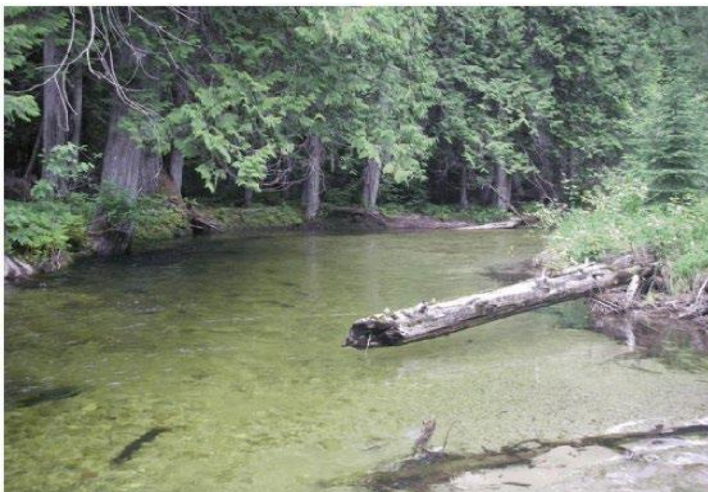
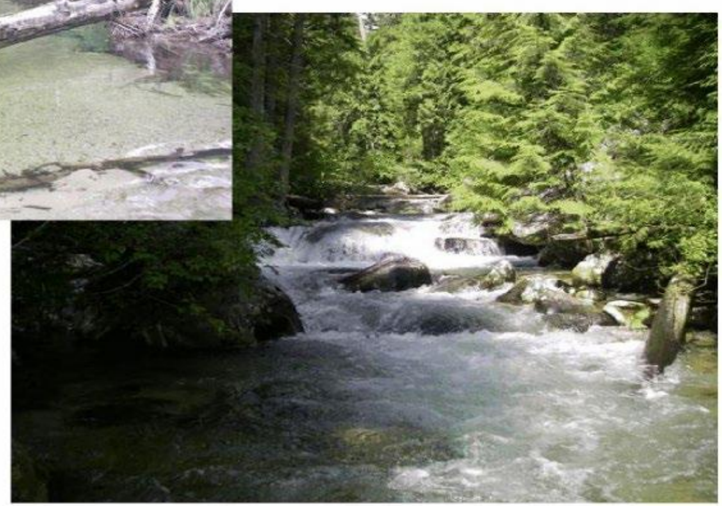
Priest River Subbasin Assessment and Total Maximum Daily Load

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).

