Coeur d'Alene Lake Tributaries Temperature Total Maximum Daily Loads

Addendum to the Coeur d'Alene Lake Subbasin Assessment and Total Maximum Daily Loads

Final

State of Idaho
Department of Environmental Quality
January 2012
Revised February 2012

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Acknowledgments

The cover photo was taken near the mouth of Mica Creek in August 2008.

This document was completed by Mark Shumar of DEQ's Technical Services Division. Staff from the DEQ Coeur d'Alene Regional Office assisted with field-verification of existing shade estimates. Kristin Keith of the Coeur d'Alene Regional Office added specific information on the Coeur d'Alene Lake tributaries subbasin and made the final edits to the document.

This document was developed with consultation from the Coeur d'Alene Lake Tributaries Watershed Advisory Group (WAG). WAG meetings were held once a month and they were open to the public. The WAG's local knowledge of the watersheds and comments on surface water standards and beneficial use designations were valuable in this TMDL process.

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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
ARU	aquatic response unit
AU	assessment unit
BMP	best management practice
C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGP	Construction General Permit
CWA	Clean Water Act
CWAL	cold water aquatic life
DEQ	Department of Environmental Quality
DMA	designated management agency
EPA	United States Environmental Protection Agency
ft	feet
GIS	geographic information systems
HED	hydroelectric development
HUC	hydrologic unit code
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
kWh	kilowatt-hour
LA	load allocation
LC	load capacity
m	meter
MDAT	maximum daily average temperature
MDMT	maximum daily maximum temperature
mi	mile
MOS	margin of safety
MWMT	maximum weekly maximum temperature
n.a.	not applicable
NA	not assessed
NB	natural background
nd	no data (data not available)
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
PNV	potential natural vegetation
SS	salmonid spawning
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
US	United States
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United State Fish and Wildlife Service
VRU	vegetation response unit
WAG	watershed advisory group
WLA	wasteload allocation
WQS	water quality standards

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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 two years and is included as the list of Category 5 waters in the Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants set at a level to achieve water quality standards.

This document addresses streams within the Coeur d'Alene Lake subbasin (hydrologic unit code [HUC] 17010303). The Coeur d'Alene Lake subbasin is located in northern Idaho and includes the Coeur d'Alene River from the confluence of the North and South Forks of the Coeur d'Alene River to Coeur d'Alene Lake, as well as tributaries to both the lake and the river. Beneficial uses of streams within the Coeur d'Alene Lake subbasin include cold water aquatic life throughout the subbasin. Recent data suggest salmonid spawning is an existing beneficial use for all the streams evaluated in this TMDL analysis. In addition, the mainstem Coeur d'Alene River has been designated by the US Fish and Wildlife Service (USFWS) as critical habitat for bull trout.

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.

An analysis of historical temperature data collected from streams within the subbasin indicates Idaho water quality standards for temperature were exceeded in 14 streams and their tributaries. All assessment units with data conclusive of exceedance(s) of temperature standards are included in this TMDL document.

This TMDL analysis has been developed to comply with Idaho's TMDL requirements. A TMDL analysis quantifies pollutant sources and allocates the responsibility for load reductions needed to return §303(d)-listed waters to a condition that meets water quality standards. For more information about these watersheds and the subbasin as a whole, see the *Coeur d'Alene Lake and River (17010303) Sub-basin Assessment and Proposed Total Maximum Daily Loads* (DEQ 1999).

Subbasin at a Glance

The Coeur d'Alene Lake subbasin (hydrologic unit code [HUC] 17010303) drains 650.5 square miles, which include the Coeur d'Alene Lake, the Coeur d'Alene River, and the waters that drain directly to the river and the lake (Figure A). The Coeur d'Alene Lake subbasin is located in Benewah, Bonner, Kootenai, and Shoshone Counties of northern Idaho. A portion of the subbasin is also within the boundaries of the Coeur d'Alene Reservation. The subbasin lies within the Northern Rocky Mountain physiographic region to the west of the Bitterroot Mountains.

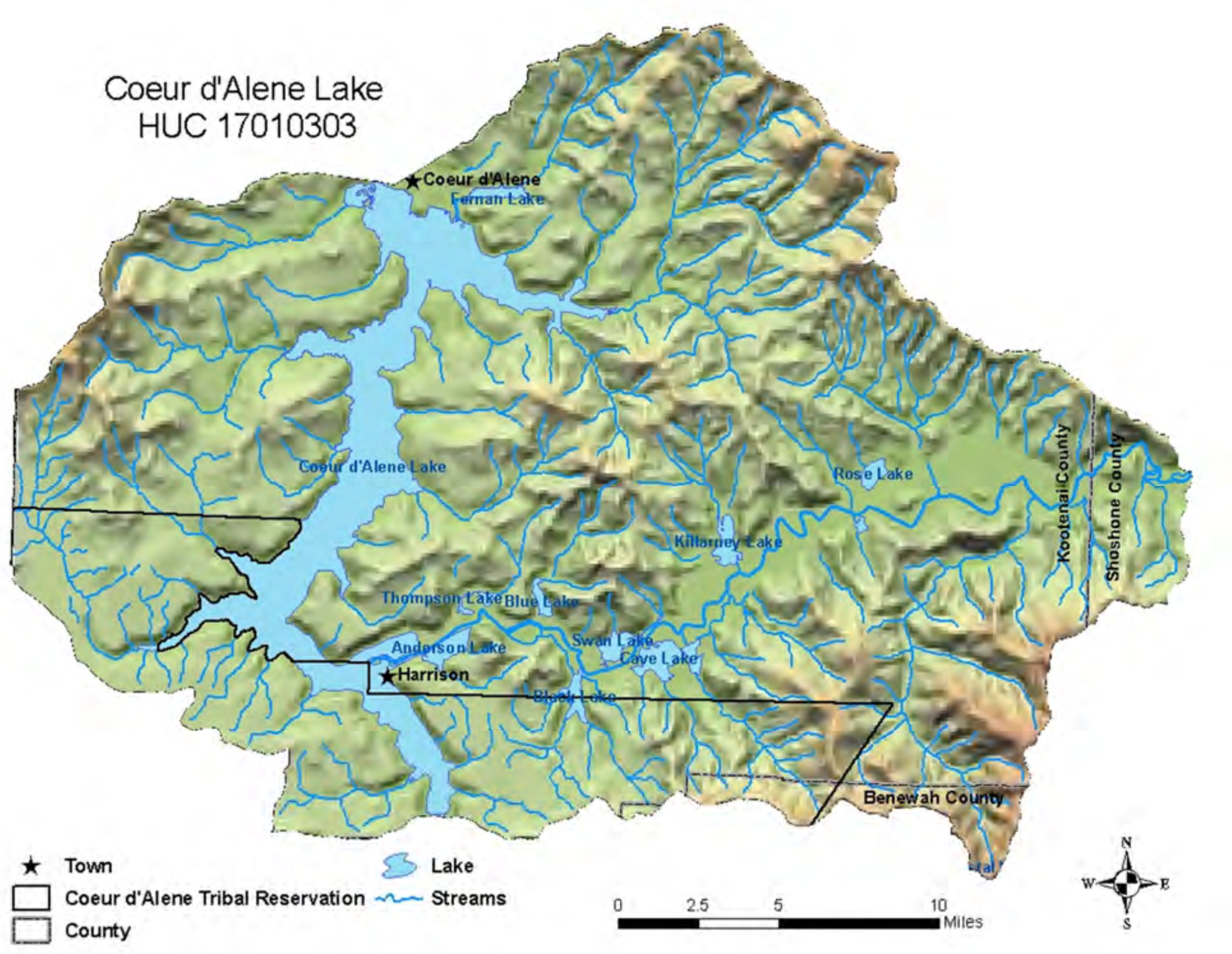

Figure A. Extent of Coeur d'Alene Lake subbasin (HUC 17010303).

The Coeur d'Alene River is the second largest tributary contributing flow to Coeur d'Alene Lake, second only to the St. Joe River. The Coeur d'Alene River flows from the confluence of the North and South Forks of the Coeur d'Alene River near Enaville, Idaho, westward to its mouth at Coeur d'Alene Lake near Harrison, Idaho. The river's tributaries flow from the Coeur d'Alene Mountains on the north and by the St. Joe Mountains on the south. Tributaries to the lake from the west flow either from the Palouse Hills or from the most southerly mountains of the Selkirk Range.

The Coeur d'Alene River flows through a generally broad floodplain ranging from 0.25 to 1.75 miles wide. Eleven lakes and numerous wetlands are located laterally to the river below Rose Lake. The lakes and wetlands are extensions of the high water table of the lower river valley. The lakes are hydrologically connected to the river by natural and man-made surface channels in all but three cases, where the connection is through the valley ground water.

Streams from the mountains have watersheds predominantly in the elevation range of 3,000–4,500 feet and are subject to winter "rain-on-snow" discharge events. The relative low elevation of these watersheds causes earlier maximum discharge than from the majority of the watersheds of the North and South Forks of the Coeur d'Alene River. Backwater conditions exist during May through September on the Coeur d'Alene River from Cataldo to the mouth due to control of surface elevation of Coeur d'Alene Lake at Post Falls Dam. The inundated channel during May through September attracts seasonal recreational boaters. Backwater conditions during spring high flows are from a natural sill at the lake outlet, not due to Post Falls Dam.

Most of the subbasin is primarily underlain by schist and gneiss of the Belt Supergroup metasediments. On the lower floodplain toward the mouth of the Coeur d'Alene River, the watershed is underlain by alluvium and lacustrine deposits. Many of the tributaries to the lake have a wedge of water-deposited alluvium (deltaic sediments) at the lowest portions of the watershed between 2,128 and 2,182 feet (Figure B). These wedges influence the hydrologic characteristics, and they result in subsurface flow into Coeur d'Alene Lake during the summer months. The wedges vary in length. Perennial flow exists upstream of the deltaic sediments on most tributaries to the lake.

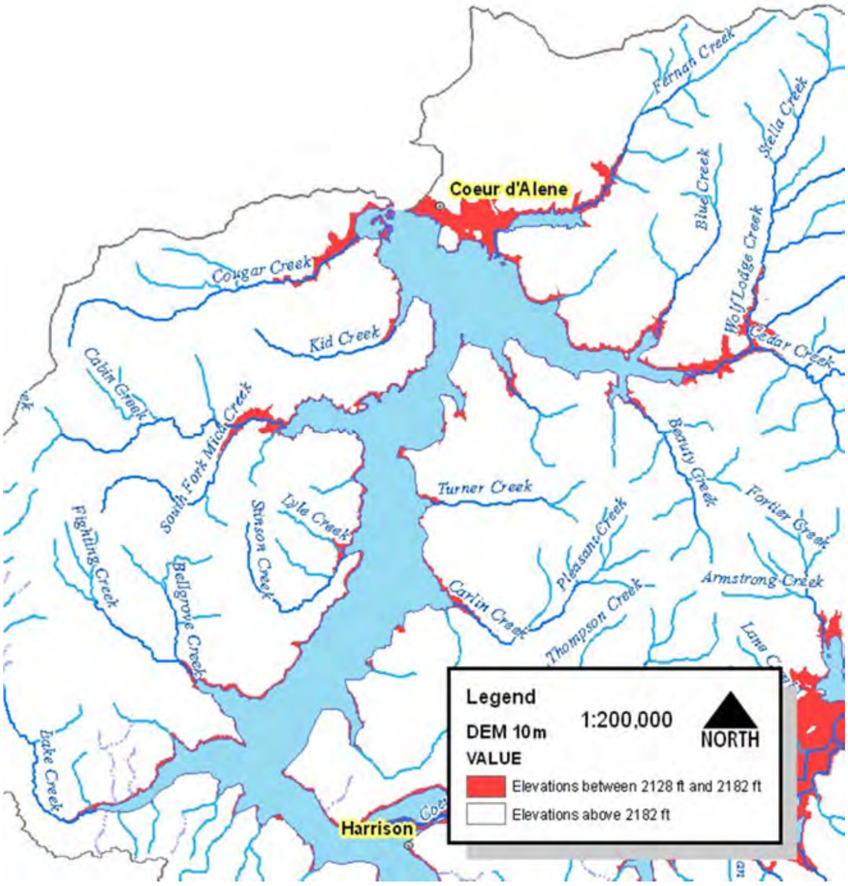

Figure B. Map of deltaic sediment deposits around Coeur d'Alene Lake (in red).

Key Findings

This document addresses streams within the Coeur d'Alene Lake subbasin (hydrologic unit code [HUC] 17010303). In this subbasin, 22 assessment units (AUs) involving 14 major watersheds were identified as having temperature-related impairment and most have been placed on the §303(d) list of impaired waters (i.e., Category 5 of the Integrated Report) by the US Environmental Protection Agency (EPA) or the State for reasons associated with temperature criteria violations. This TMDL analysis addresses those streams included in Category 5 of *Idaho's 2010 Integrated Report* (DEQ 2011) as well as streams not listed but found to be impaired (denoted by * in Table A). Table A and Figure C shows all the streams addressed in this temperature TMDL document.

Table A. Streams listed in Category 5 for temperature in the final 2010 Integrated Report or found impaired and addressed in this TMDL analysis.

Stream	Assessment Units
Latour Creek and tributaries	ID17010303PN015_02
Rose Creek and tributaries	ID17010303PN021_02
Killarney Lake tributaries	ID17010303PN022_02
Blue Lake Creek and tributaries	ID17010303PN024_02
Carlin Creek and tributaries	ID17010303PN026_02
Cedar Creek and tributaries	ID17010303PN030_02 ID17010303PN030_03
Coeur d'Alene River	ID17010303PN007_06 ID17010303PN016_06
Fourth of July Creek and tributaries	ID17010303PN020_02 ID17010303PN020_03
Fernan Creek and tributaries	ID17010303PN032_03* ID17010303PN034_02 ID17010303PN034_02a* ID17010303PN034_03
Beauty Creek and tributaries	ID17010303PN028_02 ID17010303PN028_03
Cougar Creek and tributaries	ID17010303PN002_02
Mica Creek and tributaries	ID17010303PN004_02
Marie Creek and tributaries	ID17010303PN031_02
Wolf Lodge Creek and tributaries	ID17010303PN029_02 ID17010303PN029_03

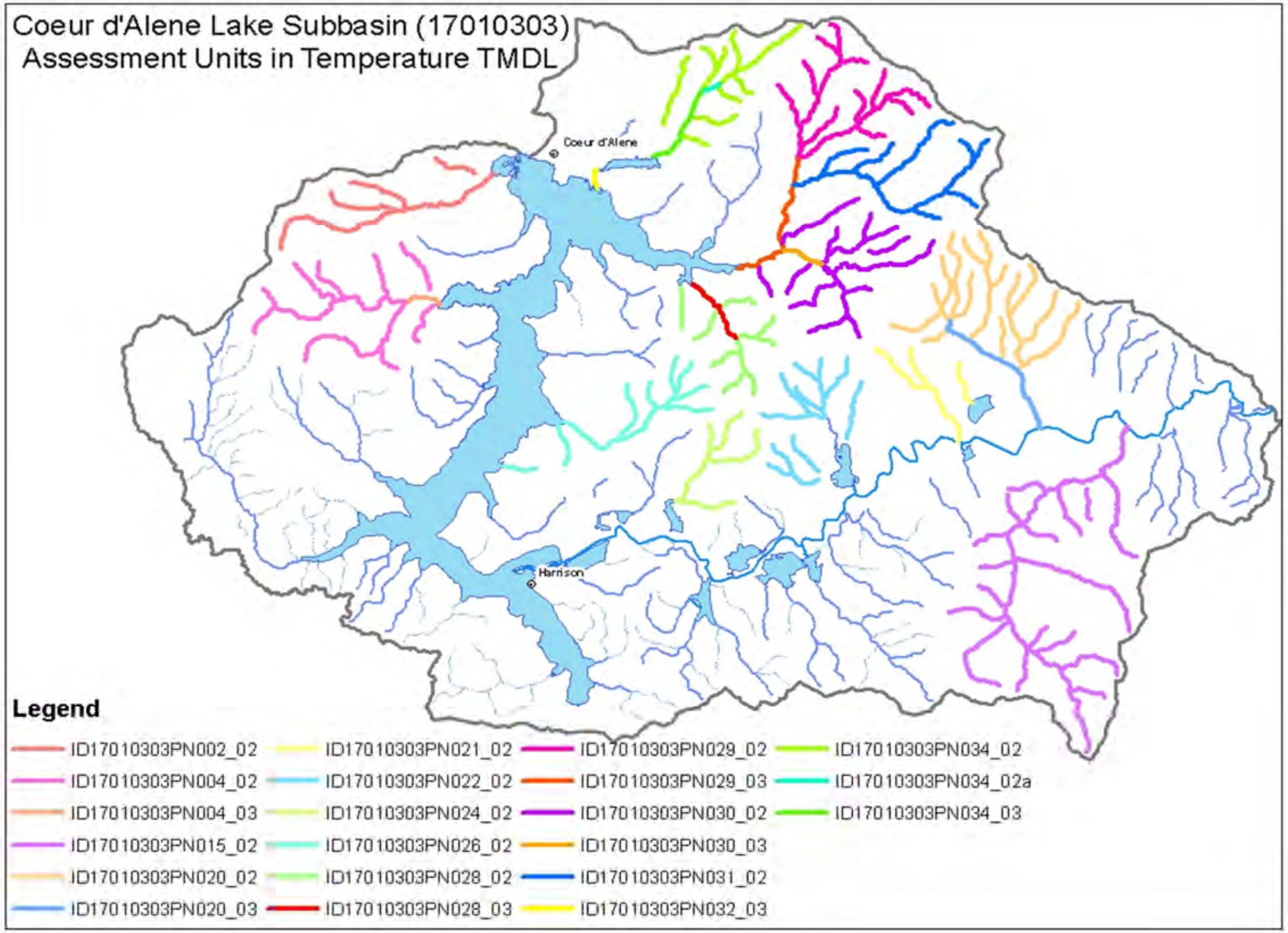

Figure C. Coeur d'Alene Lake subbasin—21 assessment units evaluated in the temperature TMDL.

The Idaho Department of Environmental Quality (DEQ) established effective shade targets for 20 AUs based on the concept of maximum shading under potential natural vegetation (PNV) resulting in the lowest possible natural stream temperatures. Shade targets were derived from effective shade curves developed for Idaho Panhandle vegetation types by DEQ and EPA. DEQ estimated existing shade from aerial photo interpretation, and these estimates were field-verified using a Solar Pathfinder to measure shade at specific locations. Comparing shade targets to estimates of existing shade results in estimates of shade deficits and the amount of shade that must be restored to individual stream reaches.

Most streams examined in this TMDL had shade deficits and excess solar loads. The Latour Creek and Wolf Lodge Creek assessment units had the largest excess loads but not necessarily the highest proportion in excess. The Mica Creek, Cougar Creek, and Carlin Creek assessment units had the lowest levels of excess solar load and lack of shade. Most of the remaining assessment units examined had similar shade deficits, mostly occurring in lower-elevation sections that have been affected by land-clearing activities.

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.

TMDLs were not developed for the Coeur d'Alene River (assessment units ID17010303PN016_06 and ID17010303PN007_06) because it is inappropriate to use PNV methodology on a river 50 meters wide or greater. Separate TMDLs for the Coeur d'Alene River using more appropriate methodology are required. However, backwater conditions in the Coeur d'Alene River, caused by operation of the Post Falls HED, result in an increase in temperature in the Coeur d'Alene River upstream from the mouth to Cataldo. As is the case with other impounded waters in the country, the flow alteration and backwater conditions preclude the ability to fully mitigate temperature impairment caused by this condition.

As a result of this temperature TMDL assessment, recommendations for changes in Integrated Report category listings were made (Table B). Twenty assessment units are recommended to be moved to Category 4a of Idaho's 2012 Integrated Report.

Table B. Summary of assessment outcomes. (Streams denoted with * are unlisted but impaired for temperature)

Water Body Segment/ Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Cougar Creek ID17010303PN002_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
North and South Forks Mica Creek ID17010303PN004_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Coeur d'Alene River ID17010303PN007_06 ID17010303PN016_06	Temperature	No	None	PNV methodology is inappropriate for this 6th order river. A separate TMDL is required.
Latour Creek and tributaries ID17010303PN015_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Fourth of July Creek ID17010303PN020_02 ID17010303PN020_03	Temperature	Yes	Move to 4a	Excess load from lack of shade
Rose Creek ID17010303PN021_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Killarney Lake tributaries ID17010303PN022_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Blue Lake Creek ID17010303PN024_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Carlin Creek ID17010303PN026_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Beauty Creek ID17010303PN028_03 ID17010303PN028_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Wolf Lodge Creek ID17010303PN029_03 ID17010303PN029_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Cedar Creek ID17010303PN030_02 ID17010303PN030_03	Temperature	Yes	Move to 4a	Excess load from lack of shade
Marie Creek ID17010303PN031_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Fernan Creek ID17010303PN032_03* ID17010303PN034_03 ID17010303PN034_02a * ID17010303PN034_02	Temperature	Yes	Move to 4a	Excess load from lack of shade

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Background

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 two years and is included as the list of Category 5 waters in the Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants set at a level to achieve water quality standards.

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. 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 period. 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 emerge from the substrate. Similar kinds of effects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

Beneficial uses of stream surface waters in the Coeur d'Alene Lake subbasin include cold water aquatic life throughout the subbasin. The coldwater aquatic community consists of both native and nonnative coldwater species. Native fishes of the subbasin streams are westslope cutthroat trout, bull trout, largescale sucker, longnose dace, mountain whitefish, northern pike minnow, redside shiner, and mottled sculpin, torrent sculpin, and shorthead sculpin (Jim Fredericks and Ryan Hardy [IDFG], Chris James [USFS], Ed Lider [retired USFS], personal communications). Nonnative coldwater species include rainbow trout, eastern brook trout, and Chinook salmon. Together, these species support a popular sport fishery. Other components of the coldwater aquatic life community include amphibians, such as Pacific giant salamanders, and diverse invertebrates.

Population numbers of westslope cutthroat trout and bull trout have severely declined, and these species occupy a fraction of their historic range (May 2009). In January and March 2009, over 80 fisheries biologists and 12 ArcGIS technical experts from several state, federal, and tribal agencies, along with personnel from private firms, attended 9 workshops to develop a status update for westslope cutthroat trout, which expands a database originally developed in 2002. The database is managed and maintained as a component of the westslope cutthroat trout interagency conservation working group. The IDFG coordinates the working group in Idaho and manages the database. Experts considered current distribution, conservation populations, and historical range of the species. Results of this effort indicated westslope cutthroat trout are currently present in all of the streams addressed in this TMDL (May 2009). Current westslope cutthroat trout distribution is illustrated in Figure 1. Those tributaries with cutthroat most likely have some spawning occurring as well, whether it is adfluvial or resident fish (Ryan Hardy, IDFG, personal communication). Therefore, salmonid spawning is considered an existing beneficial use for all the streams evaluated in this TMDL analysis.

Since 2005, the mainstem Coeur d'Alene River has been designated by the US Fish and Wildlife Service (USFWS) as critical habitat for bull trout. The Coeur d'Alene River was identified as a migratory corridor, which provides the primary constituent elements of critical habitat necessary for seasonal use for migrating bull trout (USFWS 2010). Bull trout temperature criteria were utilized in assessing the Coeur d'Alene River for temperature impairment.

About Assessment Units

Prior to 2002, impaired waters were defined as stream segments with geographical descriptive boundaries. In 2002, DEQ modified the structure and format of Idaho's §303(d) list by combining it with the §305(b) report, required by the CWA to inform Congress of the state of Idaho's waters. This combined report is called the Integrated Report. This modification included identifying stream segments by AUs instead of non-uniform stream segments and defining the use support of stream AUs by 5 categories in the Integrated Report. AUs now define all the waters of the state of Idaho. These units and the methods used to describe them can be found in the *Water Body Assessment Guidance* (Grafe et al. 2002).

AUs are groups of similar streams that have similar land-use practices, ownership, or management. Stream order, however, is the main basis for determining AUs—even if ownership and land use change significantly, an AU remains the same for the same stream order. Because AUs are a subdivision of water body identification numbers, they provide a direct tie 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. All AUs for this TMDL are located in Idaho (ID) in the subbasin identified by hydrologic unit code 17010303 in the Panhandle Basin (identified by PN); therefore, the ID17010303PN portion of the AU identification number is shared by all AUs in this TMDL. The unique designator for the AU is identified after the PN portion of the AU number (e.g., ID17010303PN**028_02** is Beauty Creek).

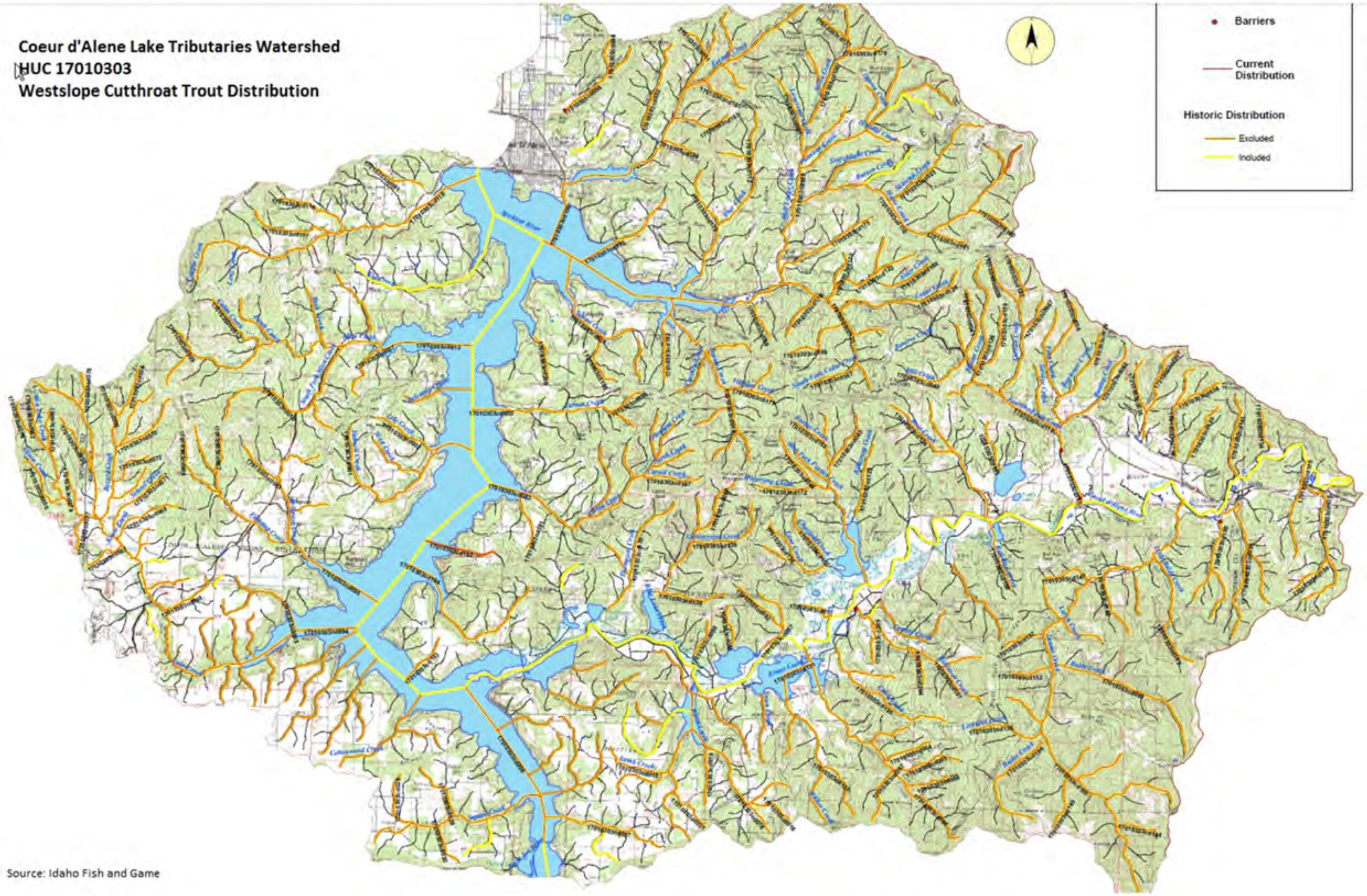

Figure 1. Westslope cutthroat trout distribution in the Coeur d'Alene Lake subbasin.

Water Quality Listing History

Idaho water quality standards for temperature are numeric values to protect cold water aquatic life, salmonid spawning, and bull trout; they are not to be exceeded unless the exceedances are infrequent, brief, or small or when natural background provisions apply. For more information on Idaho's water quality standards for temperature, see Appendix A. Water temperature data collected from a stream is evaluated against the standards to determine whether water quality standards have been exceeded.

If the water quality standards are exceeded, the water body is listed on Idaho's §303(d) list (i.e., Category 5 of Idaho's Integrated Report) of impaired water bodies. Table 1 lists water bodies on the Idaho §303(d) list for temperature pollution in the Coeur d'Alene Lake subbasin. Following completion of the 1998 §303(d) list, additional streams in the Coeur d'Alene Lake subbasin were monitored and added to the §303(d) list for temperature in 2002 and 2010. Temperature listings in Idaho's 2010 Integrated Report (DEQ 2011) were based on results from an analysis of temperature data collected from 1999 to 2008 by DEQ and the US Forest Service (USFS) (Table 1). For more information on this data assessment see Appendix B.

All AUs with data conclusively demonstrating exceedance(s) of Idaho water quality standards for temperature are included in this TMDL document. For these TMDLs, temperature criteria for protection of cold water aquatic life and salmonid spawning beneficial uses have been applied throughout the subbasin. Criteria for protecting the bull trout beneficial use have been applied in applicable watersheds as defined by state and federal criteria. Assessments found widespread exceedances of Idaho numeric water temperature criteria, particularly for salmonid spawning.

Table 1. Water quality listing history and data collection dates and sources used for §303(d) listing.

Stream	Assessment Units	Temperature Data Dates	Temperature Data Source	Original §303(d) listing
Cougar Creek	ID17010303PN002_02	6/19/1998–11/14/1998	DEQ	2002
Mica Creek and tributaries	ID17010303PN004_02	6/19/1998–11/14/1998	DEQ	2002
Coeur d'Alene River: South Fork Coeur d'Alene to Latour Creek	ID17010303PN007_06	1995, 1996, 1997, 1998, 1999, 2003, 2005, 2006	DEQ USFS	1998
Coeur d'Alene River: Latour Creek to mouth	ID17010303PN016_06	1995, 1996, 1997, 1998, 1999, 2003	DEQ USFS	1998
Latour Creek and tributaries	ID17010303PN015_02	—	—	1998
Fourth of July Creek and tributaries	ID17010303PN020_02 ID17010303PN020_03	2004, 2006	USFS	2010
Rose Creek and tributaries	ID17010303PN021_02	2004	USFS	2010
Killarney Lake tributaries	ID17010303PN022_02	2004	USFS	2010
Blue Lake Creek and tributaries	ID17010303PN024_02	2004, 2008	USFS	2010
Carlin Creek and tributaries	ID17010303PN026_02	2004, 2008	USFS	2010
Beauty Creek and tributaries	ID17010303PN028_02	2004	USFS	2010
Beauty Creek and tributaries	ID17010303PN028_03	7/31/1999–9/29/1999 2004	DEQ USFS	2002
Wolf Lodge Creek and tributaries	ID17010303PN029_02 ID17010303PN029_03	2001, 2006	USFS	2002
Cedar Creek and tributaries	ID17010303PN030_02 ID17010303PN030_03	2000, 2001, 2004–2006	USFS	2010
Marie Creek and tributaries	ID17010303PN031_02	6/22/2001–11/18/2001	DEQ	2002
Fernan Creek and tributaries	ID17010303PN032_03 ID17010303PN034_02 ID17010303PN034_02a ID17010303PN034_03	—	—	EPA addition to 1998 §303(d) list

Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources so as 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 regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water Quality Planning and Management, 40 CFR Part 130) require a margin of safety be a part of the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

The 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 determined, 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 under which water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. The warm summer months of April through September are considered the key period in this TMDL when critical conditions (i.e., elevated stream temperatures) may occur. These months coincide with salmonid spawning and rearing and represent the time when stream temperatures are most likely to be elevated and impair this beneficial use.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows 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 a 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. These "other measures" must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loads 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, as in the case of this temperature TMDL. For certain pollutants whose effects are long term, such as temperature, EPA allows for seasonal or annual loads (Water Quality Planning and Management, 40 CFR Part 130).

Instream Water Quality Targets

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

The PNV approach is described briefly below. Additionally, the procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in Shumar and de Varona (2009). For a more complete discussion of shade and its effects on stream water temperature, see the *South Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2003) and *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and de Varona 2009).

Potential Natural Vegetation for Temperature TMDLs

There are several important contributors of heat to a stream, including groundwater 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. Streamside 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.

PNV along a stream is that 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 shade was estimated for 21 AUs from visual interpretation of aerial photos. These estimates were partially field-verified by measuring shade with a Solar Pathfinder at systematically located points along the streams (see below for methodology). 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.

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. 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.[1]

Aerial Photo Interpretation

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.

[1] A unit conversion table is provided in Appendix C.

Estimates of shade were marked out on a 1:100,000 or 1:250,000 national hydrography dataset taking into account plant type and natural breaks in vegetation density. 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 we estimated shade for a particular stream segment at between 50% and 59%, a shade class of 50% would be assigned to that stream segment. The estimate is based on a general observation of the aerial photos and best professional judgment about the kind of vegetation present, its density, and stream width. The estimate is conservative in that it may overestimate the solar load to the stream. 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 shade estimates made from aerial photos are strongly influenced by canopy cover. It is not always possible when using this method to visualize or anticipate shade characteristics resulting from topography and landform. However, research has shown that canopy cover and shade are similar (OWEB 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade.

Pathfinder Methodology

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 reach, ten traces are taken at systematic intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Traces were taken following the manufacturer's instructions. Systematic sampling was used because it is easiest to accomplish without biasing the sampling location. For each sampled reach, the sampler started at a unique location (such as 50 to 100 meters from a bridge or fence line) and then proceeded upstream or downstream stopping to take additional traces at fixed intervals (e.g., every 50 meters, every 50 paces, etc.).

When possible, the sampler also measured bankfull widths, photographed the landscape, and took notes while taking Solar Pathfinder traces. This documentation helps show changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) are present.

Stream Morphology

Measures of current bankfull width or near-stream disturbance zone width (the human-caused disturbance area between riparian vegetation) may not reflect widths present under natural conditions. 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 smaller percentage of the water surface in wider streams, and widened streams can also have less vegetative cover if shoreline vegetation has eroded away.

Stream width alteration may not be discernible from aerial photo interpretation. Accordingly, stream width must be estimated from available information. DEQ uses regional curves for the major basins in Idaho, developed with data compiled by the Idaho Department of Lands, to estimate natural bankfull width (Figure 2).

For each stream evaluated in the loading analysis, natural bankfull width was estimated based on the drainage area of the Clearwater curve from Figure 2. A number of the northern Idaho regional curves in Figure 2 were compared to regional curves developed by the USFS (E. Lider, personal communication) and Watershed Professionals Network, LLC (S. Perkins, personal communication) from North Fork Coeur d’Alene River subbasin data. The USFS curve provided a linear function ($Y = 0.3984X + 16.529$); a power function was also calculated for the same USFS data ($Y = 5.0426X^{0.5654}$). The Watershed Professionals Network curve was also a power function ($Y = 9.2596X^{0.4169}$). In the end, the Clearwater regional curve ($Y = 5.64X^{0.52}$) best represented a natural bankfull width scenario for the Coeur d’Alene Lake tributaries (see Appendix D). Although most of the curves examined had reasonably similar estimates, the Clearwater regional curve was chosen to represent natural bankfull width because data for the Clearwater regional curve is more inclusive of a natural, wilderness-type setting.

For the loading analyses, the Clearwater curve was used for natural width if the stream’s existing width (sometimes viewed from the aerial photo, not measured in the field) was wider than predicted by the Clearwater curve. If the existing width was much smaller, existing width was used in the loading analysis for natural width. In most cases, the Clearwater curve estimates were used for natural bankfull width in most segments of each stream’s loading analysis. Most existing bankfull widths were equivalent to natural bankfull width. Exceptions where existing widths were slightly different than predicted included the lowest portion of Fernan Creek below the lake, Beauty Creek, and Wolf Lodge Creek.

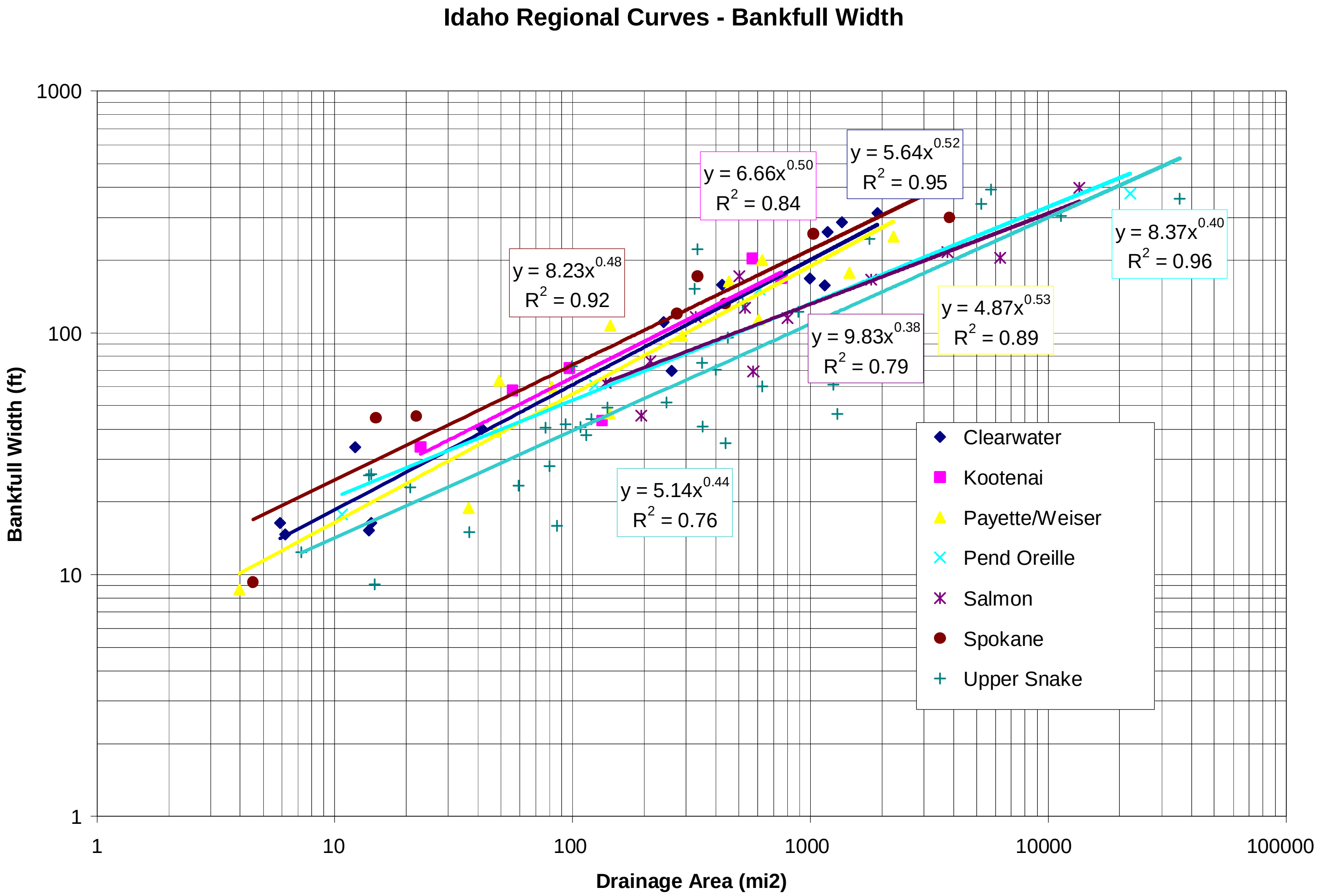

Figure 2. Bankfull width as a function of drainage area.

Design Conditions

Streams examined in this document are found in two subecoregions (i.e., level IV ecoregions) in the Northern Rockies Level III Ecoregion of McGrath et al. (2001). Streams on the western side of Coeur d'Alene Lake (Mica Creek, Cougar Creek, and tributaries) and the lowest portions of Fernan Creek, Beauty Creek, Carlin Creek, and Wolf Lodge Creek are found in the Northern Idaho Hills and Low Relief Mountains Level IV Ecoregion. Common forest tree species include grand fir, western redcedar, Douglas-fir, and ponderosa pine. Western hemlock is uncommon in this ecoregion.

The upper portions of Fernan Creek and Wolf Lodge Creek as well as Marie Creek, Cedar Creek, Fourth of July Creek, Blue Lake Creek, Killarney Lake tributaries, Rose Creek, and Latour Creek and their tributaries are in the Coeur d'Alene Metasedimentary Zone Level IV Ecoregion (McGrath et al. 2001). This ecoregion contains forests of Douglas-fir, grand fir, western redcedar, western hemlock, mountain hemlock, subalpine fir, and Engelmann spruce, with whitebark pine at higher elevations.

The Panhandle National Forest has 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 2). 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 warm/dry forests of Group A (VRUs 1, 2, and 3) or the moderately warm and moderately cool/moist assemblage of forests of Group B (VRUs 4, 5, and 6). Latour Creek has a small portion of its headwaters that extends into the cool/wet-to-moist forests of Group C (VRUs 7 and 8). In addition to these forest types, Shumar and de Varona (2009) includes 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.

Table 2. 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 Target Selection

To determine PNV shade targets for the Coeur d'Alene Lake tributaries, DEQ examined effective shade curves developed for the Panhandle region of Idaho based on VRUs (see Shumar and de Varona 2009). 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 3). Shumar and de Varona (2009) provide an explanation of how shade curves were developed for the Panhandle region of Idaho.

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.

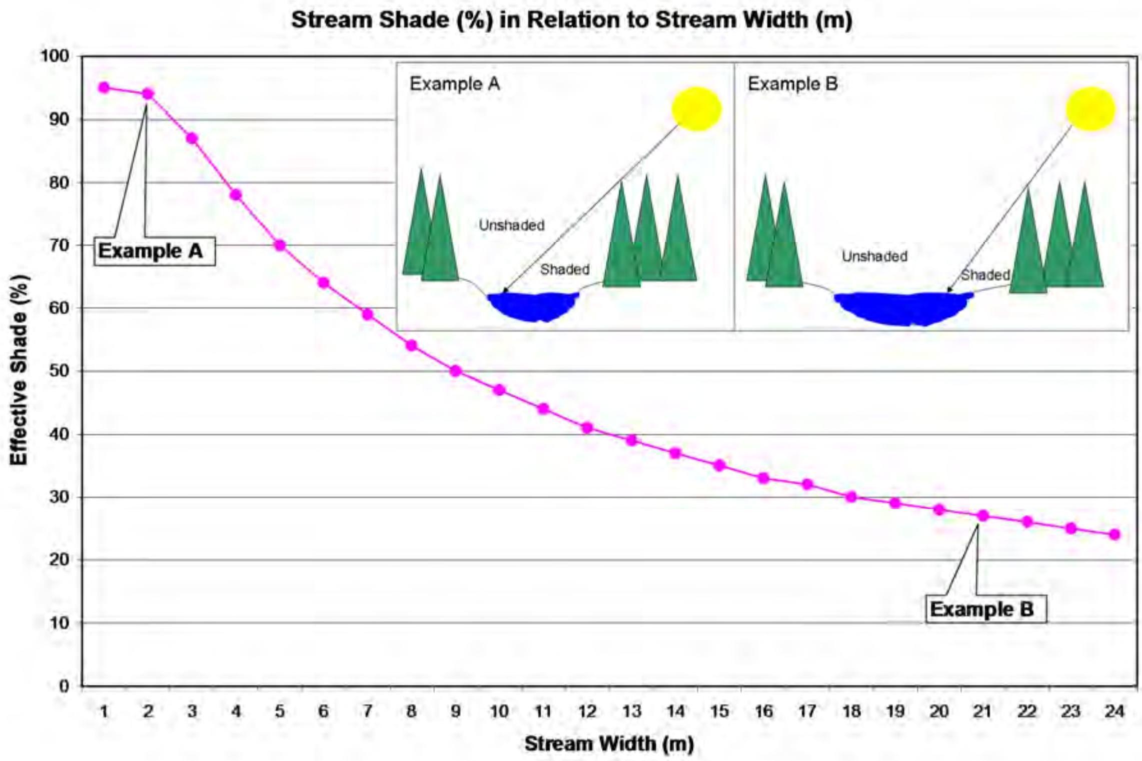

Figure 3. Example relationship between stream width and shade.

<u>Shade Curves</u>

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 (see 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. 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. Forest groups encountered in this analysis include A (Table 3), B (Table 44), and C (Table 5), with Forest Groups A and B predominant. Forest Group D did not occur on any streams in this analysis. The target value percentages in the tables result from averaging three aspect-based shade curves, one for each cardinal direction (N-S and E-W) and one for the 45 degree angles (see Shumar and de Varona 2009).

Table 3. Shade targets for Forest Group A vegetation type at various stream widths.

Group A Forest - VRUs 1, 2, 3	1m	2m	3m	4m	5m	6m	7m	8m	9m
0/180 aspect	94	93	87	76	69	63	58	54	51
45/135/225/315 aspect	94	94	88	79	71	65	61	57	53
90/270 aspect	95	95	92	83	76	70	64	59	52
Target (%)	**95**	**94**	**89**	**80**	**72**	**66**	**61**	**56**	**52**

Table 4. Shade targets for Forest Group B vegetation type at various stream widths.

Group B Forest - VRUs 4,5,6	1m	2m	3m	4m	5m	6m	7m	8m	9m
0/180 aspect	98	98	97	95	93	91	89	86	82
45/135/225/315 aspect	98	98	97	95	94	92	89	86	82
90/270 aspect	98	98	98	97	96	95	94	92	87
Target (%)	**98**	**98**	**97**	**96**	**94**	**93**	**91**	**88**	**84**

Group B Forest - VRUs 4,5,6	10m	11m	12m	13m	14m	15m	20m	24m	25m
0/180 aspect	79	75	72	69	66	64	53	47	45
45/135/225/315 aspect	78	75	72	69	66	63	52	45	44
90/270 aspect	81	74	68	64	59	55	43	37	35
Target (%)	**79**	**75**	**71**	**67**	**64**	**61**	**49**	**43**	**41**

Table 5. Shade targets for Forest Group C vegetation type at various stream widths.

Group C Forest - VRUs 7, 8	1m	2m	3m	4m	5m	6m	7m	8m	9m
0/180 aspect	97	97	95	93	91	88	84	79	75
45/135/225/315 aspect	98	97	96	94	91	88	84	79	75
90/270 aspect	98	98	97	96	95	93	89	83	74
Target (%)	**98**	**97**	**96**	**94**	**92**	**90**	**86**	**80**	**75**

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 (see 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. Because this is the only nonforest group used in the analysis, a large number of stream width/target combinations were needed (Table 6). Stream gradients are presented in Figure 4.

