2	3	2
05th Trib to Pine Creek	1.4	3	2	3	2
06th Trib to Pine Creek	0.4	2	1	2	1
07th Trib to Pine Creek	0.8	2	2	2	2
Big Bear Gulch	7.2	6	5	6	5
Pine Creek	31.8	13	11	10	10
Texas Gulch	2.4	4	3	4	3

Table C10. Bankfull width estimates in Big Bear Creek (056_04, 056_05) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
Big Bear Creek	45.4	16	14	12	12	10

Table C11. Bankfull width estimates in Middle Potlatch Creek (062_02, 062_03) for streams in load analysis.

Location	Area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP (m)
01st Trib to M Potlatch Creek	1.2	3	2	3	2	
02nd Trib to M Potlatch Cr_T1	0.7	2	2	2	1	
02nd Trib to M Potlatch Cr_T2	0.7	2	2	2	1	
02nd Trib to M Potlatch Creek	3.3	4	4	4	3	
03rd Trib to M Pot Cr Trib	0.5	2	1	2	1	
03rd Trib to M Potlatch Creek	7.0	6	5	6	5	
04th Trib to M Potlatch Creek	0.6	2	2	2	1	
05th Trib to M Potlatch Creek	1.2	3	2	3	2	
06th Trib to M Potlatch Creek	0.7	2	2	2	1	
07th Trib to M Potlatch Creek	1.2	3	2	3	2	
08th Trib to M Potlatch Creek	0.9	2	2	2	2	
09th Trib to M Potlatch Creek	0.4	2	1	2	1	
10th Trib to M Potlatch Creek	0.5	2	1	2	1	
11th Trib to M Potlatch Creek	1.2	3	2	3	2	
American Ridge Gulch	1.3	3	2	3	2	
Fix Ridge Gulch	1.5	3	3	3	2	
Howell Creek	5.8	6	5	5	4	
Howell Creek_Trib1	0.4	2	1	2	1	
Howell Creek_Trib2	0.7	2	2	2	1	
Middle Potlatch Creek	55.4	17	15	13	14	12
Tomer Butte	1.7	3	3	3	2	
Tomer Butte_Trib	0.6	2	2	2	1	

Table C12. Existing and target solar loads for Potlatch River – Headwaters 1st- and 2nd-order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
049_02	01st Trib to Potlatch River	1	190	Upland	98%	0.12	1	200	20	10%	5.49	1	200	1,000	1,000	-88%
049_02	01st Trib to Potlatch River	2	1500	Upland	98%	0.12	1	2,000	200	80%	1.22	1	2,000	2,000	2,000	-18%
049_02	01st Trib to Potlatch River	3	760	Upland	98%	0.12	2	2,000	200	60%	2.44	2	2,000	5,000	5,000	-38%
049_02	01st Trib to Potlatch River	4	550	Upland	96%	0.24	3	2,000	500	80%	1.22	3	2,000	2,000	2,000	-16%
049_02	01st Trib to Purdue Creek	1	2100	Upland	98%	0.12	1	2,000	200	80%	1.22	1	2,000	2,000	2,000	-18%
049_02	01st Trib to Purdue Creek	2	140	Upland	98%	0.12	2	300	40	70%	1.83	2	300	500	500	-28%
049_02	01st Trib to WF Potlatch River	1	1500	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
049_02	01st Trib to WF Potlatch River	2	230	Upland/Alder	87%	0.79	2	500	400	60%	2.44	2	500	1,000	600	-27%
049_02	01st Trib to WF Potlatch River	3	680	Upland/Alder	87%	0.79	2	1,000	800	50%	3.05	2	1,000	3,000	2,000	-37%
049_02	02nd Trib to Potlatch River	1	1100	Breakland	95%	0.31	1	1,000	300	90%	0.61	1	1,000	600	300	-5%
049_02	02nd Trib to Potlatch River	2	750	Upland	98%	0.12	2	2,000	200	80%	1.22	2	2,000	2,000	2,000	-18%
049_02	02nd Trib to Purdue Creek	1	1700	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
049_02	02nd Trib to Purdue Creek	2	670	Alder	86%	0.85	2	1,000	900	50%	3.05	2	1,000	3,000	2,000	-36%
049_02	02nd Trib to WF Potlatch River	1	730	Upland	98%	0.12	1	700	90	80%	1.22	1	700	900	800	-18%
049_02	02nd Trib to WF Potlatch River	2	690	Upland	98%	0.12	2	1,000	100	80%	1.22	2	1,000	1,000	900	-18%
049_02	02nd Trib to WF Potlatch River	3	360	Upland	98%	0.12	2	700	90	70%	1.83	2	700	1,000	900	-28%
049_02	02nd Trib to WF Potlatch River	4	1200	Upland/Alder	74%	1.59	3	4,000	6,000	60%	2.44	3	4,000	10,000	4,000	-14%
049_02	02nd Trib to WF Potlatch River	5	230	Alder	72%	1.71	3	700	1,000	50%	3.05	3	700	2,000	1,000	-22%
049_02	02nd Trib to WF Potlatch River	6	830	Upland/Alder	61%	2.38	4	3,000	7,000	60%	2.44	4	3,000	7,000	0	-1%
049_02	02nd Trib to WF Potlatch River	7	130	Alder	59%	2.50	4	500	1,000	30%	4.27	4	500	2,000	1,000	-29%
049_02	03rd Trib to Potlatch River	1	1200	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
049_02	03rd Trib to Potlatch River	2	900	Upland/Alder	87%	0.79	2	2,000	2,000	60%	2.44	2	2,000	5,000	3,000	-27%
049_02	03rd Trib to Potlatch River	3	670	Alder	86%	0.85	2	1,000	900	20%	4.88	2	1,000	5,000	4,000	-66%
049_02	03rd Trib to Potlatch River	3	710	Upland	96%	0.24	3	2,000	500	60%	2.44	3	2,000	5,000	5,000	-36%
049_02	03rd Trib to Potlatch River	4	290	Alder	72%	1.71	3	900	2,000	20%	4.88	3	900	4,000	2,000	-52%
049_02	03rd Trib to WF Potlatch River	1	1400	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
049_02	03rd Trib to WF Potlatch River	2	1100	Alder	86%	0.85	2	2,000	2,000	20%	4.88	2	2,000	10,000	8,000	-66%
049_02	03rd Trib to WF Potlatch River	3	390	Alder	72%	1.71	3	1,000	2,000	50%	3.05	3	1,000	3,000	1,000	-22%
049_02	03rd Trib to WF Potlatch River	4	330	Upland/Alder	74%	1.59	3	1,000	2,000	90%	0.61	3	1,000	600	(1,000)	0%
049_02	03rd Trib to WF Potlatch River	5	110	Alder	72%	1.71	3	300	500	30%	4.27	3	300	1,000	500	-42%
049_02	03rd Trib to WF Potlatch River_T	1	1000	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
049_02	03rd Trib to WF Potlatch River_T	2	910	Alder	86%	0.85	2	2,000	2,000	20%	4.88	2	2,000	10,000	8,000	-66%
049_02	04th Trib to Potlatch River	1	1100	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
049_02	04th Trib to Potlatch River	2	950	Upland/Alder	87%	0.79	2	2,000	2,000	90%	0.61	2	2,000	1,000	(1,000)	0%
049_02	04th Trib to Potlatch River	3	690	Upland/Alder	87%	0.79	2	1,000	800	80%	1.22	2	1,000	1,000	200	-7%
049_02	04th Trib to Potlatch River	4	150	Upland	96%	0.24	3	500	100	90%	0.61	3	500	300	200	-6%
049_02	04th Trib to Potlatch River	5	220	Alder	72%	1.71	3	700	1,000	80%	1.22	3	700	900	(100)	0%
049_02	04th Trib to Potlatch River	6	720	Alder	72%	1.71	3	2,000	3,000	70%	1.83	3	2,000	4,000	1,000	-2%
049_02	04th Trib to Potlatch River	7	250	Upland/Alder	61%	2.38	4	1,000	2,000	40%	3.66	4	1,000	4,000	2,000	-21%
049_02	04th Trib to Potlatch River	8	250	Alder	59%	2.50	4	1,000	3,000	10%	5.49	4	1,000	5,000	2,000	-49%
049_02	04th Trib to Potlatch River	9	720	Alder	59%	2.50	4	3,000	8,000	20%	4.88	4	3,000	10,000	2,000	-39%
049_02	04th Trib to Potlatch River_Trib	1	670	Upland	98%	0.12	1	700	90	90%	0.61	1	700	400	300	-8%
049_02	04th Trib to Potlatch River_Trib	2	550	Alder	91%	0.55	1	600	300	30%	4.27	1	600	3,000	3,000	-61%

049_02	04th Trib to Potlatch River_Trib	3	530	Alder	86%	0.85	2	1,000	900	20%	4.88	2	1,000	5,000	4,000	-66%
049_02	04th Trib to WF Potlatch River	1	190	Upland	98%	0.12	1	200	20	90%	0.61	1	200	100	80	-8%
049_02	04th Trib to WF Potlatch River	2	1300	Upland	98%	0.12	1	1,000	100	80%	1.22	1	1,000	1,000	900	-18%
049_02	04th Trib to WF Potlatch River	3	120	Alder	86%	0.85	2	200	200	30%	4.27	2	200	900	700	-56%
049_02	05th Trib to WF Potlatch River	1	1300	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
049_02	05th Trib to WF Potlatch River	2	350	Upland/Alder	87%	0.79	2	700	600	60%	2.44	2	700	2,000	1,000	-27%
049_02	05th Trib to WF Potlatch River	3	1500	Upland/Alder	74%	1.59	3	5,000	8,000	80%	1.22	3	5,000	6,000	(2,000)	0%
049_02	05th Trib to WF Potlatch River_T	1	580	Upland	98%	0.12	1	600	70	80%	1.22	1	600	700	600	-18%
049_02	05th Trib to WF Potlatch River_T	2	580	Upland/Alder	92%	0.49	1	600	300	60%	2.44	1	600	1,000	700	-32%
049_02	05th Trib to WF Potlatch River_T	3	540	Upland/Alder	87%	0.79	2	1,000	800	50%	3.05	2	1,000	3,000	2,000	-37%
049_02	Cougar Creek	1	1800	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
049_02	Cougar Creek	2	1200	Alder	86%	0.85	2	2,000	2,000	60%	2.44	2	2,000	5,000	3,000	-26%
049_02	Cougar Creek	3	680	Upland/Alder	87%	0.79	3	2,000	2,000	60%	2.44	3	2,000	5,000	3,000	-27%
049_02	Cougar Creek	4	2600	Alder	59%	2.50	4	10,000	30,000	50%	3.05	4	10,000	30,000	0	-9%
049_02	Cougar Creek Trib	1	2200	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
049_02	Feather Creek	1	3600	Breakland	95%	0.31	1	4,000	1,000	90%	0.61	1	4,000	2,000	1,000	-5%
049_02	Feather Creek	2	960	Upland	98%	0.12	2	2,000	200	60%	2.44	2	2,000	5,000	5,000	-38%
049_02	Feather Creek	3	860	Upland_Alder	74%	1.59	3	3,000	5,000	50%	3.05	3	3,000	9,000	4,000	-24%
049_02	Feather Creek	4	330	Upland_Alder	74%	1.59	3	1,000	2,000	50%	3.05	3	1,000	3,000	1,000	-24%
049_02	Feather Creek	5	1200	Upland/Alder	61%	2.38	4	5,000	10,000	60%	2.44	4	5,000	10,000	0	-1%
049_02	Feather Creek	6	200	Upland/Alder	61%	2.38	4	800	2,000	40%	3.66	4	800	3,000	1,000	-21%
049_02	Feather Creek	7	520	Upland/Alder	52%	2.93	5	3,000	9,000	50%	3.05	5	3,000	9,000	0	-2%
049_02	Feather Creek	8	490	Upland	92%	0.49	5	2,000	1,000	60%	2.44	5	2,000	5,000	4,000	-32%
049_02	Feather Creek	9	230	Upland/Alder	52%	2.93	5	1,000	3,000	50%	3.05	5	1,000	3,000	0	-2%
049_02	Head Creek	1	120	Upland	98%	0.12	1	100	10	80%	1.22	1	100	100	90	-18%
049_02	Head Creek	2	2300	Upland	98%	0.12	2	5,000	600	90%	0.61	2	5,000	3,000	2,000	-8%
049_02	Laguna Creek	1	2100	Breakland	95%	0.31	1	2,000	600	90%	0.61	1	2,000	1,000	400	-5%
049_02	Laguna Creek	2	1200	Upland	98%	0.12	2	2,000	200	60%	2.44	2	2,000	5,000	5,000	-38%
049_02	Laguna Creek	3	650	Upland_Alder	74%	1.59	3	2,000	3,000	50%	3.05	3	2,000	6,000	3,000	-24%
049_02	Nat Brown Creek	1	2700	Upland	98%	0.12	1	3,000	400	90%	0.61	1	3,000	2,000	2,000	-8%
049_02	Nat Brown Creek	2	440	Upland/Alder	87%	0.79	2	900	700	80%	1.22	2	900	1,000	300	-7%
049_02	Nat Brown Creek	3	370	Alder	86%	0.85	2	700	600	60%	2.44	2	700	2,000	1,000	-26%
049_02	Nat Brown Creek	4	320	Alder	72%	1.71	3	1,000	2,000	50%	3.05	3	1,000	3,000	1,000	-22%
049_02	Nat Brown Creek	5	190	Alder	72%	1.71	3	600	1,000	70%	1.83	3	600	1,000	0	-2%
049_02	Nat Brown Creek	6	270	Alder	72%	1.71	3	800	1,000	10%	5.49	3	800	4,000	3,000	-62%
049_02	Nat Brown Creek	7	1100	Upland/Alder	61%	2.38	4	4,000	10,000	80%	1.22	4	4,000	5,000	(5,000)	0%
049_02	Nat Brown Creek	8	130	Alder	59%	2.50	4	500	1,000	10%	5.49	4	500	3,000	2,000	-49%
049_02	Pasture Creek	1	2400	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
049_02	Porcupine Creek	1	320	Upland	98%	0.12	1	300	40	10%	5.49	1	300	2,000	2,000	-88%
049_02	Porcupine Creek	2	94	Upland	98%	0.12	1	90	10	20%	4.88	1	90	400	400	-78%
049_02	Porcupine Creek	3	2000	Upland	98%	0.12	2	4,000	500	90%	0.61	2	4,000	2,000	2,000	-8%
049_02	Porcupine Creek	4	540	Upland	96%	0.24	3	2,000	500	70%	1.83	3	2,000	4,000	4,000	-26%
049_02	Porcupine Creek	5	240	Upland	96%	0.24	3	700	200	60%	2.44	3	700	2,000	2,000	-36%
049_02	Porcupine Creek	6	840	Upland	94%	0.37	4	3,000	1,000	70%	1.83	4	3,000	5,000	4,000	-24%
049_02	Potlatch River	1	800	Upland	98%	0.12	1	800	100	80%	1.22	1	800	1,000	900	-18%
049_02	Potlatch River	2	550	Upland	98%	0.12	1	600	70	90%	0.61	1	600	400	300	-8%
049_02	Potlatch River	3	71	Alder	86%	0.85	2	100	90	20%	4.88	2	100	500	400	-66%
049_02	Potlatch River	4	120	Open Water												
049_02	Potlatch River	5	810	Upland	98%	0.12	2	2,000	200	30%	4.27	2	2,000	9,000	9,000	-68%
049_02	Potlatch River	6	330	Alder	72%	1.71	3	1,000	2,000	30%	4.27	3	1,000	4,000	2,000	-42%

