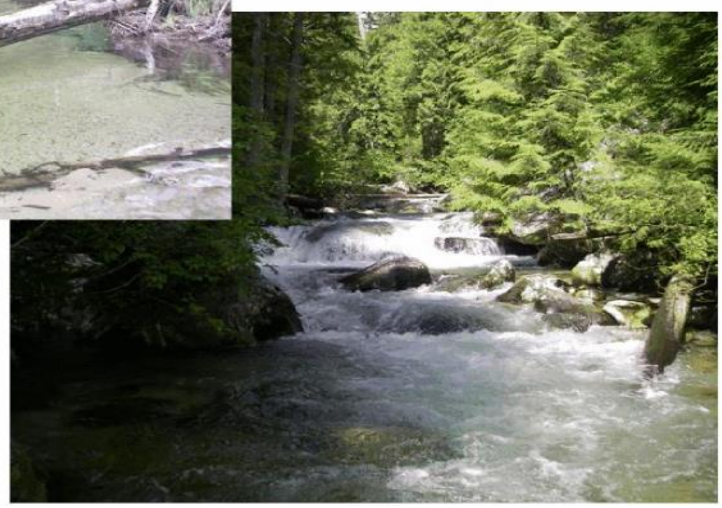
Priest River Subbasin Assessment and Total Maximum Daily Load

2016 Temperature Addendum

Hydrologic Unit Code 17010215



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The cover photos were taken by Tyson Clyne (Idaho Department of Environmental Quality [DEQ]) during field validation of existing shade estimates of Lion and Indian Creeks.

This document could not have been completed without help from Mark Shumar and Jessica De Varona from DEQ's Technical Services Division. Existing shade estimates were field verified by Valena Berry and Tyson Clyne from the DEQ Coeur d'Alene Regional Office.

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Abbreviations, Acronyms, and Symbols

§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
§	section (usually a section of federal or state rules or statutes)
ARU	aquatic response unit
AU	assessment unit
BLM	US Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
CGP	Construction General Permit
CW	cold water
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DMA	designated management agency
DO	dissolved oxygen
DWS	domestic water supply
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
FPA	Idaho Forest Practices Act
FS	fully supporting
GIS	geographic information system
IDAPA	Refers to citations of Idaho administrative rules
IDL	Idaho Department of Lands
kWh	kilowatt hours
LA	load allocation
LiDAR	Light Detection And Ranging
LC	load capacity
m^2	square meters
MDAT	maximum daily average temperature
MDMT	maximum daily maximum temperature
mg/L	milligrams per liter
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer systems
MSGP	Multi-Sector General Permit
MWMT	maximum weekly maximum temperature
n.a.	not applicable
n.e.	not evaluated
NAIP	National Agriculture Imagery Program

NB natural background

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NREL National Renewable Energy Laboratory

NTU nephelometric turbidity unit

PCR primary contact recreation

PNV potential natural vegetation

SCR secondary contact recreation

SFI DEQ's Stream Fish Index

SHI DEQ's Stream Habitat Index

SMI DEQ's Stream Macroinvertebrate Index

SS salmonid spawning

SWMP stormwater management program

SWPPP stormwater pollution prevention plan

TMDL total maximum daily load

USC United States Code

USFS US Forest Service

USFWS US Fish and Wildlife Service

VRU vegetation response unit

WAG watershed advisory group

WLA wasteload allocation

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 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. 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 must be published every 2 years. 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 21 water bodies (28 assessment units [AUs]) in the Priest River subbasin that have been placed in Category 5 of Idaho's federally-approved 2012 Integrated Report (DEQ 2014) as a result of exceedances of the Idaho water quality standards for temperature. In 2001 and 2003, the US Environmental Protection Agency (EPA) approved TMDLs that addressed sediment and temperature impairments in the subbasin. The temperature-impaired streams have been reevaluated in this analysis because of new techniques in temperature TMDL development. The previous TMDLs relied on a mathematical equation to prescribe shade based on elevation to achieve a desired stream temperature. Due to the elevation of the watersheds analyzed, the shade requirements in most locations exceeded 100%. Complete stream shade is not achievable in a natural setting, so those streams addressed by the earlier TMDL have been reevaluated in this document using potential natural vegetation (PNV) methods as detailed in Shumar and De Varona (2009).

Elevated stream temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with coldwater species being the least tolerant of high water temperatures. Elevated stream temperatures can also be harmful to aquatic invertebrates, amphibians, and mollusks, although less is known about these effects.

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Priest River subbasin, located in the Idaho Panhandle. For more detailed information about the subbasin and previous TMDLs, see the *Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001).

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.

Subbasin at a Glance

The Priest River subbasin (hydrologic unit code 17010215) is located in the northwest corner of the Idaho Panhandle adjacent to the state of Washington and Canadian border (Figure A). Landownership within the subbasin is mixed with majority of land owned and managed by Idaho and the US Forest Service. The majority of the lower portion of the watershed is privately owned land. Other tracts of privately owned land occur near Nordman, Coolin, and the lower reaches of Lamb Creek.

Thirty AU-pollutant combinations are included in Category 5 of Idaho's 2012 Integrated Report (DEQ 2014) (Figure A; Table A). The majority of AU-pollutant combinations are associated with exceedances of Idaho water quality temperature criteria.

Other listed pollutants include combined biota/bioassessment, fishes bioassessment, *Escherichia coli* (*E. coli*), and fecal coliform.

For more information about the Priest River subbasin, see the *Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001).

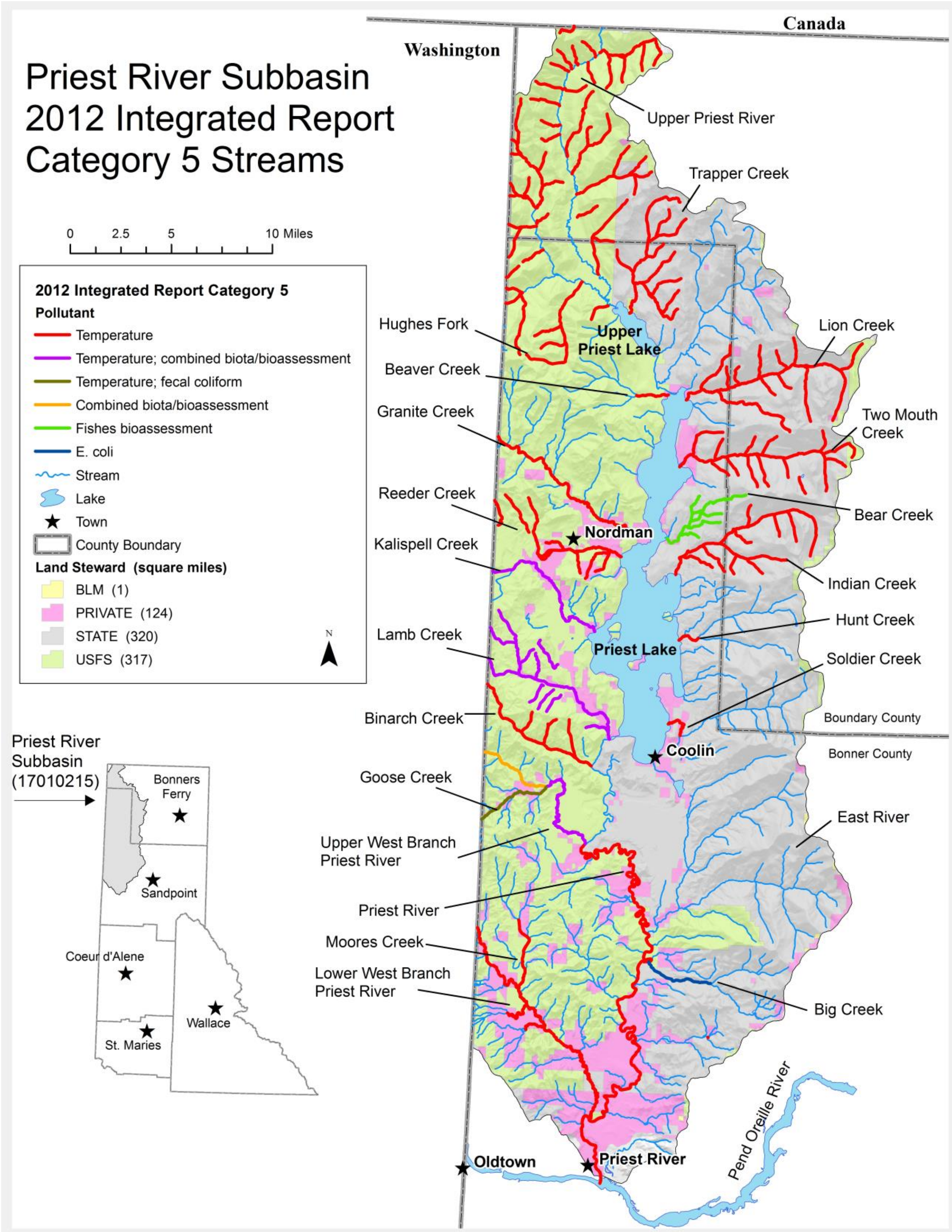

Figure A. Subbasin at a glance.

Table A. Priest River subbasin 2012 Integrated Report Category 5 streams.

Assessment Unit Name	Assessment Unit Number	Pollutants
Lower Priest River—Upper West Branch Priest River to mouth	ID17010215PN001 _05	Temperature
Big Creek—source to mouth	ID17010215PN002_03	*E. coli*
Soldier Creek—source to mouth	ID17010215PN008_03	Temperature
Hunt Creek	ID17010215PN009_03	Temperature
Indian Creek—source to mouth	ID17010215PN010_02	Temperature
Indian Creek	ID17010215PN010_03	Temperature
Bear Creek—source to mouth	ID17010215PN011_02	Fishes bioassessment
Two Mouth Creek—source to mouth	ID17010215PN012_02	Temperature
Lion Creek—source to mouth	ID17010215PN013_02	Temperature
Trapper Creek—source to mouth	ID17010215PN017_02	Temperature
Trapper Creek—source to mouth	ID17010215PN017_03	Temperature
Upper Priest River—ID/Canadian border to mouth	ID17010215PN018_02	Temperature
Hughes Fork—source to mouth	ID17010215PN019_02	Temperature
Beaver Creek—source to mouth	ID17010215PN020_03	Temperature
Granite Creek—ID/WA border to mouth	ID17010215PN022_04	Temperature
Reeder Creek—source to mouth	ID17010215PN023_02	Temperature
Reeder Creek—source to mouth	ID17010215PN023_03	Temperature
Kalispell Creek—ID/WA border to mouth	ID17010215PN024_03	Temperature; combined biota/habitat bioassessment
Lamb Creek—ID/WA border to mouth	ID17010215PN025_02	Temperature; combined biota/habitat bioassessment
Binarch Creek—ID/WA border to mouth	ID17010215PN026_02	Temperature
Upper West Branch Priest River—ID/WA to Goose Creek	ID17010215PN027_03	Combined biota/habitat bioassessment
Upper West Branch Priest River—ID/WA border to mouth	ID17010215PN027_04	Temperature; combined biota/habitat bioassessment
Goose Creek—ID/WA border to mouth	ID17010215PN028_03	Temperature; fecal coliform
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_03	Temperature
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_04	Temperature
Moores Creek	ID17010215PN031_03	Temperature

In 2001, the Idaho Department of Environmental Quality (DEQ) conducted a subbasin assessment and developed TMDLs to address excess sediment impairment in Kalispell Creek and the lower West Branch Priest River (DEQ 2001). A TMDL addendum was developed by DEQ in 2003. The addendum addressed additional sediment-impaired waters, and temperature

TMDLs were developed for the main stem East River, Middle Fork East River, and North Fork East River (DEQ 2003). Twelve AUs are addressed in the TMDL and TMDL addendum that were approved by EPA in 2001 and 2003, respectively (Table B). Following EPA approval, the AU-pollutant combinations were placed in Category 4a of Idaho's 2012 Integrated Report (Figure B).

Table B. Assessment unit-pollutant combinations addressed in the 2000 and 2003 EPA-approved TMDLs currently in Category 4a (has a TMDL) of the 2002 Integrated Report.

Stream Name	Assessment Unit Number	Pollutants
Lower Priest River	ID17010215PN001_05	Sediment
Middle Fork East River	ID17010215PN003_02	Temperature
Middle Fork East River	ID17010215PN003_03	Temperature
Main stem East River	ID17010215PN003_04	Sediment and temperature
North Fork East River	ID17010215PN004_02	Temperature
North Fork East River	ID17010215PN004_03	Temperature
Reeder Creek	ID17010215PN023_02	Sediment
Reeder Creek	ID17010215PN023_03	Sediment
Kalispell Creek	ID17010215PN024_03	Sediment
Binarch Creek	ID17010215PN026_02	Sediment
Lower West Branch Priest River	ID17010215PN030_03	Sediment
Lower West Branch Priest River	ID17010215PN030_04	Sediment

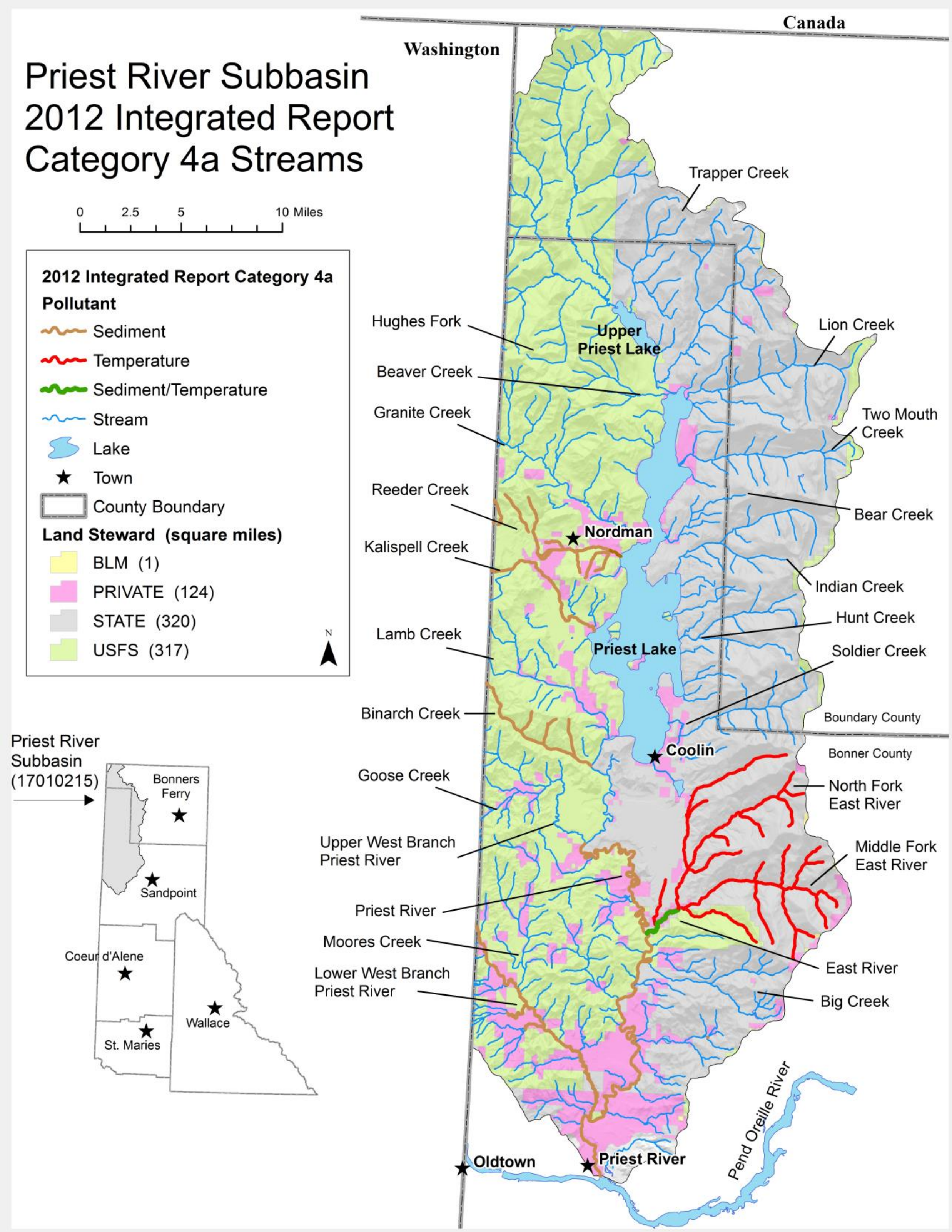

Figure B. Priest River subbasin 2012 Integrated Report Category 4a streams.

Key Findings

DEQ established effective shade targets for §303(d) waters and all tributary waters identified as having temperature impairment based on the concept of maximum shading under PNV. Shade targets were derived from effective shade curves developed by DEQ and EPA for Idaho Panhandle vegetation types. DEQ estimated existing shade from aerial photo interpretation, and the accuracy of the aerial photo interpretations were field verified with a Solar Pathfinder at ten sites scattered throughout the subbasin. Depending on the magnitude of error between measured shade and estimated shade, the estimated shade value was adjusted to reflect the measured shade value or remained unchanged.

The eastside drainages, such as Trapper, Lion, Two Mouth, and Indian Creeks and East River, originate high on the Selkirk Crest above Priest Lake. This high elevation rocky terrain is subject to heavy snows and wind that result in reduced vegetation stature. The forests in this region are often reduced in height and cover compared to lower elevation forests. DEQ produced a specific shade curve for these Rocky/High Elevation areas from forest data collected by LiDAR images of four unharvested headwater locations. Average canopy cover and average height data from LiDAR results were used to calculate shade targets.

Additionally, stream locations are scattered throughout low elevation areas around the lake where the riparian community is dominated by thinleaf alder meadows. In those locations (Trapper, Lion, Two Mouth, Snow, Soldier, Lamb, Reeder, and Floss Creeks and East River), DEQ used an alder shade curve from Shumar and De Varona (2009) for shade targets.

Existing and PNV shade was converted to solar loads from data collected on flat-plate collectors at the Spokane, Washington, National Renewable Energy Laboratory weather station. The difference between existing and target solar load, assuming existing load is higher, is the load reduction necessary to bring a stream back into compliance with water quality standards. PNV shade and associated target solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (so long as there are no point sources or any other anthropogenic sources of heat in the watershed) and are considered to be consistent with the Idaho water quality standards.

Most AUs examined lack shade and have excess solar loads as a result. Some AUs have relatively low excess loads with needed reductions varying from 1%–19%. Others have considerably larger excess loads. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should key in on the largest differences between existing and target shade as locations to prioritize implementation efforts.

As part of the subbasin assessment process, recent data were reviewed to reevaluate the appropriateness of causes of impairment by pollutants other than temperature. As a result of this TMDL assessment, recommendations for changes in Integrated Report category listings were made (Table C). Twenty-three AUs are recommended to be moved to Category 4a of Idaho's next Integrated Report. Five AUs with updated temperature TMDLs using the PNV methods will remain in Category 4a. Combined biota/habitat bioassessment is recommended to be removed as a pollutant for two AUs because temperature is the cause of impairment. Recent data indicate that Big Creek is not impaired by *E. coli,* and it is recommended for delisting.

Table C. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Lower Priest River	ID17010215PN001_05	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Big Creek—source to mouth	ID17010215PN002_03	*E. coli*	No	Move to 2	Recent data suggests no impairment
Middle Fork East River	ID17010215PN003_02 ID17010215PN003_03	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method
East River	ID17010215PN003_04	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method
North Fork East River	ID17010215PN004_02 ID17010215PN004_03	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method
Soldier Creek	ID17010215PN008_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Hunt Creek	ID17010215PN009_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Indian Creek	ID17010215PN010_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Indian Creek	ID17010215PN010_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Two Mouth Creek	ID17010215PN012_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lion Creek	ID17010215PN013_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Trapper Creek	ID17010215PN017_02 ID17010215PN017_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Upper Priest River	ID17010215PN018_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Hughes Fork	ID17010215PN019_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Beaver Creek	ID17010215PN020_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Granite Creek	ID17010215PN022_04	Temperature	Yes	Move to 4a	Excess solar Load from lack of shade
Reeder Creek	ID17010215PN023_02 ID17010215PN023_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Kalispell Creek	ID17010215PN024_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Kalispell Creek	ID17010215PN024_03	Combined biota/habitat bioassessment	No	Remove as a pollutant	Cause of impairment is temperature
Lamb Creek	ID17010215PN025_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lamb Creek	ID17010215PN025_02	Combined biota/habitat bioassessment	No	Remove as a pollutant	Cause of impairment is temperature
Binarch Creek	ID17010215PN026_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Upper West Branch Priest River	ID17010215PN027_03	Combined biota/habitat bioassessment	No	None	Insufficient data; additional pollutants cannot be ruled out
Upper West Branch Priest River	ID17010215PN027_04	Temperature	Yes	Move to 4a	Excess solar load from lack of shade

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Upper West Branch Priest River	ID17010215PN027_04	Combined biota/habitat bioassessment	No	None	Insufficient data; additional pollutants cannot be ruled out
Goose Creek	ID17010215PN028_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lower West Branch Priest River	ID17010215PN030_03 ID17010215PN030_04	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Moores Creek	ID17010215PN031_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade

Public Participation

The Priest River subbasin Watershed Advisory Group (WAG) started meeting in November 2011. Executive appointment letters were sent out by DEQ in March 2013, and the WAG has been meeting monthly since April 2013. The WAG represents a diverse group of people and interests. Each diverse group has had a voice in the process and in the recommendations developed in the TMDL. The WAG has been, and will continue to be, open to all interested parties.

During development of the Priest River temperature TMDL, numerous public meetings were held to engage, inform, and solicit information from diverse groups. Some meetings focused on information sharing by state employees with expertise of interest to the WAG. In other meetings, maps were presented highlighting stream reaches that appeared to lack shade and could possibly have elevated stream temperatures. The WAG reviewed the maps and identified corrections to the DEQ staff. DEQ staff solicited and received comments from the WAG on the draft TMDL narrative.

As the WAG process continues, DEQ and the WAG will support engaging all interested persons to further the WAG goals to improve stream temperature in the Priest River subbasin. The DEQ will pursue outreach and coordination as opportunities are presented.

Introduction

This document addresses 21 water bodies in the Priest River subbasin that have been placed in Category 5 of Idaho's federally approved 2012 Integrated Report (DEQ 2014). The purpose of this total maximum daily load (TMDL) addendum is to characterize and document pollutant loads within the Priest River subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Priest River subbasin. The TMDL 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 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.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the US 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 Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The 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 Section 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 Subbasin Assessment—Watershed Characterization

1.1 Physical and Biological Characteristics

The Priest River subbasin is 981 square miles, primarily in the northwest corner of the Idaho Panhandle within Bonner and Boundary Counties. Headwaters of the upper Priest River originate within the Nelson Mountain Range of British Columbia. Headwaters of major streams on the western side of the basin originate in northeastern Washington. The subbasin is flanked on the east by the Selkirk Mountain range, and bordered on the west by the mountain crest separating the Kaniksu and Colville National Forests. Elevation within the subbasin ranges from 2,075 feet at the city of Priest River to more than 7,000 feet within the Selkirk Mountains.

Hydrologically, the subwatershed has four major complexes or divisions: (1) upper Priest River and its tributaries, (2) upper Priest Lake covering 1,338 acres and receiving upper Priest River and other tributaries (upper Priest Lake has a 2.7-mile outflow channel called *The Thoroughfare*, which drains to Priest Lake), (3) Priest Lake, which covers 23,300 acres and has numerous tributaries, and (4) lower Priest River, the outflow from Priest Lake, which flows 45 river miles to its confluence with the Pend Oreille River at the city of Priest River. Lower Priest River has several major tributaries.

1.1.1 Hydrological Characteristics

The Priest River subbasin has an abundance of tributaries with approximately 1,315 miles of perennial streams. Upper and lower Priest River flows north to south, while the aspects of most other tributaries are from east to west. Tributaries on the northern and eastern sides of the basin originate in the Selkirk Mountains, and a large percentage of their stream channels are moderate-to-steep-gradient channels flowing through deep V-shaped mountainous valleys. On the western side of the subbasin, from Reeder Creek down to lower West Branch Priest River, a large percentage of the stream lengths have gradual gradients (less than 1.5%) flowing through valley floodplains. Stream order and stream gradient maps for the subbasin are in Appendix A. For a more detailed description of the hydrological characteristics of the Priest River subbasin, refer to the *Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001).

1.1.2 Fisheries

Historically, four native salmonids have been reported in the Priest River subbasin: Westslope Cutthroat Trout (*Onchorhynchus clarki*), Bull Trout (*Salvelinus confluentus*), Mountain Whitefish (*Prosopium williamsoni*), and Pygmy Whitefish (*Prosopium coulterii*).

In 1998, the US Fish and Wildlife Service (USFWS) listed Bull Trout as threatened under the federal Endangered Species Act. Westslope Cutthroat Trout is considered a species of special concern by Idaho, and a *sensitive species* by Region 1 of the US Forest Service (USFS). Cutthroat Trout can be found in most tributaries in the basin, but the current range of Bull Trout is limited, primarily found in streams of the northern one-third of the subbasin and upper Priest Lake.

The upper Priest Lake and Priest River watersheds have been identified as key Bull Trout watersheds in the State of Idaho Bull Trout Conservation Plan (Batt 1996). EPA identified streams protected for Bull Trout spawning and rearing (40 CFR §131.33 Idaho; section 2.3.1, Figure 4), and in September 2010, the USFWS identified the Priest River subbasin as critical habitat for Bull Trout (USFWS 2010).

For more information on the physical and biological characteristics and fisheries of the Priest River subbasin, refer to the *Priest River Subbasin Assessment and Total Maximum Daily Load* and *Addendum Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001 and 2003).

1.2 Cultural Characteristics

Landownership within the Priest River subbasin is illustrated in Figure 1. Over 85% of the subbasin is forested and is administered by state, federal, and Canadian provincial agencies. The majority of the land on the west side of the subbasin is the Idaho Panhandle National Forests, administered by the USFS Priest Lake Ranger District. The majority of the land on the east side of the subbasin is Idaho State Endowment Trust lands administered by the Idaho Department of Lands (IDL). These public lands are managed primarily for timber production, but some lands are special management areas (including experimental forests and recreation areas), research natural areas, federal grazing allotments, and some land is leased for cabin and business development.

For more information on the cultural characteristics of the Priest River subbasin, refer to the *Priest River Subbasin Assessment and Total Maximum Daily Load* and *Addendum Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001 and 2003).

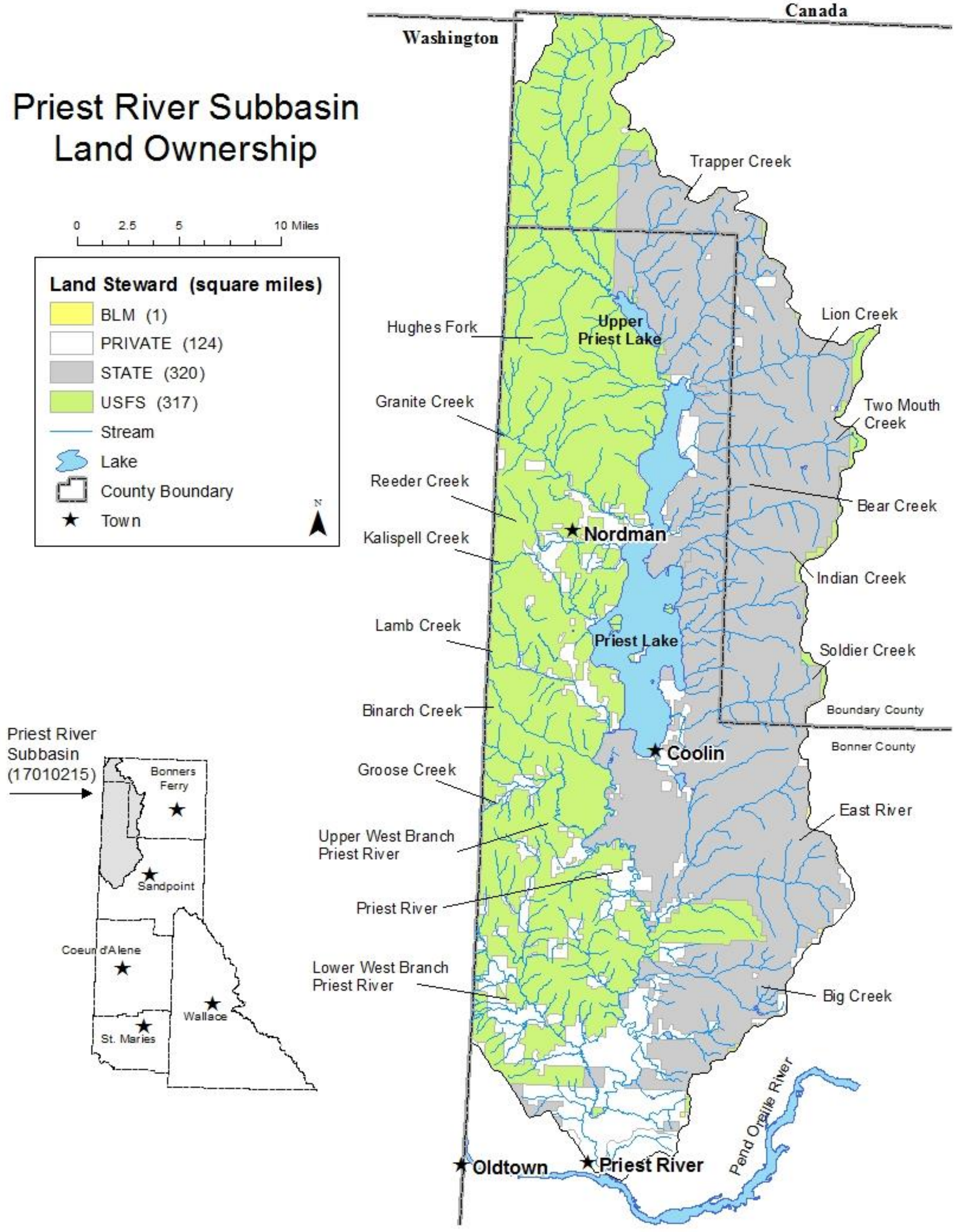

Figure 1. Priest River subbasin landownership.

2 Subbasin Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

2.1.1 Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management (Figure 2). Stream order, however, is the main basis for determining AUs—although ownership and land use can change significantly, the AU remains the same. The AUs and methodology used to describe them are found in the *Water Body Assessment Guidance* (Grafe et al 2002).

Using AUs to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of EPA's §305(b) report, a component of the CWA wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, a direct tie is established to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

However, the framework of using AUs for reporting and communicating needs to be reconciled with the legacy of §303(d)-listed streams. Due to the nature of the court-ordered 1994 §303(d) listings, and the subsequent 1998 §303(d) list, all segments were added with boundaries from "headwater to mouth." To deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the watershed scale (hydrologic unit code), so that all the waters in the drainage are and have been considered for TMDL purposes since 1994.

The boundaries from the 1998 §303(d)-listed segments were transferred to the AU framework using an approach similar to how DEQ has been writing subbasin assessments and TMDLs. All AUs contained in the listed segment were carried forward to the 2002 §303(d) listings in Category 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the §303(d) list. This was necessary to maintain the integrity of the 1998 §303(d) list and to maintain continuity with the TMDL program.

When assessing new data that indicate full support, only the AU that the monitoring data represent will be removed (delisted) from the §303(d) list (Category 5 of the Integrated Report).

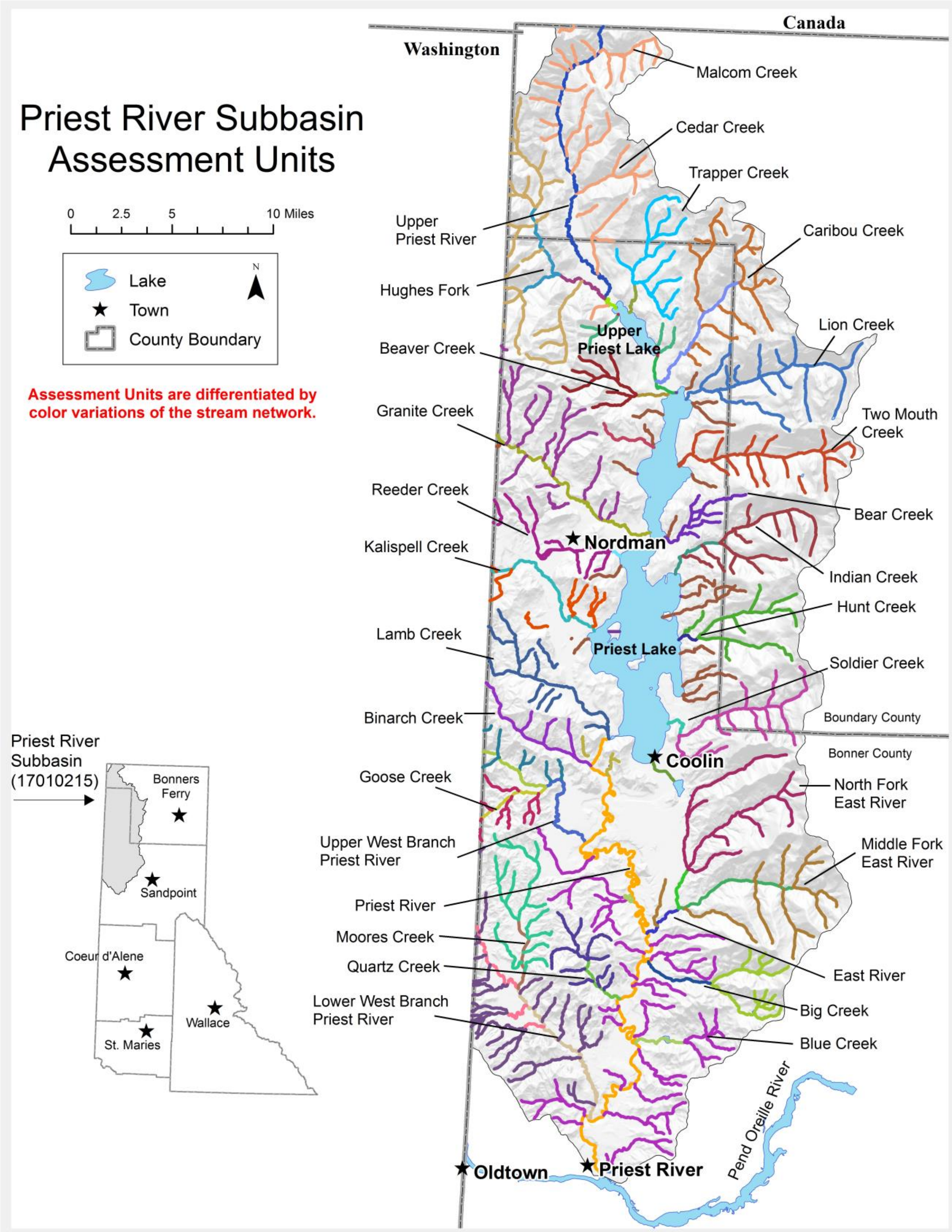

Figure 2. Priest River subbasin assessment units.

2.1.2 Listed Waters

Impaired water bodies that do not meet applicable water quality standards for one or more beneficial uses by one or more pollutants are placed in on Idaho's §303(d) list to meet the requirements of the CWA (Category 5 of the Integrated Report). Waters can only be removed from Category 5 by having either an EPA-approved TMDL or EPA approval to remove based on good cause. Twenty-six AUs are included in Category 5 of Idaho's 2012 Integrated Report with the majority of exceedances to Idaho's water quality temperature criteria.

Analyses of historical temperature data collected from streams within the Priest River subbasin indicate Idaho water quality standards for temperature were exceeded in 22 streams (29 AUs) and their tributaries. Table 1 provides a summary of the listing history of temperature-impaired water bodies in the Priest River subbasin. Table 2 provides other listed pollutants including combined biota/habitat bioassessment, fish bioassessment, *Escherichia coli* (*E. coli*), and fecal coliform.

Table 1. Water quality listing history of temperature-impaired water bodies in the Priest River subbasin.

Assessment Unit Name	Assessment Unit Number	1998	2002	2008	2010	2012
Lower Priest River—Upper West Branch Priest River to mouth	ID17010215PN001_05		X	X	X	X
Middle Fork East River	ID17010215PN003_02		X	X	X	X
Middle Fork East River	ID17010215PN003_03		X	X	X	X
East River	ID17010215PN003_04		X	X	X	X
North Fork East River	ID17010215PN004_02				X	X
North Fork East River—source to mouth	ID17010215PN004_03	X	X	X	X	X
Soldier Creek—source to mouth	ID17010215PN008_03	X	X	X	X	X
Hunt Creek—source to mouth	ID17010215PN009_03					X
Indian Creek—source to mouth	ID17010215PN010_02		X	X	X	X
Indian Creek—source to mouth	ID17010215PN010_03					X
Two Mouth Creek—source to mouth	ID17010215PN012_02	X	X	X	X	X
Lion Creek—source to mouth	ID17010215PN013_02	X	X	X	X	X
Trapper Creek—source to mouth	ID17010215PN017_02		X	X	X	X
Trapper Creek—source to mouth	ID17010215PN017_03		X	X	X	X
Upper Priest River—ID/Canadian border to mouth	ID17010215PN018_02		X	X	X	X
Hughes Fork—source to mouth	ID17010215PN019_02		X	X	X	X
Hughes Fork/Gold Creek	ID17010215PN019_03	X	X			
Beaver Creek—source to mouth	ID17010215PN020_03		X	X	X	X

Assessment Unit Name	Assessment Unit Number	1998	2002	2008	2010	2012
Granite Creek—ID/WA border to mouth	ID17010215PN022_04	X	X	X	X	X
Reeder Creek—source to mouth	ID17010215PN023_02	X	X	X	X	X
Reeder Creek—source to mouth	ID17010215PN023_03	X	X	X	X	X
Kalispell Creek—ID/WA border to mouth	ID17010215PN024_03	X	X	X	X	X
Lamb Creek—ID/WA border to mouth	ID17010215PN025_02		X	X	X	X
Binarch Creek—ID/WA border to mouth	ID17010215PN026_02		X	X	X	X
Upper West Branch Priest River—ID/WA border to mouth	ID17010215PN027_04		X	X	X	X
Goose Creek—ID/WA border to mouth	ID17010215PN028_03					X
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_03			X	X	X
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_04		X	X	X	X
Moores Creek—source to mouth	ID17010215PN031_03					X

Table 2. Priest River subbasin water bodies listed in Integrated Report Category 5 as impaired for other pollutants.

Assessment Unit Name	Assessment Unit Number	Pollutants
Big Creek—source to mouth	ID17010215PN002_03	*E. coli*
Bear Creek—source to mouth	ID17010215PN011_02	Fishes bioassessment
Kalispell Creek—ID/WA border to mouth	ID17010215PN024_03	Combined biota/bioassessment
Lamb Creek—ID/WA border to mouth	ID17010215PN025_02	Combined biota/bioassessment
Upper West Branch Priest River—ID/WA to Goose Creek	ID17010215PN027_03	Combined biota/bioassessment
Goose Creek—ID/WA border to mouth	ID17010215PN028_03	Fecal coliform

Category 4a of Idaho's Integrated Report lists waters with a TMDL completed and approved by the EPA. Thirteen AU-pollutant combinations are included in Category 4a of Idaho's 2012 Integrated Report (Table 3). These AUs have existing TMDLs covered either in the *Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001) or the *Addendum Priest River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2003). The temperature TMDLs are revised in this addendum using the potential natural vegetation (PNV) method.

Table 3. Priest River subbasin 2012 Integrated Report Category 4a streams.

Assessment Unit Name	Assessment Unit Number	Pollutant
Lower Priest River—Upper West Branch Priest River to mouth	ID17010215PN001_05	Sediment
Middle Fork East River	ID17010215PN003_02	Temperature
Middle Fork East River	ID17010215PN003_03	Temperature
East River	ID17010215PN003_04	Sediment and temperature
North Fork East River	ID17010215PN004_02	Temperature
North Fork East River	ID17010215PN004_03	Temperature
Reeder Creek—source to mouth	ID17010215PN023_02	Sediment
Reeder Creek—source to mouth	ID17010215PN023_03	Sediment
Kalispell Creek—ID/WA border to mouth	ID17010215PN024_03	Sediment
Binarch Creek—ID/WA border to mouth	ID17010215PN026_02	Sediment
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_03	Sediment
Lower West Branch Priest River—ID/WA border to mouth	ID17010215PN030_04	Sediment

2.2 Applicable Water Quality Standards

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 the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) 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 (swimming) or secondary (boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

2.2.1 Existing Uses

Existing uses under the CWA 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 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.

2.2.2 Designated Uses

Designated uses under the CWA 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.

2.2.3 Undesignated Surface Waters

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). These undesignated surface waters ultimately need to be designated for appropriate uses. In the interim, and absent information on existing uses, DEQ presumes most of these 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 cold water and recreation use 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 water 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.

2.2.4 Beneficial Uses in the Subbasin

Table 4 lists the beneficial uses of water bodies in the Priest River subbasin. Priest River subbasin has few designated beneficial uses. Designated waters are those identified in Idaho's water quality standards and include larger waters such as Upper Priest River, Upper Priest Lake, Priest Lake Thoroughfare, and Lower Priest River. The smaller water's beneficial uses have been determined through individual assessments and have been identified as presumed to exist. Generally, all waters in Priest River subbasin have cold water aquatic life, salmonid spawning, and a recreation beneficial as presumed uses.

Table 4. Priest River subbasin beneficial uses of examined streams.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Lower Priest River—Upper West Branch Priest River to mouth	ID17010215PN001_05	CW, PCR, DWS	Designated
Middle Fork East River	ID17010215PN003_02 ID17010215PN003_03	CW, SCR, SS	Presumed
East River	ID17010215PN003_04	CW, PCR, SS	Presumed
North Fork East River	ID17010215PN004_02 ID17010215PN004_03	CW, SCR, SS CW, SCR, SS	Presumed Presumed
Soldier Creek	ID17010215PN008_03	CW, PCR, SS	Presumed
Hunt Creek	ID17010215PN009_03	CW, SCR, SS	Presumed
Indian Creek	ID17010215PN010_02 ID17010215PN010_03	CW, SCR, SS CW, SCR, SS	Presumed Presumed
Two Mouth Creek	ID17010215PN012_02	CW, SCR, SS	Presumed
Lion Creek	ID17010215PN013_02	CW, SCR, SS	Presumed
Trapper Creek	ID17010215PN017_02 ID17010215PN017_03	CW, SCR, SS CW, PCR, SS	Presumed Presumed
Upper Priest River—ID/Canadian border to mouth	ID17010215PN018_02	CW, SS, PCR, DWS	Designated
Hughes Fork	ID17010215PN019_02	CW, SCR, SS	Presumed
Beaver Creek	ID17010215PN020_03	CW, SCR, SS	Presumed
Granite Creek	ID17010215PN022_04	CW, PCR, SS	Presumed
Reeder Creek	ID17010215PN023_02 ID17010215PN023_03	CW, SCR, SS CW, PCR, SS	Presumed Presumed
Kalispell Creek	ID17010215PN024_03	CW, PCR, SS	Presumed
Lamb Creek	ID17010215PN025_02	CW, SCR, SS	Presumed
Binarch Creek	ID17010215PN026_02	CW, SCR, SS	Presumed
Upper West Branch Priest River	ID17010215PN027_04	CW, PCR, SS	Presumed
Goose Creek	ID17010215PN028_03	CW, SCR, SS	Presumed
Lower West Branch Priest River	ID17010215PN030_03 ID17010215PN030_04	CW, SCR CW, PCR, SS	Presumed Presumed
Moores Creek	ID17010215PN031_03	CW, PCR, SS	Presumed

a. CW = cold water, SS = salmonid spawning, PCR= primary contact recreation, SCR = secondary contact recreation, DWS = domestic water supply

2.2.5 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 5). Water quality standards that apply to salmonid spawning are discussed in Appendix B.

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

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

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

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 3).

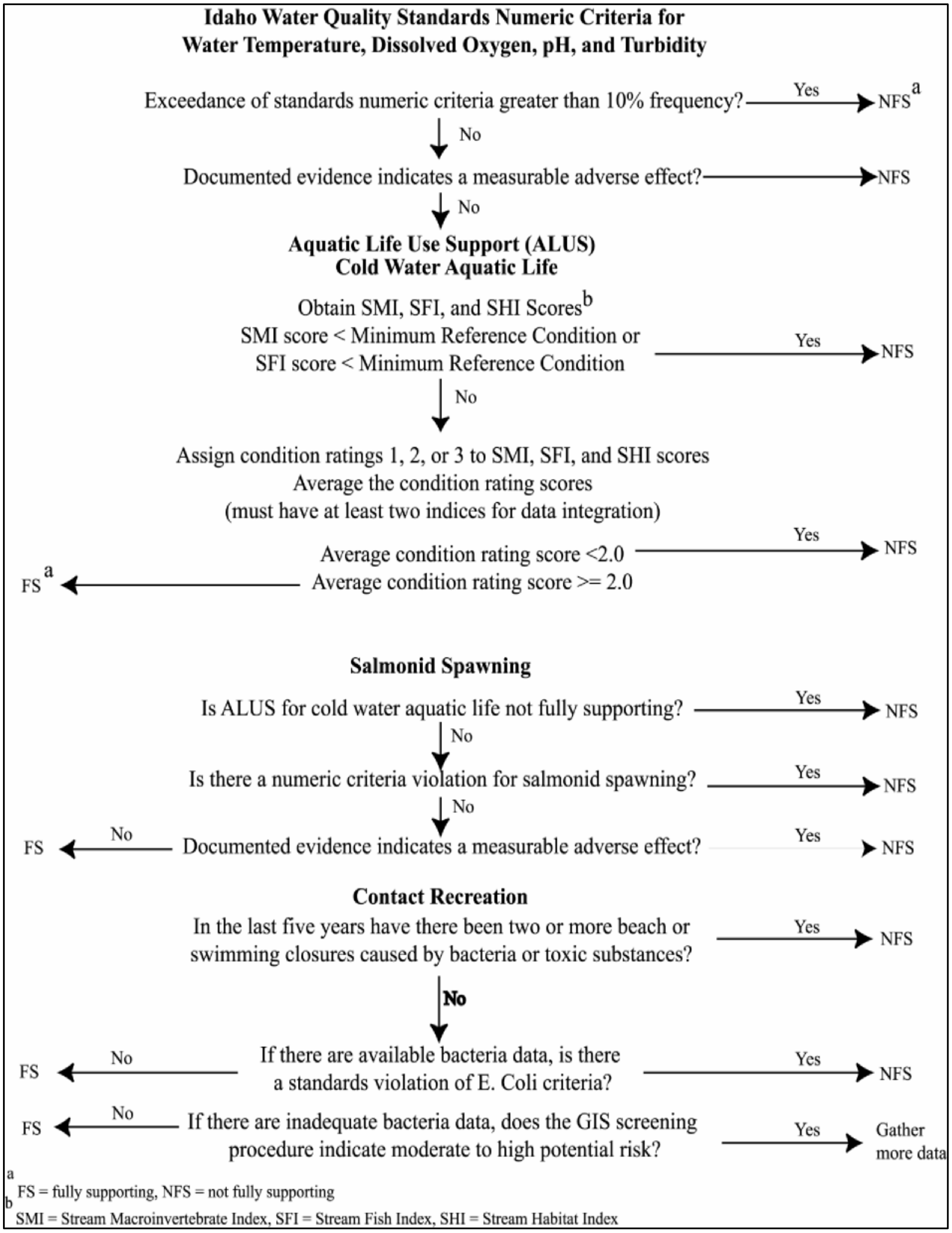

Figure 3. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 Summary and Analysis of Existing Water Quality Data

Temperature criteria for protection of cold water aquatic life and salmonid spawning beneficial uses were applied throughout the subbasin. Stream temperature data were collected and/or assessed following the completion of TMDLs in 2003. Stream temperature data loggers were deployed following the methodologies outlined by DEQ to ensure the data collected are representative of the location and to help eliminate sampling error (DEQ 2000) (Figure 4). The elevation at which the data logger was deployed was taken into consideration when evaluating the salmonid spawning windows. Future efforts to monitor stream water temperature should follow the same protocols.

2.3.1 Status of Beneficial Uses

Data were evaluated against the cold water aquatic life, spring and fall salmonid spawning, and bull trout criteria. Assessments found widespread exceedances of Idaho numeric water temperature criteria, particularly for salmonid spawning (Table 6). Data recorded within the subbasin did not exceed the cold water aquatic life beneficial use criteria; however, the salmonid spawning criteria are more protective (lower temperature) than the cold water aquatic life criteria. Therefore, when temperature data exceed the more protective criteria (salmonid spawning), the water body is assessed as impaired.

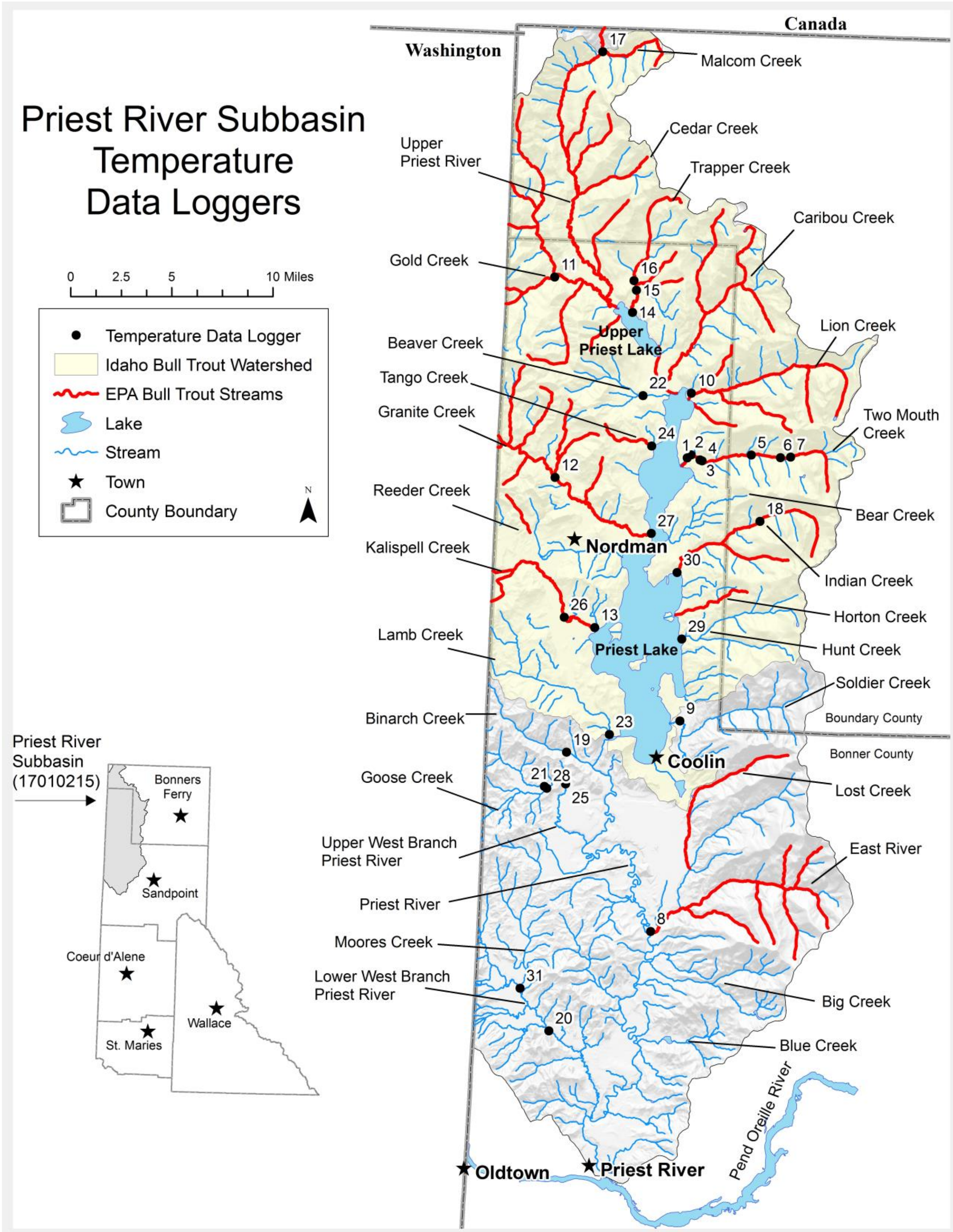

Figure 4. Priest River subbasin temperature data logger locations.

All AUs assessed in this document exceed the 13 °C maximum weekly maximum temperature and require TMDL development. Gold, Granite, Malcom, North Fork Indian, Beaver, and Tango Creeks do not exceed the salmonid spawning criteria. All creeks but North Fork Indian Creek fail either the Idaho Bull Trout criteria or federal Bull Trout criteria or both.

It is currently DEQ's policy to allow for minor exceedances of water quality temperature criteria when the exceedance occurs less than 10% of the critical time period and no other evidence of thermal inputs exists (Grafe et al. 2002). Exceptions are also made for water temperature exceedances that occur during periods when air temperatures exceed the 90th percentile of air temperatures recorded in the area (Grafe et al. 2002). The data evaluated in Table 6 and Table 7 exceed the salmonid spawning criteria by more than 10%.

Table 6. Temperature data evaluated in the Priest River subbasin.

Stream Name	Assessment Unit Number	Map ID	Temperature Logger ID	Number of Spring Spawning Dates Evaluated	Percent Exceedance of Spring Spawning Dates (%)	Number of Fall Spawning Dates Evaluated	Percent Exceedance of Fall Spawning Dates (%)
					13 °C MWMT[a]		13 °C MWMT[a]
Two Mouth Creek 1	ID17010215PN012_02	1	1996SCDATL0005	0	0	61	39
Two Mouth Creek 2	ID17010215PN012_02	2	1996SCDATL0006	0	0	61	21
Two Mouth Creek 3	ID17010215PN012_02	3	1996SCDATL0007	0	0	61	26
Two Mouth Creek 4	ID17010215PN012_02	4	1996SCDATL0008	0	0	61	21
Two Mouth Creek 5	ID17010215PN012_02	5	1996SCDATL0009	0	0	61	16
Two Mouth Creek 6	ID17010215PN012_02	6	1996SCDATL0010	0	0	61	10
Two Mouth Creek 7	ID17010215PN012_02	7	1996SCDATL0011	13	69	61	2
East River	ID17010215PN003_04	8	1997SCDATL0009	0	0	69	57
Soldier Creek[b]	ID17010215PN008_03	9	1997SCDATL0010	0	0	69	49
Lion Creek	ID17010215PN013_02	10	1997SCDATL0011	0	0	69	35
Gold Creek	ID17010215PN019_03	11	1997SCDATL0012	0	0	69	3
Granite Creek	ID17010215PN022_04	12	1997SCDATL0013	0	0	69	4
Kalispell Creek	ID17010215PN024_03	13	1997SCDATL0014	0	0	69	26
Trapper Creek 1	ID17010215PN017_03	14	1998SCDATL0043	26	81	66	61
Trapper Creek 2	ID17010215PN017_03	15	1998SCDATL0044	26	73	66	58
Trapper Creek 3	ID17010215PN017_02	16	1998SCDATL0045	26	46	66	44
Malcom Creek	ID17010215PN018_02	17	1999SCDATL0053	0	0	54	4
North Fork Indian Creek	ID17010215PN010_02	18	1999SCDATL0054	0	0	51	2
Binarch Creek[b]	ID17010215PN026_02	19	2000SCDATL0002	8	100	76	58
Lower West Branch Priest River[b]	ID17010215PN030_04	20	2000SCDATL0019	8	100	63	46
Upper West Branch Priest River[b]	ID17010215PN027_03	21	2000SCDATL0031	8	100	63	60
Beaver Creek	ID17010215PN020_03	22	2001SCDATL0007	0	0	72	0

Stream Name	Assessment Unit Number	Map ID	Temperature Logger ID	Number of Spring Spawning Dates Evaluated	Percent Exceedance of Spring Spawning Dates (%)	Number of Fall Spawning Dates Evaluated	Percent Exceedance of Fall Spawning Dates (%)
					13 °C MWMT[a]		13 °C MWMT[a]
Lamb Creek	ID17010215PN025_02	23	2001SCDATL0014	0	0	72	33
Tango Creek	ID17010215PN021_02	24	2001SCDATL0020	0	0	72	0
Upper West Branch Priest River[b]	ID17010215PN027_04	25	2001SCDATL0021	0	0	72	64
Kalispell Creek	ID17010215PN024_03	26	2001SCDATL0024	0	0	72	49
Granite Creek	ID17010215PN022_04	27	2001SCDATL0030	0	0	72	42
Goose Creek	ID17010215PN028_03	28	2011SKTTL0001	62	49	74	26
Hunt Creek	ID17010215PN009_03	29	2011SKTTL0002	62	0	93	0
Indian Creek	ID17010215PN010_03	30	2011SKTTL0003	62	1	74	1
Moores Creek	ID17010215PN031_03	31	2011SKTTL0004	62	6	87	26

a. MWMT = maximum weekly maximum temperature
b. Assessment unit not within state or federal Bull Trout watershed

Table 7. Bull Trout temperature criteria evaluation for temperature data loggers located in Bull Trout watersheds.