Table 6. Shade targets for Nonforest Group 1 vegetation type at various stream widths.

Group 1 Nonforest - Hardwoods	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m
0/180 aspect		93		75		61		53		47	
45/135/225/315 aspect		93		77		64		55		49	
90/270 aspect		95		82		69		57		47	
Target (%)	**97**	**94**	**86**	**78**	**71**	**65**	**60**	**55**	**52**	**48**	**45**

Group 1 Nonforest - Hardwoods	12m	13m	14m	15m	16m	17m	18m	19m	20m	21m	22m
0/180 aspect	42		38		35		32		30		28
45/135/225/315 aspect	43		39		35		32		30		27
90/270 aspect	39		34		30		27		25		23
Target (%)	**41**	**39**	**37**	**35**	**33**	**32**	**30**	**29**	**28**	**27**	**26**

When stream orders increase to the 5th and 6th level, streams and their associated floodplains become wider and a second group of nonforest vegetation is needed for describing shade targets (Nonforest Group 2). However, none of the streams examined in this TMDL exceeded 4th order.

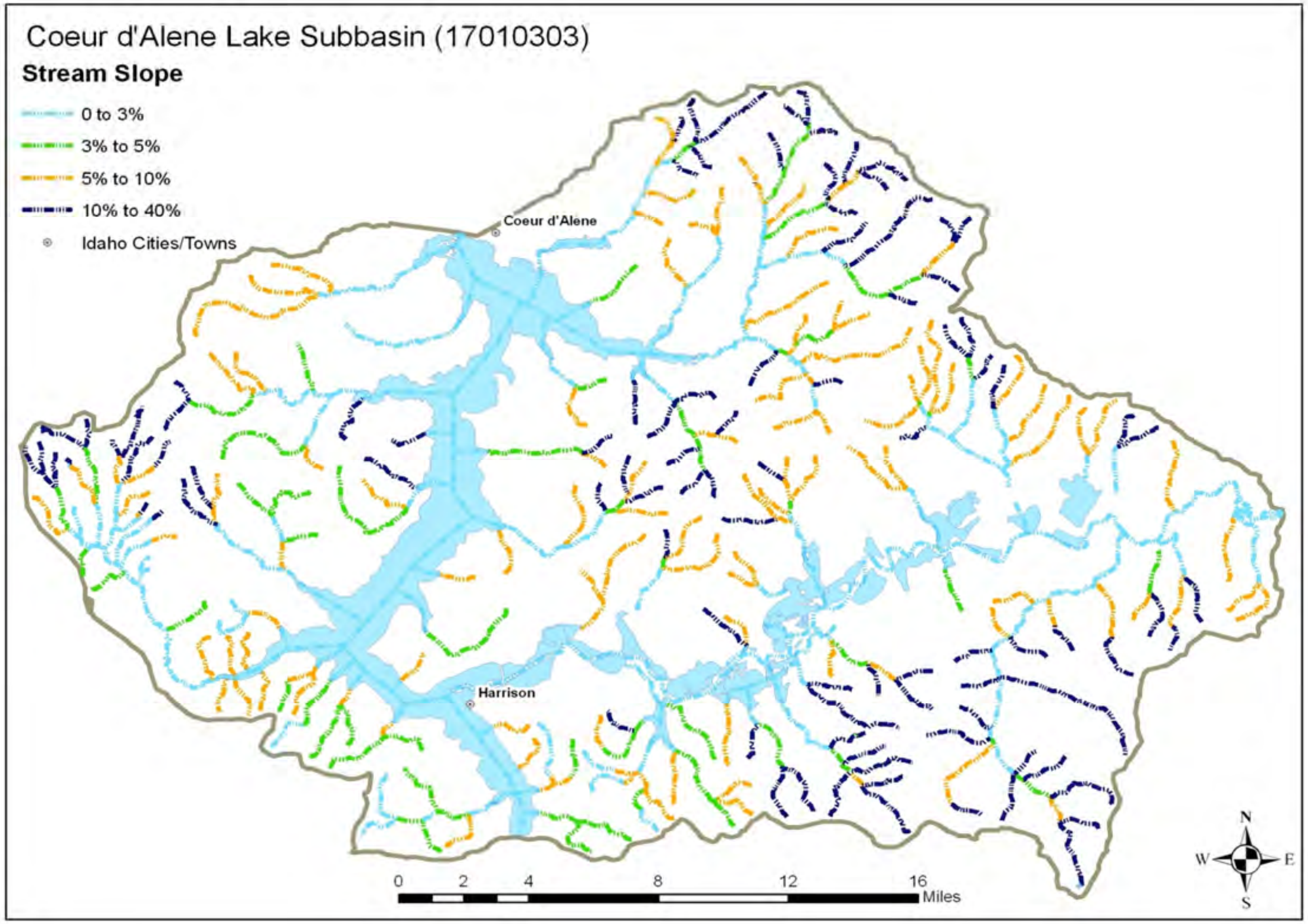

Figure 4. Stream gradient (slope) categories for the Coeur d'Alene Lake subbasin.

Monitoring Points

The accuracy of the aerial photo interpretations was field-verified with a Solar Pathfinder during summer 2007 at 21 sites on 3 streams, again in 2010 at 20 sites on 12 streams, and on Mica Creek in 2011. Solar Pathfinder data collected within the Coeur d'Alene Lake subbasin were collected at 10 transects per sampling reach and averaged to best determine the shade value for each reach. The results of these field observations are presented in Appendix E (Tables E-2 and E-3). The average shade value was then translated to a 10% shade class for comparison with the estimated shade class to determine the accuracy of the aerial photo interpretations made in the office.

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. Overall, our original photo interpretations were often correct (19 of 39 sites) or slightly under-estimated existing shade with an average difference of 4% ± 5.2 (mean ± 95% confidence interval) in 2007 and 4% ± 9.8 in 2010. If we examine these data for an individual stream in 2007, sites on Beauty Creek were slightly overestimated by 4% ± 4.8, whereas sites on Marie Creek (3% ± 6.5) and Latour Creek (8% ± 7.4) were underestimated. The site on Mica Creek in 2011 showed that we had substantially underestimated shade in these low-gradient waters near the lake. These results were used to calibrate our visual interpretations, and aerial photo interpretations were corrected accordingly. Existing shade levels presented in this document reflect those corrections.

Follow-up monitoring of effective shade can take place on any reach throughout the study streams and be compared to estimates of existing shade seen on Figure 5 and in more-detailed figures in Appendix F and described in Tables F-1 through F-22 in Appendix F. 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 toward meeting shade targets (Figure 6). It is important to note that many existing shade estimates have not been field-verified and may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies 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 toward target levels. Ten equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

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), then 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). These months coincide with the time of year when stream temperatures are increasing, deciduous vegetation is in leaf, and spring and fall salmonid spawning is occurring. These months are when cold water aquatic life criteria are more likely to be exceeded. Late July and early August typically represent the period of highest stream temperatures. Tables F-1 through F-22 in Appendix F show the PNV shade targets (identified as target shade) and their 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. 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.

Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (Water Quality Planning and Management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed) but may be aggregated by type of source or area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather station. Existing shade data are presented in Tables F-1 through F-22 (Appendix F). Like load capacities (target loads), existing loads in Tables F-1 through F-22 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 load 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 seen in Figure 7. The percent reduction shown in the right-hand column of each table in Appendix F represents how much total excess load there is in relation to total existing load.

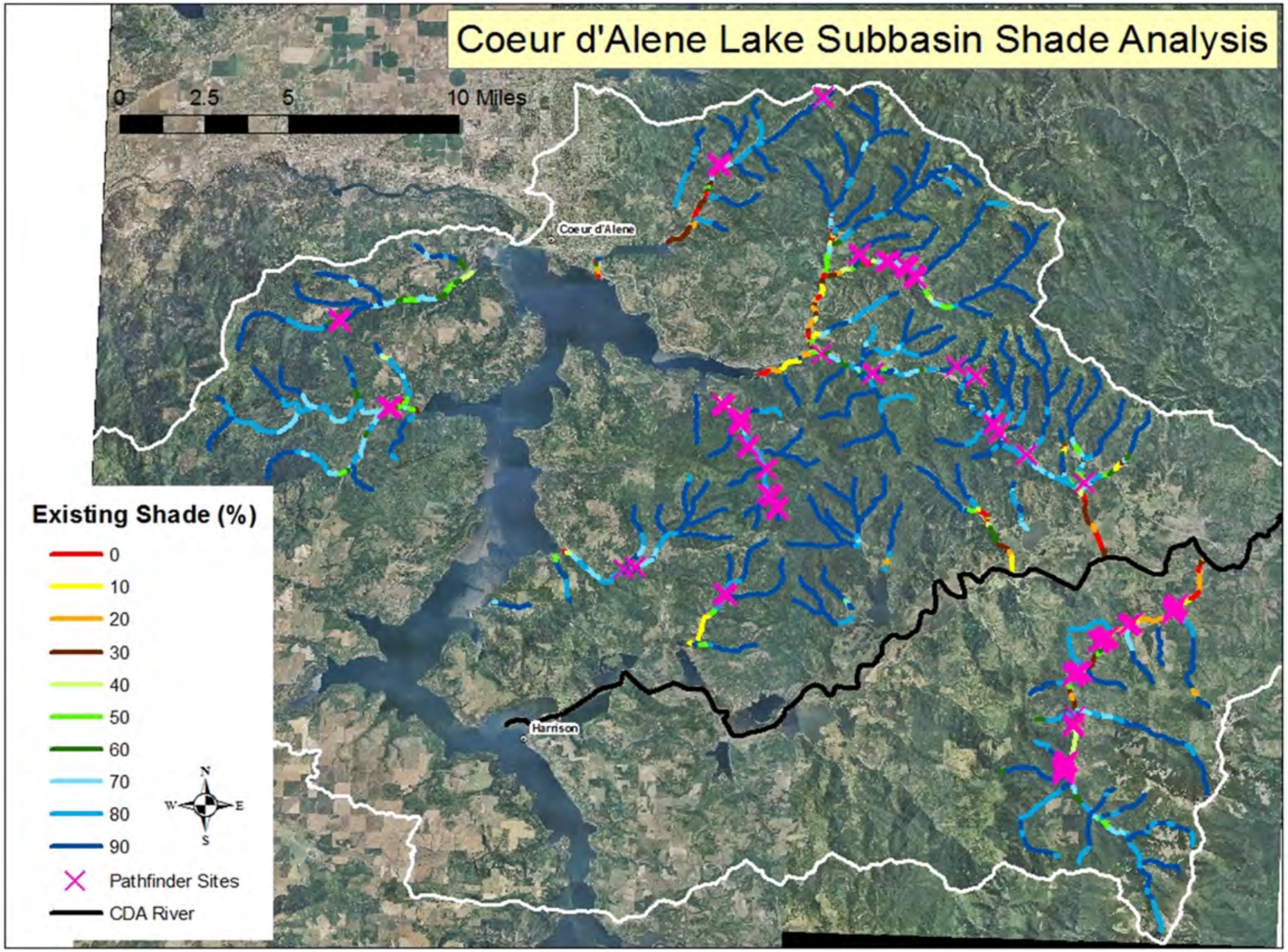

Figure 5. Existing shade estimated for 21 assessment units in the Coeur d'Alene Lake subbasin.

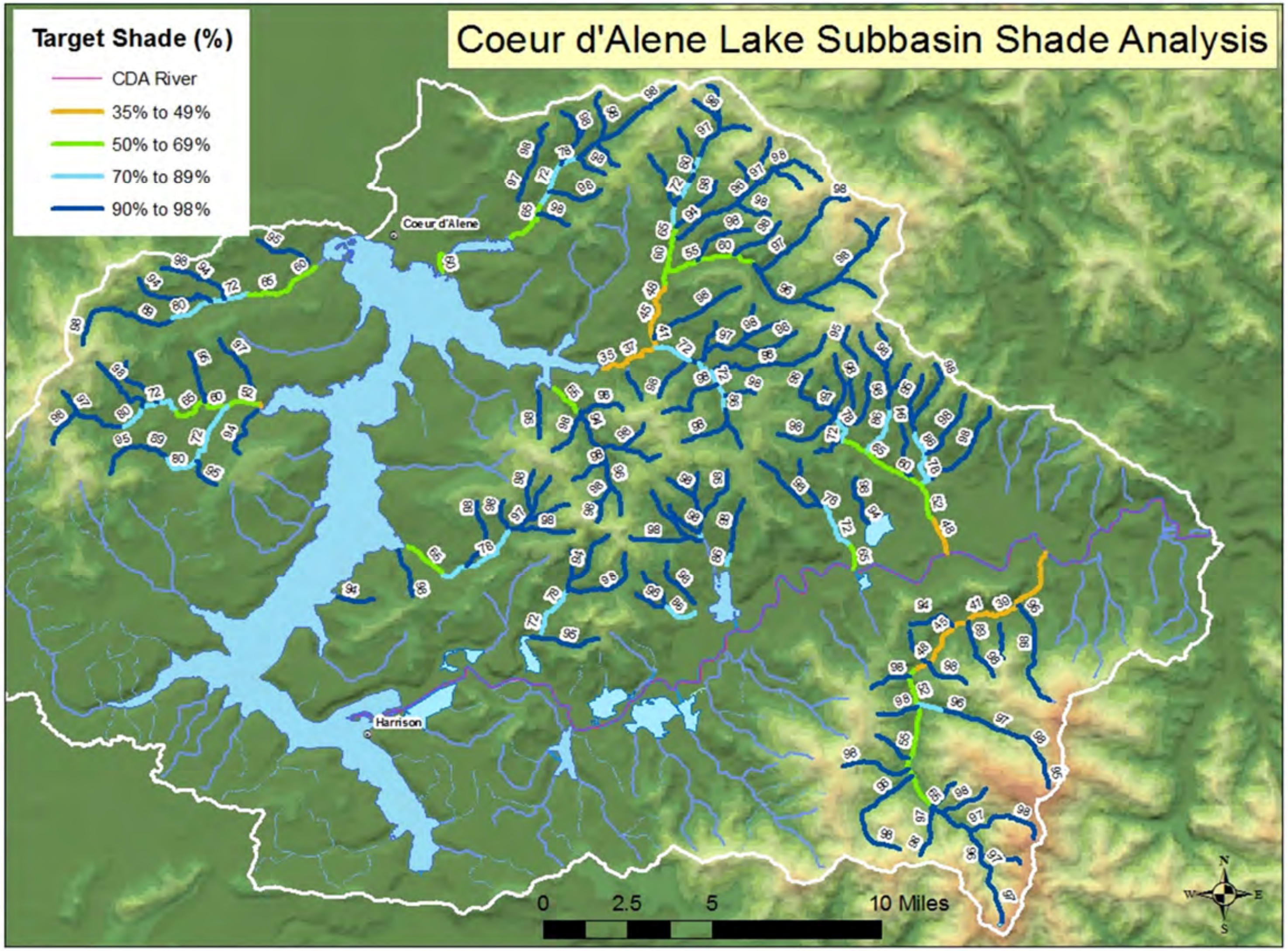

Figure 6. Target shade for 21 assessment units in the Coeur d'Alene Lake subbasin.

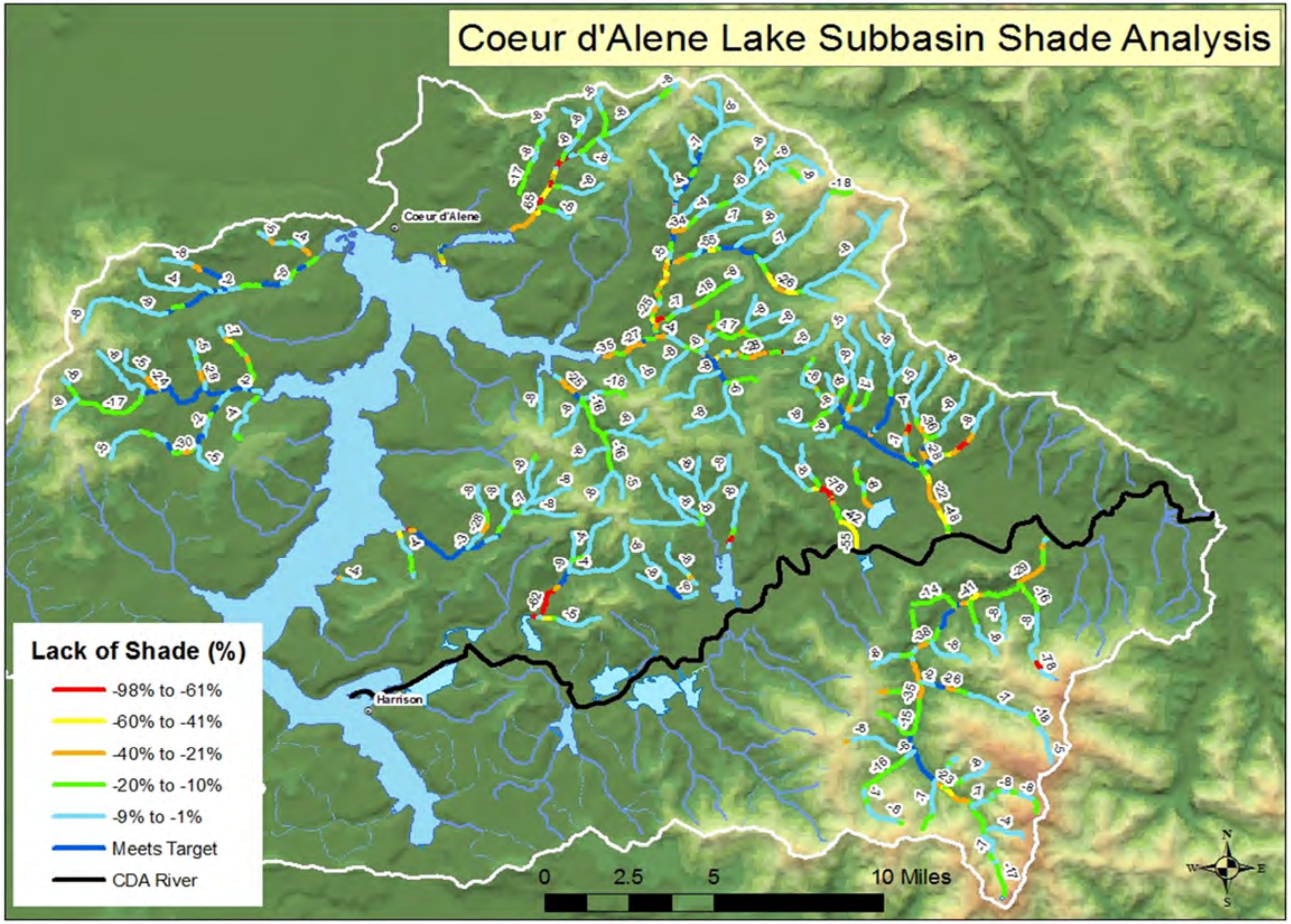

Figure 7. Lack of shade (difference between existing and target) for 21 assessment units in the Coeur d'Alene Lake subbasin.

Load Allocation

This TMDL is based on PNV, which is equivalent to solar loads at background conditions. As such, the load allocation is essentially the desire to achieve natural background conditions. However, 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. Load allocations are stream-reach specific and are dependent upon the target load for a given reach. Tables F-1 through F-22 in Appendix F show the target shade, which is converted to a target summer load by multiplying the inverse fraction (1 minus shade fraction) by the average loading measured by a flat-plate collector for the months of April through September. This calculation provides the load capacity of the stream and the solar load necessary to achieve background conditions. At this level of solar loading, there is no opportunity to further remove shade from the stream by any activity without exceeding its load capacity. Because this TMDL is dependent upon background conditions for achieving water quality standards, all tributaries to the waters examined also need to be in natural conditions in order to prevent excess heat loads to the system.

Table 7 shows the total existing, target, and excess heat load (kWh/day) for each AU examined and the average lack of shade (difference between existing and target shade) for each AU. 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. Large streams have higher existing and target loads by virtue of their larger channel widths. Table 7 lists the tributaries in order of their excess loads, from highest to lowest. Therefore, large tributaries tend to be listed first and small tributaries last.

Although this TMDL analysis focuses on total heat loads for streams in this subbasin, it is important to note that differences between existing and target shade, as depicted in lack-of-shade figures (Figure 7 and in figures in Appendix F) and the last column of each load analysis table (Tables F-1 through F-22 in Appendix F), 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.

Table 7. Total solar loads and lack of shade for all tributaries.

Assessment Unit (Major Water Body)	Existing Load (kWh/day)	Target Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade Average (%)
ID17010303PN029_02, 029_03 (Wolf Lodge Creek)	560,000	340,000	220,000 (39%)	-18
ID17010303PN015_02 (Latour Creek)	790,000	580,000	210,000 (27%)	-19
ID17010303PN034_02a, 034_03, 032_03 (Fernan Creek)	200,000	72,000	120,000 (60%)	-37
ID17010303PN031_02 (Marie Creek)	170,000	95,000	71,000 (42%)	-19
ID17010303PN015_02 (Latour tributaries)	98,000	30,000	70,000 (71%)	-15
ID17010303PN021_02 (Rose Creek)	99,000	33,000	67,000(68%)	-35
ID17010303PN020_02 (Fourth of July tributaries)	97,000	35,000	64,000 (66%)	-19
ID17010303PN020_02, 020_03 (Fourth of July Creek)	230,000	180,000	55,000 (24%)	-17
ID17010303PN024_02 (Blue Lake Creek)	66,000	21,000	46,000 (70%)	-20
ID17010303PN028_02, 028_03 (Beauty Creek)	67,000	27,000	41,000 (61%)	-10
ID17010303PN030_02 (Cedar tributaries)	59,000	19,000	40,000 (68%)	-15
ID17010303PN029_02 (Wolf Lodge tributaries)	68,000	38,000	31,000 (46%)	-16
ID17010303PN034_02 (Fernan tributaries)	33,000	4,800	29,000 (88%)	-15
ID17010303PN022_02 (Killarney Lake tributaries)	41,000	15,000	26,000 (63%)	-13
ID17010303PN030_02, 030_03 (Cedar Creek)	46,000	25,000	22,000 (48%)	-23
ID17010303PN002_02 (Cougar Creek)	110,000	88,000	20,000 (18%)	-10
ID17010303PN004_02 (North Fork Mica Creek)	91,000	74,000	17,000 (19%)	-8
ID17010303PN026_02 (Carlin Creek)	70,000	57,000	14,000 (20%)	-12
ID17010303PN028_02 (Beauty Creek tributaries)	15,000	3,100	13,000 (87%)	-10
ID17010303PN004_02, 004_03 (Mica Creek)	60,000	49,000	11,000 (18%)	-18
ID17010303PN004_02 (South Fork Mica Creek)	47,000	38,000	8,900 (19%)	-8

All AUs lack shade to some degree. Although Wolf Lodge Creek has the largest excess load, it is derived from two AUs (ID17010303PN029_02 and 029_03). AU ID17010303PN015_02 (Latour Creek, Larch Creek, Baldy Creek, and other Latour Creek tributaries) has the largest excess load for a single AU of those examined, which is not surprising considering Latour Creek is one of the largest watersheds examined with large existing and target loads. However, Latour Creek's excess load was only 27% of its total existing load, a relatively small proportion compared to many other AUs in the analysis. Latour Creek riparian shade has been affected throughout its watershed. Wolf Lodge Creek has a high excess load as well, but its proportion in excess (39%) is slightly higher than in Latour Creek, suggesting that Wolf Lodge Creek is in slightly poorer condition regarding shade. Portions of Wolf Lodge Creek below Marie Creek have a substantial lack of shade.

Cougar Creek (ID17010303PN002_02) and Mica Creek (ID17010303PN004_02 and 004_03) AUs have the lowest proportion of existing load in excess (18% for each) and some of the lowest average lack of shade values. Both of these watersheds have numerous reaches that either meet shade targets or have existing shade within the same 10% shade class as their target. The North Fork and South Fork Mica are also in reasonably good condition, with excess loads of only 18–19%. Beauty Creek in is reasonably good condition as well. However, because of the dominance of reaches that lack shade by <9%, the resulting excess load becomes substantial. In reality, tributaries to Beauty Creek at least are likely in good condition.

Many of the remaining AUs fall somewhere in the middle, where excess loads represent >30% of their total existing loads and lack of shade averages approximately 10–37%. Many of these AUs (e.g., Cougar Creek, ID17010303PN002_02) have many reaches that meet shade targets and many headwater tributaries where the existing 10% shade class (usually the 90% shade class) is within 9% of the target shade (often 98%). Only in the lower reaches where there have been impacts to shade from land-clearing activities (residential and agricultural development) do we see substantial lack of shade.

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

Wasteload Allocation

The City of Harrison's wastewater treatment plant is the only National Pollutant Discharge Elimination System (NPDES)-permitted point source in the affected watersheds. However, it discharges directly into a wetland with no hydrologic connection to the Coeur d'Alene River (the Trail of the Coeur d'Alene's levee divides the wetland from the Coeur d'Alene River). Therefore no wasteload allocations are necessary in this TMDL. Should a point source be proposed that would have thermal consequences on these waters, then background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09 and IDAPA 58.01.02.401.01) are applicable (see Appendix A).

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.

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 period represents the time when the combination of increasing air and water temperatures coincide with increasing solar inputs and vegetative shade. The critical time periods are June when spring salmonid spawning is occurring, July and August when maximum temperatures may exceed cold water aquatic life criteria, and September during fall salmonid spawning. 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.

Construction Stormwater and TMDL Wasteload Allocations

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. In the past, stormwater was treated as a nonpoint source of pollutants. However, because stormwater can be managed on-site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires an NPDES permit.

The Construction General Permit

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 Construction General Permit (CGP) from EPA after developing a site-specific Stormwater Pollution Prevention Plan (SWPPP).

Stormwater Pollution Prevention Plan

In order to obtain the CGP, operators must develop a site-specific SWPPP. Operators must document the erosion, sediment, and pollution controls they intend to use; inspect the controls periodically; and maintain best management practices (BMPs) throughout the life of the project.

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. TMDLs developed in the past that did not have a wasteload allocation for construction stormwater activities or new TMDLs are considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement appropriate BMPs.

Typically, specific requirements also must be followed to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post-construction stormwater management. Sediment is usually the main pollutant of concern in stormwater from construction sites. The application of specific BMPs from Idaho's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) is generally sufficient to meet the standards and requirements of the CGP, unless local ordinances have more stringent and site-specific standards that are applicable.

Climate Change

Substantial scientific evidence indicates that air temperatures are rising across much of the earth, including the American West, and that 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 National Research Council (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). Nearly all of the westslope cutthroat trout habitat within the Coeur d'Alene Lake subbasin was predicted to be at high risk from these factors, particularly winter flooding (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.

Implementation Strategies

Implementation strategies for TMDLs produced using PNV-based shade and solar loading should incorporate the load analysis tables presented in this TMDL (Appendix F). These tables need to be updated, first to field-verify the existing shade levels that have not yet been field-verified 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 reductions in solar loads.

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 bankfull widths significantly wider (over 3 meters) than the estimated natural bankfull widths should also be a focus of future monitoring efforts. In these areas, existing and potential shade is limited due to the over-widened stream channel. The cause for the over widening is most likely excess bed load sediment. The excess bed load alters the bankfull 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 mid-channel 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.

Beaver damming is also a naturally occurring phenomenon within the Coeur d'Alene Lake 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.

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.

Unique hydrologic conditions exist at the lower portions of tributaries to Coeur d'Alene Lake. First, many of the tributaries to the lake have a wedge of water-deposited alluvium (deltaic sediments) at the lowest portions of the watershed. These wedges influence the hydrologic characteristics, and they result in subsurface flow into Coeur d'Alene Lake during the summer months. Second, DEQ determined during the CWA §401 water quality certification process for the Post Falls Hydroelectric Development (HED) that backwater conditions exist in the tributaries to Coeur d'Alene Lake to operation of the Post Falls HED. The backwater conditions result in an increase in temperature in the affected water bodies (DEQ 2008). Meeting shade targets on the reaches described above may not be realistic. Therefore, it is important to understand where these areas of influence are and prioritize PNV implementation efforts upstream of these areas.

In addition to the hydrologic effects described above, other confounding conditions exist on Fernan Creek below Fernan Lake. For example, this reach is directly below a lake outlet; therefore, it is heavily influenced by temperatures in Fernan Lake. In addition, a dam, which controls the elevation of Fernan Lake, exists directly above this reach. Consequently, this reach is significantly dewatered during the late summer months. Operational changes of the dam below Fernan Lake to increase flow may mitigate excess heat loading due to loss of flow in that reach. As such, meeting shade targets in this reach may not be realistic.

As is the case with other impounded waters in the country, the flow alteration and backwater conditions on the Coeur d'Alene River caused by Post Falls HED preclude the ability to fully mitigate temperature impairment caused by this condition. However, excessive heat loading to the Coeur d'Alene River will be reduced with the following measures: First, excess heat loading from tributaries to the Coeur d'Alene River will be reduced through progress toward TMDL shade targets on those tributaries. This includes progress toward TMDL shade targets as directed by temperature TMDLs for the North Fork and South Fork Coeur d'Alene Rivers (draft TMDLs are written for both rivers). Second, the temperature conditions in the Coeur d'Alene River will likely benefit from efforts implemented under Avista's water quality improvement plans as mandated under the settlement agreement between Avista, DEQ, and Idaho Department of Fish and Game (Avista 2008). Next, bull trout restoration efforts directed by the US Fish and Wildlife Service will likely focus on restoring cool-water refugia for migrating bull trout in the Coeur d'Alene River during the warmest summer months. Lastly, restoration efforts as set forth under the focus of CERCLA (superfund) activities within the Coeur d'Alene Basin are likely to improve temperature conditions in the watershed and the Coeur d'Alene River.

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 vegetation community to become well-established and provide maximum shade. Shade targets will not be achieved all at once. Given their smaller bankfull widths, smaller streams may reach shade targets sooner than larger streams.

DEQ and the designated watershed advisory group (WAG) will continue to re-evaluate 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.

Approach

TMDLs will be implemented through the continuation of ongoing pollution control activities in the subbasin. The designated WAG, designated management agencies (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 responsible DMA will recommend specific control actions then 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.

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 that it manages.

Reasonable Assurance

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

Monitoring Strategy

Monitoring conducted within the Coeur d'Alene Lake 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 help to ensure the data are compatible and useable during the DEQ assessment process.

Monitoring progress toward 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).

Pollutant Trading

Pollutant trading (i.e., water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is voluntary. Parties trade only if both are better off as a result of the trade. Trading allows parties to decide how to best reduce pollutant loads within the limits of certain requirements. The appeal of trading emerges when pollutant sources face substantially different pollutant-reduction costs. Typically, a party facing relatively high pollutant-reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is recognized in Idaho's water quality standards in IDAPA 58.01.02.055.06. Currently, DEQ's policy is to allow for pollutant trading as a means to meet TMDLs and restore water quality limited water bodies to compliance with water quality standards. The *Water Quality Pollutant Trading Guidance* (DEQ 2010) sets forth the procedures for pollutant trading. No pollutant trading is currently planned for watersheds in the Coeur d'Alene Lake subbasin.

Public Participation

During the development of this document a watershed advisory group was convened. The Coeur d'Alene Lake Tributaries Watershed Advisory Group (WAG) provided DEQ with local knowledge of the watersheds, pertinent water quality data, reviewed beneficial uses designations and applicable surface water standards, and also provided comments on draft documents. Public meeting were held every first Wednesday of the month and were open to the public. Meetings were advertised in local papers and posted to the DEQ webpage. Ten (11) meetings have been held to date and meetings will continue into the future to discuss TMDL implementation.

Conclusions

Fourteen major watersheds representing 22 AUs were identified as having stream temperature problems in the Coeur d'Alene Lake subbasin. This TMDL examined the relationship between existing shade levels and shade targets, which were developed from vegetation types in the region, on 20 AUs. Existing and target shade levels were converted to solar loads to analyze excess loading to streams. The 2 AUs making up the Coeur d'Alene River did not receive a TMDL and will be addressed with other measures.

Most streams examined in this TMDL lacked shade and had excess solar loads. The Latour Creek and Wolf Lodge Creek AUs had the largest excess loads but not necessarily the highest proportion in excess. Mica Creek, Cougar Creek, and Carlin Creek AUs had the lowest levels of excess load and lack of shade. Most remaining AUs examined had similar patterns of shade deficits, mostly occurring in lower-elevation sections affected by land-clearing activities. A summary of assessment outcomes for streams addressed in the Coeur d'Alene Lake subbasin is presented in Table 8.

Target shade levels for individual reaches should be the goal land managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as priority locations for implementation efforts. Additional field-verification with the Solar Pathfinder will help to narrow down the focus of implementation activities by better defining existing shade levels.

TMDLs were not developed for the Coeur d'Alene River, because it is inappropriate to use PNV methodology on a river 50 meters wide or greater. Separate TMDLs for the Coeur d'Alene River using more appropriate methodology are required. However, backwater conditions in the Coeur d'Alene River, caused by operation of the Post Falls HED, result in an increase in temperature in the Coeur d'Alene River upstream from the mouth to Cataldo. As is the case with other impounded waters in the country, the flow alteration and backwater conditions preclude the ability to fully mitigate temperature impairment caused by this condition. However, excessive heat loading to the Coeur d'Alene River will be reduced with progress toward PNV shade targets on tributaries to the river, and through implementation of water quality improvement plans developed under other conservation programs in the watershed.

Table 8. Summary of assessment outcomes. (Streams denoted with * are unlisted but impaired for temperature.)

Water Body Segment/ Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Cougar Creek ID17010303PN002_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
North and South Forks Mica Creek ID17010303PN004_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Coeur d'Alene River ID17010303PN007_06 ID17010303PN016_06	Temperature	No	None	PNV methodology is inappropriate for this 6th order river. A separate TMDL is required.
Latour Creek and tributaries ID17010303PN015_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Fourth of July Creek ID17010303PN020_02 ID17010303PN020_03	Temperature	Yes	Move to 4a	Excess load from lack of shade
Rose Creek ID17010303PN021_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Killarney Lake tributaries ID17010303PN022_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Blue Lake Creek ID17010303PN024_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Carlin Creek ID17010303PN026_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Beauty Creek ID17010303PN028_03 ID17010303PN028_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Wolf Lodge Creek ID17010303PN029_03 ID17010303PN029_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Cedar Creek ID17010303PN030_02 ID17010303PN030_03	Temperature	Yes	Move to 4a	Excess load from lack of shade
Marie Creek ID17010303PN031_02	Temperature	Yes	Move to 4a	Excess load from lack of shade
Fernan Creek ID17010303PN032_03* ID17010303PN034_03 ID17010303PN034_02a * ID17010303PN034_02	Temperature	Yes	Move to 4a	Excess load from lack of shade

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Glossary

§305(b)

Refers to section 305 subsection "b" of the Clean Water Act. The term "305(b)" generally describes a report of each state's water quality and is the principle means by which the US Environmental Protection Agency, Congress, and the public evaluate whether US waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.

§303(d)

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

Acre-foot

A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.

Adfluvial

Describes fish whose life history involves seasonal migration from lakes to streams for spawning.

Alluvium

Unconsolidated recent stream deposition.

Ambient

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

Anthropogenic

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

Aquatic

Occurring, growing, or living in water.

Aquifer

An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding water to wells or springs.

Assessment Unit (AU)

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

Beneficial Use

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

Best Management Practices (BMPs)

Structural, nonstructural, or managerial techniques that are effective and practical means to control nonpoint source pollutants.

Best Professional Judgment

A conclusion and/or interpretation derived by a trained and/or technically competent individual by interpreting and synthesizing information.

Biological Integrity

1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).

Biota

The animal and plant life of a given region.

Clean Water Act (CWA)

The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to develop information about, and control the quality of, the nation's water resources.

Community

A group of interacting organisms living together in a given place.

Criteria

In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels and to limit the number of violations per year. The US Environmental Protection Agency develops criteria guidance; states establish criteria.

Designated Uses
Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge
The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO)
The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance
Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.

Ecosystem
The interacting system of a biological community and its nonliving (abiotic) environmental surroundings.

Environment
The complete range of external conditions, physical and biological, that affect a particular organism or community.

Erosion
The wearing away of areas of the earth's surface by water, wind, ice, and other forces.

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

Existing Beneficial Use or Existing Use
A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's water quality standards (IDAPA 58.01.02).

Flow
See Discharge.

Geographic Information Systems (GIS)
A georeferenced database.

Gradient
The slope of the land, water, or streambed surface.

Ground Water
Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and emerges again as streamflow.

Growth Rate

A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time or number of individuals added to a population.

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Basin

The area of land drained by a river system, a reach of a river and its tributaries, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Unit

One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, and cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, 4th-field hydrologic units have been more commonly called subbasins; 5th- and 6th-field hydrologic units have since been delineated for much of the country and are known as watersheds and subwatersheds, respectively.

Hydrologic Unit Code (HUC)

The number assigned to a hydrologic unit. Often used to refer to 4th-field hydrologic units.

Instantaneous

A condition or measurement at a moment (instant) in time.

Load Allocation (LA)

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

Load(ing)

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

Load(ing) 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.

Loess

A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's loading capacity set aside to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mean

Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Monitoring

A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth

The location where flowing water enters into a larger water body.

National Pollutant Discharge Elimination System (NPDES)

A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

Natural Condition

The condition that exists with little or no anthropogenic influence.

Nonpoint Source

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

Not Assessed (NA)

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

Nutrient

Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.

Parameter

A variable, measurable property whose value is a determinant of the characteristics of a system (e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake).

Phosphorus

An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Point Source

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

Pollutant

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

Pollution

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

Population

A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Potential Natural Vegetation (PNV)

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

Qualitative	Descriptive of kind, type, or direction.
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Resident	A term that describes fish that do not migrate.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
River	A large natural or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stream	A natural water course containing flowing water at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
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.

Stressors

Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.

Subbasin

A large watershed of several hundred thousand acres. This is the name commonly given to 4th-field hydrologic units (also see Hydrologic Unit).

Subbasin Assessment (SBA)

A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.

Subwatershed

A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th-field hydrologic units.

Surface Water

All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Threatened Species

Species, determined by the US Fish and Wildlife Service, that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

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.

Tributary

A stream feeding into a larger stream or lake.

Wasteload Allocation (WLA)

The portion of receiving water's loading 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

A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Criteria

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

Water Quality Limited

A label that describes water bodies for which one or more water quality criteria are not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.

Water Quality Standards

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

Water Table

The upper surface of ground water; below this point, the soil is saturated with water.

Watershed

1) All the land that contributes runoff to a common point in a drainage network or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region that contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)

A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

Wetland

An area that is at least some of the time saturated by surface or ground water so as to support vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

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Appendix A. State and Site-Specific Standards and Water Quality 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 north Idaho. The adjusted spawning and incubation windows account for differences in elevation, a watershed characteristic not accounted for originally (Table A-1). Fall spawning can occur as early as August 15 and continue with incubation into the following spring up to June 1. As 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
- 9 °C as a maximum daily average water temperature

DEQ is currently seeking to change the water quality criteria with removal of the salmonid spawning 9 °C maximum daily average temperature.

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). As 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 below (Table A-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 also.

Table A-1. State and federal water temperature standards applicable in the Coeur d'Alene Lake 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="2">Salmonid Spawning</td><td rowspan="2">Applies to entire subbasin where beneficial use is designated or existing</td><td>13 °C (55.4 °F)
Maximum Daily Maximum Temperature (MDMT)</td><td rowspan="2"><u>Spring Spawning</u>

>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"><u>Fall Spawning</u>

Aug 15–Nov 15</td></tr>
<tr><td>9 °C (48.2 °F)
Maximum Daily Average Temperature (MDAT)</td></tr>
<tr><td rowspan="2">Idaho Bull Trout Criteria[a]</td><td rowspan="2">Only applies to the Coeur d'Alene River</td><td>13 °C (55.4 °F)
Maximum Weekly Maximum Temperature (MWMT)</td><td><u>Rearing</u>
Jun 1–Aug 31</td><td>n.a.</td></tr>
<tr><td>9 °C (48.2 °F)
Maximum Daily Average Temperature (MDAT)</td><td>n.a.</td><td><u>Spawning</u>
Sep 1–Oct 31</td></tr>
<tr><td>US Environmental Protection Agency Bull Trout Criteria</td><td>Cougar Creek
Fernan Creek
Kid Creek
Mica Creek
South Fork Mica Creek
Squaw Creek
Turner Creek</td><td>10 °C (50 °F)
Maximum Weekly Maximum Temperature (MWMT)</td><td colspan="2">Jun 1–Sep 30</td></tr>
</table>

[a] Current Idaho temperature criteria for bull trout have not been approved or disapproved by the US Environmental Protection Agency.

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 B. Assessment of Compliance with Idaho Water Quality Standards for Temperature, US Forest Service Data

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Coeur d'Alene Lake Subbasin (HUC 17010303): Assessment of Compliance with Idaho Water Quality Standards for Temperature, US Forest Service Data

Kajsa Stromberg and Valena Berry
DEQ Coeur d'Alene Regional Office
July 17, 2009

From 1999 to 2008, the Coeur d'Alene River Ranger District of the US Forest Service (USFS) Idaho Panhandle National Forests collected stream temperature data on streams in the Coeur d'Alene Lake subbasin (hydrologic unit code 17010303). Temperature data were collected from 60 sites on 15 assessment units and 27 streams (Figure B-1; Table B-1). These data were supplied to the Idaho Department of Environmental Quality (DEQ) and analyzed for compliance with Idaho water quality standards.

Beneficial uses of stream surface waters in the Coeur d'Alene Lake subbasin include cold water aquatic life throughout the subbasin. Therefore, data were analyzed for compliance with Idaho water quality criteria for cold water aquatic life and salmonid spawning (IDAPA 58.01.02.250.02.b and 02.f; Table B-2). The coldwater aquatic community consists of both native and nonnative coldwater species. Native fishes of the subbasin streams are westslope cutthroat trout, bull trout, largescale sucker, longnose dace, mountain whitefish, northern pikeminnow, redside shiner, and mottled, torrent, and shorthead sculpin (Jim Fredericks and Ryan Hardy [IDFG], Chris James [USFS], Ed Lider [retired USFS]). Nonnative coldwater species include rainbow trout, eastern brook trout, and Chinook salmon. Together, these species support a popular sport fishery. Other components of the coldwater aquatic life community include amphibians, such as Pacific giant salamanders, and diverse invertebrates.

Population numbers of westslope cutthroat trout and bull trout have severely declined, and they occupy a fraction of their historic range (May 2009). In January and March 2009, over 80 fisheries biologists and 12 ArcGIS technical experts from several state, federal, and tribal agencies, along with personnel from private firms, attended 9 workshops to develop a status update for westslope cutthroat trout and expand a database originally developed in 2002. The database is managed and maintained as a component of the westslope cutthroat trout interagency conservation working group. Coordination of the working group in Idaho and management of the database is currently provided by the Idaho Department of Fish and Game. Experts considered current distribution, conservation populations, and historical range of the species. Results of this effort indicated westslope cutthroat trout are currently present in most of the streams in the subbasin (May 2009). Current westslope cutthroat trout distribution is illustrated in a map in Figure 1 in the Background section of the TMDL document. Those tributaries with cutthroat trout most likely have some spawning occurring as well, whether it is adfluvial or resident fish (Ryan Hardy, IDFG, personal communication). Therefore, salmonid spawning is considered a beneficial use for all the streams evaluated in this TMDL analysis.

Since 2005, the mainstem Coeur d'Alene River has been designated by the US Fish and Wildlife Service as critical habitat for bull trout. The Coeur d'Alene River was identified as a migratory corridor, which provides the primary constituent elements of critical habitat necessary for seasonal use for migrating bull trout (USFWS 2010).

Temperature data from all of the assessment units exceeded Idaho water quality standards (Table B-3). Data from 5 assessment units exceeded the criteria for cold water aquatic life; all assessment units exceeded criteria for salmonid spawning where applicable. Idaho bull trout criteria were assessed for the Coeur d'Alene River, which exceeded Idaho bull trout temperature criteria. Overall, the exceedances were not infrequent, brief, and small, and the air temperature exemptions did not affect compliance status. Therefore, the 15 assessment units evaluated with USFS data were listed in Section 5 of Idaho's draft 2010 Integrated Report for a temperature impairment (Table B-4).

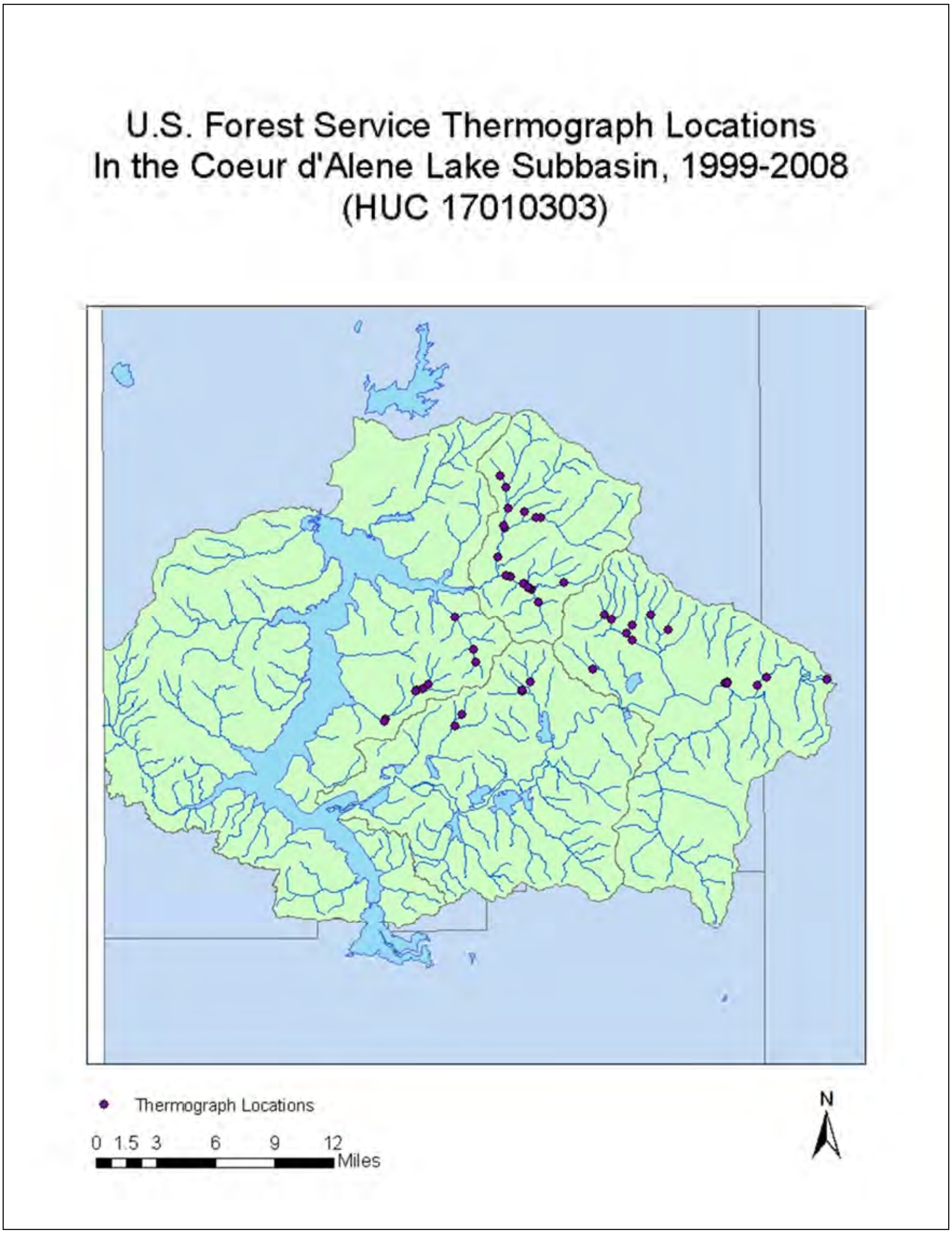


Figure B-1. Temperature data were collected from 60 sites and 15 assessment units.

