# Big Lost River Subbasin Temperature Total Maximum Daily Load

2016 Addendum and Five-Year Review

Hydrologic Unit Code 17040218

**Final**

**State of Idaho**
**Department of Environmental Quality**

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2016 Addendum and Five-Year Review

**June 2016**

**Prepared by**
**Technical Services, State Office**
**Department of Environmental Quality**
**1410 N. Hilton**
**Boise, ID 83706**

## Acknowledgments

Cover photo taken by Mark Shumar (Idaho Department of Environmental Quality) of the North Fork Big Lost River on September 10, 2015.

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# Abbreviations, Acronyms, and Symbols

| | |
|---|---|
| **§303(d)** | Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section |
| **AG Plan** | Idaho Agricultural Pollution Abatement Plan |
| **AU** | assessment unit |
| **BAG** | basin advisory group |
| **BMP** | best management practice |
| **BURP** | Beneficial Use Reconnaissance Program |
| **C** | Celsius |
| **CFR** | Code of Federal Regulations |
| **CGP** | Construction General Permit |
| **CWA** | Clean Water Act |
| **DEQ** | Idaho Department of Environmental Quality |
| **EPA** | US Environmental Protection Agency |
| **GIS** | geographic information systems |
| **HUC** | hydrologic unit code |
| **IDAPA** | Refers to citations of Idaho administrative rules |
| **KWh** | kilowatt-hour |
| **LA** | load allocation |
| **LC** | load capacity |
| **m** | meter |
| **MOS** | margin of safety |
| **MS4** | Municipal Separate Storm Sewer System |
| **MSGP** | Multi-Sector General Permit |
| **NB** | natural background |
| **NPDES** | National Pollutant Discharge Elimination System |
| **NREL** | National Renewable Energy Laboratory |
| **PNV** | potential natural vegetation |
| **SWPPP** | Stormwater Pollution Prevention Plan |
| **TMDL** | total maximum daily load |
| **US** | United States |
| **USC** | United States Code |
| **WAG** | watershed advisory group |
| **WLA** | wasteload allocation |

# Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to CWA §303, 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. CWA §303(d) establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published every 2 years 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 17 assessment units (AUs) and associated water bodies in the Big Lost River subbasin that have been placed in Category 4a of Idaho's most recent federally approved Integrated Report, which require updating to the potential natural vegetation (PNV) temperature TMDL format as part of a 5-year review. This document addresses only the temperature TMDLs for these AUs. More information about these watersheds and the subbasin is available in the *Big Lost River Watershed Subbasin Assessment and TMDL* (DEQ 2004) and *Big Lost River Subbasin Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011).

This TMDL has been developed to comply with Idaho's TMDL requirements. A TMDL determines instream water quality targets, calculates load capacities, estimates existing pollutant sources, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards.

## Subbasin at a Glance

The Big Lost River subbasin (hydrologic unit code 17040218) is located in south-central Idaho centered above the town of Arco, Idaho (Figure A). For this subbasin, a large number of AUs are listed in two groups in Category 4a of the current Integrated Report for temperature pollution. The first group includes 11 AUs that received temperature TMDLs in the *Big Lost River Watershed Subbasin Assessment and TMDL* (DEQ 2004). These temperature TMDLs were produced using an older method of determining needed percent reductions without estimating a daily load. The second group includes 25 AUs that received temperature TMDLs using the updated PNV method in the *Big Lost River Subbasin Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011). The intent of the 2011 TMDL was to produce new temperature TMDLs for newly listed AUs, and it did not update the existing 2004 temperature TMDLs to PNV. This assessment updates those 2004 temperature TMDLs using PNV and includes daily loads.

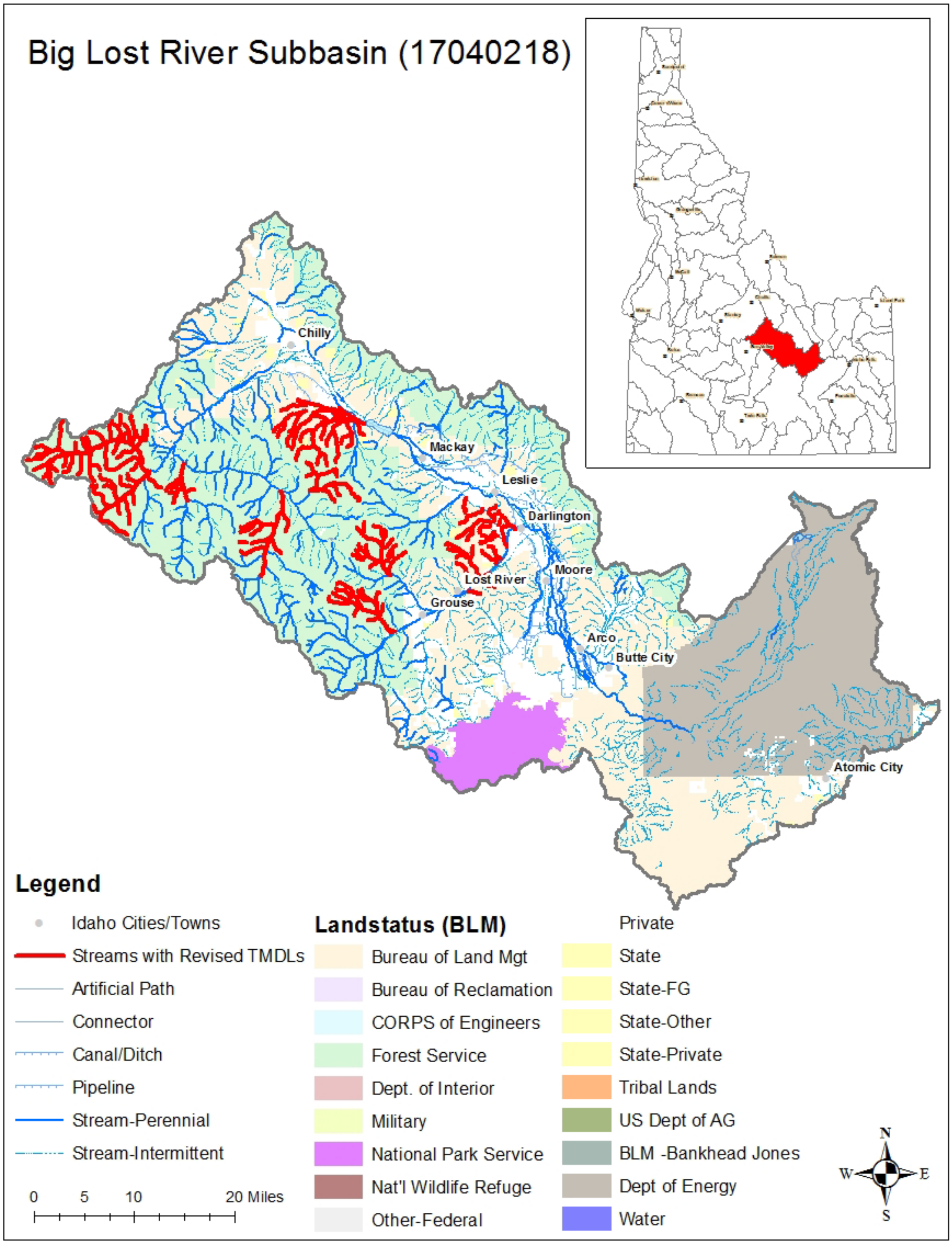


**Figure A. Subbasin at a glance.**

## Key Findings

Seventeen AUs were placed on the 1998 §303(d) list of impaired waters, or subsequent lists, for reasons associated with temperature criteria violations, and the Idaho Department of Environmental Quality developed temperature TMDLs for these waters in 2004 (DEQ 2004). This addendum updates 17 AUs with new temperature TMDLs, 11 AUs already listed in Category 4a with approved temperature TMDLs and 6 AUs newly found to be associated with the temperature issues on the original 11 AUs.

Effective target shade levels were established for 17 AUs (original TMDLs did not identify AUs but considered watersheds by name as impaired) based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation that was partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02). A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table A.

All AUs lack shade and have excess solar loads, except of the 3rd-order AU of Bear Creek, which did not show an excess load. Low-gradient, wide streams (Star Hope, Wildhorse, and Warm Springs Creeks) tended to have the highest excess loads. These systems are more accessible and were used more frequently for pasturing livestock and agricultural conversion. Percent reductions needed in solar loads to achieve target levels varied from 42% in Star Hope Creek to 0% in Bear Creek. Most AUs required reductions at 26% or less. Comparisons between 2004 and current reductions show slightly smaller percent reductions are needed in 2015.

Target shade levels for individual stream segments 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 A. Summary of assessment outcomes.**

| Water Body | Assessment Unit Number | Pollutant | TMDL Completed | Recommended Changes to Next Integrated Report | Justification |
|---|---|---|---|---|---|
| North Fork Big Lost River | ID17040218SK027_02<br>ID17040218SK027_03 | Temperature | Yes | Add 2nd-order AU to 3rd-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Summit Creek | ID17040218SK028_02<br>ID17040218SK028_03 | Temperature | Yes | Add 3rd-order AU to 2nd-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Wildhorse Creek | ID17040218SK030_02<br>ID17040218SK030_04 | Temperature | Yes | Add 2nd-order AU to 4th-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Star Hope Creek | ID17040218SK035_02<br>ID17040218SK035_04<br>ID17040218SK036_04 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Corral Creek | ID17040218SK041_02 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Warm Springs Creek | ID17040218SK043_02<br>ID17040218SK043_03 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Antelope Creek/Darlington Canal tributaries | ID17040218SK046_02 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Cherry Creek | ID17040218SK050_02<br>ID17040218SK050_04 | Temperature | Yes | In 2004 TMDL but was not added to Category 4; both AUs must be added | TMDL update |
| Bear Creek | ID17040218SK053_02<br>ID17040218SK053_03 | Temperature | Yes | Add 2nd-order AU to 3rd order AU already in Category 4a | Excess solar load from a lack of existing shade |

## Public Participation

Input from the watershed advisory group and the general public will be provided after the public comment period.

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# Introduction

This total maximum daily load (TMDL) and 5-year review addresses 9 water bodies and 17 assessment units (AUs) in the Big Lost River subbasin that have been placed in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2014). The subbasin assessment characterizes and documents pollutant loads within the Big Lost River subbasin. While not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

This subbasin assessment develops TMDLs for each pollutant of concern for the Big Lost River subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. A TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR 130). A TMDL is water body- and pollutant-specific and allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

For this subbasin, a large number of AUs are listed in two groups in Category 4a of the current Integrated Report for temperature pollution. The first group includes 11 AUs that received temperature TMDLs in the *Big Lost River Watershed Subbasin Assessment and TMDL* (DEQ 2004). These temperature TMDLs were produced using an older method of determining needed percent reductions without estimating a daily load. The second group includes 25 AUs that received temperature TMDLs using the updated potential natural vegetation (PNV) method in the *Big Lost River Subbasin Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011). The intent of the 2011 TMDL was to produce new temperature TMDLs for newly listed AUs, and it did not update those existing 2004 temperature TMDLs to PNV.

This document addresses 17 AUs in the Big Lost River subbasin placed in Category 4a of Idaho's most recent federally approved Integrated Report that require updating to the PNV temperature TMDL format as part of a 5-year review. This document only addresses the temperature TMDLs for these AUs. More information about these watersheds and the subbasin is available in the *Big Lost River Watershed Subbasin Assessment and TMDL* (DEQ 2004) and *Big Lost River Subbasin Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011).

## Regulatory Requirements

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

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

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

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

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

Idaho Code §39-3611(7) requires a 5-year cyclic review process for Idaho TMDLs:

> The director shall review and reevaluate each TMDL, supporting subbasin assessment, implementation plan(s) and all available data periodically at intervals of no greater than five (5) years. Such reviews shall include the assessments required by section 39-3607, Idaho Code, and an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL and subbasin assessment were based. If the members of the watershed advisory group, with the concurrence of the basin advisory group, advise the director that the water quality standards, the subbasin assessment, or the implementation plan(s) are not attainable or are inappropriate based upon supporting data, the director shall initiate the process or processes to determine whether to make recommended modifications. The director shall report to the legislature annually the results of such reviews.

To meet the intent and purpose of Idaho Code §39-3611(7), this document reviews the 2011 addendum and 5-year review (DEQ 2011) and addresses water bodies in the Big Lost River subbasin that are in Idaho’s most recent Category 4a of the Integrated Report (DEQ 2014). This report reviews the approved TMDL and implementation plan, considers the most current and applicable information in conformance with Idaho Code §39-3607, evaluates the appropriateness of the TMDL to current watershed conditions, evaluates the implementation plan, and consults with the watershed advisory group (WAG). An evaluation of the recommendations presented is provided. Final decisions for TMDL modifications are decided by the DEQ director. Approval of TMDL modifications is decided by EPA, with consultation by DEQ.

# 1 Subbasin Assessment—Subbasin Characterization

The Big Lost River subbasin (hydrologic unit code 17040218) is located in south-central Idaho centered north of the town of Arco, Idaho. The subbasin lies on the northern edge of the Snake River Plain and has a complex geology based on volcanism and range uplift. Most of this subbasin lies within Custer County, with about 25% in Butte County and a small portion in Jefferson County. The landownership, population, and economic status of the area have remained largely unchanged since the 2011 assessment. Land status is shown in Figure 1.

Further discussion of the physical, biological, and cultural characteristics is provided in the *Big Lost River Subbasin Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011).

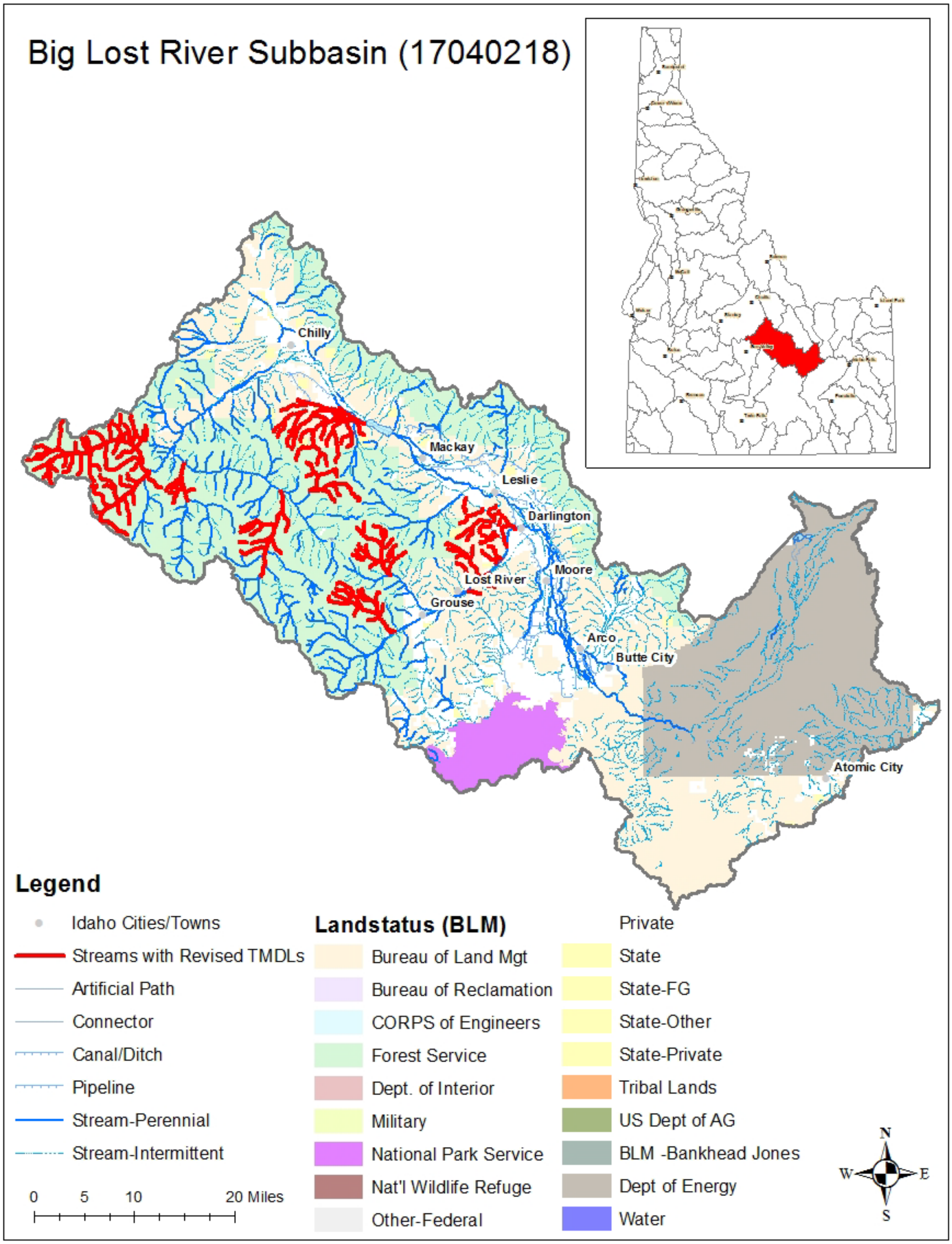


**Figure 1. Big Lost River subbasin.**

# 2 Subbasin Assessment—Water Quality Concerns and Status

## 2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

### 2.1.1 Assessment Units

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

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

### 2.1.2 Listed Waters

Waters listed under Category 4a of the Integrated Report for temperature TMDLs completed in 2004 that are being updated are identified below:

- North Fork Big Lost River: ID17040218SK027_02 and ID17040218SK027_03
- Summit Creek: ID17040218SK028_02 and ID17040218SK028_03
- Wildhorse Creek: ID17040218SK030_02 and ID17040218SK030_04
- Star Hope Creek: ID17040218SK035_02, ID17040218SK035_04, and ID17040218SK036_04
- Corral Creek: ID17040218SK041_02
- Warm Springs Creek: ID17040218SK043_02 and ID17040218SK043_03
- Antelope Creek/Darlington Canal tributaries: ID17040218SK046_02
- Cherry Creek: ID17040218SK050_02 and ID17040218SK050_04
- Bear Creek: ID17040218SK053_02 and ID17040218SK053_03

## 2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

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

### 2.2.1 Existing Uses

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

### 2.2.2 Designated Uses

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

### 2.2.3 Undesignated Surface Waters

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated waters ultimately need to be designated for appropriate uses. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the numeric cold water criteria and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for existing uses. However, if for example, cold water aquatic life is not found to be an existing use, a use designation (rulemaking) to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

### 2.2.4 Beneficial Uses in the Subbasin

Refer to section 2.2 of the 2004 TMDL for the subbasin's beneficial uses (DEQ 2004).

### 2.2.5 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 1). For more about temperature criteria and natural background provisions relevant to the PNV approach, see Appendix A.

**Table 1. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.**

| Parameter | Primary Contact Recreation | Secondary Contact Recreation | Cold Water Aquatic Life | Salmonid Spawning[a] |
|---|---|---|---|---|
| ***Water Quality Standards: IDAPA 58.01.02.250–251*** | | | | |
| **Temperature**[b] | — | — | 22 °C or less daily maximum; 19 °C or less daily average<br>**Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average | 13 °C or less daily maximum; 9 °C or less daily average<br>**Bull Trout**: Not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June–August; not to exceed 9 °C daily average in September and October |
| ***EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131*** | | | | |
| **Temperature** | — | — | — | 7-day moving average of 10 °C or less maximum daily temperature for June–September |

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

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 2).

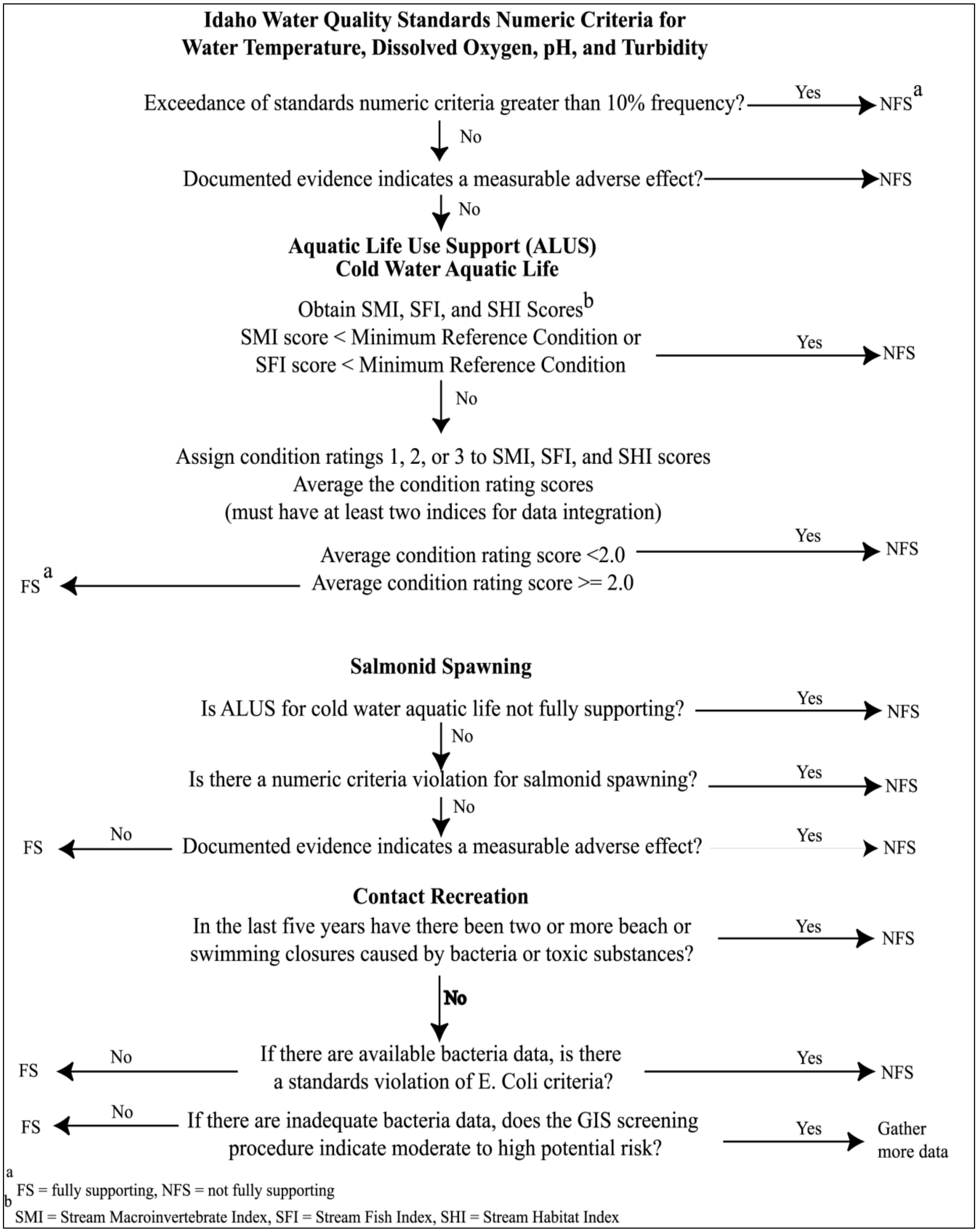


**Figure 2. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).**

## 2.3 Summary and Analysis of Existing Water Quality Data

No new data have been collected for these streams since the *Big Lost River Total Maximum Daily Load Addendum and Five Year Review* (DEQ 2011) other than that data necessary for conversion to PNV-style temperature TMDLs (i.e., shade, channel width, and plant communities). Data sources are provided in Appendix B.

# 3 Subbasin Assessment—Pollutant Source Inventory

Pollution within the Big Lost River subbasin is primarily from excess sediment, bacteria, and temperature. Load allocations and wasteload allocations were established in the *Big Lost River Subbasin Assessment and TMDL* approved by EPA in 2004 (DEQ 2004) and *Total Maximum Daily Load Addendum and Five Year Review* approved by EPA in 2011 (DEQ 2011).

The primary source of excess sediment, bacteria, and temperature in the Big Lost River subbasin is streambank erosion and vegetation loss from livestock grazing. The more bare and unstable streambanks become, the higher the volume of direct sediment delivery to the stream. Excess sediment in the substrate of a stream decreases natural hydrologic functioning and restricts habitat for aquatic wildlife. Unstable, eroding streambanks become denuded of vegetation. Higher vegetative cover holds streambanks together with root masses, but as streambanks erode and vegetative cover is lost, erosion is accelerated. Loss of vegetative cover increases solar radiation to the water surface. Without vegetative shading on the streambanks, the temperature of the stream increases and aquatic wildlife must seek out cooler refuges upstream or in alternate locations, which decreases available habitat. In areas with regular grazing, eroding streambanks can also deliver an excess bacteria load from domestic cattle.

## 3.1 Point Sources

Point sources of pollution are affiliated with known discrete discharges and are regulated through the National Pollution Discharge Elimination System (NPDES). Two point source sites exist in the TMDL waters addressed: the Idaho Department of Fish and Game's Mackay Fish Hatchery located at the source of Whiskey Creek, a tributary to Warm Springs Creek, and the Clear Springs Foods, Inc. Lost River Hatchery at the source of Warm Springs Creek, at Hamilton Springs. The two hatcheries received wasteload allocations for temperature in the 2004 TMDL (DEQ 2004) and those allocations are revised in this addendum and 5-year review.

## 3.2 Nonpoint Sources

Temperature load allocations in the 2004 TMDL were based on the percent reduction of the highest observed temperature exceedance for the spring or fall spawning period, whichever was greater, to attain water quality standards. Nonpoint source load allocations are modified to daily solar loads in this addendum and 5-year review.

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

Section 4 of the 2011 TMDL addendum and 5-year review lists recent water quality improvement projects throughout the subbasin (DEQ 2011).

# 5 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 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.

Load capacity can be summarized by the following equation:

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

where:

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

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

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

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 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 load 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 is the case in this temperature TMDL. For certain pollutants whose effects are long term, such as temperature, EPA allows for seasonal or annual loads.

## 5.1 Instream Water Quality Targets

For the 17 AUs temperature TMDLs, we used a PNV approach. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLs, the natural level of shade and channel width become the TMDL target. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria. See Appendix A for further discussion of water quality standards and natural background provisions.

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

### 5.1.1 Factors Controlling Water Temperature in Streams

Several important factors contribute heat to a stream, including ground water temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the source of heat that is most controllable. The parameters that affect the amount of solar radiation hitting a stream throughout its length are shade and stream morphology. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Stream morphology (i.e., structure) affects riparian vegetation density and water storage in the alluvial aquifer. Riparian vegetation and channel morphology are the factors influencing shade that are most likely to have been influenced by anthropogenic activities and can be most readily corrected and addressed by a TMDL.

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

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

### 5.1.2 Potential Natural Vegetation for Temperature TMDLs

PNV along a stream is the riparian plant community that could grow to an overall mature state, although some level of natural disturbance is usually included in the development and use of shade targets. Vegetation can be removed by disturbance either naturally (e.g., wildfire, disease/old age, wind damage, and wildlife grazing) or anthropogenically (e.g., domestic livestock grazing, vegetation removal, and erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar load to the stream without any anthropogenic removal of shade-producing vegetation. Vegetation levels less than PNV (with the exception of natural levels of disturbance and age distribution) result in the stream heating up from anthropogenically created additional solar inputs.

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

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

PNV shade and the associated solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (as long as no point sources or other anthropogenic sources of heat exist in the watershed) and are considered to be consistent with the Idaho water quality standards, even if they exceed numeric criteria by more than 0.3 °C.

#### *5.1.2.1 Existing Shade Estimates*

Existing shade was estimated for the 17 AUs from visual interpretation of aerial photos. Estimates of existing shade based on plant type and density were marked out as stream segments on a 1:100,000 or 1:250,000 hydrography taking into account natural breaks in vegetation density. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. Each segment was assigned a single value representing the bottom of a 10% shade class (adapted from the cumulative watershed effects process, IDL 2000). For example, if shade for a particular stream segment was estimated somewhere between 50% and 59%, we assigned a 50% shade class to that segment. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and stream width. Streams where the banks and water are clearly visible are usually in low shade classes (10%, 20%, or 30%). Streams with dense forest or heavy brush where no portion of the stream is visible are usually in high shade classes (70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (40%, 50%, or 60%).

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

### Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at 19 sites. The Solar Pathfinder is a device that allows tracing the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a stream segment, ten traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Ten traces were taken following the manufacturer's instructions (i.e., orient to south and level). Systematic sampling was used because it is easiest to accomplish without biasing the sampling location. For each sampled segment, the sampler started at a unique location, such as 50 to 100 meters (m) from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 50 m, 50 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances.

When possible, the sampler also measured bankfull widths, recorded notes, and photographed the landscape of the stream at several unique locations while taking traces. Special attention was given to changes in riparian plant communities and the kinds of plant species (the large, dominant, shade-producing ones) were present. Densiometer readings can also be taken at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream.

In general, the original aerial photo interpretation tended to overestimate shade on streams. The average difference between original interpretation class and field verified class was 5% ± 6.12 [average ± 95% C.I.] (Table 2). Nine of the 19 sites showed overestimation, whereas four of the 19 sites showed underestimated shade. Site 1 on the North Fork Big Lost River was split in half because the field site crossed a boundary between two shade classes. Half the site had overestimated shade and half was accurately interpreted. Overall, seven locations were accurately classified for existing shade. These data were used to correct the shade class at the specific field site locations and to "calibrate the eyes" for a second round of aerial photo interpretation to reduce error.

**Table 2. Solar Pathfinder field verification results for the Big Lost River subbasin.**

| aerial class | pathfinder actual | pathfinder class | delta | | Site Name |
|---|---|---|---|---|---|
| 50 | 55.7 | 50 | 0 | | Cherry |
| 40 | 37.5 | 30 | 10 | | Bear 1 |
| 50 | 72.5 | 70 | -20 | | Bear 2 |
| 60 | 75.6 | 70 | -10 | | Bear 3 |
| 30 | 22.2 | 20 | 10 | | Corral 1 |
| 50 | 61.7 | 60 | -10 | | Corral 2 |
| 70 | 75.9 | 70 | 0 | | Coyote 1 |
| 30 | 42.2 | 40 | -10 | | Coyote 2 |
| 80 | 59.1 | 50 | 30 | | Bellas 1 |
| 80 | 76.1 | 70 | 10 | | Bellas 2 |
| 0 | 1.3 | 0 | 0 | | Star Hope |
| 80 | 43.3 | 40 | 40 | | Miller |
| 20 | 20.5 | 20 | 0 | | NF 1a |
| 10 | 6.8 | 0 | 10 | | NF 1b |
| 20 | 13.1 | 10 | 10 | | NF 2 |
| 0 | 4.3 | 0 | 0 | | NF 3 |
| 0 | 5.5 | 0 | 0 | | NF 4 |
| 30 | 19.9 | 10 | 20 | | Summitt1 |
| 20 | 20.1 | 20 | 0 | | Summitt2 |
| 30 | 29.6 | 20 | 10 | | Summitt3 |
| | | | 5 | average | |
| | | | 13.95 | std dev | |
| | | | 6.12 | 95%CI | |

### *5.1.2.2 Target Shade Determination*

PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in Idaho (Shumar and De Varona 2009). A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, shade decreases as vegetation has less ability to shade the center of wide streams. As the vegetation gets taller, the more shade the plant community is able to provide at any given channel width.

#### Natural Bankfull Widths

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

Since, existing bankfull width may not be discernible from aerial photo interpretation and may not reflect natural bankfull widths, this parameter must be estimated from available information. We used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bankfull width (Figure 3).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Upper Snake basin curve from Figure 3. Although estimates from other curves were examined (i.e., Salmon basin, Payette/Weiser basin), the Upper Snake curve was ultimately chosen because of its proximity to the Big Lost River watershed and similarity in climate and geology. Existing width data should also be evaluated and compared to these curve estimates if such data are available. However, for the Big Lost River watershed, only a few Beneficial Use Reconnaissance Program (BURP) sites exist, and bankfull width data from those sites represent only spot data (e.g., only three measured widths in a reach just several hundred meters long) that are not always representative of the stream as a whole.

In general, we found BURP bankfull width data to be reasonably similar to natural bankfull width estimates from the Upper Snake basin curve and chose not to make natural widths any smaller than these Upper Snake basin estimates. In some instances (Star Hope and Wildhorse Creeks), current widths were substantially larger than basin estimates. Some of the differences in width are due to the amount of beaver dam activity on those streams. Natural bankfull width estimates for each stream in this analysis are presented in Appendix C, Table C-1. The load analysis tables in Appendix C contain a natural bankfull width and an existing bankfull width for every stream segment in the analysis based on the bankfull width results presented in Table C-1. Existing widths and natural widths are the same in load tables when there are no data to support making them differ.

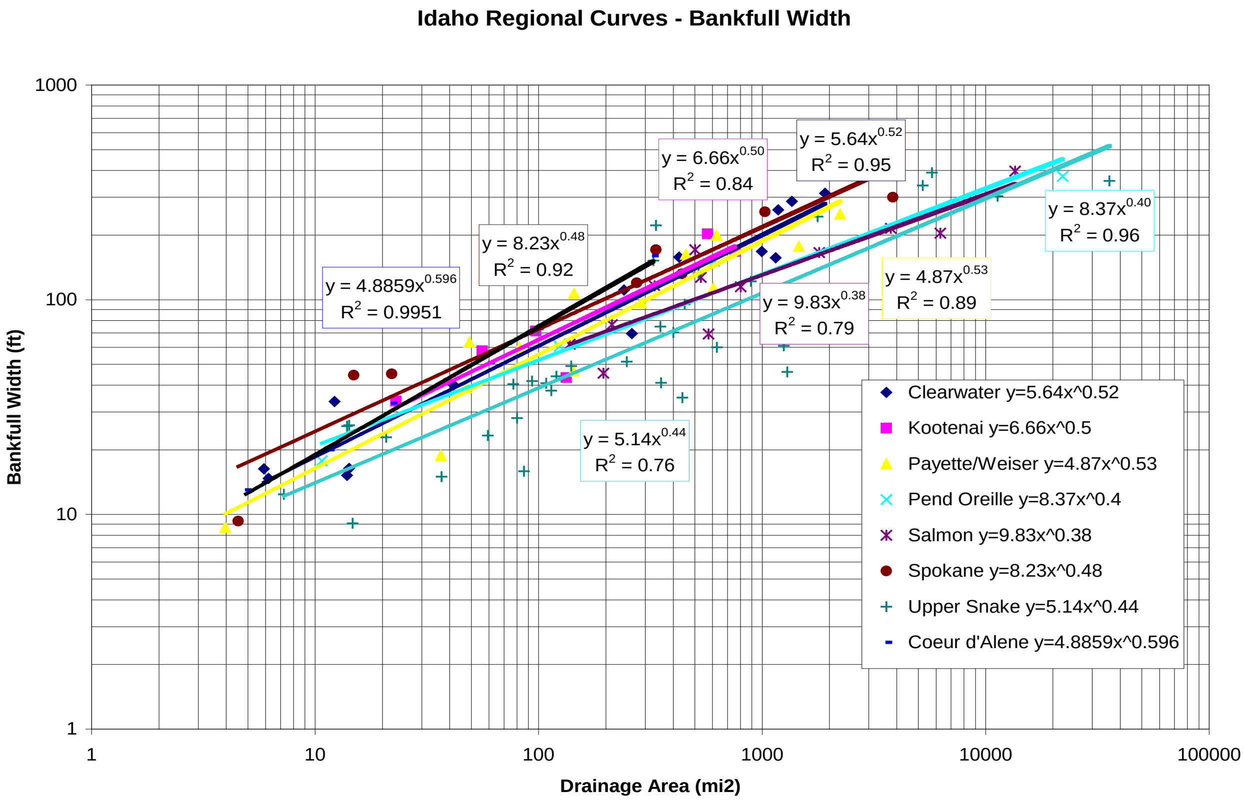


**Figure 3. Bankfull width as a function of drainage area.**

## Design Conditions

The Big Lost River subbasin is located mostly within the Middle Rockies Level 3 Ecoregion, with the North Fork and portions of the East Fork extending into the Idaho Batholith Level 3 Ecoregion (McGrath et al. 2001). The majority of the Big Lost River below Bartlett Point, is in the Dry Intermontane Sagebrush Valleys Level 4 Ecoregion known for low precipitation due to high mountain rain-shadow and deep valley fill, both resulting in little surface drainage of water. Most of the East Fork Big Lost River, Antelope Creek, and Warm Springs Creek are in the Dry Gneissic-Schistose-Volcanic Hills Level 4 Ecoregion underlain by Quaternary and Tertiary volcanic rock. This area is slightly wetter than the Dry Intermontane region below it. Headwaters of Corral Creek and Bear Creek are likely in the Barren Hills Level 4 Ecoregion with open Douglas fir-lodgepole-subalpine fir forests and aspen groves in narrow elevation bands predominantly on north-facing slopes. Wildhorse Creek, Summit Creek, and North Fork Big Lost River, as well as a portion of the East Fork near the North Fork confluence are in the Dry Partly Wooded Mountains Level 4 Ecoregion of the Idaho Batholith Level 3 Ecoregion. This area is known for its mosaic of shrubland, open Douglas fir, and aspen forests.

Determining appropriate PNV for riparian areas along streams is often difficult given past histories and changing environments. For forested areas in upper portions of each watershed we relied upon potential vegetation descriptions provided by the Salmon-Challis National Forest. These headwater areas are primarily in dry Douglas fir without ponderosa pine and occasionally aspen groves, subalpine fir, and Douglas fir/lodgepole pine in gentle or steep terrain. For shrub-dominated riparian, we used an elevational zone concept with respect to dominant willow communities. Those willow communities above 7,000-feet elevation were placed into the Drummond willow community type. Between 7,000 feet and 5,000 feet we used a Geyer willow community type. In lower Warm Springs Creek, we used the yellow willow community type. There were exceptions to this general pattern where it seemed appropriate, including specific reaches where willows of lower stature were put into a lemon willow community type, or areas of darker nonwillow vegetation that we chose to call alder. In the drier regions of the various watersheds, the dominant vegetation type near the stream channel was sagebrush/grass. These areas tended to have ephemeral or intermittent streams, but as long as a channel was present, they were included in the analysis. In many of the alpine headwater locations, especially above treeline, the alpine meadow or "grass" community type was selected.

### Shade Curve Selection

To determine PNV shade targets for the Big Lost subbasin, effective shade curves from Salmon-Challis National Forest types and southern Idaho nonforest types were examined (Table 3) (Shumar and De Varona 2009). These curves were produced using vegetation community modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Big Lost River subbasin, curves for the most similar vegetation type were selected for shade target determinations. In general, most tributary streams at high elevations start as grass meadow and/or rock/bare areas, then progress into various forest types first as subalpine fir types then as drier Douglas fir types. These streams will continue downstream into various shrub or aspen types depending on elevation and site characteristics. Streams in drier regions can start out in sagebrush/grass or grass meadow, move into shrub or aspen, and then back into sagebrush/grass before becoming completely ephemeral and disappearing into alluvium.

**Table 3. Shade curves for target selection for the various vegetation types in the analysis.**

| Salmon-Challis National Forest Types | Southern Idaho Nonforest Types |
|---|---|
| Subalpine fir/moist | Mountain alder |
| Subalpine fir/dry-steep | Geyer willow/sedge |
| Subalpine fir/dry-gentle | Lemon willow |
| Subalpine fir/whitebark pine | Drummond willow/sedge |
| Subalpine fir/Douglas fir | Yellow willow |
| Douglas Fir/lodgepole-steep | Aspen |
| Douglas fir/lodgepole-gentle | Sagebrush/grass |
| Dry Douglas fir without Ponderosa pine | Graminoid (grass) |
| Whitebark pine | — |

## 5.2 Load Capacity

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

We obtained solar load data from flat-plate collectors at the NREL weather stations in Boise and Pocatello, Idaho. The solar load data used in this TMDL analysis are spring/summer averages (i.e., an average load for the 6-month period from April through September). As such, load capacity calculations are also based on this 6-month period, which coincides with the time of year when stream temperatures are increasing, deciduous vegetation is in leaf, and fall spawning is occurring. During this period, temperatures may affect beneficial uses such as spring and fall salmonid spawning and cold water aquatic life criteria may be exceeded during summer months. Late July and early August typically represent the period of highest stream temperatures. However, solar gains can begin early in the spring and affect not only the highest temperatures reached later in the summer but also salmonid spawning temperatures in spring and fall.

In Appendix C, Tables C-2 to C-18 and Figures C-2, C-5, C-8, C-11, C-14, and C-17 show the PNV shade targets. The tables also show corresponding target summer loads (in kilowatt-hours per square meter per day [kWh/m$^2$/day] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segments channel width, which typically only has one or two significant figures, dictates the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce apparent rounding errors.