Stream Name	Assessment Unit Number	Map ID	Temp Logger ID	Idaho Criteria				Federal Criteria	
				Number of Rearing Days Evaluated	Percent Exceedance Rearing Days (%) 13 °C MWMT[a]	Number of Spawning Days Evaluated	Percent Exceedance of Fall Spawning Days (%) 9 °C MDAT[b]	Number of Days Evaluated	Percent Days Exceeding 10 °C MWMT[a] (%)
Two Mouth Creek 1	ID17010215PN012_02	1	1996SCDATL0005	31	84	30	43	68	74
Two Mouth Creek 2	ID17010215PN012_02	2	1996SCDATL0006	31	74	30	47	68	75
Two Mouth Creek 3	ID17010215PN012_02	3	1996SCDATL0007	31	77	30	50	68	75
Two Mouth Creek 4	ID17010215PN012_02	4	1996SCDATL0008	31	61	30	40	68	71
Two Mouth Creek 5	ID17010215PN012_02	5	1996SCDATL0009	31	42	30	37	68	60
Two Mouth Creek 6	ID17010215PN012_02	6	1996SCDATL0010	31	10	30	30	68	47
Two Mouth Creek 7	ID17010215PN012_02	7	1996SCDATL0011	31	6	30	13	68	34
East River	ID17010215PN003_04	8	1997SCDATL0009	n.a.	n.a.	n.a.	n.a.	48	90
Lion Creek	ID17010215PN013_02	10	1997SCDATL0011	18	89	53	42	48	71
Gold Creek	ID17010215PN019_03	11	1997SCDATL0012	18	0	53	30	48	60
Granite Creek	ID17010215PN022_04	12	1997SCDATL0013	18	0	53	28	48	58
Kalispell Creek	ID17010215PN024_03	13	1997SCDATL0014	18	78	53	51	48	65
Trapper Creek 1	ID17010215PN017_03	14	1998SCDATL0043	31	100	35	77	111	79
Trapper Creek 2	ID17010215PN017_03	15	1998SCDATL0044	31	100	35	91	111	79
Trapper Creek 3	ID17010215PN017_02	16	1998SCDATL0045	31	68	35	80	111	77
Malcom Creek	ID17010215PN018_02	17	1999SCDATL0053	31	0	23	0	63	49
North Fork Indian Creek	ID17010215PN010_02	18	1999SCDATL0054	31	0	20	0	60	2
Tango Creek	ID17010215PN021_02	24	2001SCDATL0020	31	0	41	29	75	43
Beaver Creek	ID17010215PN020_03	22	2001SCDATL0007	31	0	41	39	n.a.	n.a.
Lamb Creek	ID17010215PN025_02	23	2001SCDATL0014	31	74	41	46	n.a.	n.a.

Stream Name	Assessment Unit Number	Map ID	Temp Logger ID	Idaho Criteria				Federal Criteria	
				Number of Rearing Days Evaluated	Percent Exceedance Rearing Days (%) 13 °C MWMT[a]	Number of Spawning Days Evaluated	Percent Exceedance of Fall Spawning Days (%) 9 °C MDAT[b]	Number of Days Evaluated	Percent Days Exceeding 10 °C MWMT[a] (%)
Kalispell Creek	ID17010215PN024_03	26	2001SCDATL0024	31	100	41	68	75	95
Granite Creek	ID17010215PN022_04	27	2001SCDATL0030	31	100	41	68	75	83
Hunt Creek	ID17010215PN009_03	29	2011SKTTL0002	92	14	61	20	n.a.	n.a.
Indian Creek	ID17010215PN010_03	30	2011SKTTL0003	92	0	57	37	n.e.	n.e.

Notes: n.a. = not applicable, n.e.= not evaluated
a. MWMT = maximum weekly maximum temperature
b. MDAT = maximum daily average temperature

2.3.2 Data Gaps

Due to time and budget constraints, data were not collected for every stream in the Priest River subbasin. Instead, DEQ used as much data as they could from a wide variety of sources. All data were reviewed by DEQ to ensure quality and consistency. Data collected that did not follow DEQ's protocol were not used for this TMDL. The watershed advisory group (WAG) is fully aware of the limited data and is receptive to additional field verification of data as the need arises.

Canopy Closure and Stream Widths

The following data sets are lacking information:

1. Canopy Closures: Field data were collected at 21 sites throughout the basin using Solar Pathfinders. Field data from the Solar Pathfinders were used to validate model estimates of canopy closures. The WAG recognizes that, although the values between the model estimates and Solar Pathfinders are often close, in some locations, the model estimates are simply incorrect. In these instances, a Solar Pathfinder (or suitable substitute) should be used in the field to determine shade.
2. Stream Widths: Like canopy closures, stream widths were estimated and not measured in most locations. The stream width measurements were based on hydrologic curves developed for streams in the Pend Oreille subbasin and supplemented with actual data from DEQ Beneficial Use Reconnaissance Program (BURP) surveys of streams in the Priest River subbasin. Since the stream width variable is especially sensitive in the temperature models, actual stream width data should be collected as part of the field verification of the temperature model.

Main Stem Priest River between Outlet Dam and Upper West Branch

The lower Priest River from Priest Lake to the upper West Branch has not been identified as impaired by DEQ; however, it is likely that water quality concerns (temperature and habitat) exist for this reach. The channel of the Priest River immediately downstream of the Outlet Dam appears to be relatively wide and shallow. Therefore, the stream would be more likely to heat up because of exposure to solar radiation. One of the reasons that this portion of the Priest River is wider and shallower today than it was 100 years ago is that the early logging in the Priest River subbasin included frequent log drives down the main stem Priest River. The log drives resulted in more vertical banks, less functional floodplain, and less channel complexity.

Because the channel profile is now much wider than it was before the log drives, more of the water is exposed to direct solar radiation. The stream temperature issue is further complicated from the warm water flowing through the Outlet Dam into Priest River. Immediately upstream of the dam, the water is backed up and relatively shallow for about 4,500 feet. Stream temperature data are needed for the water above and below Outlet Dam.

3 Subbasin Assessment—Pollutant Source Inventory

Pollution within the Priest River subbasin is primarily from temperature. Load allocations were established in the *Priest River Subbasin Assessment and Total Maximum Daily Load,* approved by EPA in 2001 (DEQ 2001).

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when anthropogenic sources cause these to reach unnatural levels, they are considered "pollutants" and can impair the beneficial uses of a stream.

Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human-influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated steam temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with coldwater species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of affects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

3.1 Point Sources

Point sources are sources of pollution from known discharge locations. The AUs being evaluated for PNV are not affected by the discharge of any identified National Pollutant Discharge Elimination System (NPDES)-permitted point sources.

3.2 Nonpoint Sources

Lack of riparian shade is the likely cause of excess water temperatures. Riparian shade loss has been caused by historic events and activities in the subbasin similar to those that have caused sediment loads. Roads, fires, and floods have affected riparian areas extensively. In addition, many riparian areas were heavily logged in the early days of timber harvest.

Channel morphology changes have also affected solar loading, as many stream segments have become wider and shallower than they were under natural background conditions. Channels and shade conditions in most watersheds are recovering as management has changed over time to protect riparian zones.

Present-day anthropogenic riparian shade losses are caused primarily by roads and residential and recreational development along streams. Many riparian roads have been removed and reclaimed in recent decades. However, there still remain travel routes in the subbasin that are located near streams and on floodplains. In this area, residential and recreational development has affected riparian shade. Planting trees in riparian areas can help restore shade and other water quality benefits of healthy riparian vegetation.

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

Nonpoint source pollution control efforts in the Priest River subbasin are numerous and widespread. For the most part, they come from the implementation of standardized best management practices (BMPs) for forestry. Timber harvest in the Priest River subbasin began in the 1890s. Logs were transported to Priest Lake, some by the use of a flume, and stored at the outlet of the lake. From 1901 to 1949, log drives down Priest River floated the logs to mills on the Pend Oreille River. Harvest was largely selective, removing only high-value species or salvage from wildfires. At this time ground skidding, even on steep slopes, was not considered problematic. As a result, skid trail density was higher than that of the present. Since 1970, cable yarding has been required on steep slopes, reducing the amount of skid trails necessary. In addition, it has become common practice to obliterate these trails when they are no longer necessary. Fuels abatement practices and site preparation activities have also been changed to reduce the amount of soil disturbances on harvested areas. In the 1960s and 1970s, clearcutting became the dominant harvest method, but decreased in the mid-1980s.

In 1974, rules and regulations were adopted under the Forest Practices Act (FPA), giving oversight of all forest practices on forest land to the state of Idaho. Inspections are made by the IDL and the federal land management agencies to ensure compliance. The Idaho Panhandle National Forest, through the federal Pacific Anadromous Fish Strategy, generally does not permit timber harvest in riparian habitat conservation areas and other areas where the activity would pose an unacceptable risk to aquatic or riparian habitat (USFS and BLM 1995). In January 2014, the Idaho State Legislature approved a new shade rule, or streamside tree retention rule, under the FPA.

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 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.

Temperature TMDLs have been developed for all AUs in the Priest River subbasin exceeding Idaho water quality criteria. AUs addressed by the *Addendum Priest River Subbasin Assessment and Total Maximum Daily Load* were reevaluated in this analysis because of new techniques in temperature TMDL development. TMDLs developed in 2001 and 2003 relied on a mathematical equation to prescribe shade based on elevation to achieve a desired stream temperature. Due to the elevation of the watersheds analyzed, the shade requirements in most locations exceeded 100%. Complete stream shade is not achievable in a natural setting, so those streams addressed by the 2003 TMDLs were reevaluated in this document using the PNV method developed by Shumar and De Varona (2009).

5.1 Instream Water Quality Targets

For the Priest River subbasin 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. Appendix B provides 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

Several important factors contribute 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 likely to be controlled. 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 the density of riparian vegetation 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 may also provide shade to the stream. 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 other optical equipment that works 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 the riparian plant community that has grown 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 solar inputs.

We can estimate PNV (and therefore target shade) from models of plant community structure (i.e., 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 there is to decrease solar gain. Streams disturbed by wildfire 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. In this case, DEQ used the Spokane, Washington, station. The difference between existing and target solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (Appendix B).

PNV shade and associated target solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (so long as there are no point sources or any other anthropogenic sources of heat 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 stream shade levels were estimated using aerial photos and geographic information system (GIS) software. The software allowed the user to view high-resolution aerial photography on a computer screen along with other information such as streams, topography, monitoring locations, road networks, and other mapping information. Stream shade levels were estimated by viewing the aerial photo at its highest resolution and relying on best-professional judgment developed while working in the field.

Existing shade was estimated for 28 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 man-made structures).

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations were field verified with a Solar Pathfinder at eleven sites scattered throughout the subbasin (see Appendix A for results). Five of these sites were collected by DEQ regional office personnel and six were from Forest Practices Water Quality Audit sites visited in 2008. These data, although limited in scope, were used to calibrate our eyes when we reexamined the original aerial photo interpretation of existing shade. The existing shade presented in this document represents corrected shade values for the eleven 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 bank-full 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 from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 50 meters, 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 bank-full 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.

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 the region. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, shade decreases because the vegetation has less ability to shade the center of wide streams. As vegetation gets taller, the plant community is able to provide more shade at any given channel width.

Natural Bank-Full Widths

Stream width must be known to calculate target shade since the width of a stream affects the amount of shade the stream receives. Bank-full 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 bank-full 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 bank-full width may not be discernible from aerial photo interpretation and may not reflect natural bank-full 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 IDL—to estimate natural bank-full width (Figure 5).

For each stream evaluated in the loading analysis, natural bank-full width is estimated based on drainage area of the Pend Oreille curve from Figure 5. Although estimates from other curves were examined (i.e. Spokane, Kootenai, Clearwater), the Pend Oreille curve was ultimately chosen because of its proximity to the Priest River subbasin and its similar topography. Tables containing natural bank-full width estimates for each stream in each subwatershed are presented in Appendix C.

Natural bank-full width curve estimates were partially field verified by using BURP data collected by DEQ. However, for the Priest River subbasin, only a few BURP sites existed at the time of this evaluation. In general, we have found in other watershed's BURP bank-full width data to agree with the natural bank-full width estimates from the Pend Oreille subbasin curve. Existing widths, where available, are presented in load tables in Appendix C. Existing width values in the tables are either based on actual data, or in some instances, it was appropriate to provide crude measurements of stream width as seen on aerial photographs. Where such data/measurements are not attainable, existing width in the table matches estimated natural width.

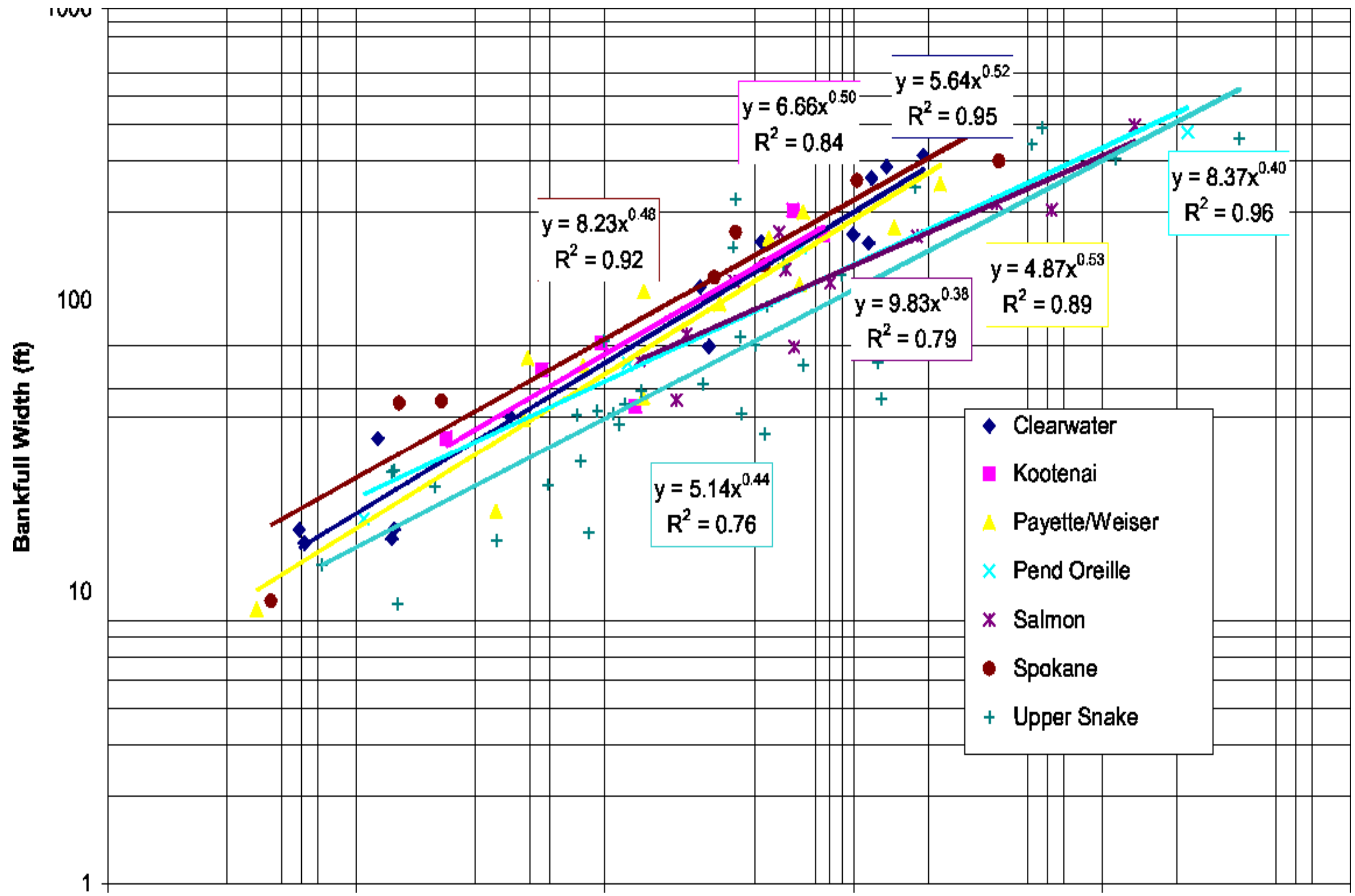

Figure 5. Bank-full width as a function of drainage area.

Design Conditions

Streams examined in this document are found in two sub-ecoregions in the Northern Rockies Level III Ecoregion defined by McGrath et al. (2001). The Priest River subbasin is located in the Northern Rockies Level 3 Ecoregion of McGrath et al. (2001). The higher elevations surrounding the Lake are in the Selkirk Mountains Level 4 Ecoregion, an area known for its mixed coniferous forests of Pacific species (grand fir, western redcedar, and western hemlock) and Rocky Mountain species (western larch, western white pine, and lodgepole pine). A combination of weather patterns, high relief and very narrow valleys results in more summer precipitation, fog, and relative humidity at low to mid elevations than elsewhere in northern Idaho. Boreal influence is stronger here resulting in lower subalpine fir-spruce zones and more extensive whitebark pine than in the rest of the Northern Rockies Ecoregion. North-facing valleys have extensive peat lands and avalanche chutes are common.

The lower elevations around the major river valleys are in the Inland Maritime Foothills and Valleys Level 4 Ecoregion (McGrath et al., 2001). Here western hemlock, western redcedar, grand fir, Douglas fir, Ponderosa pine, lodgepole pine, and western larch are common. Birch, alder, and aspen are common on floodplains and as seral stands on uplands.

The Idaho Panhandle National Forests have grouped this wide variety of forests into habitat types, which form the basis for 11 vegetation response units (VRUs) that can be grouped into four basic forest types (A–D) based on temperature and moisture (Table 8). VRUs are further explained in the procedures manual for PNV temperature TMDLs (Shumar and De Varona 2009). These VRUs were used as the basis for developing shade curves used to set target shade levels for the streams in this analysis.

Most streams examined are in the moderately warm and moderately cool/moist assemblage of forests of Group B (VRUs 4, 5, and 6). Other forest types include Groups A and C as well as stunted forests at high elevation rocky sites. In addition to these forest types, Shumar and De Varona (2009) include shade curves developed for two lower-elevation hardwood-conifer mix forests that occur at lower elevation, wider floodplains. The labels for these groups, although identified as Nonforest Group 1 and 2, are perhaps a misnomer because they are a mix of both coniferous and hardwood species and have a substantial tree component. The stream forest/vegetation type for each AU is listed in Tables D-1 through D-37 (Appendix D).

The east-side drainages originate high on the Selkirk Crest above Priest Lake. This high elevation rocky terrain is subject to heavy snows and wind that result in reduced vegetation stature. While not completely Krummholz in nature, the forests in this region are often reduced in height and cover compared to lower elevation forests. A specific shade curve was produced for these Rocky/High Elevation areas from forest data collected by LiDAR images of four unharvested headwater locations (Keokee, Devils, and Uleda Creeks). This LiDAR was flown in August 2012 for the East River drainage. The data provided density, crown size, and tree height for the riparian community. The result was an average canopy cover to produce the shade curve. The Rocky/High Elevation forest/vegetation type is listed as applicable in Tables D-1 through D-37 (Appendix D).

Additionally, stream locations are scattered throughout low elevation areas around the lake where the riparian community is dominated by thinleaf alder meadows. In those locations

(Trapper, Lion, Two Mouth, Snow, Soldier, Lamb, Reeder, and Floss Creeks and East River), an alder shade curve was used from Shumar and De Varona (2009) for shade targets.

In a few instances, rock outcrop or avalanche paths have directly influenced the streamside vegetation. A forest or hardwood shade curve would not be appropriate for targets in these areas as the vegetation is unlikely to attain target levels. In such locations, we have set the existing shade level as interpreted through aerial photos as the target shade level. The avalanche forest/vegetation type is listed as applicable in Tables D-1 through D-37 (Appendix D).

Table 8. Idaho Panhandle National Forests basic forest types and vegetation response units.

Forest Type	Vegetation Response Units	Forest Description
Group A	1, 2, and 3	This group contains the warmer and drier habitat types. These areas include warm, dry grasslands to moderately cool and dry upland sites. The dry, lower-elevation open ridges are composed of Douglas-fir and ponderosa pine in well-stocked and fairly open-growing conditions. Moderately moist upland areas and dense draws also include larch and lodgepole pine, with lesser amounts of ponderosa pine. While the growing season is fairly long, high solar inputs and moderately shallow soils often result in soils that dry out early in the growing season, which results in low-to-moderate site productivity.
Group B	4, 5, and 6	This group occupies most of the moist sites along benches and stream bottoms. The moderating effects of the inland maritime climate ecologically influence this group. This group is widespread throughout the forest and has the most biological productivity. Douglas and grand fir, lodgepole and ponderosa pine, western larch, western redcedar, and quaking aspen commonly occur within the vegetation group.
Group C	7 and 8	This group contains the moist, lower subalpine forest setting and is common on the northwest- to east-facing slopes, riparian and poorly drained subalpine sites, and moist forest pockets. Vegetation productivity is moderate to high as a result of the high moisture-holding capacity and nutrient productivity of loess deposits, adequate precipitation, and a good growing season.
Group D	9, 10, and 11	This group is typified by cool and moderately dry conditions with moderate solar input. The local climate is characterized by a short growing season with early summer frosts. Due to generally shallow soils, slope position, and aspect, soil moisture is often limited during late summer months. This group is generally found on rolling ridges and upper reaches of convex mountain slopes. Subalpine fir, lodgepole pine, and Engelmann spruce are dominant tree species within this vegetation group.

Shade Curve Selection

To determine PNV shade targets for the Priest River subbasin, effective shade curves for the Kaniksu National Forest groups A, B, C, and were examined (Figures D-13 to D-15, Appendix D) and for Rocky/High Elevation and Thin Leaf Alder Forest groups (Figures D-16 to D-18, Appendix D). Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. As a stream becomes wider, a given vegetation type loses its ability to shade wider and wider streams (Figure 6). Shumar and De Varona (2009) provide an explanation of how shade curves were developed for the Idaho Panhandle.

The effective shade calculations are based on a 6-month period from April through September. This period coincides with the critical time when temperatures could negatively affect cold water aquatic life and salmonid spawning beneficial uses. Late July and early August typically represent the period of highest stream temperatures.

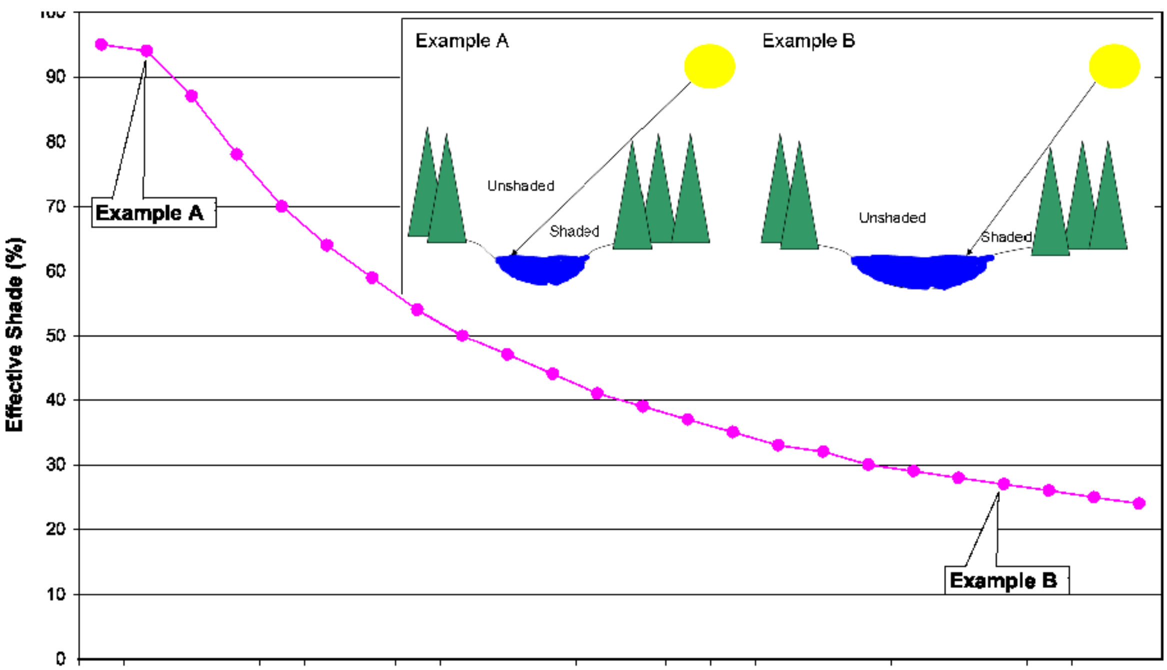

Figure 6. Example relationship between stream width and shade.

The use of the various shade curves described below is based on an aquatic response unit (ARU) filter, which is a USFS method used to differentiate between forest and nonforest riparian vegetation (Shumar and De Varona 2009). If the stream order is between 1st and 4th and the gradient is ≥3%, then one of the Forest Group shade curves is used for that section of stream. Stream order and stream gradients are presented in Appendix A. Which Forest Group shade curve is used for a particular section of stream depends on the predominant forest type (i.e., VRU) surrounding the stream in that section. For example, Group B tends to be the dominant shade curve used in this TMDL. Shade target percentages in Group B are determined from averaging three aspect-based shade curves, one for each cardinal direction (N-S and E-W) and one for the 45 degree angles (Figure D-14, Appendix D).

If stream orders are between 1st and 4th, but the gradient is <3%, then the stream falls into the Nonforest Group 1 category from the ARU filter (Shumar and De Varona 2009). Generally, the lower portions of most streams fall into the <3% slope class. Shade curves developed for this group include a variety of coniferous and deciduous vegetation (Shumar and De Varona 2009). Shade curves were developed for even-numbered channel widths only (i.e., 2 meters, 4 meters, etc.). Targets for odd-numbered widths are extrapolated by averaging the higher and lower even-numbered width targets (Table 9). When stream orders increase to the 5th and 6th level, streams and their associated floodplains become wider and a second group of nonconiferous forest vegetation is needed for describing shade targets (Table 10). Shumar and De Varona (2009) provide more explanation in determining shade targets.

Table 9. Shade targets for Nonforest Group 1 vegetation type at various stream widths.

Non-Forest	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m	13m	14m	15m	16m	17m	18m	19m	20m	21m	22m	23m	24m	25m
Group 1 - Hardw oods - 0/180		93		75		61		53		47		42		38		35		32		30		28		26	
45/135/225/315		93		77		64		55		49		43		39		35		32		30		27		25	
90/270		95		82		69		57		47		39		34		30		27		25		23		21	
Target (%)	**97**	**94**	**86**	**78**	**72**	**65**	**60**	**55**	**52**	**48**	**45**	**41**	**39**	**37**	**35**	**33**	**32**	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**24**

Non-Forest	26m	27m	28m	29m	30m	31m	32m	33m	34m	35m	36m	37m	38m	39m	40m	41m	42m	43m	44m	45m	46m	47m	48m	49m	50m
Group 1 - Hardw oods - 0/180	24		23		22		20		19		18		17		17		16		15		15		14		14
45/135/225/315	24		22		21		19		18		17		17		16		15		14		14		13		13
90/270	20		19		17		16		16		15		14		13		13		12		12		11		11
Target (%)	**23**	**22**	**21**	**21**	**20**	**19**	**18**	**18**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**15**	**14**	**14**	**14**	**14**	**13**	**13**	**13**

Table 10. Shade targets for Nonforest Group 2 vegetation type at various stream widths.

Non-Forest	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m	13m	14m	15m	16m	17m	18m	19m	20m	21m	22m	23m	24m	25m
Group 2 - Hardw oods - 0/180		86		67		54		47		41		37		34		31		29		26		25		23	
45/135/225/315		88		69		57		49		43		39		35		32		29		27		25		23	
90/270		90		74		62		53		44		37		32		28		25		23		21		20	
Target (%)	**94**	**88**	**79**	**70**	**64**	**58**	**54**	**50**	**47**	**43**	**41**	**38**	**36**	**34**	**32**	**30**	**29**	**28**	**27**	**25**	**25**	**24**	**23**	**22**	**21**

Non-Forest	26m	27m	28m	29m	30m	31m	32m	33m	34m	35m	36m	37m	38m	39m	40m	41m	42m	43m	44m	45m	46m	47m	48m	49m	50m
Group 2 - Hardw oods - 0/18	22		20		19		18		17		17		16		15		14		14		13		13		12
45/135/225/315	21		20		19		18		17		16		15		14		14		13		13		12		12
90/270	18		17		16		15		14		14		13		12		12		11		11		10		10
Target (%)	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**13**	**12**	**12**	**12**	**12**	**11**

The east-side drainages such as Trapper, Lion, Two Mouth, and Indian Creeks, and East River originate high on the Selkirk Crest above Priest Lake. These high-elevation rocky areas have a specific shade curve produced from forest data collected by LiDAR images of four unharvested headwater locations (Keokee, Devils, and Uleda Creeks). The result was an average canopy cover of 65% and average height of 33 feet (see Table D-42) used in the Shade.xls Temperature Model (Shumar and De Varona 2009) to produce the shade curve.

Stream locations are scattered throughout low elevation areas around the lake where the riparian community is dominated by thinleaf alder meadows. In those locations (Trapper, Lion, Two Mouth, Snow, Soldier, Lamb, Reeder, and Floss Creeks and East River), we used an alder shade curve (Figure D-18, Appendix D) from Shumar and De Varona (2009) for shade targets.

In rock outcrop or avalanche locations, the existing shade level was set as interpreted through aerial photos as the target shade level. Hence, if we estimate existing shade in an avalanche path to be 50%, then the target shade associated with that stream segment is likewise set at 50%.

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 reaches within that stream. These loads are determined by multiplying the solar load received 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 Spokane, Washington. The solar loads used in this TMDL 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.

In Appendix D, Figures D-1, D-4, D-7, and D-10 and Tables D-1 through D-37 show the PNV shade targets. 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 segments 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.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (40 CFR §130.2(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 watershed) but may be aggregated by type of source or land 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 no 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 Spokane, Washington, NREL weather station. Existing shade data are presented in Appendix D, Figures D-2, D-5, D-8, and D-11. Like load capacities (target loads), existing loads in Appendix D, Tables D-1 through D-37 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 (Appendix D, Figures D-3, D-6, D-9, and D-12).

It is important to note, in some instances, existing load was less than the target load (as depicted by a credit in the excess load column in Appendix D, Tables D-1 through D-37). In such cases, WAG priorities are to field verify the sites to determine the true existing shade and to determine if the sites are candidates for delisting based on whether they have met their target shade.

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. In Appendix D, Tables D-1 through D-37 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 11–Table 14 show 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 (Appendix D, Figures D-3, D-6, D-9, and D-12), 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 11–Table 14 and provides a general level of comparison among streams.

As stated previously, in some instances, the target solar load was less than the existing solar load. In such cases, WAG priorities are to field verify the sites to determine the true existing shade and to determine whether the AU is a candidate for delisting. Until this field verification can be made, the WAG determined the AU will remain in a status of being impaired by temperature on Idaho’s Integrated Report

From the loading analysis, the upper Priest River has the greatest need for implementation where Trapper Creek, upper Priest River, and Hughes Fork have solar load reduction requirements of 40% or greater (Table 11). The 3rd order reach of Trapper Creek needs to be field verified for solar loading because target loads are greater than the estimated existing loads.

Table 11. Total solar loads and average lack of shade for the upper Priest River region.

Water Body	Assessment Unit Number	Total Existing Load in kWh/day	Total Target Load in kWh/day	Excess Load in kWh/day	Necessary Percent Reduction
Trapper Creek	17010215PN017_02	140,000	85,000	56,000	40%
Trapper Creek	17010215PN017_03	34,000	47,000	-13,000	0
Upper Priest River: ID/Canadian border to mouth	17010215PN018_02	180,000	64,000	120,000	66%
Hughes Fork: source to mouth	17010215PN019_02	170,000	55,000	120,000	71%

In the eastside region of the subbasin, Indian Creek has the greatest need for implementation with 46% shade reduction requirement on the 3rd order reach. Soldier Creek is also in need of implementation to reduce the solar load reduction requirement of 29%. Two AUs in the eastside region, 3rd order Hunt and Lion Creeks, have targets greater than the estimated existing load (Table 12). These AUs should be prioritized for field verification of solar loading before any decisions are made that the AUs are meeting background conditions for shade.

Table 12. Total solar loads and average lack of shade for the Priest Lake eastside region.

Water Body	Assessment Unit Number	Total Existing Load in kWh/day	Total Target Load in kWh/day	Excess Load in kWh/day	Necessary Percent Reduction
Soldier Creek: source to mouth	17010215PN008_03	140,000	100,000	40,000	29%
Hunt Creek: source to mouth	17010215PN009_03	9,000	12,000	-3,000	0%
Indian Creek: source to mouth	17010215PN010_02	190,000	170,000	26,000	14%
Indian Creek: source to mouth	17010215PN010_03	120,000	57,000	55,000	46%
Two Mouth Creek: source to mouth	17010215PN012_02	610,000	530,000	77,000	13%
Lion Creek: source to mouth	17010215PN013_02	860,000	900,000	-34,000	0%

In the westside region of the subbasin, Reeder Creek is the biggest candidate for implementation projects, with a 33% solar load reduction requirement on the 2nd order AU. Kalispell and Lamb Creeks had load reduction requirements of less than 10% (Table 13). Beaver Creek should be prioritized for field verification of existing loads.

Table 13. Total solar loads and average lack of shade for the Priest Lake westside region.

Water Body	Assessment Unit Number	Total Existing Load in kWh/day	Total Target Load in kWh/day	Excess Load in kWh/day	Necessary Percent Reduction
Beaver Creek: source to mouth	17010215PN020_03	30,000	30,000	0	0%
Granite Creek ID/WA border to mouth	17010215PN022_04	990,000	850,000	140,000	14%
Reeder Creek: source to mouth	17010215PN023_02	200,000	150,000	50,000	33%
Reeder Creek: source to mouth	17010215PN023_03	18,000	16,000	2,000	11%
Kalispell Creek: source to mouth	17010215PN024_03	440,000	420,000	17,000	4%
Lamb Creek: ID/WA border to mouth	17010215PN025_02	470,000	430,000	29,000	6%

In the lower Priest River region of the subbasin, the Middle Fork East River, North Fork East River, Binarch Creek, and Moores Creek all had solar loading reduction requirements of greater than 40%. These creeks should be prioritized for implementation. Goose Creek and East River had load reduction requirements of 33% and 29%, respectively. The 3rd order of the North Fork East River should be prioritized for field verification of solar loading—especially because the 2nd order AU has such high load reduction requirements (Table 14).

It is important to note, rivers such as the lower Priest River have very large target and existing loads because of their large width, and shade does not affect them as much. In such circumstances, a lack of near-shore shade does not create proportionally large excess loads.

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

Table 14. Total solar loads and average lack of shade for the Lower Priest River region.

Water Body	Assessment Unit Number	Total Existing Load in kWh/day	Total Target Load in kWh/day	Excess Load in kWh/day	Necessary Percent Reduction
Priest River	17010215PN001_05	13,000,000	11,000,000	1,900,000	15%
Middle Fork East River	17010215PN003_02	130,000	60,000	75,000	58%
Middle Fork East River	17010215PN003_03	250,000	240,000	13,000	5%
East River	17010215PN003_04	250,000	180,000	73,000	29%
North Fork East River	17010215PN004_02	190,000	100,000	99,000	52%
North Fork East River	17010215PN004_03	68,000	74,000	-6,000	0%
Binarch Creek: ID/WA border to mouth	17010215PN026_02	140,000	66,000	74,000	53%
Upper West Branch Priest River	17010215PN027_04	530,000	520,000	11,000	2%
Goose Creek	17010215PN028_03	160,000	110,000	52,000	33%
Lower West Branch Priest River: ID/WA border to mouth	17010215PN030_03	340,000	300,000	41,000	12%
Lower West Branch Priest River: ID/WA border to mouth	17010215PN030_04	1,100,000	900,000	230,000	21%
Moores Creek	17010215PN031_03	140,000	76,000	63,000	45%

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 coincides with increasing solar inputs and increasing vegetative shade. The critical time period is April through June when spring salmonids spawning is occurring, July and August when maximum temperatures exceed cold water aquatic life criteria, and September when fall salmonids 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

All load allocations within this document are directed at nonpoint source activities. The completion of on-the-ground actions designed to reduce pollutant loads will be completed through designated management agency (DMA) and citizen participation. DEQ’s continued interaction with these groups will help ensure progress is made towards pollutant reductions. DEQ will inform these groups on the current water quality data, updated BMPs, and potential funding sources.

It is anticipated that forested streamside shade will be improved with the 2014 initiative to revise the Idaho FPA (IDAPA 20.02.01). The adopted changes will significantly enhance streamside shade requirements for Class I streams (fish bearing or domestic water use), and further clarify filtering and shade requirements on Class II streams. Implementation of the new streamside shade rules may, or may not, result in full achievement of shade targets.

This initiative had its origin from a quadrennial interagency audit of statewide timber harvesting activities that was conducted in 2000 between IDL and DEQ. Throughout 2012 and 2013, IDL advanced the proposed rulemaking process working in conjunction with the Idaho Forest Practices Act Advisory Committee, Idaho Board of Land Commissioners, and other interested parties.

With DEQ concurrence, IDL obtained 2014 legislative approval for the proposed rule changes with a date of July 1, 2014, for implementation.

5.4.5 Construction Stormwater and TMDL Wasteload Allocations

No known NPDES-permitted point sources exist in the affected watersheds. Thus, no wasteload allocations are discussed in this TMDL. If a point source is proposed that would have thermal consequence on these waters, background provisions addressing such discharges in Idaho water quality standards (IDAPA 58.01.02.200.09 and IDAPA 58.01.02.401.03) should be involved (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 man-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 Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

5.4.5.1 Municipal Separate Storm Sewer Systems

Polluted stormwater runoff is commonly transported through 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 United States
- Designed or used to collect or convey stormwater (including storm drains, pipes, and ditches)
- 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 NPDES permit from EPA, implement a comprehensive municipal stormwater management program (SWMP), and use BMPs to control pollutants in stormwater discharges to the maximum extent practicable.

5.4.5.2 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 United States, the facility must be permitted under EPA's most recent 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 (40 CFR 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 in December 2013. 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.

5.4.5.3 Construction Stormwater

The CWA 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 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.

5.4.6 Reserve for Growth

No allowances have been made for future growth in these PNV TMDLs. No point source discharges exist in the waters for which PNV TMDLs were developed. Expanded nonpoint source activities will have the same PNV targets.

5.4.7 Climate Change

Substantial scientific evidence indicates that air temperatures are rising across much of the earth, including the American West, and most of this warming is due to increasing concentrations of carbon dioxide and other heat-trapping gases in the atmosphere (NRC 2010). While climate naturally varies in short- and long-term patterns, research suggests that human activities are causing an increase in greenhouse gases and causing air temperature changes far outside the natural range of variability (NRC 2010).

If predictions about the future climate are accurate, these changes pose economic and environmental threats to many parts of the world, including Idaho. Water resources and aquatic life may be particularly affected. Many possible impacts to water quality and aquatic life in the Pacific Northwest are presented by Hamlet et al. (2005); Karl et al. (2009); Mote and Salathé (2009); the NRC (2010); and Isaak et al. (2010) and can be summarized as follows:

- Increasingly warm air temperatures
- Amplified precipitation variability with decreased summer precipitation and increased winter precipitation
- Increased insect outbreaks, wildfire activity, and altered stream hydrologies
- Altered vegetation conditions—forests are predicted to change in the future with altered species composition adapted to the most recent climate conditions
- Warming water temperatures in streams and rivers

Scientists have also evaluated the risk posed to Westslope Cutthroat Trout and Bull Trout by predicted summer temperature increases, uncharacteristic winter flooding, and increased wildfires. They determined that 65% of habitat currently occupied by Westslope Cutthroat Trout will be at high risk from one or more of these factors (Williams et al. 2009).

Other research has evaluated possible risks to Bull Trout from a changing climate. Researchers found that predicted warming could result in losses of 18%–92% of thermally suitable natal habitat areas and an even greater proportion of large (>10,000 hectares) habitat patches (Rieman et al. 2007). In addition, stream temperature increases associated with a changing climate may allow nonnative species such as Eastern Brook Trout, Rainbow Trout, and Smallmouth Bass to invade further upstream and potentially threaten the persistence of native trout (Fausch et al. 2006; Rieman et al. 2007; Rahel and Olden 2008; Isaak et al. 2010).

These temperature TMDLs are designed to ensure compliance with Idaho water quality standards based on current and historic climatic conditions. If predictions are correct, future changes in stream temperature related to warming air temperatures and changing climate may warrant further investigation. This information also suggests that efforts to protect and restore water quality are all the more important. Shade can provide cooling effects to the stream fairly independent of climate and can help to insulate the stream from increasing air temperatures.

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 (Appendix D, Tables D-1–D-37). 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.

Due to the historic prevalence of extensive stand-replacing forest fires within the Priest River subbasin, it is recognized that attainment of target shade for all stream reaches at any one time may not be fully achievable. Frequent lightning starts, difficult access, and occasional wind-driven events during drought years have all contributed to wildland fire playing a significant role in shaping the natural landscape. A rough approximation of mid- to upper-elevation streamside shade segments significantly impacted by extensive fire at different points in time ranges from 5% to 30%. This estimation may be within the natural range of variability for the Priest River subbasin. More recent large-stand replacement fire events included the 1967 Sundance Fire (15,850 acres within the subbasin) and the Trapper Peak Fire (16,600 acres within the subbasin). DEQ views fire events as part of the natural landscape and background (Lieberg 1899; Larsen and Lowdermilk 1920; Anderson 1968; IDL 1933).

Beaver damming is a naturally occurring phenomenon within the Priest River subbasin. If not recognized during the aerial photo interpretation, the beaver dam and resulting pond could result in a misinterpretation of the existing shade, target shade, and stream width. When noted, beaver dams were incorporated into the PNV model as natural. If beaver dams are found to be causing erroneous PNV analysis during implementation of this TMDL, the area should be noted and incorporated into the TMDL 5-year review. Efforts to reach full target shade in these areas may not be practical.

Portions of some watersheds have natural conditions that limit riparian vegetation growth. Steep topography, rocky slopes, or rock cliffs limit vegetative growth in these areas, and achieving potential natural shade as depicted by the modeled shade curve is not practical in these areas.

These natural occurrences may result in a lack of shade as identified in the model, but these areas will not be expected to reach full potential shading from riparian vegetation.

Stream segments with existing bank-full widths significantly wider (over 3 meters) than the estimated natural bank-full widths should be a focus of future monitoring efforts. In these areas, existing and potential shade is limited due to the overwidened stream channel. The cause for the overwidening is most likely excess bed load sediment. The excess bed load alters the bank-full width-to-depth ratio, making the stream wider than it would be naturally. The greater width-to-depth ratio results in a wide, shallow stream, oftentimes with midchannel bars or extensive point bars. The excess near-bank stress applied to the streambanks in these situations also exacerbates the problem by causing bank instability and erosion. The eroded material is transported downstream resulting in more stream widening. In these locations, measures should be taken to mitigate bank erosion before the full potential riparian vegetation can be established.

5.5.1 Time Frame

Increases in shade provided to the stream from riparian vegetation may only take a few years to establish, but many years will be required for vegetation to achieve its full potential to reduce solar inputs. Once implementation actions and strategies have been established, at least 20 years (depending on vegetation type) will be required for a diverse and mature vegetative community to become well established and provide maximum shade. Achievement of shade targets will not occur at once. Shade targets for smaller streams may be reached sooner than those established for larger streams given their smaller bank-full widths.

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

5.5.2 Approach

TMDLs will be implemented through the continuation of ongoing pollution control activities in the watershed. The designated WAG, DMAs, local organizations, and other appropriate public process participants are expected to do the following:

- Develop BMPs to achieve load allocations.
- Give reasonable assurance that management actions will meet load allocations through both quantitative and qualitative analysis of management measures.
- Adhere to measurable milestones for progress.
- Develop a timeline for implementation, including cost and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, if individual BMPs are effective, and if load allocations are being met.

The Priest River WAG supports efforts by landowners within the basin to improve streamside shade on stream segments where existing shade falls significantly short of target shade. This WAG explicitly endorses requests for grant approval or extraordinary funding where the difference between existing shade and target shade exceeds 20%. Additionally, proposed projects shall not further degrade riparian areas. Examples of streamside shade improvement projects may include tree planting, site-specific riparian management plans, riparian fencing, and stream morphology improvement.

The WAG will continue to work with the public. As the TMDL process continues, the WAG will support engaging all interested persons to further the WAG goals to improve stream temperature to support native fish populations in the Priest River subbasin.

This WAG explicitly endorses requests for grant approval or extraordinary funding in instances where watershed restoration projects are implemented following extensive or extreme fire events, provided significant degradation of near-stream areas is not expected to occur from the proposed project.

5.5.3 Responsible Parties

In addition to the DMAs, the public—through the WAG and other equivalent organizations or processes—will have opportunities to be involved in developing the implementation plan to the maximum extent practical. The following Idaho DMAs are responsible for management activities:

- 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
- DEQ for all other activities

Although not an Idaho DMA, the USFS is responsible for implementing TMDL activities on land it manages.

The responsible DMA will recommend specific control actions and submit the implementation plan to DEQ. DEQ will act as a repository for the implementation plan and conduct 5-year reviews of progress toward TMDL goals.

5.5.4 Implementation Monitoring Strategy

Monitoring conducted within the Priest River subbasin to evaluate the effectiveness of BMPs and ambient water quality will be done using DEQ-approved monitoring procedures at the time of sampling. These procedures will ensure the data collected are compatible and usable during the DEQ assessment process.

Effective shade monitoring can take place on any reach throughout the Priest River subbasin and compared to estimates of existing shade. Those areas with the largest disparity between existing shade estimates and shade targets should be monitored with Solar Pathfinders to verify the existing shade levels and to determine progress towards meeting shade targets. It is important to note that many existing shade estimates have not been field verified and may require adjustment during the implementation process. Stream segments for each change in existing shade vary in length depending on 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 towards target levels. Ten equally spaced Solar Pathfinder measurements within that segment averaged together should suffice to determine new shade levels in the future.

Monitoring progress towards achieving shade targets will follow the guidelines established in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona 2009).

6 Conclusions

Effective shade targets were established for all streams based on the concept of maximum shading under PNV equals natural background temperature levels. Shade targets were actually derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation field verified with Solar Pathfinder data.

Most AUs examined lack shade and have excess solar loads as a result. These AUs have been recommended to remain, or be placed in Category 4a of Idaho's Integrated Report (Table 15). Some AUs have relatively low excess loads with needed reductions varying from 1%–19%. Others have considerably larger excess loads. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should key in on the largest differences between existing and target shade as locations to prioritize implementation efforts.

Table 15. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Lower Priest River	ID17010215PN001_05	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Big Creek—source to mouth	ID17010215PN002_03	*E. coli*	No	Move to 2	Recent data suggests no impairment
Middle Fork East River	ID17010215PN003_02 ID17010215PN003_03	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method
East River	ID17010215PN003_04	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method
North Fork East River	ID17010215PN004_02 ID17010215PN004_03	Temperature	Yes	Remain in 4a	Excess solar load from lack of shade; updated using PNV method

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Soldier Creek	ID17010215PN008_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Hunt Creek	ID17010215PN009_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Indian Creek	ID17010215PN010_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Indian Creek	ID17010215PN010_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Two Mouth Creek	ID17010215PN012_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lion Creek	ID17010215PN013_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Trapper Creek	ID17010215PN017_02 ID17010215PN017_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Upper Priest River	ID17010215PN018_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Hughes Fork	ID17010215PN019_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Beaver Creek	ID17010215PN020_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Granite Creek	ID17010215PN022_04	Temperature	Yes	Move to 4a	Excess solar Load from lack of shade
Reeder Creek	ID17010215PN023_02 ID17010215PN023_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Kalispell Creek	ID17010215PN024_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Kalispell Creek	ID17010215PN024_03	Combined biota/habitat bioassessment	No	Remove as a pollutant	Cause of impairment is temperature
Lamb Creek	ID17010215PN025_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lamb Creek	ID17010215PN025_02	Combined biota/habitat bioassessment	No	Remove as a pollutant	Cause of impairment is temperature
Binarch Creek	ID17010215PN026_02	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Upper West Branch Priest River	ID17010215PN027_03	Combined biota/habitat bioassessment	No	None	Insufficient data; additional pollutants cannot be ruled out
Upper West Branch Priest River	ID17010215PN027_04	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Upper West Branch Priest River	ID17010215PN027_04	Combined biota/habitat bioassessment	No	None	Insufficient data; additional pollutants cannot be ruled out
Goose Creek	ID17010215PN028_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Lower West Branch Priest River	ID17010215PN030_03 ID17010215PN030_04	Temperature	Yes	Move to 4a	Excess solar load from lack of shade
Moores Creek	ID17010215PN031_03	Temperature	Yes	Move to 4a	Excess solar load from lack of shade

This document was prepared with input from the public, as described in Appendix E. 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 F.

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GIS Coverages

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Glossary

§303(d)

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

Assessment Unit (AU)

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Exceedance

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

Fully Supporting

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

Load Allocation (LA)

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

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

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

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

Not Fully Supporting

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

Point Source

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

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

Water Quality Standards

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

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Appendix A. Data Sources and Pathfinder Results

Table A-1. Data sources for the Priest River subbasin TMDLs.

Water Body	Data Source	Type of Data	Collection Date
10 water bodies	DEQ CDA Regional Office, FPA Water Quality Audit	Solar Pathfinder effective shade and stream width	2008, 2009
Middle Fork of East River Tributaries	Idaho Department of Lands	LIDAR	2012
All waters	DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation	2009

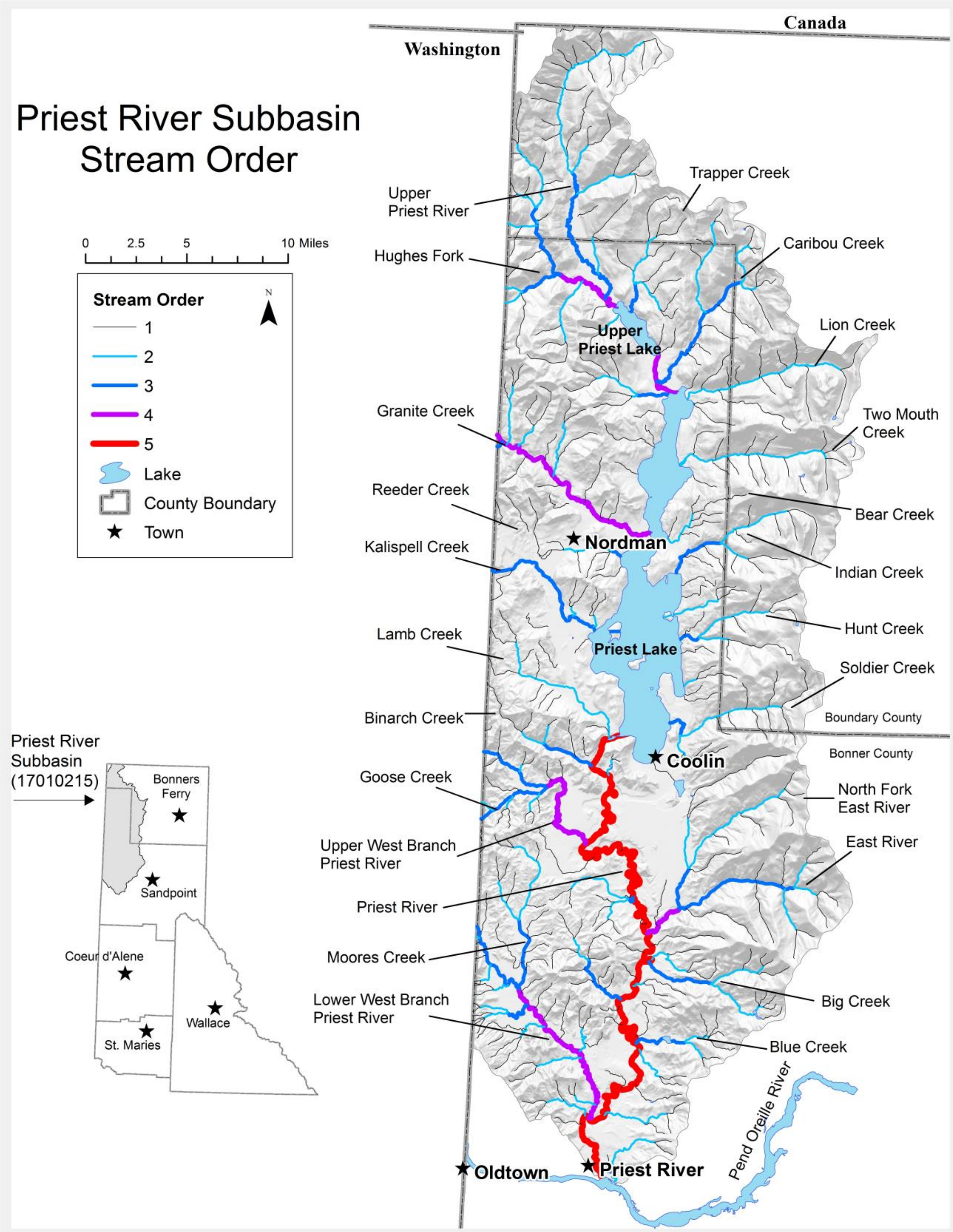

Figure A-1. Stream orders for the Priest River region.

