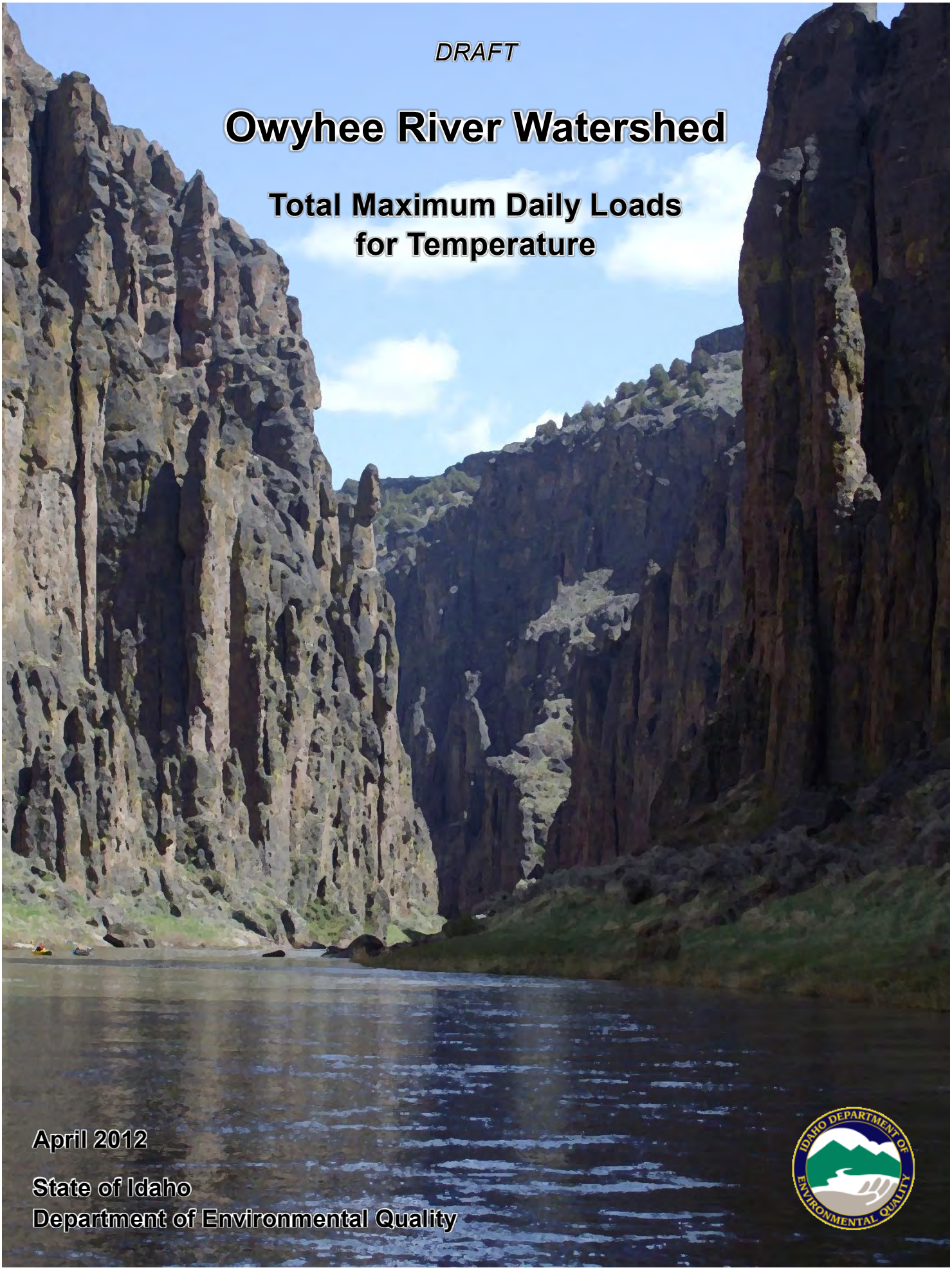

DRAFT

Owyhee River Watershed

Total Maximum Daily Loads for Temperature

April 2012

State of Idaho
Department of Environmental Quality

Owyhee River Watershed Total Maximum Daily Loads for Temperature

Addendum to the Upper Owyhee, North and Middle Fork Owyhee, and South Fork Owyhee Subbasin Assessments and Total Maximum Daily Loads

April 2012

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The cover photograph is of the Owyhee River near the Oregon border and was taken by Hawk Stone in April 2009. Notice the yellow raft in the bottom left corner.

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Abbreviations, Acronyms, and Symbols

°C	degrees Celsius
BLM	US Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
cat	category (of the Integrated Report)
CWA	Clean Water Act
CWAL	cold water aquatic life
DEQ	Department of Environmental Quality
EPA	US Environmental Protection Agency
FS	fully supporting
ft	feet
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
NB	natural background
NFS	not fully supporting
NPDES	National Pollutant Discharge Elimination System
PCR	primary contact recreation
PNV	potential natural vegetation
SCR	secondary contact recreation
SS	salmonid spawning
TMDL	total maximum daily load
WLA	wasteload allocation
WSA	wilderness study area

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Executive Summary

This document addresses the temperature impairments of 36 assessment units in the Owyhee River watershed in southwest Idaho. The Owyhee River watershed incorporates the Upper, South, and North and Middle Fork Owyhee River subbasins.

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) establishes requirements for states and tribes to identify and prioritize water bodies that do not meet water quality standards. States and tribes must periodically publish a prioritized list (a "§303(d) list") of impaired waters. This list is currently published every 2 years 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) of pollutants, set at a level to achieve water quality standards.

Temperature TMDLs were previously written for many assessment units in the Owyhee River watershed (DEQ 1999a, 1999b, 2003). However, the Idaho Department of Environmental Quality (DEQ) recommended rewriting those TMDLs using more appropriate shade targets based on knowledge of local vegetation types and natural stream widths (DEQ 2009a, 2009b). This document revises 25 previous TMDLs and establishes 11 new TMDLs (Table A).

Table A. Summary of new and revised TMDLs.

Subbasin	Hydrologic Unit Code (HUC)	Assessment Units with New TMDLs	Assessment Units with Updated TMDLs
Upper Owyhee River	17050104	11	10
South Fork Owyhee River	17050105	0	2
North & Middle Fork Owyhee River	17050107	0	13

Temperature analyses were completed using the potential natural vegetation method (Shumar and De Varona 2009). Shade levels were found to vary widely, but in general, the lower portion of a stream was more likely to meet its shade target than the upper portion. This difference is mainly because canyon walls, more prevalent in the lower reaches of a watershed, provide isolation and topographic shade to a stream. The following is a summary of the existing shade in the watershed:

- **Excellent shading:** Owyhee and South Fork Owyhee Rivers, lower Red Canyon, and lower Battle Creek
- **Good shading**: North and Middle Fork Owyhee Rivers; Camas, Deep, and Noon Creeks; East Fork Red Canyon; and the lower reaches of Cabin, Corral, Juniper, Nickel, Pole, Pleasant Valley, and Smith Creeks
- **Fair shading:** Camel Creek; West Fork Red Canyon; and the upper reaches of Battle, Cabin, Corral, Juniper, and Pleasant Valley Creeks

- **Poor shading:** Beaver, Castle, and Thomas Creeks and the upper reaches of Nickel, Pole, and Smith Creeks

To implement this TMDL, land managers should work to attain target shade levels for individual stream reaches. Priority should be given to areas with the greatest discrepancies between existing and target shade levels. A summary of assessment outcomes for all assessment units addressed in this addendum is provided in Tables B–D.

Table B. Summary of assessment outcomes for the Upper Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050104SW001_06	Owyhee River between Juniper Creek and South Fork	Leave in Cat 2	Meets targets
ID17050104SW006_06	Owyhee River between Blue and Juniper Creeks	Cat 3 to Cat 2	Meets targets
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	Cat 5 to Cat 4a	TMDL completed
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	Cat 5 to Cat 4a	TMDL completed
ID17050104SW026_04	Deep Creek between Hurry Back and Nickel Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW026_05	Deep Creek between Nickel Creek and Owyhee River	Leave in Cat 4a	TMDL updated
ID17050104SW028_02	Pole Creek upstream of Mud Flat	Leave in Cat 4a	TMDL updated
ID17050104SW028_03	Pole Creek between Camas Creek and Mud Flat	Leave in Cat 4a	TMDL updated
ID17050104SW028_04	Pole Creek between Camas and Deep Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_02	Nickel, Smith, and Thomas Creek headwaters	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_03	Nickel, Smith and Thomas Creeks—3rd order	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_04	Nickel and Smith Creeks—4th order	Cat 3 to Cat 4a	TMDL completed
ID17050104SW032_02	Castle Creek upstream of Skunk Creek	Leave in Cat 4a	TMDL updated
ID17050104SW032_03	Castle Creek between Skunk and Deep Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	Cat 5 to Cat 4a	TMDL completed
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	Cat 5 to Cat 4a	TMDL completed
ID17050104SW034_02	West Fork Red Canyon	Leave in Cat 4a	TMDL updated
ID17050104SW034_03	East Fork Red Canyon and Red Canyon upstream of Petes Creek	Leave in Cat 4a	TMDL updated
ID17050104SW034_04	Red Canyon between Petes Creek and Owyhee River	Leave in Cat 4a	TMDL updated

Table C. Summary of assessment outcomes for the South Fork Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050105SW001_06	South Fork Owyhee River upstream of Little Owyhee River	Leave in Cat 4a	TMDL updated
ID17050105SW001_07	South Fork Owyhee River downstream of Little Owyhee River	Leave in Cat 4a	TMDL updated

Table D. Summary of assessment outcomes for the North and Middle Fork Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050107SW001_07	Owyhee River between South Fork and Oregon border	Cat 3 to Cat 1	Meets targets
ID17050107SW004_02	Middle Fork Owyhee River upstream of Summit Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW004_03	Middle Fork Owyhee River downstream of Summit Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW008_02	North Fork Owyhee River upstream of Big Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW008_03	North Fork Owyhee River between Big Spring and Pleasant Valley Creeks	Leave in Cat 4a	TMDL updated
ID17050107SW008_04	North Fork Owyhee River between Pleasant Valley and Juniper Creeks, and Juniper Creek between Cabin Creek and North Fork Owyhee River	Leave in Cat 4a	TMDL updated
ID17050107SW008_05	North Fork Owyhee River downstream of Juniper Creek	Leave in Cat 4a	TMDL updated
ID17050107SW009_02	Pleasant Valley Creek upstream of East Fork Pleasant Valley Creek	Leave in Cat 4a	TMDL updated
ID17050107SW009_03	Pleasant Valley Creek between North Fork Owyhee River and East Fork Pleasant Valley Creek	Leave in Cat 4a	TMDL updated
ID17050107SW010_02	Noon Creek	Leave in Cat 4a	TMDL updated
ID17050107SW011_02	Cabin and Corral Creek headwaters	Leave in Cat 4a	TMDL updated
ID17050107SW011_03	Cabin and Corral Creeks—3rd order	Leave in Cat 4a	TMDL updated
ID17050107SW012_02	Juniper Creek upstream of Buck Creek	Leave in Cat 4a	TMDL updated
ID17050107SW012_03	Juniper Creek between Buck and Cabin Creeks	Leave in Cat 4a	TMDL updated

Watershed Overview

The Owyhee River watershed encompasses a large area of southwest Idaho. It incorporates the Upper Owyhee River subbasin (hydrologic unit code [HUC] 17050104), South Fork Owyhee River subbasin (HUC 17050105), and North and Middle Fork Owyhee River subbasin (HUC 17050107) (Figure A).

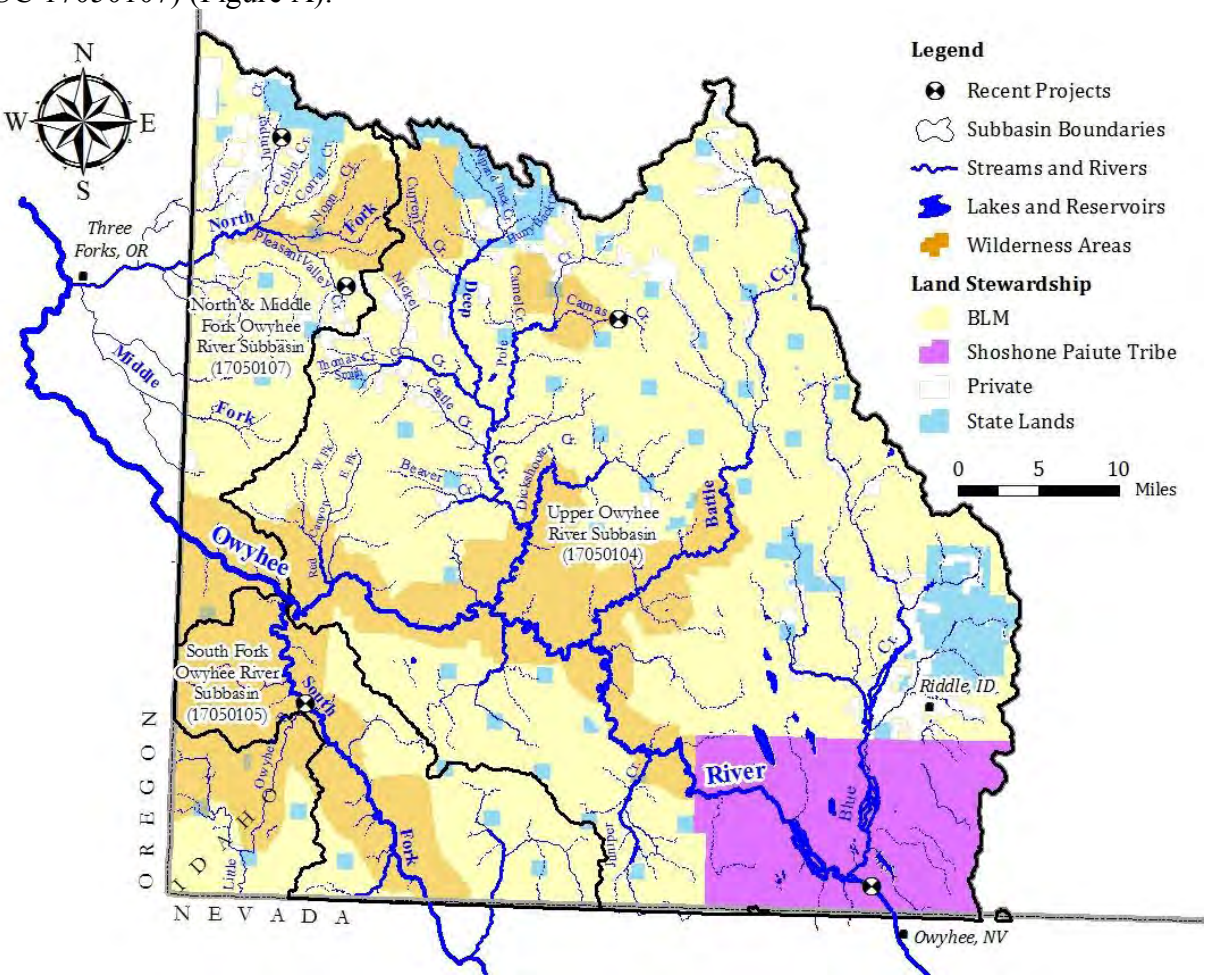

Figure A. Watershed at a glance.

The headwaters of the Owyhee River and its South Fork originate in the Independence and Bull Run Mountains of northern Nevada. Both flow through deep canyons to their confluence 8 miles upstream of the Oregon border. At that point, the river is nearly one thousand feet below the surrounding plateau. The North and Middle Forks flow from the canyons of South Mountain and the western flanks of Juniper Mountain and join the main Owyhee River at Three Forks, Oregon.

Deep Creek drains the eastern slopes of Juniper Mountain and flows through dry tablelands to its confluence with the Owyhee River. Battle Creek is more arid still and is named after a nearby 1864 battle that killed Michael Jordan and James Carroll, known for discovering gold in Silver City.

Several assessment units were listed on Idaho's 2010 §303(d) list for temperature pollution (Table E) (DEQ 2011).

Table E. Assessment units on Idaho's 2010 §303(d) list.

Assessment Unit	Description	Pollutant
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	Temperature
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	
ID17050104SW031_02	Nickel, Smith, and Thomas Creek headwaters	
ID17050104SW031_03	Nickel, Smith, and Thomas Creeks—3rd order	
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	

The 4th-order of Nickel Creek was mistakenly not listed on Idaho's 2010 §303(d) list (Table F), despite instructions to do so in the original TMDL. TMDLs were developed in this addendum for all of these assessment units.

Table F. Impaired assessment units not on Idaho's 2010 §303(d) list.

Assessment Unit	Description	Pollutant
ID17050104SW031_04	Nickel and Smith Creeks—4th order	Temperature

Public Participation

This document was sent to the watershed advisory group (WAG) in February 2012. The WAG was invited to review, comment upon, and provide local insight into the TMDL. These comments were incorporated in April 2012.

The TMDL will now be opened to public comment.

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1 Watershed Characterization

This document addresses temperature impairments in 36 assessment units in three subbasins (identified by hydrologic unit codes, or HUCs) in the Owyhee River watershed:

- HUC 17050104—Upper Owyhee River subbasin
- HUC 17050105—South Fork Owyhee River subbasin
- HUC 17050107—North and Middle Fork Owyhee River subbasin

1.1 Introduction—Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a prioritized list (a "§303(d) list") of impaired waters. This list is currently published every 2 years 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 is an addendum to three existing TMDLs and addresses the water bodies in the Owyhee River watershed that have been placed on Idaho's current §303(d) list (DEQ 2011). This addendum updates 25 existing TMDLs and establishes 11 new temperature TMDLs.

1.2 Physical and Biological Characteristics

Detailed discussions of the physical, biological, climate, subbasin, subwatershed, and stream characteristics of the Owyhee River watershed are provided in the following three TMDLs approved by the US Environmental Protection Agency (EPA):

- *Upper Owyhee Watershed Subbasin Assessment and Total Maximum Daily Load* (approved by EPA in March 2003) (DEQ 2003)
- *South Fork Owyhee River Subbasin Assessment and Total Maximum Daily Load* (approved by EPA in March 2000) (DEQ 1999a)
- *North and Middle Fork Owyhee Subbasin Assessment and Total Maximum Daily Load* (approved by EPA in February 2000) (DEQ 1999b)

No significant physical and biological changes have occurred since the publication of these documents.

1.3 Cultural Characteristics

A detailed discussion of the cultural characteristics of the Owyhee River watershed is provided in the above referenced documents.

The main change has been to the wilderness status of much of the land in the watershed. On March 30, 2009, the Owyhee Public Lands Management Act ("Owyhee Initiative") was signed into law. Senator Mike Crapo's website enumerates many of the benefits of the act:

- Resolution of decades-old public lands conflicts and certainty for various user groups.
- Better enforcement and prevention of indiscriminate off-road/off-trail travel by motorized vehicles.
- Designation of over 517,000 acres of wilderness, including 55,000 acres of cow-free wilderness.
- Designation of nearly 315 miles of wild and scenic rivers.
- Establishment of a coordinated Science Review to address management issues affecting public and private rangelands in Owyhee County.
- Establishment of a Research and Conservation Center in Owyhee County for collaborative research projects.
- Preservation of outstanding recreational opportunities.
  (Source: *http://www.crapo.senate.gov/issues/documents/Summary.4.14.08.doc*)

The following changes have occurred as a result of the act:

Upper Owyhee River Subbasin

- Upper Deep Creek was released from Wilderness Study Area (WSA) status.
- Most of Pole Creek was released from WSA status. Camas Creek and a few miles of Pole Creek are now in the Pole Creek Wilderness.
- Current Creek, from Indian Meadows to Mud Flat Road, is now in the North Fork Owyhee Wilderness.
- Lower Deep Creek and most of Dickshooter Creek are now in the Owyhee River Wilderness.
- Lower Battle Creek is included in the Owyhee River Wilderness.
- Lower Red Canyon is included in the Owyhee River Wilderness. Upper Red Canyon was released from WSA status.
- The only grazing change will be that the isthmus between Deep and Battle Creeks (approximately 36 square miles) is now ungrazed.
- Battle, Deep, Dickshooter, and Red Canyon Creeks and the Owyhee River are now generally Wild or Recreational Rivers when they flow through wilderness.

South Fork Owyhee River Subbasin

- The entire corridor of the South Fork Owyhee River, with the exception of the 45 Ranch, is now wilderness.

North and Middle Fork Owyhee River Subbasin

- The North Fork Owyhee River is now a Recreational River from the state line to Juniper Mountain Road and a Wild River for 15 miles upstream of Juniper Mountain Road. The watershed has largely become wilderness, from about 1 mile upstream of the Mud Flat Road crossing, almost to the very headwaters. Additionally, the north side of the river will be mostly ungrazed. The Indian Meadows area was released from WSA status.

- The entire Noon Creek watershed and Big Springs Creek watersheds are encompassed by the new wilderness area and will be ungrazed.
- The lower part of Pleasant Valley Creek was included in the wilderness, and the upper part was released from WSA status.
- Most of the Juniper, Cabin, and Corral Creek watersheds were released from WSA status, as was the entire Middle Fork Owyhee River watershed.

Please see Figure A for a map of the new wilderness areas.

2 Water Quality Concerns and Status

This section provides an overview of the assessment units addressed in this addendum, beneficial uses applicable to those assessment units, and the water quality criteria in place to protect those uses. This section also summarizes existing water quality data and identifies any data gaps found during the TMDL analysis.

2.1 Water Quality Limited Assessment Units in the Subbasin

Section 303(d) of the CWA states that waters unable to support their beneficial uses and that 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.

Ten assessment units have been added to the §303(d) list for temperature impairment since publication of the original 25 TMDLs. Table 1 shows the reason for the listings. An eleventh assessment unit (ID17050104SW031_04) is also impaired by temperature but was mistakenly omitted from the 2010 Integrated Report.

Table 1. New temperature-impaired §303(d)-listed segments in the Owyhee River basin.

Assessment Unit	Description	Listing Reason[a]
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	BLM temperature data
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	
ID17050104SW031_02	Nickel, Smith, and Thomas Creek headwaters	DEQ temperature data
ID17050104SW031_03	Nickel, Smith, and Thomas Creeks—3rd order	
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	BURP data
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	

[a] BLM = Bureau of Land Management; BURP = DEQ's Beneficial Use Reconnaissance Program

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards, defined in IDAPA 58.01.02, designate 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 briefly described in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) gives a more detailed description of beneficial uses. A summary of beneficial uses for the assessment units addressed in this addendum and their support status is provided in Tables 2–4.

2.2.1 Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing instream water uses and the level of water quality necessary to protect those uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.054). Existing uses include uses actually occurring, whether or not the level of water quality to fully support the uses exists.

2.2.2 Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the State and are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (IDAPA 58.01.02.109–.02.160). In Idaho, these designated uses include aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use.

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.

2.2.3 Presumed Uses

In Idaho, most water bodies listed in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated in the future. In the interim, and absent information on existing uses, the Idaho Department of Environmental Quality (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 will apply the numeric cold water aquatic life criteria and primary or secondary contact recreation criteria to undesignated waters.

Table 2. Beneficial uses of §303(d)-listed streams in the Upper Owyhee River subbasin.

Assessment Unit and Description		Beneficial Uses	Use Type	Use Support
ID17050104SW023_02	Battle Creek—1st and 2nd order	CWAL PCR	Presumed Presumed	NFS FS
ID17050104SW023_03	Battle Creek—3rd order	CWAL PCR	Presumed Presumed	NFS FS
ID17050104SW023_04	Battle Creek—4th order	CWAL PCR	Presumed Presumed	NFS FS
ID17050104SW026_04	Deep Creek—4th order	CWAL	Presumed	NFS
ID17050104SW026_05	Deep Creek—Nickel Creek to mouth	CWAL SS SCR	Presumed Presumed Presumed	NFS NFS FS
ID17050104SW028_02	Pole Creek—1st and 2nd order	CWAL	Presumed	NFS
ID17050104SW028_03	Pole Creek—3rd order	CWAL	Presumed	NFS
ID17050104SW028_04	Pole Creek—4th order	CWAL	Presumed	NFS
ID17050104SW029_03	Camas Creek—3rd order	CWAL	Presumed	NFS
ID17050104SW030_02	Camel Creek—1st and 2nd order	CWAL	Presumed	NFS
ID17050104SW031_02	Nickel Creek—source to mouth	CWAL	Presumed	NFS
ID17050104SW031_03	Nickel, Thomas, and Smith Creeks—3rd order	CWAL SS SCR	Presumed Presumed Presumed	NFS NFS FS
ID17050104SW031_04	Nickel Creek—4th order	None listed	None listed	None listed
ID17050104SW032_02	Castle Creek—1st and 2nd order	CWAL	Presumed	NFS
ID17050104SW032_03	Castle Creek—3rd order	CWAL	Presumed	NFS
ID17050104SW033_02	Beaver Creek—1st and 2nd order	CWAL	Presumed	NFS
ID17050104SW033_03	Beaver Creek—3rd order	CWAL	Not listed	NFS
ID17050104SW033_04	Beaver Creek—4th order	CWAL	Not listed	NFS
ID17050104SW034_02	Red Canyon—1st and 2nd order	CWAL	Designated	NFS
ID17050104SW034_03	Red Canyon—3rd order	CWAL PCR	Designated Designated	NFS FS
ID17050104SW034_04	Red Canyon—4th order	CWAL	Designated	NFS

Note: PCR/SCR = primary/secondary contact recreation; CWAL = cold water aquatic life; SS = salmonid spawning; NFS = not fully supporting; FS = fully supporting

Table 3. Beneficial uses of §303(d)-listed streams in the South Fork Owyhee River subbasin.

Assessment Unit and Description		Beneficial Uses	Use Type	Use Support
ID17050105SW001_06	South Fork Owyhee River above Little Owyhee river	CWAL PCR	Designated Designated	NFS FS
ID17050105SW001_07	South Fork Owyhee River below Little Owyhee River	CWAL PCR	Designated Designated	NFS FS

Note: PCR = primary contact recreation; CWAL = cold water aquatic life; NFS = not fully supporting; FS = fully supporting

Table 4. Beneficial uses of §303(d)-listed streams in the North and Middle Fork Owyhee River subbasin.

Assessment Unit and Description		Beneficial Uses	Use Type	Use Support
ID17050107SW008_02	North Fork Owyhee River and tributaries—1st and 2nd order	PCR CWAL SS	Designated Designated Designated	FS NFS NFS
ID17050107SW008_03	North Fork Owyhee River—3rd order	PCR CWAL SS	Designated Designated Designated	FS NFS NFS
ID17050107SW008_04	North Fork Owyhee River and Juniper Creek—4th order	PCR CWAL SS	Designated Designated Designated	FS NFS NFS
ID17050107SW008_05	North Fork Owyhee River—5th order	PCR CWAL SS	Designated Designated Designated	FS NFS NFS
ID17050107SW004_02	Middle Fork Owyhee River and tributaries—1st and 2nd order	SS CWAL	Designated Designated	NFS NFS
ID17050107SW004_03	Middle Fork Owyhee River—3rd order	SS CWAL	Designated Designated	NFS NFS
ID17050107SW009_02	Pleasant Valley Creek and tributaries—1st and 2nd order	SS CWAL	Existing Presumed	NFS NFS
ID17050107SW009_03	Pleasant Valley Creek—3rd order	SS CWAL	Existing Presumed	NFS NFS
ID17050107SW010_02	Noon Creek—entire watershed	CWAL SS	Designated Existing	FS NFS
ID17050107SW011_02	Cabin and Corral Creeks and tributaries—1st and 2nd order	SCR CWAL SS	Presumed Presumed Existing	FS NFS NFS
ID17050107SW011_03	Cabin and Corral Creeks—3rd order	SCR CWAL SS	Presumed Presumed Existing	NFS NFS NFS
ID17050107SW012_02	Juniper Creek and tributaries—1st and 2nd order	SCR CWAL SS	Presumed Presumed Existing	FS NFS NFS
ID17050107SW012_03	Juniper Creek—3rd order	SCR CWAL SS	Presumed Presumed Existing	FS NFS NFS

Note: PCR/SCR = primary/secondary contact recreation; CWAL = cold water aquatic life; SS = salmonid spawning; NFS = not fully supporting; FS = fully supporting

2.3 Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250).

The temperature criteria are numeric:

- **Cold Water Aquatic Life—**22 °C or less daily maximum; 19 °C or less daily average
- **Salmonid Spawning—**13 °C or less daily maximum; 9 °C or less daily average

The rules contain an exemption for extremely hot days. See Appendix A for more information and water quality standards for temperature.

Figure 1 provides an outline of the stream assessment process for determining support status of common beneficial uses (Grafe et al. 2002).

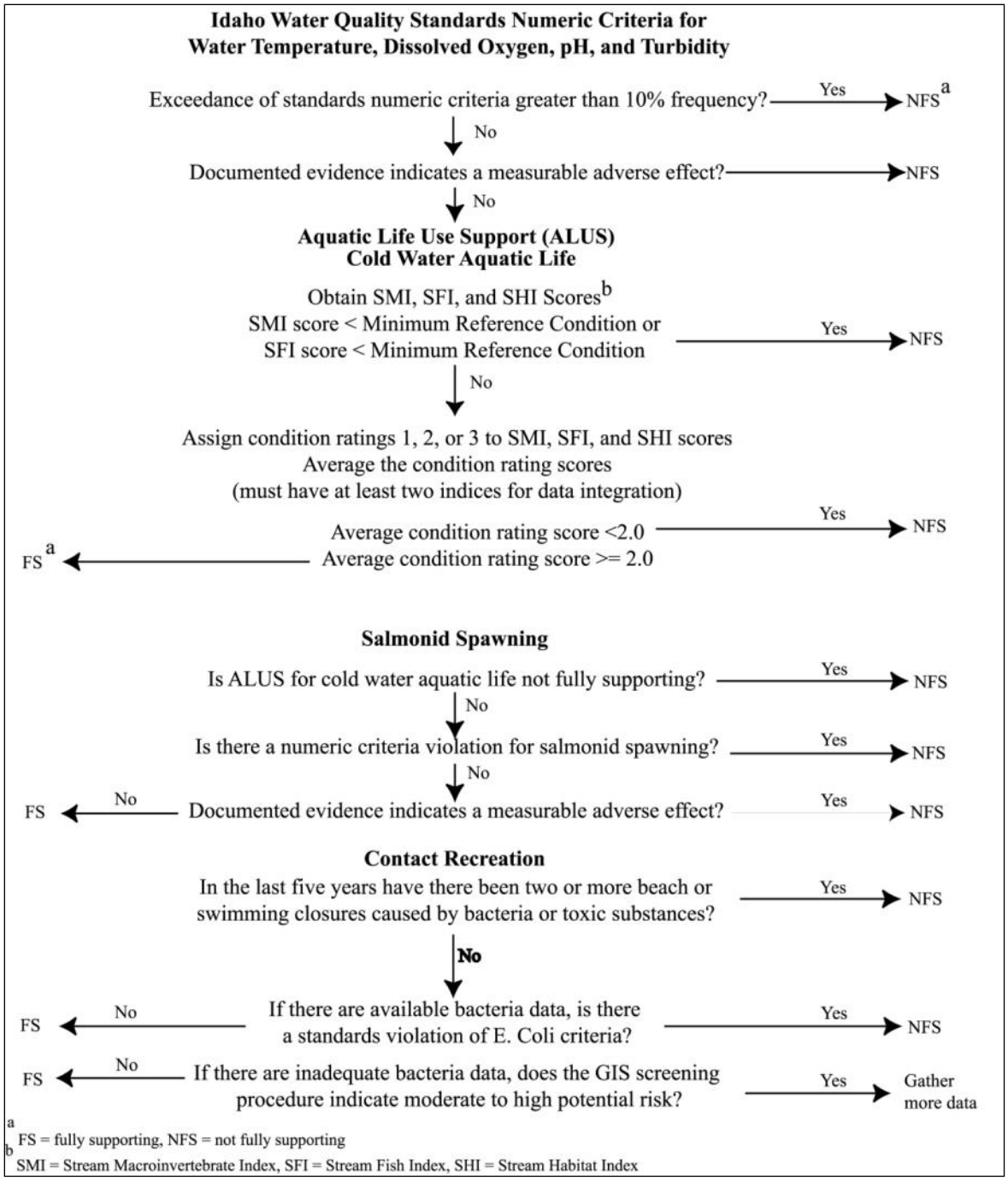

Figure 1. Determination steps and criteria for determining support status of beneficial uses in wadeable streams.

2.4 Summary and Analysis of Existing Water Quality Data

A detailed analysis of existing water quality data for the Upper Owyhee River subbasin is provided in the *Upper Owyhee River TMDL Five-Year Review* (DEQ 2009a).

Aside from the Solar Pathfinder traces addressed later in this document, no recent data exist for the South Fork Owyhee River subbasin.

A detailed analysis of existing water quality data for the North and Middle Fork Owyhee River subbasin is provided in the *North and Middle Fork Owyhee River TMDL Five-Year Review* (DEQ 2009b).

2.5 Data Gaps

The largest data gap was incomplete verification of aerial shade estimates. This gap can be addressed by collecting more Solar Pathfinder traces from impaired assessment units.

3 Pollutant Source Inventory

3.1 Point Sources

There are no point sources of pollution in the Owyhee River watershed.

3.2 Nonpoint Sources

Nonpoint source temperature pollution is caused by removal of streamside vegetation and by morphological changes that reduce shading to the stream. Detailed discussions of nonpoint sources in the Owyhee River watershed are provided in the three original TMDLs (DEQ 1999a, 1999b, 2003)

3.3 Pollutant Transport

Detailed discussions of pollutant transport are provided in the original TMDLs.

4 Monitoring and Status of Water Quality Improvements

A riparian assessment of the Upper Owyhee River watershed was conducted in summer 2003. The assessment included an inventory of the privately owned §303(d)-listed stream segments and unlisted stream segments. The surveys showed that upland areas above streams have minimal impact on riparian function and stream conditions.

During this assessment, riparian proper functioning condition (PFC) monitoring, along with other data collection, was completed on private lands.

Several water quality improvement projects have been installed in the watershed (Figure A):

- Camas Creek—12 off-channel retention ponds and 6,000 feet of riparian fencing
- Pleasant Valley Creek—3 off-site watering troughs and 17,000 feet of riparian fencing
- Juniper Creek—one permanent diversion in place of a temporary diversion that had to be removed and reinstalled each year

- South Fork Owyhee River:
  - 800 feet of willow pole planting, to stabilize the channel bank
  - 5,710 feet of pipeline installed to replace earthen ditches and reduce irrigation water-induced erosion
  - 40 acres of pasture planting to reduce erosion
  - 640 feet of rip-rap installed to stabilize and protect streambank
  - 4 structures for permanent diversions installed in place of temporary diversions that had to be removed and reinstalled each year
  - 26 acres of wetland restored to provide the biological benefits of a wetland

- Owyhee River headwaters—the Shoshone-Paiute Tribe has been collecting water quality data for the last few years within the boundaries of the Duck Valley Indian Reservation. Several water quality improvement projects have been implemented, including water troughs on the uplands, fencing, and pasture rotation. As a result, the Tribe has noticed significant improvement in water quality on the reservation, especially a decrease in bacteria counts (John Crum, personal communication, April 2012).

These projects should help decrease the water temperatures and sediment levels in each stream, but the exact results are unknown.

For more details, please see the Upper Owyhee River and North and Middle Fork Owyhee River TMDL five-year reviews (DEQ 2009a, 2009b).

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (or *load capacity*) on discharge of a pollutant from all sources to ensure water quality standards are met. This load capacity (LC) can be represented by an equation:

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

Where:

MOS = margin of safety. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, 40 CFR Part 130 requires a margin of safety, which is effectively a reduction in the load capacity available for allocation to pollutant sources. This TMDL features an implicit MOS.

NB = natural background. When present, NB may be considered part of the load allocation (LA), but it is often considered separately because it represents a part of the load not subject to control. NB is also effectively a reduction in the load capacity available for allocation to human-made pollutant sources.

LA = load allocation for all nonpoint sources

WLA = wasteload allocation for all point sources

A load is a quantity of a pollutant discharged over some period; numerically, it is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, federal rules allow for "other appropriate measures" (e.g., shade) 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 loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques preclude more accurate estimates.

The TMDL process is applied to a stream that is not attaining its beneficial use (i.e., is §303(d)-listed [in Category 5 of the Integrated Report]) and can be simplified as follows:

1. Set a water-quality target at which the beneficial use will be attained. This can be a year-round target, or it might only apply during certain times (i.e., a critical period) (section 5.1).
2. Determine what pollutant load would cause the target to be reached. This is the load capacity (section 5.2).
3. Measure the existing pollutant load (section 5.3).
4. Calculate the reduction needed to reach the load capacity, including a margin of safety (section 5.4).
5. Assign load and wasteload allocations to the individual pollutant sources in an equitable manner (section 5.4).
6. Devise an implementation plan to effect these reductions (section 5.5).