The AU with the largest target load (i.e., load capacity) was the Warm Springs Creek complex (ID17040218SK043_02) with 1.1 million kWh/day (Table C-13). The smallest target load was in the Wildhorse Creek tributaries AU (ID17040218SK030_02) with 23,000 kWh/day (Table C-15).

## 5.3 Estimates of Existing Pollutant Loads

Regulations allow that loads "...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. Currently, two NPDES-permitted point sources are found in the affected AUs. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather stations. Existing shade data are presented in Tables C-2 to C-18 and Figures C-1, C-4, C-7, C-10, C-13, and C-16. Like load capacities (target loads), existing loads in Tables C-2 to C-18 are presented on an area basis (kWh/m$^2$/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. If the existing load exceeds the target load, the difference becomes the excess load (i.e., shade deficit), which is discussed in section 5.4 and depicted in the shade deficit figures (Tables C-3, C-6, C-9, C-12, C-15, and C-18).

The AU with the largest existing load was the Warm Springs Creek complex (ID17040218SK043_02) with 1.4 million kWh/day (Table C-13). The smallest existing load was in the Wildhorse Creek tributaries AU (ID17040218SK030_02) with 28,000 kWh/day (Table C-15).

## 5.4 Load and Wasteload Allocation

Because this TMDL is based on PNV, which is equivalent to background load, the load allocation is essentially the desire to achieve 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. Therefore, load allocations are stream segment specific and depend upon the target load for a given segment. In Appendix C, Tables C-2 to C-18 show the target shade and corresponding target summer load. This target load (i.e., load capacity) is necessary to achieve background conditions. No opportunity exists to further remove shade from the stream by any activity without exceeding its load capacity. Additionally, because this TMDL depends upon background conditions for achieving water quality standards, all tributaries to the waters examined must be in natural conditions to prevent excess heat loads to the system.

Table 4 shows the total existing, target, and excess loads and the average shade deficit for each water body examined. The size of a stream influences the size of the excess load. Large streams (3rd and 4th order) have higher existing and target loads by virtue of their larger channel widths. Table 4 lists the tributaries in order of their excess loads, from highest to lowest. Therefore, large tributaries tend to be listed first and small (2nd order) tributaries last.

Although this TMDL analysis focuses on total solar loads, it is important to note that differences between existing and target shade, as depicted in the shade deficit figures (Figures C-3, C-6, C-9, C-12, C-15, and C-18), are the key to successfully restoring these waters to achieving water quality standards. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each load analysis table contains a column that lists the lack of shade on the stream segment. This value is derived from subtracting target shade from existing shade for each segment. Thus, stream segments with the largest lack of shade are in the worst shape. The average lack of shade derived from the last column in each load analysis table is also listed in Table 4 and provides a general level of comparison among streams.

**Table 4. Total solar loads and average lack of shade for all waters.**

| Water Body | Assessment Unit Number | Total Existing Load | Total Target Load | Excess Load (% Reduction) | Average Shade Deficit (%) |
|---|---|---|---|---|---|
| | | (kWh/day) | | | |
| Star Hope Creek | ID17040218SK035_04 | 1,200,000 | 690,000 | 500,000 (42) | -5 |
| Warm Springs Creek | ID17040218SK043_02 | 1,400,000 | 1,100,000 | 320,000 (23) | -13 |
| North Fork Big Lost River | ID17040218SK027_03 | 990,000 | 790,000 | 200,000 (20) | -17 |
| Wildhorse Creek | ID17040218SK030_04 | 560,000 | 380,000 | 180,000 (32) | -7 |
| Summit Creek and tributaries | ID17040218SK028_02 | 450,000 | 370,000 | 82,000 (18) | -11 |
| Star Hope Creek | ID17040218SK036_04 | 340,000 | 270,000 | 66,000 (19) | -4 |
| North Fork Big Lost River and tributaries | ID17040218SK027_02 | 370,000 | 320,000 | 48,000 (13) | -11 |
| Cherry Creek | ID17040218SK050_04 | 120,000 | 74,000 | 42,000 (35) | -10 |
| Cherry Creek | ID17040218SK050_02 | 140,000 | 98,000 | 37,000 (26) | -15 |
| Bear Creek tributaries | ID17040218SK053_02 | 160,000 | 130,000 | 32,000 (20) | -13 |
| Warm Springs Creek | ID17040218SK043_03 | 190,000 | 170,000 | 21,000 (11) | -11 |
| Corral Creek | ID17040218SK041_02 | 190,000 | 170,000 | 18,000 (9) | -11 |
| Star Hope Creek tributaries | ID17040218SK035_02 | 95,000 | 81,000 | 15,000 (16) | -9 |
| Antelope Creek and Darlington tributaries | ID17040218SK046_02 | 290,000 | 270,000 | 15,000 (5) | -9 |
| Summit Creek | ID17040218SK028_03 | 40,000 | 28,000 | 12,000 (30) | -16 |
| Wildhorse Creek tributaries | ID17040218SK030_02 | 28,000 | 23,000 | 4,400 (16) | -8 |
| Bear Creek | ID17040218SK053_03 | 130,000 | 130,000 | 0 (0) | -8 |

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

The lower 4th-order segment of Star Hope Creek (ID17040218SK035_04) had the largest excess load and the highest needed percent reduction (42%). This section of creek is dominated by the low statured lemon willow and tends to have low shade targets, hence shade deficits are not substantial (-5% on average). The stream appears to have been overwidened in that existing channel widths are much larger than are predicted by the regional hydrology curve. This phenomenon also occurs in the 4th-order section of Wildhorse Creek (ID17040218SK030_04), which occupies a similar position on the landscape. The upper 4th-order AU of Star Hope Creek (ID17040218SK036_04) is almost completely dominated by beaver ponds. We recognize these ponds and do not penalize the stream for having wide channels due to beaver ponds. The relationship between beaver activity and channel width in these low-gradient streams is not clear. Star Hope and Wildhorse Creeks may be unfairly judged in this analysis. More work is needed during TMDL implementation to determine appropriate actions for these streams.

The 3rd-order section of the North Fork Big Lost River and the Warm Springs Creek complex of streams are next in line with high excess loads. Percent reductions needed are around 20%. Warm Springs Creek is driven by two large spring outlets, both of which have aquaculture facilities associated with the spring outlets. Warm Springs and Pole Stackyard Creeks flow through low-gradient pastures that appear to have been converted from shrub-dominated riparian to pasture grass. These agricultural activities affect shade levels to some degree, although Warm Springs Creek is naturally very wide.

Most other AUs lack shade to some degree, although shade deficits are not substantial. Percent reductions in solar load needed to achieve targets vary from 5% to 26%. The 3rd-order reach of Summit Creek (30% reduction) and the 4th-order reach of Cherry Creek (35% reduction) are the exceptions with more needed reductions. The Summit Creek AU is very small, only 890 meters long from the Kane Creek confluence to the mouth of Summit Creek.

The 3rd-order reach of Bear Creek had no excess load, despite lacking shade in some locations. Bear Creek has enough locations with substantial shade, greater than targets predict, to counteract losses in other parts of the stream resulting in a no net gain in solar load.

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

The original 2004 temperature TMDLs for these streams (DEQ 2004) used differences in temperature between the stream and criteria to produced percent reductions needed (DEQ 2004, Table 60). In the revised PNV temperature TMDLs, percent reductions are based on excess solar loads (differences between existing solar loads and target solar loads). Comparing the two is somewhat problematic and may not show realistic differences either in actual conditions (then versus now) or in techniques. A comparison of percent reductions between the two TMDLs for each stream system is provided in Table 5. These data suggest that percent reductions from a solar load basis are slightly less than from a temperature basis but are somewhat comparable.

**Table 5. Percent reduction comparisons between the 2004 and 2015 TMDLs.**

| Stream Name | 2004 % Reductions | 2015 % Reductions |
|---|---|---|
| Corral Creek | 37.5–40.1 | 9 (1 AU) |
| Star Hope Creek | 33.8–36.9 | 16, 19, 42 (3 AUs) |
| Wildhorse Creek | 20.6–22.2 | 16, 32 (2 AUs) |
| North Fork Big Lost River | 30.3–31.6 | 13, 20 (2 AUs) |
| Summit Creek | 22.4–27 | 18, 30 (2 AUs) |
| Warm Springs Creek | 37.8–37.9 | 11, 23 (2 AUs) |
| Cherry Creek | 30.4–45.4 | 26, 35 (2 AUs) |
| Bear Creek | 33–36.4 | 0, 20 (2 AUs) |

## Modified Waste Load Allocation

This document also established modified WLAs for two hatcheries which use ground water from the Warm Springs Creek area.  A complete description can be found in Appendix D. Based on the collected data, the hatcheries do not continually increase the temperature of the spring sources before they are discharged from the present day outfall structure. The current wasteload allocation for both hatcheries is to meet the numeric state water quality standard including salmonid spawning temperatures during spring and fall months. Meeting the standard is not possible because the source water at the Mackay Fish Hatchery (11 °C) already exceeds the 9°C daily average for salmonid spawning. However, to protect salmonid spawning to the extent practicable, DEQ is modifying the current temperature wasteload allocation for the hatcheries to the inflow daily average temperature plus 0.15 ºC for each facility. This wasteload allocation is consistent with IDAPA 58.01.02.400.01(b), which allows for up to a 0.3 °C temperature increase above natural background. This 0.3 ºC increase must be divided between all the point sources found within the AU; specifically the Mackay Fish Hatchery and Lost River Hatchery. The wasteload allocation also reflects the actual natural background conditions for temperature. Each facility will need to measure continuous inflow temperature daily to determine compliance. Upon approval of this modification, the temperature wasteload allocations in the 2004 TMDL will be superseded and no longer apply; the new wasteload allocations will become part of the next General Aquaculture Permit.

### 5.4.1 Water Diversion

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

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

> It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local

> agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

Additionally, Idaho water quality standards indicate the following:

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

In this TMDL, we have not quantified what impact, if any, diversions are having on stream temperature. Water diversions are allowed for in state statute, and it is possible for a water body to be 100% allocated. Diversions notwithstanding, reaching shade targets as discussed in the TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature. This TMDL will lead to cooler water by achieving shade that would be expected under natural conditions and water temperatures resulting from that shade. DEQ encourages local landowners and holders of water rights to voluntarily do whatever they can to help instream flow for the purpose of keeping channel water cooler for aquatic life.

### 5.4.2 Margin of Safety

The margin of safety in this TMDL is considered implicit in the design. Because the target is essentially background conditions, loads (shade levels) are allocated to lands adjacent to these streams at natural background levels. Because shade levels are established at natural background or system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the load analysis. Although the load analysis used in this TMDL involves gross estimations that are likely to have large variances, load allocations are applied to the stream and its riparian vegetation rather than specific nonpoint source activities and can be adjusted as more information is gathered from the stream environment.

### 5.4.3 Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to include the 6-month period from April through September. This time period is when the combination of increasing air and water temperatures coincide with increasing solar inputs and vegetative shade. The critical time periods are April through June when spring salmonid spawning occurs, July and August when maximum temperatures may exceed cold water aquatic life criteria, and September when fall salmonid spawning is most likely to be affected by higher temperatures. Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angle.

### 5.4.4 Reasonable Assurance

CWA §319 requires each state to develop and submit a nonpoint source management plan. The *Idaho Nonpoint Source Management Plan* was approved by EPA in March 2015 (DEQ 2015). The plan identifies programs to achieve implementation of nonpoint source best management practices (BMPs), includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups (BAGs) and WAGs. The Upper Snake BAG is the designated WAG for the Big Lost River subbasin.

Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 6.

**Table 6. State of Idaho's regulatory authority for nonpoint pollution sources.**

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

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

The Idaho water quality standards and wastewater treatment requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of

BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; Idaho Soil and Water Conservation Commission for grazing and agricultural activities, Idaho Transportation Department for public road construction, Idaho State Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.010.24).

### 5.4.5 Stormwater and TMDL Wasteload Allocation

Two known NPDES-permitted point sources (aquaculture facilities under IDG-130000) exist in the affected watersheds and their wasteload allocations are addressed in Appendix D. If an additional point source is proposed that would have thermal consequences on these waters, background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09 and 58.01.02.401.01) should be involved (Appendix A).

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for CWA purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP). There are currently two active CGPs and two inactive MSGPs in the Big Lost River watershed.

#### *5.4.5.1 Municipal Separate Storm Sewer Systems*

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

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

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program, and use BMPs to control pollutants in stormwater discharges to the maximum extent practicable. Due to low population within this subbasin, there are no MS4s within the Big Lost River watershed.

#### *5.4.5.2 Industrial Stormwater Requirements*

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

**Multi-Sector General Permit and Stormwater Pollution Prevention Plans**

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

**Industrial Facilities Discharging to Impaired Water Bodies**

EPA's Multi-Sector General Permit (MSGP), which became effective for Idaho on August 12, 2015, has grouped the different regulated industries into 29 sectors, based on their typical activities since the different industrial activities have sector-specific types of material that may be exposed to stormwater: https://www.epa.gov/sites/production/files/2015-10/documents/msgp2015_finalpermit.pdf .

Any facility that discharges to an impaired water body without an EPA-approved or established TMDL must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (Part 6.2.4.1 of EPA's MSGP). If the pollutant of concern is not detected and is not expected to be present in the facilities discharge, or it is detected but it has been determined that its presence is caused solely by natural background sources, the the permittee may request to discontinue monitoring for that pollutant. When storm water is discharged to a water body that has an EPA-approved or established TMDL, then the permittee is not required to monitor for the pollutant(s) which the TMDL was developed for unless EPA informs the permittee upon examination of the applicable TMDL and its wasteload allocation, that they are subject to such a requirement consistent with the assumptions and requirements of the applicable TMDL. Part 8 of EPA's MSGP, details the stormwater management practices and monitoring that are required for the different industrial sectors. Part 9.10.3 discusses the additional conditions that DEQ specified in the certification of EPA's MSGP.

**TMDL Industrial Stormwater Requirements**

When a TMDL is being developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically; operators must also follow specific requirements to be consistent with any local pollutant allocations. Specific storm water management practices and monitoring that are required for the different industrial sectors are addressed in Part 8 of EPA's MSGP.

There are two inactive MSGPs in the Big Lost River subbasin, Warrington Construction – Moore wastewater improvements (IDR12E942) and Cascade Pipeline – Arco drinking water distribution system upgrades (IDR12DL09). The Moore wastewater improvements involved upgrades at that wastewater land application facility. No wastewaters are discharged to streams and the multi-sector activities did not impact the Big Lost River system. The City of Arco drinking water distribution upgrades involved line replacement within road right-of-ways and did not impact any portion of the Big Lost River system.

#### *5.4.5.3 Construction Stormwater*

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, which is due to expire February 17, 2017. .DEQ is currently in the process of certifying EPA's 2017 Construction General Permit.

**Construction General Permit and Stormwater Pollution Prevention Plans**

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

**TMDL Construction Stormwater Requirements**

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

There are two active CGPs in the watershed, Idaho Gold Corporation – Champagne Mine (IDR12F605) and City of Arco – drinking water distribution system upgrades (IDR12DN30). The Champagne Mine construction activity involving site clean-up commenced five years ago and is largely complete except for on-going maintenance. The Champagne Creek watershed is located north of Craters of the Moon National Monument and is not connected to the Big Lost River system. The City of Arco drinking water distribution upgrades involved line replacement within road right-of-ways and did not impact any portion of the Big Lost River system.

**Postconstruction Stormwater Management**

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

### 5.4.6 Reserve for Growth

Given the nature of the pollutants and landscape, no allowances have been made for future growth. Such growth would come as a result of land use changes that would affect present day sources and types of pollutants and would be assessed in a future TMDL review.

## 5.5 Implementation Strategies

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

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land-use activities (e.g., logging, grazing, and mining). It is important to field verify existing shade for each stream segment to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

### 5.5.1 Time Frame

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

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

### 5.5.2 Approach and Responsible Parties

The designated management agencies, WAG, DEQ, and other appropriate participants will plan BMPs specific to each impaired reach with a load allocation. The public will also have the opportunity to be involved with implementation planning. The plan will include measureable milestones and a timeline for implementation. Monitoring conducted with DEQ-approved methods will measure progress toward meeting Idaho's water quality standards. Target shade levels are provided for the entire reach of each stream with a temperature TMDL, so shade can be monitored anywhere in each applicable reach.

### 5.5.3 Implementation Monitoring Strategy

Effective shade monitoring can take place on any segment throughout the 17 AUs in the Big Lost River subbasin and be compared to existing shade estimates provided in Appendix C (Figures C-1, C-4, C-7, C-10, C-13, and C-16 and Tables C-2 to C-18). Those areas with the largest disparity between existing and target shade should be monitored with Solar Pathfinders to verify existing shade levels and determine progress toward meeting shade targets. Since many existing shade estimates have not been field verified, they may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Ten equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

### 5.5.4 Pollutant Trading

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

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

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

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2010 under revision).

#### *5.5.4.1 Trading Components*

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

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

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

#### *5.5.4.2 Watershed-Specific Environmental Protection*

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

#### *5.5.4.3 Trading Framework*

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ’s pollutant trading guidance (DEQ 2010).

# 6 Conclusions

Effective shade targets were established for 17 AUs and associated streams based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation and partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho’s water quality standards (IDAPA 58.01.02). A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table 7.

All AUs lack shade and have excess solar loads, except the 3rd-order AU of Bear Creek, which did not show an excess load. Low-gradient, wide streams (Star Hope, Wildhorse, and Warm Springs Creeks) have the highest excess loads. These systems are more accessible and are used more for livestock pasturing and agricultural conversion. Percent reductions needed in solar loads to achieve target levels varied from 42% in Star Hope Creek to 0% in Bear Creek. Most AUs required reductions at 26% or less. Comparisons between 2004 and current reductions show slightly smaller percent reductions are needed in 2015.

Target shade levels for individual stream segments 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.

The current wasteload allocations for IDFG's Mackay Fish Hatchery and Clear Springs Foods Lost River Hatchery on Warm Springs Creek are to meet the numeric state water quality standard including salmonid spawning temperatures during spring and fall months. Meeting this standard is not possible because the source water (11 °C at the Mackay Fish Hatchery) already exceeds the 9 °C daily average for salmonid spawning. However, to protect salmonid spawning to the extent practicable, DEQ is modifying the current temperature wasteload allocation for the hatcheries to the inflow daily average temperature plus 0.15 ºC for each facility.

**Table 7. Summary of assessment outcomes.**

| Water Body | Assessment Unit Number | Pollutant | TMDL Completed | Recommended Changes to Next Integrated Report | Justification |
|---|---|---|---|---|---|
| North Fork Big Lost River | ID17040218SK027_02<br>ID17040218SK027_03 | Temperature | Yes | Add 2nd-order AU to 3rd-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Summit Creek | ID17040218SK028_02<br>ID17040218SK028_03 | Temperature | Yes | Add 3rd-order AU to 2nd-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Wildhorse Creek | ID17040218SK030_02<br>ID17040218SK030_04 | Temperature | Yes | Add 2nd-order AU to 4th-order AU already in Category 4a | Excess solar load from a lack of existing shade |
| Star Hope Creek | ID17040218SK035_02<br>ID17040218SK035_04<br>ID17040218SK036_04 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Corral Creek | ID17040218SK041_02 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Warm Springs Creek | ID17040218SK043_02<br>ID17040218SK043_03 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Antelope Creek/Darlington Canal tributaries | ID17040218SK046_02 | Temperature | Yes | No changes, already in Category 4a | TMDL update |
| Cherry Creek | ID17040218SK050_02<br>ID17040218SK050_04 | Temperature | Yes | In 2004 TMDL but was not added to Category 4; both AUs must be added | TMDL update |
| Bear Creek | ID17040218SK053_02<br>ID17040218SK053_03 | Temperature | Yes | Add 2nd-order AU to 3rd order AU already in Category 4a | Excess solar load from a lack of existing shade |

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

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## GIS Coverages

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

USDA – FSA Aerial Photography Field Office - 2013 National Agricultural Imagery Program (NAIP) 0.5m imagery

USDA – FSA Aerial Photography Field Office - 2011 National Agricultural Imagery Program (NAIP) 1.0m imagery

# Glossary

**§303(d)**

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

**Ambient**

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

**Anthropogenic**

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

**Assessment Unit (AU)**

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

**Beneficial Use**

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

**Beneficial Use Reconnaissance Program (BURP)**

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

**Exceedance**

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

**Fully Supporting**

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

**Load Allocation (LA)**

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

**Load**

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

**Load Capacity (LC)**

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

**Margin of Safety (MOS)**

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

**Natural Condition**

The condition that exists with little or no anthropogenic influence.

**Nonpoint Source**

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

**Not Assessed (NA)**

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

**Not Fully Supporting**

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

**Point Source**

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

**Pollutant**

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

**Pollution**

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

**Potential Natural Vegetation (PNV)**

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

**Riparian**

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

**Stream Order**

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

**Total Maximum Daily Load (TMDL)**

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

**Wasteload Allocation (WLA)**

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

**Water Body**

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

**Water Quality Criteria**

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

**Water Quality Standards**

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

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# Appendix A. State and Site-Specific Water Quality Standards and Criteria

## Water Quality Standards Applicable to Salmonid Spawning Temperature

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

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

For the purposes of a temperature TMDL, the highest recorded water temperature in a recorded data set (excluding any high water temperatures that may occur on days when air temperatures exceed the 90th percentile of the highest annual maximum weekly maximum air temperatures) is compared to the daily maximum criterion of 13 °C. The difference between the two water temperatures represents the temperature reduction necessary to achieve compliance with temperature standards.

## Natural Background Provisions

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

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

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

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# Appendix B. Data Sources

**Table B-1. Data sources for Big Lost River subbasin.**

| Water Body | Data Source | Type of Data | Collection Date |
|---|---|---|---|
| 17 assessment units (see Section 6, Table 7 for stream names) | DEQ Idaho Falls Regional Office | Solar Pathfinder effective shade and stream width | Summer 2015 |
| 17 assessment units | DEQ Technical Services, State Office | Aerial photo interpretation of existing shade and stream width estimation | Summer/fall 2015 |
| 17 assessment units | DEQ IDASA Database | Temperature | Variable |

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# Appendix C. Bankfull Width Estimates, Target Solar Load Tables, and Shade Figures

**Table C-1. Bankfull width estimates for streams in the load analysis.**

| Location | area (sq mi) | Upper Snake (m) | Salmon (m) | Payette/Weiser (m) | field data (m) |
|---|---|---|---|---|---|
| Bear Creek @ mouth | 19 | 6 | 9 | 7 | |
| Bear Creek ab Big Springs | 18.4 | 6 | 9 | 7 | |
| Bear Creek bl Death Canyon | 15.1 | 5 | 8 | 6 | 6.3(96), 3.4(14) |
| Bear Creek ab Death Canyon | 10.8 | 4 | 7 | 5 | 8.7(96) |
| Bear Creek at fork confluence | 8.9 | 4 | 7 | 5 | 6.2(97) |
| Death Canyon @ mouth | 4.3 | 3 | 5 | 3 | |
| Left Fork Death Canyon | 2.3 | 2 | 4 | 2 | |
| Right Fork Death Canyon | 1.5 | 2 | 3 | 2 | |
| Right Fork Bear @ mouth | 5 | 3 | 6 | 3 | 5(96) |
| Right Fork Bear ab Lone Pine Creek | 1.9 | 2 | 4 | 2 | |
| Lone Pine Creek @ mouth | 2.4 | 2 | 4 | 2 | |
| Middle Fork Bear ab Right Fork | 3.9 | 3 | 5 | 3 | 7.7(96) |
| Left Fork Bear @ mouth | 0.9 | 1 | 3 | 1 | |
| Cherry Creek ab Left Fork | 19.5 | 6 | 9 | 7 | 3.2(01) |
| Cherry Creek ab Middle Fork | 8.8 | 4 | 7 | 5 | 2.6(01) |
| Middle Fork Cherry Creek @ mouth | 5.9 | 3 | 6 | 4 | |
| Middle Fork Cherry ab forked trib. | 2.3 | 2 | 4 | 2 | |
| Lupine Creek @ mouth | 4.5 | 3 | 5 | 3 | 1.3(98), 2.1(01), 1.8(01) |
| Mud Lake Creek @ mouth | 2 | 2 | 4 | 2 | |
| Carcass Creek @ mouth | 0.75 | 1 | 3 | 1 | 0.8(98) |
| Crawford Canyon @ mouth | 1.8 | 2 | 4 | 2 | |
| Richardson Canyon @ mouth | 1.9 | 2 | 4 | 2 | 1.2(98) |
| Star Hope Creek @ mouth | 75.9 | 11 | 16 | 15 | 20.1(01) |
| Star Hope Creek ab Ramsey Creek | 66.7 | 10 | 15 | 14 | 18.7(01), 13.7(03) |
| Star Hope Creek ab Bellas Canyon | 56 | 9 | 14 | 13 | 14.5(14) |
| Star Hope Creek bl Bear Canyon | 12 | 5 | 8 | 6 | 5(01), 7.2(08) |
| Bellas Canyon @ mouth | 3.1 | 3 | 5 | 3 | 4.7(96) |
| Howell Canyon @ mouth | 2.2 | 2 | 4 | 2 | |
| Ramsey Creek @ mouth | 3.7 | 3 | 5 | 3 | 1.9 (01), 1.3(12) |
| Un-named (upper) | 1.5 | 2 | 3 | 2 | |
| Un-named (potholes) | 0.82 | 1 | 3 | 1 | |
| Corral Creek ab Coyote Creek | 8.7 | 4 | 7 | 5 | 4.1(01), 2.4(12) |
| Corral Creek @ 8350ft | 4.6 | 3 | 5 | 3 | |
| Corral Creek @ 9290ft | 1.6 | 2 | 4 | 2 | |
| Corral Creek @ mouth | 18.8 | 6 | 9 | 7 | |
| Coyote Creek @ mouth | 7.3 | 4 | 6 | 4 | |
| Coyote Creek ab Horse Wallow Creek | 2.9 | 3 | 4 | 3 | |
| Horse Wallow Creek @ mouth | 2.3 | 2 | 4 | 2 | |

**Table C-1 (cont.) Bankfull width estimates for streams in the load analysis.**

| Location | area (sq mi) | Upper Snake (m) | Salmon (m) | Payette/Weiser (m) | field data (m) |
|---|---|---|---|---|---|
| Wildhorse Creek @ mouth | 57 | 9 | 14 | 13 | 16.7(03) |
| Wildhorse Creek bl Fall Creek | 49.5 | 9 | 13 | 12 | 13.1(01), 13.7(14) |
| Burnt Aspen Creek @ mouth | 1.7 | 2 | 4 | 2 | 1.7(98) |
| Bailey Creek @ mouth | 1.1 | 2 | 3 | 2 | 2(96) |
| Summit Creek @ mouth | 45.8 | 8 | 13 | 11 | |
| Summit Creek ab Kane Creek | 25.8 | 7 | 10 | 8 | 6.6(01) bl Phi Kappa |
| Summit Creek bl Big Fall Creek | 15.7 | 5 | 9 | 6 | 6.3(96) ab Big Fall |
| Summit Creek ab Little Fall Creek | 6 | 3 | 6 | 4 | |
| Park Creek @ mouth | 1.14 | 2 | 3 | 2 | |
| Little Fall Creek @ mouth | 3.3 | 3 | 5 | 3 | |
| Big Fall Creek @ mouth | 3.9 | 3 | 5 | 3 | 4.3(96), 2.5(01) |
| Phi Kappa Creek @ mouth | 2.7 | 2 | 4 | 3 | 4.7(96), 1.5(12) |
| 7th Tributary @ mouth | 1.8 | 2 | 4 | 2 | |
| NF Big Lost River ab Summit Creek | 60.6 | 10 | 14 | 13 | 9.6(11) |
| NF Big Lost River bl Blind Creek | 18.2 | 6 | 9 | 7 | 6.5(15), 10.6(11) |
| NF Big Lost River ab Blind Creek | 10.5 | 4 | 7 | 5 | 6(96) |
| Blind Creek @ mouth | 7.7 | 4 | 7 | 4 | |
| tirb to Blind Creek | 7 | 4 | 6 | 4 | 3.7(96) |
| Hunter Creek @ mouth | 4.2 | 3 | 5 | 3 | 4.7(96) |
| Bear Creek @ mouth | 2.2 | 2 | 4 | 2 | 2.7(96) |
| Squib Canyon @ mouth | 2.1 | 2 | 4 | 2 | 2(96) |
| Miller Canyon @ mouth | 3.8 | 3 | 5 | 3 | 5.7(96) |
| Glide Canyon @ mouth | 1.3 | 2 | 3 | 2 | 3.3(96) |
| Park Canyon @ mouth | 2.1 | 2 | 4 | 2 | 3.3(96) |
| Corral Creek @ mouth | 2 | 2 | 4 | 2 | |
| Toolbox Creek @ mouth | 1.4 | 2 | 3 | 2 | 2.7(96) |
| Chicken Creek @ mouth | 3 | 3 | 5 | 3 | 2(96) |
| Horse Creek @ mouth | 1.2 | 2 | 3 | 2 | 2(96) |
| Little Burnt Creek @ mouth | 1.7 | 2 | 4 | 2 | |
| Grasshopper Creek @ mouth | 4.2 | 3 | 5 | 3 | 2.7(96) |
| Bartlett Creek @ mouth | 3.7 | 3 | 5 | 3 | 3(98) |
| Warm Springs Creek bl Hamilton Springs | | | | | 14.3(96) |
| Garden Creek @ mouth | 3.7 | 3 | 5 | 3 | |
| Boone Creek @ mouth | 2.8 | 2 | 4 | 3 | 2.1(98) |
| Lehman Creek @ mouth | 10.8 | 4 | 7 | 5 | 2.4(98) ab lowest trib |
| WF Lehman Creek | 3.4 | 3 | 5 | 3 | |
| EF Lehman Creek | 4.2 | 3 | 5 | 3 | |
| Hamilton Creek @ mouth | 5 | 3 | 6 | 3 | |
| Wood Canyon | 2.1 | 2 | 4 | 2 | |
| Marsh Canyon | 8.9 | 4 | 7 | 5 | |
| Sheep Canyon | 4.2 | 3 | 5 | 3 | |
| Granite Spring Canyon | 2.4 | 2 | 4 | 2 | |

**Table C-2. Existing and target solar loads for Antelope Creek/Darlington canal tributaries (ID17040218SK046_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/$m^2$/day) | Segment Width (m) | Segment Area ($m^2$) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/$m^2$/day) | Segment Width (m) | Segment Area ($m^2$) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 046_02 | Wood Canyon | 1 | 430 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 60% | 2.51 | 1 | 400 | 1,000 | 100 | -5% |
| 046_02 | Wood Canyon | 2 | 370 | aspen | 100% | 0.00 | 1 | 400 | 0 | 80% | 1.25 | 1 | 400 | 500 | 500 | -20% |
| 046_02 | Wood Canyon | 3 | 370 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 40% | 3.76 | 1 | 400 | 2,000 | 1,000 | -25% |
| 046_02 | Wood Canyon | 4 | 320 | aspen | 100% | 0.00 | 1 | 300 | 0 | 70% | 1.88 | 1 | 300 | 600 | 600 | -30% |
| 046_02 | Wood Canyon | 5 | 3600 | sage/grass | 39% | 3.82 | 2 | 7,000 | 30,000 | 20% | 5.02 | 2 | 7,000 | 40,000 | 10,000 | -19% |
| 046_02 | 2nd trib | 1 | 640 | dry DF w/o Ppine | 94% | 0.38 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -4% |
| 046_02 | 2nd trib | 2 | 1300 | rock/bare/ephemeral | 0% | 6.27 | 1 | 1,000 | 6,000 | 0% | 6.27 | 1 | 1,000 | 6,000 | 0 | 0% |
| 046_02 | Marsh Canyon | 1 | 1900 | aspen | 100% | 0.00 | 1 | 2,000 | 0 | 90% | 0.63 | 1 | 2,000 | 1,000 | 1,000 | -10% |
| 046_02 | Marsh Canyon | 2 | 360 | aspen | 100% | 0.00 | 1 | 400 | 0 | 80% | 1.25 | 1 | 400 | 500 | 500 | -20% |
| 046_02 | Marsh Canyon | 3 | 360 | aspen | 99% | 0.06 | 2 | 700 | 40 | 80% | 1.25 | 2 | 700 | 900 | 900 | -19% |
| 046_02 | Marsh Canyon | 4 | 320 | sage/grass | 39% | 3.82 | 2 | 600 | 2,000 | 50% | 3.14 | 2 | 600 | 2,000 | 0 | 0% |
| 046_02 | Marsh Canyon | 5 | 760 | aspen | 99% | 0.06 | 2 | 2,000 | 100 | 70% | 1.88 | 2 | 2,000 | 4,000 | 4,000 | -29% |
| 046_02 | Marsh Canyon | 6 | 210 | sage/grass | 39% | 3.82 | 2 | 400 | 2,000 | 40% | 3.76 | 2 | 400 | 2,000 | 0 | 0% |
| 046_02 | Marsh Canyon | 7 | 370 | sage/grass | 39% | 3.82 | 2 | 700 | 3,000 | 30% | 4.39 | 2 | 700 | 3,000 | 0 | -9% |
| 046_02 | Marsh Canyon | 8 | 4400 | sage/grass | 27% | 4.58 | 3 | 10,000 | 50,000 | 20% | 5.02 | 3 | 10,000 | 50,000 | 0 | -7% |
| 046_02 | Marsh Canyon | 9 | 1200 | rock/bare/ephemeral | 0% | 6.27 | 4 | 5,000 | 30,000 | 0% | 6.27 | 4 | 5,000 | 30,000 | 0 | 0% |
| 046_02 | 1st to Marsh | 1 | 1700 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 60% | 2.51 | 1 | 2,000 | 5,000 | 1,000 | -5% |
| 046_02 | 1st to Marsh | 2 | 1500 | aspen | 100% | 0.00 | 1 | 2,000 | 0 | 90% | 0.63 | 1 | 2,000 | 1,000 | 1,000 | -10% |
| 046_02 | 2nd to Marsh | 1 | 380 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 046_02 | 2nd to Marsh | 2 | 180 | aspen | 100% | 0.00 | 1 | 200 | 0 | 90% | 0.63 | 1 | 200 | 100 | 100 | -10% |
| 046_02 | 2nd to Marsh | 3 | 1800 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 40% | 3.76 | 1 | 2,000 | 8,000 | 4,000 | -25% |
| 046_02 | 3rd to Marsh | 1 | 2600 | rock/bare/ephemeral | 0% | 6.27 | 1 | 3,000 | 20,000 | 0% | 6.27 | 1 | 3,000 | 20,000 | 0 | 0% |
| 046_02 | 4th trib | 1 | 1200 | dry DF w/o Ppine | 94% | 0.38 | 1 | 1,000 | 400 | 90% | 0.63 | 1 | 1,000 | 600 | 200 | -4% |
| 046_02 | 4th trib | 2 | 600 | sage/grass | 65% | 2.19 | 1 | 600 | 1,000 | 60% | 2.51 | 1 | 600 | 2,000 | 1,000 | -5% |
| 046_02 | 4th trib | 3 | 1600 | dry DF w/o Ppine | 94% | 0.38 | 1 | 2,000 | 800 | 90% | 0.63 | 1 | 2,000 | 1,000 | 200 | -4% |
| 046_02 | 4th trib | 4 | 440 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 60% | 2.51 | 1 | 400 | 1,000 | 100 | -5% |
| 046_02 | 4th trib | 5 | 740 | rock/bare/ephemeral | 0% | 6.27 | 1 | 700 | 4,000 | 0% | 6.27 | 1 | 700 | 4,000 | 0 | 0% |
| 046_02 | 5th trib | 1 | 2400 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 60% | 2.51 | 1 | 2,000 | 5,000 | 1,000 | -5% |
| 046_02 | Sheep Canyon | 1 | 810 | dry DF w/o Ppine | 94% | 0.38 | 1 | 800 | 300 | 90% | 0.63 | 1 | 800 | 500 | 200 | -4% |
| 046_02 | Sheep Canyon | 2 | 1900 | aspen | 99% | 0.06 | 2 | 4,000 | 300 | 80% | 1.25 | 2 | 4,000 | 5,000 | 5,000 | -19% |
| 046_02 | Sheep Canyon | 3 | 250 | sage/grass | 39% | 3.82 | 2 | 500 | 2,000 | 60% | 2.51 | 2 | 500 | 1,000 | (1,000) | 0% |
| 046_02 | Sheep Canyon | 4 | 3900 | sage/grass | 27% | 4.58 | 3 | 10,000 | 50,000 | 50% | 3.14 | 3 | 10,000 | 30,000 | (20,000) | 0% |
| 046_02 | trib to Sheep | 1 | 1100 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 046_02 | trib to Sheep | 2 | 81 | grass | 55% | 2.82 | 1 | 80 | 200 | 60% | 2.51 | 1 | 80 | 200 | 0 | 0% |
| 046_02 | trib to Sheep | 3 | 1500 | sage/grass | 39% | 3.82 | 2 | 3,000 | 10,000 | 60% | 2.51 | 2 | 3,000 | 8,000 | (2,000) | 0% |
| 046_02 | Granite Spring | 1 | 1700 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 60% | 2.51 | 1 | 2,000 | 5,000 | 1,000 | -5% |
| 046_02 | Granite Spring | 2 | 3400 | sage/grass | 39% | 3.82 | 2 | 7,000 | 30,000 | 30% | 4.39 | 2 | 7,000 | 30,000 | 0 | -9% |
| 046_02 | Dry Hollow | 1 | 1000 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 046_02 | Dry Hollow | 2 | 1300 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 40% | 3.76 | 1 | 1,000 | 4,000 | 2,000 | -25% |
| 046_02 | Dry Hollow | 3 | 550 | rock/bare/ephemeral | 0% | 6.27 | 1 | 600 | 4,000 | 0% | 6.27 | 1 | 600 | 4,000 | 0 | 0% |
| | | | | | | | *Totals* | | 270,000 | | | | | 290,000 | 15,000 | |

*Note*: All assessment unit (AU) numbers start with ID17040218SK in all load tables (Tables C-2–C-18). Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