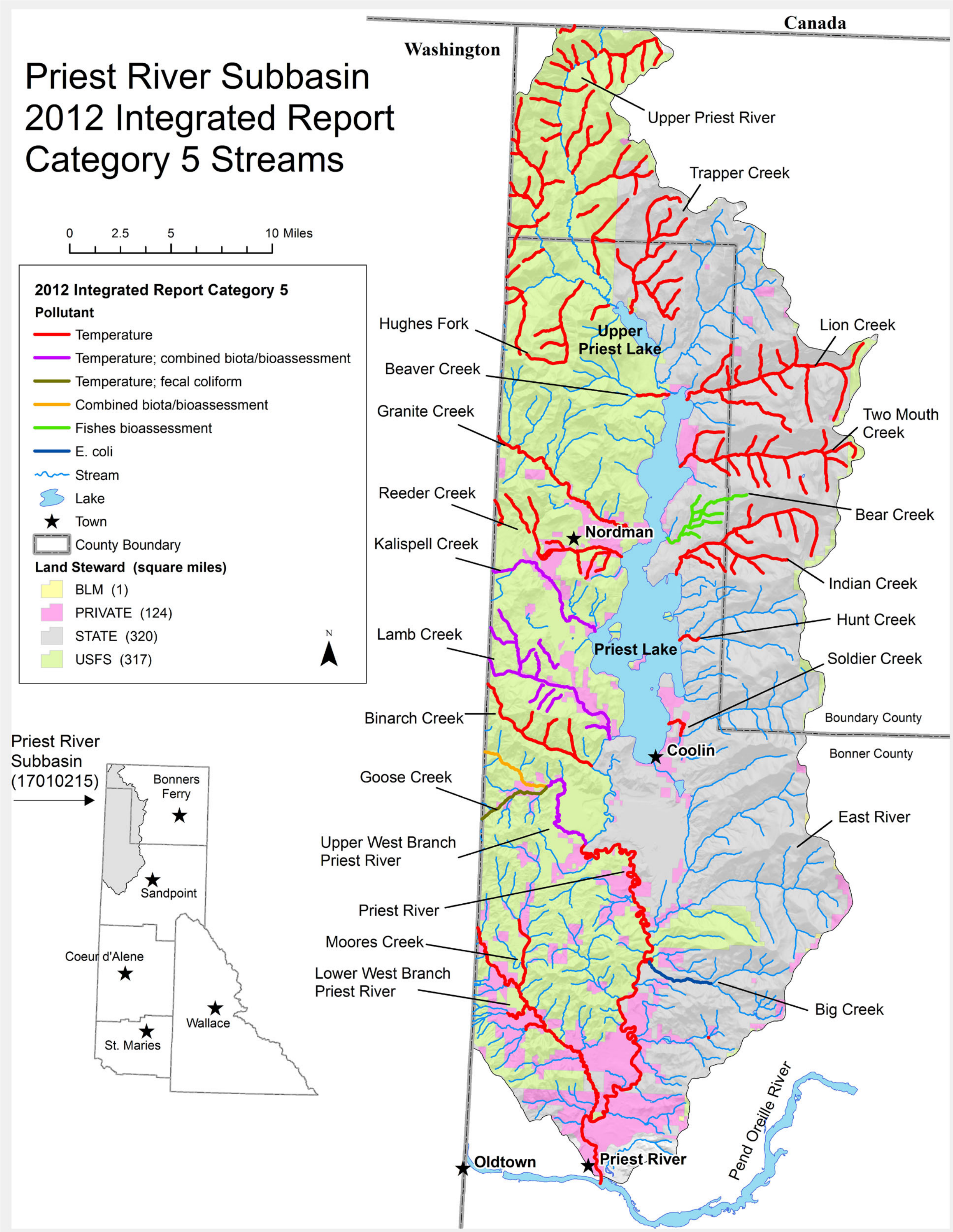

Figure A. Subbasin at a glance.

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

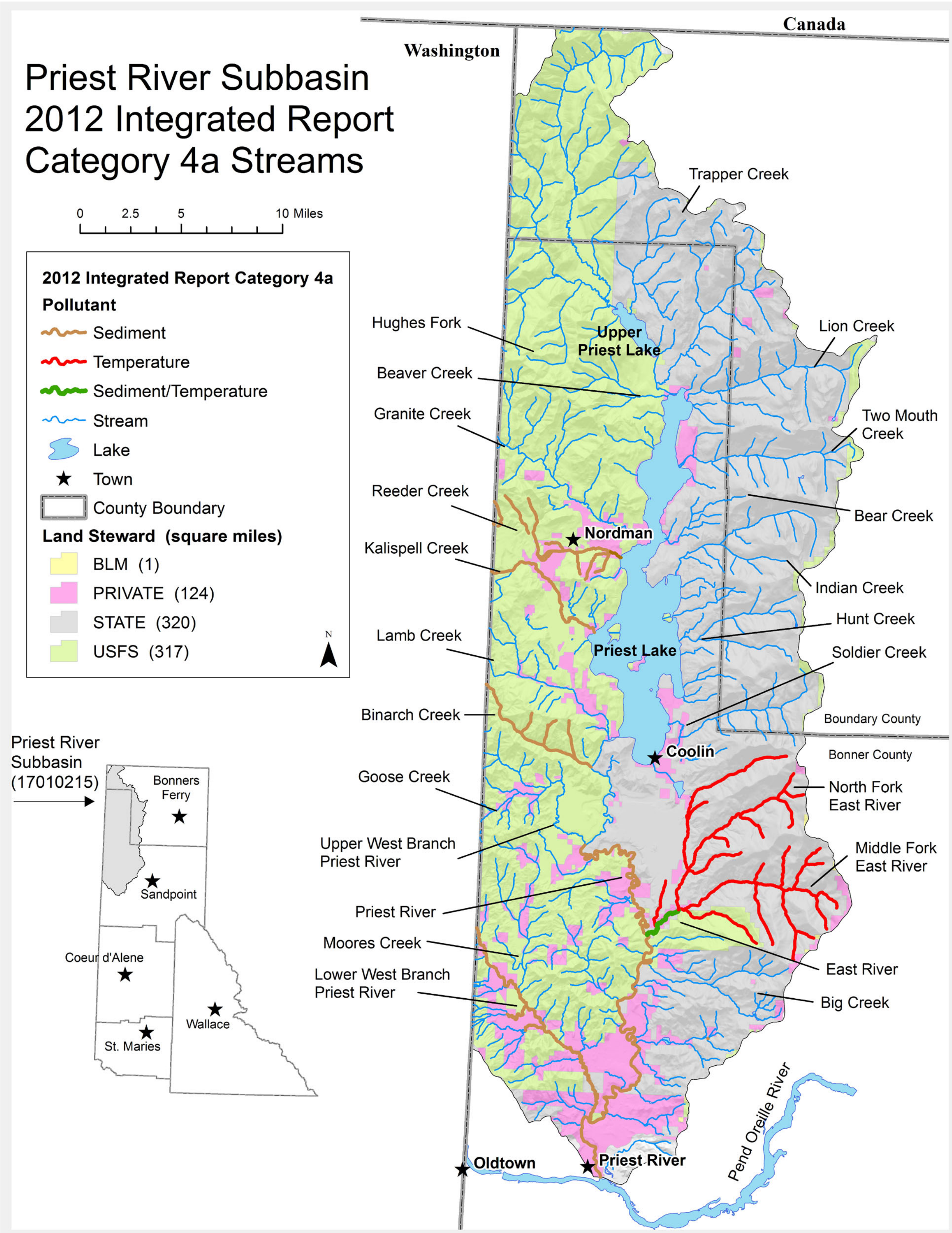

Figure B. Priest River subbasin 2012 Integrated Report Category 4a streams.