049_02	Potlatch River	7	330	Alder	72%	1.71	3	1,000	2,000	20%	4.88	3	1,000	5,000	3,000	-52%
049_02	Potlatch River	8	340	Upland/Alder	74%	1.59	3	1,000	2,000	30%	4.27	3	1,000	4,000	2,000	-44%
049_02	Purdue Creek	1	1600	Breakland	95%	0.31	1	2,000	600	90%	0.61	1	2,000	1,000	400	-5%
049_02	Purdue Creek	2	1200	Upland	98%	0.12	2	2,000	200	90%	0.61	2	2,000	1,000	800	-8%
049_02	Purdue Creek	3	1700	Upland/Alder	74%	1.59	3	5,000	8,000	60%	2.44	3	5,000	10,000	2,000	-14%
049_02	Purdue Creek	4	230	Alder	59%	2.50	4	900	2,000	50%	3.05	4	900	3,000	1,000	-9%
049_02	Purdue Creek	5	550	Alder	59%	2.50	4	2,000	5,000	50%	3.05	4	2,000	6,000	1,000	-9%
049_02	Purdue Creek	6	650	Upland/Alder	52%	2.93	5	3,000	9,000	70%	1.83	5	3,000	5,000	(4,000)	0%
049_02	Sheep Creek	1	880	Upland	98%	0.12	1	900	100	90%	0.61	1	900	500	400	-8%
049_02	Sheep Creek	2	480	Upland	98%	0.12	1	500	60	80%	1.22	1	500	600	500	-18%
049_02	Sheep Creek	3	1300	Upland	98%	0.12	2	3,000	400	50%	3.05	2	3,000	9,000	9,000	-48%
049_02	Sheep Creek	4	150	Upland	96%	0.24	3	500	100	60%	2.44	3	500	1,000	900	-36%
049_02	Sheep Creek	5	260	Upland	96%	0.24	3	800	200	70%	1.83	3	800	1,000	800	-26%
049_02	Sheep Creek	6	200	Upland	94%	0.37	4	800	300	90%	0.61	4	800	500	200	-4%
049_02	Sheep Creek	7	450	Upland	94%	0.37	4	2,000	700	60%	2.44	4	2,000	5,000	4,000	-34%
049_02	Talapus Creek	1	2500	Upland	98%	0.12	1	3,000	400	90%	0.61	1	3,000	2,000	2,000	-8%
049_02	Talapus Creek	2	930	Upland	98%	0.12	2	2,000	200	80%	1.22	2	2,000	2,000	2,000	-18%
049_02	Talapus Creek	3	66	Alder	72%	1.71	3	200	300	60%	2.44	3	200	500	200	-12%
049_02	West Fork Potlatch River	1	2500	Breakland	95%	0.31	1	3,000	900	90%	0.61	1	3,000	2,000	1,000	-5%
049_02	West Fork Potlatch River	2	410	Upland/Alder	87%	0.79	2	800	600	50%	3.05	2	800	2,000	1,000	-37%
049_02	West Fork Potlatch River	3	320	Alder	86%	0.85	2	600	500	50%	3.05	2	600	2,000	2,000	-36%
049_02	West Fork Potlatch River	4	460	Alder	72%	1.71	3	1,000	2,000	40%	3.66	3	1,000	4,000	2,000	-32%
049_02	West Fork Potlatch River	5	950	Alder	59%	2.50	4	4,000	10,000	50%	3.05	4	4,000	10,000	0	-9%
049_02	West Fork Potlatch River	6	130	Alder	50%	3.05	5	700	2,000	60%	2.44	5	700	2,000	0	0%
049_02	West Fork Potlatch River	7	510	Alder	50%	3.05	5	3,000	9,000	50%	3.05	5	3,000	9,000	0	0%
049_02	West Fork Potlatch River	8	310	Alder	43%	3.48	6	2,000	7,000	30%	4.27	6	2,000	9,000	2,000	-13%
049_02	West Fork Potlatch River	9	220	Alder	38%	3.78	7	2,000	8,000	30%	4.27	7	2,000	9,000	1,000	-8%
049_02	West Fork Potlatch River	10	270	Alder	34%	4.03	8	2,000	8,000	50%	3.05	8	2,000	6,000	(2,000)	0%
049_02	West Fork Potlatch River	11	320	Alder	31%	4.21	9	3,000	10,000	30%	4.27	9	3,000	10,000	0	-1%
049_02	Wolf Creek	1	2700	Upland	98%	0.12	2	5,000	600	90%	0.61	2	5,000	3,000	2,000	-8%
							Totals		250,000					430,000	180,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C13. Existing and target solar loads for Potlatch River – Headwaters 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
049_03	Potlatch River	9	150	Upland/Alder	61%	2.38	4	600	1,000	60%	2.44	4	600	1,000	0	-1%
049_03	Potlatch River	10	510	Upland/Alder	61%	2.38	4	2,000	5,000	50%	3.05	4	2,000	6,000	1,000	-11%
049_03	Potlatch River	11	110	Upland/Alder	61%	2.38	4	400	1,000	50%	3.05	4	400	1,000	0	-11%
049_03	Potlatch River	12	240	Upland/Alder	61%	2.38	4	1,000	2,000	50%	3.05	4	1,000	3,000	1,000	-11%
049_03	Potlatch River	13	260	Alder	50%	3.05	5	1,000	3,000	40%	3.66	5	1,000	4,000	1,000	-10%
049_03	Potlatch River	14	140	Alder	50%	3.05	5	700	2,000	40%	3.66	5	700	3,000	1,000	-10%
049_03	Potlatch River	15	140	Upland/Alder	52%	2.93	5	700	2,000	60%	2.44	5	700	2,000	0	0%
049_03	Potlatch River	16	110	Upland/Alder	52%	2.93	5	600	2,000	50%	3.05	5	600	2,000	0	-2%
049_03	Potlatch River	17	350	Upland/Alder	52%	2.93	5	2,000	6,000	40%	3.66	5	2,000	7,000	1,000	-12%
049_03	Potlatch River	18	280	Alder	43%	3.48	6	2,000	7,000	20%	4.88	6	2,000	10,000	3,000	-23%
049_03	Potlatch River	19	230	Alder	43%	3.48	6	1,000	3,000	50%	3.05	6	1,000	3,000	0	0%
049_03	Potlatch River	20	220	Alder	43%	3.48	6	1,000	3,000	40%	3.66	6	1,000	4,000	1,000	-3%
049_03	Potlatch River	21	980	Alder	38%	3.78	7	7,000	30,000	10%	5.49	7	7,000	40,000	10,000	-28%
049_03	West Fork Potlatch River	12	410	Alder	91%	0.55	1	400	200	30%	4.27	1	400	2,000	2,000	-61%
049_03	West Fork Potlatch River	13	350	Alder	86%	0.85	2	700	600	40%	3.66	2	700	3,000	2,000	-46%
049_03	West Fork Potlatch River	14	870	Alder	72%	1.71	3	3,000	5,000	40%	3.66	3	3,000	10,000	5,000	-32%
049_03	West Fork Potlatch River	15	1500	Alder	59%	2.50	4	6,000	20,000	60%	2.44	4	6,000	10,000	(10,000)	0%
049_03	West Fork Potlatch River	16	170	Alder	50%	3.05	5	900	3,000	40%	3.66	5	900	3,000	0	-10%
049_03	West Fork Potlatch River	17	260	Alder	50%	3.05	5	1,000	3,000	50%	3.05	5	1,000	3,000	0	0%
049_03	West Fork Potlatch River	18	70	Alder	43%	3.48	6	400	1,000	40%	3.66	6	400	1,000	0	-3%
049_03	West Fork Potlatch River	19	530	Alder	43%	3.48	6	3,000	10,000	30%	4.27	6	3,000	10,000	0	-13%
049_03	West Fork Potlatch River	20	110	Alder	38%	3.78	7	800	3,000	50%	3.05	7	800	2,000	(1,000)	0%
049_03	West Fork Potlatch River	21	280	Alder	38%	3.78	7	2,000	8,000	10%	5.49	7	2,000	10,000	2,000	-28%
049_03	West Fork Potlatch River	22	310	Alder	34%	4.03	8	2,000	8,000	40%	3.66	8	2,000	7,000	(1,000)	0%
							Totals		130,000					150,000	18,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C14. Existing and target solar loads for Potlatch River – Headwaters 4th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
049_04	Potlatch River	22	840	Alder	34%	4.03	8	7,000	30,000	20%	4.88	8	7,000	30,000	0	-14%
049_04	Potlatch River	23	510	Alder	31%	4.21	9	5,000	20,000	20%	4.88	9	5,000	20,000	0	-11%
049_04	Potlatch River	24	420	Upland/Alder	33%	4.09	9	4,000	20,000	20%	4.88	9	4,000	20,000	0	-13%
049_04	Potlatch River	25	340	Alder	28%	4.39	10	3,000	10,000	20%	4.88	10	3,000	10,000	0	-8%
049_04	Potlatch River	26	400	Alder	28%	4.39	10	4,000	20,000	20%	4.88	10	4,000	20,000	0	-8%
049_04	Potlatch River	27	270	Alder	28%	4.39	10	3,000	10,000	40%	3.66	10	3,000	10,000	0	0%
049_04	Potlatch River	28	280	Alder	26%	4.51	11	3,000	10,000	10%	5.49	11	3,000	20,000	10,000	-16%
049_04	Potlatch River	29	1100	Alder	26%	4.51	11	10,000	50,000	20%	4.88	11	10,000	50,000	0	-6%
049_04	Potlatch River	30	590	Alder	24%	4.64	12	7,000	30,000	10%	5.49	12	7,000	40,000	10,000	-14%
049_04	Potlatch River	31	610	Alder	24%	4.64	12	7,000	30,000	20%	4.88	12	7,000	30,000	0	-4%
049_04	Potlatch River	32	650	Alder	24%	4.64	12	8,000	40,000	10%	5.49	12	8,000	40,000	0	-14%
							Totals		270,000					290,000	20,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C15. Existing and target solar loads for Potlatch River – 4th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
048_04	Potlatch River	1	950	Alder	21%	3.78	14	7,000	30,000	20%	4.88	7	7,000	30,000	0	-1%
048_04	Potlatch River	2	710	Alder	21%	3.78	14	5,000	20,000	10%	5.49	7	5,000	30,000	10,000	-11%
048_04	Potlatch River	3	460	Alder	21%	3.78	14	3,000	10,000	50%	3.05	7	3,000	9,000	(1,000)	0%
048_04	Potlatch River	4	500	Upland/Alder	22%	3.60	15	4,000	10,000	10%	5.49	7	4,000	20,000	10,000	-12%
048_04	Potlatch River	5	630	Alder	19%	4.03	15	5,000	20,000	40%	3.66	8	5,000	20,000	0	0%
048_04	Potlatch River	6	900	Upland/Alder	22%	3.84	15	7,000	30,000	30%	4.27	8	7,000	30,000	0	0%
048_04	Potlatch River	7	510	Upland/Alder	21%	3.84	16	4,000	20,000	20%	4.88	8	4,000	20,000	0	-1%
048_04	Potlatch River	8	430	Upland/Alder	21%	3.84	16	3,000	10,000	30%	4.27	8	3,000	10,000	0	0%
048_04	Potlatch River	9	870	Upland/Alder	21%	4.09	16	8,000	30,000	20%	4.88	9	8,000	40,000	10,000	-1%
048_04	Potlatch River	10	1600	Upland/Alder	20%	4.09	17	10,000	40,000	30%	4.27	9	10,000	40,000	0	0%
048_04	Potlatch River	11	2600	Alder	16%	4.39	18	30,000	100,000	30%	4.27	10	30,000	100,000	0	0%
048_04	Potlatch River	12	490	Alder	15%	4.51	19	5,000	20,000	10%	5.49	11	5,000	30,000	10,000	-5%
							Totals		340,000					380,000	39,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C16. Existing and target solar loads for Potlatch River – 5th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
048_05	Potlatch River	13	640	Upland/Alder	18%	4.39	19	7,000	30,000	30%	4.27	11	7,000	30,000	0	0%
048_05	Potlatch River	14	630	Upland	46%	1.95	19	7,000	10,000	40%	3.66	11	7,000	30,000	20,000	-6%
048_05	Potlatch River	15	360	Upland	46%	1.95	19	4,000	8,000	30%	4.27	11	4,000	20,000	10,000	-16%
048_05	Potlatch River	16	1400	Upland	44%	2.20	20	20,000	40,000	40%	3.66	12	20,000	70,000	30,000	-4%
048_05	Potlatch River	17	530	Upland/Alder	17%	4.51	20	6,000	30,000	30%	4.27	12	6,000	30,000	0	0%
048_05	Potlatch River	18	2100	Upland/Alder	17%	4.58	21	30,000	100,000	40%	3.66	13	30,000	100,000	0	0%
048_05	Potlatch River	19	160	Alder	14%	4.76	21	2,000	10,000	0%	6.10	13	2,000	10,000	0	-14%
048_05	Potlatch River	20	330	Upland/Alder	16%	4.58	22	4,000	20,000	20%	4.88	13	4,000	20,000	0	0%
048_05	Potlatch River	21	840	Alder	13%	4.76	22	10,000	50,000	20%	4.88	13	10,000	50,000	0	0%
048_05	Potlatch River	22	420	Upland/Alder	16%	4.70	22	6,000	30,000	30%	4.27	14	6,000	30,000	0	0%
048_05	Potlatch River	23	1900	Upland	41%	2.62	22	30,000	80,000	30%	4.27	14	30,000	100,000	20,000	-11%
048_05	Potlatch River	24	270	Breakland/Alder	15%	4.76	23	4,000	20,000	20%	4.88	14	4,000	20,000	0	0%
048_05	Potlatch River	25	2800	Breakland	25%	3.90	23	40,000	200,000	30%	4.27	15	40,000	200,000	0	0%
							Totals		630,000					710,000	80,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C17. Existing and target solar loads for Potlatch River – 5th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
045_05	Potlatch River	26	600	Breakland	24%	4.64	24	10,000	50,000	30%	4.27	24	10,000	40,000	(10,000)	0%
045_05	Potlatch River	27	1200	Breakland	24%	4.64	24	30,000	100,000	40%	3.66	24	30,000	100,000	0	0%
045_05	Potlatch River	28	830	Breakland	24%	4.64	24	20,000	90,000	40%	3.66	24	20,000	70,000	(20,000)	0%
045_05	Potlatch River	29	2400	Breakland/Alder	14%	5.25	25	60,000	300,000	30%	4.27	25	60,000	300,000	0	0%
045_05	Potlatch River	30	480	Breakland/Alder	14%	5.25	25	10,000	50,000	20%	4.88	25	10,000	50,000	0	0%
045_05	Potlatch River	31	580	Breakland/Alder	13%	5.31	26	20,000	100,000	40%	3.66	26	20,000	70,000	(30,000)	0%
045_05	Potlatch River	32	360	Breakland/Alder	13%	5.31	26	9,000	50,000	30%	4.27	26	9,000	40,000	(10,000)	0%
045_05	Potlatch River	33	910	Breakland/Alder	13%	5.31	26	20,000	100,000	40%	3.66	26	20,000	70,000	(30,000)	0%
045_05	Potlatch River	34	1000	Breakland/Alder	13%	5.31	26	30,000	200,000	30%	4.27	26	30,000	100,000	(100,000)	0%
045_05	Potlatch River	35	840	Breakland/Alder	13%	5.31	27	20,000	100,000	30%	4.27	27	20,000	90,000	(10,000)	0%
045_05	Potlatch River	36	1700	Alder	11%	5.43	27	50,000	300,000	20%	4.88	27	50,000	200,000	(100,000)	0%
045_05	Potlatch River	37	470	Breakland/Alder	13%	5.31	27	10,000	50,000	40%	3.66	27	10,000	40,000	(10,000)	0%
045_05	Potlatch River	38	850	Breakland	21%	4.82	28	20,000	100,000	40%	3.66	28	20,000	70,000	(30,000)	0%
045_05	Potlatch River	39	1000	Breakland/Alder	12%	5.37	28	30,000	200,000	20%	4.88	28	30,000	100,000	(100,000)	0%
045_05	Potlatch River	40	1000	Alder	11%	5.43	28	30,000	200,000	10%	5.49	28	30,000	200,000	0	-1%
045_05	Potlatch River	41	530	Alder	10%	5.49	29	20,000	100,000	20%	4.88	29	20,000	100,000	0	0%
045_05	Potlatch River	42	1300	Alder	10%	5.49	29	40,000	200,000	10%	5.49	29	40,000	200,000	0	0%
045_05	Potlatch River	43	730	Breakland/Alder	12%	5.37	29	20,000	100,000	20%	4.88	29	20,000	100,000	0	0%
045_05	Potlatch River	44	1700	Breakland/Alder	12%	5.37	30	50,000	300,000	10%	5.49	30	50,000	300,000	0	-2%
045_05	Potlatch River	45	370	Breakland/Alder	12%	5.37	30	10,000	50,000	20%	4.88	30	10,000	50,000	0	0%
045_05	Potlatch River	46	1300	Breakland/Alder	12%	5.37	30	40,000	200,000	20%	4.88	30	40,000	200,000	0	0%
045_05	Potlatch River	47	430	Breakland/Alder	11%	5.43	31	10,000	50,000	10%	5.49	31	10,000	50,000	0	-1%
045_05	Potlatch River	48	800	Alder	9%	5.55	31	20,000	100,000	20%	4.88	31	20,000	100,000	0	0%
045_05	Potlatch River	49	1400	Breakland/Alder	11%	5.43	31	40,000	200,000	10%	5.49	31	40,000	200,000	0	-1%
045_05	Potlatch River	50	490	Breakland/Alder	11%	5.43	31	20,000	100,000	20%	4.88	31	20,000	100,000	0	0%
045_05	Potlatch River	51	1100	Alder	9%	5.55	32	40,000	200,000	10%	5.49	32	40,000	200,000	0	0%
045_05	Potlatch River	52	810	Breakland/Alder	11%	5.43	32	30,000	200,000	10%	5.49	32	30,000	200,000	0	-1%
045_05	Potlatch River	53	1300	Alder	9%	5.55	32	40,000	200,000	0%	6.10	32	40,000	200,000	0	-9%
045_05	Potlatch River	54	470	Alder	9%	5.55	33	20,000	100,000	10%	5.49	33	20,000	100,000	0	0%
045_05	Potlatch River	55	390	Breakland/Alder	11%	5.43	33	10,000	50,000	20%	4.88	33	10,000	50,000	0	0%
045_05	Potlatch River	56	610	Alder	9%	5.55	33	20,000	100,000	20%	4.88	33	20,000	100,000	0	0%
045_05	Potlatch River	57	420	Alder	9%	5.55	33	10,000	60,000	20%	4.88	33	10,000	50,000	(10,000)	0%
045_05	Potlatch River	58	400	Alder	9%	5.55	33	10,000	60,000	30%	4.27	33	10,000	40,000	(20,000)	0%
045_05	Potlatch River	59	820	Alder	9%	5.55	33	30,000	200,000	10%	5.49	33	30,000	200,000	0	0%
							Totals		4,600,000					4,100,000	-480,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C18. Existing and target solar loads for Potlatch River – 6th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
044_06	Potlatch River	60	300	Hawthorn	9%	5.55	34	10,000	60,000	10%	5.49	34	10,000	50,000	(10,000)	0%
044_06	Potlatch River	61	530	Hawthorn	9%	5.55	34	20,000	100,000	20%	4.88	34	20,000	100,000	0	0%
044_06	Potlatch River	62	880	Breakland/Alder	10%	5.49	34	30,000	200,000	20%	4.88	34	30,000	100,000	(100,000)	0%
044_06	Potlatch River	63	810	Cottonwood	20%	4.88	35	30,000	100,000	20%	4.88	35	30,000	100,000	0	0%
044_06	Potlatch River	64	200	Hawthorn	9%	5.55	35	7,000	40,000	20%	4.88	35	7,000	30,000	(10,000)	0%
044_06	Potlatch River	65	230	Hawthorn	9%	5.55	35	8,000	40,000	20%	4.88	35	8,000	40,000	0	0%
044_06	Potlatch River	66	300	Hawthorn	9%	5.55	35	10,000	60,000	20%	4.88	35	10,000	50,000	(10,000)	0%
044_06	Potlatch River	67	2200	Hawthorn	9%	5.55	36	80,000	400,000	10%	5.49	36	80,000	400,000	0	0%
044_06	Potlatch River	68	590	Cottonwood	19%	4.94	37	20,000	100,000	20%	4.88	37	20,000	100,000	0	0%
044_06	Potlatch River	69	290	Hawthorn	8%	5.61	37	10,000	60,000	10%	5.49	37	10,000	50,000	(10,000)	0%
044_06	Potlatch River	70	470	Cottonwood	19%	4.94	37	20,000	100,000	20%	4.88	37	20,000	100,000	0	0%
044_06	Potlatch River	71	390	Hawthorn	8%	5.61	38	10,000	60,000	10%	5.49	38	10,000	50,000	(10,000)	0%
044_06	Potlatch River	72	800	Cottonwood	18%	5.00	38	30,000	200,000	10%	5.49	38	30,000	200,000	0	-8%
044_06	Potlatch River	73	800	Cottonwood	18%	5.00	39	30,000	200,000	20%	4.88	39	30,000	100,000	(100,000)	0%
044_06	Potlatch River	74	2000	Cottonwood	17%	5.06	40	80,000	400,000	10%	5.49	40	80,000	400,000	0	-7%
044_06	Potlatch River	75	640	Cottonwood	17%	5.06	41	30,000	200,000	10%	5.49	41	30,000	200,000	0	-7%
044_06	Potlatch River	76	224	Hawthorn	8%	5.61	41	9,000	50,000	20%	4.88	41	9,000	40,000	(10,000)	0%
							Totals		2,400,000					2,100,000	-260,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C19. Existing and target solar loads for Cedar Creek – 4th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
046_04	Cedar Creek	1	690	Breakland	95%	0.31	1	700	200	80%	1.22	1	700	900	700	-15%
046_04	Cedar Creek	2	370	Breakland/Alder	91%	0.55	1	400	200	30%	4.27	1	400	2,000	2,000	-61%
046_04	Cedar Creek	3	210	Breakland/Alder	87%	0.79	2	400	300	40%	3.66	2	400	1,000	700	-47%
046_04	Cedar Creek	4	260	Breakland	94%	0.37	2	500	200	50%	3.05	2	500	2,000	2,000	-44%
046_04	Cedar Creek	5	510	Breakland/Alder	87%	0.79	2	1,000	800	40%	3.66	2	1,000	4,000	3,000	-47%
046_04	Cedar Creek	6	410	Alder	72%	1.71	3	1,000	2,000	20%	4.88	3	1,000	5,000	3,000	-52%
046_04	Cedar Creek	7	190	Breakland	89%	0.67	3	600	400	50%	3.05	3	600	2,000	2,000	-39%
046_04	Cedar Creek	8	310	Breakland/Alder	74%	1.59	3	900	1,000	40%	3.66	3	900	3,000	2,000	-34%
046_04	Cedar Creek	9	420	Breakland/Alder	61%	2.38	4	2,000	5,000	60%	2.44	4	2,000	5,000	0	-1%
046_04	Cedar Creek	10	190	Breakland/Alder	61%	2.38	4	800	2,000	40%	3.66	4	800	3,000	1,000	-21%
046_04	Cedar Creek	11	250	Breakland	79%	1.28	4	1,000	1,000	70%	1.83	4	1,000	2,000	1,000	-9%
046_04	Cedar Creek	12	96	Breakland/Alder	61%	2.38	4	400	1,000	50%	3.05	4	400	1,000	0	-11%
046_04	Cedar Creek	13	160	Breakland/Alder	52%	2.93	5	800	2,000	70%	1.83	5	800	1,000	(1,000)	0%
046_04	Cedar Creek	14	380	Alder	50%	3.05	5	2,000	6,000	60%	2.44	5	2,000	5,000	(1,000)	0%
046_04	Cedar Creek	15	190	Alder	50%	3.05	5	1,000	3,000	50%	3.05	5	1,000	3,000	0	0%
046_04	Cedar Creek	16	230	Breakland	71%	1.77	5	1,000	2,000	70%	1.83	5	1,000	2,000	0	-1%
046_04	Cedar Creek	17	180	Breakland/Alder	46%	3.29	6	1,000	3,000	40%	3.66	6	1,000	4,000	1,000	-6%
046_04	Cedar Creek	18	1000	Breakland	65%	2.14	6	6,000	10,000	60%	2.44	6	6,000	10,000	0	-5%
046_04	Cedar Creek	19	590	Breakland	60%	2.44	7	4,000	10,000	70%	1.83	7	4,000	7,000	(3,000)	0%
046_04	Cedar Creek	20	600	Breakland	55%	2.75	8	5,000	10,000	60%	2.44	8	5,000	10,000	0	0%
046_04	Cedar Creek	21	350	Breakland	55%	2.75	8	3,000	8,000	70%	1.83	8	3,000	5,000	(3,000)	0%
046_04	Cedar Creek	22	730	Breakland	51%	2.99	9	7,000	20,000	60%	2.44	9	7,000	20,000	0	0%
							Totals		88,000					98,000	10,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C20. Existing and target solar loads for Boulder Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
047_03	Boulder Creek	1	280	Upland	98%	0.12	1	300	40	90%	0.61	1	300	200	200	-8%
047_03	Boulder Creek	2	190	Upland/Alder	92%	0.49	1	200	100	30%	4.27	1	200	900	800	-62%
047_03	Boulder Creek	3	450	Upland	98%	0.12	1	500	60	80%	1.22	1	500	600	500	-18%
047_03	Boulder Creek	4	430	Upland	98%	0.12	2	900	100	90%	0.61	2	900	500	400	-8%
047_03	Boulder Creek	5	760	Upland	98%	0.12	2	2,000	200	80%	1.22	2	2,000	2,000	2,000	-18%
047_03	Boulder Creek	6	440	Upland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
047_03	Boulder Creek	7	2000	Upland	94%	0.37	4	8,000	3,000	80%	1.22	4	8,000	10,000	7,000	-14%
047_03	Boulder Creek	8	690	Upland	92%	0.49	5	3,000	1,000	70%	1.83	5	3,000	5,000	4,000	-22%
047_03	Boulder Creek	9	1400	Upland	90%	0.61	6	8,000	5,000	80%	1.22	6	8,000	10,000	5,000	-10%
							Totals		12,000					31,000	20,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C21. Existing and target solar loads for East Fork Potlatch River – 4th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
051_04	East Fork Potlatch River	1	230	Upland/Alder	52%	2.93	5	1,000	3,000	30%	4.27	5	1,000	4,000	1,000	-22%
051_04	East Fork Potlatch River	2	690	Upland/Alder	52%	2.93	5	3,000	9,000	40%	3.66	5	3,000	10,000	1,000	-12%
051_04	East Fork Potlatch River	3	370	Upland/Alder	52%	2.93	5	2,000	6,000	50%	3.05	5	2,000	6,000	0	-2%
051_04	East Fork Potlatch River	4	280	Upland/Alder	46%	3.29	6	2,000	7,000	40%	3.66	6	2,000	7,000	0	-6%
051_04	East Fork Potlatch River	5	230	Upland/Alder	46%	3.29	6	1,000	3,000	50%	3.05	6	1,000	3,000	0	0%
051_04	East Fork Potlatch River	6	700	Upland/Alder	46%	3.29	6	4,000	10,000	40%	3.66	6	4,000	10,000	0	-6%
051_04	East Fork Potlatch River	7	410	Upland/Alder	41%	3.60	7	3,000	10,000	30%	4.27	7	3,000	10,000	0	-11%
051_04	East Fork Potlatch River	8	460	Upland/Alder	41%	3.60	7	3,000	10,000	40%	3.66	7	3,000	10,000	0	-1%
051_04	East Fork Potlatch River	9	360	Alder	38%	3.78	7	3,000	10,000	20%	4.88	7	3,000	10,000	0	-18%
051_04	East Fork Potlatch River	10	520	Alder	34%	4.03	8	4,000	20,000	30%	4.27	8	4,000	20,000	0	-4%
051_04	East Fork Potlatch River	11	350	Alder	34%	4.03	8	3,000	10,000	40%	3.66	8	3,000	10,000	0	0%
051_04	East Fork Potlatch River	12	1500	Alder	31%	4.21	9	10,000	40,000	30%	4.27	9	10,000	40,000	0	-1%
051_04	East Fork Potlatch River	13	500	Upland/Alder	31%	4.21	10	5,000	20,000	50%	3.05	10	5,000	20,000	0	0%
051_04	East Fork Potlatch River	14	360	Upland/Alder	31%	4.21	10	4,000	20,000	40%	3.66	10	4,000	10,000	(10,000)	0%
051_04	East Fork Potlatch River	15	620	Upland/Alder	31%	4.21	10	6,000	30,000	30%	4.27	10	6,000	30,000	0	-1%
							Totals		210,000					200,000	-8,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C22. Existing and target solar loads for Ruby Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
052_03	Ruby Creek	1	1400	Upland/Alder	87%	0.79	2	3,000	2,000	70%	1.83	2	3,000	5,000	3,000	-17%
052_03	Ruby Creek	2	470	Alder	72%	1.71	3	1,000	2,000	50%	3.05	3	1,000	3,000	1,000	-22%
052_03	Ruby Creek	3	330	Upland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
052_03	Ruby Creek	4	490	Upland	94%	0.37	4	2,000	700	70%	1.83	4	2,000	4,000	3,000	-24%
052_03	Ruby Creek	5	530	Alder	59%	2.50	4	2,000	5,000	50%	3.05	4	2,000	6,000	1,000	-9%
052_03	Ruby Creek	6	250	Alder	59%	2.50	4	1,000	3,000	60%	2.44	4	1,000	2,000	(1,000)	0%
							Totals		15,000					22,000	7,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C23. Existing and target solar loads for Moose Creek – Headwaters 1st and 2nd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
053_02	01st Trib to Moose Creek	1	2700	Upland	98%	0.12	2	5,000	600	90%	0.61	2	5,000	3,000	2,000	-8%
053_02	02nd Trib to Moose Creek	1	1600	Breakland	95%	0.31	1	2,000	600	90%	0.61	1	2,000	1,000	400	-5%
053_02	02nd Trib to Moose Creek	2	280	Breakland	94%	0.37	2	600	200	50%	3.05	2	600	2,000	2,000	-44%
053_02	03rd Trib to Moose Creek	1	2300	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
053_02	03rd Trib to Moose Creek	2	560	Upland/Alder	87%	0.79	2	1,000	800	70%	1.83	2	1,000	2,000	1,000	-17%
053_02	03rd Trib to Moose Creek	3	260	Open Water												
053_02	03rd Trib to Moose Creek	4	650	Alder	86%	0.85	2	1,000	900	30%	4.27	2	1,000	4,000	3,000	-56%
053_02	03rd Trib to Moose Creek	4	220	Alder	72%	1.71	3	700	1,000	40%	3.66	3	700	3,000	2,000	-32%
053_02	03rd Trib to Moose Creek	5	680	Alder	72%	1.71	3	2,000	3,000	50%	3.05	3	2,000	6,000	3,000	-22%
053_02	03rd Trib to Moose Creek_Trib1	1	1600	Upland	98%	0.12	1	2,000	200	90%	0.61	1	2,000	1,000	800	-8%
053_02	03rd Trib to Moose Creek_Trib1	2	750	Upland/Alder	87%	0.79	2	2,000	2,000	70%	1.83	2	2,000	4,000	2,000	-17%
053_02	03rd Trib to Moose Creek_Trib1	3	140	Alder	72%	1.71	3	400	700	40%	3.66	3	400	1,000	300	-32%
053_02	03rd Trib to Moose Creek_Trib2	1	1100	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
053_02	03rd Trib to Moose Creek_Trib2	2	790	Alder	86%	0.85	2	2,000	2,000	40%	3.66	2	2,000	7,000	5,000	-46%
053_02	04th Trib to Moose Creek	1	1200	Upland/Alder	92%	0.49	1	1,000	500	80%	1.22	1	1,000	1,000	500	-12%
053_02	04th Trib to Moose Creek	2	490	Upland/Alder	87%	0.79	2	1,000	800	60%	2.44	2	1,000	2,000	1,000	-27%
053_02	04th Trib to Moose Creek	3	320	Alder	86%	0.85	2	600	500	60%	2.44	2	600	1,000	500	-26%
053_02	04th Trib to Moose Creek	4	340	Upland/Alder	87%	0.79	2	700	600	60%	2.44	2	700	2,000	1,000	-27%
053_02	04th Trib to Moose Creek	5	560	Upland/Alder	74%	1.59	3	2,000	3,000	30%	4.27	3	2,000	9,000	6,000	-44%
053_02	04th Trib to Moose Creek	6	150	Alder	72%	1.71	3	500	900	20%	4.88	3	500	2,000	1,000	-52%
053_02	04th Trib to Moose Creek	7	180	Alder	72%	1.71	3	500	900	10%	5.49	3	500	3,000	2,000	-62%
053_02	05th Trib to Moose Creek	1	1600	Upland/Alder	92%	0.49	1	2,000	1,000	20%	4.88	1	2,000	10,000	9,000	-72%
053_02	05th Trib to Moose Creek	2	340	Upland	98%	0.12	2	700	90	70%	1.83	2	700	1,000	900	-28%
053_02	05th Trib to Moose Creek	3	260	Open Water												
053_02	Moose Creek	1	2500	Upland	98%	0.12	1	3,000	400	90%	0.61	1	3,000	2,000	2,000	-8%
053_02	Moose Creek	2	290	Upland	98%	0.12	2	600	70	60%	2.44	2	600	1,000	900	-38%
053_02	Moose Creek	2	310	Upland	98%	0.12	2	600	70	80%	1.22	2	600	700	600	-18%
053_02	Moose Creek	3	100	Alder	86%	0.85	2	200	200	10%	5.49	2	200	1,000	800	-76%
053_02	Moose Creek	4	620	Upland/Alder	87%	0.79	2	1,000	800	30%	4.27	2	1,000	4,000	3,000	-57%
053_02	Moose Creek	5	2300	Alder	72%	1.71	3	7,000	10,000	30%	4.27	3	7,000	30,000	20,000	-42%
053_02	Moose Creek	6	2300	Alder	72%	1.71	3	7,000	10,000	30%	4.27	3	7,000	30,000	20,000	-42%
							Totals		42,000					140,000	92,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C24. Existing and target solar loads for Moose Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
053_03	Moose Creek	7	160	Alder	59%	2.50	4	600	2,000	40%	3.66	4	600	2,000	0	-19%
053_03	Moose Creek	8	200	Alder	59%	2.50	4	800	2,000	60%	2.44	4	800	2,000	0	0%
053_03	Moose Creek	9	630	Alder	59%	2.50	4	3,000	8,000	40%	3.66	4	3,000	10,000	2,000	-19%
053_03	Moose Creek	10	900	Alder	50%	3.05	5	5,000	20,000	40%	3.66	5	5,000	20,000	0	-10%
053_03	Moose Creek	11	350	Alder	43%	3.48	6	2,000	7,000	30%	4.27	6	2,000	9,000	2,000	-13%
053_03	Moose Creek	12	590	Upland/Alder	46%	3.29	6	4,000	10,000	30%	4.27	6	4,000	20,000	10,000	-16%
053_03	Moose Creek	13	1300	Open Water												
053_03	Moose Creek	14	240	Open Water												
053_03	Moose Creek	15	950	Upland/Alder	41%	3.60	7	7,000	30,000	10%	5.49	7	7,000	40,000	10,000	-31%
053_03	Moose Creek	16	650	Upland	81%	1.16	8	5,000	6,000	60%	2.44	8	5,000	10,000	4,000	-21%
							Totals		85,000					110,000	28,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C25. Existing and target solar loads for Corral Creek – Headwaters 1st and 2nd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
054_02	01st Trib to Corral Creek	1	940	Upland	98%	0.12	1	900	100	90%	0.61	1	900	500	400	-8%
054_02	01st Trib to Corral Creek	2	570	Upland/Alder	87%	0.79	2	1,000	800	40%	3.66	2	1,000	4,000	3,000	-47%
054_02	01st Trib to Corral Creek	3	370	Upland/Alder	87%	0.79	2	700	600	70%	1.83	2	700	1,000	400	-17%
054_02	01st Trib to Corral Creek	4	250	Upland/Alder	87%	0.79	2	500	400	80%	1.22	2	500	600	200	-7%
054_02	01st Trib to WF Corral Creek	1	520	Upland	98%	0.12	1	500	60	90%	0.61	1	500	300	200	-8%
054_02	01st Trib to WF Corral Creek	2	1100	Upland	98%	0.12	2	2,000	200	90%	0.61	2	2,000	1,000	800	-8%
054_02	01st Trib to WF Corral Creek	3	910	Grassland	21%	4.82	3	3,000	10,000	50%	3.05	3	3,000	9,000	(1,000)	0%
054_02	02nd Trib to Corral Creek	1	660	Upland	98%	0.12	1	700	90	90%	0.61	1	700	400	300	-8%
054_02	02nd Trib to Corral Creek	2	1200	Upland	98%	0.12	2	2,000	200	80%	1.22	2	2,000	2,000	2,000	-18%
054_02	02nd Trib to WF Corral Creek	1	140	Upland	98%	0.12	1	100	10	80%	1.22	1	100	100	90	-18%
054_02	02nd Trib to WF Corral Creek	2	1700	Upland	98%	0.12	2	3,000	400	90%	0.61	2	3,000	2,000	2,000	-8%
054_02	02nd Trib to WF Corral Creek	3	420	Upland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
054_02	03rd Trib to Corral Creek	1	1000	Upland	98%	0.12	1	1,000	100	80%	1.22	1	1,000	1,000	900	-18%
054_02	03rd Trib to Corral Creek	2	570	Upland/Alder	87%	0.79	2	1,000	800	30%	4.27	2	1,000	4,000	3,000	-57%
054_02	03rd Trib to Corral Creek	3	130	Upland/Alder	87%	0.79	2	300	200	20%	4.88	2	300	1,000	800	-67%
054_02	03rd Trib to Corral Creek	4	230	Upland/Alder	87%	0.79	2	500	400	60%	2.44	2	500	1,000	600	-27%
054_02	03rd Trib to Corral Creek	5	670	Upland/Alder	74%	1.59	3	2,000	3,000	40%	3.66	3	2,000	7,000	4,000	-34%
054_02	03rd Trib to Corral Creek	6	540	Upland	96%	0.24	3	2,000	500	60%	2.44	3	2,000	5,000	5,000	-36%
054_02	04th Trib to Corral Creek	1	400	Upland	98%	0.12	1	400	50	60%	2.44	1	400	1,000	1,000	-38%
054_02	04th Trib to Corral Creek	2	260	Alder	91%	0.55	1	300	200	30%	4.27	1	300	1,000	800	-61%
054_02	04th Trib to Corral Creek	3	420	Alder	91%	0.55	1	400	200	10%	5.49	1	400	2,000	2,000	-81%
054_02	04th Trib to Corral Creek	4	740	Upland/Alder	87%	0.79	2	1,000	800	40%	3.66	2	1,000	4,000	3,000	-47%
054_02	04th Trib to Corral Creek	5	210	Upland/Alder	87%	0.79	2	400	300	70%	1.83	2	400	700	400	-17%
054_02	04th Trib to Corral Creek	6	320	Upland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
054_02	04th Trib to Corral Creek	7	400	Upland	96%	0.24	3	1,000	200	70%	1.83	3	1,000	2,000	2,000	-26%
054_02	Corral Creek	1	1400	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
054_02	Corral Creek	2	520	Upland	98%	0.12	1	500	60	80%	1.22	1	500	600	500	-18%
054_02	Corral Creek	3	510	Upland	98%	0.12	2	1,000	100	70%	1.83	2	1,000	2,000	2,000	-28%
054_02	Corral Creek	4	220	Upland	98%	0.12	2	400	50	80%	1.22	2	400	500	500	-18%
054_02	Corral Creek	5	140	Upland/Alder	87%	0.79	2	300	200	30%	4.27	2	300	1,000	800	-57%
054_02	Corral Creek	6	490	Alder	86%	0.85	2	1,000	900	10%	5.49	2	1,000	5,000	4,000	-76%
054_02	Corral Creek	7	410	Upland/Alder	87%	0.79	2	800	600	60%	2.44	2	800	2,000	1,000	-27%
054_02	Corral Creek	8	110	Alder	86%	0.85	2	200	200	30%	4.27	2	200	900	700	-56%
054_02	Corral Creek	9	340	Upland/Alder	74%	1.59	3	1,000	2,000	70%	1.83	3	1,000	2,000	0	-4%
054_02	Corral Creek	10	210	Alder	72%	1.71	3	600	1,000	30%	4.27	3	600	3,000	2,000	-42%
054_02	Corral Creek	11	110	Alder	72%	1.71	3	300	500	30%	4.27	3	300	1,000	500	-42%
054_02	Corral Creek	12	100	Alder	72%	1.71	3	300	500	50%	3.05	3	300	900	400	-22%
054_02	Corral Creek	13	1200	Grassland	21%	4.82	3	4,000	20,000	40%	3.66	3	4,000	10,000	(10,000)	0%
054_02	Corral Creek	14	380	Upland/Alder	61%	2.38	4	2,000	5,000	70%	1.83	4	2,000	4,000	(1,000)	0%
054_02	East Fork Corral Creek	1	1300	Upland	98%	0.12	1	1,000	100	90%	0.61	1	1,000	600	500	-8%
054_02	East Fork Corral Creek	2	110	Grassland	55%	2.75	1	100	300	30%	4.27	1	100	400	100	-25%
054_02	East Fork Corral Creek	3	130	Upland	98%	0.12	1	100	10	70%	1.83	1	100	200	200	-28%
054_02	East Fork Corral Creek	4	410	Grassland	55%	2.75	1	400	1,000	30%	4.27	1	400	2,000	1,000	-25%

054_02	East Fork Corral Creek	5	370	Grassland	31%	4.21	2	700	3,000	20%	4.88	2	700	3,000	0	-11%
054_02	East Fork Corral Creek	6	150	Grassland	31%	4.21	2	300	1,000	40%	3.66	2	300	1,000	0	0%
054_02	East Fork Corral Creek	7	1500	Grassland	31%	4.21	2	3,000	10,000	10%	5.49	2	3,000	20,000	10,000	-21%
054_02	East Fork Corral Creek	8	290	Upland/Alder	74%	1.59	3	900	1,000	50%	3.05	3	900	3,000	2,000	-24%
054_02	East Fork Corral Creek	9	430	Upland/Alder	74%	1.59	3	1,000	2,000	90%	0.61	3	1,000	600	(1,000)	0%
054_02	East Fork Corral Creek	10	360	Upland	96%	0.24	3	1,000	200	90%	0.61	3	1,000	600	400	-6%
054_02	East Fork Corral Creek	11	270	Grassland	21%	4.82	3	800	4,000	40%	3.66	3	800	3,000	(1,000)	0%
054_02	East Fork Corral Creek	12	450	Upland/Alder	74%	1.59	3	1,000	2,000	30%	4.27	3	1,000	4,000	2,000	-44%
054_02	East Fork Corral Creek	13	220	Upland/Alder	61%	2.38	4	900	2,000	40%	3.66	4	900	3,000	1,000	-21%
054_02	East Fork Corral Creek	14	190	Grassland	16%	5.12	4	800	4,000	30%	4.27	4	800	3,000	(1,000)	0%
054_02	East Fork Corral Creek	15	370	Upland/Alder	61%	2.38	4	1,000	2,000	60%	2.44	4	1,000	2,000	0	-1%
054_02	East Fork Corral Creek	16	560	Upland/Alder	61%	2.38	4	2,000	5,000	70%	1.83	4	2,000	4,000	(1,000)	0%
054_02	Tee Meadow Creek	1	720	Upland	98%	0.12	1	700	90	90%	0.61	1	700	400	300	-8%
054_02	Tee Meadow Creek	2	780	Upland/Alder	87%	0.79	2	2,000	2,000	30%	4.27	2	2,000	9,000	7,000	-57%
054_02	Tee Meadow Creek	3	140	Upland/Alder	87%	0.79	2	300	200	40%	3.66	2	300	1,000	800	-47%
054_02	Tee Meadow Creek	4	120	Upland	96%	0.24	3	400	100	70%	1.83	3	400	700	600	-26%
054_02	Tee Meadow Creek	6	130	Upland/Alder	74%	1.59	3	400	600	40%	3.66	3	400	1,000	400	-34%
054_02	Tee Meadow Creek	7	220	Upland	96%	0.24	3	700	200	80%	1.22	3	700	900	700	-16%
054_02	Tee Meadow Creek	8	590	Upland	96%	0.24	3	2,000	500	60%	2.44	3	2,000	5,000	5,000	-36%
054_02	Tee Meadow Creek	9	340	Grassland	16%	5.12	4	1,000	5,000	20%	4.88	4	1,000	5,000	0	0%
054_02	Tee Meadow Creek	10	150	Alder	59%	2.50	4	600	2,000	30%	4.27	4	600	3,000	1,000	-29%
054_02	Tee Meadow Creek	11	120	Upland/Alder	61%	2.38	4	500	1,000	60%	2.44	4	500	1,000	0	-1%
054_02	Tee Meadow Creek	12	61	Grassland	16%	5.12	4	200	1,000	30%	4.27	4	200	900	(100)	0%
054_02	West Fork Corral Creek	1	920	Upland	98%	0.12	1	900	100	90%	0.61	1	900	500	400	-8%
054_02	West Fork Corral Creek	2	440	Upland	98%	0.12	1	400	50	80%	1.22	1	400	500	500	-18%
054_02	West Fork Corral Creek	3	180	Grassland	55%	2.75	1	200	500	40%	3.66	1	200	700	200	-15%
054_02	West Fork Corral Creek	4	280	Upland	98%	0.12	1	300	40	60%	2.44	1	300	700	700	-38%
054_02	West Fork Corral Creek	5	210	Upland/Alder	92%	0.49	1	200	100	40%	3.66	1	200	700	600	-52%
054_02	West Fork Corral Creek	6	310	Upland	98%	0.12	1	300	40	60%	2.44	1	300	700	700	-38%
054_02	West Fork Corral Creek	7	450	Grassland	31%	4.21	2	900	4,000	40%	3.66	2	900	3,000	(1,000)	0%
054_02	West Fork Corral Creek	8	430	Grassland	31%	4.21	2	900	4,000	50%	3.05	2	900	3,000	(1,000)	0%
054_02	West Fork Corral Creek	9	100	Grassland	31%	4.21	2	200	800	50%	3.05	2	200	600	(200)	0%
054_02	West Fork Corral Creek	10	620	Upland	98%	0.12	2	1,000	100	80%	1.22	2	1,000	1,000	900	-18%
054_02	West Fork Corral Creek	11	560	Upland/Alder	87%	0.79	2	1,000	800	70%	1.83	2	1,000	2,000	1,000	-17%
							Totals		120,000					180,000	65,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C26. Existing and target solar loads for Corral Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
054_03	Corral Creek	15	680	Upland/Alder	61%	2.38	4	3,000	7,000	70%	1.83	4	3,000	5,000	(2,000)	0%
054_03	Corral Creek	16	290	Upland/Alder	61%	2.38	4	1,000	2,000	80%	1.22	4	1,000	1,000	(1,000)	0%
054_03	Corral Creek	17	510	Alder	59%	2.50	4	2,000	5,000	40%	3.66	4	2,000	7,000	2,000	-19%
054_03	Corral Creek	18	210	Upland/Alder	52%	2.93	5	1,000	3,000	70%	1.83	5	1,000	2,000	(1,000)	0%
054_03	Corral Creek	19	500	Upland/Alder	52%	2.93	5	3,000	9,000	30%	4.27	5	3,000	10,000	1,000	-22%
054_03	Corral Creek	20	1000	Grassland	13%	5.31	5	5,000	30,000	40%	3.66	5	5,000	20,000	(10,000)	0%
054_03	Corral Creek	21	390	Upland/Alder	52%	2.93	5	2,000	6,000	30%	4.27	5	2,000	9,000	3,000	-22%
054_03	Corral Creek	22	140	Upland/Alder	46%	3.29	6	800	3,000	70%	1.83	6	800	1,000	(2,000)	0%
054_03	Corral Creek	23	310	Upland/Alder	46%	3.29	6	2,000	7,000	40%	3.66	6	2,000	7,000	0	-6%
054_03	Corral Creek	24	880	Upland/Alder	46%	3.29	6	5,000	20,000	60%	2.44	6	5,000	10,000	(10,000)	0%
054_03	Corral Creek	25	360	Upland/Alder	46%	3.29	6	2,000	7,000	40%	3.66	6	2,000	7,000	0	-6%
054_03	Corral Creek	26	170	Upland/Alder	46%	3.29	6	1,000	3,000	60%	2.44	6	1,000	2,000	(1,000)	0%
054_03	Corral Creek	27	250	Alder	38%	3.78	7	2,000	8,000	30%	4.27	7	2,000	9,000	1,000	-8%
054_03	Corral Creek	28	400	Alder	38%	3.78	7	3,000	10,000	60%	2.44	7	3,000	7,000	(3,000)	0%
054_03	Corral Creek	29	170	Alder	38%	3.78	7	1,000	4,000	30%	4.27	7	1,000	4,000	0	-8%
054_03	Corral Creek	30	100	Alder	38%	3.78	7	700	3,000	20%	4.88	7	700	3,000	0	-18%
054_03	Corral Creek	31	540	Alder	38%	3.78	7	4,000	20,000	50%	3.05	7	4,000	10,000	(10,000)	0%
054_03	Corral Creek	32	310	Alder	38%	3.78	7	2,000	8,000	20%	4.88	7	2,000	10,000	2,000	-18%
054_03	Corral Creek	33	150	Upland/Alder	41%	3.60	7	1,000	4,000	60%	2.44	7	1,000	2,000	(2,000)	0%
054_03	Corral Creek	34	240	Upland/Alder	37%	3.84	8	2,000	8,000	50%	3.05	8	2,000	6,000	(2,000)	0%
054_03	Corral Creek	35	1100	Grassland	8%	5.61	8	9,000	50,000	10%	5.49	8	9,000	50,000	0	0%
054_03	Corral Creek	36	320	Upland/Alder	37%	3.84	8	3,000	10,000	30%	4.27	8	3,000	10,000	0	-7%
054_03	Corral Creek	37	1200	Upland/Alder	33%	4.09	9	10,000	40,000	60%	2.44	9	10,000	20,000	(20,000)	0%
054_03	Corral Creek	38	810	Upland/Alder	33%	4.09	9	7,000	30,000	70%	1.83	9	7,000	10,000	(20,000)	0%
054_03	Corral Creek	39	480	Upland/Alder	31%	4.21	10	5,000	20,000	60%	2.44	10	5,000	10,000	(10,000)	0%
054_03	Corral Creek	40	110	Upland/Alder	31%	4.21	10	1,000	4,000	80%	1.22	10	1,000	1,000	(3,000)	0%
054_03	Corral Creek	41	330	Upland/Alder	31%	4.21	10	3,000	10,000	60%	2.44	10	3,000	7,000	(3,000)	0%
054_03	Corral Creek	42	230	Upland	72%	1.71	10	2,000	3,000	70%	1.83	10	2,000	4,000	1,000	-2%
							Totals		330,000					240,000	-90,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C27. Existing and target solar loads for Pine Creek – Headwaters 1st and 2nd orders.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
055_02	01st Trib to Big Bear Gulch	1	57	Alder	91%	0.55	1	60	30	10%	5.49	1	60	300	300	-81%
055_02	01st Trib to Big Bear Gulch	2	130	Open Water												
055_02	01st Trib to Big Bear Gulch	3	72	Alder	91%	0.55	1	70	40	30%	4.27	1	70	300	300	-61%
055_02	01st Trib to Big Bear Gulch	4	91	Open Water												
055_02	01st Trib to Big Bear Gulch	5	56	Alder	91%	0.55	1	60	30	20%	4.88	1	60	300	300	-71%
055_02	01st Trib to Big Bear Gulch	6	54	Open Water												
055_02	01st Trib to Big Bear Gulch	7	410	Alder	91%	0.55	1	400	200	10%	5.49	1	400	2,000	2,000	-81%
055_02	01st Trib to Big Bear Gulch	8	230	Breakland/Alder	87%	0.79	2	500	400	70%	1.83	2	500	900	500	-17%
055_02	01st Trib to Big Bear Gulch	9	120	Breakland/Alder	87%	0.79	2	200	200	30%	4.27	2	200	900	700	-57%
055_02	01st Trib to Big Bear Gulch	10	220	Breakland/Alder	87%	0.79	2	400	300	20%	4.88	2	400	2,000	2,000	-67%
055_02	01st Trib to Big Bear Gulch	11	200	Breakland	89%	0.67	3	600	400	80%	1.22	3	600	700	300	-9%
055_02	01st Trib to Big Bear Gulch	12	250	Breakland	89%	0.67	3	800	500	10%	5.49	3	800	4,000	4,000	-79%
055_02	01st Trib to Pine Creek	1	350	Breakland/Alder	91%	0.55	1	400	200	80%	1.22	1	400	500	300	-11%
055_02	01st Trib to Pine Creek	2	320	Breakland/Alder	91%	0.55	1	300	200	90%	0.61	1	300	200	0	-1%
055_02	01st Trib to Pine Creek	3	180	Alder	86%	0.85	2	400	300	50%	3.05	2	400	1,000	700	-36%
055_02	01st Trib to Pine Creek	4	190	Breakland	94%	0.37	2	400	100	90%	0.61	2	400	200	100	-4%
055_02	01st Trib to Pine Creek	5	230	Breakland/Alder	87%	0.79	2	500	400	80%	1.22	2	500	600	200	-7%
055_02	01st Trib to Pine Creek	6	230	Breakland	89%	0.67	3	700	500	90%	0.61	3	700	400	(100)	0%
055_02	01st Trib to Pine Creek	7	350	Breakland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
055_02	01st Trib to Pine Creek	8	130	Breakland/Alder	74%	1.59	3	400	600	10%	5.49	3	400	2,000	1,000	-64%
055_02	02nd Trib to Big Bear Gulch	1	150	Breakland/Alder	91%	0.55	1	200	100	20%	4.88	1	200	1,000	900	-71%
055_02	02nd Trib to Big Bear Gulch	2	180	Breakland/Alder	91%	0.55	1	200	100	70%	1.83	1	200	400	300	-21%
055_02	02nd Trib to Big Bear Gulch	3	260	Breakland/Alder	91%	0.55	1	300	200	20%	4.88	1	300	1,000	800	-71%
055_02	02nd Trib to Big Bear Gulch	4	240	Breakland/Alder	91%	0.55	1	200	100	70%	1.83	1	200	400	300	-21%
055_02	02nd Trib to Big Bear Gulch	5	130	Breakland/Alder	91%	0.55	1	100	50	20%	4.88	1	100	500	500	-71%
055_02	02nd Trib to Big Bear Gulch	6	320	Breakland/Alder	87%	0.79	2	600	500	30%	4.27	2	600	3,000	3,000	-57%
055_02	02nd Trib to Big Bear Gulch	7	540	Breakland	94%	0.37	2	1,000	400	80%	1.22	2	1,000	1,000	600	-14%
055_02	02nd Trib to Big Bear Gulch	8	230	Breakland	89%	0.67	3	700	500	20%	4.88	3	700	3,000	3,000	-69%
055_02	02nd Trib to Big Bear Gulch	9	300	Breakland	89%	0.67	3	900	600	60%	2.44	3	900	2,000	1,000	-29%
055_02	02nd Trib to Big Bear Gulch	10	170	Breakland	89%	0.67	3	500	300	70%	1.83	3	500	900	600	-19%
055_02	02nd Trib to Big Bear Gulch	11	81	Open Water												
055_02	02nd Trib to Big Bear Gulch	12	110	Breakland	89%	0.67	3	300	200	70%	1.83	3	300	500	300	-19%
055_02	02nd Trib to Pine Creek	1	940	Breakland/Alder	91%	0.55	1	900	500	60%	2.44	1	900	2,000	2,000	-31%
055_02	02nd Trib to Pine Creek	2	400	Breakland/Alder	87%	0.79	2	800	600	10%	5.49	2	800	4,000	3,000	-77%
055_02	02nd Trib to Pine Creek	3	160	Breakland/Alder	87%	0.79	2	300	200	40%	3.66	2	300	1,000	800	-47%
055_02	02nd Trib to Pine Creek	4	230	Breakland/Alder	87%	0.79	2	500	400	80%	1.22	2	500	600	200	-7%
055_02	02nd Trib to Pine Creek	5	260	Breakland/Alder	87%	0.79	2	500	400	10%	5.49	2	500	3,000	3,000	-77%
055_02	02nd Trib to Pine Creek	6	250	Breakland/Alder	74%	1.59	3	800	1,000	60%	2.44	3	800	2,000	1,000	-14%
055_02	02nd Trib to Pine Creek	7	770	Breakland/Alder	74%	1.59	3	2,000	3,000	80%	1.22	3	2,000	2,000	(1,000)	6%
055_02	03rd Trib to Big Bear Gulch	1	230	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
055_02	03rd Trib to Big Bear Gulch	2	89	Breakland/Alder	91%	0.55	1	90	50	60%	2.44	1	90	200	200	-31%
055_02	03rd Trib to Big Bear Gulch	3	500	Breakland/Alder	91%	0.55	1	500	300	50%	3.05	1	500	2,000	2,000	-41%
055_02	03rd Trib to Big Bear Gulch	4	510	Breakland/Alder	87%	0.79	2	1,000	800	70%	1.83	2	1,000	2,000	1,000	-17%