**Table C-3. Existing and target solar loads for 2nd-order Bear Creek (ID17040218SK053_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 053_02 | LF Bear Creek | 1 | 1100 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 053_02 | LF Bear Creek | 2 | 250 | aspen | 100% | 0.00 | 1 | 300 | 0 | 90% | 0.63 | 1 | 300 | 200 | 200 | -10% |
| 053_02 | LF Bear Creek | 3 | 220 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 70% | 1.88 | 1 | 200 | 400 | 200 | -17% |
| 053_02 | MF Bear Creek | 1 | 490 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 053_02 | MF Bear Creek | 2 | 490 | subalpine fir/moist | 96% | 0.25 | 1 | 500 | 100 | 90% | 0.63 | 1 | 500 | 300 | 200 | -6% |
| 053_02 | MF Bear Creek | 3 | 180 | grass | 55% | 2.82 | 1 | 200 | 600 | 30% | 4.39 | 1 | 200 | 900 | 300 | -25% |
| 053_02 | MF Bear Creek | 4 | 110 | grass | 55% | 2.82 | 1 | 100 | 300 | 20% | 5.02 | 1 | 100 | 500 | 200 | -35% |
| 053_02 | MF Bear Creek | 5 | 630 | subalpine fir/moist | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 053_02 | MF Bear Creek | 6 | 240 | subalpine fir/moist | 96% | 0.25 | 1 | 200 | 50 | 80% | 1.25 | 1 | 200 | 300 | 300 | -16% |
| 053_02 | MF Bear Creek | 7 | 2300 | subalpine fir/dry-steep | 99% | 0.06 | 2 | 5,000 | 300 | 90% | 0.63 | 2 | 5,000 | 3,000 | 3,000 | -9% |
| 053_02 | MF Bear Creek | 8 | 540 | aspen | 99% | 0.06 | 3 | 2,000 | 100 | 90% | 0.63 | 3 | 2,000 | 1,000 | 900 | -9% |
| 053_02 | MF Bear Creek | 9 | 1300 | aspen | 99% | 0.06 | 3 | 4,000 | 300 | 90% | 0.63 | 3 | 4,000 | 3,000 | 3,000 | -9% |
| 053_02 | MF Bear Creek | 10 | 220 | aspen | 99% | 0.06 | 3 | 700 | 40 | 50% | 3.14 | 3 | 700 | 2,000 | 2,000 | -49% |
| 053_02 | MF Bear Creek | 11 | 100 | alder | 72% | 1.76 | 3 | 300 | 500 | 70% | 1.88 | 3 | 300 | 600 | 100 | -2% |
| 053_02 | RF Bear Creek | 1 | 940 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 053_02 | RF Bear Creek | 2 | 270 | whitebark pine | 99% | 0.06 | 1 | 300 | 20 | 90% | 0.63 | 1 | 300 | 200 | 200 | -9% |
| 053_02 | RF Bear Creek | 3 | 400 | Drummond willow | 87% | 0.82 | 1 | 400 | 300 | 90% | 0.63 | 1 | 400 | 300 | 0 | 3% |
| 053_02 | RF Bear Creek | 4 | 540 | DF/lodgepole-gentle | 100% | 0.00 | 1 | 500 | 0 | 90% | 0.63 | 1 | 500 | 300 | 300 | -10% |
| 053_02 | RF Bear Creek | 5 | 1400 | Drummond willow | 76% | 1.50 | 2 | 3,000 | 5,000 | 80% | 1.25 | 2 | 3,000 | 4,000 | (1,000) | 0% |
| 053_02 | RF Bear Creek | 6 | 430 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 50% | 3.14 | 2 | 900 | 3,000 | 2,000 | -26% |
| 053_02 | RF Bear Creek | 7 | 1400 | Drummond willow | 56% | 2.76 | 3 | 4,000 | 10,000 | 30% | 4.39 | 3 | 4,000 | 20,000 | 10,000 | -26% |
| 053_02 | RF Bear Creek | 8 | 1100 | alder | 72% | 1.76 | 3 | 3,000 | 5,000 | 70% | 1.88 | 3 | 3,000 | 6,000 | 1,000 | -2% |
| 053_02 | Lone Pine Creek | 1 | 1500 | grass | 55% | 2.82 | 1 | 2,000 | 6,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 0 | -5% |
| 053_02 | Lone Pine Creek | 2 | 920 | subalpine fir/dry-steep | 99% | 0.06 | 1 | 900 | 60 | 90% | 0.63 | 1 | 900 | 600 | 500 | -9% |
| 053_02 | Lone Pine Creek | 3 | 610 | dry DF w/o Ppine | 94% | 0.38 | 2 | 1,000 | 400 | 90% | 0.63 | 2 | 1,000 | 600 | 200 | -4% |
| 053_02 | Lone Pine Creek | 4 | 380 | aspen | 99% | 0.06 | 2 | 800 | 50 | 80% | 1.25 | 2 | 800 | 1,000 | 1,000 | -19% |
| 053_02 | Lone Pine Creek | 5 | 530 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 80% | 1.25 | 2 | 1,000 | 1,000 | (1,000) | 0% |
| 053_02 | trib to Lone Pine | 1 | 500 | rock/bare/ephemeral | 0% | 6.27 | 1 | 500 | 3,000 | 0% | 6.27 | 1 | 500 | 3,000 | 0 | 0% |
| 053_02 | trib to Lone Pine | 2 | 1800 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 2,000 | -15% |
| 053_02 | trib to Lone Pine | 3 | 750 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 60% | 2.51 | 1 | 800 | 2,000 | 1,000 | -27% |
| 053_02 | LF Death Canyon | 1 | 220 | aspen | 100% | 0.00 | 1 | 200 | 0 | 80% | 1.25 | 1 | 200 | 300 | 300 | -20% |
| 053_02 | LF Death Canyon | 2 | 2100 | sage/grass | 39% | 3.82 | 2 | 4,000 | 20,000 | 60% | 2.51 | 2 | 4,000 | 10,000 | (10,000) | 0% |
| 053_02 | LF Death Canyon | 3 | 780 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| 053_02 | RF Death Canyon | 1 | 170 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 053_02 | RF Death Canyon | 2 | 170 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 053_02 | RF Death Canyon | 3 | 2600 | sage/grass | 39% | 3.82 | 2 | 5,000 | 20,000 | 40% | 3.76 | 2 | 5,000 | 20,000 | 0 | 0% |
| 053_02 | Death Canyon | 1 | 470 | Geyer willow | 82% | 1.13 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | -2% |
| 053_02 | Death Canyon | 2 | 710 | Geyer willow | 82% | 1.13 | 2 | 1,000 | 1,000 | 50% | 3.14 | 2 | 1,000 | 3,000 | 2,000 | -32% |
| 053_02 | Death Canyon | 3 | 680 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 50% | 3.14 | 3 | 2,000 | 6,000 | 1,000 | -14% |
| 053_02 | Death Canyon | 4 | 360 | Geyer willow | 64% | 2.26 | 3 | 1,000 | 2,000 | 40% | 3.76 | 3 | 1,000 | 4,000 | 2,000 | -24% |
| 053_02 | Death Canyon | 5 | 460 | Geyer willow | 64% | 2.26 | 3 | 1,000 | 2,000 | 50% | 3.14 | 3 | 1,000 | 3,000 | 1,000 | -14% |
| 053_02 | trib to Death Canyon | 1 | 870 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 053_02 | trib to Death Canyon | 2 | 780 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 60% | 2.51 | 1 | 800 | 2,000 | 1,000 | -27% |
| 053_02 | trib to Death Canyon | 3 | 780 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| 053_02 | trib to Death Canyon | 4 | 220 | Geyer willow | 82% | 1.13 | 2 | 400 | 500 | 50% | 3.14 | 2 | 400 | 1,000 | 500 | -32% |
| 053_02 | Coyote Canyon | 1 | 2100 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 2,000 | -15% |
| 053_02 | un-named | 1 | 230 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 053_02 | un-named | 2 | 800 | dry DF w/o Ppine | 94% | 0.38 | 1 | 800 | 300 | 80% | 1.25 | 1 | 800 | 1,000 | 700 | -14% |
| 053_02 | un-named | 3 | 410 | Geyer willow | 93% | 0.44 | 1 | 400 | 200 | 30% | 4.39 | 1 | 400 | 2,000 | 2,000 | -63% |
| 053_02 | un-named | 4 | 1100 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| | | | | | | | *Totals* | | 130,000 | | | | | 160,000 | 32,000 | |

**Table C-4. Existing and target solar loads for 3rd-order Bear Creek (ID17040218SK053_03).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/ day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/ day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 053_03 | Bear Creek | 1 | 1600 | alder | 59% | 2.57 | 4 | 6,000 | 20,000 | 70% | 1.88 | 4 | 6,000 | 10,000 | (10,000) | 0% |
| 053_03 | Bear Creek | 2 | 1200 | Geyer willow | 53% | 2.95 | 4 | 5,000 | 10,000 | 70% | 1.88 | 4 | 5,000 | 9,000 | (1,000) | 0% |
| 053_03 | Bear Creek | 3 | 430 | Geyer willow | 45% | 3.45 | 5 | 2,000 | 7,000 | 40% | 3.76 | 5 | 2,000 | 8,000 | 1,000 | -5% |
| 053_03 | Bear Creek | 4 | 250 | Geyer willow | 45% | 3.45 | 5 | 1,000 | 3,000 | 60% | 2.51 | 5 | 1,000 | 3,000 | 0 | 0% |
| 053_03 | Bear Creek | 5 | 530 | Geyer willow | 45% | 3.45 | 5 | 3,000 | 10,000 | 40% | 3.76 | 5 | 3,000 | 10,000 | 0 | -5% |
| 053_03 | Bear Creek | 6 | 230 | Geyer willow | 45% | 3.45 | 5 | 1,000 | 3,000 | 20% | 5.02 | 5 | 1,000 | 5,000 | 2,000 | -25% |
| 053_03 | Bear Creek | 7 | 1300 | Geyer willow | 45% | 3.45 | 5 | 7,000 | 20,000 | 30% | 4.39 | 5 | 7,000 | 30,000 | 10,000 | -15% |
| 053_03 | Bear Creek | 8 | 350 | Geyer willow | 40% | 3.76 | 6 | 2,000 | 8,000 | 60% | 2.51 | 6 | 2,000 | 5,000 | (3,000) | 0% |
| 053_03 | Bear Creek | 9 | 150 | Geyer willow | 40% | 3.76 | 6 | 900 | 3,000 | 30% | 4.39 | 6 | 900 | 4,000 | 1,000 | -10% |
| 053_03 | Bear Creek | 10 | 900 | Geyer willow | 40% | 3.76 | 6 | 5,000 | 20,000 | 30% | 4.39 | 6 | 5,000 | 20,000 | 0 | -10% |
| 053_03 | Bear Creek | 11 | 800 | Geyer willow | 40% | 3.76 | 6 | 5,000 | 20,000 | 60% | 2.51 | 6 | 5,000 | 10,000 | (10,000) | 0% |
| 053_03 | Bear Creek | 12 | 420 | Geyer willow | 40% | 3.76 | 6 | 3,000 | 10,000 | 10% | 5.64 | 6 | 3,000 | 20,000 | 10,000 | -30% |
| | | | | | | | *Totals* | | 130,000 | | | | | 130,000 | 0 | |

**Table C-5. Existing and target solar loads for Corral Creek (ID17040218SK041_02).**

| 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 |
| 041_02 | Corral Creek | 1 | 700 | grass | 55% | 2.82 | 1 | 700 | 2,000 | 50% | 3.14 | 1 | 700 | 2,000 | 0 | -5% |
| 041_02 | Corral Creek | 2 | 580 | subalpine fir/moist | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 041_02 | Corral Creek | 3 | 420 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 40% | 3.76 | 1 | 400 | 2,000 | 1,000 | -15% |
| 041_02 | Corral Creek | 4 | 360 | Drummond willow | 76% | 1.50 | 2 | 700 | 1,000 | 80% | 1.25 | 2 | 700 | 900 | (100) | 0% |
| 041_02 | Corral Creek | 5 | 410 | Drummond willow | 76% | 1.50 | 2 | 800 | 1,000 | 60% | 2.51 | 2 | 800 | 2,000 | 1,000 | -16% |
| 041_02 | Corral Creek | 6 | 900 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 041_02 | Corral Creek | 7 | 170 | grass | 31% | 4.33 | 2 | 300 | 1,000 | 40% | 3.76 | 2 | 300 | 1,000 | 0 | 0% |
| 041_02 | Corral Creek | 8 | 400 | subalpine fir/moist | 96% | 0.25 | 2 | 800 | 200 | 80% | 1.25 | 2 | 800 | 1,000 | 800 | -16% |
| 041_02 | Corral Creek | 9 | 450 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | 0% |
| 041_02 | Corral Creek | 10 | 280 | Drummond willow | 76% | 1.50 | 2 | 600 | 900 | 60% | 2.51 | 2 | 600 | 2,000 | 1,000 | -16% |
| 041_02 | Corral Creek | 11 | 320 | beaver ponds | 20% | 5.02 | 2 | 600 | 3,000 | 20% | 5.02 | 2 | 600 | 3,000 | 0 | 0% |
| 041_02 | Corral Creek | 12 | 1200 | Drummond willow | 56% | 2.76 | 3 | 4,000 | 10,000 | 60% | 2.51 | 3 | 4,000 | 10,000 | 0 | 0% |
| 041_02 | Corral Creek | 13 | 300 | beaver ponds | 30% | 4.39 | 3 | 900 | 4,000 | 30% | 4.39 | 3 | 900 | 4,000 | 0 | 0% |
| 041_02 | Corral Creek | 14 | 1200 | Drummond willow | 56% | 2.76 | 3 | 4,000 | 10,000 | 60% | 2.51 | 3 | 4,000 | 10,000 | 0 | 0% |
| 041_02 | Corral Creek | 15 | 570 | Drummond willow | 45% | 3.45 | 4 | 2,000 | 7,000 | 40% | 3.76 | 4 | 2,000 | 8,000 | 1,000 | -5% |
| 041_02 | Corral Creek | 16 | 900 | Drummond willow | 45% | 3.45 | 4 | 4,000 | 10,000 | 50% | 3.14 | 4 | 4,000 | 10,000 | 0 | 0% |
| 041_02 | Corral Creek | 17 | 390 | Drummond willow | 45% | 3.45 | 4 | 2,000 | 7,000 | 60% | 2.51 | 4 | 2,000 | 5,000 | (2,000) | 0% |
| 041_02 | Corral Creek | 18 | 740 | beaver ponds | 20% | 5.02 | 4 | 3,000 | 20,000 | 20% | 5.02 | 4 | 3,000 | 20,000 | 0 | 0% |
| 041_02 | 1st to Corral | 1 | 1000 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 041_02 | 1st to Corral | 2 | 1200 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 30% | 4.39 | 1 | 1,000 | 4,000 | 1,000 | -25% |
| 041_02 | 1st to Corral | 3 | 270 | dry DF w/o Ppine | 94% | 0.38 | 2 | 500 | 200 | 80% | 1.25 | 2 | 500 | 600 | 400 | -14% |
| 041_02 | 1st to Corral | 4 | 290 | sage/grass | 39% | 3.82 | 2 | 600 | 2,000 | 50% | 3.14 | 2 | 600 | 2,000 | 0 | 0% |
| 041_02 | 2nd to Corral | 1 | 450 | dry DF w/o Ppine | 94% | 0.38 | 1 | 500 | 200 | 80% | 1.25 | 1 | 500 | 600 | 400 | -14% |
| 041_02 | 2nd to Corral | 2 | 330 | grass | 55% | 2.82 | 1 | 300 | 800 | 50% | 3.14 | 1 | 300 | 900 | 100 | -5% |
| 041_02 | 2nd to Corral | 3 | 790 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 50% | 3.14 | 1 | 800 | 3,000 | 2,000 | -37% |
| 041_02 | 2nd to Corral | 4 | 950 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 30% | 4.39 | 2 | 2,000 | 9,000 | 1,000 | -9% |
| 041_02 | 2nd to Corral | 5 | 550 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 20% | 5.02 | 2 | 1,000 | 5,000 | 1,000 | -19% |
| 041_02 | 2nd to Corral | 6 | 170 | Drummond willow | 76% | 1.50 | 2 | 300 | 500 | 50% | 3.14 | 2 | 300 | 900 | 400 | -26% |
| 041_02 | Coyote Creek | 1 | 260 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 041_02 | Coyote Creek | 2 | 810 | sage/grass | 65% | 2.19 | 1 | 800 | 2,000 | 50% | 3.14 | 1 | 800 | 3,000 | 1,000 | -15% |
| 041_02 | Coyote Creek | 3 | 1100 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 30% | 4.39 | 1 | 1,000 | 4,000 | 1,000 | -25% |
| 041_02 | Coyote Creek | 4 | 430 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 40% | 3.76 | 2 | 900 | 3,000 | 2,000 | -36% |
| 041_02 | Coyote Creek | 5 | 1100 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 041_02 | Coyote Creek | 6 | 940 | grass | 21% | 4.95 | 3 | 3,000 | 10,000 | 30% | 4.39 | 3 | 3,000 | 10,000 | 0 | 0% |
| 041_02 | Coyote Creek | 7 | 970 | Drummond willow | 56% | 2.76 | 3 | 3,000 | 8,000 | 40% | 3.76 | 3 | 3,000 | 10,000 | 2,000 | -16% |
| 041_02 | Coyote Creek | 8 | 640 | Drummond willow | 45% | 3.45 | 4 | 3,000 | 10,000 | 70% | 1.88 | 4 | 3,000 | 6,000 | (4,000) | 0% |
| 041_02 | Coyote Creek | 9 | 470 | Drummond willow | 45% | 3.45 | 4 | 2,000 | 7,000 | 50% | 3.14 | 4 | 2,000 | 6,000 | (1,000) | 0% |
| 041_02 | Coyote Creek | 10 | 45 | Drummond willow | 45% | 3.45 | 4 | 200 | 700 | 0% | 6.27 | 4 | 200 | 1,000 | 300 | -45% |
| 041_02 | Coyote Creek | 11 | 300 | Drummond willow | 45% | 3.45 | 4 | 1,000 | 3,000 | 40% | 3.76 | 4 | 1,000 | 4,000 | 1,000 | -5% |
| 041_02 | Coyote Creek | 12 | 240 | Drummond willow | 45% | 3.45 | 4 | 1,000 | 3,000 | 30% | 4.39 | 4 | 1,000 | 4,000 | 1,000 | -15% |
| 041_02 | Coyote Creek | 13 | 69 | beaver ponds | 0% | 6.27 | 4 | 300 | 2,000 | 0% | 6.27 | 4 | 300 | 2,000 | 0 | 0% |
| 041_02 | Coyote Creek | 14 | 340 | Drummond willow | 45% | 3.45 | 4 | 1,000 | 3,000 | 50% | 3.14 | 4 | 1,000 | 3,000 | 0 | 0% |
| 041_02 | Horse Wallow | 1 | 740 | aspen | 100% | 0.00 | 1 | 700 | 0 | 90% | 0.63 | 1 | 700 | 400 | 400 | -10% |
| 041_02 | Horse Wallow | 2 | 540 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 80% | 1.25 | 1 | 500 | 600 | 200 | -7% |
| 041_02 | Horse Wallow | 3 | 150 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 0% | 6.27 | 1 | 200 | 1,000 | 800 | -87% |
| 041_02 | Horse Wallow | 4 | 420 | Drummond willow | 87% | 0.82 | 1 | 400 | 300 | 70% | 1.88 | 1 | 400 | 800 | 500 | -17% |
| 041_02 | Horse Wallow | 5 | 400 | Drummond willow | 76% | 1.50 | 2 | 800 | 1,000 | 80% | 1.25 | 2 | 800 | 1,000 | 0 | 0% |
| 041_02 | Horse Wallow | 6 | 310 | Drummond willow | 76% | 1.50 | 2 | 600 | 900 | 70% | 1.88 | 2 | 600 | 1,000 | 100 | -6% |
| 041_02 | Horse Wallow | 7 | 130 | Drummond willow | 76% | 1.50 | 2 | 300 | 500 | 60% | 2.51 | 2 | 300 | 800 | 300 | -16% |
| 041_02 | Horse Wallow | 8 | 680 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 40% | 3.76 | 2 | 1,000 | 4,000 | 0 | 0% |
| 041_02 | trib to Horse Wallow | 1 | 680 | dry DF w/o Ppine | 94% | 0.38 | 1 | 700 | 300 | 90% | 0.63 | 1 | 700 | 400 | 100 | -4% |
| 041_02 | trib to Horse Wallow | 2 | 500 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 80% | 1.25 | 1 | 500 | 600 | 200 | -7% |
| 041_02 | trib to Horse Wallow | 3 | 280 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 70% | 1.88 | 1 | 300 | 600 | 400 | -17% |
| 041_02 | trib to Horse Wallow | 4 | 240 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 50% | 3.14 | 1 | 200 | 600 | 200 | -15% |
| | | | | | | | *Totals* | | 170,000 | | | | | 190,000 | 18,000 | |

**Table C-6. Existing and target solar loads for 2nd-order North Fork Big Lost River (ID17040218SK027_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 027_02 | 1st trib to NF | 1 | 450 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 027_02 | 1st trib to NF | 2 | 1200 | subalpine fir/moist | 96% | 0.25 | 1 | 1,000 | 300 | 90% | 0.63 | 1 | 1,000 | 600 | 300 | -6% |
| 027_02 | 2nd trib to NF | 1 | 680 | rock/bare/ephemeral | 0% | 6.27 | 1 | 700 | 4,000 | 0% | 6.27 | 1 | 700 | 4,000 | 0 | 0% |
| 027_02 | 2nd trib to NF | 2 | 370 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 027_02 | 2nd trib to NF | 3 | 730 | subalpine fir/WBP | 100% | 0.00 | 1 | 700 | 0 | 90% | 0.63 | 1 | 700 | 400 | 400 | -10% |
| 027_02 | 2nd trib to NF | 4 | 1400 | subalpine fir/moist | 96% | 0.25 | 1 | 1,000 | 300 | 90% | 0.63 | 1 | 1,000 | 600 | 300 | -6% |
| 027_02 | Hunter Creek | 1 | 510 | rock/bare/ephemeral | 0% | 6.27 | 1 | 500 | 3,000 | 0% | 6.27 | 1 | 500 | 3,000 | 0 | 0% |
| 027_02 | Hunter Creek | 2 | 170 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | Hunter Creek | 3 | 280 | subalpine fir/WBP | 100% | 0.00 | 1 | 300 | 0 | 90% | 0.63 | 1 | 300 | 200 | 200 | -10% |
| 027_02 | Hunter Creek | 4 | 64 | grass | 55% | 2.82 | 1 | 60 | 200 | 70% | 1.88 | 1 | 60 | 100 | (100) | 0% |
| 027_02 | Hunter Creek | 5 | 2000 | dry DF w/o Ppine | 94% | 0.38 | 2 | 4,000 | 2,000 | 90% | 0.63 | 2 | 4,000 | 3,000 | 1,000 | -4% |
| 027_02 | Hunter Creek | 6 | 2100 | dry DF w/o Ppine | 92% | 0.50 | 3 | 6,000 | 3,000 | 90% | 0.63 | 3 | 6,000 | 4,000 | 1,000 | -2% |
| 027_02 | Blind Creek | 1 | 550 | grass | 55% | 2.82 | 1 | 600 | 2,000 | 50% | 3.14 | 1 | 600 | 2,000 | 0 | -5% |
| 027_02 | Blind Creek | 2 | 1200 | Drummond willow | 87% | 0.82 | 1 | 1,000 | 800 | 70% | 1.88 | 1 | 1,000 | 2,000 | 1,000 | -17% |
| 027_02 | Blind Creek | 3 | 390 | DF/lodgepole-steep | 98% | 0.13 | 1 | 400 | 50 | 90% | 0.63 | 1 | 400 | 300 | 300 | -8% |
| 027_02 | Blind Creek | 4 | 640 | Drummond willow | 45% | 3.45 | 4 | 3,000 | 10,000 | 70% | 1.88 | 4 | 3,000 | 6,000 | (4,000) | 0% |
| 027_02 | tribs to Blind | 1 | 1400 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 027_02 | tribs to Blind | 2 | 1200 | subalpine fir/DF | 100% | 0.00 | 1 | 1,000 | 0 | 90% | 0.63 | 1 | 1,000 | 600 | 600 | -10% |
| 027_02 | tribs to Blind | 3 | 450 | rock/bare/ephemeral | 0% | 6.27 | 1 | 500 | 3,000 | 0% | 6.27 | 1 | 500 | 3,000 | 0 | 0% |
| 027_02 | tribs to Blind | 4 | 310 | grass | 55% | 2.82 | 1 | 300 | 800 | 50% | 3.14 | 1 | 300 | 900 | 100 | -5% |
| 027_02 | tribs to Blind | 5 | 1100 | subalpine fir/DF | 100% | 0.00 | 1 | 1,000 | 0 | 90% | 0.63 | 1 | 1,000 | 600 | 600 | -10% |
| 027_02 | tribs to Blind | 6 | 190 | DF/lodgepole-gentle | 100% | 0.00 | 2 | 400 | 0 | 90% | 0.63 | 2 | 400 | 300 | 300 | -10% |
| 027_02 | tribs to Blind | 7 | 260 | Drummond willow | 76% | 1.50 | 2 | 500 | 800 | 60% | 2.51 | 2 | 500 | 1,000 | 200 | -16% |
| 027_02 | tribs to Blind | 8 | 440 | subalpine fir/moist | 96% | 0.25 | 2 | 900 | 200 | 80% | 1.25 | 2 | 900 | 1,000 | 800 | -16% |
| 027_02 | tribs to Blind | 9 | 360 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 027_02 | tribs to Blind | 10 | 460 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 80% | 1.25 | 1 | 500 | 600 | 200 | -7% |
| 027_02 | tribs to Blind | 11 | 890 | subalpine fir/DF | 100% | 0.00 | 2 | 2,000 | 0 | 90% | 0.63 | 2 | 2,000 | 1,000 | 1,000 | -10% |
| 027_02 | tribs to Blind | 12 | 490 | dry DF w/o Ppine | 92% | 0.50 | 3 | 1,000 | 500 | 70% | 1.88 | 3 | 1,000 | 2,000 | 2,000 | -22% |
| 027_02 | tribs to Blind | 13 | 580 | lemon willow | 35% | 4.08 | 3 | 2,000 | 8,000 | 50% | 3.14 | 3 | 2,000 | 6,000 | (2,000) | 0% |
| 027_02 | tribs to Blind | 14 | 1400 | rock/bare/ephemeral | 0% | 6.27 | 1 | 1,000 | 6,000 | 0% | 6.27 | 1 | 1,000 | 6,000 | 0 | 0% |
| 027_02 | tribs to Blind | 15 | 220 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | tribs to Blind | 16 | 200 | subalpine fir/DF | 100% | 0.00 | 1 | 200 | 0 | 90% | 0.63 | 1 | 200 | 100 | 100 | -10% |
| 027_02 | tribs to Blind | 17 | 140 | rock/bare/ephemeral | 10% | 5.64 | 1 | 100 | 600 | 10% | 5.64 | 1 | 100 | 600 | 0 | 0% |
| 027_02 | tribs to Blind | 18 | 190 | grass | 31% | 4.33 | 2 | 400 | 2,000 | 30% | 4.39 | 2 | 400 | 2,000 | 0 | -1% |
| 027_02 | tribs to Blind | 19 | 1700 | subalpine fir/moist | 96% | 0.25 | 2 | 3,000 | 800 | 90% | 0.63 | 2 | 3,000 | 2,000 | 1,000 | -6% |
| 027_02 | tribs to Blind | 20 | 290 | beaver ponds | 0% | 6.27 | 4 | 1,000 | 6,000 | 0% | 6.27 | 4 | 1,000 | 6,000 | 0 | 0% |
| 027_02 | tribs to Blind | 21 | 310 | lemon willow | 27% | 4.58 | 4 | 1,000 | 5,000 | 40% | 3.76 | 4 | 1,000 | 4,000 | (1,000) | 0% |
| 027_02 | tribs to Blind | 22 | 1200 | lemon willow | 27% | 4.58 | 4 | 5,000 | 20,000 | 30% | 4.39 | 4 | 5,000 | 20,000 | 0 | 0% |
| 027_02 | tribs to Blind | 23 | 350 | lemon willow | 27% | 4.58 | 4 | 1,000 | 5,000 | 60% | 2.51 | 4 | 1,000 | 3,000 | (2,000) | 0% |
| 027_02 | tribs to Blind | 24 | 500 | lemon willow | 27% | 4.58 | 4 | 2,000 | 9,000 | 40% | 3.76 | 4 | 2,000 | 8,000 | (1,000) | 0% |

**Table C-6 (cont.) Existing and target solar loads for 2nd-order North Fork Big Lost River (ID17040218SK027_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 027_02 | Bear Creek | 1 | 580 | grass | 55% | 2.82 | 1 | 600 | 2,000 | 50% | 3.14 | 1 | 600 | 2,000 | 0 | -5% |
| 027_02 | Bear Creek | 2 | 580 | subalpine fir/moist | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 027_02 | Bear Creek | 3 | 180 | grass | 55% | 2.82 | 1 | 200 | 600 | 30% | 4.39 | 1 | 200 | 900 | 300 | -25% |
| 027_02 | Bear Creek | 4 | 450 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 70% | 1.88 | 1 | 500 | 900 | 500 | -17% |
| 027_02 | Bear Creek | 5 | 670 | subalpine fir/dry-steep | 99% | 0.06 | 2 | 1,000 | 60 | 90% | 0.63 | 2 | 1,000 | 600 | 500 | -9% |
| 027_02 | Bear Creek | 6 | 460 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | 0% |
| 027_02 | Bear Creek | 7 | 820 | DF/lodgepole-gentle | 100% | 0.00 | 2 | 2,000 | 0 | 90% | 0.63 | 2 | 2,000 | 1,000 | 1,000 | -10% |
| 027_02 | Bear Creek | 8 | 250 | Drummond willow | 76% | 1.50 | 2 | 500 | 800 | 80% | 1.25 | 2 | 500 | 600 | (200) | 0% |
| 027_02 | Bear Creek | 9 | 80 | Drummond willow | 76% | 1.50 | 2 | 200 | 300 | 70% | 1.88 | 2 | 200 | 400 | 100 | -6% |
| 027_02 | 6th trib to NF | 1 | 1100 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 027_02 | 6th trib to NF | 2 | 350 | aspen | 100% | 0.00 | 1 | 400 | 0 | 80% | 1.25 | 1 | 400 | 500 | 500 | -20% |
| 027_02 | 6th trib to NF | 3 | 330 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 20% | 5.02 | 1 | 300 | 2,000 | 1,000 | -45% |
| 027_02 | 6th trib to NF | 4 | 54 | beaver ponds | 0% | 6.27 | 1 | 50 | 300 | 0% | 6.27 | 1 | 50 | 300 | 0 | 0% |
| 027_02 | Squib Canyon | 1 | 460 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 027_02 | Squib Canyon | 2 | 400 | Drummond willow | 87% | 0.82 | 1 | 400 | 300 | 80% | 1.25 | 1 | 400 | 500 | 200 | -7% |
| 027_02 | Squib Canyon | 3 | 240 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | Squib Canyon | 4 | 250 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | Squib Canyon | 5 | 190 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 30% | 4.39 | 1 | 200 | 900 | 700 | -57% |
| 027_02 | Squib Canyon | 6 | 110 | dry DF w/o Ppine | 94% | 0.38 | 1 | 100 | 40 | 80% | 1.25 | 1 | 100 | 100 | 60 | -14% |
| 027_02 | Squib Canyon | 7 | 87 | Drummond willow | 87% | 0.82 | 1 | 90 | 70 | 30% | 4.39 | 1 | 90 | 400 | 300 | -57% |
| 027_02 | Squib Canyon | 8 | 180 | dry DF w/o Ppine | 94% | 0.38 | 2 | 400 | 200 | 80% | 1.25 | 2 | 400 | 500 | 300 | -14% |
| 027_02 | Squib Canyon | 9 | 180 | Drummond willow | 76% | 1.50 | 2 | 400 | 600 | 30% | 4.39 | 2 | 400 | 2,000 | 1,000 | -46% |
| 027_02 | Squib Canyon | 10 | 220 | dry DF w/o Ppine | 94% | 0.38 | 2 | 400 | 200 | 80% | 1.25 | 2 | 400 | 500 | 300 | -14% |
| 027_02 | Squib Canyon | 11 | 1100 | dry DF w/o Ppine | 94% | 0.38 | 2 | 2,000 | 800 | 90% | 0.63 | 2 | 2,000 | 1,000 | 200 | -4% |
| 027_02 | Squib Canyon | 12 | 290 | Drummond willow | 76% | 1.50 | 2 | 600 | 900 | 60% | 2.51 | 2 | 600 | 2,000 | 1,000 | -16% |
| 027_02 | 8th trib to NF | 1 | 1400 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 027_02 | 8th trib to NF | 2 | 280 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 40% | 3.76 | 1 | 300 | 1,000 | 300 | -25% |
| 027_02 | Glide Canyon | 1 | 230 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | Glide Canyon | 2 | 200 | dry DF w/o Ppine | 94% | 0.38 | 1 | 200 | 80 | 80% | 1.25 | 1 | 200 | 300 | 200 | -14% |
| 027_02 | Glide Canyon | 3 | 340 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 40% | 3.76 | 1 | 300 | 1,000 | 300 | -25% |
| 027_02 | Glide Canyon | 4 | 830 | dry DF w/o Ppine | 94% | 0.38 | 1 | 800 | 300 | 90% | 0.63 | 1 | 800 | 500 | 200 | -4% |
| 027_02 | Glide Canyon | 5 | 480 | dry DF w/o Ppine | 94% | 0.38 | 2 | 1,000 | 400 | 90% | 0.63 | 2 | 1,000 | 600 | 200 | -4% |
| 027_02 | Glide Canyon | 6 | 240 | Drummond willow | 76% | 1.50 | 2 | 500 | 800 | 40% | 3.76 | 2 | 500 | 2,000 | 1,000 | -36% |
| 027_02 | trib to Glide Canyon | 1 | 340 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 60% | 2.51 | 1 | 300 | 800 | 100 | -5% |
| 027_02 | trib to Glide Canyon | 2 | 1600 | dry DF w/o Ppine | 94% | 0.38 | 1 | 2,000 | 800 | 90% | 0.63 | 1 | 2,000 | 1,000 | 200 | -4% |
| 027_02 | Miller Canyon | 1 | 260 | grass | 55% | 2.82 | 1 | 300 | 800 | 50% | 3.14 | 1 | 300 | 900 | 100 | -5% |
| 027_02 | Miller Canyon | 2 | 440 | rock/bare/ephemeral | 0% | 6.27 | 1 | 400 | 3,000 | 0% | 6.27 | 1 | 400 | 3,000 | 0 | 0% |
| 027_02 | Miller Canyon | 3 | 500 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 027_02 | Miller Canyon | 4 | 330 | subalpine fir/moist | 96% | 0.25 | 1 | 300 | 80 | 90% | 0.63 | 1 | 300 | 200 | 100 | -6% |
| 027_02 | Miller Canyon | 5 | 190 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | Miller Canyon | 6 | 470 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | 0% |
| 027_02 | Miller Canyon | 7 | 530 | DF/lodgepole-gentle | 100% | 0.00 | 2 | 1,000 | 0 | 90% | 0.63 | 2 | 1,000 | 600 | 600 | -10% |
| 027_02 | Miller Canyon | 8 | 420 | Drummond willow | 76% | 1.50 | 2 | 800 | 1,000 | 70% | 1.88 | 2 | 800 | 2,000 | 1,000 | -6% |
| 027_02 | Miller Canyon | 9 | 2000 | dry DF w/o Ppine | 92% | 0.50 | 3 | 6,000 | 3,000 | 70% | 1.88 | 3 | 6,000 | 10,000 | 7,000 | -22% |
| 027_02 | Miller Canyon | 10 | 330 | Drummond willow | 56% | 2.76 | 3 | 1,000 | 3,000 | 40% | 3.76 | 3 | 1,000 | 4,000 | 1,000 | -16% |

**Table C-6 (cont.) Existing and target solar loads for 2nd-order North Fork Big Lost River (ID17040218SK027_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 027_02 | trib to Miller Canyon | 1 | 1700 | grass | 55% | 2.82 | 1 | 2,000 | 6,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 0 | -5% |
| 027_02 | trib to Miller Canyon | 2 | 460 | DF/lodgepole-gentle | 100% | 0.00 | 1 | 500 | 0 | 90% | 0.63 | 1 | 500 | 300 | 300 | -10% |
| 027_02 | Park Canyon | 1 | 930 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 027_02 | Park Canyon | 2 | 1300 | subalpine fir/moist | 96% | 0.25 | 1 | 1,000 | 300 | 90% | 0.63 | 1 | 1,000 | 600 | 300 | -6% |
| 027_02 | Park Canyon | 3 | 630 | dry DF w/o Ppine | 94% | 0.38 | 2 | 1,000 | 400 | 90% | 0.63 | 2 | 1,000 | 600 | 200 | -4% |
| 027_02 | Park Canyon | 4 | 520 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 70% | 1.88 | 2 | 1,000 | 2,000 | 0 | -6% |
| 027_02 | Corral Creek | 1 | 670 | rock/bare/ephemeral | 0% | 6.27 | 1 | 700 | 4,000 | 0% | 6.27 | 1 | 700 | 4,000 | 0 | 0% |
| 027_02 | Corral Creek | 2 | 1000 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 027_02 | Corral Creek | 3 | 410 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 60% | 2.51 | 1 | 400 | 1,000 | 100 | -5% |
| 027_02 | Corral Creek | 4 | 1200 | DF/lodgepole-steep | 98% | 0.13 | 2 | 2,000 | 300 | 90% | 0.63 | 2 | 2,000 | 1,000 | 700 | -8% |
| 027_02 | Corral Creek | 5 | 1000 | dry DF w/o Ppine | 94% | 0.38 | 2 | 2,000 | 800 | 90% | 0.63 | 2 | 2,000 | 1,000 | 200 | -4% |
| 027_02 | Toolbox Creek | 1 | 300 | dry DF w/o Ppine | 94% | 0.38 | 1 | 300 | 100 | 90% | 0.63 | 1 | 300 | 200 | 100 | -4% |
| 027_02 | Toolbox Creek | 2 | 340 | grass | 55% | 2.82 | 1 | 300 | 800 | 50% | 3.14 | 1 | 300 | 900 | 100 | -5% |
| 027_02 | Toolbox Creek | 3 | 190 | dry DF w/o Ppine | 94% | 0.38 | 1 | 200 | 80 | 90% | 0.63 | 1 | 200 | 100 | 20 | -4% |
| 027_02 | Toolbox Creek | 4 | 430 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 027_02 | Toolbox Creek | 5 | 820 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 027_02 | Toolbox Creek | 6 | 360 | Drummond willow | 76% | 1.50 | 2 | 700 | 1,000 | 30% | 4.39 | 2 | 700 | 3,000 | 2,000 | -46% |
| 027_02 | Toolbox Creek | 7 | 120 | Drummond willow | 76% | 1.50 | 2 | 200 | 300 | 80% | 1.25 | 2 | 200 | 300 | 0 | 0% |
| 027_02 | Chicken Creek | 1 | 76 | sage/grass | 65% | 2.19 | 1 | 80 | 200 | 60% | 2.51 | 1 | 80 | 200 | 0 | -5% |
| 027_02 | Chicken Creek | 2 | 300 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | Chicken Creek | 3 | 83 | Drummond willow | 87% | 0.82 | 1 | 80 | 70 | 30% | 4.39 | 1 | 80 | 400 | 300 | -57% |
| 027_02 | Chicken Creek | 4 | 360 | Drummond willow | 87% | 0.82 | 1 | 400 | 300 | 80% | 1.25 | 1 | 400 | 500 | 200 | -7% |
| 027_02 | Chicken Creek | 5 | 110 | Drummond willow | 87% | 0.82 | 1 | 100 | 80 | 50% | 3.14 | 1 | 100 | 300 | 200 | -37% |
| 027_02 | Chicken Creek | 6 | 280 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | Chicken Creek | 7 | 84 | Drummond willow | 87% | 0.82 | 1 | 80 | 70 | 40% | 3.76 | 1 | 80 | 300 | 200 | -47% |
| 027_02 | Chicken Creek | 8 | 130 | Drummond willow | 87% | 0.82 | 1 | 100 | 80 | 70% | 1.88 | 1 | 100 | 200 | 100 | -17% |
| 027_02 | Chicken Creek | 9 | 150 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 30% | 4.39 | 1 | 200 | 900 | 500 | -35% |
| 027_02 | Chicken Creek | 10 | 190 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 70% | 1.88 | 1 | 200 | 400 | 200 | -17% |
| 027_02 | Chicken Creek | 11 | 110 | sage/grass | 39% | 3.82 | 2 | 200 | 800 | 50% | 3.14 | 2 | 200 | 600 | (200) | 0% |
| 027_02 | Chicken Creek | 12 | 1200 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 027_02 | Chicken Creek | 13 | 740 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 80% | 1.25 | 2 | 1,000 | 1,000 | (1,000) | 0% |
| 027_02 | Chicken Creek | 14 | 730 | Drummond willow | 56% | 2.76 | 3 | 2,000 | 6,000 | 70% | 1.88 | 3 | 2,000 | 4,000 | (2,000) | 0% |
| 027_02 | Chicken Creek | 15 | 85 | Drummond willow | 56% | 2.76 | 3 | 300 | 800 | 40% | 3.76 | 3 | 300 | 1,000 | 200 | -16% |
| 027_02 | Chicken Creek | 16 | 380 | Drummond willow | 56% | 2.76 | 3 | 1,000 | 3,000 | 30% | 4.39 | 3 | 1,000 | 4,000 | 1,000 | -26% |
| 027_02 | Chicken Creek | 17 | 73 | Drummond willow | 56% | 2.76 | 3 | 200 | 600 | 70% | 1.88 | 3 | 200 | 400 | (200) | 0% |
| 027_02 | Chicken Creek | 18 | 380 | sage/grass | 27% | 4.58 | 3 | 1,000 | 5,000 | 20% | 5.02 | 3 | 1,000 | 5,000 | 0 | -7% |
| 027_02 | trib to Chicken | 1 | 630 | sage/grass | 65% | 2.19 | 1 | 600 | 1,000 | 60% | 2.51 | 1 | 600 | 2,000 | 1,000 | -5% |
| 027_02 | trib to Chicken | 2 | 670 | dry DF w/o Ppine | 94% | 0.38 | 1 | 700 | 300 | 90% | 0.63 | 1 | 700 | 400 | 100 | -4% |
| 027_02 | trib to Chicken | 3 | 320 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | 14th trib to NF | 1 | 450 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 027_02 | 14th trib to NF | 2 | 1000 | DF/lodgepole-steep | 98% | 0.13 | 1 | 1,000 | 100 | 90% | 0.63 | 1 | 1,000 | 600 | 500 | -8% |
| 027_02 | 14th trib to NF | 3 | 670 | Drummond willow | 87% | 0.82 | 1 | 700 | 600 | 80% | 1.25 | 1 | 700 | 900 | 300 | -7% |
| 027_02 | Zipper Creek | 1 | 760 | sage/grass | 65% | 2.19 | 1 | 800 | 2,000 | 60% | 2.51 | 1 | 800 | 2,000 | 0 | -5% |
| 027_02 | Zipper Creek | 2 | 400 | aspen | 100% | 0.00 | 1 | 400 | 0 | 80% | 1.25 | 1 | 400 | 500 | 500 | -20% |
| 027_02 | Zipper Creek | 3 | 310 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |

**Table C-6 (cont.) Existing and target solar loads for 2nd-order North Fork Big Lost River (ID17040218SK027_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/ day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/ day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 027_02 | Horse Creek | 1 | 1500 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 60% | 2.51 | 1 | 2,000 | 5,000 | 1,000 | -5% |
| 027_02 | Horse Creek | 2 | 550 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 80% | 1.25 | 2 | 1,000 | 1,000 | (1,000) | 0% |
| 027_02 | Horse Creek | 3 | 440 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 60% | 2.51 | 2 | 900 | 2,000 | 1,000 | -16% |
| 027_02 | Horse Creek | 4 | 58 | Drummond willow | 76% | 1.50 | 2 | 100 | 200 | 30% | 4.39 | 2 | 100 | 400 | 200 | -46% |
| 027_02 | Horse Creek | 5 | 560 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 60% | 2.51 | 2 | 1,000 | 3,000 | 1,000 | -16% |
| 027_02 | Horse Creek | 6 | 330 | Drummond willow | 76% | 1.50 | 2 | 700 | 1,000 | 30% | 4.39 | 2 | 700 | 3,000 | 2,000 | -46% |
| 027_02 | Horse Creek | 7 | 56 | sage/grass | 39% | 3.82 | 2 | 100 | 400 | 20% | 5.02 | 2 | 100 | 500 | 100 | -19% |
| 027_02 | 17th trib to NF | 1 | 270 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 50% | 3.14 | 1 | 300 | 900 | 700 | -37% |
| 027_02 | 17th trib to NF | 2 | 450 | aspen | 100% | 0.00 | 1 | 500 | 0 | 80% | 1.25 | 1 | 500 | 600 | 600 | -20% |
| 027_02 | 17th trib to NF | 3 | 760 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 50% | 3.14 | 1 | 800 | 3,000 | 2,000 | -37% |
| 027_02 | 17th trib to NF | 4 | 320 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 70% | 1.88 | 1 | 300 | 600 | 400 | -17% |
| 027_02 | Little Burnt Creek | 1 | 1100 | subalpine fir/dry-steep | 99% | 0.06 | 1 | 1,000 | 60 | 90% | 0.63 | 1 | 1,000 | 600 | 500 | -9% |
| 027_02 | Little Burnt Creek | 2 | 100 | grass | 55% | 2.82 | 1 | 100 | 300 | 50% | 3.14 | 1 | 100 | 300 | 0 | -5% |
| 027_02 | Little Burnt Creek | 3 | 540 | DF/lodgepole-steep | 98% | 0.13 | 1 | 500 | 60 | 90% | 0.63 | 1 | 500 | 300 | 200 | -8% |
| 027_02 | Little Burnt Creek | 4 | 740 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 80% | 1.25 | 2 | 1,000 | 1,000 | (1,000) | 0% |
| 027_02 | Little Burnt Creek | 5 | 120 | Drummond willow | 76% | 1.50 | 2 | 200 | 300 | 60% | 2.51 | 2 | 200 | 500 | 200 | -16% |
| 027_02 | Little Burnt Creek | 6 | 1000 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 027_02 | Little Burnt Creek | 7 | 150 | Drummond willow | 76% | 1.50 | 2 | 300 | 500 | 50% | 3.14 | 2 | 300 | 900 | 400 | -26% |
| 027_02 | Little Burnt Creek | 8 | 47 | Drummond willow | 76% | 1.50 | 2 | 90 | 100 | 70% | 1.88 | 2 | 90 | 200 | 100 | -6% |
| 027_02 | Little Burnt Creek | 9 | 50 | beaver ponds | 0% | 6.27 | 2 | 100 | 600 | 0% | 6.27 | 2 | 100 | 600 | 0 | 0% |
| 027_02 | Little Burnt Creek | 10 | 48 | Drummond willow | 76% | 1.50 | 2 | 100 | 200 | 30% | 4.39 | 2 | 100 | 400 | 200 | -46% |
| 027_02 | Grasshopper Creek | 1 | 1500 | grass | 55% | 2.82 | 1 | 2,000 | 6,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 0 | -5% |
| 027_02 | Grasshopper Creek | 2 | 490 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 60% | 2.51 | 1 | 500 | 1,000 | 600 | -27% |
| 027_02 | Grasshopper Creek | 3 | 560 | grass | 31% | 4.33 | 2 | 1,000 | 4,000 | 50% | 3.14 | 2 | 1,000 | 3,000 | (1,000) | 0% |
| 027_02 | Grasshopper Creek | 4 | 2200 | sage/grass | 39% | 3.82 | 2 | 4,000 | 20,000 | 40% | 3.76 | 2 | 4,000 | 20,000 | 0 | 0% |
| 027_02 | Grasshopper Creek | 5 | 1500 | Drummond willow | 56% | 2.76 | 3 | 5,000 | 10,000 | 70% | 1.88 | 3 | 5,000 | 9,000 | (1,000) | 0% |
| 027_02 | Grasshopper Creek | 6 | 100 | sage/grass | 27% | 4.58 | 3 | 300 | 1,000 | 30% | 4.39 | 3 | 300 | 1,000 | 0 | 0% |
| 027_02 | Grasshopper Creek | 7 | 100 | Drummond willow | 56% | 2.76 | 3 | 300 | 800 | 70% | 1.88 | 3 | 300 | 600 | (200) | 0% |
| 027_02 | Grasshopper Creek | 8 | 200 | sage/grass | 27% | 4.58 | 3 | 600 | 3,000 | 20% | 5.02 | 3 | 600 | 3,000 | 0 | -7% |
| 027_02 | Grasshopper Creek | 9 | 300 | Drummond willow | 56% | 2.76 | 3 | 900 | 2,000 | 70% | 1.88 | 3 | 900 | 2,000 | 0 | 0% |
| 027_02 | tribs to Grasshopper | 1 | 430 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 60% | 2.51 | 1 | 400 | 1,000 | 100 | -5% |
| 027_02 | tribs to Grasshopper | 2 | 190 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 80% | 1.25 | 1 | 200 | 300 | 100 | -7% |
| 027_02 | tribs to Grasshopper | 3 | 200 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 70% | 1.88 | 1 | 200 | 400 | 200 | -17% |
| 027_02 | tribs to Grasshopper | 4 | 60 | Drummond willow | 87% | 0.82 | 1 | 60 | 50 | 30% | 4.39 | 1 | 60 | 300 | 300 | -57% |
| 027_02 | tribs to Grasshopper | 5 | 330 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | tribs to Grasshopper | 6 | 240 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 30% | 4.39 | 1 | 200 | 900 | 700 | -57% |
| 027_02 | tribs to Grasshopper | 7 | 690 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 70% | 1.88 | 2 | 1,000 | 2,000 | 0 | -6% |
| 027_02 | tribs to Grasshopper | 8 | 450 | grass | 31% | 4.33 | 2 | 900 | 4,000 | 30% | 4.39 | 2 | 900 | 4,000 | 0 | -1% |
| 027_02 | tribs to Grasshopper | 9 | 500 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 30% | 4.39 | 2 | 1,000 | 4,000 | 0 | -9% |
| 027_02 | tribs to Grasshopper | 10 | 160 | grass | 31% | 4.33 | 2 | 300 | 1,000 | 30% | 4.39 | 2 | 300 | 1,000 | 0 | -1% |
| 027_02 | tribs to Grasshopper | 11 | 250 | Drummond willow | 76% | 1.50 | 2 | 500 | 800 | 50% | 3.14 | 2 | 500 | 2,000 | 1,000 | -26% |
| 027_02 | tribs to Grasshopper | 12 | 190 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 027_02 | tribs to Grasshopper | 13 | 270 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 027_02 | tribs to Grasshopper | 14 | 1400 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 027_02 | tribs to Grasshopper | 15 | 94 | Drummond willow | 87% | 0.82 | 1 | 90 | 70 | 80% | 1.25 | 1 | 90 | 100 | 30 | -7% |

**Table C-6 (cont.) Existing and target solar loads for 2nd-order North Fork Big Lost River (ID17040218SK027_02).**

| 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 |
| 027_02 | Bartlett Creek | 1 | 170 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 027_02 | Bartlett Creek | 2 | 570 | subalpine fir/moist | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 027_02 | Bartlett Creek | 3 | 130 | grass | 55% | 2.82 | 1 | 100 | 300 | 50% | 3.14 | 1 | 100 | 300 | 0 | -5% |
| 027_02 | Bartlett Creek | 4 | 260 | grass | 55% | 2.82 | 1 | 300 | 800 | 70% | 1.88 | 1 | 300 | 600 | (200) | 0% |
| 027_02 | Bartlett Creek | 5 | 330 | subalpine fir/moist | 96% | 0.25 | 1 | 300 | 80 | 90% | 0.63 | 1 | 300 | 200 | 100 | -6% |
| 027_02 | Bartlett Creek | 6 | 370 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 027_02 | Bartlett Creek | 7 | 1300 | DF/lodgepole-steep | 98% | 0.13 | 2 | 3,000 | 400 | 90% | 0.63 | 2 | 3,000 | 2,000 | 2,000 | -8% |
| 027_02 | Bartlett Creek | 8 | 430 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | 0% |
| 027_02 | Bartlett Creek | 9 | 100 | Drummond willow | 76% | 1.50 | 2 | 200 | 300 | 50% | 3.14 | 2 | 200 | 600 | 300 | -26% |
| 027_02 | Bartlett Creek | 10 | 920 | DF/lodgepole-steep | 98% | 0.13 | 3 | 3,000 | 400 | 90% | 0.63 | 3 | 3,000 | 2,000 | 2,000 | -8% |
| 027_02 | Bartlett Creek | 11 | 940 | Drummond willow | 56% | 2.76 | 3 | 3,000 | 8,000 | 80% | 1.25 | 3 | 3,000 | 4,000 | (4,000) | 0% |
| 027_02 | Bartlett Creek | 12 | 290 | Drummond willow | 56% | 2.76 | 3 | 900 | 2,000 | 50% | 3.14 | 3 | 900 | 3,000 | 1,000 | -6% |
| 027_02 | Bartlett Creek | 13 | 190 | Drummond willow | 56% | 2.76 | 3 | 600 | 2,000 | 20% | 5.02 | 3 | 600 | 3,000 | 1,000 | -36% |
| 027_02 | last trib to NF | 1 | 2100 | DF/lodgepole-steep | 98% | 0.13 | 1 | 2,000 | 300 | 90% | 0.63 | 1 | 2,000 | 1,000 | 700 | -8% |
| 027_02 | last trib to NF | 2 | 130 | Drummond willow | 76% | 1.50 | 2 | 300 | 500 | 60% | 2.51 | 2 | 300 | 800 | 300 | -16% |
| 027_02 | last trib to NF | 3 | 74 | Drummond willow | 76% | 1.50 | 2 | 100 | 200 | 30% | 4.39 | 2 | 100 | 400 | 200 | -46% |
| 027_02 | last trib to NF | 4 | 150 | Drummond willow | 76% | 1.50 | 2 | 300 | 500 | 80% | 1.25 | 2 | 300 | 400 | (100) | 0% |
| 027_02 | NF Big Lost River | 1 | 880 | rock/bare/ephemeral | 0% | 6.27 | 1 | 900 | 6,000 | 0% | 6.27 | 1 | 900 | 6,000 | 0 | 0% |
| 027_02 | NF Big Lost River | 2 | 290 | grass | 55% | 2.82 | 1 | 300 | 800 | 60% | 2.51 | 1 | 300 | 800 | 0 | 0% |
| 027_02 | NF Big Lost River | 3 | 320 | subalpine fir/WBP | 100% | 0.00 | 1 | 300 | 0 | 90% | 0.63 | 1 | 300 | 200 | 200 | -10% |
| 027_02 | NF Big Lost River | 4 | 330 | grass | 55% | 2.82 | 1 | 300 | 800 | 60% | 2.51 | 1 | 300 | 800 | 0 | 0% |
| 027_02 | NF Big Lost River | 5 | 430 | subalpine fir/moist | 96% | 0.25 | 2 | 900 | 200 | 90% | 0.63 | 2 | 900 | 600 | 400 | -6% |
| 027_02 | NF Big Lost River | 6 | 310 | grass | 31% | 4.33 | 2 | 600 | 3,000 | 50% | 3.14 | 2 | 600 | 2,000 | (1,000) | 0% |
| 027_02 | NF Big Lost River | 7 | 860 | subalpine fir/DF | 100% | 0.00 | 2 | 2,000 | 0 | 90% | 0.63 | 2 | 2,000 | 1,000 | 1,000 | -10% |
| 027_02 | NF Big Lost River | 8 | 970 | subalpine fir/moist | 95% | 0.31 | 3 | 3,000 | 900 | 90% | 0.63 | 3 | 3,000 | 2,000 | 1,000 | -5% |
| 027_02 | NF Big Lost River | 9 | 1300 | subalpine fir/moist | 95% | 0.31 | 3 | 4,000 | 1,000 | 80% | 1.25 | 3 | 4,000 | 5,000 | 4,000 | -15% |
| 027_02 | NF Big Lost River | 10 | 250 | subalpine fir/moist | 93% | 0.44 | 4 | 1,000 | 400 | 90% | 0.63 | 4 | 1,000 | 600 | 200 | -3% |
| 027_02 | NF Big Lost River | 11 | 1500 | Drummond willow | 45% | 3.45 | 4 | 6,000 | 20,000 | 80% | 1.25 | 4 | 6,000 | 8,000 | (10,000) | 0% |
| | | | | | | | *Totals* | | 320,000 | | | | | 370,000 | 48,000 | |

**Table C-7. Existing and target solar loads for 3rd-order North Fork Big Lost River (ID17040218SK027_03).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 027_03 | NF Big Lost River | 1 | 1000 | Drummond willow | 33% | 4.20 | 6 | 6,000 | 30,000 | 60% | 2.51 | 6 | 6,000 | 20,000 | (10,000) | 0% |
| 027_03 | NF Big Lost River | 2 | 240 | Drummond willow | 33% | 4.20 | 6 | 1,000 | 4,000 | 30% | 4.39 | 6 | 1,000 | 4,000 | 0 | -3% |
| 027_03 | NF Big Lost River | 3 | 200 | Drummond willow | 33% | 4.20 | 6 | 1,000 | 4,000 | 10% | 5.64 | 6 | 1,000 | 6,000 | 2,000 | -23% |
| 027_03 | NF Big Lost River | 4 | 81 | Drummond willow | 33% | 4.20 | 6 | 500 | 2,000 | 30% | 4.39 | 6 | 500 | 2,000 | 0 | -3% |
| 027_03 | NF Big Lost River | 5 | 210 | Drummond willow | 33% | 4.20 | 6 | 1,000 | 4,000 | 20% | 5.02 | 6 | 1,000 | 5,000 | 1,000 | -13% |
| 027_03 | NF Big Lost River | 6 | 500 | Drummond willow | 33% | 4.20 | 6 | 3,000 | 10,000 | 10% | 5.64 | 6 | 3,000 | 20,000 | 10,000 | -23% |
| 027_03 | NF Big Lost River | 7 | 440 | Drummond willow | 33% | 4.20 | 6 | 3,000 | 10,000 | 20% | 5.02 | 6 | 3,000 | 20,000 | 10,000 | -13% |
| 027_03 | NF Big Lost River | 8 | 870 | Drummond willow | 33% | 4.20 | 6 | 5,000 | 20,000 | 30% | 4.39 | 6 | 5,000 | 20,000 | 0 | -3% |
| 027_03 | NF Big Lost River | 9 | 830 | Drummond willow | 33% | 4.20 | 6 | 5,000 | 20,000 | 20% | 5.02 | 6 | 5,000 | 30,000 | 10,000 | -13% |
| 027_03 | NF Big Lost River | 10 | 2200 | Drummond willow | 29% | 4.45 | 7 | 20,000 | 90,000 | 10% | 5.64 | 7 | 20,000 | 100,000 | 10,000 | -19% |
| 027_03 | NF Big Lost River | 11 | 150 | Drummond willow | 29% | 4.45 | 7 | 1,000 | 4,000 | 0% | 6.27 | 7 | 1,000 | 6,000 | 2,000 | -29% |
| 027_03 | NF Big Lost River | 12 | 680 | Drummond willow | 29% | 4.45 | 7 | 5,000 | 20,000 | 30% | 4.39 | 7 | 5,000 | 20,000 | 0 | 0% |
| 027_03 | NF Big Lost River | 13 | 1250 | Drummond willow | 29% | 4.45 | 7 | 9,000 | 40,000 | 0% | 6.27 | 7 | 9,000 | 60,000 | 20,000 | -29% |
| 027_03 | NF Big Lost River | 14 | 240 | Drummond willow | 26% | 4.64 | 8 | 2,000 | 9,000 | 0% | 6.27 | 8 | 2,000 | 10,000 | 1,000 | -26% |
| 027_03 | NF Big Lost River | 15 | 160 | Drummond willow | 26% | 4.64 | 8 | 1,000 | 5,000 | 20% | 5.02 | 8 | 1,000 | 5,000 | 0 | -6% |
| 027_03 | NF Big Lost River | 16 | 1200 | Drummond willow | 26% | 4.64 | 8 | 10,000 | 50,000 | 0% | 6.27 | 8 | 10,000 | 60,000 | 10,000 | -26% |
| 027_03 | NF Big Lost River | 17 | 410 | Drummond willow | 26% | 4.64 | 8 | 3,000 | 10,000 | 10% | 5.64 | 8 | 3,000 | 20,000 | 10,000 | -16% |
| 027_03 | NF Big Lost River | 18 | 350 | Drummond willow | 26% | 4.64 | 8 | 3,000 | 10,000 | 0% | 6.27 | 8 | 3,000 | 20,000 | 10,000 | -26% |
| 027_03 | NF Big Lost River | 19 | 150 | Drummond willow | 26% | 4.64 | 8 | 1,000 | 5,000 | 10% | 5.64 | 8 | 1,000 | 6,000 | 1,000 | -16% |
| 027_03 | NF Big Lost River | 20 | 780 | Drummond willow | 26% | 4.64 | 8 | 6,000 | 30,000 | 0% | 6.27 | 8 | 6,000 | 40,000 | 10,000 | -26% |
| 027_03 | NF Big Lost River | 21 | 430 | Drummond willow | 26% | 4.64 | 8 | 3,000 | 10,000 | 10% | 5.64 | 8 | 3,000 | 20,000 | 10,000 | -16% |
| 027_03 | NF Big Lost River | 22 | 340 | Drummond willow | 26% | 4.64 | 8 | 3,000 | 10,000 | 0% | 6.27 | 8 | 3,000 | 20,000 | 10,000 | -26% |
| 027_03 | NF Big Lost River | 23 | 540 | Drummond willow | 23% | 4.83 | 9 | 5,000 | 20,000 | 10% | 5.64 | 9 | 5,000 | 30,000 | 10,000 | -13% |
| 027_03 | NF Big Lost River | 24 | 260 | Drummond willow | 23% | 4.83 | 9 | 2,000 | 10,000 | 0% | 6.27 | 9 | 2,000 | 10,000 | 0 | -23% |
| 027_03 | NF Big Lost River | 25 | 410 | Drummond willow | 23% | 4.83 | 9 | 4,000 | 20,000 | 10% | 5.64 | 9 | 4,000 | 20,000 | 0 | -13% |
| 027_03 | NF Big Lost River | 26 | 890 | Drummond willow | 23% | 4.83 | 9 | 8,000 | 40,000 | 0% | 6.27 | 9 | 8,000 | 50,000 | 10,000 | -23% |
| 027_03 | NF Big Lost River | 27 | 64 | Drummond willow | 23% | 4.83 | 9 | 600 | 3,000 | 10% | 5.64 | 9 | 600 | 3,000 | 0 | -13% |
| 027_03 | NF Big Lost River | 28 | 1300 | Drummond willow | 23% | 4.83 | 9 | 10,000 | 50,000 | 0% | 6.27 | 9 | 10,000 | 60,000 | 10,000 | -23% |
| 027_03 | NF Big Lost River | 29 | 190 | Drummond willow | 23% | 4.83 | 9 | 2,000 | 10,000 | 10% | 5.64 | 9 | 2,000 | 10,000 | 0 | -13% |
| 027_03 | NF Big Lost River | 30 | 1400 | Drummond willow | 23% | 4.83 | 9 | 10,000 | 50,000 | 0% | 6.27 | 9 | 10,000 | 60,000 | 10,000 | -23% |
| 027_03 | NF Big Lost River | 31 | 1400 | Drummond willow | 21% | 4.95 | 10 | 14,000 | 69,000 | 0% | 6.27 | 10 | 14,000 | 88,000 | 19,000 | -21% |
| 027_03 | NF Big Lost River | 32 | 100 | Drummond willow | 21% | 4.95 | 10 | 1,000 | 5,000 | 10% | 5.64 | 10 | 1,000 | 5,600 | 600 | -11% |
| 027_03 | NF Big Lost River | 33 | 560 | Drummond willow | 21% | 4.95 | 10 | 5,600 | 28,000 | 0% | 6.27 | 10 | 5,600 | 35,000 | 7,000 | -21% |
| 027_03 | NF Big Lost River | 34 | 130 | Drummond willow | 21% | 4.95 | 10 | 1,300 | 6,400 | 10% | 5.64 | 10 | 1,300 | 7,300 | 900 | -11% |
| 027_03 | NF Big Lost River | 35 | 480 | Drummond willow | 21% | 4.95 | 10 | 4,800 | 24,000 | 0% | 6.27 | 10 | 4,800 | 30,000 | 6,000 | -21% |
| 027_03 | NF Big Lost River | 36 | 490 | Drummond willow | 21% | 4.95 | 10 | 4,900 | 24,000 | 10% | 5.64 | 10 | 4,900 | 28,000 | 4,000 | -11% |
| 027_03 | NF Big Lost River | 37 | 260 | Drummond willow | 21% | 4.95 | 10 | 2,600 | 13,000 | 0% | 6.27 | 10 | 2,600 | 16,000 | 3,000 | -21% |
| 027_03 | NF Big Lost River | 38 | 420 | Drummond willow | 21% | 4.95 | 10 | 4,200 | 21,000 | 10% | 5.64 | 10 | 4,200 | 24,000 | 3,000 | -11% |
| | | | | | | | *Totals* | | 790,000 | | | | | 990,000 | 200,000 | |

**Table C-8. Existing and target solar loads for 2nd-order Star Hope Creek (ID17040218SK035_02).**

| 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 |
| 035_02 | Bellas Canyon | 1 | 140 | subalpine fir/moist | 98% | 0.13 | 1 | 100 | 10 | 90% | 0.63 | 1 | 100 | 60 | 50 | -8% |
| 035_02 | Bellas Canyon | 2 | 220 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 035_02 | Bellas Canyon | 3 | 190 | subalpine fir/moist | 96% | 0.25 | 1 | 200 | 50 | 80% | 1.25 | 1 | 200 | 300 | 300 | -16% |
| 035_02 | Bellas Canyon | 4 | 400 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 50% | 3.14 | 1 | 400 | 1,000 | 0 | -5% |
| 035_02 | Bellas Canyon | 5 | 1840 | subalpine fir/moist | 96% | 0.25 | 2 | 4,000 | 1,000 | 90% | 0.63 | 2 | 4,000 | 3,000 | 2,000 | -6% |
| 035_02 | Bellas Canyon | 6 | 1180 | dry DF w/o Ppine | 92% | 0.50 | 3 | 4,000 | 2,000 | 90% | 0.63 | 3 | 4,000 | 3,000 | 1,000 | -2% |
| 035_02 | Bellas Canyon | 7 | 290 | dry DF w/o Ppine | 92% | 0.50 | 3 | 900 | 500 | 80% | 1.25 | 3 | 900 | 1,000 | 500 | -12% |
| 035_02 | Bellas Canyon | 8 | 410 | lemon willow | 35% | 4.08 | 3 | 1,000 | 4,000 | 50% | 3.14 | 3 | 1,000 | 3,000 | (1,000) | 0% |
| 035_02 | Howell Canyon | 1 | 1300 | rock/bare/ephemeral | 0% | 6.27 | 1 | 1,000 | 6,000 | 0% | 6.27 | 1 | 1,000 | 6,000 | 0 | 0% |
| 035_02 | Howell Canyon | 2 | 2100 | DF/lodgepole-gentle | 100% | 0.00 | 1 | 2,000 | 0 | 90% | 0.63 | 1 | 2,000 | 1,000 | 1,000 | -10% |
| 035_02 | Howell Canyon | 3 | 180 | beaver ponds | 60% | 2.51 | 2 | 400 | 1,000 | 60% | 2.51 | 2 | 400 | 1,000 | 0 | 0% |
| 035_02 | Howell Canyon | 4 | 320 | lemon willow | 49% | 3.20 | 2 | 600 | 2,000 | 80% | 1.25 | 2 | 600 | 800 | (1,000) | 0% |
| 035_02 | Howell Canyon | 5 | 280 | beaver ponds | 60% | 2.51 | 2 | 600 | 2,000 | 60% | 2.51 | 2 | 600 | 2,000 | 0 | 0% |
| 035_02 | Howell Canyon | 6 | 600 | lemon willow | 49% | 3.20 | 2 | 1,000 | 3,000 | 60% | 2.51 | 2 | 1,000 | 3,000 | 0 | 0% |
| 035_02 | un-named trib | 1 | 700 | sage/grass | 65% | 2.19 | 1 | 700 | 2,000 | 50% | 3.14 | 1 | 700 | 2,000 | 0 | -15% |
| 035_02 | un-named trib | 2 | 1300 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 30% | 4.39 | 1 | 1,000 | 4,000 | 1,000 | -25% |
| 035_02 | un-named trib | 3 | 840 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| 035_02 | Ramey Creek | 1 | 560 | grass | 55% | 2.82 | 1 | 600 | 2,000 | 50% | 3.14 | 1 | 600 | 2,000 | 0 | -5% |
| 035_02 | Ramey Creek | 2 | 220 | subalpine fir/moist | 96% | 0.25 | 1 | 200 | 50 | 90% | 0.63 | 1 | 200 | 100 | 50 | -6% |
| 035_02 | Ramey Creek | 3 | 930 | grass/whitebark pine | 80% | 1.25 | 1 | 900 | 1,000 | 80% | 1.25 | 1 | 900 | 1,000 | 0 | 0% |
| 035_02 | Ramey Creek | 4 | 310 | grass | 55% | 2.82 | 1 | 300 | 800 | 50% | 3.14 | 1 | 300 | 900 | 100 | -5% |
| 035_02 | Ramey Creek | 5 | 1100 | subalpine fir/WBP | 100% | 0.00 | 1 | 1,000 | 0 | 80% | 1.25 | 1 | 1,000 | 1,000 | 1,000 | -20% |
| 035_02 | Ramey Creek | 6 | 760 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 035_02 | Ramey Creek | 7 | 380 | sage/grass | 39% | 3.82 | 2 | 800 | 3,000 | 30% | 4.39 | 2 | 800 | 4,000 | 1,000 | -9% |
| 035_02 | Ramey Creek | 8 | 300 | Drummond willow | 76% | 1.50 | 2 | 600 | 900 | 70% | 1.88 | 2 | 600 | 1,000 | 100 | -6% |
| 035_02 | Ramey Creek | 9 | 43 | Drummond willow | 56% | 2.76 | 3 | 100 | 300 | 30% | 4.39 | 3 | 100 | 400 | 100 | -26% |
| 035_02 | Ramey Creek | 10 | 260 | Drummond willow | 56% | 2.76 | 3 | 800 | 2,000 | 70% | 1.88 | 3 | 800 | 2,000 | 0 | 0% |
| 035_02 | Ramey Creek | 11 | 760 | DF/lodgepole-gentle | 99% | 0.06 | 3 | 2,000 | 100 | 80% | 1.25 | 3 | 2,000 | 3,000 | 3,000 | -19% |
| 035_02 | Ramey Creek | 12 | 810 | lemon willow | 35% | 4.08 | 3 | 2,000 | 8,000 | 60% | 2.51 | 3 | 2,000 | 5,000 | (3,000) | 0% |
| 035_02 | Ramey Creek | 13 | 190 | lemon willow | 35% | 4.08 | 3 | 600 | 2,000 | 0% | 6.27 | 3 | 600 | 4,000 | 2,000 | -35% |
| 035_02 | Ramey Creek | 14 | 160 | lemon willow | 35% | 4.08 | 3 | 500 | 2,000 | 40% | 3.76 | 3 | 500 | 2,000 | 0 | 0% |
| 035_02 | 1st to Ramey | 1 | 700 | rock/bare/ephemeral | 0% | 6.27 | 1 | 700 | 4,000 | 0% | 6.27 | 1 | 700 | 4,000 | 0 | 0% |
| 035_02 | 1st to Ramey | 2 | 980 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 035_02 | 1st to Ramey | 3 | 190 | Drummond willow | 87% | 0.82 | 1 | 200 | 200 | 80% | 1.25 | 1 | 200 | 300 | 100 | -7% |
| 035_02 | 1st to Ramey | 4 | 250 | subalpine fir/WBP | 99% | 0.06 | 2 | 500 | 30 | 80% | 1.25 | 2 | 500 | 600 | 600 | -19% |
| 035_02 | 1st to Ramey | 5 | 150 | grass | 31% | 4.33 | 2 | 300 | 1,000 | 50% | 3.14 | 2 | 300 | 900 | (100) | 0% |
| 035_02 | 1st to Ramey | 6 | 320 | subalpine fir/WBP | 99% | 0.06 | 2 | 600 | 40 | 80% | 1.25 | 2 | 600 | 800 | 800 | -19% |
| 035_02 | 2nd to Ramey | 1 | 1330 | subalpine fir/WBP | 100% | 0.00 | 1 | 1,000 | 0 | 90% | 0.63 | 1 | 1,000 | 600 | 600 | -10% |
| 035_02 | 2nd to Ramey | 2 | 1320 | subalpine fir/moist | 96% | 0.25 | 2 | 3,000 | 800 | 90% | 0.63 | 2 | 3,000 | 2,000 | 1,000 | -6% |
| 035_02 | 2nd to Ramey | 3 | 150 | grass | 31% | 4.33 | 2 | 300 | 1,000 | 30% | 4.39 | 2 | 300 | 1,000 | 0 | -1% |
| 035_02 | 2nd to Ramey | 4 | 63 | Drummond willow | 76% | 1.50 | 2 | 100 | 200 | 60% | 2.51 | 2 | 100 | 300 | 100 | -16% |
| 035_02 | un-named potholes | 1 | 2800 | sage/grass | 65% | 2.19 | 1 | 3,000 | 7,000 | 60% | 2.51 | 1 | 3,000 | 8,000 | 1,000 | -5% |
| 035_02 | un-named potholes | 2 | 620 | grass | 55% | 2.82 | 1 | 600 | 2,000 | 30% | 4.39 | 1 | 600 | 3,000 | 1,000 | -25% |
| 035_02 | un-named potholes | 3 | 200 | lemon willow | 80% | 1.25 | 1 | 200 | 300 | 60% | 2.51 | 1 | 200 | 500 | 200 | -20% |
| | | | | | | | *Totals* | | 81,000 | | | | | 95,000 | 15,000 | |

**Table C-9. Existing and target solar loads for lower 4th-order Star Hope Creek (ID17040218SK035_04).**

| 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 |
| 035_04 | Star Hope Creek | 1 | 55 | lemon willow | 12% | 5.52 | 9 | 500 | 3,000 | 20% | 5.02 | 14 | 800 | 4,000 | 1,000 | 0% |
| 035_04 | Star Hope Creek | 2 | 150 | lemon willow | 12% | 5.52 | 9 | 1,000 | 6,000 | 10% | 5.64 | 14 | 2,000 | 10,000 | 4,000 | -2% |
| 035_04 | Star Hope Creek | 3 | 300 | lemon willow | 12% | 5.52 | 9 | 3,000 | 20,000 | 10% | 5.64 | 14 | 4,000 | 20,000 | 0 | -2% |
| 035_04 | Star Hope Creek | 4 | 350 | lemon willow | 12% | 5.52 | 9 | 3,000 | 20,000 | 10% | 5.64 | 14 | 5,000 | 30,000 | 10,000 | -2% |
| 035_04 | Star Hope Creek | 5 | 420 | lemon willow | 12% | 5.52 | 9 | 4,000 | 20,000 | 0% | 6.27 | 14 | 6,000 | 40,000 | 20,000 | -12% |
| 035_04 | Star Hope Creek | 6 | 150 | lemon willow | 12% | 5.52 | 9 | 1,000 | 6,000 | 10% | 5.64 | 14 | 2,000 | 10,000 | 4,000 | -2% |
| 035_04 | Star Hope Creek | 7 | 690 | lemon willow | 12% | 5.52 | 9 | 6,000 | 30,000 | 0% | 6.27 | 14 | 10,000 | 60,000 | 30,000 | -12% |
| 035_04 | Star Hope Creek | 8 | 240 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 0% | 6.27 | 14 | 3,000 | 20,000 | 10,000 | -12% |
| 035_04 | Star Hope Creek | 9 | 220 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 10% | 5.64 | 14 | 3,000 | 20,000 | 10,000 | -2% |
| 035_04 | Star Hope Creek | 10 | 200 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 20% | 5.02 | 14 | 3,000 | 20,000 | 10,000 | 0% |
| 035_04 | Star Hope Creek | 11 | 140 | lemon willow | 12% | 5.52 | 9 | 1,000 | 6,000 | 0% | 6.27 | 14 | 2,000 | 10,000 | 4,000 | -12% |
| 035_04 | Star Hope Creek | 12 | 1100 | lemon willow | 12% | 5.52 | 9 | 10,000 | 60,000 | 10% | 5.64 | 14 | 20,000 | 100,000 | 40,000 | -2% |
| 035_04 | Star Hope Creek | 13 | 160 | lemon willow | 11% | 5.58 | 10 | 1,600 | 8,900 | 0% | 6.27 | 14 | 2,200 | 14,000 | 5,100 | -11% |
| 035_04 | Star Hope Creek | 14 | 270 | lemon willow | 11% | 5.58 | 10 | 2,700 | 15,000 | 10% | 5.64 | 14 | 3,800 | 21,000 | 6,000 | -1% |
| 035_04 | Star Hope Creek | 15 | 220 | lemon willow | 11% | 5.58 | 10 | 2,200 | 12,000 | 10% | 5.64 | 15 | 3,300 | 19,000 | 7,000 | -1% |
| 035_04 | Star Hope Creek | 16 | 350 | lemon willow | 11% | 5.58 | 10 | 3,500 | 20,000 | 10% | 5.64 | 15 | 5,300 | 30,000 | 10,000 | -1% |
| 035_04 | Star Hope Creek | 17 | 410 | lemon willow | 11% | 5.58 | 10 | 4,100 | 23,000 | 10% | 5.64 | 15 | 6,200 | 35,000 | 12,000 | -1% |
| 035_04 | Star Hope Creek | 18 | 570 | lemon willow | 11% | 5.58 | 10 | 5,700 | 32,000 | 0% | 6.27 | 15 | 8,600 | 54,000 | 22,000 | -11% |
| 035_04 | Star Hope Creek | 19 | 360 | lemon willow | 11% | 5.58 | 10 | 3,600 | 20,000 | 10% | 5.64 | 16 | 5,800 | 33,000 | 13,000 | -1% |
| 035_04 | Star Hope Creek | 20 | 1200 | lemon willow | 11% | 5.58 | 10 | 12,000 | 67,000 | 0% | 6.27 | 16 | 19,000 | 120,000 | 53,000 | -11% |
| 035_04 | Star Hope Creek | 21 | 110 | lemon willow | 11% | 5.58 | 10 | 1,100 | 6,100 | 0% | 6.27 | 17 | 1,900 | 12,000 | 5,900 | -11% |
| 035_04 | Star Hope Creek | 22 | 730 | lemon willow | 10% | 5.64 | 11 | 8,000 | 45,000 | 0% | 6.27 | 17 | 12,000 | 75,000 | 30,000 | -10% |
| 035_04 | Star Hope Creek | 23 | 260 | lemon willow | 10% | 5.64 | 11 | 2,900 | 16,000 | 10% | 5.64 | 17 | 4,400 | 25,000 | 9,000 | 0% |
| 035_04 | Star Hope Creek | 24 | 1400 | lemon willow | 10% | 5.64 | 11 | 15,000 | 85,000 | 0% | 6.27 | 18 | 25,000 | 160,000 | 75,000 | -10% |
| 035_04 | Star Hope Creek | 25 | 190 | lemon willow | 10% | 5.64 | 11 | 2,100 | 12,000 | 10% | 5.64 | 19 | 3,600 | 20,000 | 8,000 | 0% |
| 035_04 | Star Hope Creek | 26 | 1700 | lemon willow | 10% | 5.64 | 11 | 19,000 | 110,000 | 0% | 6.27 | 19 | 32,000 | 200,000 | 90,000 | -10% |
| 035_04 | Star Hope Creek | 27 | 270 | lemon willow | 10% | 5.64 | 11 | 3,000 | 17,000 | 10% | 5.64 | 20 | 5,400 | 30,000 | 13,000 | 0% |
| | | | | | | | *Totals* | | 690,000 | | | | | 1,200,000 | 500,000 | |

**Table C-10. Existing and target solar loads for upper 4th-order Star Hope Creek (ID17040218SK036_04).**

| 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 |
| 036_04 | Star Hope Creek | 1 | 110 | beaver ponds | 0% | 6.27 | 5 | 600 | 4,000 | 0% | 6.27 | 5 | 600 | 4,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 2 | 1400 | lemon willow | 22% | 4.89 | 5 | 7,000 | 30,000 | 20% | 5.02 | 5 | 7,000 | 40,000 | 10,000 | -2% |
| 036_04 | Star Hope Creek | 3 | 78 | beaver ponds | 0% | 6.27 | 20 | 1,600 | 10,000 | 0% | 6.27 | 20 | 1,600 | 10,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 4 | 180 | lemon willow | 18% | 5.14 | 6 | 1,000 | 5,000 | 20% | 5.02 | 7 | 1,000 | 5,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 5 | 360 | lemon willow | 18% | 5.14 | 6 | 2,000 | 10,000 | 10% | 5.64 | 7 | 3,000 | 20,000 | 10,000 | -8% |
| 036_04 | Star Hope Creek | 6 | 53 | lemon willow | 18% | 5.14 | 6 | 300 | 2,000 | 0% | 6.27 | 7 | 400 | 3,000 | 1,000 | -18% |
| 036_04 | Star Hope Creek | 7 | 180 | beaver ponds | 0% | 6.27 | 16 | 2,900 | 18,000 | 0% | 6.27 | 16 | 2,900 | 18,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 8 | 620 | lemon willow | 16% | 5.27 | 7 | 4,000 | 20,000 | 10% | 5.64 | 9 | 6,000 | 30,000 | 10,000 | -6% |
| 036_04 | Star Hope Creek | 9 | 210 | lemon willow | 16% | 5.27 | 7 | 1,000 | 5,000 | 20% | 5.02 | 9 | 2,000 | 10,000 | 5,000 | 0% |
| 036_04 | Star Hope Creek | 10 | 67 | lemon willow | 16% | 5.27 | 7 | 500 | 3,000 | 10% | 5.64 | 9 | 600 | 3,000 | 0 | -6% |
| 036_04 | Star Hope Creek | 11 | 710 | lemon willow | 16% | 5.27 | 7 | 5,000 | 30,000 | 20% | 5.02 | 9 | 6,000 | 30,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 12 | 140 | beaver ponds | 0% | 6.27 | 15 | 2,100 | 13,000 | 0% | 6.27 | 15 | 2,100 | 13,000 | 0 | 0% |
| 036_04 | Star Hope Creek | 13 | 890 | lemon willow | 14% | 5.39 | 8 | 7,000 | 40,000 | 0% | 6.27 | 11 | 10,000 | 60,000 | 20,000 | -14% |
| 036_04 | Star Hope Creek | 14 | 48 | beaver ponds | 0% | 6.27 | 16 | 770 | 4,800 | 0% | 6.27 | 16 | 770 | 4,800 | 0 | 0% |
| 036_04 | Star Hope Creek | 15 | 400 | lemon willow | 12% | 5.52 | 9 | 4,000 | 20,000 | 10% | 5.64 | 13 | 5,000 | 30,000 | 10,000 | -2% |
| 036_04 | Star Hope Creek | 16 | 440 | beaver ponds | 0% | 6.27 | 20 | 8,800 | 55,000 | 0% | 6.27 | 20 | 8,800 | 55,000 | 0 | 0% |
| | | | | | | | *Totals* | | 270,000 | | | | | 340,000 | 66,000 | |