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).

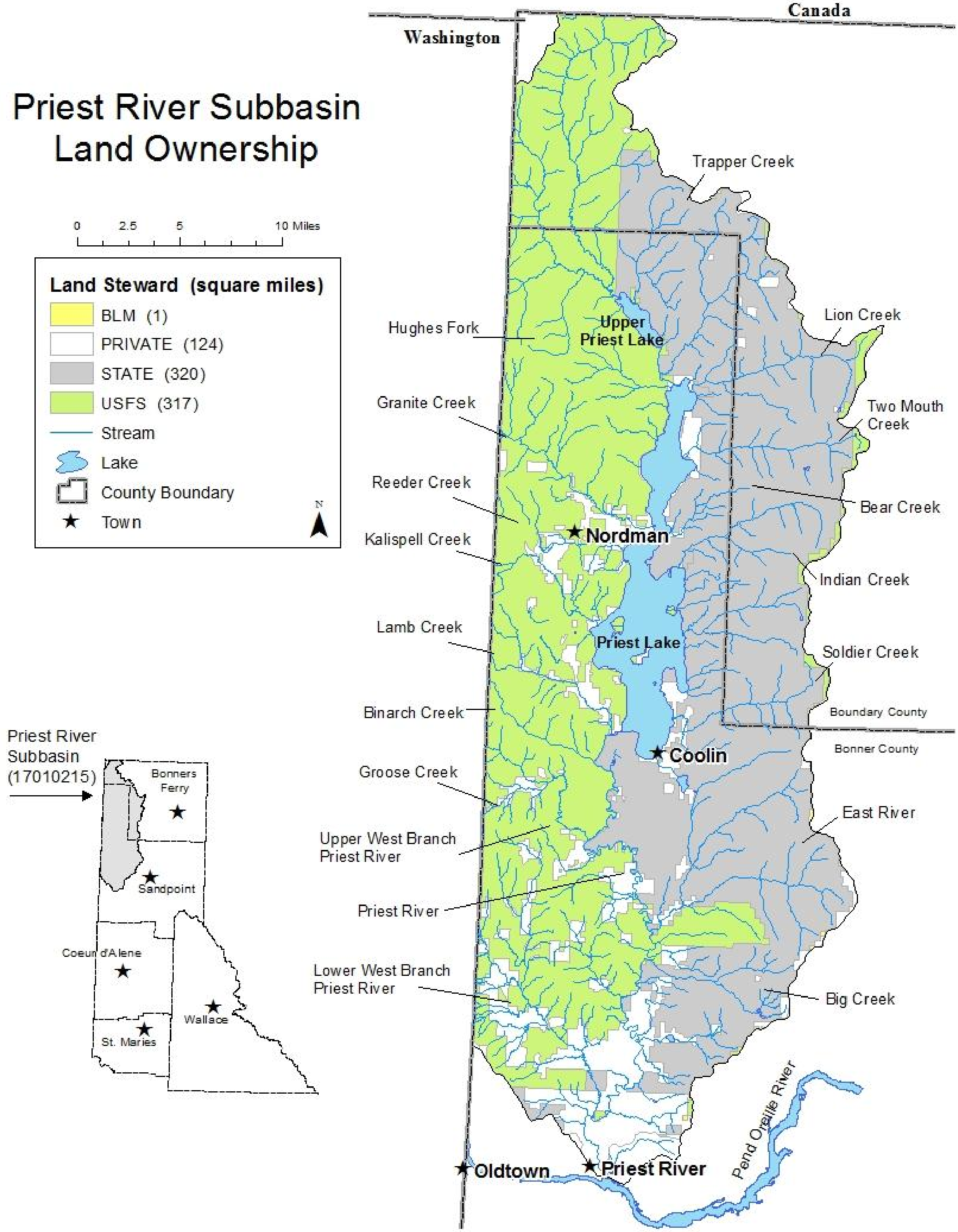

Figure 1. Priest River subbasin landownership.

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).