The pollutant addressed in this TMDL is *heat* (listed as temperature), measured in kilowatt-hours (kWh). The loads are expressed in kilowatt-hours per day.

5.1 Instream Water Quality Targets

Streams in the Owyhee River watershed often exceed state temperature criteria, even in their pristine condition. As an alternative to rigid criteria, the Idaho water quality standards include a natural background provision:

> When natural background conditions exceed any applicable water quality criteria … the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions… (IDAPA 58.01.02.200.09)

In these situations, natural background conditions essentially become the water quality standard, and absent other anthropogenic sources of thermal pollution, the natural levels of shade and channel width become the TMDL target.

See Appendix A for further discussion of water quality standards and background provisions.

5.1.1 Potential Natural Vegetation instead of Temperature Measurements

There are several important contributors of heat to a stream, including ground water temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the most likely to be affected by anthropogenic activities, mainly through changes to streamside vegetation.

Along with topographic features such as canyon walls, streamside vegetation provides shade to the water. The idea behind potential natural vegetation (PNV) TMDLs is to set shade targets and thermal loads equal to the natural levels that would be experienced by the stream. *Natural* in this case means in the absence of any anthropogenic removal of shading vegetation.

The PNV method has several stages:

1. The existing shading level is estimated using aerial photography. These estimates are ground-checked using a Solar Pathfinder, a device that measures shade.
2. The target shade (the natural background or potential natural vegetation condition) is established using knowledge of local plants, riparian conditions, and similar systems. These factors together take the form of an effective shade curve, which establishes target shade for different stream widths and vegetation heights.
3. The existing and target conditions are compared.
    a. Where existing shade is less than target shade, it means that water is being heated above natural background levels.
    b. The difference between existing and target shade indicates the increase in shading needed to bring the stream back into compliance with water quality standards.
    c. Implementation efforts can be directed to areas with the largest difference between existing and target shade.
4. At all stages of the process, the shade values (percentages) are converted into incident solar load, measured in kilowatt-hours per square meter per day ($kWh/m^2/day$). This conversion fulfills the TMDL requirement for the load to be expressed as a quantity of a pollutant discharged over time. The load is dependent upon the width of the stream, which can be measured in the field or estimated from aerial photographs or hydrologic curves.
5. The existing shade condition can be updated whenever a new aerial photograph is taken or after field verification using the Solar Pathfinder.

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.

The procedures for developing PNV analyses are described in Shumar and De Varona (2009). For a more complete discussion of shade and its effects on stream water temperature, please refer to the *South Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2004a).

5.1.2 Target Selection

The previous temperature TMDLs (DEQ 1999a, 1999b, and 2003) used the SSTEMP model (Bartholow 2002), which indicated that shade targets had to range from 88 to 100% to meet the numeric temperature criteria in June. For example, Deep Creek was assigned a 100% shade target along its entire length.

Our analysis of vegetation types shows that the natural level of vegetative shade is highly variable and can range from as high as 100% on small headwater streams to as low as 7% on the

Owyhee River itself. We developed targets by determining natural riparian plant communities for the watershed and examining the appropriate shade curves.

Riparian Species

Nip And Tuck Creek and the streams of Juniper Mountain (Thomas, Smith, Castle, and Beaver Creeks on the east side, Red Canyon Creek to the south) feature riparian communities dominated by yellow willow (*Salix lutea)* and western juniper (*Juniperus occidentalis*). These streams tend to have dry headwaters in sagebrush/grass communities that extend out of and are intertwined with the juniper zone.

The entire South Fork Owyhee River features a sagebrush/grass riparian type. The intermittent and flashy nature of the river prevents the establishment of other riparian species.

An aspen (*Populus tremuloides)* vegetation type occurs at the headwaters of Juniper Creek, and an aspen and alder (*Alnus* sp.*)* mixed community occurs in the upper drainage of the Middle Fork Owyhee River.

The rest of the creeks in the Owyhee River watershed are dominated by willow communities. Above 5,600 feet, riparian vegetation is generally represented by a yellow willow type community. Below this elevation, riparian vegetation is represented by the coyote willow (*Salix exigua*) type community.

Other plant communities likely exist along portions of these streams, but it is difficult to determine without extensive fieldwork. Shade curves developed for most plant community types are based on groupings of species (e.g., dogwood, sumac, chokecherry, currant, willow, and juniper) and not an individual species.

A number of streams enter long, narrow canyon sections where a combination of dense willow growth and canyon walls provide for exceptional shade quality. These streams will experience less solar loading than a similar stream shaded by vegetation alone.

Effective Shade Curves

To determine PNV shade targets for the Owyhee River watershed, we examined effective shade curves developed specifically for southern Idaho (Shumar and De Varona 2009; Hansen and Hall 2002):

- Dry stream reaches were placed in the sagebrush/grass vegetation type, the shade curve for which is based on typical canopies and heights for *Artemisia* spp. and bunchgrasses. This vegetation type is usually more typical of upland areas but is also appropriate for intermittent streams.
- We did not have a curve for western juniper, and so we used the Utah juniper (*Juniperus osteosperma*) vegetation type. Utah juniper is similar in mature height to western juniper (8 m and 9 m, respectively), and the overall plant community used to construct the shade curve consisted of smaller deciduous shrubs similar in size to those in the southwest Idaho region. Riparian communities of western and Utah juniper produce similar levels of shade.

- We used the graminoid shade curve for the grass-dominated meadows on the headwaters of Battle, Camas, Camel, Castle, Current, Nickel, and West Fork Red Canyon Creeks. This shade curve is entirely based on grasses and sedges, which are shorter than typical riparian shrubs.
- For the remainder of the creeks, we used shade targets based on the yellow and coyote (sandbar) willow types.
- Ponds and reservoirs, when visible in the aerial photographs, were also assigned shade targets. A natural lake is assigned a shade target of zero, whereas a man-made reservoir is assigned the shade target from the inflowing stream. This strategy allows us to quantify the thermal impact of the reservoir, which can be substantial.

An effective shade curve describes how well a given vegetation type is able to shade streams of various widths. The seven curves used in this TMDL appear in Appendix B.

A map of the resulting shade targets is shown in Figure 2. Target shade maps are shown by region in Appendix C (Figures C2, C5, C8, C11, and C14).

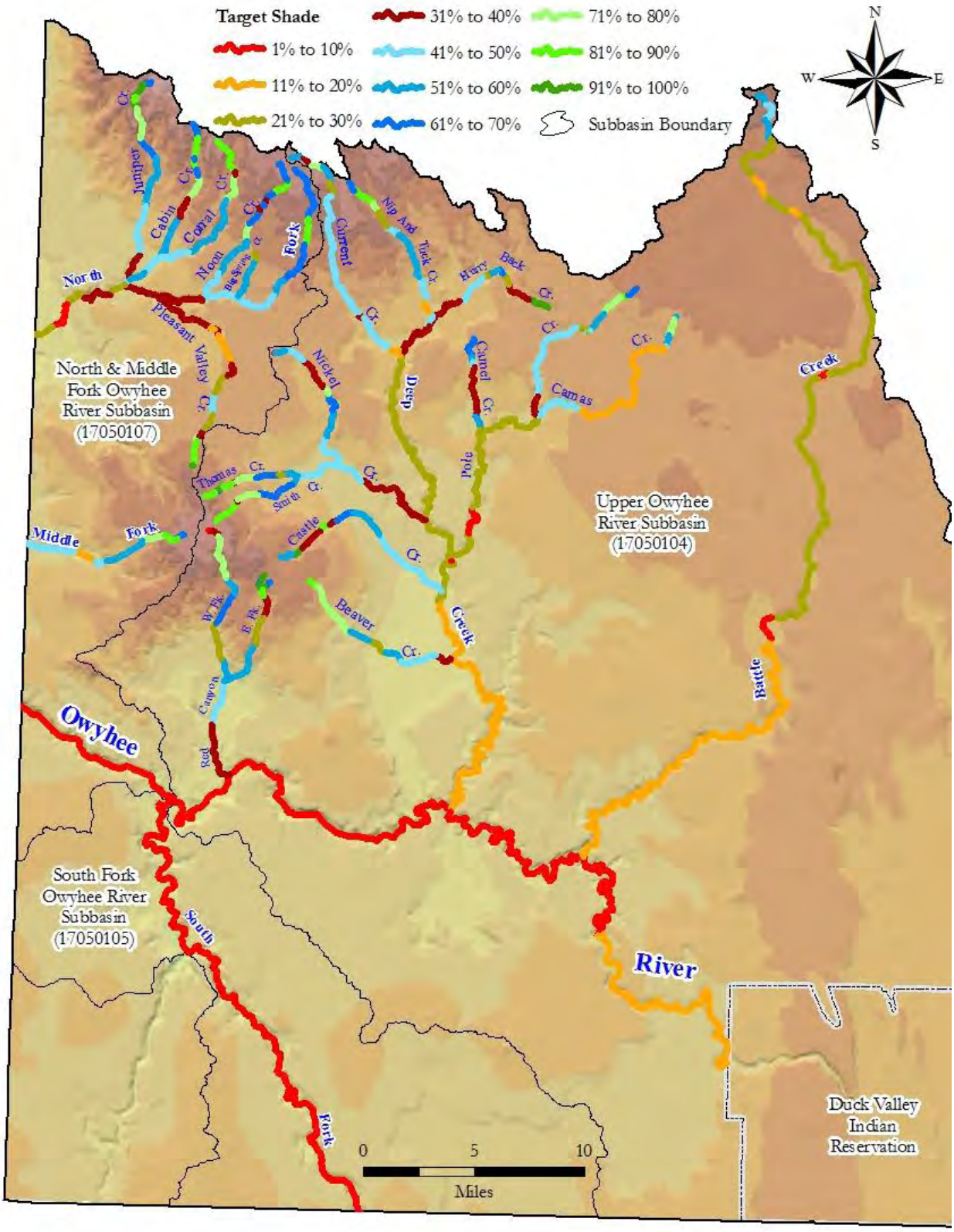

Figure 2. Target shade for the Owyhee River watershed.

5.2 Load Capacity

TMDLs must express loads as a quantity of a pollutant discharged over time. To this end, the load capacity is measured in kilowatt-hours per day and equals the incident solar load at the PNV shade targets for a given stream area.

Insolation is a term that describes the rate of solar radiation energy per unit of horizontal surface area. To calculate the solar load for a given stream segment, the following steps were used:

1. The unshaded insolation was determined to be 6.38 kWh/m^2/day, as measured on a flat-plate collector (discussed below).
2. This value was then multiplied by the fraction of the solar radiation that was *not* blocked by shade (i.e., percent open). For example, a juniper forest provides 89% shade to a 2 m wide stream. So the effective insolation is 11% × 6.38 kWh/m^2/day = 0.702 kWh/m^2/day.
3. This value is then multiplied by the area of the stream segment (in square meters), to yield the solar load. In this example, for a segment 500 m long, the area would be 1000 m^2. The resulting load capacity is 1000 m^2 × 0.702 kWh/m^2/day = 702 kWh/day.

We obtained solar flat-plate collector data from the National Renewable Energy Laboratory weather station in Boise and used an average insolation for the 6-month period from April through September. These months coincide with time of year when stream temperatures are increasing and deciduous vegetation is in leaf. Late July and early August typically present the highest stream temperatures, and April and September coincide with salmonid spawning.

Tables D2–D46 in Appendix D show the PNV shade targets and their corresponding target summer load capacities (in kilowatt-hours per day). In these tables, the load capacity is the target solar load.

Load capacities varied from as low as 16,000 kWh/day on the headwaters of Juniper Creek to nearly 20,000,000 kWh/day on the Owyhee River.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (Water Quality Planning and Management, 40 CFR § 130.2(I)).

Existing pollutant loads in this TMDL were estimated using aerial photographs and partially field verified using Solar Pathfinders. Like target shade, existing shade was also converted to a solar load (Appendix D, Tables D2–D46). Existing loads varied from about 18,000 kWh/day on Camel Creek to nearly 17,000,000 kWh/day on the Owyhee River.

5.3.1 Aerial Photo Interpretation

Existing shade levels were estimated for 45 assessment units (§303(d)-listed streams along with some unlisted tributaries to those streams) from visual interpretation of aerial photographs taken

between 2004 and 2009. Shade estimates are based on a general intuitive observation about the kind of vegetation present, its density, and the stream width.

Each stream is divided into segments, separated by natural breaks in vegetation density. Each segment is then assigned a single value representing the bottom of a 10% shade class (IDL 2000). For example, if we estimate that shade for a particular section of stream is 56%, then we assign the 50% shade class. Streams where the banks and water are clearly visible are usually in low shade classes (i.e., 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 (i.e., 70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (i.e., 40%, 50%, or 60%).

The estimate of shade made from an aerial photograph does not always take into account nonvegetative shading, such as hillsides or canyons. The streams in this subbasin particularly benefit from topographic shading; for example, the Owyhee River is 30% shaded by its canyon walls alone.

5.3.2 Field Verification of Existing Shade

The Solar Pathfinder is a device for measuring shade on a stream. It was used to verify the aerial photograph estimates. Solar Pathfinder fieldwork took place between 2008 and 2010.

Wadeable Streams

For wadeable streams, 32 sites were visited. The exact locations of the Solar Pathfinder sites can be seen in Appendix C (Figures C3, C6, C9, C12, and C15).

Table 5 compares the accuracy of the aerial photo interpretations with Solar Pathfinder measurements on wadeable streams. In general, our photograph interpretation ("Aerial" column) overestimated shade by an average of 11.5%. The actual Solar Pathfinder results were used as the existing shade values. We also used the Solar Pathfinder data to calibrate our estimates and reassess the aerial photographs.

The large overestimates on Castle Creek turned out to be in a recently burned area, and field verification revealed that a sage/grass vegetation type was more appropriate than juniper for this area.

Table 5. Solar Pathfinder field verification results.

Location Description	Pathfinder Actual (%)	Shade Class (%)		Diff-erence (%)
		Pathfinder	Aerial	
Battle Cr., 1200 m upstream of Battle Creek Res.	5	0	10	10
Battle Cr., at T9S R1E S23 SWNE	5	0	0	0
Battle Cr., by the road at T9S R1E S05 SWSW	27	20	50	30
Battle Cr., by the road at T9S R1E S23 NESE	31	30	30	0
Beaver Cr., 2200 m down from the Brace Ranch	43	40	30	(10)
Beaver Cr., 2700 m down from the Brace Ranch	7	0	0	0
Cabin Cr., upstream of Corral Creek Road	40	40	70	30
Castle Cr., 2000 m down from Castlehead Spring	48	40	80	40
Castle Cr., 1400 m down from Castlehead Spring	39	30	70	40
Castle Cr., 800 m down from Castlehead Spring	25	20	90	70
Corral Cr., downstream of Corral Creek Road	42	40	60	20
Corral Cr., upstream of Corral Creek Road	40	40	50	10
East Fork Red Canyon, 250 m up from West Fork	39	30	40	10
Hurry Back Cr., 500 m upstream from Mud Flat Rd.	17	10	10	0
Juniper Cr., downstream of Corral Creek Road	30	30	30	0
Juniper Cr., downstream of Pleasant Valley Road	42	40	50	10
Juniper Cr., upstream of Pleasant Valley Road	65	60	40	(20)
MF Owyhee R., north of Cottonwood Spring	60	60	80	20
NF Owyhee R., downstream of Pleasant Valley Road	28	20	20	0
NF Owyhee R., upstream of Pleasant Valley Road	20	20	10	(10)
NF Owyhee R., upstream of Juniper Creek	29	20	30	10
NF Owyhee R., upstream of Pleasant Valley Creek	30	30	40	10
Noon Cr., upstream of Corral Creek Road, site 1	51	50	60	10
Noon Cr., upstream of Corral Creek Road, site 2	53	50	60	10
Owyhee R., 300 m upstream from Juniper Creek	6	0	20	20
Owyhee R., 500 m downstream from Juniper Creek	13	10	10	0
Pleasant Valley Cr., upstream of NF Owyhee River	27	20	60	40
Red Canyon, 260 m up from jeep trail crossing	56	50	40	(10)
Red Canyon, at The Garden	59	50	50	0
WF Red Canyon, 1300 m down from Trout Springs	44	40	80	40
WF Red Canyon, 1900 m down from Trout Springs	39	30	40	10
West Fork Red Canyon, 500 m up from East Fork	55	50	50	0
			Average	11.5
			Standard deviation	18.8
			95% confidence interval	6.4

Large Rivers

On the large rivers, shade was measured with a Solar Pathfinder attached to a boat (see Figure E6 in Appendix E). Shade levels were measured at 32 locations on the Owyhee River and 138 locations on the South Fork (Figures 3 and 4). Such a large percentage of the South Fork Owyhee River was measured that no aerial photograph interpretation was required.

The averaged shade levels were used as the existing shade values in the loading tables. They show that in general, shade increases with the depth of each canyon.

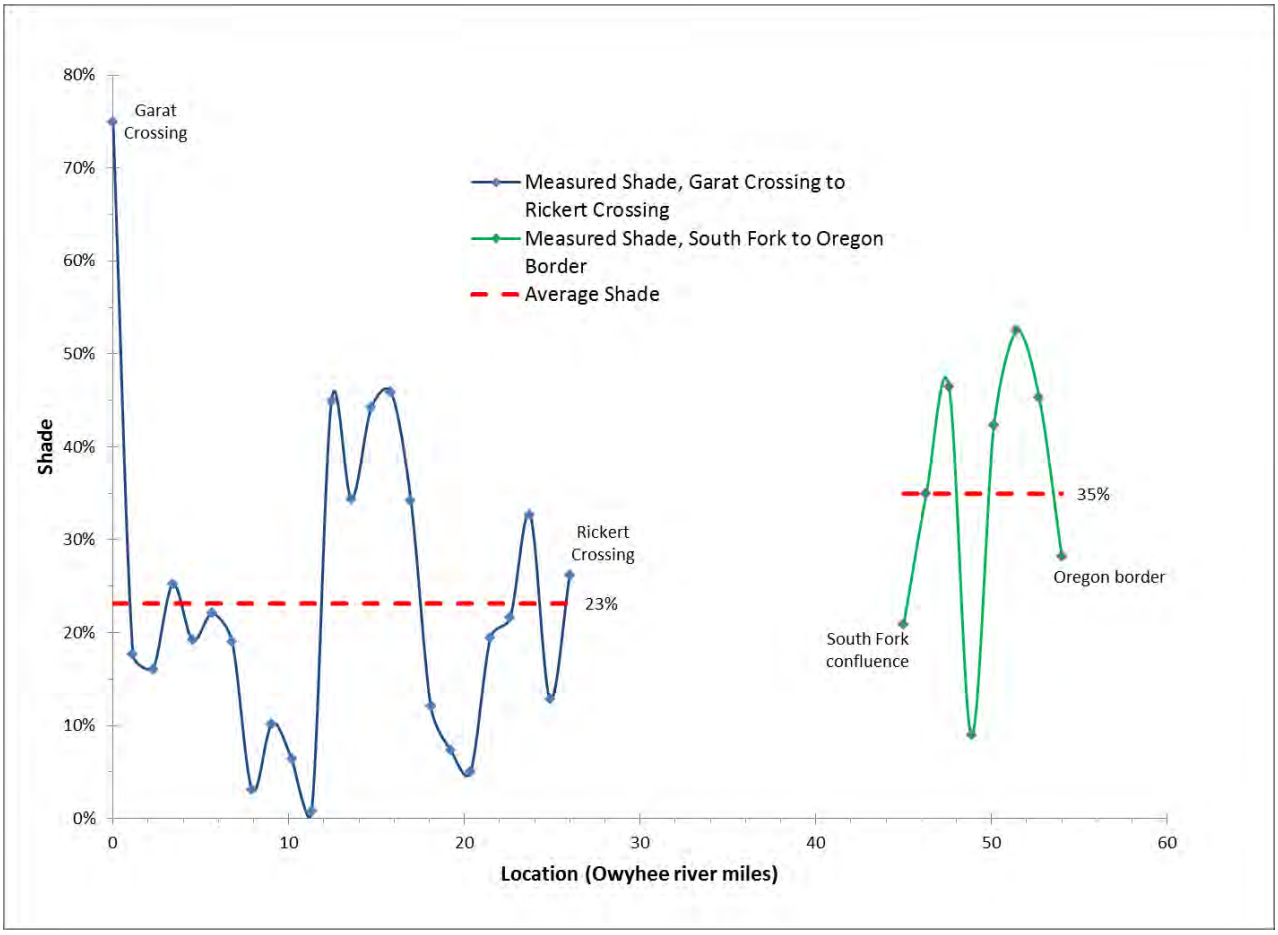

Figure 3. Solar Pathfinder results for the Owyhee River (two sections).

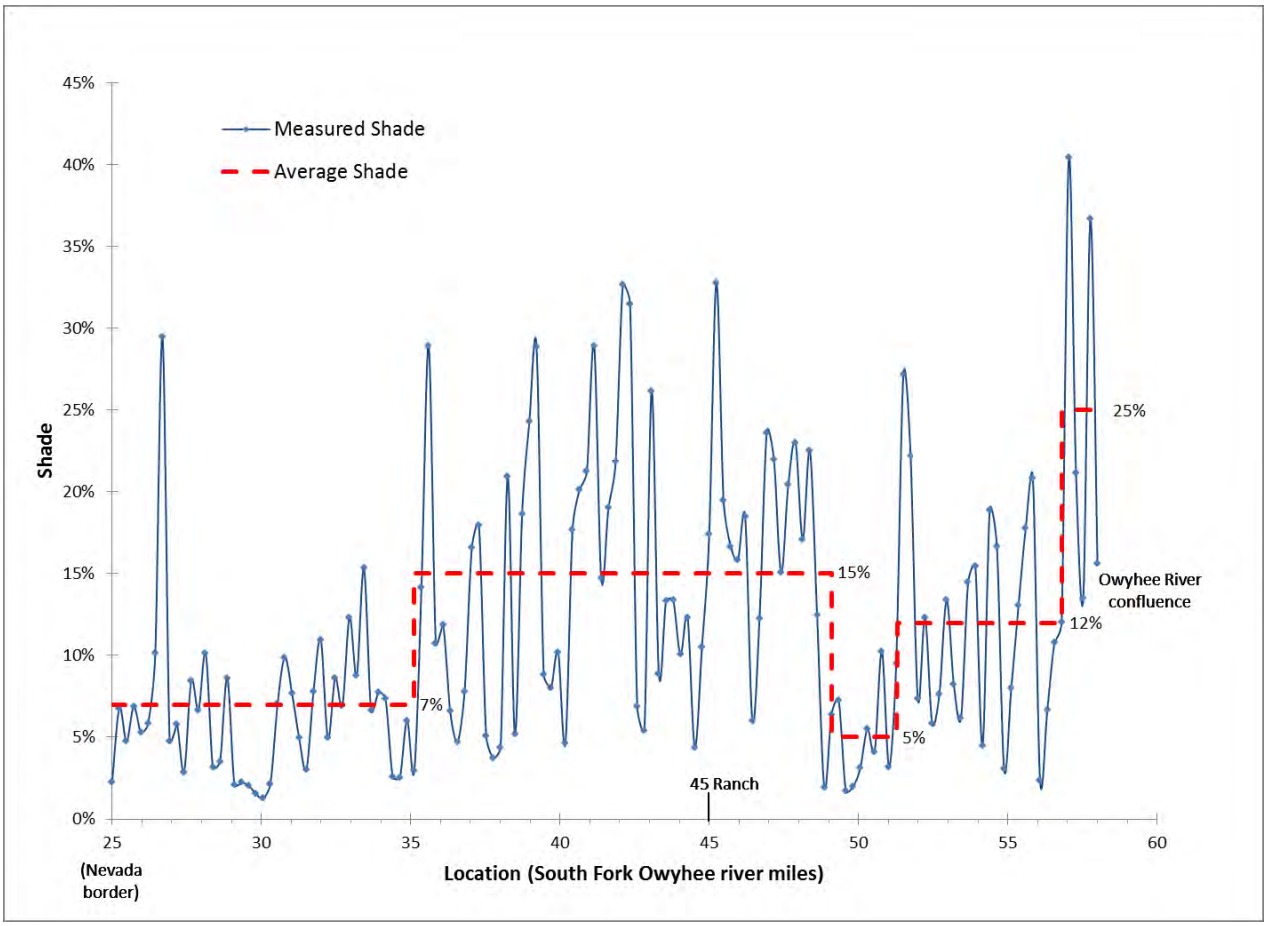

Figure 4. Solar Pathfinder results for the South Fork Owyhee River.

The existing shade classes are shown in Figure 5 and in more detail in Appendix C (Figures C3, C6, C9, C12, and C15).

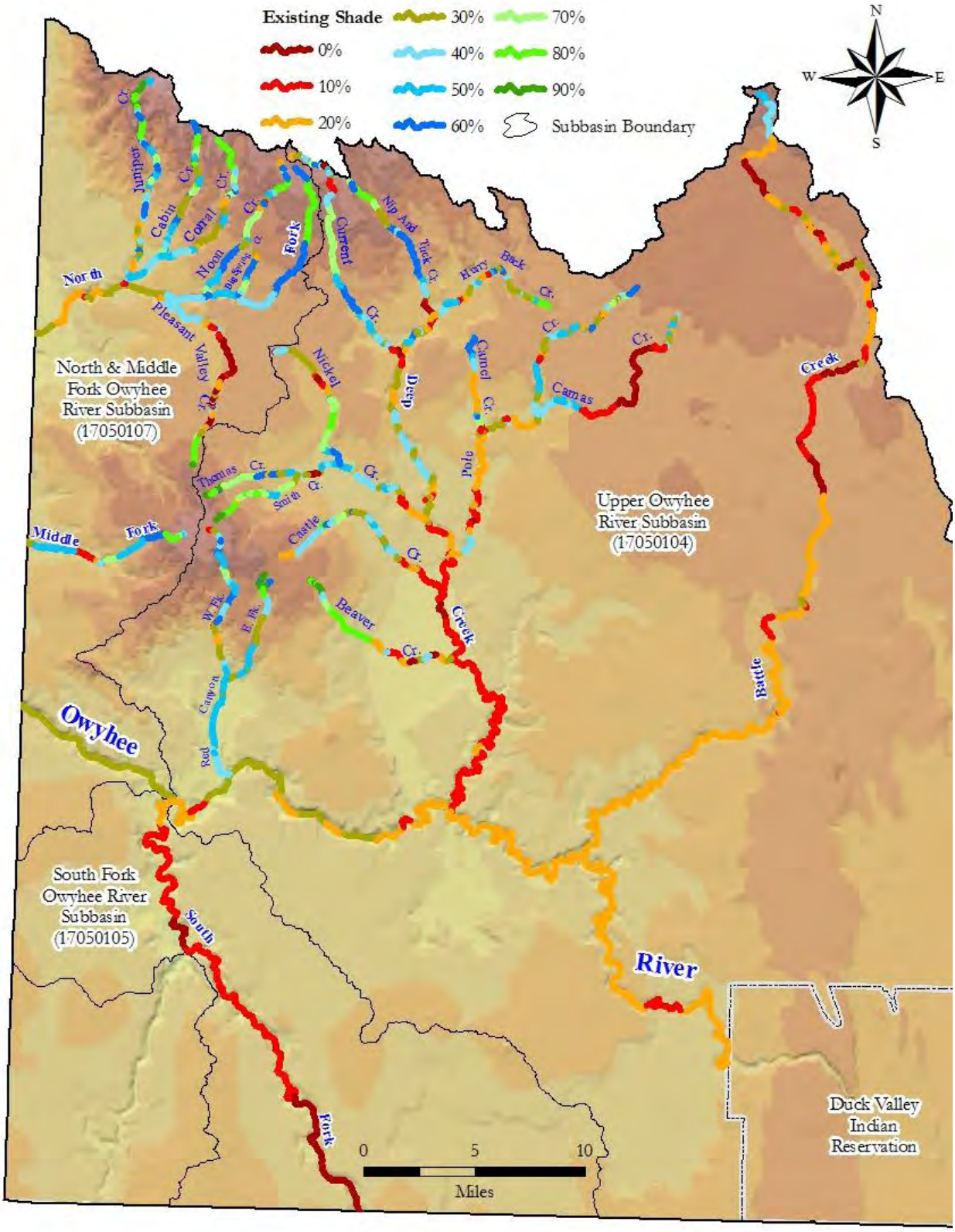

Figure 5. Existing shade for the Owyhee River watershed.

5.3.3 Field Verification of Stream Width

Canopy shading is highly dependent upon stream width; a tree can shade a small creek far more easily than a large river.

When available, field data and aerial photographs were used to determine the existing stream widths. However, these data were sparse, and so stream widths often had to be estimated. Figure 6 shows the Upper Snake Basin hydrologic curve, compiled by Diane Hopster of the Idaho Department of Lands. This curve relates theoretical channel width to drainage area for any given stream. This particular curve was chosen because the Upper Snake and Owyhee River basins are a close match in their geology and meteorology.

In the loading analysis, the existing width was stipulated to be the smaller of either the predicted width from the hydrologic curve or the measured width (Appendix F, Table F1).

At present, the load analysis tables generally equate natural and existing widths. However, channels may naturally be narrower than their present widths. Anthropogenic impacts, such as grazing, tend to make streams wider and shallower; thus, vegetation is able to shade less of the water's surface. A geomorphological analysis of stream widths is beyond the scope of this TMDL, but the load analysis tables could easily be adjusted were such an analysis to be performed.

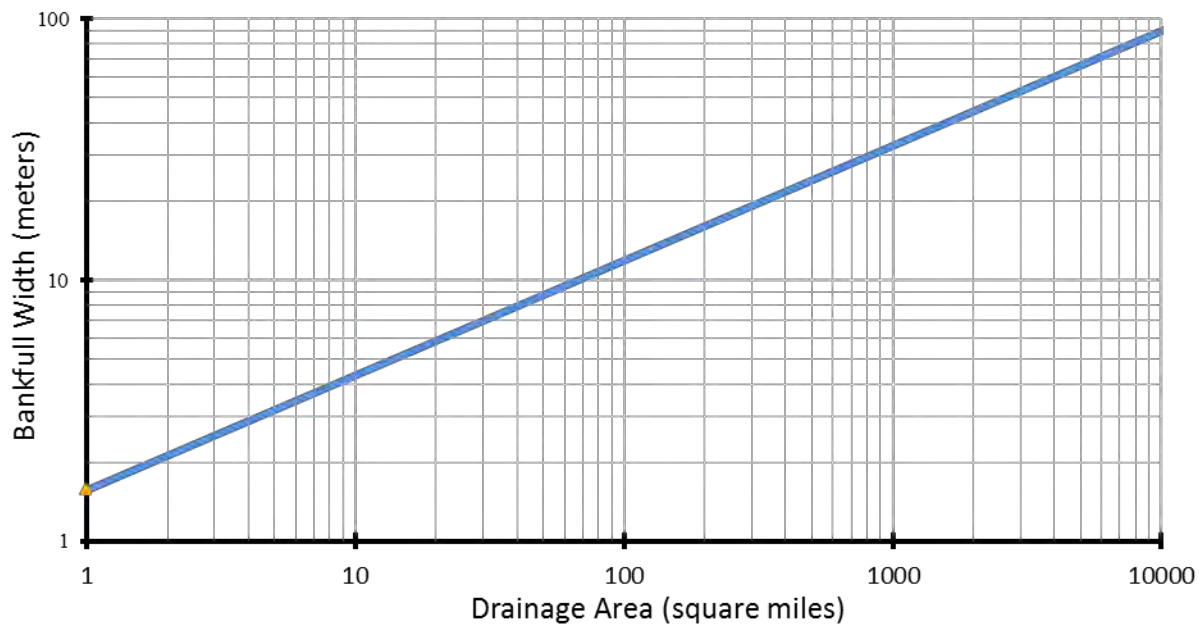

Figure 6. Bankfull width as a function of drainage area in the Upper Snake River basin.

5.4 Load Allocation

In the absence of any point sources of pollution, and because the margin of safety is implicit, **the load allocations are simply equal to the load capacities**.

Load capacities (target loads) and existing loads have been established for each stream section (Appendix D, Tables D2–D46). They are summarized, in order of assessment unit, in Tables 6–8 below.

Loads are allocated to each stream and its riparian vegetation, not to any specific nonpoint source activities. The size of an assessment unit influences the size of the load. Large assessment units have high load allocations by virtue of their large area.

Table 6. Load allocations in the Upper Owyhee River subbasin.

Assessment Unit and Description		Load Allocation (kWh/day)
ID17050104SW001_06	Owyhee River between Juniper Creek and South Fork	19,800,270
ID17050104SW006_06	Owyhee River between Blue and Juniper Creeks	1,374,188
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	279,597
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	1,858,326
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	3,943,473
ID17050104SW026_04	Deep Creek between Hurry Back and Nickel Creeks	1,117,479
ID17050104SW026_05	Deep Creek between Nickel Creek and Owyhee River	4,215,652
ID17050104SW028_02	Pole Creek upstream of Mud Flat	22,579
ID17050104SW028_03	Pole Creek between Camas Creek and Mud Flat	241,690
ID17050104SW028_04	Pole Creek between Camas and Deep Creeks	1,043,736
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	240,656
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	37,408
ID17050104SW031_02	Nickel, Smith, and Thomas Creek headwaters	50,939
ID17050104SW031_03	Nickel, Smith, and Thomas Creeks—3rd order	140,430
ID17050104SW031_04	Nickel and Smith Creeks—4th order	362,702
ID17050104SW032_02	Castle Creek upstream of Skunk Creek	31,702
ID17050104SW032_03	Castle Creek between Skunk and Deep Creeks	159,708
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	52,435
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	20,873
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	92,283
ID17050104SW034_02	West Fork Red Canyon	139,324
ID17050104SW034_03	East Fork Red Canyon and Red Canyon upstream of Petes Creek	164,713
ID17050104SW034_04	Red Canyon between Petes Creek and Owyhee River	172,944

Table 7. Load allocations in the South Fork Owyhee River subbasin.

Assessment Unit and Description		Load Allocation (kWh/day)
ID17050105SW001_06	South Fork Owyhee River upstream of Little Owyhee River	3,570,248
ID17050105SW001_07	South Fork Owyhee River downstream of Little Owyhee River	2,494,947

Table 8. Load allocations in the North and Middle Fork Owyhee River subbasin.

Assessment Unit and Description		Load Allocation (kWh/day)
ID17050107SW001_07	Owyhee River between South Fork and Oregon border	3,723,242
ID17050107SW004_02	Middle Fork Owyhee River upstream of Summit Springs Creek	39,197
ID17050107SW004_03	Middle Fork Owyhee River downstream of Summit Springs Creek	154,367
ID17050107SW008_02	North Fork Owyhee River upstream of Big Springs Creek	87,927
ID17050107SW008_03	North Fork Owyhee River between Big Spring and Pleasant Valley Creeks	168,304
ID17050107SW008_04	North Fork Owyhee River between Pleasant Valley and Juniper Creeks and Juniper Creek between Cabin Creek and North Fork Owyhee River	92,766
ID17050107SW008_05	North Fork Owyhee River downstream of Juniper Creek	511,677
ID17050107SW009_02	Pleasant Valley Creek upstream of East Fork Pleasant Valley Creek	98,610
ID17050107SW009_03	Pleasant Valley Creek between North Fork Owyhee River and East Fork Pleasant Valley Creek	219,557
ID17050107SW010_02	Noon Creek	98,429
ID17050107SW011_02	Cabin and Corral Creek headwaters	141,365
ID17050107SW011_03	Cabin and Corral Creeks—3rd order	52,964
ID17050107SW012_02	Juniper Creek upstream of Buck Creek	16,240
ID17050107SW012_03	Juniper Creek between Buck and Cabin Creeks	141,810

Each assessment unit must attain natural shade levels to meet water quality standards. Even if shade exceeded targets in one area, it could not be correspondingly reduced in another. In other words, the *entire stream* must be at natural background shade levels to satisfy the TMDL. Additionally, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system. Load analyses were conducted for some of these tributaries and are included in Appendix D.

The excess heat energy entering the water is called the *excess load* and is simply the difference between the target and existing loads:

$$\text{Excess Load} = \text{Existing Load} - \text{Target Load}$$

If the excess load value is positive, it means that excess heat energy is warming the water. If it is zero or negative, then the stream segment is at natural background conditions.

Tables 9–11 show the existing and excess loads for each assessment unit. These are calculated from the load analysis tables in Appendix D (numbers may differ slightly due to rounding). Tables 9–11 include a column that shows the percentage of the total existing load that is attributable to excess load, which neatly summarizes the severity of the temperature problem for each assessment unit. The assessment units are presented and color coded in order of the severity of their impairment.

Assessment units with excess loads 0% or less (dark green) are in excellent condition and meet their shade targets. Streams with negative excess loads have more shade than their target. This situation is typically caused by deep canyons and the resultant topographic shading. Even though they surpass their shade targets, there is no opportunity to remove shade from these streams, because they would no longer be at “natural” (i.e., current) shade levels.