**Table C-11. Existing and target solar loads for 2nd-order Summit Creek (ID17040218SK028_02).**

| 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 | Park Creek | 1 | 1300 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 028_02 | Park Creek | 2 | 590 | grass | 31% | 4.33 | 2 | 1,000 | 4,000 | 30% | 4.39 | 2 | 1,000 | 4,000 | 0 | -1% |
| 028_02 | Park Creek | 3 | 96 | Drummond willow | 76% | 1.50 | 2 | 200 | 300 | 70% | 1.88 | 2 | 200 | 400 | 100 | -6% |
| 028_02 | Park Creek | 4 | 120 | beaver ponds | 0% | 6.27 | 2 | 200 | 1,000 | 0% | 6.27 | 2 | 200 | 1,000 | 0 | 0% |
| 028_02 | Park Creek | 5 | 350 | Drummond willow | 76% | 1.50 | 2 | 700 | 1,000 | 70% | 1.88 | 2 | 700 | 1,000 | 0 | -6% |
| 028_02 | Little Fall Creek | 1 | 880 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 028_02 | Little Fall Creek | 2 | 720 | lemon willow | 80% | 1.25 | 1 | 700 | 900 | 70% | 1.88 | 1 | 700 | 1,000 | 100 | -10% |
| 028_02 | Little Fall Creek | 3 | 220 | lemon willow | 80% | 1.25 | 1 | 200 | 300 | 60% | 2.51 | 1 | 200 | 500 | 200 | -20% |
| 028_02 | Little Fall Creek | 4 | 360 | lemon willow | 80% | 1.25 | 1 | 400 | 500 | 50% | 3.14 | 1 | 400 | 1,000 | 500 | -30% |
| 028_02 | Little Fall Creek | 5 | 450 | grass | 31% | 4.33 | 2 | 900 | 4,000 | 30% | 4.39 | 2 | 900 | 4,000 | 0 | -1% |
| 028_02 | Little Fall Creek | 6 | 1100 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 50% | 3.14 | 2 | 2,000 | 6,000 | 3,000 | -26% |
| 028_02 | Little Fall Creek | 7 | 820 | grass | 31% | 4.33 | 2 | 2,000 | 9,000 | 30% | 4.39 | 2 | 2,000 | 9,000 | 0 | -1% |
| 028_02 | Little Fall Creek | 8 | 520 | Drummond willow | 56% | 2.76 | 3 | 2,000 | 6,000 | 40% | 3.76 | 3 | 2,000 | 8,000 | 2,000 | -16% |
| 028_02 | Little Fall Creek | 9 | 200 | Drummond willow | 56% | 2.76 | 3 | 600 | 2,000 | 50% | 3.14 | 3 | 600 | 2,000 | 0 | -6% |
| 028_02 | Little Fall Creek | 10 | 150 | grass | 21% | 4.95 | 3 | 500 | 2,000 | 30% | 4.39 | 3 | 500 | 2,000 | 0 | 0% |
| 028_02 | Little Fall Creek | 11 | 190 | Drummond willow | 56% | 2.76 | 3 | 600 | 2,000 | 50% | 3.14 | 3 | 600 | 2,000 | 0 | -6% |
| 028_02 | Little Fall Creek | 12 | 620 | dry DF w/o Ppine | 92% | 0.50 | 3 | 2,000 | 1,000 | 70% | 1.88 | 3 | 2,000 | 4,000 | 3,000 | -22% |
| 028_02 | Little Fall Creek | 13 | 410 | sage/grass | 27% | 4.58 | 3 | 1,000 | 5,000 | 20% | 5.02 | 3 | 1,000 | 5,000 | 0 | -7% |
| 028_02 | 3rd trib to Summit | 1 | 84 | grass | 55% | 2.82 | 1 | 80 | 200 | 50% | 3.14 | 1 | 80 | 300 | 100 | -5% |
| 028_02 | 3rd trib to Summit | 2 | 1600 | subalpine fir/moist | 96% | 0.25 | 1 | 2,000 | 500 | 90% | 0.63 | 1 | 2,000 | 1,000 | 500 | -6% |
| 028_02 | 3rd trib to Summit | 3 | 160 | dry DF w/o Ppine | 94% | 0.38 | 1 | 200 | 80 | 70% | 1.88 | 1 | 200 | 400 | 300 | -24% |
| 028_02 | Big Fall Creek | 1 | 1100 | rock/bare/ephemeral | 0% | 6.27 | 1 | 1,000 | 6,000 | 0% | 6.27 | 1 | 1,000 | 6,000 | 0 | 0% |
| 028_02 | Big Fall Creek | 2 | 510 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 50% | 3.14 | 1 | 500 | 2,000 | 2,000 | -37% |
| 028_02 | Big Fall Creek | 3 | 310 | subalpine fir/moist | 96% | 0.25 | 1 | 300 | 80 | 90% | 0.63 | 1 | 300 | 200 | 100 | -6% |
| 028_02 | Big Fall Creek | 4 | 700 | Drummond willow | 76% | 1.50 | 2 | 1,000 | 2,000 | 60% | 2.51 | 2 | 1,000 | 3,000 | 1,000 | -16% |
| 028_02 | Big Fall Creek | 5 | 890 | dry DF w/o Ppine | 94% | 0.38 | 2 | 2,000 | 800 | 80% | 1.25 | 2 | 2,000 | 3,000 | 2,000 | -14% |
| 028_02 | Big Fall Creek | 6 | 330 | Drummond willow | 76% | 1.50 | 2 | 700 | 1,000 | 60% | 2.51 | 2 | 700 | 2,000 | 1,000 | -16% |
| 028_02 | Big Fall Creek | 7 | 320 | dry DF w/o Ppine | 92% | 0.50 | 3 | 1,000 | 500 | 90% | 0.63 | 3 | 1,000 | 600 | 100 | -2% |
| 028_02 | Big Fall Creek | 8 | 230 | Drummond willow | 56% | 2.76 | 3 | 700 | 2,000 | 30% | 4.39 | 3 | 700 | 3,000 | 1,000 | -26% |
| 028_02 | Big Fall Creek | 9 | 220 | Drummond willow | 56% | 2.76 | 3 | 700 | 2,000 | 50% | 3.14 | 3 | 700 | 2,000 | 0 | -6% |
| 028_02 | Big Fall Creek | 10 | 850 | dry DF w/o Ppine | 92% | 0.50 | 3 | 3,000 | 2,000 | 80% | 1.25 | 3 | 3,000 | 4,000 | 2,000 | -12% |
| 028_02 | Big Fall Creek | 11 | 310 | Drummond willow | 56% | 2.76 | 3 | 900 | 2,000 | 30% | 4.39 | 3 | 900 | 4,000 | 2,000 | -26% |
| 028_02 | Big Fall Creek | 12 | 190 | dry DF w/o Ppine | 92% | 0.50 | 3 | 600 | 300 | 70% | 1.88 | 3 | 600 | 1,000 | 700 | -22% |
| 028_02 | trib to Big Fall | 1 | 1100 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 028_02 | trib to Big Fall | 2 | 610 | subalpine fir/moist | 96% | 0.25 | 1 | 600 | 200 | 80% | 1.25 | 1 | 600 | 800 | 600 | -16% |
| 028_02 | trib to Big Fall | 3 | 500 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 70% | 1.88 | 1 | 500 | 900 | 500 | -17% |
| 028_02 | Phi Kappa Creek | 1 | 1800 | grass | 55% | 2.82 | 1 | 2,000 | 6,000 | 50% | 3.14 | 1 | 2,000 | 6,000 | 0 | -5% |
| 028_02 | Phi Kappa Creek | 2 | 1200 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 70% | 1.88 | 2 | 2,000 | 4,000 | 1,000 | -6% |
| 028_02 | Phi Kappa Creek | 3 | 260 | Drummond willow | 76% | 1.50 | 2 | 500 | 800 | 30% | 4.39 | 2 | 500 | 2,000 | 1,000 | -46% |
| 028_02 | Phi Kappa Creek | 4 | 470 | Drummond willow | 76% | 1.50 | 2 | 900 | 1,000 | 80% | 1.25 | 2 | 900 | 1,000 | 0 | 0% |
| 028_02 | Phi Kappa Creek | 5 | 410 | DF/lodgepole-steep | 98% | 0.13 | 2 | 800 | 100 | 90% | 0.63 | 2 | 800 | 500 | 400 | -8% |
| 028_02 | Phi Kappa Creek | 6 | 320 | subalpine fir/moist | 96% | 0.25 | 2 | 600 | 200 | 90% | 0.63 | 2 | 600 | 400 | 200 | -6% |
| 028_02 | Phi Kappa Creek | 7 | 360 | sage/grass | 39% | 3.82 | 2 | 700 | 3,000 | 10% | 5.64 | 2 | 700 | 4,000 | 1,000 | -29% |

**Table C-11 (cont.) Existing and target solar loads for 2nd-order of Summit Creek (ID17040218SK028_02).**

| 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 | 6th trib to Summit | 1 | 810 | rock/bare/ephemeral | 0% | 6.27 | 1 | 800 | 5,000 | 0% | 6.27 | 1 | 800 | 5,000 | 0 | 0% |
| 028_02 | 6th trib to Summit | 2 | 520 | dry DF w/o Ppine | 94% | 0.38 | 1 | 500 | 200 | 90% | 0.63 | 1 | 500 | 300 | 100 | -4% |
| 028_02 | 6th trib to Summit | 3 | 840 | rock/bare/ephemeral | 0% | 6.27 | 1 | 800 | 5,000 | 0% | 6.27 | 1 | 800 | 5,000 | 0 | 0% |
| 028_02 | 7th trib to Summit | 1 | 890 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 028_02 | 7th trib to Summit | 2 | 1000 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 30% | 4.39 | 1 | 1,000 | 4,000 | 2,000 | -35% |
| 028_02 | 7th trib to Summit | 3 | 1400 | Drummond willow | 76% | 1.50 | 2 | 3,000 | 5,000 | 50% | 3.14 | 2 | 3,000 | 9,000 | 4,000 | -26% |
| 028_02 | 7th trib to Summit | 4 | 520 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 20% | 5.02 | 2 | 1,000 | 5,000 | 1,000 | -19% |
| 028_02 | 8th trib to Summit | 1 | 940 | grass | 55% | 2.82 | 1 | 900 | 3,000 | 50% | 3.14 | 1 | 900 | 3,000 | 0 | -5% |
| 028_02 | 8th trib to Summit | 2 | 500 | sage/grass | 65% | 2.19 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -15% |
| 028_02 | 8th trib to Summit | 3 | 650 | Drummond willow | 87% | 0.82 | 1 | 700 | 600 | 70% | 1.88 | 1 | 700 | 1,000 | 400 | -17% |
| 028_02 | 8th trib to Summit | 4 | 720 | sage/grass | 65% | 2.19 | 1 | 700 | 2,000 | 30% | 4.39 | 1 | 700 | 3,000 | 1,000 | -35% |
| 028_02 | 9th trib to Summit | 1 | 2100 | dry DF w/o Ppine | 94% | 0.38 | 1 | 2,000 | 800 | 90% | 0.63 | 1 | 2,000 | 1,000 | 200 | -4% |
| 028_02 | 9th trib to Summit | 2 | 97 | dry DF w/o Ppine | 94% | 0.38 | 2 | 200 | 80 | 90% | 0.63 | 2 | 200 | 100 | 20 | -4% |
| 028_02 | 9th trib to Summit | 3 | 770 | grass | 31% | 4.33 | 2 | 2,000 | 9,000 | 50% | 3.14 | 2 | 2,000 | 6,000 | (3,000) | 0% |
| 028_02 | 9th trib to Summit | 4 | 340 | sage/grass | 39% | 3.82 | 2 | 700 | 3,000 | 30% | 4.39 | 2 | 700 | 3,000 | 0 | -9% |
| 028_02 | Summit Creek | 1 | 1600 | lemon willow | 80% | 1.25 | 1 | 2,000 | 3,000 | 80% | 1.25 | 1 | 2,000 | 3,000 | 0 | 0% |
| 028_02 | Summit Creek | 2 | 860 | lemon willow | 80% | 1.25 | 1 | 900 | 1,000 | 50% | 3.14 | 1 | 900 | 3,000 | 2,000 | -30% |
| 028_02 | Summit Creek | 3 | 1400 | Drummond willow | 76% | 1.50 | 2 | 3,000 | 5,000 | 80% | 1.25 | 2 | 3,000 | 4,000 | (1,000) | 0% |
| 028_02 | Summit Creek | 4 | 390 | Drummond willow | 76% | 1.50 | 2 | 800 | 1,000 | 60% | 2.51 | 2 | 800 | 2,000 | 1,000 | -16% |
| 028_02 | Summit Creek | 5 | 220 | dry DF w/o Ppine | 94% | 0.38 | 2 | 400 | 200 | 80% | 1.25 | 2 | 400 | 500 | 300 | -14% |
| 028_02 | Summit Creek | 6 | 270 | lemon willow | 49% | 3.20 | 2 | 500 | 2,000 | 50% | 3.14 | 2 | 500 | 2,000 | 0 | 0% |
| 028_02 | Summit Creek | 7 | 2200 | dry DF w/o Ppine | 92% | 0.50 | 3 | 7,000 | 4,000 | 80% | 1.25 | 3 | 7,000 | 9,000 | 5,000 | -12% |
| 028_02 | Summit Creek | 8 | 310 | Drummond willow | 56% | 2.76 | 3 | 900 | 2,000 | 60% | 2.51 | 3 | 900 | 2,000 | 0 | 0% |
| 028_02 | Summit Creek | 9 | 300 | Drummond willow | 56% | 2.76 | 3 | 900 | 2,000 | 50% | 3.14 | 3 | 900 | 3,000 | 1,000 | -6% |
| 028_02 | Summit Creek | 10 | 260 | Drummond willow | 45% | 3.45 | 4 | 1,000 | 3,000 | 30% | 4.39 | 4 | 1,000 | 4,000 | 1,000 | -15% |
| 028_02 | Summit Creek | 11 | 190 | Drummond willow | 45% | 3.45 | 4 | 800 | 3,000 | 50% | 3.14 | 4 | 800 | 3,000 | 0 | 0% |
| 028_02 | Summit Creek | 12 | 86 | Drummond willow | 45% | 3.45 | 4 | 300 | 1,000 | 30% | 4.39 | 4 | 300 | 1,000 | 0 | -15% |
| 028_02 | Summit Creek | 13 | 130 | Drummond willow | 45% | 3.45 | 4 | 500 | 2,000 | 60% | 2.51 | 4 | 500 | 1,000 | (1,000) | 0% |
| 028_02 | Summit Creek | 14 | 150 | Drummond willow | 45% | 3.45 | 4 | 600 | 2,000 | 40% | 3.76 | 4 | 600 | 2,000 | 0 | 0% |
| 028_02 | Summit Creek | 15 | 170 | Drummond willow | 45% | 3.45 | 4 | 700 | 2,000 | 60% | 2.51 | 4 | 700 | 2,000 | 0 | 0% |
| 028_02 | Summit Creek | 16 | 640 | Drummond willow | 45% | 3.45 | 4 | 3,000 | 10,000 | 10% | 5.64 | 4 | 3,000 | 20,000 | 10,000 | -35% |
| 028_02 | Summit Creek | 17 | 850 | Drummond willow | 45% | 3.45 | 4 | 3,000 | 10,000 | 20% | 5.02 | 4 | 3,000 | 20,000 | 10,000 | -25% |
| 028_02 | Summit Creek | 18 | 520 | Drummond willow | 38% | 3.89 | 5 | 3,000 | 10,000 | 20% | 5.02 | 5 | 3,000 | 20,000 | 10,000 | -18% |
| 028_02 | Summit Creek | 19 | 120 | Drummond willow | 38% | 3.89 | 5 | 600 | 2,000 | 30% | 4.39 | 5 | 600 | 3,000 | 1,000 | -8% |
| 028_02 | Summit Creek | 20 | 340 | Drummond willow | 38% | 3.89 | 5 | 2,000 | 8,000 | 50% | 3.14 | 5 | 2,000 | 6,000 | (2,000) | 0% |
| 028_02 | Summit Creek | 21 | 470 | Drummond willow | 38% | 3.89 | 5 | 2,000 | 8,000 | 20% | 5.02 | 5 | 2,000 | 10,000 | 2,000 | -18% |
| 028_02 | Summit Creek | 22 | 280 | Drummond willow | 38% | 3.89 | 5 | 1,000 | 4,000 | 50% | 3.14 | 5 | 1,000 | 3,000 | (1,000) | 0% |
| 028_02 | Summit Creek | 23 | 270 | ponds | 0% | 6.27 | 5 | 1,000 | 6,000 | 10% | 5.64 | 5 | 1,000 | 6,000 | 0 | 0% |
| 028_02 | Summit Creek | 24 | 410 | Drummond willow | 38% | 3.89 | 5 | 2,000 | 8,000 | 10% | 5.64 | 5 | 2,000 | 10,000 | 2,000 | -28% |
| 028_02 | Summit Creek | 25 | 720 | Drummond willow | 33% | 4.20 | 6 | 4,000 | 20,000 | 20% | 5.02 | 6 | 4,000 | 20,000 | 0 | -13% |
| 028_02 | Summit Creek | 26 | 290 | Drummond willow | 33% | 4.20 | 6 | 2,000 | 8,000 | 30% | 4.39 | 6 | 2,000 | 9,000 | 1,000 | -3% |
| 028_02 | Summit Creek | 27 | 310 | Drummond willow | 33% | 4.20 | 6 | 2,000 | 8,000 | 20% | 5.02 | 6 | 2,000 | 10,000 | 2,000 | -13% |
| 028_02 | Summit Creek | 28 | 210 | Drummond willow | 33% | 4.20 | 6 | 1,000 | 4,000 | 30% | 4.39 | 6 | 1,000 | 4,000 | 0 | -3% |
| 028_02 | Summit Creek | 29 | 320 | Drummond willow | 33% | 4.20 | 6 | 2,000 | 8,000 | 10% | 5.64 | 6 | 2,000 | 10,000 | 2,000 | -23% |
| 028_02 | Summit Creek | 30 | 700 | Drummond willow | 33% | 4.20 | 6 | 4,000 | 20,000 | 30% | 4.39 | 6 | 4,000 | 20,000 | 0 | -3% |
| 028_02 | Summit Creek | 31 | 1700 | Drummond willow | 29% | 4.45 | 7 | 10,000 | 40,000 | 30% | 4.39 | 7 | 10,000 | 40,000 | 0 | 0% |
| 028_02 | Summit Creek | 32 | 120 | Drummond willow | 29% | 4.45 | 7 | 800 | 4,000 | 10% | 5.64 | 7 | 800 | 5,000 | 1,000 | -19% |
| 028_02 | Summit Creek | 33 | 720 | Drummond willow | 29% | 4.45 | 7 | 5,000 | 20,000 | 30% | 4.39 | 7 | 5,000 | 20,000 | 0 | 0% |
| 028_02 | Summit Creek | 34 | 190 | Drummond willow | 29% | 4.45 | 7 | 1,000 | 4,000 | 10% | 5.64 | 7 | 1,000 | 6,000 | 2,000 | -19% |
| 028_02 | Summit Creek | 35 | 200 | Drummond willow | 29% | 4.45 | 7 | 1,000 | 4,000 | 30% | 4.39 | 7 | 1,000 | 4,000 | 0 | 0% |
| | | | | | | | *Totals* | | 370,000 | | | | | 450,000 | 82,000 | |

**Table C-12. Existing and target solar loads for 3rd-order Summit Creek (ID17040218SK028_03).**

| 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_03 | Summit Creek | 1 | 370 | Drummond willow | 26% | 4.64 | 8 | 3,000 | 10,000 | 20% | 5.02 | 8 | 3,000 | 20,000 | 10,000 | -6% |
| 028_03 | Summit Creek | 2 | 280 | Drummond willow | 26% | 4.64 | 8 | 2,000 | 9,000 | 0% | 6.27 | 8 | 2,000 | 10,000 | 1,000 | -26% |
| 028_03 | Summit Creek | 3 | 240 | Drummond willow | 26% | 4.64 | 8 | 2,000 | 9,000 | 10% | 5.64 | 8 | 2,000 | 10,000 | 1,000 | -16% |
| | | | | | | | *Totals* | | 28,000 | | | | | 40,000 | 12,000 | |

**Table C-13. Existing and target solar loads for 2nd-order Warm Springs Creek (ID17040218SK043_02).**

| 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 |
| 043_02 | Warm Springs Creek | 1 | 160 | Yellow willow | 16% | 5.27 | 14 | 2,200 | 12,000 | 20% | 5.02 | 14 | 2,200 | 11,000 | (1,000) | 0% |
| 043_02 | Warm Springs Creek | 2 | 190 | Yellow willow | 16% | 5.27 | 14 | 2,700 | 14,000 | 10% | 5.64 | 14 | 2,700 | 15,000 | 1,000 | -6% |
| 043_02 | Warm Springs Creek | 3 | 410 | Yellow willow | 16% | 5.27 | 14 | 5,700 | 30,000 | 0% | 6.27 | 14 | 5,700 | 36,000 | 6,000 | -16% |
| 043_02 | Warm Springs Creek | 4 | 110 | Yellow willow | 16% | 5.27 | 14 | 1,500 | 7,900 | 10% | 5.64 | 14 | 1,500 | 8,500 | 600 | -6% |
| 043_02 | Warm Springs Creek | 5 | 2000 | Yellow willow | 16% | 5.27 | 14 | 28,000 | 150,000 | 0% | 6.27 | 14 | 28,000 | 180,000 | 30,000 | -16% |
| 043_02 | Warm Springs Creek | 6 | 510 | Yellow willow | 16% | 5.27 | 14 | 7,100 | 37,000 | 10% | 5.64 | 14 | 7,100 | 40,000 | 3,000 | -6% |
| 043_02 | Warm Springs Creek | 7 | 520 | Yellow willow | 16% | 5.27 | 14 | 7,300 | 38,000 | 0% | 6.27 | 14 | 7,300 | 46,000 | 8,000 | -16% |
| 043_02 | Warm Springs Creek | 8 | 770 | Yellow willow | 21% | 4.95 | 11 | 8,500 | 42,000 | 10% | 5.64 | 11 | 8,500 | 48,000 | 6,000 | -11% |
| 043_02 | Warm Springs Creek | 9 | 1100 | Yellow willow | 21% | 4.95 | 11 | 12,000 | 59,000 | 0% | 6.27 | 11 | 12,000 | 75,000 | 16,000 | -21% |
| 043_02 | Warm Springs Creek | 10 | 6200 | Yellow willow | 27% | 4.58 | 8 | 50,000 | 200,000 | 0% | 6.27 | 8 | 50,000 | 300,000 | 100,000 | -27% |
| 043_02 | Pole Stackyard Creek | 1 | 1800 | Yellow willow | 34% | 4.14 | 6 | 10,000 | 40,000 | 0% | 6.27 | 6 | 10,000 | 60,000 | 20,000 | -34% |
| 043_02 | Pole Stackyard Creek | 2 | 300 | Yellow willow | 34% | 4.14 | 6 | 2,000 | 8,000 | 10% | 5.64 | 6 | 2,000 | 10,000 | 2,000 | -24% |
| 043_02 | Pole Stackyard Creek | 3 | 120 | Yellow willow | 34% | 4.14 | 6 | 700 | 3,000 | 0% | 6.27 | 6 | 700 | 4,000 | 1,000 | -34% |
| 043_02 | Pole Stackyard Creek | 4 | 760 | Yellow willow | 34% | 4.14 | 6 | 5,000 | 20,000 | 10% | 5.64 | 6 | 5,000 | 30,000 | 10,000 | -24% |
| 043_02 | Pole Stackyard Creek | 5 | 440 | Yellow willow | 34% | 4.14 | 6 | 3,000 | 10,000 | 0% | 6.27 | 6 | 3,000 | 20,000 | 10,000 | -34% |
| 043_02 | Pole Stackyard Creek | 6 | 280 | Yellow willow | 34% | 4.14 | 6 | 2,000 | 8,000 | 10% | 5.64 | 6 | 2,000 | 10,000 | 2,000 | -24% |
| 043_02 | Pole Stackyard Creek | 7 | 1100 | Yellow willow | 34% | 4.14 | 6 | 7,000 | 30,000 | 0% | 6.27 | 6 | 7,000 | 40,000 | 10,000 | -34% |
| 043_02 | Pole Stackyard Creek | 8 | 260 | Yellow willow | 24% | 4.77 | 9 | 2,000 | 10,000 | 10% | 5.64 | 9 | 2,000 | 10,000 | 0 | -14% |
| 043_02 | Mackay hatchery to Warm Springs | 1 | 310 | Yellow willow | 30% | 4.39 | 7 | 2,000 | 9,000 | 0% | 6.27 | 7 | 2,000 | 10,000 | 1,000 | -30% |
| 043_02 | Mackay hatchery to Warm Springs | 2 | 240 | Yellow willow | 30% | 4.39 | 7 | 2,000 | 9,000 | 40% | 3.76 | 7 | 2,000 | 8,000 | (1,000) | 0% |
| 043_02 | Mackay hatchery to Warm Springs | 3 | 570 | Yellow willow | 30% | 4.39 | 7 | 4,000 | 20,000 | 0% | 6.27 | 7 | 4,000 | 30,000 | 10,000 | -30% |
| 043_02 | Mackay hatchery to Warm Springs | 4 | 110 | Yellow willow | 30% | 4.39 | 7 | 800 | 4,000 | 50% | 3.14 | 7 | 800 | 3,000 | (1,000) | 0% |
| 043_02 | Mackay hatchery to Warm Springs | 5 | 2700 | Yellow willow | 30% | 4.39 | 7 | 20,000 | 90,000 | 0% | 6.27 | 7 | 20,000 | 100,000 | 10,000 | -30% |
| 043_02 | Mackay hatchery to canal | 1 | 3900 | Yellow willow | 39% | 3.82 | 5 | 20,000 | 80,000 | 0% | 6.27 | 5 | 20,000 | 100,000 | 20,000 | -39% |
| 043_02 | Garden Creek | 1 | 290 | grass | 55% | 2.82 | 1 | 300 | 800 | 60% | 2.51 | 1 | 300 | 800 | 0 | 0% |
| 043_02 | Garden Creek | 2 | 580 | aspen | 100% | 0.00 | 1 | 600 | 0 | 90% | 0.63 | 1 | 600 | 400 | 400 | -10% |
| 043_02 | Garden Creek | 3 | 310 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 80% | 1.25 | 1 | 300 | 400 | 200 | -7% |
| 043_02 | Garden Creek | 4 | 1100 | alder | 91% | 0.56 | 1 | 1,000 | 600 | 90% | 0.63 | 1 | 1,000 | 600 | 0 | -1% |
| 043_02 | Garden Creek | 5 | 1700 | aspen | 99% | 0.06 | 2 | 3,000 | 200 | 80% | 1.25 | 2 | 3,000 | 4,000 | 4,000 | -19% |
| 043_02 | Garden Creek | 6 | 210 | Drummond willow | 76% | 1.50 | 2 | 400 | 600 | 40% | 3.76 | 2 | 400 | 2,000 | 1,000 | -36% |
| 043_02 | Garden Creek | 7 | 380 | Drummond willow | 56% | 2.76 | 3 | 1,000 | 3,000 | 50% | 3.14 | 3 | 1,000 | 3,000 | 0 | -6% |
| 043_02 | Garden Creek | 8 | 1300 | sage/grass | 27% | 4.58 | 3 | 4,000 | 20,000 | 40% | 3.76 | 3 | 4,000 | 20,000 | 0 | 0% |
| 043_02 | Garden Creek | 9 | 590 | sage/grass | 27% | 4.58 | 3 | 2,000 | 9,000 | 20% | 5.02 | 3 | 2,000 | 10,000 | 1,000 | -7% |
| 043_02 | trib to Garden | 1 | 170 | dry DF w/o Ppine | 96% | 0.25 | 1 | 200 | 50 | 90% | 0.63 | 1 | 200 | 100 | 50 | -6% |
| 043_02 | trib to Garden | 2 | 420 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 60% | 2.51 | 1 | 400 | 1,000 | 0 | 0% |
| 043_02 | trib to Garden | 3 | 510 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 80% | 1.25 | 1 | 500 | 600 | 200 | -7% |
| 043_02 | trib to Garden | 4 | 980 | alder | 91% | 0.56 | 1 | 1,000 | 600 | 90% | 0.63 | 1 | 1,000 | 600 | 0 | -1% |
| 043_02 | trib to Garden | 5 | 810 | sage/grass | 65% | 2.19 | 1 | 800 | 2,000 | 60% | 2.51 | 1 | 800 | 2,000 | 0 | -5% |

**Table C-13 (cont.) Existing and target solar loads for 2nd-order Warm Springs Creek (ID17040218SK043_02).**

| 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 |
| 043_02 | Boone Creek | 1 | 790 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 90% | 0.63 | 1 | 800 | 500 | (200) | 0% |
| 043_02 | Boone Creek | 2 | 680 | aspen | 100% | 0.00 | 1 | 700 | 0 | 90% | 0.63 | 1 | 700 | 400 | 400 | -10% |
| 043_02 | Boone Creek | 3 | 710 | Drummond willow | 87% | 0.82 | 1 | 700 | 600 | 90% | 0.63 | 1 | 700 | 400 | (200) | 0% |
| 043_02 | Boone Creek | 4 | 920 | aspen | 100% | 0.00 | 1 | 900 | 0 | 90% | 0.63 | 1 | 900 | 600 | 600 | -10% |
| 043_02 | Boone Creek | 5 | 2500 | aspen | 99% | 0.06 | 2 | 5,000 | 300 | 80% | 1.25 | 2 | 5,000 | 6,000 | 6,000 | -19% |
| 043_02 | Boone Creek | 6 | 860 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| 043_02 | trib to Boone | 1 | 300 | DF/lodgepole-gentle | 100% | 0.00 | 1 | 300 | 0 | 90% | 0.63 | 1 | 300 | 200 | 200 | -10% |
| 043_02 | trib to Boone | 2 | 1000 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 0 | 0% |
| 043_02 | trib to Boone | 3 | 1600 | aspen | 100% | 0.00 | 1 | 2,000 | 0 | 90% | 0.63 | 1 | 2,000 | 1,000 | 1,000 | -10% |
| 043_02 | West Fork Lehman Creek | 1 | 370 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 60% | 2.51 | 1 | 400 | 1,000 | 0 | 0% |
| 043_02 | West Fork Lehman Creek | 2 | 610 | dry DF w/o Ppine | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 043_02 | West Fork Lehman Creek | 3 | 1500 | aspen | 99% | 0.06 | 2 | 3,000 | 200 | 90% | 0.63 | 2 | 3,000 | 2,000 | 2,000 | -9% |
| 043_02 | West Fork Lehman Creek | 4 | 1600 | alder | 86% | 0.88 | 2 | 3,000 | 3,000 | 80% | 1.25 | 2 | 3,000 | 4,000 | 1,000 | -6% |
| 043_02 | West Fork Lehman Creek | 5 | 590 | aspen | 99% | 0.06 | 3 | 2,000 | 100 | 90% | 0.63 | 3 | 2,000 | 1,000 | 900 | -9% |
| 043_02 | East Fork Lehman Creek | 1 | 250 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 90% | 0.63 | 1 | 300 | 200 | 0 | 0% |
| 043_02 | East Fork Lehman Creek | 2 | 250 | grass | 55% | 2.82 | 1 | 300 | 800 | 60% | 2.51 | 1 | 300 | 800 | 0 | 0% |
| 043_02 | East Fork Lehman Creek | 3 | 670 | Drummond willow | 87% | 0.82 | 1 | 700 | 600 | 80% | 1.25 | 1 | 700 | 900 | 300 | -7% |
| 043_02 | East Fork Lehman Creek | 4 | 360 | grass | 55% | 2.82 | 1 | 400 | 1,000 | 60% | 2.51 | 1 | 400 | 1,000 | 0 | 0% |
| 043_02 | East Fork Lehman Creek | 5 | 1800 | aspen | 99% | 0.06 | 2 | 4,000 | 300 | 80% | 1.25 | 2 | 4,000 | 5,000 | 5,000 | -19% |
| 043_02 | East Fork Lehman Creek | 6 | 1100 | aspen | 99% | 0.06 | 3 | 3,000 | 200 | 90% | 0.63 | 3 | 3,000 | 2,000 | 2,000 | -9% |
| 043_02 | trib to EF Lehman | 1 | 1900 | aspen | 100% | 0.00 | 1 | 2,000 | 0 | 80% | 1.25 | 1 | 2,000 | 3,000 | 3,000 | -20% |
| 043_02 | 1st trib to Lehman | 1 | 340 | aspen | 100% | 0.00 | 1 | 300 | 0 | 90% | 0.63 | 1 | 300 | 200 | 200 | -10% |
| 043_02 | 1st trib to Lehman | 2 | 1200 | aspen | 100% | 0.00 | 1 | 1,000 | 0 | 80% | 1.25 | 1 | 1,000 | 1,000 | 1,000 | -20% |
| 043_02 | 1st trib to Lehman | 3 | 1100 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 30% | 4.39 | 1 | 1,000 | 4,000 | 2,000 | -35% |
| 043_02 | 1st trib to Lehman | 4 | 550 | sage/grass | 65% | 2.19 | 1 | 600 | 1,000 | 20% | 5.02 | 1 | 600 | 3,000 | 2,000 | -45% |
| 043_02 | Lehman Creek | 1 | 2100 | aspen | 97% | 0.19 | 4 | 8,000 | 2,000 | 80% | 1.25 | 4 | 8,000 | 10,000 | 8,000 | -17% |
| 043_02 | Lehman Creek | 2 | 260 | pond | 0% | 6.27 | 4 | 1,000 | 6,000 | 0% | 6.27 | 4 | 1,000 | 6,000 | 0 | 0% |
| 043_02 | Lehman Creek | 3 | 69 | aspen | 97% | 0.19 | 4 | 300 | 60 | 90% | 0.63 | 4 | 300 | 200 | 100 | -7% |
| 043_02 | Lehman Creek | 4 | 610 | aspen | 97% | 0.19 | 4 | 2,000 | 400 | 80% | 1.25 | 4 | 2,000 | 3,000 | 3,000 | -17% |
| 043_02 | Lehman Creek | 5 | 140 | Drummond willow | 45% | 3.45 | 4 | 600 | 2,000 | 60% | 2.51 | 4 | 600 | 2,000 | 0 | 0% |
| 043_02 | Lehman Creek | 6 | 210 | pond | 0% | 6.27 | 4 | 800 | 5,000 | 0% | 6.27 | 4 | 800 | 5,000 | 0 | 0% |
| 043_02 | trib to Hamilton | 1 | 660 | grass | 55% | 2.82 | 1 | 700 | 2,000 | 60% | 2.51 | 1 | 700 | 2,000 | 0 | 0% |
| 043_02 | trib to Hamilton | 2 | 2300 | sage/grass | 39% | 3.82 | 2 | 5,000 | 20,000 | 40% | 3.76 | 2 | 5,000 | 20,000 | 0 | 0% |
| 043_02 | Hamilton Creek | 1 | 590 | dry DF w/o Ppine | 96% | 0.25 | 1 | 600 | 200 | 90% | 0.63 | 1 | 600 | 400 | 200 | -6% |
| 043_02 | Hamilton Creek | 2 | 530 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 70% | 1.88 | 1 | 500 | 900 | (100) | 0% |
| 043_02 | Hamilton Creek | 3 | 1400 | aspen | 100% | 0.00 | 1 | 1,000 | 0 | 80% | 1.25 | 1 | 1,000 | 1,000 | 1,000 | -20% |
| 043_02 | Hamilton Creek | 4 | 300 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 60% | 2.51 | 1 | 300 | 800 | 100 | -5% |
| 043_02 | Hamilton Creek | 5 | 640 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 20% | 5.02 | 2 | 1,000 | 5,000 | 1,000 | -19% |
| 043_02 | Hamilton Creek | 6 | 300 | aspen | 99% | 0.06 | 2 | 600 | 40 | 80% | 1.25 | 2 | 600 | 800 | 800 | -19% |
| 043_02 | Hamilton Creek | 7 | 280 | aspen | 99% | 0.06 | 2 | 600 | 40 | 50% | 3.14 | 2 | 600 | 2,000 | 2,000 | -49% |
| 043_02 | Hamilton Creek | 8 | 390 | aspen | 99% | 0.06 | 2 | 800 | 50 | 80% | 1.25 | 2 | 800 | 1,000 | 1,000 | -19% |
| 043_02 | Hamilton Creek | 9 | 220 | sage/grass | 39% | 3.82 | 2 | 400 | 2,000 | 30% | 4.39 | 2 | 400 | 2,000 | 0 | -9% |
| 043_02 | Hamilton Creek | 10 | 96 | aspen | 99% | 0.06 | 2 | 200 | 10 | 80% | 1.25 | 2 | 200 | 300 | 300 | -19% |
| 043_02 | Hamilton Creek | 11 | 540 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 30% | 4.39 | 2 | 1,000 | 4,000 | 0 | -9% |
| 043_02 | Hamilton Creek | 12 | 440 | sage/grass | 27% | 4.58 | 3 | 1,000 | 5,000 | 40% | 3.76 | 3 | 1,000 | 4,000 | (1,000) | 0% |
| 043_02 | Hamilton Creek | 13 | 2300 | sage/grass | 27% | 4.58 | 3 | 7,000 | 30,000 | 20% | 5.02 | 3 | 7,000 | 40,000 | 10,000 | -7% |
| | | | | | | | *Totals* | | 1,100,000 | | | | | 1,400,000 | 320,000 | |

**Table C-14. Existing and target solar loads for 3rd-order Warm Springs Creek (ID17040218SK043_03).**

| 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 |
| 043_03 | Warm Springs Creek | 1 | 780 | yellow willow | 19% | 5.08 | 12 | 9,400 | 48,000 | 0% | 6.27 | 12 | 9,400 | 59,000 | 11,000 | -19% |
| 043_03 | Warm Springs Creek | 3 | 610 | yellow willow | 12% | 5.52 | 20 | 12,000 | 66,000 | 0% | 6.27 | 20 | 12,000 | 75,000 | 9,000 | -12% |
| 043_03 | Warm Springs Creek | 4 | 510 | yellow willow | 12% | 5.52 | 20 | 10,000 | 55,000 | 10% | 5.64 | 20 | 10,000 | 56,000 | 1,000 | -2% |
| | | | | | | | | *Totals* | 170,000 | | | | | 190,000 | 21,000 | |

**Table C-15. Existing and target solar loads for 2nd-order Wildhorse Creek (ID17040218SK030_02).**

| Segment Details | | | | | Target | | | | | Existing | | | | | Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AU | Stream Name | Number (top to bottom) | Length (m) | Vegetation Type | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Shade | Solar Radiation (kWh/m²/day) | Segment Width (m) | Segment Area (m²) | Solar Load (kWh/day) | Excess Load (kWh/day) | Lack of Shade |
| 030_02 | un-named tributary | 1 | 1600 | rock/bare/ephemeral | 0% | 6.27 | 1 | 2,000 | 10,000 | 0% | 6.27 | 1 | 2,000 | 10,000 | 0 | 0% |
| 030_02 | Burnt Aspen Creek | 1 | 1100 | subalpine fir/moist | 96% | 0.25 | 1 | 1,000 | 300 | 90% | 0.63 | 1 | 1,000 | 600 | 300 | -6% |
| 030_02 | Burnt Aspen Creek | 2 | 430 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 50% | 3.14 | 1 | 400 | 1,000 | 100 | -15% |
| 030_02 | Burnt Aspen Creek | 3 | 740 | subalpine fir/moist | 96% | 0.25 | 2 | 1,000 | 300 | 90% | 0.63 | 2 | 1,000 | 600 | 300 | -6% |
| 030_02 | Burnt Aspen Creek | 4 | 340 | sage/grass | 39% | 3.82 | 2 | 700 | 3,000 | 30% | 4.39 | 2 | 700 | 3,000 | 0 | -9% |
| 030_02 | Burnt Aspen Creek | 5 | 84 | lemon willow | 49% | 3.20 | 2 | 200 | 600 | 70% | 1.88 | 2 | 200 | 400 | (200) | 0% |
| 030_02 | trib to Burnt Aspen | 1 | 480 | subalpine fir/dry-steep | 99% | 0.06 | 1 | 500 | 30 | 90% | 0.63 | 1 | 500 | 300 | 300 | -9% |
| 030_02 | trib to Burnt Aspen | 2 | 1300 | dry DF w/o Ppine | 94% | 0.38 | 1 | 1,000 | 400 | 90% | 0.63 | 1 | 1,000 | 600 | 200 | -4% |
| 030_02 | trib to Burnt Aspen | 3 | 490 | sage/grass | 65% | 2.19 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -15% |
| 030_02 | un-named tributary | 1 | 400 | DF/lodgepole-steep | 98% | 0.13 | 1 | 400 | 50 | 90% | 0.63 | 1 | 400 | 300 | 300 | -8% |
| 030_02 | un-named tributary | 2 | 1000 | dry DF w/o Ppine | 94% | 0.38 | 1 | 1,000 | 400 | 90% | 0.63 | 1 | 1,000 | 600 | 200 | -4% |
| 030_02 | un-named tributary | 3 | 300 | dry DF w/o Ppine | 94% | 0.38 | 1 | 300 | 100 | 80% | 1.25 | 1 | 300 | 400 | 300 | -14% |
| 030_02 | un-named tributary | 4 | 100 | sage/grass | 65% | 2.19 | 1 | 100 | 200 | 50% | 3.14 | 1 | 100 | 300 | 100 | -15% |
| 030_02 | Bailey Creek | 1 | 500 | subalpine fir/dry-gentle | 100% | 0.00 | 1 | 500 | 0 | 90% | 0.63 | 1 | 500 | 300 | 300 | -10% |
| 030_02 | Bailey Creek | 2 | 1100 | subalpine fir/moist | 96% | 0.25 | 1 | 1,000 | 300 | 90% | 0.63 | 1 | 1,000 | 600 | 300 | -6% |
| 030_02 | Bailey Creek | 3 | 1400 | subalpine fir/moist | 96% | 0.25 | 2 | 3,000 | 800 | 90% | 0.63 | 2 | 3,000 | 2,000 | 1,000 | -6% |
| 030_02 | Bailey Creek | 4 | 160 | lemon willow | 49% | 3.20 | 2 | 300 | 1,000 | 50% | 3.14 | 2 | 300 | 900 | (100) | 0% |
| 030_02 | Bailey Creek | 5 | 580 | sage/grass | 39% | 3.82 | 2 | 1,000 | 4,000 | 30% | 4.39 | 2 | 1,000 | 4,000 | 0 | -9% |
| | | | | | | | | *Totals* | 23,000 | | | | | 28,000 | 4,400 | |