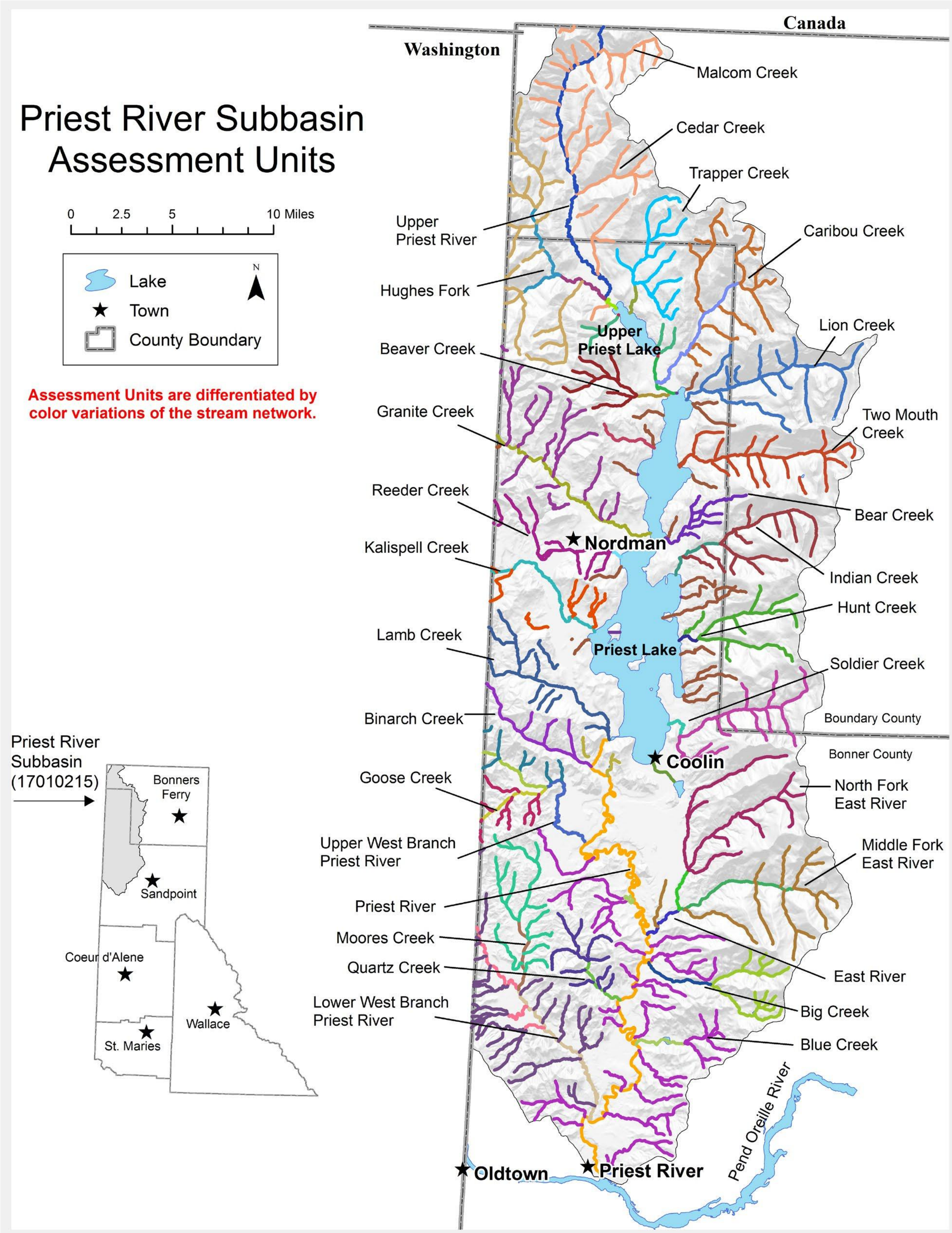

Figure 2. Priest River subbasin assessment units.

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).