055_02	03rd Trib to Big Bear Gulch	5	1100	Breakland/Alder	74%	1.59	3	3,000	5,000	80%	1.22	3	3,000	4,000	(1,000)	0%
055_02	03rd Trib to Pine Creek	1	730	Breakland/Alder	91%	0.55	1	700	400	70%	1.83	1	700	1,000	600	-21%
055_02	03rd Trib to Pine Creek	2	260	Breakland/Alder	91%	0.55	1	300	200	30%	4.27	1	300	1,000	800	-61%
055_02	03rd Trib to Pine Creek	3	250	Breakland/Alder	87%	0.79	2	500	400	60%	2.44	2	500	1,000	600	-27%
055_02	03rd Trib to Pine Creek	4	370	Breakland/Alder	87%	0.79	2	700	600	10%	5.49	2	700	4,000	3,000	-77%
055_02	03rd Trib to Pine Creek	5	460	Breakland/Alder	87%	0.79	2	900	700	30%	4.27	2	900	4,000	3,000	-57%
055_02	03rd Trib to Pine Creek	6	250	Breakland/Alder	74%	1.59	3	800	1,000	70%	1.83	3	800	1,000	0	-4%
055_02	03rd Trib to Pine Creek	7	860	Breakland/Alder	74%	1.59	3	3,000	5,000	50%	3.05	3	3,000	9,000	4,000	-24%
055_02	03rd Trib to Pine Creek	8	140	Alder	59%	2.50	4	600	2,000	20%	4.88	4	600	3,000	1,000	-39%
055_02	04th Trib to Big Bear Gulch	1	360	Breakland	95%	0.31	1	400	100	90%	0.61	1	400	200	100	-5%
055_02	04th Trib to Big Bear Gulch	2	650	Breakland/Alder	91%	0.55	1	700	400	60%	2.44	1	700	2,000	2,000	-31%
055_02	04th Trib to Big Bear Gulch	3	310	Breakland/Alder	87%	0.79	2	600	500	70%	1.83	2	600	1,000	500	-17%
055_02	04th Trib to Big Bear Gulch	4	210	Breakland/Alder	87%	0.79	2	400	300	20%	4.88	2	400	2,000	2,000	-67%
055_02	04th Trib to Big Bear Gulch	5	190	Breakland	94%	0.37	2	400	100	90%	0.61	2	400	200	100	-4%
055_02	04th Trib to Big Bear Gulch	6	140	Breakland/Alder	74%	1.59	3	400	600	60%	2.44	3	400	1,000	400	-14%
055_02	04th Trib to Big Bear Gulch	7	250	Breakland	89%	0.67	3	800	500	90%	0.61	3	800	500	0	0%
055_02	04th Trib to Big Bear Gulch	8	100	Breakland/Alder	74%	1.59	3	300	500	70%	1.83	3	300	500	0	-4%
055_02	04th Trib to Pine Creek	1	170	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
055_02	04th Trib to Pine Creek	2	690	Breakland/Alder	91%	0.55	1	700	400	50%	3.05	1	700	2,000	2,000	-41%
055_02	04th Trib to Pine Creek	3	530	Breakland/Alder	87%	0.79	2	1,000	800	60%	2.44	2	1,000	2,000	1,000	-27%
055_02	04th Trib to Pine Creek	4	110	Alder	86%	0.85	2	200	200	10%	5.49	2	200	1,000	800	-76%
055_02	04th Trib to Pine Creek	5	370	Breakland/Alder	87%	0.79	2	700	600	40%	3.66	2	700	3,000	2,000	-47%
055_02	04th Trib to Pine Creek	6	730	Breakland	89%	0.67	3	2,000	1,000	70%	1.83	3	2,000	4,000	3,000	-19%
055_02	05th Trib to Pine Creek	1	420	Breakland/Alder	91%	0.55	1	400	200	80%	1.22	1	400	500	300	-11%
055_02	05th Trib to Pine Creek	2	220	Alder	86%	0.85	2	400	300	60%	2.44	2	400	1,000	700	-26%
055_02	05th Trib to Pine Creek	3	1900	Breakland	89%	0.67	3	6,000	4,000	90%	0.61	3	6,000	4,000	0	0%
055_02	06th Trib to Pine Creek	1	600	Breakland/Alder	91%	0.55	1	600	300	20%	4.88	1	600	3,000	3,000	-71%
055_02	06th Trib to Pine Creek	2	330	Alder	91%	0.55	1	300	200	10%	5.49	1	300	2,000	2,000	-81%
055_02	06th Trib to Pine Creek	3	630	Breakland	94%	0.37	2	1,000	400	90%	0.61	2	1,000	600	200	-4%
055_02	06th Trib to Pine Creek	4	430	Breakland	94%	0.37	2	900	300	80%	1.22	2	900	1,000	700	-14%
055_02	07th Trib to Pine Creek	1	130	Breakland/Alder	91%	0.55	1	100	50	30%	4.27	1	100	400	400	-61%
055_02	07th Trib to Pine Creek	2	320	Breakland/Alder	91%	0.55	1	300	200	60%	2.44	1	300	700	500	-31%
055_02	07th Trib to Pine Creek	3	1100	Breakland/Alder	87%	0.79	2	2,000	2,000	70%	1.83	2	2,000	4,000	2,000	-17%
055_02	07th Trib to Pine Creek	4	550	Breakland	89%	0.67	3	2,000	1,000	90%	0.61	3	2,000	1,000	0	0%
055_02	Big Bear Gulch	1	130	Alder	91%	0.55	1	100	50	10%	5.49	1	100	500	500	-81%
055_02	Big Bear Gulch	2	230	Breakland/Alder	91%	0.55	1	200	100	30%	4.27	1	200	900	800	-61%
055_02	Big Bear Gulch	3	290	Breakland/Alder	91%	0.55	1	300	200	70%	1.83	1	300	500	300	-21%
055_02	Big Bear Gulch	4	320	Breakland/Alder	91%	0.55	1	300	200	60%	2.44	1	300	700	500	-31%
055_02	Big Bear Gulch	5	300	Breakland/Alder	91%	0.55	1	300	200	70%	1.83	1	300	500	300	-21%
055_02	Big Bear Gulch	6	200	Alder	86%	0.85	2	400	300	20%	4.88	2	400	2,000	2,000	-66%
055_02	Big Bear Gulch	7	120	Alder	86%	0.85	2	200	200	30%	4.27	2	200	900	700	-56%
055_02	Big Bear Gulch	8	260	Alder	86%	0.85	2	500	400	20%	4.88	2	500	2,000	2,000	-66%
055_02	Big Bear Gulch	9	190	Breakland/Alder	87%	0.79	2	400	300	70%	1.83	2	400	700	400	-17%
055_02	Big Bear Gulch	10	110	Alder	86%	0.85	2	200	200	30%	4.27	2	200	900	700	-56%
055_02	Big Bear Gulch	11	150	Alder	86%	0.85	2	300	300	50%	3.05	2	300	900	600	-36%
055_02	Big Bear Gulch	12	410	Breakland/Alder	74%	1.59	3	1,000	2,000	70%	1.83	3	1,000	2,000	0	-4%
055_02	Big Bear Gulch	13	430	Breakland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
055_02	Big Bear Gulch	14	210	Breakland/Alder	74%	1.59	3	600	1,000	70%	1.83	3	600	1,000	0	-4%
055_02	Big Bear Gulch	15	430	Breakland/Alder	61%	2.38	4	2,000	5,000	70%	1.83	4	2,000	4,000	(1,000)	0%
055_02	Big Bear Gulch	16	200	Alder	59%	2.50	4	800	2,000	60%	2.44	4	800	2,000	0	0%
055_02	Big Bear Gulch	17	76	Alder	59%	2.50	4	300	800	10%	5.49	4	300	2,000	1,000	-49%

055_02	Big Bear Gulch	18	69	Breakland	79%	1.28	4	300	400	80%	1.22	4	300	400	0	0%
055_02	Big Bear Gulch	19	270	Breakland	79%	1.28	4	1,000	1,000	80%	1.22	4	1,000	1,000	0	0%
055_02	Big Bear Gulch	20	960	Breakland/Alder	52%	2.93	5	5,000	10,000	70%	1.83	5	5,000	9,000	(1,000)	0%
055_02	Big Bear Gulch	21	440	Breakland/Alder	46%	3.29	6	3,000	10,000	80%	1.22	6	3,000	4,000	(6,000)	0%
055_02	Big Bear Gulch	22	260	Breakland/Alder	46%	3.29	6	2,000	7,000	70%	1.83	6	2,000	4,000	(3,000)	0%
055_02	Big Bear Gulch	23	700	Breakland	65%	2.14	6	4,000	9,000	80%	1.22	6	4,000	5,000	(4,000)	0%
055_02	Pine Creek	1	470	Breakland/Alder	91%	0.55	1	500	300	80%	1.22	1	500	600	300	-11%
055_02	Pine Creek	2	410	Breakland/Alder	91%	0.55	1	400	200	70%	1.83	1	400	700	500	-21%
055_02	Pine Creek	3	220	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
055_02	Pine Creek	4	190	Breakland/Alder	91%	0.55	1	200	100	50%	3.05	1	200	600	500	-41%
055_02	Pine Creek	5	210	Breakland/Alder	91%	0.55	1	200	100	40%	3.66	1	200	700	600	-51%
055_02	Pine Creek	6	360	Breakland/Alder	91%	0.55	1	400	200	30%	4.27	1	400	2,000	2,000	-61%
055_02	Pine Creek	7	310	Breakland/Alder	91%	0.55	1	300	200	60%	2.44	1	300	700	500	-31%
055_02	Pine Creek	8	300	Breakland/Alder	87%	0.79	2	600	500	30%	4.27	2	600	3,000	3,000	-57%
055_02	Pine Creek	9	300	Breakland/Alder	87%	0.79	2	600	500	50%	3.05	2	600	2,000	2,000	-37%
055_02	Pine Creek	10	320	Breakland/Alder	87%	0.79	2	600	500	20%	4.88	2	600	3,000	3,000	-67%
055_02	Pine Creek	11	290	Breakland/Alder	87%	0.79	2	600	500	70%	1.83	2	600	1,000	500	-17%
055_02	Pine Creek	12	270	Breakland/Alder	87%	0.79	2	500	400	20%	4.88	2	500	2,000	2,000	-67%
055_02	Pine Creek	13	340	Breakland/Alder	87%	0.79	2	700	600	10%	5.49	2	700	4,000	3,000	-77%
055_02	Pine Creek	14	110	Breakland/Alder	87%	0.79	2	200	200	10%	5.49	2	200	1,000	800	-77%
055_02	Pine Creek	15	130	Breakland	94%	0.37	2	300	100	90%	0.61	2	300	200	100	-4%
055_02	Pine Creek	16	120	Breakland/Alder	74%	1.59	3	400	600	10%	5.49	3	400	2,000	1,000	-64%
055_02	Pine Creek	17	120	Breakland	89%	0.67	3	400	300	90%	0.61	3	400	200	(100)	0%
055_02	Pine Creek	18	290	Breakland/Alder	74%	1.59	3	900	1,000	70%	1.83	3	900	2,000	1,000	-4%
055_02	Pine Creek	19	470	Breakland	89%	0.67	3	1,000	700	80%	1.22	3	1,000	1,000	300	-9%
055_02	Pine Creek	20	160	Breakland	89%	0.67	3	500	300	50%	3.05	3	500	2,000	2,000	-39%
055_02	Pine Creek	21	170	Breakland	89%	0.67	3	500	300	80%	1.22	3	500	600	300	-9%
055_02	Pine Creek	22	430	Breakland/Alder	74%	1.59	3	1,000	2,000	40%	3.66	3	1,000	4,000	2,000	-34%
055_02	Pine Creek	23	230	Breakland/Alder	74%	1.59	3	700	1,000	60%	2.44	3	700	2,000	1,000	-14%
055_02	Pine Creek	24	51	Breakland/Alder	74%	1.59	3	200	300	20%	4.88	3	200	1,000	700	-54%
055_02	Pine Creek	25	46	Breakland/Alder	61%	2.38	4	200	500	10%	5.49	4	200	1,000	500	-51%
055_02	Pine Creek	26	16	Breakland/Alder	61%	2.38	4	60	100	10%	5.49	4	60	300	200	-51%
055_02	Pine Creek	27	73	Breakland/Alder	61%	2.38	4	300	700	10%	5.49	4	300	2,000	1,000	-51%
055_02	Pine Creek	28	130	Breakland/Alder	61%	2.38	4	500	1,000	60%	2.44	4	500	1,000	0	-1%
055_02	Pine Creek	29	150	Breakland/Alder	61%	2.38	4	600	1,000	20%	4.88	4	600	3,000	2,000	-41%
055_02	Pine Creek	30	200	Breakland/Alder	61%	2.38	4	800	2,000	40%	3.66	4	800	3,000	1,000	-21%
055_02	Pine Creek	31	780	Breakland	79%	1.28	4	3,000	4,000	60%	2.44	4	3,000	7,000	3,000	-19%
055_02	Pine Creek	32	440	Breakland	79%	1.28	4	2,000	3,000	60%	2.44	4	2,000	5,000	2,000	-19%
055_02	Pine Creek	33	400	Breakland	79%	1.28	4	2,000	3,000	80%	1.22	4	2,000	2,000	(1,000)	0%
055_02	Pine Creek	34	540	Breakland/Alder	52%	2.93	5	3,000	9,000	50%	3.05	5	3,000	9,000	0	-2%
055_02	Pine Creek	35	520	Breakland/Alder	52%	2.93	5	3,000	9,000	50%	3.05	5	3,000	9,000	0	-2%
055_02	Pine Creek	36	440	Breakland/Alder	52%	2.93	5	2,000	6,000	60%	2.44	5	2,000	5,000	(1,000)	0%
055_02	Pine Creek	37	420	Breakland	71%	1.77	5	2,000	4,000	50%	3.05	5	2,000	6,000	2,000	-21%
055_02	Pine Creek	38	180	Breakland	71%	1.77	5	900	2,000	60%	2.44	5	900	2,000	0	-11%
055_02	Pine Creek	39	200	Breakland/Alder	46%	3.29	6	1,000	3,000	50%	3.05	6	1,000	3,000	0	0%
055_02	Pine Creek	40	300	Breakland/Alder	46%	3.29	6	2,000	7,000	60%	2.44	6	2,000	5,000	(2,000)	0%
055_02	Pine Creek	41	250	Breakland	65%	2.14	6	2,000	4,000	60%	2.44	6	2,000	5,000	1,000	-5%
055_02	Pine Creek	42	140	Breakland/Alder	46%	3.29	6	800	3,000	50%	3.05	6	800	2,000	(1,000)	0%
055_02	Pine Creek	43	280	Alder	43%	3.48	6	2,000	7,000	40%	3.66	6	2,000	7,000	0	-3%
055_02	Pine Creek	44	450	Breakland	65%	2.14	6	3,000	6,000	90%	0.61	6	3,000	2,000	(4,000)	0%

055_02	Pine Creek	45	250	Breakland	65%	2.14	6	2,000	4,000	80%	1.22	6	2,000	2,000	(2,000)	0%
055_02	Pine Creek	46	940	Breakland	60%	2.44	7	7,000	20,000	90%	0.61	7	7,000	4,000	(20,000)	0%
055_02	Pine Creek	47	380	Breakland/Alder	40%	3.66	7	3,000	10,000	70%	1.83	7	3,000	5,000	(5,000)	0%
055_02	Pine Creek	48	370	Breakland	60%	2.44	7	3,000	7,000	80%	1.22	7	3,000	4,000	(3,000)	0%
055_02	Pine Creek	49	510	Breakland	60%	2.44	7	4,000	10,000	90%	0.61	7	4,000	2,000	(8,000)	0%
055_02	Pine Creek	50	300	Breakland/Alder	40%	3.66	7	2,000	7,000	60%	2.44	7	2,000	5,000	(2,000)	0%
055_02	Pine Creek	51	760	Breakland/Alder	40%	3.66	7	5,000	20,000	70%	1.83	7	5,000	9,000	(10,000)	0%
055_02	Pine Creek	52	920	Breakland/Alder	36%	3.90	8	7,000	30,000	40%	3.66	8	7,000	30,000	0	0%
055_02	Texas Gulch	1	550	Grassland	55%	2.75	1	600	2,000	20%	4.88	1	600	3,000	1,000	-35%
055_02	Texas Gulch	2	780	Grassland	55%	2.75	1	800	2,000	10%	5.49	1	800	4,000	2,000	-45%
055_02	Texas Gulch	3	190	Alder	91%	0.55	1	200	100	30%	4.27	1	200	900	800	-61%
055_02	Texas Gulch	4	630	Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
055_02	Texas Gulch	5	140	Alder	86%	0.85	2	300	300	30%	4.27	2	300	1,000	700	-56%
055_02	Texas Gulch	6	860	Breakland	94%	0.37	2	2,000	700	90%	0.61	2	2,000	1,000	300	-4%
055_02	Texas Gulch	7	320	Breakland/Alder	87%	0.79	2	600	500	70%	1.83	2	600	1,000	500	-17%
055_02	Texas Gulch	8	940	Breakland/Alder	87%	0.79	2	2,000	2,000	80%	1.22	2	2,000	2,000	0	-7%
055_02	Texas Gulch	9	210	Breakland/Alder	74%	1.59	3	600	1,000	70%	1.83	3	600	1,000	0	-4%
055_02	Texas Gulch	10	490	Breakland	89%	0.67	3	1,000	700	90%	0.61	3	1,000	600	(100)	0%
055_02	Texas Gulch	11	300	Alder	72%	1.71	3	900	2,000	10%	5.49	3	900	5,000	3,000	-62%
055_02	Texas Gulch	12	270	Breakland/Alder	74%	1.59	3	800	1,000	60%	2.44	3	800	2,000	1,000	-14%
055_02	Texas Gulch	13	1400	Breakland	79%	1.28	4	6,000	8,000	80%	1.22	4	6,000	7,000	(1,000)	0%
055_02	Texas Gulch	14	430	Breakland	79%	1.28	4	2,000	3,000	70%	1.83	4	2,000	4,000	1,000	-9%
							Totals		320,000					380,000	62,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C28. Existing and target solar loads for Pine Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
055_03	Pine Creek	53	620	Breakland/Alder	36%	3.90	8	5,000	20,000	70%	1.83	8	5,000	9,000	(10,000)	0%
055_03	Pine Creek	54	480	Breakland	55%	2.75	8	4,000	10,000	50%	3.05	8	4,000	10,000	0	-5%
055_03	Pine Creek	55	1100	Breakland/Alder	33%	4.09	9	10,000	40,000	50%	3.05	9	10,000	30,000	(10,000)	0%
055_03	Pine Creek	56	850	Breakland/Alder	33%	4.09	9	8,000	30,000	60%	2.44	9	8,000	20,000	(10,000)	0%
055_03	Pine Creek	57	150	Alder	28%	4.39	10	2,000	9,000	50%	3.05	10	2,000	6,000	(3,000)	0%
055_03	Pine Creek	58	610	Breakland/Alder	30%	4.27	10	6,000	30,000	70%	1.83	10	6,000	10,000	(20,000)	0%
055_03	Pine Creek	59	590	Breakland/Alder	30%	4.27	10	6,000	30,000	50%	3.05	10	6,000	20,000	(10,000)	0%
055_03	Pine Creek	60	1100	Cottonwood	54%	2.81	11	10,000	30,000	70%	1.83	11	10,000	20,000	(10,000)	0%
055_03	Pine Creek	61	740	Cottonwood	54%	2.81	11	8,000	20,000	60%	2.44	11	8,000	20,000	0	0%
							Totals		220,000					150,000	-73,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C29. Existing and target solar loads for Big Bear Creek – 4th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
056_04	Big Bear Creek	1	1500	Alder	91%	0.55	1	2,000	1,000	20%	4.88	1	2,000	10,000	9,000	-71%
056_04	Big Bear Creek	2	360	Alder	91%	0.55	1	400	200	10%	5.49	1	400	2,000	2,000	-81%
056_04	Big Bear Creek	3	350	Breakland/Alder	91%	0.55	1	400	200	30%	4.27	1	400	2,000	2,000	-61%
056_04	Big Bear Creek	4	97	Alder	91%	0.55	1	100	50	20%	4.88	1	100	500	500	-71%
056_04	Big Bear Creek	5	530	Alder	91%	0.55	1	500	300	20%	4.88	1	500	2,000	2,000	-71%
056_04	Big Bear Creek	6	550	Alder	86%	0.85	2	1,000	900	30%	4.27	2	1,000	4,000	3,000	-56%
056_04	Big Bear Creek	7	350	Alder	86%	0.85	2	700	600	40%	3.66	2	700	3,000	2,000	-46%
056_04	Big Bear Creek	8	600	Alder	86%	0.85	2	1,000	900	20%	4.88	2	1,000	5,000	4,000	-66%
056_04	Big Bear Creek	9	320	Alder	86%	0.85	2	600	500	30%	4.27	2	600	3,000	3,000	-56%
056_04	Big Bear Creek	10	220	Alder	86%	0.85	2	400	300	20%	4.88	2	400	2,000	2,000	-66%
056_04	Big Bear Creek	11	200	Breakland/Alder	87%	0.79	2	400	300	40%	3.66	2	400	1,000	700	-47%
056_04	Big Bear Creek	12	440	Alder	86%	0.85	2	900	800	20%	4.88	2	900	4,000	3,000	-66%
056_04	Big Bear Creek	13	590	Breakland/Alder	74%	1.59	3	2,000	3,000	40%	3.66	3	2,000	7,000	4,000	-34%
056_04	Big Bear Creek	14	280	Alder	72%	1.71	3	800	1,000	20%	4.88	3	800	4,000	3,000	-52%
056_04	Big Bear Creek	15	400	Alder	72%	1.71	3	1,000	2,000	30%	4.27	3	1,000	4,000	2,000	-42%
056_04	Big Bear Creek	16	290	Alder	72%	1.71	3	900	2,000	40%	3.66	3	900	3,000	1,000	-32%
056_04	Big Bear Creek	17	200	Breakland/Alder	74%	1.59	3	600	1,000	50%	3.05	3	600	2,000	1,000	-24%
056_04	Big Bear Creek	18	80	Alder	72%	1.71	3	200	300	30%	4.27	3	200	900	600	-42%
056_04	Big Bear Creek	19	210	Breakland/Alder	74%	1.59	3	600	1,000	50%	3.05	3	600	2,000	1,000	-24%
056_04	Big Bear Creek	20	240	Alder	72%	1.71	3	700	1,000	30%	4.27	3	700	3,000	2,000	-42%
056_04	Big Bear Creek	21	240	Alder	72%	1.71	3	700	1,000	40%	3.66	3	700	3,000	2,000	-32%
056_04	Big Bear Creek	22	310	Alder	59%	2.50	4	1,000	3,000	20%	4.88	4	1,000	5,000	2,000	-39%
056_04	Big Bear Creek	23	160	Breakland/Alder	61%	2.38	4	600	1,000	30%	4.27	4	600	3,000	2,000	-31%
056_04	Big Bear Creek	24	180	Alder	59%	2.50	4	700	2,000	20%	4.88	4	700	3,000	1,000	-39%
056_04	Big Bear Creek	25	120	Breakland/Alder	61%	2.38	4	500	1,000	50%	3.05	4	500	2,000	1,000	-11%
056_04	Big Bear Creek	26	990	Breakland/Alder	61%	2.38	4	4,000	10,000	70%	1.83	4	4,000	7,000	(3,000)	0%
056_04	Big Bear Creek	27	380	Breakland/Alder	61%	2.38	4	2,000	5,000	60%	2.44	4	2,000	5,000	0	-1%
056_04	Big Bear Creek	28	580	Breakland/Alder	61%	2.38	4	2,000	5,000	70%	1.83	4	2,000	4,000	(1,000)	0%
056_04	Big Bear Creek	29	340	Alder	50%	3.05	5	2,000	6,000	50%	3.05	5	2,000	6,000	0	0%
056_04	Big Bear Creek	30	570	Breakland/Alder	52%	2.93	5	3,000	9,000	60%	2.44	5	3,000	7,000	(2,000)	0%
056_04	Big Bear Creek	31	420	Breakland/Alder	52%	2.93	5	2,000	6,000	70%	1.83	5	2,000	4,000	(2,000)	0%
056_04	Big Bear Creek	32	380	Alder	50%	3.05	5	2,000	6,000	50%	3.05	5	2,000	6,000	0	0%
056_04	Big Bear Creek	33	610	Breakland/Alder	52%	2.93	5	3,000	9,000	60%	2.44	5	3,000	7,000	(2,000)	0%
056_04	Big Bear Creek	34	540	Breakland/Alder	46%	3.29	6	3,000	10,000	50%	3.05	6	3,000	9,000	(1,000)	0%
056_04	Big Bear Creek	35	1400	Breakland/Alder	46%	3.29	6	8,000	30,000	60%	2.44	6	8,000	20,000	(10,000)	0%
056_04	Big Bear Creek	36	450	Breakland/Alder	46%	3.29	6	3,000	10,000	40%	3.66	6	3,000	10,000	0	-6%
056_04	Big Bear Creek	37	180	Alder	38%	3.78	7	1,000	4,000	50%	3.05	7	1,000	3,000	(1,000)	0%
056_04	Big Bear Creek	38	140	Alder	38%	3.78	7	1,000	4,000	40%	3.66	7	1,000	4,000	0	0%
056_04	Big Bear Creek	39	250	Breakland/Alder	40%	3.66	7	2,000	7,000	50%	3.05	7	2,000	6,000	(1,000)	0%
056_04	Big Bear Creek	40	190	Alder	38%	3.78	7	1,000	4,000	60%	2.44	7	1,000	2,000	(2,000)	0%
056_04	Big Bear Creek	41	180	Alder	38%	3.78	7	1,000	4,000	50%	3.05	7	1,000	3,000	(1,000)	0%
056_04	Big Bear Creek	42	350	Breakland/Alder	40%	3.66	7	2,000	7,000	60%	2.44	7	2,000	5,000	(2,000)	0%
056_04	Big Bear Creek	43	730	Breakland/Alder	40%	3.66	7	5,000	20,000	50%	3.05	7	5,000	20,000	0	0%