**Table C-16. Existing and target solar loads for 3rd-order Wildhorse Creek (ID17040218SK030_04).**

| 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_04 | Wildhorse Creek | 1 | 690 | lemon willow | 12% | 5.52 | 9 | 6,000 | 30,000 | 0% | 6.27 | 13 | 9,000 | 60,000 | 30,000 | -12% |
| 030_04 | Wildhorse Creek | 2 | 57 | lemon willow | 12% | 5.52 | 9 | 500 | 3,000 | 10% | 5.64 | 13 | 700 | 4,000 | 1,000 | -2% |
| 030_04 | Wildhorse Creek | 3 | 350 | lemon willow | 12% | 5.52 | 9 | 3,000 | 20,000 | 0% | 6.27 | 13 | 5,000 | 30,000 | 10,000 | -12% |
| 030_04 | Wildhorse Creek | 4 | 180 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 10% | 5.64 | 13 | 2,000 | 10,000 | 0 | -2% |
| 030_04 | Wildhorse Creek | 5 | 170 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 0% | 6.27 | 13 | 2,000 | 10,000 | 0 | -12% |
| 030_04 | Wildhorse Creek | 6 | 170 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 10% | 5.64 | 13 | 2,000 | 10,000 | 0 | -2% |
| 030_04 | Wildhorse Creek | 7 | 1700 | lemon willow | 12% | 5.52 | 9 | 20,000 | 100,000 | 0% | 6.27 | 14 | 20,000 | 100,000 | 0 | -12% |
| 030_04 | Wildhorse Creek | 8 | 180 | lemon willow | 22% | 4.89 | 5 | 900 | 4,000 | 40% | 3.76 | 5 | 900 | 3,000 | (1,000) | 0% |
| 030_04 | Wildhorse Creek | 9 | 110 | beaver ponds | 0% | 6.27 | 9 | 1,000 | 6,000 | 0% | 6.27 | 9 | 1,000 | 6,000 | 0 | 0% |
| 030_04 | Wildhorse Creek | 10 | 180 | beaver ponds | 10% | 5.64 | 9 | 2,000 | 10,000 | 10% | 5.64 | 9 | 2,000 | 10,000 | 0 | 0% |
| 030_04 | Wildhorse Creek | 11 | 1400 | lemon willow | 12% | 5.52 | 9 | 10,000 | 60,000 | 0% | 6.27 | 15 | 20,000 | 100,000 | 40,000 | -12% |
| 030_04 | Wildhorse Creek | 12 | 1300 | lemon willow | 12% | 5.52 | 9 | 10,000 | 60,000 | 0% | 6.27 | 16 | 20,000 | 100,000 | 40,000 | -12% |
| 030_04 | Wildhorse Creek | 13 | 170 | lemon willow | 12% | 5.52 | 9 | 2,000 | 10,000 | 10% | 5.64 | 16 | 3,000 | 20,000 | 10,000 | -2% |
| 030_04 | Wildhorse Creek | 14 | 1000 | lemon willow | 12% | 5.52 | 9 | 9,000 | 50,000 | 0% | 6.27 | 16 | 20,000 | 100,000 | 50,000 | -12% |
| | | | | | | | *Totals* | | 380,000 | | | | | 560,000 | 180,000 | |

**Table C-17. Existing and target solar loads for 2nd-order Cherry Creek (ID17040218SK050_02).**

| 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 |
| 050_02 | trib to Lupine | 1 | 2000 | sage/grass | 65% | 2.19 | 1 | 2,000 | 4,000 | 60% | 2.51 | 1 | 2,000 | 5,000 | 1,000 | -5% |
| 050_02 | Lupine Creek | 1 | 450 | sage/grass | 65% | 2.19 | 1 | 500 | 1,000 | 60% | 2.51 | 1 | 500 | 1,000 | 0 | -5% |
| 050_02 | Lupine Creek | 2 | 1200 | grass | 55% | 2.82 | 1 | 1,000 | 3,000 | 50% | 3.14 | 1 | 1,000 | 3,000 | 0 | -5% |
| 050_02 | Lupine Creek | 3 | 1100 | Drummond willow | 76% | 1.50 | 2 | 2,000 | 3,000 | 80% | 1.25 | 2 | 2,000 | 3,000 | 0 | 0% |
| 050_02 | Lupine Creek | 4 | 2400 | alder | 86% | 0.88 | 2 | 5,000 | 4,000 | 70% | 1.88 | 2 | 5,000 | 9,000 | 5,000 | -16% |
| 050_02 | Lupine Creek | 5 | 56 | Drummond willow | 56% | 2.76 | 3 | 200 | 600 | 70% | 1.88 | 3 | 200 | 400 | (200) | 0% |
| 050_02 | Lupine Creek | 6 | 54 | beaver pond | 20% | 5.02 | 3 | 200 | 1,000 | 20% | 5.02 | 3 | 200 | 1,000 | 0 | 0% |
| 050_02 | Lupine Creek | 7 | 420 | Geyer willow | 64% | 2.26 | 3 | 1,000 | 2,000 | 60% | 2.51 | 3 | 1,000 | 3,000 | 1,000 | -4% |
| 050_02 | Blue Rock | 1 | 1130 | rock/bare/epemeral | 0% | 6.27 | 1 | 1,000 | 6,000 | 0% | 6.27 | 1 | 1,000 | 6,000 | 0 | 0% |
| 050_02 | Blue Rock | 2 | 880 | sage/grass | 65% | 2.19 | 1 | 900 | 2,000 | 60% | 2.51 | 1 | 900 | 2,000 | 0 | -5% |
| 050_02 | Blue Rock | 3 | 1000 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 60% | 2.51 | 2 | 2,000 | 5,000 | (3,000) | 0% |
| 050_02 | Mud Lake | 1 | 940 | sage/grass | 65% | 2.19 | 1 | 900 | 2,000 | 60% | 2.51 | 1 | 900 | 2,000 | 0 | -5% |
| 050_02 | Mud Lake | 2 | 480 | grass | 55% | 2.82 | 1 | 500 | 1,000 | 50% | 3.14 | 1 | 500 | 2,000 | 1,000 | -5% |
| 050_02 | Mud Lake | 3 | 250 | aspen | 100% | 0.00 | 1 | 300 | 0 | 80% | 1.25 | 1 | 300 | 400 | 400 | -20% |
| 050_02 | Mud Lake | 4 | 210 | Drummond willow | 76% | 1.50 | 2 | 400 | 600 | 50% | 3.14 | 2 | 400 | 1,000 | 400 | -26% |
| 050_02 | Mud Lake | 5 | 1500 | sage/grass | 39% | 3.82 | 2 | 3,000 | 10,000 | 40% | 3.76 | 2 | 3,000 | 10,000 | 0 | 0% |
| 050_02 | Carcass Creek | 1 | 360 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 60% | 2.51 | 1 | 400 | 1,000 | 100 | -5% |
| 050_02 | Carcass Creek | 2 | 300 | Drummond willow | 87% | 0.82 | 1 | 300 | 200 | 60% | 2.51 | 1 | 300 | 800 | 600 | -27% |
| 050_02 | Carcass Creek | 3 | 560 | aspen | 100% | 0.00 | 1 | 600 | 0 | 80% | 1.25 | 1 | 600 | 800 | 800 | -20% |
| 050_02 | Carcass Creek | 4 | 200 | aspen | 100% | 0.00 | 1 | 200 | 0 | 90% | 0.63 | 1 | 200 | 100 | 100 | -10% |
| 050_02 | Carcass Creek | 5 | 330 | aspen | 100% | 0.00 | 1 | 300 | 0 | 70% | 1.88 | 1 | 300 | 600 | 600 | -30% |
| 050_02 | Carcass Creek | 6 | 720 | sage/grass | 65% | 2.19 | 1 | 700 | 2,000 | 30% | 4.39 | 1 | 700 | 3,000 | 1,000 | -35% |
| 050_02 | MF Cherry Creek | 1 | 850 | rock/bare/epemeral | 0% | 6.27 | 1 | 900 | 6,000 | 0% | 6.27 | 1 | 900 | 6,000 | 0 | 0% |
| 050_02 | MF Cherry Creek | 2 | 1200 | alder | 91% | 0.56 | 1 | 1,000 | 600 | 70% | 1.88 | 1 | 1,000 | 2,000 | 1,000 | -21% |
| 050_02 | MF Cherry Creek | 3 | 340 | alder | 86% | 0.88 | 2 | 700 | 600 | 80% | 1.25 | 2 | 700 | 900 | 300 | -6% |
| 050_02 | MF Cherry Creek | 4 | 510 | aspen | 99% | 0.06 | 2 | 1,000 | 60 | 80% | 1.25 | 2 | 1,000 | 1,000 | 900 | -19% |
| 050_02 | MF Cherry Creek | 5 | 440 | alder | 86% | 0.88 | 2 | 900 | 800 | 60% | 2.51 | 2 | 900 | 2,000 | 1,000 | -26% |
| 050_02 | 1st to MF Cherry | 1 | 150 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 050_02 | 1st to MF Cherry | 2 | 180 | grass | 55% | 2.82 | 1 | 200 | 600 | 50% | 3.14 | 1 | 200 | 600 | 0 | -5% |
| 050_02 | 1st to MF Cherry | 3 | 440 | dry DF w/o Ppine | 94% | 0.38 | 1 | 400 | 200 | 80% | 1.25 | 1 | 400 | 500 | 300 | -14% |
| 050_02 | 1st to MF Cherry | 4 | 1200 | alder | 91% | 0.56 | 1 | 1,000 | 600 | 60% | 2.51 | 1 | 1,000 | 3,000 | 2,000 | -31% |
| 050_02 | 2nd to MF Cherry | 1 | 750 | sage/grass | 65% | 2.19 | 1 | 800 | 2,000 | 60% | 2.51 | 1 | 800 | 2,000 | 0 | -5% |
| 050_02 | 2nd to MF Cherry | 2 | 560 | grass | 55% | 2.82 | 1 | 600 | 2,000 | 50% | 3.14 | 1 | 600 | 2,000 | 0 | -5% |
| 050_02 | 2nd to MF Cherry | 3 | 1100 | alder | 91% | 0.56 | 1 | 1,000 | 600 | 70% | 1.88 | 1 | 1,000 | 2,000 | 1,000 | -21% |
| 050_02 | 2nd to MF Cherry | 4 | 580 | Drummond willow | 87% | 0.82 | 1 | 600 | 500 | 50% | 3.14 | 1 | 600 | 2,000 | 2,000 | -37% |
| 050_02 | 3rd to MF Cherry | 1 | 300 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 60% | 2.51 | 1 | 300 | 800 | 100 | -5% |
| 050_02 | 3rd to MF Cherry | 2 | 810 | Drummond willow | 87% | 0.82 | 1 | 800 | 700 | 70% | 1.88 | 1 | 800 | 2,000 | 1,000 | -17% |
| 050_02 | 3rd to MF Cherry | 3 | 520 | Drummond willow | 87% | 0.82 | 1 | 500 | 400 | 80% | 1.25 | 1 | 500 | 600 | 200 | -7% |
| 050_02 | 4th to MF Cherry | 1 | 720 | aspen | 100% | 0.00 | 1 | 700 | 0 | 80% | 1.25 | 1 | 700 | 900 | 900 | -20% |
| 050_02 | 4th to MF Cherry | 2 | 94 | sage/grass | 65% | 2.19 | 1 | 90 | 200 | 30% | 4.39 | 1 | 90 | 400 | 200 | -35% |
| 050_02 | 4th to MF Cherry | 3 | 170 | aspen | 100% | 0.00 | 1 | 200 | 0 | 80% | 1.25 | 1 | 200 | 300 | 300 | -20% |
| 050_02 | 4th to MF Cherry | 4 | 910 | sage/grass | 65% | 2.19 | 1 | 900 | 2,000 | 40% | 3.76 | 1 | 900 | 3,000 | 1,000 | -25% |
| 050_02 | Crawford Canyon | 1 | 1200 | sage/grass | 65% | 2.19 | 1 | 1,000 | 2,000 | 60% | 2.51 | 1 | 1,000 | 3,000 | 1,000 | -5% |
| 050_02 | Crawford Canyon | 2 | 260 | sage/grass | 65% | 2.19 | 1 | 300 | 700 | 40% | 3.76 | 1 | 300 | 1,000 | 300 | -25% |
| 050_02 | Crawford Canyon | 3 | 110 | aspen | 99% | 0.06 | 2 | 200 | 10 | 90% | 0.63 | 2 | 200 | 100 | 90 | -9% |
| 050_02 | Crawford Canyon | 4 | 540 | aspen | 99% | 0.06 | 2 | 1,000 | 60 | 50% | 3.14 | 2 | 1,000 | 3,000 | 3,000 | -49% |
| 050_02 | Crawford Canyon | 5 | 860 | sage/grass | 39% | 3.82 | 2 | 2,000 | 8,000 | 40% | 3.76 | 2 | 2,000 | 8,000 | 0 | 0% |
| 050_02 | trib to Crawford | 1 | 460 | sage/grass | 65% | 2.19 | 1 | 500 | 1,000 | 60% | 2.51 | 1 | 500 | 1,000 | 0 | -5% |
| 050_02 | trib to Crawford | 2 | 350 | aspen | 100% | 0.00 | 1 | 400 | 0 | 80% | 1.25 | 1 | 400 | 500 | 500 | -20% |
| 050_02 | trib to Crawford | 3 | 420 | sage/grass | 65% | 2.19 | 1 | 400 | 900 | 30% | 4.39 | 1 | 400 | 2,000 | 1,000 | -35% |
| 050_02 | trib to Crawford | 4 | 200 | aspen | 100% | 0.00 | 1 | 200 | 0 | 80% | 1.25 | 1 | 200 | 300 | 300 | -20% |
| 050_02 | trib to Crawford | 5 | 450 | sage/grass | 65% | 2.19 | 1 | 500 | 1,000 | 40% | 3.76 | 1 | 500 | 2,000 | 1,000 | -25% |
| 050_02 | trib to Crawford | 6 | 300 | sage/grass | 39% | 3.82 | 2 | 600 | 2,000 | 40% | 3.76 | 2 | 600 | 2,000 | 0 | 0% |
| 050_02 | trib to Crawford | 7 | 490 | grass | 31% | 4.33 | 2 | 1,000 | 4,000 | 30% | 4.39 | 2 | 1,000 | 4,000 | 0 | -1% |
| 050_02 | Richardson Canyon | 1 | 240 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 050_02 | Richardson Canyon | 2 | 620 | Drummond willow | 87% | 0.82 | 1 | 600 | 500 | 80% | 1.25 | 1 | 600 | 800 | 300 | -7% |
| 050_02 | Richardson Canyon | 3 | 730 | Drummond willow | 87% | 0.82 | 1 | 700 | 600 | 50% | 3.14 | 1 | 700 | 2,000 | 1,000 | -37% |
| 050_02 | Richardson Canyon | 4 | 170 | sage/grass | 65% | 2.19 | 1 | 200 | 400 | 60% | 2.51 | 1 | 200 | 500 | 100 | -5% |
| 050_02 | Richardson Canyon | 5 | 170 | aspen | 100% | 0.00 | 1 | 200 | 0 | 70% | 1.88 | 1 | 200 | 400 | 400 | -30% |
| 050_02 | Richardson Canyon | 6 | 650 | sage/grass | 65% | 2.19 | 1 | 700 | 2,000 | 40% | 3.76 | 1 | 700 | 3,000 | 1,000 | -25% |
| 050_02 | Richardson Canyon | 7 | 1200 | aspen | 99% | 0.06 | 2 | 2,000 | 100 | 90% | 0.63 | 2 | 2,000 | 1,000 | 900 | -9% |
| 050_02 | Richardson Canyon | 8 | 360 | aspen | 99% | 0.06 | 2 | 700 | 40 | 50% | 3.14 | 2 | 700 | 2,000 | 2,000 | -49% |
| 050_02 | Richardson Canyon | 9 | 300 | sage/grass | 39% | 3.82 | 2 | 600 | 2,000 | 20% | 5.02 | 2 | 600 | 3,000 | 1,000 | -19% |
| 050_02 | Richardson Canyon | 10 | 230 | alder | 86% | 0.88 | 2 | 500 | 400 | 50% | 3.14 | 2 | 500 | 2,000 | 2,000 | -36% |
| 050_02 | Richardson Canyon | 11 | 250 | sage/grass | 39% | 3.82 | 2 | 500 | 2,000 | 30% | 4.39 | 2 | 500 | 2,000 | 0 | -9% |
| | | | | | | | *Totals* | | 98,000 | | | | | 140,000 | 37,000 | |

**Table C-18. Existing and target solar loads for 4th-order Cherry Creek (ID17040218SK050_04).**

| 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 |
| 050_04 | MF Cherry Creek | 1 | 220 | alder | 72% | 1.76 | 3 | 700 | 1,000 | 60% | 2.51 | 3 | 700 | 2,000 | 1,000 | -12% |
| 050_04 | MF Cherry Creek | 2 | 390 | alder | 72% | 1.76 | 3 | 1,000 | 2,000 | 40% | 3.76 | 3 | 1,000 | 4,000 | 2,000 | -32% |
| 050_04 | MF Cherry Creek | 3 | 410 | alder | 72% | 1.76 | 3 | 1,000 | 2,000 | 60% | 2.51 | 3 | 1,000 | 3,000 | 1,000 | -12% |
| 050_04 | MF Cherry Creek | 4 | 350 | Geyer willow | 64% | 2.26 | 3 | 1,000 | 2,000 | 50% | 3.14 | 3 | 1,000 | 3,000 | 1,000 | -14% |
| 050_04 | MF Cherry Creek | 5 | 300 | beaver ponds | 20% | 5.02 | 3 | 900 | 5,000 | 20% | 5.02 | 3 | 900 | 5,000 | 0 | 0% |
| 050_04 | MF Cherry Creek | 6 | 690 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 40% | 3.76 | 3 | 2,000 | 8,000 | 3,000 | -24% |
| 050_04 | Cherry Creek | 1 | 520 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 50% | 3.14 | 5 | 3,000 | 9,000 | 4,000 | -14% |
| 050_04 | Cherry Creek | 2 | 640 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 70% | 1.88 | 5 | 3,000 | 6,000 | 1,000 | 0% |
| 050_04 | Cherry Creek | 3 | 510 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 60% | 2.51 | 5 | 3,000 | 8,000 | 3,000 | -4% |
| 050_04 | Cherry Creek | 4 | 200 | Geyer willow | 64% | 2.26 | 3 | 600 | 1,000 | 40% | 3.76 | 5 | 1,000 | 4,000 | 3,000 | -24% |
| 050_04 | Cherry Creek | 5 | 670 | Geyer willow | 64% | 2.26 | 3 | 2,000 | 5,000 | 60% | 2.51 | 5 | 3,000 | 8,000 | 3,000 | -4% |
| 050_04 | Cherry Creek | 6 | 190 | Geyer willow | 53% | 2.95 | 4 | 800 | 2,000 | 60% | 2.51 | 6 | 1,000 | 3,000 | 1,000 | 0% |
| 050_04 | Cherry Creek | 7 | 780 | Geyer willow | 53% | 2.95 | 4 | 3,000 | 9,000 | 50% | 3.14 | 6 | 5,000 | 20,000 | 10,000 | -3% |
| 050_04 | Cherry Creek | 8 | 180 | beaver ponds | 20% | 5.02 | 4 | 700 | 4,000 | 20% | 5.02 | 6 | 1,000 | 5,000 | 1,000 | 0% |
| 050_04 | Cherry Creek | 9 | 410 | Geyer willow | 53% | 2.95 | 4 | 2,000 | 6,000 | 40% | 3.76 | 6 | 2,000 | 8,000 | 2,000 | -13% |
| 050_04 | Cherry Creek | 10 | 390 | Geyer willow | 53% | 2.95 | 4 | 2,000 | 6,000 | 50% | 3.14 | 6 | 2,000 | 6,000 | 0 | -3% |
| 050_04 | Cherry Creek | 11 | 92 | Geyer willow | 53% | 2.95 | 4 | 400 | 1,000 | 20% | 5.02 | 6 | 600 | 3,000 | 2,000 | -33% |
| 050_04 | Cherry Creek | 12 | 190 | Geyer willow | 53% | 2.95 | 4 | 800 | 2,000 | 50% | 3.14 | 6 | 1,000 | 3,000 | 1,000 | -3% |
| 050_04 | Cherry Creek | 13 | 480 | Geyer willow | 53% | 2.95 | 4 | 2,000 | 6,000 | 50% | 3.14 | 6 | 3,000 | 9,000 | 3,000 | -3% |
| | | | | | | | *Totals* | | 74,000 | | | | | 120,000 | 42,000 | |

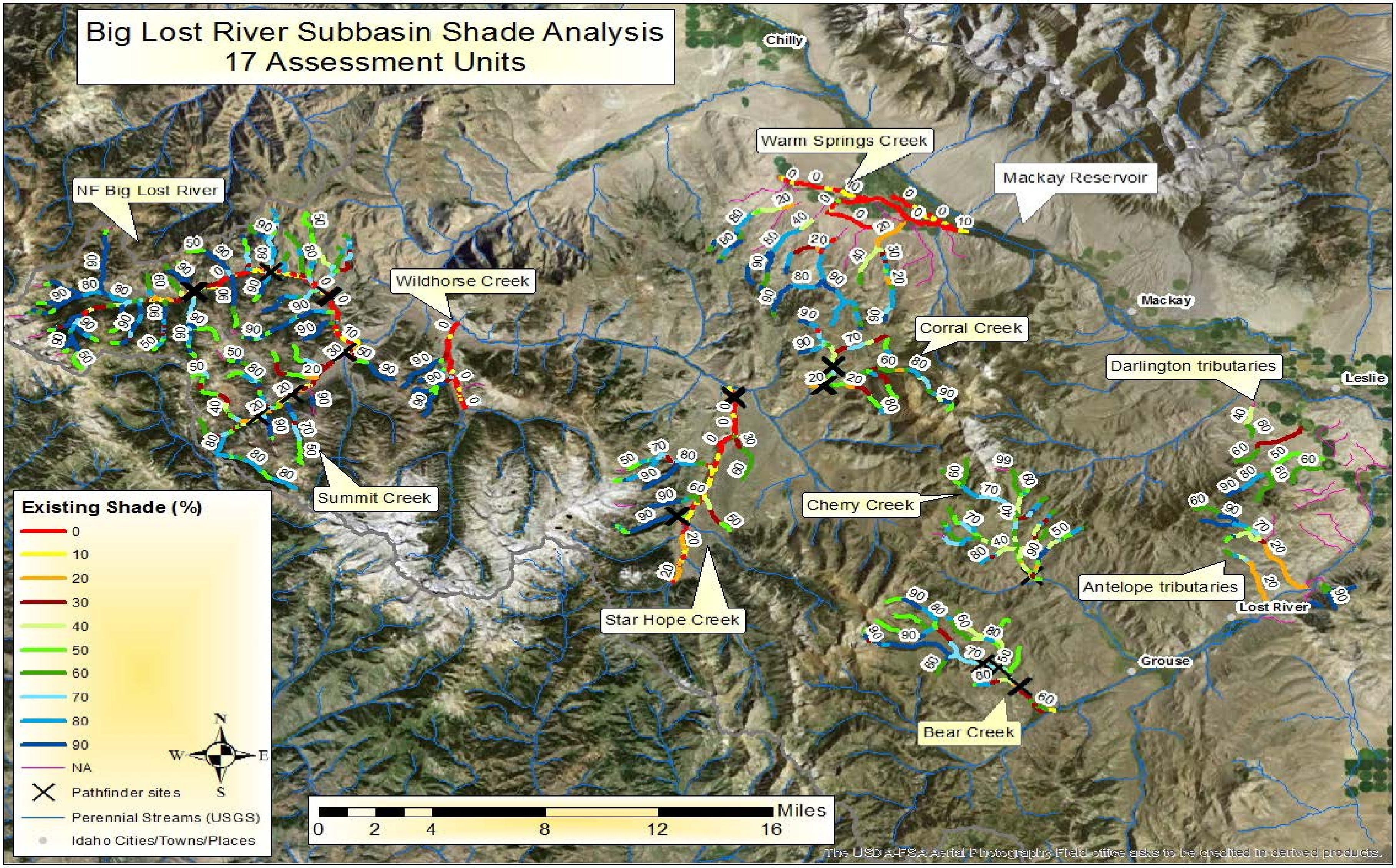


**Figure C-1. Existing shade estimated for the 17 AUs of Big Lost River subbasin by aerial photo interpretation.**

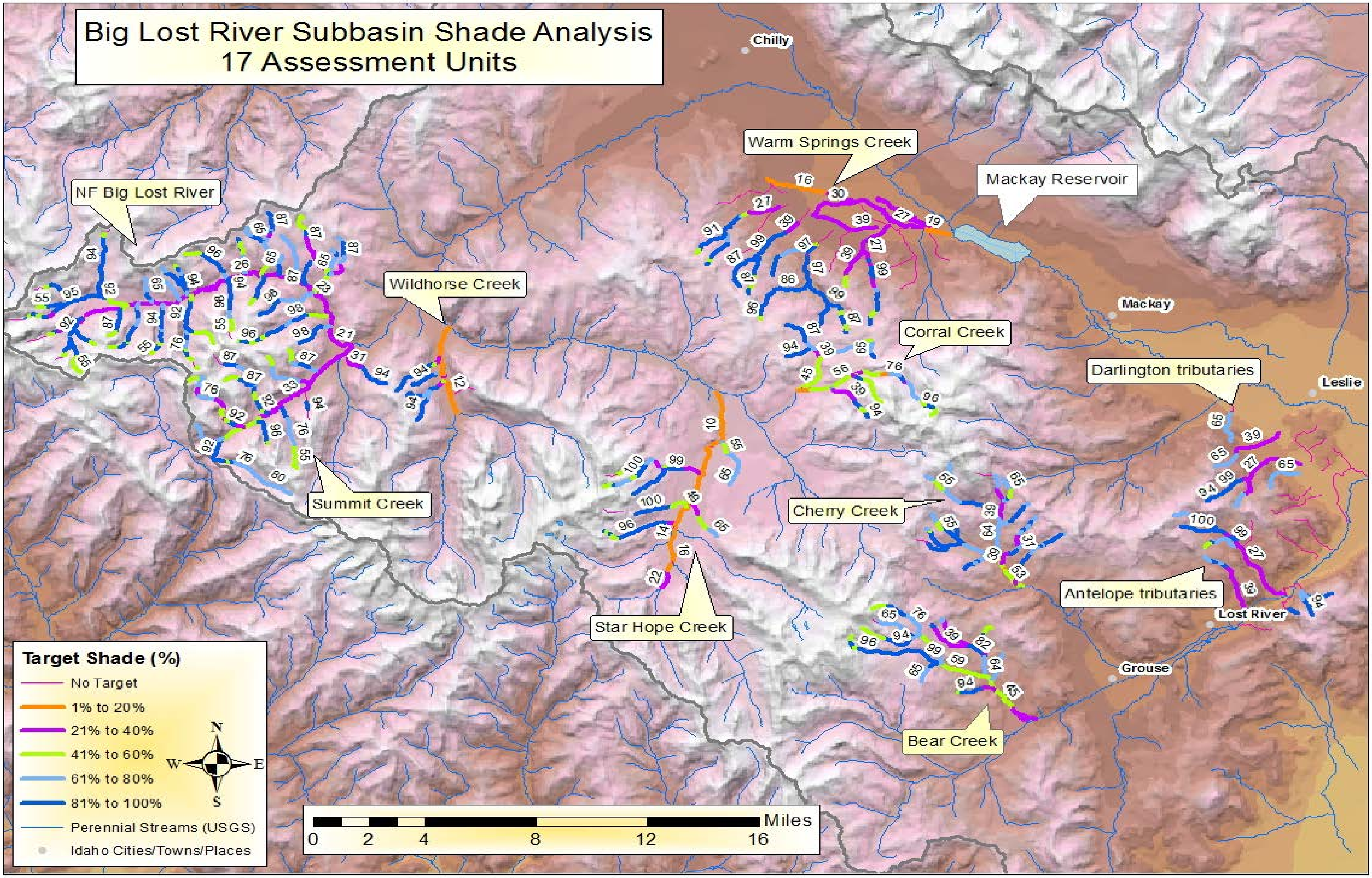


**Figure C-2. Target shade for the 17 AUs of Big Lost River subbasin by aerial photo interpretation.**

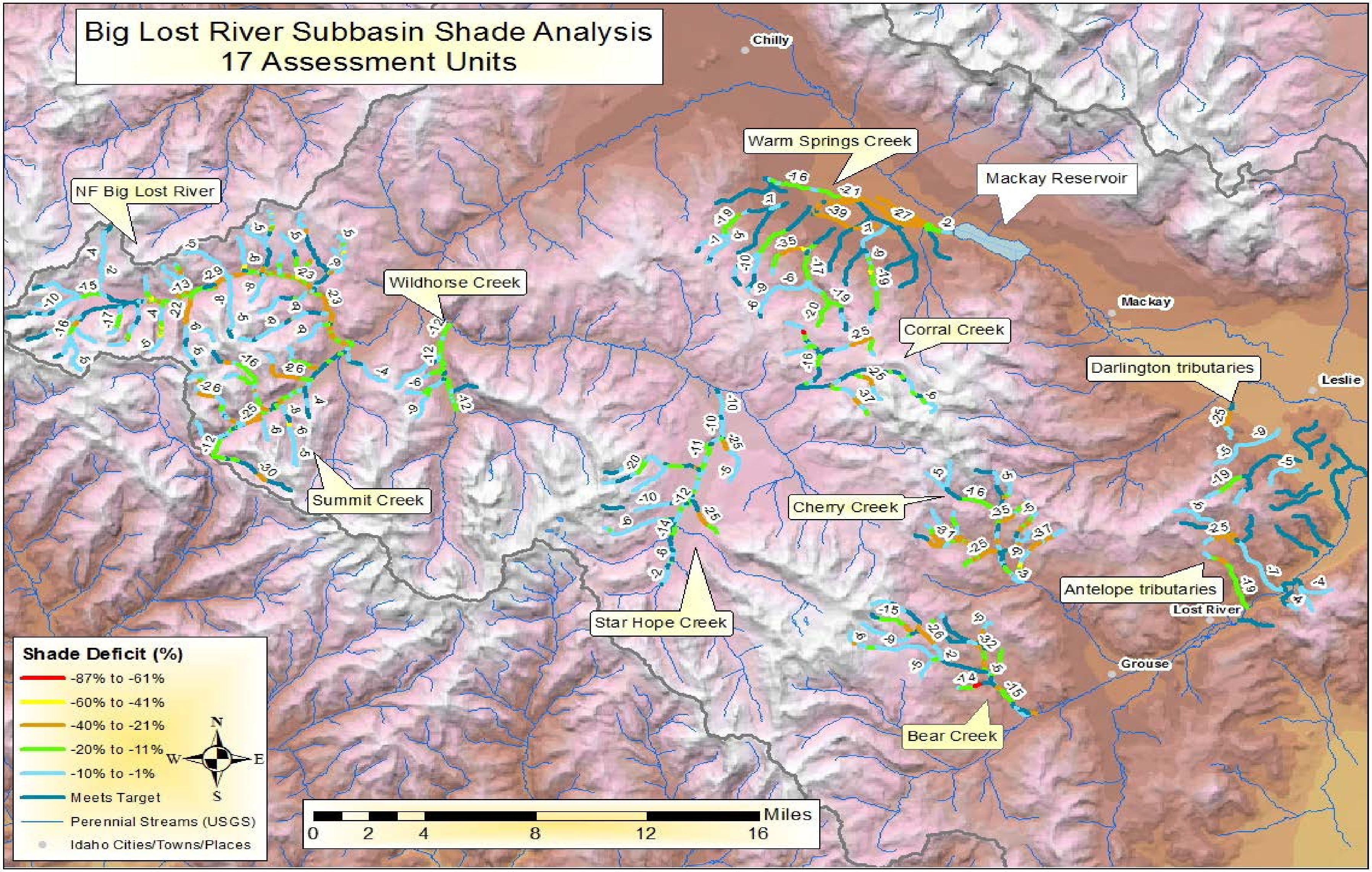


**Figure C-3. Shade deficit (difference between existing and target) for the 17 AUs of Big Lost River subbasin by aerial photo interpretation.**

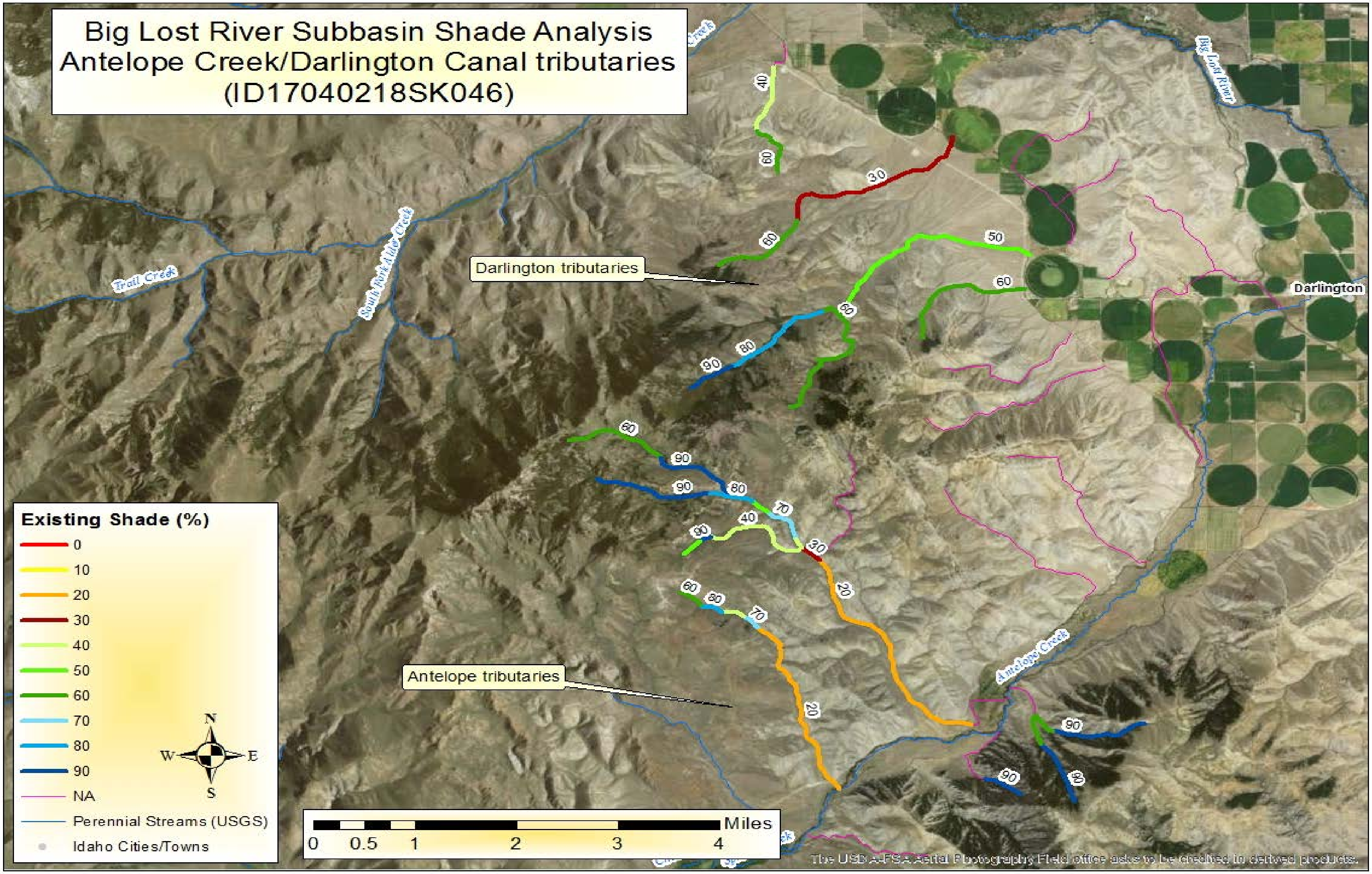


**Figure C-4. Existing shade estimated for the Antelope Creek/Darlington canal tributaries by aerial photo interpretation.**

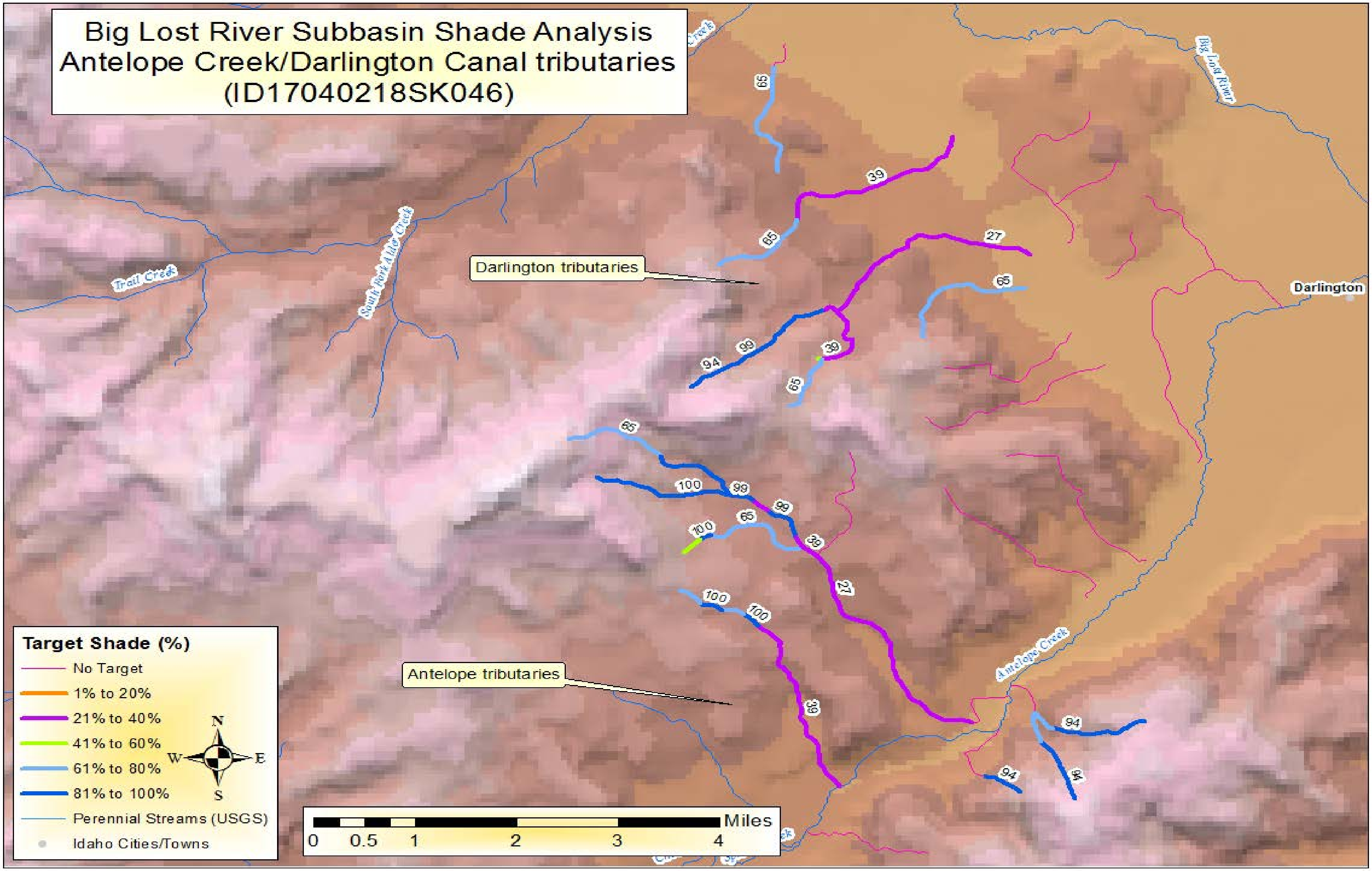


**Figure C-5. Target shade for the Antelope Creek/Darlington canal tributaries.**

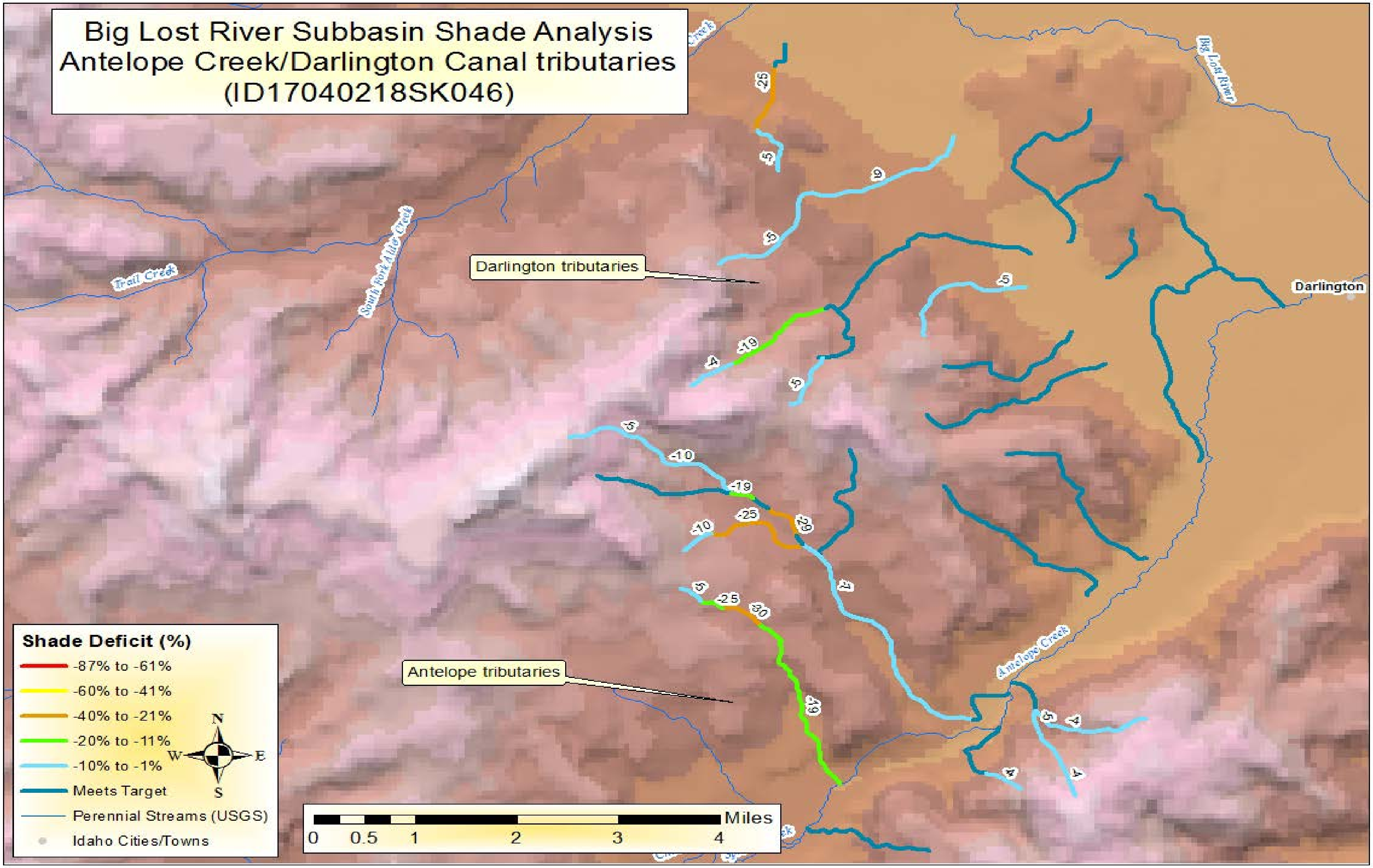


Figure C-6. Shade deficit (difference between existing and target) for the Antelope Creek/Darlington canal tributaries.