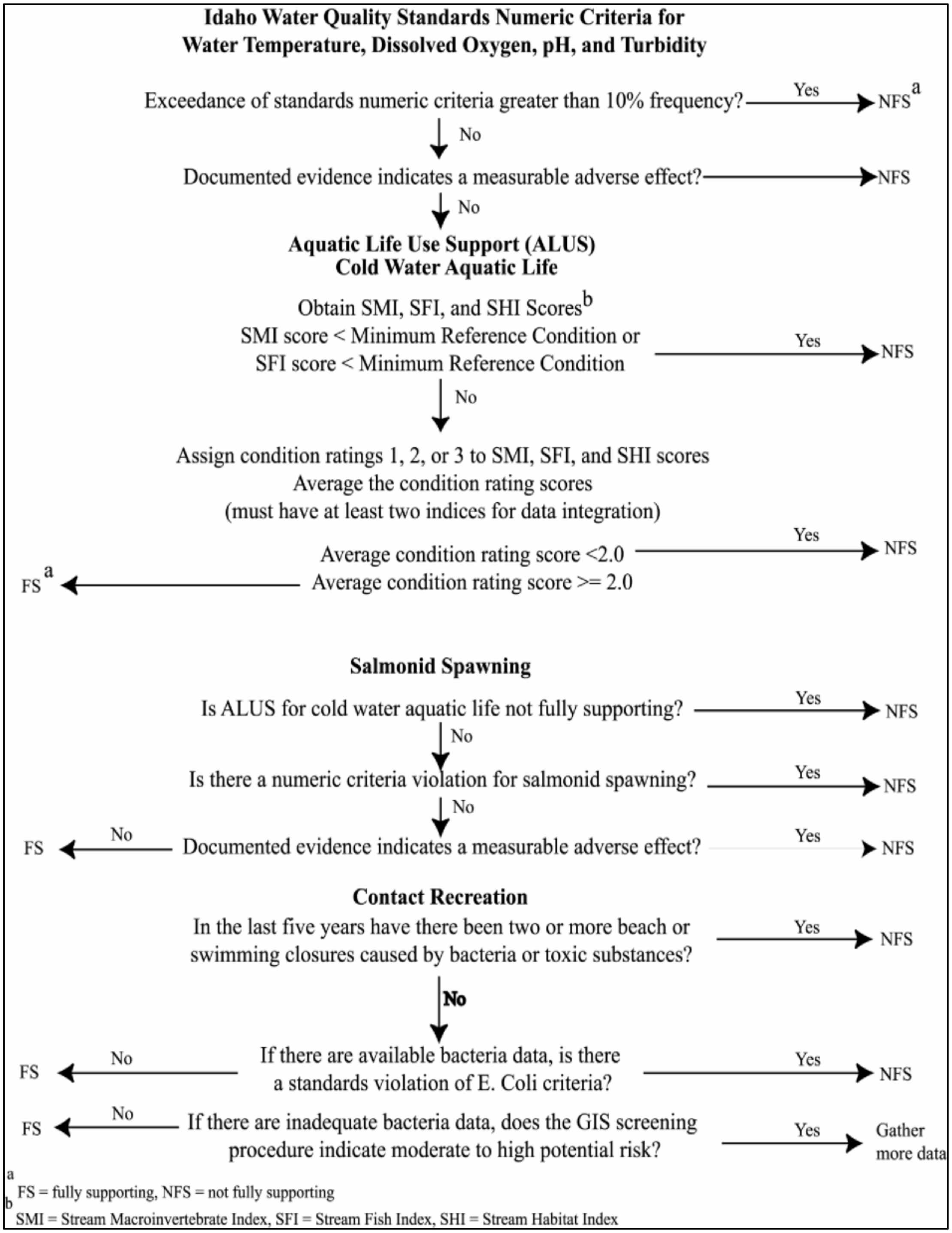

Figure 3. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

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.

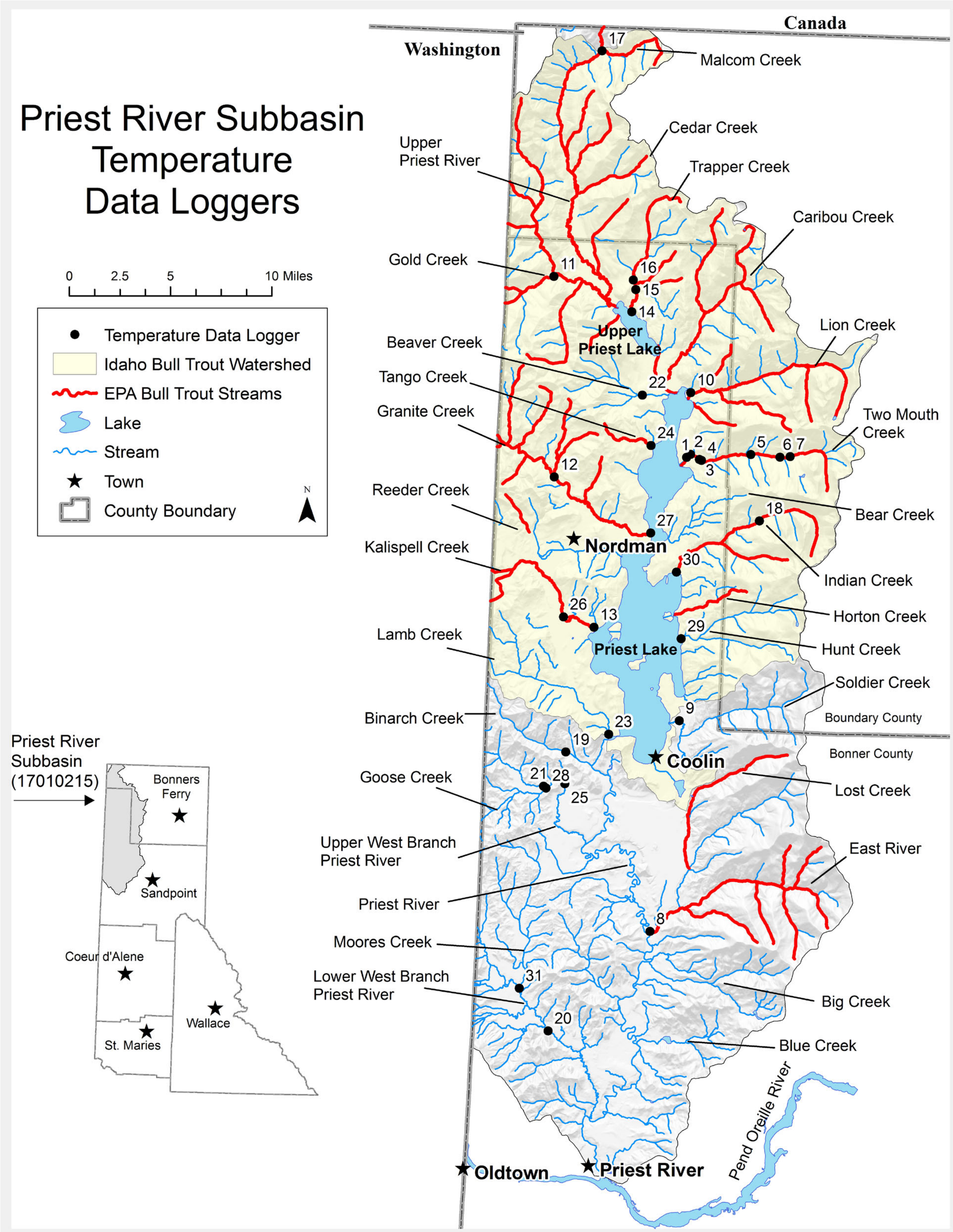

Figure 4. Priest River subbasin temperature data logger locations.