056_04	Big Bear Creek	44	1000	Breakland/Alder	40%	3.66	7	7,000	30,000	60%	2.44	7	7,000	20,000	(10,000)	0%
056_04	Big Bear Creek	45	390	Breakland/Alder	36%	3.90	8	3,000	10,000	60%	2.44	8	3,000	7,000	(3,000)	0%
056_04	Big Bear Creek	46	530	Breakland/Alder	36%	3.90	8	4,000	20,000	50%	3.05	8	4,000	10,000	(10,000)	0%
056_04	Big Bear Creek	47	730	Breakland/Alder	36%	3.90	8	6,000	20,000	50%	3.05	8	6,000	20,000	0	0%
056_04	Big Bear Creek	48	720	Breakland/Alder	36%	3.90	8	6,000	20,000	40%	3.66	8	6,000	20,000	0	0%
056_04	Big Bear Creek	49	540	Breakland/Alder	33%	4.09	9	5,000	20,000	40%	3.66	9	5,000	20,000	0	0%
056_04	Big Bear Creek	50	240	Breakland/Alder	33%	4.09	9	2,000	8,000	60%	2.44	9	2,000	5,000	(3,000)	0%
056_04	Big Bear Creek	51	410	Alder	31%	4.21	9	4,000	20,000	10%	5.49	9	4,000	20,000	0	-21%
056_04	Big Bear Creek	52	420	Breakland/Alder	33%	4.09	9	4,000	20,000	50%	3.05	9	4,000	10,000	(10,000)	0%
056_04	Big Bear Creek	53	1000	Breakland/Alder	33%	4.09	9	9,000	40,000	60%	2.44	9	9,000	20,000	(20,000)	0%
056_04	Big Bear Creek	54	340	Hawthorn	29%	4.33	10	3,000	10,000	30%	4.27	10	3,000	10,000	0	0%
056_04	Big Bear Creek	55	410	Hawthorn	29%	4.33	10	4,000	20,000	60%	2.44	10	4,000	10,000	(10,000)	0%
056_04	Big Bear Creek	56	200	Cottonwood	59%	2.50	10	2,000	5,000	40%	3.66	10	2,000	7,000	2,000	-19%
056_04	Big Bear Creek	57	150	Cottonwood	59%	2.50	10	2,000	5,000	10%	5.49	10	2,000	10,000	5,000	-49%
056_04	Big Bear Creek	58	960	Hawthorn	29%	4.33	10	10,000	40,000	30%	4.27	10	10,000	40,000	0	0%
056_04	Big Bear Creek	59	240	Hawthorn	29%	4.33	10	2,000	9,000	10%	5.49	10	2,000	10,000	1,000	-19%
056_04	Big Bear Creek	60	130	Cottonwood	59%	2.50	10	1,000	3,000	10%	5.49	10	1,000	5,000	2,000	-49%
056_04	Big Bear Creek	61	180	Hawthorn	29%	4.33	10	2,000	9,000	30%	4.27	10	2,000	9,000	0	0%
056_04	Big Bear Creek	62	410	Hawthorn	27%	4.45	11	5,000	20,000	20%	4.88	11	5,000	20,000	0	-7%
056_04	Big Bear Creek	63	280	Cottonwood	54%	2.81	11	3,000	8,000	60%	2.44	11	3,000	7,000	(1,000)	0%
056_04	Big Bear Creek	64	160	Cottonwood	54%	2.81	11	2,000	6,000	60%	2.44	11	2,000	5,000	(1,000)	0%
056_04	Big Bear Creek	65	220	Cottonwood	54%	2.81	11	2,000	6,000	50%	3.05	11	2,000	6,000	0	-4%
056_04	Big Bear Creek	66	320	Hawthorn	27%	4.45	11	4,000	20,000	10%	5.49	11	4,000	20,000	0	-17%
							Totals		550,000					520,000	-30,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C30. Existing and target solar loads for Big Bear Creek – 5th order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
056_05	Big Bear Creek	67	1100	Hawthorn	27%	4.45	11	10,000	40,000	10%	5.49	11	10,000	50,000	10,000	-17%
056_05	Big Bear Creek	68	150	Cottonwood	54%	2.81	11	2,000	6,000	50%	3.05	11	2,000	6,000	0	-4%
056_05	Big Bear Creek	69	340	Hawthorn	27%	4.45	11	4,000	20,000	10%	5.49	11	4,000	20,000	0	-17%
							Totals		66,000					76,000	10,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C31. Existing and target solar loads for Middle Potlatch Creek – Headwaters 1st and 2nd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
062_02	01st Trib to M Potlatch Creek	1	345	Breakland/Alder	91%	0.55	1	300	200	20%	4.88	1	300	1,000	800	-71%
062_02	01st Trib to M Potlatch Creek	2	628	Breakland/Alder	91%	0.55	1	600	300	40%	3.66	1	600	2,000	2,000	-51%
062_02	01st Trib to M Potlatch Creek	3	722	Breakland/Alder	87%	0.79	2	1,000	800	30%	4.27	2	1,000	4,000	3,000	-57%
062_02	01st Trib to M Potlatch Creek	4	581	Breakland/Alder	87%	0.79	2	1,000	800	20%	4.88	2	1,000	5,000	4,000	-67%
062_02	01st Trib to M Potlatch Creek	5	222	Breakland/Alder	74%	1.59	3	700	1,000	10%	5.49	3	700	4,000	3,000	-64%
062_02	01st Trib to M Potlatch Creek	6	578	Breakland/Alder	74%	1.59	3	2,000	3,000	30%	4.27	3	2,000	9,000	6,000	-44%
062_02	01st Trib to M Potlatch Creek	7	277	Breakland/Alder	74%	1.59	3	800	1,000	20%	4.88	3	800	4,000	3,000	-54%
062_02	02nd Trib to M Potlatch Cr_T1	1	75	Breakland	95%	0.31	1	80	20	70%	1.83	1	80	100	80	-25%
062_02	02nd Trib to M Potlatch Cr_T1	2	210	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
062_02	02nd Trib to M Potlatch Cr_T1	3	240	Breakland/Alder	91%	0.55	1	200	100	40%	3.66	1	200	700	600	-51%
062_02	02nd Trib to M Potlatch Cr_T1	4	158	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
062_02	02nd Trib to M Potlatch Cr_T1	5	97	Breakland/Alder	87%	0.79	2	200	200	80%	1.22	2	200	200	0	-7%
062_02	02nd Trib to M Potlatch Cr_T1	6	707	Breakland/Alder	87%	0.79	2	1,000	800	20%	4.88	2	1,000	5,000	4,000	-67%
062_02	02nd Trib to M Potlatch Cr_T1	7	374	Breakland/Alder	74%	1.59	3	1,000	2,000	40%	3.66	3	1,000	4,000	2,000	-34%
062_02	02nd Trib to M Potlatch Cr_T2	1	157	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
062_02	02nd Trib to M Potlatch Cr_T2	2	815	Breakland/Alder	87%	0.79	2	2,000	2,000	30%	4.27	2	2,000	9,000	7,000	-57%
062_02	02nd Trib to M Potlatch Cr_T2	3	990	Breakland/Alder	74%	1.59	3	3,000	5,000	10%	5.49	3	3,000	20,000	20,000	-64%
062_02	02nd Trib to M Potlatch Creek	1	85	Breakland	95%	0.31	1	90	30	20%	4.88	1	90	400	400	-75%
062_02	02nd Trib to M Potlatch Creek	2	50	Open Water												
062_02	02nd Trib to M Potlatch Creek	3	540	Breakland	95%	0.31	1	500	200	70%	1.83	1	500	900	700	-25%
062_02	02nd Trib to M Potlatch Creek	4	96	Alder	91%	0.55	1	100	50	10%	5.49	1	100	500	500	-81%
062_02	02nd Trib to M Potlatch Creek	5	444	Breakland/Alder	87%	0.79	2	900	700	60%	2.44	2	900	2,000	1,000	-27%
062_02	02nd Trib to M Potlatch Creek	6	671	Breakland/Alder	87%	0.79	2	1,000	800	10%	5.49	2	1,000	5,000	4,000	-77%
062_02	02nd Trib to M Potlatch Creek	7	1031	Breakland/Alder	74%	1.59	3	3,000	5,000	10%	5.49	3	3,000	20,000	20,000	-64%
062_02	02nd Trib to M Potlatch Creek	8	390	Breakland/Alder	61%	2.38	4	2,000	5,000	10%	5.49	4	2,000	10,000	5,000	-51%
062_02	02nd Trib to M Potlatch Creek	9	665	Breakland/Alder	61%	2.38	4	3,000	7,000	20%	4.88	4	3,000	10,000	3,000	-41%
062_02	02nd Trib to M Potlatch Creek	10	355	Breakland/Alder	52%	2.93	5	2,000	6,000	40%	3.66	5	2,000	7,000	1,000	-12%
062_02	02nd Trib to M Potlatch Creek	11	303	Breakland/Alder	52%	2.93	5	2,000	6,000	20%	4.88	5	2,000	10,000	4,000	-32%
062_02	03rd Trib to M Pot Cr Trib	1	637	Breakland/Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
062_02	03rd Trib to M Pot Cr Trib	2	1036	Breakland/Alder	91%	0.55	1	1,000	500	30%	4.27	1	1,000	4,000	4,000	-61%
062_02	03rd Trib to M Pot Cr Trib	3	243	Breakland/Alder	87%	0.79	2	500	400	20%	4.88	2	500	2,000	2,000	-67%
062_02	03rd Trib to M Pot Cr Trib	4	251	Breakland/Alder	87%	0.79	2	500	400	40%	3.66	2	500	2,000	2,000	-47%
062_02	03rd Trib to M Potlatch Creek	1	1067	Breakland	95%	0.31	1	1,000	300	80%	1.22	1	1,000	1,000	700	-15%
062_02	03rd Trib to M Potlatch Creek	2	486	Breakland/Alder	91%	0.55	1	500	300	60%	2.44	1	500	1,000	700	-31%
062_02	03rd Trib to M Potlatch Creek	3	342	Breakland/Alder	91%	0.55	1	300	200	30%	4.27	1	300	1,000	800	-61%
062_02	03rd Trib to M Potlatch Creek	4	892	Breakland/Alder	87%	0.79	2	2,000	2,000	70%	1.83	2	2,000	4,000	2,000	-17%
062_02	03rd Trib to M Potlatch Creek	5	1010	Breakland	94%	0.37	2	2,000	700	90%	0.61	2	2,000	1,000	300	-4%
062_02	03rd Trib to M Potlatch Creek	6	280	Breakland	89%	0.67	3	800	500	70%	1.83	3	800	1,000	500	-19%
062_02	03rd Trib to M Potlatch Creek	7	320	Breakland	89%	0.67	3	1,000	700	90%	0.61	3	1,000	600	(100)	0%
062_02	03rd Trib to M Potlatch Creek	8	432	Breakland/Alder	74%	1.59	3	1,000	2,000	60%	2.44	3	1,000	2,000	0	-14%
062_02	03rd Trib to M Potlatch Creek	9	508	Breakland	89%	0.67	3	2,000	1,000	80%	1.22	3	2,000	2,000	1,000	-9%
062_02	03rd Trib to M Potlatch Creek	10	602	Breakland/Alder	74%	1.59	3	2,000	3,000	50%	3.05	3	2,000	6,000	3,000	-24%
062_02	03rd Trib to M Potlatch Creek	11	521	Breakland/Alder	61%	2.38	4	2,000	5,000	70%	1.83	4	2,000	4,000	(1,000)	0%

062_02	03rd Trib to M Potlatch Creek	12	209	Breakland/Alder	61%	2.38	4	800	2,000	20%	4.88	4	800	4,000	2,000	-41%
062_02	03rd Trib to M Potlatch Creek	13	823	Breakland/Alder	61%	2.38	4	3,000	7,000	70%	1.83	4	3,000	5,000	(2,000)	0%
062_02	03rd Trib to M Potlatch Creek	14	402	Breakland/Alder	61%	2.38	4	2,000	5,000	30%	4.27	4	2,000	9,000	4,000	-31%
062_02	03rd Trib to M Potlatch Creek	15	696	Breakland/Alder	52%	2.93	5	3,000	9,000	60%	2.44	5	3,000	7,000	(2,000)	0%
062_02	03rd Trib to M Potlatch Creek	16	759	Breakland/Alder	52%	2.93	5	4,000	10,000	30%	4.27	5	4,000	20,000	10,000	-22%
062_02	03rd Trib to M Potlatch Creek	17	218	Breakland/Alder	52%	2.93	5	1,000	3,000	20%	4.88	5	1,000	5,000	2,000	-32%
062_02	03rd Trib to M Potlatch Creek	18	161	Breakland/Alder	52%	2.93	5	800	2,000	10%	5.49	5	800	4,000	2,000	-42%
062_02	03rd Trib to M Potlatch Creek	19	146	Breakland/Alder	52%	2.93	5	700	2,000	40%	3.66	5	700	3,000	1,000	-12%
062_02	03rd Trib to M Potlatch Creek	20	763	Breakland/Alder	46%	3.29	6	5,000	20,000	10%	5.49	6	5,000	30,000	10,000	-36%
062_02	03rd Trib to M Potlatch Creek	21	256	Breakland/Alder	46%	3.29	6	2,000	7,000	0%	6.10	6	2,000	10,000	3,000	-46%
062_02	03rd Trib to M Potlatch Creek	22	270	Breakland/Alder	46%	3.29	6	2,000	7,000	60%	2.44	6	2,000	5,000	(2,000)	0%
062_02	03rd Trib to M Potlatch Creek	23	143	Breakland/Alder	46%	3.29	6	900	3,000	50%	3.05	6	900	3,000	0	0%
062_02	03rd Trib to M Potlatch Creek	24	181	Breakland/Alder	46%	3.29	6	1,000	3,000	60%	2.44	6	1,000	2,000	(1,000)	0%
062_02	03rd Trib to M Potlatch Creek	25	180	Breakland/Alder	46%	3.29	6	1,000	3,000	30%	4.27	6	1,000	4,000	1,000	-16%
062_02	03rd Trib to M Potlatch Creek	26	156	Breakland/Alder	46%	3.29	6	900	3,000	40%	3.66	6	900	3,000	0	-6%
062_02	03rd Trib to M Potlatch Creek	27	172	Alder	43%	3.48	6	1,000	3,000	20%	4.88	6	1,000	5,000	2,000	-23%
062_02	04th Trib to M Potlatch Creek	1	598	Breakland/Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
062_02	04th Trib to M Potlatch Creek	2	256	Breakland/Alder	87%	0.79	2	500	400	20%	4.88	2	500	2,000	2,000	-67%
062_02	04th Trib to M Potlatch Creek	3	193	Breakland/Alder	87%	0.79	2	400	300	50%	3.05	2	400	1,000	700	-37%
062_02	04th Trib to M Potlatch Creek	4	235	Breakland/Alder	87%	0.79	2	500	400	30%	4.27	2	500	2,000	2,000	-57%
062_02	04th Trib to M Potlatch Creek	5	1085	Breakland/Alder	74%	1.59	3	3,000	5,000	60%	2.44	3	3,000	7,000	2,000	-14%
062_02	05th Trib to M Potlatch Creek	1	1411	Breakland/Alder	91%	0.55	1	1,000	500	10%	5.49	1	1,000	5,000	5,000	-81%
062_02	05th Trib to M Potlatch Creek	2	300	Breakland/Alder	87%	0.79	2	600	500	30%	4.27	2	600	3,000	3,000	-57%
062_02	05th Trib to M Potlatch Creek	3	291	Breakland/Alder	87%	0.79	2	600	500	20%	4.88	2	600	3,000	3,000	-67%
062_02	05th Trib to M Potlatch Creek	4	863	Breakland/Alder	74%	1.59	3	3,000	5,000	60%	2.44	3	3,000	7,000	2,000	-14%
062_02	06th Trib to M Potlatch Creek	1	608	Breakland/Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
062_02	06th Trib to M Potlatch Creek	2	978	Breakland/Alder	87%	0.79	2	2,000	2,000	20%	4.88	2	2,000	10,000	8,000	-67%
062_02	06th Trib to M Potlatch Creek	3	812	Breakland/Alder	74%	1.59	3	2,000	3,000	60%	2.44	3	2,000	5,000	2,000	-14%
062_02	07th Trib to M Potlatch Creek	1	1577	Breakland/Alder	91%	0.55	2	3,000	2,000	10%	5.49	2	3,000	20,000	20,000	-81%
062_02	07th Trib to M Potlatch Creek	2	673	Breakland/Alder	87%	0.79	2	1,000	800	20%	4.88	2	1,000	5,000	4,000	-67%
062_02	07th Trib to M Potlatch Creek	3	409	Breakland/Alder	87%	0.79	2	800	600	30%	4.27	2	800	3,000	2,000	-57%
062_02	07th Trib to M Potlatch Creek	4	541	Breakland	89%	0.67	3	2,000	1,000	60%	2.44	3	2,000	5,000	4,000	-29%
062_02	07th Trib to M Potlatch Creek	5	541	Breakland	89%	0.67	3	2,000	1,000	70%	1.83	3	2,000	4,000	3,000	-19%
062_02	08th Trib to M Potlatch Creek	1	1546	Breakland/Alder	91%	0.55	1	2,000	1,000	10%	5.49	1	2,000	10,000	9,000	-81%
062_02	08th Trib to M Potlatch Creek	2	1422	Breakland	94%	0.37	2	3,000	1,000	70%	1.83	2	3,000	5,000	4,000	-24%
062_02	09th Trib to M Potlatch Creek	1	1168	Breakland/Alder	91%	0.55	1	1,000	500	10%	5.49	1	1,000	5,000	5,000	-81%
062_02	09th Trib to M Potlatch Creek	2	317	Breakland/Alder	87%	0.79	2	600	500	20%	4.88	2	600	3,000	3,000	-67%
062_02	09th Trib to M Potlatch Creek	3	430	Breakland	94%	0.37	2	900	300	70%	1.83	2	900	2,000	2,000	-24%
062_02	10th Trib to M Potlatch Creek	1	583	Breakland/Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
062_02	10th Trib to M Potlatch Creek	2	263	Breakland/Alder	91%	0.55	1	300	200	60%	2.44	1	300	700	500	-31%
062_02	10th Trib to M Potlatch Creek	3	235	Breakland	94%	0.37	2	500	200	80%	1.22	2	500	600	400	-14%
062_02	10th Trib to M Potlatch Creek	4	674	Breakland/Alder	87%	0.79	2	1,000	800	70%	1.83	2	1,000	2,000	1,000	-17%
062_02	11th Trib to M Potlatch Creek	1	1098	Breakland	95%	0.31	1	1,000	300	10%	5.49	1	1,000	5,000	5,000	-85%
062_02	11th Trib to M Potlatch Creek	2	505	Hawthorn	88%	0.73	2	1,000	700	60%	2.44	2	1,000	2,000	1,000	-28%
062_02	11th Trib to M Potlatch Creek	3	708	Hawthorn	71%	1.77	3	2,000	4,000	50%	3.05	3	2,000	6,000	2,000	-21%
062_02	American Ridge Gulch	1	1494	Hawthorn	97%	0.18	1	1,000	200	20%	4.88	1	1,000	5,000	5,000	-77%
062_02	American Ridge Gulch	2	381	Hawthorn	88%	0.73	2	800	600	10%	5.49	2	800	4,000	3,000	-78%
062_02	American Ridge Gulch	3	637	Hawthorn	88%	0.73	2	1,000	700	40%	3.66	2	1,000	4,000	3,000	-48%
062_02	American Ridge Gulch	4	365	Hawthorn	71%	1.77	3	1,000	2,000	10%	5.49	3	1,000	5,000	3,000	-61%
062_02	American Ridge Gulch	5	581	Cottonwood	96%	0.24	3	2,000	500	50%	3.05	3	2,000	6,000	6,000	-46%
062_02	Fix Ridge Gulch	1	1871	Breakland	95%	0.31	1	2,000	600	10%	5.49	1	2,000	10,000	9,000	-85%

062_02	Fix Ridge Gulch	2	705	Breakland	94%	0.37	2	1,000	400	70%	1.83	2	1,000	2,000	2,000	-24%
062_02	Fix Ridge Gulch	3	331	Breakland/Alder	74%	1.59	3	1,000	2,000	10%	5.49	3	1,000	5,000	3,000	-64%
062_02	Fix Ridge Gulch	4	1054	Breakland	79%	1.28	4	4,000	5,000	80%	1.22	4	4,000	5,000	0	0%
062_02	Howell Creek	1	487	Breakland/Alder	91%	0.55	1	500	300	10%	5.49	1	500	3,000	3,000	-81%
062_02	Howell Creek	2	99	Breakland/Alder	91%	0.55	1	100	50	40%	3.66	1	100	400	400	-51%
062_02	Howell Creek	3	51	Open Water												
062_02	Howell Creek	4	138	Breakland/Alder	91%	0.55	1	100	50	60%	2.44	1	100	200	200	-31%
062_02	Howell Creek	5	180	Breakland/Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
062_02	Howell Creek	6	249	Breakland/Alder	91%	0.55	1	200	100	50%	3.05	1	200	600	500	-41%
062_02	Howell Creek	7	391	Breakland/Alder	87%	0.79	2	800	600	60%	2.44	2	800	2,000	1,000	-27%
062_02	Howell Creek	8	163	Alder	86%	0.85	2	300	300	20%	4.88	2	300	1,000	700	-66%
062_02	Howell Creek	9	147	Breakland/Alder	87%	0.79	2	300	200	40%	3.66	2	300	1,000	800	-47%
062_02	Howell Creek	10	349	Alder	86%	0.85	2	700	600	30%	4.27	2	700	3,000	2,000	-56%
062_02	Howell Creek	11	332	Breakland	94%	0.37	2	700	300	60%	2.44	2	700	2,000	2,000	-34%
062_02	Howell Creek	12	527	Breakland/Alder	74%	1.59	3	2,000	3,000	20%	4.88	3	2,000	10,000	7,000	-54%
062_02	Howell Creek	13	817	Breakland/Alder	74%	1.59	3	2,000	3,000	10%	5.49	3	2,000	10,000	7,000	-64%
062_02	Howell Creek	14	212	Breakland/Alder	61%	2.38	4	800	2,000	60%	2.44	4	800	2,000	0	-1%
062_02	Howell Creek	15	441	Breakland/Alder	61%	2.38	4	2,000	5,000	50%	3.05	4	2,000	6,000	1,000	-11%
062_02	Howell Creek	16	88	Open Water												
062_02	Howell Creek	17	785	Alder	59%	2.50	4	3,000	8,000	10%	5.49	4	3,000	20,000	10,000	-49%
062_02	Howell Creek	18	185	Breakland/Alder	52%	2.93	5	900	3,000	30%	4.27	5	900	4,000	1,000	-22%
062_02	Howell Creek	19	1193	Alder	50%	3.05	5	6,000	20,000	10%	5.49	5	6,000	30,000	10,000	-40%
062_02	Howell Creek	20	272	Breakland/Alder	46%	3.29	6	2,000	7,000	30%	4.27	6	2,000	9,000	2,000	-16%
062_02	Howell Creek	21	369	Breakland/Alder	46%	3.29	6	2,000	7,000	20%	4.88	6	2,000	10,000	3,000	-26%
062_02	Howell Creek	22	460	Breakland/Alder	46%	3.29	6	3,000	10,000	60%	2.44	6	3,000	7,000	(3,000)	0%
062_02	Howell Creek_Trib1	1	556	Breakland/Alder	91%	0.55	1	600	300	10%	5.49	1	600	3,000	3,000	-81%
062_02	Howell Creek_Trib1	2	855	Breakland/Alder	87%	0.79	2	2,000	2,000	30%	4.27	2	2,000	9,000	7,000	-57%
062_02	Howell Creek_Trib1	3	268	Breakland/Alder	74%	1.59	3	800	1,000	60%	2.44	3	800	2,000	1,000	-14%
062_02	Howell Creek_Trib2	1	1680	Breakland/Alder	91%	0.55	1	2,000	1,000	20%	4.88	1	2,000	10,000	9,000	-71%
062_02	Howell Creek_Trib2	2	603	Breakland/Alder	87%	0.79	2	1,000	800	40%	3.66	2	1,000	4,000	3,000	-47%
062_02	Howell Creek_Trib2	3	252	Breakland/Alder	74%	1.59	3	800	1,000	30%	4.27	3	800	3,000	2,000	-44%
062_02	Middle Potlatch Creek	1	498	Grassland	55%	2.75	1	500	1,000	20%	4.88	1	500	2,000	1,000	-35%
062_02	Middle Potlatch Creek	2	153	Grassland	55%	2.75	1	200	500	30%	4.27	1	200	900	400	-25%
062_02	Middle Potlatch Creek	3	158	Grassland	55%	2.75	1	200	500	20%	4.88	1	200	1,000	500	-35%
062_02	Middle Potlatch Creek	4	452	Grassland	55%	2.75	1	500	1,000	60%	2.44	1	500	1,000	0	0%
062_02	Middle Potlatch Creek	5	381	Grassland	55%	2.75	1	400	1,000	40%	3.66	1	400	1,000	0	-15%
062_02	Middle Potlatch Creek	6	1397	Grassland	31%	4.21	2	3,000	10,000	20%	4.88	2	3,000	10,000	0	-11%
062_02	Middle Potlatch Creek	7	123	Grassland	31%	4.21	2	200	800	20%	4.88	2	200	1,000	200	-11%
062_02	Tomer Butte	1	536	Breakland	95%	0.31	1	500	200	80%	1.22	1	500	600	400	-15%
062_02	Tomer Butte	2	309	Breakland/Alder	91%	0.55	1	300	200	60%	2.44	1	300	700	500	-31%
062_02	Tomer Butte	3	476	Breakland/Alder	87%	0.79	2	1,000	800	20%	4.88	2	1,000	5,000	4,000	-67%
062_02	Tomer Butte	4	251	Breakland/Alder	87%	0.79	2	500	400	60%	2.44	2	500	1,000	600	-27%
062_02	Tomer Butte	5	732	Breakland/Alder	74%	1.59	3	2,000	3,000	10%	5.49	3	2,000	10,000	7,000	-64%
062_02	Tomer Butte	6	203	Breakland/Alder	61%	2.38	4	800	2,000	20%	4.88	4	800	4,000	2,000	-41%
062_02	Tomer Butte_Trib	1	447	Breakland	95%	0.31	1	400	100	10%	5.49	1	400	2,000	2,000	-85%
062_02	Tomer Butte_Trib	2	669	Breakland/Alder	91%	0.55	1	700	400	80%	1.22	1	700	900	500	-11%
062_02	Tomer Butte_Trib	3	1177	Breakland/Alder	87%	0.79	2	2,000	2,000	20%	4.88	2	2,000	10,000	8,000	-67%
							Totals		300,000					670,000	390,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table C32. Existing and target solar loads for Middle Potlatch Creek – 3rd order.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
062_03	Middle Potlatch Creek	8	1493	Grassland	31%	4.21	2	3,000	10,000	20%	4.88	2	3,000	10,000	0	-11%
062_03	Middle Potlatch Creek	9	720	Grassland	21%	4.82	3	2,000	10,000	20%	4.88	3	2,000	10,000	0	-1%
062_03	Middle Potlatch Creek	10	270	Breakland	89%	0.67	3	800	500	60%	2.44	3	800	2,000	2,000	-29%
062_03	Middle Potlatch Creek	11	476	Breakland/Alder	74%	1.59	3	1,000	2,000	30%	4.27	3	1,000	4,000	2,000	-44%
062_03	Middle Potlatch Creek	12	1900	Breakland/Alder	74%	1.59	3	6,000	10,000	60%	2.44	3	6,000	10,000	0	-14%
062_03	Middle Potlatch Creek	13	90	Alder	59%	2.50	4	400	1,000	20%	4.88	4	400	2,000	1,000	-39%
062_03	Middle Potlatch Creek	14	224	Breakland/Alder	61%	2.38	4	900	2,000	50%	3.05	4	900	3,000	1,000	-11%
062_03	Middle Potlatch Creek	15	329	Breakland/Alder	61%	2.38	4	1,000	2,000	40%	3.66	4	1,000	4,000	2,000	-21%
062_03	Middle Potlatch Creek	16	593	Breakland/Alder	61%	2.38	4	2,000	5,000	20%	4.88	4	2,000	10,000	5,000	-41%
062_03	Middle Potlatch Creek	17	675	Breakland/Alder	61%	2.38	4	3,000	7,000	30%	4.27	4	3,000	10,000	3,000	-31%
062_03	Middle Potlatch Creek	18	579	Breakland/Alder	52%	2.93	5	3,000	9,000	20%	4.88	5	3,000	10,000	1,000	-32%
062_03	Middle Potlatch Creek	19	871	Alder	50%	3.05	5	4,000	10,000	30%	4.27	5	4,000	20,000	10,000	-20%
062_03	Middle Potlatch Creek	20	327	Breakland/Alder	52%	2.93	5	2,000	6,000	50%	3.05	5	2,000	6,000	0	-2%
062_03	Middle Potlatch Creek	21	493	Breakland	71%	1.77	5	2,000	4,000	60%	2.44	5	2,000	5,000	1,000	-11%
062_03	Middle Potlatch Creek	22	1093	Breakland	65%	2.14	6	7,000	10,000	40%	3.66	6	7,000	30,000	20,000	-25%
062_03	Middle Potlatch Creek	23	397	Breakland	65%	2.14	6	2,000	4,000	40%	3.66	6	2,000	7,000	3,000	-25%
062_03	Middle Potlatch Creek	24	568	Breakland/Alder	46%	3.29	6	3,000	10,000	30%	4.27	6	3,000	10,000	0	-16%
062_03	Middle Potlatch Creek	25	164	Breakland/Alder	40%	3.66	7	1,000	4,000	30%	4.27	7	1,000	4,000	0	-10%
062_03	Middle Potlatch Creek	26	224	Breakland/Alder	40%	3.66	7	2,000	7,000	30%	4.27	7	2,000	9,000	2,000	-10%
062_03	Middle Potlatch Creek	27	519	Breakland/Alder	40%	3.66	7	4,000	10,000	30%	4.27	7	4,000	20,000	10,000	-10%
062_03	Middle Potlatch Creek	28	644	Breakland/Alder	40%	3.66	7	5,000	20,000	40%	3.66	7	5,000	20,000	0	0%
062_03	Middle Potlatch Creek	29	261	Breakland/Alder	40%	3.66	7	2,000	7,000	40%	3.66	7	2,000	7,000	0	0%
062_03	Middle Potlatch Creek	30	392	Breakland/Alder	36%	3.90	8	3,000	10,000	30%	4.27	8	3,000	10,000	0	-6%
062_03	Middle Potlatch Creek	31	282	Alder	34%	4.03	8	2,000	8,000	20%	4.88	8	2,000	10,000	2,000	-14%
062_03	Middle Potlatch Creek	32	591	Breakland/Alder	36%	3.90	8	5,000	20,000	40%	3.66	8	5,000	20,000	0	0%
062_03	Middle Potlatch Creek	33	656	Breakland/Alder	36%	3.90	8	5,000	20,000	30%	4.27	8	5,000	20,000	0	-6%
062_03	Middle Potlatch Creek	34	567	Breakland/Alder	33%	4.09	9	5,000	20,000	60%	2.44	9	5,000	10,000	(10,000)	0%
062_03	Middle Potlatch Creek	35	511	Breakland/Alder	33%	4.09	9	5,000	20,000	30%	4.27	9	5,000	20,000	0	-3%
062_03	Middle Potlatch Creek	36	378	Hawthorn	32%	4.15	9	3,000	10,000	50%	3.05	9	3,000	9,000	(1,000)	0%
062_03	Middle Potlatch Creek	37	320	Hawthorn	32%	4.15	9	3,000	10,000	60%	2.44	9	3,000	7,000	(3,000)	0%
062_03	Middle Potlatch Creek	38	1287	Hawthorn	29%	4.33	10	10,000	40,000	60%	2.44	10	10,000	20,000	(20,000)	0%
062_03	Middle Potlatch Creek	39	323	Hawthorn	29%	4.33	10	3,000	10,000	60%	2.44	10	3,000	7,000	(3,000)	0%
062_03	Middle Potlatch Creek	40	215	Hawthorn	29%	4.33	10	2,000	9,000	20%	4.88	10	2,000	10,000	1,000	-9%
062_03	Middle Potlatch Creek	41	80	Hawthorn	27%	4.45	11	900	4,000	30%	4.27	11	900	4,000	0	0%
062_03	Middle Potlatch Creek	42	2382	Hawthorn	27%	4.45	11	30,000	100,000	0%	6.10	11	30,000	200,000	100,000	-27%
062_03	Middle Potlatch Creek	43	230	Hawthorn	25%	4.58	12	3,000	10,000	80%	1.22	12	3,000	4,000	(6,000)	0%
062_03	Middle Potlatch Creek	44	125	Hawthorn	25%	4.58	12	2,000	9,000	80%	1.22	12	2,000	2,000	(7,000)	0%
062_03	Middle Potlatch Creek	45	252	Hawthorn	25%	4.58	12	3,000	10,000	80%	1.22	12	3,000	4,000	(6,000)	0%
062_03	Middle Potlatch Creek	46	827	Hawthorn	25%	4.58	12	10,000	50,000	70%	1.83	12	10,000	20,000	(30,000)	0%
062_03	Middle Potlatch Creek	47	949	Cottonwood	51%	2.99	12	10,000	30,000	50%	3.05	12	10,000	30,000	0	-1%
							Totals		540,000					620,000	80,000	

Note: All assessment unit (AU) numbers start with ID17060306CL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

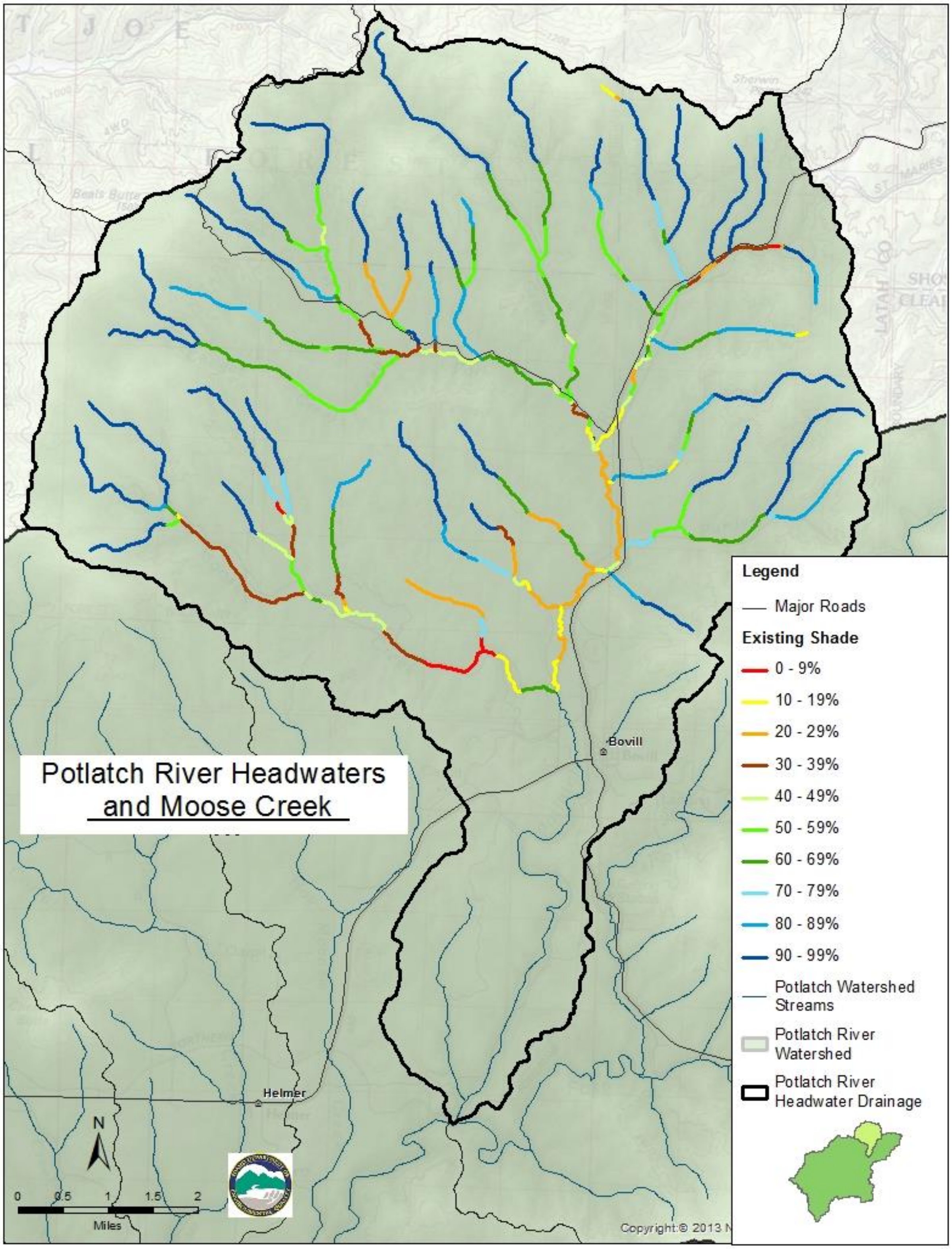


Figure C10. Potlatch River Headwaters (049_02, 049_03, 049_04) and Moose Creek (053_02, 053_03) existing shade levels.