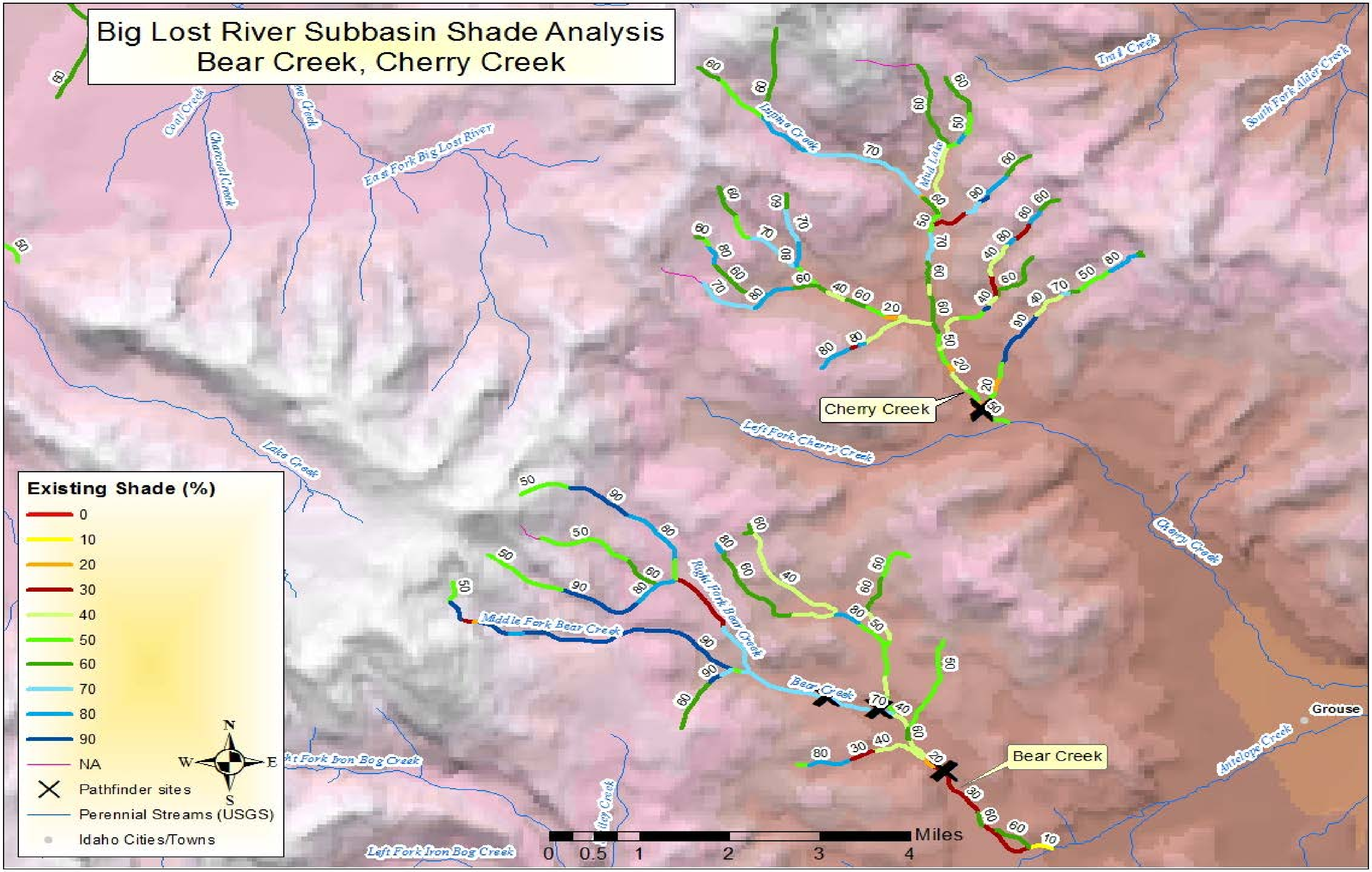


Figure C-7. Existing shade estimated for the Bear Creek and Cherry Creek watersheds by aerial photo interpretation.

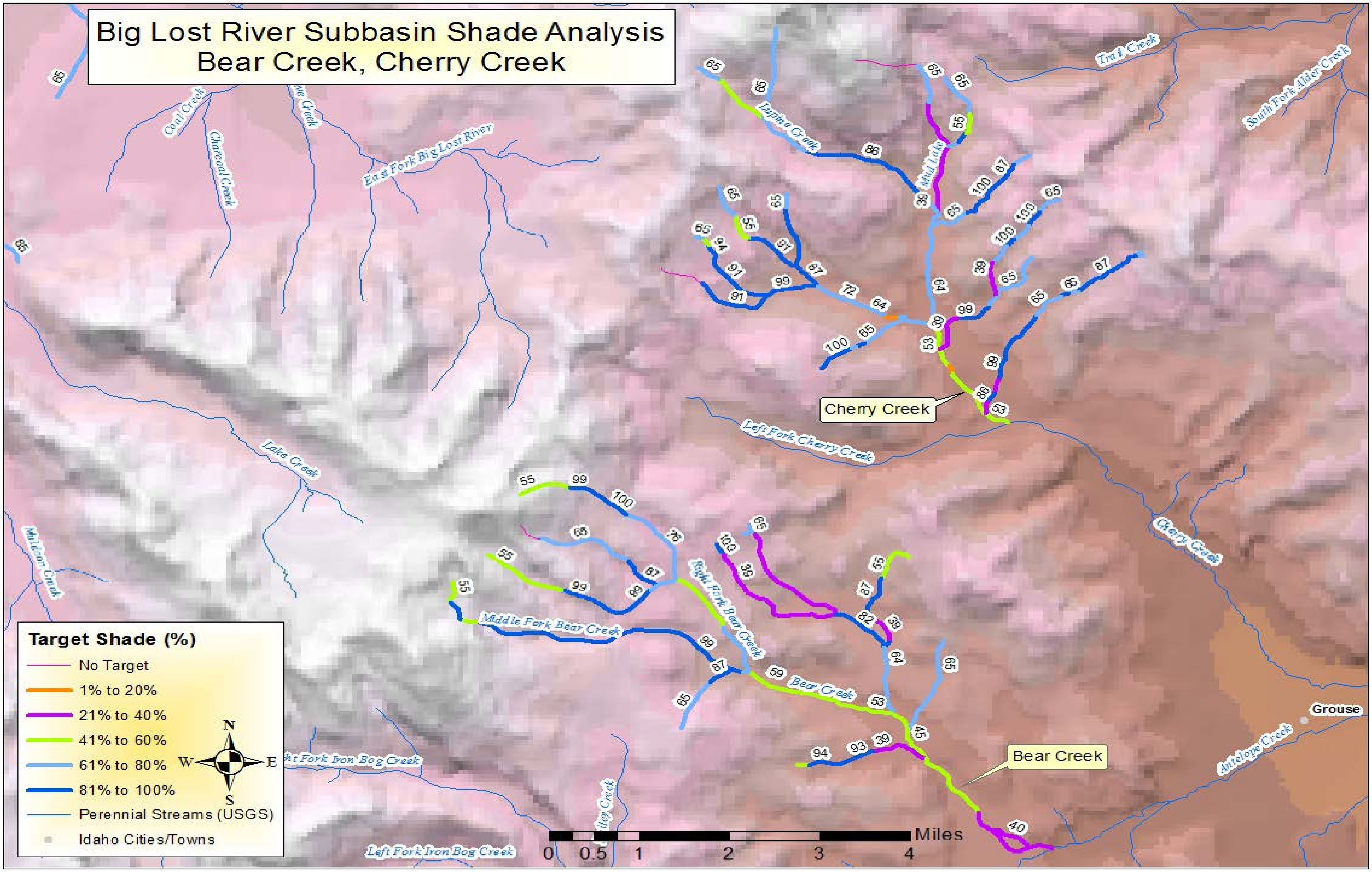


**Figure C-8. Target shade for the Bear Creek and Cherry Creek watersheds.**

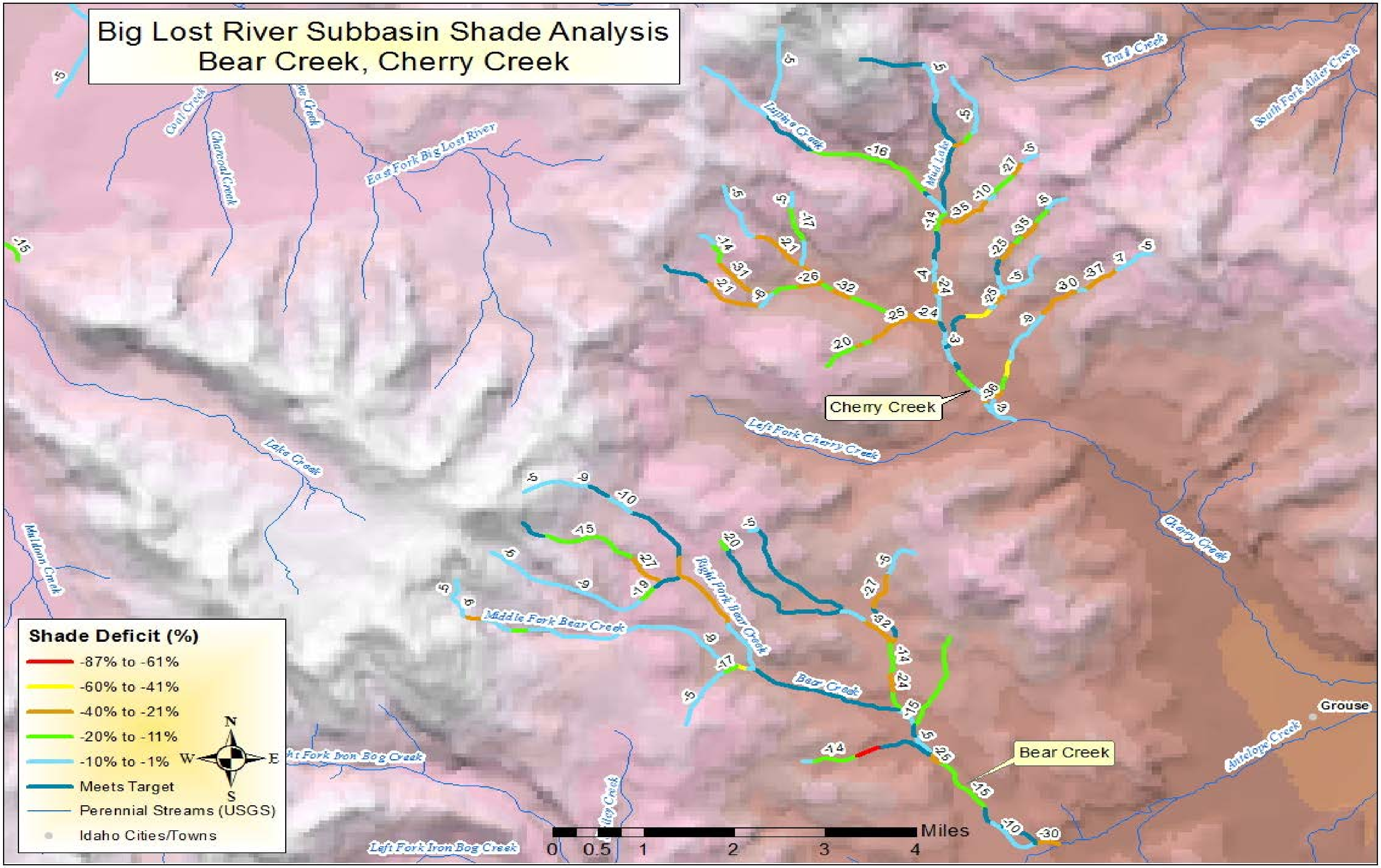


Figure C-9. Shade deficit (difference between existing and target) for the Bear Creek and Cherry Creek watersheds.

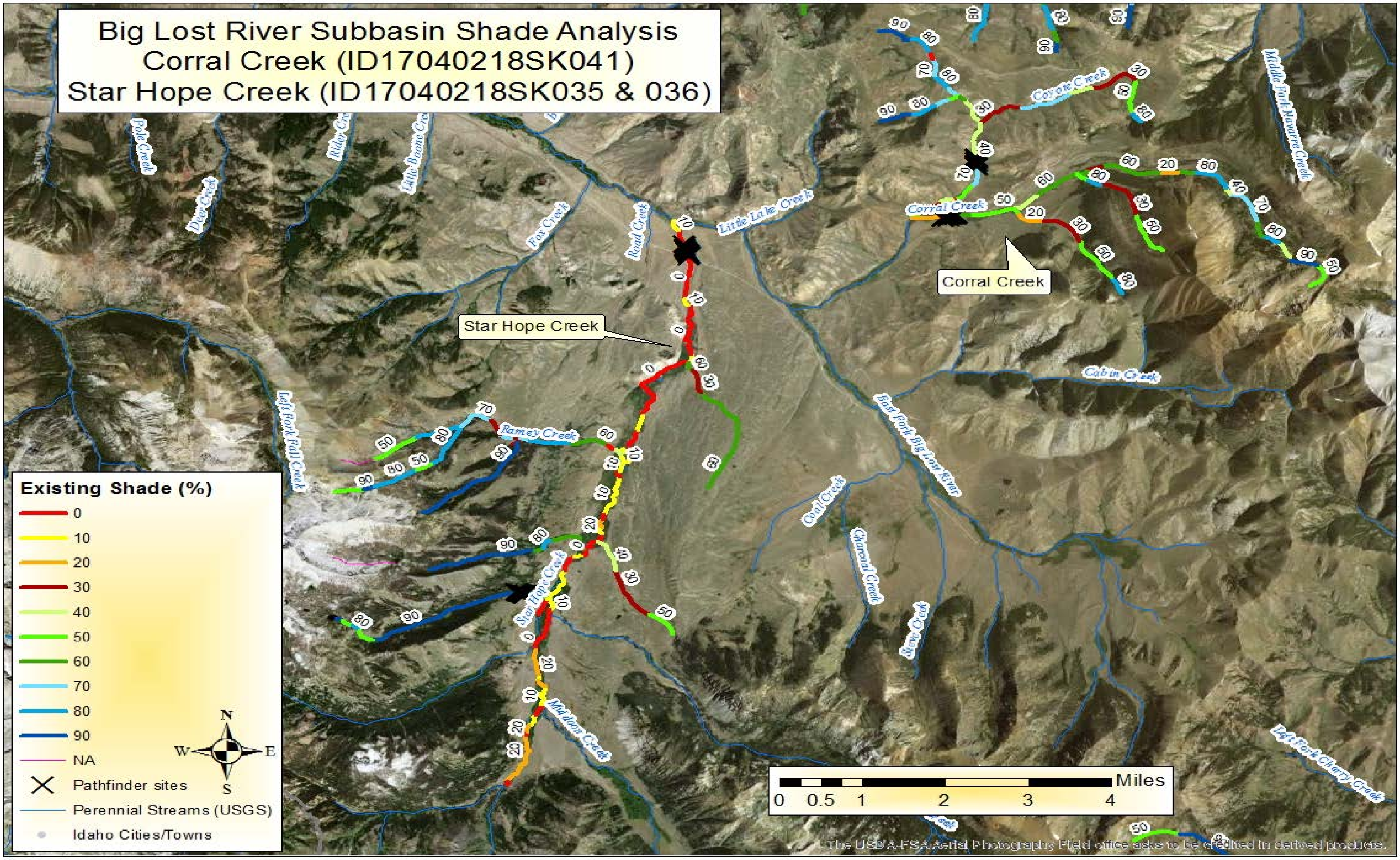


**Figure C-10. Existing shade estimated for the Corral Creek and Star Hope Creek watersheds by aerial photo interpretation.**

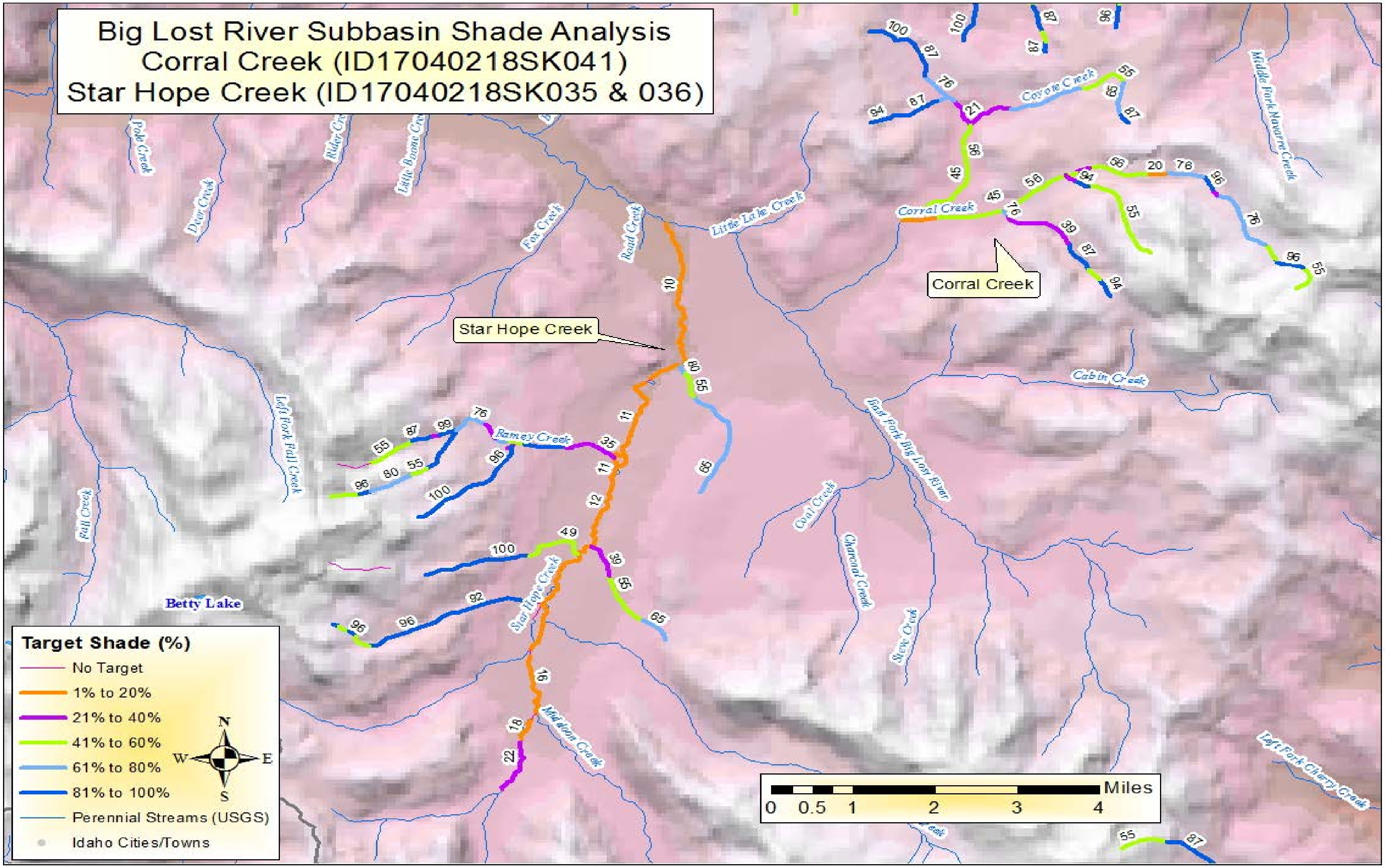


**Figure C-11. Target shade for the Corral Creek and Star Hope Creek watersheds.**

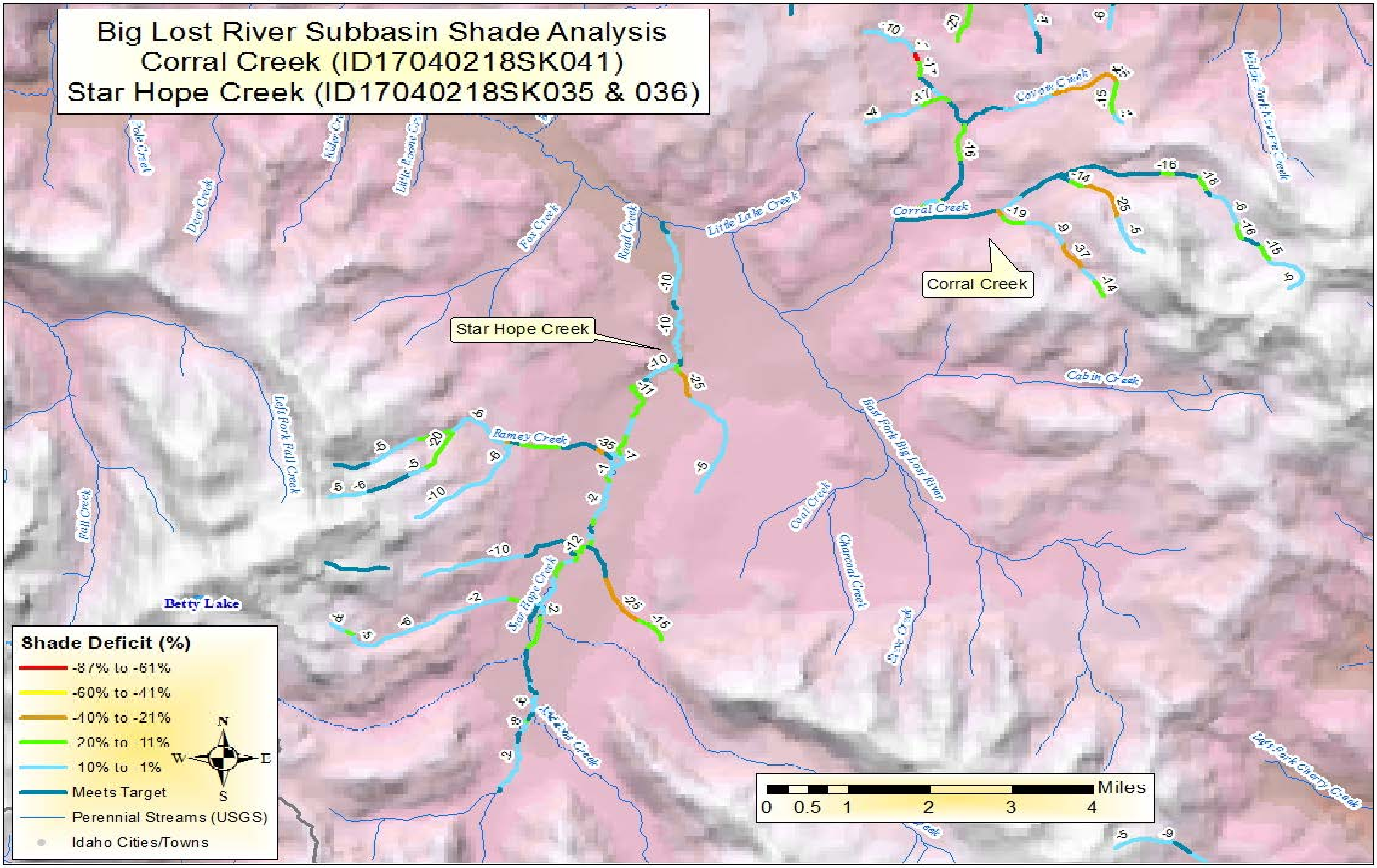


**Figure C-12. Shade deficit (difference between existing and target) for the Corral Creek and Star Hope Creek watersheds.**

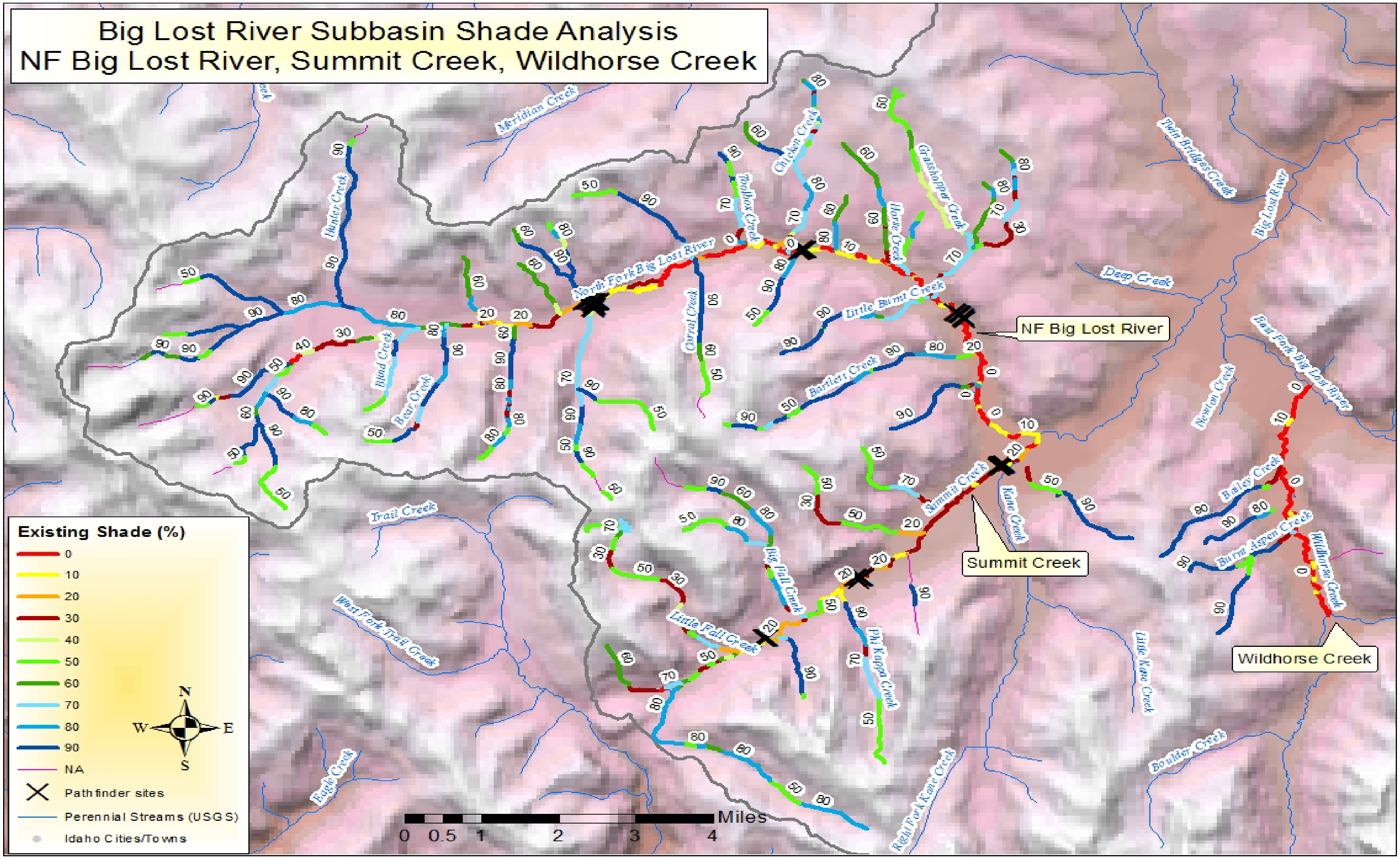


**Figure C-13. Existing shade estimated for the North Fork Big Lost River, Summit Creek, and Wildhorse Creek watersheds by aerial photo interpretation.**

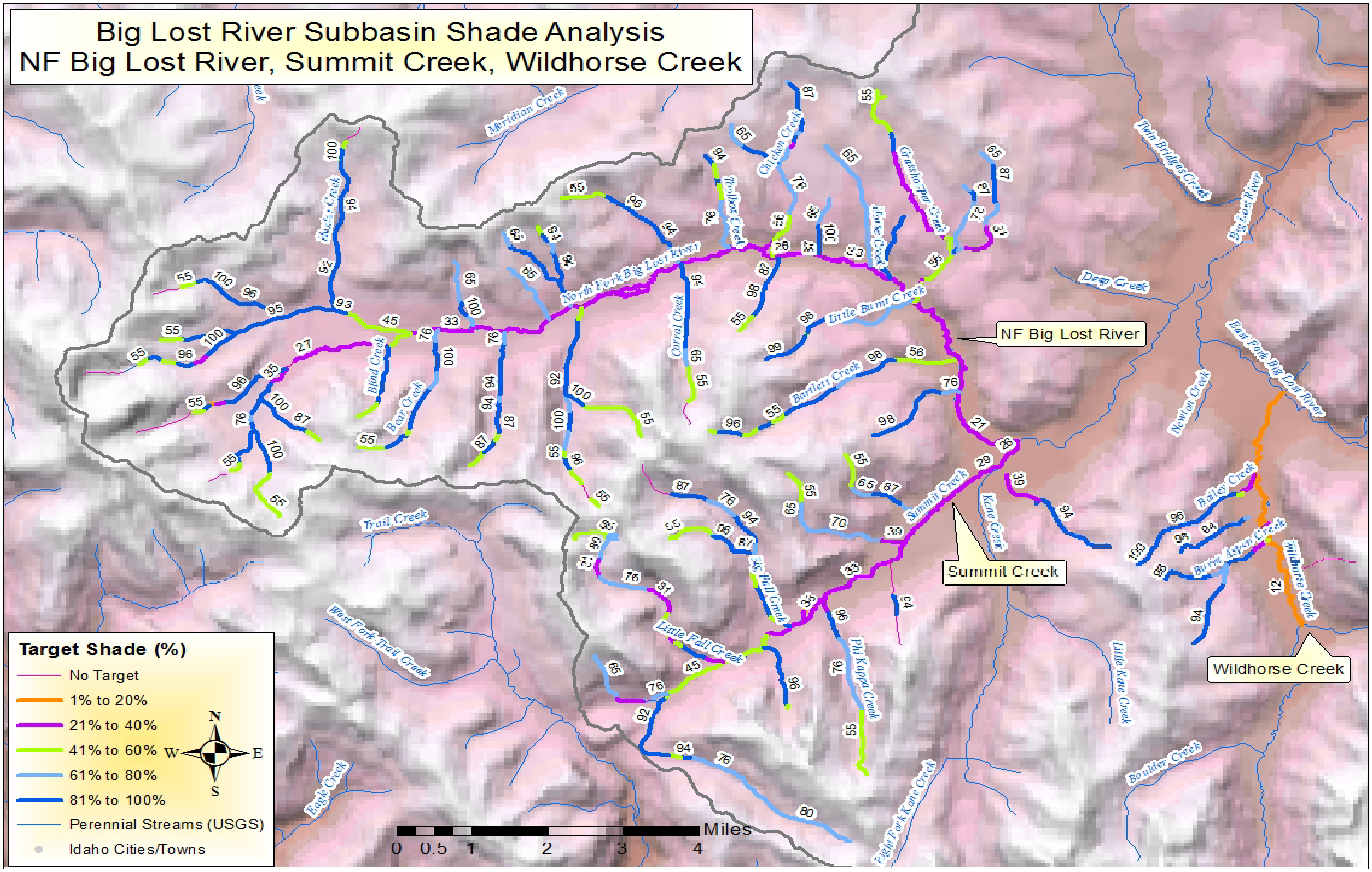


**Figure C-14. Target shade for the North Fork Big Lost River, Summit Creek, and Wildhorse Creek watersheds.**

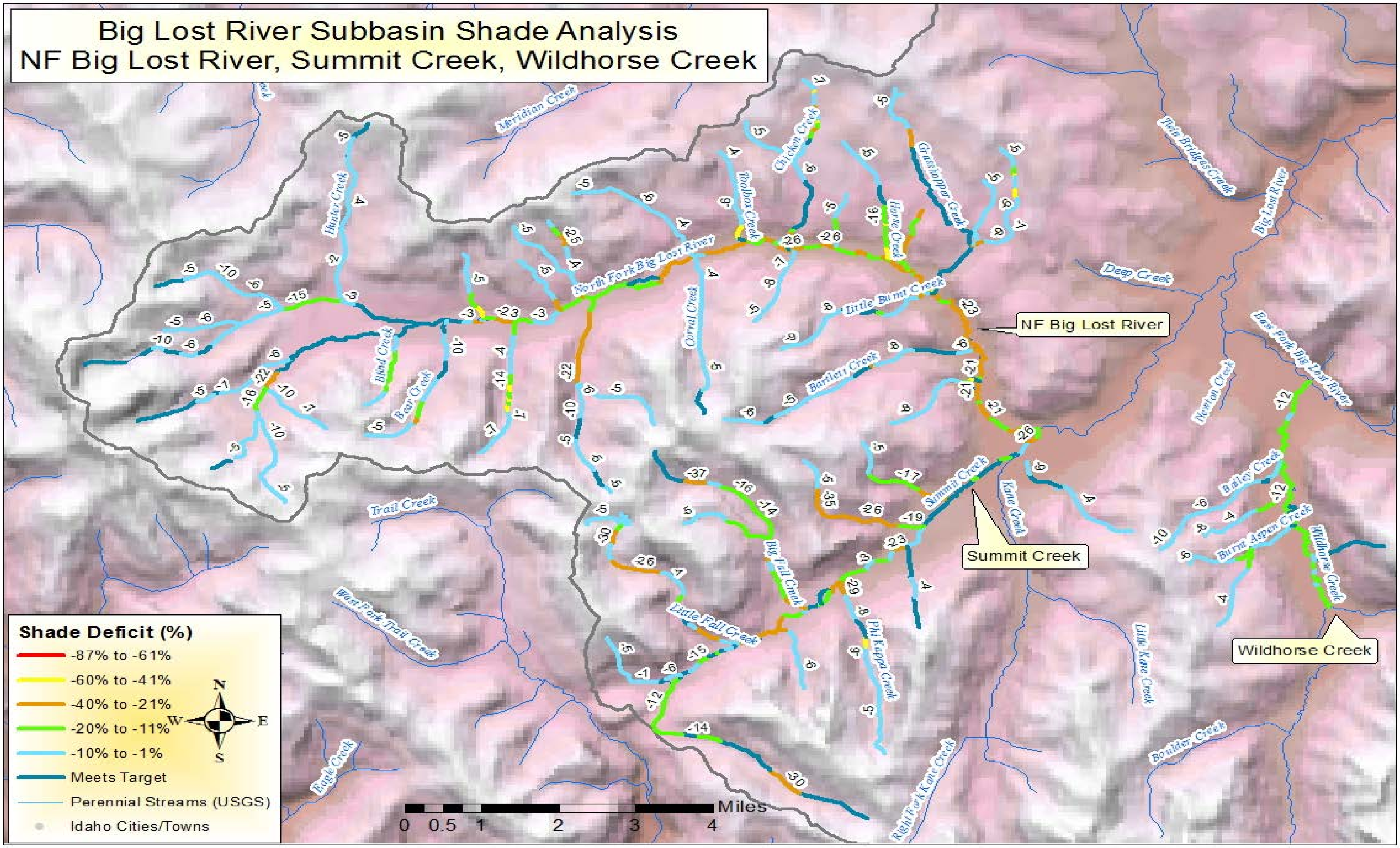


**Figure C-15. Shade deficit (difference between existing and target) for the North Fork Big Lost River, Summit Creek, and Wildhorse Creek watersheds.**

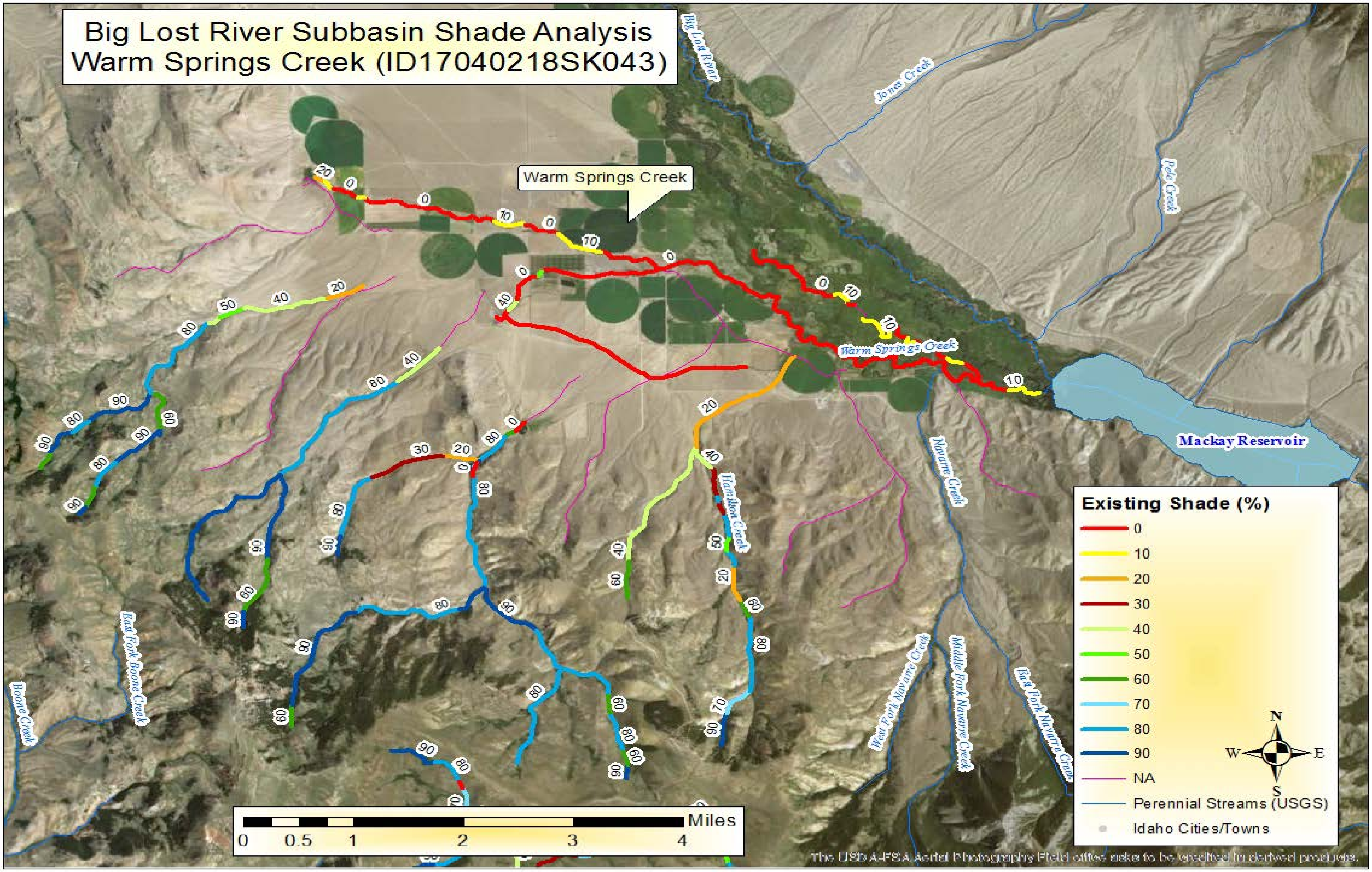


Figure C-16. Existing shade estimated for the Warm Springs Creek watershed by aerial photo interpretation.