Assessment units with excess loads less than 10% (light green) should be considered in good condition. Because of the analysis methodology (see section 5.4.3), these streams may, in fact, be meeting their targets. In any case, they are within the margin of error of this method and should be treated with low priority.

Assessment units with excess loads above 10% have real shade deficiencies, and those that exceed 30% (red) have serious problems. These streams should be targeted for improvement.

Table 9. Excess solar loads in the Upper Owyhee River subbasin, by assessment unit.

Assessment Unit and Description		Existing Load (kWh/day)	Excess Load (kWh/day)	Excess Load (% of Existing Load)
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	41,215	20,342	49.4%
ID17050104SW028_02	Pole Creek upstream of Mud Flat	39,473	16,894	42.8%
ID17050104SW032_03	Castle Creek between Skunk and Deep Creeks	252,737	93,029	36.8%
ID17050104SW031_02	Nickel, Smith and Thomas Creek headwaters	75,986	25,047	33.0%
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	2,614,026	755,700	28.9%
ID17050104SW032_02	Castle Creek upstream of Skunk Creek	44,379	12,677	28.6%
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	127,811	35,528	27.8%
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	48,175	10,767	22.3%
ID17050104SW034_02	West Fork Red Canyon	162,613	23,289	14.3%
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	320,014	40,417	12.6%
ID17050104SW031_04	Nickel and Smith Creeks—4th order	398,591	35,889	9.0%
ID17050104SW026_05	Deep Creek between Nickel Creek and Owyhee River	4,477,580	261,928	5.8%
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	251,640	10,984	4.4%
ID17050104SW034_03	East Fork Red Canyon and Red Canyon upstream of Petes Creek	171,609	6,896	4.0%
ID17050104SW028_03	Pole Creek between Camas Creek and Mud Flat	248,686	6,996	2.8%
ID17050104SW028_04	Pole Creek between Camas and Deep Creeks	1,072,497	28,761	2.7%
ID17050104SW031_03	Nickel, Smith, and Thomas Creeks—3rd order	137,674	-2,756	-2.0%
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	3,848,914	-94,559	-2.5%
ID17050104SW026_04	Deep Creek between Hurry Back and Nickel Creeks	1,073,818	-43,661	-4.1%
ID17050104SW006_06	Owyhee River between Blue and Juniper Creeks	1,315,046	-59,142	-4.5%
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	46,612	-5,822	-12.5%
ID17050104SW001_06	Owyhee River between Juniper Creek and South Fork	16,936,648	-2,863,622	-16.9%
ID17050104SW034_04	Red Canyon between Petes Creek and Owyhee River	144,545	-28,399	-19.6%

Table 10. Excess solar loads in the South Fork Owyhee River subbasin, by assessment unit.

Assessment Unit and Description		Existing Load (kWh/day)	Excess Load (kWh/day)	Excess Load (% of Existing Load)
ID17050105SW001_06	South Fork Owyhee River upstream of Little Owyhee River	3,268,622	-301,626	-9.2%
ID17050105SW001_07	South Fork Owyhee River downstream of Little Owyhee River	2,281,934	-213,013	-9.3%

Table 11. Excess solar loads in the North and Middle Fork Owyhee River subbasin, by assessment unit.

Assessment Unit and Description		Existing Load (kWh/day)	Excess Load (kWh/day)	Excess Load (% of Existing Load)
ID17050107SW009_02	Pleasant Valley Creek upstream of East Fork Pleasant Valley Cr	128,653	30,043	23.4%
ID17050107SW011_02	Cabin and Corral Creek headwaters	177,268	35,903	20.2%
ID17050107SW012_02	Juniper Creek upstream of Buck Creek	19,855	3,615	18.2%
ID17050107SW004_02	Middle Fork Owyhee River upstream of Summit Springs Creek	45,024	5,826	12.9%
ID17050107SW012_03	Juniper Creek between Buck and Cabin Creeks	160,770	18,960	11.8%
ID17050107SW011_03	Cabin and Corral Creeks—3rd order	57,548	4,584	8.0%
ID17050107SW008_03	North Fork Owyhee River between Big Spring and Pleasant Valley Creeks	181,485	13,181	7.3%
ID17050107SW008_04	North Fork Owyhee River between Pleasant Valley and Juniper Creeks and Juniper Creek between Cabin Creek and North Fork Owyhee River	99,471	6,705	6.7%
ID17050107SW009_03	Pleasant Valley Creek between North Fork Owyhee River and East Fork Pleasant Valley Creek	233,125	13,568	5.8%
ID17050107SW010_02	Noon Creek	100,338	1,909	1.9%
ID17050107SW008_02	North Fork Owyhee River upstream of Big Springs Creek	89,205	1,278	1.4%
ID17050107SW004_03	Middle Fork Owyhee River downstream of Summit Springs	155,940	1,573	1.0%
ID17050107SW008_05	North Fork Owyhee River downstream of Juniper Creek	511,740	63	0.0%
ID17050107SW001_07	Owyhee River between South Fork and Oregon border	2,772,627	-950,615	-34.3%

5.4.1 Discussion

Battle Creek is the one of the largest tributaries in the analysis, with wide channels resulting from its large drainage area. The 3rd-order section has very high excess loads, but the 4th-order section is in a deep, shady canyon and is within its target load (Table 9). Of all the tributaries, Battle Creek contributes the highest excess load to the Owyhee River.

Deep Creek is similar in size to Battle Creek but has a much lower overall excess load (Table 9). Although open in places, the creek enjoys considerable shade from the narrow canyons in its upper and middle portions (see Appendix C, Figures C10, C13, and C16, for lack of shade on Deep Creek).

Castle Creek and the lower parts of Beaver Creek have high excess loads because they lack shade for large portions of their lengths (Table 9, and Appendix C, Figure C13). Castle Creek was affected by wildfire in its headwaters, and both streams lack the protection of narrow canyons, resulting in increased access and reduced shade.

The lower parts of Cabin, Corral, Deep, Nickel, Noon, Pole, and Camas Creeks; Red Canyon; and the North and Middle Forks of the Owyhee River all enjoy the shade benefits of isolated narrow canyons. The upper sections of these streams are generally more exposed.

The Owyhee and South Fork Owyhee Rivers exceed their target shade. The rivers are relatively wide and thus have low riparian shade targets. The canyon walls provide more shade than would be provided by a mature coyote willow community and also prevent any larger plant community (such as a cottonwood forest) from developing.

See Figures 2, 5, and 7 and Appendix C (Figures C1–C16) for figures of target, existing, and lack of shading on these creeks.

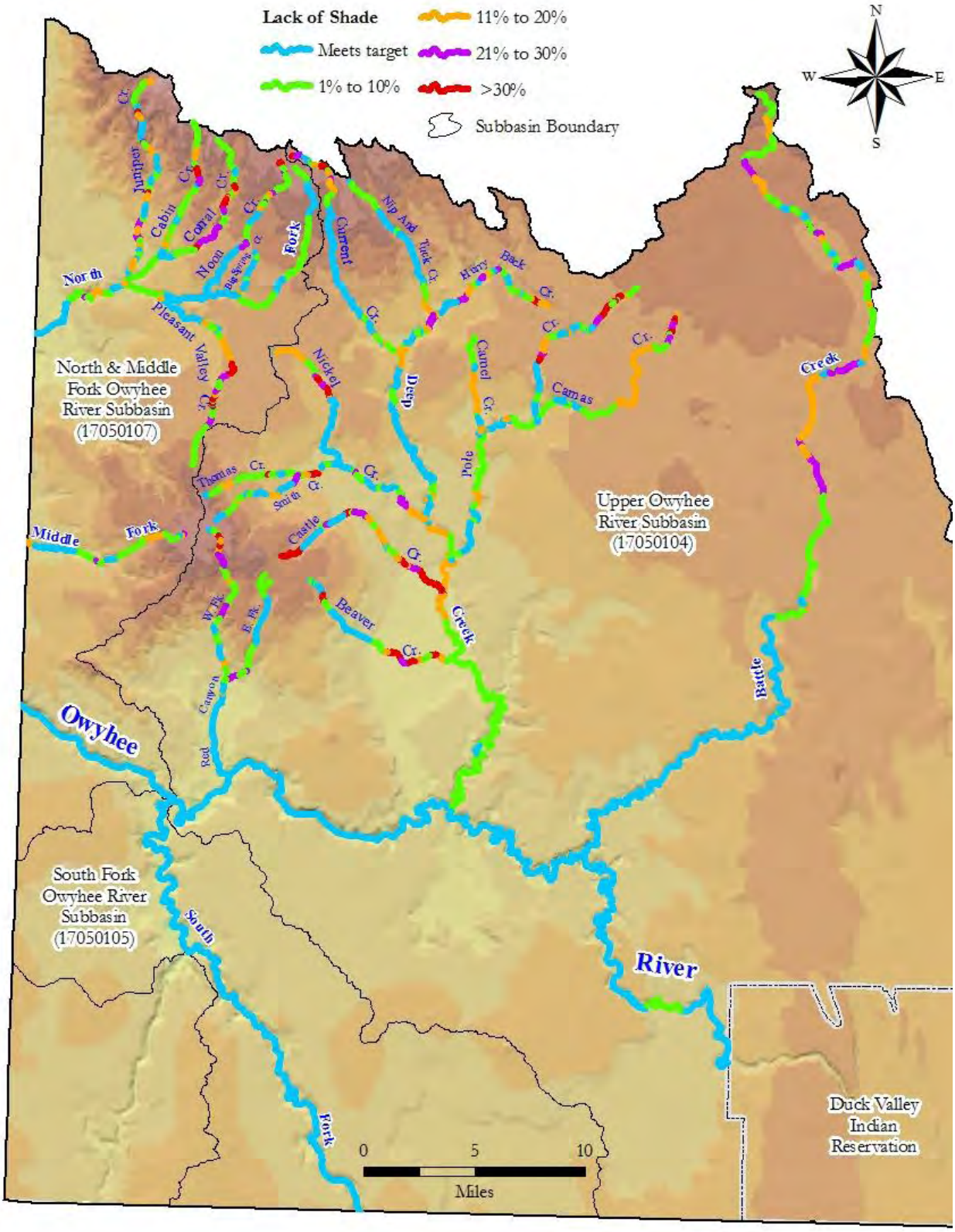

Figure 7. Lack of shade (difference between existing and target) for the Owyhee River watershed.

5.4.2 Wasteload Allocation

There are no National Pollutant Discharge Elimination System (NPDES) permitted point sources in the watershed, and thus, no wasteload allocations. Should a point source be proposed that would have thermal consequences on these waters, then background provisions addressing such discharges in Idaho water quality standards (IDAPA 58.01.02.200.09 and.02.401.01) should be invoked. Please see Appendix A for more information.

5.4.3 Margin of Safety

The margin of safety in this TMDL is implicit in the design; the analysis method results in underreporting of existing shade.

Target shade is stipulated as any integer between 0 and 100%; however, existing shade is rounded down to a 10% class interval. For example, if Juniper Creek had 39% shade, it would be reported in the 30% existing shade class. If its target were 37%, Juniper Creek would be described as lacking 7% shade, when, in fact, it actually exceeds the shade target.

This rounding error (of up to 9%) functions as a margin of safety.

It is unrealistic to set shade targets higher than their potential, and so any stream segment with a lack of shade less than 10% may, in fact, meet its target.

5.4.4 Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to be inclusive of the 6-month period from April through September. These months coincide with the time of year when stream temperatures are increasing and deciduous vegetation is in leaf. Late July and early August typically present the highest stream temperatures, and March 1–July 15 is salmonid spawning season (DEQ 2003). Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angles.

5.5 Implementation Strategies

One of the great benefits of the PNV method is how well it dovetails with the needs of land managers by highlighting exactly where riparian improvement needs to occur. Although much of the TMDL analysis focuses on total heat *loads*, it is important to note that differences between *shade levels* are the key to successfully restoring these waters. Priority should go to areas with the largest differences between existing and target shade (Figure 7 and Appendix C Figures C4, C7, C10, C13, and C16). These stream segments should first be evaluated to determine whether their lack of shade represents a genuine problem.

Implementation plans have already been written for the Upper Owyhee and North and Middle Fork Owyhee subbasins (DEQ 2004b, 2002). The methods outlined in these documents should continue, using the shade maps as a guide to prioritize management activities that maintain or improve shade.

No implementation plan is necessary for the Idaho portion of the South Fork Owyhee River, because the river is at natural conditions.

5.5.1 Time Frame

If implementation of best management practices (BMPs) is enthusiastically embraced, some improvement might be seen within several years. However, the slow rate of ecological change means that full satisfaction of the TMDL requirements will likely take decades.

5.5.2 Approach

Improving the condition of streamside vegetation will increase shade and lower stream temperatures. This improvement could be achieved by directly planting trees and shrubs or by altering grazing management and implementing BMPs.

5.5.3 Responsible Parties

DEQ and the designated management agencies have primary responsibility for overseeing implementation in cooperation with landowners and managers. Their general responsibilities are outlined below:

- **Idaho Department of Environmental Quality** will oversee and track overall progress on the specific implementation plan and monitor the watershed response.
- **Idaho Department of Lands** will maintain and update approved BMPs for grazing management on State-owned lands.
- **Idaho Soil and Water Conservation Commission**, working in cooperation with local soil and water conservation districts and the Idaho State Department of Agriculture, will provide technical assistance to landowners. The commission will help landowners design BMPs appropriate for their properties and identify and seek appropriate cost-share funds. The commission also will provide periodic project reviews to ensure BMPs are working effectively.

DEQ should ensure that the designated management agencies are aware of the updated shade maps found in Appendix C of this document.

5.5.4 Monitoring Strategy

Interpretation of aerial photography is inexact, and so the maps and load analysis tables should not be viewed as complete until they are verified. Certain streams—namely Camel, Camas, Pole, Thomas, Smith, Nickel, Current, Big Spring, and Nip And Tuck Creeks—were not visited at all. Field verification should occur periodically, ideally every 5 years. New existing shade data can easily be incorporated into the load analysis tables and can be used to monitor progress toward the TMDL goals.

The Solar Pathfinder is an easy and inexpensive tool for monitoring. Please see Shumar and De Varona (2009) for instructions as to its use.

6 Public Participation and Comment Opportunities

The development of the Owyhee River watershed TMDL addendum included the following public participation:

- December 15, 2011: letter sent to the watershed advisory group (WAG) asking for its assistance
- February 9, 2012: first draft of the TMDL sent to the WAG for comment and local input
- April 3, 2012: WAG comments incorporated into document

The general public will have an opportunity to comment on this draft document during a 30-day public comment period to be held in April 2012. Those comments will be included in Appendix G of the final document.

7 Conclusions

This addendum to three previous temperature TMDLs compares each stream with its own potential natural shading, rather than to numeric temperature criteria. Previously, streams had to meet shade targets of up to 100%, without regard to whether or not a mature plant community could provide that much shade.

The Owyhee and South Fork Owyhee Rivers and the lower parts of Battle Creek and Red Canyon meet their shade targets. The rivers in the watershed derive most of their shade from the canyon walls, not from riparian vegetation, which is virtually nonexistent. Portions of Nickel, Smith, Thomas, and Deep Creeks also meet their shade targets. Beaver and Castle Creeks are in the worst condition.

Most streams in the North and Middle Fork Owyhee subbasin are in good condition and have low excess solar loads. Pleasant Valley Creek had the highest excess loads but still only requires an overall reduction of 12%. For photographs of the streams discussed in this document, see Appendix E.

PNV TMDLs were established for all thermally impaired assessment units mentioned in this document (Tables 12–14).

Table 12. Summary of assessment outcomes for the Upper Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050104SW001_06	Owyhee River between Juniper Creek and South Fork	Leave in Cat 2	Meets targets
ID17050104SW006_06	Owyhee River between Blue and Juniper Creeks	Cat 3 to Cat 2	Meets targets
ID17050104SW023_02	Battle Creek upstream of Antelope Flat	Cat 5 to Cat 4a	TMDL completed
ID17050104SW023_03	Battle Creek between Antelope Flat and Big Springs Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW023_04	Battle Creek between Big Springs Creek and Owyhee River	Cat 5 to Cat 4a	TMDL completed
ID17050104SW026_04	Deep Creek between Hurry Back and Nickel Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW026_05	Deep Creek between Nickel Creek and Owyhee River	Leave in Cat 4a	TMDL updated
ID17050104SW028_02	Pole Creek upstream of Mud Flat	Leave in Cat 4a	TMDL updated
ID17050104SW028_03	Pole Creek between Camas Creek and Mud Flat	Leave in Cat 4a	TMDL updated
ID17050104SW028_04	Pole Creek between Camas and Deep Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW029_03	Camas Creek between Big Springs Butte and Pole Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW030_02	Camel Creek upstream of Sunshine Valley Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_02	Nickel, Smith, and Thomas Creek headwaters	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_03	Nickel, Smith and Thomas Creeks—3rd order	Cat 5 to Cat 4a	TMDL completed
ID17050104SW031_04	Nickel and Smith Creeks—4th order	Cat 3 to Cat 4a	TMDL completed
ID17050104SW032_02	Castle Creek upstream of Skunk Creek	Leave in Cat 4a	TMDL updated
ID17050104SW032_03	Castle Creek between Skunk and Deep Creeks	Leave in Cat 4a	TMDL updated
ID17050104SW033_02	Beaver Creek upstream of Carter Creek	Cat 5 to Cat 4a	TMDL completed
ID17050104SW033_03	Beaver Creek between Carter and Trap Creeks	Cat 5 to Cat 4a	TMDL completed
ID17050104SW033_04	Beaver Creek between Trap and Deep Creeks	Cat 5 to Cat 4a	TMDL completed
ID17050104SW034_02	West Fork Red Canyon	Leave in Cat 4a	TMDL updated
ID17050104SW034_03	East Fork Red Canyon and Red Canyon upstream of Petes Creek	Leave in Cat 4a	TMDL updated
ID17050104SW034_04	Red Canyon between Petes Creek and Owyhee River	Leave in Cat 4a	TMDL updated

Table 13. Summary of assessment outcomes for the South Fork Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050105SW001_06	South Fork Owyhee River upstream of Little Owyhee River	Leave in Cat 4a	TMDL updated
ID17050105SW001_07	South Fork Owyhee River downstream of Little Owyhee River	Leave in Cat 4a	TMDL updated

Table 14. Summary of assessment outcomes for the North and Middle Fork Owyhee River subbasin.

Assessment Unit	Description	Recommended Changes to Integrated Report	Justification
ID17050107SW001_07	Owyhee River between South Fork and Oregon border	Cat 3 to Cat 1	Meets targets
ID17050107SW004_02	Middle Fork Owyhee River upstream of Summit Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW004_03	Middle Fork Owyhee River downstream of Summit Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW008_02	North Fork Owyhee River upstream of Big Springs Creek	Leave in Cat 4a	TMDL updated
ID17050107SW008_03	North Fork Owyhee River between Big Spring and Pleasant Valley Creeks	Leave in Cat 4a	TMDL updated
ID17050107SW008_04	North Fork Owyhee River between Pleasant Valley and Juniper Creeks, and Juniper Creek between Cabin Creek and North Fork Owyhee River	Leave in Cat 4a	TMDL updated
ID17050107SW008_05	North Fork Owyhee River downstream of Juniper Creek	Leave in Cat 4a	TMDL updated
ID17050107SW009_02	Pleasant Valley Creek upstream of East Fork Pleasant Valley Creek	Leave in Cat 4a	TMDL updated
ID17050107SW009_03	Pleasant Valley Creek between North Fork Owyhee River and East Fork Pleasant Valley Creek	Leave in Cat 4a	TMDL updated
ID17050107SW010_02	Noon Creek	Leave in Cat 4a	TMDL updated
ID17050107SW011_02	Cabin and Corral Creek headwaters	Leave in Cat 4a	TMDL updated
ID17050107SW011_03	Cabin and Corral Creeks—3rd order	Leave in Cat 4a	TMDL updated
ID17050107SW012_02	Juniper Creek upstream of Buck Creek	Leave in Cat 4a	TMDL updated
ID17050107SW012_03	Juniper Creek between Buck and Cabin Creeks	Leave in Cat 4a	TMDL updated

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Geographic Information Systems (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.

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.

Anthropogenic

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

Aquatic

Occurring, growing, or living in water.

Assessment Unit (AU)

A segment of a water body that is treated as a homogeneous 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 Reconnaissance Program (BURP)

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

Best Management Practices (BMPs)

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

Biological Integrity

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

Clean Water Act

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

Community

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

Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels and to limit the number of violations per year. The US Environmental Protection Agency develops criteria guidance; states establish criteria.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and emerges again as streamflow.
Headwater	The origin or beginning of a stream.
Insolation	The rate of delivery of direct solar radiation per unit of horizontal surface area.
Intermittent Stream	1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available streamflow. 2) A stream that has a period of zero flow for at least one week during most years.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is allocated to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load(ing) Capacity (LC)	How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon

allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

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

Monitoring

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

National Pollutant Discharge Elimination System (NPDES)

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

Natural Condition

The condition that exists with little or no anthropogenic influence.

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernible 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.

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 alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Reach

A stream section with fairly homogenous physical characteristics.

Riparian

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

Stream

A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Subbasin

A large watershed of several hundred thousand acres. This is the name commonly given to 4th-field hydrologic units.

Total Maximum Daily Load (TMDL)

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

Tributary

A stream feeding into a larger stream or lake.

Wasteload Allocation (WLA)

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

Water Body

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

Water Pollution

Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a water body suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality 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.
Watershed	1) All the land that contributes runoff to a common point in a drainage network or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region that contributes water to a point of interest in a water body.

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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 1 (Grafe et al. 2002). Fall spawning can occur as early as August 15 and continue with incubation into the following spring up to June 1. IDAPA 58.01.02.250.02.f.ii states that the following water quality criteria must be met during that time period:

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

In a conventional temperature TMDL, the highest recorded water temperature in a data set (excluding extraordinarily hot days) is compared with 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

In many Idaho streams, natural temperatures may exceed the numeric criteria during certain periods. If potential natural vegetation targets are achieved, and 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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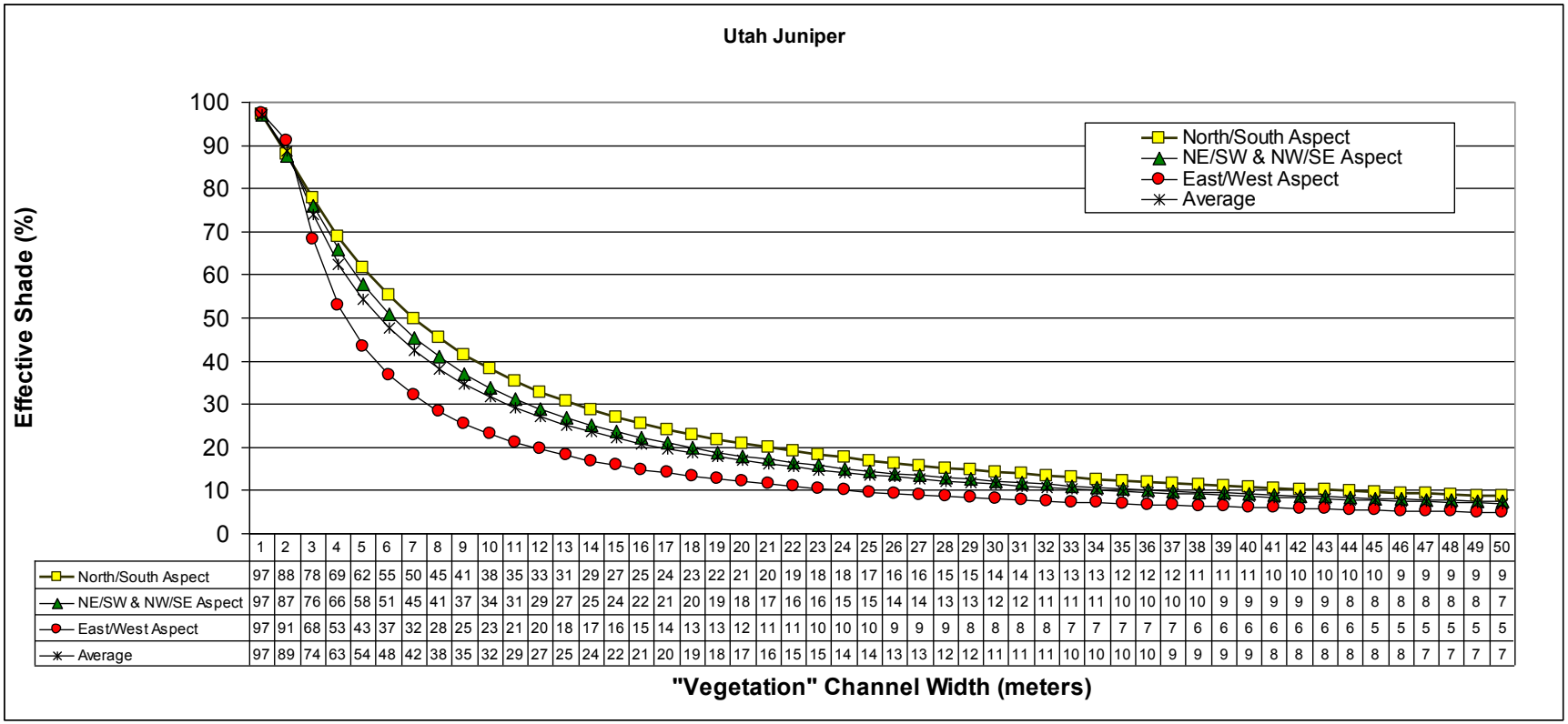
Appendix B. Effective Shade Curves



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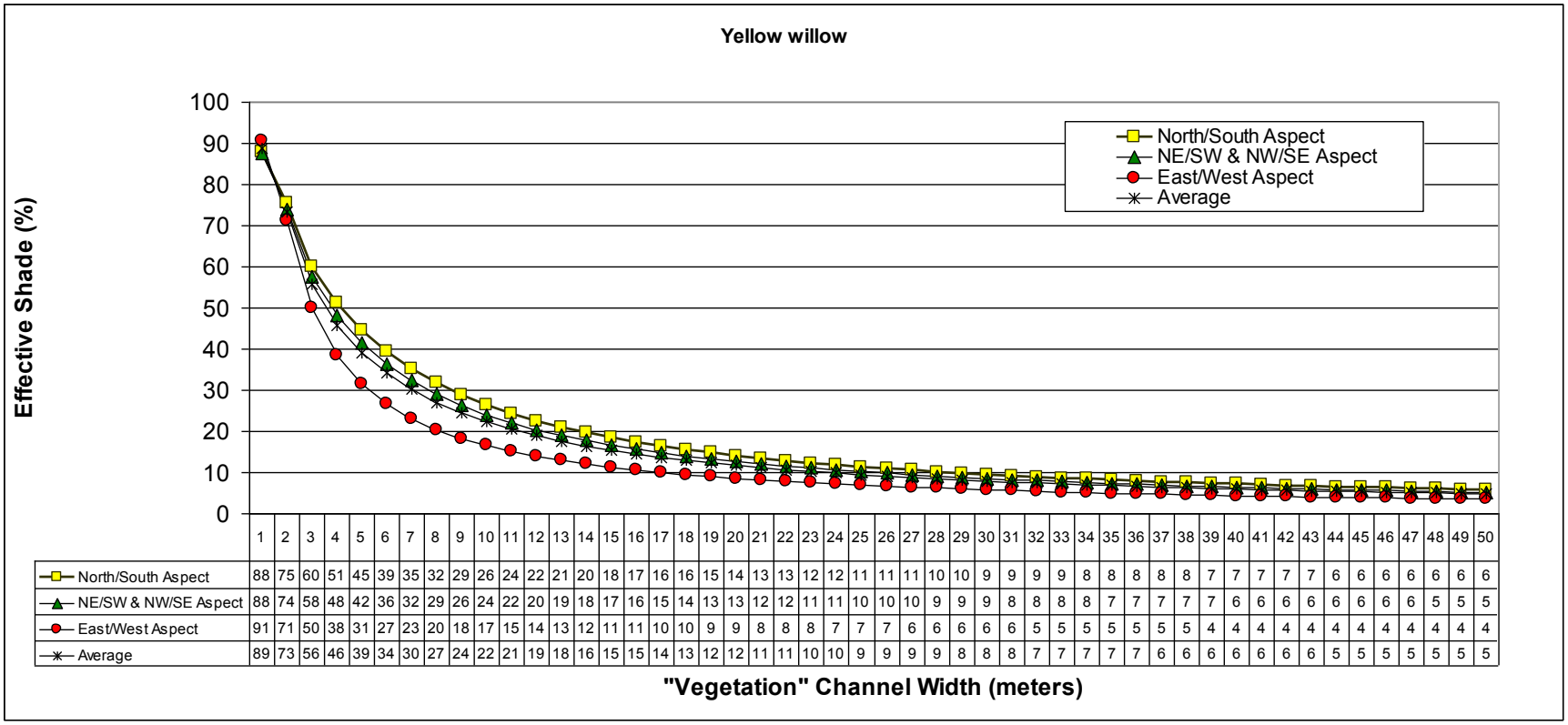
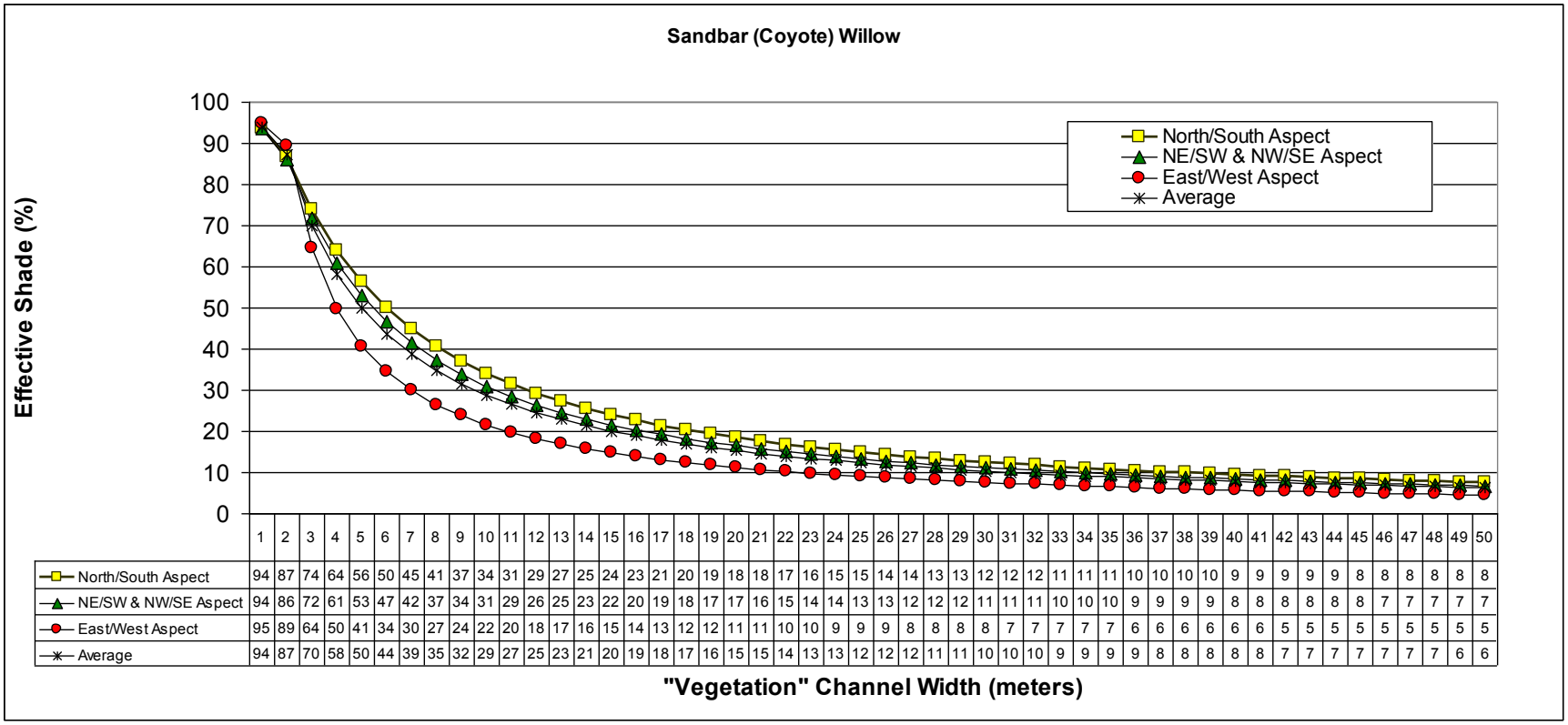
North/South Aspect	97	88	78	69	62	55	50	45	41	38	35	33	31	29	27	25	24	23	22	21	20	19	18	18	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10	10	10	10	9	9	9	9	9
NE/SW & NW/SE Aspect	97	87	76	66	58	51	45	41	37	34	31	29	27	25	24	22	21	20	19	18	17	16	16	15	15	14	14	13	13	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	8	7
East/West Aspect	97	91	68	53	43	37	32	28	25	23	21	20	18	17	16	15	14	13	13	12	11	11	10	10	10	9	9	9	8	8	8	8	7	7	7	7	7	6	6	6	6	6	6	6	5	5	5	5	5	5
Average	97	89	74	63	54	48	42	38	35	32	29	27	25	24	22	21	20	19	18	17	16	15	15	14	14	13	13	12	12	11	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	8	7	7	7	7

Figure B1. Shade targets for the Utah juniper vegetation type at various stream widths.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	88	75	60	51	45	39	35	32	29	26	24	22	21	20	18	17	16	16	15	14	13	13	12	12	11	11	11	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	6	6	6	6	6	6	6
NE/SW & NW/SE Aspect	88	74	58	48	42	36	32	29	26	24	22	20	19	18	17	16	15	14	13	13	12	12	11	11	10	10	10	9	9	9	8	8	8	8	7	7	7	7	7	6	6	6	6	6	6	6	6	5	5	5
East/West Aspect	91	71	50	38	31	27	23	20	18	17	15	14	13	12	11	11	10	10	9	9	8	8	8	7	7	7	6	6	6	6	6	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4
Average	89	73	56	46	39	34	30	27	24	22	21	19	18	16	15	15	14	13	12	12	11	11	10	10	9	9	9	9	8	8	8	7	7	7	7	7	6	6	6	6	6	6	6	5	5	5	5	5	5	5

Figure B2. Shade targets for the yellow willow vegetation type at various stream widths.