Table B-1. Temperature monitoring locations in the Coeur d'Alene River subbasin for streams in this analysis, 1999–2008.

Assessment Unit Name	Assessment Unit Number	Stream Name	USFS Site Description	Year	Latitude	Longitude
Coeur d'Alene River, Latour Creek to Harrison	ID17010303PN007_06	Coeur d'Alene River	CDA River at Cataldo (Bottom)	2003	47.551647	-116.369345
		Coeur d'Alene River	CDA River at Cataldo (Top)	2003	47.552537	-116.367163
		Coeur d'Alene River	Cataldo	2006	47.551463	-116.367264
Coeur d'Alene River, South Fork Coeur d'Alene River to Latour Creek	ID17010303PN016_06	Coeur d'Alene River	CDA River below the South Fork	2005	47.553731	-116.259893
		Coeur d'Alene River	CDA River at Cataldo, off I-90	2005	47.549794	-116.334592
		Coeur d'Alene River	Below SF	2007	47.553731	-116.259893
		Coeur d'Alene River	Near Cataldo	2007	47.549794	-116.334592
		Coeur d'Alene River	Cataldo gauging station	2008	47.555007	-116.324444
Fourth of July Creek, headwaters and tributaries	ID17010303PN020_02	Curran Creek	Curran Creek above private land (Lower Reach)	2004	47.594420	-116.469252
		Curran Creek	Mouth	2006	47.588039	-116.476224
		Fern Creek	Above private land	2006	47.602204	-116.448816
		Mason Creek	Mason near mouth (lower reach) near I-90	2004	47.598839	-116.492091
		Mason Creek	Above I-90	2006	47.598839	-116.492091
		Mill Creek	Above I-90	2006	47.602120	-116.499049
		Rantenan Creek	Just above private land	2006	47.591090	-116.430907
Fourth of July Creek, lower	ID17010303PN020_03	Fourth of July Creek	Below Curran Creek	2006	47.583099	-116.469787
Rose Creek	ID17010303PN021_02	Rose Creek	Rose Creek (lower reach) on private land	2004	47.562570	-116.512027
Tributaries to Killarney Lake	ID17010303PN022_02	Armstrong Creek	Located on FS and private boundary	2004	47.546734	-116.588443
		Armstrong Creek tributary	70 m upstream from confluence with Armstrong	2004	47.547137	-116.589267
		Fortier Creek	Fortier Cr above private land (middle reach)	2004	47.553036	-116.580477
Cottonwood Creek	ID17010303PN024_02	Blue Lake Creek	None	2008	47.529674	-116.653463
		Cottonwood Creek	Cottonwood near confluence with Blue Lake Cr. off 614	2004	47.521154	-116.661805
		Cottonwood Creek	None	2008	47.521154	-116.661805

Assessment Unit Name	Assessment Unit Number	Stream Name	USFS Site Description	Year	Latitude	Longitude
Carlin Creek	ID17010303PN026_02	Carlin Creek	Lower Carlin Creek	2004	47.526696	-116.736731
		Carlin Creek	None	2008	47.525241	-116.738286
		Carrill Creek	Lower Carrill at mouth (20 m upstream from Pleasant Cr.)	2004	47.548256	-116.696566
		Johns Creek	Mouth of Johns Creek just above trail 257	2004	47.546715	-116.703948
		No Creek	Lower No approx. 120 m from trail crossing	2004	47.552182	-116.690496
		Pleasant Creek	Lower Pleasant Cr. below Carrill Cr., above No	2004	47.547535	-116.702450
		Pleasant Creek	Above mouth	2008	47.546597	-116.703552
Beauty Creek, headwaters and tributaries	ID17010303PN028_02	Beauty Creek	Right fork above road 438 up unnamed tributary	1999	47.568570	-116.638594
		Beauty Creek	Left fork above road 438 above unnamed tributary	1999	47.568264	-116.638430
		Beauty Creek	Upper Beauty, middle Sec 19 off 438	2004	47.576836	-116.641579
Beauty Creek, lower	ID17010303PN028_03	Beauty Creek	Beauty Cr. at confluence with Caribou Cr.	1999	47.601377	-116.660546
		Beauty Creek	Beauty Cr. at confluence with Caribou Cr.	2001	47.601377	-116.660546
		Beauty Creek	Beauty Cr. at confluence with Caribou Cr.	2002	47.601377	-116.660546
		Beauty Creek	Lower Beauty Cr. below Caribou Cr.	2004	47.601372	-116.660881
		Beauty Creek	below Caribou Cr.	2008	47.601388	-116.660722
Wolf Lodge Creek, upper	ID17010303PN029_02	Lonesome Creek	Lonesome Creek below Stella Cr.	2001	47.695623	-116.604885
		Lonesome Creek	Lonesome Creek (upper reach) (2 readings)	2001	47.704557	-116.610943
		Lonesome Creek	Mouth	2006	47.695719	-116.604972
		Stella Creek	Above Lonesome Creek	2006	47.695726	-116.604801
Wolf Lodge Creek, lower	ID17010303PN029_03	Wolf Lodge Creek	Above Marie Cr. Just below Meyers Hill Road	2006	47.668033	-116.607421
		Wolf Lodge Creek	Under Funk's bridge	2006	47.642197	-116.614255

Assessment Unit Name	Assessment Unit Number	Stream Name	USFS Site Description	Year	Latitude	Longitude
Cedar Creek, headwaters and tributaries	ID17010303PN030_02	Alder Creek	Lower Alder, 40 m upstream from I-90	2004	47.625535	-116.586320
		Alder Creek	Lower Alder, 60 m upstream from I-90	2005	47.625621	-116.586073
		Alder Creek	25-30 m upstream from I-90	2006	47.625518	-116.586449
		Cedar Creek	Upper reach above SF Cedar	2000	47.625560	-116.543267
		Cedar Creek	Upper reach above SF Cedar	2001	47.625560	-116.543267
		Cedar Creek	Upper reach above SF Cedar	2004	47.621169	-116.577986
		Cedar Creek	Cedar Cr. below the SF	2005	47.621804	-116.580878
		Cedar Creek	Cedar Cr. below the SF	2006	47.622710	-116.582157
		South Fork Cedar Creek	Lower to mid SF, up from I-90	2004	47.612052	-116.570028
Cedar Creek, lower	ID17010303PN030_03	Cedar Creek	Cedar Creek, lower reach north of I-90	2000	47.630413	-116.600462
		Cedar Creek	Cedar Creek, lower reach north of I-90	2001	47.630413	-116.600462
		Cedar Creek	Lower Cedar Cr, near Strauss house	2005	47.630995	-116.605288
Marie Creek	ID17010303PN031_02	Marie Creek	Marie Cr. near bridge	2001	47.665833	-116.607157
		Marie Creek	Lower Marie off trail	2005	47.673439	-116.572753
		Marie Creek	Trail 214 at Marie Cr. floodplain, Approx. 600 ft below Burton	2006	47.673541	-116.568078
		Searchlight Creek	Above Trail 241	2006	47.677455	-116.584984

Table B-2. Water temperature criteria applied in Coeur d’Alene Lake subbasin streams.

Beneficial Use	Location	Temperature Criteria[a]	Dates	
Cold Water Aquatic Life	Applies to entire subbasin	22 °C MDMT	All year	
		19 °C MDAT		
Salmonid Spawning	Applies to all water bodies addressed in this TMDL document	13 °C MDMT	Spring > 4,000ft Jun 1–July 31 3,000–4,000ft May 15–July 15 <3,000ft May 1–July 1	Fall Aug 15–Nov 15
		9 °C MDAT		
Idaho Bull Trout Criteria	Only applies to the Coeur d’Alene River	13 °C MWMT	Rearing Jun 1–Aug 31	N/A
		9 °C MDAT	N/A	Spawning Sep 1–Oct 31
EPA Bull Trout Criteria	Cougar Creek Fernan Creek Kid Creek Mica Creek South Fork Mica Creek Squaw Creek Turner Creek	10 °C MWMT	Jun 1–Sep 30	

[a] MDMT = maximum daily maximum temperature; MDAT = maximum daily average temperature; MWMT = maximum weekly maximum temperature

Table B-3. Temperature monitoring locations and assessment results for data collected by the US Forest Service in the Coeur d'Alene River subbasin streams in this analysis, 1999–2008.
Note: O indicates pass, X indicates fail, and NA indicates data unavailable for assessment.

Assessment Unit Name	Assessment Unit	Stream Name	USFS Site Description	Year	Criteria Evaluation			
					CWAL[a]	SS[b]—spring	SS[b]—fall	ID Bull Trout
Coeur d'Alene River, Latour Creek to Harrison	ID17010303PN007_06	Coeur d'Alene River	CDA River at Cataldo (Bottom)	2003	X	X	X	X
			CDA River at Cataldo (Top)	2003	X	X	X	X
			Cataldo	2006	X	X	X	X
Coeur d'Alene River, South Fork Coeur d'Alene River to Latour Creek	ID17010303PN016_06	Coeur d'Alene River	CDA River below the South Fork	2005	O	X	X	X
			CDA River at Cataldo, off I-90	2005	O	NA	X	X
			Below SF	2007	O	NA	X	X
			Near Cataldo	2007	X	X	X	X
			Cataldo gauging station	2008	O	NA	X	X
Fourth of July Creek, headwaters and tributaries	ID17010303PN020_02	Curran Creek	Curran Creek above private land (Lower Reach)	2004	O	O	X	NA
			Mouth	2006	O	X	X	NA
		Fern Creek	Above private land	2006	O	X	X	NA
		Mason Creek	Mason near mouth (lower reach) near I-90	2004	O	X	X	NA
			Above I-90	2006	O	X	X	NA
		Mill Creek	Above I-90	2006	O	X	X	NA
		Rantenan Creek	Just above private land	2006	O	X	X	NA
Fourth of July Creek, lower	ID17010303PN020_03	Fourth of July Creek	Below Curran Creek	2006	O	X	X	NA
Rose Creek	ID17010303PN021_02	Rose Creek	Rose Creek (lower reach) on private land	2004	X	X	X	NA
Tributaries to Killarney Lake	ID17010303PN022_02	Armstrong Creek	Located on FS and private boundary	2004	O	X	X	NA
		Armstrong Creek tributary	70 m upstream from confluence with Armstrong	2004	O	X	X	NA
		Fortier Creek	Fortier Cr above private land (middle reach)	2004	O	X	X	NA

Assessment Unit Name	Assessment Unit	Stream Name	USFS Site Description	Year	Criteria Evaluation			
					CWAL[a]	SS[b]—spring	SS[b]—fall	ID Bull Trout
Cottonwood Creek	ID17010303PN024_02	Blue Lake Creek	None	2008	O	X	X	NA
		Cottonwood Creek	Cottonwood near confluence with Blue Lake Cr. off 614	2004	X	X	X	NA
			None	2008	O	X	X	NA
Carlin Creek	ID17010303PN026_02	Carlin Creek	Lower Carlin Creek	2004	O	X	X	NA
			None	2008	O	X	X	NA
		Carrill Creek	Lower Carrill at mouth (20 m upstream from Pleasant Cr.)	2004	O	X	X	NA
		Johns Creek	Mouth of Johns Creek just above trail 257	2004	O	X	X	NA
		No Creek	Lower No approx. 120 m from trail crossing	2004	O	X	X	NA
		Pleasant Creek	Lower Pleasant Cr. below Carrill Cr., above No	2004	O	X	X	NA
			Above mouth	2008	O	X	X	NA
Beauty Creek, headwaters and tributaries	ID17010303PN028_02	Beauty Creek	Right fork above road 438 up unnamed tributary	1999	O	X	X	NA
			Left fork above road 438 above unnamed tributary	1999	O	X	X	NA
			Upper Beauty, middle Sec 19 off 438	2004	O	X	X	NA
Beauty Creek, lower	ID17010303PN028_03	Beauty Creek	Beauty Cr. at confluence with Caribou Cr.	1999	O	X	X	NA
			Beauty Cr. at confluence with Caribou Cr.	2001	O	NA	X	NA
			Beauty Cr. at confluence with Caribou Cr.	2002	O	X	X	NA
			Lower Beauty Cr. below Caribou Cr.	2004	O	X	X	NA
			below Caribou Cr.	2008	O	X	X	NA
Wolf Lodge Creek, upper	ID17010303PN029_02	Lonesome Creek	Lonesome Creek below Stella Cr.	2001	O	NA	X	NA
			Lonesome Creek (upper reach) (2 readings)	2001	O	X	NA	NA
			Mouth	2006	O	X	X	NA
		Stella Creek	Above Lonesome Creek	2006	O	X	X	NA

Assessment Unit Name	Assessment Unit	Stream Name	USFS Site Description	Year	Criteria Evaluation			
					CWAL[a]	SS[b]—spring	SS[b]—fall	ID Bull Trout
Wolf Lodge Creek, lower	ID17010303PN029_03	Wolf Lodge Creek	Above Marie Cr. Just below Meyers Hill Road	2006	O	X	X	NA
			Under Funk's bridge	2006	O	X	X	NA
Cedar Creek, headwaters and tributaries	ID17010303PN030_02	Alder Creek	Lower Alder, 40 m upstream from I-90	2004	O	X	X	NA
			Lower Alder, 60 m upstream from I-90	2005	O	X	X	NA
			25-30 m upstream from I-90	2006	O	X	X	NA
		Cedar Creek	Upper reach above SF Cedar	2000	O	NA	X	NA
			Upper reach above SF Cedar	2001	O	X	X	NA
			Upper reach above SF Cedar	2004	X	X	NA	NA
			Cedar Cr. below the SF	2005	X	X	X	NA
			Cedar Cr. below the SF	2006	O	X	X	NA
		South Fork Cedar Creek	Lower to mid SF, up from I-90	2004	O	X	X	NA
Cedar Creek, lower	ID17010303PN030_03	Cedar Creek	Cedar Creek, lower reach north of I-90	2000	O	NA	X	NA
			Cedar Creek, lower reach north of I-90	2001	O	X	X	NA
			Lower Cedar Cr, near Strauss house	2005	O	X	X	NA
Marie Creek	ID17010303PN031_02	Marie Creek	Marie Cr. near bridge	2001	O		NA	
			Lower Marie off trail	2005	O	X	X	NA
			Trail 214 at Marie Cr. floodplain, Approx. 600 ft below Burton	2006	O	X	X	NA
		Searchlight Creek	Above Trail 241	2006	O	X	X	NA

[a] CWAL = cold water aquatic life
[b] SS = salmonid spawning

Table B-4. Temperature assessment status of selected Coeur d'Alene Lake subbasin streams. Italics indicate changes in status related to temperature.

Assessment Unit Name	Assessment Unit	2002 Water Quality Status (for Temp)	2008 Water Quality Status (for Temp)	2010 Water Quality Status
Coeur d'Alene River, Latour Creek to Harrison	ID17010303PN007_06	Impaired: Exceeds WQS for COLD and SS	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for CWAL and SS
Coeur d'Alene River, South Fork Coeur d'Alene River to Latour Creek	ID17010303PN016_06	Impaired: Exceeds WQS for COLD and SS	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for CWAL and SS
Fourth of July Creek, headwaters and tributaries	ID17010303PN020_02	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for [1]CWAL and SS*
Fourth of July Creek, lower	ID17010303PN020_03	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for SS*
Rose Creek	ID17010303PN021_02	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for CWAL and SS*
Tributaries to Killarney Lake	ID17010303PN022_02	Not Assessed	Full Support	*Impaired: Exceeds WQS for SS*
Cottonwood Creek	ID17010303PN024_02	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for CWAL and SS*
Carlin Creek	ID17010303PN026_02	Full Support	Full Support	*Impaired: Exceeds WQS for SS*
Beauty Creek, headwaters and tributaries	ID17010303PN028_02	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for SS*
Beauty Creek, lower	ID17010303PN028_03	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for [1]CWAL and SS
Wolf Lodge Creek, upper	ID17010303PN029_02	Full Support	Full Support	*Impaired: Exceeds WQS for SS*
Wolf Lodge Creek, lower	ID17010303PN029_03	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for [1]CWAL and SS
Cedar Creek, headwaters and tributaries	ID17010303PN030_02	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for CWAL and SS*
Cedar Creek, lower	ID17010303PN030_03	Not Assessed	Not Assessed	*Impaired: Exceeds WQS for SS*
Marie Creek	ID17010303PN031_02	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for CWAL and SS	Impaired: Exceeds WQS for [1]CWAL and SS

Note: WQS = water quality standards; CWAL = Cold Water Aquatic Life; SS = Salmonid Spawning
[1]*CWAL listing was prior to this assessment.*

DATA SUMMARY

Data Source: USDA Forest Service
Water Body: Armstrong Creek (ID17010303PN022_02)
Data Collection Period: 5/26/2004–10/21/2004

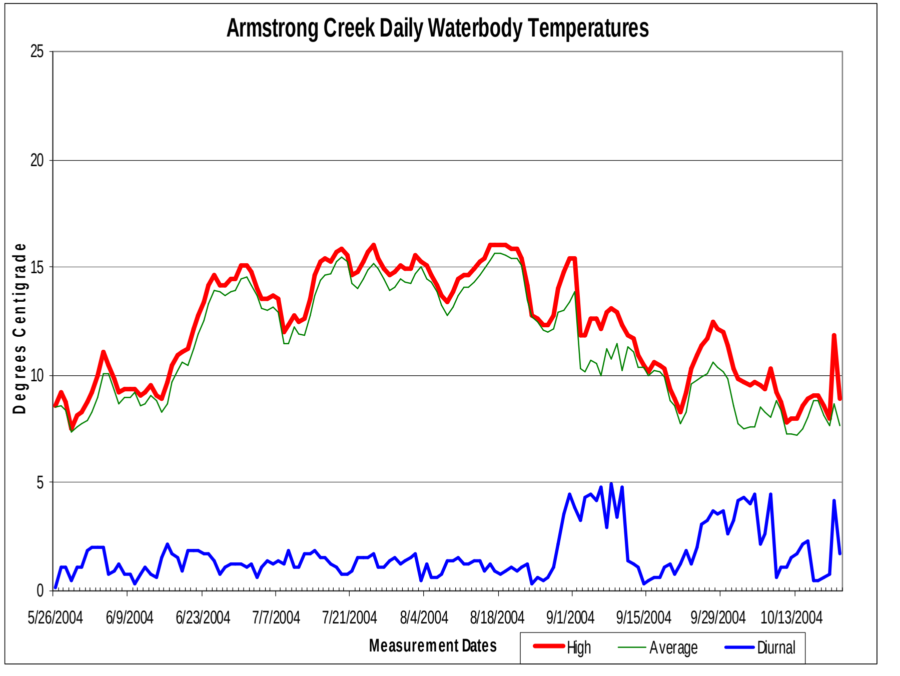
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	18	35%	
9 °C Average Spring	35	69%	
Spring Days Eval'd w/in Dates	51	15-Apr	15-Jul
13 °C Instantaneous Fall	14	21%	
9 °C Average Fall	43	63%	
Fall Days Eval'd w/in Dates	68	15-Aug	15-Nov
13 °C Instantaneous Total *	32	27%	
9 °C Average Total *	78	66%	
Tot Days Eval'd w/in Both Dates *	119		

* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Beauty Creek, upper, (ID17010303PN028_02)
Data Collection Period: 5/20/2004–10/20/2004

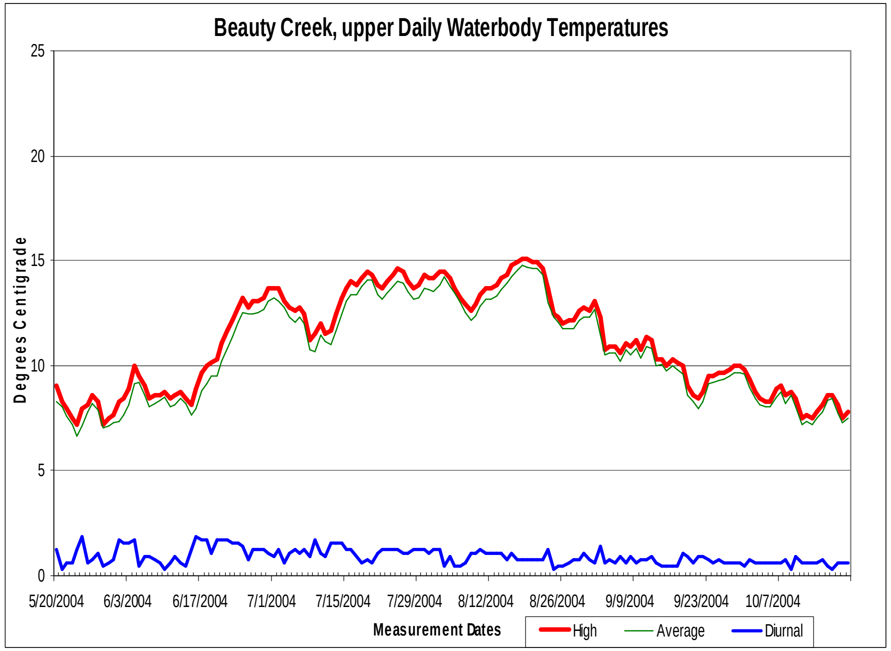
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	0	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	10	18%	
9 °C Average Spring	30	53%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	10	15%	
9 °C Average Fall	43	64%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	20	16%	
9 °C Average Total *	73	59%	
Tot Days Eval'd w/in Both Dates *	124		

* If spring & fall dates overlap double counting may occur.

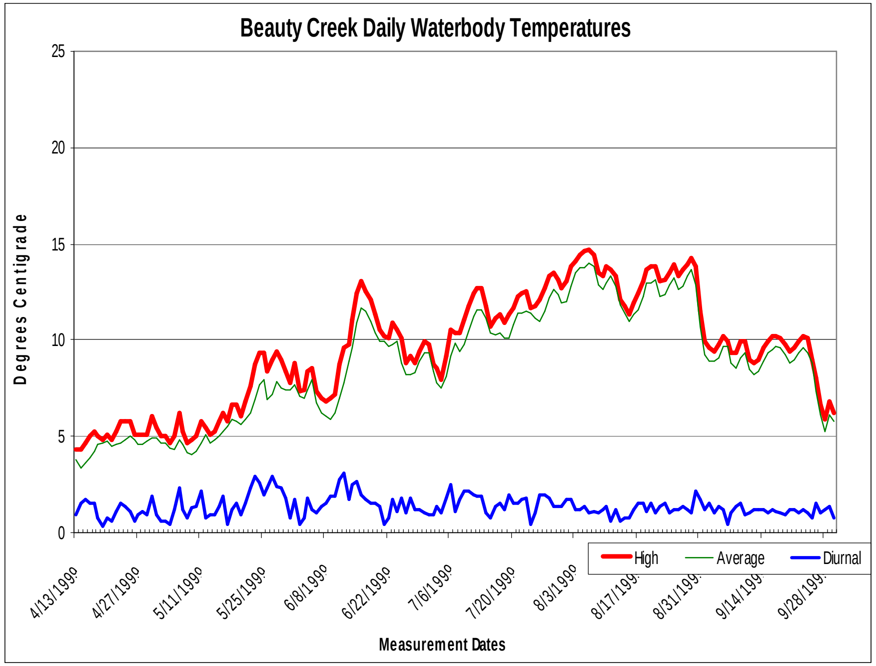


Data Source: USDA Forest Service
Water Body: Beauty Creek at confluence with Carabou Creek, (ID17010303PN028_03)
Data Collection Period: 4/13/1999–9/30/1999

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	0	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	1	1%	
9 °C Average Spring	23	25%	
Spring Days Eval'd w/in Dates	92	15-Apr	15-Jul
13 °C Instantaneous Fall	13	28%	
9 °C Average Fall	31	66%	
Fall Days Eval'd w/in Dates	47	15-Aug	15-Nov
13 °C Instantaneous Total *	14	10%	
9 °C Average Total *	54	39%	
Tot Days Eval'd w/in Both Dates *	139		

* If spring & fall dates overlap double counting may occur.

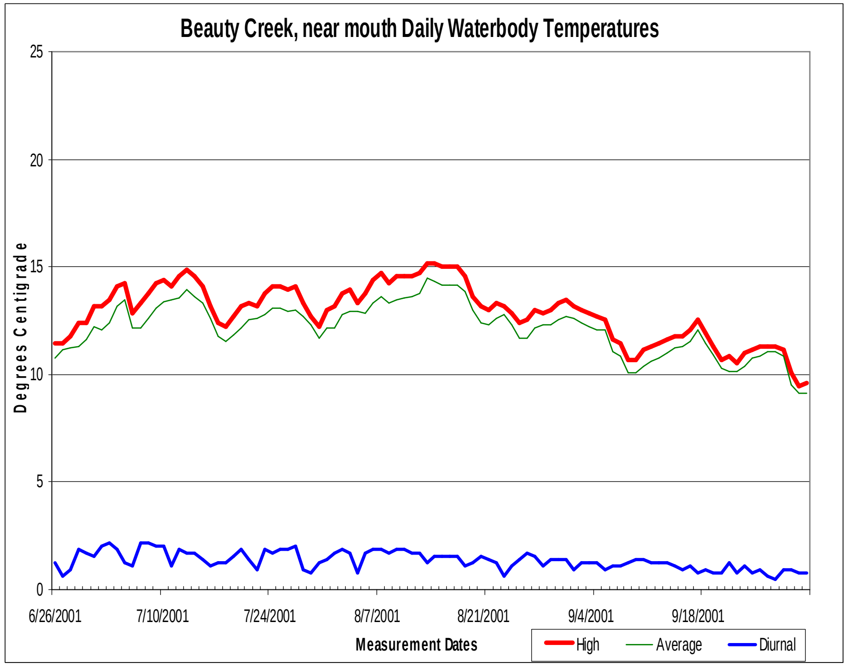


Data Source: USDA Forest Service
Water Body: Beauty Creek, near mouth, (ID17010303PN028_03)
Data Collection Period: 6/26/2001–10/1/2001

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	0	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	14	70%	
9 °C Average Spring	20	100%	
Spring Days Eval'd w/in Dates	20	15-Apr	15-Jul
13 °C Instantaneous Fall	11	23%	
9 °C Average Fall	48	100%	
Fall Days Eval'd w/in Dates	48	15-Aug	15-Nov
13 °C Instantaneous Total *	25	37%	
9 °C Average Total *	68	100%	
Tot Days Eval'd w/in Both Dates *	68		

* If spring & fall dates overlap double counting may occur.

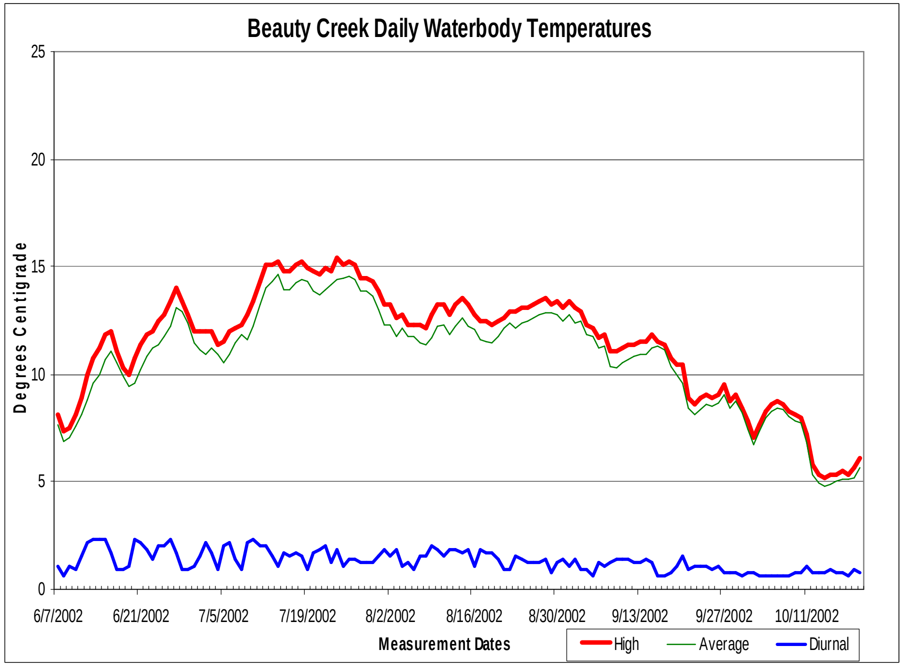


Data Source: USDA Forest Service
Water Body: Beauty Creek, near mouth, (ID17010303PN028_03)
Data Collection Period: 6/7/2002–10/20/2002

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	9	23%	
9 °C Average Spring	33	85%	
Spring Days Eval'd w/in Dates	39	15-Apr	15-Jul
13 °C Instantaneous Fall	11	16%	
9 °C Average Fall	38	57%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	20	19%	
9 °C Average Total *	71	67%	
Tot Days Eval'd w/in Both Dates *	106		

* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Beauty Creek, at campground, (ID17010303PN028_03)
Data Collection Period: 5/20/2004–10/21/2004

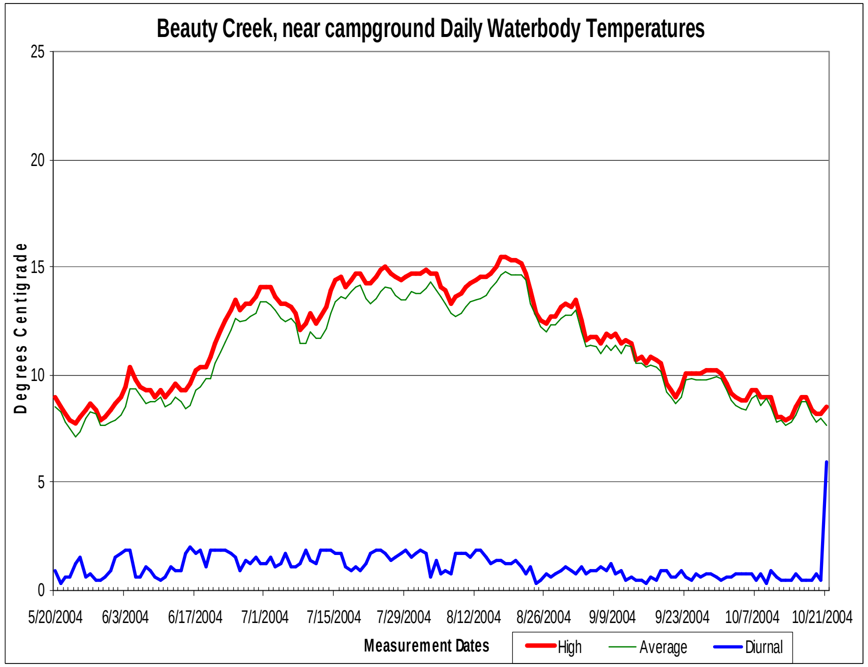
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	0	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

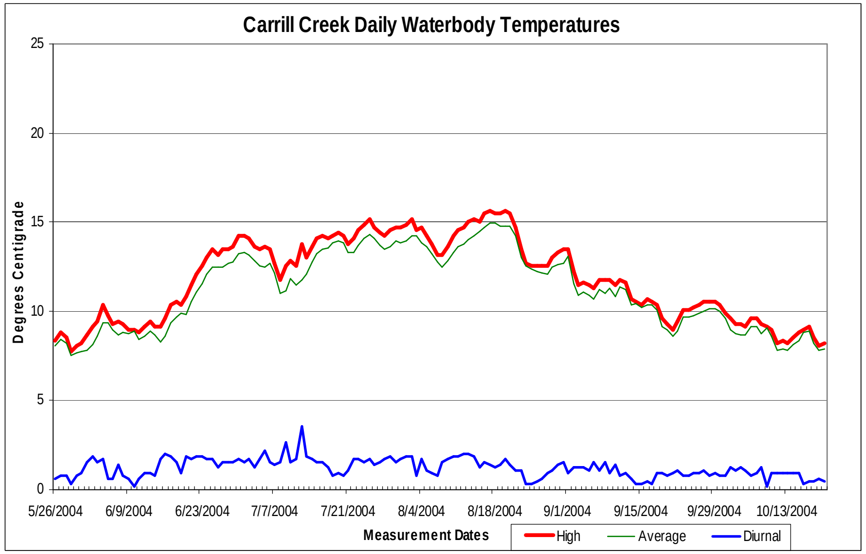
Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	14	25%	
9 °C Average Spring	32	56%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	13	19%	
9 °C Average Fall	47	69%	
Fall Days Eval'd w/in Dates	68	15-Aug	15-Nov
13 °C Instantaneous Total *	27	22%	
9 °C Average Total *	79	63%	
Tot Days Eval'd w/in Both Dates *	125		

* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Carrill Creek, near mouth, (ID17010303PN026_02)
Data Collection Period: 5/26/2004–10/20/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep



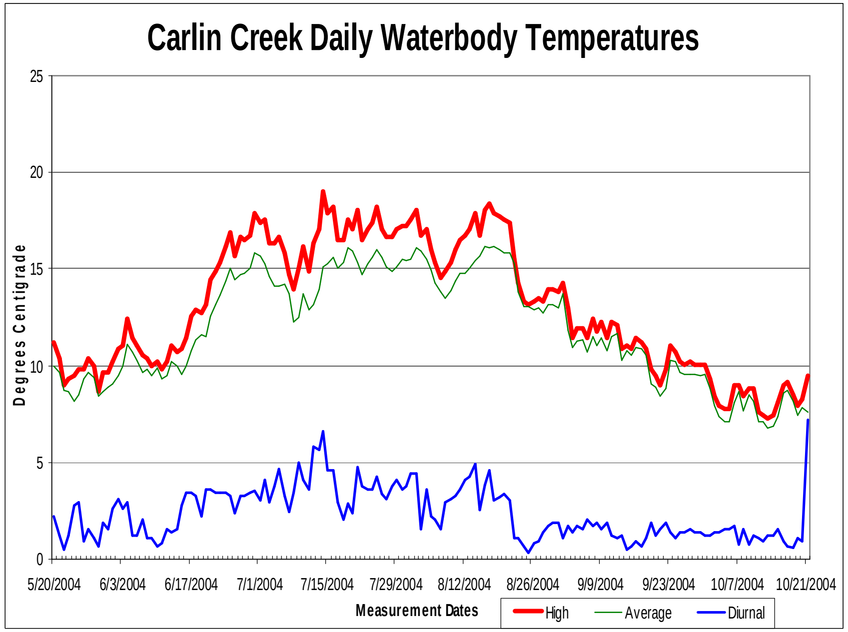
Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	17	33%	
9 °C Average Spring	32	63%	
Spring Days Eval'd w/in Dates	51	15-Apr	15-Jul
13 °C Instantaneous Fall	13	19%	
9 °C Average Fall	48	72%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	30	25%	
9 °C Average Total *	80	68%	
Tot Days Eval'd w/in Both Dates *	118		
* If spring & fall dates overlap double counting may occur.			

Data Source: USDA Forest Service
Water Body: Carlin Creek, (ID17010303PN026_02)
Data Collection Period: 5/20/2004–10/21/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	26	46%	
9 °C Average Spring	50	88%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	19	28%	
9 °C Average Fall	44	65%	
Fall Days Eval'd w/in Dates	68	15-Aug	15-Nov
13 °C Instantaneous Total *	45	36%	
9 °C Average Total *	94	75%	
Tot Days Eval'd w/in Both Dates *	125		

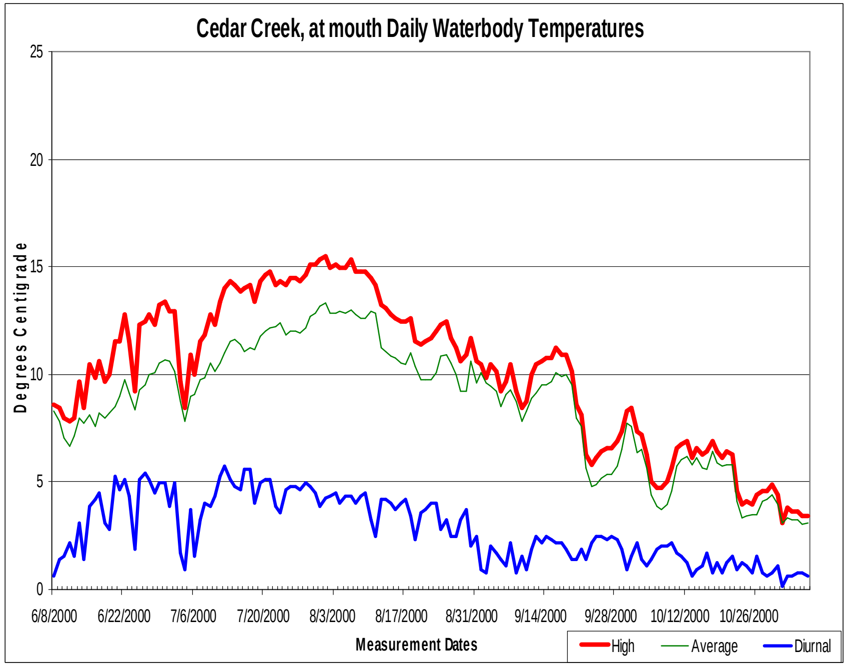
* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Cedar Creek at Mouth, (ID17010303PN030_03)
Data Collection Period: 6/8/2000–11/5/2000

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	7	18%	
9 °C Average Spring	20	53%	
Spring Days Eval'd w/in Dates	38	15-Apr	15-Jul
13 °C Instantaneous Fall	0	0%	
9 °C Average Fall	31	37%	
Fall Days Eval'd w/in Dates	83	15-Aug	15-Nov
13 °C Instantaneous Total *	7	6%	
9 °C Average Total *	51	42%	
Tot Days Eval'd w/in Both Dates *	121		
* If spring & fall dates overlap double counting may occur.			



Data Source: USDA Forest Service
Water Body: Cedar Creek at Mouth, (ID17010303PN030_03)
Data Collection Period: 5/20/2004–8/5/2004

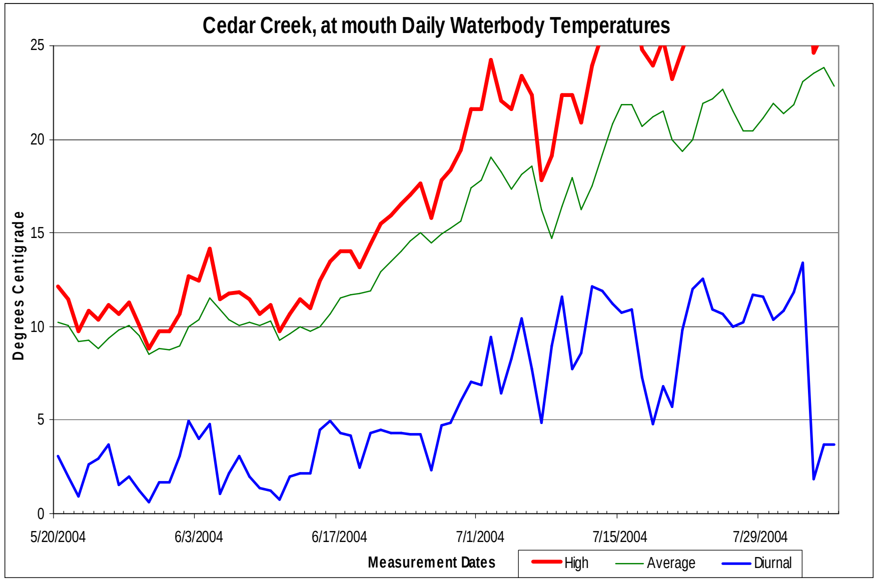
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	31	69%	
19 °C Average	25	56%	
Days Evaluated & Date Range	45	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	31	54%	
9 °C Average Spring	52	91%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	0	0%	
9 °C Average Fall	0	0%	
Fall Days Eval'd w/in Dates	0	15-Aug	15-Nov
13 °C Instantaneous Total *	31	54%	
9 °C Average Total *	52	91%	
Tot Days Eval'd w/in Both Dates *	57		

* If spring & fall dates overlap double counting may occur.

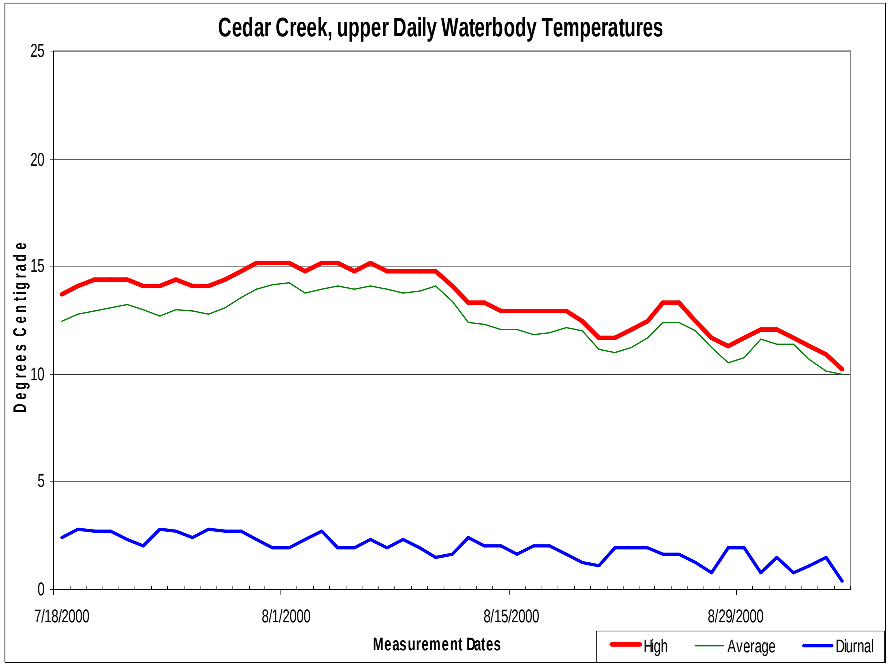


Data Source: USDA Forest Service
Water Body: Cedar Creek, upper, (ID17010303PN030_02)
Data Collection Period: 7/18/2000–9/4/2000

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	49	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	0	0%	
Spring Days Eval'd w/in Dates	0	15-Apr	15-Jul
13 °C Instantaneous Fall	2	10%	
9 °C Average Fall	21	100%	
Fall Days Eval'd w/in Dates	21	15-Aug	15-Nov
13 °C Instantaneous Total *	2	10%	
9 °C Average Total *	21	100%	
Tot Days Eval'd w/in Both Dates *	21		

* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Cedar Creek, upper site, (ID17010303PN030_02)
Data Collection Period: 5/11/2001–9/18/2001

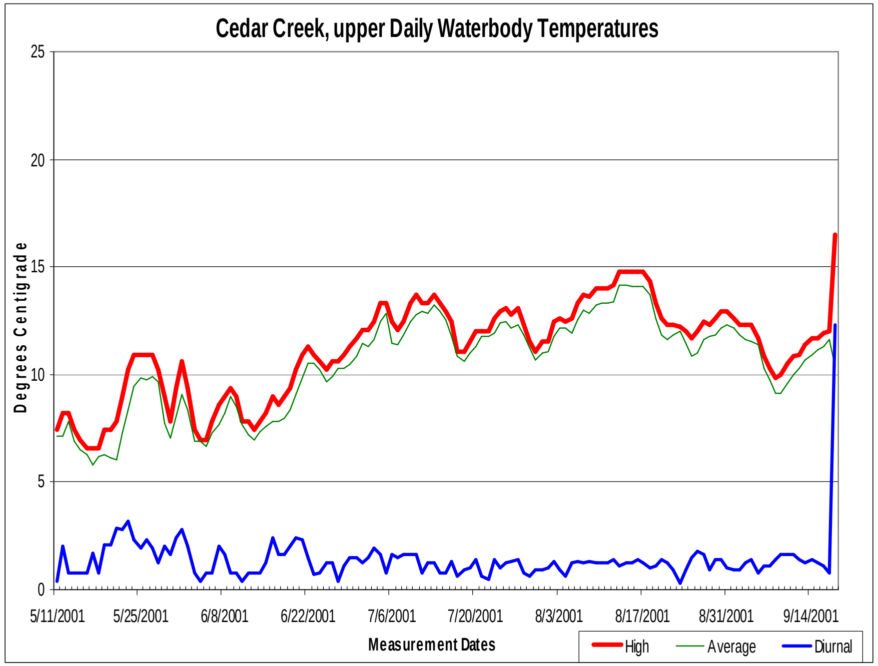
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	89	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	8	12%	
9 °C Average Spring	32	48%	
Spring Days Eval'd w/in Dates	66	15-Apr	15-Jul
13 °C Instantaneous Fall	6	17%	
9 °C Average Fall	35	100%	
Fall Days Eval'd w/in Dates	35	15-Aug	15-Nov
13 °C Instantaneous Total *	14	14%	
9 °C Average Total *	67	66%	
Tot Days Eval'd w/in Both Dates *	101		

* If spring & fall dates overlap double counting may occur.