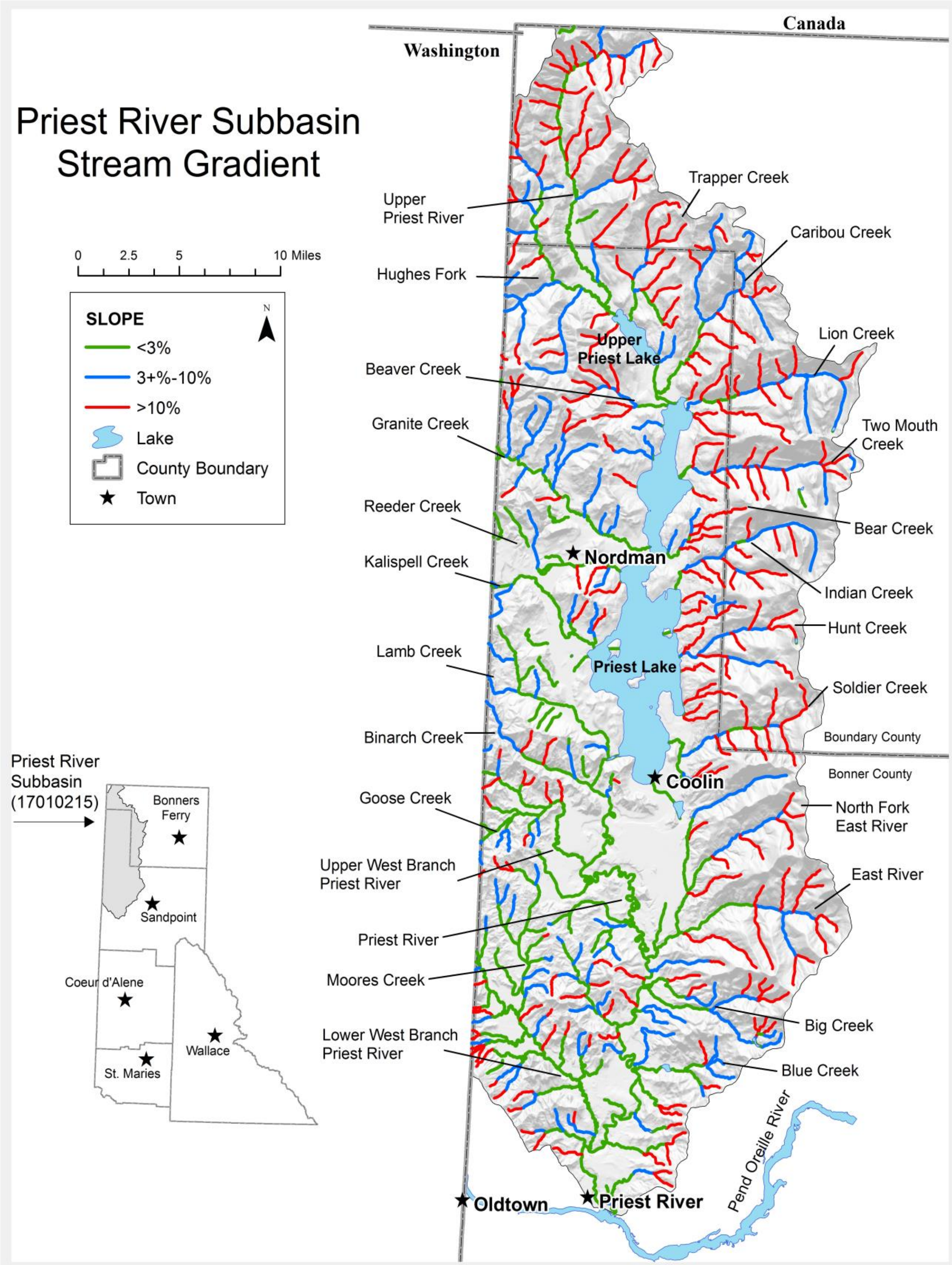

Figure A-2. Stream gradient for the Priest River region.

Pathfinder Results.

Table A-2. Solar pathfinder results collected by DEQ in the Priest River tributaries subbasin.

Site (Stream Name)	Average shade level (%)
Lion Creek	75%
Two Mouth Creek	45%
Indian Creek	79%
Kalispell Creek	63%
Granite Creek	22%

Table A-3. Solar pathfinder results collected by FPA audits in the Priest River tributaries subbasin.

Stream Name	FPA audit site	Average shade level (%)
Cougar Creek	Lake Fly	82%
Hunt Creek	Cat Hunt	86%
Moores Creek	57 Bear Paws	29%
Alder Creek	Gold Cup	65%
Tunnel Creek	POL Industrial	84%
Fox Creek	MF Fox	81%

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 (including Westslope Cutthroat Trout), the default spawning and incubation period recognized by the Idaho Department of Environmental Quality (DEQ) is generally from March 15 to July 1 each year (Grafe et al. 2002). The Coeur d'Alene Regional Office further divided the general spawning and incubation windows with assistance from the Idaho Department of Fish and Game to better reflect and protect salmonid spawning and incubation in northern Idaho. The adjusted spawning and incubation windows account for differences in elevation, a watershed characteristic not accounted for originally (Table B-1). Fall spawning can occur as early as August 15 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 the specified time period:

13 °C as a maximum daily maximum water temperature

DEQ recently changed the water quality criteria and removed the salmonid spawning 9 °C maximum daily average temperature. This was adopted by the Idaho Legislature in 2012.

The cold water aquatic life beneficial use, of which salmonid spawning is a subset, identifies water temperatures intended to protect and maintain a viable community for coldwater fish species and for other coldwater species (IDAPA 58.01.02.250.02.b). Per IDAPA 58.01.02.250.02.b., the following water quality criteria need to be met for cold water aquatic life:

- 22 °C maximum daily maximum water temperature
- 19 °C maximum daily average water temperature

Bull Trout (*Salvelinus confluentus*) is listed as a threatened species by the US Fish and Wildlife Service. To protect the species in Idaho, a recovery plan was developed by the state in which water temperature criteria were set to protect the threatened species (IDAPA 58.01.02.250.02.g). The US Environmental Protection Agency (EPA) also promulgated Bull Trout water quality temperature criteria (40 CFR 131.33). State and federal temperature criteria are summarized in Table B-1.

The cold water aquatic life criteria is not discussed in this section because where the cold water aquatic life beneficial use criteria apply, the salmonid spawning criteria also apply and are more protective (i.e., require a lower temperature) than the cold water aquatic life criteria. When temperature data exceed the more protective criteria (salmonid spawning), the water body is identified as impaired by temperature regardless of whether it fails the cold water aquatic life criteria.

Table B-1. State and federal water temperature standards applicable in the Priest River tributaries subbasin.

<table>
<tr><th>Type</th><th>Location</th><th>Criteria</th><th colspan="2">Dates</th></tr>
<tr><td rowspan="2">Cold Water Aquatic Life</td><td rowspan="2">Applies to entire subbasin</td><td>22 °C (71.6 °F) Maximum Daily Maximum Temperature (MDMT)</td><td colspan="2" rowspan="2">Applies entire year</td></tr>
<tr><td>19 °C (66.2 °F) Maximum Daily Average Temperature (MDAT)</td></tr>
<tr><td rowspan="3">Salmonid Spawning</td><td rowspan="3">Applies to entire subbasin where beneficial use is designated or existing</td><td rowspan="2">13 °C (55.4 °F) Maximum Daily Maximum Temperature (MDMT)</td><td>Spring Spawning</td><td>Fall Spawning</td></tr>
<tr><td rowspan="2">>4,000 ft
Jun 1–July 31
3,000–4,000 ft
May 15–July 15
<3,000 ft
May 1–July 1</td><td rowspan="2">Aug 15–Nov 15</td></tr>
<tr><td>9 °C (48.2 °F) Maximum Daily Average Temperature (MDAT)</td></tr>
<tr><td rowspan="4">Idaho Bull Trout Criteria[a]</td><td rowspan="4">Applies to the entire drainage to Priest Lake, excluding Soldier Creek</td><td rowspan="2">13 °C (55.4 °F) Maximum Weekly Maximum Temperature (MWMT)</td><td>Rearing</td><td rowspan="2">NA</td></tr>
<tr><td>Jun 1–Aug 31</td></tr>
<tr><td rowspan="2">9 °C (48.2 °F) Maximum Daily Average Temperature (MDAT)</td><td rowspan="2">NA</td><td>Spawning</td></tr>
<tr><td>Sep 1–
Oct 31</td></tr>
<tr><td>US Environmental Protection Agency
Bull Trout Criteria</td><td>Abandon, Athol, Bath, Bear, Bench, Blacktail, Bog, Boulder, Bugle, Canyon, Caribou, Cedar, Chicopee, Deadman, East Fork Trapper, Fedar, Floss, Gold, Granite, Horton, Hughes Fork, Indian, Jackson, Jost, Kalispell, Kent, Keokee, Lime, Lion, Lost, Lucky, Malcom, Middle Fork East River, Muskegon, North Fork Granite, North Fork Indian, Packer, Rock, Ruby, South Fork Granite, South Fork Indian, South Fork Lion, Squaw, Tango, Tarlac, Trapper, Two Mouth, Uleda, and Zero Creeks, Priest River (above Priest Lake), The Thoroughfare, East River</td><td>10 °C (50 °F) Maximum Weekly Maximum Temperature (MWMT)</td><td colspan="2">Jun 1–Sep 30</td></tr>
<tr><td colspan="5">a. Current Idaho temperature criteria for Bull Trout have not been approved or disapproved by the US Environmental Protection Agency.</td></tr>
</table>

Natural Background Provisions

For potential natural vegetation temperature TMDLs, it is assumed that natural temperatures may exceed these numeric 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's water quality standards apply (IDAPA 58.01.02.200.09):

> 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.

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).

Minor Exceedances of Water Quality Standards for Temperature

It is currently DEQ's policy to allow for minor exceedances of water quality temperature criteria when the exceedance occurs less than 10% of the critical time period and there is no other evidence of thermal inputs (Grafe et al. 2002). Exceptions are also made for water temperature exceedances that occur during periods when air temperatures exceed the 90th percentile of air temperatures recorded in the area (Grafe et al. 2002).

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Appendix C. Estimates of Natural Bank-full Width

Table C-1. Bank-full width estimation for Binarch Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Binarch Creek @ mouth	10.6	8	7	5	6	
Binarch Cr ab 3rd tributary	8.62	7	6	5	5	5.4
Binarch Cr ab 2nd tributary	6.26	6	5	4	4	
Binarch Cr ab 1st tributary	4.4	5	4	3	4	
Binarch Cr @ state border	0.99	2	2	2	2	

Table C-2. Bank-full width estimation for Beaver Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Beaver Creek @ mouth	10.19	8	6	5	6	4.9
Beaver Cr ab 4th tributary	6.72	6	5	4	5	
Beaver Cr ab 3rd tributary	4.69	5	4	3	4	
Beaver Cr ab 2nd tributary	3.19	4	4	3	3	
Baver Cr ab 1st tributary	1.96	3	3	2	2	

Table C-3. Bank-full width estimation for East River.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP data (m)
Lost Creek @ mouth	10.78	8	7	5	6	
Lost Cr ab 1st tributary	8.27	7	6	5	5	
Waters Cr @ mouth	1.86	3	3	2	2	
North Fork East River @ mouth	20.02	11	9	7	8	9.2
NF East River ab Lost Creek	16.36	10	8	7	7	
NF East River ab 3rd tributary	7.9	7	6	5	5	6.6
NF East River ab 2nd tributary	2.62	4	3	3	3	
Canyon Creek @ mouth	4.66	5	4	3	4	
Tarlac Creek @ mouth	3.15	4	4	3	3	
Uleda Creek @ mouth	5.49	6	5	4	4	
Middle Fork East River @ mouth	34.66	14	12	10	11	
MF East River ab Canyon Creek	29.95	13	11	9	10	8.4
MF East River ab Tarlac Creek	19.31	10	9	7	8	
MF East River ab Uleda Creek	9.75	7	6	5	6	
MF East River ab 1st tributary	1.8	3	3	2	2	
East River @ mouth	61.89	18	16	14	15	
East River ab 1st tributary	55.89	17	15	13	14	
East R. bl N. & Middle East Rivers	54.69	17	15	13	14	

Table C-4. Bank-full width estimation for Goose Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Goose Creek @ mouth	22.55	11	10	8	9	
Goose Cr ab 3rd tributary	20.83	11	9	8	8	
Goose Cr ab Blonc Creek	18.64	10	9	7	8	
Goose Cr ab 2nd tributary	16.45	10	8	7	7	
Goose Cr ab Consalus Creek	9.64	7	6	5	6	
Goose Cr ab 1st tributary	8.23	7	6	5	5	
Goose Creek @ state border	8.1	7	6	5	5	
Blonc Creek @ mouth	1.06	3	2	2	2	
Consalus Creek @ mouth	6.31	6	5	4	4	

Table C-5. Bank-full width estimation for Granite Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
SF Granite Creek @ mouth	34.11	14	12	10	11	
NF Granite Creek @ mouth	29.53	13	11	9	10	
Granite Creek @ mouth	98.72	23	20	17	19	23.5
Granite Cr ab Fedar Creek	88.49	22	19	16	18	
Granite Cr ab Blacktail Creek	79.15	20	18	16	17	
Granite Cr ab Athol Creek	74.18	20	17	15	16	
Granite Cr ab Packer Creek	68.99	19	17	14	16	
Granite Cr @ NF & SF confluence	63.69	18	16	14	15	
Zero Creek @ mouth	5.02	5	5	4	4	
Packer Creek @ mouth	4.1	5	4	3	4	
Athol Creek @ mouth	2.14	4	3	2	3	
Blacktail Creek @ mouth	6.31	6	5	4	4	
Jost Creek @ mouth	2.79	4	3	3	3	
Fedar Creek @ mouth	2.81	4	3	3	3	
un-connected stream # 33 @ mouth	1.16	3	2	2	2	

Table C-6. Bank-full width estimation for Hughes Fork Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Bench Creek @ mouth	4.6	5	4	3	4	
Jackson Creek @ mouth	7.13	6	5	4	5	
Gold Creek @ mouth	21.28	11	9	8	8	9.8
Gold Cr ab Muskegon Cr	12.07	8	7	6	6	6.9
Muskegon Creek @ mouth	6.36	6	5	4	4	
South Fork Gold Cr @ mouth	2.8	4	3	3	3	
Boulder Cr @ mouth	9.09	7	6	5	5	5.7
Boulder Cr ab 1st tributary	3.56	5	4	3	3	
Hughes Fork @ mouth	59.66	18	16	13	14	
Hughes Fork ab Boulder Cr	49.95	16	14	12	13	7.6
Hughes Fork ab Gold Cr	27.21	12	11	9	10	7.8
Hughes Fork ab Jackson Cr	16.13	10	8	7	7	
Hughes Fork ab Bench Cr	10.8	8	7	5	6	

Table C-7. Bank-full width estimation for Hunt Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
SF Hunt Creek @ mouth	7.23	6	5	4	5	
Sf Hunt Cr ab 1st tributary	5.35	6	5	4	4	
Hunt Creek @ mouth	18.58	10	9	7	8	
Hunt Cr ab 3rd tributary	17.78	10	9	7	8	
Hunt Cr ab SF Hunt Creek	10.02	8	6	5	6	
Hunt Cr ab 2nd tributary	5.48	6	5	4	4	
Hunt Cr ab 1st tributary	1.77	3	3	2	2	

Table C-8. Bank-full width estimation for Indian Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
North Fork Indian Creek @ mouth	14.2	9	8	6	7	9.9, 15
North Fork Indian ab 3rd tributay	10.89	8	7	5	6	
North Fork Indian ab 1st tributary	5.65	6	5	4	4	
South Fork Indian Creek @ mouth	5.82	6	5	4	4	6.3
South Fork Indian ab 2nd tributary	4.81	5	4	4	4	
South Fork Indian ab 1st tributary	2.82	4	3	3	3	
Indian Creek @ mouth	23.5	11	10	8	9	
Indian Cr ab 2nd tributary	22.26	11	10	8	9	
Indian Cr ab 1st tributary	20.95	11	9	8	8	
Indian Cr @ confluence of NF & SF	20.05	11	9	7	8	

Table C-9. Bank-full width estimation for Kalispell Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Kalispell Creek @ mouth	45.99	16	14	12	13	
Kalispell Cr ab 2nd tributary	44.62	16	14	11	12	
Kalispell Cr ab 1st tributary	42.2	15	13	11	12	8
Kalispell Cr ab Bath Creek	19.12	10	9	7	8	6.8, 6
Kalispell Cr @ state border	12.99	9	7	6	7	
Bath Creek @ mouth	5.86	6	5	4	4	
Nuisance Creek @ mouth	5.74	6	5	4	4	
un-connected stream # 30 @ end	2.42	4	3	2	3	

Table C-10. Bank-full width estimation for Lamb Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Lamb Creek @ mouth	22.31	11	10	9	9	
Lamb Cr ab 5th tributary	21.32	11	9	9	8	7.2
Lamb Cr ab 4th tributary	15.12	9	8	8	7	
Lamb Cr ab 2nd tributary	12.48	8	7	7	6	
Lamb Cr ab 1st tributary	11.83	8	7	7	6	
Lamb Cr ab NF Lamb Creek	5.22	6	5	5	4	4.7
Lamb Creek @ state border	3.11	4	4	4	3	
un-connected stream #28 @ end	1.06	3	2	3	2	
North Fork Lamb Creek @ mouth	5.75	6	5	5	4	
NF Lamb Cr ab 1st tributary	4.26	5	4	5	4	
NF Lamb Cr ab Skip Creek	1.53	3	3	3	2	
Skip Creek @ mouth	2.08	4	3	3	3	

Table C-11. Bank-full width estimation for Lion Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Kent Creek @ mouth	3.71	5	4	4	3	
South Fork Lion Creek @ mouth	4.58	5	4	5	4	
Lucky Creek @ mouth	1.66	3	3	3	2	
Lion Creek @ mouth	28.48	13	11	10	10	17.2
Lion Cr ab Lucky Creek	26.39	12	10	9	9	
Lion Cr ab South Fork Lion Cr	21.04	11	9	9	8	
Lion Cr ab 6th tributary	15.86	9	8	8	7	
Lion Cr ab 2nd tributary	11.7	8	7	7	6	
Lion Cr ab Kent Creek	7.23	6	5	6	5	
Lion Cr ab 1st tributary	3.04	4	4	4	3	

Table C-12. Bank-full width estimation for Lower West Branch Priest River.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
LWB Priest River @ mouth	82.69	21	18	15	17	14.7
LWB Priest River ab Pine Creek	74.49	20	18	14	16	
LWB Priest River ab Peewee Creek	71.46	19	17	14	16	
LWB Priest River ab Snow Creek	57.72	18	15	13	14	
LWB Priest River ab Tunnel Creek	54.53	17	15	13	14	9.7
LWB Priest River ab Moores Creek	38.78	15	13	11	12	
LWB Priest River ab Ole Creek	35.2	14	12	11	11	
LWB Priest River ab Slough Creek	33.04	13	12	10	11	
LWB Priest River ab Bear Paw Cr	20.16	11	9	8	8	
Bear Paw Creek @ mouth	8.83	7	6	6	5	
Mosquito Creek @ mouth	1.59	3	3	3	2	
Roger Creek @ mouth	0.62	2	2	2	1	
Slough Creek @ mouth	1.13	3	2	3	2	
Ole Creek @ mouth	3.14	4	4	4	3	
Tunnel Creek @ mouth	4.06	5	4	4	4	
Snow Creek @ mouth	9.7	7	6	6	6	
Snow Cr ab 2nd tributary	6.43	6	5	5	5	
Peewee Creek @ mouth	2.98	4	4	4	3	
Pine Creek @ mouth	5.1	5	5	5	4	
Moores Creek @ mouth	14.81	9	8	7	7	
Moores Cr ab 7th tributary	12.32	8	7	7	6	
Moores Cr ab 4th tributary	7.79	7	6	6	5	
Moores Cr ab West Fork Moores Cr	6.91	6	5	6	5	
Moores Cr ab 2nd tributary	3.16	4	4	4	3	
West Fork Moores Creek @ mouth	4.64	5	4	5	4	
WF Moores Cr ab 2nd tributary	2.55	4	3	4	3	
Moores Cr 7th tributary @ mouth	1.13	3	2	3	2	

Table C-13. Bank-full width estimation for Priest River.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Upper Priest River @ mouth	114.57	24	22	19	20	21.4, 18.8
Upper Priest R. ab Malcom Creek	1.65	3	3	2	2	
The Thorofare bl Upper Priest Lake	145.13	27	24	21	23	
The Thorofare ab Priest Lake	190.28	31	28	25	26	
Priest River bl Lake	595.45	54	50	45	48	
Priest River @ mouth	957.87	68	63	58	61	

Table C-14. Bank-full width estimation for Reeder Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Reeder Creek @ mouth	12.81	9	7	7	6	
Reeder Cr ab 3rd tributary	11.4	8	7	7	6	
Reeder Cr ab 2nd tributary	8.84	7	6	6	5	3.2
Reeder Cr ab Indian Creek	1.61	3	3	3	2	
un-connected stream # 32 @ end	0.79	2	2	2	2	
Indian Creek @ mouth	2.28	4	3	4	3	
Reeder Cr 3rd tributary @ mouth	1.36	3	2	3	2	
3rd tributary ab tributary 3.1	0.62	2	2	2	1	

Table C-15. Bank-full width estimation for Soldier Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Lee Creek @ mouth	3.71	5	4	4	3	
Lee Cr ab 1st tributary	1.64	3	3	3	2	
Soldier Creek @ mouth	25.04	12	10	9	9	
Soldier Cr ab Lee Creek	19.09	10	9	8	8	
Soldier Cr ab 7th tributary	16.38	10	8	8	7	
Soldier Cr ab 5th tributary	12.74	9	7	7	6	
Soldier Cr ab 3rd tributary	9.69	7	6	6	6	
Soldier Cr ab 1st tributary	3.98	5	4	4	4	

Table C-16. Bank-full width estimation for Trapper Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Floss Creek @ mouth	3.62	5	4	4	3	
Floss Cr ab 1st tributary	1.32	3	2	3	2	
Floss Cr 1st tributary @ mouth	2.04	4	3	3	2	
East Fork Trapper Cr @ mouth	4.97	5	5	5	4	
East Fork Trapper Cr ab Floss Cr	1.19	3	2	3	2	
Trapper Creek @ mouth	19.13	10	9	8	8	7.7
Trapper Cr ab East Fork Trapper Cr	12.7	8	7	7	6	5.1
Trapper Cr ab 1st tributary	3.87	5	4	4	3	7.6

Table C-17. Bank-full width estimation for Two Mouth Creek.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Two Mouth 12th tributay @ mouth	1.59	3	3	3	2	
Two Mouth 7th tributay @ mouth	0.81	2	2	2	2	
Two Mouth 2nd tributay @ mouth	1.11	3	2	3	2	
Two Mouth Creek @ mouth	24.14	12	10	9	9	11.5, 15.2
Two Mouth Cr ab 12th tributay	21.84	11	9	9	9	
Two Mouth Cr ab 10th tributay	19.57	10	9	8	8	
Two Mouth Cr ab 7th tributay	15.26	9	8	8	7	22.1
Two Mouth Cr ab 5th tributay	12.69	8	7	7	6	
Two Mouth Cr ab 2nd tributay	3.09	4	4	4	3	
Two Mouth Cr ab 1st tributay	2.58	4	3	4	3	

Table C-18. Bank-full width estimation for Upper West Branch Priest River.

Location	area (sq mi)	Spokane (m)	Kootenai (m)	PendOreille (m)	Clearwater (m)	BURP Data (m)
Upper W Branch Priest R. @ mouth	69.9	19	17	14	16	
UWB Priest R. ab 6th tributary	63.16	18	16	13	15	13
UWB Priest R. ab Goose Creek	38.85	15	13	11	12	
UWB Priest R. ab 4th tributary	37.16	14	12	11	11	
UWB Priest R. ab 2nd tributary	34.36	14	12	10	11	
UWB Priest R. @ state border	33.89	14	12	10	11	11.1
Tola Creek @ state border	0.39	2	1	2	1	

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Appendix D. Existing and Potential Solar Load Tables and Target Shade Curves

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Load Analysis Tables for the Upper Priest River Region

Note: All assessment unit (AU) numbers start with ID17010215 in all load tables (Tables D-1–D-37). Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table D-1. Existing and potential solar loads for the upper Priest River named tributaries.

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
018_02	Rock Creek	1	1800	Group B	98%	0.11	2	4,000	500	70%	1.71	2	4,000	7,000	7,000	-28%
018_02	Rock Creek	2	2000	Group B	97%	0.17	3	6,000	1,000	80%	1.14	3	6,000	7,000	6,000	-17%
018_02	Rock Creek	3	2400	Group B	96%	0.23	4	10,000	2,000	90%	0.57	4	10,000	6,000	4,000	-6%
018_02	Lime Creek	1	3000	Group B	97%	0.17	3	9,000	2,000	80%	1.14	3	9,000	10,000	8,000	-17%
018_02	Lime Creek	2	3430	Group B	94%	0.34	5	20,000	7,000	90%	0.57	6	20,000	10,000	3,000	-4%
018_02	trib to Lime Cr.	1	360	Group B	98%	0.11	1	400	50	80%	1.14	1	400	500	500	-18%
018_02	trib to Lime Cr.	2	250	Group B	98%	0.11	1	300	30	60%	2.28	1	300	700	700	-38%
018_02	trib to Lime Cr.	3	800	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
018_02	trib to Lime Cr.	4	330	Group B	98%	0.11	2	700	80	90%	0.57	2	700	400	300	-8%
018_02	Cedar Creek	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
018_02	Cedar Creek	2	4760	Group B	96%	0.23	4	20,000	5,000	80%	1.14	4	20,000	20,000	20,000	-16%
018_02	1st trib to Cedar	1	1600	Group B	98%	0.11	1	2,000	200	70%	1.71	1	2,000	3,000	3,000	-28%
018_02	1st trib to Cedar	2	390	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
018_02	2nd trib to Cedar	1	690	Group C	98%	0.11	1	700	80	70%	1.71	1	700	1,000	900	-28%
018_02	2nd trib to Cedar	2	500	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
018_02	2nd trib to Cedar	3	430	Group B	97%	0.17	3	1,000	200	70%	1.71	3	1,000	2,000	2,000	-27%
018_02	3rd trib to Cedar	1	210	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
018_02	3rd trib to Cedar	2	2600	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
018_02	Ruby Creek	1	550	Group B	98%	0.11	1	600	70	50%	2.85	1	600	2,000	2,000	-48%
018_02	Ruby Creek	2	470	Group B	98%	0.11	1	500	60	60%	2.28	1	500	1,000	900	-38%
018_02	Ruby Creek	3	280	Group B	98%	0.11	2	600	70	50%	2.85	2	600	2,000	2,000	-48%
018_02	Ruby Creek	4	2800	Group B	97%	0.17	3	8,000	1,000	90%	0.57	3	8,000	5,000	4,000	-7%
018_02	Ruby Creek	5	530	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
018_02	Ruby Creek	6	2500	Group B	96%	0.23	4	10,000	2,000	90%	0.57	4	10,000	6,000	4,000	-6%
018_02	trib to Ruby	1	1800	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
018_02	Snow Creek	1	440	Group B	98%	0.11	1	400	50	60%	2.28	1	400	900	900	-38%
018_02	Snow Creek	2	710	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
018_02	Snow Creek	3	360	Group B	98%	0.11	2	700	80	70%	1.71	2	700	1,000	900	-28%
018_02	Snow Creek	4	1250	Group B	97%	0.17	3	4,000	700	90%	0.57	3	4,000	2,000	1,000	-7%
018_02	Togo Gulch	1	2000	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
							Totals		25,000					100,000	83,000	

Table D-2. Existing and potential solar loads for the upper Priest River unnamed tributaries.

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
018_02	border stream	1	820	Rock/	40%	3.42	1	800	3,000	40%	3.42	1	800	3,000	0	0%
018_02	border stream	2	410	Avalanche	60%	2.28	2	800	2,000	60%	2.28	2	800	2,000	0	0%
018_02	(Snowy Top)	3	410	Group C	96%	0.23	3	1,000	200	90%	0.57	3	1,000	600	400	-6%
018_02	1st tributary	1	810	Rock/	60%	2.28	1	800	2,000	60%	2.28	1	800	2,000	0	0%
018_02	1st tributary	2	680	Avalanche	70%	1.71	2	1,000	2,000	70%	1.71	2	1,000	2,000	0	0%
018_02	1st tributary	3	260	Group B	97%	0.17	3	800	100	90%	0.57	3	800	500	400	-7%
018_02	2nd tributary	1	610	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
018_02	2nd tributary	2	70	Group B	98%	0.11	2	100	10	50%	2.85	2	100	300	300	-48%
018_02	2nd tributary	3	1100	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
018_02	3rd tributary	1	1700	Rock/	60%	2.28	2	3,000	7,000	60%	2.28	2	3,000	7,000	0	0%
018_02	4th tributary	1	1700	Avalanche	50%	2.85	1	2,000	6,000	50%	2.85	1	2,000	6,000	0	0%
018_02	4th tributary	2	330	Rock/	40%	3.42	2	700	2,000	40%	3.42	2	700	2,000	0	0%
018_02	5th tributary	1	720	Avalanche	60%	2.28	1	700	2,000	60%	2.28	1	700	2,000	0	0%
018_02	5th tributary	2	770	Rock/	70%	1.71	2	2,000	3,000	70%	1.71	2	2,000	3,000	0	0%
018_02	5th tributary	3	120	Avalanche	50%	2.85	3	400	1,000	50%	2.85	3	400	1,000	0	0%
018_02	6th tributary	1	630	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
018_02	6th tributary	2	1300	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
018_02	7th tributary	1	1200	Nonforest 1	97%	0.17	1	1,000	200	80%	1.14	1	1,000	1,000	800	-17%
018_02	7th tributary	2	1200	Nonforest 1	94%	0.34	2	2,000	700	90%	0.57	2	2,000	1,000	300	-4%
018_02	8th tributary	1	940	Group B	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
018_02	8th tributary	2	1500	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
018_02	9th tributary	1	1700	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
018_02	10th tributary	1	1700	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
							Totals		33,000					46,000	14,000	

Table D-3. Existing and potential solar loads for Malcom Creek.

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
018_02	1st tributary	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
018_02	1st tributary	2	350	Group B	98%	0.11	2	700	80	80%	1.14	2	700	800	700	-18%
018_02	Spread Creek	1	1500	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
018_02	Spread Creek	2	60	Group B	98%	0.11	2	100	10	40%	3.42	2	100	300	300	-58%
018_02	Spread Creek	3	940	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
018_02	Continental Cr.	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
018_02	Continental Cr.	2	80	Group B	98%	0.11	2	200	20	40%	3.42	2	200	700	700	-58%
018_02	Continental Cr.	3	700	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
018_02	Malcom Creek	1	3400	Group B	98%	0.11	1	3,000	300	90%	0.57	1	3,000	2,000	2,000	-8%
018_02	Malcom Creek	2	1000	Group B	97%	0.17	3	3,000	500	80%	1.14	3	3,000	3,000	3,000	-17%
018_02	Malcom Creek	3	450	Group B	96%	0.23	4	2,000	500	90%	0.57	4	2,000	1,000	500	-6%
018_02	Malcom Creek	4	1420	Group B	94%	0.34	5	7,000	2,000	80%	1.14	5	7,000	8,000	6,000	-14%
018_02	Malcom Creek	5	550	Group B	94%	0.34	5	3,000	1,000	70%	1.71	5	3,000	5,000	4,000	-24%
018_02	Malcom Creek	6	740	Group B	94%	0.34	5	4,000	1,000	90%	0.57	6	4,000	2,000	1,000	-4%
							Totals		6,300					29,000	24,000	

Table D-4. Existing and potential solar loads for Hughes Fork Creek.

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
019_02	Hughes Fork	1	2200	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
019_02	Hughes Fork	2	160	Avalanche Path	60%	2.28	2	300	700	60%	2.28	2	300	700	0	0%
019_02	Hughes Fork	3	110	Group B	98%	0.11	2	200	20	80%	1.14	2	200	200	200	-18%
019_02	Hughes Fork	4	980	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
019_02	Hughes Fork	5	380	Group B	97%	0.17	3	1,000	200	80%	1.14	3	1,000	1,000	800	-17%
019_02	Hughes Fork	6	480	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
019_02	Hughes Fork	7	230	Group B	97%	0.17	3	700	100	80%	1.14	3	700	800	700	-17%
019_02	Hughes Fork	8	2750	Group B	97%	0.17	3	8,000	1,000	90%	0.57	3	8,000	5,000	4,000	-7%
019_02	Hughes Fork	9	700	Group B	96%	0.23	4	3,000	700	70%	1.71	4	3,000	5,000	4,000	-26%
019_02	Hughes Fork	10	620	Nonforest 1	78%	1.25	4	2,000	3,000	60%	2.28	4	2,000	5,000	2,000	-18%
019_02	Hughes Fork	11	490	Nonforest 1	78%	1.25	4	2,000	3,000	70%	1.71	4	2,000	3,000	0	-8%
019_02	Hughes Fork	12	1300	Nonforest 1	72%	1.60	5	7,000	10,000	40%	3.42	10	10,000	30,000	20,000	-32%
							Totals		19,000					53,000	34,000	

Table D-5. Existing and potential solar loads for Hughes Fork tributaries.

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
019_02	Bench Creek	1	1420	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
019_02	Bench Creek	2	1040	Group B	96%	0.23	4	4,000	900	90%	0.57	4	4,000	2,000	1,000	-6%
019_02	Bench Creek	3	320	Group B	94%	0.34	5	2,000	700	80%	1.14	5	2,000	2,000	1,000	-14%
019_02	Bench Creek	4	320	Group B	94%	0.34	5	2,000	700	70%	1.71	5	2,000	3,000	2,000	-24%
019_02	1st trib to Bench	1	680	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
019_02	2nd trib to Bench	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
019_02	1st tributary	1	700	Group B	98%	0.11	1	700	80	90%	0.57	1	700	400	300	-8%
019_02	2nd tributary	1	760	Group B	98%	0.11	1	800	90	90%	0.57	1	800	500	400	-8%
019_02	3rd tributary	1	1700	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
019_02	4th tributary	1	1700	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
019_02	5th tributary	1	1000	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
019_02	5th tributary	2	270	Group B	98%	0.11	2	500	60	30%	3.99	2	500	2,000	2,000	-68%
019_02	Jackson Creek	1	1650	Group B	97%	0.17	3	5,000	900	90%	0.57	3	5,000	3,000	2,000	-7%
019_02	Jackson Creek	2	740	Group B	92%	0.46	6	4,000	2,000	80%	1.14	6	4,000	5,000	3,000	-12%
019_02	Ledge Creek	1	1300	Group B	98%	0.11	2	3,000	300	70%	1.71	2	3,000	5,000	5,000	-28%
019_02	Ledge Creek	2	1400	Group B	97%	0.17	3	4,000	700	90%	0.57	3	4,000	2,000	1,000	-7%
019_02	6th tributary	1	1200	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
019_02	6th tributary	2	740	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
							Totals		8,300					38,000	30,000	

Table D-6. Existing and potential solar loads for Gold Creek.

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
019_02	Muskegon Cr.	1	1660	Group B	94%	0.34	5	8,000	3,000	80%	1.14	5	8,000	9,000	6,000	-14%
019_02	trib. to Muskegon	1	310	Group B	98%	0.11	1	300	30	90%	0.57	1	300	200	200	-8%
019_02	SF Gold Creek	1	860	Group C	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
019_02	SF Gold Creek	2	2200	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
019_02	SF Gold Creek	3	2200	Group B	96%	0.23	4	9,000	2,000	90%	0.57	4	9,000	5,000	3,000	-6%
019_02	SF Gold Creek	4	120	Group B	96%	0.23	4	500	100	80%	1.14	4	500	600	500	-16%
019_02	trib. to Gold Cr.	1	1090	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
019_02	trib. to Gold Cr.	2	350	Group B	98%	0.11	2	700	80	90%	0.57	2	700	400	300	-8%
019_02	Gold Creek	1	1500	Group B	90%	0.57	7	10,000	6,000	80%	1.14	7	10,000	10,000	4,000	-10%
							Totals		12,000					29,000	17,000	

Table D-7. Existing and potential solar loads for Boulder Creek.

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
019_02	1st tributary	1	810	Group B	98%	0.11	1	800	90	90%	0.57	1	800	500	400	-8%
019_02	1st tributary	2	1400	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
019_02	2nd tributary	1	1400	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
019_02	2nd tributary	2	970	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
019_02	Boulder Creek	1	540	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
019_02	Boulder Creek	2	950	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
019_02	Boulder Creek	3	4550	Group B	96%	0.23	4	20,000	5,000	80%	1.14	4	20,000	20,000	20,000	-16%
019_02	Boulder Creek	4	4480	Group B	92%	0.46	6	30,000	10,000	90%	0.57	6	30,000	20,000	10,000	-2%
							Totals		16,000					47,000	37,000	

Table D-8. Existing and potential solar loads for Trapper Creek.

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
017_02	1st tributary	1	1000	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
017_02	1st tributary	2	1500	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
017_02	1st tributary	3	130	Group B	98%	0.11	2	300	30	60%	2.28	2	300	700	700	-38%
017_02	1st tributary	4	1240	Group B	97%	0.17	3	4,000	700	90%	0.57	3	4,000	2,000	1,000	-7%
017_02	trib to 1st trib	1	420	Rocky/High Elv	95%	0.29	1	400	100	80%	1.14	1	400	500	400	-15%
017_02	trib to 1st trib	2	630	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
017_02	trib to 1st trib	3	350	Group B	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
017_02	trib to 1st trib	4	410	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
017_02	trib to 1st trib	5	920	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
017_02	2nd tributary	1	200	Group B	98%	0.11	1	200	20	90%	0.57	1	200	100	80	-8%
017_02	2nd tributary	2	550	Group B	98%	0.11	1	600	70	70%	1.71	1	600	1,000	900	-28%
017_02	2nd tributary	3	890	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
017_02	3rd tributary	1	950	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
017_02	3rd tributary	2	1400	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
017_02	EF Trapper Cr.	1	900	Group B	98%	0.11	1	900	100	90%	0.57	1	900	500	400	-8%
017_02	EF Trapper Cr.	2	2000	Group B	98%	0.11	2	4,000	500	80%	1.14	2	4,000	5,000	5,000	-18%
017_02	EF Trapper Cr.	3	900	Group B	97%	0.17	3	3,000	500	80%	1.14	3	3,000	3,000	3,000	-17%
017_02	EF Trapper Cr.	4	680	Group B	94%	0.34	5	3,000	1,000	90%	0.57	5	3,000	2,000	1,000	-4%
017_02	Trapper Creek	2	1220	Rocky/High Elv	89%	0.63	2	2,000	1,000	70%	1.71	2	2,000	3,000	2,000	-19%
017_02	Trapper Creek	3	430	Group B	98%	0.11	2	900	100	70%	1.71	2	900	2,000	2,000	-28%
017_02	Trapper Creek	4	2200	Group B	96%	0.23	4	9,000	2,000	80%	1.14	7	20,000	20,000	20,000	-16%
017_02	Trapper Creek	5	1860	Group B	94%	0.34	5	9,000	3,000	90%	0.57	7	10,000	6,000	3,000	-4%
017_02	Trapper Creek	6	700	Rocky/High Elv	54%	2.62	6	4,000	10,000	80%	1.14	7	5,000	6,000	(4,000)	0%
017_02	Trapper Creek	7	1030	Group B	92%	0.46	6	6,000	3,000	80%	1.14	7	7,000	8,000	5,000	-12%
017_02	Trapper Creek	8	1080	Group B	90%	0.57	7	8,000	5,000	90%	0.57	7	8,000	5,000	0	0%
017_03	Trapper Creek	9	970	Thinleaf alder	34%	3.76	8	8,000	30,000	50%	2.85	8	8,000	20,000	(10,000)	0%
017_03	Trapper Creek	10	1100	Group B	87%	0.74	8	9,000	7,000	90%	0.57	8	9,000	5,000	(2,000)	0%
017_03	Trapper Creek	11	620	Nonforest 1	55%	2.57	8	5,000	10,000	70%	1.71	8	5,000	9,000	(1,000)	0%
							Totals		76,000					110,000	37,000	

Table D-9. Existing and potential solar loads for Floss Creek.

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
017_02	1st tributary	1	1700	Group B	98%	0.11	1	2,000	200	80%	1.14	1	2,000	2,000	2,000	-18%
017_02	1st tributary	2	240	Pond	0%	5.70	2	500	3,000	0%	5.70	2	500	3,000	0	0%
017_02	1st tributary	3	650	Thinleaf alder	86%	0.80	2	1,000	800	70%	1.71	2	1,000	2,000	1,000	-16%
017_02	1st tributary	4	890	Thinleaf alder	43%	3.25	6	5,000	20,000	40%	3.42	6	5,000	20,000	0	-3%
017_02	1st tributary	5	620	Nonforest 1	86%	0.80	3	2,000	2,000	80%	1.14	3	2,000	2,000	0	-6%
017_02	trib to 1st trib	1	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
017_02	trib to 1st trib	2	1400	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
017_02	Floss Creek	1	980	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
017_02	Floss Creek	2	1500	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
017_02	Floss Creek	3	710	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
017_02	Floss Creek	4	910	Thinleaf alder	59%	2.34	4	4,000	9,000	60%	2.28	4	4,000	9,000	0	0%
017_02	Floss Creek	5	160	Thinleaf alder	59%	2.34	4	600	1,000	70%	1.71	4	600	1,000	0	0%
							Totals		37,000					47,000	11,000	

Load Analysis Tables for the Eastside Priest Lake Region

Table D-10. Existing and potential solar loads for Lion Creek.

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
013_02	Lion Creek	1	360	Lake	0%	5.70	240	86,400	492,000	0%	5.70	240	86,400	492,000	0	0%
013_02	Lion Creek	2	1200	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
013_02	Lion Creek	3	290	Rocky/High Elv	67%	1.88	4	1,000	2,000	70%	1.71	4	1,000	2,000	0	0%
013_02	Lion Creek	4	2100	Rocky/High Elv	67%	1.88	4	8,000	20,000	80%	1.14	4	8,000	9,000	(10,000)	0%
013_02	Lion Creek	5	850	Rocky/High Elv	67%	1.88	4	3,000	6,000	80%	1.14	4	3,000	3,000	(3,000)	0%
013_02	Lion Creek	6	390	Rocky/High Elv	60%	2.28	5	2,000	5,000	50%	2.85	5	2,000	6,000	1,000	-10%
013_02	Lion Creek	7	1000	Rocky/High Elv	60%	2.28	5	5,000	10,000	80%	1.14	5	5,000	6,000	(4,000)	0%
013_02	Lion Creek	8	1200	Rocky/High Elv	54%	2.62	6	7,000	20,000	80%	1.14	6	7,000	8,000	(10,000)	0%
013_02	Lion Creek	9	920	Rocky/High Elv	48%	2.96	7	6,000	20,000	70%	1.71	7	6,000	10,000	(10,000)	0%
013_02	Lion Creek	10	700	Rocky/High Elv	44%	3.19	8	6,000	20,000	40%	3.42	8	6,000	20,000	0	-4%
013_02	Lion Creek	11	4160	Rocky/High Elv	44%	3.19	8	30,000	100,000	50%	2.85	8	30,000	90,000	(10,000)	0%
013_02	Lion Creek	12	1140	Rocky/High Elv	40%	3.42	9	10,000	30,000	50%	2.85	9	10,000	30,000	0	0%
013_02	Lion Creek	13	270	Thinleaf alder	31%	3.93	9	2,000	8,000	50%	2.85	9	2,000	6,000	(2,000)	0%
013_02	Lion Creek	14	450	Thinleaf alder	31%	3.93	9	4,000	20,000	30%	3.99	9	4,000	20,000	0	-1%
013_02	Lion Creek	15	160	Thinleaf alder	31%	3.93	9	1,000	4,000	60%	2.28	9	1,000	2,000	(2,000)	0%
013_02	Lion Creek	16	1500	Group B	83%	0.97	9	10,000	10,000	80%	1.14	10	20,000	20,000	10,000	-3%
013_02	Lion Creek	17	360	Group B	83%	0.97	10	3,600	3,500	70%	1.71	12	4,300	7,400	3,900	-13%
013_02	Lion Creek	18	1130	Group B	83%	0.97	10	11,000	11,000	70%	1.71	17	19,000	32,000	21,000	-13%
013_02	Lion Creek	19	230	Nonforest	48%	2.96	10	2,300	6,800	20%	4.56	20	4,600	21,000	14,000	-28%
							Totals		790,000					790,000	-1,100	

Table D-11. Existing and potential solar loads for Lion Creek tributaries.

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
013_02	1st tributary	1	840	Rocky/High Elv	95%	0.29	1	800	200	90%	0.57	1	800	500	300	-5%
013_02	1st tributary	2	180	Avalanche/	60%	2.28	2	400	900	60%	2.28	2	400	900	0	0%
013_02	1st tributary	3	200	Rocky/High Elv	89%	0.63	2	400	300	80%	1.14	2	400	500	200	-9%
013_02	1st tributary	4	1200	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
013_02	1st tributary	5	620	Rocky/High Elv	76%	1.37	3	2,000	3,000	90%	0.57	3	2,000	1,000	(2,000)	0%
013_02	2nd tributary	1	780	AV/Rock	80%	1.14	1	800	900	80%	1.14	1	800	900	0	0%
013_02	2nd tributary	2	520	Rocky/High Elv	95%	0.29	1	500	100	90%	0.57	1	500	300	200	-5%
013_02	2nd tributary	3	910	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
013_02	3rd tributary	1	650	Rocky/High Elv	95%	0.29	1	700	200	90%	0.57	1	700	400	200	-5%
013_02	3rd tributary	2	220	Rocky/High Elv	89%	0.63	2	400	300	90%	0.57	2	400	200	(100)	0%
013_02	3rd tributary	3	260	Group C	97%	0.17	2	500	90	90%	0.57	2	500	300	200	-7%
013_02	3rd tributary	4	340	Group B	98%	0.11	2	700	80	90%	0.57	2	700	400	300	-8%
013_02	3rd tributary	5	340	Rocky/High Elv	89%	0.63	2	700	400	90%	0.57	2	700	400	0	0%
013_02	4th tributary	1	880	Rocky/High Elv	95%	0.29	1	900	300	90%	0.57	1	900	500	200	-5%
013_02	4th tributary	2	770	Rocky/High Elv	89%	0.63	2	2,000	1,000	80%	1.14	2	2,000	2,000	1,000	-9%
013_02	5th tributary	1	350	Group C	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
013_02	5th tributary	2	250	Group B	98%	0.11	1	300	30	90%	0.57	1	300	200	200	-8%
013_02	5th tributary	3	210	Rocky/High Elv	95%	0.29	1	200	60	90%	0.57	1	200	100	40	-5%
013_02	5th tributary	4	580	Rocky/High Elv	89%	0.63	2	1,000	600	80%	1.14	2	1,000	1,000	400	-9%
013_02	5th tributary	5	460	Rocky/High Elv	89%	0.63	2	900	600	90%	0.57	2	900	500	(100)	0%
013_02	6th tributary	1	870	Rocky/High Elv	95%	0.29	1	900	300	90%	0.57	1	900	500	200	-5%
013_02	6th tributary	2	320	Rocky/High Elv	89%	0.63	2	600	400	80%	1.14	2	600	700	300	-9%
013_02	6th tributary	3	640	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
013_02	6th tributary	4	460	Rocky/High Elv	76%	1.37	3	1,000	1,000	60%	2.28	3	1,000	2,000	1,000	-16%
013_02	6th tributary	5	180	Group B	97%	0.17	3	500	90	70%	1.71	3	500	900	800	-27%
013_02	6th tributary	6	230	Group B	97%	0.17	3	700	100	90%	0.57	3	700	400	300	-7%
013_02	7th tributary	1	670	Rocky/High Elv	95%	0.29	1	700	200	80%	1.14	1	700	800	600	-15%
013_02	7th tributary	2	410	Rocky/High Elv	89%	0.63	2	800	500	90%	0.57	2	800	500	0	0%
013_02	7th tributary	3	660	Rocky/High Elv	89%	0.63	2	1,000	600	80%	1.14	2	1,000	1,000	400	-9%
013_02	8th tributary	1	740	Rocky/High Elv	95%	0.29	1	700	200	80%	1.14	1	700	800	600	-15%
013_02	8th tributary	2	300	Rocky/High Elv	89%	0.63	2	600	400	70%	1.71	2	600	1,000	600	-19%
013_02	8th tributary	3	700	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
013_02	8th tributary	4	60	Lake	0%	5.70	80	4,800	27,000	0%	5.70	80	4,800	27,000	0	0%
013_02	SF Lion Creek	1	1070	Rocky/High Elv	95%	0.29	1	1,000	300	90%	0.57	1	1,000	600	300	-5%
013_02	SF Lion Creek	2	2420	Rocky/High Elv	76%	1.37	3	7,000	10,000	90%	0.57	3	7,000	4,000	(6,000)	0%
013_02	SF Lion Creek	3	3940	Rocky/High Elv	60%	2.28	5	20,000	50,000	90%	0.57	5	20,000	10,000	(40,000)	0%
013_02	SF Lion Creek	4	560	Group B	94%	0.34	5	3,000	1,000	90%	0.57	5	3,000	2,000	1,000	-4%
013_02	Lucky Creek	1	50	Lake	35%	3.71	30	1,500	5,600	30%	3.99	30	1,500	6,000	400	-5%
013_02	Lucky Creek	2	1100	Rocky/High Elv	95%	0.29	1	1,000	300	90%	0.57	1	1,000	600	300	-5%
013_02	Lucky Creek	3	330	Rocky/High Elv	89%	0.63	2	700	400	80%	1.14	2	700	800	400	-9%
013_02	Lucky Creek	4	3100	Group B	97%	0.17	3	9,000	2,000	90%	0.57	3	9,000	5,000	3,000	-7%
017_02	Kent Creek	1	180	Rocky/High Elv	95%	0.29	1	200	60	80%	1.14	1	200	200	100	-15%
017_02	Kent Creek	2	1590	Rocky/High Elv	89%	0.63	2	3,000	2,000	90%	0.57	2	3,000	2,000	0	0%
017_02	Kent Creek	3	920	Rocky/High Elv	76%	1.37	3	3,000	4,000	90%	0.57	3	3,000	2,000	(2,000)	0%
017_02	Kent Creek	4	750	Rocky/High Elv	76%	1.37	3	2,000	3,000	80%	1.14	3	2,000	2,000	(1,000)	0%
017_02	Kent Creek	5	300	Rocky/High Elv	67%	1.88	4	1,000	2,000	60%	2.28	4	1,000	2,000	0	-7%
017_02	Kent Creek	6	960	Rocky/High Elv	67%	1.88	4	4,000	8,000	80%	1.14	4	4,000	5,000	(3,000)	0%
							Totals		130,000					91,000	-40,000	

Table D-12. Existing and potential solar loads for Two Mouth Creek.

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
012_02	Two Mouth Creek	1	3060	Rocky/High Elv	67%	1.88	4	10,000	20,000	80%	1.14	4	10,000	10,000	(10,000)	0%
012_02	Two Mouth Creek	2	3380	Rocky/High Elv	54%	2.62	6	20,000	50,000	80%	1.14	6	20,000	20,000	(30,000)	0%
012_02	Two Mouth Creek	3	670	Rocky/High Elv	54%	2.62	6	4,000	10,000	80%	1.14	8	5,000	6,000	(4,000)	0%
012_02	Two Mouth Creek	4	580	Group B	92%	0.46	6	3,000	1,000	80%	1.14	8	5,000	6,000	5,000	-12%
012_02	Two Mouth Creek	5	360	Thinleaf alder	38%	3.53	7	3,000	10,000	40%	3.42	15	5,000	20,000	10,000	0%
012_02	Two Mouth Creek	6	110	Rocky/High Elv	44%	3.19	8	900	3,000	70%	1.71	8	900	2,000	(1,000)	0%
012_02	Two Mouth Creek	7	500	Group B	87%	0.74	8	4,000	3,000	70%	1.71	8	4,000	7,000	4,000	-17%
012_02	Two Mouth Creek	8	620	Group B	87%	0.74	8	5,000	4,000	70%	1.71	10	6,000	10,000	6,000	-17%
012_02	Two Mouth Creek	9	1810	Group B	87%	0.74	8	10,000	7,000	80%	1.14	8	10,000	10,000	3,000	-7%
012_02	Two Mouth Creek	10	1150	Group B	87%	0.74	8	9,000	7,000	70%	1.71	8	9,000	20,000	10,000	-17%
012_02	Two Mouth Creek	11	241	Group B	83%	0.97	9	2,000	2,000	60%	2.28	15	4,000	9,000	7,000	-23%
012_02	Two Mouth Creek	12	1700	Group B	83%	0.97	9	20,000	20,000	80%	1.14	11	20,000	20,000	0	-3%
012_02	Two Mouth Creek	13	300	Group B	83%	0.97	9	3,000	3,000	70%	1.71	9	3,000	5,000	2,000	-13%
012_02	Two Mouth Creek	14	420	Nonforest 1	52%	2.74	9	4,000	10,000	30%	3.99	20	8,000	30,000	20,000	-22%
012_02	Two Mouth Creek	15	1580	Nonforest 1	52%	2.74	9	10,000	30,000	40%	3.42	14	20,000	70,000	40,000	-12%
							Totals		180,000					250,000	62,000	

Table D-13. Existing and potential solar loads for Two Mouth Creek tributaries.

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
012_02	1st tributary	1	970	Rocky/High Elv	95%	0.29	1	1,000	300	90%	0.57	1	1,000	600	300	-5%
012_02	1st tributary	2	130	Rocky/High Elv	89%	0.63	2	300	200	70%	1.71	2	300	500	300	-19%
012_02	1st tributary	3	330	Rocky/High Elv	89%	0.63	2	700	400	90%	0.57	2	700	400	0	0%
012_02	1st tributary	4	430	Rocky/High Elv	89%	0.63	2	900	600	90%	0.57	2	900	500	(100)	0%
012_02	2nd tributary	1	120	Lake	0%	5.70	60	7,200	41,000	0%	5.70	60	7,200	41,000	0	0%
012_02	2nd tributary	2	400	Group D	96%	0.23	1	400	90	90%	0.57	1	400	200	100	-6%
012_02	2nd tributary	3	360	Group C	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
012_02	2nd tributary	4	700	Lake/Meadows	0%	5.70	20	14,000	80,000	0%	5.70	20	14,000	80,000	0	0%
012_02	2nd tributary	5	710	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
012_02	2nd tributary	6	470	Rocky/High Elv	76%	1.37	3	1,000	1,000	90%	0.57	3	1,000	600	(400)	0%
012_02	2nd tributary	7	680	Rocky/High Elv	76%	1.37	3	2,000	3,000	90%	0.57	3	2,000	1,000	(2,000)	0%
012_02	2nd tributary	8	340	Rocky/High Elv	76%	1.37	3	1,000	1,000	90%	0.57	3	1,000	600	(400)	0%
012_02	3rd tributary	1	690	Rocky/High Elv	95%	0.29	1	700	200	90%	0.57	1	700	400	200	-5%
012_02	3rd tributary	2	690	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
012_02	3rd tributary	3	430	Rocky/High Elv	89%	0.63	2	900	600	90%	0.57	2	900	500	(100)	0%
012_02	4th tributary	1	250	Lake	0%	5.70	150	37,500	214,000	0%	5.70	150	37,500	214,000	0	0%
012_02	4th tributary	2	490	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
012_02	4th tributary	3	1170	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
012_02	5th tributary	1	960	Rocky/High Elv	95%	0.29	1	1,000	300	90%	0.57	1	1,000	600	300	-5%
012_02	5th tributary	2	1000	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
012_02	6th tributary	1	490	Rocky/High Elv	95%	0.29	1	500	100	90%	0.57	1	500	300	200	-5%
012_02	6th tributary	2	710	Rocky/High Elv	95%	0.29	1	700	200	90%	0.57	1	700	400	200	-5%
012_02	6th tributary	3	810	Rocky/High Elv	89%	0.63	2	2,000	1,000	80%	1.14	2	2,000	2,000	1,000	-9%
012_02	6th tributary	4	260	Rocky/High Elv	76%	1.37	3	800	1,000	90%	0.57	3	800	500	(500)	0%
012_02	6th tributary	5	610	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
012_02	7th tributary	1	570	Rocky/High Elv	95%	0.29	1	600	200	90%	0.57	1	600	300	100	-5%
012_02	7th tributary	2	280	Rocky/High Elv	95%	0.29	1	300	90	90%	0.57	1	300	200	100	-5%
012_02	7th tributary	3	290	Rocky/High Elv	95%	0.29	1	300	90	60%	2.28	1	300	700	600	-35%
012_02	7th tributary	4	940	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
012_02	7th tributary	5	590	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
012_02	8th tributary	1	570	Group B	98%	0.11	1	600	70	90%	0.57	1	600	300	200	-8%
012_02	8th tributary	2	390	Group B	98%	0.11	1	400	50	80%	1.14	1	400	500	500	-18%
012_02	8th tributary	3	250	Group B	98%	0.11	2	500	60	90%	0.57	2	500	300	200	-8%
012_02	8th tributary	4	540	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
012_02	9th tributary	1	390	Rocky/High Elv	95%	0.29	1	400	100	90%	0.57	1	400	200	100	-5%
012_02	9th tributary	2	1360	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
012_02	10th tributary	1	230	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
012_02	10th tributary	2	360	Group B	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
012_02	10th tributary	3	700	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
012_02	11th tributary	1	1900	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
012_02	12th tributary	1	120	Group B	98%	0.11	1	100	10	90%	0.57	1	100	60	50	-8%
012_02	12th tributary	2	140	Group B	98%	0.11	1	100	10	70%	1.71	1	100	200	200	-28%
012_02	12th tributary	3	120	Group B	98%	0.11	1	100	10	90%	0.57	1	100	60	50	-8%
012_02	12th tributary	4	800	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
012_02	12th tributary	5	2600	Group B	97%	0.17	3	8,000	1,000	90%	0.57	3	8,000	5,000	4,000	-7%
							Totals		350,000					370,000	15,000	

Table D-14. Existing and potential solar loads for Indian Creek.