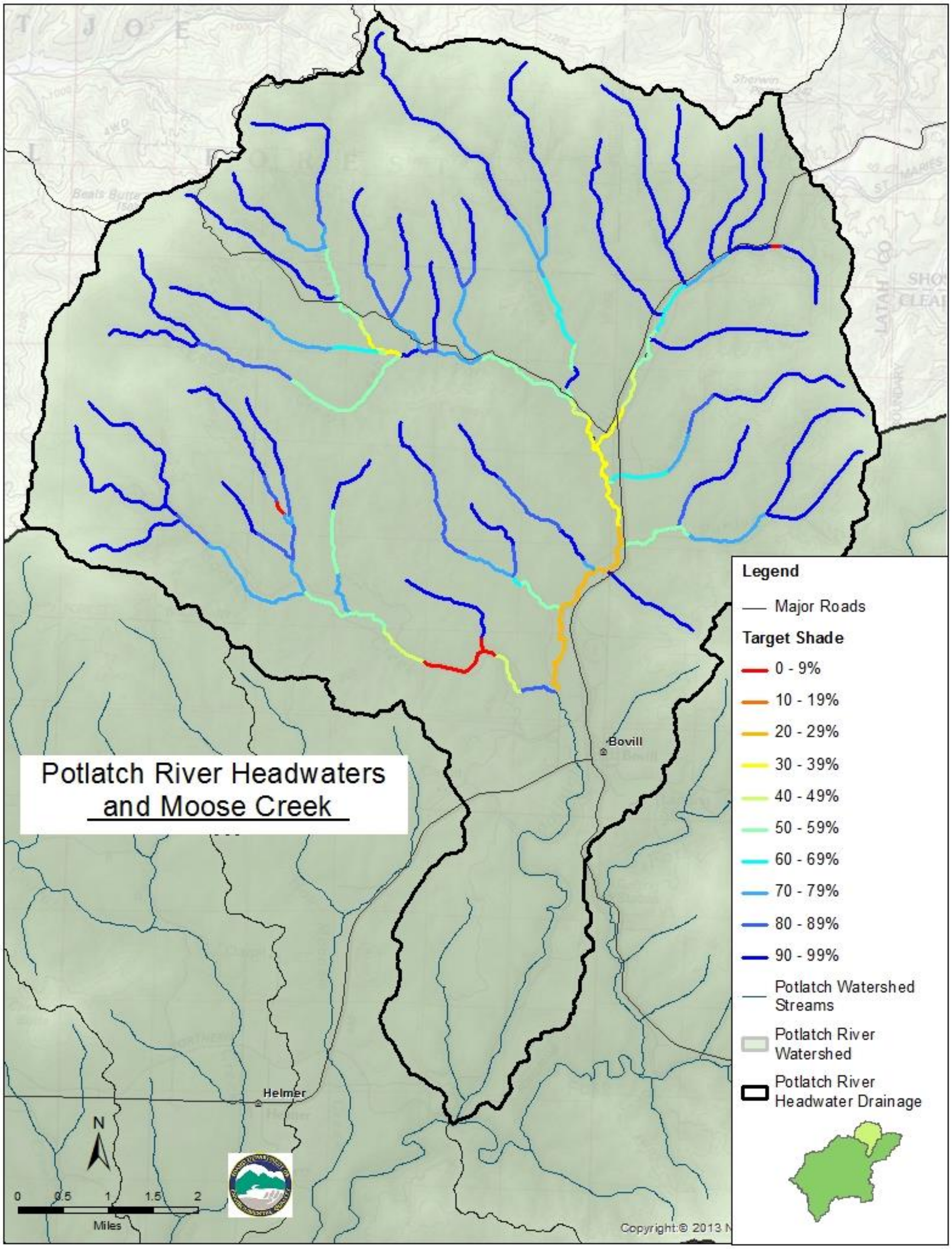


Figure C11. Potlatch River Headwaters (049_02, 049_03, 049_04) and Moose Creek (053_02, 053_03) target shade levels.

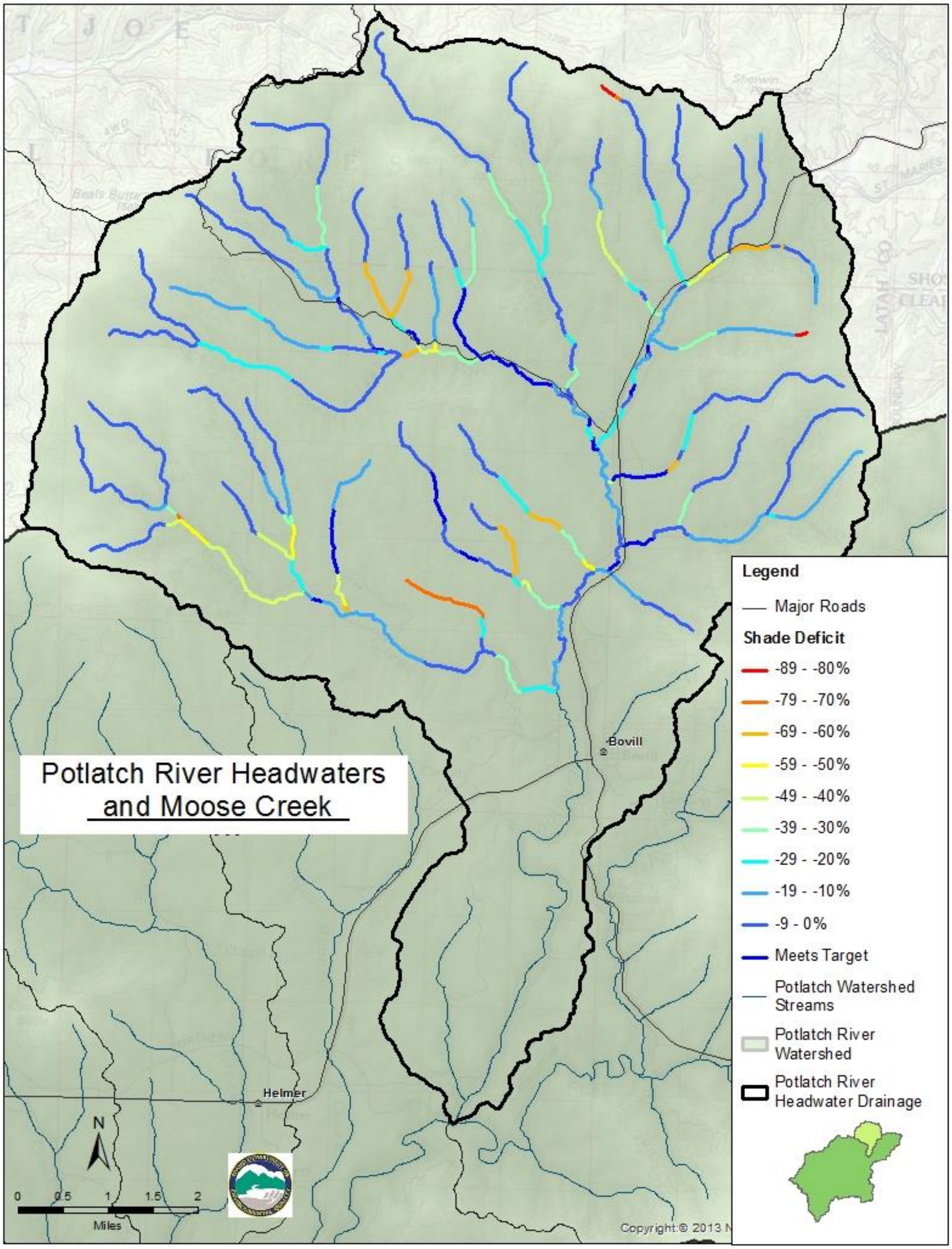


Figure C12. Potlatch River Headwaters (049_02, 049_03, 049_04) and Moose Creek (053_02, 053_03) shade deficit levels.

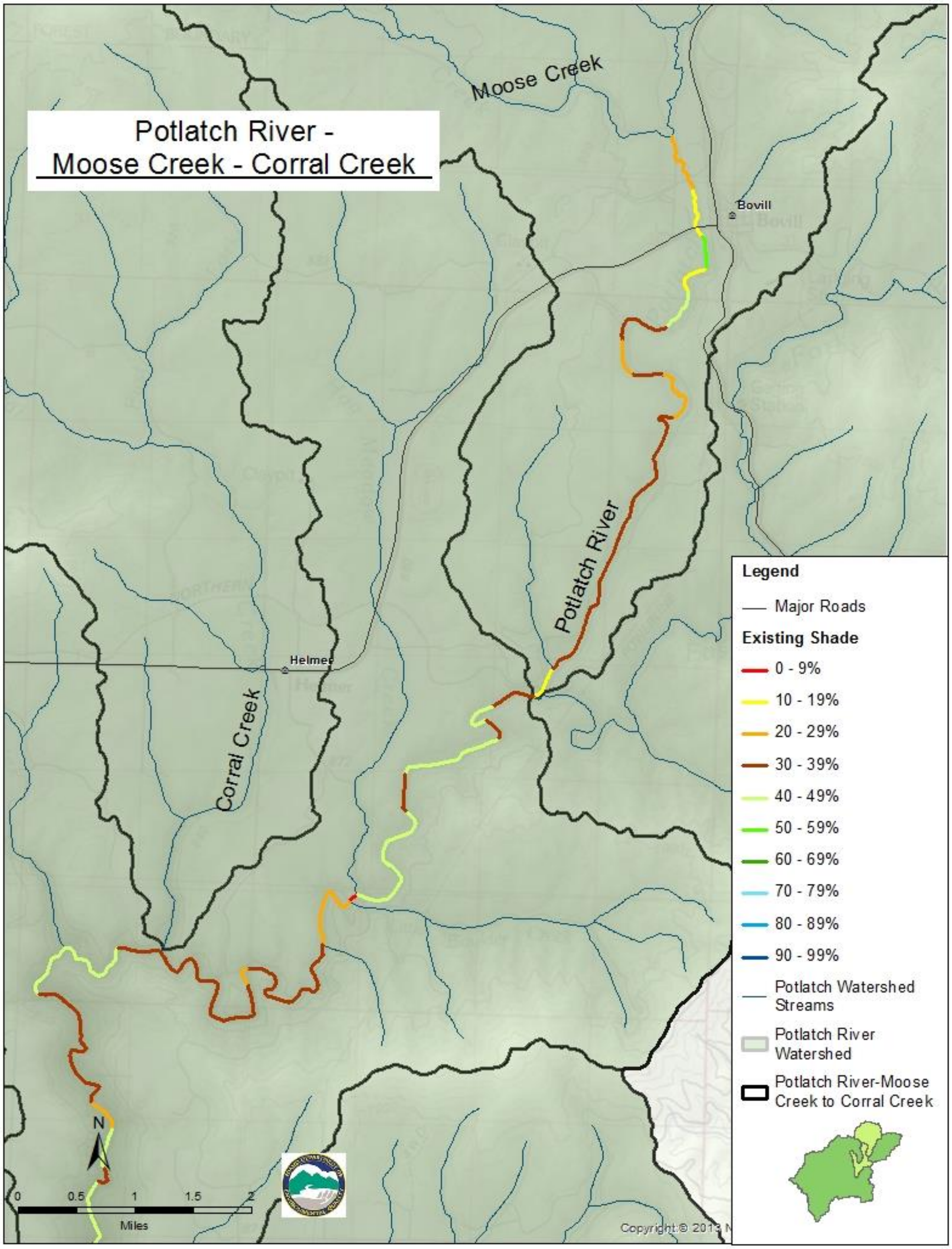


Figure C13. Potlatch River (048_04, 048_05) existing shade levels.

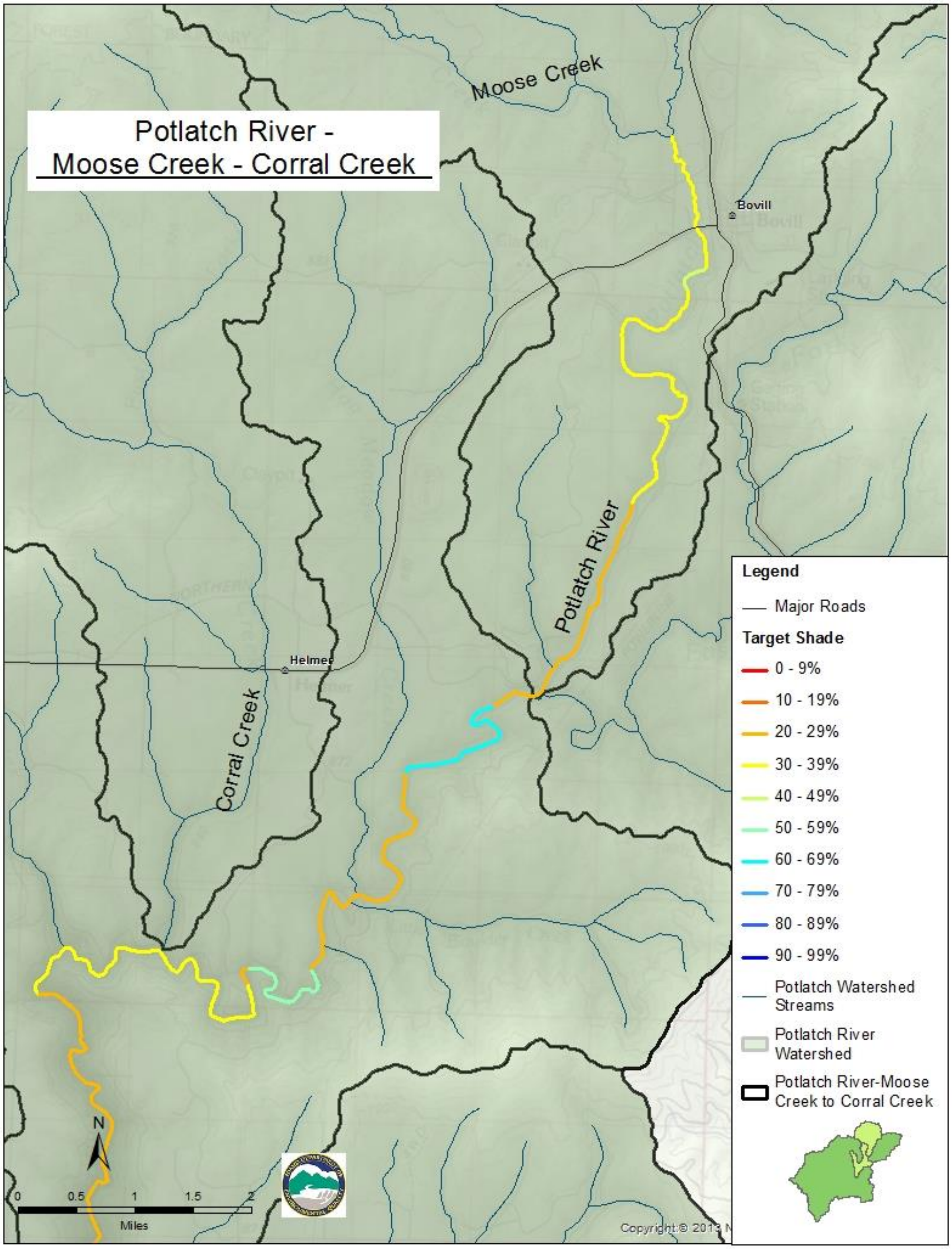


Figure C14. Potlatch River (048_04, 048_05) target shade levels.

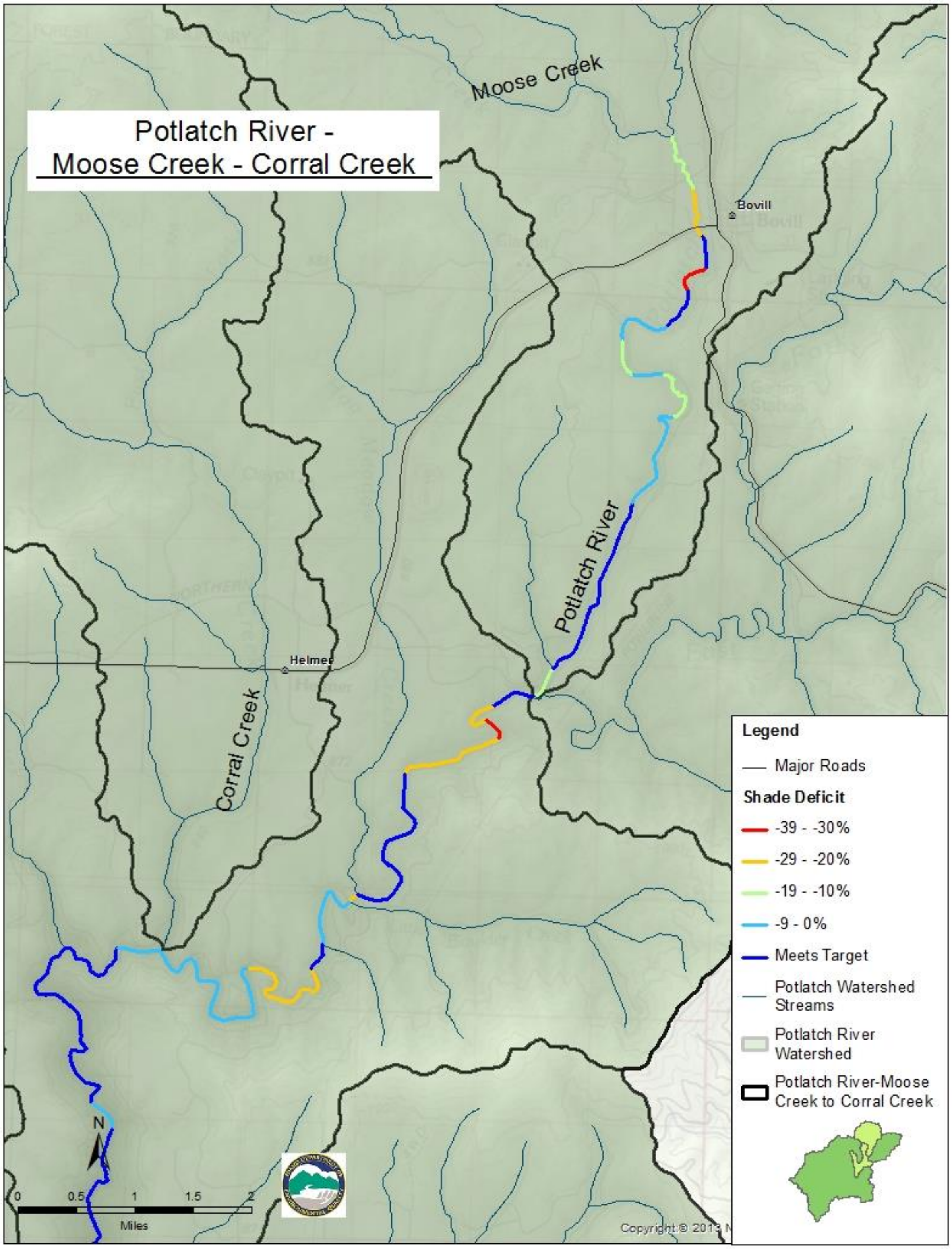


Figure C15. Potlatch River (048_04, 048_05) shade deficit levels.

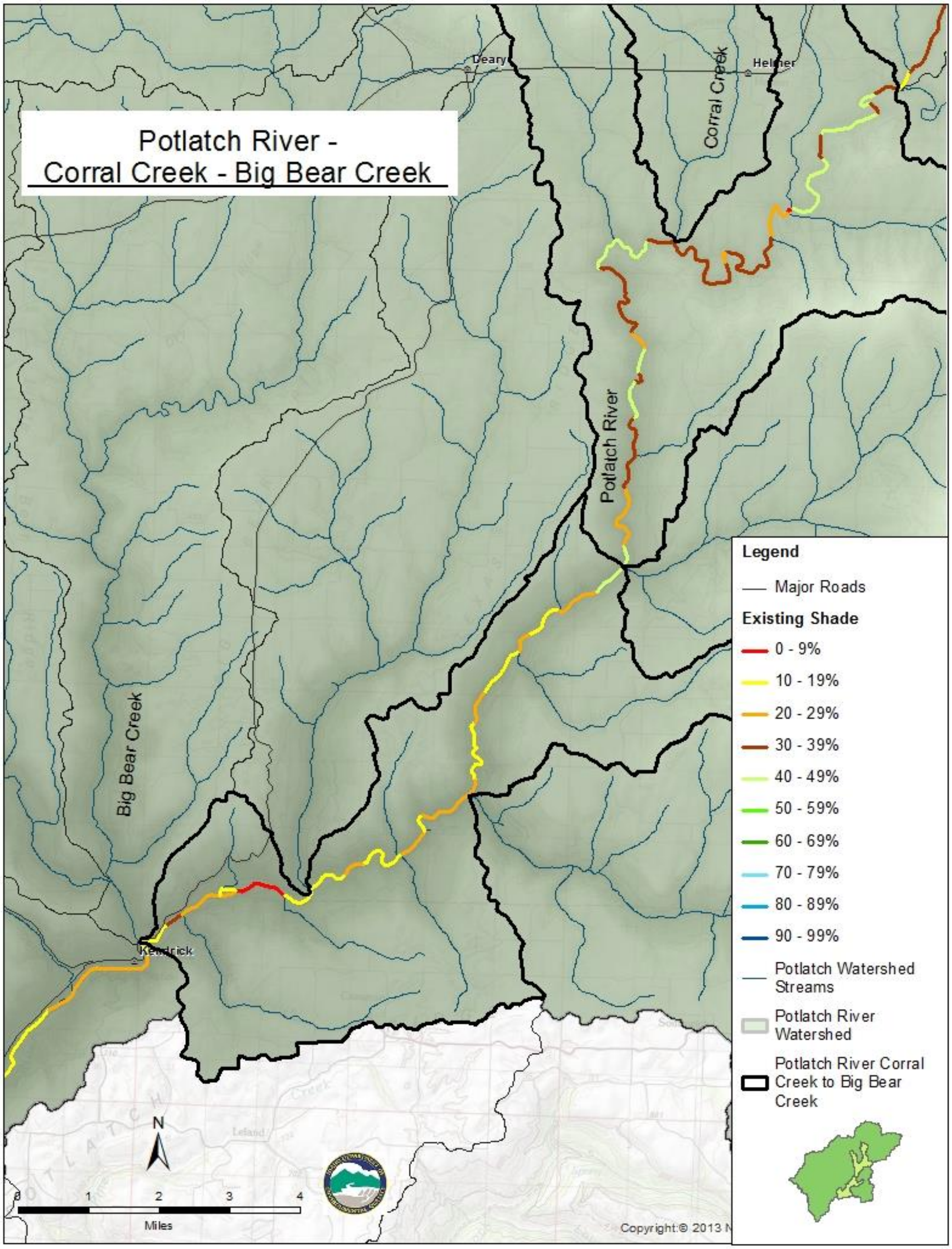


Figure C16. Potlatch River (045_05) existing shade levels.

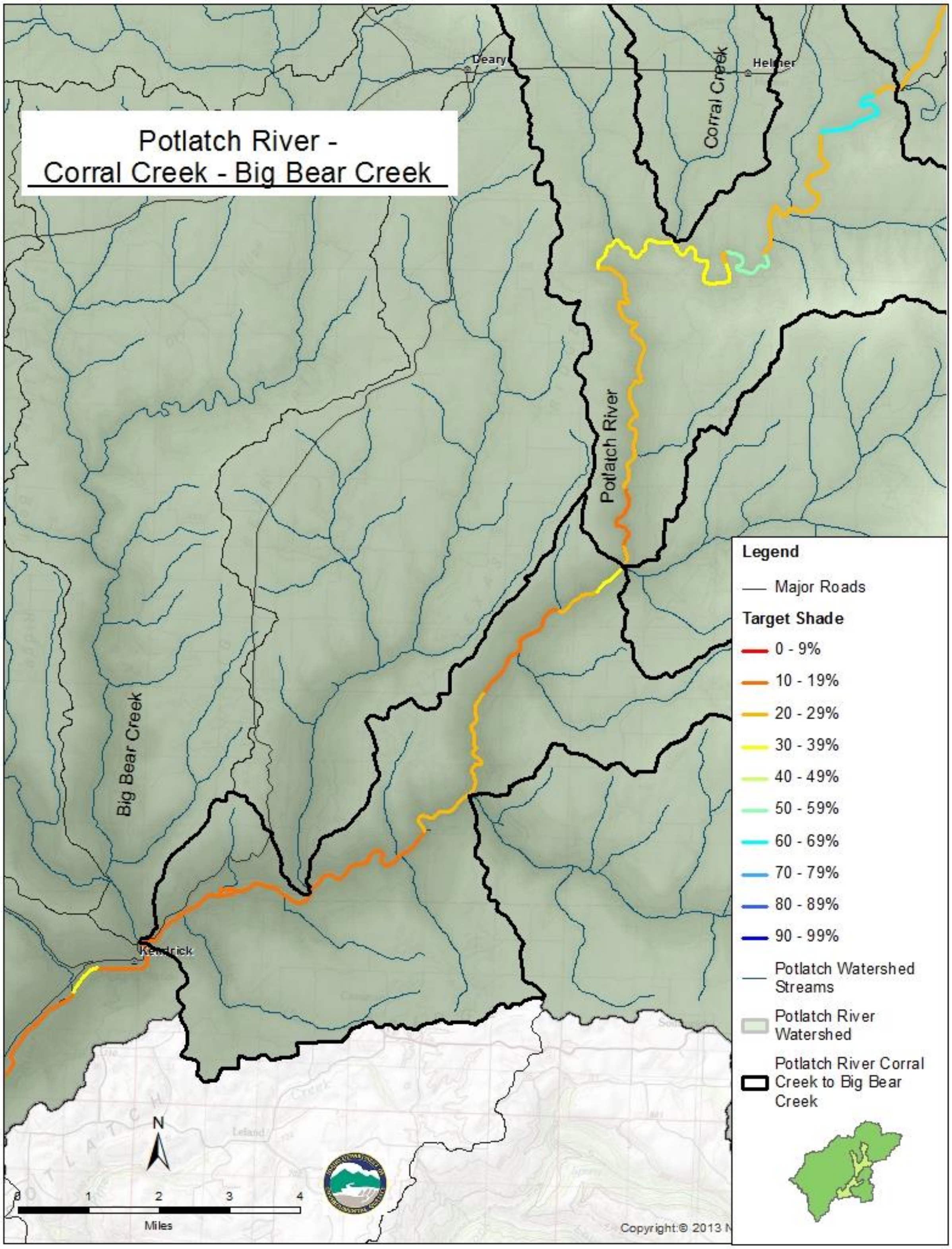


Figure C17. Potlatch River (045_05) target shade levels.

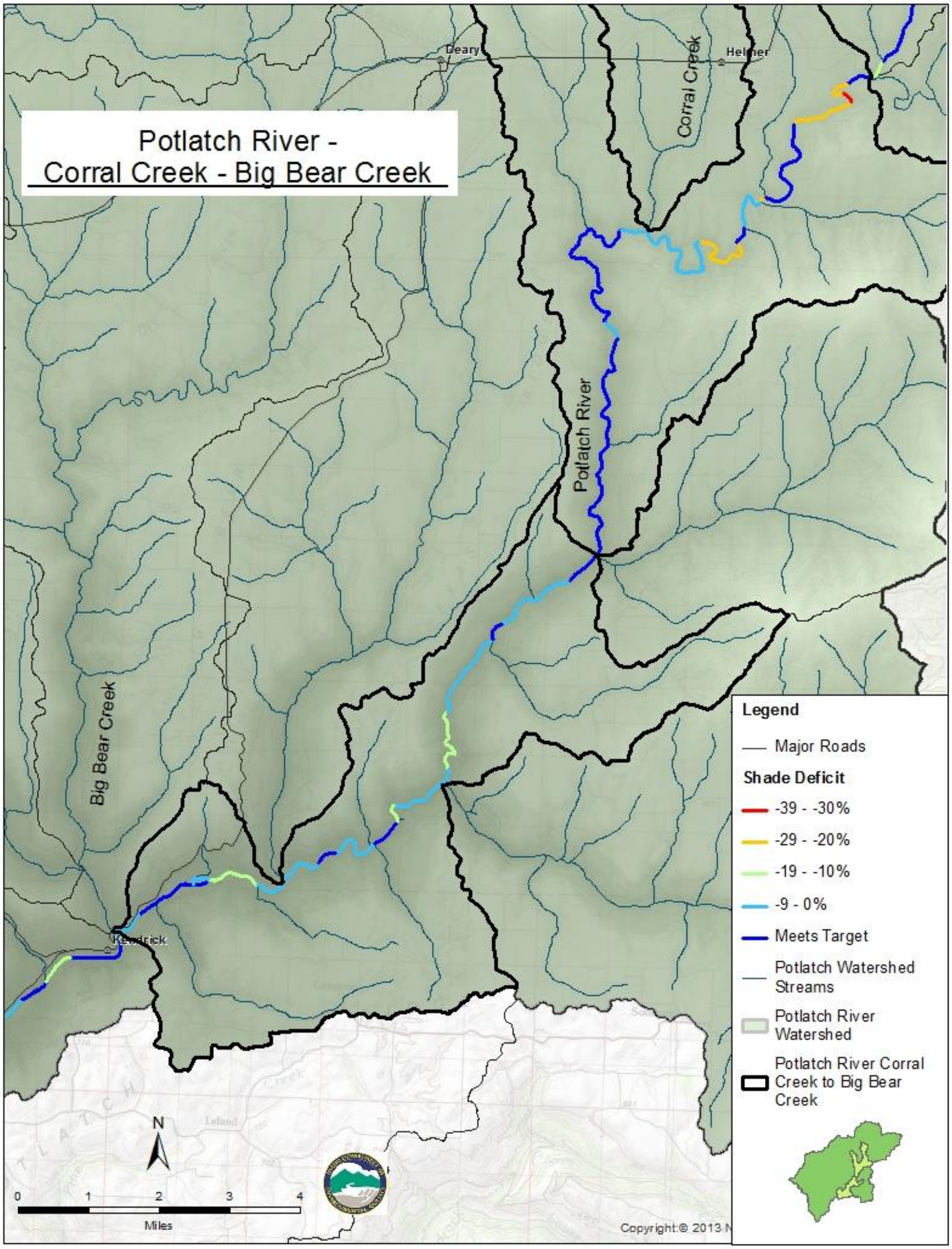


Figure C18. Potlatch River (045_05) shade deficit levels.