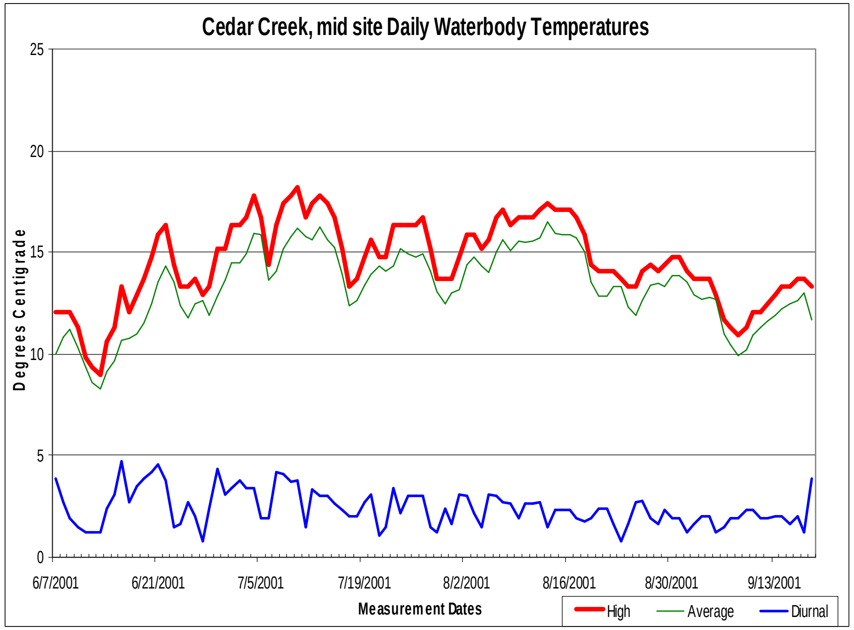


Data Source: USDA Forest Service
Water Body: Cedar Creek, mid site, (ID17010303PN030_02)
Data Collection Period: 6/7/2001–9/18/2001

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	89	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	27	69%	
9 °C Average Spring	37	95%	
Spring Days Eval'd w/in Dates	39	15-Apr	15-Jul
13 °C Instantaneous Fall	26	74%	
9 °C Average Fall	35	100%	
Fall Days Eval'd w/in Dates	35	15-Aug	15-Nov
13 °C Instantaneous Total *	53	72%	
9 °C Average Total *	72	97%	
Tot Days Eval'd w/in Both Dates *	74		

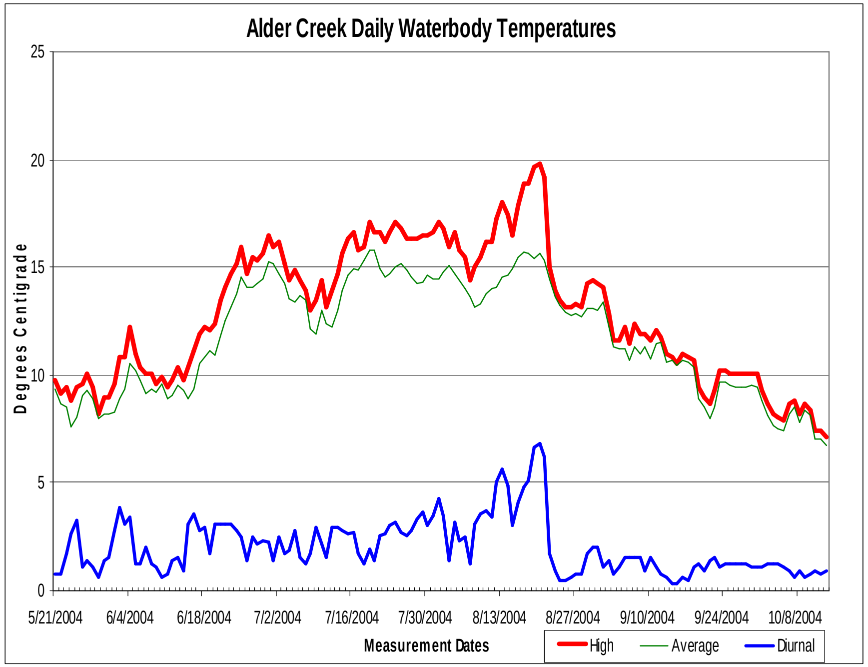
* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Alder Creek – Tributary to Cedar Creek, (ID17010303PN030_02)
Data Collection Period: 5/21/2004–10/13/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	25	45%	
9 °C Average Spring	44	79%	
Spring Days Eval'd w/in Dates	56	15-Apr	15-Jul
13 °C Instantaneous Fall	18	30%	
9 °C Average Fall	43	72%	
Fall Days Eval'd w/in Dates	60	15-Aug	15-Nov
13 °C Instantaneous Total *	43	37%	
9 °C Average Total *	87	75%	
Tot Days Eval'd w/in Both Dates *	116		
* If spring & fall dates overlap double counting may occur.			

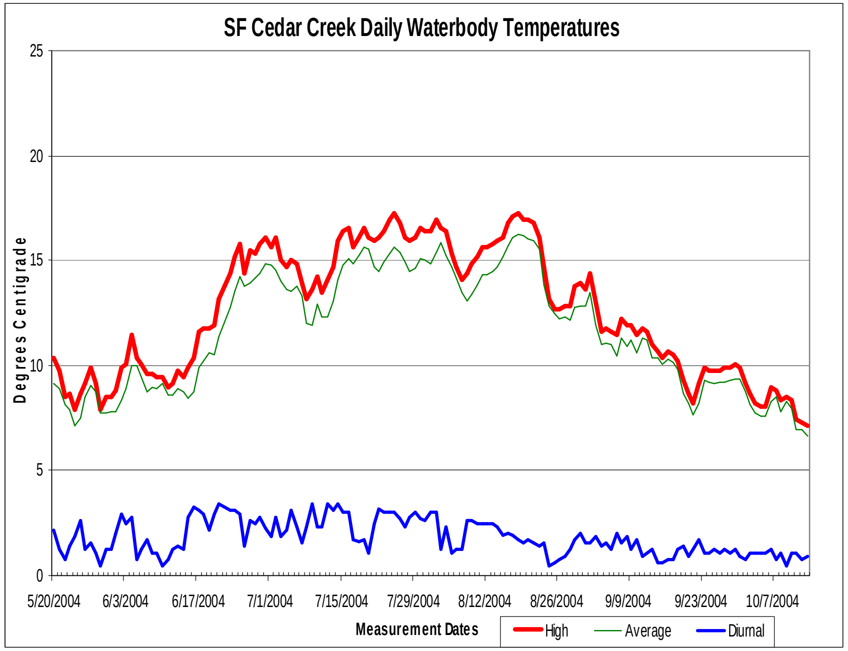


Data Source: USDA Forest Service
Water Body: SF Cedar Creek, mid site, (ID17010303PN030_03)
Data Collection Period: 5/20/2004–10/13/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	25	44%	
9 °C Average Spring	35	61%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	14	23%	
9 °C Average Fall	43	72%	
Fall Days Eval'd w/in Dates	60	15-Aug	15-Nov
13 °C Instantaneous Total *	39	33%	
9 °C Average Total *	78	67%	
Tot Days Eval'd w/in Both Dates *	117		

* If spring & fall dates overlap double counting may occur.

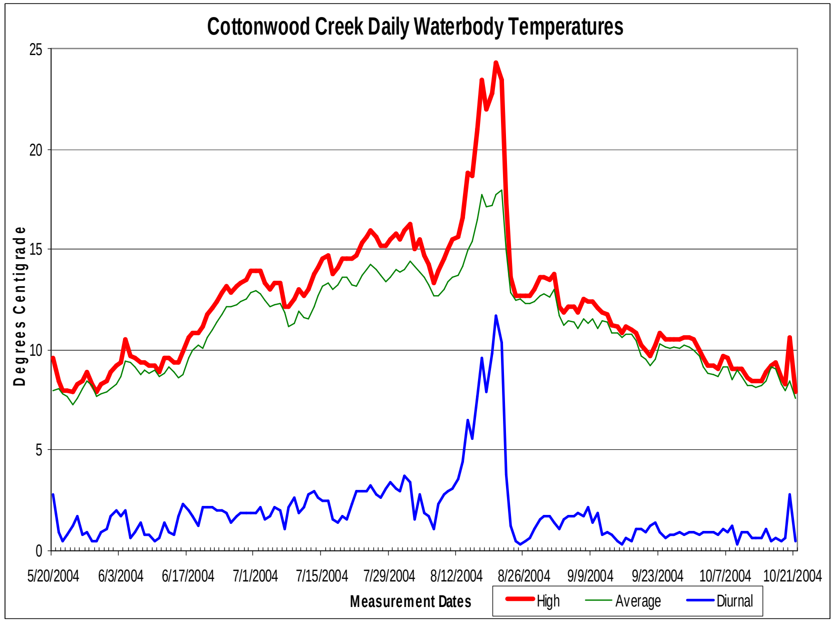


Data Source: USDA Forest Service
Water Body: Cottonwood Creek, (ID17010303PN024_02)
Data Collection Period: 5/20/2004–10/21/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	4	4%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	13	23%	
9 °C Average Spring	33	58%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	13	19%	
9 °C Average Fall	53	78%	
Fall Days Eval'd w/in Dates	68	15-Aug	15-Nov
13 °C Instantaneous Total *	26	21%	
9 °C Average Total *	86	69%	
Tot Days Eval'd w/in Both Dates *	125		

* If spring & fall dates overlap double counting may occur.

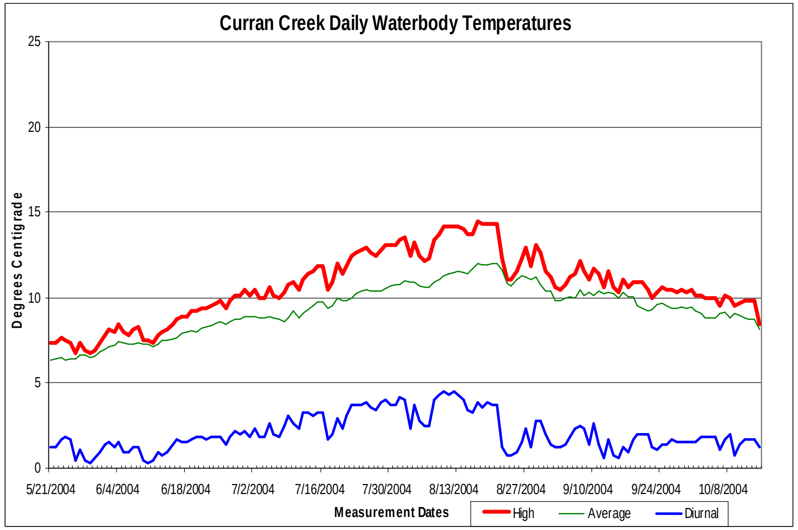


Data Source: USDA Forest Service
Water Body: Curran Creek, (ID17010303PN020_02)
Data Collection Period: 5/21/2004–10/14/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	5	9%	
Spring Days Eval'd w/in Dates	56	15-Apr	15-Jul
13 °C Instantaneous Fall	8	13%	
9 °C Average Fall	52	85%	
Fall Days Eval'd w/in Dates	61	15-Aug	15-Nov
13 °C Instantaneous Total *	8	7%	
9 °C Average Total *	57	49%	
Tot Days Eval'd w/in Both Dates *	117		

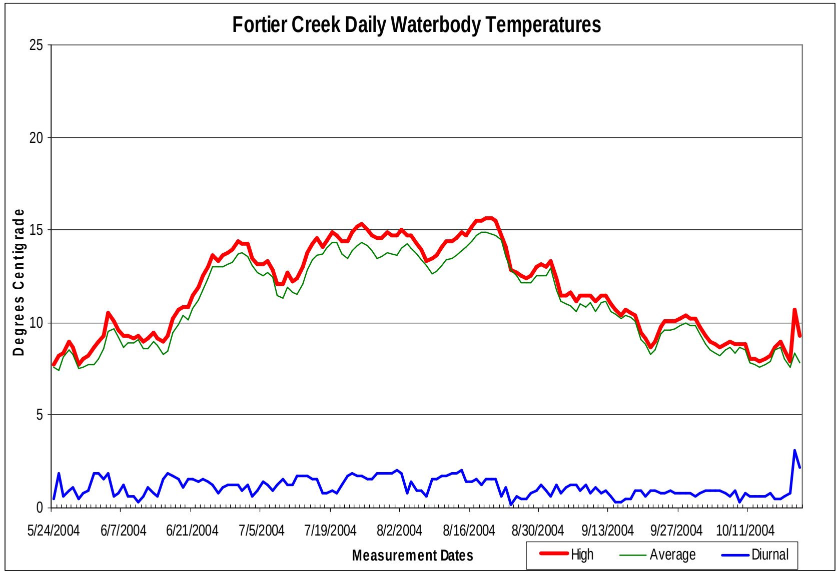
* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Fortier Creek, (ID17010303PN022_02)
Data Collection Period: 5/24/2004–10/21/2004

Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep



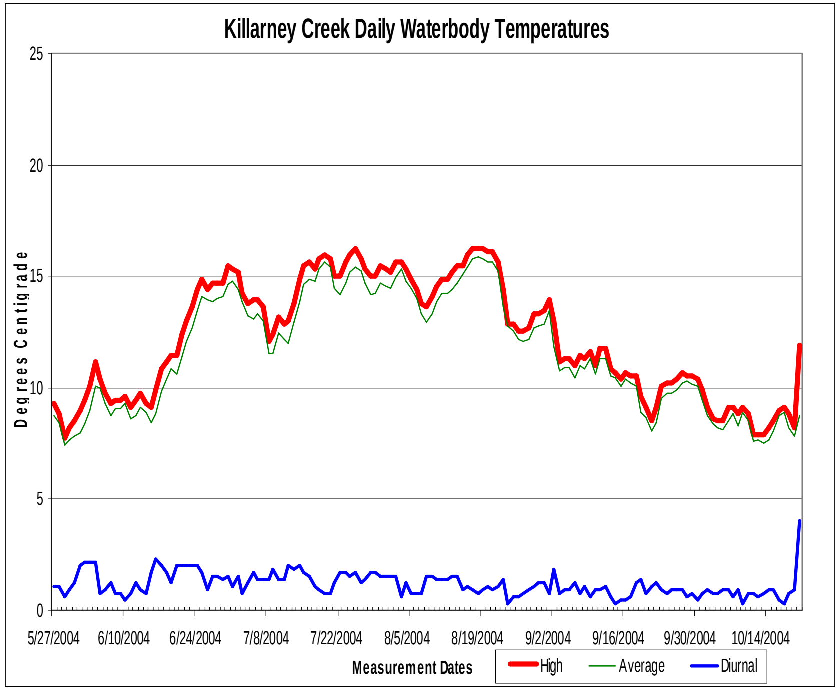
Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	14	26%	
9 °C Average Spring	33	62%	
Spring Days Eval'd w/in Dates	53	15-Apr	15-Jul
13 °C Instantaneous Fall	11	16%	
9 °C Average Fall	45	66%	
Fall Days Eval'd w/in Dates	68	15-Aug	15-Nov
13 °C Instantaneous Total *	25	21%	
9 °C Average Total *	78	64%	
Tot Days Eval'd w/in Both Dates *	121		

* If spring & fall dates overlap double counting may occur.

Data Source: USDA Forest Service
Water Body: Killarney Creek, (ID17010303PN022_02)
Data Collection Period: 5/27/2004–10/20/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep



Idaho Salmonid Spawning Criteria Exceedance Summary			
Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	19	38%	
9 °C Average Spring	37	74%	
Spring Days Eval'd w/in Dates	50	15-Apr	15-Jul
13 °C Instantaneous Fall	13	19%	
9 °C Average Fall	44	66%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	32	27%	
9 °C Average Total *	81	69%	
Tot Days Eval'd w/in Both Dates *	117		

* If spring & fall dates overlap double counting may occur.

Data Source: USDA Forest Service
Water Body: Lonesome Creek, upper – Tributary to Wolf Lodge, (ID17010303PN029_02)
Data Collection Period: 7/17/2001–9/17/2001

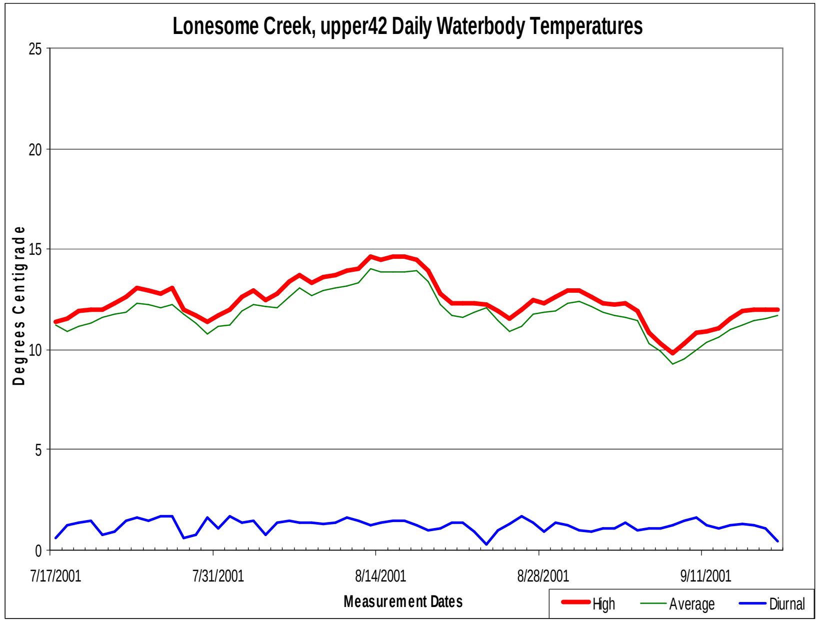
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	63	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	0	0%	
Spring Days Eval'd w/in Dates	0	15-Apr	15-Jul
13 °C Instantaneous Fall	4	12%	
9 °C Average Fall	34	100%	
Fall Days Eval'd w/in Dates	34	15-Aug	15-Nov
13 °C Instantaneous Total *	4	12%	
9 °C Average Total *	34	100%	
Tot Days Eval'd w/in Both Dates *	34		

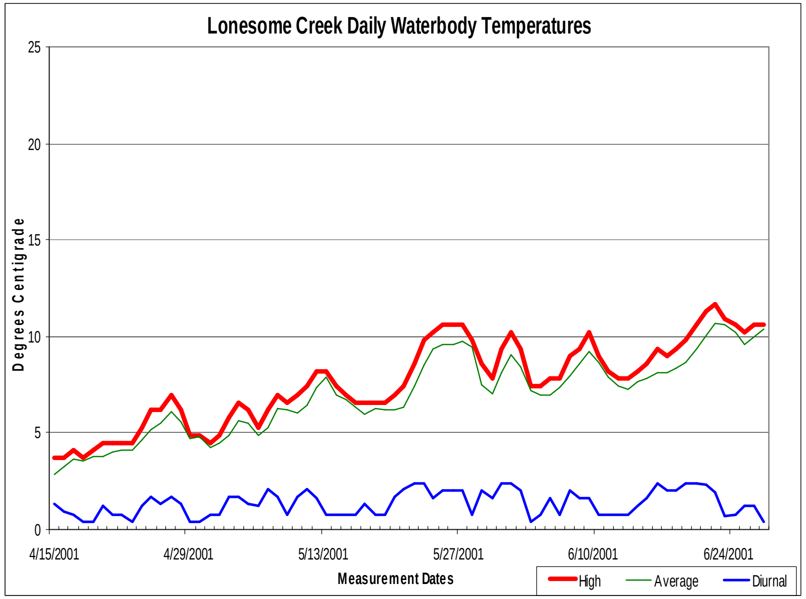
* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Lonesome Creek, upper – tributary to Wolf Lodge, (ID17010303PN029_02)
Data Collection Period: 4/15/2001–6/27/2001

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	6	22-Jun	21-Sep

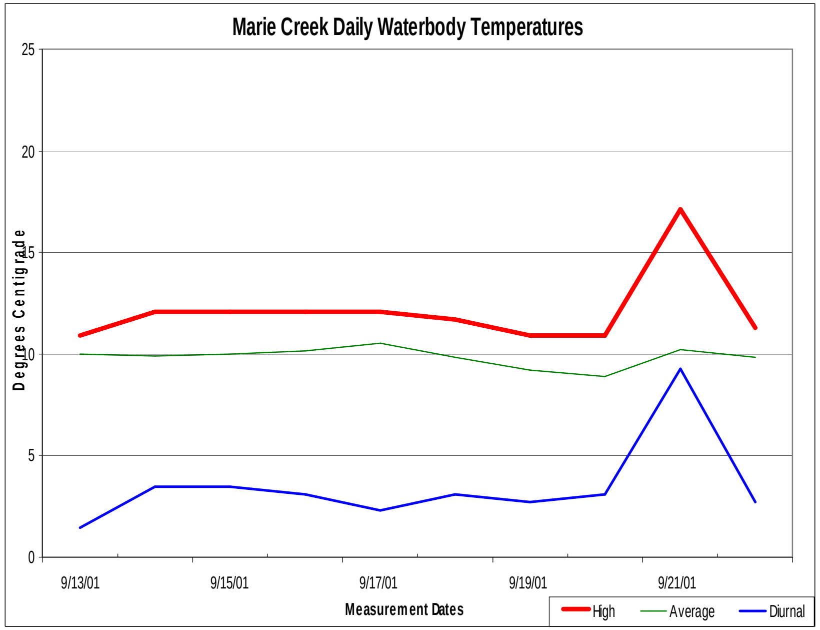
Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	15	20%	
Spring Days Eval'd w/in Dates	74	15-Apr	15-Jul
13 °C Instantaneous Fall	0	0%	
9 °C Average Fall	0	0%	
Fall Days Eval'd w/in Dates	0	15-Aug	15-Nov
13 °C Instantaneous Total *	0	0%	
9 °C Average Total *	15	20%	
Tot Days Eval'd w/in Both Dates *	74		
* If spring & fall dates overlap double counting may occur.			



Data Source: USDA Forest Service
Water Body: Marie Creek, (ID17010303PN031_02)
Data Collection Period: 9/13/2001–9/22/2001

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	9	22-Jun	21-Sep

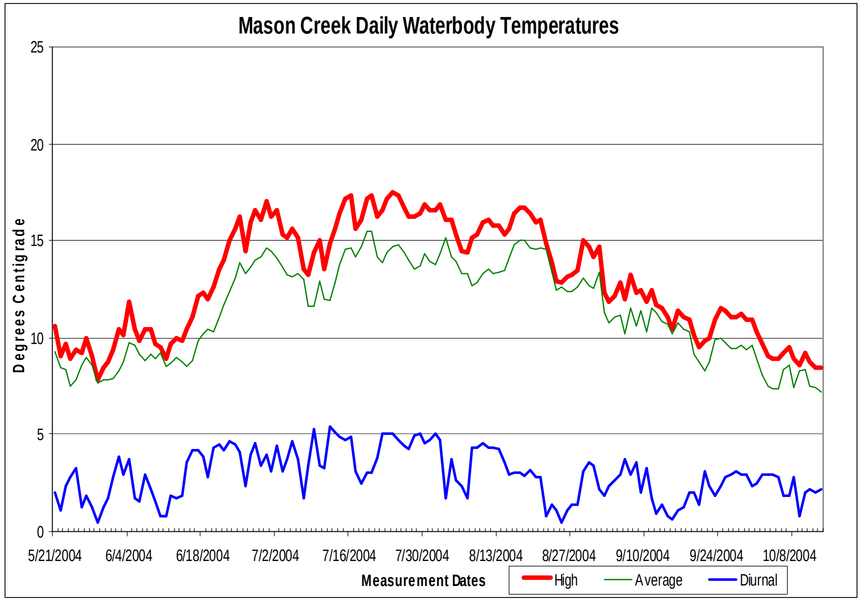
Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	0	0%	
Spring Days Eval'd w/in Dates	0	15-Apr	15-Jul
13 °C Instantaneous Fall	1	10%	
9 °C Average Fall	9	90%	
Fall Days Eval'd w/in Dates	10	15-Aug	15-Nov
13 °C Instantaneous Total *	1	10%	
9 °C Average Total *	9	90%	
Tot Days Eval'd w/in Both Dates *	10		
* If spring & fall dates overlap double counting may occur.			



Data Source: USDA Forest Service
Water Body: Mason Creek, (ID17010303PN020_02)
Data Collection Period: 5/21/2004–10/13/2001

Idaho Cold Water Aquatic Life **Criteria Exceedance Summary**			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning **Criteria Exceedance Summary**			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	25	45%	
9 °C Average Spring	36	64%	
Spring Days Eval'd w/in Dates	56	15-Apr	15-Jul
13 °C Instantaneous Fall	17	28%	
9 °C Average Fall	44	73%	
Fall Days Eval'd w/in Dates	60	15-Aug	15-Nov
13 °C Instantaneous Total *	42	36%	
9 °C Average Total *	80	69%	
Tot Days Eval'd w/in Both Dates *	116		
* If spring & fall dates overlap double counting may occur.			



Data Source: USDA Forest Service
Water Body: No Creek, near mouth, (ID17010303PN026_02)
Data Collection Period: 5/26/2004–10/20/2004

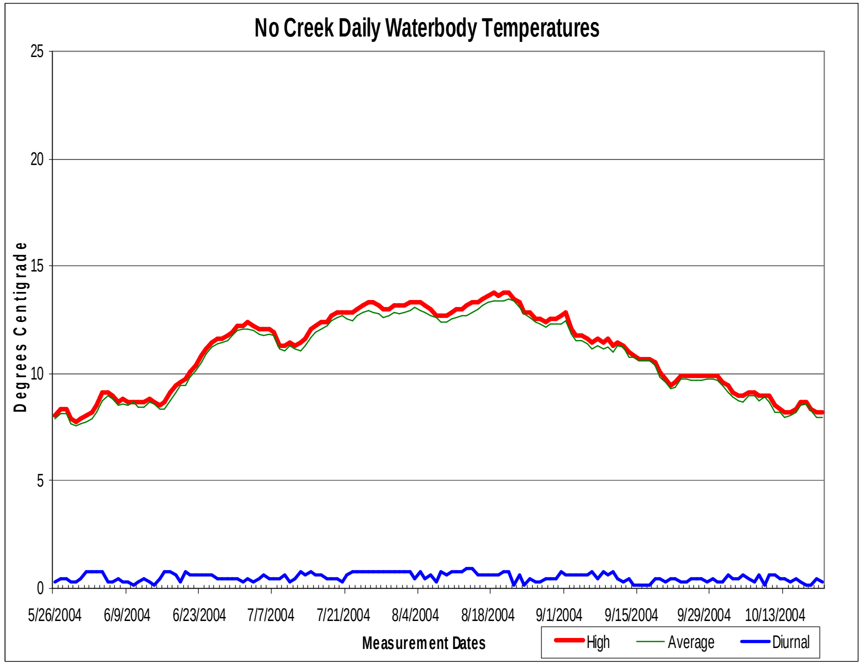
Idaho Cold Water Aquatic Life
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Number	Prcnt	
13 °C Instantaneous Spring	0	0%	
9 °C Average Spring	28	55%	
Spring Days Eval'd w/in Dates	51	15-Apr	15-Jul
13 °C Instantaneous Fall	9	13%	
9 °C Average Fall	49	73%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	9	8%	
9 °C Average Total *	77	65%	
Tot Days Eval'd w/in Both Dates *	118		

* If spring & fall dates overlap double counting may occur.

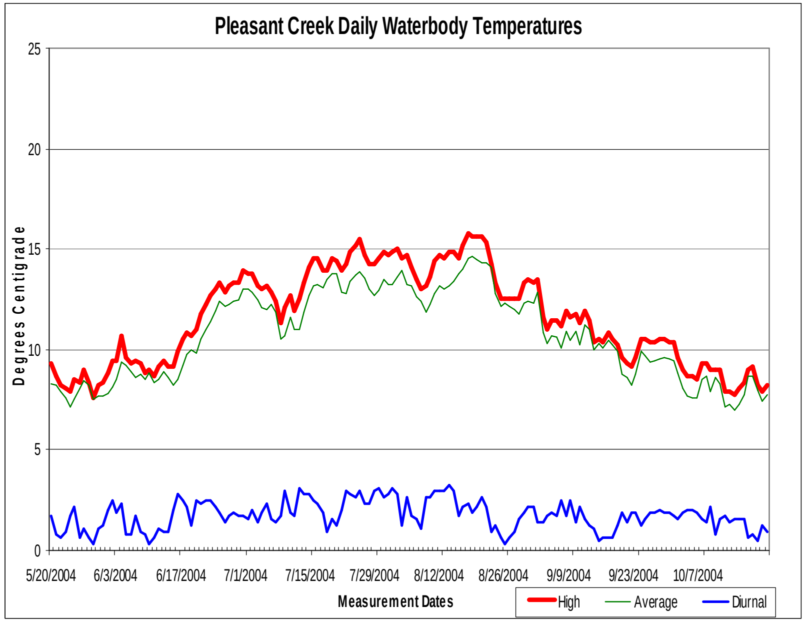


Data Source: USDA Forest Service
Water Body: Pleasant Creek, near mouth, (ID17010303PN026_02)
Data Collection Period: 5/20/2004–10/20/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	0	0%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep

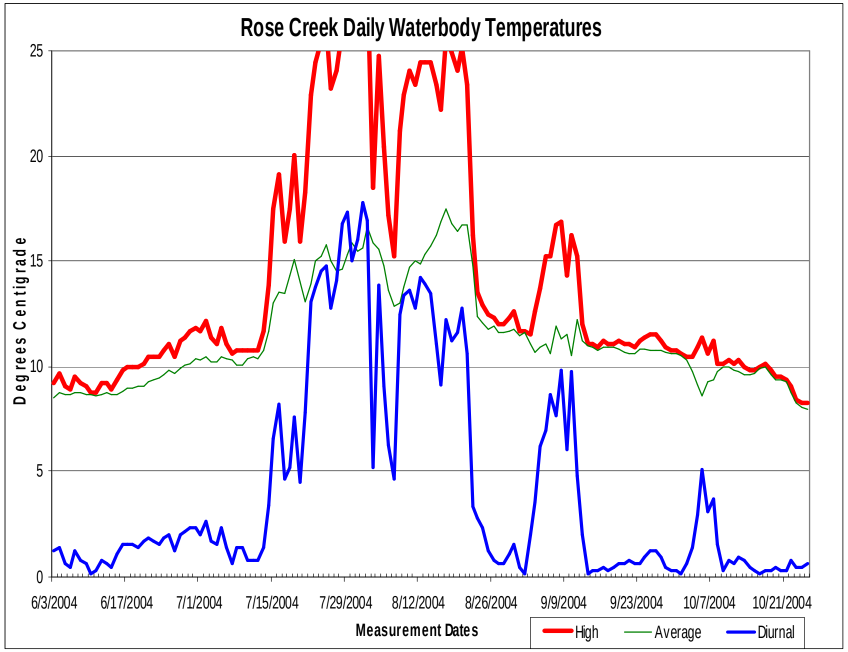
Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	14	25%	
9 °C Average Spring	31	54%	
Spring Days Eval'd w/in Dates	57	15-Apr	15-Jul
13 °C Instantaneous Fall	13	19%	
9 °C Average Fall	43	64%	
Fall Days Eval'd w/in Dates	67	15-Aug	15-Nov
13 °C Instantaneous Total *	27	22%	
9 °C Average Total *	74	60%	
Tot Days Eval'd w/in Both Dates *	124		

* If spring & fall dates overlap double counting may occur.



Data Source: USDA Forest Service
Water Body: Rose Creek, near mouth, (ID17010303PN021_02)
Data Collection Period: 6/3/2004–10/25/2004

Idaho Cold Water Aquatic Life Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
22 °C Instantaneous	26	28%	
19 °C Average	0	0%	
Days Evaluated & Date Range	92	22-Jun	21-Sep



Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Number	Prcnt	
13 °C Instantaneous Spring	2	5%	
9 °C Average Spring	28	65%	
Spring Days Eval'd w/in Dates	43	15-Apr	15-Jul
13 °C Instantaneous Fall	17	24%	
9 °C Average Fall	67	93%	
Fall Days Eval'd w/in Dates	72	15-Aug	15-Nov
13 °C Instantaneous Total *	19	17%	
9 °C Average Total *	95	83%	
Tot Days Eval'd w/in Both Dates *	115		

* If spring & fall dates overlap double counting may occur.

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Appendix C. Unit Conversion Chart

Table C-1. Metric–English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (gal) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 gal = 3.78 L 1 L= 0.26 gal 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 gal = 11.35 L 3 L = 0.79 gal 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (cfs)[a]	Cubic Meters per Second (m^3/sec)	1 cfs = 0.03 m^3/sec 1 m^3/sec = 35.31 cfs	3 cfs = 0.09 m^3/sec 3 m^3/sec = 105.94 cfs
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[b]	3 ppm = 3 mg/L
Weight	Pounds (lb)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lb	3 lb = 1.36 kg 3 kg = 6.61 lb
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

[a] 1 cfs = 0.65 million gallons per day; 1 million gallons per day = 1.55 cfs.
[b] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

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Appendix D. Estimates of Natural Bankfull Width

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Table D-1. Regional curve estimates and existing measurements of bankfull width.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	Average existing (m)
CDA River below SF/NF Confluence	1200	69	151	85	54	~80
Mica Creek @ mouth	23.5	9	8	9	11	
Mica Creek bl SF/NF confluenece	22.7	9	8	9	10	
north side tributary to Mica Creek	1.25	2	5	2	3	
south side tributary to Mica Creek	0.85	2	5	1	3	
SF Mica Creek @ mouth	8.14	5	6	5	7	
SF Mica Creek ab Hwy 95	4.58	4	6	4	5	
NF Mica Creek @ mouth	14.5	7	7	7	9	
NF Mica Creek bl Cabin Creek	7.47	5	6	5	7	
Cougar Creek @ mouth	16.4	7	7	7	9	
Cougar Creek bl NF Cougar Creek	8.86	5	6	5	7	
Cougar Creek ab NF Cougar Creek	6.99	5	6	5	6	
Heine Rd tributary to Cougar Creek	1.64	2	5	2	3	
Beauty Creek @ mouth	10.9	6	6	6	8	7.3
Beauty Creek bl Varnum Creek	7.16	5	6	5	6	6.1
Beauty Creek ab Varnum Creek	4.58	4	6	4	5	
SF Beauty Creek @ mouth	1.26	2	5	2	3	
Tributary to SF Beauty Creek	0.28	1	5	1	2	
2nd tributary to Beauty Creek	0.83	2	5	1	3	
Varnum Creek @ mouth	2.58	3	5	3	4	
Varnum Creek ab Hagerman Creek	1.26	2	5	2	3	
Hagerman Creek @ mouth	0.64	1	5	1	2	
3rd tributary to Beauty Creek	0.62	1	5	1	2	
Caribou Creek @ mouth	1.11	2	5	2	3	
Un-named tributary west of Beauty Creek	1.17	2	5	2	3	
Fernan Creek bl Fernan Lake	18.8	8	7	8	10	4.4
Fernan Creek @ Fernan Lake	15.4	7	7	7	9	
Fernan Creek bl Dry Gulch	7.75	5	6	5	7	4.4
Fernan Creek ab State Creek	3.03	3	5	3	4	
Wolf Lodge Creek @ mouth	62.8	15	13	16	16	
Wolf Lodge Creek ab Cedar Creek	43.6	12	10	13	14	14
Wolf Lodge Creek ab Marie Creek	18.7	8	7	8	10	10.5
Wolf Lodge Creek ab Lonesome Creek	7.23	5	6	5	6	7
Wolf Lodge Creek ab Blue Grouse Creek	2.7	3	5	3	4	
Stella Creek @ mouth	7.06	5	6	5	6	4.3
Stella Creek ab 3rd tributary	4.48	4	6	4	5	
Stella Creek ab 1st tributary	1.03	2	5	2	3	
1st tributary to Stella Creek	0.46	1	5	1	2	
2nd tributary to Stella Creek	1.21	2	5	2	3	
3rd tributary to Stella Creek	0.99	2	5	2	3	
Lonsome Creek @ mouth	10.75	6	6	6	8	
Lonsome Creek ab un-named tributary	9.45	6	6	5	7	
Lonsome Creek ab Stella Creek	1.61	2	5	2	3	
un-named tributary to Lonsome Creek	1.05	2	5	2	3	

Table D-1 (cont.). Regional curve estimates and existing measurements of bankfull width.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	Average existing (m)
Phantom Creek @ mouth	1.79	2	5	2	4	
Blue Grouse Creek @ mouth	1.23	2	5	2	3	
Holliday Creek @ mouth	0.37	1	5	1	2	
Onawa Creek @ mouth	0.68	1	5	1	2	
Rutherford Gulch @ mouth	3.27	3	5	3	5	
Cedar Creek @ mouth	15.85	7	7	7	9	4.4
Cedar Creek bl Alder Creek	14.55	7	7	7	9	
Cedar Creek ab SF Cedar Creek	3.17	3	5	3	5	3.2
un-named tributary to Cedar Creek	0.75	1	5	1	3	
SF Cedar Creek @ mouth	6.73	5	6	5	6	
SF Cedar Creek bl 2nd tributary	4.31	4	6	4	5	
SF Cedar Creek bl 1st tributary	2.6	3	5	3	4	
1st tributary to SF Cedar Creek	1.41	2	5	2	3	
2nd tributary to SF Cedar Creek	0.5	1	5	1	2	
3rd tributary to SF Cedar Creek	1.93	2	5	2	4	
Alder Creek @ mouth	4.36	4	6	4	5	
Alder Creek ab 1st fork	1.33	2	5	2	3	
1st fork to Alder Creek	1.47	2	5	2	3	
Chinese Gulch @ mouth	0.33	1	5	1	2	
Un-named stream south of Wolf Lodge Creek	0.8	2	5	1	3	
Marie Creek @ mouth	17.9	8	7	8	9	6.4
Marie Creek bl Skitwish Creek	13.5	7	7	7	8	8
Marie Creek ab Skitwish Creek	9.19	5	6	5	7	8
Latour Creek @ mouth	52.2	13	11	14	15	
Latour Creek ab Little Baldy Creek	46.4	13	11	13	14	12.5
Latour Creek ab Baldy Creek	25.1	9	8	10	11	8
Latour Creek ab Butler Creek	14.6	7	7	7	9	7.9
Larch Creek @ mouth	0.77	2	5	1	3	1.7
Baldy Creek @ mouth	8.6	5	6	5	7	
Pleasant Creek @ mouth	4.11	4	6	3	5	
Pleasant Creek bl No Creek	2.68	3	5	3	4	
1st tributary to Pleasant Creek	0.17	1	5	1	1	
No Creek @ mouth	0.83	2	5	1	3	
Carrill Creek @ mouth	1.21	2	5	2	3	
Carlin Creek @ mouth	11.95	6	6	6	8	
Carlin Creek ab 2nd tributary	6.59	5	6	4	6	3.5
Carlin Creek ab Pleasant Creek	1	2	5	2	3	
2nd tributary to Carlin Creek	1.3	2	5	2	3	
Un-named stream south of Carlin Creek	1.56	2	5	2	3	
Hungry Hollow @ mouth	1.71	2	5	2	4	
Blue Lake Creek @ mouth	7.62	5	6	5	7	
Blue Lake Creek ab 1st tributary	1.43	2	5	2	3	
1st tributary to Blue Lake Creek	0.65	1	5	1	2	
Cottonwood Creek @ mouth	2.93	3	5	3	4	

Table D-1 (cont.). Regional curve estimates and existing measurements of bankfull width.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	Average existing (m)
un-named stream south of Blue Lake Creek	1.71	2	5	2	4	
Lane Creek @ mouth	2.46	3	5	3	4	
Lane Creek ab McGinnis Creek	0.96	2	5	2	3	
McGinnis Creek @ mouth	1.15	2	5	2	3	
Chatfield Creek @ mouth	0.79	2	5	1	3	
Armstrong Creek @ mouth	3.08	3	5	3	5	
Armstrong Creek ab tributary	1.05	2	5	2	3	
tributary to Armstrong Creek	1.86	2	5	2	4	
Fortier Creek ab Armstrong Creek	4.51	4	6	4	5	3.9 (ab WF)
Fortier Creek ab 1st tributary	0.94	2	5	1	3	
1st tributary to Fortier Creek	0.57	1	5	1	2	
2nd tributary to Fortier Creek	1.75	2	5	2	4	
WF Fortier Creek @ mouth	0.72	1	5	1	2	
Killarney Creek @ mouth	2.48	3	5	3	4	
Rose Creek @ mouth	11.37	6	6	6	8	
Rose Creek ab marsh	7.09	5	6	5	6	
Rose Creek ab tributary	3.07	3	5	3	5	
tributary to Rose Creek	1.46	2	5	2	3	
Un-named stream to Rose Lake	0.99	2	5	2	3	
4th of July Creek @ mouth	28.32	10	8	10	11	
4th of July Creek bl Bentley Creek	23.76	9	8	9	11	
4th of July Creek ab Bentley Creek	16.44	7	7	7	9	5.17
4th of July Creek ab Curran Creek	9.74	6	6	6	7	4.43
4th of July Creek ab Mason Creek	5.59	4	6	4	6	
4th of July Creek ab Rooney Draw	2.1	3	5	2	4	
Rooney Draw @ mouth	0.55	1	5	1	2	
Boyle Draw @ mouth	0.83	2	5	1	3	
Mill Creek @ mouth	1.92	2	5	2	4	
Mason Creek @ mouth	2.51	3	5	3	4	
Mason Creek ab tributary	1.58	2	5	2	3	
tributary to Mason Creek	0.9	2	5	1	3	
Terrill Draw @ mouth	0.68	1	5	1	2	
Curran Creek @ mouth	4.76	4	6	4	5	
Curran Creek ab 1st tributary	1.25	2	5	2	3	
1st tributary to Curran Creek	0.8	2	5	1	3	
2nd tributary to Curran Creek	0.73	1	5	1	2	
Service Creek @ mouth	0.76	1	5	1	3	
Bentley Creek @ 4th of July Creek	7.3	5	6	5	6	
Bentley Creek ab Fern Creek	2.25	3	5	2	4	
Fern Creek @ mouth	5	4	6	4	6	
Fern Creek ab Ranienan Creek	2.64	3	5	3	4	
Fern Creek ab 1st tributary	0.74	1	5	1	2	
1st tributary to Fern Creek	1.31	2	5	2	3	
Ranienan Creek @ mouth	1.99	2	5	2	4	

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Appendix E. Data Sources and Solar Pathfinder Results

Table E-1. Data sources for the Coeur d'Alene Lake tributaries TMDLs.

Water Body	Data Source	Type of Data	Collection Date
Beauty Creek, Latour Creek, Marie Creek	DEQ	Solar Pathfinder effective shade and stream width	Summer 2007
Nine waters and associated tributaries (see Appendix E)	DEQ	Aerial photo interpretation of existing shade and stream width estimation	March–April 2007, 2008
Cougar Creek	DEQ	Temperature	6/19/1998–11/14/1998
Mica Creek and tributaries	DEQ	Temperature	6/19/1998–11/14/1998
Coeur d'Alene River: South Fork Coeur d'Alene to Latour Creek	DEQ USFS	Temperature	1995, 1996, 1997, 1998, 1999, 2003, 2005, 2006
Coeur d'Alene River: Latour Creek to mouth	DEQ USFS	Temperature	1995, 1996, 1997, 1998, 1999, 2003
Latour Creek and tributaries	—	Temperature	—
Fourth of July Creek and tributaries	USFS	Temperature	2004, 2006
Rose Creek and tributaries	USFS	Temperature	2004
Killarney Lake tributaries	USFS	Temperature	2004
Blue Lake Creek and tributaries	USFS	Temperature	2004, 2008
Carlin Creek and tributaries	USFS	Temperature	2004, 2008
Beauty Creek and tributaries	USFS	Temperature	2004
Beauty Creek and tributaries	DEQ USFS	Temperature	7/31/1999–9/29/1999 2004
Wolf Lodge Creek and tributaries	USFS	Temperature	2001, 2006
Cedar Creek and tributaries	USFS	Temperature	2000, 2001, 2004–2006
Marie Creek and tributaries	DEQ	Temperature	6/22/2001–11/18/2001
Fernan Creek and tributaries	—	Temperature	—

Table E-2. Solar Pathfinder Results, 2007.

aerial class	pathfinder actual	pathfinder class	delta		
90	93.8	90	0		beauty-1
40	39.9	30	10		beauty-2
80	77.8	70	10		beauty-3
90	90.8	90	0		beauty-4
80	81.1	80	0		beauty-5
60	75.4	70	-10		marie-1
70	75.9	70	0		marie-2
70	78.3	70	0		marie-3
60	75.7	70	-10		latour-1
60	69.5	60	0		latour-2
50	48.2	40	10		latour-3
20	24.2	20	0		latour-4
20	29.6	20	0		latour-5a
30	55.3	50	-20		latour-5b
20	17.6	10	10		latour-6
20	56.2	50	-30		latour-7a
40	68.6	60	-20		latour-7b
20	51.4	50	-30		latour-8
0	5.5	0	0		latour-9
10	16	10	0		latour-10
10	21.1	20	-10		latour-11
45	55	49	-4	average	
28.57	27.03	27.55	12.07	std dev	
12.22	11.56	11.78	5.16	95%CI	

aerial class	pathfinder actual	pathfinder class	delta		
90	93.8	90	0		beauty-1
40	39.9	30	10		beauty-2
80	77.8	70	10		beauty-3
90	90.8	90	0		beauty-4
80	81.1	80	0		beauty-5
76	77	72	4	average	
20.74	21.60	24.90	5.48	std dev	
18.18	18.93	21.83	4.80	95%CI	

aerial class	pathfinder actual	pathfinder class	delta		
60	75.4	70	-10		marie-1
70	75.9	70	0		marie-2
70	78.3	70	0		marie-3
67	77	70	-3	average	
5.77	1.55	0.00	5.77	std dev	
6.53	1.75	#NUM!	6.53	95%CI	

aerial class	pathfinder actual	pathfinder class	delta		
60	75.7	70	-10		latour-1
60	69.5	60	0		latour-2
50	48.2	40	10		latour-3
20	24.2	20	0		latour-4
20	29.6	20	0		latour-5a
30	55.3	50	-20		latour-5b
20	17.6	10	10		latour-6
20	56.2	50	-30		latour-7a
40	68.6	60	-20		latour-7b
20	51.4	50	-30		latour-8
0	5.5	0	0		latour-9
10	16	10	0		latour-10
10	21.1	20	-10		latour-11
28	41	35	-8	average	
19.22	23.47	22.95	13.63	std dev	
10.45	12.76	12.48	7.41	95%CI	

Table E-3. Solar Pathfinder Results, 2010.

aerial class	pathfinder actual	pathfinder class	delta		
80	87.3	80	0		fernan #1
90	87.3	80	10		fernan #1
50	76.6	70	-20		fernan #2
60	86.5	80	-20		fernan #3
90	86.5	80	10		fernan #3
90	91	90	0		searchlight
90	93	90	0		cedar #1
80	67.8	60	20		cedar #2
80	63.5	60	20		cedar #3
10	80.5	80	-70		4th july #2
80	80.1	80	0		4th july #3
30	82.9	80	-50		fern
70	58.4	50	20		curran
90	89.2	80	10		beauty #1
90	92.9	90	0		beauty #3
80	89.6	90	-10		carlin
90	95.3	90	0		carlin trib
80	88.1	80	0		blue lake
90	92.5	90	0		cottonwood
90	92.8	90	0		cougar
			-4	average	
			22.34	std dev	
			9.79	95%CI	

4th of July #1 and Beauty trib #2 were not on the hydrography in question.