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
010_02	1st tributary	1	500	Group D	96%	0.23	1	500	100	90%	0.57	1	500	300	200	-6%
010_02	1st tributary	2	460	Group B	98%	0.11	1	500	60	80%	1.14	1	500	600	500	-18%
010_02	1st tributary	3	1500	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
010_02	1st tributary	4	520	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
010_02	2nd tributary	1	200	Group B	98%	0.11	1	200	20	90%	0.57	1	200	100	80	-8%
010_02	2nd tributary	2	560	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
010_02	2nd tributary	3	1530	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
010_03	Indian Creek	1	1500	Group B	87%	0.74	8	10,000	7,000	70%	1.71	10	20,000	30,000	20,000	-17%
010_03	Indian Creek	2	1900	Group B	83%	0.97	9	20,000	20,000	70%	1.71	11	20,000	30,000	10,000	-13%
010_03	Indian Creek	3	700	Nonforest 1	52%	2.74	9	6,000	20,000	40%	3.42	12	8,000	30,000	10,000	-12%
010_03	Indian Creek	4	880	Group B	83%	0.97	9	8,000	8,000	70%	1.71	12	10,000	20,000	10,000	-13%
010_03	Indian Creek	5	220	Group B	83%	0.97	9	2,000	2,000	60%	2.28	13	3,000	7,000	5,000	-23%
							Totals		58,000					120,000	61,000	

Table D-15. Existing and potential solar loads for North Fork Indian Creek.

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
010_02	1st tributary	1	560	Rocky/High Elv	95%	0.29	1	600	200	90%	0.57	1	600	300	100	-5%
010_02	1st tributary	2	640	Rocky/High Elv	89%	0.63	2	1,000	600	90%	0.57	2	1,000	600	0	0%
010_02	1st tributary	3	1370	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
010_02	2nd tributary	1	900	Rocky/High Elv	95%	0.29	1	900	300	90%	0.57	1	900	500	200	-5%
010_02	2nd tributary	2	920	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
010_02	3rd tributary	1	220	Group B	98%	0.11	1	200	20	90%	0.57	1	200	100	80	-8%
010_02	3rd tributary	2	820	Group B	98%	0.11	1	800	90	80%	1.14	1	800	900	800	-18%
010_02	3rd tributary	3	810	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
010_02	4th tributary	1	1900	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
010_02	N.F. Indian Cr.	1	540	Rocky/High Elv	95%	0.29	1	500	100	80%	1.14	1	500	600	500	-15%
010_02	N.F. Indian Cr.	2	980	Rocky/High Elv	89%	0.63	2	2,000	1,000	70%	1.71	2	2,000	3,000	2,000	-19%
010_02	N.F. Indian Cr.	3	960	Rocky/High Elv	76%	1.37	3	3,000	4,000	70%	1.71	3	3,000	5,000	1,000	-6%
010_02	N.F. Indian Cr.	4	1740	Rocky/High Elv	67%	1.88	4	7,000	10,000	80%	1.14	4	7,000	8,000	(2,000)	0%
010_02	N.F. Indian Cr.	5	1220	Rocky/High Elv	60%	2.28	5	6,000	10,000	80%	1.14	5	6,000	7,000	(3,000)	0%
010_02	N.F. Indian Cr.	6	1100	Rocky/High Elv	54%	2.62	6	7,000	20,000	70%	1.71	6	7,000	10,000	(10,000)	0%
010_02	N.F. Indian Cr.	7	640	Rocky/High Elv	54%	2.62	6	4,000	10,000	60%	2.28	7	4,000	9,000	(1,000)	0%
010_02	N.F. Indian Cr.	8	1800	Rocky/High Elv	48%	2.96	7	10,000	30,000	70%	1.71	8	10,000	20,000	(10,000)	0%
010_02	N.F. Indian Cr.	9	1000	Rocky/High Elv	48%	2.96	7	7,000	20,000	70%	1.71	9	9,000	20,000	0	0%
010_02	N.F. Indian Cr.	10	1800	Rocky/High Elv	48%	2.96	7	10,000	30,000	70%	1.71	15	30,000	50,000	20,000	0%
							Totals		140,000					140,000	4,300	

Table D-16. Existing and potential solar loads for South Fork Indian Creek.

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
010_02	1st tributary	1	1700	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
010_02	2nd tributary	1	500	Group D	96%	0.23	1	500	100	90%	0.57	1	500	300	200	-6%
010_02	2nd tributary	2	1180	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
010_02	SF Indian Creek	1	1200	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
010_02	SF Indian Creek	2	2100	Group B	96%	0.23	4	8,000	2,000	90%	0.57	4	8,000	5,000	3,000	-6%
010_02	SF Indian Creek	3	900	Group B	94%	0.34	5	5,000	2,000	80%	1.14	5	5,000	6,000	4,000	-14%
010_02	SF Indian Creek	4	340	Rocky/High Elv	60%	2.28	5	2,000	5,000	80%	1.14	5	2,000	2,000	(3,000)	0%
010_02	SF Indian Creek	5	810	Rocky/High Elv	60%	2.28	5	4,000	9,000	70%	1.71	6	5,000	9,000	0	0%
010_02	SF Indian Creek	6	500	Rocky/High Elv	60%	2.28	5	3,000	7,000	90%	0.57	6	3,000	2,000	(5,000)	0%
							Totals		27,000					28,000	2,000	

Table D-17. Existing and potential solar loads for Hunt Creek.

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
009_02	1st tributary	1	570	Group C	98%	0.11	1	600	70	90%	0.57	1	600	300	200	-8%
009_02	1st tributary	2	460	Group D	96%	0.23	1	500	100	90%	0.57	1	500	300	200	-6%
009_02	1st tributary	3	460	Group C	97%	0.17	2	900	200	90%	0.57	2	900	500	300	-7%
009_02	1st tributary	4	820	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
009_02	1st tributary	5	490	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
009_02	2nd tributary	1	850	Group B	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
009_02	2nd tributary	2	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
009_02	3rd tributary	1	1800	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
009_02	4th tributary	1	290	Group A	94%	0.34	1	300	100	80%	1.14	1	300	300	200	-14%
009_02	4th tributary	2	850	Group B	98%	0.11	1	900	100	90%	0.57	1	900	500	400	-8%
009_02	4th tributary	3	560	Group A	93%	0.40	2	1,000	400	90%	0.57	2	1,000	600	200	-3%
009_02	4th tributary	4	440	Group B	98%	0.11	2	900	100	80%	1.14	2	900	1,000	900	-18%
009_02	4th tributary	5	410	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
009_02	4th tributary	6	410	Group B	97%	0.17	3	1,000	200	80%	1.14	3	1,000	1,000	800	-17%
009_02	Hunt Creek	1	530	Lake	0%	5.70	120	63,600	363,000	0%	5.70	120	63,600	363,000	0	0%
009_02	Hunt Creek	2	180	Group C	98%	0.11	1	200	20	90%	0.57	1	200	100	80	-8%
009_02	Hunt Creek	3	70	Lake	31%	3.93	30	2,100	8,300	30%	3.99	30	2,100	8,400	100	-1%
009_02	Hunt Creek	4	430	Group D	96%	0.23	1	400	90	90%	0.57	1	400	200	100	-6%
009_02	Hunt Creek	5	570	Group C	97%	0.17	2	1,000	200	90%	0.57	2	1,000	600	400	-7%
009_02	Hunt Creek	6	1560	Group B	97%	0.17	3	5,000	900	90%	0.57	3	5,000	3,000	2,000	-7%
009_02	Hunt Creek	7	3200	Group B	94%	0.34	5	20,000	7,000	90%	0.57	5	20,000	10,000	3,000	-4%
009_02	Hunt Creek	8	730	Group B	92%	0.46	6	4,000	2,000	70%	1.71	6	4,000	7,000	5,000	-22%
009_02	Hunt Creek	9	1010	Group B	92%	0.46	6	6,000	3,000	90%	0.57	6	6,000	3,000	0	-2%
009_02	Hunt Creek	10	1530	Group A	65%	2.00	6	9,000	20,000	70%	1.71	6	9,000	20,000	0	0%
009_03	Hunt Creek	11	250	Group A	60%	2.28	7	2,000	5,000	70%	1.71	7	2,000	3,000	(2,000)	0%
009_03	Hunt Creek	12	1650	Group B	87%	0.74	8	10,000	7,000	90%	0.57	8	10,000	6,000	(1,000)	0%
							Totals		420,000					440,000	17,000	

Table D-18. Existing and potential solar loads for Soldier Creek.

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
008_02	1st tributary	1	90	Lake	19%	4.62	50	4,500	21,000	10%	5.13	50	4,500	23,000	2,000	-9%
008_02	1st tributary	2	900	Group C	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
008_02	1st tributary	3	890	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
008_02	1st tributary	4	1630	Group B	97%	0.17	3	5,000	900	60%	2.28	7	10,000	20,000	20,000	-37%
008_02	2nd tributary	1	1210	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
008_02	2nd tributary	2	1260	Group B	98%	0.11	2	3,000	300	70%	1.71	2	3,000	5,000	5,000	-28%
008_02	2nd tributary	3	650	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
008_02	3rd tributary	1	1280	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
008_02	3rd tributary	2	640	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
008_02	4th tributary	1	850	Group C	98%	0.11	1	900	100	70%	1.71	1	900	2,000	2,000	-28%
008_02	4th tributary	2	1270	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
008_02	4th tributary	3	840	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
008_02	5th tributary	1	660	Group B	98%	0.11	1	700	80	90%	0.57	1	700	400	300	-8%
008_02	5th tributary	2	640	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
008_02	5th tributary	3	530	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
008_02	5th tributary	4	480	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
008_02	6th tributary	1	790	Group B	98%	0.11	1	800	90	80%	1.14	1	800	900	800	-18%
008_02	6th tributary	2	860	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
008_02	7th tributary	1	2100	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
008_02	Soldier Creek	1	1290	Group D	96%	0.23	2	3,000	700	50%	2.85	2	3,000	9,000	8,000	-46%
008_02	Soldier Creek	2	3430	Group B	96%	0.23	4	10,000	2,000	60%	2.28	4	10,000	20,000	20,000	-36%
008_02	Soldier Creek	3	1280	Group B	92%	0.46	6	8,000	4,000	50%	2.85	7	9,000	30,000	30,000	-42%
008_02	Soldier Creek	4	1650	Group B	90%	0.57	7	10,000	6,000	50%	2.85	11	20,000	60,000	50,000	-40%
008_02	Soldier Creek	5	1100	Group B	90%	0.57	7	8,000	5,000	70%	1.71	10	10,000	20,000	20,000	-20%
008_02	Soldier Creek	6	1430	Nonforest 1	55%	2.57	8	10,000	30,000	60%	2.28	10	10,000	20,000	(10,000)	0%
008_02	Soldier Creek	7	1400	Group A	56%	2.51	8	10,000	30,000	70%	1.71	10	10,000	20,000	(10,000)	0%
008_02	Soldier Creek	8	900	Group B	87%	0.74	8	7,000	5,000	70%	1.71	10	9,000	20,000	20,000	-17%
008_02	Soldier Creek	9	610	Group B	87%	0.74	8	5,000	4,000	80%	1.14	10	6,000	7,000	3,000	-7%
008_02	Soldier Creek	10	440	Group B	87%	0.74	8	4,000	3,000	50%	2.85	10	4,000	10,000	7,000	-37%
008_03	Soldier Creek	11	1180	Thinleaf alder	31%	3.93	9	10,000	40,000	10%	5.13	10	10,000	50,000	10,000	-21%
008_03	Soldier Creek	12	520	Thinleaf alder	31%	3.93	9	5,000	20,000	0%	5.70	10	5,000	30,000	10,000	-31%
008_03	Soldier Creek	13	320	Thinleaf alder	31%	3.93	9	3,000	10,000	30%	3.99	10	3,000	10,000	0	-1%
008_03	Soldier Creek	14	850	Thinleaf alder	31%	3.93	9	8,000	30,000	10%	5.13	12	10,000	50,000	20,000	-21%
							Totals		210,000					430,000	230,000	

Load Analysis Tables for the Westside Priest Lake Region

Table D-19. Existing and potential solar loads for Beaver Creek.

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
020_02	1st tributary	1	2100	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
020_02	2nd tributary	1	260	Group B	98%	0.11	1	300	30	50%	2.85	1	300	900	900	-48%
020_02	2nd tributary	2	2800	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
020_02	3rd tributary	1	1500	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	3rd tributary	2	350	Group B	98%	0.11	2	700	80	80%	1.14	2	700	800	700	-18%
020_02	3rd tributary	3	560	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
020_02	4th tributary	1	620	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
020_02	4th tributary	2	530	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
020_02	4th tributary	3	1320	Group B	97%	0.17	3	4,000	700	80%	1.14	3	4,000	5,000	4,000	-17%
020_02	trib to 4th trib	1	1400	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
020_02	trib to 4th trib	2	1100	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
020_02	trib to 4th trib	3	1000	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
020_02	Beaver Creek	1	210	Group B	98%	0.11	1	200	20	60%	2.28	1	200	500	500	-38%
020_02	Beaver Creek	2	810	Group B	98%	0.11	1	800	90	80%	1.14	1	800	900	800	-18%
020_02	Beaver Creek	3	420	Group B	98%	0.11	2	800	90	60%	2.28	2	800	2,000	2,000	-38%
020_02	Beaver Creek	4	2800	Group B	96%	0.23	4	10,000	2,000	90%	0.57	4	10,000	6,000	4,000	-6%
020_02	Beaver Creek	5	2640	Group B	94%	0.34	5	10,000	3,000	80%	1.14	5	10,000	10,000	7,000	-14%
020_03	Beaver Creek	1	1700	Nonforest 1	65%	2.00	6	10,000	20,000	70%	1.71	6	10,000	20,000	0	0%
020_03	Beaver Creek	2	1000	Nonforest 1	65%	2.00	6	6,000	10,000	60%	2.28	6	6,000	10,000	0	-5%
							Totals		38,000					67,000	29,000	

Table D-20. Existing and potential solar loads for Granite Creek.

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
022_04	NF Granite Cr.	1	600	Nonforest 1	48%	2.96	10	6,000	18,000	40%	3.42	10	6,000	21,000	3,000	-8%
022_04	Granite Creek	1	470	Nonforest 1	39%	3.48	13	6,100	21,000	30%	3.99	13	6,100	24,000	3,000	-9%
022_04	Granite Creek	2	1100	Group B	62%	2.17	14	15,000	32,000	60%	2.28	14	15,000	34,000	2,000	-2%
022_04	Granite Creek	3	500	Nonforest 1	37%	3.59	14	7,000	25,000	50%	2.85	14	7,000	20,000	(5,000)	0%
022_04	Granite Creek	4	680	Group B	62%	2.17	14	9,500	21,000	60%	2.28	14	9,500	22,000	1,000	-2%
022_04	Granite Creek	5	310	Nonforest 1	37%	3.59	14	4,300	15,000	50%	2.85	14	4,300	12,000	(3,000)	0%
022_04	Granite Creek	6	320	Group B	62%	2.17	14	4,500	9,700	60%	2.28	14	4,500	10,000	300	-2%
022_04	Granite Creek	7	930	Nonforest 1	37%	3.59	14	13,000	47,000	50%	2.85	14	13,000	37,000	(10,000)	0%
022_04	Granite Creek	8	340	Nonforest 1	35%	3.71	15	5,100	19,000	40%	3.42	15	5,100	17,000	(2,000)	0%
022_04	Granite Creek	9	2100	Group B	59%	2.34	15	32,000	75,000	60%	2.28	15	32,000	73,000	(2,000)	0%
022_04	Granite Creek	10	1060	Nonforest 1	35%	3.71	15	16,000	59,000	40%	3.42	15	16,000	55,000	(4,000)	0%
022_04	Granite Creek	11	870	Nonforest 1	35%	3.71	15	13,000	48,000	20%	4.56	15	13,000	59,000	11,000	-15%
022_04	Granite Creek	12	570	Nonforest 1	35%	3.71	15	8,600	32,000	30%	3.99	15	8,600	34,000	2,000	-5%
022_04	Granite Creek	13	710	Nonforest 1	35%	3.71	15	11,000	41,000	10%	5.13	15	11,000	56,000	15,000	-25%
022_04	Granite Creek	14	1250	Nonforest 1	35%	3.71	15	19,000	70,000	20%	4.56	15	19,000	87,000	17,000	-15%
022_04	Granite Creek	15	4990	Nonforest 1	33%	3.82	16	80,000	310,000	10%	5.13	16	80,000	410,000	100,000	-23%
022_04	Granite Creek	16	150	Nonforest 1	33%	3.82	16	2,400	9,200	20%	4.56	23	3,500	16,000	6,800	-13%
							Totals		850,000					990,000	140,000	

Table D-21. Existing and potential solar loads for Reeder Creek.

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
023_02	border stream	1	560	Group B	98%	0.11	1	600	70	90%	0.57	1	600	300	200	-8%
023_02	border stream	2	800	Group B	98%	0.11	1	800	90	60%	2.28	1	800	2,000	2,000	-38%
023_02	(W of Indian Cr)	3	1000	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
023_02	Indian Creek	1	1030	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
023_02	Indian Creek	2	390	Group B	98%	0.11	2	800	90	60%	2.28	2	800	2,000	2,000	-38%
023_02	Indian Creek	3	2300	Group B	96%	0.23	4	9,000	2,000	80%	1.14	4	9,000	10,000	8,000	-16%
023_02	1st tributary	1	270	Nonforest 1	97%	0.17	1	300	50	80%	1.14	1	300	300	300	-17%
023_02	1st tributary	2	1600	Thinleaf alder	86%	0.80	2	3,000	2,000	70%	1.71	2	3,000	5,000	3,000	-16%
023_02	2nd tributary	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
023_02	2nd tributary	2	190	Group B	98%	0.11	2	400	50	70%	1.71	2	400	700	700	-28%
023_02	3rd tributary	1	40	Group B	98%	0.11	1	40	5	90%	0.57	1	40	20	20	-8%
023_02	3rd tributary	2	390	Group B	98%	0.11	1	400	50	60%	2.28	1	400	900	900	-38%
023_02	3rd tributary	3	240	Group B	98%	0.11	1	200	20	70%	1.71	1	200	300	300	-28%
023_02	3rd tributary	4	460	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
023_02	3rd tributary	5	400	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
023_02	3rd tributary	6	220	Group B	98%	0.11	2	400	50	60%	2.28	2	400	900	900	-38%
023_02	3rd tributary	7	890	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
023_02	3rd tributary	8	420	Group B	98%	0.11	2	800	90	60%	2.28	2	800	2,000	2,000	-38%
023_02	3rd tributary	9	410	Group B	97%	0.17	3	1,000	200	70%	1.71	3	1,000	2,000	2,000	-27%
023_02	trib to 3rd trib	1	520	Group B	98%	0.11	1	500	60	70%	1.71	1	500	900	800	-28%
023_02	trib to 3rd trib	2	1400	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
023_02	trib to 3rd trib	3	280	Group B	98%	0.11	2	600	70	80%	1.14	2	600	700	600	-18%
023_02	Reeder Creek	1	470	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
023_02	Reeder Creek	2	2800	Group B	97%	0.17	3	8,000	1,000	80%	1.14	3	8,000	9,000	8,000	-17%
023_02	Reeder Creek	3	1400	Thinleaf alder	59%	2.34	4	6,000	10,000	60%	2.28	4	6,000	10,000	0	0%
023_02	Reeder Creek	4	6090	Thinleaf alder	50%	2.85	5	30,000	90,000	40%	3.42	5	30,000	100,000	10,000	-10%
023_02	Reeder Creek	5	670	Thinleaf alder	43%	3.25	6	4,000	10,000	50%	2.85	6	4,000	10,000	0	0%
023_02	Reeder Creek	6	1300	Thinleaf alder	43%	3.25	6	8,000	30,000	40%	3.42	6	8,000	30,000	0	-3%
023_02	Reeder Creek	7	260	Nonforest 1	65%	2.00	6	2,000	4,000	50%	2.85	6	2,000	6,000	2,000	-15%
023_03	Reeder Creek	8	450	Nonforest 1	60%	2.28	7	3,000	7,000	50%	2.85	7	3,000	9,000	2,000	-10%
023_03	Reeder Creek	9	580	Nonforest 1	60%	2.28	7	4,000	9,000	60%	2.28	7	4,000	9,000	0	0%
							Totals		170,000					220,000	56,000	

Table D-22 Existing and potential solar loads for Kalispell Creek.

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
024_02	un-connected	1	330	Group B	98%	0.11	1	300	30	60%	2.28	1	300	700	700	-38%
024_02	stream 30	2	950	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
024_02	stream 30	3	1700	Group B	96%	0.23	4	7,000	2,000	70%	1.71	4	7,000	10,000	8,000	-26%
024_02	Nuisance Cr.	1	540	Group B	94%	0.34	5	3,000	1,000	70%	1.71	5	3,000	5,000	4,000	-24%
024_02	Bath Creek	1	570	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
024_02	Bath Creek	2	740	Group B	96%	0.23	4	3,000	700	60%	2.28	4	3,000	7,000	6,000	-36%
024_02	Bath Creek	3	500	Group B	96%	0.23	4	2,000	500	50%	2.85	4	2,000	6,000	6,000	-46%
024_02	Bath Creek	4	2200	Group B	94%	0.34	5	10,000	3,000	60%	2.28	5	10,000	20,000	20,000	-34%
024_02	Hazard Creek	1	290	Group B	98%	0.11	1	300	30	70%	1.71	1	300	500	500	-28%
024_02	Hazard Creek	2	2300	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
024_02	Hazard Creek	3	440	Nonforest 1	86%	0.80	3	1,000	800	80%	1.14	3	1,000	1,000	200	-6%
024_02	Hazard Creek	4	630	Nonforest 1	86%	0.80	3	2,000	2,000	70%	1.71	3	2,000	3,000	1,000	-16%
024_02	trib to Hazard	1	1200	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
024_02	trib to Hazard	2	330	Group B	98%	0.11	2	700	80	60%	2.28	2	700	2,000	2,000	-38%
024_02	trib to Hazard	3	720	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
024_02	2nd tributary	1	2500	Group B	98%	0.11	1	3,000	300	90%	0.57	1	3,000	2,000	2,000	-8%
024_02	2nd tributary	2	800	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
024_02	2nd tributary	3	610	Nonforest 1	86%	0.80	3	2,000	2,000	60%	2.28	3	2,000	5,000	3,000	-26%
024_02	2nd tributary	4	160	Nonforest 1	86%	0.80	3	500	400	70%	1.71	3	500	900	500	-16%
024_02	trib to 2nd trib	1	2200	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
024_03	Kalispell Creek	1	2270	Nonforest 1	55%	2.57	8	20,000	50,000	60%	2.28	8	20,000	50,000	0	0%
024_03	Kalispell Creek	2	290	Group B	87%	0.74	8	2,000	1,000	70%	1.71	8	2,000	3,000	2,000	-17%
024_03	Kalispell Creek	3	1300	Nonforest 1	52%	2.74	9	10,000	30,000	60%	2.28	9	10,000	20,000	(10,000)	0%
024_03	Kalispell Creek	4	1800	Nonforest 1	52%	2.74	9	20,000	50,000	50%	2.85	9	20,000	60,000	10,000	-2%
024_03	Kalispell Creek	5	1100	Nonforest 1	48%	2.96	10	11,000	33,000	40%	3.42	10	11,000	38,000	5,000	-8%
024_03	Kalispell Creek	6	440	Nonforest 1	45%	3.14	11	4,800	15,000	50%	2.85	11	4,800	14,000	(1,000)	0%
024_03	Kalispell Creek	7	860	Nonforest 1	45%	3.14	11	9,500	30,000	40%	3.42	11	9,500	32,000	2,000	-5%
024_03	Kalispell Creek	8	390	Nonforest 1	45%	3.14	11	4,300	13,000	50%	2.85	11	4,300	12,000	(1,000)	0%
024_03	Kalispell Creek	9	4990	Nonforest 1	41%	3.36	12	60,000	200,000	40%	3.42	12	60,000	210,000	10,000	-1%
							Totals		440,000					510,000	81,000	

Table D-23. Existing and potential solar loads for Lamb Creek.

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
025_02	1st tributary	1	580	Group B	98%	0.11	1	600	70	60%	2.28	1	600	1,000	900	-38%
025_02	1st tributary	2	450	Group B	98%	0.11	1	500	60	80%	1.14	1	500	600	500	-18%
025_02	1st tributary	3	910	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
025_02	1st tributary	4	380	Thinleaf alder	86%	0.80	2	800	600	50%	2.85	2	800	2,000	1,000	-36%
025_02	2nd tributary	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
025_02	3rd tributary	1	2000	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
025_02	4th tributary	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
025_02	4th tributary	2	280	Group B	98%	0.11	1	300	30	50%	2.85	1	300	900	900	-48%
025_02	5th tributary	1	250	Group B	98%	0.11	1	300	30	60%	2.28	1	300	700	700	-38%
025_02	5th tributary	2	1500	Group B	98%	0.11	1	2,000	200	70%	1.71	1	2,000	3,000	3,000	-28%
025_02	5th tributary	3	350	Group B	98%	0.11	2	700	80	80%	1.14	2	700	800	700	-18%
025_02	stream 28	1	830	Group B	98%	0.11	1	800	90	90%	0.57	1	800	500	400	-8%
025_02	stream 28	2	220	Group B	98%	0.11	1	200	20	50%	2.85	1	200	600	600	-48%
025_02	stream 28	3	290	Group B	98%	0.11	2	600	70	80%	1.14	2	600	700	600	-18%
025_02	stream 28	4	300	Group B	98%	0.11	2	600	70	70%	1.71	2	600	1,000	900	-28%
025_02	stream 28	5	160	Group B	98%	0.11	2	300	30	50%	2.85	2	300	900	900	-48%
025_02	stream 28	6	610	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
025_02	stream 28	7	850	Group B	97%	0.17	3	3,000	500	70%	1.71	3	3,000	5,000	5,000	-27%
025_02	Lamb Creek	1	540	Group B	96%	0.23	4	2,000	500	70%	1.71	4	2,000	3,000	3,000	-26%
025_02	Lamb Creek	2	2300	Group B	96%	0.23	4	9,000	2,000	80%	1.14	4	9,000	10,000	8,000	-16%
025_02	Lamb Creek	3	420	Group B	94%	0.34	5	2,000	700	70%	1.71	5	2,000	3,000	2,000	-24%
025_02	Lamb Creek	4	350	Nonforest 1	72%	1.60	5	2,000	3,000	60%	2.28	5	2,000	5,000	2,000	-12%
025_02	Lamb Creek	5	380	Thinleaf alder	38%	3.53	7	3,000	10,000	50%	2.85	7	3,000	9,000	(1,000)	0%
025_02	Lamb Creek	6	1100	Thinleaf alder	38%	3.53	7	8,000	30,000	60%	2.28	7	8,000	20,000	(10,000)	0%
025_02	Lamb Creek	7	1600	Thinleaf alder	38%	3.53	7	10,000	40,000	50%	2.85	7	10,000	30,000	(10,000)	0%
025_02	Lamb Creek	8	1300	Thinleaf alder	34%	3.76	8	10,000	40,000	30%	3.99	8	10,000	40,000	0	-4%
025_02	Lamb Creek	9	440	Nonforest 1	55%	2.57	8	4,000	10,000	50%	2.85	8	4,000	10,000	0	-5%
025_02	Lamb Creek	10	1900	Thinleaf alder	34%	3.76	8	20,000	80,000	20%	4.56	8	20,000	90,000	10,000	-14%
025_02	Lamb Creek	11	860	Thinleaf alder	31%	3.93	9	8,000	30,000	40%	3.42	9	8,000	30,000	0	0%
025_02	Lamb Creek	12	200	Thinleaf alder	31%	3.93	30	6,000	24,000	30%	3.99	30	6,000	24,000	0	-1%
025_02	Lamb Creek	13	470	Thinleaf alder	31%	3.93	9	4,000	20,000	40%	3.42	9	4,000	10,000	(10,000)	0%
025_02	Lamb Creek	14	320	Thinleaf alder	31%	3.93	9	3,000	10,000	60%	2.28	9	3,000	7,000	(3,000)	0%
025_02	Lamb Creek	15	360	Thinleaf alder	31%	3.93	9	3,000	10,000	30%	3.99	9	3,000	10,000	0	-1%
025_02	Lamb Creek	16	1300	Nonforest 1	52%	2.74	9	10,000	30,000	60%	2.28	9	10,000	20,000	(10,000)	0%
025_02	Lamb Creek	17	600	Nonforest 1	52%	2.74	9	5,000	10,000	50%	2.85	9	5,000	10,000	0	-2%
							Totals		350,000					360,000	4,500	

Table D-24. Existing and potential solar loads for North Fork Lamb Creek.

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
025_02	Skip Creek	1	2900	Group B	97%	0.17	3	9,000	2,000	80%	1.14	3	9,000	10,000	8,000	-17%
025_02	1st tributary	1	300	Group B	98%	0.11	1	300	30	60%	2.28	1	300	700	700	-38%
025_02	1st tributary	2	920	Group B	98%	0.11	1	900	100	70%	1.71	1	900	2,000	2,000	-28%
025_02	1st tributary	3	360	Group B	98%	0.11	2	700	80	80%	1.14	2	700	800	700	-18%
025_02	1st tributary	4	120	Thinleaf alder	86%	0.80	2	200	200	50%	2.85	2	200	600	400	-36%
025_02	NF Lamb Creek	1	640	Nonforest 1	97%	0.17	1	600	100	80%	1.14	1	600	700	600	-17%
025_02	NF Lamb Creek	2	320	Nonforest 1	97%	0.17	1	300	50	70%	1.71	1	300	500	500	-27%
025_02	NF Lamb Creek	3	1100	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
025_02	NF Lamb Creek	4	290	pond	27%	4.16	40	12,000	50,000	20%	4.56	40	12,000	55,000	5,000	-7%
025_02	NF Lamb Creek	5	330	Group B	97%	0.17	3	1,000	200	80%	1.14	3	1,000	1,000	800	-17%
025_02	NF Lamb Creek	6	410	Thinleaf alder	72%	1.60	3	1,000	2,000	50%	2.85	3	1,000	3,000	1,000	-22%
025_02	NF Lamb Creek	7	540	Thinleaf alder	59%	2.34	4	2,000	5,000	60%	2.28	4	2,000	5,000	0	0%
025_02	NF Lamb Creek	8	190	Thinleaf alder	78%	1.25	4	800	1,000	50%	2.85	4	800	2,000	1,000	-28%
025_02	NF Lamb Creek	9	440	Nonforest 1	78%	1.25	4	2,000	3,000	60%	2.28	4	2,000	5,000	2,000	-18%
025_02	NF Lamb Creek	10	1400	Thinleaf alder	50%	2.85	5	7,000	20,000	50%	2.85	5	7,000	20,000	0	0%
							Totals		84,000					110,000	24,000	

Load Analysis Tables for the Lower Priest River Region

Table D-25. Existing and potential solar loads for Binarch Creek.

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
026_02	1st tributary	1	740	Group B	98%	0.11	1	700	80	70%	1.71	1	700	1,000	900	-28%
026_02	1st tributary	2	1200	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
026_02	2nd tributary	1	360	Group B	98%	0.11	1	400	50	80%	1.14	1	400	500	500	-18%
026_02	2nd tributary	2	670	Group B	98%	0.11	2	1,000	100	70%	1.71	2	1,000	2,000	2,000	-28%
026_02	2nd tributary	3	550	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
026_02	trib to 2nd trib	1	280	Group B	98%	0.11	1	300	30	70%	1.71	1	300	500	500	-28%
026_02	trib to 2nd trib	2	560	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
026_02	3rd tributary	1	2350	Group B	98%	0.11	1	2,000	200	80%	1.14	1	2,000	2,000	2,000	-18%
026_02	3rd tributary	2	790	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
026_02	Binarch Creek	1	640	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
026_02	Binarch Creek	2	1500	Group B	97%	0.17	3	5,000	900	70%	1.71	3	5,000	9,000	8,000	-27%
026_02	Binarch Creek	3	1000	Group B	96%	0.23	4	4,000	900	60%	2.28	4	4,000	9,000	8,000	-36%
026_02	Binarch Creek	4	320	Group B	96%	0.23	4	1,000	200	50%	2.85	4	1,000	3,000	3,000	-46%
026_02	Binarch Creek	5	370	Group B	96%	0.23	4	1,000	200	60%	2.28	4	1,000	2,000	2,000	-36%
026_02	Binarch Creek	6	90	pond	35%	3.71	30	2,700	10,000	30%	3.99	30	2,700	11,000	1,000	-5%
026_02	Binarch Creek	7	360	Group B	94%	0.34	5	2,000	700	70%	1.71	5	2,000	3,000	2,000	-24%
026_02	Binarch Creek	8	1000	Group B	94%	0.34	5	5,000	2,000	50%	2.85	5	5,000	10,000	8,000	-44%
026_02	Binarch Creek	9	310	Nonforest 1	72%	1.60	5	2,000	3,000	60%	2.28	5	2,000	5,000	2,000	-12%
026_02	Binarch Creek	10	1700	Nonforest 1	72%	1.60	5	9,000	10,000	50%	2.85	5	9,000	30,000	20,000	-22%
026_02	Binarch Creek	11	870	Nonforest 1	65%	2.00	6	5,000	10,000	60%	2.28	6	5,000	10,000	0	-5%
026_02	Binarch Creek	12	340	Nonforest 1	65%	2.00	6	2,000	4,000	40%	3.42	6	2,000	7,000	3,000	-25%
026_02	Binarch Creek	13	2460	Nonforest 1	65%	2.00	6	10,000	20,000	70%	1.71	6	10,000	20,000	0	0%
026_02	Binarch Creek	14	740	Group B	90%	0.57	7	5,000	3,000	80%	1.14	7	5,000	6,000	3,000	-10%
							Totals		66,000					140,000	74,000	

Table D-26. Existing and potential solar loads for Goose Creek.

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
028_02	1st tributary	1	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
028_02	1st tributary	2	840	Group B	98%	0.11	2	2,000	200	60%	2.28	2	2,000	5,000	5,000	-38%
028_02	Consalus Creek	1	550	Nonforest 1	72%	1.60	5	3,000	5,000	60%	2.28	5	3,000	7,000	2,000	-12%
028_02	Consalus Creek	2	450	Nonforest 1	72%	1.60	5	2,000	3,000	70%	1.71	5	2,000	3,000	0	-2%
028_02	Consalus Creek	3	250	Nonforest 1	72%	1.60	5	1,000	2,000	50%	2.85	5	1,000	3,000	1,000	-22%
028_02	2nd tributary	1	110	Group B	98%	0.11	1	100	10	60%	2.28	1	100	200	200	-38%
028_02	2nd tributary	2	1200	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
028_02	2nd tributary	3	620	Group B	98%	0.11	2	1,000	100	70%	1.71	2	1,000	2,000	2,000	-28%
028_02	2nd tributary	4	290	Nonforest 1	86%	0.80	3	900	700	50%	2.85	3	900	3,000	2,000	-36%
028_02	2nd tributary	5	790	Nonforest 1	86%	0.80	3	2,000	2,000	40%	3.42	3	2,000	7,000	5,000	-46%
028_02	trib To 2nd trib	1	130	Group B	98%	0.11	1	100	10	60%	2.28	1	100	200	200	-38%
028_02	trib To 2nd trib	2	1400	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
028_02	trib To 2nd trib	3	140	Group B	98%	0.11	2	300	30	70%	1.71	2	300	500	500	-28%
028_02	Blonc Creek	1	1050	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
028_02	Blonc Creek	2	740	Nonforest 1	94%	0.34	2	1,000	300	90%	0.57	2	1,000	600	300	-4%
028_02	Blonc Creek	3	520	Nonforest 1	94%	0.34	2	1,000	300	40%	3.42	2	1,000	3,000	3,000	-54%
028_02	Blonc Creek	4	200	Nonforest 1	86%	0.80	3	600	500	60%	2.28	3	600	1,000	500	-26%
028_02	Blonc Creek	5	910	Nonforest 1	86%	0.80	3	3,000	2,000	40%	3.42	3	3,000	10,000	8,000	-46%
028_02	3rd tributary	1	810	Group B	98%	0.11	1	800	90	90%	0.57	1	800	500	400	-8%
028_02	3rd tributary	2	280	Group B	98%	0.11	2	600	70	70%	1.71	2	600	1,000	900	-28%
028_02	3rd tributary	3	240	Nonforest 1	94%	0.34	2	500	200	60%	2.28	2	500	1,000	800	-34%
028_02	3rd tributary	4	320	Nonforest 1	94%	0.34	2	600	200	80%	1.14	2	600	700	500	-14%
028_02	3rd tributary	5	1230	Nonforest 1	86%	0.80	3	4,000	3,000	50%	2.85	3	4,000	10,000	7,000	-36%
028_02	1st trib to 3rd	1	340	Group B	98%	0.11	1	300	30	80%	1.14	1	300	300	300	-18%
028_02	1st trib to 3rd	2	510	Group B	98%	0.11	1	500	60	70%	1.71	1	500	900	800	-28%
028_02	1st trib to 3rd	3	390	Group B	98%	0.11	2	800	90	60%	2.28	2	800	2,000	2,000	-38%
028_02	2nd trib to 3rd	1	370	Nonforest 1	97%	0.17	1	400	70	80%	1.14	1	400	500	400	-17%
028_02	2nd trib to 3rd	2	750	Nonforest 1	94%	0.34	2	2,000	700	70%	1.71	2	2,000	3,000	2,000	-24%
028_02	2nd trib to 3rd	3	150	Nonforest 1	94%	0.34	2	300	100	50%	2.85	2	300	900	800	-44%
028_03	Goose Creek	1	1010	Nonforest 1	65%	2.00	6	6,000	10,000	60%	2.28	6	6,000	10,000	0	-5%
028_03	Goose Creek	2	750	Nonforest 1	60%	2.28	7	5,000	10,000	40%	3.42	7	5,000	20,000	10,000	-20%
028_03	Goose Creek	3	610	Nonforest 1	55%	2.57	8	5,000	10,000	50%	2.85	8	5,000	10,000	0	-5%
028_03	Goose Creek	4	1130	Nonforest 1	55%	2.57	8	9,000	20,000	40%	3.42	8	9,000	30,000	10,000	-15%
028_03	Goose Creek	5	2760	Nonforest 1	52%	2.74	9	20,000	50,000	30%	3.99	9	20,000	80,000	30,000	-22%
028_03	Goose Creek	6	250	Nonforest 1	52%	2.74	9	2,000	5,000	40%	3.42	9	2,000	7,000	2,000	-12%
							Totals		130,000					230,000	100,000	

Table D-27. Existing and potential solar loads for Upper West Branch Priest River.

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
027_02	Tola Cr	1	760	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
027_02	2nd tributary	1	680	Group B	98%	0.11	1	700	80	70%	1.71	1	700	1,000	900	-28%
027_02	2nd tributary	2	140	Group B	98%	0.11	1	100	10	80%	1.14	1	100	100	90	-18%
027_02	2nd tributary	3	1200	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
027_02	3rd tributary	1	1600	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
027_02	4th tributary	1	970	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
027_02	4th tributary	2	610	Nonforest 1	94%	0.34	2	1,000	300	60%	2.28	2	1,000	2,000	2,000	-34%
027_02	4th tributary	3	260	Nonforest 1	86%	0.80	3	800	600	70%	1.71	3	800	1,000	400	-16%
027_02	trib to 4th trib	1	630	Group B	98%	0.11	1	600	70	90%	0.57	1	600	300	200	-8%
027_02	trib to 4th trib	2	330	Group B	98%	0.11	2	700	80	80%	1.14	2	700	800	700	-18%
027_02	trib to 4th trib	3	190	Group B	98%	0.11	2	400	50	60%	2.28	2	400	900	900	-38%
027_02	5th tributary	1	1400	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
027_02	5th tributary	2	260	Group B	98%	0.11	2	500	60	50%	2.85	2	500	1,000	900	-48%
027_02	6th tributary	1	760	Group B	98%	0.11	1	800	90	70%	1.71	1	800	1,000	900	-28%
027_02	6th tributary	2	390	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
027_02	6th tributary	3	570	Group B	98%	0.11	2	1,000	100	70%	1.71	2	1,000	2,000	2,000	-28%
027_03	UWB Priest R.	1	1950	Nonforest 1	48%	2.96	10	20,000	59,000	40%	3.42	10	20,000	68,000	9,000	-8%
027_03	UWB Priest R.	2	320	Nonforest 1	48%	2.96	10	3,200	9,500	50%	2.85	10	3,200	9,100	(400)	0%
027_03	UWB Priest R.	3	2090	Nonforest 1	45%	3.14	11	23,000	72,000	40%	3.42	11	23,000	79,000	7,000	-5%
027_03	UWB Priest R.	4	1300	Nonforest 1	45%	3.14	11	14,000	44,000	10%	5.13	11	14,000	72,000	28,000	-35%
027_03	UWB Priest R.	5	1000	Nonforest 1	45%	3.14	11	11,000	34,000	40%	3.42	11	11,000	38,000	4,000	-5%
027_04	UWB Priest R.	1	5310	Nonforest 1	39%	3.48	13	69,000	240,000	40%	3.42	13	69,000	240,000	0	0%
027_04	UWB Priest R.	2	130	Nonforest 1	37%	3.59	14	1,800	6,500	50%	2.85	14	1,800	5,100	(1,400)	0%
027_04	UWB Priest R.	3	600	Nonforest 1	37%	3.59	14	8,400	30,000	20%	4.56	14	8,400	38,000	8,000	-17%
027_04	UWB Priest R.	4	950	Nonforest 1	37%	3.59	14	13,000	47,000	50%	2.85	14	13,000	37,000	(10,000)	0%
027_04	UWB Priest R.	5	2700	Nonforest 1	37%	3.59	14	38,000	140,000	30%	3.99	14	38,000	150,000	10,000	-7%
027_04	UWB Priest R.	6	320	Nonforest 1	37%	3.59	14	4,500	16,000	50%	2.85	14	4,500	13,000	(3,000)	0%
027_04	UWB Priest R.	7	460	Nonforest 1	37%	3.59	14	6,400	23,000	40%	3.42	14	6,400	22,000	(1,000)	0%
027_04	UWB Priest R.	8	360	Nonforest 1	37%	3.59	14	5,000	18,000	10%	5.13	14	5,000	26,000	8,000	-27%
							Totals		740,000					820,000	79,000	

Table D-28. Existing and potential solar loads for North Fork East River.

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
004_02	1st tributary	3	890	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
004_02	Race Creek	2	2100	Group B	98%	0.11	2	4,000	500	80%	1.14	2	4,000	5,000	5,000	-18%
004_02	Junta Creek	1	1300	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
004_02	Junta Creek	2	1600	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
004_02	4th tributary	1	80	Group B	98%	0.11	1	80	9	90%	0.57	1	80	50	40	-8%
004_02	4th tributary	2	600	Group B	98%	0.11	1	600	70	60%	2.28	1	600	1,000	900	-38%
004_02	4th tributary	3	1100	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
004_02	NF East River	1	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
004_02	NF East River	2	870	Group B	96%	0.23	4	3,000	700	80%	1.14	4	3,000	3,000	2,000	-16%
004_02	NF East River	3	2700	Group B	94%	0.34	5	10,000	3,000	70%	1.71	5	10,000	20,000	20,000	-24%
004_02	NF East River	4	630	Group B	92%	0.46	6	4,000	2,000	60%	2.28	6	4,000	9,000	7,000	-32%
004_02	NF East River	5	1800	Group B	92%	0.46	6	10,000	5,000	70%	1.71	6	10,000	20,000	20,000	-22%
004_02	NF East River	6	720	Group B	92%	0.46	6	4,000	2,000	60%	2.28	6	4,000	9,000	7,000	-32%
004_02	NF East River	7	1000	Thinleaf alder	43%	3.25	6	6,000	20,000	60%	2.28	6	6,000	10,000	(10,000)	0%
004_02	NF East River	8	760	Nonforest 1	60%	2.28	7	5,000	10,000	70%	1.71	7	5,000	9,000	(1,000)	0%
004_02	NF East River	9	1100	Nonforest 1	60%	2.28	7	8,000	20,000	50%	2.85	7	8,000	20,000	0	-10%
004_02	NF East River	10	320	Nonforest 1	60%	2.28	7	2,000	5,000	40%	3.42	7	2,000	7,000	2,000	-20%
004_02	NF East River	11	920	Nonforest 1	55%	2.57	8	7,000	20,000	50%	2.85	8	7,000	20,000	0	-5%
004_03	NF East River	12	890	Nonforest 1	55%	2.57	8	7,000	20,000	50%	2.85	8	7,000	20,000	0	-5%
004_03	NF East River	13	490	Nonforest 1	55%	2.57	8	4,000	10,000	40%	3.42	8	4,000	10,000	0	-15%
004_03	NF East River	14	1600	Nonforest 1	55%	2.57	8	10,000	30,000	60%	2.28	8	10,000	20,000	(10,000)	0%
004_03	NF East River	15	420	Thinleaf alder	34%	3.76	8	3,000	10,000	40%	3.42	8	3,000	10,000	0	0%
004_03	NF East River	16	180	Nonforest 1	34%	3.76	8	1,000	4,000	30%	3.99	9	2,000	8,000	4,000	-4%
							Totals		160,000					210,000	56,000	

Table D-29. Existing and potential solar loads for Lost Creek.

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
004_02	1st tributary	1	2200	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
004_02	Lost Creek	1	1800	Group B	98%	0.11	1	2,000	200	70%	1.71	1	2,000	3,000	3,000	-28%
004_02	Lost Creek	2	2600	Group B	97%	0.17	3	8,000	1,000	60%	2.28	3	8,000	20,000	20,000	-37%
004_02	Lost Creek	3	660	Group B	96%	0.23	4	3,000	700	90%	0.57	4	3,000	2,000	1,000	-6%
004_02	Lost Creek	4	570	Group B	96%	0.23	4	2,000	500	80%	1.14	4	2,000	2,000	2,000	-16%
004_02	Lost Creek	5	3310	Group B	94%	0.34	5	20,000	7,000	90%	0.57	5	20,000	10,000	3,000	-4%
004_02	Lost Creek	6	580	Group B	92%	0.46	6	3,000	1,000	80%	1.14	6	3,000	3,000	2,000	-12%
004_02	Lost Creek	7	250	Group B	92%	0.46	6	2,000	900	70%	1.71	6	2,000	3,000	2,000	-22%
004_02	Lost Creek	8	890	Group B	92%	0.46	6	5,000	2,000	90%	0.57	6	5,000	3,000	1,000	-2%
004_02	Lost Creek	9	530	Group B	92%	0.46	6	3,000	1,000	90%	0.57	6	3,000	2,000	1,000	-2%
							Totals		15,000					50,000	37,000	

Table D-30. Existing and potential solar loads for East River.

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
003_02	1st tributary	1	280	Thinleaf alder	86%	0.80	2	600	500	50%	2.85	2	600	2,000	2,000	-36%
003_02	1st tributary	2	110	Group B	98%	0.11	2	200	20	80%	1.14	2	200	200	200	-18%
003_02	1st tributary	3	230	Nonforest 1	94%	0.34	2	500	200	60%	2.28	2	500	1,000	800	-34%
003_02	1st tributary	4	1000	Group B	97%	0.17	3	3,000	500	80%	1.14	3	3,000	3,000	3,000	-17%
003_02	1st tributary	5	860	Nonforest 1	78%	1.25	4	3,000	4,000	70%	1.71	4	3,000	5,000	1,000	-8%
003_02	1st tributary	6	80	Nonforest 1	72%	1.60	5	400	600	10%	5.13	5	400	2,000	1,000	-62%
003_02	1st tributary	7	870	Thinleaf alder	50%	2.85	5	4,000	10,000	40%	3.42	5	4,000	10,000	0	-10%
003_04	East River	1	1900	Nonforest 1	39%	3.48	13	25,000	87,000	20%	4.56	13	25,000	110,000	23,000	-19%
003_04	East River	2	780	Nonforest 1	39%	3.48	13	10,000	35,000	0%	5.70	13	10,000	57,000	22,000	-39%
003_04	East River	3	1300	Nonforest 1	39%	3.48	13	17,000	59,000	10%	5.13	13	17,000	87,000	28,000	-29%
							Totals		200,000					280,000	81,000	

Table D-31. Existing and potential solar loads for Middle Fork East River.

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
003_02	MF East River	1	870	Rocky/High Elv	95%	0.29	1	900	300	70%	1.71	1	900	2,000	2,000	-25%
003_02	MF East River	2	2000	Group B	97%	0.17	3	6,000	1,000	80%	1.14	3	6,000	7,000	6,000	-17%
003_02	MF East River	3	2000	Group B	96%	0.23	4	8,000	2,000	70%	1.71	4	8,000	10,000	8,000	-26%
003_03	MF East River	4	2320	Rocky/High Elv	54%	2.62	6	10,000	30,000	70%	1.71	6	10,000	20,000	(10,000)	0%
003_03	MF East River	5	1100	Group B	87%	0.74	8	9,000	7,000	60%	2.28	8	9,000	20,000	10,000	-27%
003_03	MF East River	6	550	Nonforest 1	55%	2.57	8	4,000	10,000	60%	2.28	8	4,000	9,000	(1,000)	0%
003_03	MF East River	7	440	Nonforest 1	55%	2.57	8	4,000	10,000	50%	2.85	8	4,000	10,000	0	-5%
003_03	MF East River	8	380	Nonforest 1	52%	2.74	9	3,000	8,000	60%	2.28	9	3,000	7,000	(1,000)	0%
003_03	MF East River	9	1100	Nonforest 1	52%	2.74	9	10,000	30,000	50%	2.85	9	10,000	30,000	0	-2%
003_03	MF East River	10	820	Nonforest 1	52%	2.74	9	7,000	20,000	40%	3.42	9	7,000	20,000	0	-12%
003_03	MF East River	11	1200	Nonforest 1	48%	2.96	10	12,000	36,000	50%	2.85	10	12,000	34,000	(2,000)	0%
003_03	MF East River	12	780	Nonforest 1	48%	2.96	10	7,800	23,000	40%	3.42	10	7,800	27,000	4,000	-8%
003_03	MF East River	13	480	Nonforest 1	48%	2.96	10	4,800	14,000	50%	2.85	10	4,800	14,000	0	0%
003_03	MF East River	14	1380	Nonforest 1	45%	3.14	11	15,000	47,000	30%	3.99	11	15,000	60,000	13,000	-15%
							Totals		240,000					270,000	29,000	

Table D-32. Existing and potential solar loads for Middle Fork East River tributaries.

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
003_02	1st tributary	1	960	Group C	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
003_02	1st tributary	2	1500	Group B	98%	0.11	2	3,000	300	70%	1.71	2	3,000	5,000	5,000	-28%
003_02	Keokee Creek	1	920	Rocky/High Elv	89%	0.63	2	2,000	1,000	90%	0.57	2	2,000	1,000	0	0%
003_02	Keokee Creek	2	940	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
003_02	Keokee Creek	3	2300	Group B	97%	0.17	3	7,000	1,000	70%	1.71	3	7,000	10,000	9,000	-27%
003_02	trib to Keokee	1	670	Rocky/High Elv	95%	0.29	1	700	200	80%	1.14	1	700	800	600	-15%
003_02	trib to Keokee	2	720	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
003_02	Uleda Creek	1	1400	Rocky/High Elv	95%	0.29	1	1,000	300	70%	1.71	1	1,000	2,000	2,000	-25%
003_02	Uleda Creek	2	850	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
003_02	Uleda Creek	3	1900	Rocky/High Elv	76%	1.37	3	6,000	8,000	70%	1.71	3	6,000	10,000	2,000	-6%
003_02	Uleda Creek	4	620	Rocky/High Elv	67%	1.88	4	2,000	4,000	60%	2.28	4	2,000	5,000	1,000	-7%
003_02	Uleda Creek	5	1000	Rocky/High Elv	60%	2.28	5	5,000	10,000	70%	1.71	5	5,000	9,000	(1,000)	0%
003_02	trib to Uleda	1	570	Rocky/High Elv	89%	0.63	2	1,000	600	70%	1.71	2	1,000	2,000	1,000	-19%
003_02	trib to Uleda	2	1020	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
003_02	Chicopee Creek	1	770	Group B	98%	0.11	1	800	90	60%	2.28	1	800	2,000	2,000	-38%
003_02	Chicopee Creek	2	510	Rocky/High Elv	95%	0.29	1	500	100	60%	2.28	1	500	1,000	900	-35%
003_02	Chicopee Creek	3	440	Group B	98%	0.11	1	400	50	60%	2.28	1	400	900	900	-38%
003_02	Chicopee Creek	4	1800	Group B	98%	0.11	2	4,000	500	70%	1.71	2	4,000	7,000	7,000	-28%
003_02	Tarlac Creek	1	1200	Rocky/High Elv	95%	0.29	1	1,000	300	70%	1.71	1	1,000	2,000	2,000	-25%
003_02	Tarlac Creek	2	1900	Group B	98%	0.11	2	4,000	500	80%	1.14	2	4,000	5,000	5,000	-18%
003_02	Tarlac Creek	3	1000	Group B	97%	0.17	3	3,000	500	70%	1.71	3	3,000	5,000	5,000	-27%
003_02	Tarlac Creek	4	1200	Group B	96%	0.23	4	5,000	1,000	80%	1.14	4	5,000	6,000	5,000	-16%
003_02	6th tributary	1	490	Rocky/High Elv	95%	0.29	1	500	100	70%	1.71	1	500	900	800	-25%
003_02	6th tributary	2	670	Rocky/High Elv	89%	0.63	2	1,000	600	80%	1.14	2	1,000	1,000	400	-9%
003_02	6th tributary	3	190	Rocky/High Elv	76%	1.37	3	600	800	70%	1.71	3	600	1,000	200	-6%
003_02	6th tributary	4	540	Group B	97%	0.17	3	2,000	300	70%	1.71	3	2,000	3,000	3,000	-27%
003_02	Canyon Creek	1	620	Thinleaf alder	91%	0.51	1	600	300	70%	1.71	1	600	1,000	700	-21%
003_02	Canyon Creek	2	2310	Group B	97%	0.17	3	7,000	1,000	70%	1.71	1	2,000	3,000	2,000	-27%
003_02	Canyon Creek	3	2950	Rocky/High Elv	76%	1.37	3	9,000	10,000	70%	1.71	1	3,000	5,000	(5,000)	-6%
003_02	Canyon Creek	4	1310	Group B	97%	0.17	3	4,000	700	80%	1.14	3	4,000	5,000	4,000	-17%
							Totals		43,000					100,000	61,000	

Table D-33. Existing and potential solar loads for Lower West Branch Priest River.