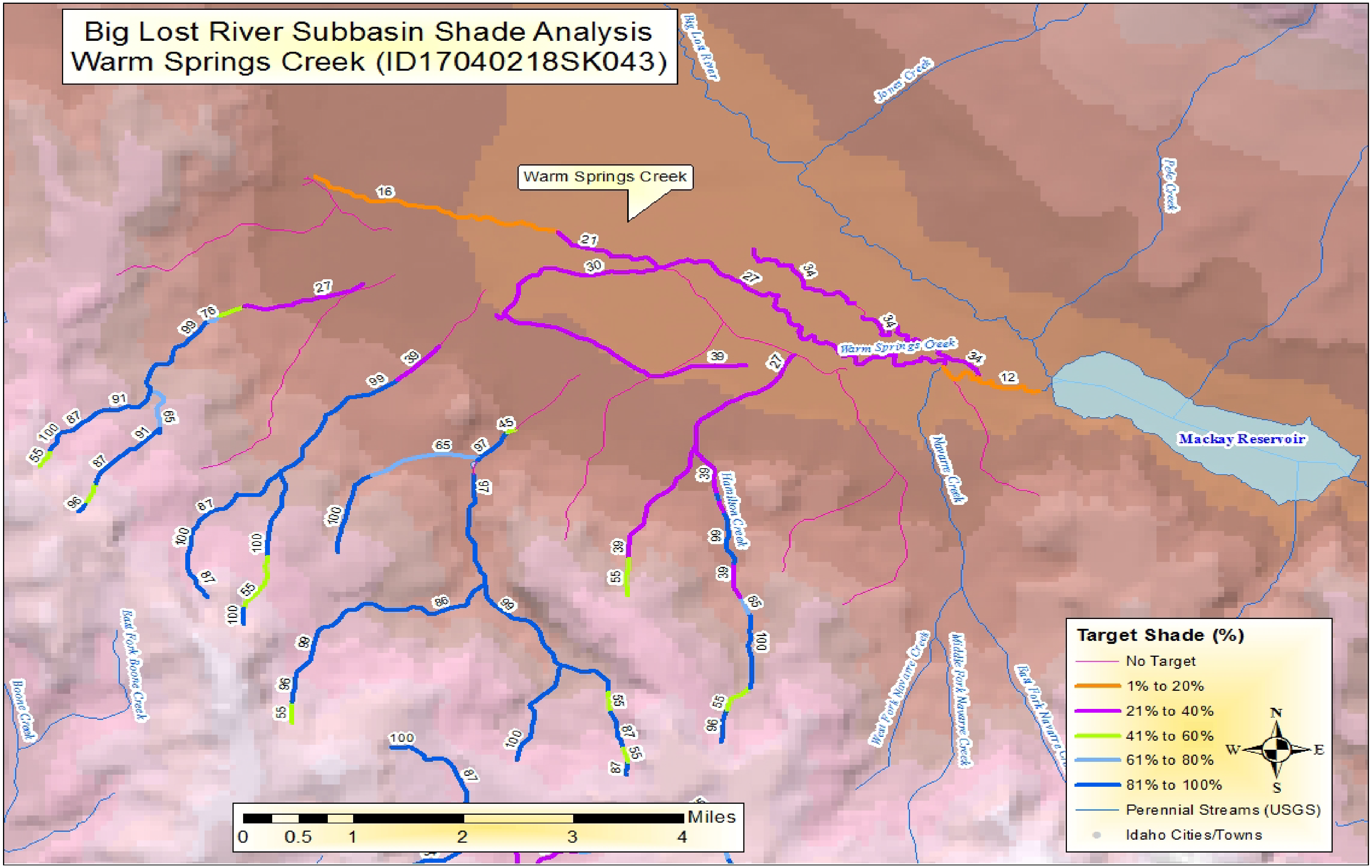


**Figure C-17. Target shade for the Warm Springs Creek watershed.**

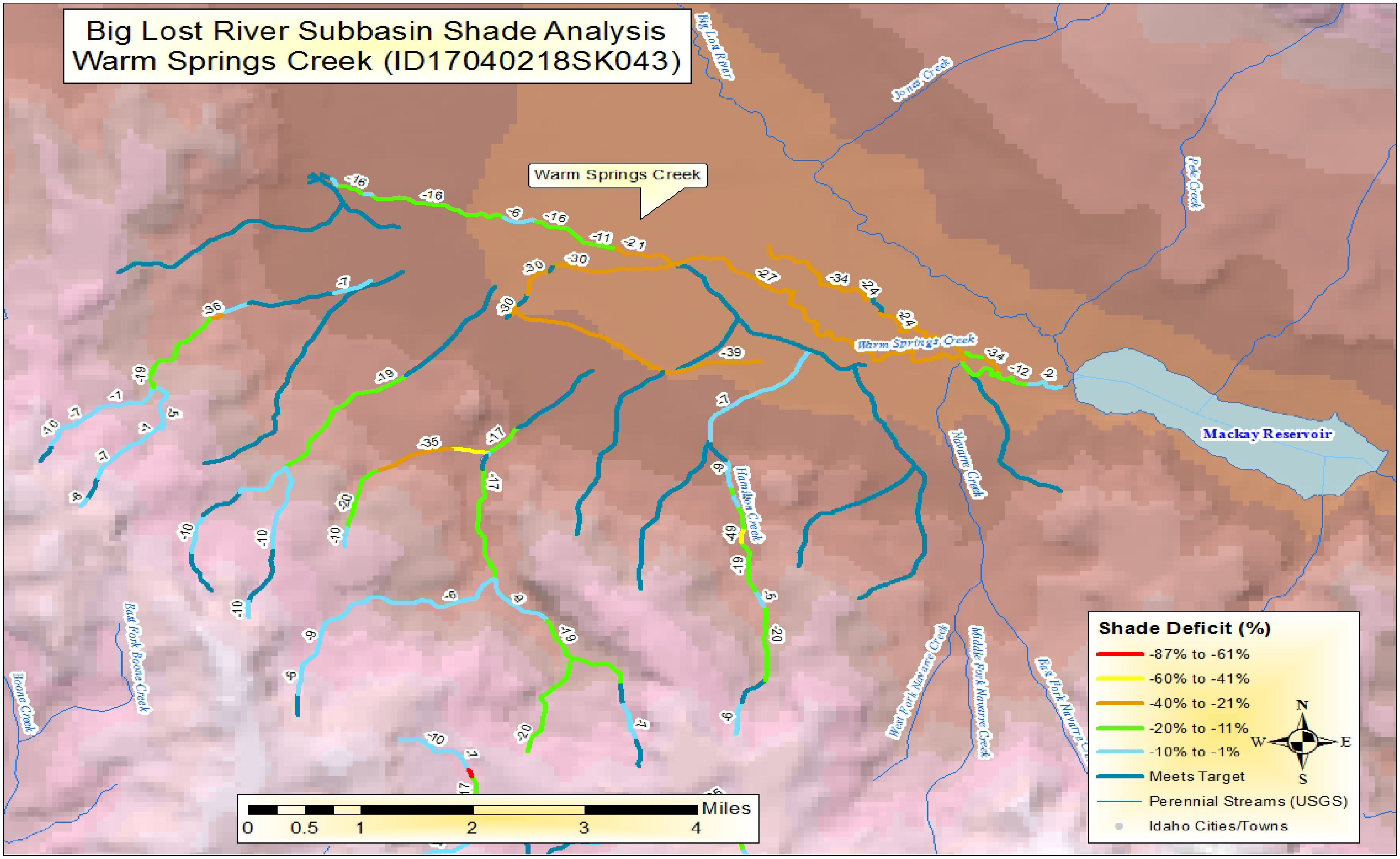


**Figure C-18. Shade deficit (difference between existing and target) for the Warm Springs Creek watershed.**

# Appendix D. Idaho Department of Fish and Game Mackay Fish Hatchery and Clear Springs Foods, Inc. Lost River Hatchery Waste Load Allocation Modification (HUC 17040218)

## Introduction

The 2004 Big Lost River subbasin assessment and total maximum daily loads (TMDLs) contained waste load allocations for the Idaho Department of Fish and Game (IDFG) Mackay Fish Hatchery and the Clear Springs Foods, Inc. Lost River hatchery. These wasteload allocations were based solely on Idaho's water quality standards for salmonid spawning and contained a 9 °C daily average during the salmonid spawning season, March 1 through June 30 and September 15 through November 15. After US Environmental Protection Agency (EPA) approval, the Idaho Department of Environmental Quality (DEQ) discovered the spring sources for both hatcheries used spring water that was at or above the 9 °C wasteload allocation, resulting in near continuous excursions of the wasteload allocation. Because this wasteload allocation was included in EPA's General Aquaculture National Pollutant Discharge Elimination System (NPDES) permit, the IDFG facility has not complied with the wasteload allocation, must report continual exceedances of temperature on monthly Discharge Monitoring Reports (DMRs), and has no mechanism to reduce spring temperatures to achieve compliance with the wasteload allocation. DEQ, in cooperation with IDFG and Clear Springs Foods collected temperature information to modify the wasteload allocation to accurately reflect the natural spring temperatures.

## IDFG Mackay Fish Hatchery (Permit # IDG-130000)

IDFG maintains and operates the Mackay Fish Hatchery at the headwaters of Warm Springs Creek, in the Big Lost River watershed. The springs collectively produce 16 to 23 cubic feet per second (cfs) of water, depending on seasonality. The Mackay Fish Hatchery collects subsurface spring flows from sources within 150 feet of each other. Spring water is collected into underground pipes before it enters the hatchery. The springs' water temperatures are constant and range from 10 °C to 13 °C (50°F to 54ºF). The two most significant spring sources, the "Six Pack" and "Hole" sources have constant temperatures of 13.0 °C and 10.6 °C, respectively. The springs flow together and mix, with a resulting temperature of 11 ºC, which has remained constant since the 1983 Borah Peak earthquake. This 11 ºC water is piped underground to four potential locations: hatchery house, large raceways, small raceways, and hole raceways (Figure D-1). IDFG collected continuous data at these locations in an attempt to determine which individual sources added the most heat. Unused water flows directly to the outfall structure for discharge.

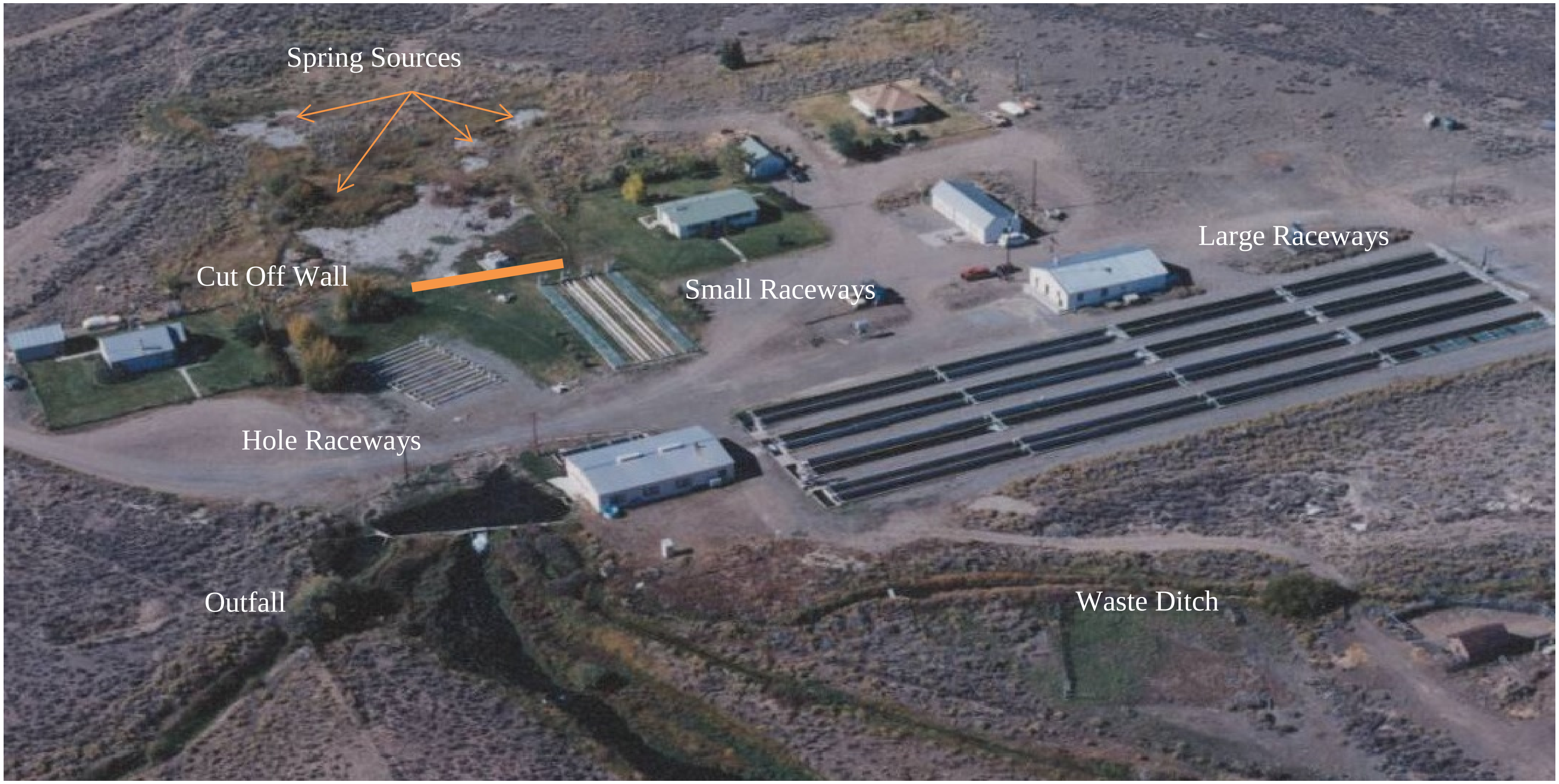


**Figure D-1. Aerial view of the Mackay Fish Hatchery.**

## Temperature Records

The spring source was fully covered with large boulders and cobble in 1984 to protect the water from hatchery contamination. From 1984–1994, measured temperature at the inflow of water to the hatchery and the combined outfall were collected with a thermometer immersed in water until stabilized, then removed after recording. Shown in Table D-1, data are averages of these "dip" recordings as reported by IDFG. During 1984–1996, the monthly average hatchery effluent temperature was 11.9 ºC with a range from 11.1 °C to 12.6 °C (Figure D-2). IDFG staff continuously monitored temperatures at the spring sources and various locations by placing Onset Hobo model continuous thermistors around the facility in 2008 through February 2015 (Table D-1) In addition, spring temperatures are monitored monthly for DMR purposes. Figure D-3 displays the monthly average temperatures for the combined spring sources and the outfall. During the monitoring period (2008–2015), the annual average effluent temperature was 10.9 °C, slightly less than the combined spring's input. Each record contained at least 70,000 data points representing temperatures taken in 30-minute intervals. This data set represents 1,021 days of temperature information, spanning all of the salmonid spawning seasons for the area. Figure D-4 displays the 1,021 daily average temperatures for both the spring source and the outfall.

**Table D-1. Measured temperature at the Mackay Fish Hatchery (2008–Feb 2015).**

| Location | Average Temperature (ºC) |
|---|---|
| Combined spring sources | 11.1 |
| Outfall (2008–Feb 2015 continuous loggers) | 10.9 |

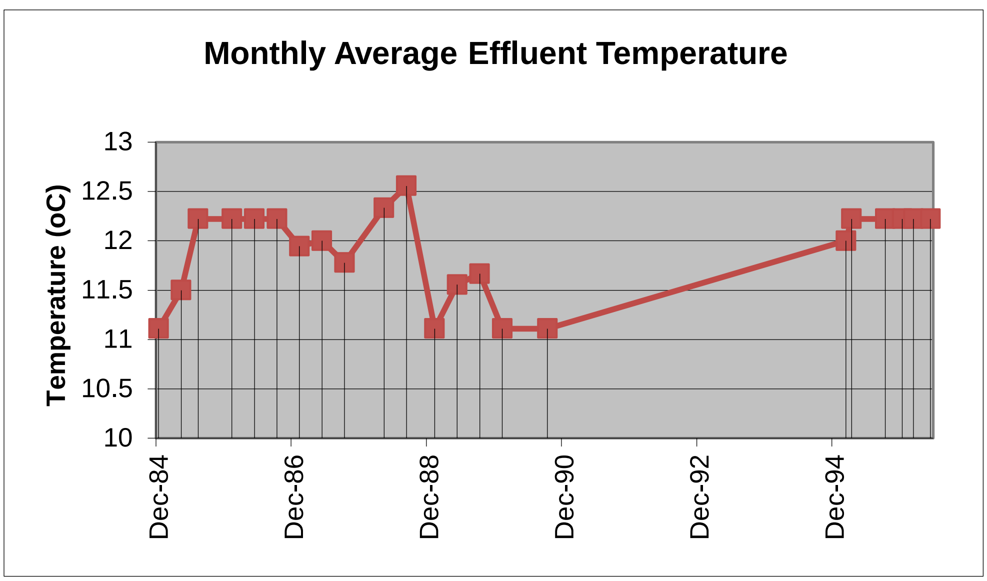


**Figure D-2. Historic monthly effluent temperature 1984–1996.**

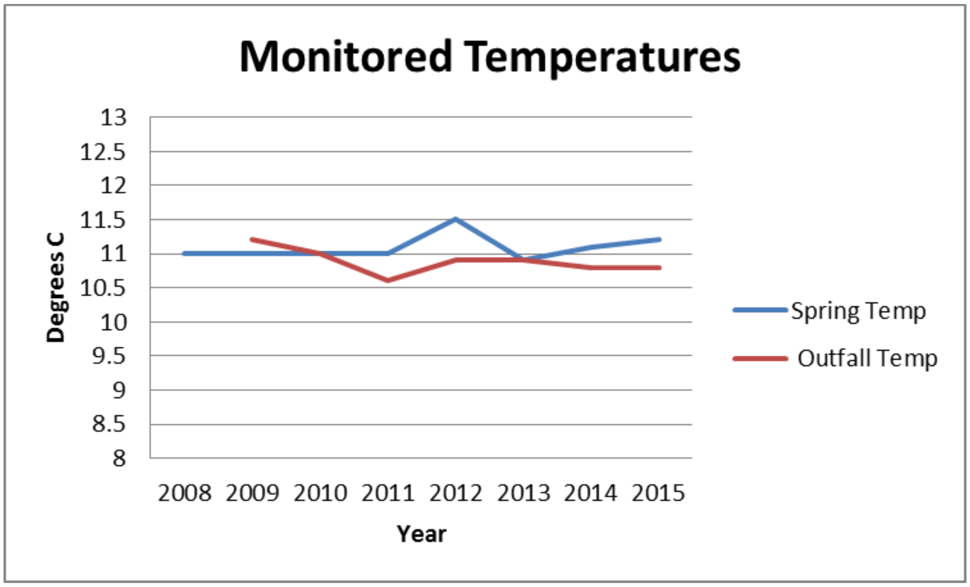


**Figure D-3. Monitored spring and outfall temperature 2008–2015, monthly averages.**

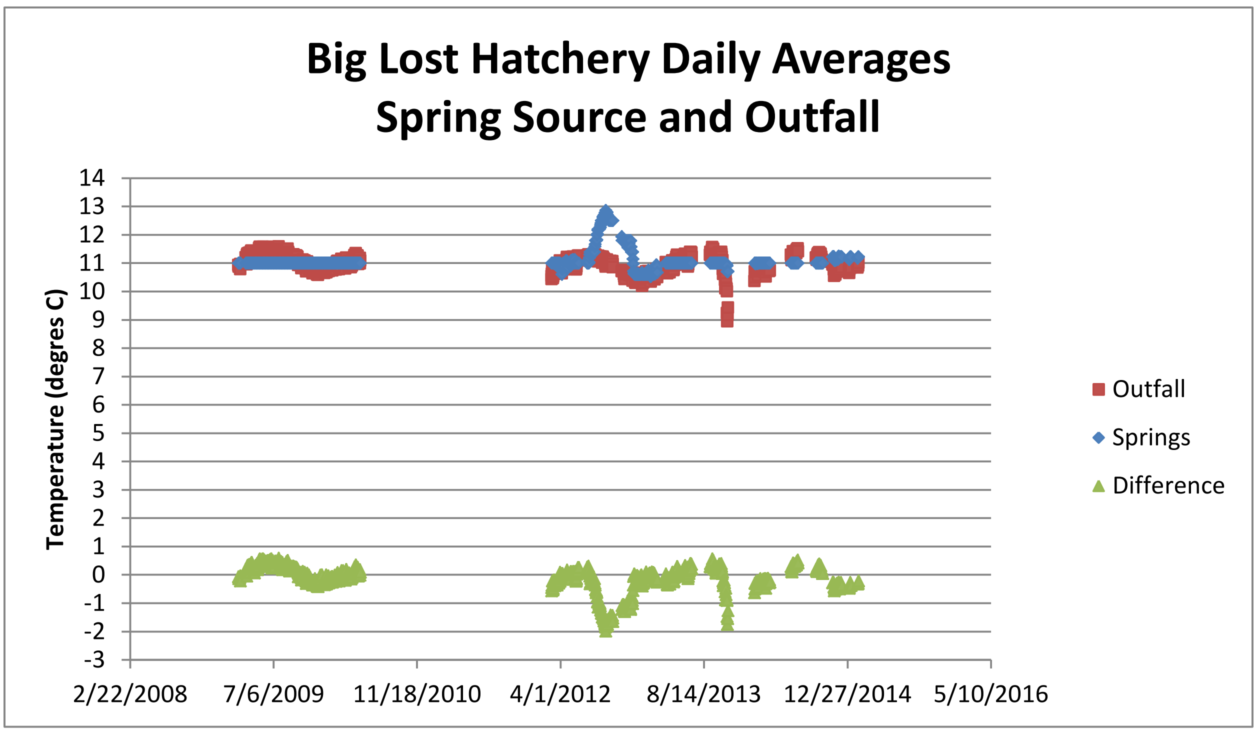


**Figure D-4. Mackay Fish Hatchery daily averages spring source and outfall.**

When the data are examined for daily averages and daily differences between the spring and outfall, 543 of 1,021 (53%) daily averages display a net water cooling between the spring source and outfall; 284 of 1,021 (28%) display temperature increases of less the 0.3 ºC, while 180 of 1,021 (18%) indicate temperature increases of more than 0.3 ºC. The daily differences are displayed in Figure D-5.

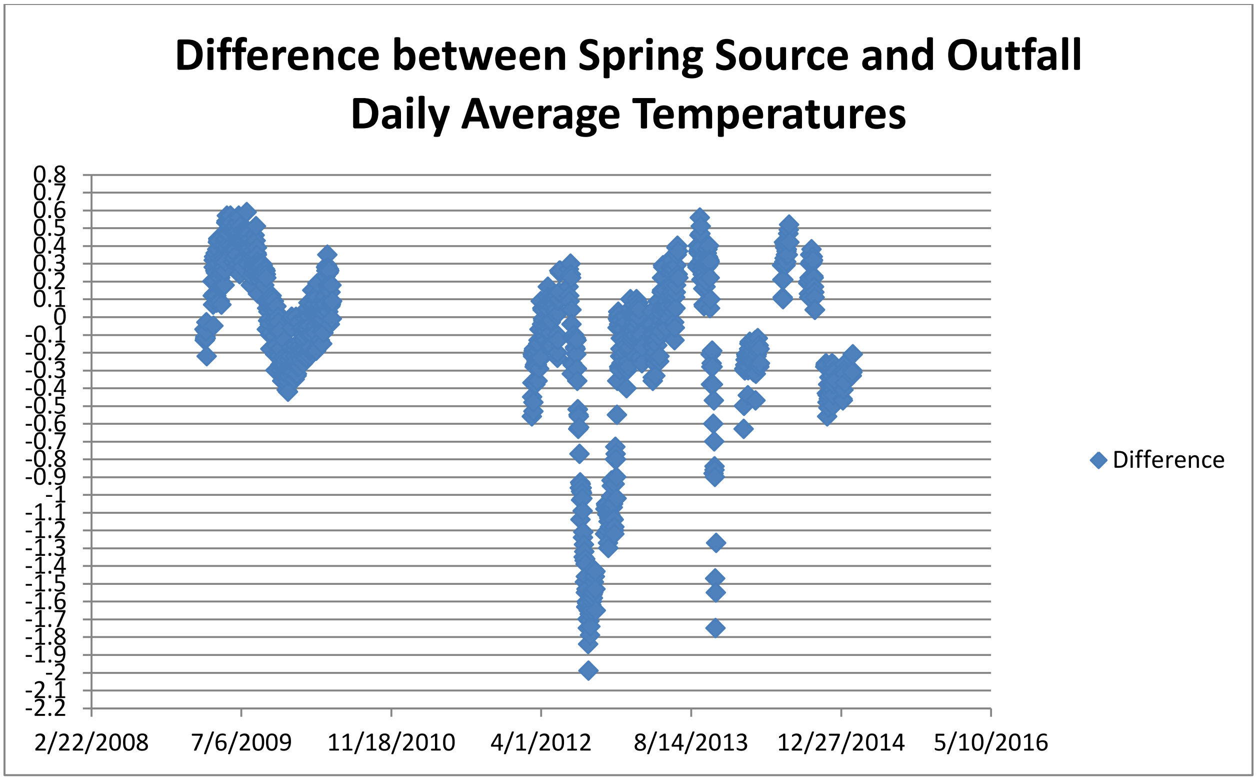


**Figure D-5. Difference between spring source and outfall daily average temperatures.**

## Clear Springs Foods, Inc. Lost River Hatchery (Permit # IDG-130000)

The Lost River Hatchery is located on the northern headwaters tributary of Warm Springs Creek. Similar to the IDFG facility, the Lost River Hatchery collects water directly as it is expressed from the spring source and immediately uses the water in aquaculture activities. Currently, the facility is not in use. Purchased by Clear Springs Foods, Inc., the hatchery is undergoing significant upgrades and construction. All the old holding tanks and raceways were removed and new construction is planned for 2015.

Clear Springs Foods collected temperature information in 2012 and 2013. Figure D-6 and Figure D-7 display 2012/2013 data reflecting the old configuration of point of diversion and delivery to the old hatchery under previous ownership. All spring temperatures were below 9 °C. In 2013, Clear Springs added additional spring sites, identified as S1 and S2 where they emerge from the ground. Each site is protected by a roof-shingled spring box. Site P1 is a pool created by a cement dam that captures additional water for diversion into the fish farm. Site H1 represents the location where S1 may enter the new hatchery. The difference in temperature between S1 and H1 results from current exposure in stream channels. It appears the spring near the point of use may exceed 9 °C, creating the same compliance issues for the Lost River Hatchery that currently occur for the IDFG Mackay Fish Hatchery.

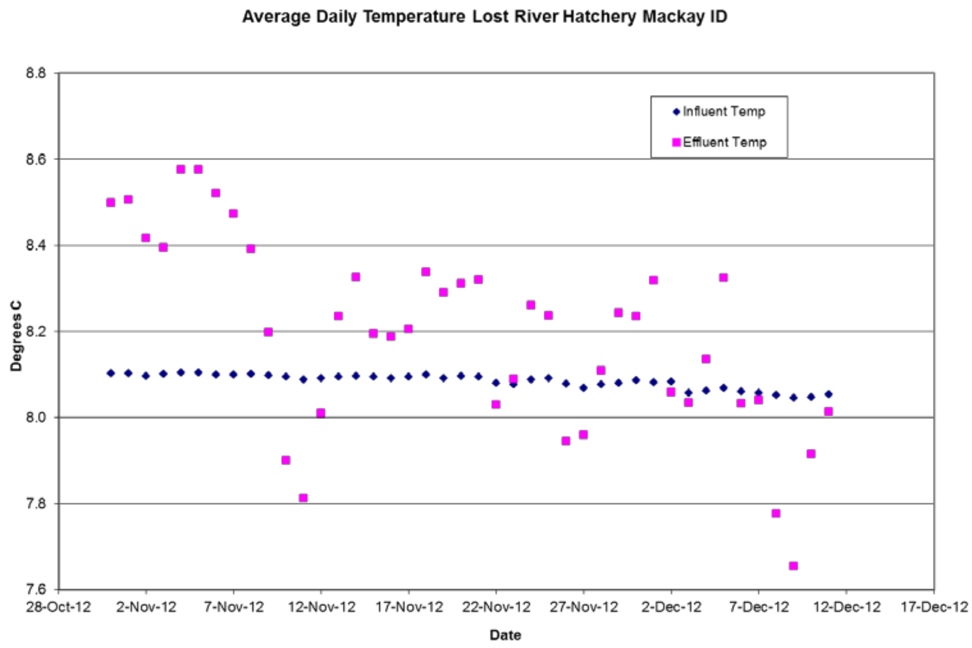


**Figure D-6. Lost River Hatchery average spring and effluent temperatures.**

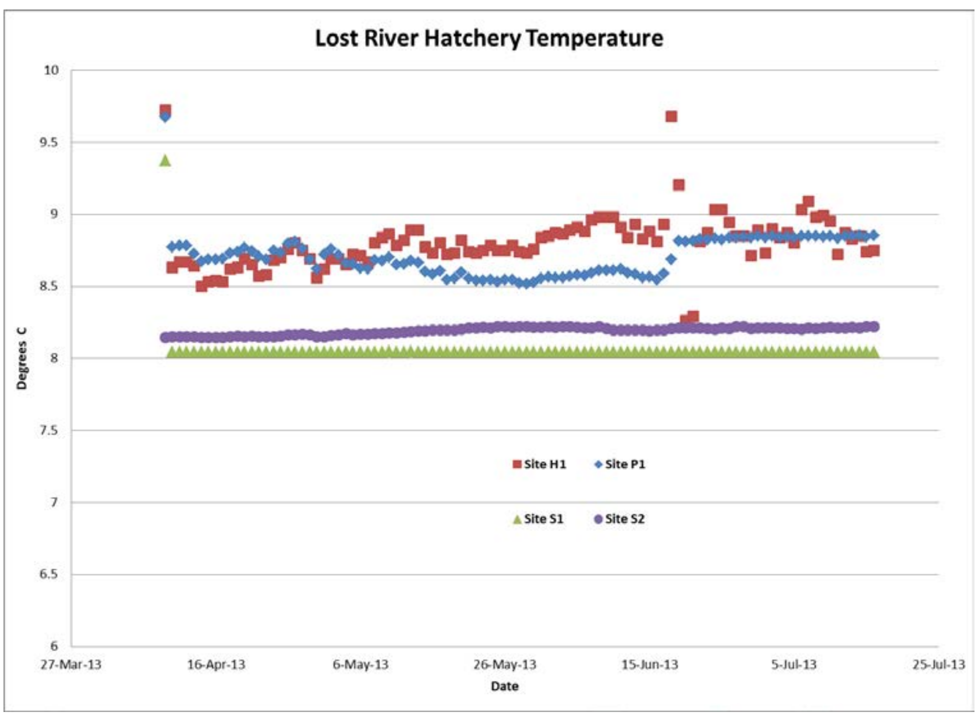


**Figure D-7. Lost River Hatchery sources and potential points of use.**

## Continued Monitoring

DEQ will establish a period of temperature records in Warm Springs Creek below each facility and at a combined downstream location to assess the Warm Springs assessment unit's (AU's) beneficial use support status for salmonid spawning related to temperature. Figure D-8 displays approximate temperature monitoring locations.


**Figure D-8. Proposed temperature monitoring network.**

## Modified Waste Load Allocation

Based on the collected data, the hatcheries do not continually increase the temperature of the spring sources before they are discharged from the present day outfall structure. The current wasteload allocation for both hatcheries is to meet the numeric state water quality standard including salmonid spawning temperatures during spring and fall months. Meeting the standard is not possible because the source water at the Mackay Fish Hatchery (11 °C) already exceeds the 9°C daily average for salmonid spawning. However, to protect salmonid spawning to the extent practicable, DEQ is modifying the current temperature wasteload allocation for the hatcheries to the inflow daily average temperature plus 0.15 ºC for each facility. This wasteload allocation is consistent with IDAPA 58.01.02.400.01(b), which allows for up to a 0.3 °C temperature increase above natural background. This 0.3 ºC increase must be divided between all the point sources found within the AU; specifically the Mackay Fish Hatchery and Lost River Hatchery. The wasteload allocation also reflects the actual natural background conditions for temperature. Each facility will need to measure continuous inflow temperature daily to determine compliance. Upon approval of this modification, the temperature wasteload allocations in the 2004 TMDL will no longer apply and the new wasteload allocations will become part of the next General Aquaculture Permit.

## Reasonable Assurance

Providing reasonable assurance for the point sources to meet the wasteload allocation is a necessary requirement of this wasteload allocation modification. The reasonable assurance for each facility is outlined below.

## Mackay Fish Hatchery

The Mackay Fish Hatchery facility does not appreciably impact Warm Springs Creek temperatures year round, and data suggest approximately 18% of the monitored daily averages will exceed the wasteload allocation. Four factors suggest the hatchery is currently implementing the most practicable best management practices (BMPs), presented below.

### Retention Time

Water used by the hatchery does not have an extended period of time for heat addition when used by the hatchery. During full production, the large raceways have a retention time of 58 minutes, the small raceways keep water 22 minutes, and the hole raceways average 35 minutes. From September through March (7 months per year), the retention times are typically only half as long, due to the lower production levels.

### Shade

During the summer months, IDFG covers the raceways with shade cloth, mounted on a frame. While designed to reduce sun burn on juvenile fish, heat stress is also reduced. The shade cloth also reduces solar insolation. Approximately 75% of the active hole and small raceways are covered during the summer months, and 10% of the large raceway is covered (Figure D-1).

### Spring Sources

The spring sources are covered in coarse, durable rock over the entire wetland area where the springs once emerged (Figure C-9). Constructed in 1984, the original intention of the rock cover was to protect the springs from contamination, but the rock cover also provides substantial temperature buffering during the high-temperature summer months.

### Temperatures

Inflow and outflow temperatures vary little from each other for many portions of the year.

\
**Figure D-9. Covered spring sources location at the Mackay Fish Hatchery.**

## Lost River Hatchery

Because the facility is not operating but being rehabilitated, the Lost River Hatchery was designed and will be constructed in a manner reflecting the current state of BMPs for aquaculture facilities. Like the Mackay Fish Hatchery, the use of shade cloth over raceways, spring source protection and temperature monitoring will demonstrate compliance with the wasteload allocation.

## Public Participation

The wasteload allocation modification for the two facilities was discussed with the Upper Snake basin advisory group on April 1, 2015. The wasteload allocation modification will go to public comment for 30 days and upon EPA approval, incorporated into the next General Aquaculture Permit and Clean Water Act §401 certified by DEQ as compliant with Idaho’s water quality standards.

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# Appendix E. Public Comments

DEQ presented the sampling plan, data results and the draft document to the Upper Snake Basin Advisory Group between 2012 and December 2015. A public comment period was conducted from March 23 through April 25, 2016. No public comments were received, aside from those provided by EPA. Those comments (in *italics*) and DEQ's responses (in **bold)** are presented below.

*The revised WLAs for the two aquaculture facilities (described in Appendix D) are not referenced in the Load and Wasteload Allocation section (5.4) of the TMDL. While it is fine to include the bulk of the rationale and discussion in Appendix D, the revised WLAs (ie. the allowance for each facility to increase source temperature by 0.15C) must be included or referenced in the wasteload allocation section of the TMDL itself.*

**The WLA language was added to section 5.4.**

*Other comments intended to improve and clarify the TMDL are as follows.*

1. *Water Diversions. General discussion of water diversions is included in section 5.4.1, p. 22. The document would be more complete if it inventoried what diversions occur in the Big Lost subbasin, the extent to which these may affect stream temperature, and whether any improvement can be made to address their impact.*

2. *Reasonable assurance. The discussion of reasonable assurance would benefit from discussion of specific programs or activities which are planned or available to increase stream shade, as called for in the TMDL.*

3. *Appendix D. This Appendix contains rationale for revising the two WLAs from the previously approved TMDL. Comments on the Modified Waste Load Allocation portion of the Appendix (copied below), include:*
    a. *You might consider moving discussion of the natural background provisions of Idaho WQS to the beginning of the paragraph to better establish an understanding of the underlying standard.*
    b. *It would help to more clearly explain that each facility is allowed to increase the incoming (natural) water temperature by no more than 0.15C. The state standard does not specify a daily average, hence to be consistent with the standard, the 0.15C increase should not be constrained to a daily average value only.*
    c. *It would help to clarify over what time period these WLA's apply to the facilities, otherwise it would be assumed that these limits apply year around.*
    d. *It would help to explain where each facility should measure temperature to be in compliance with this WLA, and/or that these locations will be established and agreed upon by IDEQ and EPA.*
    e. *"Upon approval of this modification, the temperature wasteload allocations in the 2004 TMDL will no longer apply and the new wasteload allocations will become part of the next General Aquaculture Permit". To clarify, the WLAs will supercede those in the 2004 TMDL when they are approved by EPA, but they will*

*not become effective as permit limits until such time as they are subsequently incorporated into the Aquaculture General Permit.*

**The language has been clarified in the document for clarity and accuracy.**

3. *Additional comments regarding the stormwater discussion and allocations are not available today, but will be provided within the next 1-2 days.*

**No additional comments were received.**

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# Appendix F. Distribution List

Salmon Challis National Forest

Upper Snake Filed Office Bureau of Land Management

Idaho Department of Fish and Game

Upper Snake BAG members

Idaho Soil Conservation Commission

Clear Springs Foods, Inc.

National Resource Conservation Service Arco Field Office

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