Table E-4. Solar Pathfinder Results, 2011.

aerial class	pathfinder actual	pathfinder class	delta		Sites
0	61.2	60	-60		mica

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Appendix F. Comparison of Existing and Target Solar Loads

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Table F-1. Existing and target solar loads for South Fork Mica 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
004_02	3rd to Mica	1	1800	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
004_02	SF Mica Creek	1	2300	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
004_02	SF Mica Creek	2	330	Group A	94%	0.34	2	700	200	80%	1.14	2	700	800	600	-14%
004_02	SF Mica Creek	3	270	Group A	89%	0.63	3	800	500	70%	1.71	3	800	1,000	500	-19%
004_02	SF Mica Creek	4	920	Group A	89%	0.63	3	3,000	2,000	80%	1.14	3	3,000	3,000	1,000	-9%
004_02	SF Mica Creek		480	Group A	80%	1.14	4	2,000	2,000	80%	1.14	4	2,000	2,000	0	0%
004_02	SF Mica Creek	5	410	Group A	80%	1.14	4	2,000	2,000	70%	1.71	4	2,000	3,000	1,000	-10%
004_02	SF Mica Creek	6	460	Group A	80%	1.14	4	2,000	2,000	50%	2.85	4	2,000	6,000	4,000	-30%
004_02	SF Mica Creek	7	200	Group A	80%	1.14	4	800	900	60%	2.28	4	800	2,000	1,000	-20%
004_02	SF Mica Creek	8	250	Group A	72%	1.60	5	1,000	2,000	70%	1.71	5	1,000	2,000	0	-2%
004_02	SF Mica Creek	9	180	Hardwoods 1	72%	1.60	5	900	1,000	60%	2.28	5	900	2,000	1,000	-12%
004_02	SF Mica Creek	10	500	Hardwoods 1	72%	1.60	5	3,000	5,000	80%	1.14	5	3,000	3,000	(2,000)	0%
004_02	SF Mica Creek	11	860	Hardwoods 1	72%	1.60	5	4,000	6,000	70%	1.71	5	4,000	7,000	1,000	-2%
004_02	SF Mica Creek	12	260	Hardwoods 1	72%	1.60	5	1,000	2,000	70%	1.71	5	1,000	2,000	0	-2%
004_02	SF Mica Creek	13	220	Hardwoods 1	72%	1.60	5	1,000	2,000	60%	2.28	5	1,000	2,000	0	-12%
004_02	SF Mica Creek	14	430	Hardwoods 1	72%	1.60	5	2,000	3,000	80%	1.14	5	2,000	2,000	(1,000)	0%
004_02	SF Mica Creek	15	880	Hardwoods 1	72%	1.60	5	4,000	6,000	70%	1.71	5	4,000	7,000	1,000	-2%
							Totals		38,000					47,000	8,900	

Table F-2. Existing and target solar loads for North Fork Mica 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	NF Mica Creek	1	410	Group B	98%	0.11	2	800	90	90%	0.57	2	800	500	400	-8%
004_02	NF Mica Creek	2	3400	Group B	97%	0.17	3	10,000	2,000	80%	1.14	3	10,000	10,000	8,000	-17%
004_02	NF Mica Creek	3	1500	Group A	80%	1.14	4	6,000	7,000	70%	1.71	4	6,000	10,000	3,000	-10%
004_02	1st to NF Mica	1	2000	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
004_02	Cabin Creek	1	2200	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
004_02	Cabin Creek	2	1500	Group A	89%	0.63	3	5,000	3,000	80%	1.14	3	5,000	6,000	3,000	-9%
004_02	2nd to NF Mica	1	2000	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
004_02	2nd to NF Mica	2	840	Group A	94%	0.34	2	2,000	700	70%	1.71	2	2,000	3,000	2,000	-24%
004_02	Rock Creek	1	940	Group A	95%	0.29	1	900	300	90%	0.57	1	900	500	200	-5%
004_02	Rock Creek	2	210	Group A	94%	0.34	2	400	100	80%	1.14	2	400	500	400	-14%
004_02	Rock Creek	3	440	Group A	94%	0.34	2	900	300	90%	0.57	2	900	500	200	-4%
004_02	Rock Creek	4	760	Group A	89%	0.63	3	2,000	1,000	60%	2.28	3	2,000	5,000	4,000	-29%
004_02	Rock Creek	5	320	Group A	89%	0.63	3	1,000	600	80%	1.14	3	1,000	1,000	400	-9%
004_02	NF Mica Creek	4	740	Hardwoods 1	72%	1.60	5	4,000	6,000	80%	1.14	5	4,000	5,000	(1,000)	0%
004_02	NF Mica Creek	5	270	Hardwoods 1	72%	1.60	5	1,000	2,000	70%	1.71	5	1,000	2,000	0	-2%
004_02	NF Mica Creek	6	1110	Hardwoods 1	72%	1.60	5	6,000	10,000	80%	1.14	5	6,000	7,000	(3,000)	0%
004_02	NF Mica Creek	7	770	Hardwoods 1	65%	2.00	6	5,000	10,000	70%	1.71	6	5,000	9,000	(1,000)	0%
004_02	NF Mica Creek	8	1200	Hardwoods 1	65%	2.00	6	7,000	10,000	80%	1.14	6	7,000	8,000	(2,000)	0%
004_02	NF Mica Creek	9	1270	Hardwoods 1	60%	2.28	7	9,000	20,000	70%	1.71	7	9,000	20,000	0	0%
							Totals		74,000					91,000	17,000	

Table F-3. Existing and target solar loads for Mica 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	northside trib	1	240	Group A	95%	0.29	1	200	60	90%	0.57	1	200	100	40	-5%
004_02	northside trib	2	400	Hardwoods 1	97%	0.17	1	400	70	90%	0.57	1	400	200	100	-7%
004_02	northside trib	3	130	Hardwoods 1	97%	0.17	1	100	20	70%	1.71	1	100	200	200	-27%
004_02	northside trib	4	350	Hardwoods 1	97%	0.17	1	400	70	40%	3.42	1	400	1,000	900	-57%
004_02	northside trib	5	780	Hardwoods 1	97%	0.17	1	800	100	80%	1.14	1	800	900	800	-17%
004_02	northside trib	6	60	Hardwoods 1	97%	0.17	1	60	10	90%	0.57	1	60	30	20	-7%
004_02	northside trib	7	350	Hardwoods 1	94%	0.34	2	700	200	70%	1.71	2	700	1,000	800	-24%
004_02	northside trib	8	1100	Hardwoods 1	94%	0.34	2	2,000	700	80%	1.14	2	2,000	2,000	1,000	-14%
004_02	northside trib	9	200	Hardwoods 1	94%	0.34	2	400	100	50%	2.85	2	400	1,000	900	-44%
004_02	northside trib	10	160	Hardwoods 1	94%	0.34	2	300	100	0%	5.70	2	300	2,000	2,000	-94%
004_02	northside trib	11	150	Hardwoods 1	94%	0.34	2	300	100	50%	2.85	2	300	900	800	-44%
004_02	southside trib	1	280	Group A	95%	0.29	1	300	90	80%	1.14	1	300	300	200	-15%
004_02	southside trib	2	2200	Group A	94%	0.34	2	4,000	1,000	90%	0.57	2	4,000	2,000	1,000	-4%
004_02	southside trib	3	330	Group A	94%	0.34	2	700	200	80%	1.14	2	700	800	600	-14%
004_03	Mica Creek	1	250	Hardwoods 1	52%	2.74	9	2,000	5,000	50%	2.85	9	2,000	6,000	1,000	-2%
004_03	Mica Creek	2	260	Hardwoods 1	52%	2.74	9	2,000	5,000	60%	2.28	9	2,000	5,000	0	0%
004_03	Mica Creek	3	150	Hardwoods 1	52%	2.74	9	1,000	3,000	60%	2.28	9	1,000	2,000	(1,000)	0%
004_03	Mica Creek	4	450	Hardwoods 1	52%	2.74	9	4,000	10,000	50%	2.85	9	4,000	10,000	0	-2%
004_03	Mica Creek	5	160	Hardwoods 1	52%	2.74	9	1,000	3,000	70%	1.71	9	1,000	2,000	(1,000)	0%
001_02	Mica Creek	6	240	Hardwoods 1	52%	2.74	9	2,000	5,000	50%	2.85	9	2,000	6,000	1,000	-2%
001_02	Mica Creek	7	300	Hardwoods 1	37%	3.59	14	4,200	15,000	30%	3.99	14	4,200	17,000	2,000	-7%
							Totals		49,000					60,000	11,000	

Table F-4. Existing and target solar loads for Cougar 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
002_02	NF Cougar Cr	1	4140	Group A	94%	0.34	2	8,000	3,000	90%	0.57	2	8,000	5,000	2,000	-4%
002_02	1st to Cougar	1	1700	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
002_02	1st to Cougar	2	390	Group A	94%	0.34	2	800	300	70%	1.71	2	800	1,000	700	-24%
002_02	1st to Cougar	3	1800	Group A	89%	0.63	3	5,000	3,000	90%	0.57	3	5,000	3,000	0	0%
002_02	2nd to Cougar	1	70	Group A	95%	0.29	1	70	20	80%	1.14	1	70	80	60	-15%
002_02	2nd to Cougar	2	600	Group A	95%	0.29	1	600	200	90%	0.57	1	600	300	100	-5%
002_02	2nd to Cougar	3	340	Group A	95%	0.29	1	300	90	70%	1.71	1	300	500	400	-25%
002_02	2nd to Cougar	4	680	Group A	95%	0.29	1	700	200	90%	0.57	1	700	400	200	-5%
002_02	2nd to Cougar	5	50	Group A	94%	0.34	2	100	30	80%	1.14	2	100	100	70	-14%
002_02	2nd to Cougar	6	730	Group A	94%	0.34	2	1,000	300	90%	0.57	2	1,000	600	300	-4%
002_02	2nd to Cougar	7	480	Group A	94%	0.34	2	1,000	300	60%	2.28	2	1,000	2,000	2,000	-34%
002_02	Cougar Creek	1	3800	Group B	98%	0.11	2	8,000	900	90%	0.57	2	8,000	5,000	4,000	-8%
002_02	Cougar Creek	2	1800	Group B	89%	0.63	3	5,000	3,000	80%	1.14	3	5,000	6,000	3,000	-9%
002_02	Cougar Creek	3	410	Group A	89%	0.63	3	1,000	600	90%	0.57	3	1,000	600	0	0%
002_02	Cougar Creek	4	500	Group A	80%	1.14	4	2,000	2,000	60%	2.28	4	2,000	5,000	3,000	-20%
002_02	Cougar Creek	5	1810	Group A	80%	1.14	4	7,000	8,000	93%	0.40	4	7,000	3,000	(5,000)	0%
002_02	Cougar Creek	6	1340	Hardwoods 1	72%	1.60	5	7,000	10,000	70%	1.71	5	7,000	10,000	0	-2%
002_02	Cougar Creek	7	400	Hardwoods 1	72%	1.60	5	2,000	3,000	60%	2.28	5	2,000	5,000	2,000	-12%
002_02	Cougar Creek	8	810	Hardwoods 1	65%	2.00	6	5,000	10,000	50%	2.85	6	5,000	10,000	0	-15%
002_02	Cougar Creek	9	1010	Hardwoods 1	65%	2.00	6	6,000	10,000	70%	1.71	6	6,000	10,000	0	0%
002_02	Cougar Creek	10	430	Hardwoods 1	65%	2.00	6	3,000	6,000	60%	2.28	6	3,000	7,000	1,000	-5%
002_02	Cougar Creek	11	730	Hardwoods 1	60%	2.28	7	5,000	10,000	50%	2.85	7	5,000	10,000	0	-10%
002_02	Cougar Creek	12	310	Hardwoods 1	60%	2.28	7	2,000	5,000	60%	2.28	7	2,000	5,000	0	0%
002_02	Cougar Creek	13	340	Hardwoods 1	60%	2.28	7	2,000	5,000	40%	3.42	7	2,000	7,000	2,000	-20%
002_02	Cougar Creek	14	380	Hardwoods 1	60%	2.28	7	3,000	7,000	40%	3.42	7	3,000	10,000	3,000	-20%
							Totals		88,000					110,000	20,000	

Table F-5. Existing and target solar loads for Latour 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
015_02	Latour Creek	1	580	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
015_02	Latour Creek	2	1200	Group C	97%	0.17	2	2,000	300	80%	1.14	2	2,000	2,000	2,000	-17%
015_02	Latour Creek	3	270	Group C	97%	0.17	2	500	90	90%	0.57	2	500	300	200	-7%
015_02	Latour Creek	4	240	Group B	98%	0.11	2	500	60	80%	1.14	2	500	600	500	-18%
015_02	Latour Creek	5	1330	Group B	97%	0.17	3	4,000	700	90%	0.57	3	4,000	2,000	1,000	-7%
015_02	Latour Creek	6	1480	Group B	96%	0.23	4	6,000	1,000	80%	1.14	4	6,000	7,000	6,000	-16%
015_02	Latour Creek	7	280	Group B	96%	0.23	4	1,000	200	90%	0.57	4	1,000	600	400	-6%
015_02	Latour Creek	8	180	Group B	96%	0.23	4	700	200	80%	1.14	4	700	800	600	-16%
015_02	Latour Creek	9	920	Group B	94%	0.34	5	5,000	2,000	70%	1.71	6	6,000	10,000	8,000	-24%
015_02	Latour Creek	10	180	Group B	94%	0.34	5	900	300	50%	2.85	7	1,000	3,000	3,000	-44%
015_02	Latour Creek	11	390	Group B	93%	0.40	6	2,000	800	50%	2.85	7	3,000	9,000	8,000	-43%
015_02	Latour Creek	12	470	Group B	93%	0.40	6	3,000	1,000	70%	1.71	7	3,000	5,000	4,000	-23%
015_02	Latour Creek	13	590	Hardwoods 1	65%	2.00	6	4,000	8,000	80%	1.14	7	4,000	5,000	(3,000)	0%
015_02	Latour Creek	14	680	Hardwoods 1	60%	2.28	7	5,000	10,000	60%	2.28	7	5,000	10,000	0	0%
015_02	Latour Creek	15	380	Hardwoods 1	60%	2.28	7	3,000	7,000	70%	1.71	7	3,000	5,000	(2,000)	0%
015_02	Latour Creek	16	420	Hardwoods 1	55%	2.57	8	3,000	8,000	70%	1.71	8	3,000	5,000	(3,000)	0%
015_02	Latour Creek	17	790	Hardwoods 1	55%	2.57	8	6,000	20,000	70%	1.71	8	6,000	10,000	(10,000)	0%
015_02	Latour Creek	18	1840	Hardwoods 1	55%	2.57	8	10,000	30,000	40%	3.42	8	10,000	30,000	0	-15%
015_02	Latour Creek	19	460	Hardwoods 1	55%	2.57	8	4,000	10,000	20%	4.56	8	4,000	20,000	10,000	-35%
015_02	Latour Creek	20	540	Hardwoods 1	55%	2.57	8	4,000	10,000	30%	3.99	8	4,000	20,000	10,000	-25%
015_02	Latour Creek	21	110	Hardwoods 1	52%	2.74	9	1,000	3,000	20%	4.56	9	1,000	5,000	2,000	-32%
015_02	Latour Creek	22	490	Hardwoods 1	52%	2.74	9	4,000	10,000	30%	3.99	9	4,000	20,000	10,000	-22%
015_02	Latour Creek	23	280	Hardwoods 1	52%	2.74	9	3,000	8,000	20%	4.56	9	3,000	10,000	2,000	-32%
015_02	Latour Creek	24	360	Hardwoods 1	52%	2.74	9	3,000	8,000	30%	3.99	9	3,000	10,000	2,000	-22%
015_02	Latour Creek	25	800	Hardwoods 1	52%	2.74	9	7,000	20,000	50%	2.85	9	7,000	20,000	0	-2%
015_02	Latour Creek	26	150	Hardwoods 1	48%	2.96	10	1,500	4,400	20%	4.56	10	1,500	6,800	2,400	-28%
015_02	Latour Creek	27	560	Hardwoods 1	48%	2.96	10	5,600	17,000	10%	5.13	10	5,600	29,000	12,000	-38%
015_02	Latour Creek	28	860	Hardwoods 1	48%	2.96	10	8,600	25,000	30%	3.99	10	8,600	34,000	9,000	-18%
015_02	Latour Creek	29	270	Hardwoods 1	48%	2.96	10	2,700	8,000	50%	2.85	10	2,700	7,700	(300)	0%
015_02	Latour Creek	30	230	Hardwoods 1	45%	3.14	11	2,500	7,800	60%	2.28	11	2,500	5,700	(2,100)	0%
015_02	Latour Creek	31	430	Hardwoods 1	45%	3.14	11	4,700	15,000	50%	2.85	11	4,700	13,000	(2,000)	0%
015_02	Latour Creek	32	340	Hardwoods 1	45%	3.14	11	3,700	12,000	60%	2.28	11	3,700	8,400	(3,600)	0%
015_02	Latour Creek	33	370	Hardwoods 1	45%	3.14	11	4,100	13,000	20%	4.56	11	4,100	19,000	6,000	-25%
015_02	Latour Creek	34	250	Hardwoods 1	45%	3.14	11	2,800	8,800	50%	2.85	11	2,800	8,000	(800)	0%
015_02	Latour Creek	35	190	Hardwoods 1	45%	3.14	11	2,100	6,600	20%	4.56	11	2,100	9,600	3,000	-25%
015_02	Latour Creek	36	170	Hardwoods 1	45%	3.14	11	1,900	6,000	10%	5.13	11	1,900	9,700	3,700	-35%
015_02	Latour Creek	37	930	Hardwoods 1	41%	3.36	12	11,000	37,000	0%	5.70	12	11,000	63,000	26,000	-41%
015_02	Latour Creek	38	210	Hardwoods 1	41%	3.36	12	2,500	8,400	10%	5.13	12	2,500	13,000	4,600	-31%
015_02	Latour Creek	39	750	Hardwoods 1	41%	3.36	12	9,000	30,000	20%	4.56	12	9,000	41,000	11,000	-21%
015_02	Latour Creek	40	1440	Hardwoods 1	39%	3.48	13	19,000	66,000	20%	4.56	13	19,000	87,000	21,000	-19%
015_02	Latour Creek	41	1030	Hardwoods 1	39%	3.48	13	13,000	45,000	10%	5.13	13	13,000	67,000	22,000	-29%
015_02	Latour Creek	42	540	Hardwoods 1	39%	3.48	13	7,000	24,000	0%	5.70	13	7,000	40,000	16,000	-39%
015_02	Latour Creek	43	1110	Hardwoods 1	39%	3.48	13	14,000	49,000	20%	4.56	13	14,000	64,000	15,000	-19%
015_02	Latour Creek	44	390	Hardwoods 1	39%	3.48	13	5,100	18,000	0%	5.70	13	5,100	29,000	11,000	-39%
015_02	Latour Creek	45	320	Hardwoods 1	39%	3.48	13	4,200	15,000	30%	3.99	13	4,200	17,000	2,000	-9%
015_02	Latour Creek	46	150	Hardwoods 1	39%	3.48	13	2,000	7,000	20%	4.56	13	2,000	9,100	2,100	-19%
							Totals		580,000					790,000	210,000	

Table F-6. Existing and target solar loads for Latour 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
015_02	Larch Creek	1	2300	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
015_02	1st to Latour	1	2100	Group A	94%	0.34	2	4,000	1,000	90%	0.57	2	4,000	2,000	1,000	-4%
015_02	2nd to Latour	1	790	Group B	98%	0.11	1	800	90	80%	1.14	1	800	900	800	-18%
015_02	2nd to Latour	2	870	Group B	98%	0.11	1	900	100	90%	0.57	1	900	500	400	-8%
015_02	2nd to Latour	3	190	Group B	98%	0.11	2	400	50	80%	1.14	2	400	500	500	-18%
015_02	2nd to Latour	4	690	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
015_02	2nd to Latour	5	240	Group B	98%	0.11	2	500	60	80%	1.14	2	500	600	500	-18%
015_02	2nd to Latour	6	230	Group B	97%	0.17	3	700	100	90%	0.57	3	700	400	300	-7%
015_02	2nd to Latour	7	150	Group B	97%	0.17	3	500	90	80%	1.14	3	500	600	500	-17%
015_02	2nd to Latour	8	930	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
015_02	3rd to Latour	1	1520	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
015_02	3rd to Latour	2	430	Group B	98%	0.11	2	900	100	80%	1.14	2	900	1,000	900	-18%
015_02	3rd to Latour	3	400	Group B	98%	0.11	2	800	90	90%	0.57	2	800	500	400	-8%
015_02	3rd to Latour	4	220	Group B	98%	0.11	2	400	50	80%	1.14	2	400	500	500	-18%
015_02	4th to Latour	1	450	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
015_02	4th to Latour	2	80	Group B	98%	0.11	1	80	9	80%	1.14	1	80	90	80	-18%
015_02	4th to Latour	3	1100	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
015_02	5th to Latour	1	910	Group B	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
015_02	5th to Latour	2	1800	Group B	97%	0.17	3	5,000	900	90%	0.57	3	5,000	3,000	2,000	-7%
015_02	6th to Latour	1	180	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
015_02	6th to Latour	2	1900	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
015_02	6th to Latour	3	500	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
015_02	6th to Latour	4	370	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
015_02	6th to Latour	5	2700	Group B	96%	0.23	4	10,000	2,000	80%	1.14	4	10,000	10,000	8,000	-16%
015_02	6th to Latour	6	540	Group B	96%	0.23	4	2,000	500	90%	0.57	4	2,000	1,000	500	-6%

Table F-7. Existing and target solar loads for Latour Creek tributaries.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
015_02	7th to Latour	2	3300	Group B	98%	0.11	2	7,000	800	90%	0.57	2	7,000	4,000	3,000	-8%
015_02	8th to Latour	1	870	Group B	98%	0.11	1	900	100	80%	1.14	1	900	1,000	900	-18%
015_02	8th to Latour	2	350	Group B	98%	0.11	2	700	80	90%	0.57	2	700	400	300	-8%
015_02	8th to Latour	3	860	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
015_02	9th to Latour	1	350	Group B	98%	0.11	1	400	50	60%	2.28	1	400	900	900	-38%
015_02	9th to Latour	2	1700	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
015_02	10th to Latour	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
015_02	10th to Latour	2	530	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
015_02	11th to Latour	1	1900	Group B	98%	0.11	1	2,000	200	80%	1.14	1	2,000	2,000	2,000	-18%
015_02	12th to Latour	1	2400	Group A	94%	0.34	2	5,000	2,000	80%	1.14	2	5,000	6,000	4,000	-14%
015_02	13th to Latour	1	2000	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
015_02	13th to Latour	2	1100	Group A	89%	0.63	3	3,000	2,000	70%	1.71	3	3,000	5,000	3,000	-19%
015_02	14th to Latour	1	1800	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
015_02	Little Baldy Cr	1	720	Group B	98%	0.11	1	700	80	90%	0.57	1	700	400	300	-8%
015_02	Little Baldy Cr	2	480	Group B	98%	0.11	1	500	60	20%	4.56	1	500	2,000	2,000	-78%
015_02	Little Baldy Cr	3	2900	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
015_02	Little Baldy Cr	4	1230	Group B	96%	0.23	4	5,000	1,000	80%	1.14	4	5,000	6,000	5,000	-16%
015_02	Little Baldy Cr	5	50	Group B	96%	0.23	4	200	50	40%	3.42	4	200	700	700	-56%
015_02	Little Baldy Cr	6	280	Group B	96%	0.23	4	1,000	200	80%	1.14	4	1,000	1,000	800	-16%
015_02	Baldy Creek	1	2100	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
015_02	Baldy Creek	2	610	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
015_02	Baldy Creek	3	3300	Group B	97%	0.17	3	10,000	2,000	90%	0.57	3	10,000	6,000	4,000	-7%
015_02	Baldy Creek	4	590	Group B	96%	0.23	4	2,000	500	80%	1.14	4	2,000	2,000	2,000	-16%
015_02	Baldy Creek	5	540	Group B	96%	0.23	4	2,000	500	70%	1.71	4	2,000	3,000	3,000	-26%
015_02	Baldy Creek	6	520	Group A	72%	1.60	5	3,000	5,000	80%	1.14	5	3,000	3,000	(2,000)	0%
015_02	Baldy Creek	7	650	Group A	72%	1.60	5	3,000	5,000	70%	1.71	5	3,000	5,000	0	-2%
							Totals		30,000					98,000	70,000	

Table F-8. Existing and target solar loads for Fourth of July 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	4th of July Creek	1	220	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
020_02	4th of July Creek	2	370	Group B	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
020_02	4th of July Creek	3	170	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
020_02	4th of July Creek	4	1400	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
020_02	4th of July Creek	5	150	Group B	97%	0.17	3	500	90	70%	1.71	3	500	900	800	-27%
020_02	4th of July Creek	6	190	Group B	97%	0.17	3	600	100	80%	1.14	3	600	700	600	-17%
020_02	4th of July Creek	7	270	Group B	97%	0.17	3	800	100	90%	0.57	3	800	500	400	-7%
020_02	4th of July Creek	8	580	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
020_02	4th of July Creek	9	190	Group B	96%	0.23	4	800	200	80%	1.14	4	800	900	700	-16%
020_02	4th of July Creek	10	220	Group B	96%	0.23	4	900	200	70%	1.71	4	900	2,000	2,000	-26%
020_02	4th of July Creek	11	600	Hardwoods 1	78%	1.25	4	2,000	3,000	80%	1.14	4	2,000	2,000	(1,000)	0%
020_02	4th of July Creek	12	100	Hardwoods 1	78%	1.25	4	400	500	70%	1.71	4	400	700	200	-8%
020_03	4th of July Creek	13	330	Hardwoods 1	72%	1.60	5	2,000	3,000	70%	1.71	5	2,000	3,000	0	-2%
020_03	4th of July Creek	14	540	Hardwoods 1	72%	1.60	5	3,000	5,000	90%	0.57	5	3,000	2,000	(3,000)	0%
020_03	4th of July Creek	15	1780	Hardwoods 1	65%	2.00	6	10,000	20,000	80%	1.14	6	10,000	10,000	(10,000)	0%
020_03	4th of July Creek	16	730	Hardwoods 1	65%	2.00	6	4,000	8,000	70%	1.71	6	4,000	7,000	(1,000)	0%
020_03	4th of July Creek	17	190	Hardwoods 1	60%	2.28	7	1,000	2,000	80%	1.14	7	1,000	1,000	(1,000)	0%
020_03	4th of July Creek	18	160	Hardwoods 1	60%	2.28	7	1,000	2,000	70%	1.71	7	1,000	2,000	0	0%
020_03	4th of July Creek	19	1110	Hardwoods 1	60%	2.28	7	8,000	20,000	80%	1.14	7	8,000	9,000	(10,000)	0%
020_03	4th of July Creek	20	430	Hardwoods 1	60%	2.28	7	3,000	7,000	50%	2.85	7	3,000	9,000	2,000	-10%
020_03	4th of July Creek	21	190	Hardwoods 1	52%	2.74	9	2,000	5,000	40%	3.42	9	2,000	7,000	2,000	-12%
020_03	4th of July Creek	22	430	Hardwoods 1	52%	2.74	9	4,000	10,000	0%	5.70	9	4,000	20,000	10,000	-52%
020_03	4th of July Creek	23	100	Hardwoods 1	52%	2.74	9	900	2,000	30%	3.99	9	900	4,000	2,000	-22%
020_03	4th of July Creek	24	80	Hardwoods 1	52%	2.74	9	700	2,000	0%	5.70	9	700	4,000	2,000	-52%
020_03	4th of July Creek	25	1100	Hardwoods 1	52%	2.74	9	10,000	30,000	30%	3.99	9	10,000	40,000	10,000	-22%
020_03	4th of July Creek	26	330	Hardwoods 1	48%	2.96	10	3,300	9,800	20%	4.56	10	3,300	15,000	5,200	-28%
020_03	4th of July Creek	27	1000	Hardwoods 1	48%	2.96	10	10,000	30,000	0%	5.70	10	10,000	57,000	27,000	-48%
020_03	4th of July Creek	28	280	Hardwoods 1	48%	2.96	10	2,800	8,300	30%	3.99	10	2,800	11,000	2,700	-18%
020_03	4th of July Creek	29	310	Hardwoods 1	48%	2.96	10	3,100	9,200	0%	5.70	10	3,100	18,000	8,800	-48%
							Totals		180,000					230,000	55,000	

Table F-9. Existing and target solar loads for Fourth of July 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
020_02	Rooney Draw	1	1200	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
020_02	Rooney Draw	2	130	Group B	98%	0.11	1	100	10	70%	1.71	1	100	200	200	-28%
020_02	Boyle Draw	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	Boyle Draw	2	930	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
020_02	Boyle Draw	3	130	Group B	98%	0.11	2	300	30	90%	0.57	2	300	200	200	-8%
020_02	Mill Creek	1	1300	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
020_02	Mill Creek	2	1400	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
020_02	Mill Creek	3	520	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
020_02	Mason Creek	1	740	Group A	95%	0.29	1	700	200	90%	0.57	1	700	400	200	-5%
020_02	Mason Creek	2	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
020_02	Mason Creek	3	1850	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
020_02	Mason Creek	4	550	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
020_02	Mason Creek	5	860	Group B	97%	0.17	3	3,000	500	80%	1.14	3	3,000	3,000	3,000	-17%
020_02	Mason Creek	6	240	Group B	97%	0.17	3	700	100	70%	1.71	3	700	1,000	900	-27%
020_02	Mason Creek	7	190	Group B	97%	0.17	3	600	100	80%	1.14	3	600	700	600	-17%
020_02	trib to Mason	1	1800	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	trib to Mason	2	640	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
020_02	trib to Mason	3	540	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
020_02	trib to Mason	4	250	Group B	98%	0.11	2	500	60	60%	2.28	2	500	1,000	900	-38%
020_02	Terrill Draw	1	1300	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
020_02	Terrill Draw	2	400	Group B	98%	0.11	1	400	50	80%	1.14	1	400	500	500	-18%
020_02	Curran Creek	1	2300	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	Curran Creek	2	1200	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
020_02	Curran Creek	3	500	Hardwoods 1	94%	0.34	2	1,000	300	90%	0.57	2	1,000	600	300	-4%
020_02	Curran Creek	4	380	Hardwoods 1	94%	0.34	2	800	300	80%	1.14	2	800	900	600	-14%
020_02	Curran Creek	5	1300	Hardwoods 1	86%	0.80	3	4,000	3,000	90%	0.57	3	4,000	2,000	(1,000)	0%
020_02	Curran Creek	6	420	Hardwoods 1	78%	1.25	4	2,000	3,000	80%	1.14	4	2,000	2,000	(1,000)	0%
020_02	Curran Creek	7	110	Hardwoods 1	78%	1.25	4	400	500	90%	0.57	4	400	200	(300)	0%
020_02	Curran Creek	8	160	Hardwoods 1	78%	1.25	4	600	800	80%	1.14	4	600	700	(100)	0%
020_02	Curran Creek	9	160	Hardwoods 1	78%	1.25	4	600	800	70%	1.71	4	600	1,000	200	-8%
020_02	Curran Creek	10	170	Hardwoods 1	78%	1.25	4	700	900	80%	1.14	4	700	800	(100)	0%
020_02	Curran Creek	11	240	Hardwoods 1	78%	1.25	4	1,000	1,000	58%	2.39	4	1,000	2,000	1,000	-20%
020_02	Curran Creek	12	130	Hardwoods 1	78%	1.25	4	500	600	90%	0.57	4	500	300	(300)	0%

Table F-9 (cont.). Existing and target solar loads for Fourth of July Creek tributaries.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
020_02	2nd to Curran	1	1700	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	Service Creek	1	690	Group B	98%	0.11	1	700	80	90%	0.57	1	700	400	300	-8%
020_02	Service Creek	2	90	Group B	98%	0.11	1	90	10	60%	2.28	1	90	200	200	-38%
020_02	Service Creek	3	120	Group B	98%	0.11	1	100	10	0%	5.70	1	100	600	600	-98%
020_02	Service Creek	4	290	Group B	98%	0.11	1	300	30	10%	5.13	1	300	2,000	2,000	-88%
020_02	Service Creek	5	90	Group B	98%	0.11	1	90	10	60%	2.28	1	90	200	200	-38%
020_02	Service Creek	6	1000	Hardwoods 1	97%	0.17	1	1,000	200	90%	0.57	1	1,000	600	400	-7%
020_02	Service Creek	7	210	Hardwoods 1	97%	0.17	1	200	30	70%	1.71	1	200	300	300	-27%
020_02	Service Creek	8	210	Hardwoods 1	97%	0.17	1	200	30	80%	1.14	1	200	200	200	-17%
020_02	Service Creek	9	210	Hardwoods 1	97%	0.17	1	200	30	50%	2.85	1	200	600	600	-47%
020_02	Service Creek	10	60	Hardwoods 1	97%	0.17	1	60	10	90%	0.57	1	60	30	20	-7%
020_02	Bentley Creek	1	2400	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
020_02	Bentley Creek	2	260	Group B	98%	0.11	2	500	60	60%	2.28	2	500	1,000	900	-38%
020_02	Bentley Creek	3	140	Group B	98%	0.11	2	300	30	70%	1.71	2	300	500	500	-28%
020_02	Bentley Creek	4	220	Group B	98%	0.11	2	400	50	30%	3.99	2	400	2,000	2,000	-68%
020_02	Bentley Creek	5	380	Group B	98%	0.11	2	800	90	10%	5.13	2	800	4,000	4,000	-88%
020_02	Bentley Creek	6	420	Group B	97%	0.17	3	1,000	200	60%	2.28	3	1,000	2,000	2,000	-37%
020_02	Bentley Creek	7	220	Group B	97%	0.17	3	700	100	50%	2.85	3	700	2,000	2,000	-47%
020_02	Bentley Creek	8	590	Group B	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
020_02	Bentley Creek	9	110	Group B	97%	0.17	3	300	50	90%	0.57	3	300	200	200	-7%
020_02	Bentley Creek	10	310	Group B	97%	0.17	3	900	200	70%	1.71	3	900	2,000	2,000	-27%
020_02	Bentley Creek	11	440	Hardwoods 1	72%	1.60	5	2,000	3,000	70%	1.71	5	2,000	3,000	0	-2%
020_02	Fern Creek	1	1500	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
020_02	Fern Creek	2	1100	Group A	94%	0.34	2	2,000	700	90%	0.57	2	2,000	1,000	300	-4%
020_02	Fern Creek	3	590	Hardwoods 1	94%	0.34	2	1,000	300	90%	0.57	2	1,000	600	300	-4%
020_02	Fern Creek	4	230	Hardwoods 1	86%	0.80	3	700	600	70%	1.71	3	700	1,000	400	-16%
020_02	Fern Creek	5	510	Hardwoods 1	86%	0.80	3	2,000	2,000	50%	2.85	3	2,000	6,000	4,000	-36%
020_02	Fern Creek	6	230	Hardwoods 1	86%	0.80	3	700	600	70%	1.71	3	700	1,000	400	-16%
020_02	Fern Creek	7	240	Hardwoods 1	86%	0.80	3	700	600	60%	2.28	3	700	2,000	1,000	-26%
020_02	Fern Creek	8	270	Hardwoods 1	78%	1.25	4	1,000	1,000	30%	3.99	4	1,000	4,000	3,000	-48%
020_02	Fern Creek	9	140	Hardwoods 1	78%	1.25	4	600	800	70%	1.71	4	600	1,000	200	-8%
020_02	Fern Creek	10	250	Hardwoods 1	78%	1.25	4	1,000	1,000	80%	1.14	4	1,000	1,000	0	0%
020_02	Fern Creek	11	710	Hardwoods 1	78%	1.25	4	3,000	4,000	50%	2.85	4	3,000	9,000	5,000	-28%
020_02	Fern Creek	12	210	Hardwoods 1	78%	1.25	4	800	1,000	83%	0.97	4	800	800	(200)	0%
020_02	Fern Creek	13	60	Hardwoods 1	78%	1.25	4	200	300	90%	0.57	4	200	100	(200)	0%
020_02	1st to Fern	1	3400	Group B	98%	0.11	2	7,000	800	90%	0.57	2	7,000	4,000	3,000	-8%
020_02	Ranienan Creek	1	3400	Group B	98%	0.11	2	7,000	800	90%	0.57	2	7,000	4,000	3,000	-8%
020_02	Ranienan Creek	2	380	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
							Totals		35,000					97,000	64,000	

Table F-10. Existing and target solar loads for Rose Creek and 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
021_02	Rose Creek	1	3200	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
021_02	Rose Creek	2	120	Group B	97%	0.17	3	400	70	80%	1.14	3	400	500	400	-17%
021_02	Rose Creek	3	150	Group B	97%	0.17	3	500	90	90%	0.57	3	500	300	200	-7%
021_02	Rose Creek	4	380	Group B	97%	0.17	3	1,000	200	50%	2.85	3	1,000	3,000	3,000	-47%
021_02	Rose Creek	5	130	Group B	97%	0.17	3	400	70	10%	5.13	3	400	2,000	2,000	-87%
021_02	Rose Creek	6	570	Hardwoods 1	78%	1.25	4	2,000	3,000	0%	5.70	4	2,000	10,000	7,000	-78%
021_02	Rose Creek	7	160	Hardwoods 1	78%	1.25	4	600	800	50%	2.85	4	600	2,000	1,000	-28%
021_02	Rose Creek	8	90	Hardwoods 1	78%	1.25	4	400	500	0%	5.70	4	400	2,000	2,000	-78%
021_02	Rose Creek	9	240	Hardwoods 1	78%	1.25	4	1,000	1,000	40%	3.42	4	1,000	3,000	2,000	-38%
021_02	Rose Creek	10	930	Hardwoods 1	72%	1.60	5	5,000	8,000	60%	2.28	5	5,000	10,000	2,000	-12%
021_02	Rose Creek	11	650	Hardwoods 1	72%	1.60	5	3,000	5,000	30%	3.99	5	3,000	10,000	5,000	-42%
021_02	Rose Creek	12	160	Hardwoods 1	65%	2.00	6	1,000	2,000	20%	4.56	6	1,000	5,000	3,000	-45%
021_02	Rose Creek	13	1100	Hardwoods 1	65%	2.00	6	7,000	10,000	10%	5.13	6	7,000	40,000	30,000	-55%
021_02	1st to Rose	1	2000	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
021_02	1st to Rose	2	580	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
021_02	1st to Rose	3	100	Group B	98%	0.11	2	200	20	10%	5.13	2	200	1,000	1,000	-88%
021_02	1st to Rose	4	60	Group B	98%	0.11	2	100	10	0%	5.70	2	100	600	600	-98%
021_02	1st to Rose Lak	1	170	Group A	95%	0.29	1	200	60	90%	0.57	1	200	100	40	-5%
021_02	1st to Rose Lak	2	190	Group B	98%	0.11	1	200	20	90%	0.57	1	200	100	80	-8%
021_02	1st to Rose Lak	3	150	Group B	98%	0.11	1	200	20	70%	1.71	1	200	300	300	-28%
021_02	1st to Rose Lak	4	790	Group B	98%	0.11	1	800	90	80%	1.14	1	800	900	800	-18%
021_02	1st to Rose Lak	5	310	Group B	98%	0.11	2	600	70	90%	0.57	2	600	300	200	-8%
021_02	1st to Rose Lak	6	420	Group B	98%	0.11	2	800	90	80%	1.14	2	800	900	800	-18%
021_02	1st to Rose Lak	7	120	Hardwoods 1	94%	0.34	2	200	70	70%	1.71	2	200	300	200	-24%
021_02	1st to Rose Lak	8	50	Hardwoods 1	94%	0.34	2	100	30	80%	1.14	2	100	100	70	-14%
021_02	1st to Rose Lak	9	430	Hardwoods 1	94%	0.34	2	900	300	70%	1.71	2	900	2,000	2,000	-24%
							Totals		33,000					99,000	67,000	

Table F-11. Existing and target solar loads for Killarney Lake 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
022_02	Lane Creek	1	2200	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
022_02	Lane Creek	2	820	Hardwoods 1	86%	0.80	3	2,000	2,000	90%	0.57	3	2,000	1,000	(1,000)	0%
022_02	Lane Creek	3	890	Hardwoods 1	86%	0.80	3	3,000	2,000	80%	1.14	3	3,000	3,000	1,000	-6%
022_02	McGinnis Creek	1	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
022_02	Chatfield Creek	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
022_02	Chatfield Creek	2	100	Hardwoods 1	94%	0.34	2	200	70	50%	2.85	2	200	600	500	-44%
022_02	Chatfield Creek	3	190	Hardwoods 1	94%	0.34	2	400	100	70%	1.71	2	400	700	600	-24%
022_02	Chatfield Creek	4	260	Hardwoods 1	94%	0.34	2	500	200	90%	0.57	2	500	300	100	-4%
022_02	Armstrong Cr	1	2900	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
022_02	Armstrong Cr	2	470	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
022_02	Armstrong Cr	3	210	Group B	97%	0.17	3	600	100	80%	1.14	3	600	700	600	-17%
022_02	1st to Armstrong	1	3000	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
022_02	WF Fortier Cr	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
022_02	1st to Fortier	1	1200	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
022_02	2nd to Fortier	1	2900	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
022_02	Fortier Creek	1	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
022_02	Fortier Creek	2	1100	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
022_02	Fortier Creek	3	600	Group B	96%	0.23	4	2,000	500	90%	0.57	4	2,000	1,000	500	-6%
022_02	Fortier Creek	4	160	Group B	96%	0.23	4	600	100	80%	1.14	4	600	700	600	-16%
022_02	Fortier Creek	5	400	Hardwoods 1	78%	1.25	4	2,000	3,000	70%	1.71	4	2,000	3,000	0	-8%
022_02	Killarney Creek	1	2500	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
022_02	Killarney Creek	2	410	Group B	97%	0.17	3	1,000	200	80%	1.14	3	1,000	1,000	800	-17%
022_02	Killarney Creek	3	420	Hardwoods 1	86%	0.80	3	1,000	800	20%	4.56	3	1,000	5,000	4,000	-66%
022_02	Killarney Creek	4	210	Hardwoods 1	86%	0.80	3	600	500	80%	1.14	3	600	700	200	-6%
							Totals		15,000					41,000	26,000	

Table F-12. Existing and target solar loads for Blue Lake Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
024_02	Blue Lake Creek	1	2500	Group A	94%	0.34	2	5,000	2,000	90%	0.57	2	5,000	3,000	1,000	-4%
024_02	Blue Lake Creek	2	640	Group A	97%	0.17	3	2,000	300	80%	1.14	3	2,000	2,000	2,000	-17%
024_02	Blue Lake Creek	3	580	Group B	97%	0.17	3	2,000	300	88%	0.68	3	2,000	1,000	700	-9%
024_02	Blue Lake Creek	4	890	Hardwoods 1	78%	1.25	4	4,000	5,000	80%	1.14	4	4,000	5,000	0	2%
024_02	Blue Lake Creek	5	280	Hardwoods 1	78%	1.25	4	1,000	1,000	50%	2.85	4	1,000	3,000	2,000	-28%
024_02	Blue Lake Creek	6	1500	Hardwoods 1	72%	1.60	5	8,000	10,000	10%	5.13	5	8,000	40,000	30,000	-62%
024_02	trib to Blue Lake	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
024_02	Cottonwood Cr	1	1450	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
024_02	Cottonwood Cr	2	1450	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
024_02	Cottonwood Cr	3	1430	Group B	97%	0.17	3	4,000	700	93%	0.40	3	4,000	2,000	1,000	-4%
024_02	un-named creek	1	2300	Group A	95%	0.29	1	2,000	600	90%	0.57	1	2,000	1,000	400	-5%
024_02	un-named creek	2	220	Group A	94%	0.34	2	400	100	80%	1.14	2	400	500	400	-14%
024_02	un-named creek	3	330	Group A	94%	0.34	2	700	200	50%	2.85	2	700	2,000	2,000	-44%
024_02	un-named creek	4	320	Hardwoods 1	94%	0.34	2	600	200	90%	0.57	2	600	300	100	-4%
024_02	un-named creek	5	230	Hardwoods 1	94%	0.34	2	500	200	10%	5.13	2	500	3,000	3,000	-84%
							Totals		21,000					66,000	46,000	

Table F-13. Existing and target solar loads for Carlin Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
026_02	Pleasant Creek	1	2000	Forest	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
026_02	Pleasant Creek	2	440	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
026_02	Pleasant Creek	3	630		97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
026_02	Pleasant Creek	4	520		96%	0.23	4	2,000	500	80%	1.14	4	2,000	2,000	2,000	-16%
026_02	1st to Pleasant	1	240		98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
026_02	1st to Pleasant	2	1900		98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
026_02	No Creek	1	2200		98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
026_02	Carrill Creek	1	2700		98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
026_02	trib to Carlin Cr	1	1500		98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
026_02	trib to Carlin Cr	2	510		98%	0.11	1	500	60	80%	1.14	1	500	600	500	-18%
026_02	trib to Carlin Cr	3	610		98%	0.11	2	1,000	100	70%	1.71	2	1,000	2,000	2,000	-28%
026_02	trib to Carlin Cr	4	1200		98%	0.11	2	2,000	200	95%	0.29	2	2,000	600	400	-3%
026_02	Carlin Creek	1	1700		98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
026_02	Carlin Creek	2	850	Nonforest	86%	0.80	3	3,000	2,000	80%	1.14	3	3,000	3,000	1,000	-6%
026_02	Carlin Creek	3	440	Group 1	86%	0.80	3	1,000	800	70%	1.71	3	1,000	2,000	1,000	-16%
026_02	Carlin Creek	4	110		78%	1.25	4	400	500	90%	0.57	4	400	200	(300)	0%
026_02	Carlin Creek	5	600		78%	1.25	4	2,000	3,000	70%	1.71	4	2,000	3,000	0	-8%
026_02	Carlin Creek	6	950		72%	1.60	5	5,000	8,000	90%	0.57	5	5,000	3,000	(5,000)	0%
026_02	Carlin Creek	7	1500		72%	1.60	5	8,000	10,000	80%	1.14	5	8,000	9,000	(1,000)	0%
026_02	Carlin Creek	8	820		65%	2.00	6	5,000	10,000	70%	1.71	6	5,000	9,000	(1,000)	0%
026_02	Carlin Creek	9	440		65%	2.00	6	3,000	6,000	80%	1.14	6	3,000	3,000	(3,000)	0%
026_02	Carlin Creek	10	600		65%	2.00	6	4,000	8,000	70%	1.71	6	4,000	7,000	(1,000)	0%
026_02	Carlin Creek	11	210		65%	2.00	6	1,000	2,000	40%	3.42	6	1,000	3,000	1,000	-25%
026_02	Carlin Creek	12	120		65%	2.00	6	700	1,000	0%	5.70	6	700	4,000	3,000	-65%
026_02	un-named (S of	1	290	Group B	98%	0.11	1	300	30	90%	0.57	1	300	200	200	-8%
026_02	un-named (S of	2	340		98%	0.11	1	300	30	80%	1.14	1	300	300	300	-18%
026_02	un-named (S of	3	460	Group A	95%	0.29	1	500	100	80%	1.14	1	500	600	500	-15%
026_02	un-named (S of	4	1100		94%	0.34	2	2,000	700	90%	0.57	2	2,000	1,000	300	-4%
026_02	un-named (S of	5	260		94%	0.34	2	500	200	50%	2.85	2	500	1,000	800	-44%
026_02	Hungry Hollow	1	1700		94%	0.34	2	3,000	1,000	90%	0.57	2	3,000	2,000	1,000	-4%
026_02	Hungry Hollow	2	110		94%	0.34	2	200	70	70%	1.71	2	200	300	200	-24%
								Totals	57,000					70,000	14,000	