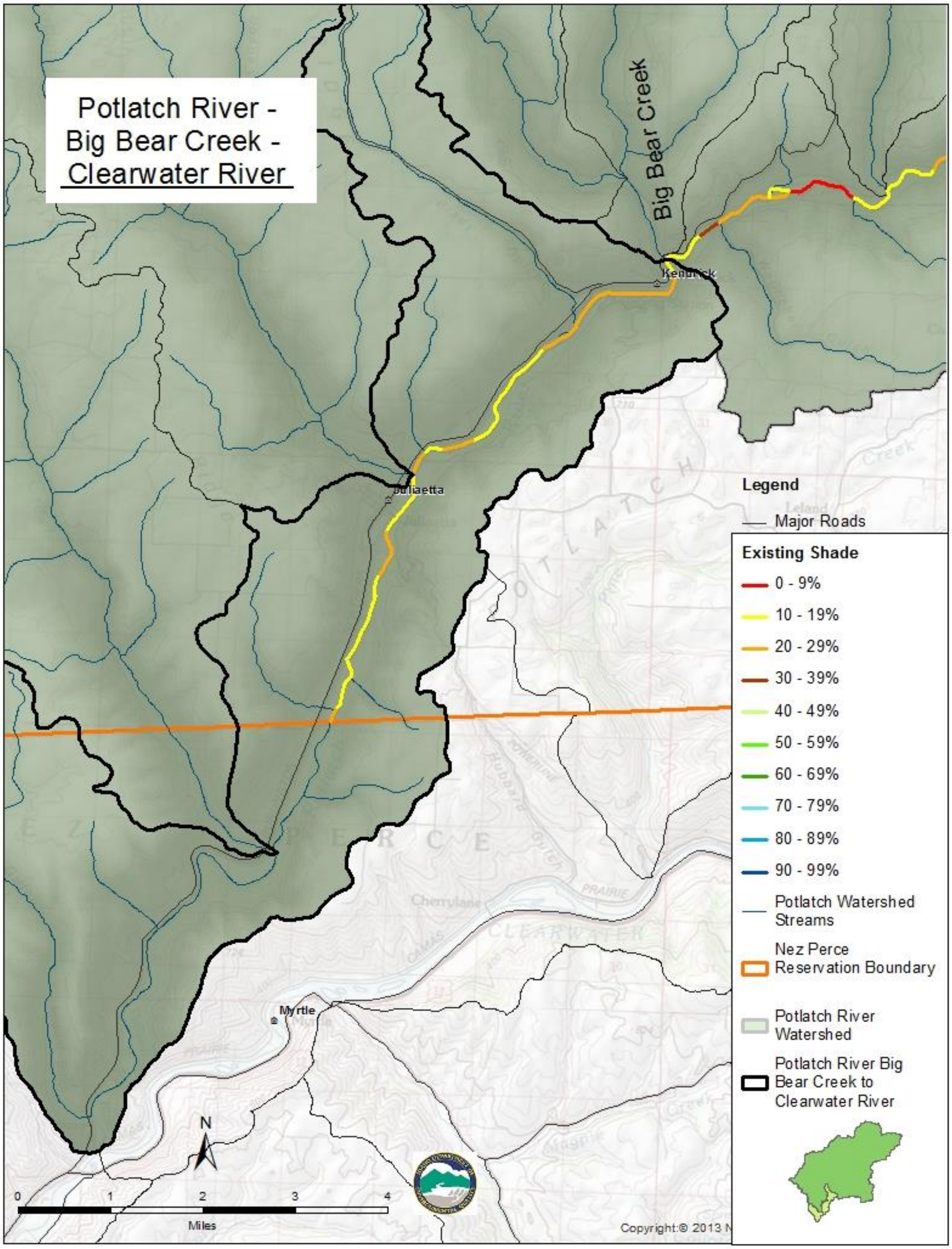


Figure C19. Potlatch River (044_06) existing shade levels.

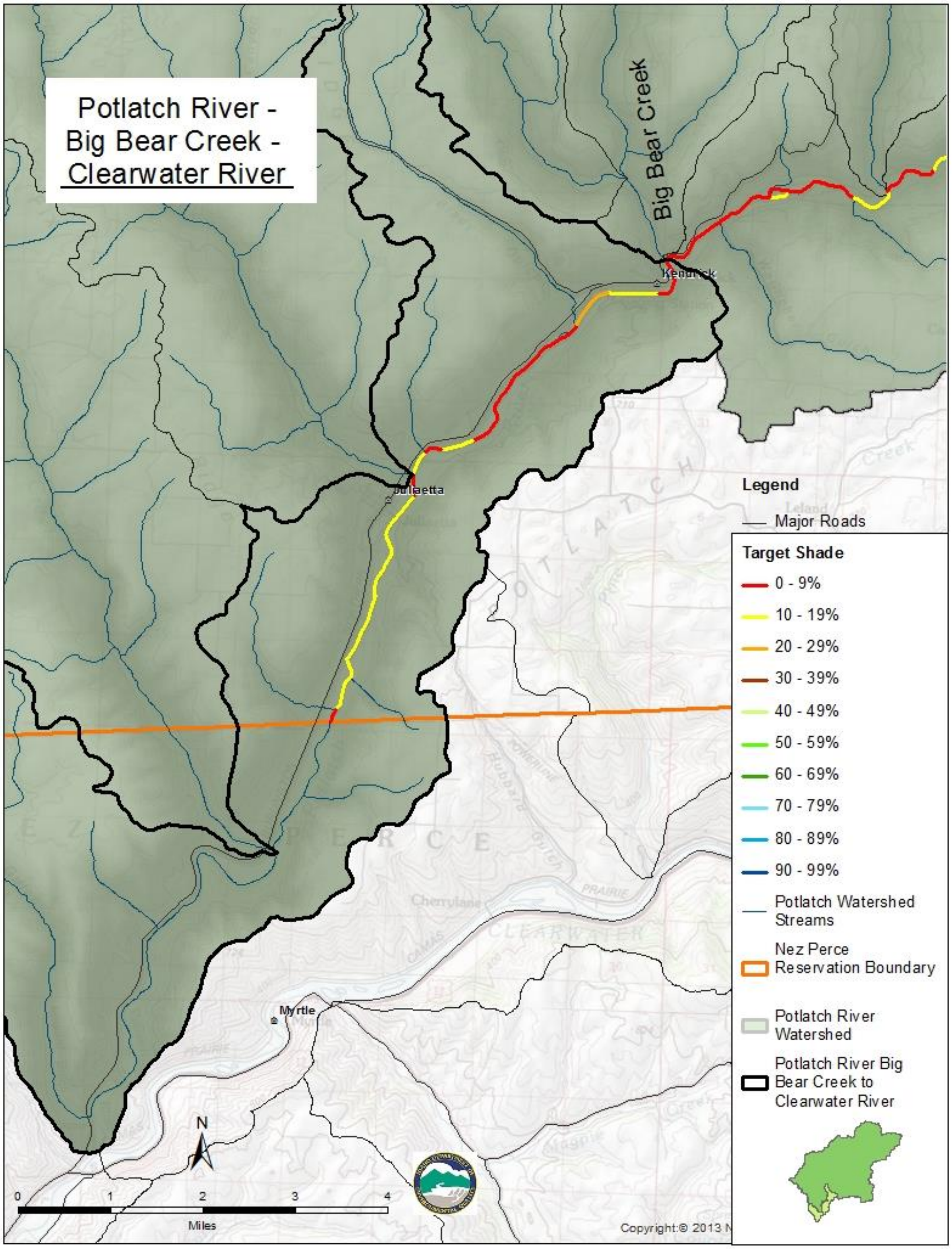


Figure C20. Potlatch River (044_06) target shade levels.

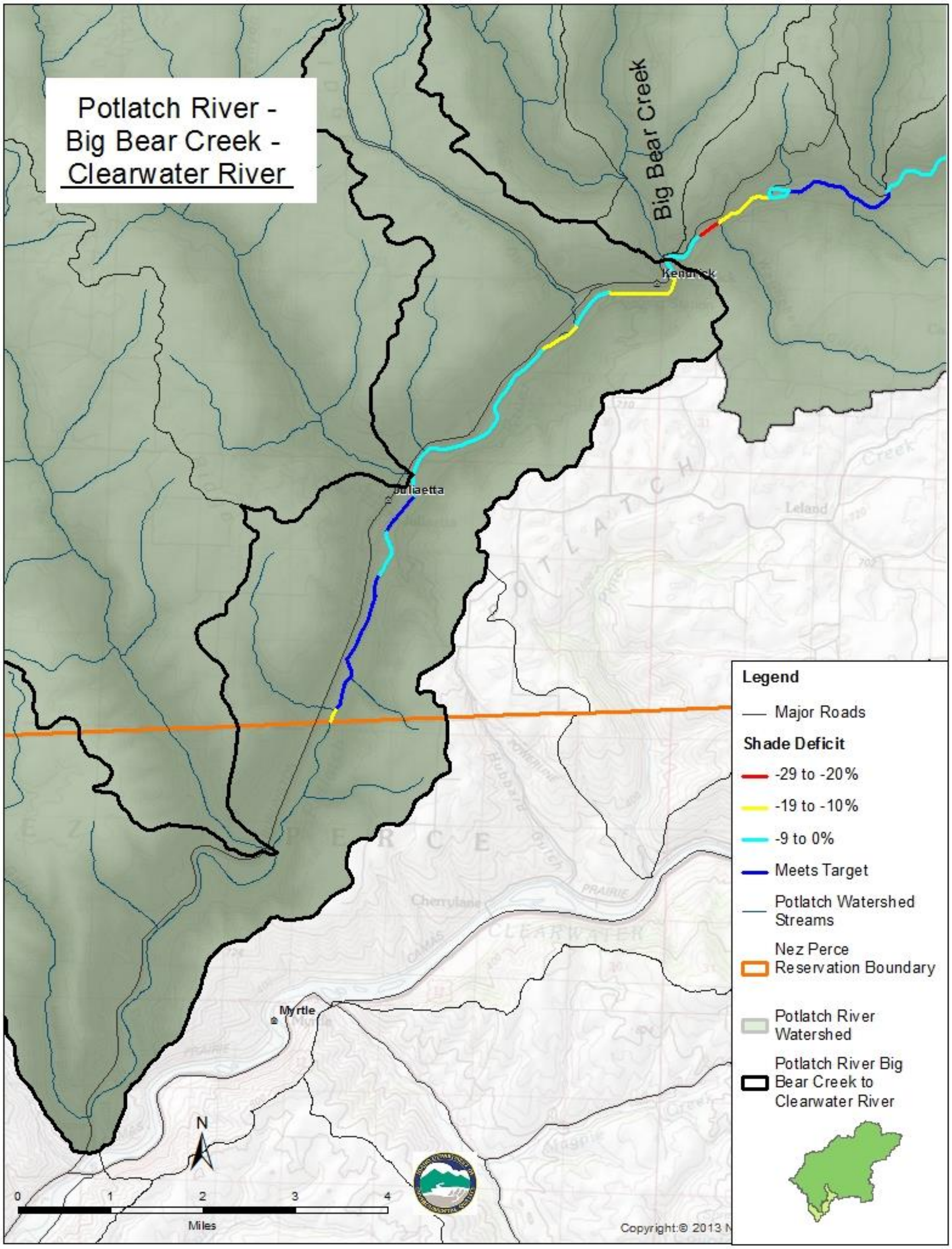


Figure C21. Potlatch River (044_06) shade deficit levels.

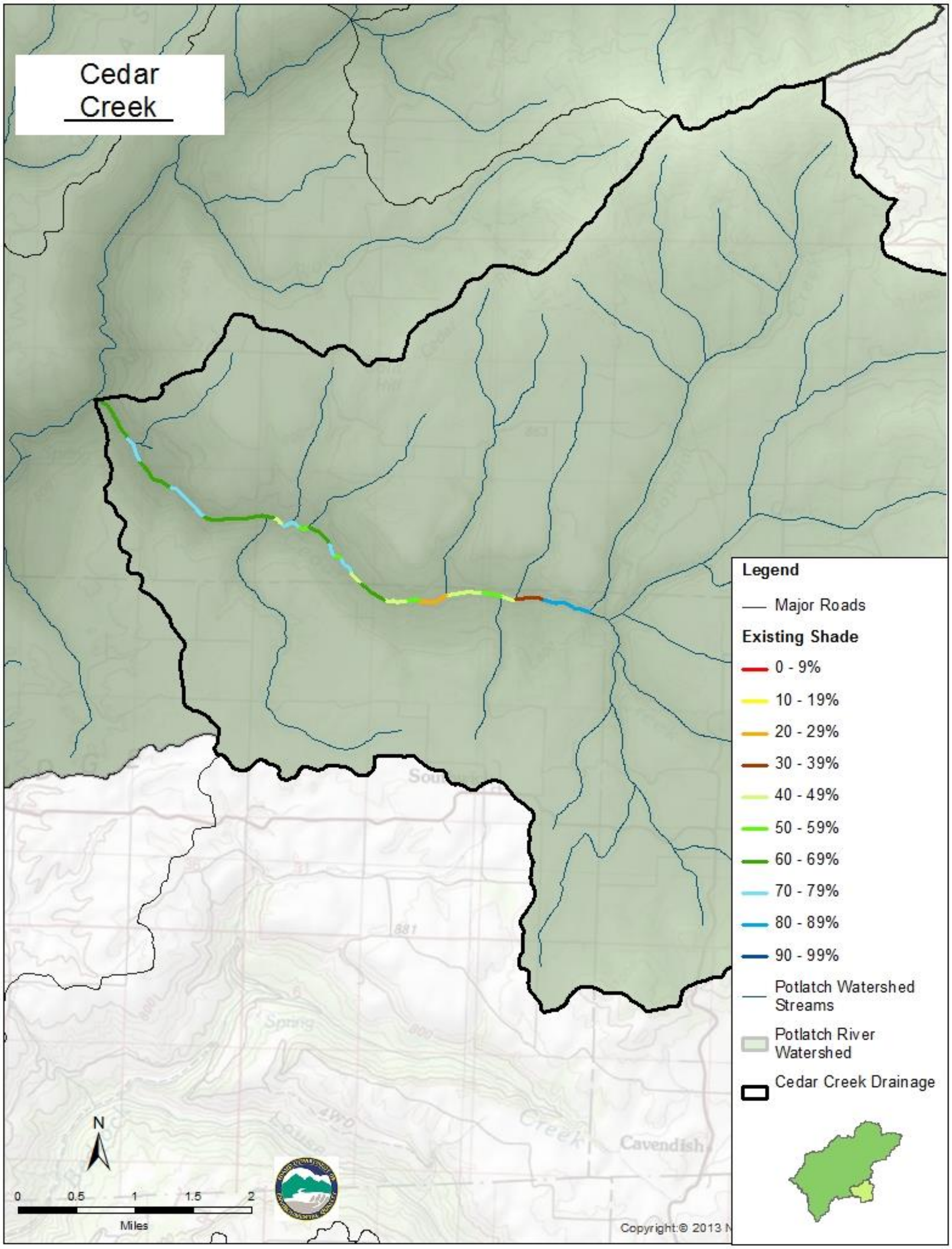


Figure C22. Cedar Creek (046_04) existing shade levels.

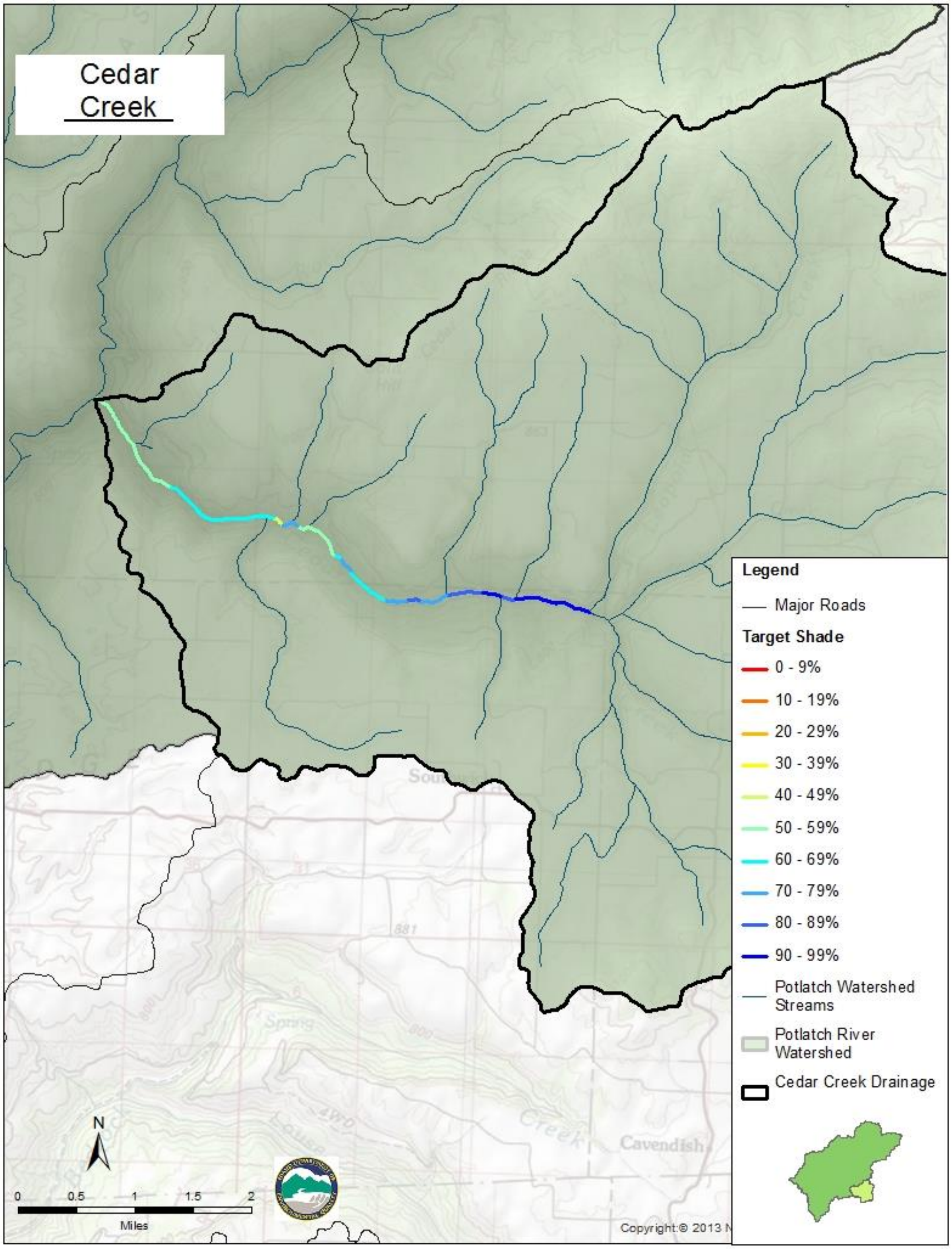


Figure C23. Cedar Creek (046_04) target shade levels.

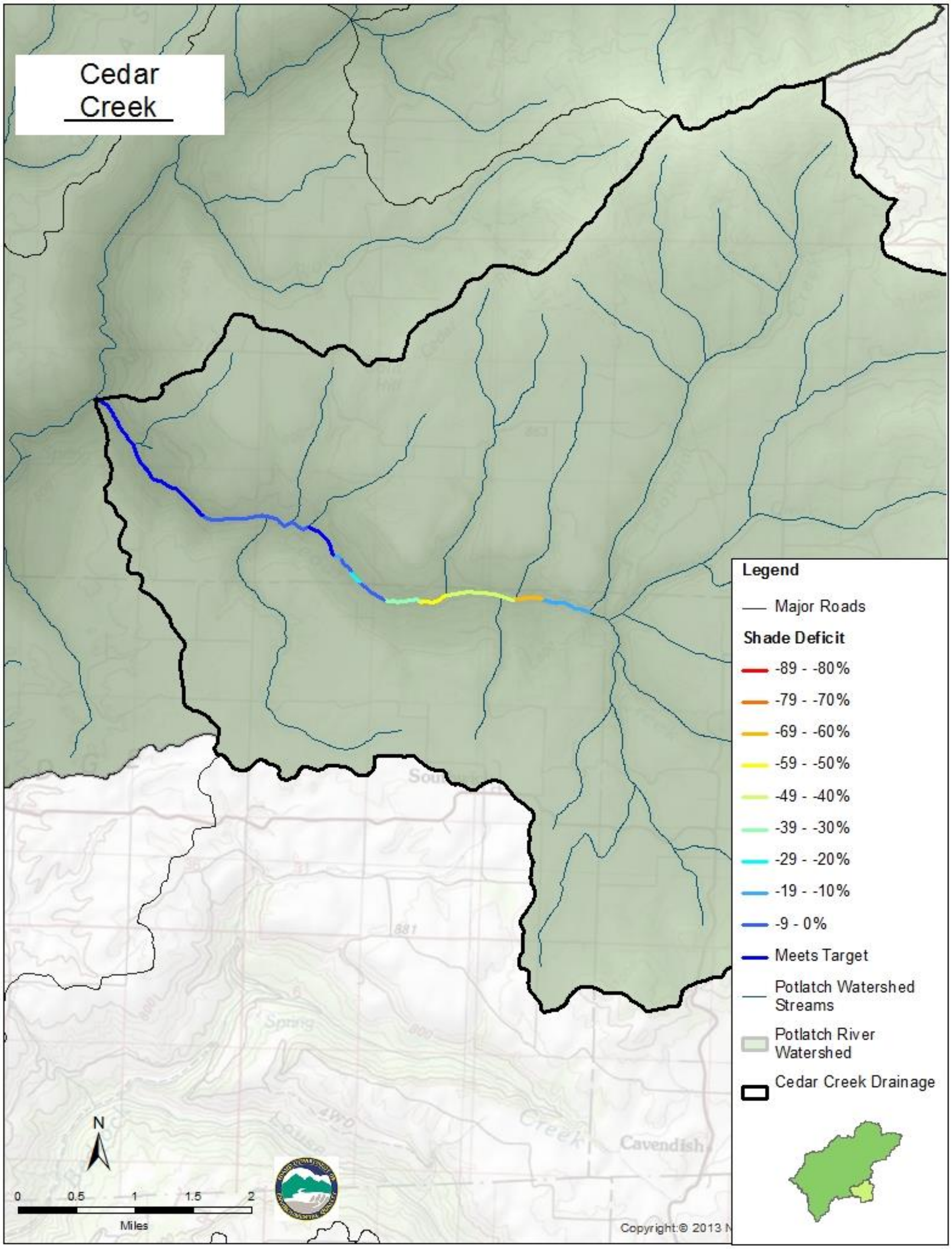


Figure C24. Cedar Creek (046_04) shade deficit levels.

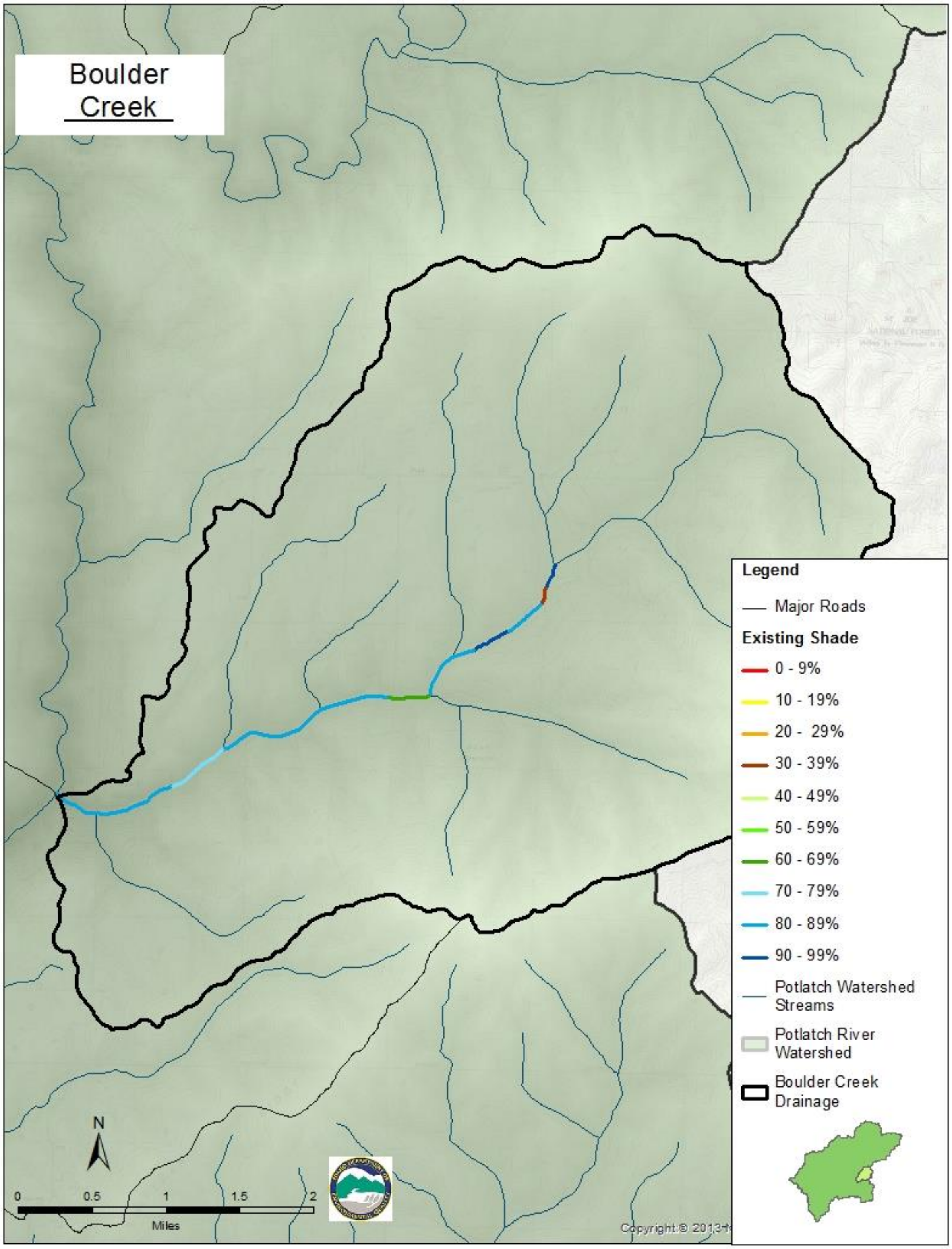


Figure C25. Boulder Creek (047_03) existing shade levels.

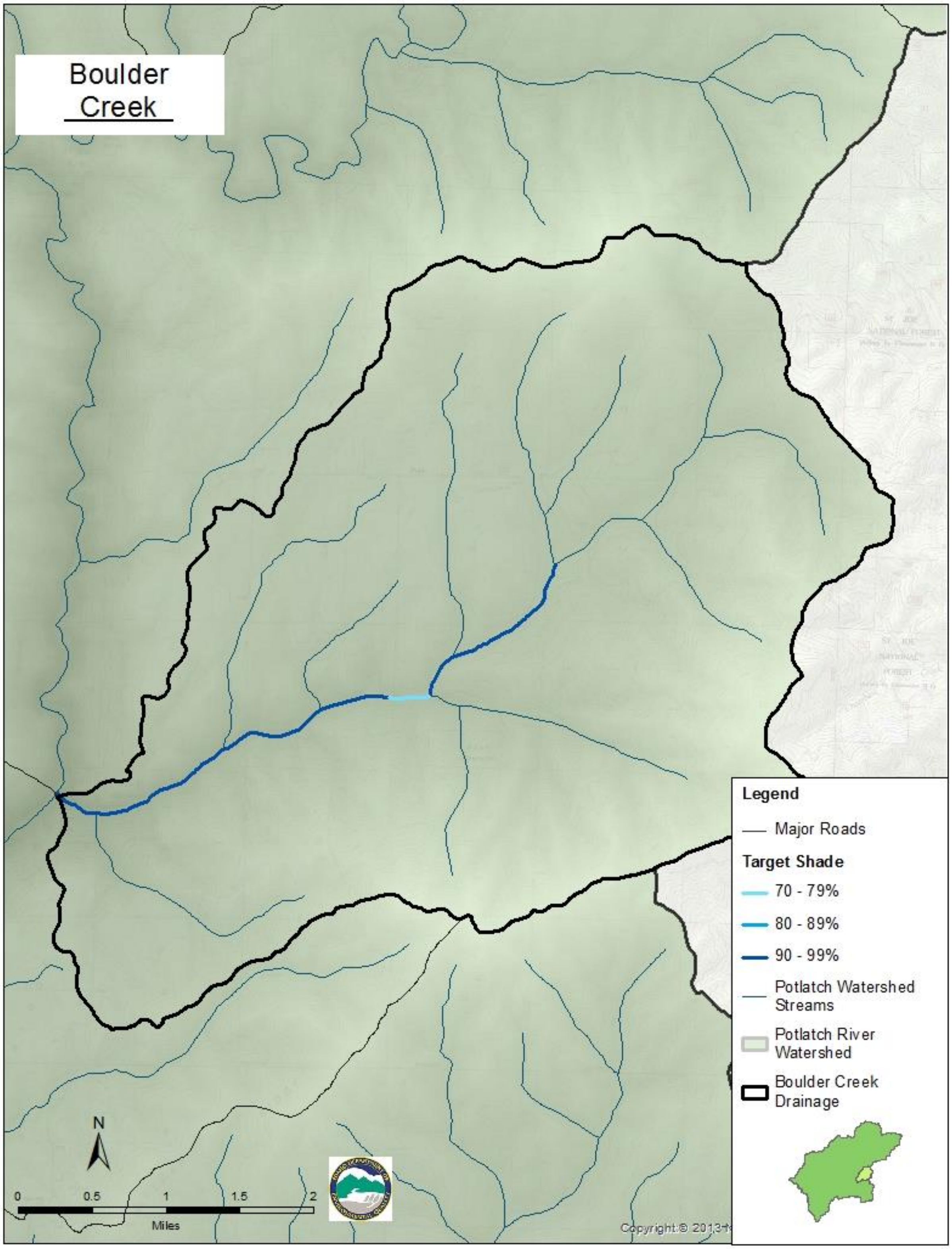


Figure C26. Boulder Creek (047_03) target shade levels.

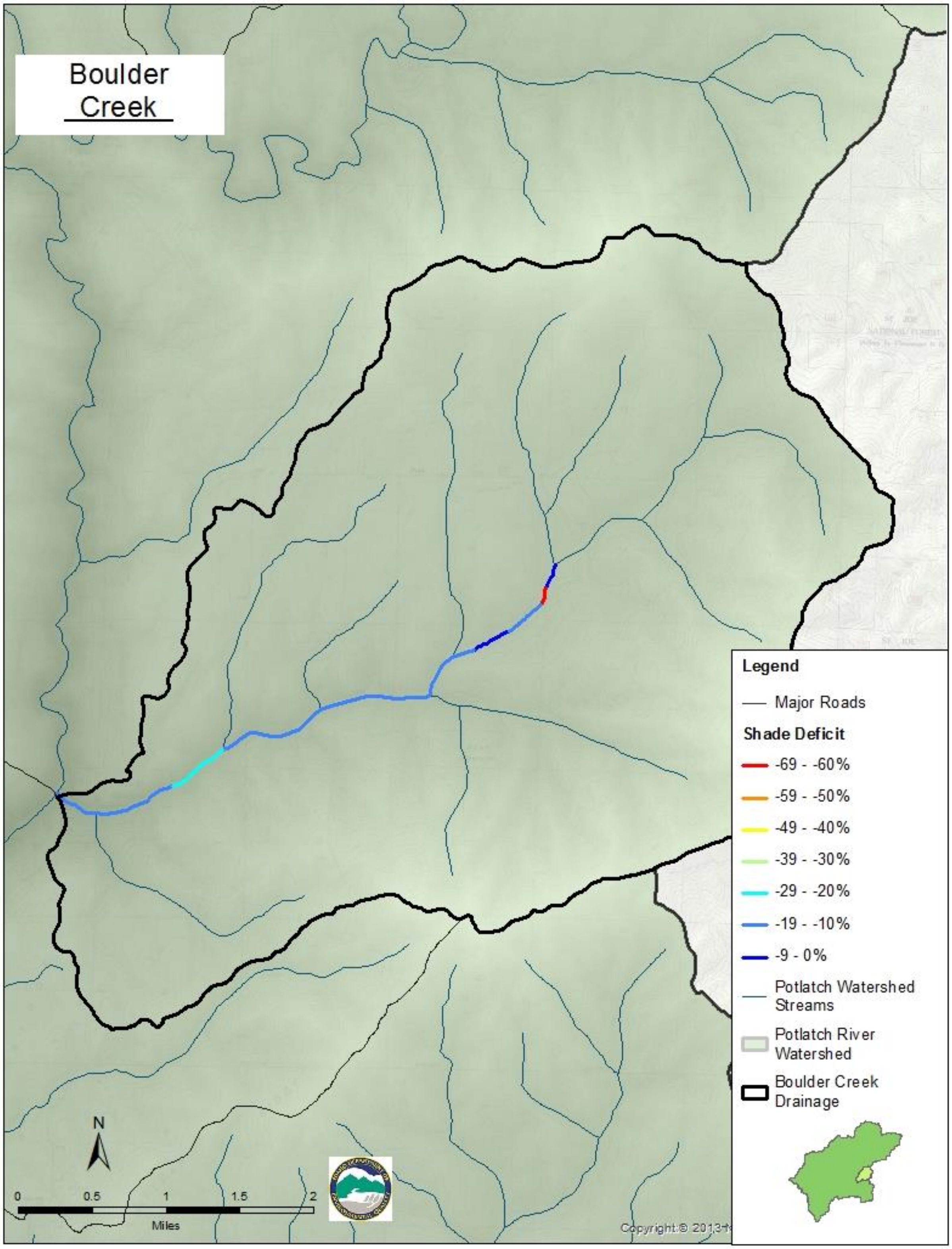


Figure C27. Boulder Creek (047_03) shade deficit levels.