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
030_03	LWB Priest R.	1	1220	Nonforest 1	55%	2.57	8	10,000	30,000	40%	3.42	8	10,000	30,000	0	-15%
030_03	LWB Priest R.	2	450	Nonforest 1	52%	2.74	9	4,000	10,000	30%	3.99	9	4,000	20,000	10,000	-22%
030_03	LWB Priest R.	3	270	Nonforest 1	52%	2.74	9	2,000	5,000	40%	3.42	9	2,000	7,000	2,000	-12%
030_03	LWB Priest R.	4	1200	Nonforest 1	48%	2.96	10	12,000	36,000	20%	4.56	10	12,000	55,000	19,000	-28%
030_03	LWB Priest R.	5	910	Nonforest 1	48%	2.96	10	9,100	27,000	30%	3.99	10	9,100	36,000	9,000	-18%
030_03	LWB Priest R.	6	4100	Nonforest 1	45%	3.14	11	45,000	140,000	50%	2.85	11	45,000	130,000	(10,000)	0%
030_03	LWB Priest R.	7	150	Nonforest 1	41%	3.36	12	1,800	6,100	40%	3.42	12	1,800	6,200	100	-1%
030_04	LWB Priest R.	1	2220	Nonforest 1	39%	3.48	13	29,000	100,000	40%	3.42	13	29,000	99,000	(1,000)	0%
030_04	LWB Priest R.	2	420	Nonforest 1	39%	3.48	13	5,500	19,000	30%	3.99	13	5,500	22,000	3,000	-9%
030_04	LWB Priest R.	3	1100	Nonforest 1	39%	3.48	13	14,000	49,000	20%	4.56	13	14,000	64,000	15,000	-19%
030_04	LWB Priest R.	4	2800	Nonforest 1	37%	3.59	14	39,000	140,000	10%	5.13	14	39,000	200,000	60,000	-27%
030_04	LWB Priest R.	5	880	Nonforest 1	37%	3.59	14	12,000	43,000	20%	4.56	14	12,000	55,000	12,000	-17%
030_04	LWB Priest R.	6	340	Nonforest 1	37%	3.59	14	4,800	17,000	10%	5.13	14	4,800	25,000	8,000	-27%
030_04	LWB Priest R.	7	1040	Nonforest 1	37%	3.59	14	15,000	54,000	20%	4.56	14	15,000	68,000	14,000	-17%
030_04	LWB Priest R.	8	860	Nonforest 1	37%	3.59	14	12,000	43,000	30%	3.99	14	12,000	48,000	5,000	-7%
030_04	LWB Priest R.	9	3100	Nonforest 1	35%	3.71	15	47,000	170,000	20%	4.56	15	47,000	210,000	40,000	-15%
030_04	LWB Priest R.	10	210	Nonforest 1	35%	3.71	15	3,200	12,000	10%	5.13	15	3,200	16,000	4,000	-25%
030_04	LWB Priest R.	11	160	Nonforest 1	35%	3.71	15	2,400	8,900	30%	3.99	15	2,400	9,600	700	-5%
030_04	LWB Priest R.	12	2260	Nonforest 1	35%	3.71	15	34,000	130,000	20%	4.56	15	34,000	160,000	30,000	-15%
030_04	LWB Priest R.	13	970	Nonforest 1	35%	3.71	15	15,000	56,000	10%	5.13	15	15,000	77,000	21,000	-25%
030_04	LWB Priest R.	14	360	Nonforest 1	35%	3.71	15	5,400	20,000	30%	3.99	15	5,400	22,000	2,000	-5%
030_04	LWB Priest R.	15	670	Nonforest 1	35%	3.71	15	10,000	37,000	0%	5.70	15	10,000	57,000	20,000	-35%
							Totals		1,200,000					1,400,000	260,000	

Table D-34. Existing and potential solar loads for Tunnel Creek.

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
030_02	1st tributary	1	830	Group A	94%	0.34	1	800	300	80%	1.14	1	800	900	600	-14%
030_02	2nd tributary	1	310	Group B	98%	0.11	1	300	30	80%	1.14	1	300	300	300	-18%
030_02	2nd tributary	2	290	Group B	98%	0.11	1	300	30	70%	1.71	1	300	500	500	-28%
030_02	2nd tributary	3	1010	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
030_02	2nd tributary	4	420	Group B	98%	0.11	2	800	90	60%	2.28	2	800	2,000	2,000	-38%
030_02	2nd tributary	5	250	Nonforest 1	86%	0.80	3	800	600	40%	3.42	3	800	3,000	2,000	-46%
030_02	2nd tributary	6	390	Nonforest 1	86%	0.80	3	1,000	800	50%	2.85	3	1,000	3,000	2,000	-36%
030_02	2nd tributary	7	760	Nonforest 1	86%	0.80	3	2,000	2,000	40%	3.42	3	2,000	7,000	5,000	-46%
030_02	1st trib to 2nd	1	1300	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
030_02	2nd trib to 2nd	1	1200	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
030_02	3rd trib to 2nd	1	1100	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
030_02	3rd trib to 2nd	2	310	Group B	98%	0.11	1	300	30	70%	1.71	1	300	500	500	-28%
030_02	3rd trib to 2nd	3	210	Group B	98%	0.11	2	400	50	60%	2.28	2	400	900	900	-38%
030_02	3rd trib to 2nd	4	80	Group B	98%	0.11	2	200	20	40%	3.42	2	200	700	700	-58%
030_02	Tunnel Creek	1	990	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
030_02	Tunnel Creek	2	430	Nonforest 1	94%	0.34	2	900	300	70%	1.71	2	900	2,000	2,000	-24%
030_02	Tunnel Creek	3	270	Nonforest 1	94%	0.34	2	500	200	60%	2.28	2	500	1,000	800	-34%
030_02	Tunnel Creek	4	1600	Nonforest 1	86%	0.80	3	5,000	4,000	40%	3.42	3	5,000	20,000	20,000	-46%
030_03	Tunnel Creek	5	250	Nonforest 1	78%	1.25	4	1,000	1,000	40%	3.42	4	1,000	3,000	2,000	-38%
030_03	Tunnel Creek	6	1100	Nonforest 1	78%	1.25	4	4,000	5,000	70%	1.71	4	4,000	7,000	2,000	-8%
030_03	Tunnel Creek	7	450	Nonforest 1	78%	1.25	4	2,000	3,000	80%	1.14	4	2,000	2,000	(1,000)	0%
030_03	Tunnel Creek	8	1400	Nonforest 1	78%	1.25	4	6,000	8,000	70%	1.71	4	6,000	10,000	2,000	-8%
							Totals		26,000					70,000	48,000	

Table D-35. Existing and potential solar loads for Snow Creek.

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
030_02	1st tributary	1	1000	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
030_02	1st tributary	2	1000	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
030_02	1st tributary	3	480	Group B	97%	0.17	3	1,000	200	60%	2.28	3	1,000	2,000	2,000	-37%
030_02	1st tributary	4	470	Group B	97%	0.17	3	1,000	200	50%	2.85	3	1,000	3,000	3,000	-47%
030_02	2nd tributary	1	1900	Group B	98%	0.11	1	2,000	200	80%	1.14	1	2,000	2,000	2,000	-18%
030_02	2nd tributary	2	310	Nonforest 1	94%	0.34	2	600	200	60%	2.28	2	600	1,000	800	-34%
030_02	2nd tributary	3	280	Nonforest 1	94%	0.34	2	600	200	50%	2.85	2	600	2,000	2,000	-44%
030_02	2nd tributary	4	670	Nonforest 1	86%	0.80	3	2,000	2,000	60%	2.28	3	2,000	5,000	3,000	-26%
030_02	2nd tributary	5	620	Nonforest 1	78%	1.25	4	2,000	3,000	0%	5.70	4	2,000	10,000	7,000	-78%
030_02	2nd tributary	6	220	Nonforest 1	78%	1.25	4	900	1,000	20%	4.56	4	900	4,000	3,000	-58%
030_02	2nd tributary	7	1400	Nonforest 1	78%	1.25	4	6,000	8,000	70%	1.71	4	6,000	10,000	2,000	-8%
030_02	trib to 2nd trib	1	1770	Group B	98%	0.11	2	4,000	500	80%	1.14	2	4,000	5,000	5,000	-18%
030_02	trib to 2nd trib	2	350	Nonforest 1	94%	0.34	2	700	200	60%	2.28	2	700	2,000	2,000	-34%
030_02	Snow Creek	1	1200	Group B	98%	0.11	1	1,000	100	70%	1.71	1	1,000	2,000	2,000	-28%
030_02	Snow Creek	2	680	Group B	98%	0.11	2	1,000	100	60%	2.28	2	1,000	2,000	2,000	-38%
030_02	Snow Creek	3	310	Group B	98%	0.11	2	600	70	30%	3.99	2	600	2,000	2,000	-68%
030_02	Snow Creek	4	1000	Group B	97%	0.17	3	3,000	500	60%	2.28	3	3,000	7,000	7,000	-37%
030_02	Snow Creek	5	420	Group B	97%	0.17	3	1,000	200	30%	3.99	3	1,000	4,000	4,000	-67%
030_02	Snow Creek	6	990	Nonforest 1	72%	1.60	5	5,000	8,000	60%	2.28	5	5,000	10,000	2,000	-12%
030_03	Snow Creek	7	130	Nonforest 1	65%	2.00	6	800	2,000	70%	1.71	6	800	1,000	(1,000)	0%
030_03	Snow Creek	8	570	Thinleaf alder	43%	3.25	6	3,000	10,000	60%	2.28	6	3,000	7,000	(3,000)	0%
030_03	Snow Creek	9	200	Thinleaf alder	43%	3.25	6	1,000	3,000	50%	2.85	6	1,000	3,000	0	0%
030_03	Snow Creek	10	1100	Nonforest 1	65%	2.00	6	7,000	10,000	60%	2.28	6	7,000	20,000	10,000	-5%
							Totals		50,000					110,000	59,000	

Table D-36. Existing and potential solar loads for Moores Creek.

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
031_02	Moores Creek	1	2400	Group B	98%	0.11	2	5,000	600	80%	1.14	2	5,000	6,000	5,000	-18%
031_02	Moores Creek	2	1000	Nonforest 1	86%	0.80	3	3,000	2,000	40%	3.42	3	3,000	10,000	8,000	-46%
031_02	Moores Creek	3	200	Nonforest 1	78%	1.25	4	800	1,000	30%	3.99	4	800	3,000	2,000	-48%
031_02	Moores Creek	4	230	Nonforest 1	78%	1.25	4	900	1,000	40%	3.42	4	900	3,000	2,000	-38%
031_02	Moores Creek	5	650	Nonforest 1	78%	1.25	4	3,000	4,000	20%	4.56	4	3,000	10,000	6,000	-58%
031_02	Moores Creek	6	240	Nonforest 1	72%	1.60	5	1,000	2,000	30%	3.99	5	1,000	4,000	2,000	-42%
031_02	Moores Creek	7	670	Nonforest 1	72%	1.60	5	3,000	5,000	60%	2.28	5	3,000	7,000	2,000	-12%
031_02	Moores Creek	8	570	Nonforest 1	72%	1.60	5	3,000	5,000	30%	3.99	5	3,000	10,000	5,000	-42%
031_02	Moores Creek	9	1270	Nonforest 1	72%	1.60	5	6,000	10,000	10%	5.13	5	6,000	30,000	20,000	-62%
031_02	Moores Creek	10	960	Nonforest 1	72%	1.60	5	5,000	8,000	50%	2.85	5	5,000	10,000	2,000	-22%
031_02	Moores Creek	11	300	Nonforest 1	72%	1.60	5	2,000	3,000	30%	3.99	5	2,000	8,000	5,000	-42%
031_02	Moores Creek	12	1400	Nonforest 1	65%	2.00	6	8,000	20,000	20%	4.56	6	8,000	40,000	20,000	-45%
031_03	Moores Creek	13	2160	Nonforest 1	65%	2.00	6	10,000	20,000	10%	5.13	6	10,000	50,000	30,000	-55%
031_03	Moores Creek	14	790	Nonforest 1	60%	2.28	7	6,000	10,000	20%	4.56	7	6,000	30,000	20,000	-40%
031_03	Moores Creek	15	780	Nonforest 1	60%	2.28	7	5,000	10,000	60%	2.28	7	5,000	10,000	0	0%
031_03	Moores Creek	16	160	Nonforest 1	60%	2.28	7	1,000	2,000	50%	2.85	7	1,000	3,000	1,000	-10%
031_03	Moores Creek	17	270	Nonforest 1	60%	2.28	7	2,000	5,000	40%	3.42	7	2,000	7,000	2,000	-20%
031_03	Moores Creek	18	580	Nonforest 1	60%	2.28	7	4,000	9,000	20%	4.56	7	4,000	20,000	10,000	-40%
031_03	Moores Creek	19	1470	Nonforest 1	60%	2.28	7	10,000	20,000	60%	2.28	7	10,000	20,000	0	0%
							Totals		140,000					280,000	140,000	

Table D-37. Existing and potential solar loads for Priest River.

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
014_04	Priest River	1	4500	Nonforest 2	25%	4.28	20	90,000	380,000	0%	5.70	20	90,000	510,000	130,000	-25%
005_05	Priest River	2	1900	Nonforest 2	17%	4.73	33	63,000	300,000	0%	5.70	33	63,000	360,000	60,000	-17%
005_05	Priest River	3	1230	Nonforest 2	17%	4.73	33	41,000	190,000	10%	5.13	33	41,000	210,000	20,000	-7%
005_05	Priest River	4	1520	Nonforest 2	16%	4.79	34	52,000	250,000	0%	5.70	34	52,000	300,000	50,000	-16%
005_05	Priest River	5	310	Nonforest 2	16%	4.79	34	11,000	53,000	10%	5.13	34	11,000	56,000	3,000	-6%
005_05	Priest River	6	8100	Nonforest 2	16%	4.79	35	280,000	1,300,000	0%	5.70	35	280,000	1,600,000	300,000	-16%
005_05	Priest River	7	1100	Nonforest 2	16%	4.79	36	40,000	190,000	10%	5.13	36	40,000	210,000	20,000	-6%
001_05	Priest River	1	23850	Nonforest 2	15%	4.85	38	910,000	4,400,000	0%	5.70	38	910,000	5,200,000	800,000	-15%
001_05	Priest River	2	420	Nonforest 2	15%	4.85	39	16,000	78,000	10%	5.13	39	16,000	82,000	4,000	-5%
001_05	Priest River	3	35320	Nonforest 2	14%	4.90	40	1,400,000	6,900,000	0%	5.70	40	1,400,000	8,000,000	1,100,000	-14%
							Totals		14,000,000					17,000,000	2,500,000	

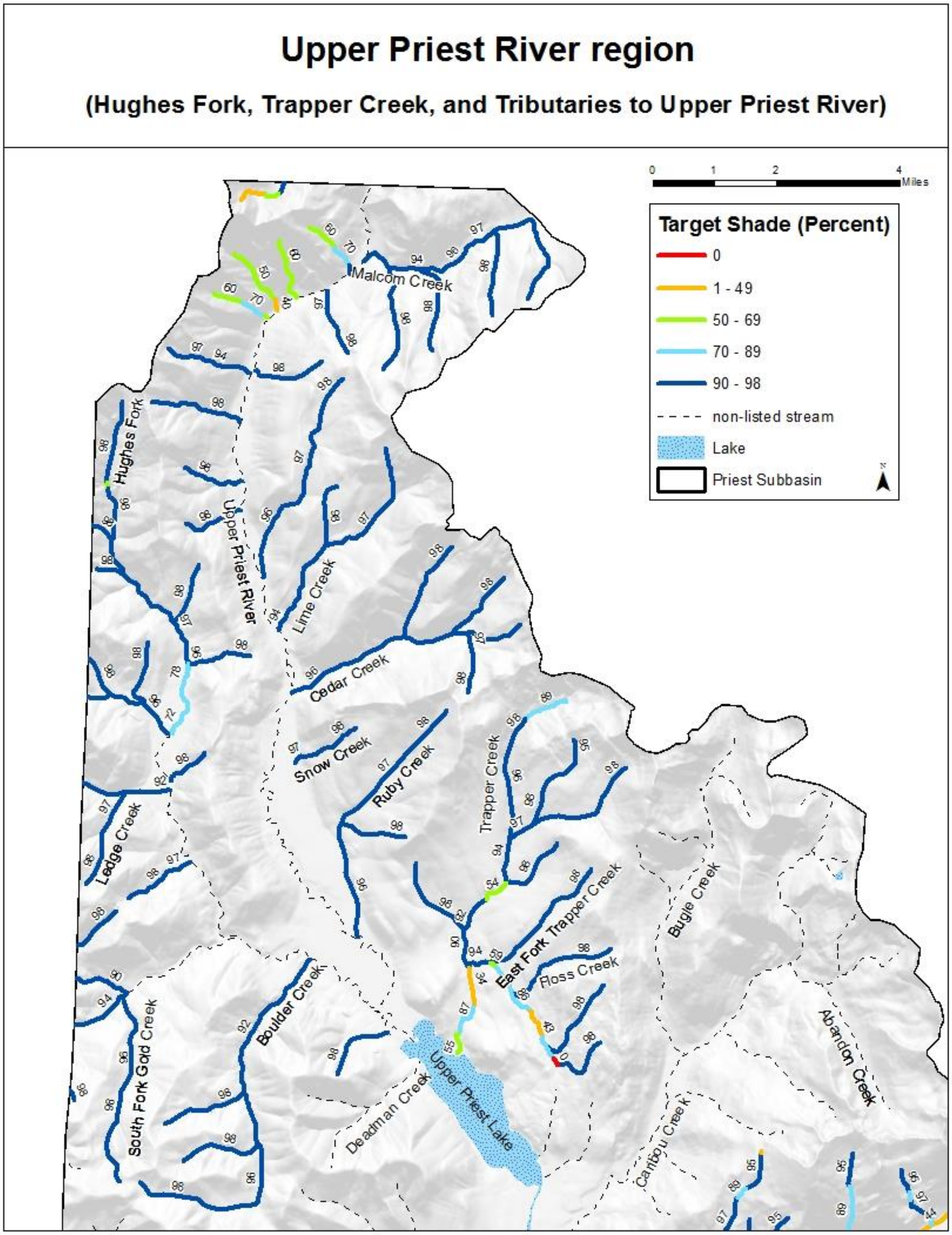


Figure D-1. Target shade for upper Priest River region.

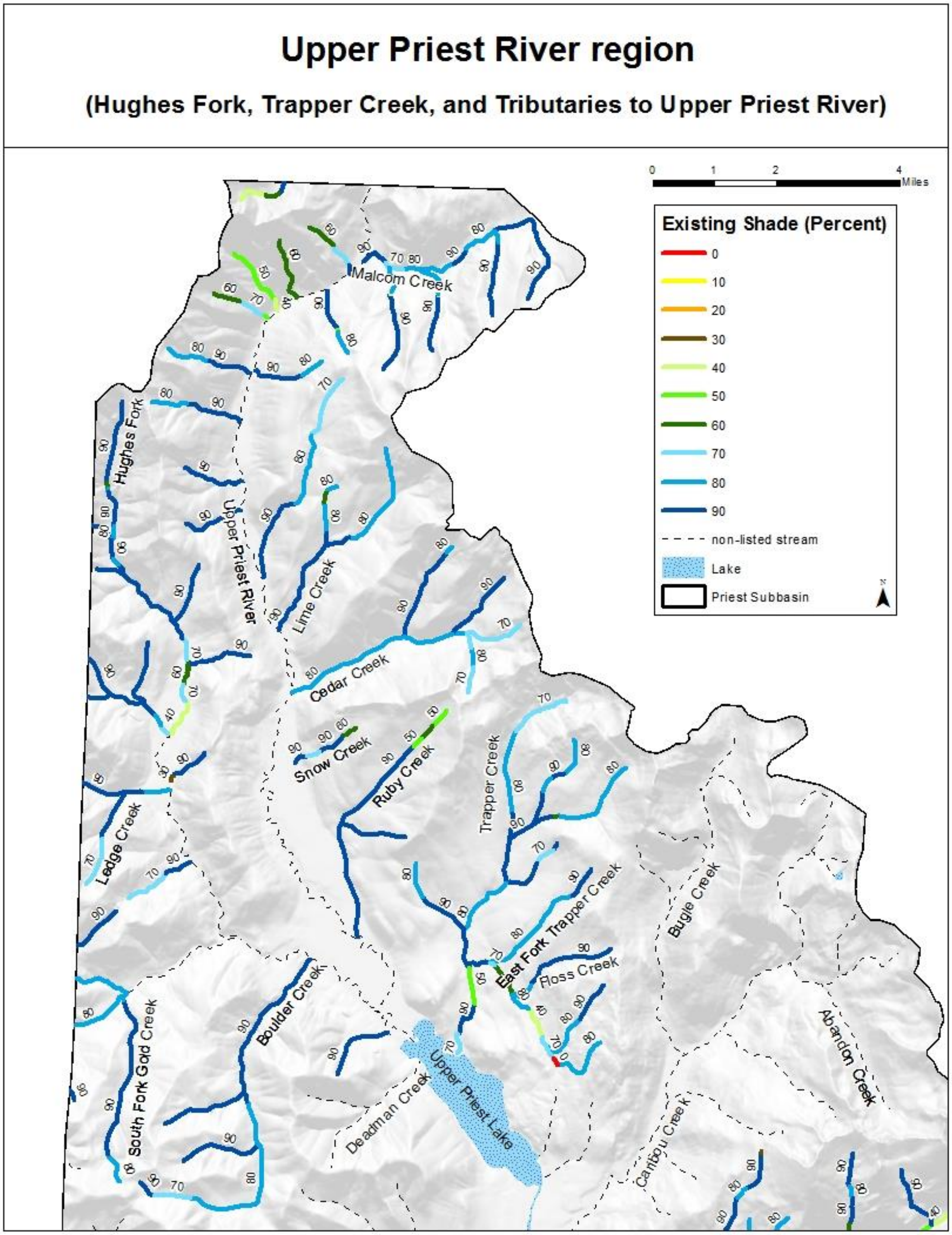


Figure D-2. Existing shade estimated for upper Priest River region.

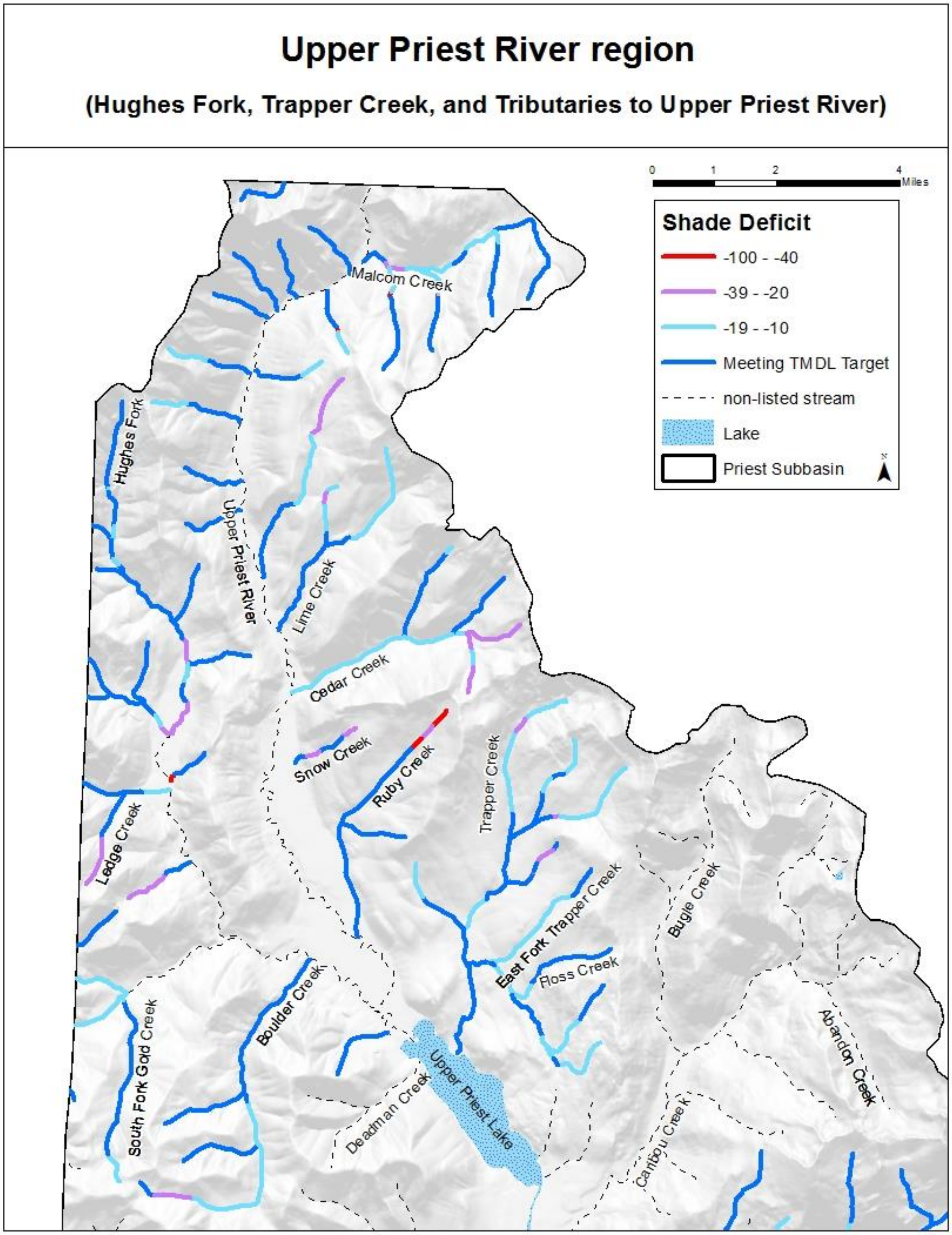


Figure D-3. Shade deficit for the upper Priest River region.

Priest Lake Eastside region

(Lion, Two Mouth, Indian, Hunt, and Soldier Creeks)

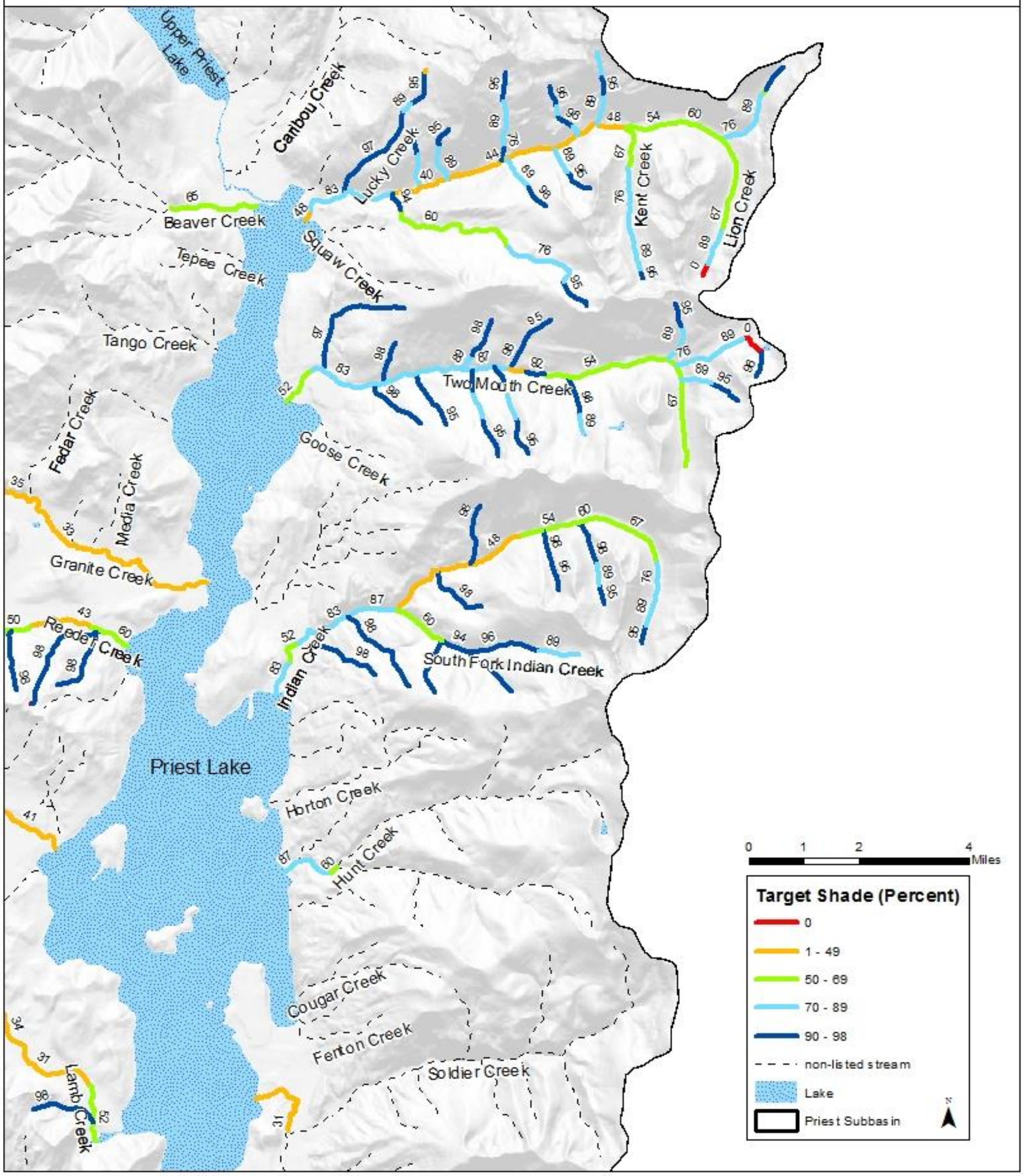


Figure D-4. Target shade for Priest Lake Eastside region.

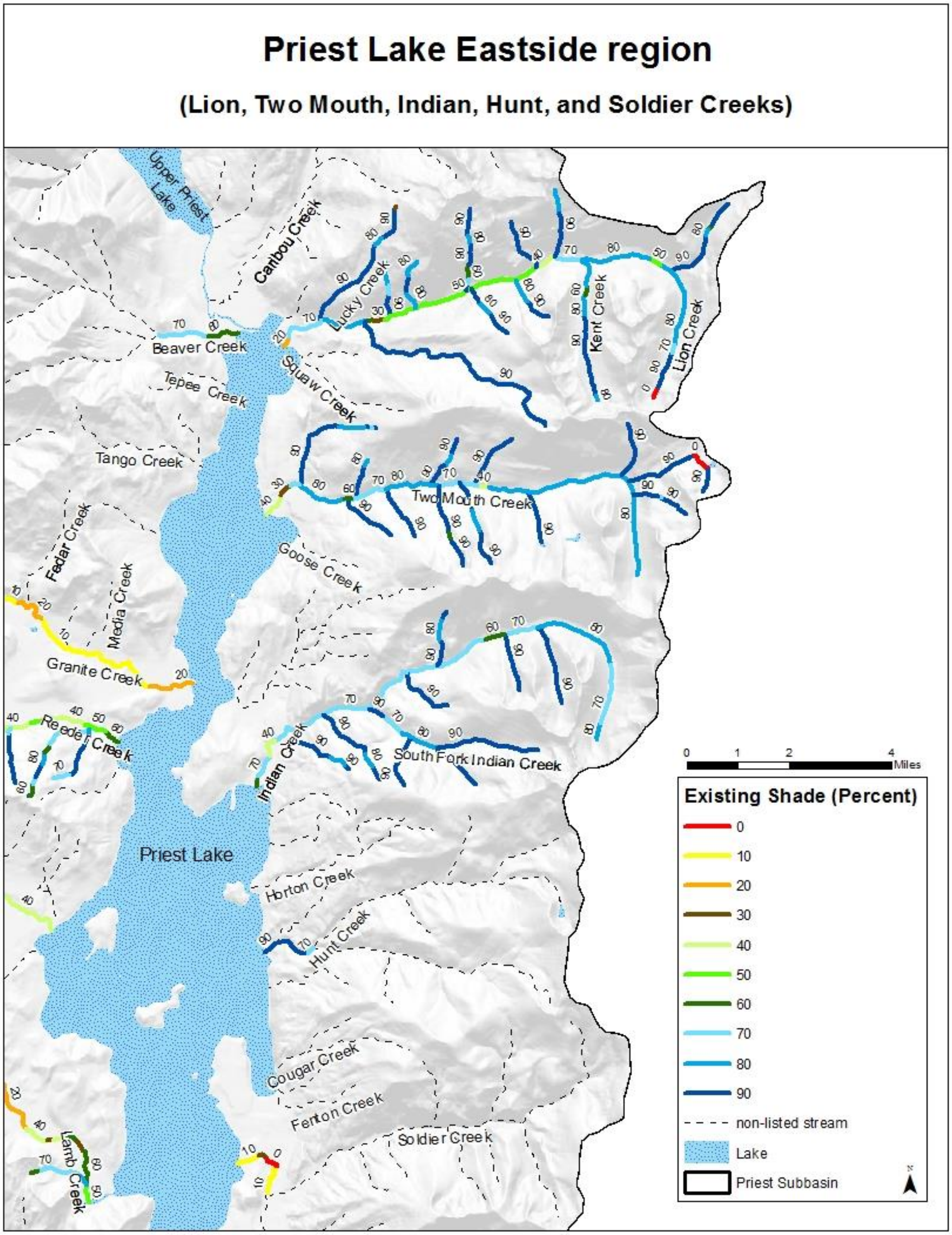


Figure D-5. Existing shade estimated for Priest Lake eastside region.

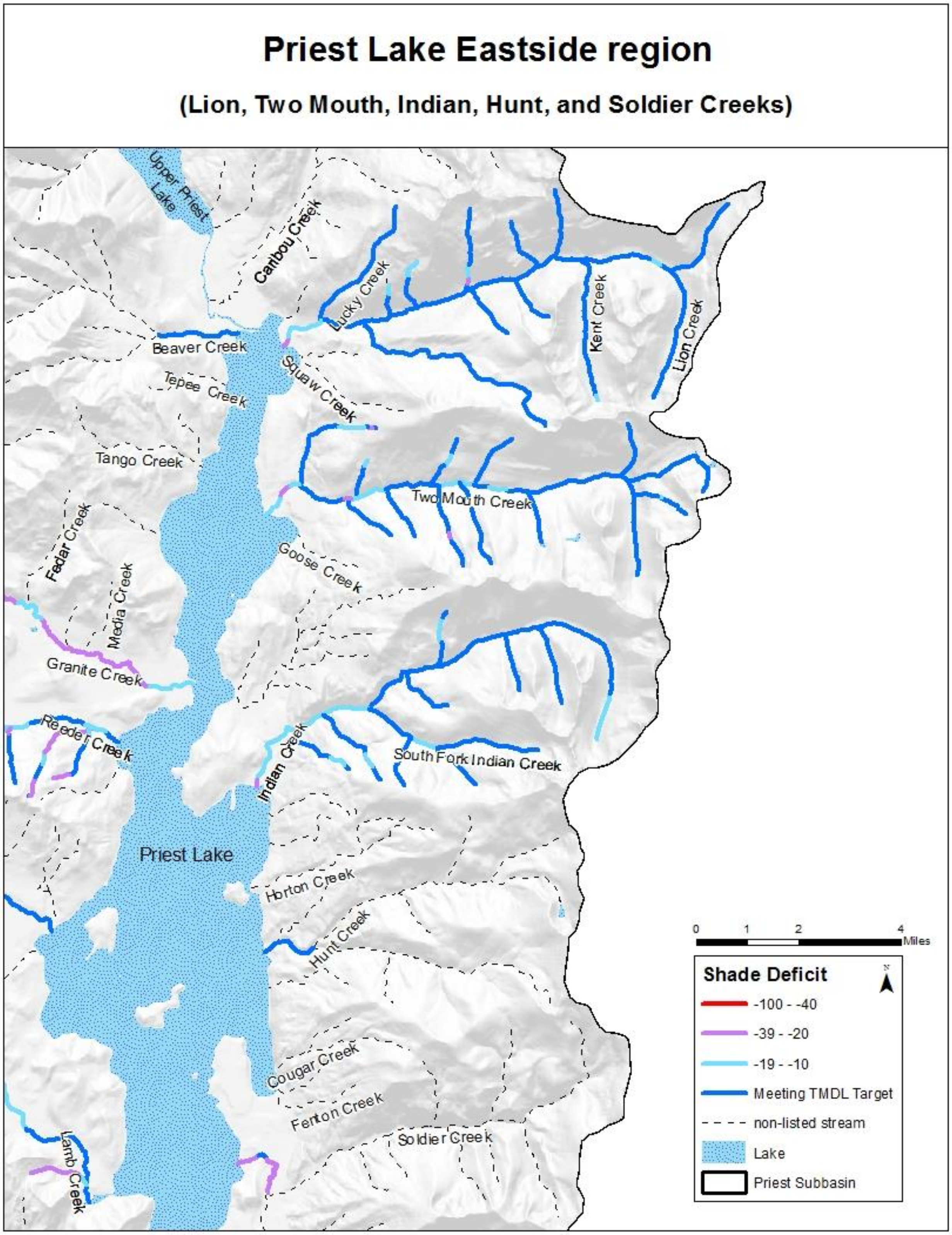


Figure D-6. Shade deficit for the Priest Lake eastside region.

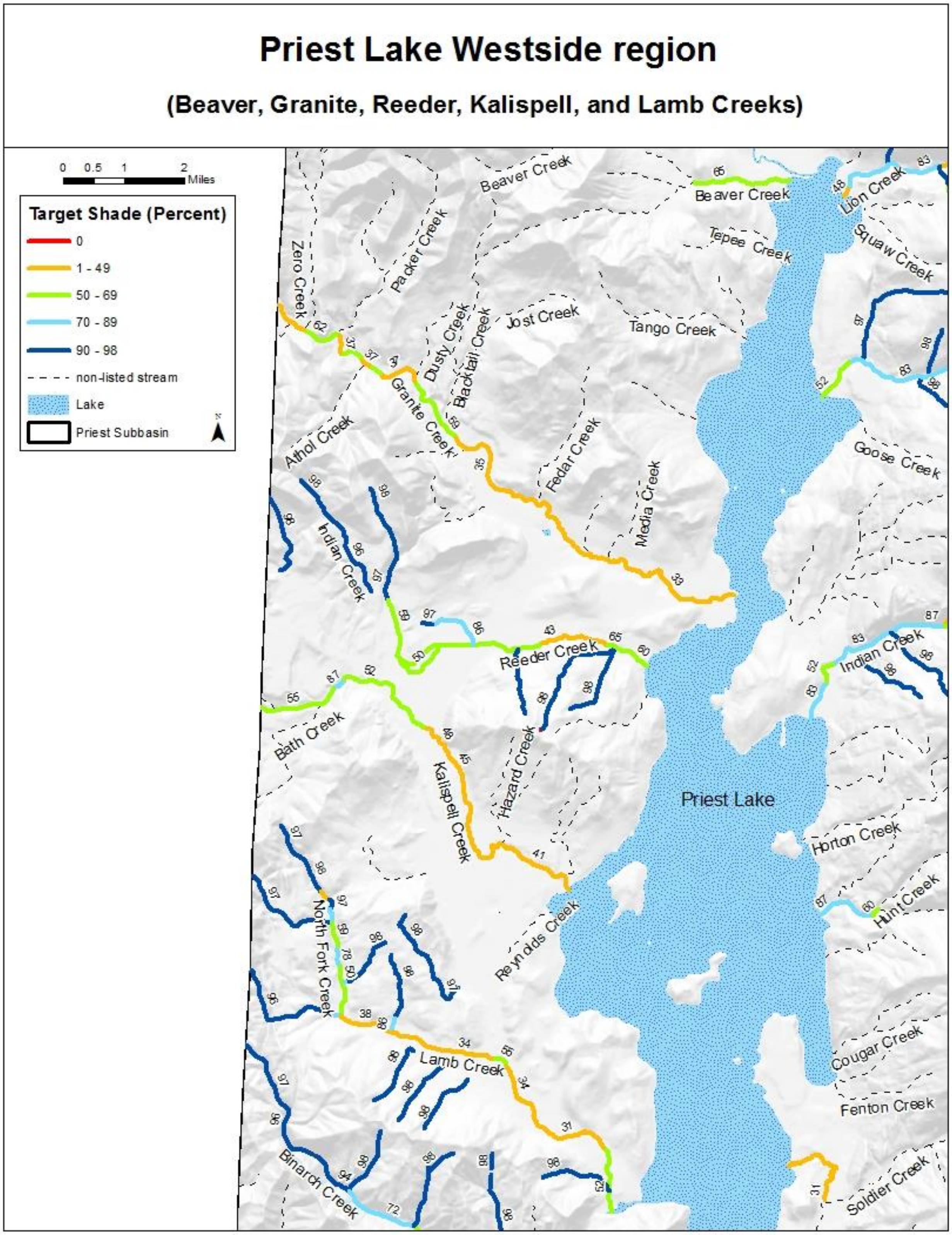


Figure D-7. Target shade for Priest Lake westside region.

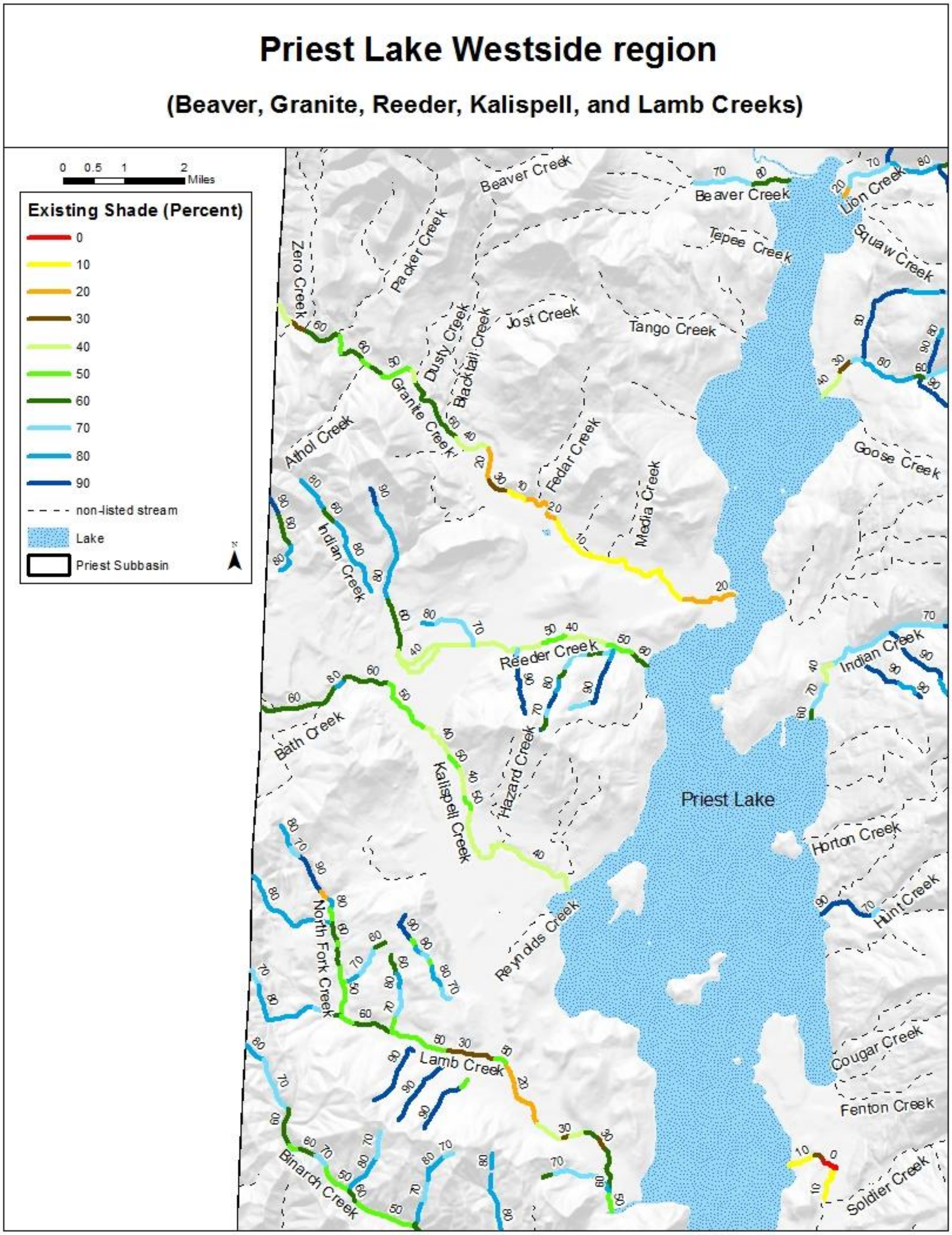


Figure D-8. Existing shade estimated for Priest Lake westside region.

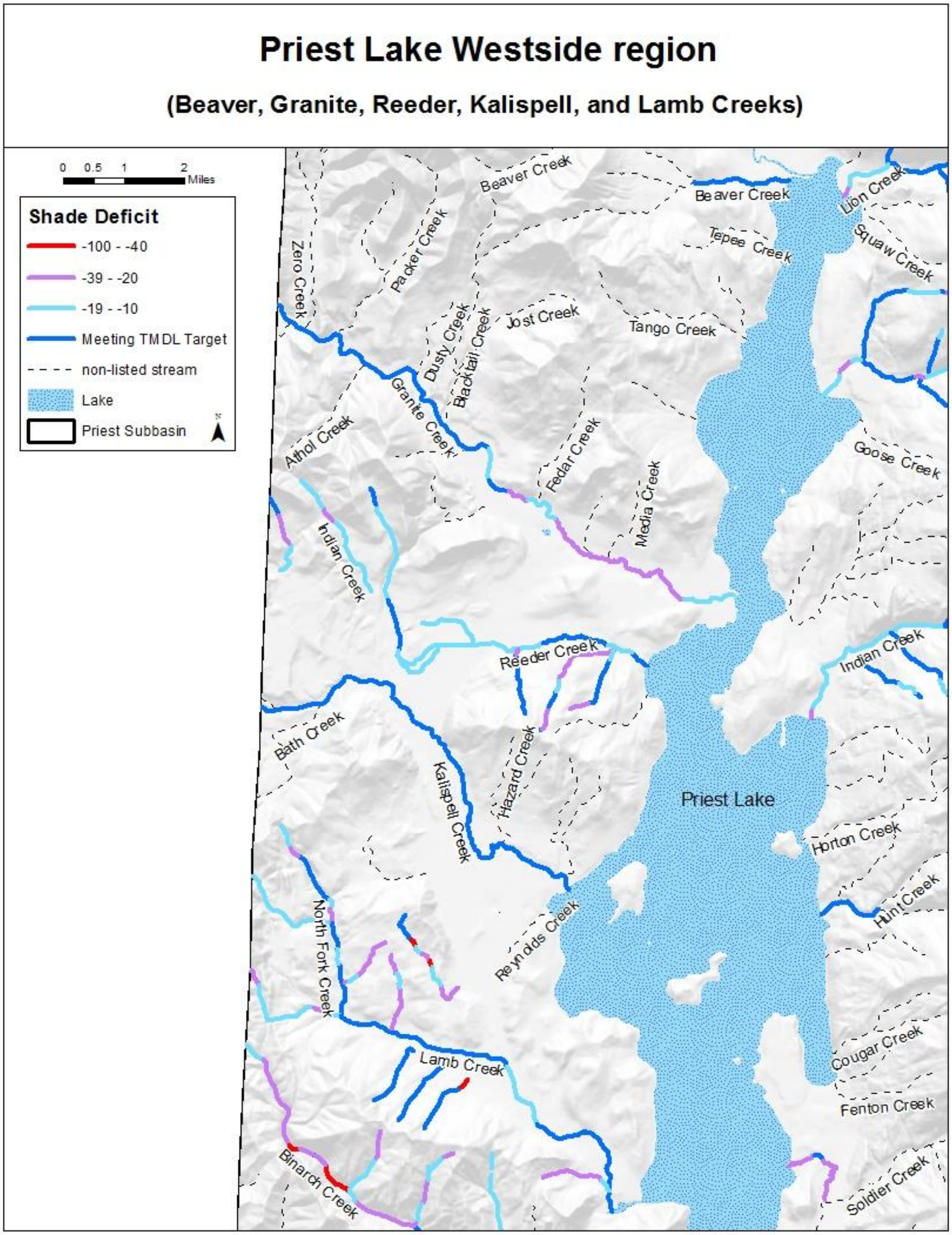


Figure D-9. Shade deficit for the Priest Lake westside region.

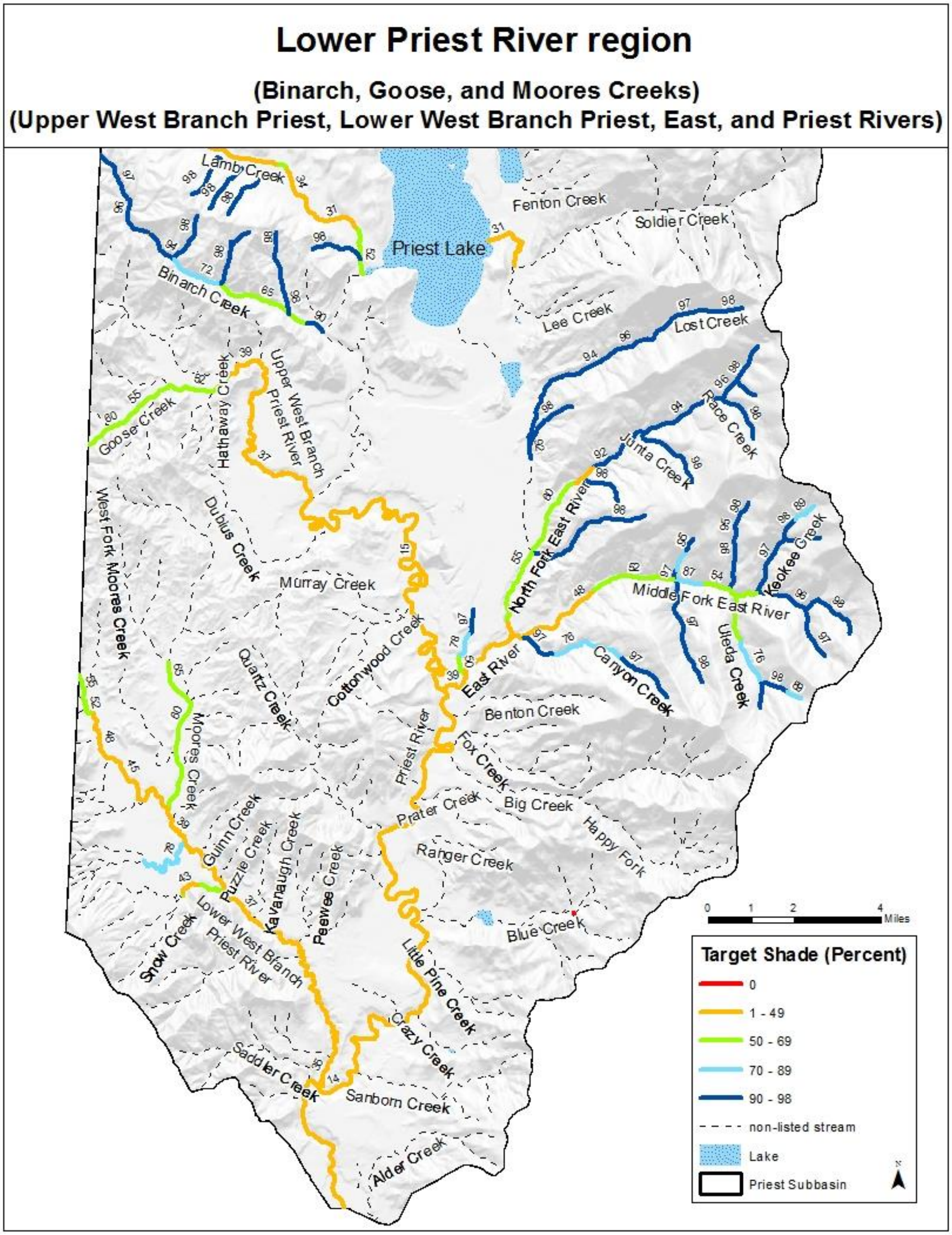


Figure D-10. Target shade for the Lower Priest River region.

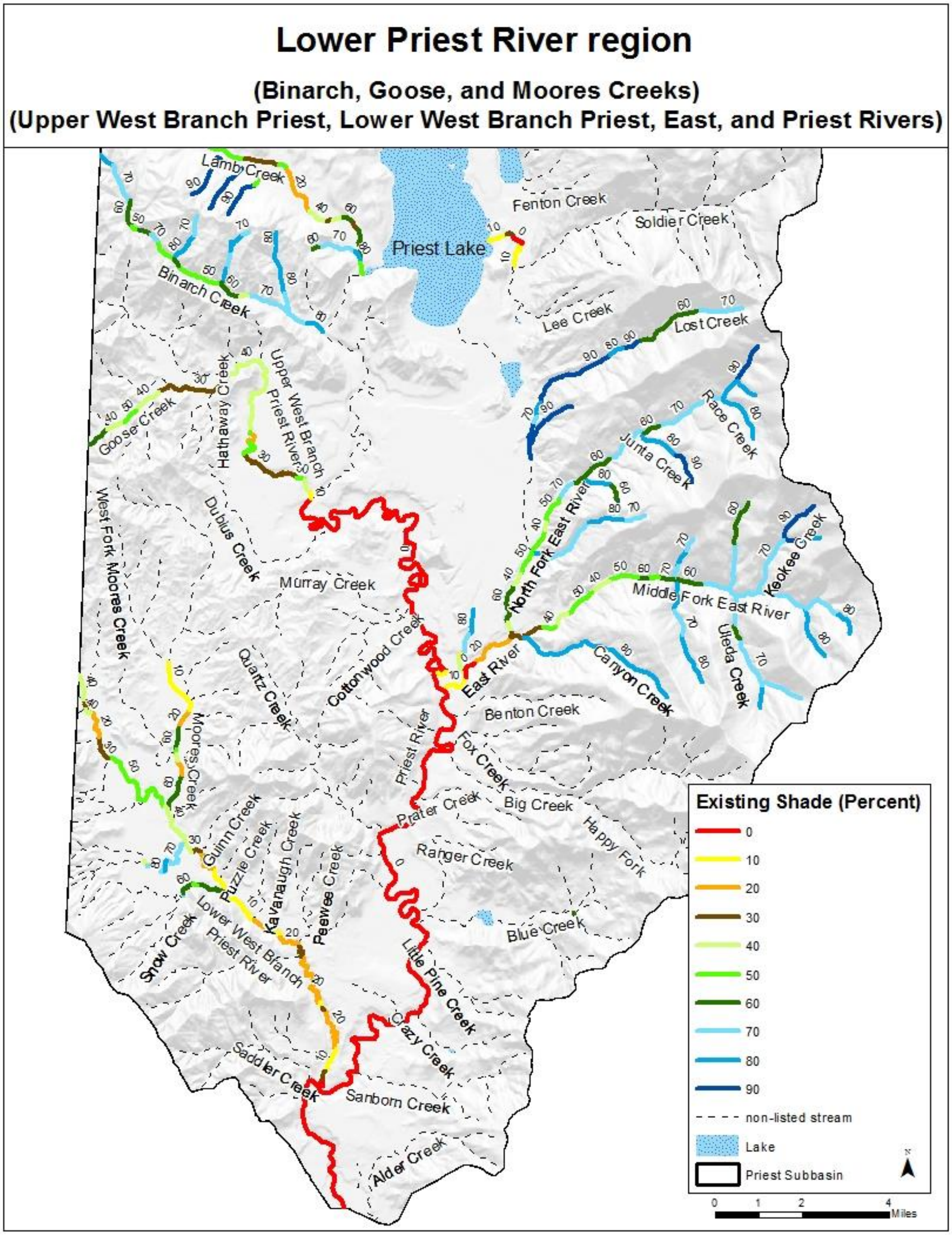


Figure D-11. Existing shade for the lower Priest River region.