Table F-14. Existing and target solar loads for Beauty 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	Beauty Creek	1	1600	Group B	98%	0.11	2	3,000	300	93%	0.40	4	6,000	2,000	2,000	-5%
028_02	Beauty Creek	2	2070	Group B	96%	0.23	4	8,000	2,000	80%	1.14	5	10,000	10,000	8,000	-16%
028_03	Beauty Creek	1	1300	Group B	94%	0.34	5	7,000	2,000	81%	1.08	6	8,000	9,000	7,000	-13%
028_03	Beauty Creek	2	900	Group B	94%	0.34	5	5,000	2,000	78%	1.25	6	5,000	6,000	4,000	-16%
028_03	Beauty Creek	3	100	Group B	93%	0.40	6	600	200	90%	0.57	6	600	300	100	-3%
028_03	Beauty Creek	4	420	Hardwoods 1	65%	2.00	6	3,000	6,000	70%	1.71	6	3,000	5,000	(1,000)	0%
028_03	Beauty Creek	5	1100	Hardwoods 1	65%	2.00	6	7,000	10,000	40%	3.42	7	8,000	30,000	20,000	-25%
028_03	Beauty Creek	6	310	Hardwoods 1	65%	2.00	6	2,000	4,000	60%	2.28	7	2,000	5,000	1,000	-5%
								Totals	27,000					67,000	41,000	

Table F-15. Existing and target solar loads for Beauty Creek tributaries.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
028_02	SF Beauty Cr	1	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
028_02	SF Beauty Cr	2	640	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
028_02	SF Beauty Cr	3	280	Group B	98%	0.11	2	600	70	89%	0.63	2	600	400	300	-9%
028_02	trib to SF	1	860	Group B	98%	0.11	1	900	100	90%	0.57	1	900	500	400	-8%
028_02	2nd to Beauty	1	2000	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
028_02	Varnum Creek	1	2110	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
028_02	Varnum Creek	2	950	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
028_02	Varnum Creek	3	200	Group B	97%	0.17	3	600	100	80%	1.14	3	600	700	600	-17%
028_02	Hagerman Cr	1	1700	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
028_02	5th to Beauty	1	1300	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
028_02	5th to Beauty	2	980	Group B	98%	0.11	1	1,000	100	93%	0.40	1	1,000	400	300	-5%
028_02	Caribou Creek	1	2300	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
028_02	Caribou Creek	2	280	Group B	98%	0.11	2	600	70	80%	1.14	2	600	700	600	-18%
028_02	un-named creek	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
028_02	un-named creek	2	140	Group A	94%	0.34	2	300	100	90%	0.57	2	300	200	100	-4%
028_02	un-named creek	3	160	Group A	94%	0.34	2	300	100	70%	1.71	2	300	500	400	-24%
028_02	un-named creek	4	220	Group A	94%	0.34	2	400	100	90%	0.57	2	400	200	100	-4%
								Totals	3,100					15,000	13,000	

Table F-16. Existing and target solar loads for Wolf Lodge 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
029_02	Wolf Lodge Cr	1	370	Group B	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
029_02	Wolf Lodge Cr	2	610	Group B	98%	0.11	1	600	70	80%	1.14	1	600	700	600	-18%
029_02	Wolf Lodge Cr	3	870	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
029_02	Wolf Lodge Cr	4	1000	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
029_02	Wolf Lodge Cr	5	1460	Group B	96%	0.23	4	6,000	1,000	90%	0.57	4	6,000	3,000	2,000	-6%
029_02	Wolf Lodge Cr	6	150	Group B	96%	0.23	4	600	100	70%	1.71	5	800	1,000	900	-26%
029_02	Wolf Lodge Cr	7	410	Group B	96%	0.23	4	2,000	500	90%	0.57	5	2,000	1,000	500	-6%
029_02	Wolf Lodge Cr	8	650	Group B	96%	0.23	4	3,000	700	80%	1.14	5	3,000	3,000	2,000	-16%
029_02	Wolf Lodge Cr	9	990	Group B	94%	0.34	5	5,000	2,000	90%	0.57	6	6,000	3,000	1,000	-4%
029_02	Wolf Lodge Cr	10	980	Group B	94%	0.34	5	5,000	2,000	80%	1.14	6	6,000	7,000	5,000	-14%
029_02	Wolf Lodge Cr	11	470	Group B	94%	0.34	5	2,000	700	60%	2.28	7	3,000	7,000	6,000	-34%
029_03	Wolf Lodge Cr	12	140	Hardwoods 1	65%	2.00	6	800	2,000	30%	3.99	7	1,000	4,000	2,000	-35%
029_03	Wolf Lodge Cr	13	500	Hardwoods 1	65%	2.00	6	3,000	6,000	70%	1.71	8	4,000	7,000	1,000	5%
029_03	Wolf Lodge Cr	14	380	Hardwoods 1	60%	2.28	7	3,000	7,000	50%	2.85	9	3,000	9,000	2,000	-10%
029_03	Wolf Lodge Cr	15	600	Hardwoods 1	55%	2.57	8	5,000	10,000	50%	2.85	10	6,000	20,000	10,000	-5%
029_03	Wolf Lodge Cr	16	270	Hardwoods 1	52%	2.74	9	2,000	5,000	0%	5.70	10	3,000	20,000	20,000	-52%
029_03	Wolf Lodge Cr	17	340	Hardwoods 1	52%	2.74	9	3,000	8,000	30%	3.99	10	3,000	10,000	2,000	-22%
029_03	Wolf Lodge Cr	18	370	Hardwoods 1	52%	2.74	9	3,000	8,000	10%	5.13	10	4,000	20,000	10,000	-42%
029_03	Wolf Lodge Cr	19	220	Hardwoods 1	48%	2.96	10	2,200	6,500	10%	5.13	11	2,400	12,000	5,500	-38%
029_03	Wolf Lodge Cr	20	200	Hardwoods 1	48%	2.96	10	2,000	5,900	0%	5.70	11	2,200	13,000	7,100	-48%
029_03	Wolf Lodge Cr	21	320	Hardwoods 1	48%	2.96	10	3,200	9,500	20%	4.56	11	3,500	16,000	6,500	-28%
029_03	Wolf Lodge Cr	22	230	Hardwoods 1	48%	2.96	10	2,300	6,800	30%	3.99	12	2,800	11,000	4,200	-18%
029_03	Wolf Lodge Cr	23	300	Hardwoods 1	45%	3.14	11	3,300	10,000	20%	4.56	12	3,600	16,000	6,000	-25%
029_03	Wolf Lodge Cr	24	250	Hardwoods 1	45%	3.14	11	2,800	8,800	30%	3.99	12	3,000	12,000	3,200	-15%
029_03	Wolf Lodge Cr	25	290	Hardwoods 1	45%	3.14	11	3,200	10,000	40%	3.42	13	3,800	13,000	3,000	-5%
029_03	Wolf Lodge Cr	26	450	Hardwoods 1	45%	3.14	11	5,000	16,000	20%	4.56	13	5,900	27,000	11,000	-25%
029_03	Wolf Lodge Cr	27	210	Hardwoods 1	41%	3.36	12	2,500	8,400	30%	3.99	13	2,700	11,000	2,600	-11%
029_03	Wolf Lodge Cr	28	200	Hardwoods 1	41%	3.36	12	2,400	8,100	0%	5.70	14	2,800	16,000	7,900	-41%
029_03	Wolf Lodge Cr	29	280	Hardwoods 1	41%	3.36	12	3,400	11,000	40%	3.42	14	3,900	13,000	2,000	-1%
029_03	Wolf Lodge Cr	30	240	Hardwoods 1	41%	3.36	12	2,900	9,800	30%	3.99	14	3,400	14,000	4,200	-11%
029_03	Wolf Lodge Cr	31	260	Hardwoods 1	39%	3.48	13	3,400	12,000	40%	3.42	15	3,900	13,000	1,000	0%
029_03	Wolf Lodge Cr	32	130	Hardwoods 1	39%	3.48	13	1,700	5,900	40%	3.42	15	2,000	6,800	900	0%
029_03	Wolf Lodge Cr	33	520	Hardwoods 1	39%	3.48	13	6,800	24,000	20%	4.56	15	7,800	36,000	12,000	-19%
029_03	Wolf Lodge Cr	34	40	Hardwoods 1	39%	3.48	13	520	1,800	90%	0.57	15	600	340	(1,500)	0%
029_03	Wolf Lodge Cr	35	1530	Hardwoods 1	37%	3.59	14	21,000	75,000	10%	5.13	16	24,000	120,000	45,000	-27%
029_03	Wolf Lodge Cr	36	530	Hardwoods 1	35%	3.71	15	8,000	30,000	20%	4.56	17	9,000	41,000	11,000	-15%
029_03	Wolf Lodge Cr	37	480	Hardwoods 1	35%	3.71	15	7,200	27,000	0%	5.70	17	8,200	47,000	20,000	-35%
							Totals		340,000					560,000	220,000	

Table F-17. Existing and target solar loads for Wolf Lodge 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
029_02	Phantom Creek	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
029_02	Phantom Creek	2	190	Group B	98%	0.11	2	400	50	70%	1.71	2	400	700	700	-28%
029_02	Phantom Creek	3	920	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
029_02	Blue Grouse Cr	1	2400	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
029_02	Onawa Creek	1	2300	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
029_02	Halliday Creek	1	1900	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
029_02	Stella Creek	1	2610	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
029_02	Stella Creek	2	680	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
029_02	Stella Creek	3	380	Group B	97%	0.17	3	1,000	200	70%	1.71	3	1,000	2,000	2,000	-27%
029_02	Stella Creek	4	780	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
029_02	Stella Creek	5	800	Group A	80%	1.14	4	3,000	3,000	90%	0.57	4	3,000	2,000	(1,000)	0%
029_02	Stella Creek	6	450	Group B	96%	0.23	4	2,000	500	80%	1.14	4	2,000	2,000	2,000	-16%
029_02	Stella Creek	7	970	Group A	72%	1.60	5	5,000	8,000	90%	0.57	5	5,000	3,000	(5,000)	0%
029_02	Stella Creek	8	460	Group B	94%	0.34	5	2,000	700	90%	0.57	5	2,000	1,000	300	-4%
029_02	1st to Stella	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
029_02	2nd to Stella	1	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
029_02	3rd to Stella	1	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
029_02	3rd to Stella	2	1000	Group A	94%	0.34	2	2,000	700	90%	0.57	2	2,000	1,000	300	-4%
029_02	Lonsome Creek	1	2900	Group A	94%	0.34	2	6,000	2,000	90%	0.57	2	6,000	3,000	1,000	-4%
029_02	Lonsome Creek	2	180	Hardwoods 1	78%	1.25	4	700	900	90%	0.57	4	700	400	(500)	0%
029_02	Lonsome Creek	3	120	Hardwoods 1	78%	1.25	4	500	600	80%	1.14	4	500	600	0	0%
029_02	Lonsome Creek	4	120	Hardwoods 1	72%	1.60	5	600	1,000	70%	1.71	5	600	1,000	0	-2%
029_02	Lonsome Creek	5	60	Hardwoods 1	72%	1.60	5	300	500	0%	5.70	5	300	2,000	2,000	-72%
029_02	Lonsome Creek	6	430	Hardwoods 1	72%	1.60	5	2,000	3,000	70%	1.71	5	2,000	3,000	0	-2%
029_02	Lonsome Creek	7	100	Hardwoods 1	72%	1.60	5	500	800	90%	0.57	5	500	300	(500)	0%
029_02	Lonsome Creek	8	40	Hardwoods 1	72%	1.60	5	200	300	70%	1.71	5	200	300	0	-2%
029_02	Lonsome Creek	9	250	Hardwoods 1	65%	2.00	6	2,000	4,000	0%	5.70	6	2,000	10,000	6,000	-65%
029_02	Lonsome Creek	10	130	Hardwoods 1	65%	2.00	6	800	2,000	10%	5.13	6	800	4,000	2,000	-55%
029_02	Lonsome Creek	11	160	Hardwoods 1	65%	2.00	6	1,000	2,000	0%	5.70	6	1,000	6,000	4,000	-65%
029_02	Lonsome Creek	12	160	Hardwoods 1	65%	2.00	6	1,000	2,000	30%	3.99	6	1,000	4,000	2,000	-35%
029_02	Lonsome Creek	13	130	Hardwoods 1	65%	2.00	6	800	2,000	40%	3.42	6	800	3,000	1,000	-25%
029_02	1st to Lonsome	1	2900	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
029_02	1st to Lonsome	2	210	Group B	98%	0.11	2	400	50	80%	1.14	2	400	500	500	-18%
							Totals		38,000					68,000	31,000	

Table F-18. Existing and target solar loads for Cedar Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
030_02	Cedar Creek	1	2900	Group B	98%	0.11	1	3,000	300	93%	0.40	1	3,000	1,000	700	-5%
030_02	Cedar Creek	2	90	Group B	98%	0.11	2	200	20	20%	4.56	2	200	900	900	-78%
030_02	Cedar Creek	3	610	Group B	98%	0.11	2	1,000	100	80%	1.14	2	1,000	1,000	900	-18%
030_02	Cedar Creek	4	80	Group B	98%	0.11	2	200	20	20%	4.56	2	200	900	900	-78%
030_02	Cedar Creek	5	190	Group B	98%	0.11	2	400	50	60%	2.28	2	400	900	900	-38%
030_02	Cedar Creek	6	790	Group B	98%	0.11	2	2,000	200	70%	1.71	2	2,000	3,000	3,000	-28%
030_02	Cedar Creek	7	370	Group B	97%	0.17	3	1,000	200	80%	1.14	3	1,000	1,000	800	-17%
030_02	Cedar Creek	8	200	Group B	97%	0.17	3	600	100	70%	1.71	3	600	1,000	900	-27%
030_02	Cedar Creek	9	450	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
030_02	Cedar Creek	10	370	Group B	97%	0.17	3	1,000	200	50%	2.85	3	1,000	3,000	3,000	-47%
030_02	Cedar Creek	11	320	Group B	97%	0.17	3	1,000	200	90%	0.57	3	1,000	600	400	-7%
030_02	Cedar Creek	12	190	Group B	97%	0.17	3	600	100	63%	2.11	3	600	1,000	900	-34%
030_02	Cedar Creek	13	180	Group B	97%	0.17	3	500	90	40%	3.42	3	500	2,000	2,000	-57%
030_02	Cedar Creek	14	70	Hardwoods 1	78%	1.25	4	300	400	40%	3.42	4	300	1,000	600	-38%
030_02	Cedar Creek	15	60	Hardwoods 1	78%	1.25	4	200	300	90%	0.57	4	200	100	(200)	0%
030_02	Cedar Creek	16	40	Hardwoods 1	78%	1.25	4	200	300	80%	1.14	4	200	200	(100)	0%
030_02	Cedar Creek	17	750	Hardwoods 1	78%	1.25	4	3,000	4,000	90%	0.57	4	3,000	2,000	(2,000)	0%
030_02	Cedar Creek	18	130	Hardwoods 1	78%	1.25	4	500	600	50%	2.85	4	500	1,000	400	-28%
030_02	Cedar Creek	19	130	Hardwoods 1	78%	1.25	4	500	600	70%	1.71	4	500	900	300	-8%
030_03	Cedar Creek	20	420	Group B	94%	0.34	5	2,000	700	80%	1.14	5	2,000	2,000	1,000	-14%
030_03	Cedar Creek	21	210	Hardwoods 1	72%	1.60	5	1,000	2,000	60%	2.28	5	1,000	2,000	0	-12%
030_03	Cedar Creek	22	300	Hardwoods 1	72%	1.60	5	2,000	3,000	60%	2.28	5	2,000	5,000	2,000	-12%
030_03	Cedar Creek	23	550	Hardwoods 1	72%	1.60	5	3,000	5,000	70%	1.71	5	3,000	5,000	0	-2%
030_03	Cedar Creek	24	490	Hardwoods 1	72%	1.60	5	2,000	3,000	68%	1.82	5	2,000	4,000	1,000	-4%
030_03	Cedar Creek	25	370	Hardwoods 1	72%	1.60	5	2,000	3,000	50%	2.85	5	2,000	6,000	3,000	-22%
							Totals		25,000					46,000	22,000	

Table F-19. Existing and target solar loads for Cedar 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
030_02	SF Cedar Creek	1	1500	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
030_02	SF Cedar Creek	2	670	Hardwoods 1	94%	0.34	2	1,000	300	90%	0.57	2	1,000	600	300	-4%
030_02	SF Cedar Creek	3	710	Hardwoods 1	86%	0.80	3	2,000	2,000	80%	1.14	3	2,000	2,000	0	-6%
030_02	SF Cedar Creek	4	660	Group A	80%	1.14	4	3,000	3,000	90%	0.57	4	3,000	2,000	(1,000)	0%
030_02	SF Cedar Creek	5	670	Hardwoods 1	72%	1.60	5	3,000	5,000	80%	1.14	5	3,000	3,000	(2,000)	0%
030_02	SF Cedar Creek	6	40	Hardwoods 1	72%	1.60	5	200	300	90%	0.57	5	200	100	(200)	0%
030_02	1st to SF Cedar	1	2500	Group B	98%	0.11	2	5,000	600	90%	0.57	2	5,000	3,000	2,000	-8%
030_02	2nd to SF Ceda	1	1500	Group B	98%	0.11	1	2,000	200	80%	1.14	1	2,000	2,000	2,000	-18%
030_02	3rd to SF Cedar	1	3600	Group B	98%	0.11	2	7,000	800	90%	0.57	2	7,000	4,000	3,000	-8%
030_02	Alder Creek	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
030_02	Alder Creek	2	1040	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
030_02	Alder Creek	3	1400	Group B	97%	0.17	3	4,000	700	80%	1.14	3	4,000	5,000	4,000	-17%
030_02	Alder Creek	4	590	Group B	97%	0.17	3	2,000	300	90%	0.57	3	2,000	1,000	700	-7%
030_02	Alder Creek	5	630	Group B	96%	0.23	4	3,000	700	90%	0.57	4	3,000	2,000	1,000	-6%
030_02	1st to Alder	1	2100	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
030_02	1st to Alder	2	1800	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
030_02	1st to Alder	3	210	Group B	98%	0.11	2	400	50	80%	1.14	2	400	500	500	-18%
030_02	1st to Alder	4	130	Group B	98%	0.11	2	300	30	70%	1.71	2	300	500	500	-28%
030_02	Chinese Gulch	1	980	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
030_02	Chinese Gulch	2	1800	Group B	98%	0.11	1	2,000	200	70%	1.71	1	2,000	3,000	3,000	-28%
030_02	Chinese Gulch	3	480	Group B	98%	0.11	1	500	60	90%	0.57	1	500	300	200	-8%
030_02	Chinese Gulch	4	100	Group B	98%	0.11	1	100	10	60%	2.28	1	100	200	200	-38%
030_02	Chinese Gulch	5	110	Group B	98%	0.11	1	100	10	80%	1.14	1	100	100	90	-18%
030_02	un-named	1	2400	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
030_02	Rutherford Gulch	1	600	Group B	98%	0.11	1	600	70	90%	0.57	1	600	300	200	-8%
030_02	Rutherford Gulch	2	2100	Group B	98%	0.11	2	4,000	500	80%	1.14	2	4,000	5,000	5,000	-18%
030_02	Rutherford Gulch	3	190	Group B	98%	0.11	2	400	50	70%	1.71	2	400	700	700	-28%
030_02	Rutherford Gulch	4	980	Group B	97%	0.17	3	3,000	500	90%	0.57	3	3,000	2,000	2,000	-7%
030_02	Rutherford Gulch	5	110	Group B	97%	0.17	3	300	50	80%	1.14	3	300	300	300	-17%
030_02	Rutherford Gulch	6	460	Group A	89%	0.63	3	1,000	600	70%	1.71	3	1,000	2,000	1,000	-19%
030_02	Rutherford Gulch	7	330	Group A	89%	0.63	3	1,000	600	10%	5.13	3	1,000	5,000	4,000	-79%
030_02	Rutherford Gulch	8	380	Group A	89%	0.63	3	1,000	600	50%	2.85	3	1,000	3,000	2,000	-39%
030_02	un-named	1	1600	Group B	98%	0.11	2	3,000	300	90%	0.57	2	3,000	2,000	2,000	-8%
							Totals		19,000					59,000	40,000	

Table F-20. Existing and target solar loads for Marie Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
031_02	Marie Creek	1	6000	Group B	98%	0.11	2	10,000	1,000	90%	0.57	2	10,000	6,000	5,000	-8%
031_02	Marie Creek	2	460	Group B	96%	0.23	4	2,000	500	80%	1.14	4	2,000	2,000	2,000	-16%
031_02	Marie Creek	3	410	Group B	96%	0.23	4	2,000	500	50%	2.85	4	2,000	6,000	6,000	-46%
031_02	Marie Creek	4	640	Group B	96%	0.23	4	3,000	700	70%	1.71	4	3,000	5,000	4,000	-26%
031_02	Marie Creek	5	320	Group B	94%	0.34	5	2,000	700	40%	3.42	5	2,000	7,000	6,000	-54%
031_02	Marie Creek	6	340	Group B	94%	0.34	5	2,000	700	50%	2.85	5	2,000	6,000	5,000	-44%
031_02	Marie Creek	7	900	Group B	94%	0.34	5	5,000	2,000	75%	1.43	8	7,000	10,000	8,000	-19%
031_02	Marie Creek	8	270	Group B	91%	0.51	7	2,000	1,000	80%	1.14	7	2,000	2,000	1,000	-11%
031_02	Marie Creek	9	1090	Hardwoods 1	60%	2.28	7	8,000	20,000	78%	1.25	8	9,000	10,000	(10,000)	0%
031_02	Marie Creek	10	820	Hardwoods 1	60%	2.28	7	6,000	10,000	75%	1.43	6	5,000	7,000	(3,000)	0%
031_02	Marie Creek	11	130	Hardwoods 1	60%	2.28	7	900	2,000	40%	3.42	7	900	3,000	1,000	-20%
031_02	Marie Creek	12	570	Hardwoods 1	55%	2.57	8	5,000	10,000	0%	5.70	8	5,000	30,000	20,000	-55%
031_02	Marie Creek	13	230	Hardwoods 1	55%	2.57	8	2,000	5,000	60%	2.28	8	2,000	5,000	0	0%
031_02	Marie Creek	14	90	Hardwoods 1	55%	2.57	8	700	2,000	0%	5.70	8	700	4,000	2,000	-55%
031_02	Marie Creek	15	360	Hardwoods 1	55%	2.57	8	3,000	8,000	50%	2.85	8	3,000	9,000	1,000	-5%
031_02	Marie Creek	16	440	Hardwoods 1	55%	2.57	8	4,000	10,000	40%	3.42	8	4,000	10,000	0	-15%
031_02	Marie Creek	17	280	Hardwoods 1	55%	2.57	8	2,000	5,000	20%	4.56	8	2,000	9,000	4,000	-35%
031_02	Marie Creek	18	250	Hardwoods 1	55%	2.57	8	2,000	5,000	30%	3.99	8	2,000	8,000	3,000	-25%
031_02	Marie Creek	19	310	Hardwoods 1	55%	2.57	8	2,000	5,000	60%	2.28	8	2,000	5,000	0	0%
031_02	1st to Marie	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
031_02	2nd to Marie	1	2100	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
031_02	3rd to Marie	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
031_02	Skitwish Creek	1	970	Group B	98%	0.11	1	1,000	100	80%	1.14	1	1,000	1,000	900	-18%
031_02	Skitwish Creek	2	5200	Group B	97%	0.17	3	20,000	3,000	90%	0.57	3	20,000	10,000	7,000	-7%
031_02	Burton Creek	1	2900	Group B	98%	0.11	2	6,000	700	90%	0.57	2	6,000	3,000	2,000	-8%
031_02	Searchlight Cr	1	3200	Group B	98%	0.11	2	6,000	700	91%	0.51	2	6,000	3,000	2,000	-7%
							Totals		95,000					170,000	71,000	

Table F-21. Existing and target solar loads for Fernan 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
034_02a	Fernan Creek	1	230	Group B	97%	0.17	3	700	100	80%	1.14	3	700	800	700	-17%
034_02a	Fernan Creek	2	150	Hardwoods 1	78%	1.25	4	600	800	60%	2.28	4	600	1,000	200	-18%
034_02a	Fernan Creek	3	90	Hardwoods 1	78%	1.25	4	400	500	0%	5.70	4	400	2,000	2,000	-78%
034_02a	Fernan Creek	4	280	Hardwoods 1	78%	1.25	4	1,000	1,000	70%	1.71	4	1,000	2,000	1,000	-8%
034_02a	Fernan Creek	5	200	Hardwoods 1	78%	1.25	4	800	1,000	77%	1.31	4	800	1,000	0	-1%
034_02a	Fernan Creek	6	90	Hardwoods 1	78%	1.25	4	400	500	0%	5.70	4	400	2,000	2,000	-78%
034_02a	Fernan Creek	7	120	Hardwoods 1	78%	1.25	4	500	600	10%	5.13	4	500	3,000	2,000	-68%
034_03	Fernan Creek	8	310	Hardwoods 1	72%	1.60	5	2,000	3,000	0%	5.70	5	2,000	10,000	7,000	-72%
034_03	Fernan Creek	9	50	Hardwoods 1	72%	1.60	5	300	500	50%	2.85	5	300	900	400	-22%
034_03	Fernan Creek	10	110	Hardwoods 1	72%	1.60	5	600	1,000	0%	5.70	5	600	3,000	2,000	-72%
034_03	Fernan Creek	11	240	Hardwoods 1	72%	1.60	5	1,000	2,000	70%	1.71	5	1,000	2,000	0	-2%
034_03	Fernan Creek	12	260	Hardwoods 1	72%	1.60	5	1,000	2,000	30%	3.99	5	1,000	4,000	2,000	-42%
034_03	Fernan Creek	13	200	Hardwoods 1	72%	1.60	5	1,000	2,000	50%	2.85	5	1,000	3,000	1,000	-22%
034_03	Fernan Creek	14	140	Hardwoods 1	72%	1.60	5	700	1,000	60%	2.28	5	700	2,000	1,000	-12%
034_03	Fernan Creek	15	80	Hardwoods 1	72%	1.60	5	400	600	0%	5.70	5	400	2,000	1,000	-72%
034_03	Fernan Creek	16	160	Hardwoods 1	72%	1.60	5	800	1,000	50%	2.85	5	800	2,000	1,000	-22%
034_03	Fernan Creek	17	770	Hardwoods 1	72%	1.60	5	4,000	6,000	30%	3.99	5	4,000	20,000	10,000	-42%
034_03	Fernan Creek	18	700	Hardwoods 1	65%	2.00	6	4,000	8,000	0%	5.70	6	4,000	20,000	10,000	-65%
034_03	Fernan Creek	19	140	Hardwoods 1	65%	2.00	6	800	2,000	20%	4.56	6	800	4,000	2,000	-45%
034_03	Fernan Creek	20	210	Hardwoods 1	65%	2.00	6	1,000	2,000	10%	5.13	6	1,000	5,000	3,000	-55%
034_03	Fernan Creek	21	1440	Hardwoods 1	65%	2.00	6	9,000	20,000	30%	3.99	6	9,000	40,000	20,000	-35%
032_03	Fernan Creek	22	60	Hardwoods 1	60%	2.28	7	400	900	90%	0.57	7	400	200	(700)	0%
032_03	Fernan Creek	23	40	Hardwoods 1	60%	2.28	7	300	700	0%	5.70	12	500	3,000	2,000	-60%
032_03	Fernan Creek	24	50	Hardwoods 1	60%	2.28	7	400	900	90%	0.57	7	400	200	(700)	0%
032_03	Fernan Creek	25	200	Hardwoods 1	60%	2.28	7	1,000	2,000	0%	5.70	40	8,000	50,000	50,000	-60%
032_03	Fernan Creek	26	90	Hardwoods 1	60%	2.28	7	600	1,000	60%	2.28	2	200	500	(500)	0%
032_03	Fernan Creek	27	100	Hardwoods 1	60%	2.28	7	700	2,000	20%	4.56	3	300	1,000	(1,000)	-40%
032_03	Fernan Creek	28	110	Hardwoods 1	60%	2.28	7	800	2,000	50%	2.85	4	400	1,000	(1,000)	-10%
032_03	Fernan Creek	29	170	Hardwoods 1	60%	2.28	7	1,000	2,000	20%	4.56	5	900	4,000	2,000	-40%
032_03	Fernan Creek	30	250	Hardwoods 1	60%	2.28	7	2,000	5,000	0%	5.70	7	2,000	10,000	5,000	-60%
							Totals		72,000					200,000	120,000	

Table F-22. Existing and target solar loads for Fernan Creek tributaries.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
034_02	Fernan Creek	1	440	Group B	98%	0.11	1	400	50	90%	0.57	1	400	200	200	-8%
034_02	Fernan Creek	2	620	Group B	98%	0.11	1	600	70	87%	0.74	1	600	400	300	-11%
034_02	Fernan Creek	3	1000	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
034_02	Fernan Creek	4	2200	Group B	98%	0.11	2	4,000	500	90%	0.57	2	4,000	2,000	2,000	-8%
034_02	Fernan Creek	5	1490	Group B	97%	0.17	3	4,000	700	80%	1.14	3	4,000	5,000	4,000	-17%
034_02	State Creek	1	1100	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
034_02	State Creek	2	1300	Group B	98%	0.11	2	3,000	300	80%	1.14	2	3,000	3,000	3,000	-18%
034_02	Jungle Gulch	1	1700	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
034_02	Smith Gulch	1	1600	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
034_02	Dry Gulch	1	1500	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
034_02	Dry Gulch	2	190	Group B	98%	0.11	1	200	20	80%	1.14	1	200	200	200	-18%
034_02	Dry Gulch	3	1000	Group B	98%	0.11	2	2,000	200	90%	0.57	2	2,000	1,000	800	-8%
034_02	Dry Gulch	4	370	Group B	98%	0.11	2	700	80	86%	0.80	2	700	600	500	-12%
034_02	Dry Gulch trib.	1	1700	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
034_02	Rondo Gulch	1	2300	Group B	98%	0.11	1	2,000	200	90%	0.57	1	2,000	1,000	800	-8%
034_02	Rondo Gulch	2	320	Group B	98%	0.11	2	600	70	80%	1.14	2	600	700	600	-18%
034_02	Rondo Gulch	3	130	Group B	98%	0.11	2	300	30	0%	5.70	2	300	2,000	2,000	-98%
034_02	unamed trib.	1	690	Group B	98%	0.11	1	700	80	90%	0.57	1	700	400	300	-8%
034_02	unamed trib.	2	950	Group B	98%	0.11	2	2,000	200	80%	1.14	2	2,000	2,000	2,000	-18%
034_02	Stacel Draw	1	1200	Group B	98%	0.11	1	1,000	100	90%	0.57	1	1,000	600	500	-8%
034_02	Stacel Draw	2	300	Group B	98%	0.11	1	300	30	80%	1.14	1	300	300	300	-18%
034_02	Stacel Draw	3	120	Group B	98%	0.11	2	200	20	90%	0.57	2	200	100	80	-8%
034_02	Stacel Draw	4	160	Group B	98%	0.11	2	300	30	80%	1.14	2	300	300	300	-18%
034_02	Stacel Draw	5	600	Group B	98%	0.11	2	1,000	100	90%	0.57	2	1,000	600	500	-8%
034_02	Stacel Draw	6	1900	Group B	97%	0.17	3	6,000	1,000	80%	1.14	3	6,000	7,000	6,000	-17%
							Totals		4,800					33,000	29,000	

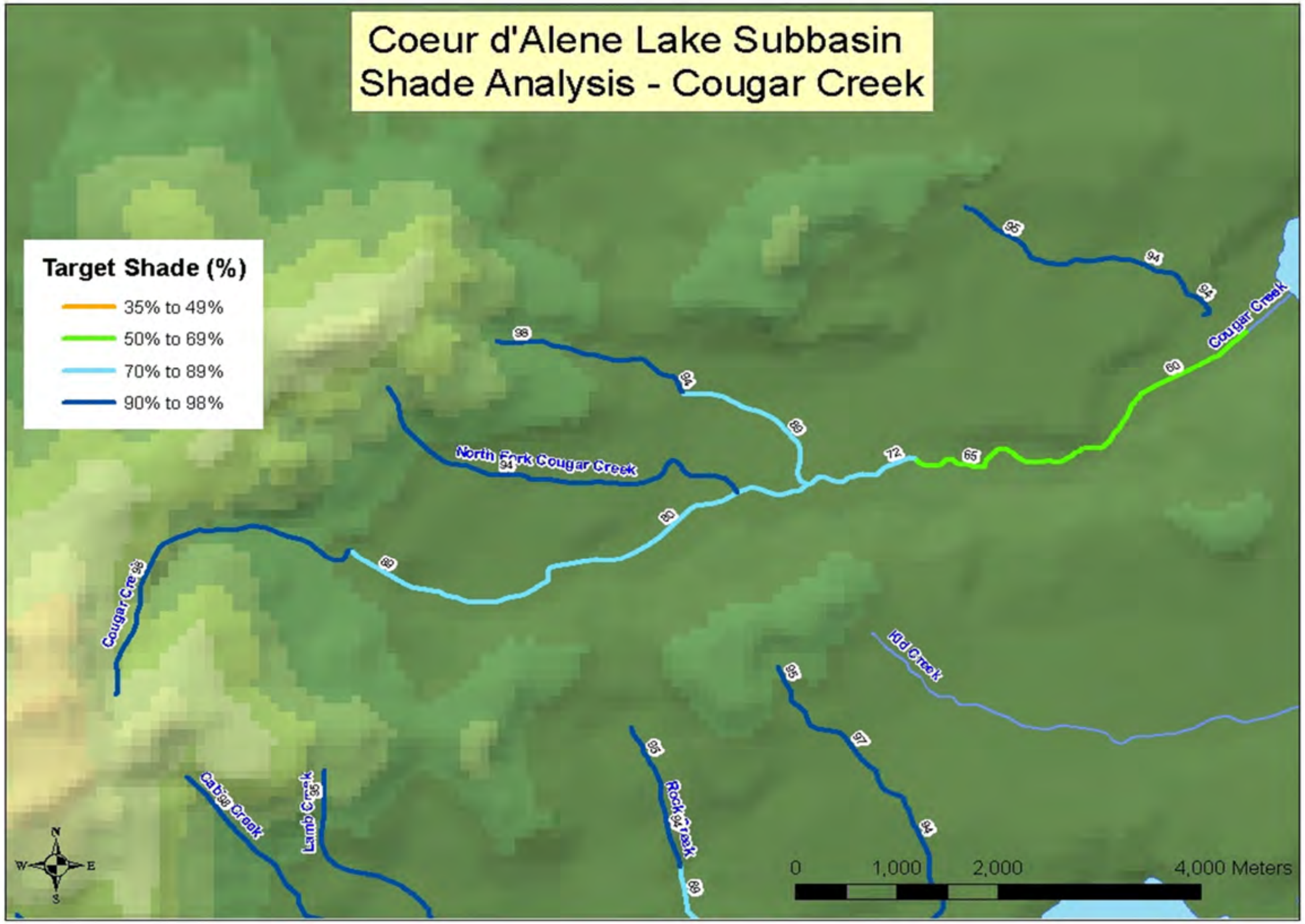

Figure F-1. Target shade for Cougar Creek (ID17010303PN002_02).

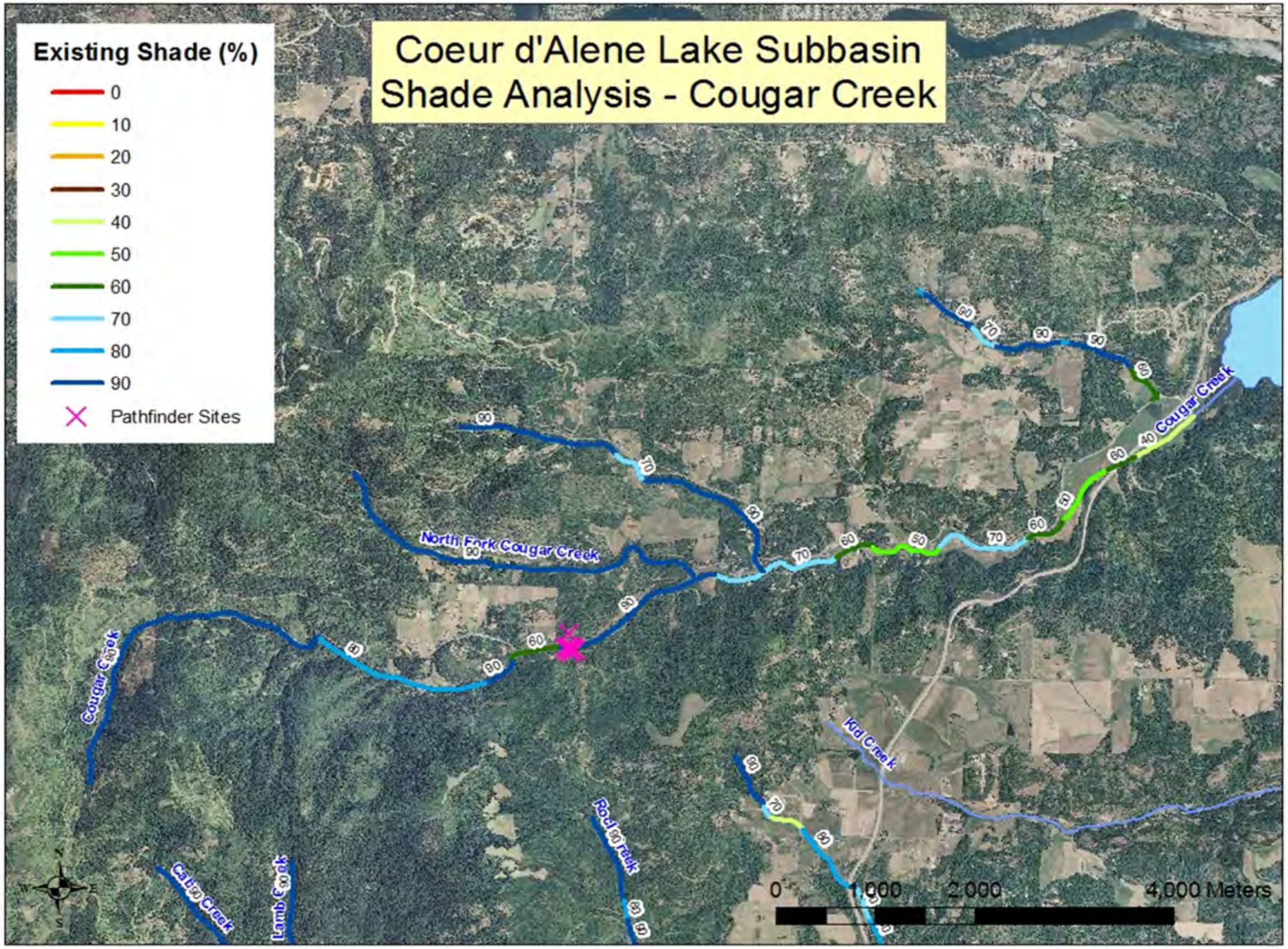

Figure F-2. Existing shade estimated for Cougar Creek (ID17010303PN002_02).

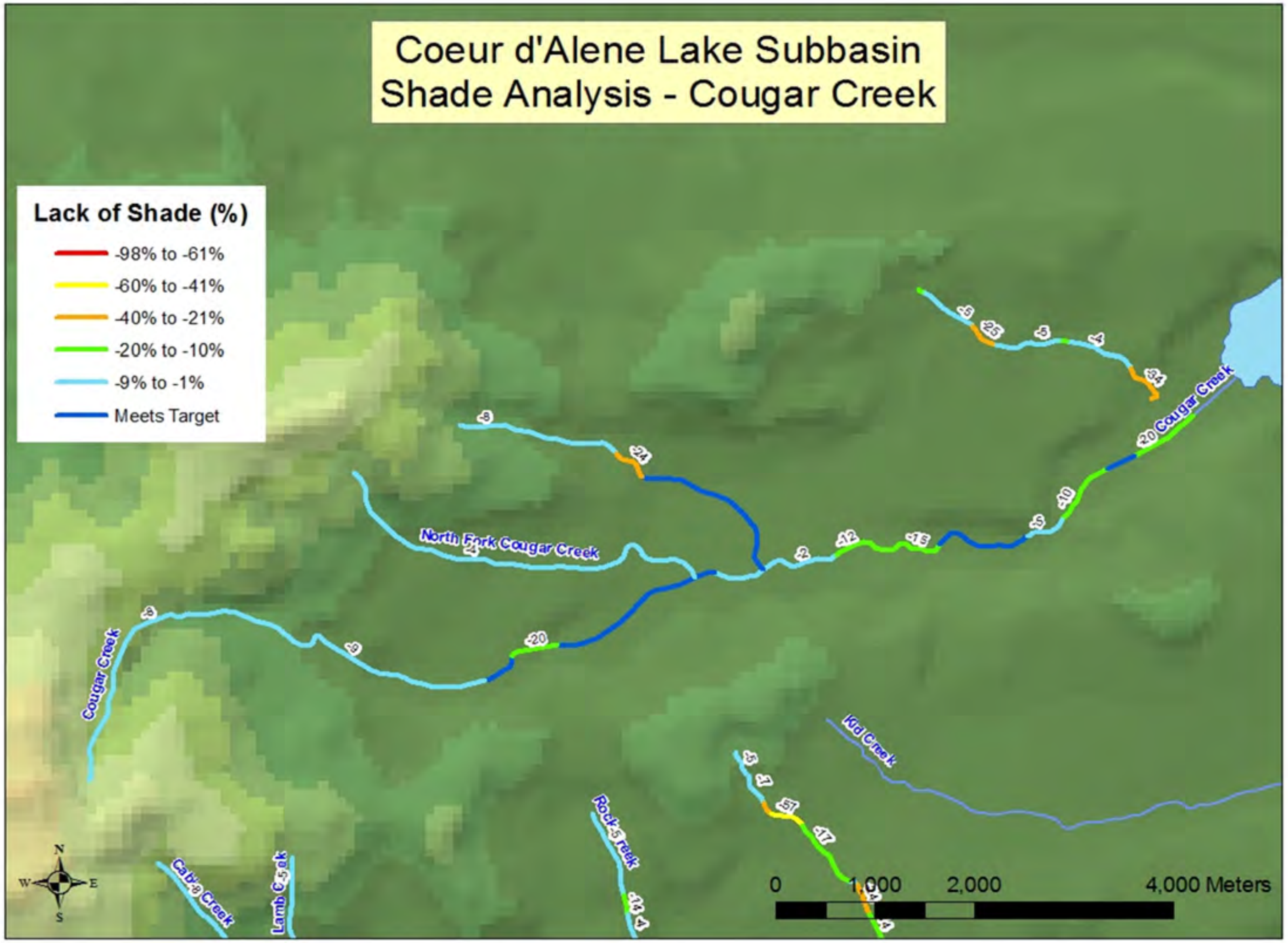

Figure F-3. Lack of shade (difference between existing and target) for Cougar Creek (ID17010303PN002_02).

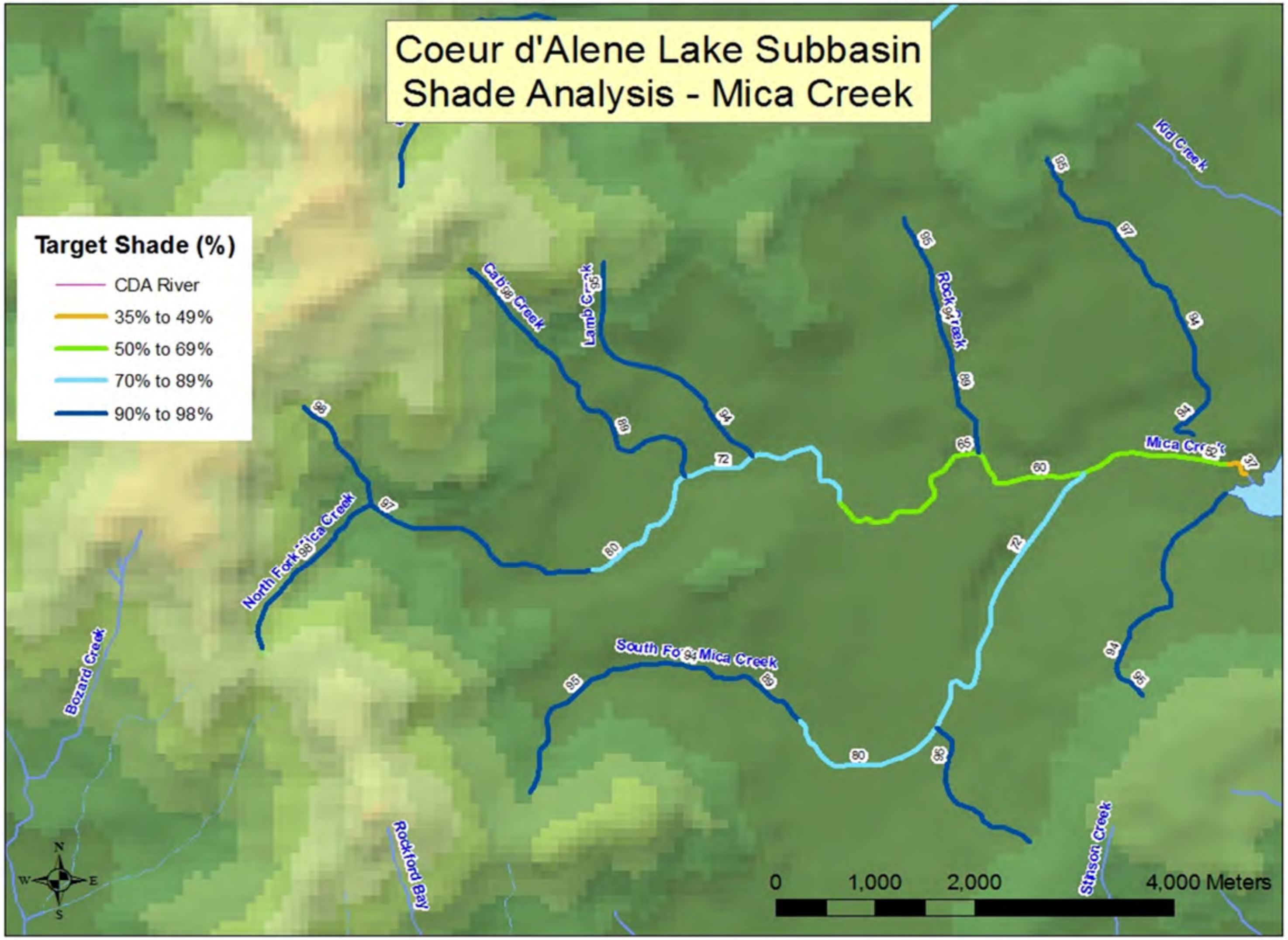

Figure F-4. Target shade for Mica Creek (ID17010303PN004_02 & _03).