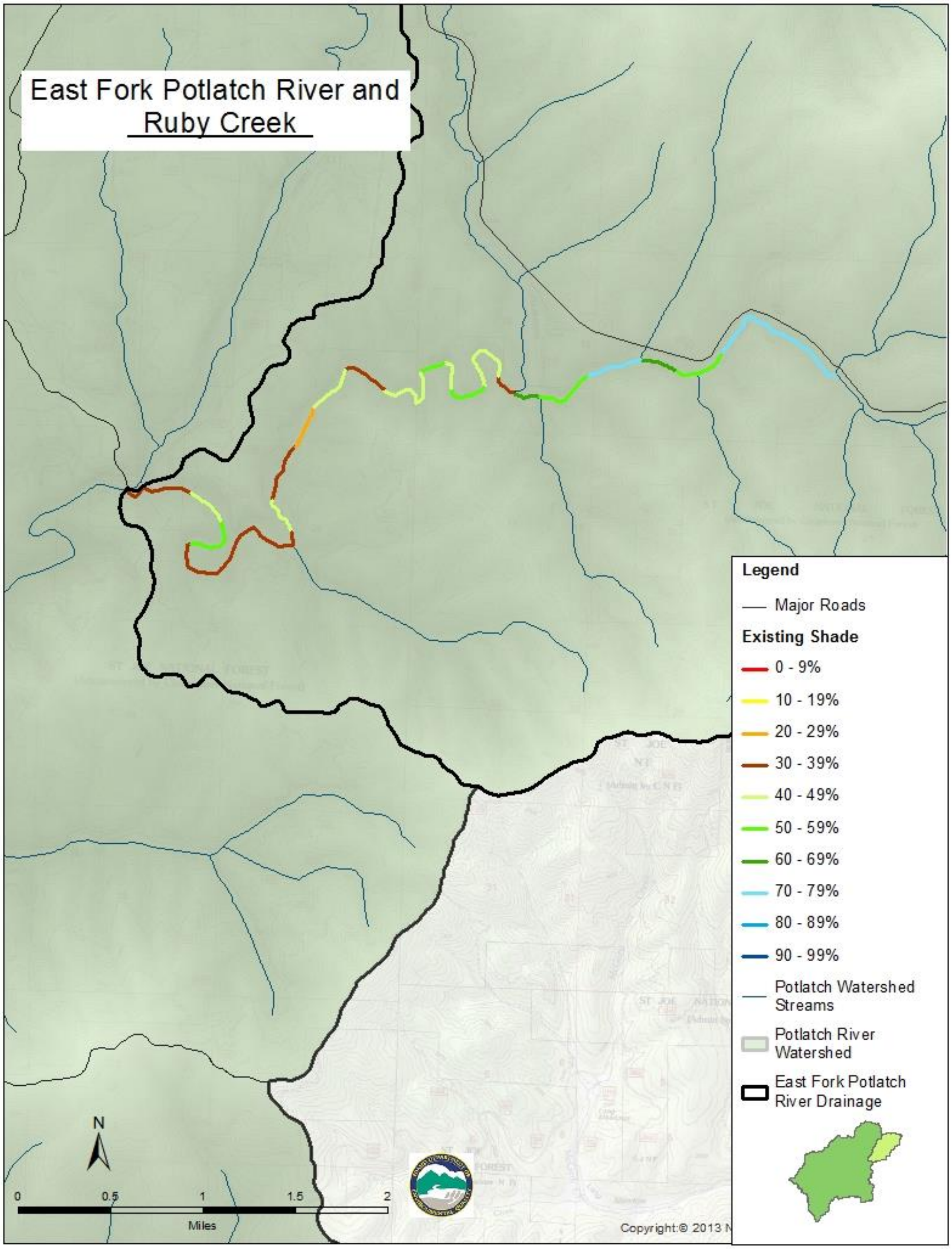


Figure C28. East Fork Potlatch River (051_04) and Ruby Creek (052_03) existing shade levels.

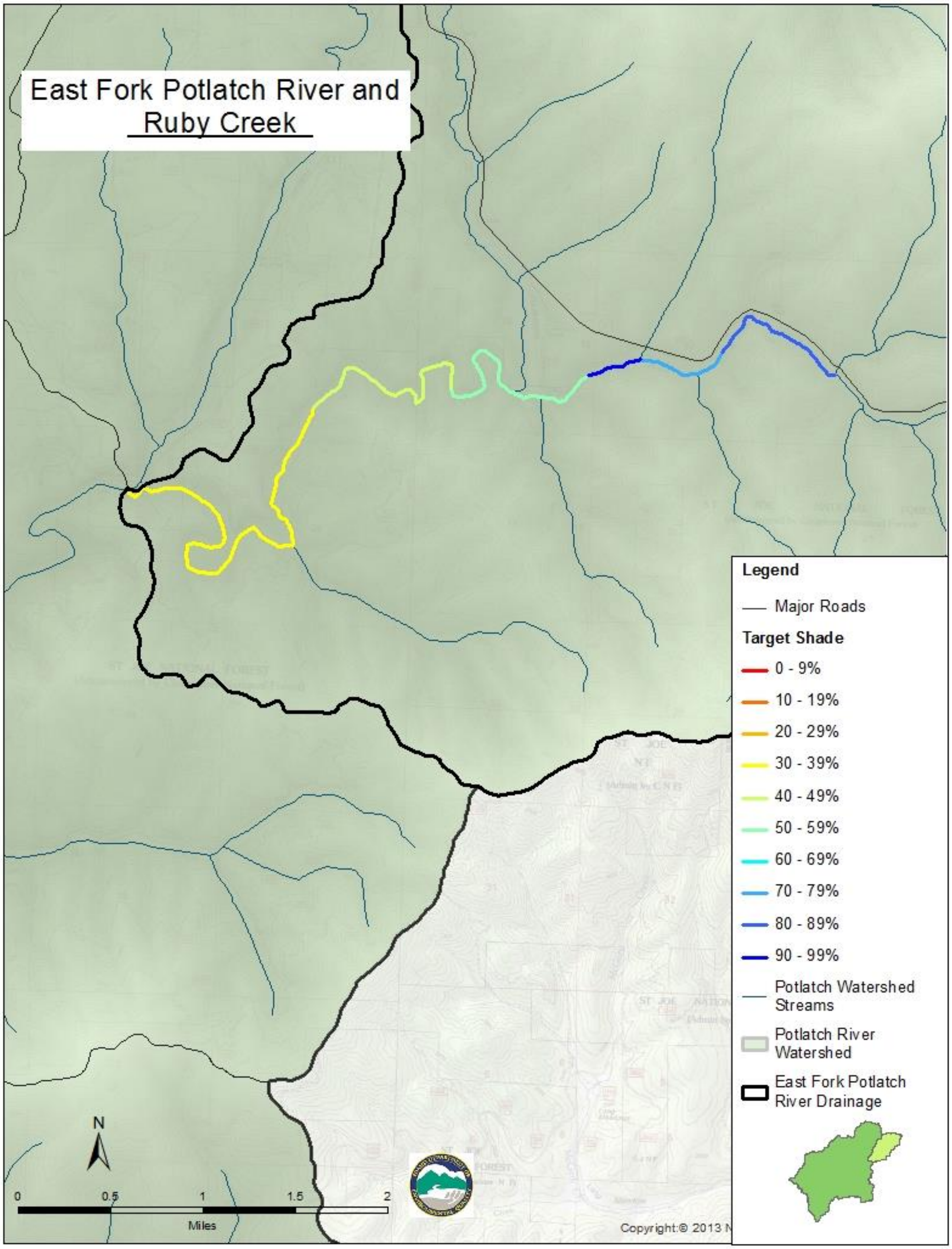


Figure C29. East Fork Potlatch River (051_04) and Ruby Creek (052_03) target shade levels.

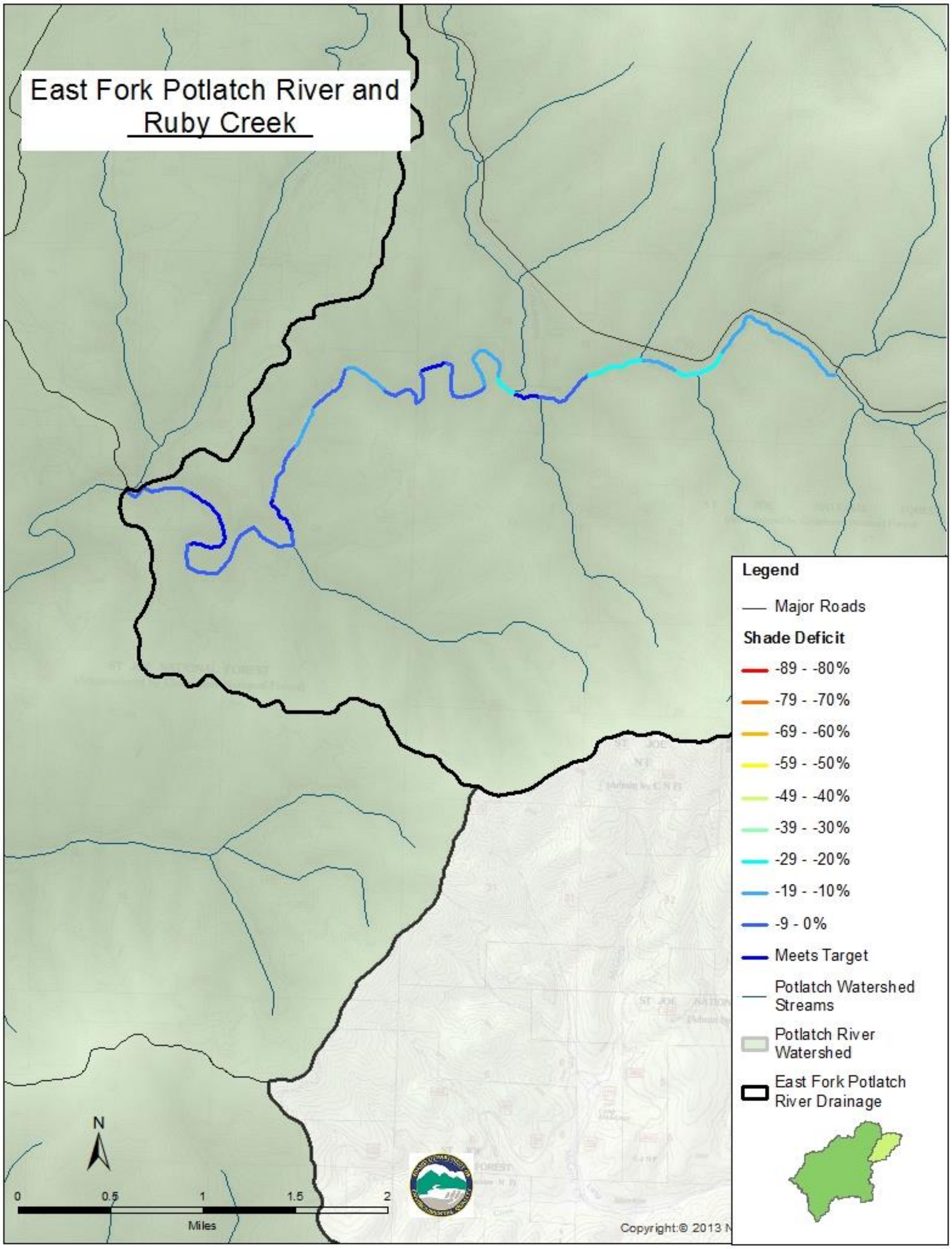


Figure C30. East Fork Potlatch River (051_04) and Ruby Creek (052_03) shade deficit levels.

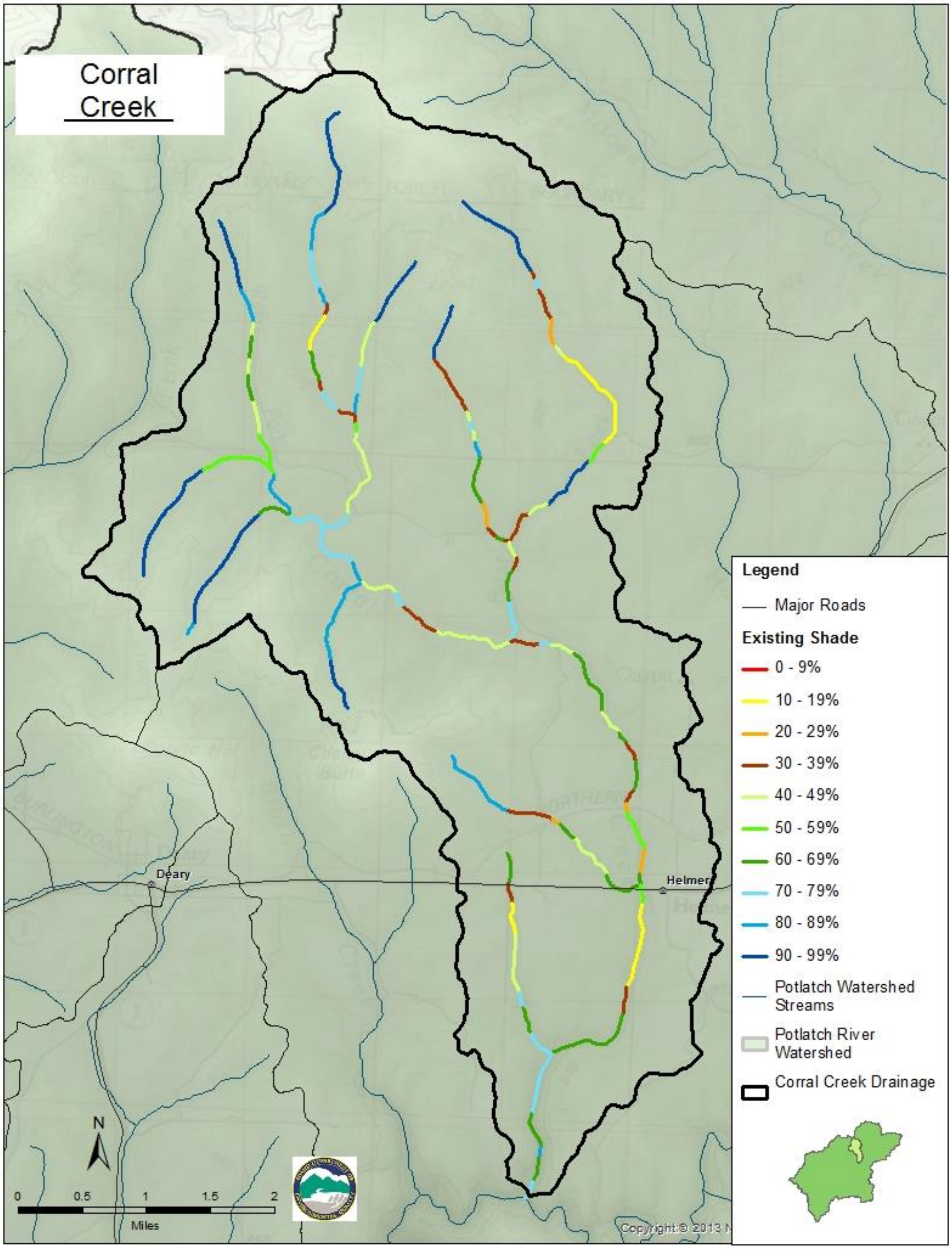


Figure C31. Corral Creek (054_02, 054_03) existing shade levels.

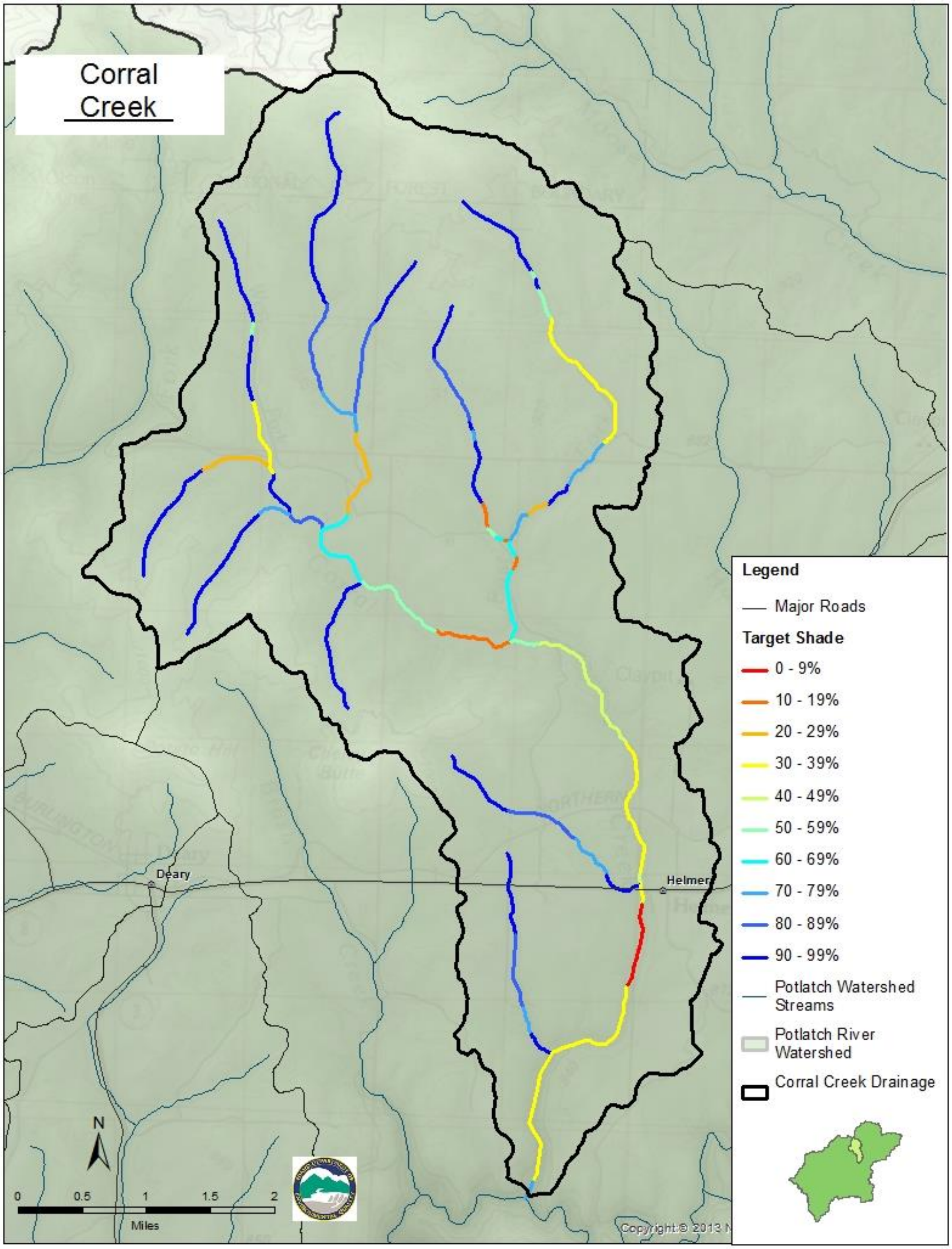


Figure C32. Corral Creek (054_02, 054_03) target shade levels.

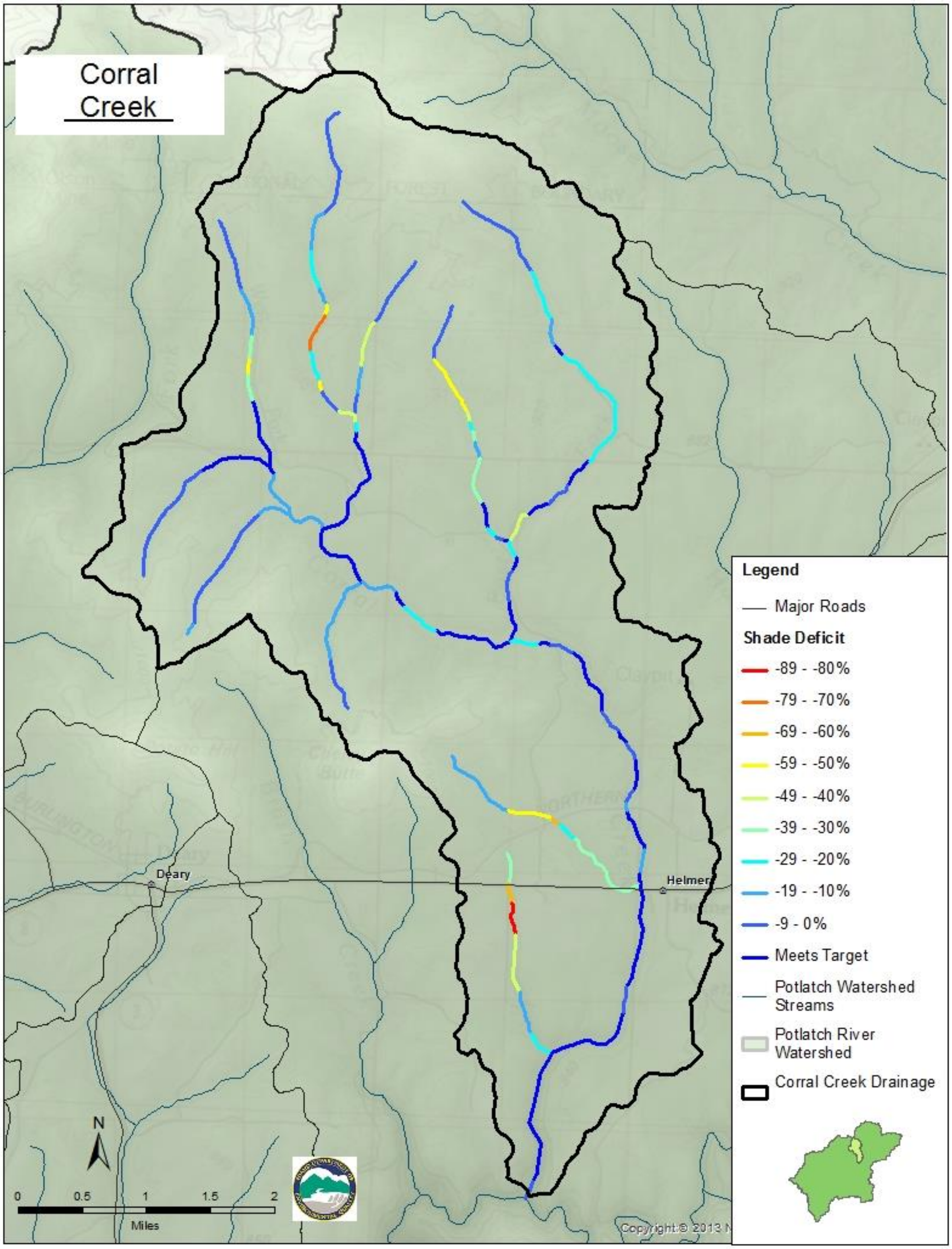


Figure C33. Corral Creek (054_02, 054_03) shade deficit levels.

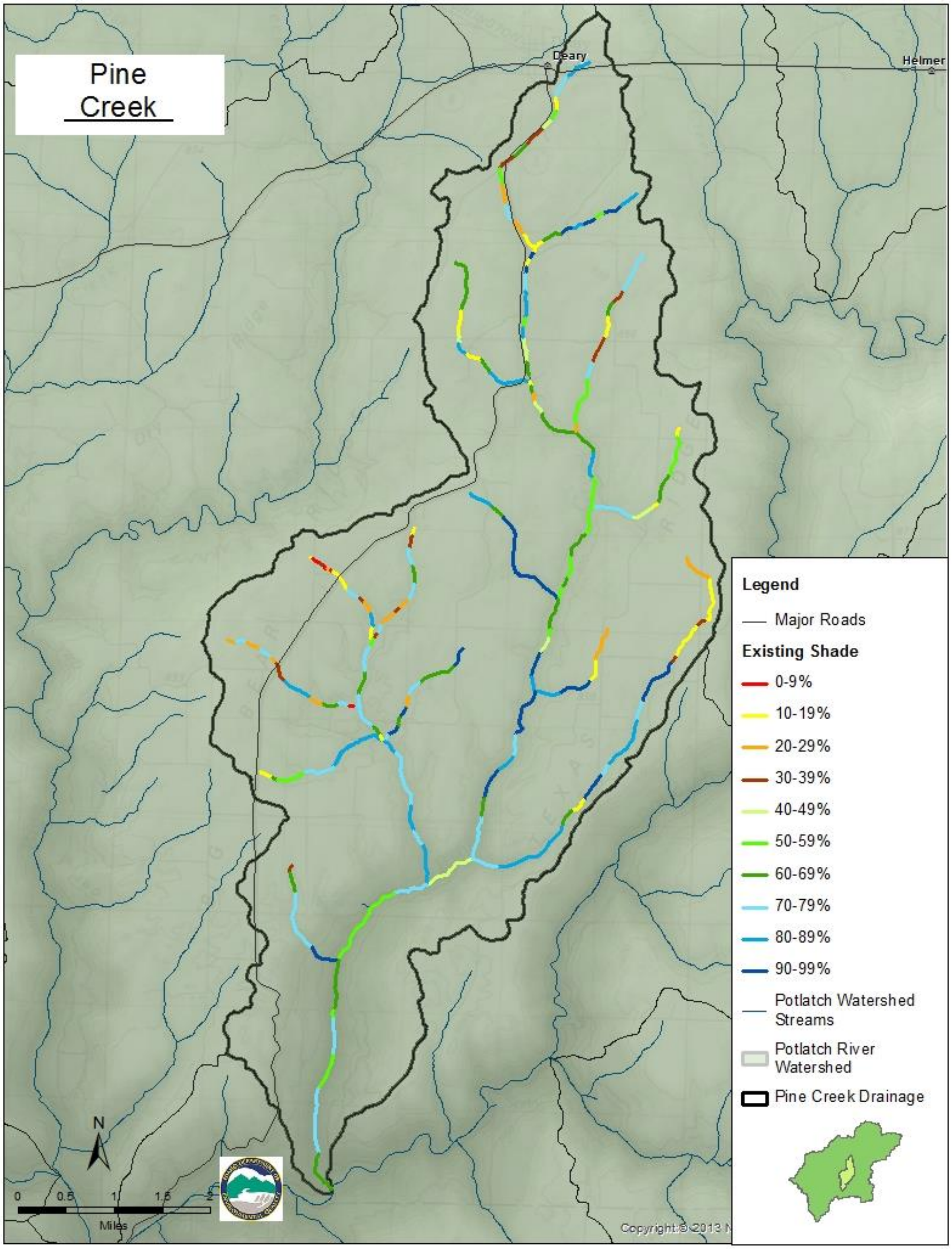


Figure C34. Pine Creek (055_02, 055_03) existing shade levels.

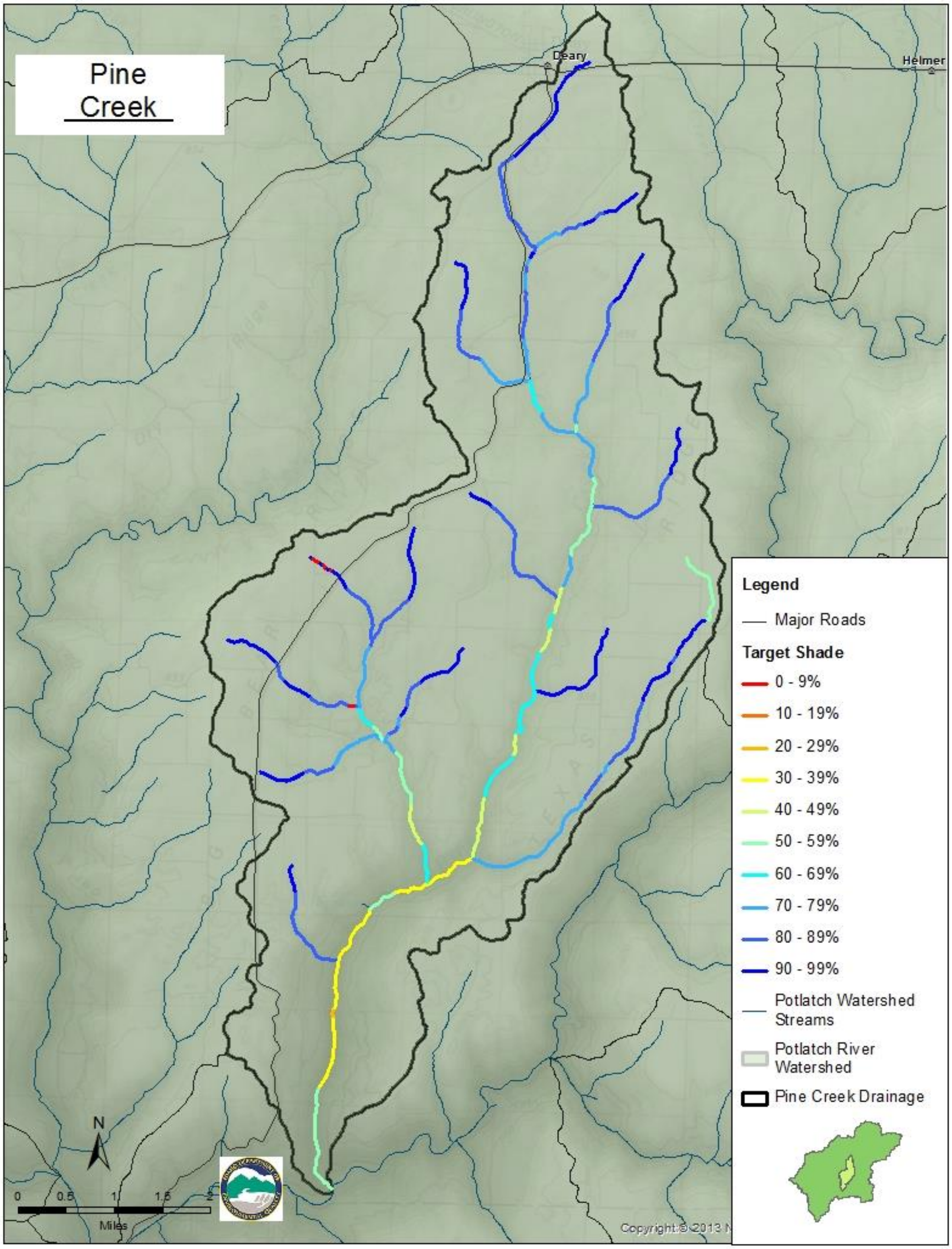


Figure C35. Pine Creek (055_02, 055_03) target shade levels.

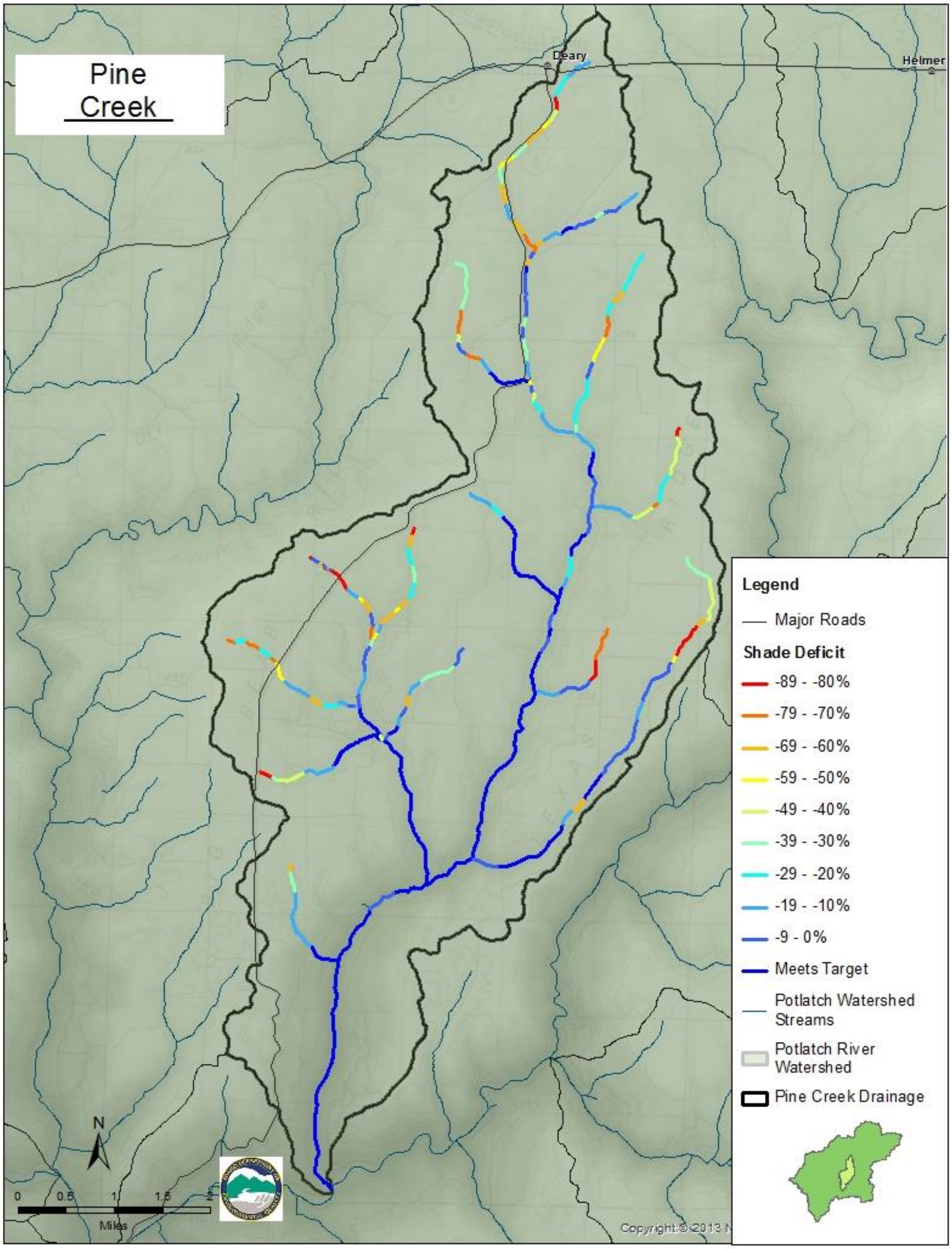


Figure C36. Pine Creek (055_02, 055_03) shade deficit levels.