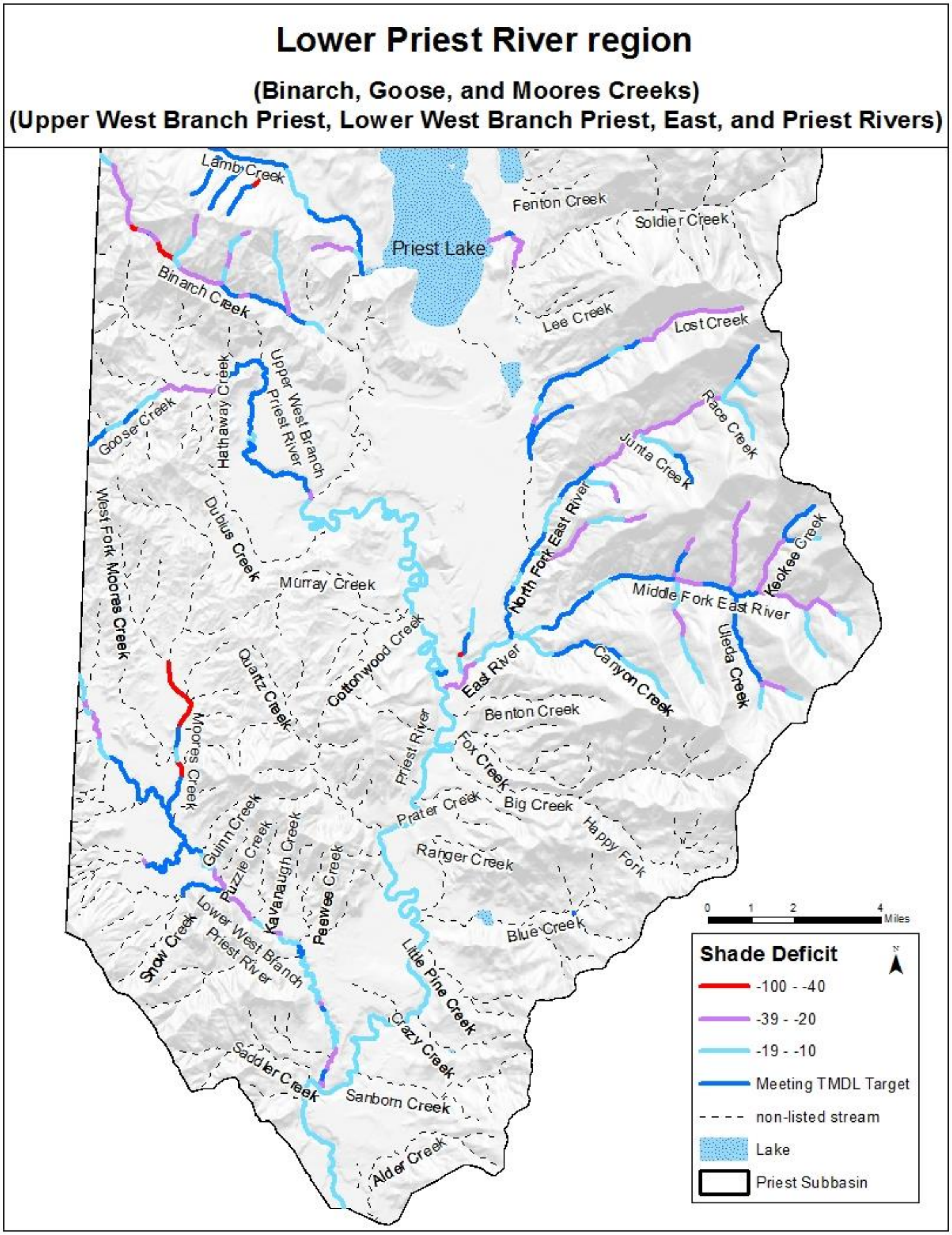
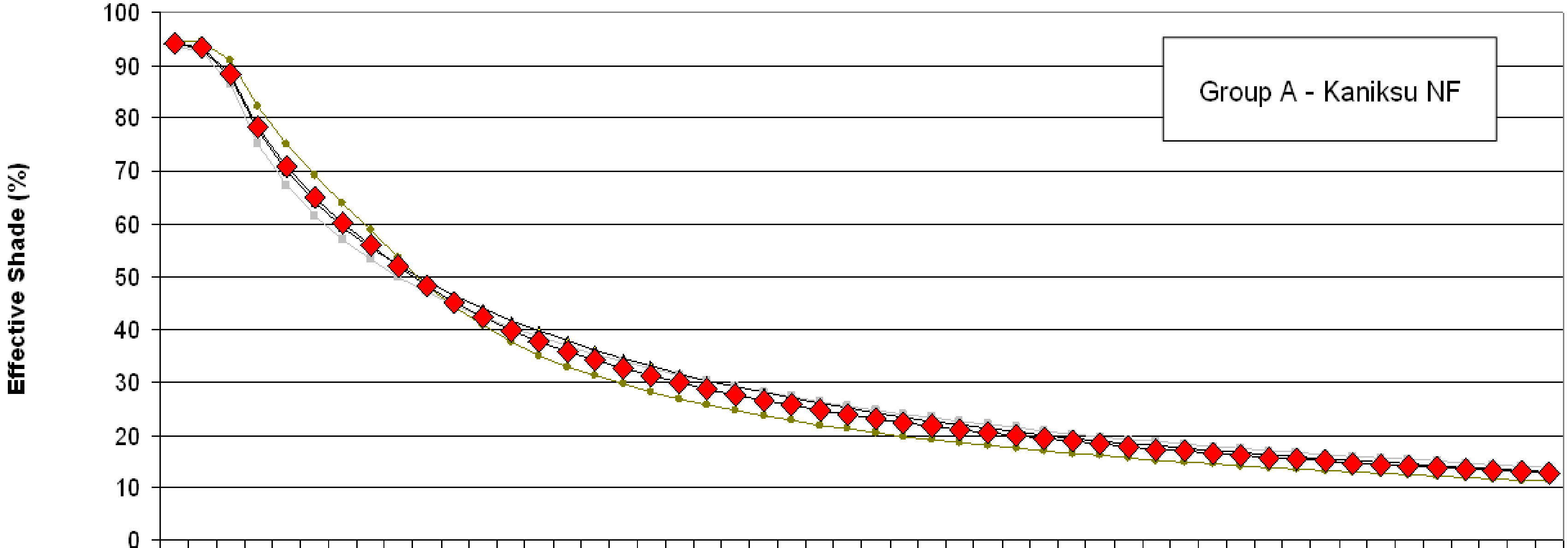


Figure D-12. Shade deficit for the lower Priest River region.

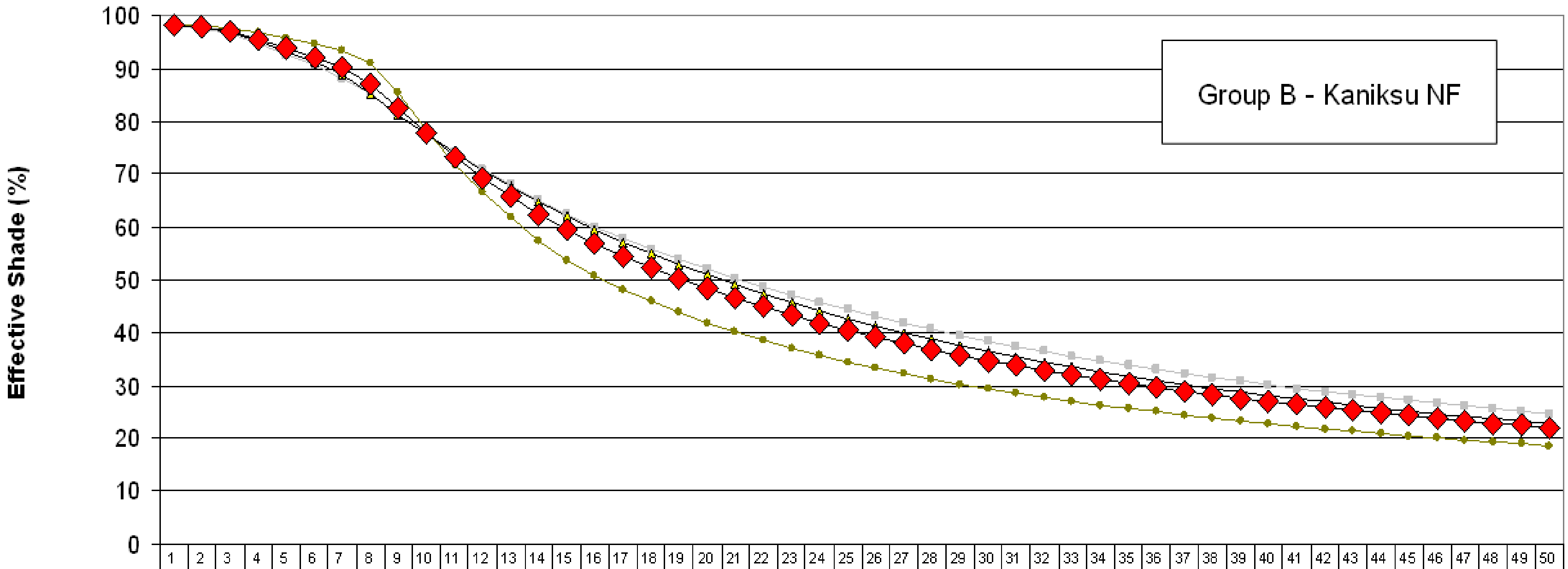


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	94	93	86	75	67	62	57	53	50	47	45	42	40	39	37	35	34	33	31	30	29	28	27	26	25
Northeast/Southwest	94	93	88	78	70	64	60	56	52	49	46	44	42	40	38	36	35	33	32	30	29	28	27	26	25
East - West	95	94	91	82	75	69	64	59	54	48	44	41	38	35	33	31	30	28	27	26	25	24	23	22	21
Average	94	93	88	78	71	65	60	56	52	48	45	42	40	38	36	34	33	31	30	29	28	27	26	25	24

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	25	24	23	23	22	21	21	20	20	19	19	18	18	17	17	17	16	16	16	15	15	15	14	14	14
Northeast/Southwest	24	23	23	22	21	21	20	19	19	18	18	17	17	17	16	16	15	15	15	14	14	14	14	13	13
East - West	20	20	19	19	18	17	17	16	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	11	11
Average	23	22	22	21	20	20	19	19	18	18	17	17	16	16	16	15	15	15	14	14	14	14	13	13	13

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure D-13. Target shade for the Kaniksu National Forest Group A forest type.

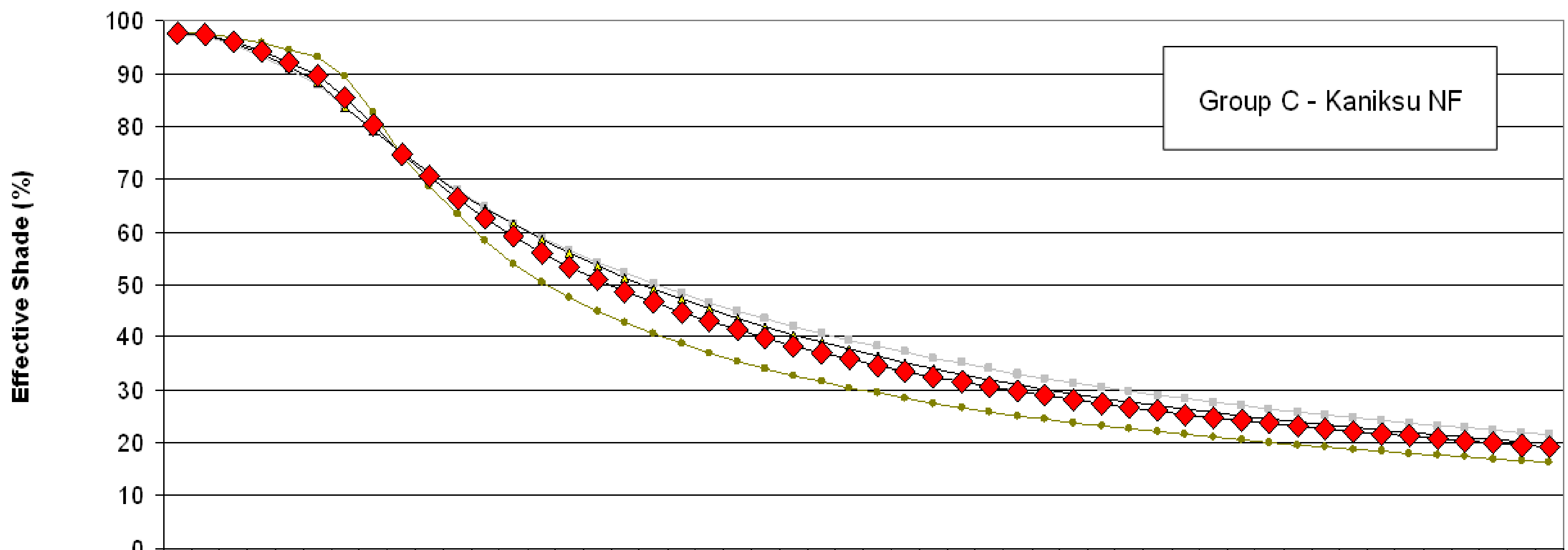


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	98	98	97	95	93	91	88	85	81	77	74	71	68	65	63	60	58	56	54	52	50	49	47	46	44
Northeast/Southwest	98	98	97	95	93	91	89	85	81	77	74	71	68	65	62	60	57	55	53	51	49	47	46	44	43
East - West	98	98	98	97	96	95	93	91	85	78	72	67	62	57	54	51	48	46	44	42	40	39	37	36	34
Average	98	98	97	96	94	92	90	87	83	78	73	69	66	62	59	57	54	52	50	48	47	45	43	42	40

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	43	42	41	40	38	37	37	36	35	34	33	32	32	31	30	29	29	28	28	27	27	26	26	25	25
Northeast/Southwest	41	40	39	38	36	35	34	33	33	32	31	30	29	29	28	27	27	26	26	25	25	24	24	23	23
East - West	33	32	31	30	29	29	28	27	26	26	25	24	24	23	23	22	22	21	21	20	20	20	19	19	19
Average	39	38	37	36	35	34	33	32	31	30	30	29	28	28	27	26	26	25	25	24	24	23	23	22	22

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure D-14. Target shade for the Kaniksu National Forest Group B forest type.

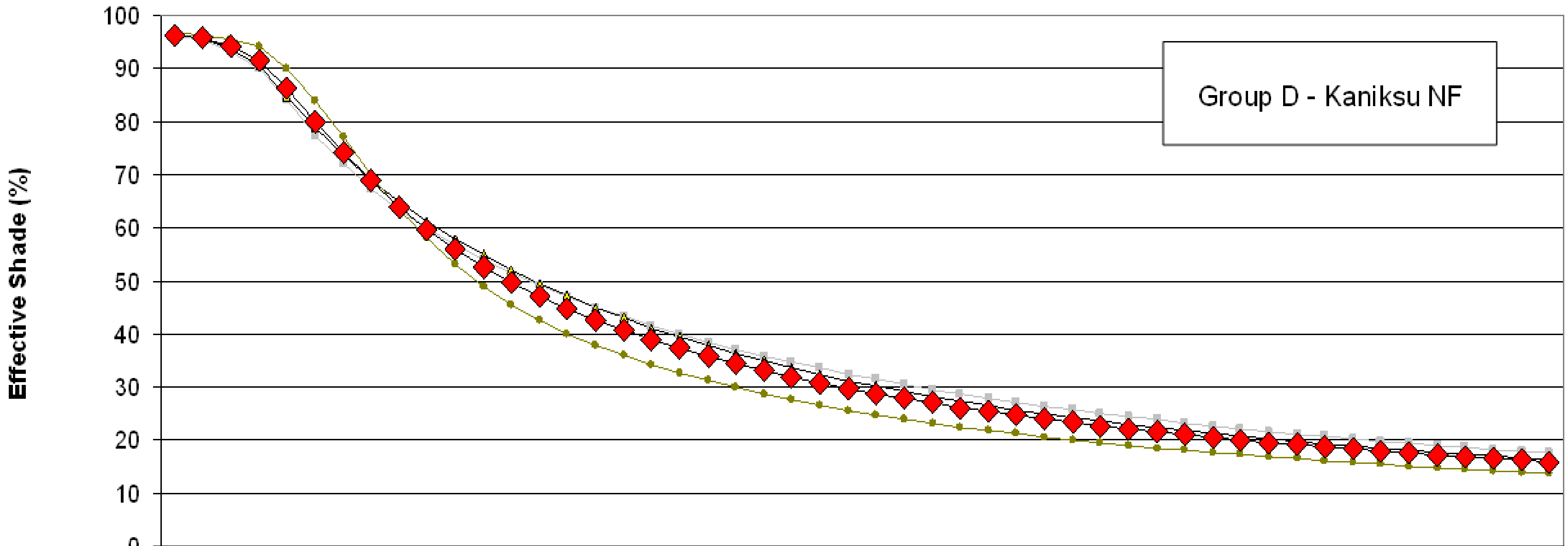


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	97	97	95	93	91	88	84	79	75	71	68	65	62	59	56	54	52	50	48	47	45	43	42	41	39
Northeast/Southwest	98	97	96	94	91	88	84	79	75	71	68	64	61	59	56	54	51	49	47	45	44	42	40	39	38
East - West	98	98	97	96	95	93	89	83	74	69	63	58	54	51	48	45	43	41	39	37	35	34	33	32	30
Average	98	97	96	94	92	90	86	80	75	70	66	62	59	56	53	51	49	47	45	43	41	40	38	37	36

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	38	37	36	35	34	33	32	31	31	30	29	28	28	27	26	26	25	25	24	24	23	23	22	22	22
Northeast/Southwest	36	35	34	33	32	31	30	29	29	28	27	26	26	25	25	24	23	23	22	22	22	21	21	20	20
East - West	29	28	28	27	26	25	24	24	23	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17	16
Average	35	34	33	32	31	30	29	28	27	27	26	25	25	24	24	23	23	22	22	21	21	20	20	20	19

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure D-15. Target shade for the Kaniksu National Forest Group C forest type.

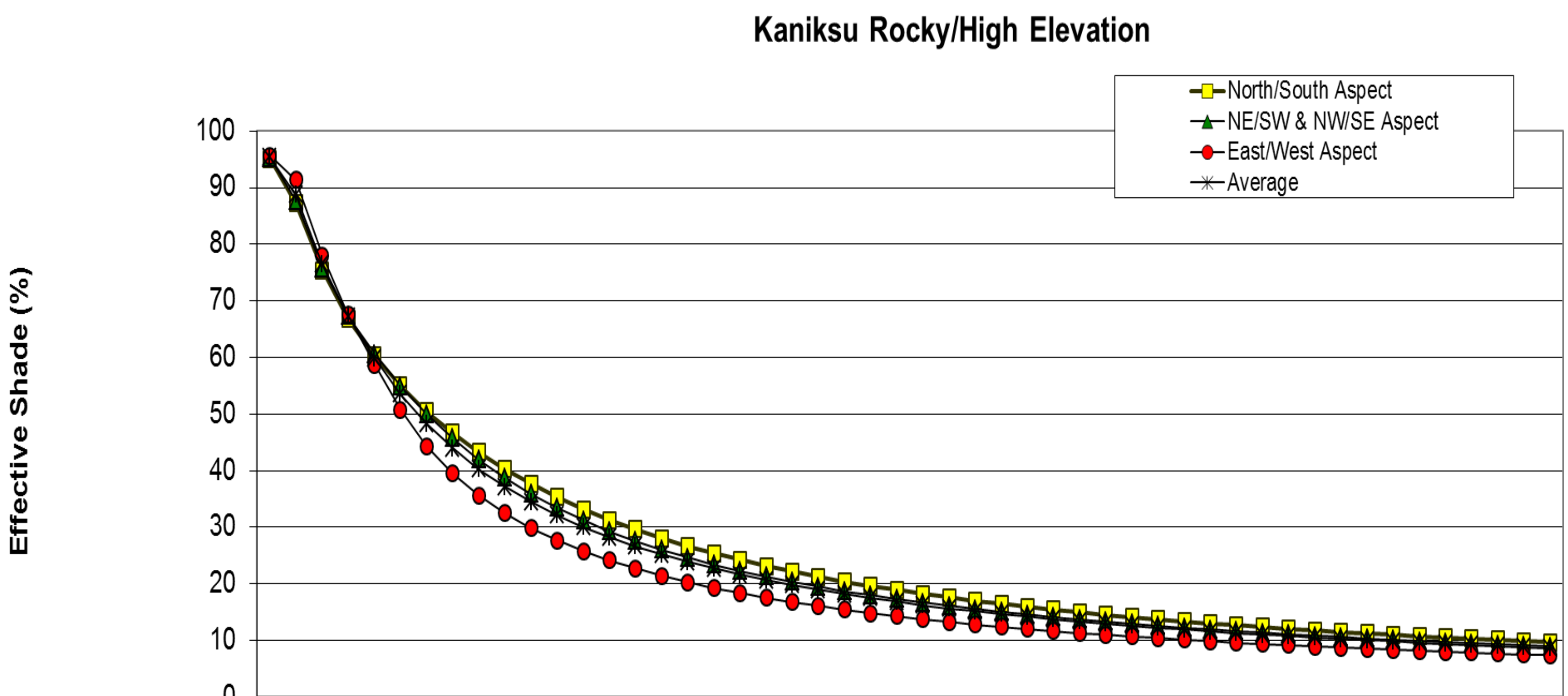


"Vegetation" Channel Width (meters)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	96	95	93	90	84	77	72	67	63	60	57	54	51	49	47	45	43	42	40	39	37	36	35	34	32
Northeast/Southwest	96	96	94	91	85	79	74	69	65	61	58	55	52	50	47	45	43	41	39	38	36	35	34	32	31
East - West	97	96	95	94	90	84	77	70	63	58	53	49	45	43	40	38	36	34	33	31	30	29	28	27	26
Average	96	96	94	92	86	80	74	69	64	60	56	53	50	47	45	43	41	39	37	36	34	33	32	31	30

"Vegetation" Channel Width (meters)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	31	31	30	29	28	27	26	26	25	24	24	23	23	22	22	21	21	20	20	19	19	19	18	18	18
Northeast/Southwest	30	29	28	27	26	26	25	24	24	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17	16
East - West	25	24	23	22	22	21	21	20	20	19	19	18	18	17	17	16	16	16	15	15	15	15	14	14	14
Average	29	28	27	26	25	25	24	23	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17	16	16

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure D-16. Target shade for the Kaniksu National Forest Group D forest type.

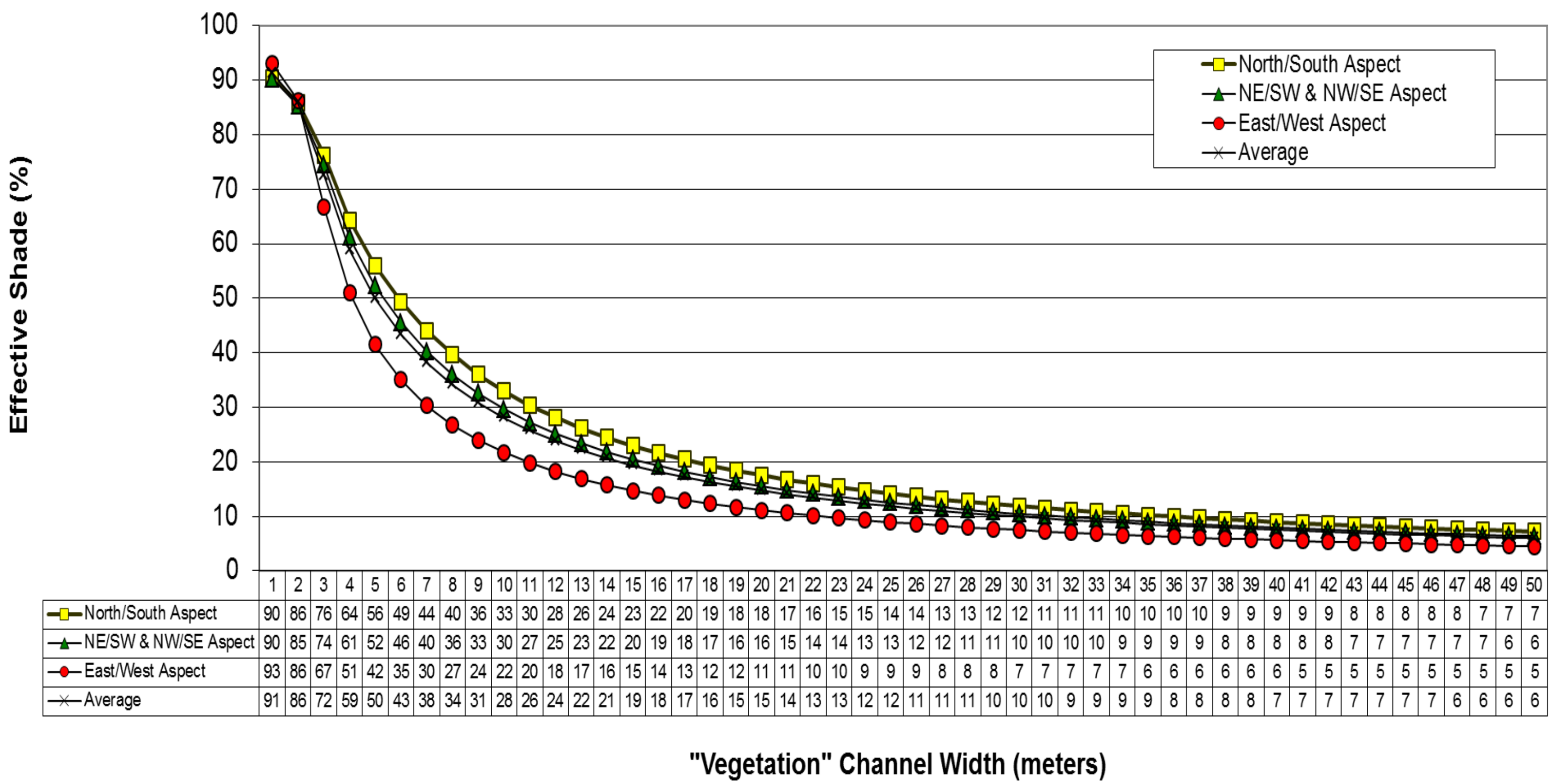


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	95	87	75	67	60	55	51	47	43	40	38	35	33	31	30	28	27	25	24	23	22	21	20	20	19
NE/SW & NW/SE Aspect	95	88	76	67	61	55	50	46	42	39	36	33	31	29	28	26	25	23	22	21	20	19	19	18	17
East/West Aspect	96	91	78	68	59	51	44	39	36	32	30	28	26	24	23	21	20	19	18	18	17	16	15	15	14
Average	95	89	76	67	60	54	48	44	40	37	34	32	30	28	27	25	24	23	22	21	20	19	18	17	17

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	18	18	17	16	16	15	15	15	14	14	13	13	13	12	12	12	12	11	11	11	11	10	10	10	10
NE/SW & NW/SE Aspect	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	11	10	10	10	10	9	9	9	9
East/West Aspect	14	13	13	12	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	8	7
Average	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	11	10	10	10	10	9	9	9	9	9

"Vegetation" Channel Width (meters)

Figure D-17. Target shade for the Kaniksu Rocky/High Elevation forest type.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	90	86	76	64	56	49	44	40	36	33	30	28	26	24	23	22	20	19	18	18	17	16	15	15	14
NE/SW & NW/SE Aspect	90	85	74	61	52	46	40	36	33	30	27	25	23	22	20	19	18	17	16	16	15	14	14	13	13
East/West Aspect	93	86	67	51	42	35	30	27	24	22	20	18	17	16	15	14	13	12	12	11	11	10	10	9	9
Average	91	86	72	59	50	43	38	34	31	28	26	24	22	21	19	18	17	16	15	15	14	13	13	12	12

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	14	13	13	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	7	7	7
NE/SW & NW/SE Aspect	12	12	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6
East/West Aspect	9	8	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5
Average	11	11	11	10	10	10	9	9	9	9	8	8	8	8	7	7	7	7	7	7	7	6	6	6	6

Figure D-18. Target shade for the thinleaf alder (*Alnus incana)* type.

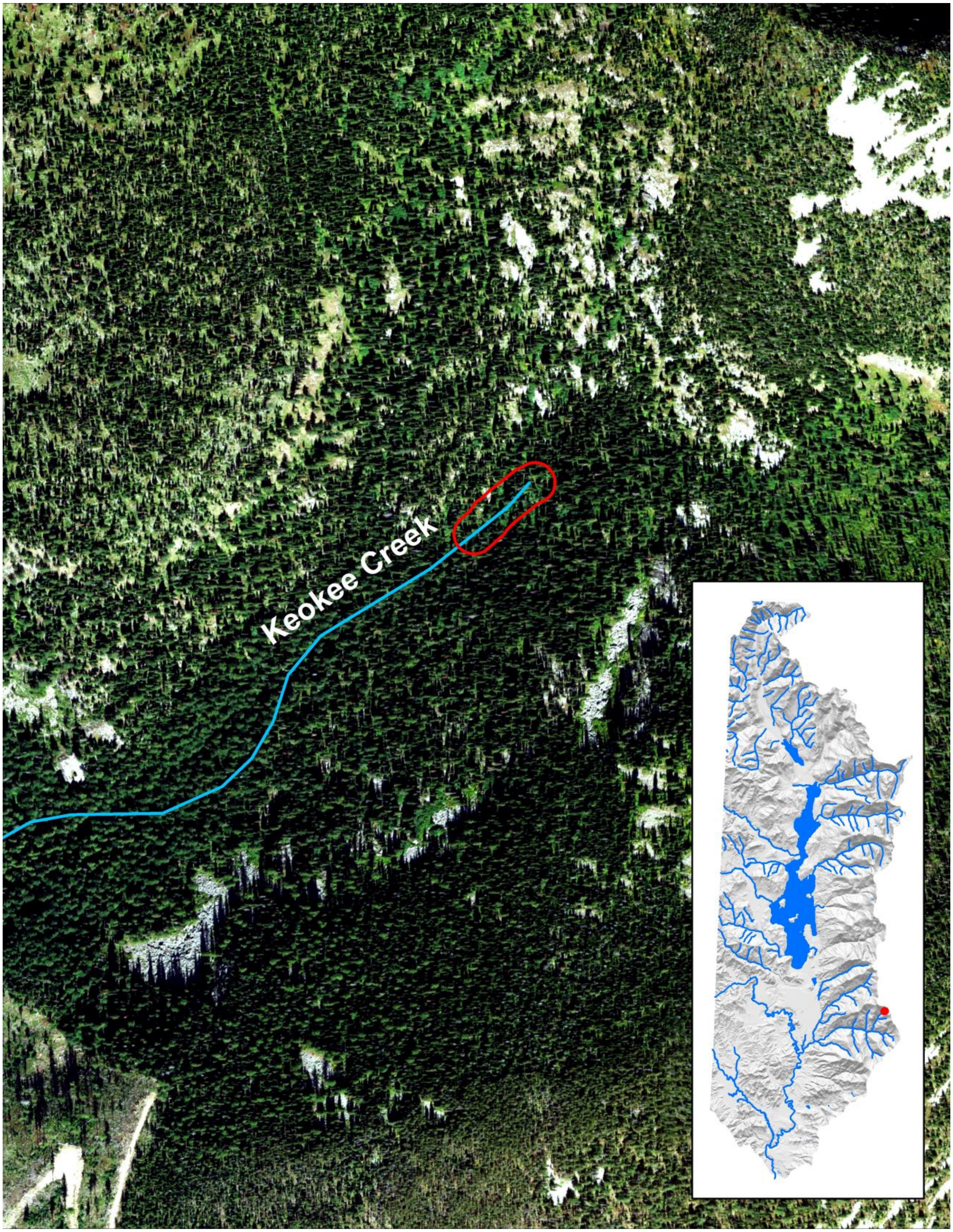


Figure D-19. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Keokee Creek using NAIP 2013 background.

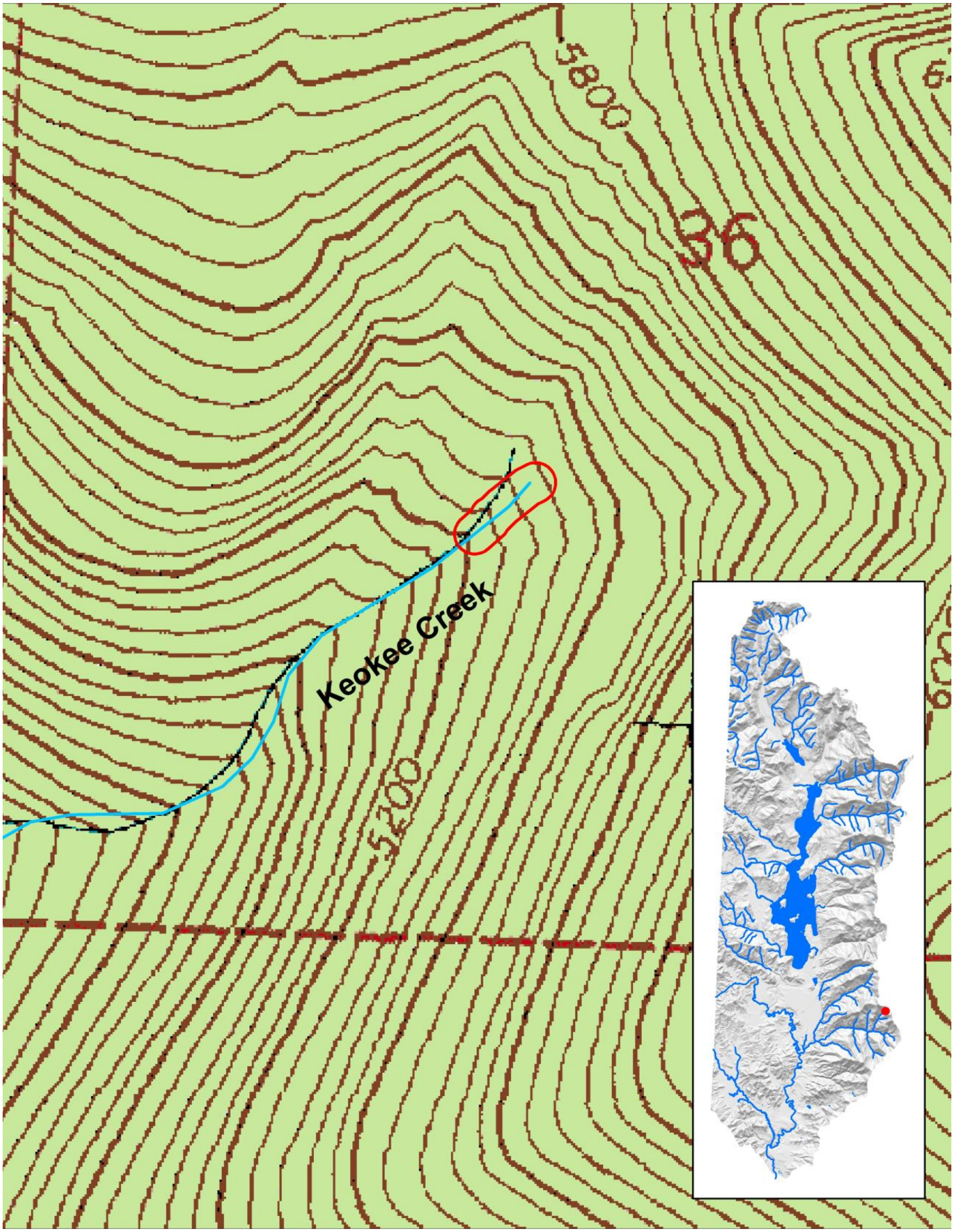


Figure D-20. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Keokee Creek using 24K topographic background.

Table D-38. LiDAR data from a riparian sample location on Keokee Creek.

Keokee Creek LiDAR data sample used for Kaniksu Rocky/High Elevation forest type				
	Average Tree Height (feet)			32.07442126
	Trees/Acre			306.7224966
	Average Crown Area (square feet)			110.4087865
OBJECTID	SPECIES	DBH (inches)	Height (feet)	Crown Area (square feet)
3345838	Alpine Fir	12.76095	36.26501	34.982569
3345839	Alpine Fir	12.589088	15.015746	37.673536
3345860	Alpine Fir	11.923086	15.488289	24.218702
3345861	Alpine Fir	12.843522	63.873454	121.093508
3345888	Alpine Fir	12.515507	44.190769	29.600635
3345889	Alpine Fir	19.207317	73.82019	102.25674
3345892	Alpine Fir	12.53248	32.378909	40.364503
3345893	Alpine Fir	19.103967	84.248125	236.805082
3345901	Alpine Fir	9.58866	13.755767	26.909668
3385662	Alpine Fir	14.513213	15.77039	2.690967
3385701	Alpine Fir	13.83767	14.722526	8.072901
3385735	Alpine Fir	10.79714	16.012472	2.690967
4693636	Douglas Fir	15.99842	56.200338	34.982569
4693711	Alpine Fir	14.960011	65.536165	153.38511
4693742	Alpine Fir	8.836782	13.945668	26.909668
4693743	Alpine Fir	15.523292	69.73744	150.694143
4693744	Alpine Fir	16.847368	68.52991	10.763867
4693745	Alpine Fir	16.645463	68.844138	40.364503
4693783	Alpine Fir	15.106464	54.045651	96.874806
4693795	Alpine Fir	12.130895	57.729071	314.84312
4693808	Alpine Fir	13.163618	50.566912	61.892237
4693859	Alpine Fir	13.42385	47.402873	266.405717
4693882	Alpine Fir	13.308337	57.684514	148.003176
4693883	Alpine Fir	19.610149	77.567814	209.895414
4693903	Alpine Fir	11.597715	13.204537	18.836768
4693920	Alpine Fir	5.997354	16.683448	40.364503
4693921	Alpine Fir	6.119403	14.765034	75.347072
4693986	Alpine Fir	13.937348	57.176571	182.985745
4694003	Alpine Fir	12.369028	49.291967	78.038038

4694004	Alpine Fir	11.949613	41.710525	137.239309
4694020	Alpine Fir	12.314398	58.674305	217.968314
4694021	Alpine Fir	12.316253	51.014652	59.20127
4694097	Alpine Fir	8.029125	17.119169	91.492873
4694098	Alpine Fir	11.414113	35.700902	69.965138
4694099	Alpine Fir	13.273669	58.050025	228.732181
4694129	Alpine Fir	7.773873	14.471687	37.673536
4694130	Alpine Fir	11.186904	47.487136	118.402541
4694131	Alpine Fir	8.758698	32.94385	113.020607
4694154	Alpine Fir	12.36752	24.530635	21.527735
4694167	Alpine Fir	8.240394	30.096086	21.527735
4694183	Alpine Fir	10.090336	32.855671	83.419972
4694204	Alpine Fir	9.436172	35.018784	164.148977
4694219	Alpine Fir	12.928256	56.259851	96.874806
4694220	Alpine Fir	9.698854	40.298233	150.694143
4694235	Alpine Fir	12.374451	45.273467	45.746436
4694252	Alpine Fir	10.965555	46.413217	129.166408
4694253	Alpine Fir	12.272659	47.798694	88.801906
4694254	Alpine Fir	11.62088	43.852056	131.857375
4694273	Alpine Fir	7.66823	19.32254	64.583204
4694316	Alpine Fir	12.074776	56.412398	252.950883
4694317	Alpine Fir	11.834651	13.443754	10.763867
4694324	Alpine Fir	7.142931	13.642598	18.836768
4694325	Alpine Fir	11.933675	58.177569	166.839944
4694355	Alpine Fir	5.275602	13.787105	61.892237
4694370	Alpine Fir	6.238771	15.261899	51.12837
4694371	Alpine Fir	7.102998	20.239289	56.510304
4694372	Alpine Fir	9.586056	33.527244	56.510304
4694420	Alpine Fir	14.53622	34.901617	34.982569
4694431	Alpine Fir	12.461533	48.603371	263.71475
4694444	Alpine Fir	9.635436	12.541314	24.218702
4694445	Alpine Fir	4.677933	14.20573	145.312209
4694455	Alpine Fir	15.033826	55.702156	215.277347
4694480	Alpine Fir	8.693367	24.297262	296.006352
4694499	Alpine Fir	12.520809	55.369619	239.496049
4694514	Alpine Fir	12.117318	40.865532	32.291602
4694515	Alpine Fir	13.993154	56.319456	67.274171
4694516	Alpine Fir	15.425983	67.973421	80.729005

4694517	Alpine Fir	8.390907	16.002731	40.364503
4694531	Alpine Fir	16.362564	65.394887	193.749613
4694551	Alpine Fir	6.733273	13.794324	69.965138
4694564	Alpine Fir	10.17741	36.410217	32.291602
4694565	Alpine Fir	12.678768	37.321704	43.055469
4694566	Alpine Fir	8.2728	30.588727	177.603811
4694582	Alpine Fir	13.361571	58.434321	139.930276
4694583	Alpine Fir	4.35415	18.509233	102.25674
4694584	Alpine Fir	8.806513	25.060837	51.12837
4694597	Alpine Fir	12.18018	49.72909	110.32964
4694630	Alpine Fir	12.118321	41.510116	312.152153
4694649	Alpine Fir	10.494795	14.100015	118.402541
4694650	Alpine Fir	9.175206	34.3927	40.364503
4694673	Alpine Fir	13.850476	54.110313	26.909668
4694674	Alpine Fir	4.857423	12.767371	51.12837
4694675	Alpine Fir	4.251428	13.809214	72.656105
4694686	Alpine Fir	6.795537	12.885756	51.12837
4694693	Alpine Fir	7.424678	15.32147	96.874806
4694694	Alpine Fir	13.525336	57.171561	156.076077
4694711	Alpine Fir	12.675797	58.411052	67.274171
4694712	Alpine Fir	6.363583	14.473113	228.732181
4694713	Alpine Fir	19.590936	82.744676	207.204447
4694748	Alpine Fir	6.071556	13.436731	164.148977
4694749	Alpine Fir	5.433416	13.60574	110.32964
4694750	Alpine Fir	11.642639	48.62893	185.676712
4694766	Alpine Fir	4.418377	13.679433	201.822513
4694774	Alpine Fir	9.187067	14.382981	91.492873
4694790	Alpine Fir	11.92562	49.183748	298.697319
4694791	Alpine Fir	6.996442	16.293821	72.656105
4694792	Alpine Fir	11.997662	31.324595	45.746436
4694806	Alpine Fir	7.808231	15.09708	45.746436
4694807	Alpine Fir	9.65271	34.620004	26.909668
4694823	Alpine Fir	6.468101	14.142814	88.801906
4694824	Alpine Fir	13.208084	58.506544	153.38511
4694825	Alpine Fir	12.867597	59.63248	196.440579
4694848	Alpine Fir	10.428783	14.981836	24.218702
4694849	Alpine Fir	4.214683	12.421868	137.239309
4694850	Alpine Fir	13.310327	37.953171	40.364503

4694863	Alpine Fir	5.062025	15.88491	118.402541
4694864	Alpine Fir	12.696551	46.672621	53.819337
4694880	Alpine Fir	5.991968	17.43504	29.600635
4694881	Alpine Fir	7.247108	18.789535	145.312209
4694901	Alpine Fir	6.582623	13.681815	96.874806
4694918	Alpine Fir	9.083017	13.321912	121.093508
4694937	Alpine Fir	7.97889	16.753515	72.656105
4694938	Alpine Fir	12.24933	47.138907	78.038038
4694939	Alpine Fir	12.415485	35.455548	134.548342
4694954	Alpine Fir	7.604441	26.083196	201.822513
4694972	Alpine Fir	6.951629	22.574371	67.274171
4694987	Alpine Fir	9.928506	34.639339	51.12837
4694988	Alpine Fir	6.780746	26.208763	212.58638
4694989	Alpine Fir	6.440735	21.751221	158.767044
4695001	Alpine Fir	5.260142	14.115593	153.38511
4695002	Alpine Fir	10.380993	37.415602	48.437403
4695003	Alpine Fir	8.600681	19.942233	121.093508
4695022	Alpine Fir	12.488089	14.779302	193.749613
4695023	Alpine Fir	13.272927	51.761336	29.600635
4695044	Alpine Fir	17.288923	69.391067	150.694143
4695076	Alpine Fir	5.231293	13.930919	51.12837
4695095	Alpine Fir	14.949169	39.784751	196.440579
4695113	Alpine Fir	13.560712	47.002945	363.280523
4695126	Alpine Fir	10.538149	46.027786	177.603811
4695127	Alpine Fir	11.383652	38.76461	29.600635
4695128	Alpine Fir	12.486679	35.722432	24.218702
4695129	Alpine Fir	9.597793	37.221472	145.312209
4695144	Alpine Fir	7.667685	15.603652	48.437403
4695154	Alpine Fir	7.361714	26.059141	26.909668
4695155	Alpine Fir	15.243801	58.265379	121.093508
4695156	Alpine Fir	5.714935	22.343087	45.746436
4695174	Alpine Fir	11.173498	13.428912	26.909668
4695190	Alpine Fir	9.230217	29.668162	64.583204
4695221	Alpine Fir	8.134142	23.17505	37.673536
4695240	Alpine Fir	9.310683	30.70514	56.510304
4695241	Alpine Fir	8.590417	15.284832	26.909668
4695242	Alpine Fir	11.057866	15.528613	69.965138
4695276	Alpine Fir	10.306634	36.77165	80.729005

4695295	Alpine Fir	13.918701	47.405532	67.274171
4695296	Alpine Fir	8.898466	15.345827	24.218702
4695297	Alpine Fir	10.603497	33.318627	180.294778
4695324	Alpine Fir	7.132582	13.94191	34.982569
4695342	Alpine Fir	13.065419	52.280114	349.825689
4695360	Alpine Fir	6.734755	14.674919	48.437403
4695361	Alpine Fir	6.353959	13.798748	113.020607
4695376	Alpine Fir	6.185159	20.206594	247.568949
4695393	Alpine Fir	11.084096	38.197719	137.239309
4695394	Alpine Fir	10.172429	33.367724	287.933452
4695395	Alpine Fir	7.668403	21.319813	24.218702
4695396	Alpine Fir	6.866376	13.437567	59.20127
4695409	Alpine Fir	13.580249	54.475221	86.110939
4695410	Alpine Fir	13.475928	45.882287	26.909668
4695422	Alpine Fir	9.419702	14.655117	10.763867
4695437	Alpine Fir	7.194038	15.388358	43.055469
4695438	Alpine Fir	6.712998	14.67679	80.729005
4695451	Alpine Fir	6.970735	23.205935	53.819337
4695452	Alpine Fir	7.209924	25.686774	282.551518
4695470	Alpine Fir	8.011758	14.81161	29.600635
4695471	Alpine Fir	12.457446	51.816129	51.12837
4695522	Alpine Fir	10.292108	29.842633	26.909668
4695523	Alpine Fir	12.667842	47.068508	94.183839
4695542	Alpine Fir	8.930038	13.581692	99.565773
4695543	Alpine Fir	12.926281	46.651771	64.583204
4695544	Alpine Fir	8.825371	21.58964	172.221878
4695563	Alpine Fir	14.325087	42.007689	43.055469
4695580	Alpine Fir	7.646757	19.030882	45.746436
4695581	Alpine Fir	6.40124	18.171809	69.965138
4695604	Alpine Fir	17.630635	72.1348	51.12837
4695605	Alpine Fir	14.377208	60.934741	131.857375
4695606	Alpine Fir	6.419139	20.528617	209.895414
4695620	Alpine Fir	5.440748	19.39476	61.892237
4695635	Alpine Fir	5.111685	19.732116	180.294778
4695669	Alpine Fir	7.76234	13.164719	21.527735
4695670	Alpine Fir	13.88476	59.224082	341.752789
4695671	Alpine Fir	6.929034	22.854002	37.673536
4695672	Alpine Fir	7.578695	21.184608	131.857375

4695689	Alpine Fir	6.826545	14.676288	26.909668
4695705	Alpine Fir	7.465423	27.131353	290.624419
4695723	Alpine Fir	9.110951	35.173441	196.440579
4695724	Alpine Fir	14.699199	49.225424	91.492873
4695742	Alpine Fir	15.090166	52.408005	118.402541
4695763	Alpine Fir	7.144139	13.221267	34.982569
4695781	Alpine Fir	13.160784	47.517893	309.461187
4695815	Alpine Fir	5.827838	20.189494	236.805082
4695829	Alpine Fir	6.954986	22.570714	59.20127
4695866	Alpine Fir	12.353904	42.922471	110.32964
4695880	Alpine Fir	14.849288	56.301095	34.982569
4695881	Alpine Fir	12.919661	38.120916	137.239309
4695882	Alpine Fir	9.050028	21.227456	24.218702
4695897	Alpine Fir	7.389216	23.197398	32.291602
4695929	Alpine Fir	14.399988	43.597362	24.218702
4695930	Alpine Fir	13.121104	42.049862	115.711574
4695931	Alpine Fir	6.900721	18.955345	99.565773
4695944	Alpine Fir	13.181339	51.147171	148.003176
4695945	Alpine Fir	7.118971	21.85656	61.892237
4695946	Alpine Fir	5.683441	19.529263	34.982569
4695968	Alpine Fir	9.291632	30.261376	129.166408
4695985	Alpine Fir	7.142302	17.385855	75.347072
4695986	Alpine Fir	10.411967	13.216852	59.20127
4695987	Alpine Fir	5.62876	11.780893	201.822513
4695988	Alpine Fir	14.646844	54.06109	290.624419
4696006	Alpine Fir	7.374389	18.470583	104.947707
4696007	Alpine Fir	7.233088	19.958495	88.801906
4696024	Alpine Fir	12.20701	46.711404	156.076077
4696056	Alpine Fir	8.711501	31.530119	166.839944
4696064	Alpine Fir	7.492742	17.031981	96.874806
4696065	Alpine Fir	6.603058	19.57489	169.530911
4696093	Alpine Fir	11.022609	33.704441	78.038038
4696094	Alpine Fir	7.9999	30.456241	80.729005
4696140	Alpine Fir	4.840161	14.463337	148.003176
4696141	Alpine Fir	4.916912	14.091031	201.822513
4696142	Alpine Fir	6.929899	16.714305	83.419972
4696159	Alpine Fir	4.635943	12.483314	69.965138
4696160	Alpine Fir	7.119352	13.670337	26.909668

4696161	Alpine Fir	4.753392	13.521567	166.839944
4696185	Alpine Fir	4.187924	13.820294	88.801906
4696186	Alpine Fir	11.270982	13.800815	10.763867
4696204	Alpine Fir	12.536183	52.866883	64.583204
4696224	Alpine Fir	9.109769	27.454289	113.020607
4696238	Alpine Fir	5.240409	13.571084	196.440579
4696239	Alpine Fir	9.434254	16.39122	24.218702
4696259	Alpine Fir	4.861672	14.274747	298.697319
4696269	Alpine Fir	8.566088	14.7944	148.003176
4696270	Alpine Fir	8.688693	25.718305	48.437403
4696271	Alpine Fir	15.255027	46.274316	26.909668
4696291	Alpine Fir	10.300458	27.698376	29.600635
4696292	Alpine Fir	13.780415	47.145084	131.857375
4696309	Alpine Fir	11.634786	45.0683	69.965138
4696337	Alpine Fir	7.9683	20.153563	129.166408
4696357	Alpine Fir	11.696745	41.84456	129.166408
4696372	Alpine Fir	13.519172	45.891705	83.419972
4696423	Alpine Fir	13.138632	59.320211	174.912845
4696424	Alpine Fir	12.153118	54.091388	285.242485
4696425	Alpine Fir	6.855562	13.663441	45.746436
4696435	Alpine Fir	5.778541	15.471739	113.020607
4696454	Alpine Fir	11.144338	34.713637	83.419972
4696455	Alpine Fir	7.807068	27.951508	75.347072
4696467	Alpine Fir	11.417794	42.606039	242.187016
4696483	Alpine Fir	13.280671	41.53013	10.763867
4696484	Alpine Fir	9.783917	35.22327	37.673536
4696504	Alpine Fir	10.261541	27.568377	94.183839
4696505	Alpine Fir	15.469103	61.081825	26.909668
4696520	Alpine Fir	12.256371	49.331729	24.218702
4696521	Alpine Fir	12.596766	58.347471	126.475441
4696539	Alpine Fir	7.859137	13.380045	64.583204
4696540	Alpine Fir	5.95934	14.062327	53.819337
4696562	Alpine Fir	9.261423	34.822426	67.274171
4696563	Alpine Fir	6.503245	29.842702	107.638674
4696577	Alpine Fir	14.779663	66.651876	64.583204
4696578	Alpine Fir	9.645996	32.750133	24.218702
4696597	Alpine Fir	12.162284	51.863294	86.110939
4696621	Alpine Fir	6.919336	16.84615	53.819337

4696637	Alpine Fir	13.613993	64.151948	48.437403
4696638	Alpine Fir	5.900061	12.961171	78.038038
4696639	Alpine Fir	8.874826	32.847445	150.694143
4696640	Alpine Fir	10.856641	15.643658	21.527735
4696657	Alpine Fir	14.365686	51.586351	86.110939
4696709	Alpine Fir	8.86873	35.343003	29.600635
4696710	Alpine Fir	13.571785	34.715422	43.055469
4696735	Alpine Fir	15.318915	55.595356	45.746436
4696736	Alpine Fir	8.422712	27.941449	29.600635
4696756	Alpine Fir	9.558503	20.124215	387.499225
4696757	Alpine Fir	8.42173	16.597266	115.711574
4696758	Alpine Fir	7.005064	13.733898	139.930276
4696797	Alpine Fir	10.983696	34.919001	78.038038
4696798	Alpine Fir	13.044094	51.883328	40.364503
4696826	Alpine Fir	4.821671	14.604619	191.058646
4696827	Alpine Fir	7.803731	14.774817	24.218702
4696828	Alpine Fir	6.903333	12.888332	69.965138
4696862	Alpine Fir	11.021154	31.851687	21.527735
4696898	Alpine Fir	13.711165	55.539149	121.093508
4696918	Alpine Fir	5.323802	21.074933	43.055469
4696919	Alpine Fir	12.092654	48.148739	45.746436
4696948	Alpine Fir	9.514814	33.159408	53.819337
4696949	Alpine Fir	4.580511	16.822704	75.347072
4696970	Alpine Fir	7.83792	31.618971	172.221878
4696971	Alpine Fir	13.161601	51.823429	182.985745
4697023	Alpine Fir	7.32518	19.257303	88.801906
4697077	Alpine Fir	8.297104	20.20757	107.638674
4697098	Alpine Fir	7.540587	22.651213	88.801906
4697099	Alpine Fir	10.868088	33.110171	40.364503
4697131	Alpine Fir	9.48065	30.133833	88.801906
4697196	Alpine Fir	8.734186	15.146324	91.492873
4697222	Alpine Fir	13.704225	55.479095	67.274171
4708957	Alpine Fir	11.280575	29.18327	34.982569
4709092	Alpine Fir	10.915603	39.376975	75.347072
4709290	Alpine Fir	12.814396	47.877777	118.402541
4709292	Alpine Fir	6.956952	28.981819	75.347072
4709301	Alpine Fir	9.883872	14.024336	115.711574
4709318	Alpine Fir	6.766452	18.829905	158.767044