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.

				Idaho Criteria				Federal Criteria	
Stream Name	Assessment Unit Number	Map ID	Temp Logger ID	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.

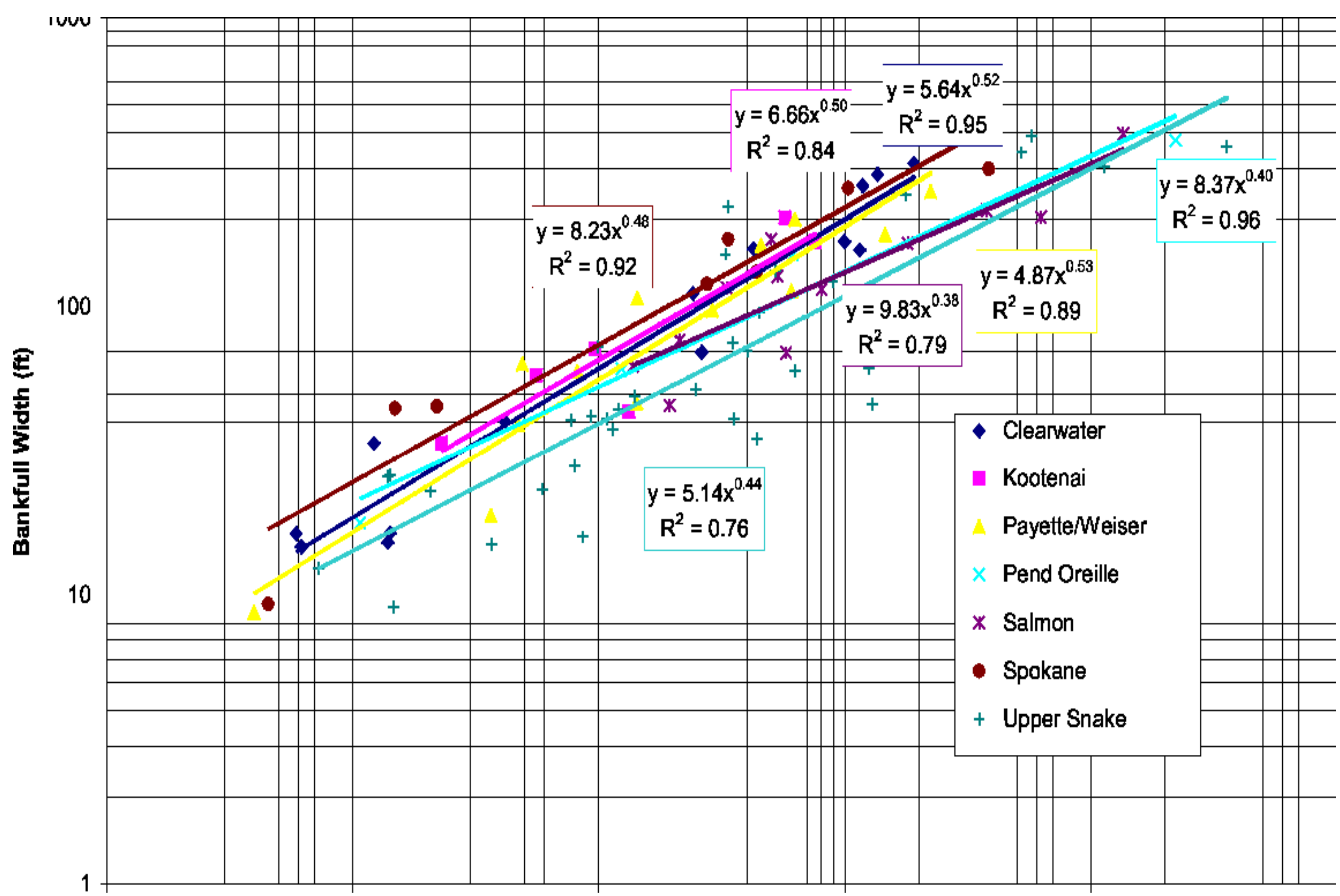

Figure 5. Bank-full width as a function of drainage area.

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.