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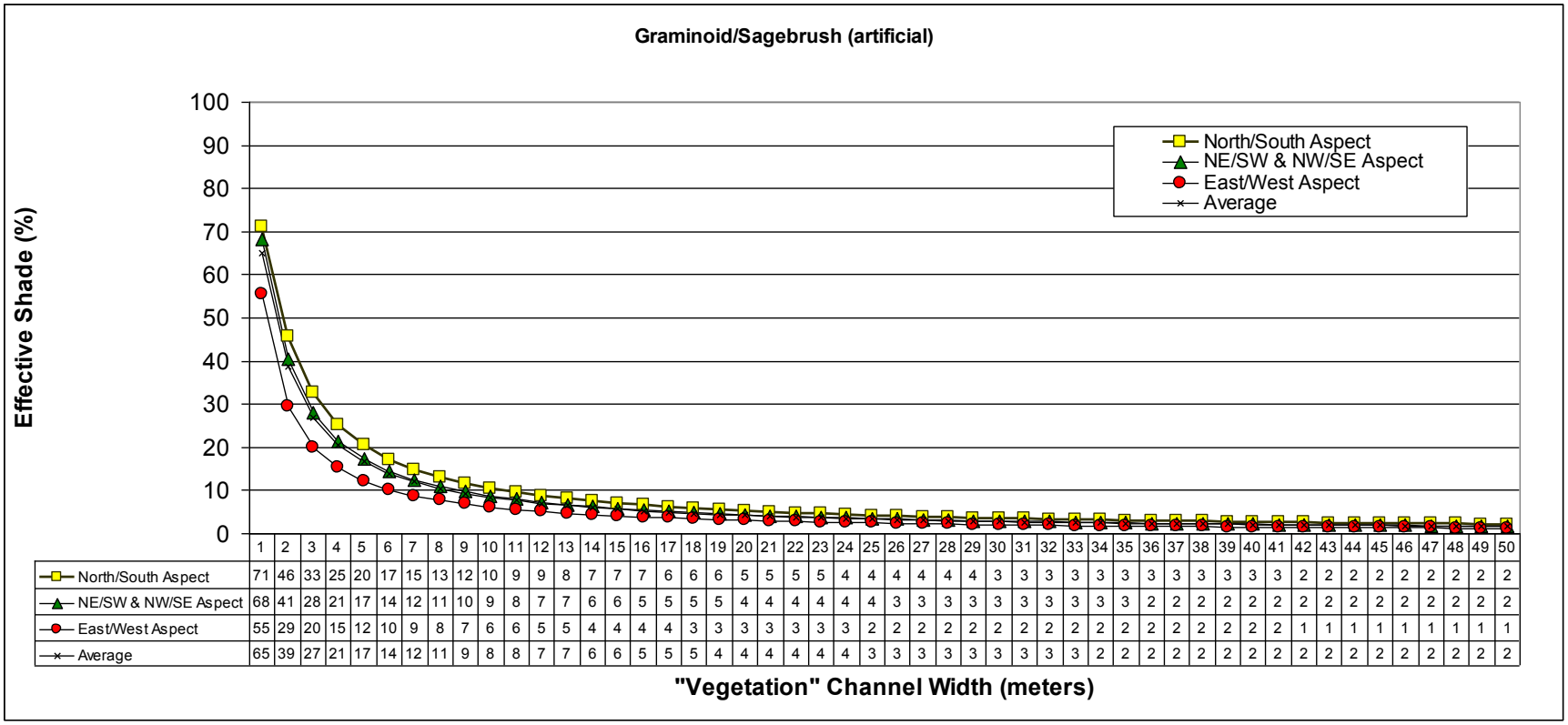
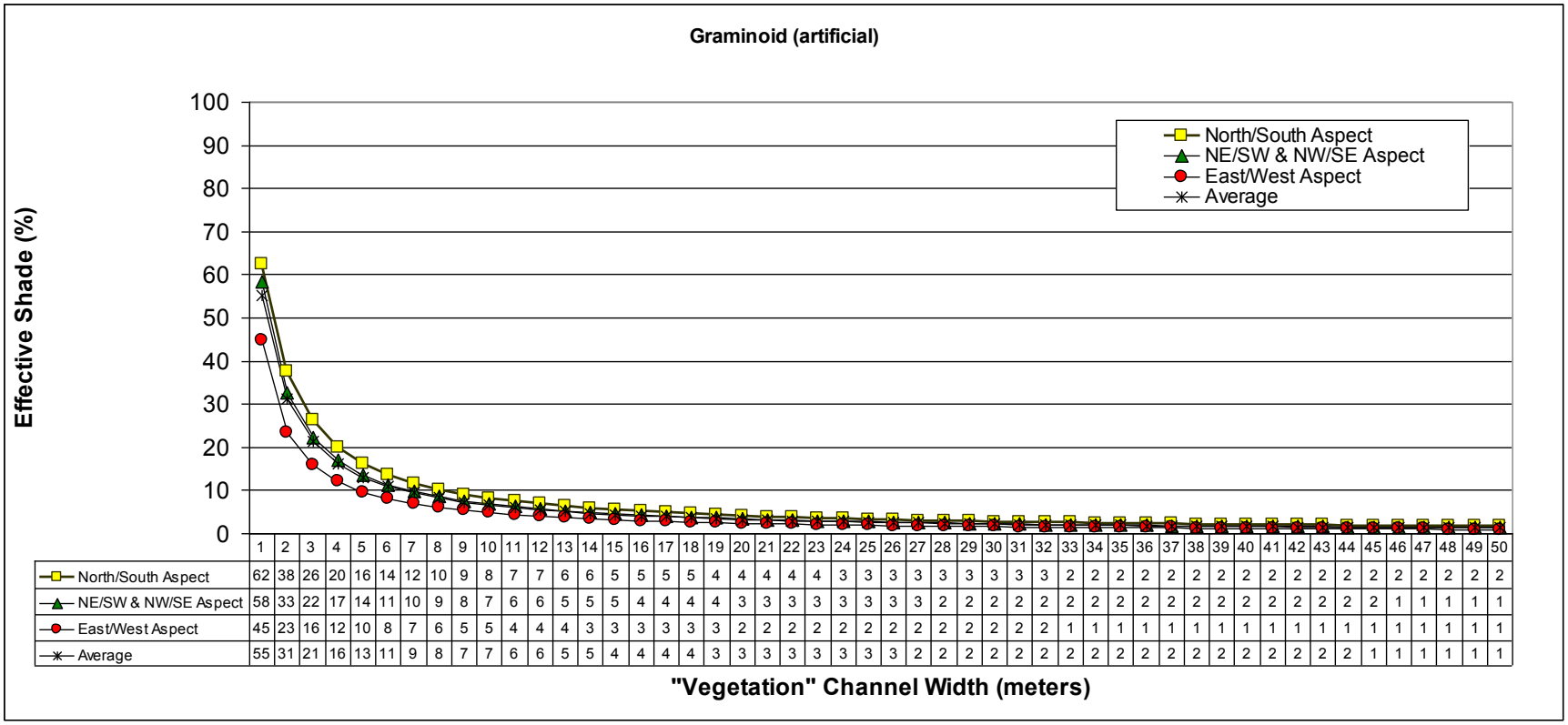
North/South Aspect	94	87	74	64	56	50	45	41	37	34	31	29	27	25	24	23	21	20	19	18	18	17	16	15	15	14	14	13	13	12	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	8
NE/SW & NW/SE Aspect	94	86	72	61	53	47	42	37	34	31	29	26	25	23	22	20	19	18	17	17	16	15	14	14	13	13	12	12	12	11	11	11	10	10	10	9	9	9	9	8	8	8	8	8	8	7	7	7	7	7
East/West Aspect	95	89	64	50	41	34	30	27	24	22	20	18	17	16	15	14	13	12	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5
Average	94	87	70	58	50	44	39	35	32	29	27	25	23	21	20	19	18	17	16	15	15	14	13	13	12	12	12	11	11	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	7	6	6

Figure B3. Shade targets for the coyote willow vegetation type at various stream widths.



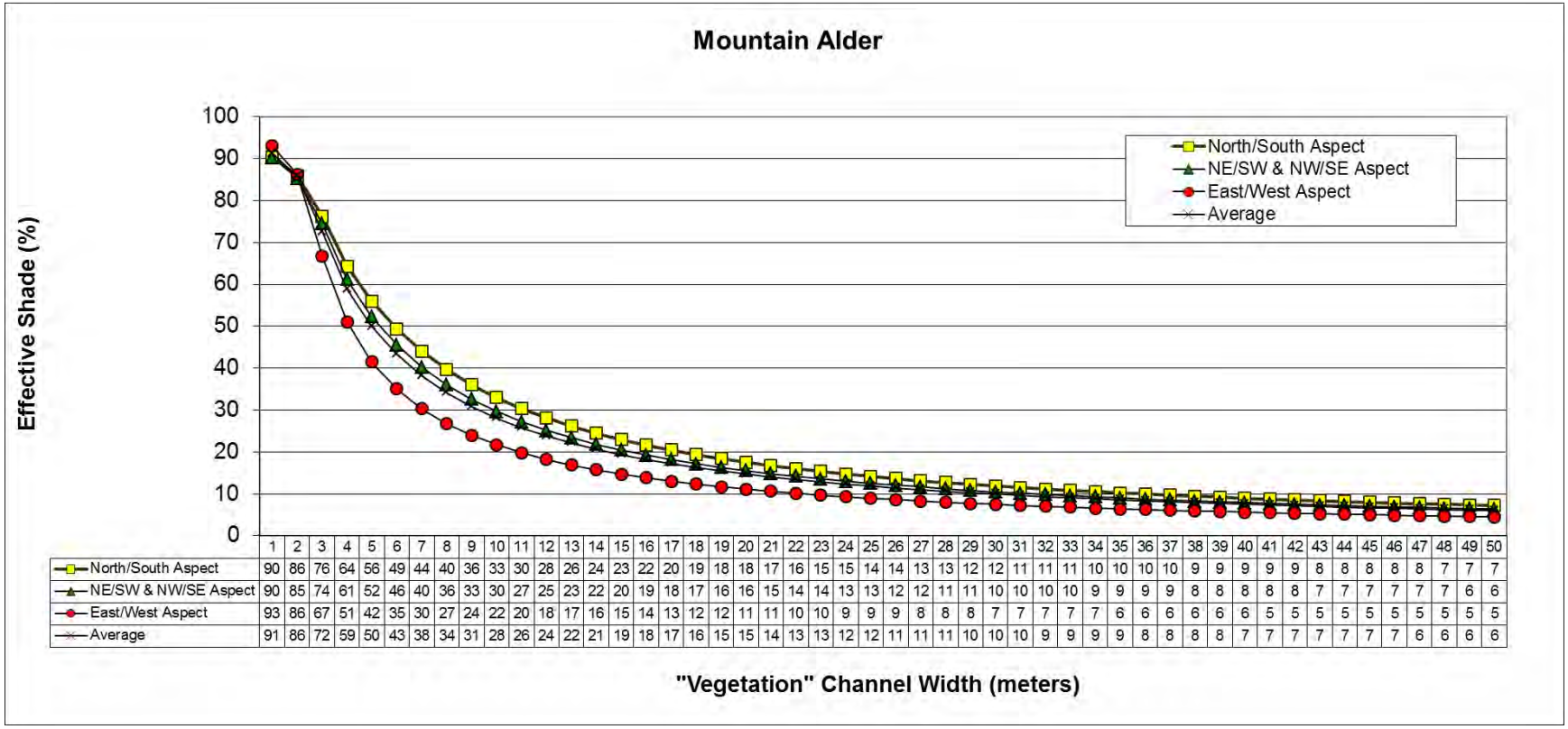
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	71	46	33	25	20	17	15	13	12	10	9	9	8	7	7	7	6	6	6	5	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2
NE/SW & NW/SE Aspect	68	41	28	21	17	14	12	11	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
East/West Aspect	55	29	20	15	12	10	9	8	7	6	6	5	5	4	4	4	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1
Average	65	39	27	21	17	14	12	11	9	8	8	7	7	6	6	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Figure B4. Shade targets for the graminoid/sagebrush vegetation type at various stream widths.



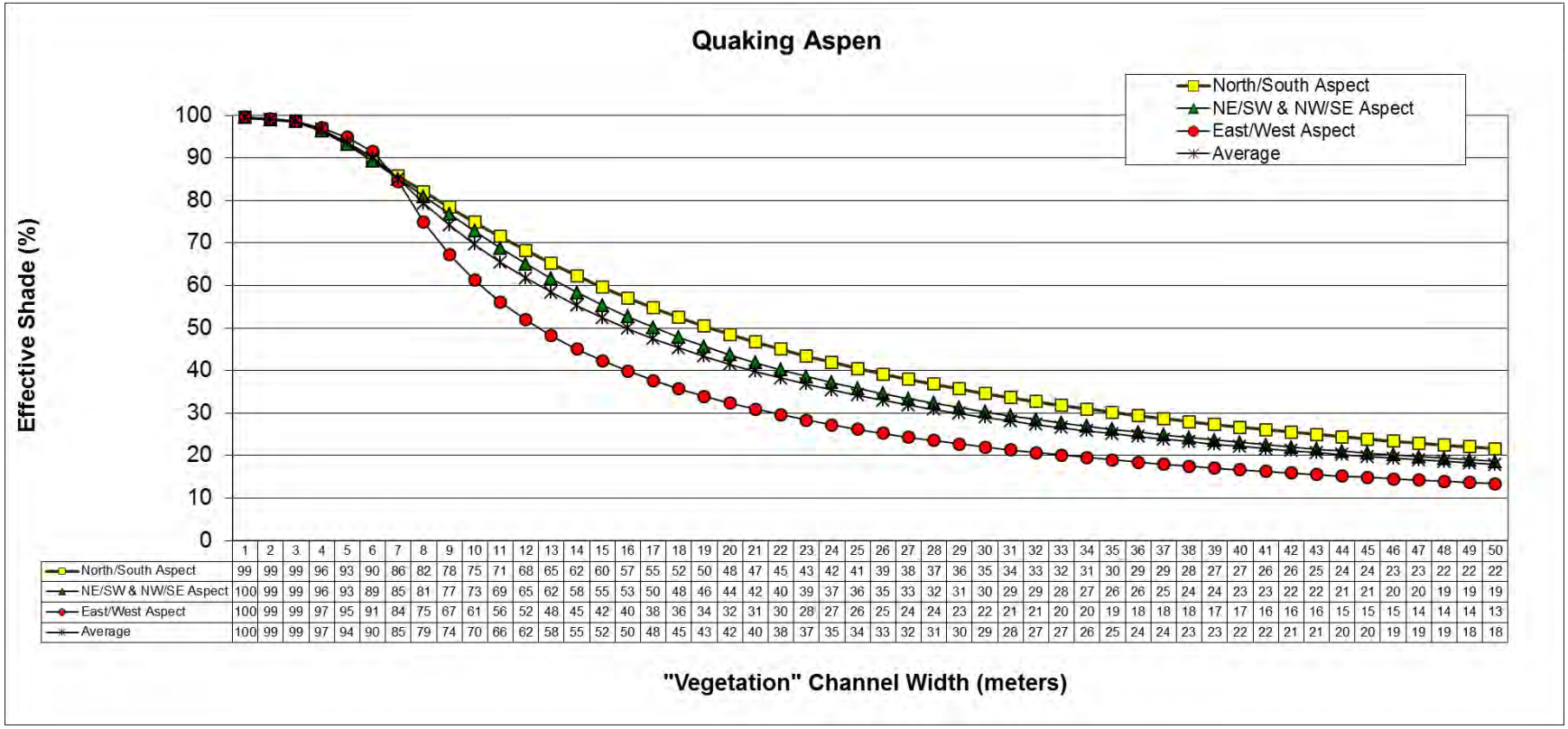
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	62	38	26	20	16	14	12	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE/SW & NW/SE Aspect	58	33	22	17	14	11	10	9	8	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
East/West Aspect	45	23	16	12	10	8	7	6	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Average	55	31	21	16	13	11	9	8	7	7	6	6	5	5	4	4	4	4	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1

Figure B5. Shade targets for the grass meadow (graminoid) vegetation type at various stream widths.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	90	86	76	64	56	49	44	40	36	33	30	28	26	24	23	22	20	19	18	18	17	16	15	15	14	14	13	13	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	7	7	7
NE/SW & NW/SE Aspect	90	85	74	61	52	46	40	36	33	30	27	25	23	22	20	19	18	17	16	16	15	14	14	13	13	12	12	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6
East/West Aspect	93	86	67	51	42	35	30	27	24	22	20	18	17	16	15	14	13	12	12	11	11	10	10	9	9	9	8	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5
Average	91	86	72	59	50	43	38	34	31	28	26	24	22	21	19	18	17	16	15	15	14	13	13	12	12	11	11	11	10	10	10	9	9	9	9	8	8	8	8	7	7	7	7	7	7	7	6	6	6	6

Figure B6. Shade targets for the mountain alder vegetation type at various stream widths.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	99	99	99	96	93	90	86	82	78	75	71	68	65	62	60	57	55	52	50	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	29	28	27	27	26	26	25	24	24	23	23	22	22	22
NE/SW & NW/SE Aspect	100	99	99	96	93	89	85	81	77	73	69	65	62	58	55	53	50	48	46	44	42	40	39	37	36	35	33	32	31	30	29	29	28	27	26	26	25	24	24	23	23	22	22	21	21	20	20	19	19	19
East/West Aspect	100	99	99	97	95	91	84	75	67	61	56	52	48	45	42	40	38	36	34	32	31	30	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	18	17	17	16	16	16	15	15	15	14	14	14	13
Average	100	99	99	97	94	90	85	79	74	70	66	62	58	55	52	50	48	45	43	42	40	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22	22	21	21	20	20	19	19	19	18	18

Figure B7. Shade targets for the quaking aspen vegetation type at various stream widths.

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Appendix C. Shade Maps

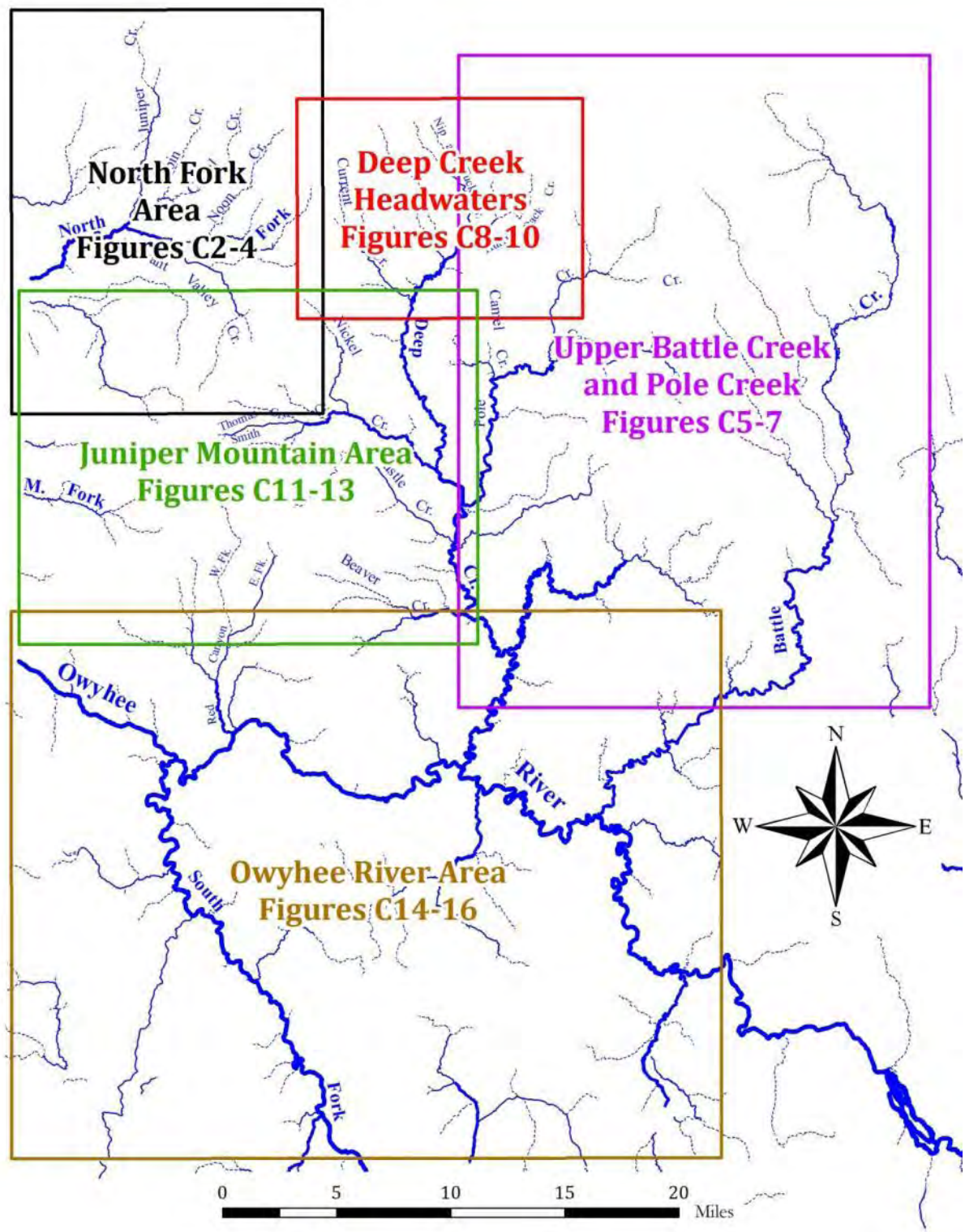

Figure C1. Overview map showing locations of detail maps in Figures C2–C16.

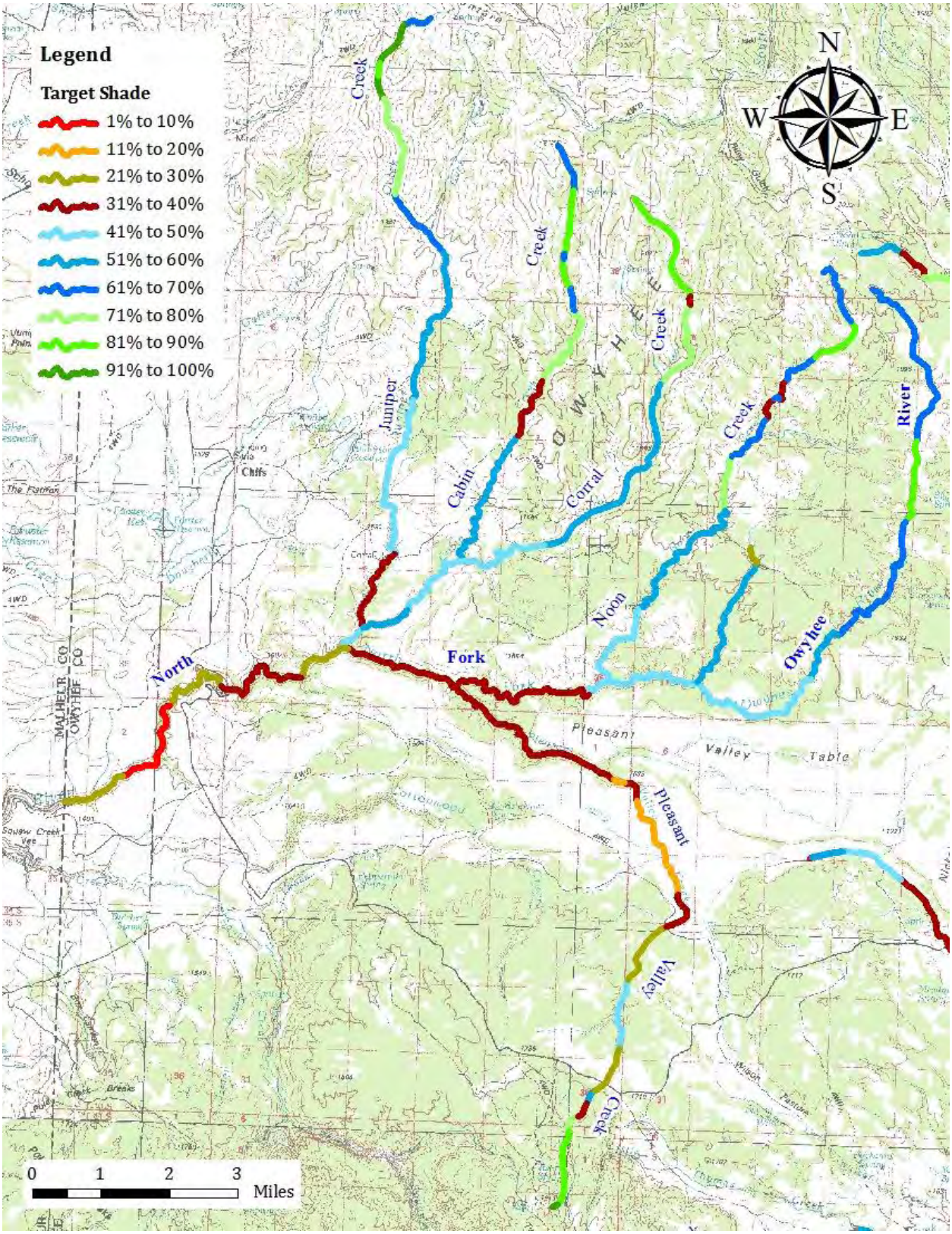

Figure C2. Target shade for the North Fork Owyhee River area.

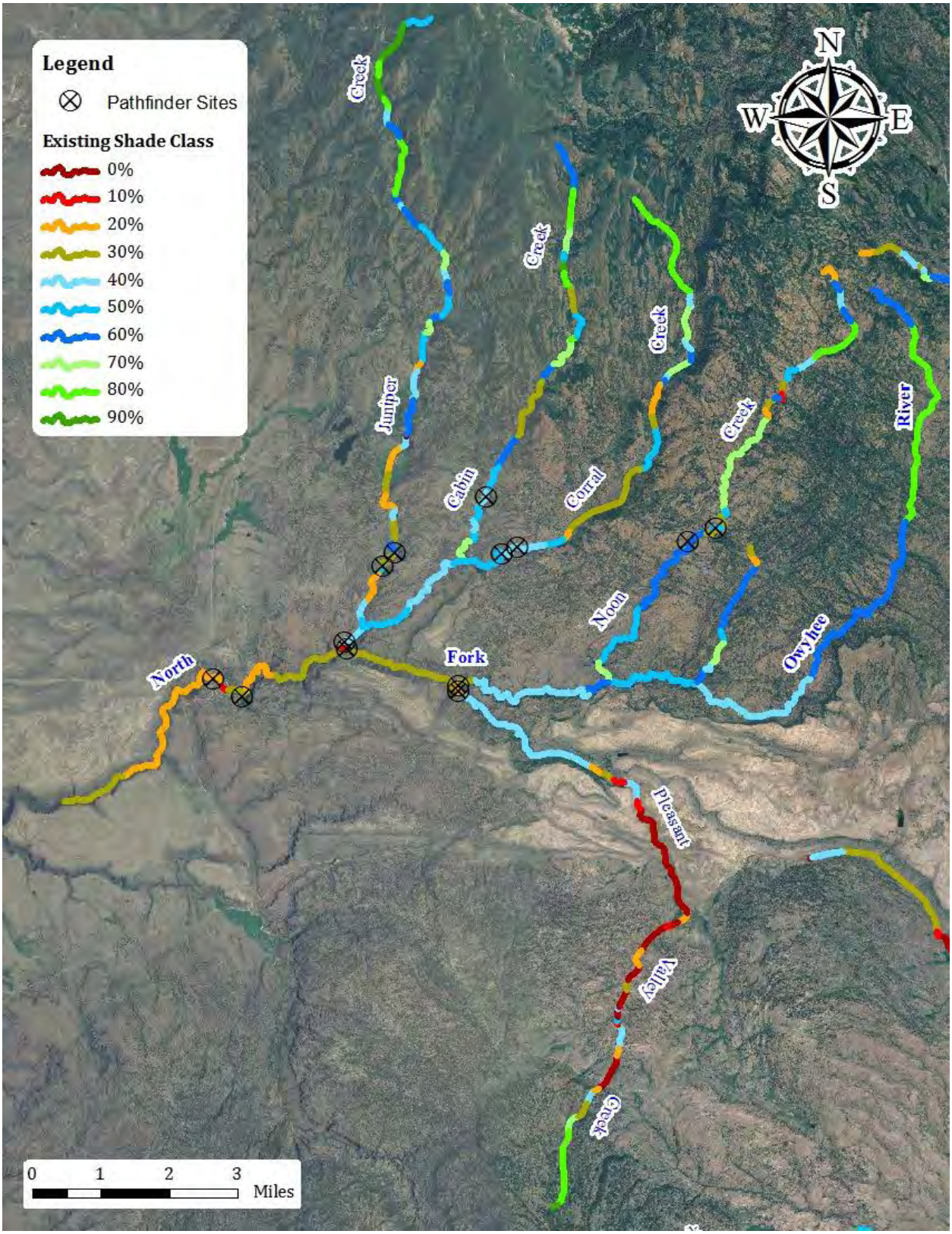

Figure C3. Existing shade for the North Fork Owyhee River area.

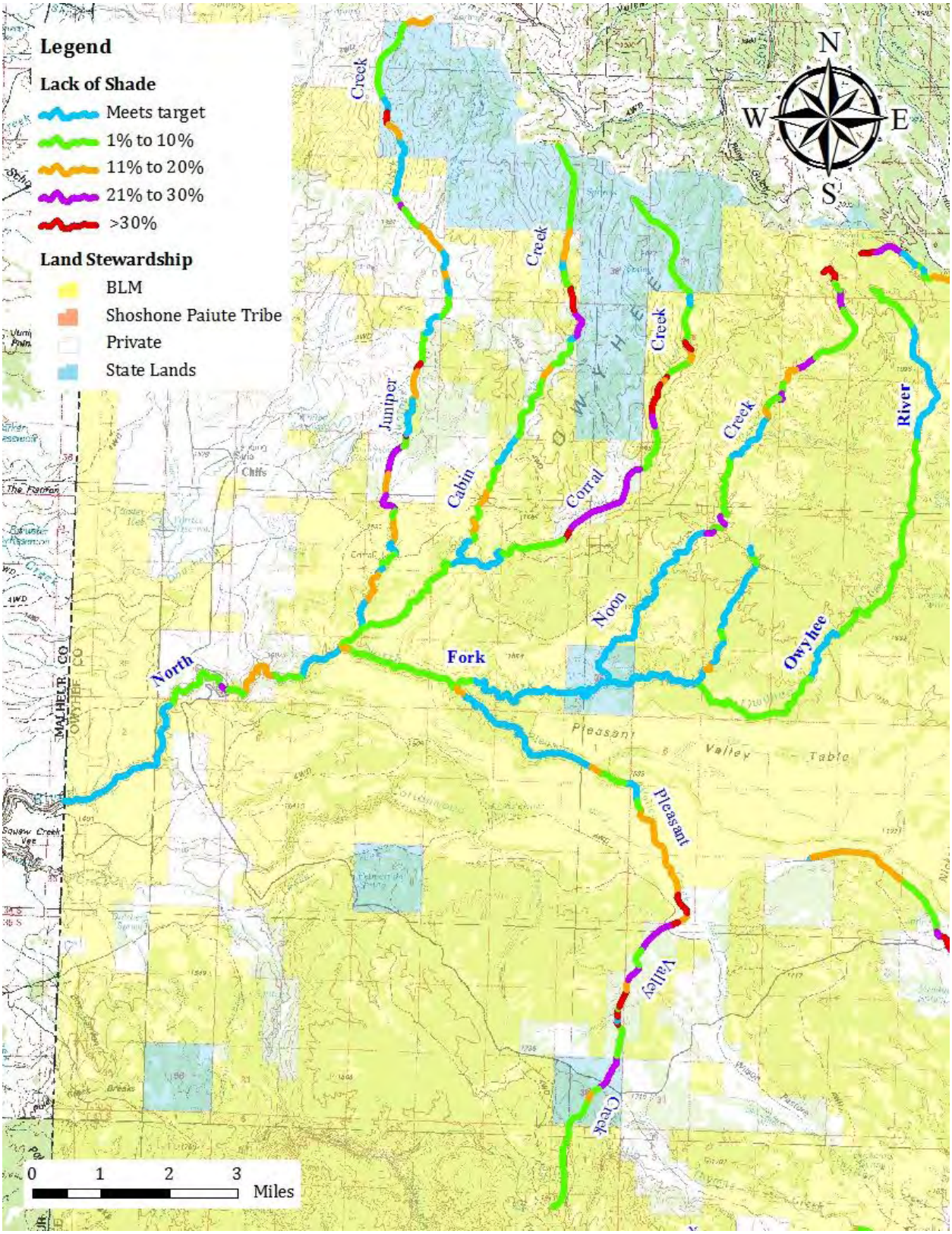

Figure C4. Lack of shade for the North Fork Owyhee River area.

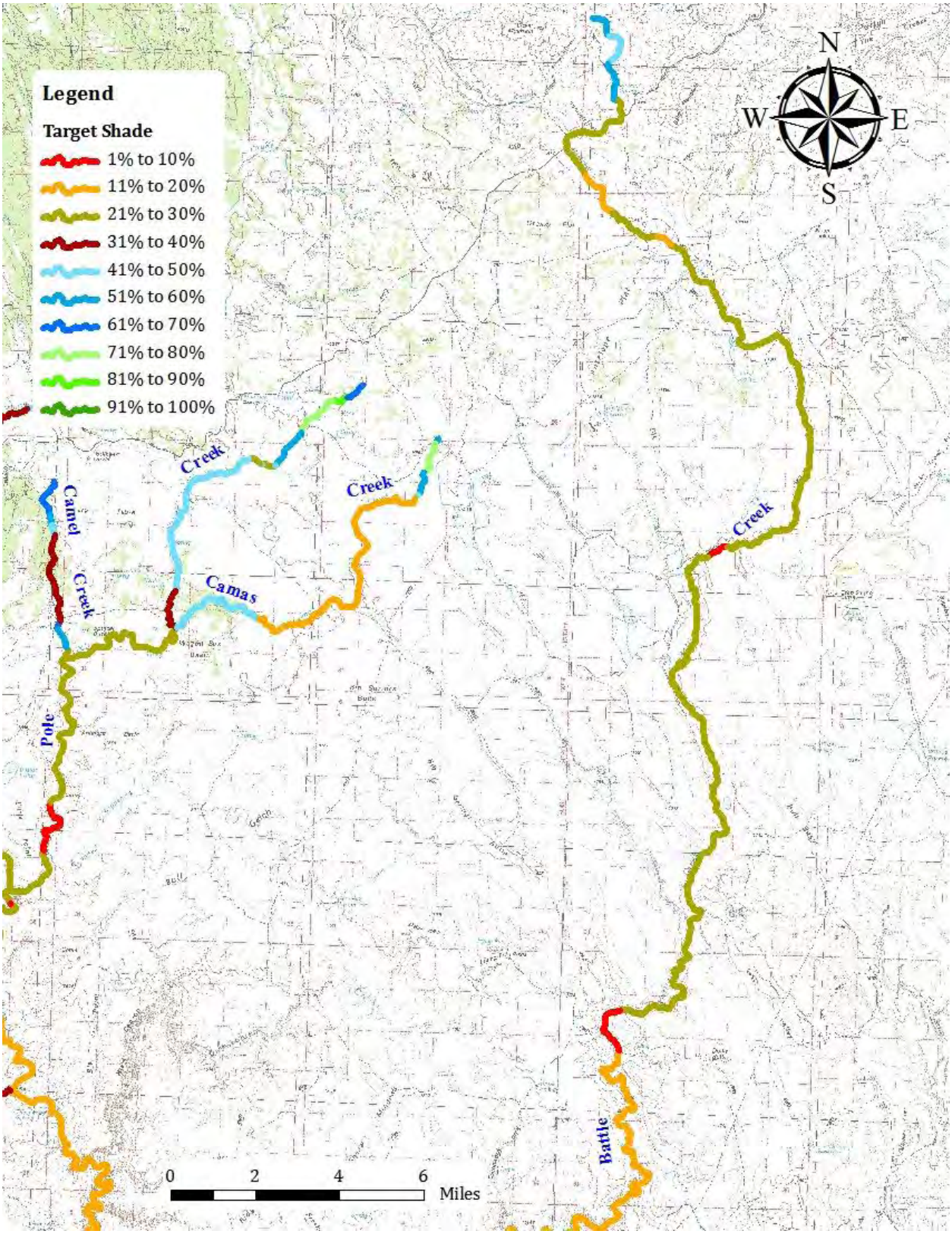

Figure C5. Target shade for Upper Battle Creek and Pole Creek.

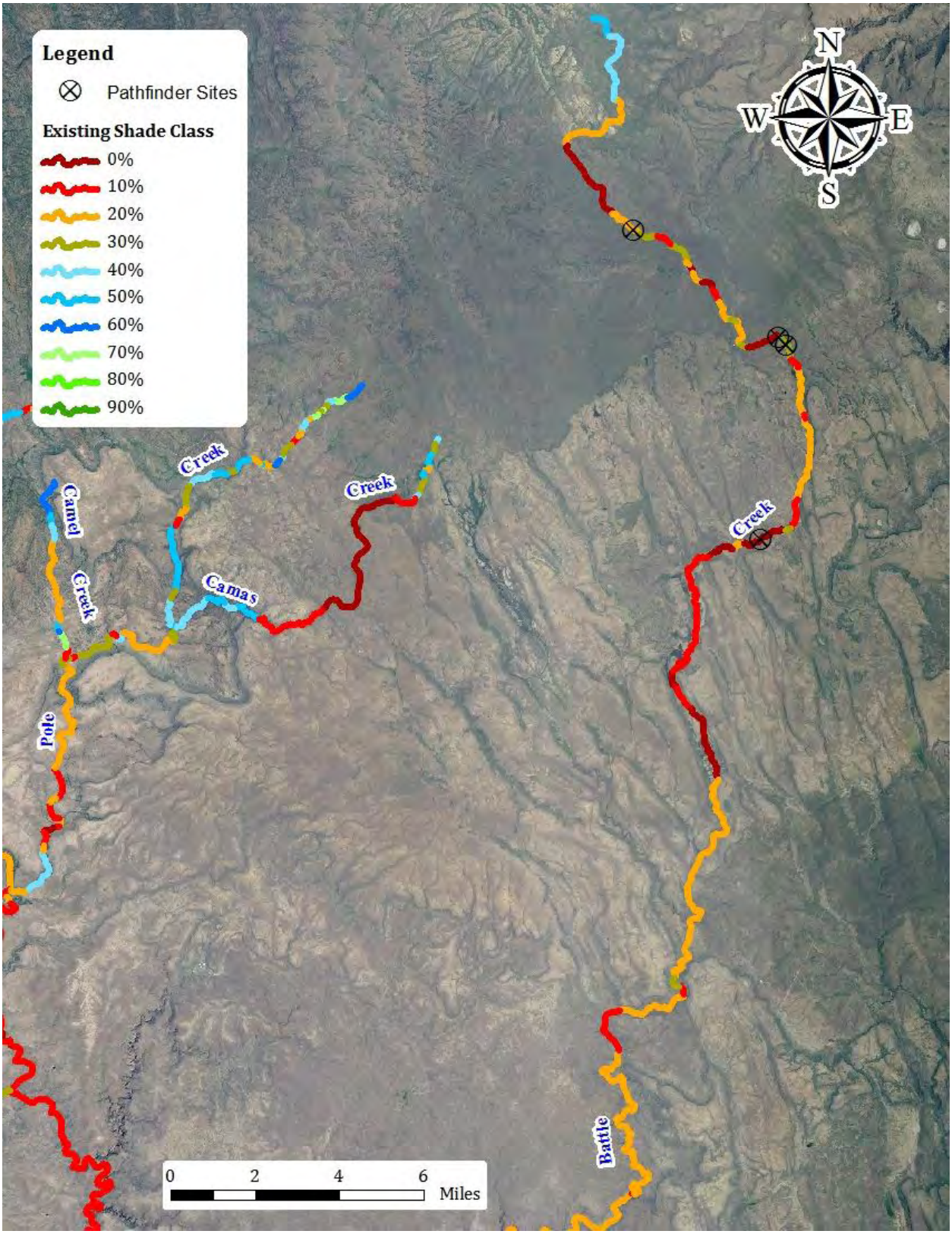

Figure C6. Existing shade for Upper Battle Creek and Pole Creek.