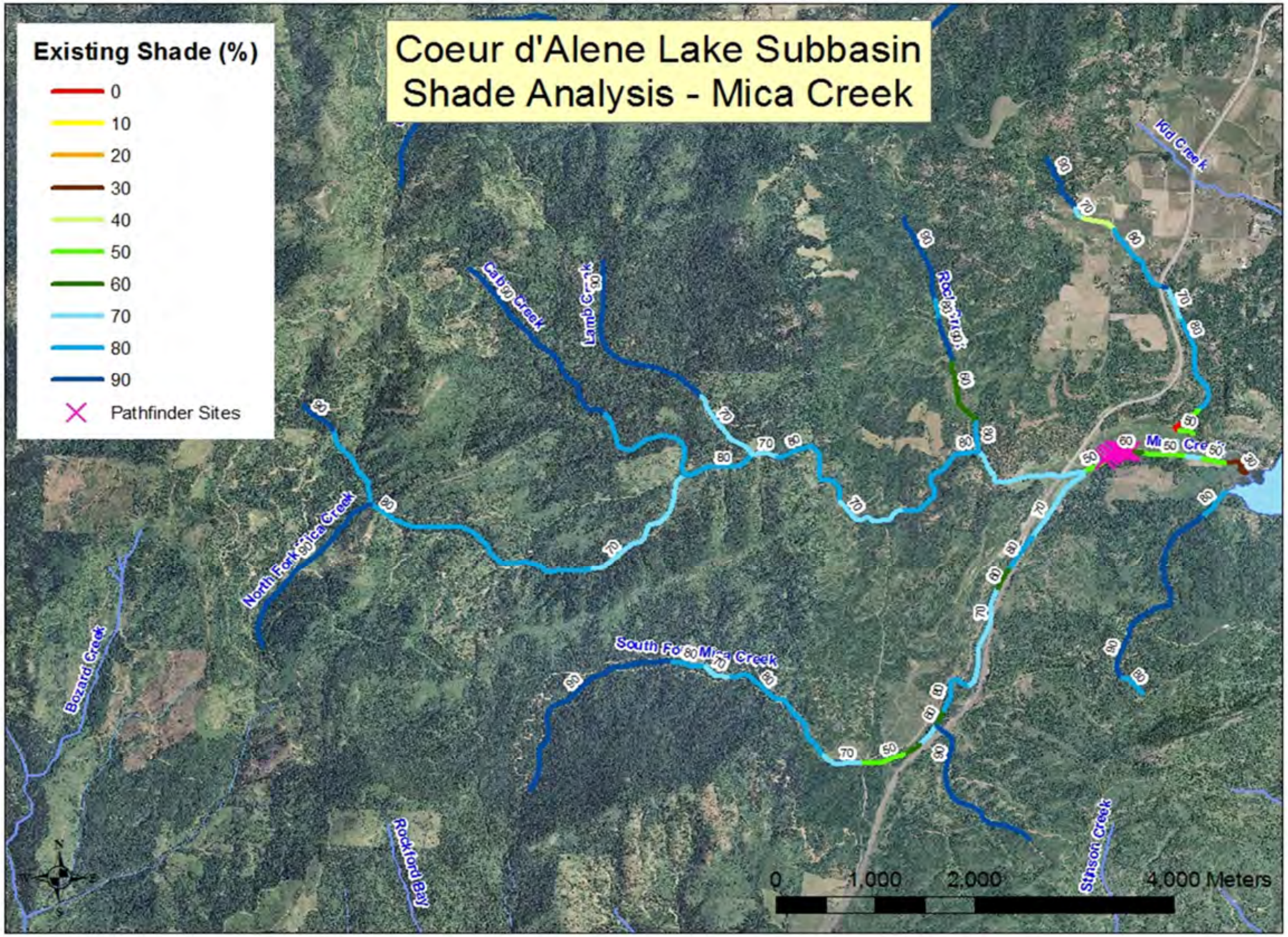

Figure F-5. Existing shade estimated for Mica Creek (ID17010303PN004_02 & _03).

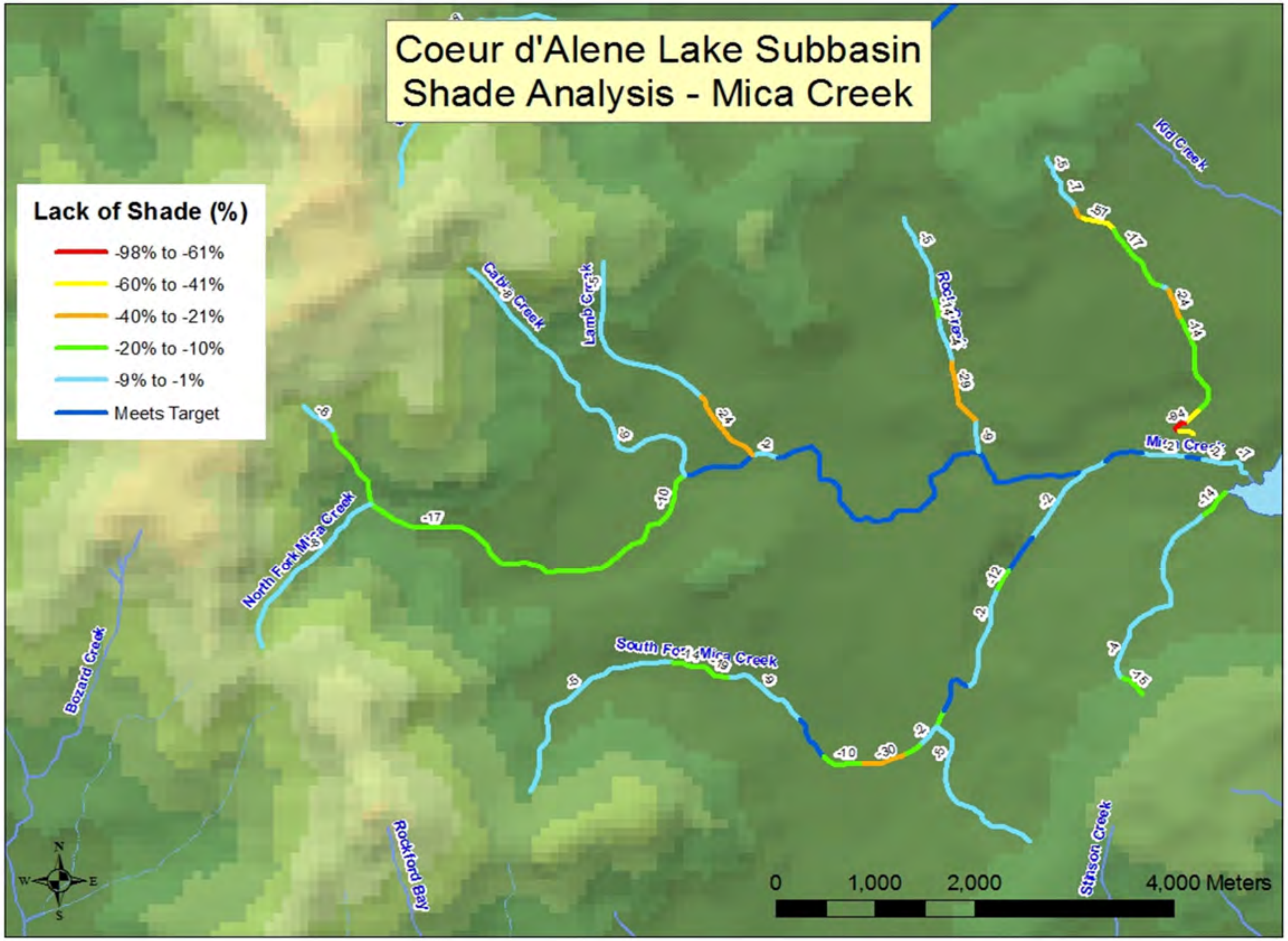

Figure F-6. Lack of shade (difference between existing and target) for Mica Creek (ID17010303PN004_02 & _03).

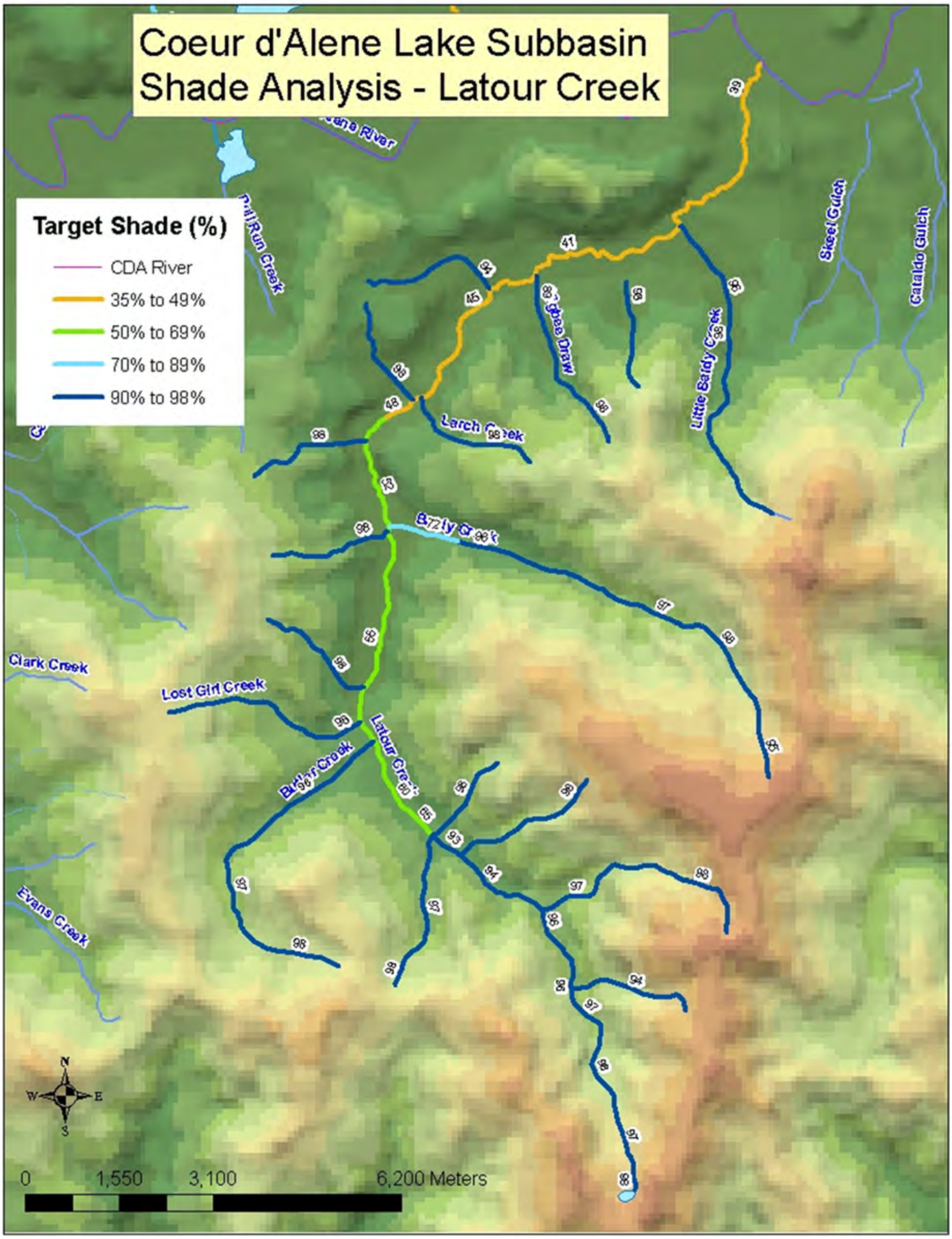

Figure F-7. Target shade for Latour Creek (ID17010303PN015_02).

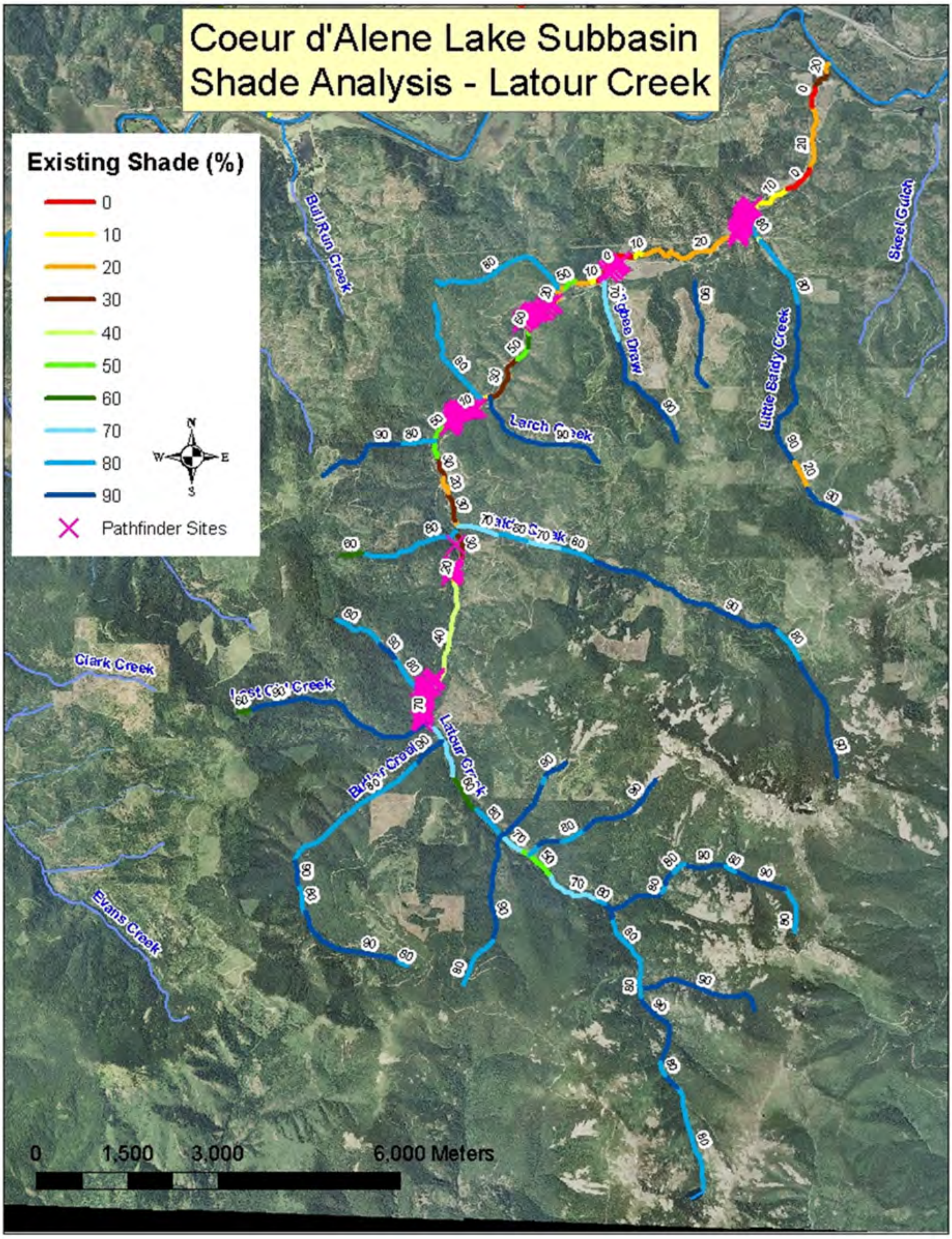

Figure F-8. Existing shade estimated for Latour Creek (ID17010303PN015_02).

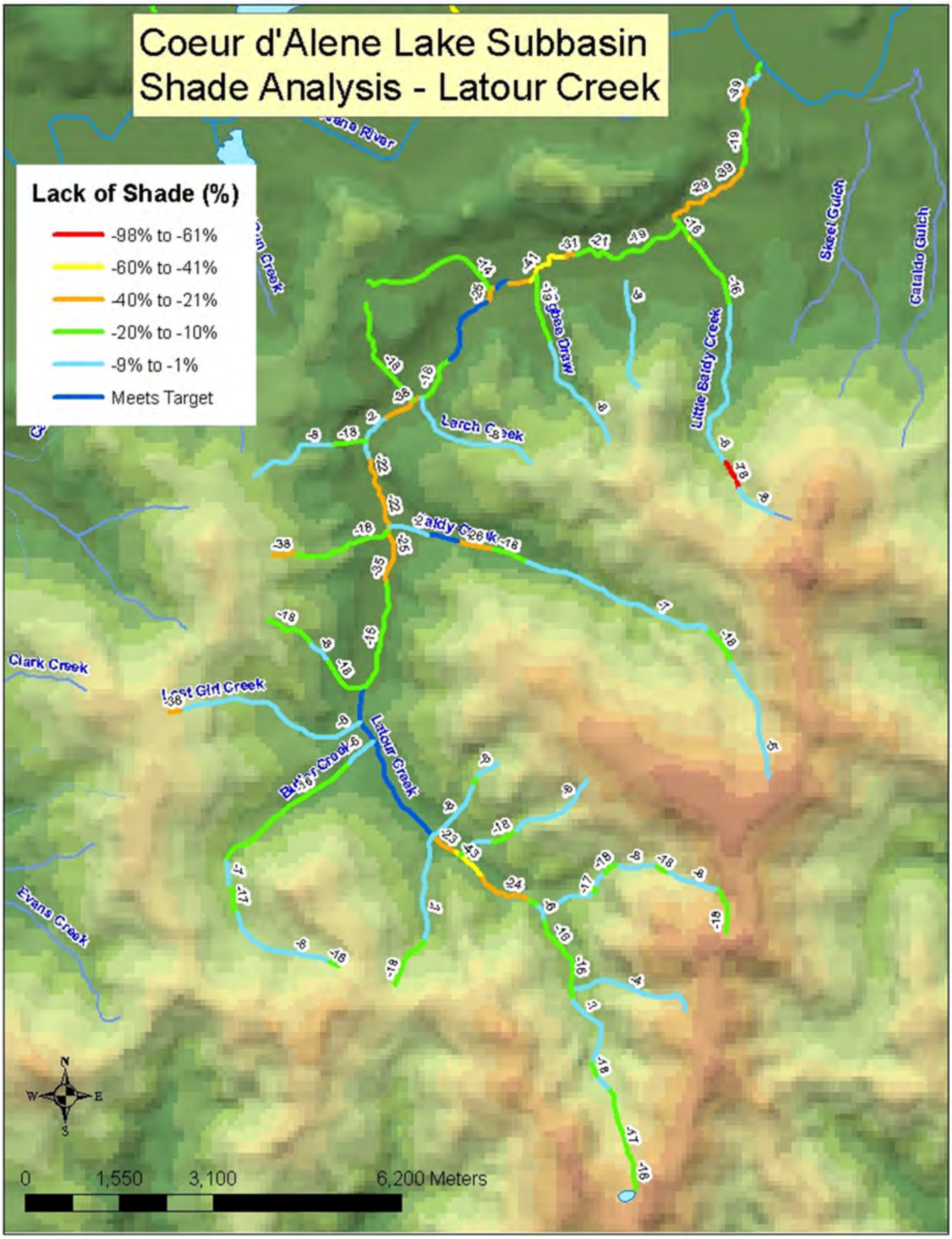

Figure F-9. Lack of shade (difference between existing and target) for Latour Creek (ID17010303PN015_02).

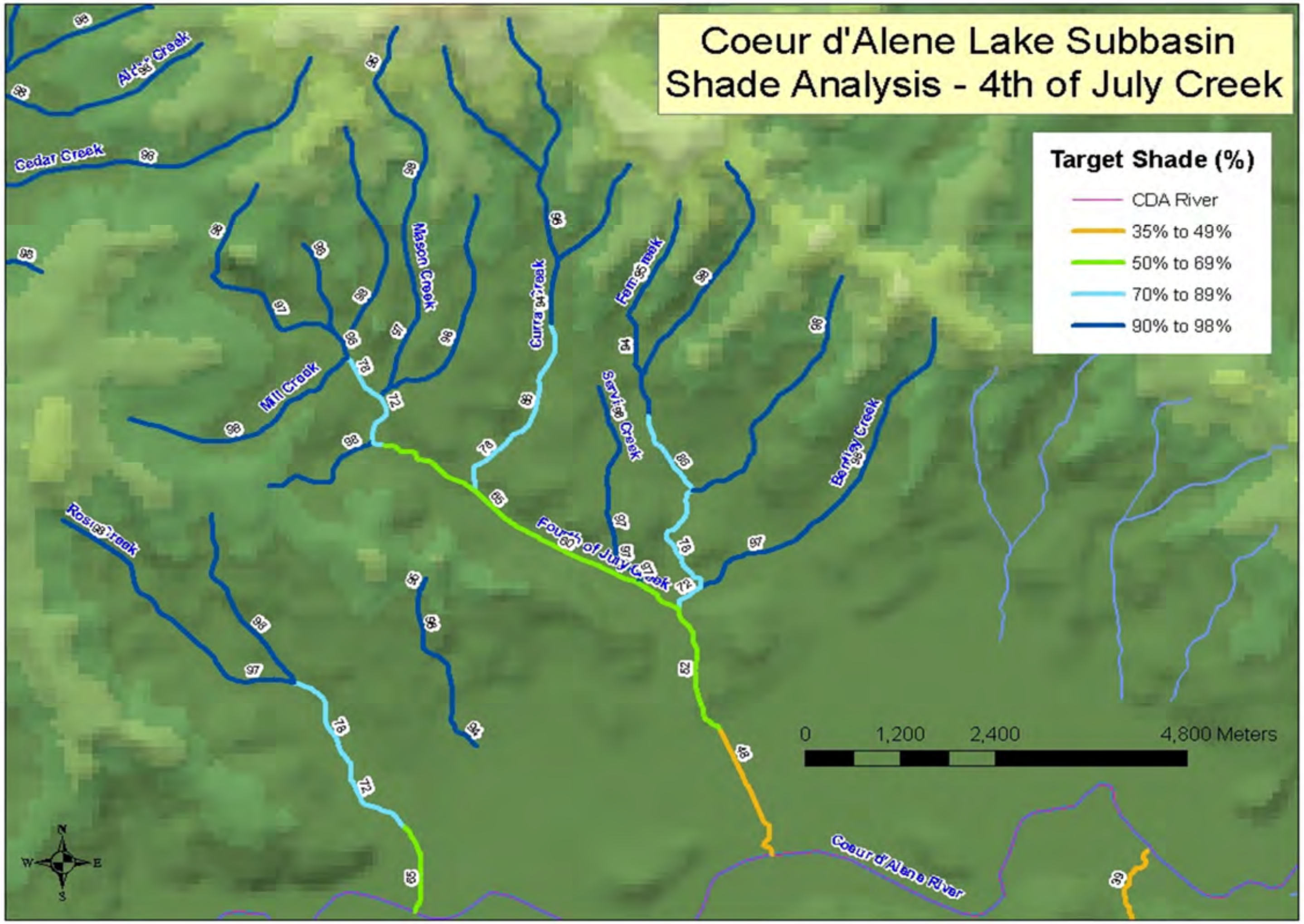

Figure F-10. Target shade for Fourth of July Creek (ID17010303PN020_02 & _03) and Rose Creek (ID17010303PN021_02).

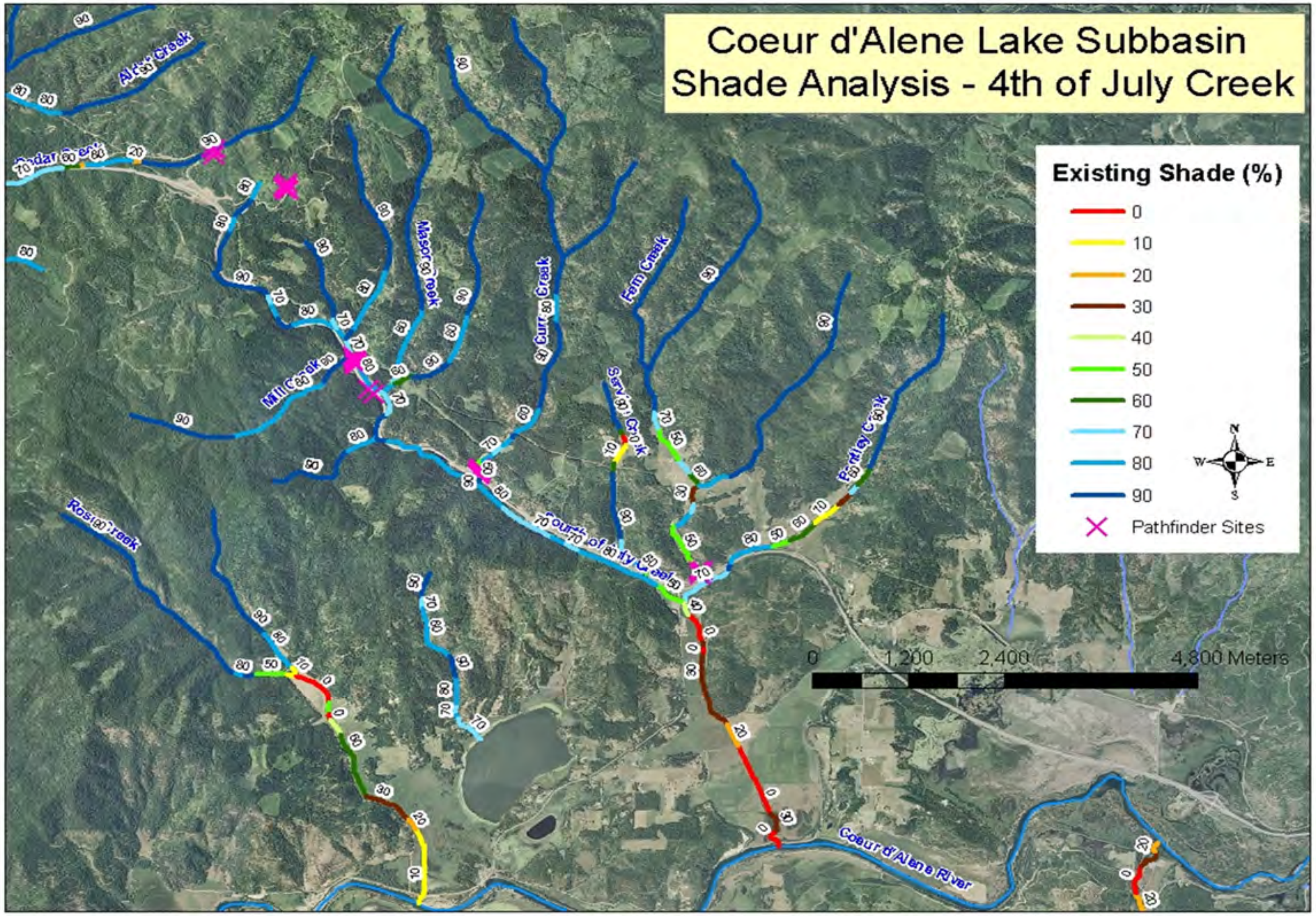

Figure F-11. Existing shade estimated for Fourth of July Creek (ID17010303PN020_02 & _03) and Rose Creek (ID17010303PN021_02).

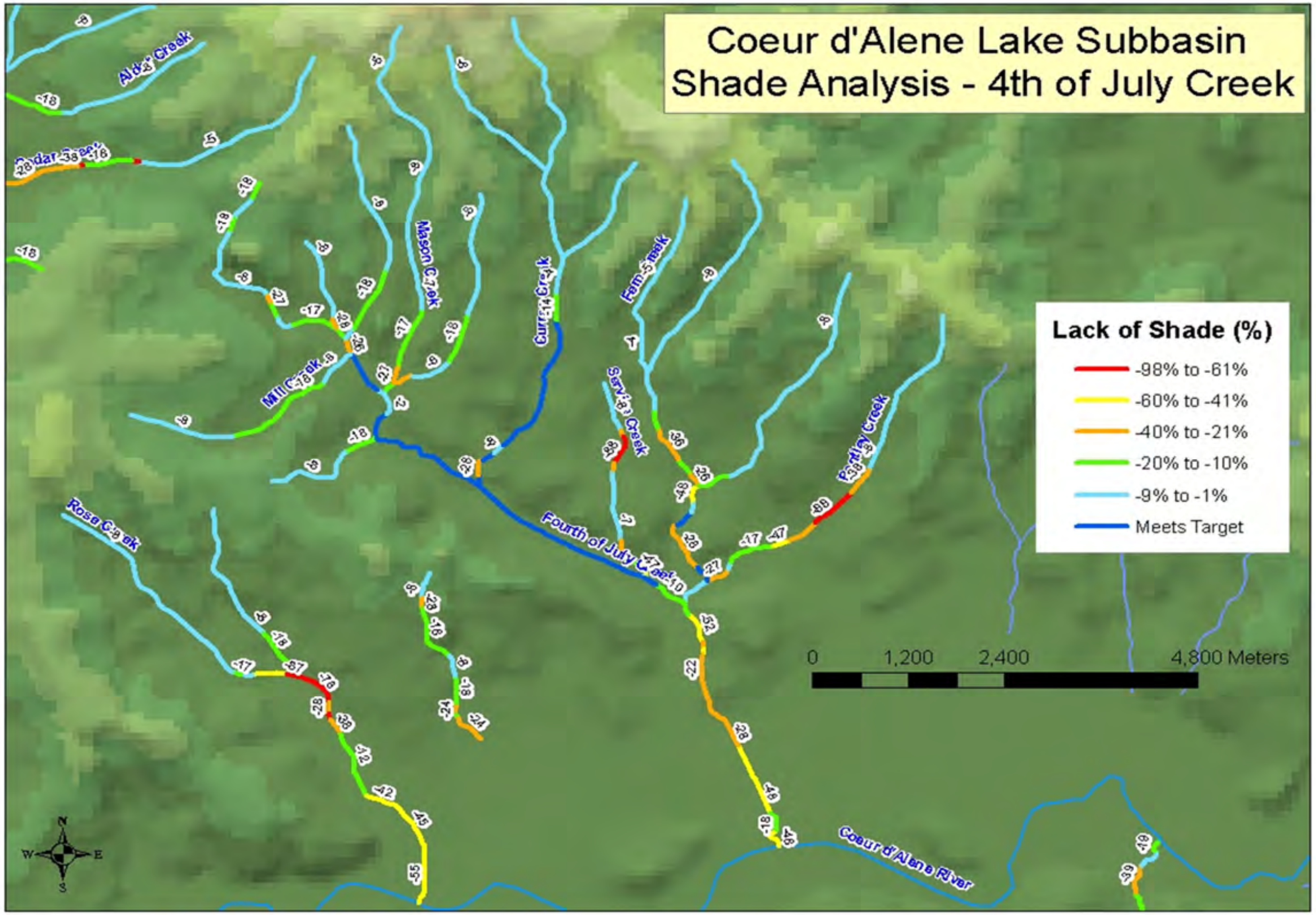

Figure F-12. Lack of shade (difference between existing and target) for Fourth of July Creek (ID17010303PN020_02 & _03) and Rose Creek (ID17010303PN021_02).

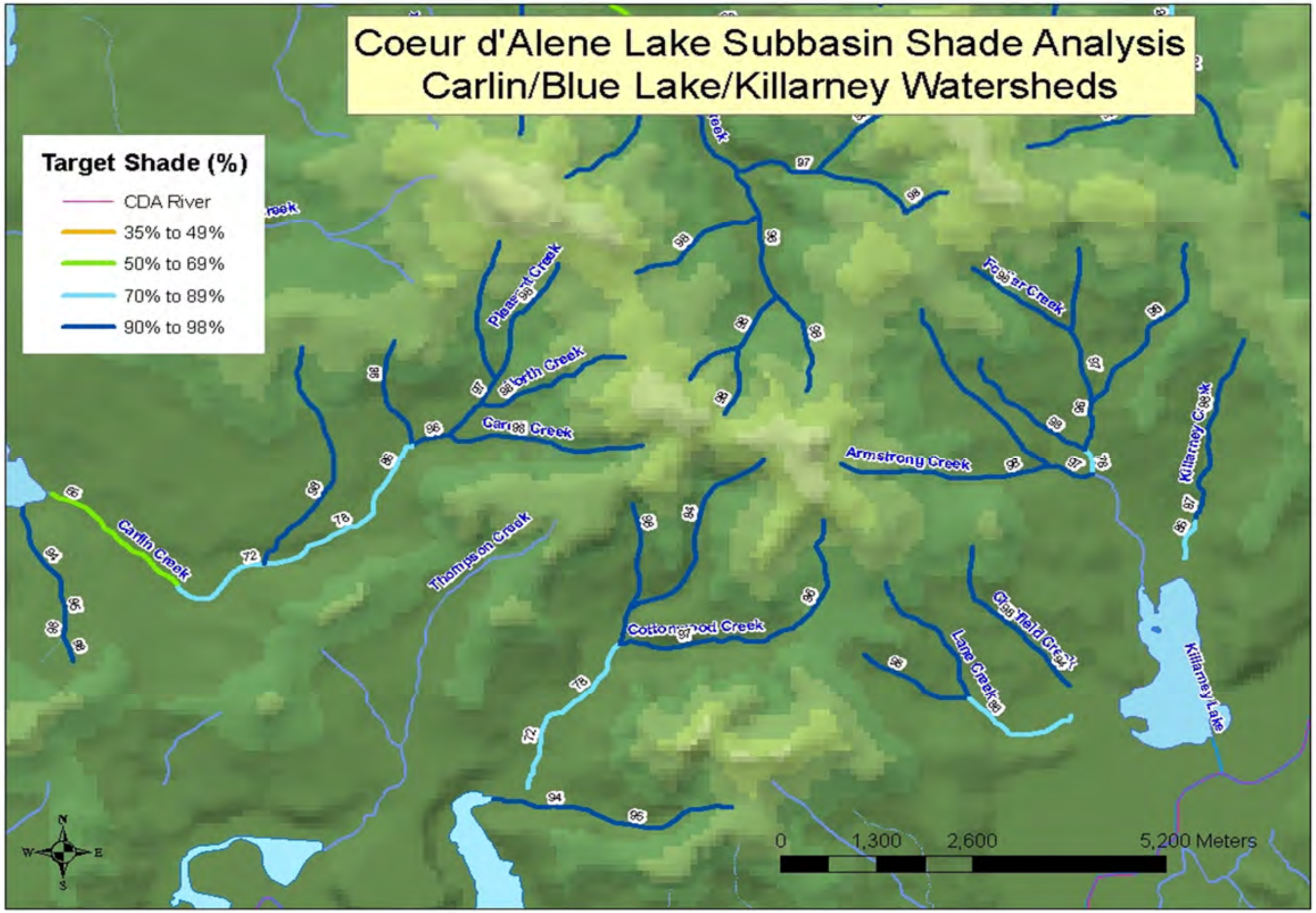

Figure F-13. Target shade for Killarney Lake tributaries (ID17010303PN022_02), Blue Lake Creek (ID17010303PN024_02), and Carlin Creek (ID17010303PN026_02).

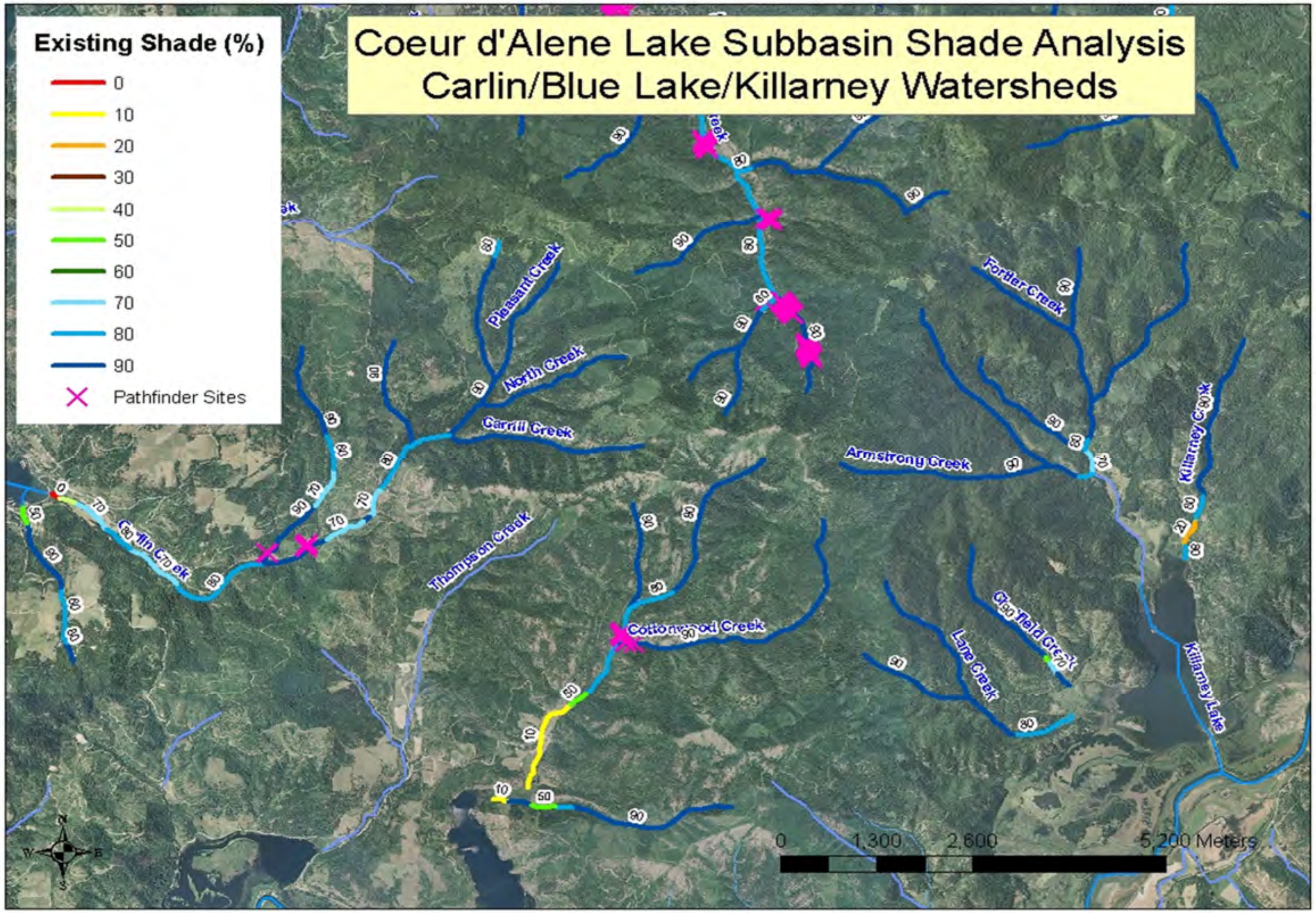

Figure F-14. Existing shade estimated for Killarney Lake tributaries (ID17010303PN022_02), Blue Lake Creek (ID17010303PN024_02), and Carlin Creek (ID17010303PN026_02).

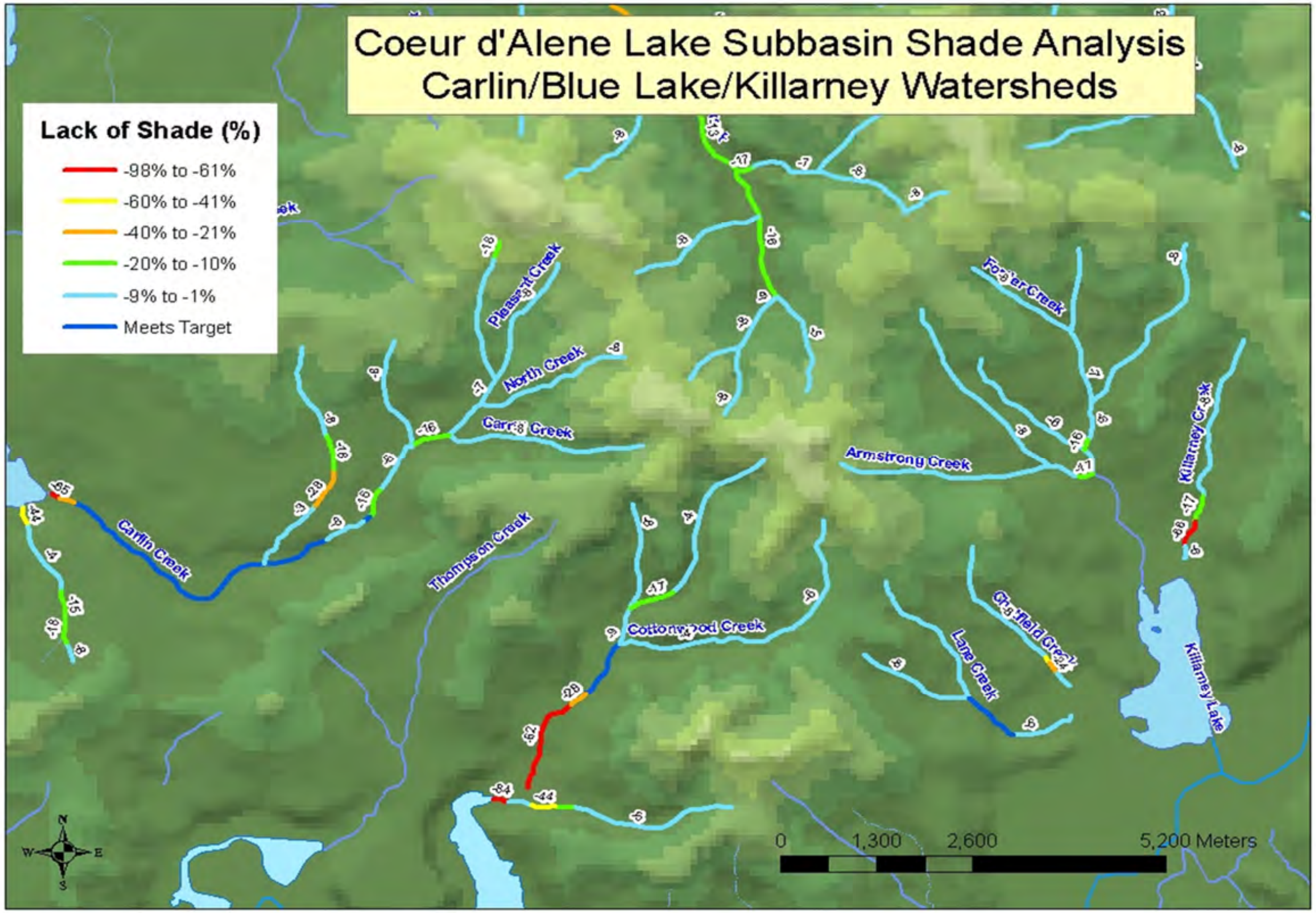

Figure F-15. Lack of shade (difference between existing and target) for Killarney Lake tributaries (ID17010303PN022_02), Blue Lake Creek (ID17010303PN024_02), and Carlin Creek (ID17010303PN026_02).

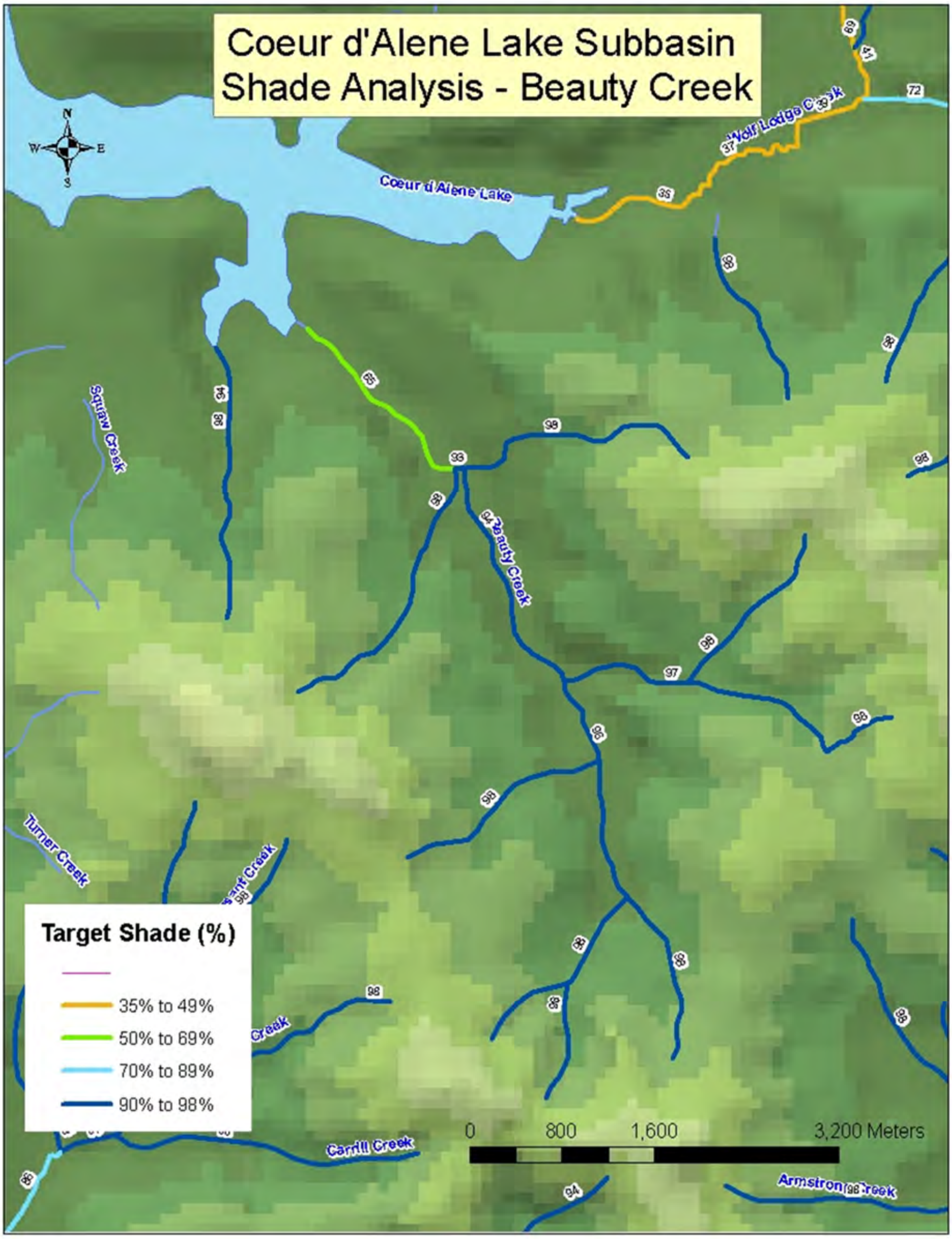

Figure F-16. Target shade for Beauty Creek (ID17010303PN028_02 & _03).