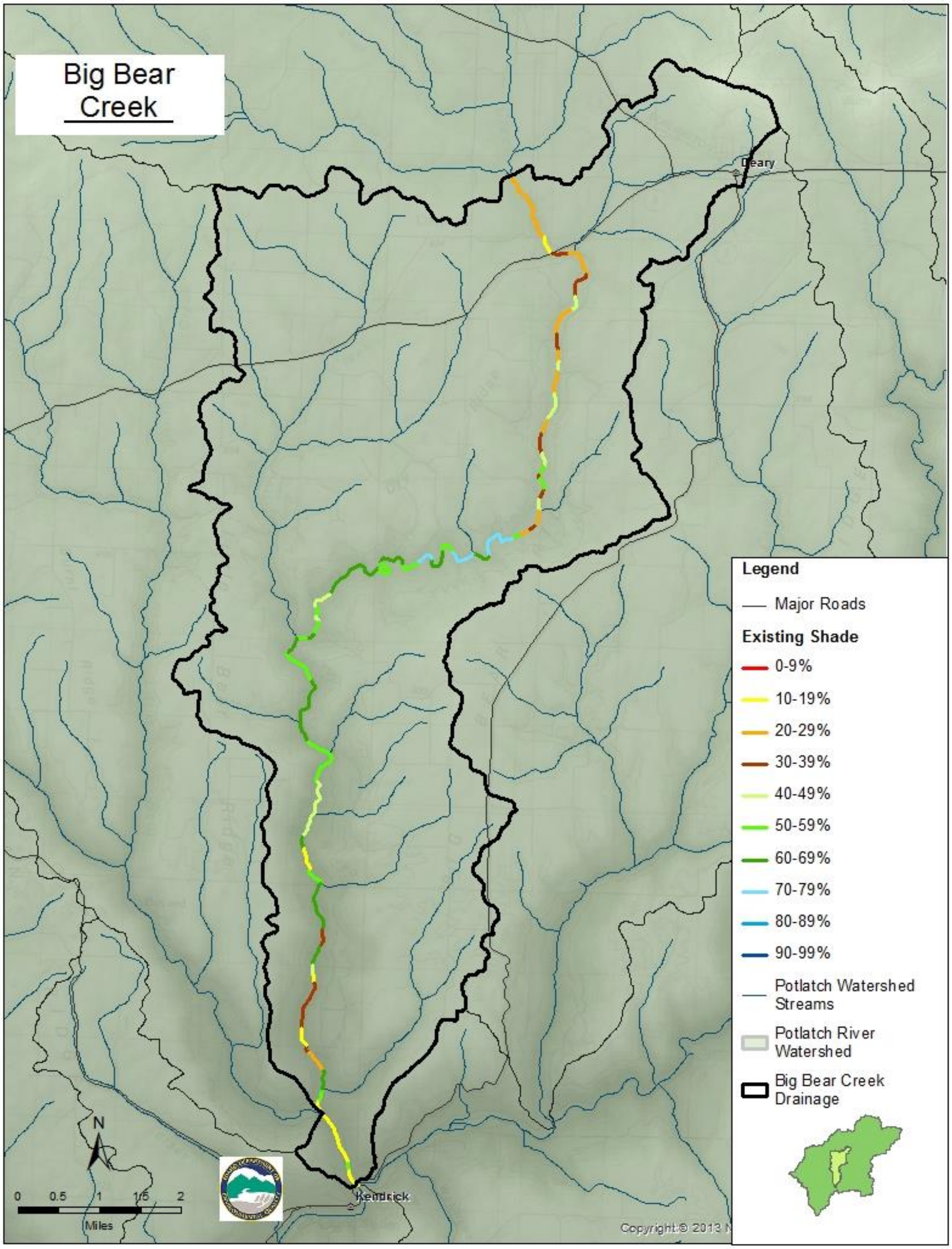


Figure C37. Big Bear Creek (056_04, 056_05) existing shade levels.

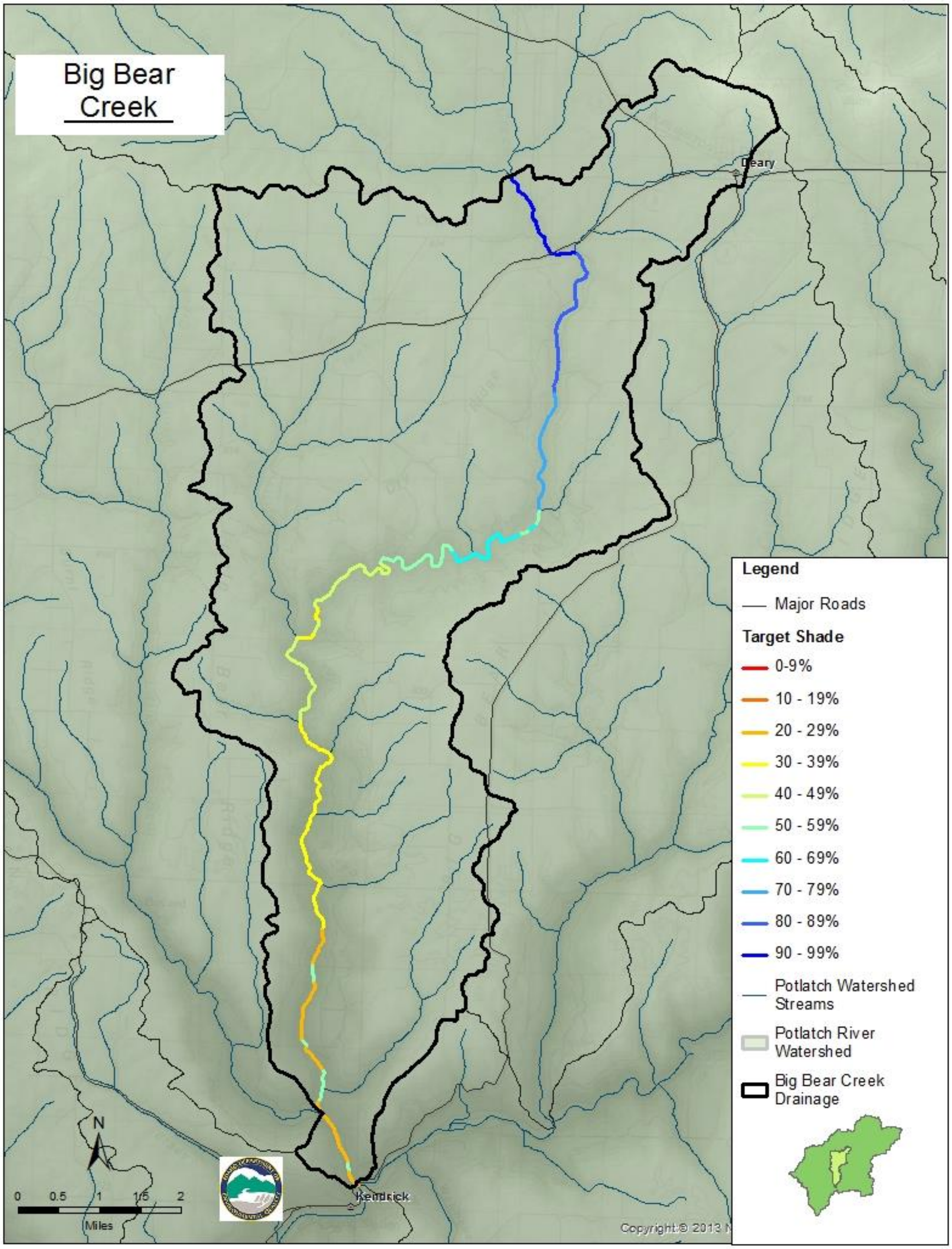


Figure C38. Big Bear Creek (056_04, 056_05) target shade levels.

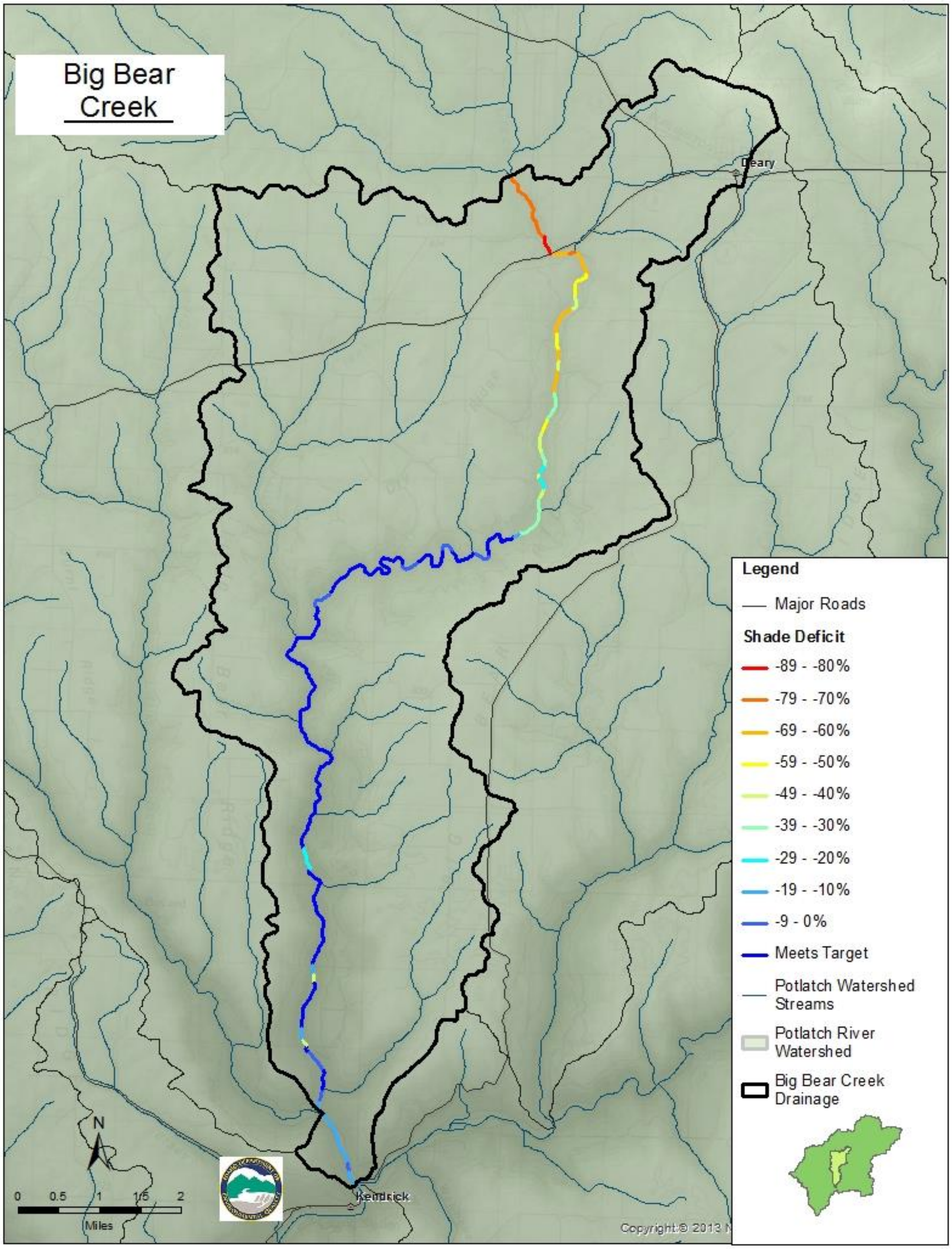


Figure C39. Big Bear Creek (056_04, 056_05) shade deficit levels.

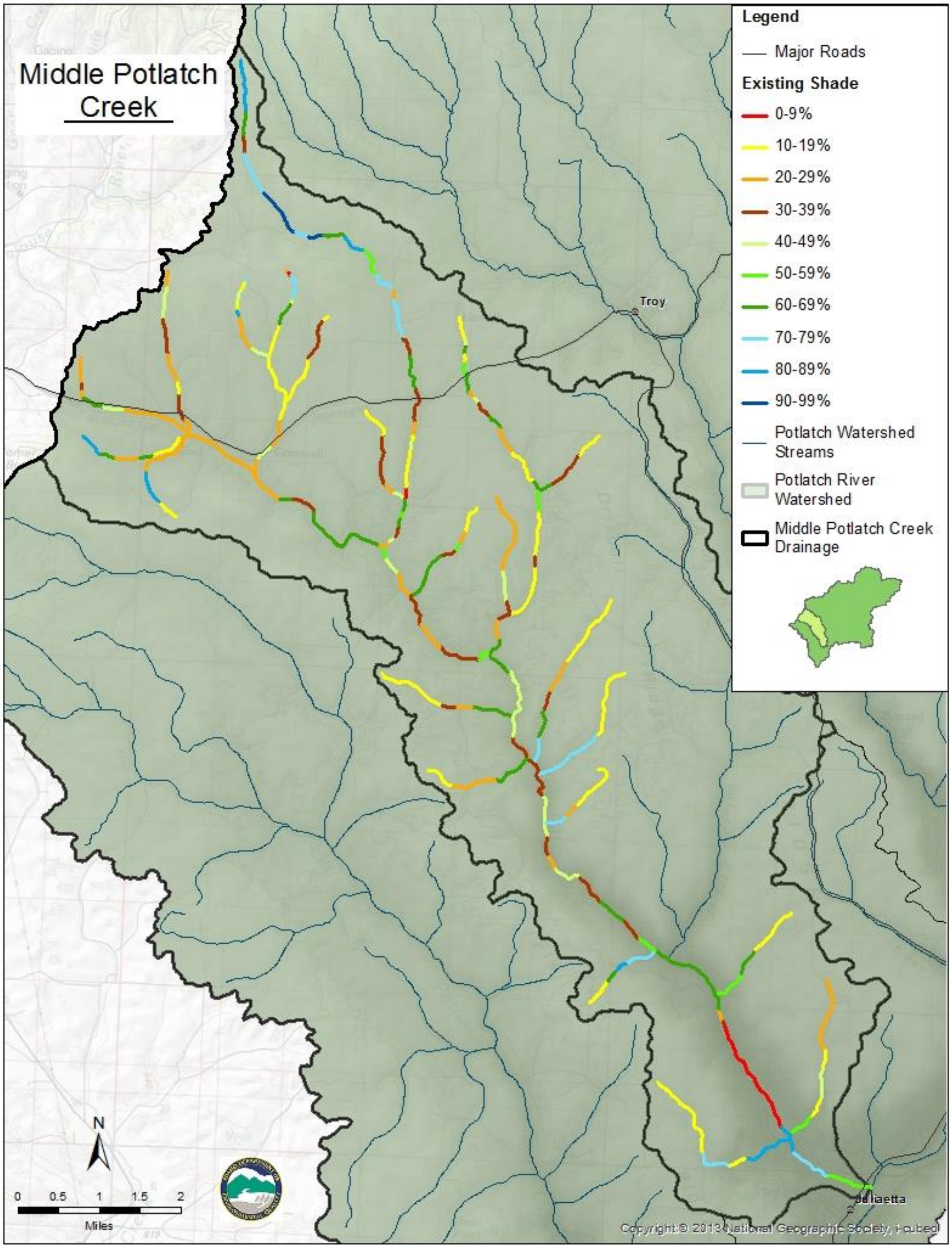


Figure C40. Middle Potlatch Creek (062_02, 062_03) existing shade levels.

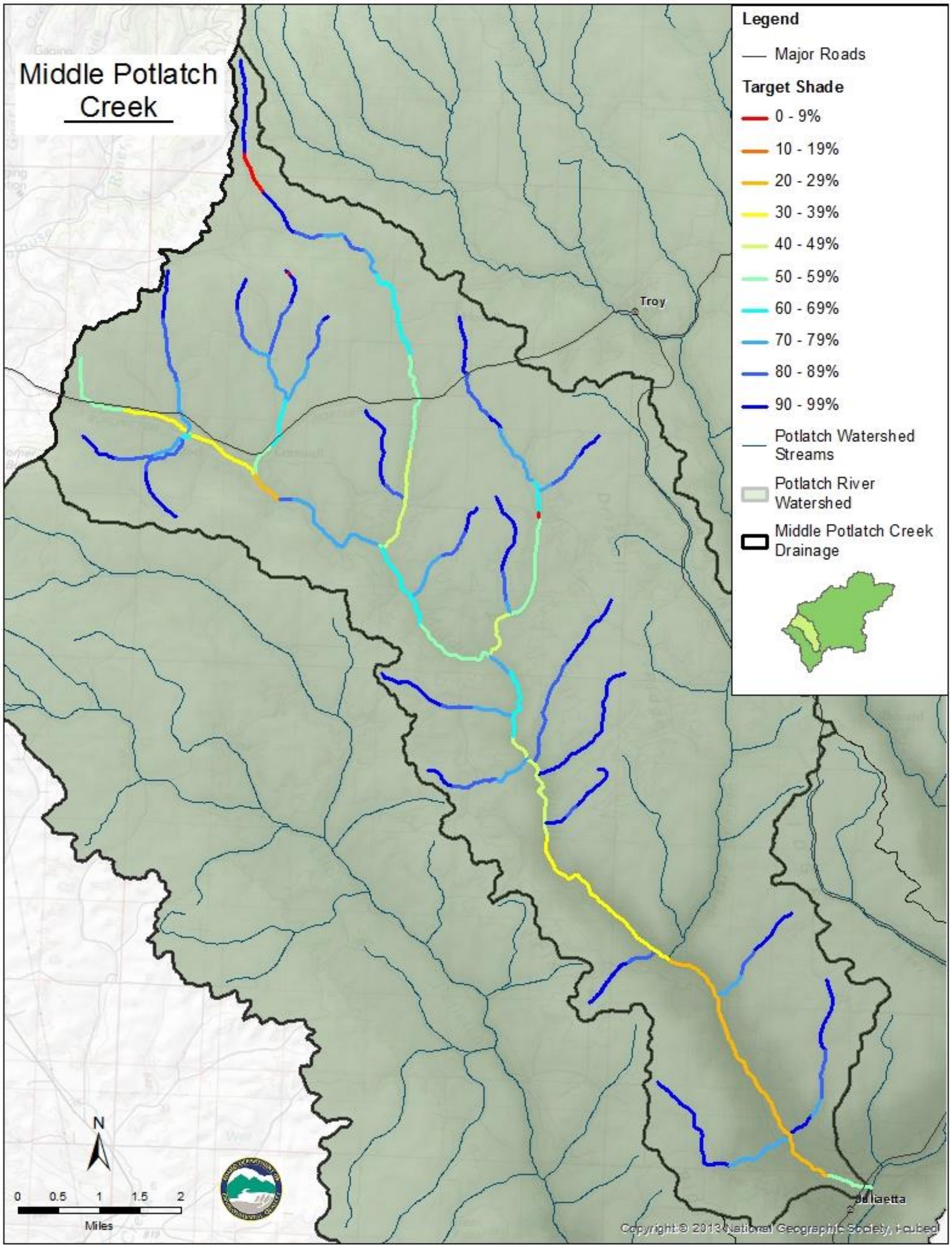


Figure C41. Middle Potlatch Creek (062_02, 062_03) target shade levels.

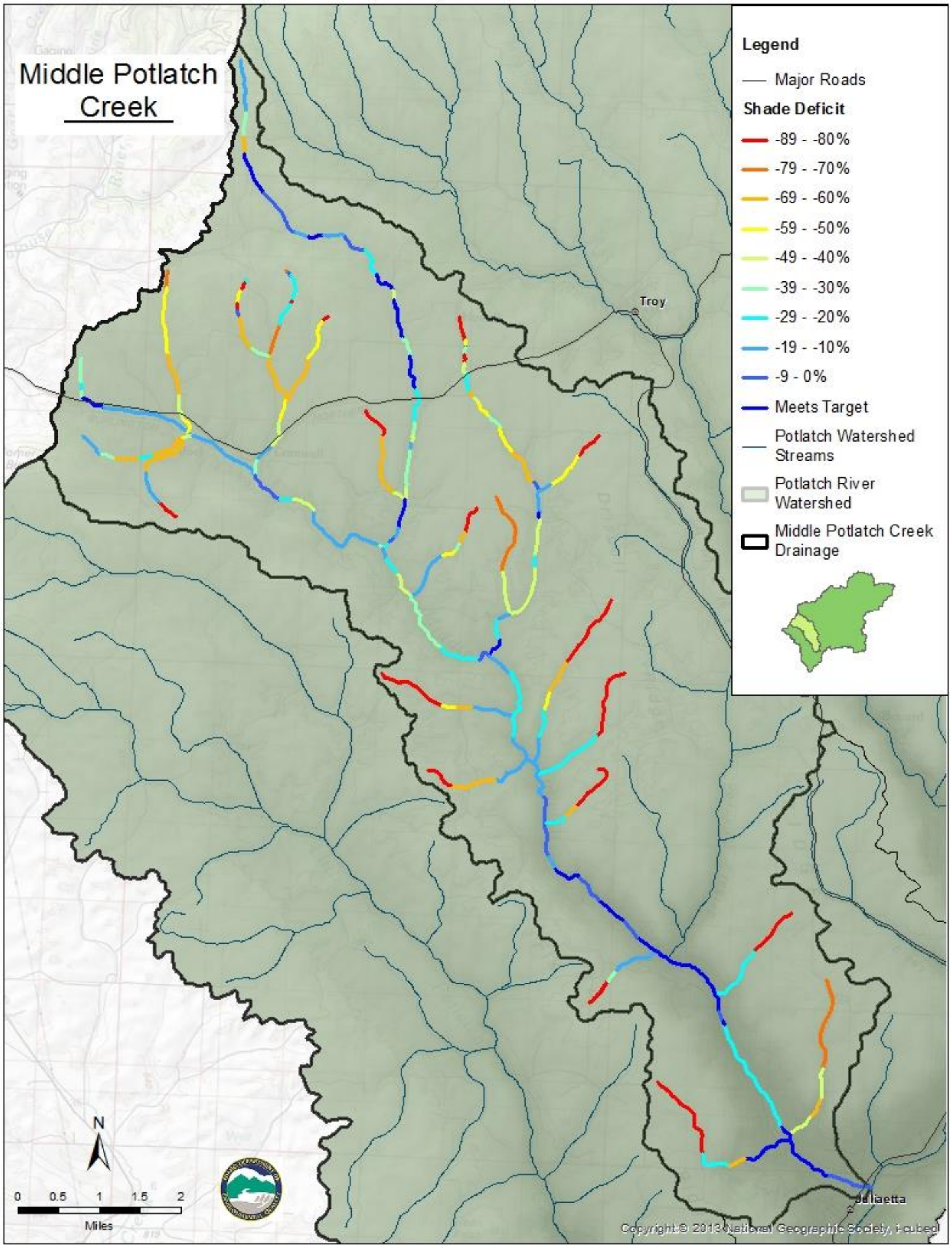


Figure C42. Middle Potlatch Creek (062_02, 062_03) shade deficit levels.

Appendix D. Managing Stormwater

Municipal Separate Storm Sewer Systems

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

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

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

Industrial Stormwater Requirements

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

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

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

Industrial Facilities Discharging to Impaired Water Bodies

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

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on

their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. EPA anticipates issuing a new MSGP. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

TMDL Industrial Stormwater Requirements

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

Construction Stormwater

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

Construction General Permit (CGP) and Stormwater Pollution Prevention Plans

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

TMDL Construction Stormwater Requirements

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

Postconstruction Stormwater Management

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing in order to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

Appendix E. Pollutant Trading

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loads within the limits of certain requirements.

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2016b).

Trading Components

The major components of pollutant trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Ratios are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database by DEQ or its designated party.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant beyond a level set by a TMDL:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the wasteload allocation.
- Nonpoint sources create credits by implementing approved BMPs that reduce the amount of pollutant runoff. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP; apply discounts to credits generated, if required; and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit) is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL is protected. To do this, hydrologically based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ's pollutant trading guidance (DEQ 2016b).

Appendix F. Public Participation and Public Comments

This TMDL was developed with participation from the Potlatch River Watershed Advisory Group (WAG).

The Potlatch River WAG voted to provide a 30-day public comment period for a public comment draft of the Potlatch River temperature TMDL during the August 2017 WAG meeting and an additional 30-day public comment period during the February 2018 WAG meeting. Notice was provided to the general public through the *Lewiston Tribune*, *Moscow-Pullman Daily News*, and the DEQ website of the opportunity to comment from August 29, 2017, through September 28, 2017 and February 16, 2018, through March 19, 2018. Copies of the document were made available through the DEQ Lewiston Regional Office and were available for download on the website.

Written comments were received from:

- US Environmental Protection Agency
  Region 10, Idaho Operations Office
  Boise, Idaho
- Idaho Conservation League
  Boise, Idaho

Comments received are addressed below.

US Environmental Protection Agency

Comment 1: I see that the permitted point sources in the watershed that are not on TMDL streams so hence you did not give them WLAs include Troy and Deary. It is expected that these point sources require a WLA if their heat load affects the listed segments downstream in the watershed. Has this factor been looked into?

Response: The permitted Troy and Deary point sources are not considered to be significant contributors of heat loads to downstream assessment units because the point sources are far enough up stream that heat inputs would dissipate by the time they reached assessment units of concern.

Comment 2: The City of Juliaetta water treatment plant is currently discharging to the Potlatch River without a permit. The facility will need a wasteload allocation. Please add it to the document before submittal.

Response: A WLA for temperature has been provided for the City of Juliaetta drinking water facility in Section 5.4.5 of the document.

Comment 3: The TMDL appears to have a temperature WLA assigned that only reflects the salmonid spawning criterion even outside of the salmonid spawning periods. Please update the TMDL to reflect that salmonid spawning temperature criterion apply during times when salmonid spawning is present and that cold water aquatic life temperature criterion apply outside of the salmonid spawning window.

Response: We have updated the TMDL to reflect this comment.

Idaho Conservation League

Comment 1: Tables 11 through 14 should include effluent temperature limits based on critical low flows in the receiving water. At pages 30-31, the TMDL failed to provide effluent temperature limits for the Juliaetta, Kendrick, and Bovill WWTPs based on Potlatch River flows below 10 cfs. These temperature limits should be included given data cited by DEQ that the minimum average monthly flow for the mouth of the Potlatch River near Spalding, ID is 0.131 cfs. As stated by DEQ at page 14 of the TMDL, "The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated." Accordingly, the load capacity for temperature must reflect critical low flow conditions in the Potlatch River.

Specifically, this TMDL should set effluent temperature limits based on dry conditions (0 cfs) in the Potlatch River. DEQ does not have flow data for the segments of the Potlatch River in which the WWTPs referenced above discharge. Consequently, DEQ based its temperature effluent limitations on flow data from the United States Geological Survey (USGS) gaging station 13341570 near the mouth of the Potlatch River. This gaging station is significantly down river from all three WWTPs, especially from Bovill's. Therefore, it's likely that the water segments of the Potlatch River directly below the effluent outfalls of the facilities cited at Table 10 contain lower flows compared to the flows recorded at the USGS gaging station. Moreover, the minimum flow calculated by DEQ is the minimum *average* monthly flow for August 2015, which means that flow rates in the Potlatch River drop below 0.131 cfs.

Response: Tables 11 through 14 are used for illustrative purposes and effluent temperatures presented in them do not represent temperature limits. However, the tables have been updated to reflect lower flow conditions. The maximum effluent temperature (°C) would be that which would increase receiving water temperature by 0.3 °C after complete mixing when the receiving water meets the appropriate temperature criteria.

Comment 2: Temperature data for the point sources referenced in Table 10 of the TMDL should be located in the 2006 DMRs and should be evaluated to determine the WLA in this TMDL. At page 28, the TMDL states, "Temperature data for the point sources in Table 10 are not available within the discharge monitoring reports in EPA's Permit Compliance System and Integrated Compliance Information System (ICIS)." Although the ICIS online database may not report temperature data for the point sources in Table 10, each of these WWTPs have NPDES permits requiring the permittees to record effluent temperatures monthly, for one year, starting January 2006. Furthermore, these temperature data should be on hand at DEQ's Lewiston Regional office, as each of these NPDES permits required the permittees to submit their effluent monitoring results to DEQ's Lewiston Regional office. DEQ should obtain this temperature data and incorporate the data into the development of waste load allocations.

If DEQ cannot locate copies of this DMR data, DEQ should request the data from EPA, so the data can be incorporated into this TMDL.

Response: Temperature data from point sources is not needed to determine the temperature WLA as the WLA is based on numeric temperature criteria from Idaho's water quality standards. The discharger will be in compliance with their WLA if their discharge does not raise the receiving water temperature, after mixing, by more than 0.3 °C above the applicable temperature

criteria. Exceedances of the WLA will be addressed through the implementation process or by the appropriate permitting agency.

Comment 3: DEQ should acquire current design flow rates for each of the point sources in Table 10 of the TMDL and ensure that the TMDL reflects effluent limitations that consider current conditions. At page 28, the TMDL states, "Design flow rates for each facility were found in that facility's NPDES permit application and were used to create a range of discharge flows that could be expected." We are concerned that this sentence does not specifically identify the NPDES permit from which DEQ found the design flow rates for each point source. Our concern is based on the fact that each of the WWTPs in Table 10 are operating according to administratively extended NPDES permits, one of which expired in 2009 while the other two expired in 2010. As a result, the NPDES permits consulted by DEQ may not reflect any changes to the design flow rates of these facilities over the last 7-8 years. In lieu of more current permits, DEQ should request current design flow rate information directly from each WWTP and ensure that the TMDL is based on current operations. This should be reflected in a revised TMDL.

Obtaining the existing flow rates of each of the WWTP facilities is critical because these facilities can and do operate above the design flow. At page A-2 of the Factsheet related to the Bovill WWTP NPDES permit, the Factsheet indicates that the facility discharges well above the design flow. This Factsheet is over seven years old, so the Bovill facility may be presently operating even further beyond its design flow.

Response: The facilities' design flow rates are not needed to calculate the WLA. The allowable daily effluent discharge temperature is that which would not exceed the applicable temperature criteria by more than 0.3 °C after mixing. Tables 11 through 14 illustrate a range of effluent discharge rates and are intended to be used as an example and should not be construed as the WLA.

Comment 4: The TMDL should provide more detail and explanation of the Waste Load Allocation and the point source effluent restrictions. We are concerned that the 2017 TMDL does not sufficiently identify and explain how and why changes were made to the Waste Load Allocation as determined in the 2008 TMDL. The Waste Load Allocation is presented in the 2008 TMDL in a different way than the 2017 TMDL, and we request DEQ present its rationale for the changes. In addition, the 2017 TMDL does not include an explanation of how individual waste load allocations were calculated. This should be incorporated into a revised version of the 2017 TMDL.

In addition, the 2017 TMDL should specifically explain how effluent temperature limitations are set for each regulated WWTP in the Potlatch River Watershed. As the TMDL is currently drafted, it does not explain how a WWTP's effluent is limited for temperature if Potlatch River flows are 20 cfs, or 50 cfs, or 120 cfs because Tables 11 and 12 only calculate the effluent temperature limitations for Potlatch River flow rates at 10, 100, 250 cfs and so on.

Response: The WLA is based on numeric temperature criteria from Idaho's water quality standards and has not changed in this TMDL. The calculation used to illustrate a range of allowable maximum effluent temperature in Tables 11 through 14 is the same that was used in the *Potlatch River Subbasin Assessment and TMDLs* (DEQ 2008). Tables 11 through 14 are meant to serve as an example of potential allowable maximum effluent temperature. Permitted

point source dischargers should use the calculation to calculate their actual allowable maximum effluent temperature using their own effluent temperature, effluent flow, and stream flow data.

Comment 5: DEQ must revise the 2017 TMDL and open an additional 30-day public comment period. The deficiencies in the 2017 TMDL noted above concern critical components of this TMDL, which determine how the TMDL will be understood, implemented, and enforced. ICL and other interested parties cannot adequately review and comment on this TMDL without knowing how DEQ will revise it per the comments we have outlined here. Accordingly, we request DEQ reissue a revised draft of the 2017 TMDL and open a new 30-day public comment period.

Response: DEQ added revisions to the TMDL and there was an additional 30-day opportunity to comment from February 16, 2018, through March 19, 2018.

Appendix G. Distribution List

Clearwater Basin Advisory Group

Potlatch River Watershed Advisory Group

Department of Environmental Quality – State Office

Department of Environmental Quality – Lewiston Regional Office

US Environmental Protection Agency, Idaho Operations Office

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