4709321	Alpine Fir	7.316677	19.466283	94.183839
4709322	Alpine Fir	10.710018	29.26215	53.819337
4709324	Alpine Fir	4.9792	17.109264	110.32964
4709331	Alpine Fir	7.807321	17.260542	80.729005
4709332	Alpine Fir	7.728486	14.994844	69.965138
4709342	Alpine Fir	8.052296	29.434922	104.947707
4709343	Alpine Fir	9.81612	25.941762	69.965138
4709612	Alpine Fir	3.652575	13.663964	126.475441
4709627	Alpine Fir	8.600972	28.441441	29.600635
4709629	Alpine Fir	9.264501	34.089872	134.548342
4709635	Alpine Fir	10.203917	34.925971	244.877982
4709638	Alpine Fir	7.201944	16.550961	48.437403
4709956	Alpine Fir	11.812966	38.766401	263.71475
4709971	Alpine Fir	6.550784	22.550609	115.711574
4709974	Alpine Fir	9.902259	14.397561	56.510304
4709977	Alpine Fir	8.014799	27.907574	234.114115
4709987	Alpine Fir	9.766242	33.576403	29.600635
4709990	Alpine Fir	7.416568	15.995247	139.930276
4710001	Alpine Fir	6.331145	23.161196	277.169585
4710002	Alpine Fir	4.775148	20.36624	247.568949
4710003	Alpine Fir	8.151151	27.537545	182.985745
4710009	Alpine Fir	4.399822	14.190162	56.510304
4712109	Alpine Fir	14.216717	59.629229	215.277347
4712110	Alpine Fir	11.505045	47.502203	177.603811
4712115	Alpine Fir	13.927414	50.9084	24.218702
4712146	Alpine Fir	16.69636	68.822563	201.822513
4712153	Alpine Fir	7.701512	19.305057	72.656105
4712161	Alpine Fir	10.651287	34.173984	374.044391
4712192	Alpine Fir	8.07563	22.624626	223.350248
4712197	Alpine Fir	14.912095	61.491566	207.204447
4712199	Alpine Fir	8.703211	30.506779	80.729005
4712217	Alpine Fir	9.695888	29.936226	83.419972
4712227	Alpine Fir	10.528887	28.907362	24.218702
4712238	Alpine Fir	7.951331	13.548732	21.527735
4712262	Alpine Fir	6.576617	19.610542	314.84312
4712291	Alpine Fir	12.247135	47.706515	69.965138
4712292	Alpine Fir	12.521007	48.894771	94.183839
4712318	Alpine Fir	8.504573	33.586352	113.020607

4712331	Alpine Fir	11.285108	51.043968	150.694143
4712332	Alpine Fir	13.154262	56.274483	177.603811
4712351	Alpine Fir	11.861245	50.459272	180.294778
4712375	Alpine Fir	7.58138	15.969379	94.183839
4712388	Alpine Fir	12.356196	45.194862	169.530911
4712398	Alpine Fir	7.491839	27.653707	118.402541
4712408	Alpine Fir	7.529718	22.992717	91.492873
4712428	Alpine Fir	13.311652	41.662302	123.784475
4712435	Alpine Fir	11.550744	57.448795	207.204447
4712452	Alpine Fir	14.328631	49.477097	185.676712
4712457	Alpine Fir	11.317319	26.276533	191.058646
4712458	Alpine Fir	5.637611	13.842896	137.239309
4712462	Alpine Fir	14.44143	64.028271	223.350248
4712473	Alpine Fir	12.446968	52.830182	164.148977
4712478	Alpine Fir	10.666954	12.96186	142.621243
4712480	Alpine Fir	8.335873	26.356266	61.892237
4712481	Alpine Fir	7.026191	12.987079	59.20127
4712489	Engelmann Spruce	25.41797	97.937205	427.863728
4712502	Alpine Fir	11.30881	13.113591	78.038038
4712503	Alpine Fir	9.425513	33.402095	67.274171
4712506	Alpine Fir	8.53225	15.26825	75.347072
4712507	Alpine Fir	7.291451	16.144785	59.20127
4712514	Alpine Fir	8.762189	21.874367	64.583204
4712515	Alpine Fir	13.397669	53.079996	142.621243
4712523	Alpine Fir	4.27505	15.169494	220.659281
4712534	Alpine Fir	15.206888	46.162667	212.58638
4712543	Alpine Fir	8.220032	30.116201	137.239309
4712547	Alpine Fir	8.262077	32.644167	24.218702
4712548	Alpine Fir	8.903715	21.834238	96.874806
4712558	Alpine Fir	6.931213	24.439151	244.877982
4712568	Alpine Fir	13.370376	49.681219	153.38511
4712580	Alpine Fir	6.167038	15.26448	83.419972
4712587	Alpine Fir	10.889366	47.302813	156.076077
4712588	Alpine Fir	7.416884	23.005376	207.204447
4712590	Alpine Fir	9.423077	32.957347	91.492873
4712599	Alpine Fir	6.743948	20.621986	110.32964
4712600	Alpine Fir	4.693457	14.864309	67.274171
4712603	Alpine Fir	15.049086	54.650707	360.589557

4712606	Alpine Fir	11.596133	44.17649	164.148977
4712617	Alpine Fir	9.687659	33.772421	72.656105
4712621	Alpine Fir	9.424806	34.441071	129.166408
4712631	Alpine Fir	6.459415	15.425756	64.583204
4712641	Alpine Fir	6.505787	15.532418	26.909668
4712644	Alpine Fir	8.734477	20.225951	18.836768
4712650	Alpine Fir	10.188897	31.783179	336.370855
4712653	Alpine Fir	9.068492	25.555086	96.874806
4712663	Alpine Fir	7.286967	19.034657	201.822513
4712664	Alpine Fir	6.97974	13.619003	29.600635
4712668	Alpine Fir	8.748607	31.093651	188.367679
4712677	Alpine Fir	5.75227	15.24245	188.367679
4712678	Alpine Fir	5.451571	16.54749	80.729005
4712694	Alpine Fir	12.928766	46.69347	156.076077
4712704	Alpine Fir	7.024285	15.38902	26.909668
4712717	Alpine Fir	4.353027	18.752855	131.857375
4712724	Alpine Fir	15.393473	44.24831	75.347072
4712727	Alpine Fir	5.110045	13.925955	188.367679
4712740	Alpine Fir	5.452848	15.379513	51.12837
4712750	Alpine Fir	7.305831	16.582293	43.055469
4712754	Alpine Fir	7.612414	15.992319	24.218702
4712759	Alpine Fir	8.871676	15.08549	24.218702
4712760	Alpine Fir	9.61821	19.684413	72.656105
4712761	Alpine Fir	8.306647	16.146849	34.982569
4712767	Alpine Fir	7.997149	36.054121	207.204447
4712775	Alpine Fir	8.111125	31.64081	75.347072
4712779	Alpine Fir	13.276753	51.56822	252.950883
4712780	Alpine Fir	8.998187	36.780445	129.166408
4712793	Alpine Fir	13.112306	49.465638	107.638674
4712797	Alpine Fir	5.377079	13.294058	255.64185
4712798	Alpine Fir	9.337644	27.961218	18.836768
4712819	Alpine Fir	14.180218	45.673795	53.819337
4712820	Alpine Fir	6.291229	14.960013	86.110939
4712821	Alpine Fir	11.575145	32.94708	148.003176
4712825	Alpine Fir	4.986739	14.156849	83.419972
4712832	Alpine Fir	14.116344	57.169336	718.488146
4712836	Alpine Fir	7.166299	15.782092	40.364503
4712862	Alpine Fir	10.564217	34.612007	34.982569

4712863	Alpine Fir	16.208739	64.132125	32.291602
4712868	Alpine Fir	20.071607	81.675192	121.093508
4712876	Alpine Fir	10.53825	35.026722	59.20127
4712895	Alpine Fir	7.41698	32.726924	126.475441
4712896	Alpine Fir	16.645249	63.129992	40.364503
4712899	Alpine Fir	6.299201	15.005297	69.965138
4712900	Alpine Fir	8.843175	14.529702	18.836768
4712904	Alpine Fir	6.826301	14.586733	156.076077
4712905	Alpine Fir	10.093426	31.04074	169.530911
4712918	Alpine Fir	9.676047	31.4307	91.492873
4712934	Alpine Fir	12.537022	47.110156	118.402541
4712953	Alpine Fir	9.071794	28.592063	72.656105
4712954	Alpine Fir	11.897913	43.523229	185.676712
4712958	Alpine Fir	7.442712	26.672417	61.892237
4712961	Alpine Fir	7.174558	20.815054	78.038038
4712976	Alpine Fir	11.941437	44.0519	156.076077
4712985	Alpine Fir	13.230385	43.284727	102.25674
4712994	Alpine Fir	9.989336	23.360765	110.32964
4712995	Alpine Fir	6.672268	15.551491	110.32964
4712998	Alpine Fir	8.759262	13.713177	21.527735
4713002	Alpine Fir	5.480002	13.852826	126.475441
4713011	Alpine Fir	11.417652	45.805	56.510304
4713019	Alpine Fir	16.758251	60.077943	75.347072
4713020	Alpine Fir	11.011056	35.027784	21.527735
4716268	Alpine Fir	6.811171	27.8958	91.492873
4716311	Alpine Fir	11.663925	39.930667	64.583204
4716367	Alpine Fir	6.700326	16.151502	177.603811
4716439	Alpine Fir	7.27493	15.464578	107.638674
4716440	Alpine Fir	7.888041	30.13531	188.367679
4716443	Alpine Fir	7.232942	19.10357	56.510304
4716447	Alpine Fir	8.679328	29.418137	164.148977
4716549	Alpine Fir	4.360959	21.223865	69.965138
4716677	Alpine Fir	10.4042	36.581481	91.492873

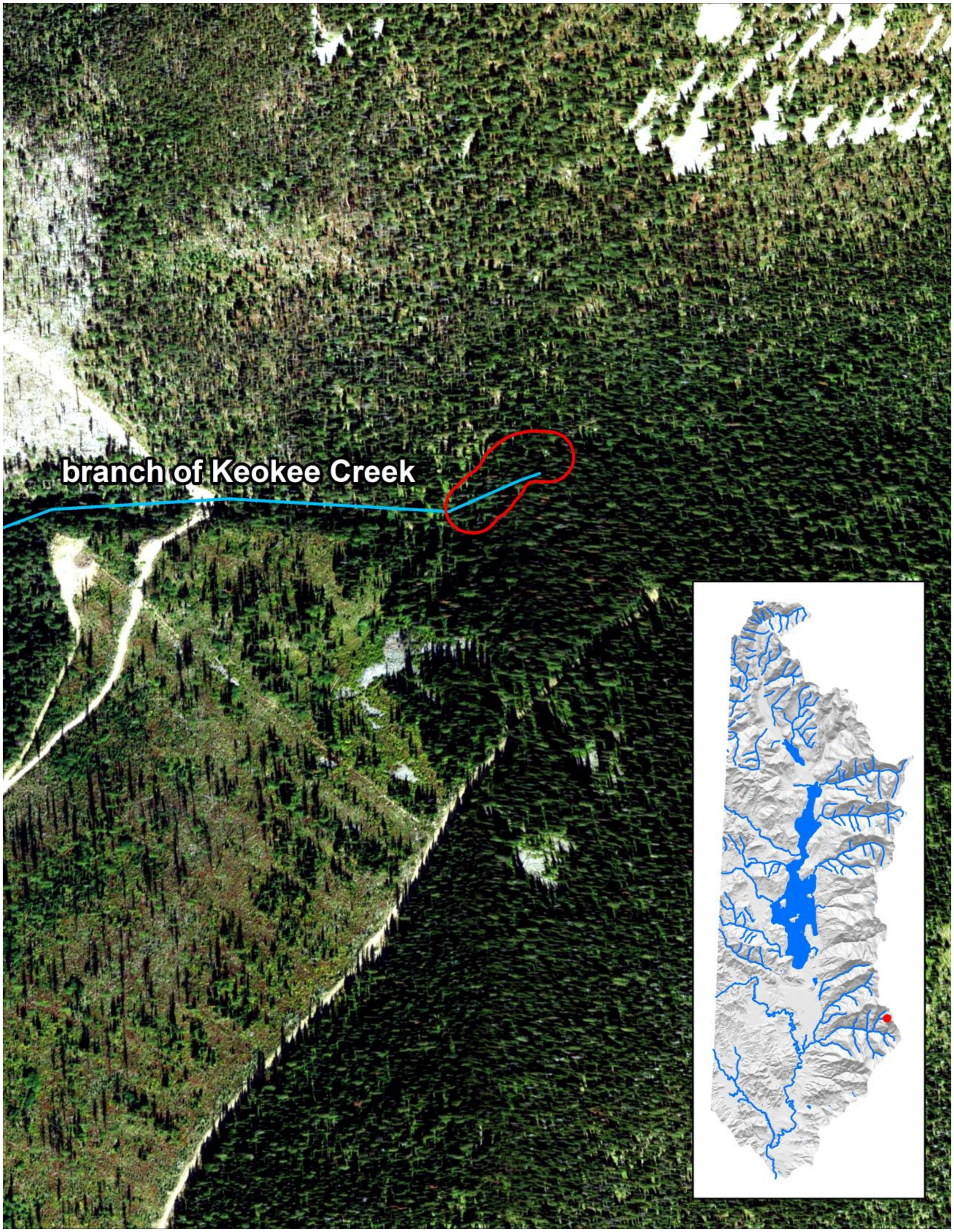


Figure D-21. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on a branch of Keokee Creek using NAIP 2013 background.

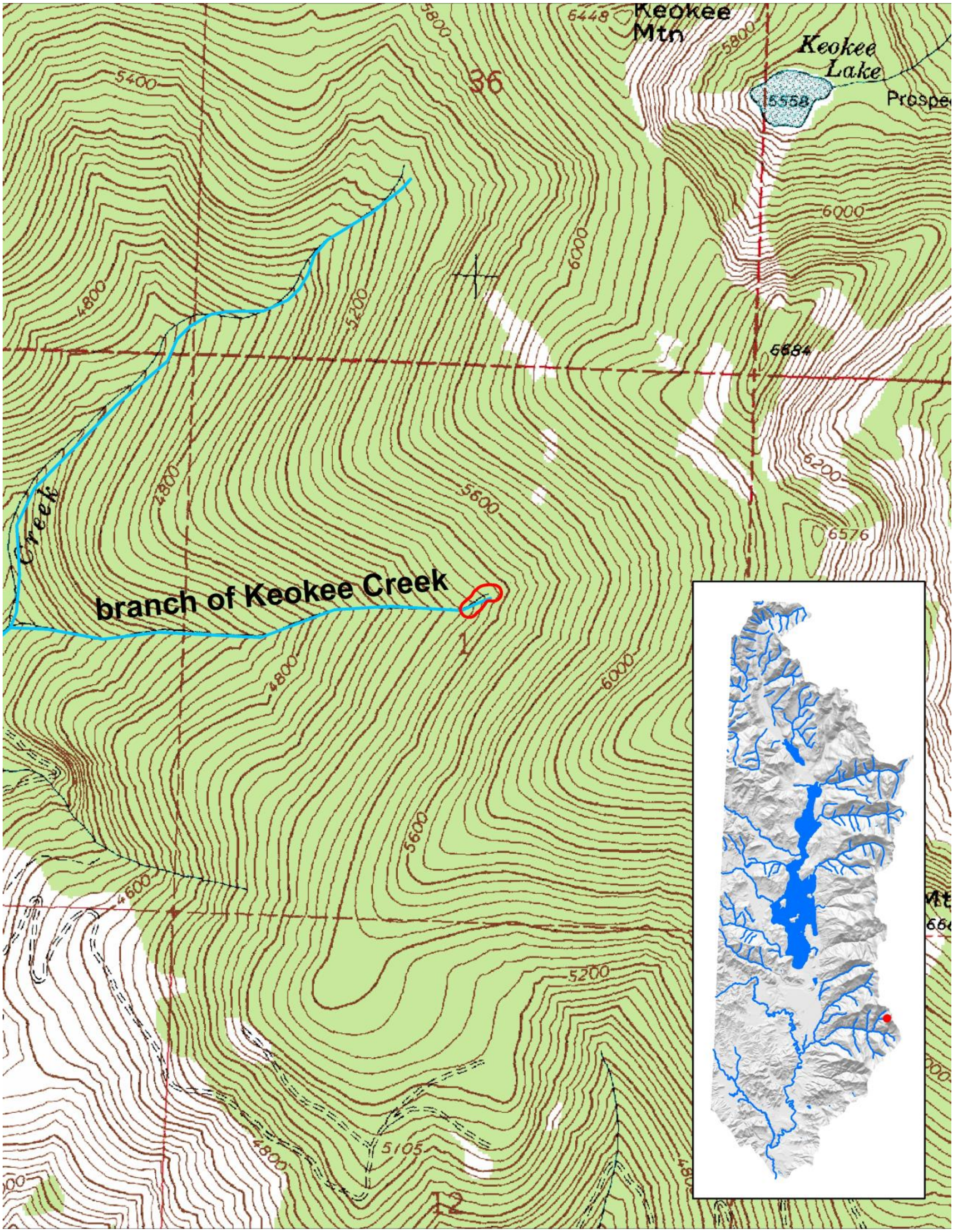


Figure D-22. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on a branch of Keokee Creek using 24K topographic background.

Table D-39. LiDAR data from a riparian sample location on a branch of Keokee Creek.

branch of Keokee Creek LiDAR data sample used for Kaniksu Rocky/High Elevation forest type				
	Average Tree Height (feet)			40.66394769
	Trees/Acre			266.4920668
	Average Crown Area (square feet)			109.2546589
OBJECTID	SPECIES	DBH (inches)	Height (feet)	Crown Area (square feet)
3338728	Alpine Fir	10.334768	37.617065	34.982569
3338729	Alpine Fir	8.780203	28.811243	51.12837
3338749	Alpine Fir	16.176044	58.470627	169.530911
3338750	Alpine Fir	10.424151	34.603595	21.527735
3340976	Alpine Fir	12.390555	54.014713	96.874806
3341019	Alpine Fir	11.577925	51.927927	172.221878
3341020	Alpine Fir	11.361334	49.016567	180.294778
3341021	Alpine Fir	11.06984	53.345733	113.020607
3341040	Alpine Fir	11.154953	52.292376	234.114115
3341049	Alpine Fir	18.447899	75.452387	360.589557
3341050	Alpine Fir	12.259797	42.32069	72.656105
3374574	Alpine Fir	13.744807	14.151228	2.690967
3374584	Alpine Fir	14.32217	13.841066	5.381934
4417203	Alpine Fir	13.052368	14.099314	29.600635
4417220	Alpine Fir	9.659375	34.744102	43.055469
4417221	Alpine Fir	8.096465	29.824572	75.347072
4417222	Alpine Fir	14.030353	44.947267	24.218702
4417223	Alpine Fir	12.058154	50.710571	94.183839
4417239	Alpine Fir	9.403131	37.023148	113.020607
4417258	Alpine Fir	6.176698	23.723443	78.038038
4417295	Alpine Fir	12.086253	58.986116	153.38511
4417296	Alpine Fir	6.101482	22.953846	24.218702
4417297	Whitebark Pine	15.958632	39.148686	48.437403
4417298	Alpine Fir	11.517712	52.901916	99.565773
4417299	Alpine Fir	12.892768	55.762449	185.676712
4417313	Alpine Fir	14.32818	63.303464	158.767044
4417314	Alpine Fir	15.640672	13.561557	18.836768
4417365	Alpine Fir	14.052427	67.1711	83.419972
4417366	Alpine Fir	11.054373	61.232938	156.076077

4417376	Alpine Fir	12.168972	47.415843	94.183839
4417377	Alpine Fir	12.950268	57.453353	137.239309
4417378	Alpine Fir	8.06665	27.600354	37.673536
4417379	Alpine Fir	14.943628	14.824753	21.527735
4417380	Alpine Fir	11.255302	54.86421	121.093508
4417402	Whitebark Pine	13.214042	28.5928	24.218702
4417403	Alpine Fir	14.667444	66.60339	118.402541
4417404	Alpine Fir	8.436661	15.144399	21.527735
4417424	Alpine Fir	20.661861	85.321972	26.909668
4417425	Alpine Fir	13.748353	60.857144	150.694143
4417444	Alpine Fir	14.108414	62.561314	91.492873
4417464	Alpine Fir	11.404169	54.771629	153.38511
4417479	Alpine Fir	10.118709	29.162417	29.600635
4417480	Alpine Fir	9.294242	28.320293	80.729005
4417481	Alpine Fir	13.126019	47.116666	26.909668
4417482	Alpine Fir	13.795202	44.830986	18.836768
4417483	Alpine Fir	11.576245	56.372733	91.492873
4417484	Alpine Fir	12.920153	50.685367	75.347072
4417504	Alpine Fir	17.90907	53.757695	29.600635
4417505	Alpine Fir	9.495996	33.544752	45.746436
4417531	Alpine Fir	13.567039	55.769981	96.874806
4417532	Alpine Fir	8.736781	15.78316	37.673536
4417533	Alpine Fir	11.661533	60.344552	161.45801
4417553	Alpine Fir	10.125411	32.004453	134.548342
4417554	Alpine Fir	11.99736	58.654856	177.603811
4417555	Alpine Fir	21.388597	87.990571	325.606988
4417580	Alpine Fir	19.928765	81.871795	40.364503
4417600	Alpine Fir	7.756322	14.250749	18.836768
4417601	Alpine Fir	15.126672	59.763744	212.58638
4417617	Alpine Fir	13.272299	62.023768	59.20127
4417649	Alpine Fir	12.015046	47.530004	53.819337
4417685	Alpine Fir	16.606327	75.252633	277.169585
4417710	Alpine Fir	18.559757	80.130332	489.755965
4417731	Alpine Fir	14.943626	61.633329	86.110939
4417754	Alpine Fir	11.865735	48.518849	169.530911
4417769	Alpine Fir	12.326156	13.681849	217.968314
4417770	Alpine Fir	9.588026	34.298612	139.930276
4417790	Alpine Fir	13.275828	57.829544	43.055469

4417791	Alpine Fir	12.307464	37.689805	24.218702
4417800	Alpine Fir	12.494626	33.100232	21.527735
4417801	Alpine Fir	7.39631	13.834221	40.364503
4417827	Alpine Fir	11.269856	42.61255	72.656105
4417828	Alpine Fir	14.522865	67.757405	102.25674
4417863	Alpine Fir	9.164231	30.830651	137.239309
4417864	Alpine Fir	8.535608	13.681109	26.909668
4417865	Alpine Fir	6.901437	25.734934	91.492873
4417866	Alpine Fir	11.906153	36.921357	29.600635
4417886	Alpine Fir	12.522407	14.841358	21.527735
4417918	Alpine Fir	6.375637	14.914101	325.606988
4417936	Alpine Fir	7.714967	13.547712	80.729005
4417937	Alpine Fir	8.296546	14.345392	177.603811
4417938	Alpine Fir	12.814554	43.632248	34.982569
4417955	Alpine Fir	11.860007	49.540397	88.801906
4417990	Alpine Fir	12.524901	34.672256	18.836768
4417991	Alpine Fir	9.732073	12.624671	37.673536
4418011	Alpine Fir	11.074554	27.209641	139.930276
4418012	Alpine Fir	12.885442	41.937603	48.437403
4418013	Alpine Fir	16.878901	67.215229	150.694143
4418027	Alpine Fir	11.335329	15.279971	24.218702
4418047	Alpine Fir	13.473569	49.973036	26.909668
4418067	Alpine Fir	12.651397	56.976833	75.347072
4418068	Alpine Fir	13.07382	60.311477	80.729005
4418069	Alpine Fir	11.99502	29.56387	29.600635
4418095	Alpine Fir	12.624592	42.341822	56.510304
4418096	Alpine Fir	11.67255	52.460248	231.423148
4418132	Alpine Fir	12.091758	14.628159	32.291602
4418167	Alpine Fir	11.968136	49.308175	75.347072
4418211	Alpine Fir	11.136123	49.089797	115.711574
4418223	Alpine Fir	11.319806	30.0336	40.364503
4418224	Alpine Fir	11.931438	55.534776	223.350248
4418240	Alpine Fir	11.658065	30.934819	64.583204
4418241	Alpine Fir	8.705508	26.914321	61.892237
4418261	Alpine Fir	10.891098	40.829136	126.475441
4418262	Alpine Fir	9.987074	35.861774	150.694143
4418263	Alpine Fir	9.795016	31.088373	118.402541
4418264	Alpine Fir	15.30884	59.963929	64.583204

4418276	Alpine Fir	16.437957	74.326871	156.076077
4418295	Alpine Fir	12.043393	53.095992	94.183839
4418334	Alpine Fir	15.113144	67.491931	137.239309
4418350	Alpine Fir	18.299672	81.050552	45.746436
4418351	Alpine Fir	10.169843	32.761938	21.527735
4418352	Alpine Fir	10.480893	27.923612	21.527735
4418380	Alpine Fir	10.529246	40.527354	37.673536
4418396	Alpine Fir	8.310161	13.11868	53.819337
4418397	Alpine Fir	11.797674	46.790254	169.530911
4418398	Alpine Fir	13.117033	56.588179	196.440579
4418399	Alpine Fir	14.207367	66.865357	258.332817
4418413	Alpine Fir	11.256958	13.161554	45.746436
4418445	Alpine Fir	13.157802	14.362828	18.836768
4418446	Alpine Fir	9.677341	32.411024	94.183839
4418447	Western Hemlock	9.330161	41.95318	32.291602
4418467	Alpine Fir	13.267045	36.057816	209.895414
4418482	Alpine Fir	6.52037	15.025164	37.673536
4418499	Alpine Fir	11.190276	46.868867	129.166408
4418500	Alpine Fir	7.157072	19.540476	126.475441
4418568	Alpine Fir	6.254656	14.191683	83.419972
4418569	Alpine Fir	14.90794	63.410086	215.277347
4418583	Alpine Fir	9.726642	27.783626	72.656105
4418597	Alpine Fir	5.71615	17.480742	145.312209
4418627	Alpine Fir	10.444663	13.714183	45.746436
4418641	Alpine Fir	12.094665	35.073929	64.583204
4418642	Alpine Fir	5.276293	18.601426	131.857375
4418643	Alpine Fir	15.171853	42.552598	166.839944
4418657	Alpine Fir	6.469507	13.814611	29.600635
4418658	Alpine Fir	15.495799	59.477776	209.895414
4418679	Alpine Fir	14.288799	55.245071	59.20127
4418708	Alpine Fir	16.237634	54.3447	78.038038
4418725	Alpine Fir	12.035642	55.613651	158.767044
4418740	Alpine Fir	9.484613	30.7866	37.673536
4418741	Alpine Fir	6.98711	18.27243	26.909668
4418742	Alpine Fir	9.187981	18.576998	247.568949
4418743	Alpine Fir	12.243806	55.820943	102.25674
4418744	Alpine Fir	16.025464	73.122805	234.114115
4418762	Alpine Fir	17.252565	55.09764	61.892237

4418763	Alpine Fir	10.252263	28.020164	129.166408
4418774	Douglas Fir	22.269388	89.807433	390.190192
4418775	Whitebark Pine	13.605291	29.637499	34.982569
4418812	Alpine Fir	15.765535	50.779409	166.839944
4418835	Alpine Fir	5.815471	17.976329	75.347072
4418848	Alpine Fir	15.520157	71.228914	231.423148
4418885	Alpine Fir	15.515874	46.097111	126.475441
4418897	Alpine Fir	7.102517	20.414419	137.239309
4418915	Alpine Fir	11.796125	58.376514	188.367679
4418927	Alpine Fir	21.61139	54.49384	61.892237
4418946	Alpine Fir	6.01155	22.858114	102.25674
4418963	Alpine Fir	15.938527	49.235881	72.656105
4418998	Alpine Fir	7.298202	21.710461	104.947707
4418999	Alpine Fir	10.678145	15.999381	32.291602
4419019	Alpine Fir	4.608721	18.807399	96.874806
4419020	Alpine Fir	11.932925	47.997633	83.419972
4419065	Alpine Fir	7.774517	26.071003	69.965138
4419066	Alpine Fir	7.810993	23.258334	153.38511
4419067	Alpine Fir	10.942048	23.75095	43.055469
4419110	Alpine Fir	4.257895	14.41531	204.51348
4419153	Alpine Fir	3.828396	13.15261	75.347072
4419154	Alpine Fir	10.573978	31.828067	18.836768
4419186	Alpine Fir	10.918372	27.593454	43.055469
4419187	Alpine Fir	9.513676	25.088715	37.673536
4419197	Alpine Fir	4.661142	19.417168	51.12837
4419218	Alpine Fir	13.77034	62.584881	137.239309
4441698	Alpine Fir	12.764597	46.574185	51.12837
4441703	Alpine Fir	8.461863	29.814548	99.565773
4441896	Alpine Fir	8.556329	36.319996	123.784475
4441897	Alpine Fir	11.391385	51.298533	134.548342
4441898	Alpine Fir	10.695961	42.485566	104.947707
4441902	Alpine Fir	5.78931	17.83469	169.530911
4441915	Alpine Fir	9.505579	33.32751	137.239309
4442301	Alpine Fir	8.549193	16.21901	69.965138
4442304	Alpine Fir	12.72539	43.384322	86.110939
4442653	Alpine Fir	12.780545	50.811722	134.548342
4442661	Alpine Fir	14.684641	58.634725	121.093508
4443373	Alpine Fir	11.130142	29.016147	29.600635

4443380	Alpine Fir	11.196055	55.892529	196.440579
4443389	Alpine Fir	10.519687	45.408094	349.825689
4443390	Alpine Fir	7.294461	12.27079	37.673536
4443391	Alpine Fir	15.694157	65.001893	236.805082
4443398	Alpine Fir	12.621305	53.711938	104.947707
4443401	Alpine Fir	11.400973	50.722164	129.166408
4443406	Alpine Fir	11.364963	54.124371	113.020607
4443407	Alpine Fir	9.225628	26.306997	24.218702
4443414	Alpine Fir	12.358637	59.637633	174.912845
4443436	Alpine Fir	13.060891	64.336376	158.767044
4443440	Alpine Fir	10.330695	14.255382	32.291602
4443441	Alpine Fir	12.538956	59.042161	158.767044
4443459	Alpine Fir	10.516614	14.143559	56.510304
4443463	Alpine Fir	12.035983	55.108126	357.89859
4443464	Alpine Fir	12.474483	57.678164	137.239309
4443482	Alpine Fir	11.205929	59.256424	126.475441
4443515	Alpine Fir	8.781289	32.505983	123.784475
4443547	Alpine Fir	15.098403	50.4794	75.347072
4443550	Alpine Fir	8.696314	33.961229	32.291602
4443556	Alpine Fir	13.711034	59.269571	148.003176
4443557	Alpine Fir	11.677823	25.528654	91.492873
4443569	Alpine Fir	9.217467	14.361775	32.291602
4443580	Alpine Fir	11.914399	51.608775	347.134722
4443603	Alpine Fir	11.567509	51.20041	139.930276
4443605	Alpine Fir	13.832207	56.144148	279.860551
4443611	Alpine Fir	14.64886	64.180357	304.079253
4443627	Alpine Fir	16.622656	73.855683	252.950883
4443645	Alpine Fir	15.259387	44.96707	75.347072
4443646	Alpine Fir	14.996022	60.1598	185.676712
4443677	Alpine Fir	7.033762	13.774817	142.621243
4443688	Alpine Fir	12.129957	51.784924	185.676712
4443721	Alpine Fir	7.897762	13.225362	67.274171
4443722	Alpine Fir	6.740563	21.009741	207.204447
4443742	Alpine Fir	6.801219	20.920145	204.51348
4443779	Alpine Fir	11.602397	31.884025	40.364503
4443791	Alpine Fir	10.15395	36.753702	78.038038
4443806	Alpine Fir	8.473789	21.737768	446.700495
4443814	Alpine Fir	5.291985	15.741709	88.801906

4443839	Alpine Fir	5.327408	20.390099	182.985745
4443862	Alpine Fir	6.222255	22.633504	137.239309
4449790	Alpine Fir	7.162655	30.472565	215.277347
4449917	Alpine Fir	6.321395	16.656257	32.291602
4449918	Alpine Fir	5.735405	18.539912	290.624419
4450179	Engelmann Spruce	23.161022	89.516079	618.922373
4450181	Alpine Fir	13.80194	54.922604	32.291602
4450278	Alpine Fir	7.668347	19.38669	279.860551
4450281	Alpine Fir	5.430446	14.390648	215.277347
4450289	Alpine Fir	11.51893	52.060554	293.315386
4495013	Alpine Fir	13.52969	57.907379	69.965138
4495054	Alpine Fir	12.232505	45.073813	24.218702
4495055	Alpine Fir	13.04209	53.368141	123.784475
4495077	Alpine Fir	14.019009	48.943856	56.510304
4495078	Alpine Fir	10.533041	14.190501	13.454834
4495111	Alpine Fir	5.475511	14.162989	83.419972
4495132	Alpine Fir	14.108613	61.719463	123.784475
4495152	Alpine Fir	10.717749	49.5622	148.003176
4495153	Alpine Fir	10.714833	42.675845	204.51348
4495175	Alpine Fir	5.643367	12.94276	166.839944
4495195	Alpine Fir	13.481571	39.131124	51.12837
4495216	Alpine Fir	13.289638	61.234683	113.020607
4495234	Alpine Fir	10.180055	34.789079	37.673536
4495252	Alpine Fir	10.975738	44.275914	193.749613
4495253	Alpine Fir	5.960035	13.19957	48.437403
4495277	Alpine Fir	9.816583	34.216314	88.801906
4495297	Alpine Fir	14.289161	57.545235	64.583204
4495298	Alpine Fir	10.205194	31.633245	29.600635
4495315	Alpine Fir	11.428868	52.005548	104.947707
4495316	Alpine Fir	9.447084	17.232919	37.673536
4495336	Alpine Fir	11.678433	34.780275	26.909668
4495337	Alpine Fir	11.488061	37.678836	24.218702
4495338	Alpine Fir	7.911996	23.722229	43.055469
4495374	Whitebark Pine	11.122545	37.142978	45.746436
4495375	Alpine Fir	14.744164	54.033389	56.510304
4495397	Alpine Fir	12.385272	55.657894	148.003176
4495412	Alpine Fir	11.197012	31.284127	34.982569
4495413	Alpine Fir	6.64107	19.266379	48.437403

4495414	Alpine Fir	6.157127	12.387008	83.419972
4495443	Alpine Fir	10.590145	29.907023	94.183839
4495444	Alpine Fir	11.579785	50.689902	196.440579
4495445	Alpine Fir	13.209196	56.416829	134.548342
4495461	Alpine Fir	12.984757	13.924534	10.763867
4495490	Alpine Fir	17.300342	69.270733	161.45801
4495504	Alpine Fir	12.549522	14.761338	24.218702
4495505	Alpine Fir	7.868636	20.30193	86.110939
4495506	Alpine Fir	13.036099	58.983002	191.058646
4495531	Alpine Fir	13.043958	60.904764	67.274171
4495532	Alpine Fir	12.04162	47.685302	139.930276
4495588	Alpine Fir	12.178339	52.690671	59.20127
4495604	Alpine Fir	9.347406	32.807415	169.530911
4495605	Alpine Fir	12.946289	60.223179	139.930276
4495606	Alpine Fir	10.476531	15.135152	13.454834
4495607	Alpine Fir	12.57087	30.164381	64.583204
4495608	Alpine Fir	13.455436	46.733801	72.656105
4495609	Whitebark Pine	10.197464	34.653515	40.364503
4495636	Alpine Fir	11.081402	57.295556	234.114115
4495637	Alpine Fir	11.443563	32.660867	21.527735
4495667	Alpine Fir	11.472746	43.766279	43.055469
4495668	Alpine Fir	10.655657	12.578625	13.454834
4495669	Alpine Fir	8.425393	28.406019	21.527735
4495684	Alpine Fir	13.676125	57.289242	121.093508
4495685	Alpine Fir	7.26891	13.944832	72.656105
4495686	Alpine Fir	12.769207	44.619595	34.982569
4495717	Alpine Fir	7.803026	15.17656	51.12837
4495718	Alpine Fir	10.854314	15.867255	16.145801
4495729	Alpine Fir	21.89054	67.967822	51.12837
4495730	Alpine Fir	12.074612	30.342575	75.347072
4495731	Alpine Fir	10.156341	36.144094	209.895414
4495732	Alpine Fir	8.905696	33.072924	45.746436
4495748	Alpine Fir	11.565962	47.148717	118.402541
4495749	Alpine Fir	9.926908	14.8188	91.492873
4495764	Alpine Fir	12.30724	58.637291	91.492873
4495765	Alpine Fir	12.416998	48.679483	43.055469
4495766	Alpine Fir	15.051061	69.023036	172.221878
4495767	Alpine Fir	15.375519	68.321319	102.25674

4495784	Alpine Fir	12.38743	45.877192	64.583204
4495799	Alpine Fir	9.724715	24.112368	16.145801
4495800	Alpine Fir	12.031437	49.6145	212.58638
4495801	Alpine Fir	12.712879	62.622798	104.947707
4495817	Alpine Fir	6.037227	16.50349	166.839944
4495836	Alpine Fir	18.8617	79.70621	400.954059
4495837	Alpine Fir	10.008754	19.378791	21.527735
4495855	Alpine Fir	11.469535	32.110614	37.673536
4495856	Alpine Fir	11.271316	33.875507	37.673536
4495869	Alpine Fir	11.822918	55.026541	137.239309
4495870	Alpine Fir	10.82567	15.519922	16.145801
4495890	Alpine Fir	11.478043	47.680324	88.801906
4495891	Alpine Fir	15.430635	70.6727	104.947707
4495892	Alpine Fir	12.392906	58.197829	102.25674
4495909	Alpine Fir	12.895297	53.46524	217.968314
4495910	Alpine Fir	13.551938	53.915293	75.347072
4495925	Alpine Fir	16.392842	70.918867	10.763867
4495926	Alpine Fir	7.939895	19.661537	115.711574
4495927	Alpine Fir	8.752234	15.62928	21.527735
4495941	Whitebark Pine	11.169991	34.163423	29.600635
4495960	Alpine Fir	11.88011	47.412178	91.492873
4495961	Alpine Fir	9.976227	21.535763	16.145801
4495973	Alpine Fir	11.956676	38.722852	45.746436
4495974	Alpine Fir	17.203605	44.962943	43.055469
4495975	Whitebark Pine	14.748299	42.241424	45.746436
4495989	Alpine Fir	9.611554	34.81043	113.020607
4495990	Alpine Fir	9.660517	29.318733	150.694143
4495991	Alpine Fir	11.46878	54.004467	104.947707
4496003	Alpine Fir	8.252973	32.999471	113.020607
4496004	Alpine Fir	10.637984	22.481994	61.892237
4496016	Alpine Fir	14.580217	63.774352	48.437403
4496034	Alpine Fir	15.264692	65.447695	126.475441
4496035	Alpine Fir	11.275211	40.708267	34.982569
4496036	Alpine Fir	11.215677	29.402169	37.673536
4496037	Alpine Fir	13.347557	55.90365	148.003176
4496038	Alpine Fir	19.43885	78.44109	34.982569
4496049	Alpine Fir	8.618754	15.506799	32.291602
4496050	Alpine Fir	15.686912	59.451551	142.621243

4496085	Alpine Fir	16.179656	62.18159	139.930276
4496101	Alpine Fir	9.669602	29.620376	126.475441
4496118	Alpine Fir	14.609216	14.717824	10.763867
4496119	Alpine Fir	6.834253	12.887083	21.527735
4496284	Alpine Fir	12.376695	53.1686	201.822513
4496506	Alpine Fir	13.88081	58.274756	99.565773
4497508	Alpine Fir	6.955394	16.053076	43.055469
4497524	Alpine Fir	8.990399	24.781571	220.659281
4497529	Alpine Fir	12.462405	48.334471	131.857375
4497541	Alpine Fir	11.802493	56.333067	193.749613
4497542	Alpine Fir	11.506658	48.361613	196.440579
4497548	Alpine Fir	11.953247	54.001194	131.857375
4497569	Alpine Fir	12.219475	59.66611	236.805082
4497611	Alpine Fir	6.278861	14.747076	56.510304
4497615	Alpine Fir	9.584615	33.894422	53.819337
4497619	Alpine Fir	12.540655	44.380728	24.218702
4497620	Alpine Fir	15.930185	65.374074	193.749613
4497623	Alpine Fir	13.299677	56.75625	150.694143
4497629	Alpine Fir	9.491339	37.2458	150.694143
4497640	Alpine Fir	8.882848	13.034813	13.454834
4497649	Alpine Fir	11.032508	36.537716	88.801906
4497670	Alpine Fir	8.960331	15.419512	26.909668
4497678	Alpine Fir	12.900276	58.41074	174.912845
4497679	Alpine Fir	12.059851	14.495747	104.947707
4497702	Alpine Fir	13.123309	44.108587	32.291602
4497712	Alpine Fir	11.699861	47.929584	96.874806
4497722	Alpine Fir	8.492388	31.691112	282.551518
4497724	Alpine Fir	11.219751	39.917213	169.530911
4497734	Alpine Fir	9.593228	39.623502	134.548342
4497743	Alpine Fir	11.569646	48.174647	134.548342
4497754	Alpine Fir	14.589815	68.388448	220.659281
4497788	Alpine Fir	10.469461	54.156693	271.787651
4506954	Alpine Fir	12.227377	59.046521	258.332817
4506968	Alpine Fir	11.659211	32.48136	40.364503
4506990	Alpine Fir	7.890938	31.079412	102.25674
4506991	Alpine Fir	10.279678	15.024773	21.527735
4506992	Alpine Fir	19.651547	82.664714	344.443756
4506993	Alpine Fir	7.813896	13.562444	32.291602

4507011	Alpine Fir	12.286894	47.565719	29.600635
4507012	Alpine Fir	14.415347	56.286652	32.291602
4507013	Alpine Fir	12.748563	49.700989	110.32964
4507028	Alpine Fir	12.387973	48.325978	75.347072
4507029	Alpine Fir	13.50089	54.921148	86.110939
4507030	Alpine Fir	12.595989	59.031752	121.093508
4507038	Alpine Fir	11.34507	36.734738	164.148977
4507050	Alpine Fir	9.87823	28.360863	126.475441
4507191	Alpine Fir	13.705998	63.407207	231.423148
4507202	Alpine Fir	11.44114	48.242217	21.527735
4507227	Alpine Fir	6.231639	12.550813	43.055469
4507230	Alpine Fir	10.510371	43.10318	161.45801

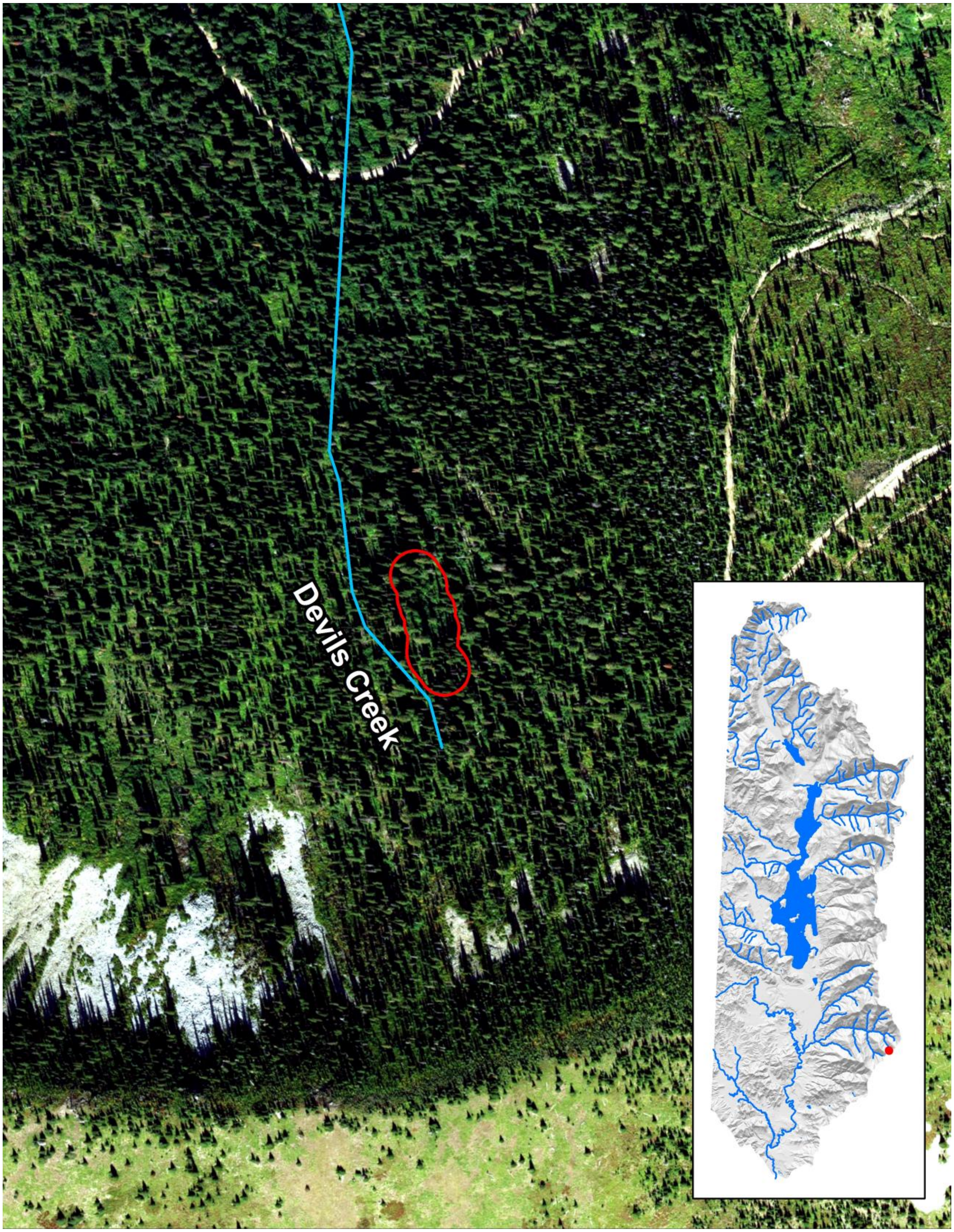


Figure D-23. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Devil's Creek using NAIP 2013 background.

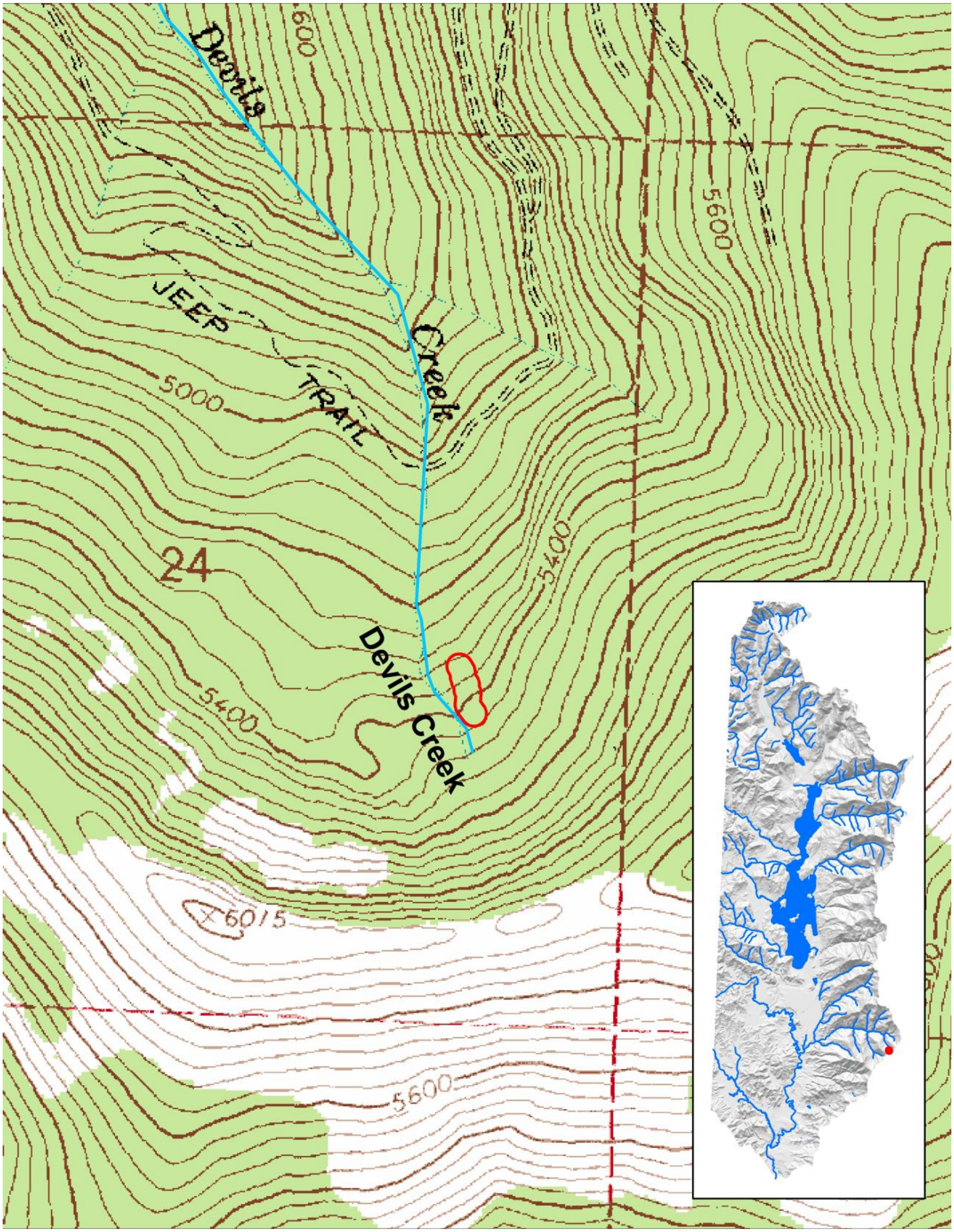


Figure D-24. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Devil's Creek using 24K topographic background.

Table D-40. LiDAR data from a riparian sample location on Devil's Creek.