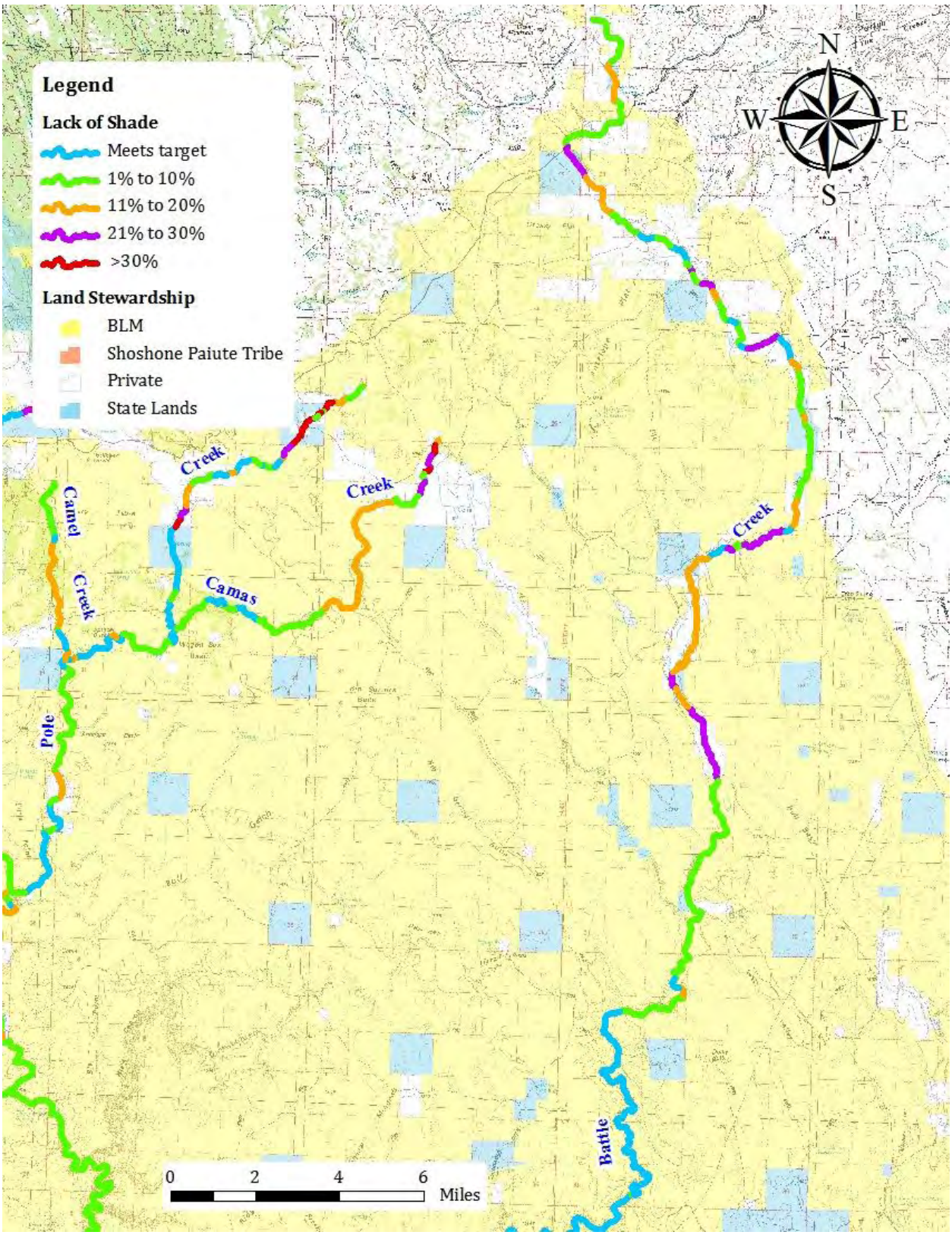

Figure C7. Lack of shade for Upper Battle Creek and Pole Creek.

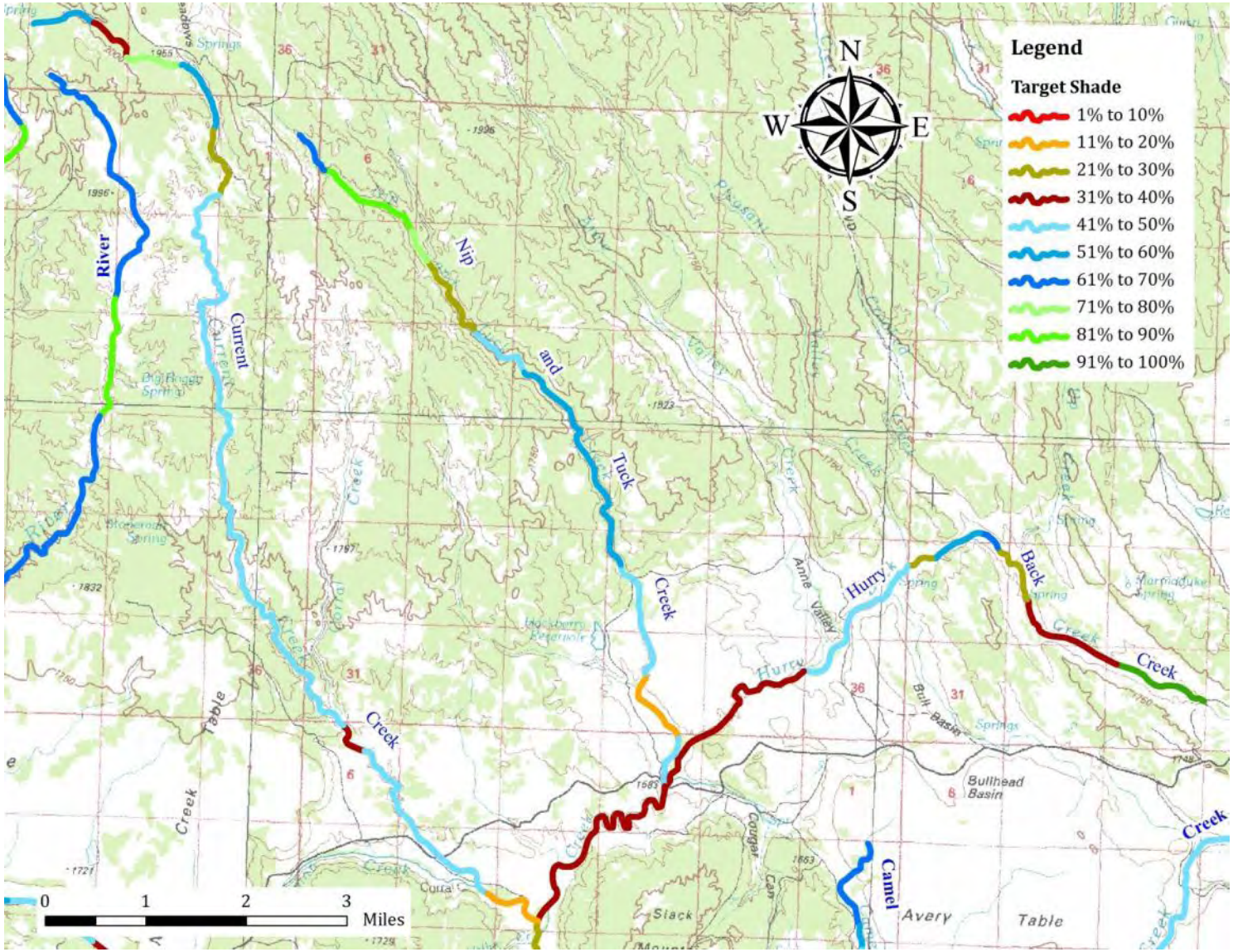

Figure C8. Target shade for Deep Creek headwaters.

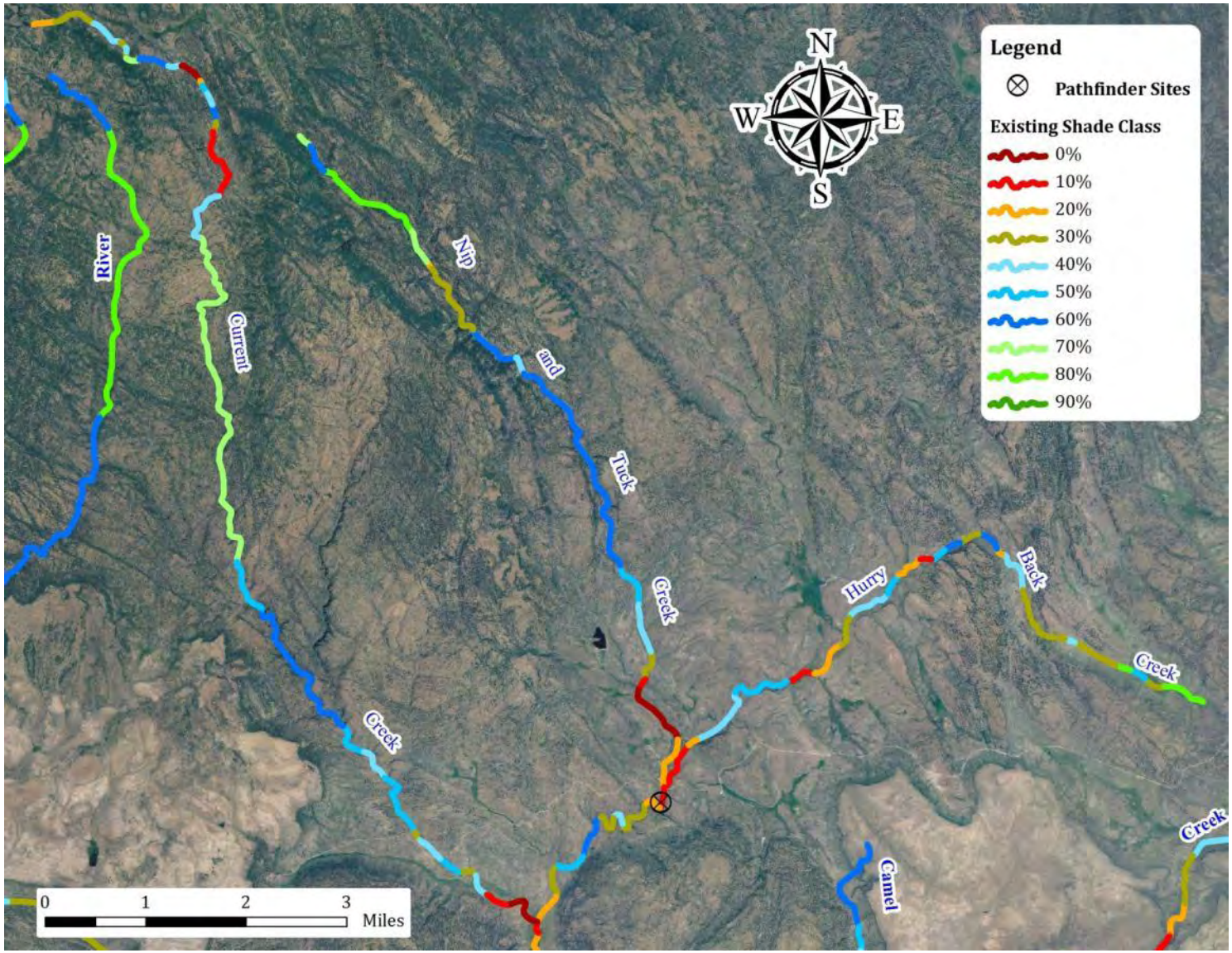

Figure C9. Existing shade for Deep Creek headwaters.

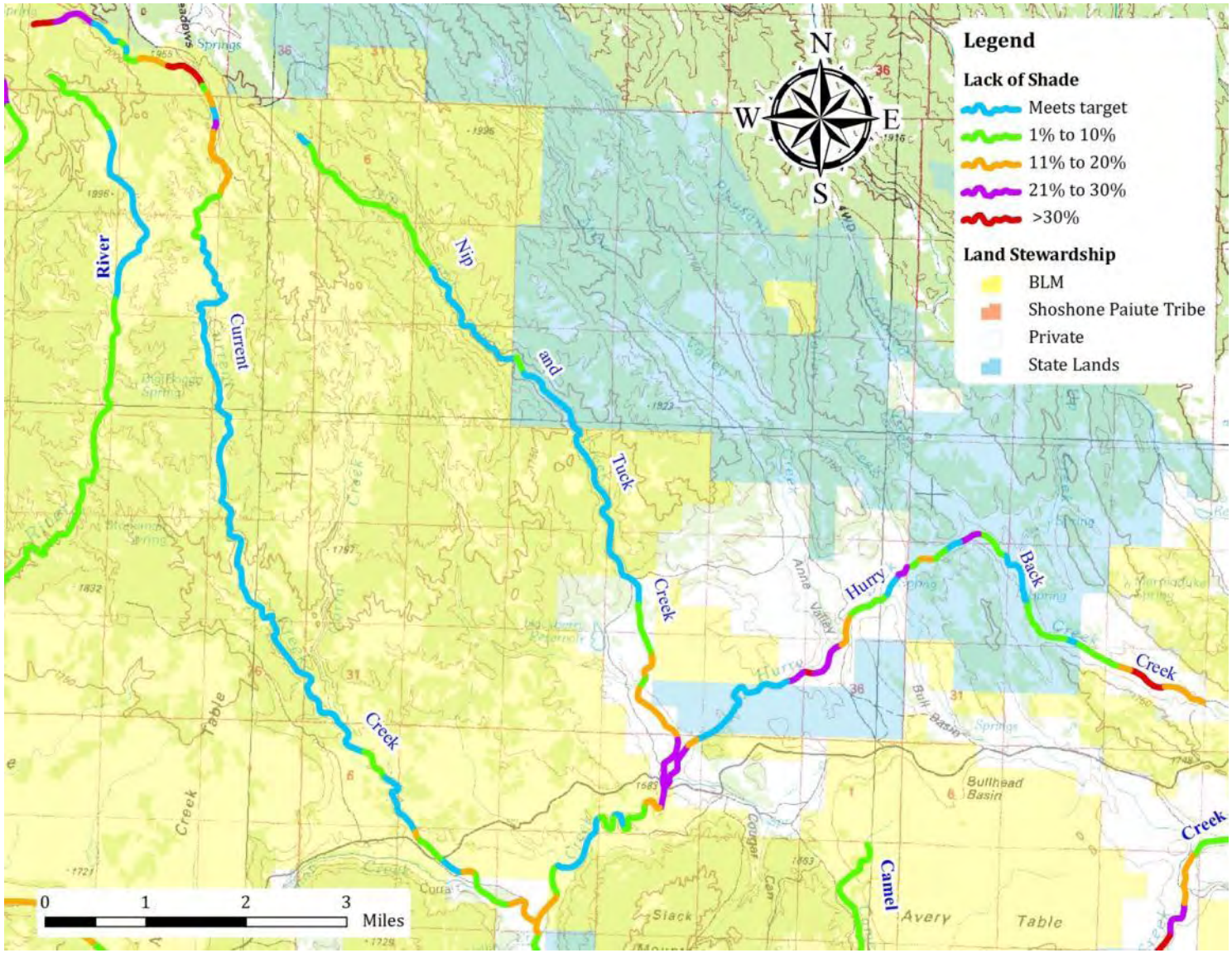

Figure C10. Lack of shade for Deep Creek headwaters.

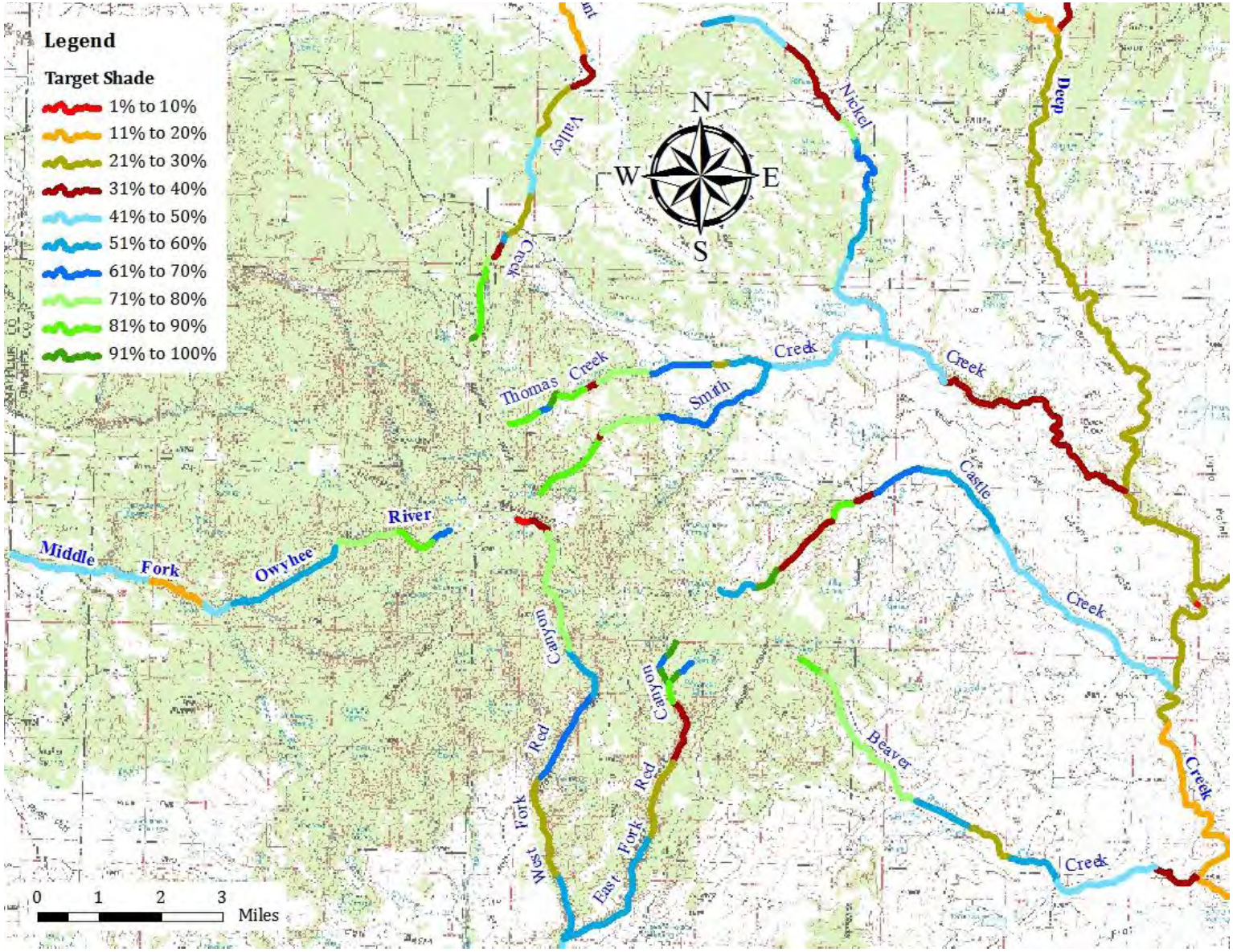

Figure C11. Target shade for Juniper Mountain area.

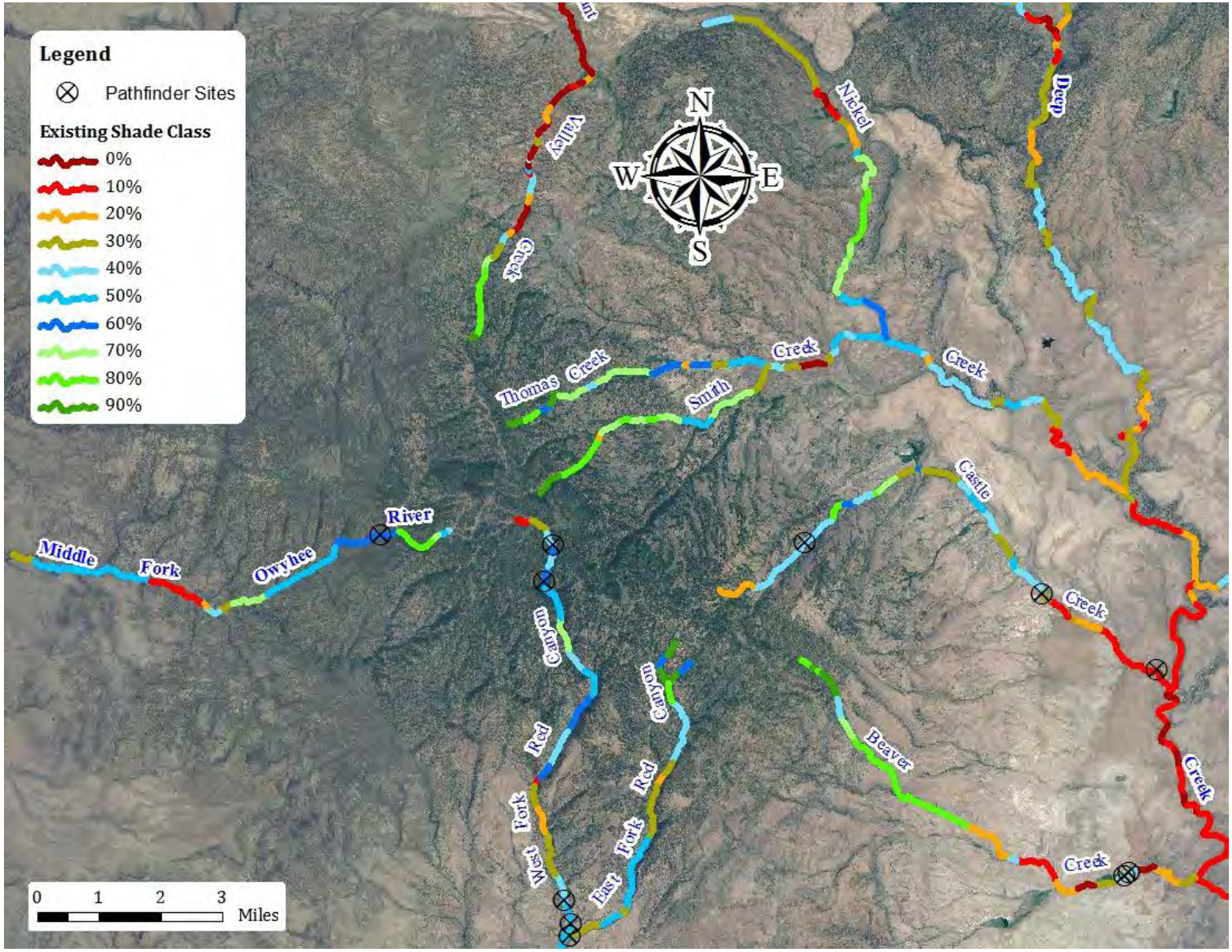

Figure C12. Existing shade for Juniper Mountain area.

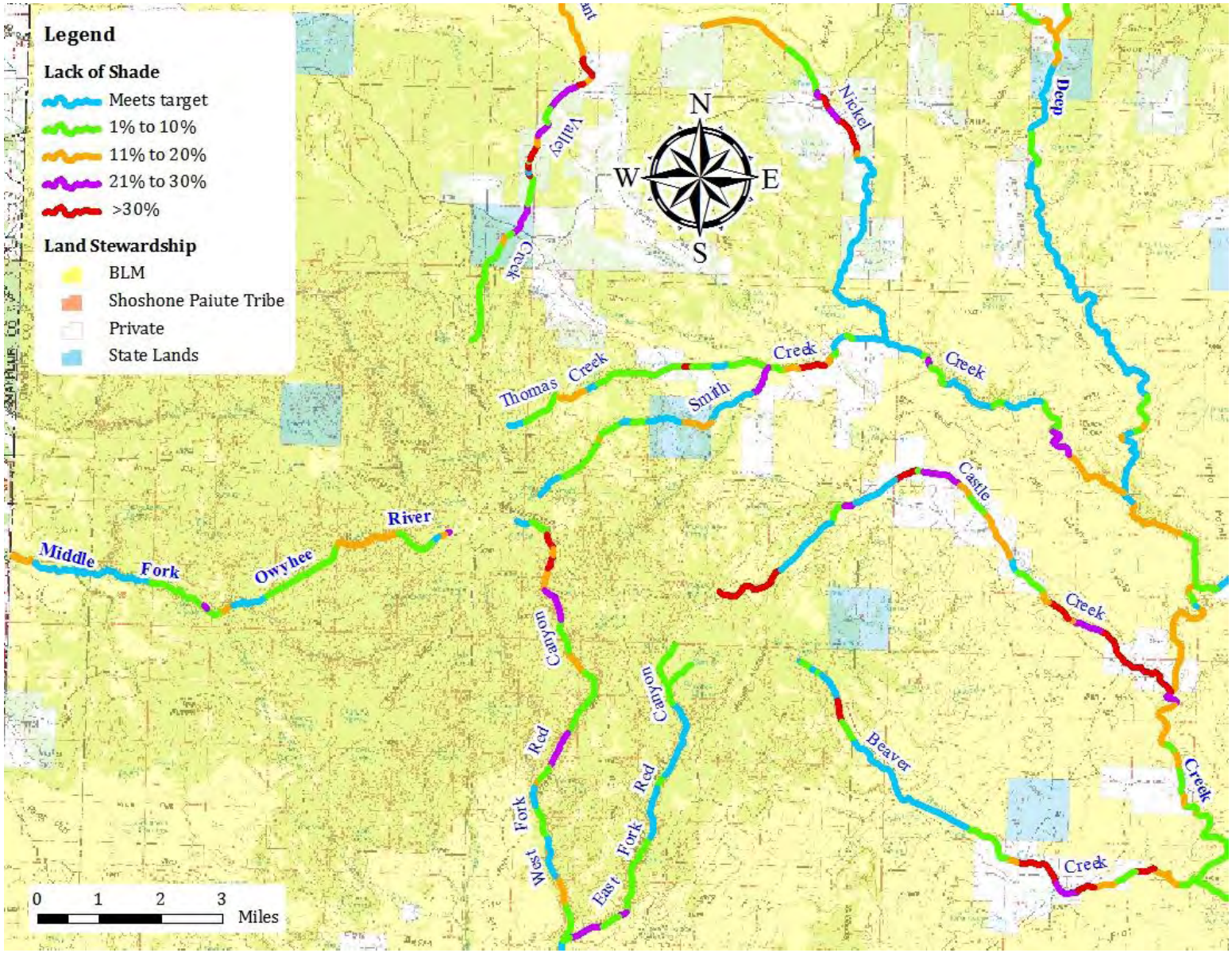

Figure C13. Lack of shade for Juniper Mountain area.

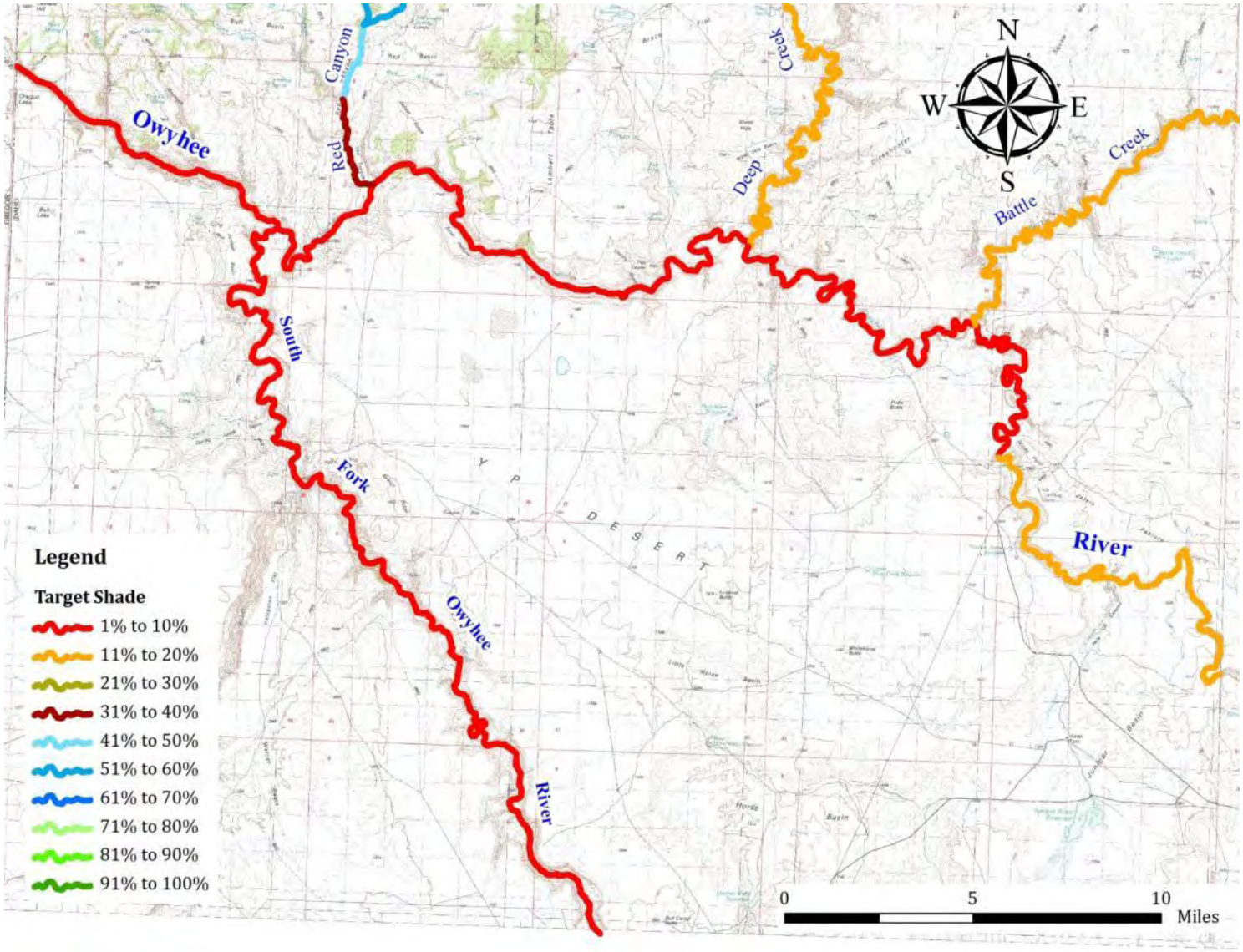

Figure C14. Target shade for Owyhee River area.

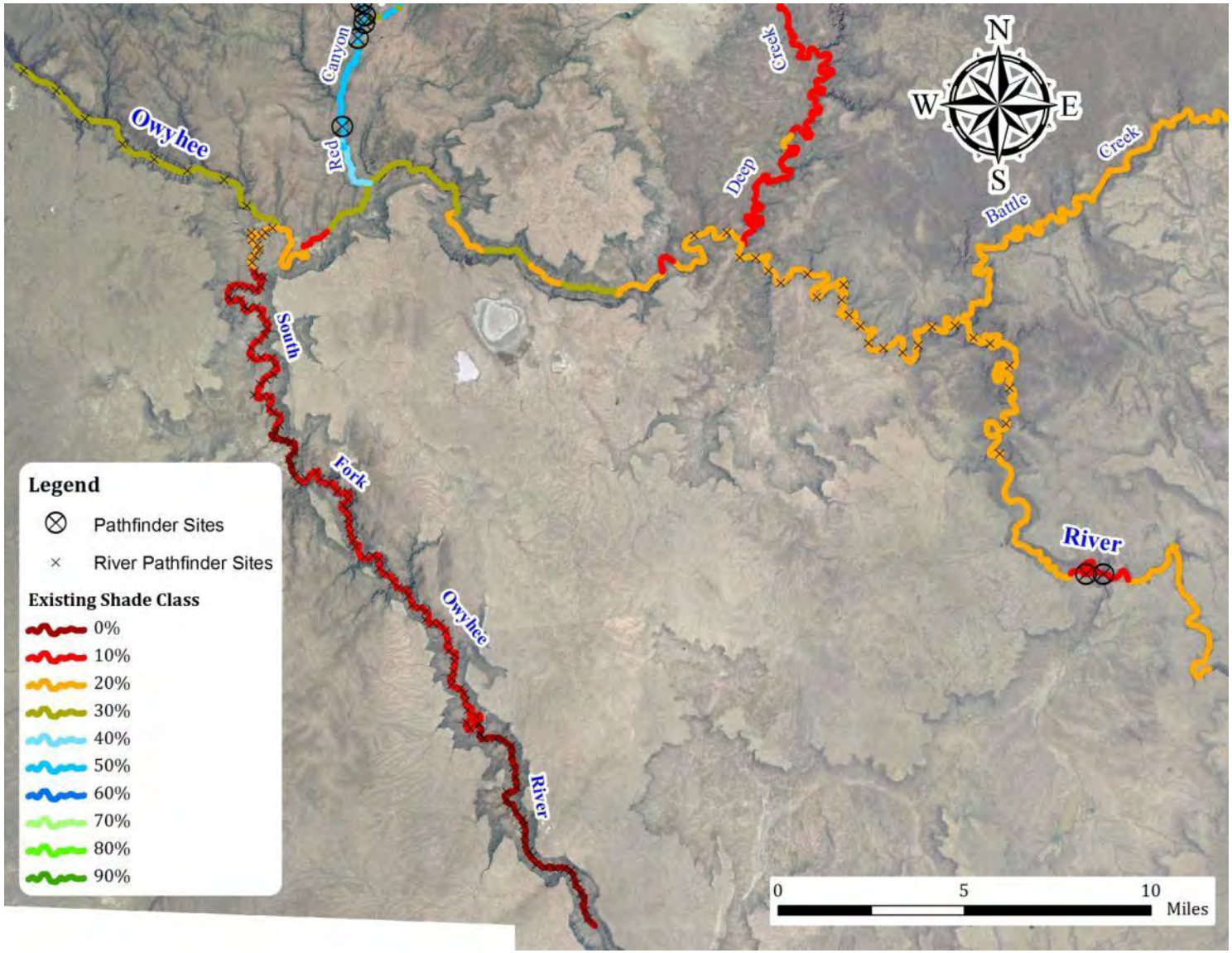

Figure C15. Existing shade for Owyhee River area.

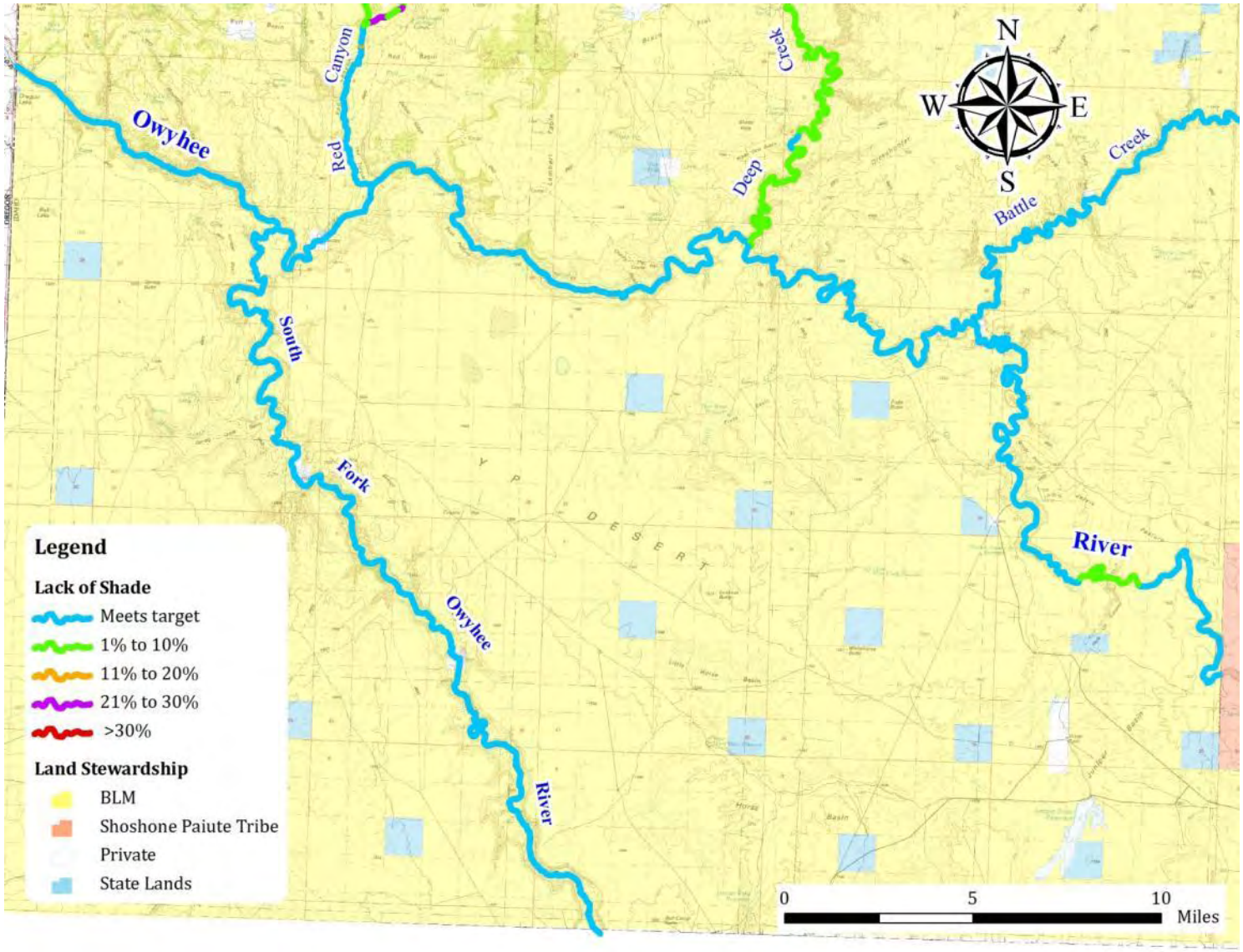

Figure C16. Lack of shade for Owyhee River area.