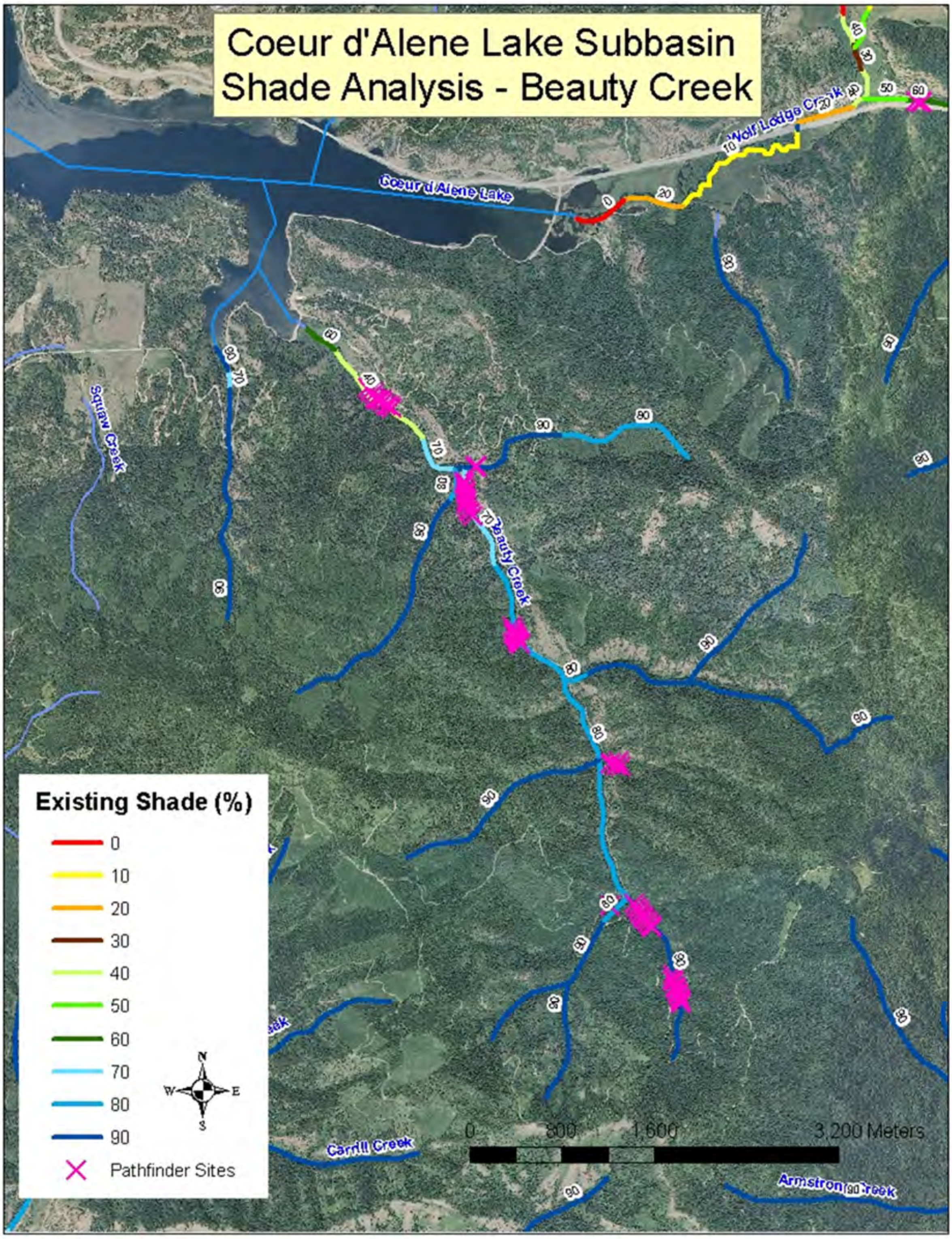

Figure F-17. Existing shade estimated for Beauty Creek (ID17010303PN028_02 & _03).

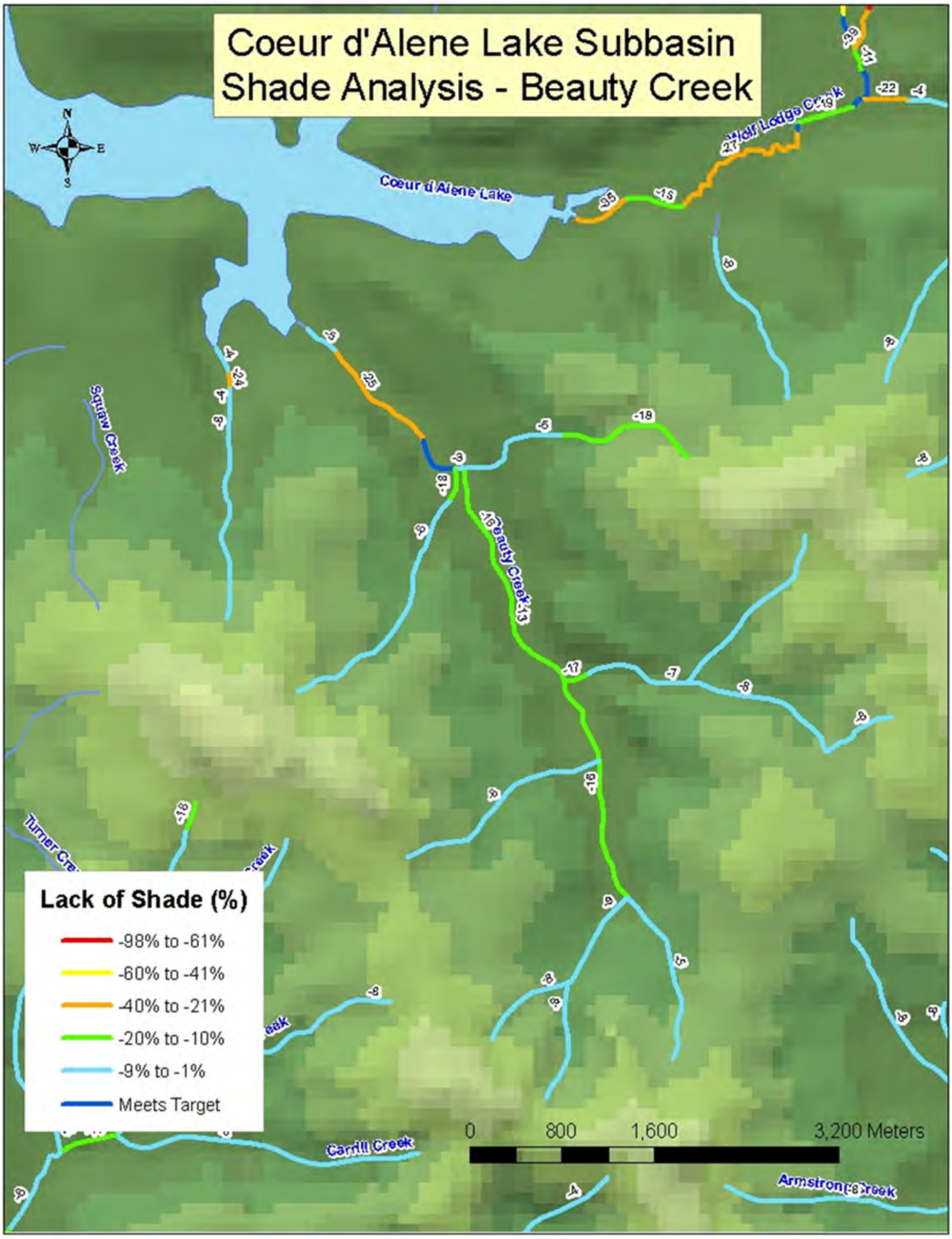

Figure F-18. Lack of shade (difference between existing and target) for Beauty Creek (ID17010303PN028_02 & _03).

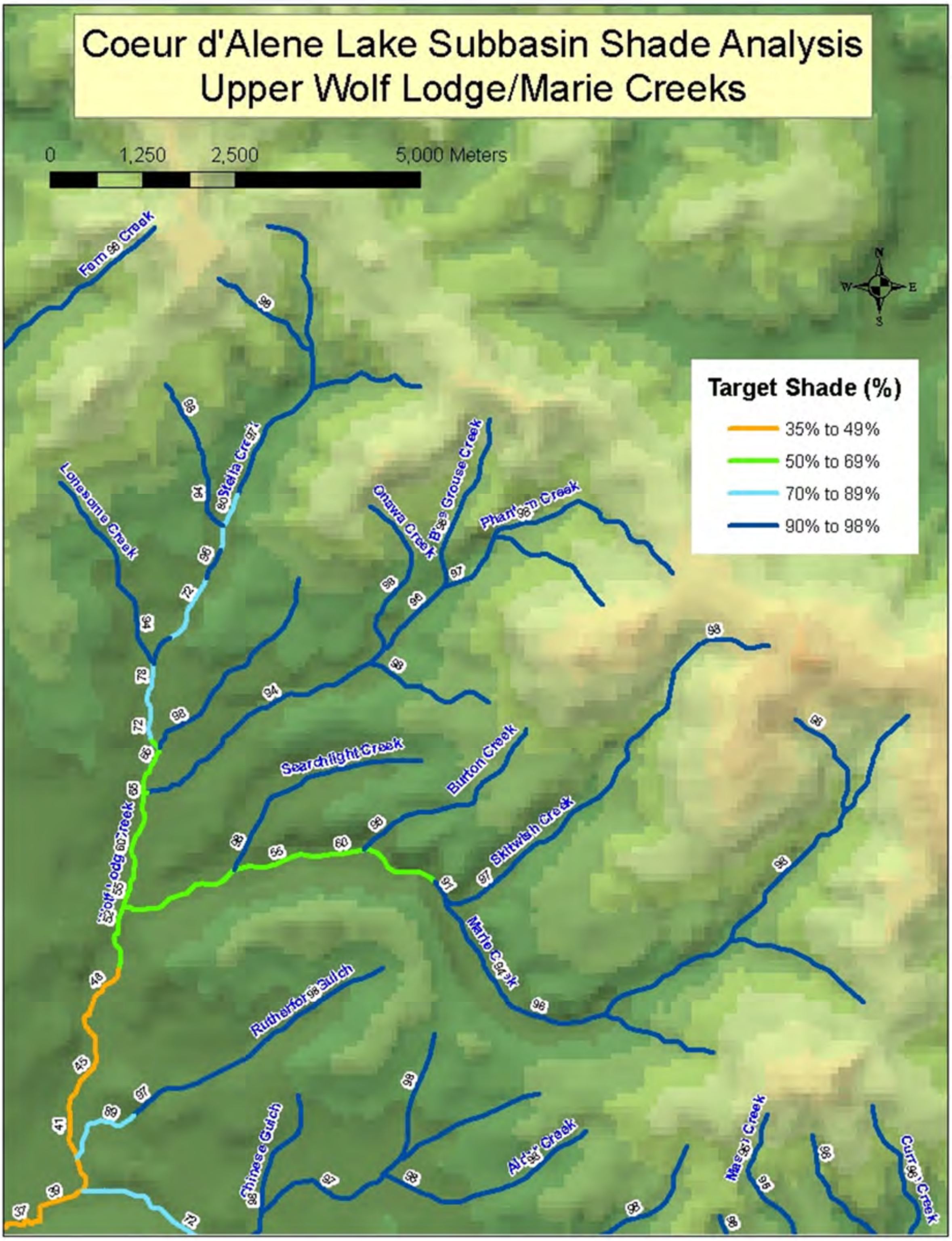

Figure F-19. Target shade for upper Wolf Lodge Creek (ID17010303PN029_02 & _03) and Marie Creek (ID17010303PN031_02).

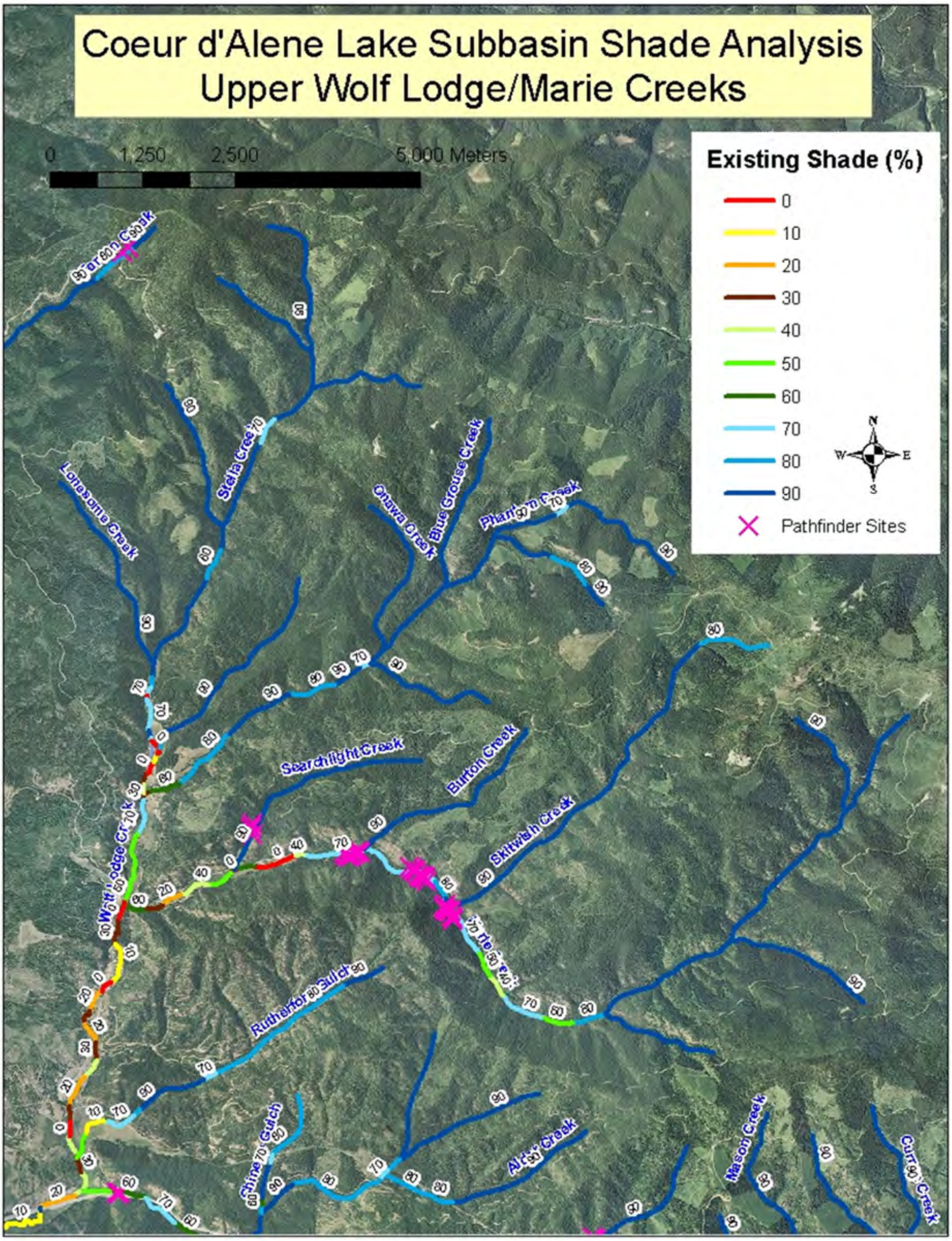

Figure F-20. Existing shade estimated for upper Wolf Lodge Creek (ID17010303PN029_02 & _03) and Marie Creek (ID17010303PN031_02).

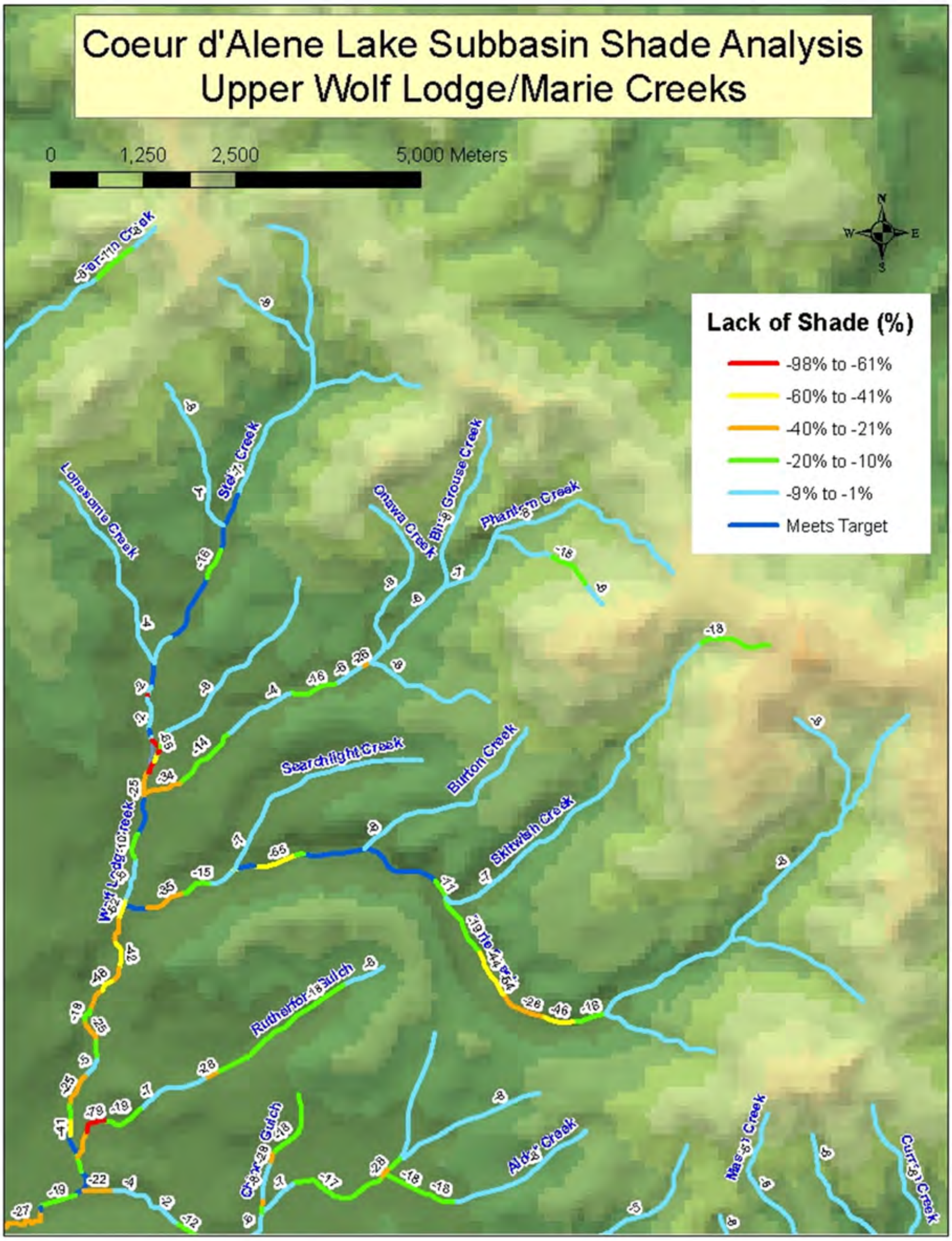

Figure F-21. Lack of shade (difference between existing and target) for upper Wolf Lodge Creek (ID17010303PN029_02 & _03) and Marie Creek (ID17010303PN031_02).

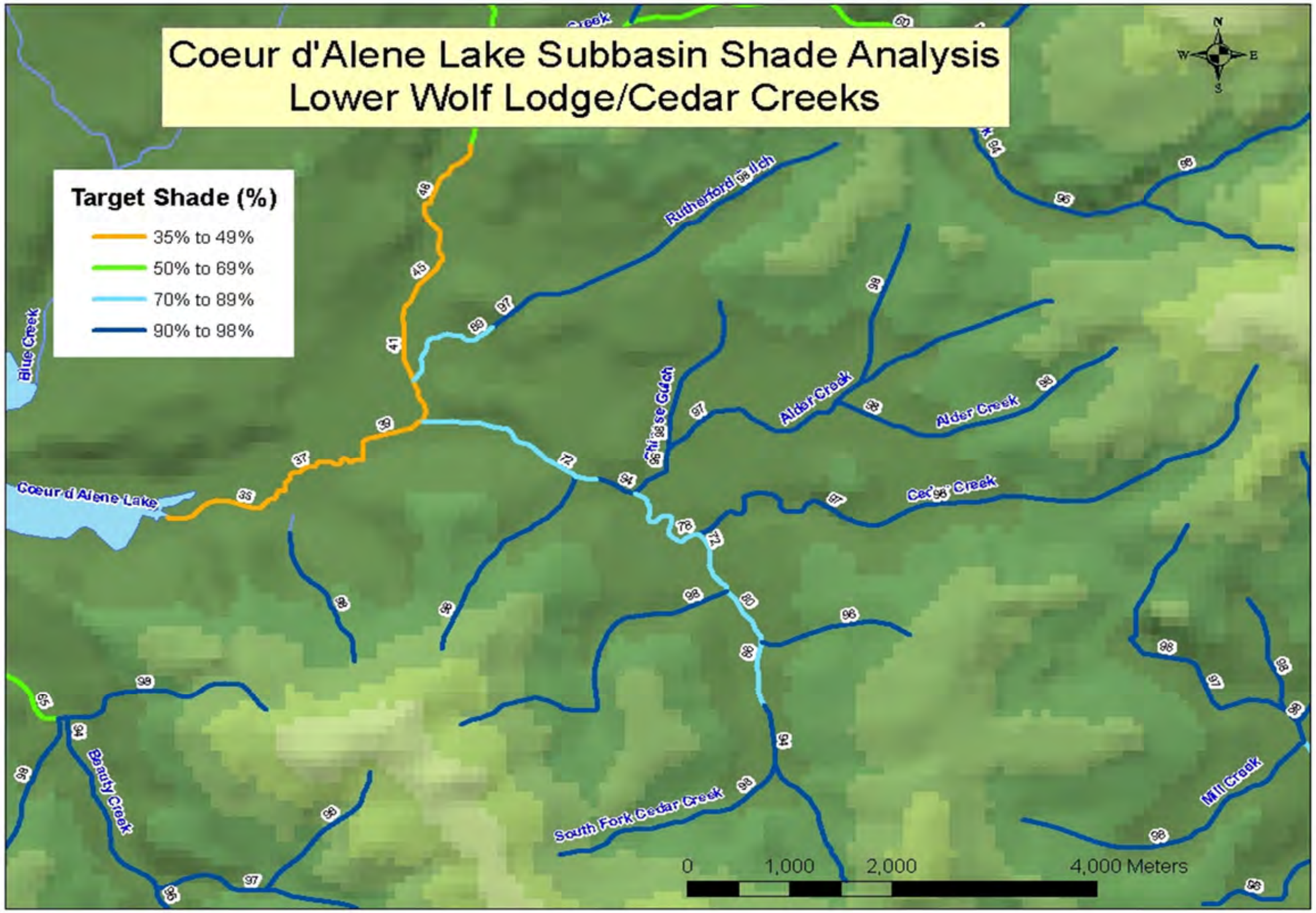

Figure F-22. Target shade for lower Wolf Lodge Creek (ID17010303PN029_03) and Cedar Creek (ID17010303PN030_02 & _03).

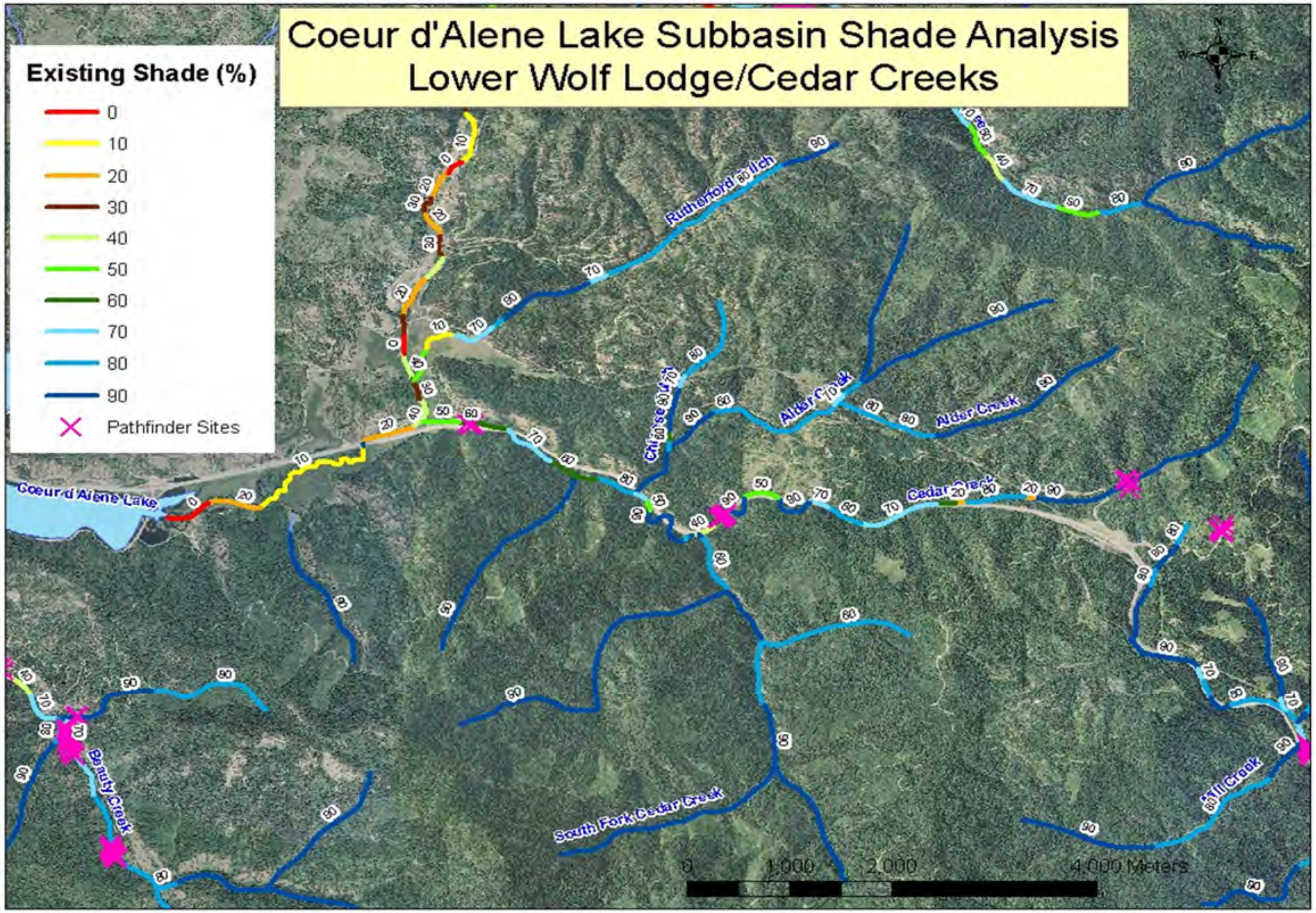

Figure F-23. Existing shade estimated for lower Wolf Lodge Creek (ID17010303PN029_03) and Cedar Creek (ID17010303PN030_02 & _03).

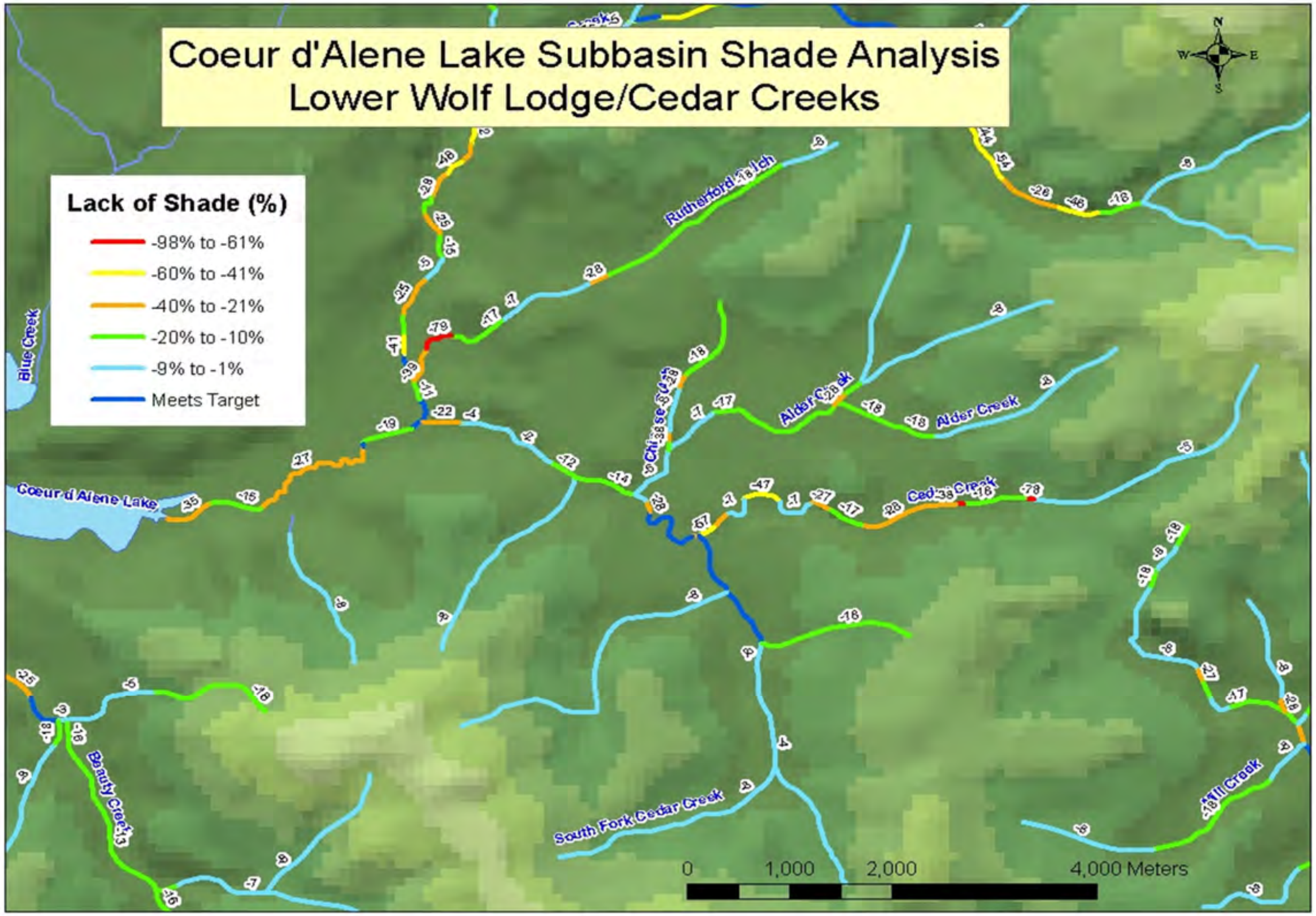

Figure F-24. Lack of shade (difference between existing and target) for lower Wolf Lodge Creek (ID17010303PN029_03) and Cedar Creek (ID17010303PN030_02 & _03).

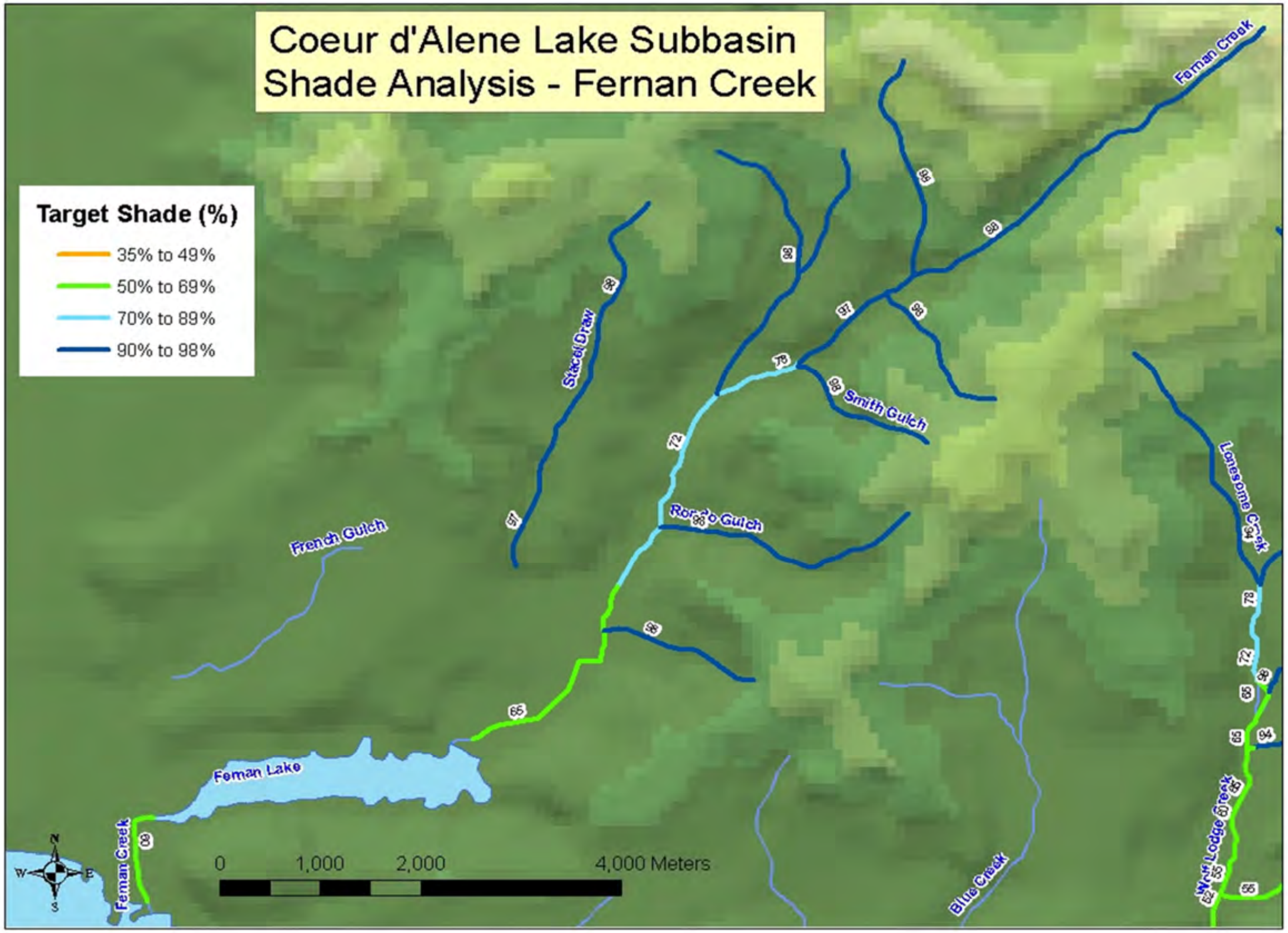

Figure F-25. Target shade for Fernan Creek (ID17010303PN034_02, _02a, & _03; ID17010303PN032_03).

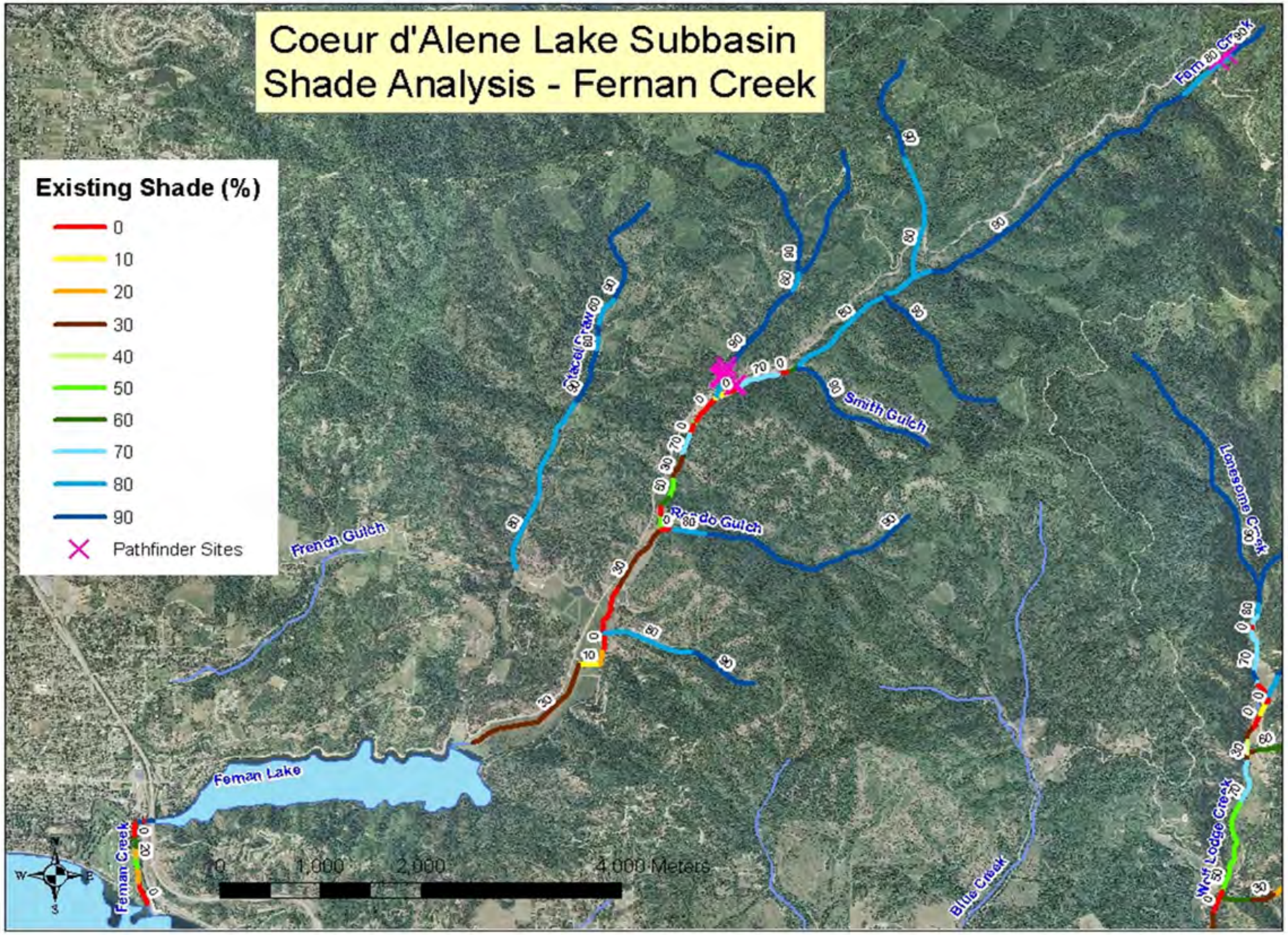

Figure F-26. Existing shade estimated for Fernan Creek (ID17010303PN034_02, _02a, & _03; ID17010303PN032_03).

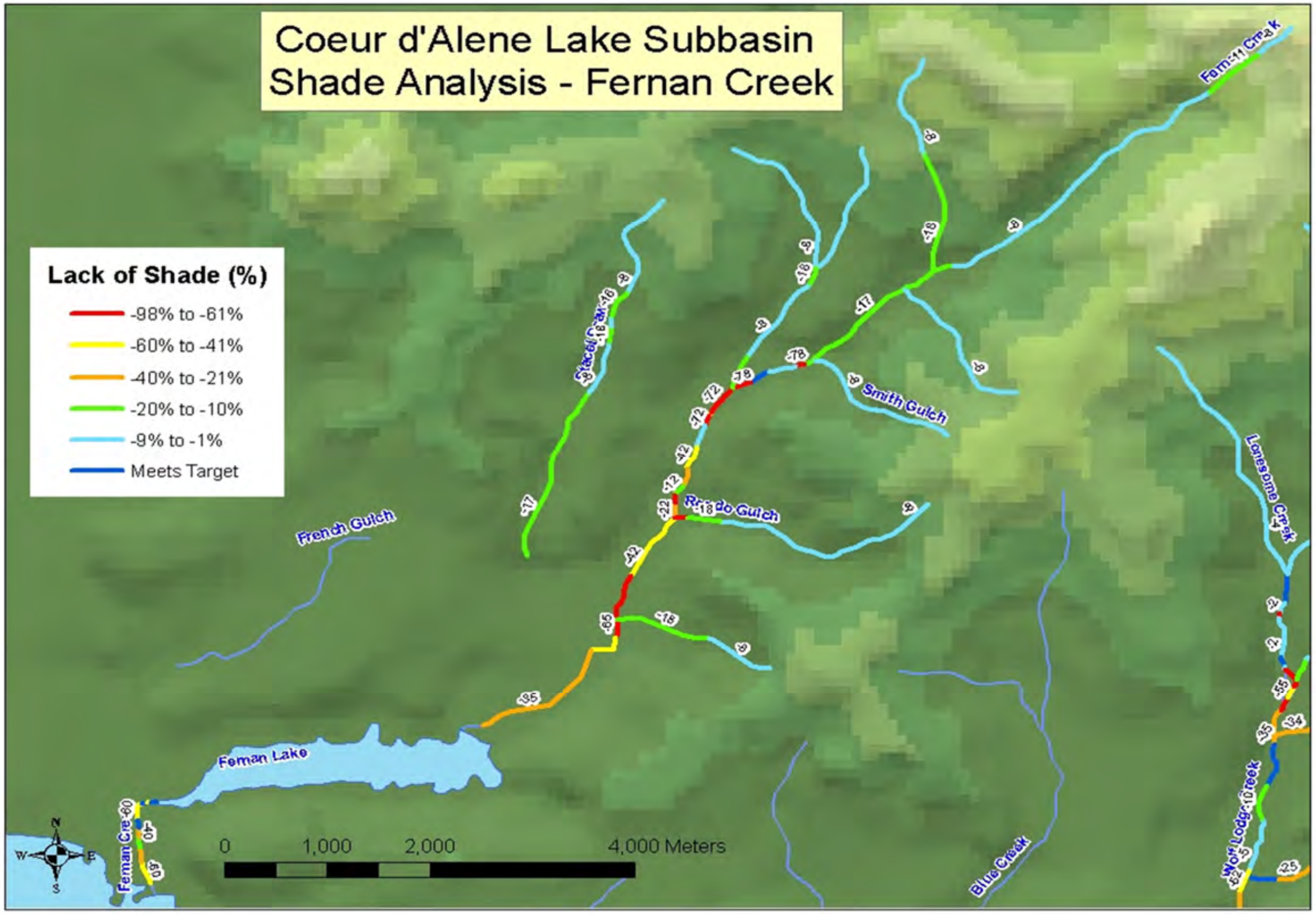

Figure F-27. Lack of shade (difference between existing and target) for Fernan Creek (ID17010303PN034_02, _02a, & _03; ID17010303PN032_03).

Appendix G. Distribution List

Aaron Prussian, US Forest Service
Ashley McFarland, University of Idaho
Miles Benker, Idaho Fish and Game
Bob Clark, North Idaho Flycasters
Bob Flagor, Kootenai-Shoshone Soil and Water Conservation District
Brett Bowers, Coeur d’Alene Lake Homeowners Association
David Fortier, Kootenai-Shoshone Soil and Water Conservation District
David Gabrielsen, Forest Capital
Diane Partridge, Idaho Department of Lands
Gordon and Mary Sanders
John Barlow, Hagadone
John Pickard
Katherine Prussian, US Forest Service
Larry Mundt
Laurya Laumatia, Coeur d’Alene Tribe
Mark Hoagan, Idaho Soil and Water Conservation District
Mike Stevenson, US Bureau of Land Management
Rusty Shephard
Sandy Schlepp
Scott Fields, Coeur d’Alene Tribe
Terry Harris
Vince Rinaldi
Bill Rust

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Appendix H. Public Comments

Comment 1:

Mica Creek page 104:
Part of the lower reaches of Mica Creek are shown in red and is listed as 0 percent shade. The section shown is on property that is aligned on an East-West line with a large hill immediately South. This hill is heavily forested and the stream bank alder is recovering. The hill and the existing forest casts a nearly permanent shade over the section listed.

Response 1:
In response to your comment, DEQ conducted solar pathfinder along the reaches on Mica Creek of concern. Indeed, the amount of shade on those reaches was much more than that originally described in the TMDL document. Maps and text in the TMDL have been adjusted accordingly.

Comment 2:
The data gathered to verify the temperatures in the CDA Lake tributaries is very extensive and as far as I can determine, very conclusive. My opinion is the streams shown in these studies that are too warm should be targeted for mitigation: structure, vegetation planting along banks, etc. The time to start to implementation is now that the study is done and the conclusion is clear. I also feel that there should be a bundling of state, federal, and industrial agencies to correct the problem that over-harvesting timber, mining and over population has created.

Response 2:
As explained on page 27 and 28 of the TMDL document, TMDLs will be implemented through the continuation of ongoing pollution control activities in the subbasin. The designated WAG, designated management agencies (DMAs), local organizations, and other appropriate public process participants will work together to get on-the-ground projects going to reduce temperature loading to the creeks.

Comment 3:
The flow of the stretch of Fernan Creek, from Lake CDA to Fernan Lake is dependent upon the lake elevations of Lake CDA. During the warm months, there is virtually no flow, and thus any amount of augmented shade would have little to no impact on water temperature. The City of Fernan also dams the flow to prevent any loss of lake elevation.

This stretch of Fernan Creek is unique and has been said to be listed in The Guinness Book of Records as the longest stream in the world that flows both directions. During sudden spring runoffs, Lake CDA rises faster than Fernan and the flow reverses. This of course, is due to the very low gradient of that stretch.

Response 3:
Your comments are noted, and the unique conditions on Fernan Creek below Fernan Lake are described on page 28 in the Implementation Section of this document. Meeting shade targets on this reach of Fernan Creek is not realistic.

Comment 4:
Page 25, please describe in a little more detail the statement, ...there are no known NPDES-permitted point sources..... Are there some known 'unpermitted point sources', such as was the case at Black Lake. Are there any known or anticipated stormwater sources that should have permits?

Response 4:

The City of Harrison's wastewater treatment plant is the only National Pollutant Discharge Elimination System (NPDES)-permitted point source in the affected watersheds. However, it discharges directly into a wetland with no hydrologic connection to the Coeur d'Alene River (the Trail of the Coeur d'Alene's levee divides the wetland from the Coeur d'Alene River). The language on page 24 for wasteload allocations addresses this source.

There are no anticipated stormwater sources that would discharge into the streams addressed in this TMDL.

Comment 5:

Page 32, Table 8, Coeur d'Alene River segment. You have it listed as "No" TMDL Completed, and Recommended Changes... is to "Move to 4a". This not possible without a completed TMDL or a proposal as '4b' as a TMDL alternative. What is the plan to deal w/ this issue?

Response 5:

Backwater conditions in the Coeur d'Alene River, caused by operation of the Post Falls HED, result in an increase in temperature in the Coeur d'Alene River upstream from the mouth to Cataldo. Therefore, as is the case with other impounded waters in the country, the flow alteration and backwater conditions preclude the ability to fully mitigate temperature impairment caused by this condition. Reductions of excessive heat loading to the Coeur d'Alene River will be with progress toward PNV shade targets on tributaries to the river, and through implementation of water quality improvement plans developed under other conservation programs in the watershed (see implementation section on page 28). TMDLs were not developed for the Coeur d'Alene River (assessment units ID17010303PN016_06 and ID17010303PN007_06) because it is inappropriate to use PNV methodology on a river 50 meters wide or greater. Because it is not possible to move these segments to 4a without a TMDL, separate TMDLs for the Coeur d'Alene River using more appropriate methodology are required, and the AUs will remain in section 5 of Idaho's Integrated Report until the TMDLs are completed.

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