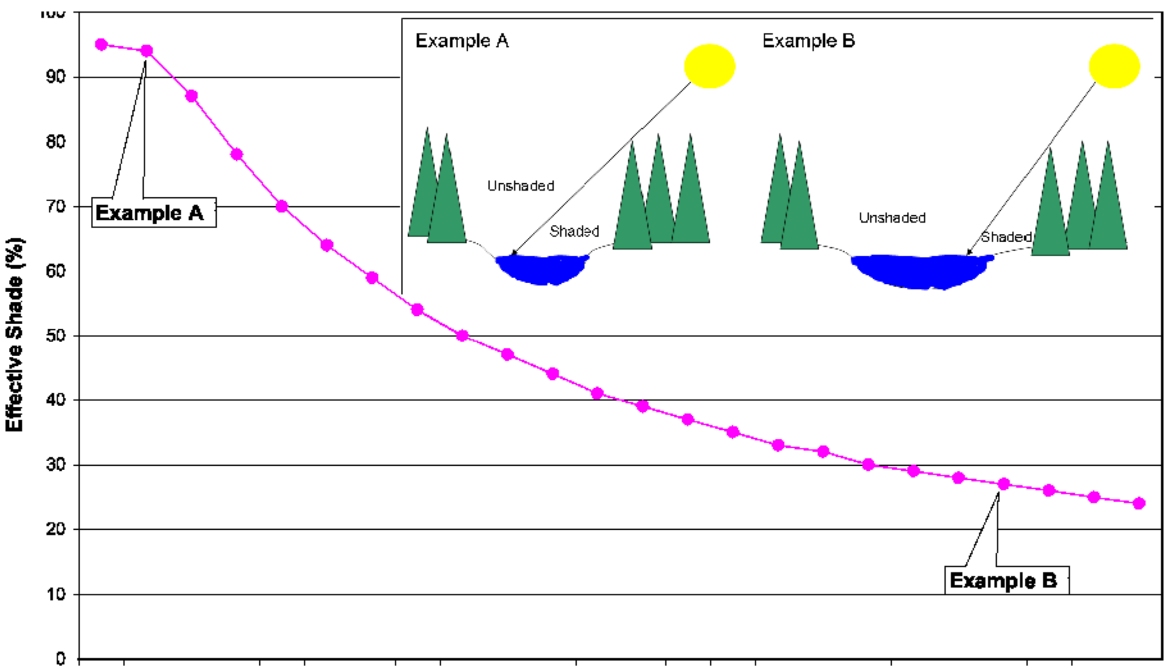

Figure 6. Example relationship between stream width and shade.

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 - Hardwoods - 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 - Hardwoods - 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 - Hardwoods - 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 - Hardwoods - 0/1	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