Appendix D. Shade Loading Tables

The following tables contain the target and existing shade levels, and the resulting load calculations, for all the analyzed streams in the Owyhee River watershed. Table D1 provides a brief explanation about each column in the tables. Each loading table contains a final column that lists the lack of shade on each stream segment. It is derived from subtracting the target shade from the existing shade for each segment. Thus, stream segments with the greatest lack of shade are in the worst condition. Please note that neither the "Lack of Shade" nor the total of the "Excess Load" column can be less than zero because of the natural background design of the TMDL. In other words, a section of stream that exceeds its target cannot compensate for a lack of shade elsewhere; the *entire* stream must be at its natural background shade level.

The shade levels reported in the loading tables are summarized visually in Figures 2, 5, and 7 in the body of the document and C2–C16 in Appendix C.

Table D1. Loading table legend.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
DEQ's Assessment Unit. All begin ID170501…	The name of the stream	Segments are numbered from upstream to downstream	The length of each segment	The vegetation type for this segment. Also the effective shade curve used	The level of shade at PNV, as indicated on the effective shade curve	The incident solar radiation under the target shading, per unit area	The natural target width of the stream at PNV	Segment length x segment width	Target Insolation x Target Segment Area This is the Load Capacity for this segment	The actual shade level, measured or estimated	The incident solar radiation under the current level of shading, per unit area	The present width of the stream	Segment length x segment width	Existing Insolation x Existing Segment Area	Existing Load - Target Load	Target Shade - Existing Shade

Table D2. Solar loads for ID17050104SW001_06 (Owyhee River between Juniper Creek and South Fork).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW001_06	Owyhee River	1	2680	Coyote willow	11%	5.68	29	77,720	441,310	10%	5.74	29	77720	446,268	4,959	1%
04SW001_06	Owyhee River	2	12030	Coyote willow	11%	5.68	29	348,870	1,980,954	20%	5.10	29	348870	1,780,632	(200,321)	0%
04SW001_06	Owyhee River	3	10000	Coyote willow	9%	5.81	33	330,000	1,915,914	20%	5.10	33	330000	1,684,320	(231,594)	0%
04SW001_06	Owyhee River	4	4690	Coyote willow	9%	5.81	36	168,840	980,251	20%	5.10	36	168840	861,759	(118,492)	0%
04SW001_06	Owyhee River	5	2670	Coyote willow	8%	5.87	39	104,130	611,201	20%	5.10	39	104130	531,480	(79,722)	0%
04SW001_06	Owyhee River	6	15760	Coyote willow	8%	5.87	41	646,160	3,792,701	20%	5.10	41	646160	3,298,001	(494,700)	0%
04SW001_06	Owyhee River	7	3440	Coyote willow	7%	5.93	43	147,920	877,669	20%	5.10	43	147920	754,984	(122,685)	0%
04SW001_06	Owyhee River	8	6530	Coyote willow	7%	5.93	44	287,320	1,704,784	20%	5.10	44	287320	1,466,481	(238,303)	0%
04SW001_06	Owyhee River	9	1190	Coyote willow	7%	5.93	45	53,550	317,734	10%	5.74	45	53550	307,484	(10,249)	0%
04SW001_06	Owyhee River	10	2550	Coyote willow	7%	5.93	45	114,750	680,858	20%	5.10	45	114750	585,684	(95,174)	0%
04SW001_06	Owyhee River	11	2600	Coyote willow	7%	5.93	45	117,000	694,208	30%	4.47	45	117000	522,522	(171,686)	0%
04SW001_06	Owyhee River	12	1730	Coyote willow	7%	5.93	45	77,850	461,915	20%	5.10	45	77850	397,346	(64,569)	0%
04SW001_06	Owyhee River	13	2500	Coyote willow	7%	5.93	45	112,500	667,508	30%	4.47	45	112500	502,425	(165,083)	0%
04SW001_06	Owyhee River	14	2660	Coyote willow	7%	5.93	45	119,700	710,228	20%	5.10	45	119700	610,949	(99,279)	0%
04SW001_06	Owyhee River	15	5790	Coyote willow	7%	5.93	46	266,340	1,580,302	30%	4.47	46	266340	1,189,474	(390,827)	0%
04SW001_06	Owyhee River	16	3150	Coyote willow	7%	5.93	46	144,900	859,750	30%	4.47	46	144900	647,123	(212,626)	0%
04SW001_06	Owyhee River	17	1350	Coyote willow	7%	5.93	46	62,100	368,464	10%	5.74	46	62100	356,578	(11,886)	0%
04SW001_06	Owyhee River	18	4230	Coyote willow	7%	5.93	46	194,580	1,154,521	20%	5.10	46	194580	993,136	(161,385)	0%
							Totals		19,800,270					16,936,648	(2,863,622)	

Table D3. Solar loads for ID17050104SW006_06 (Owyhee River between Blue and Juniper Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW006_06	Owyhee River	1	10970	Coyote willow	15%	5.42	20	219,400	1,189,806	20%	5.10	20	219400	1,119,818	(69,989)	0%
04SW006_06	Owyhee River	2	1700	Coyote willow	15%	5.42	20	34,000	184,382	10%	5.74	20	34000	195,228	10,846	5%
							Totals		1,374,188					1,315,046	(59,143)	

Table D4. Solar loads for ID17050104SW023_02 (Battle Creek upstream of Antelope Flat).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW023_02	Battle	1	1100	Meadow	55%	2.87	1	1,100	3,158	50%	3.19	1	1100	3,509	351	5%
04SW023_02	Battle	2	1580	Meadow	50%	3.19	2	3,160	10,080	40%	3.83	2	3160	12,096	2,016	10%
04SW023_02	Battle	3	1700	Yellow willow	56%	2.81	3	5,100	14,317	40%	3.83	3	5100	19,523	5,206	16%
04SW023_02	Battle	4	3500	Sage/grass	27%	4.66	3	10,500	48,903	20%	5.10	3	10500	53,592	4,689	7%
04SW023_02	Battle	5	1450	Sage/grass	21%	5.04	4	5,800	29,233	0%	6.38	4	5800	37,004	7,771	21%
04SW023_02	Battle	6	1950	Sage/grass	17%	5.30	5	9,750	51,630	0%	6.38	5	9750	62,205	10,575	17%
04SW023_02	Battle	7	1500	Yellow willow	30%	4.47	7	10,500	46,893	20%	5.10	7	10500	53,592	6,699	10%
04SW023_02	Battle	8	720	Yellow willow	30%	4.47	7	5,040	22,509	30%	4.47	7	5040	22,509	0	0%
04SW023_02	Battle	9	650	Water	15%	5.42	15	9,750	52,874	10%	5.74	15	9750	55,985	3,110	5%
							Totals		279,597					320,014	40,417	

Table D5. Solar loads for ID17050104SW023_03 (Battle Creek between Antelope Flat and Big Springs Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW023_03	Battle	1	1060	Yellow willow	30%	4.47	7	7,420	33,138	30%	4.47	7	7420	33,138	0	0%
04SW023_03	Battle	2	170	Yellow willow	27%	4.66	8	1,360	6,334	20%	5.10	8	1360	6,941	607	7%
04SW023_03	Battle	3	340	Yellow willow	27%	4.66	8	2,720	12,668	0%	6.38	8	2720	17,354	4,685	27%
04SW023_03	Battle	4	560	Yellow willow	27%	4.66	8	4,480	20,865	20%	5.10	8	4480	22,866	2,001	7%
04SW023_03	Battle	5	630	Yellow willow	27%	4.66	8	5,040	23,473	0%	6.38	8	5040	32,155	8,682	27%
04SW023_03	Battle	6	560	Yellow willow	27%	4.66	8	4,480	20,865	10%	5.74	8	4480	25,724	4,859	17%
04SW023_03	Battle	7	880	Yellow willow	27%	4.66	8	7,040	32,788	20%	5.10	8	7040	35,932	3,144	7%
04SW023_03	Battle	8	310	Yellow willow	27%	4.66	8	2,480	11,550	30%	4.47	8	2480	11,076	(475)	0%
04SW023_03	Battle	9	1100	Yellow willow	27%	4.66	8	8,800	40,985	20%	5.10	8	8800	44,915	3,930	7%
04SW023_03	Battle	10	320	Yellow willow	27%	4.66	8	2,560	11,923	30%	4.47	8	2560	11,433	(490)	0%
04SW023_03	Battle	11	470	Yellow willow	27%	4.66	8	3,760	17,512	0%	6.38	8	3760	23,989	6,477	27%
04SW023_03	Battle	12	350	Yellow willow	27%	4.66	8	2,800	13,041	0%	6.38	8	2800	17,864	4,823	27%
04SW023_03	Battle	13	630	Yellow willow	27%	4.66	8	5,040	23,473	0%	6.38	8	5040	32,155	8,682	27%
04SW023_03	Battle	14	1000	Yellow willow	27%	4.66	8	8,000	37,259	30%	4.47	8	8000	35,728	(1,531)	0%
04SW023_03	Battle	15	490	Yellow willow	27%	4.66	8	3,920	18,257	10%	5.74	8	3920	22,509	4,252	17%
04SW023_03	Battle	16	1210	Yellow willow	24%	4.85	9	10,890	52,803	20%	5.10	9	10890	55,583	2,779	4%
04SW023_03	Battle	17	300	Yellow willow	24%	4.85	9	2,700	13,092	20%	5.10	9	2700	13,781	689	4%
04SW023_03	Battle	18	510	Yellow willow	24%	4.85	9	4,590	22,256	20%	5.10	9	4590	23,427	1,171	4%
04SW023_03	Battle	19	180	Yellow willow	24%	4.85	9	1,620	7,855	10%	5.74	9	1620	9,302	1,447	14%
04SW023_03	Battle	20	900	Yellow willow	24%	4.85	9	8,100	39,275	20%	5.10	9	8100	41,342	2,067	4%
04SW023_03	Battle	21	620	Yellow willow	24%	4.85	9	5,580	27,056	20%	5.10	9	5580	28,480	1,424	4%
04SW023_03	Battle	22	80	Water	24%	4.85	9	720	3,491	0%	6.38	60	4800	30,624	27,133	24%
04SW023_03	Battle	23	2000	Yellow willow	24%	4.85	9	18,000	87,278	20%	5.10	9	18000	91,872	4,594	4%
04SW023_03	Battle	24	1280	Yellow willow	24%	4.85	9	11,520	55,858	10%	5.74	9	11520	66,148	10,290	14%
04SW023_03	Battle	25	190	Yellow willow	24%	4.85	9	1,710	8,291	30%	4.47	9	1710	7,637	(655)	0%
04SW023_03	Battle	26	1500	Yellow willow	24%	4.85	9	13,500	65,459	0%	6.38	9	13500	86,130	20,671	24%
04SW023_03	Battle	27	510	Yellow willow	22%	4.98	10	5,100	25,380	0%	6.38	10	5100	32,538	7,158	22%
04SW023_03	Battle	28	640	Yellow willow	22%	4.98	10	6,400	31,849	20%	5.10	10	6400	32,666	817	2%
04SW023_03	Battle	29	290	Yellow willow	22%	4.98	10	2,900	14,432	0%	6.38	10	2900	18,502	4,070	22%
04SW023_03	Battle	30	900	Water	22%	4.98	10	9,000	44,788	0%	6.38	130	117000	746,460	701,672	22%
04SW023_03	Battle	31	6500	Yellow willow	22%	4.98	10	65,000	323,466	10%	5.74	10	65000	373,230	49,764	12%
04SW023_03	Battle	32	700	Water	21%	5.04	11	7,700	38,810	0%	6.38	11	7700	49,126	10,316	21%
04SW023_03	Battle	33	930	Yellow willow	21%	5.04	11	10,230	51,561	10%	5.74	11	10230	58,741	7,179	11%
04SW023_03	Battle	34	3530	Yellow willow	21%	5.04	11	38,830	195,711	0%	6.38	11	38830	247,735	52,024	21%
04SW023_03	Battle	35	7410	Coyote willow	25%	4.79	12	88,920	425,482	20%	5.10	6	44460	226,924	(198,558)	5%
							Totals		1,858,326					2,614,026	755,701	

Table D6. Solar loads for ID17050104SW023_04 (Battle Creek between Big Springs Creek and Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW023_04	Battle	1	2650	Coyote willow	21%	5.04	14	37,100	186,991	20%	5.10	12	31800	162,307	(24,684)	1%
04SW023_04	Battle	2	570	Coyote willow	21%	5.04	14	7,980	40,221	30%	4.47	14	7980	35,639	(4,582)	0%
04SW023_04	Battle	3	400	Coyote willow	21%	5.04	14	5,600	28,225	10%	5.74	14	5600	32,155	3,930	11%
04SW023_04	Battle	4	3020	Coyote willow	21%	5.04	14	42,280	213,100	20%	5.10	14	42280	215,797	2,697	1%
04SW023_04	Battle	5	2180	Sage/grass	6%	6.00	14	30,520	183,035	10%	5.74	14	30520	175,246	(7,789)	0%
04SW023_04	Battle	6	9800	Coyote willow	20%	5.10	15	147,000	750,288	20%	5.10	15	147000	750,288	0	0%
04SW023_04	Battle	7	9100	Coyote willow	19%	5.17	16	145,600	752,432	20%	5.10	16	145600	743,142	(9,289)	0%
04SW023_04	Battle	8	9400	Coyote willow	18%	5.23	17	159,800	836,010	20%	5.10	17	159800	815,619	(20,390)	0%
04SW023_04	Battle	9	10000	Coyote willow	17%	5.30	18	180,000	953,172	20%	5.10	18	180000	918,720	(34,452)	0%
							Totals		3,943,473					3,848,914	(94,559)	

Table D7. Solar loads for ID17050104SW026_02 (Deep Creek—1st- and 2nd-order rangeland tributaries).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_02	Hurry Back	1	690	Yellow willow	89%	0.70	1	690	484	80%	1.28	1	690	880	396	9%
04SW026_02	Hurry Back	2	360	Yellow willow	89%	0.70	1	360	253	30%	4.47	1	360	1,608	1,355	59%
04SW026_02	Hurry Back	3	290	Yellow willow	89%	0.70	1	290	204	50%	3.19	1	290	925	722	39%
04SW026_02	Hurry Back	4	240	Yellow willow	89%	0.70	1	240	168	80%	1.28	1	240	306	138	9%
04SW026_02	Hurry Back	5	750	Sage/grass	39%	3.89	2	1,500	5,838	30%	4.47	2	1500	6,699	861	9%
04SW026_02	Hurry Back	6	170	Sage/grass	39%	3.89	2	340	1,323	40%	3.83	2	340	1,302	(22)	0%
04SW026_02	Hurry Back	7	990	Sage/grass	39%	3.89	2	1,980	7,706	30%	4.47	2	1980	8,843	1,137	9%
04SW026_02	Hurry Back	8	180	Sage/grass	27%	4.66	3	540	2,515	30%	4.47	3	540	2,412	(103)	0%
04SW026_02	Hurry Back	9	770	Sage/grass	27%	4.66	3	2,310	10,759	40%	3.83	3	2310	8,843	(1,916)	0%
04SW026_02	Hurry Back	10	130	Sage/grass	27%	4.66	3	390	1,816	20%	5.10	3	390	1,991	174	7%
04SW026_02	Hurry Back	11	400	Coyote willow	70%	1.91	3	1,200	2,297	60%	2.55	3	1200	3,062	766	10%
04SW026_02	Hurry Back	12	330	Coyote willow	58%	2.68	4	1,320	3,537	30%	4.47	4	1320	5,895	2,358	28%
04SW026_02	Hurry Back	13	280	Coyote willow	58%	2.68	4	1,120	3,001	60%	2.55	4	1120	2,858	(143)	0%
04SW026_02	Hurry Back	14	270	Coyote willow	58%	2.68	4	1,080	2,894	50%	3.19	4	1080	3,445	551	8%
04SW026_02	Hurry Back	15	190	Sage/grass	21%	5.04	4	760	3,831	10%	5.74	4	760	4,364	533	11%
04SW026_02	Hurry Back	16	260	Sage/grass	21%	5.04	4	1,040	5,242	20%	5.10	4	1040	5,308	66	1%
							Totals		51,867					58,741	6,874	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to Deep Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D8. Solar loads for ID17050104SW026_02a (Deep Creek—1st- and 2nd-order forested tributaries).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_02a	Current	1	360	Meadow	55%	2.87	1	360	1,034	20%	5.10	1	360	1,837	804	35%
04SW026_02a	Current	2	700	Meadow	55%	2.87	1	700	2,010	30%	4.47	1	700	3,126	1,117	25%
04SW026_02a	Current	3	550	Sage/grass	39%	3.89	2	1,100	4,281	40%	3.83	2	1100	4,211	(70)	0%
04SW026_02a	Current	4	120	Sage/grass	39%	3.89	2	240	934	30%	4.47	2	240	1,072	138	9%
04SW026_02a	Current	5	70	Sage/grass	39%	3.89	2	140	545	40%	3.83	2	140	536	(9)	0%
04SW026_02a	Current	6	110	Sage/grass	39%	3.89	2	220	856	30%	4.47	2	220	983	126	9%
04SW026_02a	Current	7	220	Yellow willow	73%	1.72	2	440	758	70%	1.91	2	440	842	84	3%
04SW026_02a	Current	8	490	Yellow willow	73%	1.72	2	980	1,688	60%	2.55	2	980	2,501	813	13%
04SW026_02a	Current	9	220	Yellow willow	73%	1.72	2	440	758	40%	3.83	2	440	1,684	926	33%
04SW026_02a	Current	10	400	Sage/grass	27%	4.66	3	1,200	5,589	0%	6.38	3	1200	7,656	2,067	27%
04SW026_02a	Current	11	90	Yellow willow	56%	2.81	3	270	758	20%	5.10	3	270	1,378	620	36%
04SW026_02a	Current	12	150	Yellow willow	56%	2.81	3	450	1,263	50%	3.19	3	450	1,436	172	6%
04SW026_02a	Current	13	200	Yellow willow	56%	2.81	3	600	1,684	40%	3.83	3	600	2,297	612	16%
04SW026_02a	Current	14	290	Yellow willow	56%	2.81	3	870	2,442	60%	2.55	3	870	2,220	(222)	0%
04SW026_02a	Current	15	160	Yellow willow	56%	2.81	3	480	1,347	30%	4.47	3	480	2,144	796	26%
04SW026_02a	Current	16	1200	Sage/grass	21%	5.04	4	4,800	24,193	10%	5.74	4	4800	27,562	3,369	11%
04SW026_02a	Current	17	950	Yellow willow	46%	3.45	4	3,800	13,092	40%	3.83	4	3800	14,546	1,455	6%
04SW026_02a	Current	18	6270	Yellow willow	46%	3.45	4	25,080	86,406	70%	1.91	4	25080	48,003	(38,402)	0%
04SW026_02a	Current	19	660	Yellow willow	46%	3.45	4	2,640	9,095	50%	3.19	4	2640	8,422	(674)	0%
04SW026_02a	Nip And Tuck	1	230	Sage/grass	65%	2.23	1	230	514	70%	1.91	1	230	440	(73)	0%
04SW026_02a	Nip And Tuck	2	480	Sage/grass	65%	2.23	1	480	1,072	60%	2.55	1	480	1,225	153	5%
04SW026_02a	Nip And Tuck	3	1800	Juniper	89%	0.70	2	3,600	2,526	80%	1.28	2	3600	4,594	2,067	9%
04SW026_02a	Nip And Tuck	4	560	Juniper	74%	1.66	3	1,680	2,787	70%	1.91	3	1680	3,216	429	4%
04SW026_02a	Nip And Tuck	5	140	Sage/grass	27%	4.66	3	420	1,956	20%	5.10	3	420	2,144	188	7%
04SW026_02a	Nip And Tuck	6	430	Sage/grass	27%	4.66	3	1,290	6,008	30%	4.47	3	1290	5,761	(247)	0%
04SW026_02a	Nip And Tuck	7	920	Sage/grass	21%	5.04	4	3,680	18,548	30%	4.47	4	3680	16,435	(2,113)	0%
04SW026_02a	Nip And Tuck	8	900	Yellow willow	46%	3.45	4	3,600	12,403	60%	2.55	4	3600	9,187	(3,216)	0%
04SW026_02a	Nip And Tuck	9	310	Yellow willow	46%	3.45	4	1,240	4,272	40%	3.83	4	1240	4,747	475	6%
04SW026_02a	Nip And Tuck	10	3880	Coyote willow	58%	2.68	4	15,520	41,587	60%	2.55	4	15520	39,607	(1,980)	0%
04SW026_02a	Nip And Tuck	11	760	Coyote willow	50%	3.19	5	3,800	12,122	50%	3.19	5	3800	12,122	0	0%
04SW026_02a	Nip And Tuck	12	800	Coyote willow	50%	3.19	5	4,000	12,760	40%	3.83	5	4000	15,312	2,552	10%
04SW026_02a	Nip And Tuck	13	510	Coyote willow	50%	3.19	5	2,550	8,135	30%	4.47	5	2550	11,388	3,254	20%
04SW026_02a	Nip And Tuck	14	190	Coyote willow	17%	5.30	5	950	5,031	10%	5.74	5	950	5,455	424	7%
							Totals		288,453					264,087	(24,366)	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to Deep Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D9. Solar loads for ID17050104SW026_03 (Deep Creek—3rd-order rangeland tributaries).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_03	Current	1	210	Coyote willow	44%	3.57	6	1,260	4,502	40%	3.83	6	1260	4,823	322	4%
04SW026_03	Current	2	350	Sage/grass	14%	5.49	6	2,100	11,522	10%	5.74	6	2100	12,058	536	4%
04SW026_03	Current	3	770	Sage/grass	14%	5.49	6	4,620	25,349	0%	6.38	6	4620	29,476	4,127	14%
04SW026_03	Hurry Back	1	210	Coyote willow	50%	3.19	5	1,050	3,350	20%	5.10	5	1050	5,359	2,010	30%
04SW026_03	Hurry Back	2	360	Coyote willow	50%	3.19	5	1,800	5,742	50%	3.19	5	1800	5,742	0	0%
04SW026_03	Hurry Back	3	770	Coyote willow	50%	3.19	5	3,850	12,282	40%	3.83	5	3850	14,738	2,456	10%
04SW026_03	Hurry Back	4	470	Coyote willow	44%	3.57	6	2,820	10,075	30%	4.47	6	2820	12,594	2,519	14%
04SW026_03	Hurry Back	5	690	Coyote willow	44%	3.57	6	4,140	14,791	20%	5.10	6	4140	21,131	6,339	24%
04SW026_03	Hurry Back	6	180	Coyote willow	44%	3.57	6	1,080	3,859	10%	5.74	6	1080	6,201	2,343	34%
							Totals		91,471					112,122	20,651	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to Deep Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D10. Solar loads for ID17050104SW026_03a (Deep Creek—3rd-order forested tributaries).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_03a	Current	1	260	Yellow willow	46%	3.45	4	1,040	3,583	50%	3.19	4	1040	3,318	(265)	0%
04SW026_03a	Current	2	2710	Yellow willow	46%	3.45	4	10,840	37,346	60%	2.55	4	10840	27,664	(9,682)	0%
04SW026_03a	Current	3	640	Yellow willow	39%	3.89	5	3,200	12,454	50%	3.19	5	3200	10,208	(2,246)	0%
04SW026_03a	Current	4	570	Coyote willow	50%	3.19	5	2,850	9,092	40%	3.83	5	2850	10,910	1,818	10%
04SW026_03a	Current	5	1170	Coyote willow	50%	3.19	5	5,850	18,662	50%	3.19	5	5850	18,662	0	0%
04SW026_03a	Current	6	150	Coyote willow	50%	3.19	5	750	2,393	30%	4.47	5	750	3,350	957	20%
04SW026_03a	Current	7	440	Coyote willow	50%	3.19	5	2,200	7,018	40%	3.83	5	2200	8,422	1,404	10%
04SW026_03a	Current	8	440	Coyote willow	50%	3.19	5	2,200	7,018	50%	3.19	5	2200	7,018	0	0%
04SW026_03a	Current	9	240	Coyote willow	50%	3.19	5	1,200	3,828	30%	4.47	5	1200	5,359	1,531	20%
04SW026_03a	Current	10	180	Coyote willow	50%	3.19	5	900	2,871	40%	3.83	5	900	3,445	574	10%
04SW026_03a	Nip And Tuck	1	220	Sage/grass	17%	5.30	5	1,100	5,825	0%	6.38	5	1100	7,018	1,193	17%
04SW026_03a	Nip And Tuck	2	870	Sage/grass	17%	5.30	5	4,350	23,035	0%	6.38	5	4350	27,753	4,718	17%
04SW026_03a	Nip And Tuck	3	850	Coyote willow	50%	3.19	5	4,250	13,558	20%	5.10	5	4250	21,692	8,135	30%
							Totals		146,681					154,817	8,136	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to Deep Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D11. Solar loads for ID17050104SW026_04 (Deep Creek between Hurry Back and Nickel Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_04	Deep	1	350	Coyote willow	32%	4.34	9	3,150	13,666	10%	5.74	9	3150	18,087	4,421	22%
04SW026_04	Deep	2	300	Coyote willow	32%	4.34	9	2,700	11,714	20%	5.10	9	2700	13,781	2,067	12%
04SW026_04	Deep	3	760	Coyote willow	32%	4.34	9	6,840	29,675	30%	4.47	9	6840	30,547	873	2%
04SW026_04	Deep	4	290	Coyote willow	32%	4.34	9	2,610	11,323	40%	3.83	9	2610	9,991	(1,332)	0%
04SW026_04	Deep	5	480	Coyote willow	32%	4.34	9	4,320	18,742	30%	4.47	9	4320	19,293	551	2%
04SW026_04	Deep	6	730	Coyote willow	32%	4.34	9	6,570	28,503	60%	2.55	9	6570	16,767	(11,737)	0%
04SW026_04	Deep	7	480	Coyote willow	32%	4.34	9	4,320	18,742	50%	3.19	9	4320	13,781	(4,961)	0%
04SW026_04	Deep	8	560	Coyote willow	32%	4.34	9	5,040	21,866	30%	4.47	9	5040	22,509	643	2%
04SW026_04	Deep	9	500	Coyote willow	32%	4.34	9	4,500	19,523	20%	5.10	9	4500	22,968	3,445	12%
04SW026_04	Deep	10	190	Coyote willow	29%	4.53	10	1,900	8,607	10%	5.74	10	1900	10,910	2,303	19%
04SW026_04	Deep	11	370	Coyote willow	29%	4.53	10	3,700	16,760	20%	5.10	10	3700	18,885	2,125	9%
04SW026_04	Deep	12	360	Coyote willow	29%	4.53	10	3,600	16,307	10%	5.74	10	3600	20,671	4,364	19%
04SW026_04	Deep	13	2110	Coyote willow	29%	4.53	10	21,100	95,579	30%	4.47	10	21100	94,233	(1,346)	0%
04SW026_04	Deep	14	910	Coyote willow	29%	4.53	10	9,100	41,221	20%	5.10	10	9100	46,446	5,225	9%
04SW026_04	Deep	15	1080	Coyote willow	29%	4.53	10	10,800	48,922	30%	4.47	10	10800	48,233	(689)	0%
04SW026_04	Deep	16	1150	Coyote willow	29%	4.53	10	11,500	52,093	40%	3.83	10	11500	44,022	(8,071)	0%
04SW026_04	Deep	17	630	Coyote willow	27%	4.66	11	6,930	32,276	30%	4.47	11	6930	30,949	(1,326)	0%
04SW026_04	Deep	18	2220	Coyote willow	27%	4.66	11	24,420	113,734	40%	3.83	11	24420	93,480	(20,254)	0%
04SW026_04	Deep	19	640	Coyote willow	27%	4.66	11	7,040	32,788	30%	4.47	11	7040	31,441	(1,347)	0%
04SW026_04	Deep	20	2560	Coyote willow	27%	4.66	11	28,160	131,152	40%	3.83	11	28160	107,796	(23,356)	0%
04SW026_04	Deep	21	800	Coyote willow	25%	4.79	12	9,600	45,936	30%	4.47	12	9600	42,874	(3,062)	0%
04SW026_04	Deep	22	930	Coyote willow	25%	4.79	12	11,160	53,401	20%	5.10	12	11160	56,961	3,560	5%
04SW026_04	Deep	23	220	Coyote willow	25%	4.79	12	2,640	12,632	10%	5.74	12	2640	15,159	2,526	15%
04SW026_04	Deep	24	200	Coyote willow	25%	4.79	12	2,400	11,484	20%	5.10	12	2400	12,250	766	5%
04SW026_04	Deep	25	260	Coyote willow	25%	4.79	12	3,120	14,929	30%	4.47	12	3120	13,934	(995)	0%
04SW026_04	Deep	26	100	Coyote willow	25%	4.79	12	1,200	5,742	10%	5.74	12	1200	6,890	1,148	15%
04SW026_04	Deep	27	1830	Coyote willow	25%	4.79	12	21,960	105,079	30%	4.47	12	21960	98,073	(7,005)	0%
04SW026_04	Hurry Back	1	300	Coyote willow	39%	3.89	7	2,100	8,173	10%	5.74	7	2100	12,058	3,885	29%
04SW026_04	Hurry Back	2	1000	Coyote willow	39%	3.89	7	7,000	27,243	50%	3.19	7	7000	22,330	(4,913)	0%
04SW026_04	Hurry Back	3	1120	Coyote willow	35%	4.15	8	8,960	37,157	40%	3.83	8	8960	34,299	(2,858)	0%
04SW026_04	Hurry Back	4	160	Coyote willow	35%	4.15	8	1,280	5,308	20%	5.10	8	1280	6,533	1,225	15%
04SW026_04	Hurry Back	5	820	Coyote willow	35%	4.15	8	6,560	27,204	10%	5.74	8	6560	37,668	10,463	25%
							Totals		1,117,479					1,073,818	(43,662)	

Table D12. Solar loads for ID17050104SW026_05 (Deep Creek between Nickel Creek and Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW026_05	Deep	1	330	Coyote willow	23%	4.91	13	4,290	21,075	30%	4.47	13	4290	19,159	(1,916)	0%
04SW026_05	Deep	2	1770	Coyote willow	23%	4.91	13	23,010	113,039	10%	5.74	13	23010	132,123	19,084	13%
04SW026_05	Deep	3	1580	Coyote willow	23%	4.91	13	20,540	100,905	20%	5.10	13	20540	104,836	3,931	3%
04SW026_05	Deep	4	360	Coyote willow	23%	4.91	13	4,680	22,991	10%	5.74	13	4680	26,873	3,882	13%
04SW026_05	Deep	5	310	Coyote willow	23%	4.91	13	4,030	19,798	20%	5.10	13	4030	20,569	771	3%
04SW026_05	Deep	6	3320	Coyote willow	21%	5.04	14	46,480	234,268	10%	5.74	14	46480	266,888	32,620	11%
04SW026_05	Deep	7	620	Coyote willow	21%	5.04	14	8,680	43,749	0%	6.38	14	8680	55,378	11,629	21%
04SW026_05	Deep	8	910	Coyote willow	21%	5.04	14	12,740	64,212	10%	5.74	14	12740	73,153	8,941	11%
04SW026_05	Deep	9	520	Coyote willow	20%	5.10	15	7,800	39,811	0%	6.38	15	7800	49,764	9,953	20%
04SW026_05	Deep	10	470	Coyote willow	19%	5.17	16	7,520	38,862	10%	5.74	16	7520	43,180	4,318	9%
04SW026_05	Deep	11	430	Coyote willow	18%	5.23	17	7,310	38,243	0%	6.38	17	7310	46,638	8,395	18%
04SW026_05	Deep	12	600	Coyote willow	17%	5.30	18	10,800	57,190	10%	5.74	18	10800	62,014	4,823	7%
04SW026_05	Deep	13	450	Coyote willow	16%	5.36	19	8,550	45,821	0%	6.38	19	8550	54,549	8,728	16%
04SW026_05	Deep	14	370	Coyote willow	16%	5.36	19	7,030	37,675	10%	5.74	19	7030	40,366	2,691	6%
04SW026_05	Deep	15	60	Coyote willow	16%	5.36	19	1,140	6,109	0%	6.38	19	1140	7,273	1,164	16%
04SW026_05	Deep	16	2970	Coyote willow	15%	5.42	20	59,400	322,126	10%	5.74	20	59400	341,075	18,949	5%
04SW026_05	Deep	17	6210	Coyote willow	15%	5.42	20	124,200	673,537	10%	5.74	20	124200	713,156	39,620	5%
04SW026_05	Deep	18	8500	Coyote willow	14%	5.49	22	187,000	1,026,032	10%	5.74	22	187000	1,073,754	47,722	4%
04SW026_05	Deep	19	680	Coyote willow	14%	5.49	22	14,960	82,083	20%	5.10	22	14960	76,356	(5,727)	0%
04SW026_05	Deep	20	9620	Coyote willow	13%	5.55	23	221,260	1,228,126	10%	5.74	23	221260	1,270,475	42,349	3%
							Totals		4,215,652					4,477,580	261,928	

Table D13. Solar loads for ID17050104SW028_02 (Pole Creek upstream of Mud Flat).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW028_02	Pole	1	810	Sage/grass	65%	2.23	1	810	1,809	60%	2.55	1	810	2,067	258	5%
04SW028_02	Pole	2	670	Yellow willow	89%	0.70	1	670	470	70%	1.91	1	670	1,282	812	19%
04SW028_02	Pole	3	260	Yellow willow	73%	1.72	2	520	896	40%	3.83	2	520	1,991	1,095	33%
04SW028_02	Pole	4	230	Yellow willow	73%	1.72	2	460	792	30%	4.47	2	460	2,054	1,262	43%
04SW028_02	Pole	5	110	Yellow willow	73%	1.72	2	220	379	70%	1.91	2	220	421	42	3%
04SW028_02	Pole	6	200	Yellow willow	73%	1.72	2	400	689	30%	4.47	2	400	1,786	1,097	43%
04SW028_02	Pole	7	170	Yellow willow	73%	1.72	2	340	586	70%	1.91	2	340	651	65	3%
04SW028_02	Pole	8	180	Yellow willow	73%	1.72	2	360	620	40%	3.83	2	360	1,378	758	33%
04SW028_02	Pole	9	200	Yellow willow	73%	1.72	2	400	689	20%	5.10	2	400	2,042	1,353	53%
04SW028_02	Pole	10	460	Yellow willow	73%	1.72	2	920	1,585	40%	3.83	2	920	3,522	1,937	33%
04SW028_02	Pole	11	220	Yellow willow	56%	2.81	3	660	1,853	20%	5.10	3	660	3,369	1,516	36%
04SW028_02	Pole	12	400	Yellow willow	56%	2.81	3	1,200	3,369	10%	5.74	3	1200	6,890	3,522	46%
04SW028_02	Pole	13	230	Yellow willow	56%	2.81	3	690	1,937	30%	4.47	3	690	3,082	1,145	26%
04SW028_02	Pole	14	290	Yellow willow	56%	2.81	3	870	2,442	30%	4.47	3	870	3,885	1,443	26%
04SW028_02	Pole	15	260	Yellow willow	56%	2.81	3	780	2,190	40%	3.83	3	780	2,986	796	16%
04SW028_02	Pole	16	270	Yellow willow	56%	2.81	3	810	2,274	60%	2.55	3	810	2,067	(207)	0%
							Totals		22,579					39,473	16,894	

Table D14. Solar loads for ID17050104SW028_03 (Pole Creek between Camas Creek and Mud Flat).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW028_03	Pole	1	50	Yellow willow	46%	3.45	4	200	689	60%	2.55	4	200	510	(179)	0%
04SW028_03	Pole	2	500	Sage/grass	21%	5.04	4	2,000	10,080	20%	5.10	4	2000	10,208	128	1%
04SW028_03	Pole	3	80	Yellow willow	46%	3.45	4	320	1,102	50%	3.19	4	320	1,021	(82)	0%
04SW028_03	Pole	4	500	Sage/grass	21%	5.04	4	2,000	10,080	20%	5.10	4	2000	10,208	128	1%
04SW028_03	Pole	5	810	Coyote willow	50%	3.19	5	4,050	12,920	50%	3.19	5	4050	12,920	0	0%
04SW028_03	Pole	6	320	Coyote willow	50%	3.19	5	1,600	5,104	30%	4.47	5	1600	7,146	2,042	20%
04SW028_03	Pole	7	540	Coyote willow	50%	3.19	5	2,700	8,613	50%	3.19	5	2700	8,613	0	0%
04SW028_03	Pole	8	1200	Coyote willow	44%	3.57	6	7,200	25,724	40%	3.83	6	7200	27,562	1,837	4%
04SW028_03	Pole	9	800	Coyote willow	44%	3.57	6	4,800	17,149	30%	4.47	6	4800	21,437	4,287	14%
04SW028_03	Pole	10	680	Coyote willow	44%	3.57	6	4,080	14,577	20%	5.10	6	4080	20,824	6,247	24%
04SW028_03	Pole	11	320	Coyote willow	44%	3.57	6	1,920	6,860	10%	5.74	7	2240	12,862	6,002	34%
04SW028_03	Pole	12	2670	Juniper	42%	3.70	7	18,690	69,160	50%	3.19	7	18690	59,621	(9,539)	0%
04SW028_03	Pole	13	350	Coyote willow	39%	3.89	7	2,450	9,535	30%	4.47	7	2450	10,942	1,407	9%
04SW028_03	Pole	14	1230	Coyote willow	35%	4.15	8	9,840	40,806	40%	3.83	8	9840	37,668	(3,139)	0%
04SW028_03	Pole	15	280	Coyote willow	35%	4.15	8	2,240	9,289	50%	3.19	8	2240	7,146	(2,144)	0%
							Totals		241,690					248,686	6,996	

Table D15. Solar loads for ID17050104SW028_04 (Pole Creek between Camas and Deep Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW028_04	Pole	1	780	Coyote willow	29%	4.53	10	7,800	35,332	30%	4.47	10	7800	34,835	(498)	0%
04SW028_04	Pole	2	2700	Coyote willow	29%	4.53	10	27,000	122,305	20%	5.10	10	27000	137,808	15,503	9%
04SW028_04	Pole	3	470	Coyote willow	29%	4.53	10	4,700	21,290	40%	3.83	10	4700	17,992	(3,298)	0%
04SW028_04	Pole	4	210	Coyote willow	29%	4.53	10	2,100	9,513	10%	5.74	10	2100	12,058	2,546	19%
04SW028_04	Pole	5	2100	Coyote willow	29%	4.53	10	21,000	95,126	30%	4.47	10	21000	93,786	(1,340)	0%
04SW028_04	Pole	6	230	Coyote willow	29%	4.53	10	2,300	10,419	10%	5.74	10	2300	13,207	2,788	19%
04SW028_04	Pole	7	550	Coyote willow	27%	4.66	11	6,050	28,177	30%	4.47	11	6050	27,019	(1,158)	0%
04SW028_04	Pole	8	5450	Coyote willow	27%	4.66	11	59,950	279,211	20%	5.10	11	59950	305,985	26,774	7%
04SW028_04	Pole	9	1370	Coyote willow	25%	4.79	12	16,440	78,665	10%	5.74	12	16440	94,398	15,733	15%
04SW028_04	Pole	10	300	Coyote willow	25%	4.79	12	3,600	17,226	20%	5.10	12	3600	18,374	1,148	5%
04SW028_04	Pole	11	780	Sage/grass	7%	5.93	12	9,360	55,537	10%	5.74	12	9360	53,745	(1,792)	0%
04SW028_04	Pole	12	320	Sage/grass	7%	5.93	12	3,840	22,784	20%	5.10	12	3840	19,599	(3,185)	0%
04SW028_04	Pole	13	240	Sage/grass	7%	5.93	12	2,880	17,088	10%	5.74	12	2880	16,537	(551)	0%
04SW028_04	Pole	14	430	Sage/grass	7%	5.93	12	5,160	30,616	0%	6.38	12	5160	32,921	2,304	7%
04SW028_04	Pole	15	610	Sage/grass	7%	5.93	12	7,320	43,432	10%	5.74	12	7320	42,031	(1,401)	0%
04SW028_04	Pole	16	220	Sage/grass	7%	5.93	12	2,640	15,664	20%	5.10	12	2640	13,475	(2,190)	0%
04SW028_04	Pole	17	2180	Coyote willow	25%	4.79	12	26,160	125,176	40%	3.83	12	26160	100,140	(25,035)	0%
04SW028_04	Pole	18	630	Coyote willow	25%	4.79	12	7,560	36,175	20%	5.10	12	7560	38,586	2,412	5%
							Totals		1,043,736					1,072,497	28,761	

Table D16. Solar loads for ID17050104SW029_02 (Camas Creek upstream of Big Springs Butte).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW029_02	Camas	1	210	Meadow	55%	2.87	1	210	603	40%	3.83	1	210	804	201	15%
04SW029_02	Camas	2	500	Yellow willow	73%	1.72	2	1,000	1,723	30%	4.47	2	1000	4,466	2,743	43%
04SW029_02	Camas	3	570	Yellow willow	73%	1.72	2	1,140	1,964	50%	3.19	2	1140	3,637	1,673	23%
04SW029_02	Camas	4	330	Yellow willow	73%	1.72	2	660	1,137	20%	5.10	2	660	3,369	2,232	53%
04SW029_02	Camas	5	300	Yellow willow	56%	2.81	3	900	2,526	50%	3.19	3	900	2,871	345	6%
04SW029_02	Camas	6	650	Yellow willow	56%	2.81	3	1,950	5,474	30%	4.47	3	1950	8,709	3,235	26%
04SW029_02	Camas	7	160	Yellow willow	46%	3.45	4	640	2,205	40%	3.83	4	640	2,450	245	6%
04SW029_02	Camas	8	1030	Meadow	16%	5.36	4	4,120	22,080	10%	5.74	4	4120	23,657	1,577	6%
04SW029_02	Camas	9	5940	Meadow	13%	5.55	5	29,700	164,853	0%	6.38	5	29700	189,486	24,633	13%
							Totals		202,564					239,448	36,883	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to the lower section of Camas Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D17. Solar loads for ID17050104SW029_03 (Camas Creek between Big Springs Butte and Pole Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW029_03	Camas	1	1280	Sage/grass	17%	5.30	5	6,400	33,891	0%	6.38	5	6400	40,832	6,941	17%
04SW029_03	Camas	2	3370	Sage/grass	14%	5.49	6	20,220	110,943	10%	5.74	6	20220	116,103	5,160	4%
04SW029_03	Camas	3	1200	Coyote willow	44%	3.57	6	7,200	25,724	50%	3.19	6	7200	22,968	(2,756)	0%
04SW029_03	Camas	4	500	Coyote willow	44%	3.57	6	3,000	10,718	40%	3.83	6	3000	11,484	766	4%
04SW029_03	Camas	5	880	Coyote willow	44%	3.57	6	5,280	18,864	50%	3.19	6	5280	16,843	(2,021)	0%
04SW029_03	Camas	6	1890	Coyote willow	44%	3.57	6	11,340	40,516	40%	3.83	6	11340	43,410	2,894	4%
							Totals		240,656					251,640	10,984	

Table D18. Solar loads for ID17050104SW030_02 (Camel Creek upstream of Sunshine Valley Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW030_02	Camel	1	1700	Sage/grass	65%	2.23	1	1,700	3,796	60%	2.55	1	1700	4,338	542	5%
04SW030_02	Camel	2	400	Meadow	55%	2.87	1	400	1,148	50%	3.19	1	400	1,276	128	5%
04SW030_02	Camel	3	400	Meadow	50%	3.19	2	800	2,552	40%	3.83	2	800	3,062	510	10%
04SW030_02	Camel	4	190	Meadow	39%	3.89	2	380	1,479	40%	3.83	2	380	1,455	(24)	0%
04SW030_02	Camel	5	3380	Meadow	39%	3.89	2	6,760	26,309	20%	5.10	2	6760	34,503	8,194	19%
04SW030_02	Camel	6	370	Coyote willow	70%	1.91	3	1,110	2,125	50%	3.19	3	1110	3,541	1,416	20%
							Totals		37,408					48,175	10,767	

Table D19. Solar loads for ID17050104SW030_03 (Camel Creek downstream of Sunshine Valley Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW030_03	Camel	1	80	Coyote willow	58%	2.68	4	320	857	50%	3.19	4	320	1,021	163	8%
04SW030_03	Camel	2	70	Coyote willow	58%	2.68	4	280	750	60%	2.55	4	280	715	(36)	0%
04SW030_03	Camel	3	660	Coyote willow	58%	2.68	4	2,640	7,074	70%	1.91	4	2640	5,053	(2,021)	0%
04SW030_03	Camel	4	490	Sage/grass	21%	5.04	4	1,960	9,879	10%	5.74	4	1960	11,254	1,376	11%
							Totals		18,561					18,043	(518)	

Note that this assessment unit is not on Idaho's §303(d) list of impaired streams and is included here only because of its contributions to Pole Creek, which is §303(d) listed. Further monitoring using DEQ's Beneficial Use Reconnaissance Program would be required to ascertain whether there is impairment.

Table D20. Solar loads for ID17050104SW031_02 (Nickel, Smith, and Thomas Creek headwaters).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW031_02	Nickel	1	40	Water	0%	6.38	1	40	255	0%	6.38	20	800	5,104	4,849	0%
04SW031_02	Nickel	2	760	Meadow	55%	2.87	1	760	2,182	40%	3.83	1	760	2,909	727	15%
04SW031_02	Nickel	3	1610	Meadow	50%	3.19	1	1,610	5,136	30%	4.47	1	1610	7,190	2,054	20%
04SW031_02	Nickel	4	1320	Sage/grass	39%	3.89	2	2,640	10,274	30%	4.47	2	2640	11,790	1,516	9%
04SW031_02	Nickel	5	210	Sage/grass	31%	4.40	2	420	1,849	30%	4.47	2	420	1,876	27	1%
04SW031_02	Nickel	6	260	Sage/grass	31%	4.40	2	520	2,289	10%	5.74	2	520	2,986	697	21%
04SW031_02	Nickel	7	300	Sage/grass	31%	4.40	2	600	2,641	0%	6.38	2	600	3,828	1,187	31%
04SW031_02	Nickel	8	470	Sage/grass	31%	4.40	2	940	4,138	10%	5.74	2	940	5,397	1,259	21%
04SW031_02	Nickel	9	690	Yellow willow	73%	1.72	2	1,380	2,377	30%	4.47	2	1380	6,163	3,786	43%
04SW031_02	Nickel	10	690	Yellow willow	73%	1.72	2	1,380	2,377	20%	5.10	2	1380	7,044	4,666	53%
04SW031_02	Smith	1	670	Yellow willow	89%	0.70	1	670	470	90%	0.64	1	670	427	(43)	0%
04SW031_02	Smith	2	1540	Yellow willow	89%	0.70	1	1,540	1,081	80%	1.28	1	1540	1,965	884	9%
04SW031_02	Smith	3	110	Sage/grass	39%	3.89	2	220	856	20%	5.10	2	220	1,123	267	19%
04SW031_02	Smith	4	660	Yellow willow	73%	1.72	2	1,320	2,274	70%	1.91	2	1320	2,526	253	3%
04SW031_02	Smith	5	300	Yellow willow	73%	1.72	2	600	1,034	80%	1.28	2	600	766	(268)	0%
04SW031_02	Smith	6	440	Yellow willow	73%	1.72	2	880	1,516	70%	1.91	2	880	1,684	168	3%
04SW031_02	Smith	7	230	Yellow willow	73%	1.72	2	460	792	80%	1.28	2	460	587	(205)	0%
04SW031_02	Smith	8	640	Coyote willow	70%	1.91	3	1,920	3,675	70%	1.91	3	1920	3,675	0	0%
04SW031_02	Smith	9	720	Coyote willow	70%	1.91	3	2,160	4,134	50%	3.19	3	2160	6,890	2,756	20%
04SW031_02	Thomas	1	440	Yellow willow	89%	0.70	1	440	309	90%	0.64	1	440	281	(28)	0%
04SW031_02	Thomas	2	410	Yellow willow	89%	0.70	1	410	288	80%	1.28	1	410	523	235	9%
04SW031_02	Thomas	3	420	Sage/grass	65%	2.23	1	420	938	60%	2.55	1	420	1,072	134	5%
04SW031_02	Thomas	4	280	Juniper	97%	0.19	1	280	54	90%	0.64	1	280	179	125	7%
							Totals		50,939					75,986	25,047	

Table D21. Solar loads for ID17050104SW031_03 (Nickel, Smith, and Thomas Creeks—3rd order).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW031_03	Nickel	1	390	Yellow willow	56%	2.81	3	1,170	3,284	20%	5.10	3	1170	5,972	2,687	36%
04SW031_03	Nickel	2	190	Coyote willow	70%	1.91	3	570	1,091	50%	3.19	3	570	1,818	727	20%
04SW031_03	Nickel	3	1230	Coyote willow	70%	1.91	3	3,690	7,063	70%	1.91	3	3690	7,063	0	0%
04SW031_03	Nickel	4	1810	Coyote willow	58%	2.68	4	7,240	19,400	80%	1.28	4	7240	9,238	(10,162)	0%
04SW031_03	Nickel	5	290	Coyote willow	58%	2.68	4	1,160	3,108	70%	1.91	4	1160	2,220	(888)	0%
04SW031_03	Nickel	6	200	Coyote willow	58%	2.68	4	800	2,144	80%	1.28	4	800	1,021	(1,123)	0%
04SW031_03	Nickel	7	990	Coyote willow	50%	3.19	5	4,950	15,791	70%	1.91	5	4950	9,474	(6,316)	0%
04SW031_03	Nickel	8	780	Coyote willow	50%	3.19	5	3,900	12,441	50%	3.19	5	3900	12,441	0	0%
04SW031_03	Nickel	9	1290	Coyote willow	50%	3.19	5	6,450	20,576	60%	2.55	5	6450	16,460	(4,115)	0%
04SW031_03	Smith	1	250	Coyote willow	70%	1.91	3	750	1,436	50%	3.19	3	750	2,393	957	20%
04SW031_03	Smith	2	1390	Coyote willow	70%	1.91	3	4,170	7,981	70%	1.91	3	4170	7,981	0	0%
04SW031_03	Smith	3	870	Coyote willow	58%	2.68	4	3,480	9,325	30%	4.47	4	3480	15,542	6,217	28%
04SW031_03	Thomas	1	120	Juniper	97%	0.19	1	120	23	90%	0.64	1	120	77	54	7%
04SW031_03	Thomas	2	730	Juniper	89%	0.70	2	1,460	1,025	70%	1.91	2	1460	2,794	1,770	19%
04SW031_03	Thomas	3	430	Sage/grass	39%	3.89	2	860	3,347	40%	3.83	2	860	3,292	(55)	0%
04SW031_03	Thomas	4	690	Yellow willow	73%	1.72	2	1,380	2,377	70%	1.91	2	1380	2,641	264	3%
04SW031_03	Thomas	5	830	Yellow willow	73%	1.72	2	1,660	2,860	70%	1.91	2	1660	3,177	318	3%
04SW031_03	Thomas	6	890	Coyote willow	70%	1.91	3	2,670	5,110	60%	2.55	3	2670	6,814	1,703	10%
04SW031_03	Thomas	7	200	Coyote willow	70%	1.91	3	600	1,148	20%	5.10	3	600	3,062	1,914	50%
04SW031_03	Thomas	8	580	Coyote willow	70%	1.91	3	1,740	3,330	60%	2.55	3	1740	4,440	1,110	10%
04SW031_03	Thomas	9	360	Sage/grass	27%	4.66	3	1,080	5,030	30%	4.47	3	1080	4,823	(207)	0%
04SW031_03	Thomas	10	1170	Coyote willow	58%	2.68	4	4,680	12,541	50%	3.19	4	4680	14,929	2,389	8%
							Totals		140,430					137,674	(2,756)	

Table D22. Solar loads for ID17050104SW031_04 (Nickel and Smith Creeks—4th order).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW031_04	Nickel	1	1120	Coyote willow	44%	3.57	6	6,720	24,009	50%	3.19	6	6720	21,437	(2,572)	0%
04SW031_04	Nickel	2	160	Coyote willow	44%	3.57	6	960	3,430	40%	3.83	6	960	3,675	245	4%
04SW031_04	Nickel	3	240	Coyote willow	44%	3.57	6	1,440	5,145	20%	5.10	6	1440	7,350	2,205	24%
04SW031_04	Nickel	4	610	Coyote willow	44%	3.57	6	3,660	13,076	40%	3.83	6	3660	14,010	934	4%
04SW031_04	Nickel	5	1600	Coyote willow	39%	3.89	7	11,200	43,588	40%	3.83	7	11200	42,874	(715)	0%
04SW031_04	Nickel	6	370	Coyote willow	39%	3.89	7	2,590	10,080	30%	4.47	7	2590	11,567	1,487	9%
04SW031_04	Nickel	7	510	Coyote willow	39%	3.89	7	3,570	13,894	50%	3.19	7	3570	11,388	(2,505)	0%
04SW031_04	Nickel	8	500	Coyote willow	35%	4.15	8	4,000	16,588	40%	3.83	8	4000	15,312	(1,276)	0%
04SW031_04	Nickel	9	1130	Coyote willow	35%	4.15	8	9,040	37,489	30%	4.47	8	9040	40,373	2,884	5%
04SW031_04	Nickel	10	1110	Coyote willow	35%	4.15	8	8,880	36,825	10%	5.74	8	8880	50,989	14,164	25%
04SW031_04	Nickel	11	2000	Coyote willow	32%	4.34	9	18,000	78,091	20%	5.10	9	18000	91,872	13,781	12%
04SW031_04	Smith	1	500	Coyote willow	50%	3.19	5	2,500	7,975	40%	3.83	5	2500	9,570	1,595	10%
04SW031_04	Smith	2	330	Coyote willow	50%	3.19	5	1,650	5,264	30%	4.47	5	1650	7,369	2,105	20%
04SW031_04	Smith	4	280	Coyote willow	50%	3.19	5	1,400	4,466	30%	4.47	5	1400	6,252	1,786	20%
04SW031_04	Smith	5	380	Coyote willow	44%	3.57	6	2,280	8,146	40%	3.83	6	2280	8,728	582	4%
04SW031_04	Smith	6	480	Coyote willow	44%	3.57	6	2,880	10,290	50%	3.19	6	2880	9,187	(1,102)	0%
04SW031_04	Smith	7	200	Coyote willow	44%	3.57	6	1,200	4,287	40%	3.83	6	1200	4,594	306	4%
04SW031_04	Smith	8	930	Coyote willow	44%	3.57	6	5,580	19,936	50%	3.19	6	5580	17,800	(2,136)	0%
04SW031_04	Smith	3	760	Sage/grass	17%	5.30	5	3,800	20,123	0%	6.38	5	3800	24,244	4,121	17%
							Totals		362,702					398,591	35,889	

Table D23. Solar loads for ID17050104SW032_02 (Castle Creek upstream of Skunk Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW032_02	Castle	1	1100	Meadow	55%	2.87	1	1,100	3,158	20%	5.10	1	1100	5,614	2,456	35%
04SW032_02	Castle	2	970	Juniper	97%	0.19	1	970	186	40%	3.83	1	970	3,713	3,528	57%
04SW032_02	Castle	3	520	Sage/grass	39%	3.89	2	1,040	4,047	40%	3.83	2	1040	3,981	(66)	0%
04SW032_02	Castle	4	1010	Sage/grass	39%	3.89	2	2,020	7,861	40%	3.83	2	2020	7,733	(129)	0%
04SW032_02	Castle	5	320	Sage/grass	39%	3.89	2	640	2,491	40%	3.83	2	640	2,450	(41)	0%
04SW032_02	Castle	6	620	Juniper	89%	0.70	2	1,240	870	80%	1.28	2	1240	1,582	712	9%
04SW032_02	Castle	7	340	Juniper	89%	0.70	2	680	477	60%	2.55	2	680	1,735	1,258	29%
04SW032_02	Castle	8	580	Sage/grass	39%	3.89	2	1,160	4,514	40%	3.83	2	1160	4,440	(74)	0%
04SW032_02	Castle	9	110	Coyote willow	70%	1.91	3	330	632	80%	1.28	3	330	421	(211)	0%
04SW032_02	Castle	10	570	Coyote willow	70%	1.91	3	1,710	3,273	70%	1.91	3	1710	3,273	0	0%
04SW032_02	Castle	11	670	Coyote willow	70%	1.91	3	2,010	3,847	30%	4.47	3	2010	8,977	5,130	40%
04SW032_02	Castle	12	60	Coyote willow	70%	1.91	3	180	345	60%	2.55	3	180	459	115	10%
							Totals		31,702					44,379	12,678	

Table D24. Solar loads for ID17050104SW032_03 (Castle Creek between Skunk and Deep Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW032_03	Castle	1	90	Coyote willow	70%	1.91	3	270	517	60%	2.55	3	270	689	172	10%
04SW032_03	Castle	2	1050	Coyote willow	58%	2.68	4	4,200	11,254	30%	4.47	4	4200	18,757	7,503	28%
04SW032_03	Castle	3	350	Coyote willow	58%	2.68	4	1,400	3,751	40%	3.83	4	1400	5,359	1,608	18%
04SW032_03	Castle	4	630	Coyote willow	58%	2.68	4	2,520	6,753	50%	3.19	4	2520	8,039	1,286	8%
04SW032_03	Castle	5	690	Coyote willow	58%	2.68	4	2,760	7,396	40%	3.83	4	2760	10,565	3,170	18%
04SW032_03	Castle	6	790	Coyote willow	50%	3.19	5	3,950	12,601	30%	4.47	5	3950	17,641	5,040	20%
04SW032_03	Castle	7	330	Coyote willow	50%	3.19	5	1,650	5,264	50%	3.19	5	1650	5,264	0	0%
04SW032_03	Castle	8	1060	Coyote willow	50%	3.19	5	5,300	16,907	40%	3.83	5	5300	20,288	3,381	10%
04SW032_03	Castle	9	300	Coyote willow	50%	3.19	5	1,500	4,785	30%	4.47	5	1500	6,699	1,914	20%
04SW032_03	Castle	10	700	Coyote willow	50%	3.19	5	3,500	11,165	10%	5.74	5	3500	20,097	8,932	40%
04SW032_03	Castle	11	140	Coyote willow	44%	3.57	6	840	3,001	30%	4.47	6	840	3,751	750	14%
04SW032_03	Castle	12	780	Coyote willow	44%	3.57	6	4,680	16,721	20%	5.10	10	7800	39,811	23,090	24%
04SW032_03	Castle	13	2780	Coyote willow	44%	3.57	6	16,680	59,594	10%	5.74	6	16680	95,777	36,182	34%
							Totals		159,708					252,737	93,029	

Table D25. Solar loads for ID17050104SW033_02 (Beaver Creek upstream of Carter Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW033_02	Beaver	1	70	Yellow willow	89%	0.70	1	70	49	90%	0.64	1	70	45	(4)	0%
04SW033_02	Beaver	2	300	Yellow willow	89%	0.70	1	300	211	80%	1.28	1	300	383	172	9%
04SW033_02	Beaver	3	190	Yellow willow	89%	0.70	1	190	133	90%	0.64	1	190	121	(12)	0%
04SW033_02	Beaver	4	120	Yellow willow	89%	0.70	1	120	84	80%	1.28	1	120	153	69	9%
04SW033_02	Beaver	5	810	Yellow willow	73%	1.72	2	1,620	2,791	90%	0.64	2	1620	1,034	(1,757)	0%
04SW033_02	Beaver	6	580	Yellow willow	73%	1.72	2	1,160	1,998	40%	3.83	2	1160	4,440	2,442	33%
04SW033_02	Beaver	7	530	Yellow willow	73%	1.72	2	1,060	1,826	70%	1.91	2	1060	2,029	203	3%
04SW033_02	Beaver	8	2600	Yellow willow	73%	1.72	2	5,200	8,958	80%	1.28	2	5200	6,635	(2,322)	0%
04SW033_02	Beaver	9	1500	Yellow willow	56%	2.81	3	4,500	12,632	80%	1.28	3	4500	5,742	(6,890)	0%
04SW033_02	Beaver	10	1700	Sage/grass	27%	4.66	3	5,100	23,753	20%	5.10	3	5100	26,030	2,278	7%
							Totals		52,435					46,612	(5,822)	

Table D26. Solar loads for ID17050104SW033_03 (Beaver Creek between Carter and Trap Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW033_03	Beaver	1	210	Coyote willow	58%	2.68	4	840	2,251	40%	3.83	4	840	3,216	965	18%
04SW033_03	Beaver	2	1410	Coyote willow	58%	2.68	4	5,640	15,113	10%	5.74	4	5640	32,385	17,272	48%
04SW033_03	Beaver	3	220	Coyote willow	50%	3.19	5	1,100	3,509	20%	5.10	5	1100	5,614	2,105	30%
							Totals		20,873					41,215	20,342	

Table D27. Solar loads for ID17050104SW033_04 (Beaver Creek between Trap and Deep Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW033_04	Beaver	1	520	Coyote willow	50%	3.19	5	2,600	8,294	20%	5.10	5	2600	13,270	4,976	30%
04SW033_04	Beaver	2	480	Coyote willow	50%	3.19	5	2,400	7,656	0%	6.38	5	2400	15,312	7,656	50%
04SW033_04	Beaver	3	640	Coyote willow	44%	3.57	6	3,840	13,720	30%	4.47	6	3840	17,149	3,430	14%
04SW033_04	Beaver	4	550	Coyote willow	44%	3.57	6	3,300	11,790	40%	3.83	6	3300	12,632	842	4%
04SW033_04	Beaver	5	490	Coyote willow	44%	3.57	6	2,940	10,504	0%	6.38	6	2940	18,757	8,253	44%
04SW033_04	Beaver	6	990	Coyote willow	39%	3.89	7	6,930	26,970	20%	5.10	7	6930	35,371	8,401	19%
04SW033_04	Beaver	7	490	Coyote willow	39%	3.89	7	3,430	13,349	30%	4.47	7	3430	15,318	1,970	9%
							Totals		92,283					127,811	35,528	

Table D28. Solar loads for ID17050104SW034_02 (West Fork Red Canyon).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW034_02	EF Red Canyon	1	390	Juniper	97%	0.19	1	390	75	90%	0.64	1	390	249	174	7%
04SW034_02	EF Red Canyon	2	460	Sage/grass	65%	2.23	1	460	1,027	60%	2.55	1	460	1,174	147	5%
04SW034_02	EF Red Canyon	3	420	Juniper	97%	0.19	1	420	80	90%	0.64	1	420	268	188	7%
04SW034_02	EF Red Canyon	4	490	Sage/grass	65%	2.23	1	490	1,094	60%	2.55	1	490	1,250	156	5%
04SW034_02	EF Red Canyon	5	360	Juniper	97%	0.19	1	360	69	90%	0.64	1	360	230	161	7%
04SW034_02	WF Red Canyon	1	400	Meadow	9%	5.81	7	2,800	16,256	10%	5.74	7	2800	16,078	(179)	0%
04SW034_02	WF Red Canyon	2	600	Meadow	31%	4.40	2	1,200	5,283	30%	4.47	2	1200	5,359	77	1%
04SW034_02	WF Red Canyon	3	430	Yellow willow	73%	1.72	2	860	1,481	40%	3.83	2	860	3,292	1,811	33%
04SW034_02	WF Red Canyon	4	160	Yellow willow	73%	1.72	2	320	551	60%	2.55	2	320	817	265	13%
04SW034_02	WF Red Canyon	5	390	Yellow willow	73%	1.72	2	780	1,344	40%	3.83	2	780	2,986	1,642	33%
04SW034_02	WF Red Canyon	6	570	Yellow willow	73%	1.72	2	1,140	1,964	60%	2.55	2	1140	2,909	946	13%
04SW034_02	WF Red Canyon	7	980	Yellow willow	73%	1.72	2	1,960	3,376	50%	3.19	2	1960	6,252	2,876	23%
04SW034_02	WF Red Canyon	8	890	Yellow willow	73%	1.72	2	1,780	3,066	70%	1.91	2	1780	3,407	341	3%
04SW034_02	WF Red Canyon	9	700	Yellow willow	56%	2.81	3	2,100	5,895	40%	3.83	3	2100	8,039	2,144	16%
04SW034_02	WF Red Canyon	10	790	Yellow willow	56%	2.81	3	2,370	6,653	50%	3.19	3	2370	7,560	907	6%
04SW034_02	WF Red Canyon	11	1200	Coyote willow	70%	1.91	3	3,600	6,890	60%	2.55	3	3600	9,187	2,297	10%
04SW034_02	WF Red Canyon	12	1000	Coyote willow	70%	1.91	3	3,000	5,742	40%	3.83	3	3000	11,484	5,742	30%
04SW034_02	WF Red Canyon	13	420	Coyote willow	70%	1.91	3	1,260	2,412	60%	2.55	3	1260	3,216	804	10%
04SW034_02	WF Red Canyon	14	240	Sage/grass	21%	5.04	4	960	4,839	10%	5.74	4	960	5,512	674	11%
04SW034_02	WF Red Canyon	15	510	Sage/grass	21%	5.04	4	2,040	10,282	30%	4.47	4	2040	9,111	(1,171)	0%
04SW034_02	WF Red Canyon	16	830	Sage/grass	21%	5.04	4	3,320	16,733	20%	5.10	4	3320	16,945	212	1%
04SW034_02	WF Red Canyon	17	1220	Sage/grass	21%	5.04	4	4,880	24,596	30%	4.47	4	4880	21,794	(2,802)	0%
04SW034_02	WF Red Canyon	18	840	Coyote willow	58%	2.68	4	3,360	9,003	40%	3.83	4	3360	12,862	3,859	18%
04SW034_02	WF Red Canyon	19	990	Coyote willow	58%	2.68	4	3,960	10,611	50%	3.19	4	3960	12,632	2,021	8%
							Totals		139,324					162,613	23,290	

Table D29. Solar loads for ID17050104SW034_03 (East Fork Red Canyon and Red Canyon upstream of Petes Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW034_03	EF Red Canyon	1	500	Juniper	89%	0.70	2	1,000	702	80%	1.28	2	1000	1,276	574	9%
04SW034_03	EF Red Canyon	2	1880	Sage/grass	39%	3.89	2	3,760	14,633	40%	3.83	2	3760	14,393	(240)	0%
04SW034_03	EF Red Canyon	3	340	Sage/grass	27%	4.66	3	1,020	4,751	30%	4.47	3	1020	4,555	(195)	0%
04SW034_03	EF Red Canyon	4	390	Sage/grass	27%	4.66	3	1,170	5,449	20%	5.10	3	1170	5,972	523	7%
04SW034_03	EF Red Canyon	5	900	Sage/grass	27%	4.66	3	2,700	12,575	30%	4.47	3	2700	12,058	(517)	0%
04SW034_03	EF Red Canyon	6	500	Sage/grass	27%	4.66	3	1,500	6,986	30%	4.47	3	1500	6,699	(287)	0%
04SW034_03	EF Red Canyon	7	2120	Coyote willow	58%	2.68	4	8,480	22,723	50%	3.19	4	8480	27,051	4,328	8%
04SW034_03	EF Red Canyon	8	240	Coyote willow	58%	2.68	4	960	2,572	30%	4.47	4	960	4,287	1,715	28%
04SW034_03	EF Red Canyon	9	510	Coyote willow	58%	2.68	4	2,040	5,466	50%	3.19	4	2040	6,508	1,041	8%
04SW034_03	EF Red Canyon	10	940	Coyote willow	58%	2.68	4	3,760	10,075	30%	4.47	4	3760	16,792	6,717	28%
04SW034_03	EF Red Canyon	11	190	Coyote willow	58%	2.68	4	760	2,036	50%	3.19	4	760	2,424	388	8%
04SW034_03	Red Canyon	1	770	Coyote willow	44%	3.57	6	4,620	16,506	50%	3.19	6	4620	14,738	(1,769)	0%
04SW034_03	Red Canyon	2	140	Coyote willow	44%	3.57	6	840	3,001	30%	4.47	6	840	3,751	750	14%
04SW034_03	Red Canyon	3	2670	Coyote willow	44%	3.57	6	16,020	57,236	50%	3.19	6	16020	51,104	(6,132)	0%
							Totals		164,713					171,609	6,896	

Table D30. Solar loads for ID17050104SW034_04 (Red Canyon between Petes Creek and Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
04SW034_04	Red Canyon	1	1980	Coyote willow	35%	4.15	8	15,840	65,688	50%	3.19	8	15840	50,530	(15,159)	0%
04SW034_04	Red Canyon	2	220	Coyote willow	35%	4.15	8	1,760	7,299	40%	3.83	8	1760	6,737	(561)	0%
04SW034_04	Red Canyon	3	160	Coyote willow	32%	4.34	9	1,440	6,247	50%	3.19	9	1440	4,594	(1,654)	0%
04SW034_04	Red Canyon	4	2400	Coyote willow	32%	4.34	9	21,600	93,709	40%	3.83	9	21600	82,685	(11,025)	0%
							Totals		172,944					144,545	(28,399)	

Table D31. Solar loads for ID17050105SW001_06 (South Fork Owyhee River upstream of Little Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
05SW001_06	SF Owyhee	1	12,740	Sage/grass	5%	6.06	16	203,840	1,235,474	7%	5.97	16	203,840	1,215,967	(19,507)	0%
05SW001_06	SF Owyhee	2	19,060	Sage/grass	4%	6.12	20	381,200	2,334,774	16%	5.38	20	381,200	2,052,655	(282,118)	0%
							Totals		3,570,248					3,268,622	(301,626)	

Table D32. Solar loads for ID17050105SW001_07 (South Fork Owyhee River downstream of Little Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
05SW001_07	SF Owyhee	1	3,470	Sage/grass	4%	6.12	23	79,810	488,820	5%	6.05	23	79,810	482,710	(6,110)	0%
05SW001_07	SF Owyhee	2	13,820	Sage/grass	4%	6.12	20	276,400	1,692,895	12%	5.62	20	276,400	1,553,584	(139,311)	0%
05SW001_07	SF Owyhee	3	3,230	Sage/grass	5%	6.06	16	51,680	313,232	26%	4.75	16	51,680	245,640	(67,592)	0%
							Totals		2,494,947					2,281,934	(213,014)	

Table D33. Solar loads for ID17050107SW001_07 (Owyhee River between South Fork and Oregon border).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW001_07	Owyhee River	1	12,670	Coyote willow	6%	6.00	49	620,830	3,723,242	30%	4.47	49	620830	2,772,627	(950,615)	0%
							Totals		3,723,242					2,772,627	(950,615)	

Table D34. Solar loads for ID17050107SW004_02 (Middle Fork Owyhee River upstream of Summit Springs Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW004_02	MF Owyhee	1	160	Sage/grass	65%	2.23	1	160	357	40%	3.83	1	160	612	255	25%
07SW004_02	MF Owyhee	2	160	Sage/grass	65%	2.23	1	160	357	50%	3.19	1	160	510	153	15%
07SW004_02	MF Owyhee	3	260	Sage/grass	65%	2.23	1	260	581	70%	1.91	1	260	498	(83)	0%
07SW004_02	MF Owyhee	4	1,100	Alder	86%	0.89	2	2,200	1,965	80%	1.28	2	2,200	2,807	842	6%
07SW004_02	MF Owyhee	5	1,850	Alder	72%	1.79	3	5,550	9,915	60%	2.55	3	5,550	14,164	4,249	12%
07SW004_02	MF Owyhee	6	2,270	Yellow willow	56%	2.81	3	6,810	19,117	50%	3.19	3	6,810	21,724	2,607	6%
07SW004_02	MF Owyhee	7	820	Yellow willow	56%	2.81	3	2,460	6,906	70%	1.91	3	2,460	4,708	(2,197)	0%
							Totals		39,197					45,024	5,826	

Table D35. Solar loads for ID17050107SW004_03 (Middle Fork Owyhee River downstream of Summit Springs Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW004_03	MF Owyhee	1	180	Yellow willow	56%	2.81	3	540	1,516	70%	1.91	3	540	1,034	(482)	0%
07SW004_03	MF Owyhee	2	430	Yellow willow	46%	3.45	4	1,720	5,926	30%	4.47	4	1,720	7,682	1,756	16%
07SW004_03	MF Owyhee	3	430	Yellow willow	46%	3.45	4	1,720	5,926	40%	3.83	4	1,720	6,584	658	6%
07SW004_03	MF Owyhee	4	120	Yellow willow	46%	3.45	4	480	1,654	20%	5.10	4	480	2,450	796	26%
07SW004_03	MF Owyhee	5	1,660	Sage/grass	17%	5.30	5	8,300	43,952	10%	5.74	5	8,300	47,659	3,707	7%
07SW004_03	MF Owyhee	6	3,750	Coyote willow	44%	3.57	6	22,500	80,388	50%	3.19	6	22,500	71,775	(8,613)	0%
07SW004_03	MF Owyhee	7	700	Coyote willow	44%	3.57	6	4,200	15,006	30%	4.47	6	4,200	18,757	3,751	14%
							Totals		154,367					155,940	1,573	

Table D36. Solar loads for ID17050107SW008_02 (North Fork Owyhee River upstream of Big Springs Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW008_02	Big Spring	1	170	Sage/grass	27%	4.66	3	510	2,375	30%	4.47	3	510	2,278	(98)	0%
07SW008_02	Big Spring	2	310	Sage/grass	27%	4.66	3	930	4,331	20%	5.10	3	930	4,747	415	7%
07SW008_02	Big Spring	3	1,860	Yellow willow	56%	2.81	3	5,580	15,664	60%	2.55	3	5,580	14,240	(1,424)	0%
07SW008_02	Big Spring	4	290	Yellow willow	56%	2.81	3	870	2,442	50%	3.19	3	870	2,775	333	6%
07SW008_02	Big Spring	5	600	Yellow willow	56%	2.81	3	1,800	5,053	70%	1.91	3	1,800	3,445	(1,608)	0%
07SW008_02	Big Spring	6	310	Yellow willow	56%	2.81	3	930	2,611	40%	3.83	3	930	3,560	949	16%
07SW008_02	Big Spring	7	400	Yellow willow	56%	2.81	3	1,200	3,369	60%	2.55	3	1,200	3,062	(306)	0%
07SW008_02	NF Owyhee	1	1,410	Sage/grass	65%	2.23	1	1,410	3,149	60%	2.55	1	1,410	3,598	450	5%
07SW008_02	NF Owyhee	2	5,220	Sage/juniper	81%	1.21	1	5,220	6,328	80%	1.28	1	5,220	6,661	333	1%
07SW008_02	NF Owyhee	3	3,760	Sage/juniper	64%	2.30	2	7,520	17,272	60%	2.55	2	7,520	19,191	1,919	4%
07SW008_02	NF Owyhee	4	1,470	Yellow willow	56%	2.81	3	4,410	12,380	60%	2.55	3	4,410	11,254	(1,125)	0%
07SW008_02	NF Owyhee	5	940	Yellow willow	46%	3.45	4	3,760	12,954	40%	3.83	4	3,760	14,393	1,439	6%
							Totals		87,927					89,205	1,278	

Table D37. Solar loads for ID17050107SW008_03 (North Fork Owyhee River between Big Spring and Pleasant Valley Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW008_03	NF Owyhee	1	2,800	Yellow willow	46%	3.45	4	11,200	38,586	40%	3.83	4	11,200	42,874	4,287	6%
07SW008_03	NF Owyhee	2	2,710	Yellow willow	46%	3.45	4	10,840	37,346	30%	4.47	4	10,840	48,411	11,065	16%
07SW008_03	NF Owyhee	3	730	Yellow willow	46%	3.45	4	2,920	10,060	60%	2.55	4	2,920	7,452	(2,608)	0%
07SW008_03	NF Owyhee	4	3,670	Yellow willow	39%	3.89	5	18,350	71,415	40%	3.83	5	18,350	70,244	(1,171)	0%
07SW008_03	NF Owyhee	5	560	Yellow willow	39%	3.89	5	2,800	10,897	30%	4.47	5	2,800	12,505	1,608	9%
							Totals		168,304					181,485	13,182	

Table D38. Solar loads for ID17050107SW008_04 (North Fork Owyhee River between Pleasant Valley and Juniper Creeks, and Juniper Creek between Cabin Creek and North Fork Owyhee River).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW008_04	Juniper	1	720	Coyote willow	44%	3.57	6	4,320	15,434	40%	3.83	6	4,320	16,537	1,102	4%
07SW008_04	NF Owyhee	1	2,900	Yellow willow	34%	4.21	6	17,400	73,268	30%	4.47	6	17,400	77,708	4,440	4%
07SW008_04	NF Owyhee	2	130	Yellow willow	30%	4.47	7	910	4,064	10%	5.74	7	910	5,225	1,161	20%
							Totals		92,766					99,471	6,704	

Table D39. Solar loads for ID17050107SW008_05 (North Fork Owyhee River downstream of Juniper Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW008_05	NF Owyhee	1	1,300	Yellow willow	30%	4.47	7	9,100	40,641	30%	4.47	7	9,100	40,641	0	0%
07SW008_05	NF Owyhee	2	800	Coyote willow	35%	4.15	8	6,400	26,541	30%	4.47	8	6,400	28,582	2,042	5%
07SW008_05	NF Owyhee	3	1,310	Coyote willow	32%	4.34	9	11,790	51,150	20%	5.10	9	11,790	60,176	9,026	12%
07SW008_05	NF Owyhee	4	490	Coyote willow	32%	4.34	9	4,410	19,132	30%	4.47	9	4,410	19,695	563	2%
07SW008_05	NF Owyhee	5	210	Coyote willow	32%	4.34	9	1,890	8,200	10%	5.74	9	1,890	10,852	2,653	22%
07SW008_05	NF Owyhee	6	2,050	Coyote willow	29%	4.53	10	20,500	92,861	20%	5.10	10	20,500	104,632	11,771	9%
07SW008_05	NF Owyhee	7	2,560	Sage/grass	8%	5.87	11	28,160	165,288	20%	5.10	11	28,160	143,729	(21,559)	0%
07SW008_05	NF Owyhee	8	1,930	Juniper	27%	4.66	12	23,160	107,865	30%	4.47	12	23,160	103,433	(4,433)	0%
							Totals		511,677					511,740	63	

Table D40. Solar loads for ID17050107SW009_02 (Pleasant Valley Creek upstream of East Fork Pleasant Valley Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW009_02	Pleasant Valley	1	130	Juniper	97%	0.19	1	130	25	90%	0.64	1	130	83	58	7%
07SW009_02	Pleasant Valley	2	1,810	Sage/juniper	81%	1.21	1	1,810	2,194	80%	1.28	1	1,810	2,310	115	1%
07SW009_02	Pleasant Valley	3	430	Yellow willow	73%	1.72	2	860	1,481	70%	1.91	2	860	1,646	165	3%
07SW009_02	Pleasant Valley	4	410	Sage/grass	39%	3.89	2	820	3,191	30%	4.47	2	820	3,662	471	9%
07SW009_02	Pleasant Valley	5	280	Yellow willow	56%	2.81	3	840	2,358	40%	3.83	3	840	3,216	857	16%
07SW009_02	Pleasant Valley	6	160	Sage/grass	27%	4.66	3	480	2,236	20%	5.10	3	480	2,450	214	7%
07SW009_02	Pleasant Valley	7	920	Sage/grass	27%	4.66	3	2,760	12,854	0%	6.38	3	2,760	17,609	4,754	27%
07SW009_02	Pleasant Valley	8	150	Sage/grass	27%	4.66	3	450	2,096	20%	5.10	3	450	2,297	201	7%
07SW009_02	Pleasant Valley	9	610	Yellow willow	46%	3.45	4	2,440	8,406	40%	3.83	4	2,440	9,340	934	6%
07SW009_02	Pleasant Valley	10	100	Yellow willow	46%	3.45	4	400	1,378	10%	5.74	4	400	2,297	919	36%
07SW009_02	Pleasant Valley	11	100	Yellow willow	46%	3.45	4	400	1,378	50%	3.19	4	400	1,276	(102)	0%
07SW009_02	Pleasant Valley	12	170	Yellow willow	46%	3.45	4	680	2,343	0%	6.38	4	680	4,338	1,996	46%
07SW009_02	Pleasant Valley	13	70	Yellow willow	46%	3.45	4	280	965	40%	3.83	4	280	1,072	107	6%
07SW009_02	Pleasant Valley	14	420	Yellow willow	46%	3.45	4	1,680	5,788	0%	6.38	4	1,680	10,718	4,930	46%
07SW009_02	Pleasant Valley	15	250	Yellow willow	46%	3.45	4	1,000	3,445	30%	4.47	4	1,000	4,466	1,021	16%
07SW009_02	Pleasant Valley	16	450	Sage/grass	21%	5.04	4	1,800	9,072	0%	6.38	4	1,800	11,484	2,412	21%
07SW009_02	Pleasant Valley	17	440	Sage/grass	21%	5.04	4	1,760	8,871	20%	5.10	4	1,760	8,983	112	1%
07SW009_02	Pleasant Valley	18	800	Sage/grass	21%	5.04	4	3,200	16,129	0%	6.38	4	3,200	20,416	4,287	21%
07SW009_02	Pleasant Valley	19	180	Yellow willow	39%	3.89	5	900	3,503	10%	5.74	5	900	5,168	1,665	29%
07SW009_02	Pleasant Valley	20	120	Yellow willow	39%	3.89	5	600	2,335	0%	6.38	5	600	3,828	1,493	39%
07SW009_02	Pleasant Valley	21	320	Yellow willow	39%	3.89	5	1,600	6,227	20%	5.10	5	1,600	8,166	1,940	19%
07SW009_02	Pleasant Valley	22	120	Yellow willow	39%	3.89	5	600	2,335	0%	6.38	5	600	3,828	1,493	39%
							Totals		98,610					128,653	30,043	

Table D41. Solar loads for ID17050107SW009_03 (Pleasant Valley Creek between North Fork Owyhee River and East Fork Pleasant Valley Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW009_02	Pleasant Valley	1	130	Juniper	97%	0.19	1	130	25	90%	0.64	1	130	83	58	7%
07SW009_02	Pleasant Valley	2	1,810	Sage/juniper	81%	1.21	1	1,810	2,194	80%	1.28	1	1,810	2,310	115	1%
07SW009_02	Pleasant Valley	3	430	Yellow willow	73%	1.72	2	860	1,481	70%	1.91	2	860	1,646	165	3%
07SW009_02	Pleasant Valley	4	410	Sage/grass	39%	3.89	2	820	3,191	30%	4.47	2	820	3,662	471	9%
07SW009_02	Pleasant Valley	5	280	Yellow willow	56%	2.81	3	840	2,358	40%	3.83	3	840	3,216	857	16%
07SW009_02	Pleasant Valley	6	160	Sage/grass	27%	4.66	3	480	2,236	20%	5.10	3	480	2,450	214	7%
07SW009_02	Pleasant Valley	7	920	Sage/grass	27%	4.66	3	2,760	12,854	0%	6.38	3	2,760	17,609	4,754	27%
07SW009_02	Pleasant Valley	8	150	Sage/grass	27%	4.66	3	450	2,096	20%	5.10	3	450	2,297	201	7%
07SW009_02	Pleasant Valley	9	610	Yellow willow	46%	3.45	4	2,440	8,406	40%	3.83	4	2,440	9,340	934	6%
07SW009_02	Pleasant Valley	10	100	Yellow willow	46%	3.45	4	400	1,378	10%	5.74	4	400	2,297	919	36%
07SW009_02	Pleasant Valley	11	100	Yellow willow	46%	3.45	4	400	1,378	50%	3.19	4	400	1,276	(102)	0%
07SW009_02	Pleasant Valley	12	170	Yellow willow	46%	3.45	4	680	2,343	0%	6.38	4	680	4,338	1,996	46%
07SW009_02	Pleasant Valley	13	70	Yellow willow	46%	3.45	4	280	965	40%	3.83	4	280	1,072	107	6%
07SW009_02	Pleasant Valley	14	420	Yellow willow	46%	3.45	4	1,680	5,788	0%	6.38	4	1,680	10,718	4,930	46%
07SW009_02	Pleasant Valley	15	250	Yellow willow	46%	3.45	4	1,000	3,445	30%	4.47	4	1,000	4,466	1,021	16%
07SW009_02	Pleasant Valley	16	450	Sage/grass	21%	5.04	4	1,800	9,072	0%	6.38	4	1,800	11,484	2,412	21%
07SW009_02	Pleasant Valley	17	440	Sage/grass	21%	5.04	4	1,760	8,871	20%	5.10	4	1,760	8,983	112	1%
07SW009_02	Pleasant Valley	18	800	Sage/grass	21%	5.04	4	3,200	16,129	0%	6.38	4	3,200	20,416	4,287	21%
07SW009_02	Pleasant Valley	19	180	Yellow willow	39%	3.89	5	900	3,503	10%	5.74	5	900	5,168	1,665	29%
07SW009_02	Pleasant Valley	20	120	Yellow willow	39%	3.89	5	600	2,335	0%	6.38	5	600	3,828	1,493	39%
07SW009_02	Pleasant Valley	21	320	Yellow willow	39%	3.89	5	1,600	6,227	20%	5.10	5	1,600	8,166	1,940	19%
07SW009_02	Pleasant Valley	22	120	Yellow willow	39%	3.89	5	600	2,335	0%	6.38	5	600	3,828	1,493	39%
							Totals		98,610					128,653	30,043	

Table D42. Solar loads for ID17050107SW010_02 (Noon Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW010_02	Noon	1	590	Sage/grass	65%	2.23	1	590	1,317	20%	5.10	1	590	3,011	1,694	45%
07SW010_02	Noon	2	210	Sage/grass	65%	2.23	1	210	469	60%	2.55	1	210	536	67	5%
07SW010_02	Noon	3	470	Sage/grass	65%	2.23	1	470	1,050	40%	3.83	1	470	1,799	750	25%
07SW010_02	Noon	4	340	Sage/grass	65%	2.23	1	340	759	60%	2.55	1	340	868	108	5%
07SW010_02	Noon	5	1,440	Sage/juniper	81%	1.21	1	1,440	1,746	80%	1.28	1	1,440	1,837	92	1%
07SW010_02	Noon	6	530	Sage/grass	65%	2.23	1	530	1,183	40%	3.83	1	530	2,029	845	25%
07SW010_02	Noon	7	520	Sage/juniper	64%	2.30	2	1,040	2,389	50%	3.19	2	1,040	3,318	929	14%
07SW010_02	Noon	8	240	Sage/grass	39%	3.89	2	480	1,868	30%	4.47	2	480	2,144	276	9%
07SW010_02	Noon	9	240	Sage/grass	39%	3.89	2	480	1,868	10%	5.74	2	480	2,756	888	29%
07SW010_02	Noon	10	130	Sage/juniper	64%	2.30	2	260	597	60%	2.55	2	260	664	66	4%
07SW010_02	Noon	11	350	Sage/grass	39%	3.89	2	700	2,724	30%	4.47	2	700	3,126	402	9%
07SW010_02	Noon	12	180	Sage/grass	39%	3.89	2	360	1,401	20%	5.10	2	360	1,837	436	19%
07SW010_02	Noon	13	1,440	Sage/juniper	64%	2.30	2	2,880	6,615	70%	1.91	2	2,880	5,512	(1,102)	0%
07SW010_02	Noon	14	1,450	Juniper	74%	1.66	3	4,350	7,216	70%	1.91	3	4,350	8,326	1,110	4%
07SW010_02	Noon	15	270	Yellow willow	56%	2.81	3	810	2,274	50%	3.19	3	810	2,584	310	6%
07SW010_02	Noon	16	260	Yellow willow	56%	2.81	3	780	2,190	30%	4.47	3	780	3,483	1,294	26%
07SW010_02	Noon	17	360	Yellow willow	56%	2.81	3	1,080	3,032	50%	3.19	3	1,080	3,445	413	6%
07SW010_02	Noon	18	210	Yellow willow	56%	2.81	3	630	1,769	30%	4.47	3	630	2,814	1,045	26%
07SW010_02	Noon	19	2,890	Yellow willow	56%	2.81	3	8,670	24,338	60%	2.55	3	8,670	22,126	(2,213)	0%
07SW010_02	Noon	20	1,850	Yellow willow	46%	3.45	4	7,400	25,494	50%	3.19	4	7,400	23,606	(1,888)	0%
07SW010_02	Noon	21	590	Yellow willow	46%	3.45	4	2,360	8,131	70%	1.91	4	2,360	4,517	(3,614)	0%
							Totals		98,429					100,338	1,909	

Table D43. Solar loads for ID17050107SW011_02 (Cabin and Corral Creek headwaters).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW011_02	Cabin	1	900	Sage/grass	65%	2.23	1	900	2,010	60%	2.55	1	900	2,297	287	5%
07SW011_02	Cabin	2	250	Sage/grass	65%	2.23	1	250	558	60%	2.55	1	250	638	80	5%
07SW011_02	Cabin	3	950	Yellow willow	89%	0.70	1	950	667	80%	1.28	1	950	1,212	545	9%
07SW011_02	Cabin	4	570	Yellow willow	89%	0.70	1	570	400	70%	1.91	1	570	1,091	691	19%
07SW011_02	Cabin	5	140	Sage/grass	65%	2.23	1	140	313	50%	3.19	1	140	447	134	15%
07SW011_02	Cabin	6	320	Yellow willow	89%	0.70	1	320	225	90%	0.64	1	320	204	(20)	0%
07SW011_02	Cabin	7	430	Yellow willow	89%	0.70	1	430	302	80%	1.28	1	430	549	247	9%
07SW011_02	Cabin	8	550	Sage/grass	65%	2.23	1	550	1,228	30%	4.47	1	550	2,456	1,228	35%
07SW011_02	Cabin	9	700	Yellow willow	73%	1.72	2	1,400	2,412	50%	3.19	2	1,400	4,466	2,054	23%
07SW011_02	Cabin	10	170	Yellow willow	73%	1.72	2	340	586	80%	1.28	2	340	434	(152)	0%
07SW011_02	Cabin	11	870	Yellow willow	73%	1.72	2	1,740	2,997	70%	1.91	2	1,740	3,330	333	3%
07SW011_02	Cabin	12	470	Yellow willow	73%	1.72	2	940	1,619	60%	2.55	2	940	2,399	780	13%
07SW011_02	Cabin	13	530	Sage/grass	39%	3.89	2	1,060	4,125	30%	4.47	2	1,060	4,734	609	9%
07SW011_02	Cabin	14	1,090	Sage/grass	39%	3.89	2	2,180	8,484	30%	4.47	2	2,180	9,736	1,252	9%
07SW011_02	Cabin	15	890	Yellow willow	56%	2.81	3	2,670	7,495	60%	2.55	3	2,670	6,814	(681)	0%
07SW011_02	Cabin	16	610	Yellow willow	56%	2.81	3	1,830	5,137	50%	3.19	3	1,830	5,838	701	6%
07SW011_02	Cabin	17	540	Yellow willow	56%	2.81	3	1,620	4,548	40%	3.83	3	1,620	6,201	1,654	16%
07SW011_02	Cabin	18	400	Yellow willow	56%	2.81	3	1,200	3,369	50%	3.19	3	1,200	3,828	459	6%
07SW011_02	Cabin	19	300	Yellow willow	56%	2.81	3	900	2,526	40%	3.83	3	900	3,445	919	16%
07SW011_02	Cabin	20	340	Yellow willow	56%	2.81	3	1,020	2,863	50%	3.19	3	1,020	3,254	390	6%
07SW011_02	Cabin	21	690	Yellow willow	56%	2.81	3	2,070	5,811	70%	1.91	3	2,070	3,962	(1,849)	0%
07SW011_02	Corral	1	2,950	Sage/juniper	81%	1.21	1	2,950	3,576	80%	1.28	1	2,950	3,764	188	1%
07SW011_02	Corral	2	220	Sage/grass	39%	3.89	1	220	856	40%	3.83	1	220	842	(14)	0%
07SW011_02	Corral	3	940	Yellow willow	73%	1.72	2	1,880	3,238	70%	1.91	2	1,880	3,598	360	3%
07SW011_02	Corral	4	240	Yellow willow	73%	1.72	2	480	827	40%	3.83	2	480	1,837	1,011	33%
07SW011_02	Corral	5	250	Yellow willow	73%	1.72	2	500	861	60%	2.55	2	500	1,276	415	13%
07SW011_02	Corral	6	690	Yellow willow	73%	1.72	2	1,380	2,377	70%	1.91	2	1,380	2,641	264	3%
07SW011_02	Corral	7	80	Yellow willow	73%	1.72	2	160	276	40%	3.83	2	160	612	337	33%
07SW011_02	Corral	8	150	Yellow willow	73%	1.72	2	300	517	60%	2.55	2	300	766	249	13%
07SW011_02	Corral	9	780	Yellow willow	56%	2.81	3	2,340	6,569	20%	5.10	3	2,340	11,943	5,375	36%
07SW011_02	Corral	10	280	Yellow willow	56%	2.81	3	840	2,358	30%	4.47	3	840	3,751	1,393	26%
07SW011_02	Corral	11	1,220	Yellow willow	56%	2.81	3	3,660	10,274	50%	3.19	3	3,660	11,675	1,401	6%
07SW011_02	Corral	12	2,400	Yellow willow	56%	2.81	3	7,200	20,212	30%	4.47	3	7,200	32,155	11,943	26%
07SW011_02	Corral	13	240	Yellow willow	56%	2.81	3	720	2,021	20%	5.10	3	720	3,675	1,654	36%
07SW011_02	Corral	14	470	Yellow willow	56%	2.81	3	1,410	3,958	50%	3.19	3	1,410	4,498	540	6%
07SW011_02	Corral	15	1,190	Yellow willow	46%	3.45	4	4,760	16,399	40%	3.83	4	4,760	18,221	1,822	6%
07SW011_02	Corral	16	680	Yellow willow	46%	3.45	4	2,720	9,371	50%	3.19	4	2,720	8,677	(694)	0%
							Totals		141,365					177,268	35,903	

Table D44. Solar loads for ID17050107SW011_03 (Cabin and Corral Creeks—3rd order).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW011_03	Corral	1	910	Yellow willow	46%	3.45	4	3,640	12,541	50%	3.19	4	3,640	11,612	(929)	0%
07SW011_03	Corral	2	2,000	Yellow willow	46%	3.45	4	8,000	27,562	40%	3.83	4	8,000	30,624	3,062	6%
07SW011_03	Corral	3	1,200	Coyote willow	58%	2.68	4	4,800	12,862	50%	3.19	4	4,800	15,312	2,450	8%
							Totals		52,964					57,548	4,583	

Table D45. Solar loads for ID17050107SW012_02 (Juniper Creek upstream of Buck Creek).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW012_02	Juniper	1	720	Sage/grass	65%	2.23	1	720	1,608	50%	3.19	1	720	2,297	689	15%
07SW012_02	Juniper	2	1,080	Aspen	100%	0.00	1	1,080	0	90%	0.64	1	1,080	689	689	10%
07SW012_02	Juniper	3	330	Yellow willow	89%	0.70	1	330	232	80%	1.28	1	330	421	189	9%
07SW012_02	Juniper	4	540	Aspen	100%	0.00	1	540	0	90%	0.64	1	540	345	345	10%
07SW012_02	Juniper	5	370	Yellow willow	73%	1.72	2	740	1,275	80%	1.28	2	740	944	(330)	0%
07SW012_02	Juniper	6	290	Yellow willow	73%	1.72	2	580	999	40%	3.83	2	580	2,220	1,221	33%
07SW012_02	Juniper	7	440	Yellow willow	73%	1.72	2	880	1,516	60%	2.55	2	880	2,246	730	13%
07SW012_02	Juniper	8	1,400	Yellow willow	73%	1.72	2	2,800	4,823	80%	1.28	2	2,800	3,573	(1,250)	0%
07SW012_02	Juniper	9	270	Sage/juniper	64%	2.30	2	540	1,240	60%	2.55	2	540	1,378	138	4%
07SW012_02	Juniper	10	140	Sage/juniper	64%	2.30	2	280	643	40%	3.83	2	280	1,072	429	24%
07SW012_02	Juniper	11	590	Sage/juniper	64%	2.30	2	1,180	2,710	60%	2.55	2	1,180	3,011	301	4%
07SW012_02	Juniper	12	260	Sage/juniper	64%	2.30	2	520	1,194	50%	3.19	2	520	1,659	464	14%
							Totals		16,240					19,855	3,614	

Table D46. Solar loads for ID17050107SW012_03 (Juniper Creek between Buck and Cabin Creeks).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number	Length (m)	Vegetation Type	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Insolation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
07SW012_03	Juniper	1	560	Sage/juniper	64%	2.30	2	1,120	2,572	50%	3.19	2	1,120	3,573	1,000	14%
07SW012_03	Juniper	2	390	Yellow willow	56%	2.81	3	1,170	3,284	70%	1.91	3	1,170	2,239	(1,045)	0%
07SW012_03	Juniper	3	330	Yellow willow	56%	2.81	3	990	2,779	40%	3.83	3	990	3,790	1,011	16%
07SW012_03	Juniper	4	320	Yellow willow	56%	2.81	3	960	2,695	60%	2.55	3	960	2,450	(245)	0%
07SW012_03	Juniper	5	590	Yellow willow	56%	2.81	3	1,770	4,969	50%	3.19	3	1,770	5,646	678	6%
07SW012_03	Juniper	6	350	Yellow willow	56%	2.81	3	1,050	2,948	60%	2.55	3	1,050	2,680	(268)	0%
07SW012_03	Juniper	7	350	Yellow willow	56%	2.81	3	1,050	2,948	70%	1.91	3	1,050	2,010	(938)	0%
07SW012_03	Juniper	8	760	Sage/juniper	51%	3.13	3	2,280	7,128	50%	3.19	3	2,280	7,273	145	1%
07SW012_03	Juniper	9	370	Sage/juniper	51%	3.13	3	1,110	3,470	20%	5.10	3	1,110	5,665	2,195	31%
07SW012_03	Juniper	10	960	Yellow willow	56%	2.81	3	2,880	8,085	40%	3.83	3	2,880	11,025	2,940	16%
07SW012_03	Juniper	11	900	Yellow willow	46%	3.45	4	3,600	12,403	60%	2.55	4	3,600	9,187	(3,216)	0%
07SW012_03	Juniper	12	70	Yellow willow	46%	3.45	4	280	965	0%	6.38	4	280	1,786	822	46%
07SW012_03	Juniper	13	260	Yellow willow	46%	3.45	4	1,040	3,583	40%	3.83	4	1,040	3,981	398	6%
07SW012_03	Juniper	14	760	Yellow willow	46%	3.45	4	3,040	10,473	20%	5.10	4	3,040	15,516	5,043	26%
07SW012_03	Juniper	15	520	Yellow willow	46%	3.45	4	2,080	7,166	40%	3.83	4	2,080	7,962	796	6%
07SW012_03	Juniper	16	590	Yellow willow	46%	3.45	4	2,360	8,131	20%	5.10	4	2,360	12,045	3,915	26%
07SW012_03	Juniper	17	210	Yellow willow	46%	3.45	4	840	2,894	40%	3.83	4	840	3,216	322	6%
07SW012_03	Juniper	18	590	Yellow willow	46%	3.45	4	2,360	8,131	30%	4.47	4	2,360	10,540	2,409	16%
07SW012_03	Juniper	19	360	Yellow willow	46%	3.45	4	1,440	4,961	60%	2.55	4	1,440	3,675	(1,286)	0%
07SW012_03	Juniper	20	530	Yellow willow	39%	3.89	5	2,650	10,313	30%	4.47	5	2,650	11,835	1,522	9%
07SW012_03	Juniper	21	200	Yellow willow	39%	3.89	5	1,000	3,892	50%	3.19	5	1,000	3,190	(702)	0%
07SW012_03	Juniper	22	710	Yellow willow	39%	3.89	5	3,550	13,816	20%	5.10	5	3,550	18,119	4,303	19%
07SW012_03	Juniper	23	540	Yellow willow	39%	3.89	5	2,700	10,508	40%	3.83	5	2,700	10,336	(172)	0%
07SW012_03	Juniper	24	190	Yellow willow	39%	3.89	5	950	3,697	50%	3.19	5	950	3,031	(667)	0%
							Totals		141,810					160,770	18,960	

Appendix E. Photographs

Photographs are presented in alphabetical order of stream name and then upstream to downstream. All photographs were taken by Hawk Stone, with the exception of E6, taken by Tipton Power.

Figure E1. Beaver Creek near Brace Ranch.

Figure E2. Deep Creek upstream of Castle Creek. This is a particularly wide section of the canyon. The still pool was formed by a small beaver dam.

Figure E3. Juniper Creek upstream of Corral Creek Road. The foliage and small canyon wall are typical of this area.

Figure E4. North Fork Owyhee River, downstream from Pleasant Valley Road. Notice the mix of deciduous and juniper vegetation and the ever-present canyon walls.

Figure E5. North Fork Owyhee River canyon, just upstream of the Oregon border. The canyon walls provide a large quantity of shade.

Figure E6. Kayak-mounted Solar Pathfinder, shown here on the Owyhee River upstream of Deep Creek.

Figure E7. Owyhee River upstream of Juniper Creek. Although still deep, the canyon here is much shallower than the lower reaches of the river.

Figure E8. Owyhee River upstream of Battle Creek. This section of river is flat and calm.

Figure E9. Owyhee River upstream of Deep Creek.

Figure E10. Owyhee River downstream of South Fork.

Figure E11. Owyhee River downstream of South Fork. Even with little riparian vegetation, the canyon walls create large amounts of topographic shade.

Figure E12. Owyhee River downstream of South Fork. Notice the rafts in the center.

Figure E13. South Fork Owyhee upstream of the Nevada border. The complete absence of riparian vegetation is caused mainly by the episodic nature of water flows.

Figure E14. South Fork Owyhee River near Coyote Hole. Notice the deepening canyon.

Figure E15. South Fork Owyhee River downstream of the Nevada border. This picture was taken in spring. The river declines to a trickle during summer.

Figure E16. South Fork Owyhee River near its mouth. The canyon is notably shallower and wider than the main Owyhee River.

Figure E17. South Fork Owyhee River canyon.

Figure E18. West Fork Red Canyon, in its headwaters on Juniper Mountain. Notice the great diversity of riparian plants.

Figure E19. West Fork Red Canyon, near its confluence with East Fork. The vegetation is sparser and less varied than the headwaters.

Appendix F. Bankfull Widths

When available, field data and aerial photographs were used to determine the actual stream widths. However, these data were sparse, and so stream widths often had to be estimated. Figure 6 (in the main body of the document) shows the Upper Snake Region hydrologic curve, compiled by Diane Hopster of the Idaho Department of Lands. This curve allows us to relate channel width to drainage area for any given stream.

In the loading analysis, the target or natural width was determined to be the smaller of either the predicted width from the hydrologic curve or the existing width.

Table F1. Bankfull widths.

Stream	Location	Area (square miles)	Bankfull Width (meters)	Source of Estimate
Battle Creek	at 5840 ft	32.1	7.2	Regional curve
	above Big Springs Creek	n/a	12.0	BURP site
	at mouth	263.7	14.3	BURP site
	below Big Springs Creek	153.2	14.3	Regional curve
	below Rock Creek	74.2	10.4	Regional curve
	below Summit Flat	5.9	3.4	Regional curve
Beaver Creek	above Carter Creek	5	2.9	BURP site
	at mouth	27.7	6.8	Regional curve
Big Spring	at mouth	3.28	3.0	Aerial photograph
Cabin Creek	at mouth	21.43	2.9	BURP site
	50 m above road crossing	6.39	2.3	BURP site
Camas Creek	above Johnston Cabin	19.5	5.8	Regional curve
	at 5740 ft	9.3	4.2	Regional curve
	at mouth	32.4	5.9	BURP site
Camel Creek	above Slack Creek	7.6	2.7	BURP site
	at mouth	15.4	5.2	Regional curve
Castle Creek	above Skunk Creek	5.3	2.7 3.5	BURP sites
	at mouth	22.8	6.2	Regional curve
	below Swisher Creek	14.4	10.0	BURP site
Corral Creek	above tributary	4.51	3.0	Aerial photograph
	at mouth	12.85	4.0	Aerial photograph
Current Creek	above Corral Creek	9.7	4.3	Regional curve
	above Stoneman Creek	16.3	5.1	BURP site
	at mouth	22.1	6.1	Regional curve

Stream	Location	Area (square miles)	Bankfull Width (meters)	Source of Estimate
Deep Creek	above Beaver Creek	313	18.1 20.8 16 15.7 15.5 10.6 10.3	BURP sites
	above Current Creek	56.5	9.2	Regional curve
	above Dickshooter Creek	354.1	20.7	Regional curve
	above Nickel Creek	97	11.7	Regional curve
	above Pole Creek	154.5	14.4	Regional curve
	at mouth	449.6	23.0	Regional curve
	below Nip And Tuck Creek	52.7	6.9 9.4 12.3	BURP sites
East Fork Red Canyon	at mouth	6.4	3.5	Regional curve
	below Buckskin Spring	2.98	2.5	Regional curve
	below Wonder Spring	1.3	1.8	Regional curve
Hurry Back Creek	at mouth	36.4	7.6	Regional curve
	below Pleasant Valley	15.6	5.2	Regional curve
Juniper Creek	at mouth	38.89	6.0	Aerial photograph
	above road crossing	14.87	4.0	BURP site
Middle Fork Owyhee River	at Oregon border	27.19	6.0	Aerial photograph
	above large tributary	4.94	3.0	Aerial photograph
	below large tributary	10.36	4.0	Aerial photograph
North Fork Owyhee River	at Oregon border	105.02	11.0	Aerial photograph
	above bridge	98.42	12.0	BURP site
	above Juniper	55.48	4.7	BURP site
Nickel Creek	above Smith Creek	16.2	5.3	Regional curve
	at mouth	55.1	9.1	Regional curve
Nip And Tuck Creek	at 5630 ft	6.7	3.6	Regional curve
	at mouth	16.3	5.3	Regional curve
Noon Creek	at mouth	10.87	4.5	Regional curve
	50 m above road crossing	7.91	2.5	BURP site
Owyhee River	below Battle Creek	1455.9	39.0	ArcMap
	below Deep Creek	2004.4	44.0	ArcMap
	below Duck Valley	961.6	20.0	ArcMap
	below Juniper Creek	1128.6	29.0	ArcMap
	below Red Canyon	2131.7	46.0	ArcMap
	below SF Owyhee River	4940.7	66.1	Regional curve

Stream	Location	Area (square miles)	Bankfull Width (meters)	Source of Estimate
Pleasant Valley Creek	at mouth	26.06	6.0	Aerial photograph
	at top	13.86	4.0	Aerial photograph
Pole Creek	above Camas Creek	30.2	7.0	Regional curve
	above Lightning Creek	99.2	7.2	BURP site
	at 5520 ft	20.7	5.9	Regional curve
	at 5660 ft	6	3.4	Regional curve
	at mouth	103.1	12.0	Regional curve
	below Camas Creek	62.6	9.7	Regional curve
Red Canyon	above Petes Creek	24.6	6.4	Regional curve
	below East Fork	17.4	4.6	BURP site
	below Petes Creek	46.5	8.5	regional curve
	at mouth	51.5	9.0	ArcMap
South Fork Owyhee River	above Little Owyhee River	1851	23.0	Field visit
	at mouth	2797	16.0	Field visit
	at Nevada border	1720	16.0	Field visit
	below Little Owyhee River	2720	23.0	Field visit
Smith Creek	above Little Smith Creek	4.9	3.2	Regional curve
	above Thomas Creek	9.7	1.8	BURP site
	at mouth	24.7	6.4	Regional curve
Thomas Creek	above Little Thomas Creek	3.4	2.7	Regional curve
	at mouth	10.3	4.4	Regional curve
West Fork Red Canyon	above Bear Creek	5.1	3.2	Regional curve
	at mouth	11	4.5	Regional curve
	below Bear Creek	7.4	3.8	Regional curve

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Appendix G. Public Comments

The watershed advisory group (WAG) provided much guidance to the direction of this TMDL during the five-year reviews of the Upper and North and Middle Fork Owyhee TMDLs (DEQ 2009a, 2009b).

The WAG made several comments:

- In some locations, 'juniper' is defined as the natural riparian vegetation. According to BLM and NRCS, juniper trees were historically far less prevalent than today. Although juniper was present in rocky pockets and on ridge tops, it was not generally a riparian plant. A 'yellow willow' vegetation curve would be more appropriate.

  Response: based upon the provided NRCS reports, we have changed many of the 'juniper' riparian targets to 'yellow willow' targets.

- Please change the colors in Figure A to better distinguish the Duck Valley Indian reservation from the wilderness area.

  Response: done

- Please show recent 319 projects on a map.

  Response: done—see Figure A

- Please ensure that this information is made available to both public and private landowners, so that if range improvements are made, they are done consistently. Please be careful with taxpayer money when deciding when, and if, to make improvements. The wilderness boundaries make much of this country inaccessible.

  Response: the TMDL implementation plan will address these concerns.

- If it is appropriate, please add a summary of the recent water quality data collected by the Shoshone-Paiute Tribe.

  Response: done

- Please add the recent 319 project information for the South Fork Owyhee River at the 45 Ranch.

  Response: done