Devil's Creek LiDAR data sample used for Kaniksu Rock/High Elevation forest type				
	Average Tree Height (feet)			33.86620555
	Trees/Acre			237.0344538
	Average Crown Area (square feet)			114.3892887
OBJECTID	SPECIES	DBH (inches)	Height (feet)	Crown Area (square feet)
3330111	Alpine Fir	12.433282	35.00068	91.492873
3330116	Alpine Fir	8.702374	28.418257	134.548342
3330117	Alpine Fir	5.248405	22.335684	169.530911
3330124	Alpine Fir	13.235975	49.862471	72.656105
3330125	Alpine Fir	12.437284	33.712957	51.12837
3330178	Alpine Fir	12.462241	44.283471	43.055469
3359767	Alpine Fir	14.369782	14.411676	8.072901
3359770	Alpine Fir	15.007876	14.347165	5.381934
3359779	Alpine Fir	13.996032	14.531112	5.381934
3359785	Alpine Fir	15.034843	14.570259	2.690967
3359806	Alpine Fir	14.623447	14.115174	5.381934
3359810	Alpine Fir	14.338021	15.6369	5.381934
3714507	Alpine Fir	16.954702	64.744544	80.729005
3714526	Alpine Fir	10.644924	32.151048	45.746436
3714565	Alpine Fir	18.591134	67.005493	465.537263
3714566	Alpine Fir	24.298591	101.221467	91.492873
3714598	Alpine Fir	13.688204	27.788656	51.12837
3714635	Alpine Fir	16.71954	61.475	158.767044
3714702	Alpine Fir	14.306989	57.36015	325.606988
3714753	Alpine Fir	10.072842	15.114382	48.437403
3714767	Alpine Fir	15.205425	66.918395	215.277347
3714785	Alpine Fir	10.040874	29.141007	193.749613
3714804	Alpine Fir	12.939299	30.90567	69.965138
3714870	Alpine Fir	11.250467	33.388856	24.218702
3714887	Alpine Fir	16.924916	65.97805	298.697319
3714888	Alpine Fir	7.412798	24.089935	150.694143
3714889	Alpine Fir	10.664106	47.377398	148.003176
3714890	Alpine Fir	7.482481	16.753462	86.110939
3715005	Alpine Fir	7.436269	15.751194	75.347072

3715031	Alpine Fir	9.060282	25.802477	24.218702
3715032	Alpine Fir	7.02013	16.949711	67.274171
3715033	Western Larch	29.648903	131.035567	863.800356
3715072	Alpine Fir	8.023246	18.65489	18.836768
3715073	Alpine Fir	9.869923	15.900744	34.982569
3715074	Alpine Fir	12.930675	49.822438	481.683064
3715075	Alpine Fir	15.593233	46.36449	164.148977
3715110	Alpine Fir	9.293069	14.664117	110.32964
3715143	Alpine Fir	12.942027	54.408995	325.606988
3715194	Alpine Fir	10.901748	14.376224	24.218702
3715211	Alpine Fir	15.670455	52.2931	24.218702
3715226	Alpine Fir	12.565586	46.652865	164.148977
3715227	Alpine Fir	14.920404	54.296875	56.510304
3715246	Alpine Fir	10.514103	15.717531	16.145801
3715276	Alpine Fir	12.136249	35.554574	29.600635
3715292	Alpine Fir	12.933166	33.924669	18.836768
3715293	Alpine Fir	22.129937	93.238586	96.874806
3715324	Alpine Fir	11.658145	52.61249	161.45801
3715340	Western Larch	26.02999	116.787433	333.679888
3715341	Alpine Fir	13.287422	33.228106	102.25674
3715358	Alpine Fir	10.957792	14.345157	29.600635
3715399	Alpine Fir	13.25812	14.218419	69.965138
3715400	Alpine Fir	12.333386	14.085709	43.055469
3715413	Alpine Fir	5.642866	14.88606	24.218702
3715427	Alpine Fir	12.955879	15.288275	16.145801
3715456	Alpine Fir	12.135032	26.326563	29.600635
3715457	Alpine Fir	4.94042	18.357148	174.912845
3715475	Alpine Fir	5.554461	13.834048	104.947707
3715493	Alpine Fir	3.76748	15.285061	247.568949
3715526	Alpine Fir	12.892966	15.450632	75.347072
3715556	Alpine Fir	13.165204	52.171438	107.638674
3715570	Alpine Fir	14.119163	59.775112	126.475441
3715629	Alpine Fir	7.223665	24.994807	43.055469
3715630	Alpine Fir	7.514438	15.30885	45.746436
3715641	Alpine Fir	7.462811	15.025472	21.527735
3715642	Alpine Fir	4.775873	19.765479	271.787651
3715670	Alpine Fir	14.914076	48.024366	45.746436
3715681	Alpine Fir	19.20387	79.36089	247.568949

3715682	Alpine Fir	5.32988	20.534134	126.475441
3715704	Alpine Fir	14.022254	30.759701	53.819337
3715716	Alpine Fir	12.170595	52.955467	37.673536
3715733	Alpine Fir	6.87407	14.447901	156.076077
3715749	Alpine Fir	6.92599	20.946588	51.12837
3715771	Alpine Fir	5.054444	13.553176	104.947707
3715803	Alpine Fir	16.906168	73.343322	113.020607
3715804	Alpine Fir	8.980987	24.619529	379.426324
3715805	Alpine Fir	4.546774	13.871136	107.638674
3715806	Alpine Fir	12.525056	55.64994	220.659281
3715823	Alpine Fir	4.367126	17.563964	115.711574
3715842	Alpine Fir	11.84519	36.982635	26.909668
3715843	Alpine Fir	11.765383	35.009296	94.183839
3715872	Alpine Fir	11.170651	35.292829	115.711574
3715887	Alpine Fir	5.766608	16.960838	107.638674
3715888	Alpine Fir	11.255174	36.769397	29.600635
3715889	Alpine Fir	14.492933	38.091736	29.600635
3715890	Alpine Fir	9.659245	15.041721	29.600635
3715891	Alpine Fir	16.042111	62.092325	390.190192
3715908	Alpine Fir	5.999255	12.888586	83.419972
3715943	Alpine Fir	13.873755	45.862019	67.274171
3715957	Alpine Fir	5.4139	20.374179	223.350248
3715974	Alpine Fir	5.373965	14.800917	21.527735
3715993	Alpine Fir	7.909686	15.325667	48.437403
3715994	Alpine Fir	6.053223	18.544995	40.364503
3715995	Alpine Fir	4.962843	14.570467	137.239309
3716024	Alpine Fir	11.723974	44.237467	64.583204
3716025	Alpine Fir	7.086329	12.578691	37.673536
3716041	Alpine Fir	8.97225	34.1079	86.110939
3716063	Whitebark Pine	12.509047	33.218252	69.965138
3716064	Alpine Fir	5.138706	21.617307	113.020607
3716065	Alpine Fir	14.87765	51.892337	10.763867
3716084	Alpine Fir	5.228323	19.261659	91.492873
3716085	Alpine Fir	12.040036	44.354533	188.367679
3716104	Alpine Fir	13.852103	49.820878	37.673536
3716136	Alpine Fir	7.901667	23.174894	61.892237
3716137	Alpine Fir	5.416749	20.90085	75.347072
3716153	Alpine Fir	12.172317	57.74484	269.096684

3716169	Alpine Fir	11.370107	29.510512	29.600635
3716170	Alpine Fir	11.733467	55.422271	96.874806
3716171	Alpine Fir	6.375863	19.624007	317.534087
3716172	Alpine Fir	5.079965	16.4949	185.676712
3716192	Alpine Fir	5.934338	14.791812	40.364503
3716193	Alpine Fir	7.248354	24.64631	43.055469
3716263	Alpine Fir	13.113969	52.54977	131.857375
3716264	Alpine Fir	8.542766	24.64575	247.568949
3716265	Alpine Fir	8.886175	14.286314	69.965138
3716266	Alpine Fir	6.06869	20.185594	123.784475
3716301	Alpine Fir	4.849015	14.219567	61.892237
3716334	Alpine Fir	9.209571	21.913039	43.055469
3716351	Alpine Fir	13.938049	15.292922	29.600635
3716352	Alpine Fir	5.314757	13.018345	61.892237
3716367	Alpine Fir	8.958886	29.328779	88.801906
3716368	Alpine Fir	5.923703	15.234827	48.437403
3716393	Alpine Fir	5.447726	20.996432	83.419972
3716394	Alpine Fir	7.518127	21.769025	78.038038
3716395	Alpine Fir	6.292237	16.755071	61.892237
3716407	Alpine Fir	9.356678	28.036561	269.096684
3716422	Alpine Fir	5.576381	18.870705	34.982569
3716423	Alpine Fir	6.832962	17.811267	191.058646
3716435	Alpine Fir	8.965642	13.740821	26.909668
3716436	Alpine Fir	8.461642	18.648258	21.527735
3716452	Alpine Fir	9.445236	13.977645	32.291602
3716453	Alpine Fir	6.763808	24.6269	48.437403
3716470	Alpine Fir	5.197285	14.360066	48.437403
3716507	Alpine Fir	4.894858	19.995195	161.45801
3716520	Alpine Fir	7.78271	24.0548	209.895414
3716521	Alpine Fir	7.948529	18.680344	37.673536
3716522	Alpine Fir	5.46052	20.565604	137.239309
3716531	Alpine Fir	6.211146	20.102717	207.204447
3716532	Alpine Fir	6.718327	21.362245	312.152153
3716533	Alpine Fir	12.561338	51.72075	368.662457
3716547	Alpine Fir	6.37081	17.594113	45.746436
3716562	Alpine Fir	5.755632	13.37672	174.912845
3716576	Alpine Fir	6.164954	21.569016	220.659281
3716590	Alpine Fir	7.172258	21.422152	172.221878

3716591	Alpine Fir	6.088052	12.610638	69.965138
3716626	Alpine Fir	11.870009	14.456172	32.291602
3716645	Alpine Fir	14.214428	51.250521	34.982569
3716660	Alpine Fir	10.616403	21.884141	37.673536
3716676	Alpine Fir	8.998121	13.724183	40.364503
3716677	Alpine Fir	12.155128	13.3168	29.600635
3716678	Alpine Fir	5.795924	18.734913	177.603811
3716693	Alpine Fir	6.869545	15.083033	45.746436
3716694	Alpine Fir	8.142178	13.109932	40.364503
3716695	Alpine Fir	8.737813	13.83792	18.836768
3716747	Alpine Fir	6.996164	22.493756	75.347072
3716778	Alpine Fir	7.12777	14.507398	325.606988
3716779	Alpine Fir	9.193199	20.398671	51.12837
3716780	Alpine Fir	5.609483	13.382068	53.819337
3716781	Alpine Fir	12.587262	15.187208	29.600635
3716801	Western Larch	29.295417	111.4425	368.662457
3716814	Alpine Fir	6.896026	22.551307	45.746436
3716815	Alpine Fir	4.944838	13.066137	37.673536
3716848	Alpine Fir	10.902135	50.779897	239.496049
3716869	Alpine Fir	10.246353	35.340524	185.676712
3716870	Alpine Fir	7.301894	14.683945	102.25674
3716871	Alpine Fir	10.852454	13.67869	21.527735
3716872	Alpine Fir	9.197386	13.177321	13.454834
3716900	Alpine Fir	6.21011	16.466087	69.965138
3716901	Alpine Fir	6.131307	19.477676	142.621243
3716913	Alpine Fir	6.279322	12.412923	123.784475
3716949	Alpine Fir	6.669765	13.977868	72.656105
3716950	Alpine Fir	12.391856	34.814774	75.347072
3716951	Alpine Fir	6.643496	13.504195	37.673536
3716952	Alpine Fir	11.32283	32.68653	107.638674
3717000	Alpine Fir	8.631928	13.23277	37.673536
3717001	Alpine Fir	7.694583	13.743185	48.437403
3717019	Alpine Fir	8.462199	13.903838	18.836768
3717020	Alpine Fir	6.669034	21.812694	188.367679
3717021	Alpine Fir	6.9541	12.482238	64.583204
3717055	Alpine Fir	4.937193	12.757837	56.510304
3717073	Alpine Fir	10.08102	36.561377	312.152153
3717083	Alpine Fir	11.111043	39.268355	59.20127

3717101	Alpine Fir	9.770977	31.587368	88.801906
3717156	Western Larch	30.992253	112.3635	522.047567
3717157	Alpine Fir	7.325264	12.674395	53.819337
3717201	Alpine Fir	12.857946	32.491928	16.145801
3717202	Alpine Fir	6.81451	17.483962	191.058646
3717251	Alpine Fir	15.659713	63.48485	285.242485
3717264	Alpine Fir	8.058379	12.883995	99.565773
3717265	Western Larch	19.766857	83.439119	26.909668
3717278	Alpine Fir	12.279836	34.75462	88.801906
3717292	Alpine Fir	7.313901	23.562956	153.38511
3717293	Alpine Fir	6.069708	12.525941	26.909668
3717309	Alpine Fir	7.051254	13.244582	88.801906
3717321	Alpine Fir	16.948341	63.454908	196.440579
3717337	Alpine Fir	8.555989	14.696888	104.947707
3717354	Alpine Fir	7.785228	13.013551	43.055469
3717355	Alpine Fir	11.143656	32.685117	72.656105
3717373	Alpine Fir	7.516302	14.229594	80.729005
3717386	Alpine Fir	13.092774	14.881746	26.909668
3717387	Alpine Fir	13.806887	58.849013	196.440579
3717398	Alpine Fir	7.844241	12.980046	24.218702
3717399	Alpine Fir	13.461233	33.428733	29.600635
3717421	Alpine Fir	6.172118	11.879028	56.510304
3717446	Alpine Fir	14.000587	14.502901	29.600635
3717478	Alpine Fir	17.677967	72.710748	252.950883
3717495	Alpine Fir	13.439627	57.60309	220.659281
3717529	Alpine Fir	13.257581	48.905174	94.183839
3717530	Alpine Fir	9.084394	13.157098	43.055469
3717552	Alpine Fir	12.866916	38.600281	32.291602
3717553	Alpine Fir	11.942724	56.938686	156.076077
3717604	Alpine Fir	12.224204	60.388619	104.947707
3717636	Alpine Fir	10.150776	27.990919	72.656105
3717663	Alpine Fir	8.605343	30.581434	75.347072
3717664	Alpine Fir	13.14571	58.664835	134.548342
3717674	Alpine Fir	12.935882	48.92557	115.711574
3717691	Alpine Fir	16.485708	74.185084	177.603811
3717692	Alpine Fir	21.722057	94.964786	43.055469
3717713	Alpine Fir	6.91312	19.348741	43.055469
3717732	Alpine Fir	14.972043	14.313274	24.218702

3717733	Alpine Fir	15.240032	72.61531	277.169585
3717734	Alpine Fir	14.785485	68.02235	148.003176
3717735	Alpine Fir	11.581931	34.707255	21.527735
3717748	Alpine Fir	13.030776	56.644267	204.51348
3717749	Alpine Fir	11.045228	32.501175	34.982569
3717800	Western Hemlock	9.477369	20.613162	24.218702
3717848	Alpine Fir	9.601102	24.701162	64.583204
3717863	Alpine Fir	16.152664	70.574733	94.183839
3717894	Western Larch	24.069793	90.159943	503.210799
3717895	Alpine Fir	8.679803	23.3398	29.600635
3717911	Alpine Fir	14.713818	43.312752	26.909668
3717912	Alpine Fir	13.440605	48.956387	75.347072
3717913	Alpine Fir	11.221356	40.545579	110.32964
3717926	Alpine Fir	13.059243	34.117794	48.437403
3717941	Alpine Fir	11.039609	34.380663	48.437403
3717942	Alpine Fir	10.381462	13.657438	29.600635
3717978	Alpine Fir	13.973433	60.013971	271.787651
3717979	Alpine Fir	10.268083	14.744802	29.600635
3717980	Alpine Fir	11.499607	50.725986	104.947707
3718016	Alpine Fir	10.206021	30.547124	43.055469
3718017	Alpine Fir	15.744413	48.053646	191.058646
3718030	Alpine Fir	8.563801	31.446271	69.965138
3718086	Alpine Fir	12.72283	47.943705	287.933452
3718087	Alpine Fir	20.578336	67.607594	10.763867
3718132	Alpine Fir	9.533834	17.904112	26.909668
3718145	Alpine Fir	13.725661	60.145719	296.006352
3718166	Alpine Fir	10.065161	15.193863	24.218702
3718167	Alpine Fir	14.098849	56.14906	113.020607
3718244	Alpine Fir	12.027778	53.05343	207.204447
3718254	Alpine Fir	9.342147	34.318511	80.729005
3718255	Alpine Fir	13.953851	14.609229	37.673536
3718276	Alpine Fir	14.739334	51.395517	185.676712
3718314	Alpine Fir	11.144057	47.966629	104.947707
3718348	Alpine Fir	12.80145	40.999832	164.148977
3718364	Alpine Fir	11.616685	39.88604	24.218702
3718381	Alpine Fir	9.746123	13.911365	37.673536
3718382	Alpine Fir	14.234577	61.537476	78.038038
3718443	Alpine Fir	11.910981	30.867386	21.527735

3718444	Alpine Fir	16.151646	73.428081	134.548342
3718480	Alpine Fir	15.729076	65.181379	199.131546
3718499	Alpine Fir	12.361602	36.955083	43.055469
3718500	Alpine Fir	16.98749	72.437944	328.297955
3718523	Alpine Fir	8.318462	15.795229	83.419972
3718524	Alpine Fir	15.276173	63.285856	40.364503
3718525	Alpine Fir	11.953929	30.02723	32.291602
3718545	Alpine Fir	12.468215	33.595815	34.982569
3718608	Alpine Fir	12.882827	59.614402	153.38511
3718658	Alpine Fir	12.644322	48.789533	26.909668
3718680	Alpine Fir	13.797088	28.35739	51.12837
3718731	Alpine Fir	14.109919	14.952352	24.218702
3718765	Alpine Fir	15.009315	68.479867	161.45801
3718788	Alpine Fir	18.992162	77.683367	320.225054
3718860	Alpine Fir	13.888511	53.015949	51.12837
3718878	Alpine Fir	11.777123	31.434629	26.909668
3718879	Whitebark Pine	14.617509	40.186945	34.982569
3718894	Alpine Fir	17.886737	47.596186	26.909668
3721765	Alpine Fir	12.569361	58.176155	134.548342
3722103	Alpine Fir	9.482134	22.401771	113.020607
3722118	Alpine Fir	5.925012	14.755395	107.638674
3722121	Alpine Fir	7.690181	22.585914	110.32964
3722122	Alpine Fir	8.184815	16.160612	258.332817
3722323	Alpine Fir	8.196372	13.626118	182.985745
3722330	Alpine Fir	7.098951	21.083838	78.038038
3722740	Alpine Fir	14.362318	60.035992	204.51348
3722748	Alpine Fir	4.593533	14.957206	48.437403
3722757	Alpine Fir	4.885935	17.594209	91.492873
3722761	Alpine Fir	6.683196	14.292348	118.402541
3722762	Alpine Fir	11.197209	37.904067	188.367679
3722780	Alpine Fir	9.956361	13.934649	26.909668
3726326	Western Larch	29.145393	117.1273	532.811434
3726341	Alpine Fir	8.93371	25.169099	53.819337
3726344	Alpine Fir	9.343304	17.401944	29.600635
3726345	Alpine Fir	15.588021	68.107962	174.912845
3726357	Alpine Fir	19.941102	79.592348	201.822513
3726361	Alpine Fir	8.533962	16.786519	64.583204
3726383	Alpine Fir	6.356736	20.340377	139.930276

3726392	Alpine Fir	13.745058	16.239744	26.909668
3726396	Alpine Fir	6.238077	18.092542	83.419972
3726409	Alpine Fir	7.641095	14.879679	88.801906
3726423	Alpine Fir	23.660466	88.163386	34.982569
3726455	Alpine Fir	7.817203	26.562232	118.402541
3726461	Western Larch	26.640037	110.8685	266.405717
3726468	Alpine Fir	5.043214	13.723827	129.166408
3726469	Alpine Fir	10.274912	15.621757	69.965138
3726494	Alpine Fir	8.355017	13.984417	26.909668
3726496	Alpine Fir	11.785952	50.789814	158.767044
3726508	Alpine Fir	4.884016	18.949864	94.183839
3726532	Alpine Fir	14.337279	61.346329	139.930276
3726546	Alpine Fir	11.248568	46.045403	129.166408
3726561	Alpine Fir	9.707508	31.866215	86.110939
3726564	Alpine Fir	6.33612	16.612433	69.965138
3726570	Alpine Fir	12.246867	14.800796	67.274171
3726572	Alpine Fir	4.786779	13.33076	102.25674
3726576	Alpine Fir	9.521768	32.812261	56.510304
3726580	Alpine Fir	7.873342	13.912486	64.583204
3726597	Alpine Fir	17.156816	66.222445	201.822513
3726616	Alpine Fir	9.219956	26.987783	150.694143
3726624	Alpine Fir	12.557902	46.1288	201.822513
3726628	Alpine Fir	5.511796	14.526748	161.45801
3726634	Alpine Fir	7.117376	20.981039	24.218702
3726639	Alpine Fir	7.411405	28.140428	158.767044
3726646	Alpine Fir	8.534607	14.684493	40.364503
3726651	Alpine Fir	6.826541	19.548123	61.892237
3726652	Alpine Fir	5.841405	18.448674	129.166408
3726683	Alpine Fir	9.268807	12.814833	13.454834
3726684	Alpine Fir	10.87445	24.730071	306.77022
3726726	Alpine Fir	13.332017	13.920144	56.510304
3726749	Alpine Fir	8.418608	14.817993	32.291602
3726770	Alpine Fir	13.256008	58.709236	250.259916
3726785	Alpine Fir	5.782073	12.724586	131.857375
3726802	Alpine Fir	6.234189	15.867886	258.332817
3726803	Alpine Fir	4.373952	19.033267	137.239309
3726837	Alpine Fir	9.118205	12.48196	21.527735
3726854	Alpine Fir	11.339092	54.720933	228.732181

3726894	Alpine Fir	6.342902	13.249593	59.20127
3726927	Alpine Fir	17.072785	70.315917	363.280523
3726929	Alpine Fir	15.576391	64.869117	193.749613
3726976	Alpine Fir	11.618303	33.73553	45.746436
3726977	Alpine Fir	12.05663	14.128441	16.145801
3727027	Alpine Fir	12.001496	51.180205	263.71475
3727032	Alpine Fir	11.322044	34.382866	34.982569
3727050	Alpine Fir	12.632624	50.29906	113.020607
3727062	Engelmann Spruce	16.1225	65.482869	328.297955
3727077	Alpine Fir	19.341739	82.0197	115.711574
3727078	Alpine Fir	13.488713	58.515067	75.347072
3727083	Alpine Fir	15.677358	59.642827	158.767044
3727128	Alpine Fir	15.052169	42.579743	107.638674
3727851	Alpine Fir	13.153471	61.492763	322.916021
3728071	Alpine Fir	17.481341	62.411667	306.77022

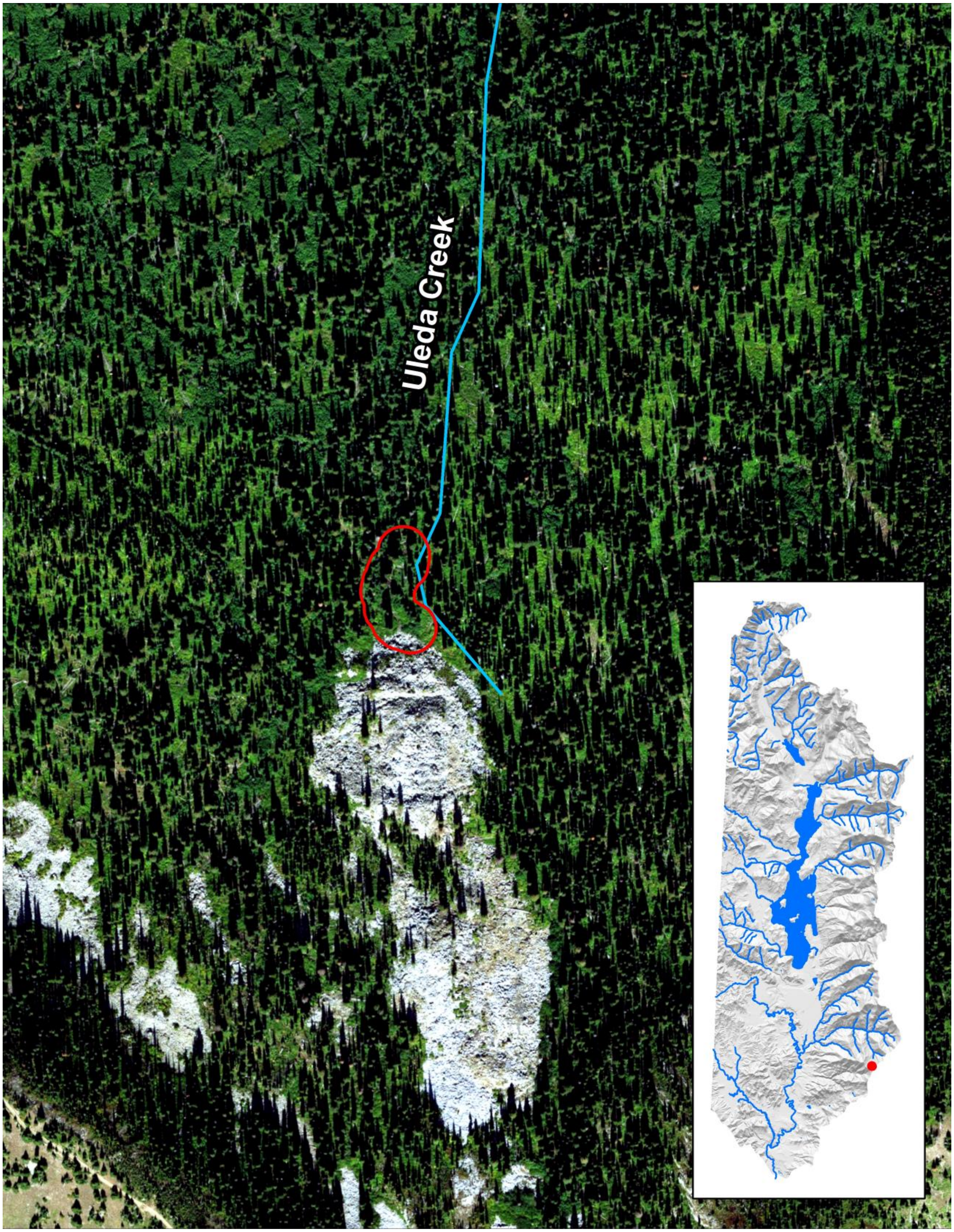


Figure D-25. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Uleda Creek using NAIP 2013 background.

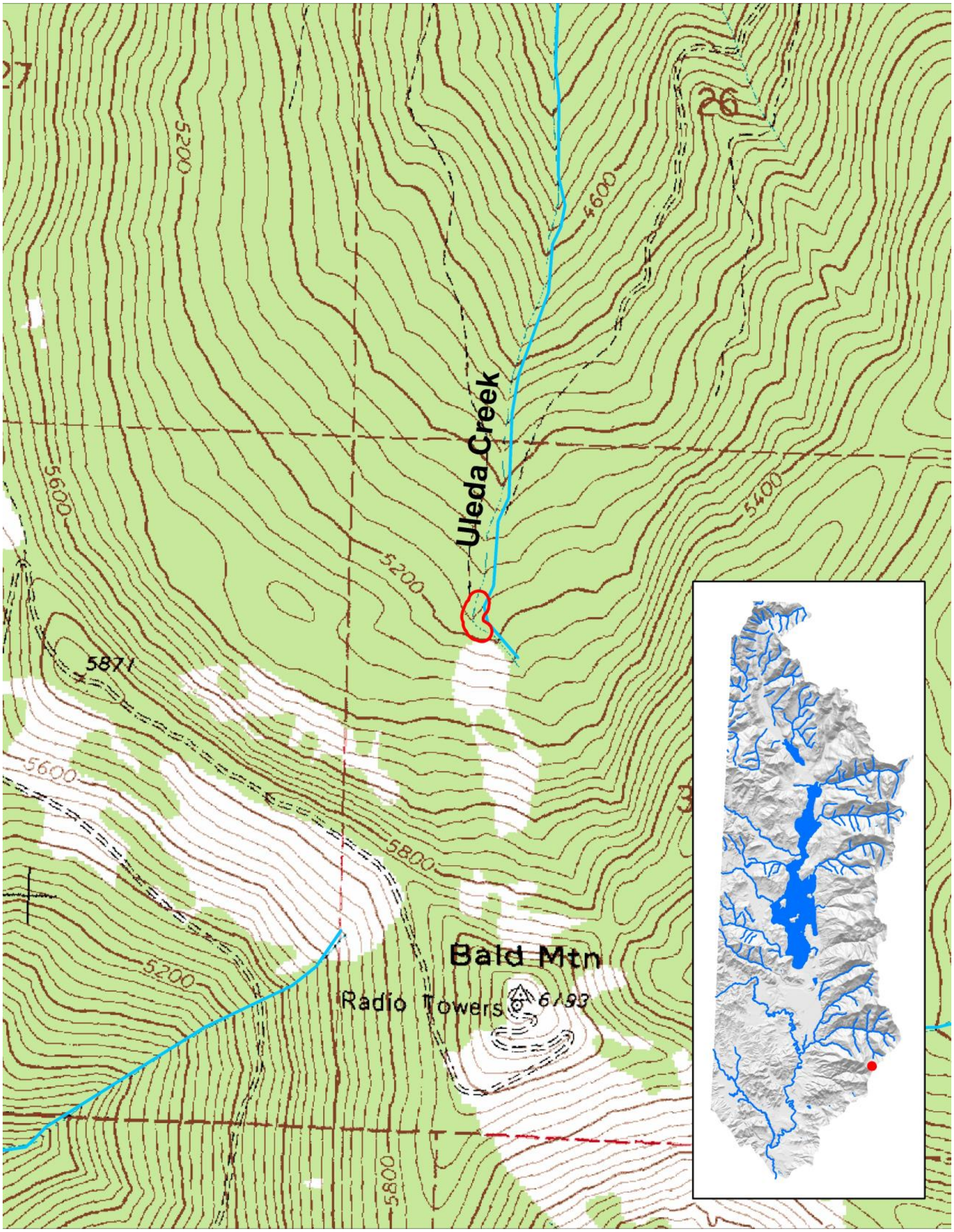


Figure D-26. Kaniksu Rocky/High Elevation forest type LiDAR data sample location on Uleda Creek using 24K topographic background.

Table D-41. LiDAR data from a riparian sample location on Uleda Creek.

Uleda Creek LiDAR data sample used for Kaniksu Rocky/High Elevation forest type				
	Average Tree Height (feet)			25.60468948
	Trees/Acre			235.4743981
	Average Crown Area (square feet)			99.91963112
OBJECTID	SPECIES	DBH (inches)	Height (feet)	Crown Area (square feet)
1377037	Alpine Fir	13.201785	36.922348	43.055469
1377039	Alpine Fir	12.148736	28.971644	32.291602
1377041	Alpine Fir	13.842439	48.902763	158.767044
1377072	Alpine Fir	9.683796	15.364793	131.857375
1377073	Alpine Fir	12.443797	14.439099	34.982569
1403148	Alpine Fir	13.429211	15.672139	2.690967
1403153	Alpine Fir	14.386658	15.397103	2.690967
1403164	Alpine Fir	13.706664	15.325785	5.381934
1403169	Alpine Fir	9.943846	15.824075	8.072901
1403196	Alpine Fir	12.242967	15.137094	5.381934
1403200	Alpine Fir	10.142162	14.608881	5.381934
1403208	Alpine Fir	10.614415	15.620792	5.381934
1403211	Alpine Fir	14.966256	15.257938	5.381934
1403214	Alpine Fir	13.732079	16.522809	2.690967
1403215	Alpine Fir	14.104485	15.919113	2.690967
1403216	Alpine Fir	13.713078	15.71633	5.381934
1403224	Alpine Fir	11.312992	15.699321	5.381934
1403225	Alpine Fir	14.007227	14.524544	2.690967
1403231	Alpine Fir	13.878084	15.328143	8.072901
1403242	Alpine Fir	14.464474	15.00237	2.690967
1403251	Alpine Fir	9.680141	12.843187	8.072901
1403257	Alpine Fir	11.016238	15.998139	5.381934
1403258	Alpine Fir	13.858749	15.511631	2.690967
1403271	Alpine Fir	10.354195	15.642602	5.381934
1403279	Alpine Fir	11.271487	14.030289	5.381934
1403284	Alpine Fir	12.27528	16.512243	5.381934
1403287	Alpine Fir	12.306726	15.813603	8.072901
1403291	Alpine Fir	12.26722	15.855039	5.381934
1609971	Alpine Fir	10.481138	24.336858	80.729005

1610058	Alpine Fir	7.165887	18.647878	94.183839
1610094	Alpine Fir	11.464044	37.124179	115.711574
1610122	Alpine Fir	6.381909	14.766013	172.221878
1610123	Alpine Fir	7.62731	17.740267	43.055469
1610144	Alpine Fir	9.548739	15.09169	21.527735
1610203	Alpine Fir	17.770482	67.785225	196.440579
1610214	Alpine Fir	9.540316	32.476883	134.548342
1610260	Alpine Fir	12.089023	54.798014	161.45801
1610284	Alpine Fir	8.863541	13.124304	67.274171
1610285	Alpine Fir	11.181325	32.233525	104.947707
1610335	Alpine Fir	10.317679	33.903699	75.347072
1610352	Alpine Fir	12.779783	29.452629	107.638674
1610353	Alpine Fir	10.472143	28.881914	48.437403
1610373	Alpine Fir	11.879423	32.088374	99.565773
1610374	Alpine Fir	8.513007	14.071796	40.364503
1610393	Alpine Fir	7.231821	20.956023	56.510304
1610411	Alpine Fir	12.877824	50.482079	53.819337
1610427	Alpine Fir	19.142815	78.383048	185.676712
1610428	Alpine Fir	11.122718	31.927375	96.874806
1610458	Alpine Fir	8.722097	34.621286	75.347072
1610486	Alpine Fir	16.41631	67.00381	368.662457
1610487	Alpine Fir	13.825775	46.003988	26.909668
1610508	Alpine Fir	11.014927	14.537747	45.746436
1610523	Alpine Fir	10.118885	13.508673	24.218702
1610524	Alpine Fir	10.010706	14.960225	26.909668
1610556	Alpine Fir	11.491075	25.871879	193.749613
1610557	Alpine Fir	7.538502	15.199556	48.437403
1610558	Alpine Fir	14.198745	45.32819	91.492873
1610587	Alpine Fir	13.864386	49.595307	158.767044
1610600	Alpine Fir	10.132209	31.941727	134.548342
1610616	Alpine Fir	8.653987	18.432579	236.805082
1610617	Alpine Fir	10.930187	26.711517	69.965138
1610618	Alpine Fir	9.397098	24.462237	18.836768
1610619	Alpine Fir	9.053677	15.620137	45.746436
1610643	Alpine Fir	7.410936	15.147813	78.038038
1610653	Alpine Fir	13.306843	15.309781	78.038038
1610666	Alpine Fir	11.446408	34.535344	99.565773
1610724	Alpine Fir	11.435709	14.224424	26.909668

1610725	Alpine Fir	8.676589	24.986719	166.839944
1610752	Alpine Fir	11.86669	30.245576	48.437403
1610753	Alpine Fir	9.43546	30.028437	188.367679
1610754	Alpine Fir	14.857129	46.477479	43.055469
1610790	Alpine Fir	12.169803	15.028724	21.527735
1610791	Alpine Fir	15.094305	30.205656	48.437403
1610803	Alpine Fir	17.986983	70.147492	487.064998
1610817	Alpine Fir	12.447437	31.395025	24.218702
1610818	Alpine Fir	10.319938	23.951676	21.527735
1610819	Alpine Fir	14.134995	43.983494	212.58638
1610846	Whitebark Pine	10.952018	32.168742	37.673536
1610883	Alpine Fir	7.523785	17.337386	80.729005
1610921	Alpine Fir	8.589368	13.546756	24.218702
1610938	Alpine Fir	6.887994	14.38006	32.291602
1610939	Alpine Fir	11.012731	13.312441	32.291602
1610953	Alpine Fir	10.722299	15.38329	24.218702
1610954	Alpine Fir	20.140997	85.2606	228.732181
1610966	Alpine Fir	10.903477	14.296011	21.527735
1610979	Alpine Fir	10.454207	30.891486	67.274171
1610991	Alpine Fir	9.36347	19.606341	104.947707
1610992	Alpine Fir	11.642178	14.021944	16.145801
1611010	Alpine Fir	12.538903	36.802037	26.909668
1611060	Alpine Fir	11.038967	32.057573	174.912845
1611061	Alpine Fir	9.210929	33.231991	86.110939
1611062	Alpine Fir	12.250024	15.103823	53.819337
1611094	Alpine Fir	10.903871	14.495331	69.965138
1611095	Alpine Fir	10.020674	26.392629	164.148977
1611112	Alpine Fir	11.187554	23.803735	150.694143
1611113	Alpine Fir	6.87564	13.434151	118.402541
1611114	Alpine Fir	8.963391	14.990911	40.364503
1611147	Alpine Fir	19.286538	72.320259	290.624419
1611180	Alpine Fir	9.142808	15.358086	24.218702
1611181	Alpine Fir	13.502975	15.463625	13.454834
1611211	Alpine Fir	8.535981	13.391235	26.909668
1611227	Alpine Fir	12.464323	27.644693	48.437403
1611237	Alpine Fir	12.80129	15.263626	43.055469
1611238	Alpine Fir	10.074368	15.12073	26.909668
1611277	Alpine Fir	11.812555	15.199134	61.892237

1611278	Alpine Fir	7.309284	13.369461	45.746436
1611290	Alpine Fir	14.463027	63.142893	209.895414
1611313	Alpine Fir	13.953065	48.39576	21.527735
1611314	Alpine Fir	22.933683	93.0086	129.166408
1611315	Alpine Fir	7.250728	13.956252	64.583204
1611316	Alpine Fir	17.367118	49.99909	78.038038
1611317	Alpine Fir	10.197477	14.536522	67.274171
1611318	Alpine Fir	13.339763	57.290602	220.659281
1611332	Alpine Fir	8.214005	13.053877	43.055469
1611333	Alpine Fir	8.751129	14.719321	48.437403
1611354	Alpine Fir	9.666509	15.169032	29.600635
1611355	Alpine Fir	8.896777	12.969416	118.402541
1611385	Alpine Fir	12.008915	16.430095	43.055469
1611393	Alpine Fir	20.63919	85.014362	250.259916
1611415	Alpine Fir	13.369246	15.396456	37.673536
1611416	Alpine Fir	11.904276	27.120292	18.836768
1611433	Alpine Fir	6.17322	13.11424	72.656105
1611445	Alpine Fir	12.954319	37.773944	21.527735
1611460	Alpine Fir	13.875235	15.678422	26.909668
1611496	Alpine Fir	13.895394	59.144161	309.461187
1611514	Alpine Fir	10.268691	33.897806	45.746436
1611536	Alpine Fir	14.80278	50.473608	309.461187
1611550	Alpine Fir	6.792042	17.620569	131.857375
1611551	Alpine Fir	8.292933	12.615283	169.530911
1611575	Alpine Fir	10.237703	33.774285	45.746436
1611588	Alpine Fir	10.172789	26.342732	269.096684
1611589	Alpine Fir	14.004357	15.281604	18.836768
1611590	Alpine Fir	13.43818	46.008014	40.364503
1611614	Alpine Fir	13.192122	39.860875	43.055469
1611615	Alpine Fir	11.587073	35.077681	88.801906
1611637	Alpine Fir	10.34495	28.475033	139.930276
1611638	Alpine Fir	10.646505	30.301899	88.801906
1611639	Alpine Fir	7.499742	20.080354	34.982569
1611654	Alpine Fir	9.072984	13.466486	80.729005
1611674	Alpine Fir	8.788711	14.325194	37.673536
1611675	Alpine Fir	9.901827	22.492078	96.874806
1611676	Alpine Fir	13.666815	14.90831	18.836768
1611709	Alpine Fir	8.068918	13.967719	29.600635

1611725	Alpine Fir	11.814795	33.929133	34.982569
1611726	Alpine Fir	10.896731	29.913172	153.38511
1611739	Alpine Fir	7.800717	23.292185	69.965138
1611769	Alpine Fir	7.718972	14.34081	94.183839
1611770	Alpine Fir	7.909387	13.958494	118.402541
1611791	Alpine Fir	8.904124	14.424875	29.600635
1611798	Alpine Fir	7.147328	13.37289	107.638674
1611799	Alpine Fir	20.522771	77.41794	357.89859
1611835	Alpine Fir	9.002549	15.818264	45.746436
1611836	Alpine Fir	10.079762	31.151329	107.638674
1611837	Alpine Fir	25.431547	105.502319	266.405717
1611851	Alpine Fir	9.396712	19.979233	43.055469
1611852	Alpine Fir	10.955895	32.054711	158.767044
1611878	Alpine Fir	7.500439	15.695422	104.947707
1611879	Alpine Fir	5.253433	14.470892	177.603811
1611890	Alpine Fir	6.856012	14.243933	123.784475
1611932	Alpine Fir	10.800589	35.290707	32.291602
1611933	Alpine Fir	12.114163	14.836026	59.20127
1611956	Alpine Fir	6.131982	16.613665	69.965138
1611957	Alpine Fir	8.797204	23.591238	204.51348
1611972	Alpine Fir	8.266498	13.012991	48.437403
1611973	Alpine Fir	10.564731	17.722422	78.038038
1611974	Alpine Fir	6.076157	15.549104	24.218702
1612004	Alpine Fir	9.170185	17.219091	83.419972
1612029	Alpine Fir	14.967481	29.608071	78.038038
1612030	Alpine Fir	7.197132	15.585268	94.183839
1612031	Alpine Fir	6.534293	17.279236	99.565773
1612050	Alpine Fir	6.610338	14.181506	107.638674
1612051	Alpine Fir	13.982059	56.175336	158.767044
1612073	Alpine Fir	9.753826	13.426403	80.729005
1612089	Alpine Fir	7.640955	14.640349	67.274171
1612090	Alpine Fir	6.432695	14.37967	166.839944
1612104	Alpine Fir	6.122302	16.71769	174.912845
1612105	Alpine Fir	8.948186	32.951048	80.729005
1612106	Alpine Fir	10.69708	15.383698	26.909668
1612122	Alpine Fir	4.740049	13.509517	96.874806
1612123	Alpine Fir	6.364639	15.874414	142.621243
1612124	Alpine Fir	8.811727	19.857992	29.600635

1612125	Alpine Fir	9.137651	14.255718	32.291602
1612135	Alpine Fir	9.47267	14.953819	72.656105
1612140	Alpine Fir	11.203137	31.562094	56.510304
1612176	Alpine Fir	20.418566	78.556025	137.239309
1612177	Alpine Fir	11.928503	41.644744	164.148977
1612191	Alpine Fir	15.261679	43.599092	150.694143
1612202	Alpine Fir	10.761417	12.626795	26.909668
1612203	Alpine Fir	10.298376	15.287418	56.510304
1612204	Alpine Fir	10.22793	31.930207	115.711574
1612215	Alpine Fir	13.389823	15.34986	21.527735
1612226	Alpine Fir	15.682884	15.77975	32.291602
1612227	Alpine Fir	12.949552	14.490232	26.909668
1612228	Alpine Fir	17.794552	74.930262	242.187016
1612248	Alpine Fir	9.223888	31.401451	172.221878
1612249	Alpine Fir	10.177	13.379727	61.892237
1612275	Alpine Fir	13.247665	15.334201	99.565773
1612286	Alpine Fir	13.278731	15.036041	78.038038
1612287	Alpine Fir	12.776994	15.999253	64.583204
1612308	Alpine Fir	13.92179	18.104843	115.711574
1612309	Alpine Fir	14.66584	49.57134	285.242485
1612327	Alpine Fir	13.019489	15.335656	37.673536
1612328	Alpine Fir	14.385967	16.717776	115.711574
1612368	Alpine Fir	5.745518	18.462307	185.676712
1612369	Alpine Fir	12.502215	13.750933	80.729005
1612386	Alpine Fir	11.936335	14.520491	113.020607
1612387	Alpine Fir	8.710726	13.433787	61.892237
1612400	Alpine Fir	13.314656	15.638197	43.055469
1612401	Alpine Fir	9.332629	29.408781	196.440579
1612412	Alpine Fir	9.238854	15.294027	75.347072
1612413	Alpine Fir	13.759901	36.314721	53.819337
1612430	Alpine Fir	13.280713	15.371311	61.892237
1612473	Alpine Fir	9.865586	34.701915	26.909668
1612474	Alpine Fir	13.022851	15.749884	43.055469
1612488	Alpine Fir	11.649288	14.242885	172.221878
1612511	Alpine Fir	14.205112	39.523867	43.055469
1612512	Alpine Fir	10.609008	15.859992	61.892237
1612513	Alpine Fir	8.818944	16.02363	29.600635
1612530	Alpine Fir	8.063443	15.144484	51.12837

1612531	Alpine Fir	12.224266	14.354072	228.732181
1612566	Alpine Fir	13.472601	15.819271	250.259916
1612567	Alpine Fir	9.412125	18.996907	540.884335
1612583	Alpine Fir	13.38982	40.592658	51.12837
1612612	Alpine Fir	26.6641	105.896919	172.221878
1612635	Alpine Fir	13.499543	15.426395	59.20127
1612636	Alpine Fir	10.568399	16.867729	53.819337
1612682	Alpine Fir	9.241816	14.859226	40.364503
1612694	Alpine Fir	12.687695	13.689446	80.729005
1612720	Alpine Fir	13.384953	15.710486	37.673536
1612721	Alpine Fir	10.910514	15.778186	21.527735
1612735	Alpine Fir	13.305229	15.860654	24.218702
1612736	Alpine Fir	12.243231	16.076307	45.746436
1612762	Alpine Fir	13.165492	16.024259	16.145801
1612763	Alpine Fir	11.988418	14.605108	104.947707
1612787	Alpine Fir	12.236067	16.674837	21.527735
1612809	Alpine Fir	11.486523	16.418569	59.20127
1612849	Alpine Fir	13.311437	15.700437	80.729005
1612890	Alpine Fir	11.261819	14.569349	185.676712
1612891	Alpine Fir	13.25268	15.651278	37.673536
1612913	Alpine Fir	12.637892	15.61429	18.836768
1612925	Alpine Fir	12.349246	16.184428	26.909668
1612984	Alpine Fir	12.019092	15.885565	32.291602
1612985	Alpine Fir	12.168659	15.335016	26.909668
1613000	Alpine Fir	11.662881	15.951459	88.801906
1613057	Alpine Fir	11.2217	15.786283	16.145801
1613067	Alpine Fir	11.69736	14.579464	115.711574
1613074	Alpine Fir	9.651003	14.616847	53.819337
1624559	Alpine Fir	12.10171	47.187483	78.038038
1624562	Alpine Fir	10.565432	32.284343	91.492873
1624563	Alpine Fir	11.276151	28.53784	107.638674
1624565	Alpine Fir	4.800321	18.976831	142.621243
1624636	Alpine Fir	10.173244	32.6592	121.093508
1624637	Alpine Fir	5.494019	13.530293	150.694143
1624638	Alpine Fir	8.185153	20.4929	110.32964
1624705	Alpine Fir	9.573585	33.942738	164.148977
1624807	Alpine Fir	7.769735	13.255784	96.874806
1624821	Alpine Fir	12.48845	15.373672	148.003176

1624991	Alpine Fir	11.612219	15.56604	26.909668
1625169	Alpine Fir	11.325656	34.724469	166.839944
1625176	Alpine Fir	7.323503	13.958221	48.437403
1625184	Alpine Fir	6.608633	14.624586	53.819337
1625198	Alpine Fir	7.090973	14.01544	118.402541
1625200	Alpine Fir	12.481407	15.316504	279.860551
1625201	Alpine Fir	13.372549	13.811418	231.423148
1625202	Alpine Fir	14.517804	61.305601	153.38511
1626222	Alpine Fir	17.567415	66.085742	290.624419
1626238	Alpine Fir	18.289147	76.608981	164.148977
1626257	Alpine Fir	8.850136	14.320506	40.364503
1626280	Alpine Fir	11.483834	27.99795	61.892237
1626287	Alpine Fir	11.249644	30.138632	317.534087
1626331	Alpine Fir	7.042332	13.653351	110.32964
1626343	Alpine Fir	8.464837	20.03584	110.32964
1626344	Alpine Fir	10.220786	16.595665	217.968314
1626359	Alpine Fir	10.390345	32.556871	169.530911
1626365	Alpine Fir	13.14842	13.97806	69.965138
1626374	Alpine Fir	9.076405	32.479283	123.784475
1626384	Alpine Fir	14.233191	47.743331	142.621243
1626400	Alpine Fir	8.798528	31.200682	118.402541
1626406	Alpine Fir	18.40208	77.550948	371.353424
1626412	Alpine Fir	7.280483	13.479422	43.055469
1626421	Engelmann Spruce	24.882704	100.457738	470.919197
1626426	Alpine Fir	6.272948	14.762005	271.787651
1626434	Alpine Fir	7.777826	13.709637	24.218702
1626444	Alpine Fir	9.82708	13.19158	80.729005
1626454	Alpine Fir	9.222974	14.65171	48.437403
1626462	Alpine Fir	13.795453	51.281082	134.548342
1626465	Alpine Fir	7.732975	13.088139	207.204447
1626479	Alpine Fir	8.193842	13.029911	88.801906
1626492	Alpine Fir	10.332543	15.140403	37.673536
1626495	Alpine Fir	9.139781	15.2248	142.621243
1626506	Alpine Fir	18.750961	75.928743	344.443756
1626513	Alpine Fir	8.432878	13.740552	53.819337
1626528	Alpine Fir	8.517597	15.317371	26.909668
1626536	Engelmann Spruce	22.00904	79.224407	360.589557
1626563	Alpine Fir	14.116956	57.618623	182.985745

1626570	Alpine Fir	8.819353	15.190571	102.25674
1626571	Alpine Fir	7.381152	13.182527	75.347072
1626586	Alpine Fir	10.837956	30.596654	191.058646
1626587	Alpine Fir	8.449729	21.747625	121.093508
1626606	Alpine Fir	13.140082	39.294392	110.32964
1626607	Alpine Fir	11.55518	27.465448	185.676712
1626617	Alpine Fir	4.216101	12.939481	110.32964
1626618	Alpine Fir	8.060626	15.414696	75.347072
1626628	Alpine Fir	8.004307	14.47717	78.038038
1626631	Alpine Fir	14.560464	32.861788	110.32964
1626637	Alpine Fir	9.514378	14.583827	29.600635
1626638	Alpine Fir	10.560818	30.344771	148.003176
1626640	Alpine Fir	12.656081	14.289997	204.51348
1626653	Alpine Fir	11.827978	30.615848	228.732181
1626659	Alpine Fir	6.166817	13.41763	182.985745
1626685	Alpine Fir	7.855022	13.342078	51.12837
1626713	Alpine Fir	12.975407	14.290013	88.801906
1626714	Alpine Fir	14.048875	16.99485	153.38511
1626719	Alpine Fir	9.184051	15.491947	59.20127
1626732	Alpine Fir	18.539006	76.853755	177.603811
1626734	Alpine Fir	9.176456	14.22536	384.808258
1626735	Alpine Fir	9.785604	13.560966	64.583204
1626752	Alpine Fir	9.981319	17.562162	107.638674
1626759	Alpine Fir	12.026551	13.946427	83.419972
1626770	Alpine Fir	11.191714	14.777418	269.096684
1626829	Alpine Fir	10.056447	15.075995	45.746436
1626838	Alpine Fir	10.929124	15.474194	13.454834
1629031	Alpine Fir	13.200338	34.440881	220.659281
1629036	Alpine Fir	7.111636	14.422871	169.530911
1629127	Alpine Fir	9.765618	33.840577	129.166408
1629130	Alpine Fir	9.363342	27.146193	174.912845
1629195	Alpine Fir	11.5837	14.092973	231.423148

Table D-42. Average canopy cover and height used in Shade model to produce Kaniksu Rocky/High Elevation shade curve.

Sites	Average Canopy Cover (%)	Average Height (m)	Overhang (m)
Keokee Creek	67	12.41	
Keokee Creek #2	78	9.78	
Devils Creek	62	10.3	
Uleda Creek	54	7.8	
Site Average	65.25	10.07 (33ft)	1

Appendix E. Public Participation and Public Comments

The TMDL addendum was developed with participation from the Priest River Watershed Advisory Group (WAG). The WAG started meeting in November 2011. Executive appointment letters were sent out in March 2013. The WAG has been meeting monthly since April 2013. The WAG represents a very diverse group of people and interests. Each of these diverse interests has had a voice in the process and recommendations in the development of the TMDL. The WAG has been, and will continue to be, open to all interested parties. DEQ's public comment period extended from April 30, 2015 through June 1, 2015. Comments received during public comment period are provided below:

- May 14, 2015 Web-comment received from Mr. Paul Koch
- May 18, 2015 Web-comment received from Mr. Todd Sudick, Bonner County Commissioner
- June 1, 2015 Letter received from Mr. Leigh Woodruff, U.S. Environmental Protection Agency
- June 1, 2015 Letter received from Mr. Kenneth Merrill, Kalispel Tribe of Indians

General Comments	Comment	Response
Mr. Koch	I feel that this is a very worthwhile project. Please proceed with this. I promise to fly fish that river.	Comment noted
Mr. Sudick	I don't see the science in the "recommended" temperature levels. The discussion on the Priest River that prompted the proposed siphon at Priest Lake didn't include any science. Comments centered around the lower 3rd of the Priest River. Since the river winds over a considerable distance, "cold" watered entered at the start of the river will be heated by the time it enters the lower third. Until someone can show me any baseline studies and the associated science I have a hard time signing on to "state water quality standards" that specify "recommended" water temperatures. The Priest River siphon looks to be an expensive boondoggle to me.	The "recommended" temperature levels in the Priest temperature addendum are those identified in Idaho Water Quality Standards according to Natural Background Conditions as Criteria (IDAPA 58.01.01.200.09). The Priest temperature addendum neither addresses nor is the basis for the Priest River siphon project mentioned.

General Comments	Comment	Response
Mr. Merrill	The Kalispel Tribe was disappointed to learn that changes have already been made to the public comment draft of the proposed TMDL addendum since its original posting. To ensure that the Tribe and other interested parties have a full opportunity to consider and comment on these changes, we request a formal 30-day extension of the public comment period. If this extension is not granted, we reserve the right to submit additional comments once we have a chance to review the new sections and any other modifications to the original document.	No changes have been made to the public comment draft since its original posting. The content that was suggested may be missing at the May 19, 2015 WAG meeting was found in the original public comment draft as confirmed in an email sent to WAG on 5/22/2015. Sorry for any confusion this may have caused. Since there have not been any changes to the public comment draft, there is no reason for a 30-day extension of the public comment period.
Mr. Merrill	The Kalispel Natural Resources Department supports the goal of the Clean Water Act and the fundamental concept of the Priest River Basin Temperature TMDL addendum to restore and protect coldwater habitat as much as possible for the recovery of sensitive native cold water salmonids such as bull trout. This goal is especially important in the Priest Lake/River Basin because it is projected to be one of the most resilient basins for providing native salmonid coldwater habitat in the face of future climate warming.	Comment noted
Mr. Merrill	Protecting and restoring maximum stream shade in stream corridors of the Priest Lake/River Basin for the coolest water temperatures possible is appropriate and supported where natural stream conditions may seasonally exceed the optimal numeric temperature criterion.	Comment noted

General Comments	Comment	Response
Mr. Merrill	As previously commented in meetings of the WAG, the proposed TMDL addendum fails to provide a workable strategy, or any reasonable assurances, that maximum stream corridor shading with maximum natural vegetation will be restored to maximum levels where stream corridor vegetation/shade has been degraded by man-caused activities, or that it will be protected where pristine conditions exist and shade is at the maximum possible	DEQ provides target loads for pollutants within the TMDL. It is up to the designated management agencies and land owners to provide the needed reductions to achieve those targets. DEQ has no control over that process.
Mr. Merrill	Reliance on the Idaho Forest Practices Act (IFPA) to restore or protect maximum stream corridor shade is fundamentally flawed because the rules allow cutting of shade trees in the stream corridor in direct conflict with the TMDL goal of achieving and maintaining the maximum possible amount of shade for any given site.	Again, DEQ provides targets for pollutant reductions. DEQ is not responsible for the FPA or its ability to achieve those targets.
Mr. Merrill	The proposed TMDL addendum appears to be confusing the estimated potential natural vegetation (PNV) from modeling as the maximum shade target needed at any given location where the TMDL goal must be for maximum shade possible for any given site without human- caused degradation. This difference needs to be clarified in the body of the text.	The PNV approach estimates target shade quantities from reference land types which have a range of shade targets under natural conditions. For any given stream segment it is not possible to know exactly what natural shade levels should be. We estimate shade targets through modeling using plant community data that has been collected by other entities. We expect resulting targets to be reasonably close to the real thing for a given plant community, but don't presume an exact fit. The targets are reasonable goals to work towards.
Mr. Merrill	PNV methodology with poorly vetted new forest type models and non-representative solar loading using solar data from Spokane is not adequate for estimating natural water temperature conditions in the Priest Lake/River Basin.	Additional description of the supplemental forest type models has been added to the document for clarification. PNV methodology and supplemental forest types have been developed by DEQ statewide in other TMDLs which have been approved by EPA.

General Comments	Comment	Response
Mr. Merrill	The new Kaniksu forest type apparently underestimates PNV as illustrated by some streams currently already exceeding the estimated PNV and should be used conservatively in any estimations.	The modeling that produces a shade curve for target purposes provides reasonable goals, but may not be exact. We anticipate that natural conditions may produce shade in excess of the target or conversely may produce levels that never achieve the target.
Mr. Merrill	Adding a split forest type within a given watershed adds some complexity in the basic assumptions for the probability of occurrence of tree species make-up and size used to derive estimated PNV. There needs to be more consideration of the estimated PNV where the split forest type is applied.	It is not known what is being referred to as a “split forest type.”
Mr. Merrill	Solar loading is considerably different between Spokane Airport and Priest Lake. Using Spokane solar data greatly overestimates summer solar loading in the Priest Lake Basin. As previously mentioned in the WAG, there is solar data available from the Priest Lake Ranger station that should be used in calculations where solar radiation is used.	DEQ in its temperature TMDLs uses solar load data from National Renewable Energy Lab (NREL) sites. These sites are regional, and 6-month average loads vary from 5.7 $kWh/m^2/day$ to 6.4 $kWh/m^2/day$ across the state. These loads are not expected to be exact and regional levels are sufficient to provide a basis for determining approximate stream loads.
Mr. Merrill	Any comparison of existing stream temperatures in the Priest Lake Basin to modeled water temperatures derived using Spokane solar radiation values will lead to erroneous conclusions.	DEQ does not model stream temperatures in its TMDL. The streams solar load is approximate and provides an ability to compare one stream to another with respect to relative heat load contribution. It is not exact nor does it need to be for the purpose intended.

General Comments	Comment	Response
Mr. Merrill	There appears to be no effective safety factor provided within the TMDL addendum with the new estimates of PNV on the streams on the eastside of Priest Lake.	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 target levels. Because shade levels are established at approximately system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the loading analysis. Although the loading 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 at presumed maximum levels, rather than specific nonpoint source activities.
Mr. Woodruff Pg. 27	Existing Shade Field Verification – It would be helpful to include, whether as a link or appendix, the Solar Pathfinder field verification data. In addition, it would be helpful to more clearly explain how field verification results were used to adjust or correct existing shade values	Pathfinder data were collected by DEQ at five sites, and additional pathfinder results were accumulated from FPA audit sites in the area. Because DEQ regional office staff was being trained to provide the aerial interpretation of existing shade, the results of the pathfinder data were incorporated without retaining the original interpretation's results. Thus, no comparison can be made regarding pre-verification shade estimates to data. We will provide the pathfinder results in an appendix.
Mr. Woodruff Pg. 30	Rocky/High Elevation Shade Curve – There is a thorough description of data and analyses associated with the other shade curves found in Shumar and De Varona 2009. We recommend that similarly thorough documentation be included for the new shade curve either as a reference or appendix within the TMDL.	DEQ has further described the Rocky/High Elevation Shade Curve.

General Comments	Comment	Response
Mr. Woodruff Pg. 71	Appendix D Lakes and Ponds – We recommend that in the methods section the TMDL provide a more thorough explanation of “lake” and “pond”. Specifically, what constitutes a lake or pond and why they are given 0% for both existing and target shade. Is 0% shade for a lake or pond an accurate representation of shade derived natural riparian vegetation around such features and does setting a target of 0% send the right message to land owners and/or management agencies? While the natural shade over beaver ponds, for example, may be less than the adjoining stream, retaining natural streamside vegetation and shade adjacent to these ponds is likely just as important as retaining shade along the stream itself.	Lakes and ponds are assumed to have an existing shade class of 0% by virtue of their size. Because lakes and ponds may be natural features in this landscape, we do not set a target shade level for them. They default to zero. It is true that beaver ponds may end up with targets based on the un-altered stream that they are on. That is because it is often too difficult to see them or to know where they are. We assume that beaver ponds associated shade target will be ignored at implementation levels.

Appendix F. Distribution List

Copies of the final report will be provided to the Idaho Department of Environmental Quality State Office, US Environmental Protection Agency, and Priest Watershed Advisory Group participants.