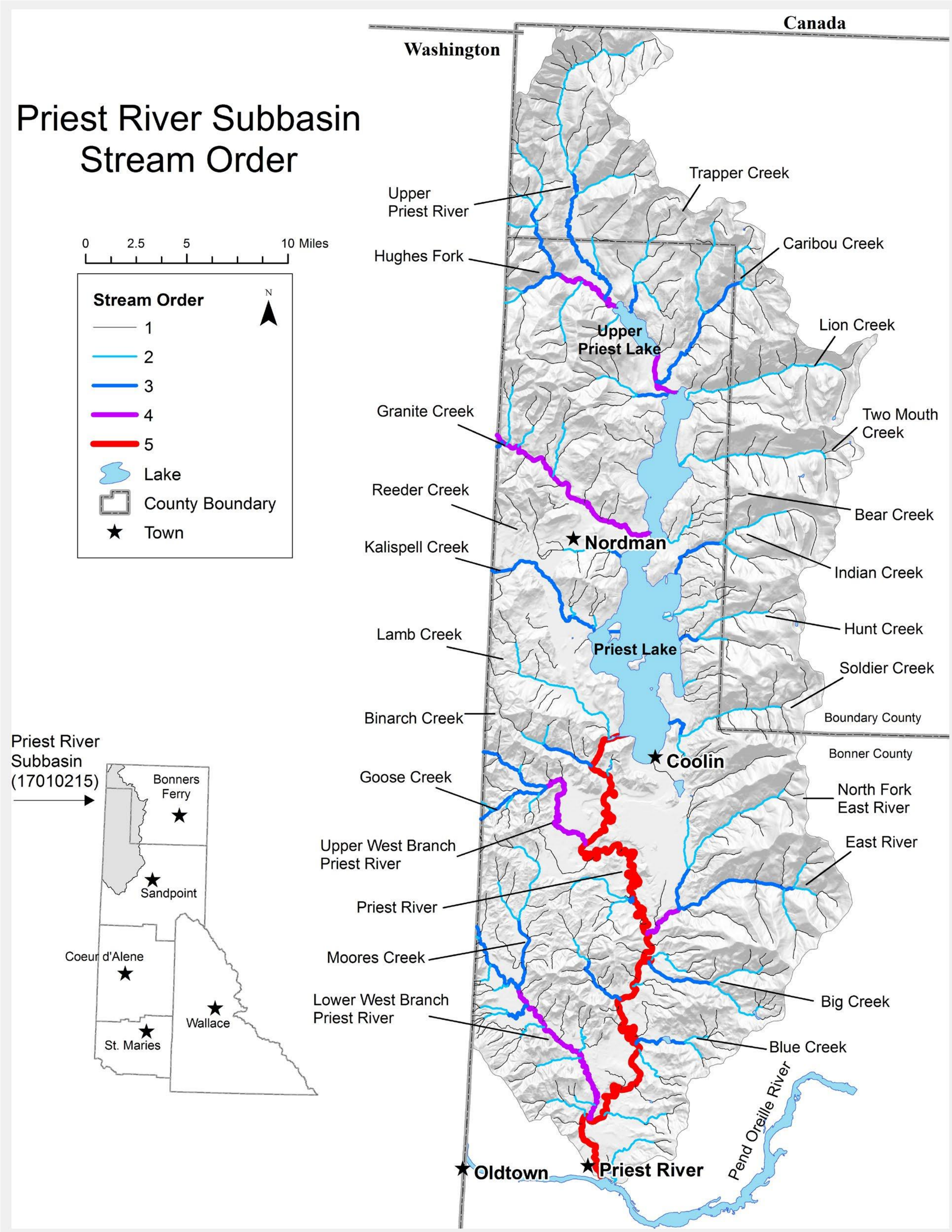

Figure A-1. Stream orders for the Priest River region.

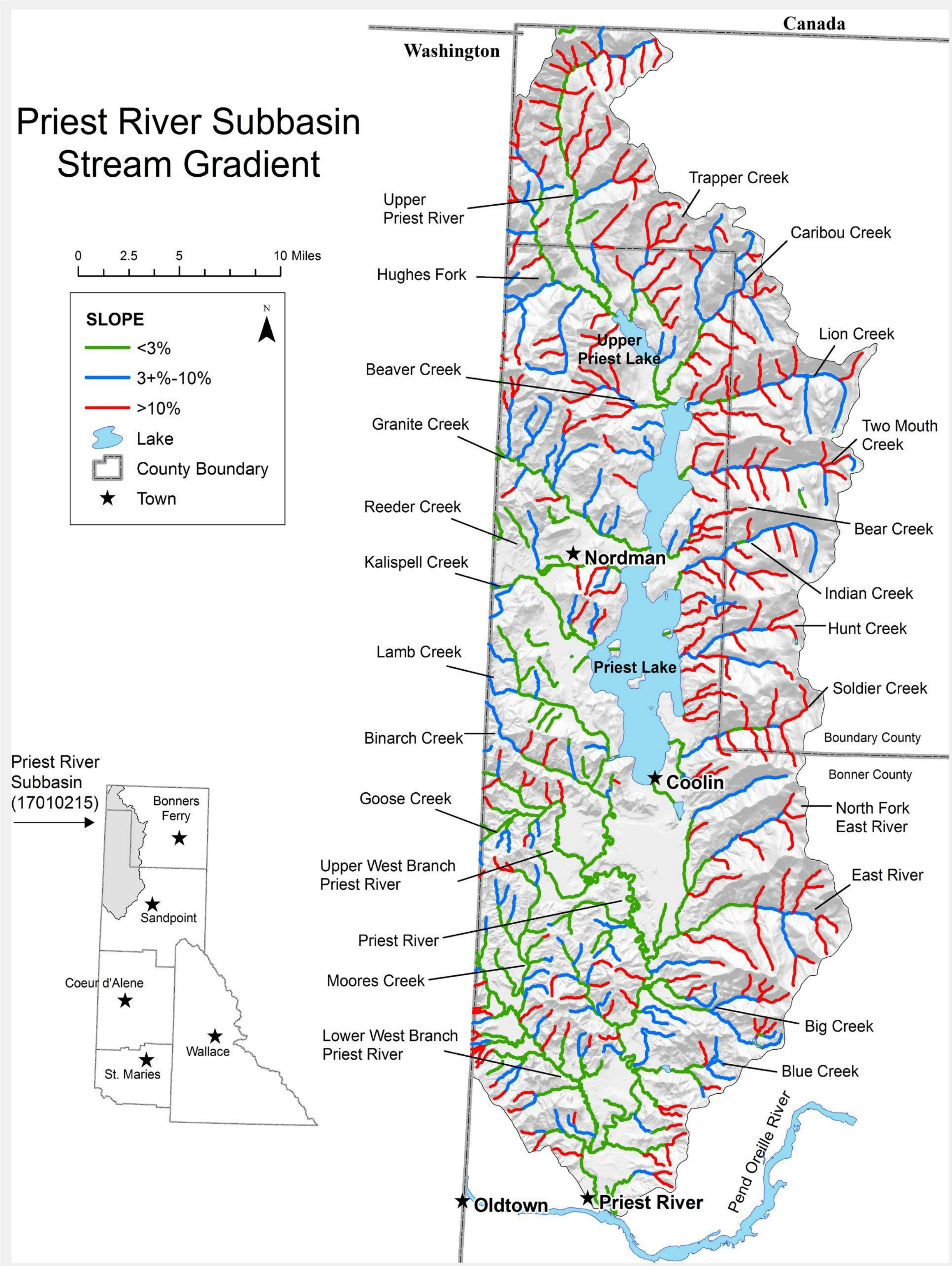

Figure A-2. Stream gradient for the Priest River region.

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/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	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/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	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/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	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/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	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/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	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/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	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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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/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
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.

AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation