Hatwai Creek Subbasin Assessment and Total Maximum Daily Loads

2019 Temperature TMDL

Hydrologic Unit Code 17060306

State of Idaho
Department of Environmental Quality
July 2019

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Abbreviations, Acronyms, and Symbols

§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
§	section (usually a section of federal or state rules or statutes)
AU	assessment unit
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
CGP	Construction General Permit
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
GIS	geographic information system
IDAPA	refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
kWh	kilowatt-hour
L	liter
LA	load allocation
LC	load capacity
m	meter
mg	milligram
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer systems
MSGP	Multi-Sector General Permit
MSL	mean sea level
N	nitrogen
NB	natural background
NO_2	nitrite
NO_3	nitrate

NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
NTU	nephelometric turbidity unit
PNV	potential natural vegetation
SFI	DEQ's Stream Fish Index
SHI	DEQ's Stream Habitat Index
SMI	DEQ's Stream Macroinvertebrate Index
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
TP	total phosphorus
US	United States
USC	United States Code
USGS	United States Geological Survey
WAG	watershed advisory group
WBAG	Water Body Assessment Guidance
WLA	wasteload allocation

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to the CWA §303, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. The CWA §303(d) establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report (DEQ 2017). 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 revises an existing temperature TMDL developed in the *Hatwai Creek Subbasin Assessment and TMDLs* (DEQ 2010). DEQ revised the temperature TMDL for three reasons. First, the 2010 TMDL did not address all perennial stream segments within the Hatwai Creek watershed. The 2010 TMDL developed loads only for the main stem of Hatwai Creek. This revised TMDL estimates loads for the main stem and perennial tributary segments, excluding those within the Nez Perce Reservation boundary and Washington State (Figure A and Figure B). Based on a request from Indian tribes in Idaho, DEQ does not develop TMDLs for waters within reservation boundaries (DEQ 2017). Second, the 2010 TMDL did not calculate loads at the assessment unit (AU) spatial scale; rather, it calculated loads for the Hatwai Creek main stem, which includes all of AU ID17060306CL067_03 and a portion of AU ID17060306CL067_02 (Figure B). The revised TMDL estimates loads for each AU to be consistent with Idaho's Integrated Report. Third, recent aerial imagery and field investigations suggest some changes to stream riparian vegetation since the TMDL was developed. Loads were updated to reflect current stream vegetation and shade conditions. Both the 2010 TMDL and this TMDL use the most up-to-date potential natural vegetation (PNV) methodology (Shumar and de Varona 2009) to calculate loads.

This TMDL describes the key physical and biological characteristics of the watershed; water quality concerns and status; pollutant sources; and recent pollution control actions in the Hatwai Creek watershed, located in north central Idaho. For more detailed information about the watershed and previous TMDLs, see the *Hatwai Creek Subbasin Assessment and TMDLs* (DEQ 2010).

The TMDL analysis establishes shade targets and solar energy load capacities, estimates existing solar energy loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

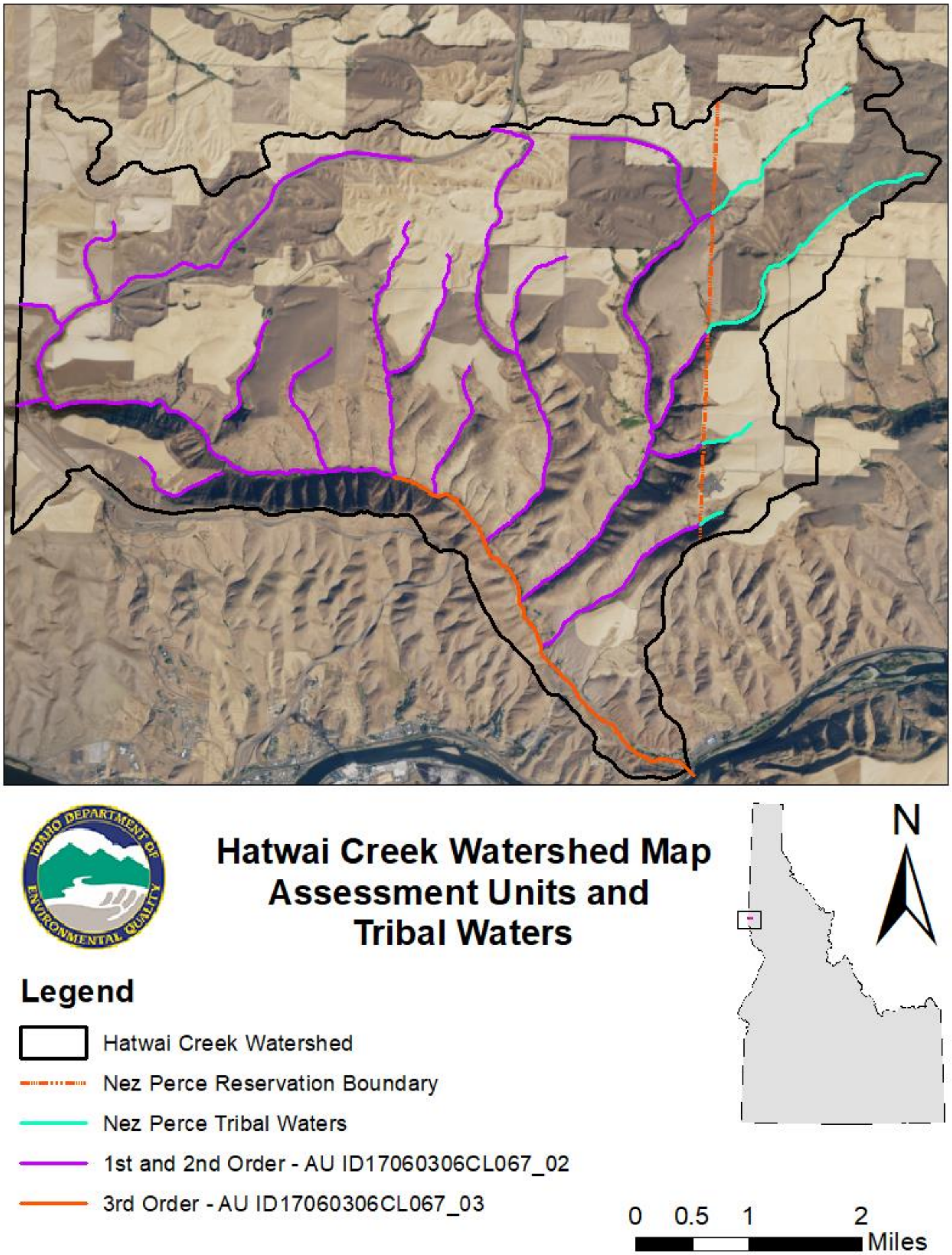

Figure A. Hatwai Creek watershed and assessment units.

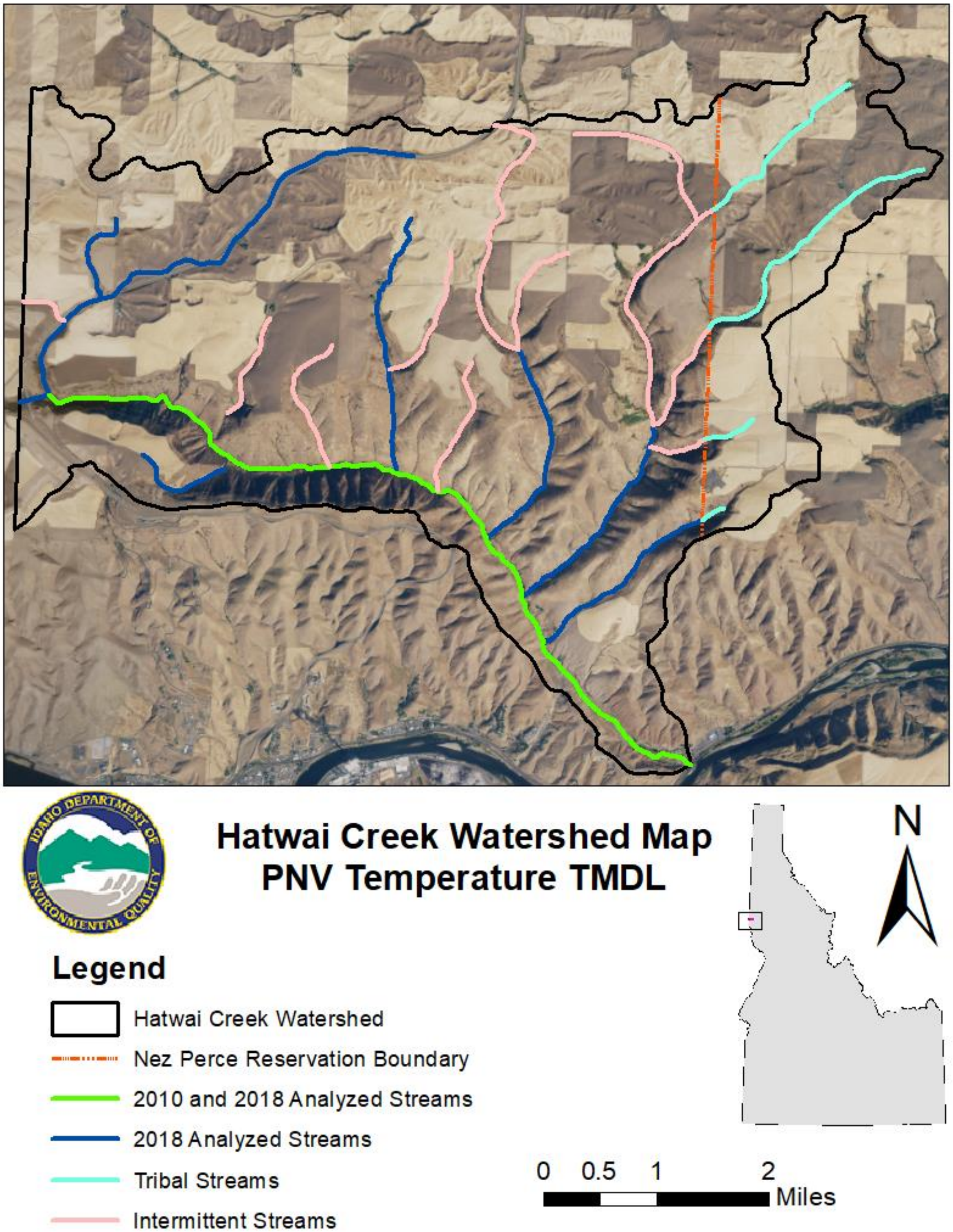

Figure B. Hatwai Creek watershed. The 2018 analyzed streams are stream segments where new heat loads are presented in this TMDL. The 2010 and 2018 analyzed streams are stream segments addressed in both the 2010 and 2018 TMDLs. Tribal stream segments were not analyzed in 2010 or 2018.

Subbasin at a Glance

The Hatwai Creek subbasin is a 32-square mile watershed located in Nez Perce County, Idaho. Hatwai Creek is a tributary of the Clearwater River (Figure A). Its headwaters begin in the rolling cropland of the Palouse at an elevation of approximately 2,900 feet above mean sea level (MSL). Hatwai Creek tributaries flow through a steep canyon and ranchland where they converge and become a 3rd-order stream. At its mouth, Hatwai Creek flows through a culvert under US Highway 95 and converges with the Clearwater River at an elevation of 788 feet above MSL.

Land uses in the watershed include dryland agriculture, ranching, and rural residences. The watershed area is 66% agricultural land and less than 1% is covered by an impervious surface (USGS 2017). Anadromous Rainbow Trout (steelhead) spawn in Hatwai Creek (NPSWCD 2014; Joe DuPont, Idaho Department of Fish and Game, personal communication, August 28, 2018). The creek is also an important historical fishery for the Nez Perce Tribe. The eastern portion of the watershed lies within the Nez Perce Reservation boundary (Figure A). For more information, see the Hatwai Creek TMDLs (DEQ 2010).

In 1989, the Idaho Department of Health and Welfare, Division of Environmental Quality, identified Hatwai Creek as impaired by nutrients, bacteria, temperature, and habitat modifications (IDHW 1989). In 1994, US Environmental Protection Agency (EPA) placed Hatwai Creek on Idaho's §303(d) list, a biannual list of impaired state waters required by the CWA §303(d). Idaho's 1994 §303(d) list was created by EPA under a court order (EPA 1994). For waters identified in §303(d) lists, states must develop TMDLs for each pollutant and submit the TMDLs to EPA for approval. In 2010, the Idaho Department of Environmental Quality (DEQ) developed the Hatwai Creek TMDLs for four pollutants: nitrate plus nitrite nitrogen, total phosphorus, bacteria (*Escherichia coli*), and stream temperature (DEQ 2010). EPA approved the Hatwai Creek TMDLs (lower Clearwater River subbasin hydrologic unit code 17060306) in 2010. The TMDLs were developed to restore and protect cold water aquatic life, salmonid spawning, and secondary contact recreation beneficial uses. The TMDL attributed all pollutant loads to nonpoint sources; there are no known point sources in the watershed.

Key Findings

EPA placed Hatwai Creek on Idaho's 1994 §303(d) list of impaired waters and identified temperature as one cause of impairment. In 2010, DEQ developed and EPA approved temperature TMDLs for two AUs in the Hatwai Creek watershed (DEQ 2010). In this document, DEQ used 2018 stream temperature measurements to assess if temperature currently exceeds applicable temperature criteria in Hatwai Creek and revise the Hatwai Creek temperature TMDLs.

Stream Temperature Impairment

In 2018, DEQ measured stream temperature in both AUs (Figure A). Monitoring methods, results, and sample locations are described in detail in the *Hatwai Creek Surface Water Quality Monitoring Report: 2018* (DEQ 2018). Stream temperature in ID17060306CL067_03 exceeded Idaho's water quality criteria for protecting salmonid spawning (13 ºC daily maximum, 9 ºC

daily average, IDAPA 58.01.02.250.02.f) but did not exceed Idaho's water quality criteria for protecting cold water aquatic life (19 ºC daily average, 22 ºC daily maximum, IDAPA 58.01.02.250.02b). Anadromous Rainbow Trout (steelhead) spawn within ID17060306CL067_03 (NPSWCD 2014; Joe DuPont, Idaho Department of Fish and Game, personal communication, August 28, 2018), so DEQ applied the salmonid spawning temperature criteria during the Clearwater River A-run and B-run steelhead spawning and incubation/emergence periods (February 1–August 15) as defined in *Geography and Timing of Salmonid Spawning in Idaho* (BioAnalysts 2014). Measured stream temperatures exceeded the salmonid spawning criteria during nearly all of the salmonid spawning period.

From May to September 2018, DEQ also measured stream temperature in ID17060306CL067_02. Monitoring methods, results, and sample locations are described in detail in the *Hatwai Creek Surface Water Quality Monitoring Report: 2018* (DEQ 2018). Water quality criteria for protecting cold water aquatic life (19 ºC daily average, 22 ºC daily maximum, IDAPA 58.01.02.250.02b) were not exceeded; daily average and daily maximum temperatures ranged from 8.51 to 17.9 ºC and 9.58 to 21.5 ºC, respectively. Steep slopes and canyon walls within most of ID17060306CL067_02 serve as a fish passage barrier (NPSWCD 2014), so DEQ does not consider salmonid spawning an existing beneficial use that must be protected within ID17060306CL067_02. Stream temperatures did not exceed criteria for protecting cold water aquatic life in the 1st-order headwaters stream segment of ID17060306CL067_02, or downstream near the mouth within ID17060306CL067_03. During the Watershed Advisory Group process, DEQ received permission from landowners in the ID17060306CL067_02 AU to access additional sampling sites. In 2019, DEQ will collect additional temperature logger data to assess temperature impairment in this AU. DEQ will retain this AU in Category 4a as being impaired by temperature however, if 2019 data also show this AU is meeting applicable temperature criteria, DEQ will propose delisting temperature as a cause of impairment for the second order AU in Idaho's next Integrated Report.

Temperature TMDLs

The Hatwai Creek TMDLs (DEQ 2010) developed temperature TMDLs for ID17060306CL067_02 and ID17060306CL067_03 (Table A).

Table A. Water bodies and pollutants for which TMDLs were developed.

Water Body	Assessment Unit Number	Pollutants
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	Temperature
Hatwai Creek—3rd order	ID17060306CL067_03	Temperature

The 2010 temperature TMDLs and revisions described here both used the PNV methodology to estimate existing and target stream shade and solar energy loads (Shumar and de Varona 2009). This methodology estimates stream effective shade and solar energy load to a stream produced by a mature riparian vegetation community without human disturbance (Shumar and de Varona 2009). Effective stream shade is the percentage of the sun's path covered by shade-producing objects for a given location (Shumar and de Varona 2009). The PNV approach assumes that if effective shading associated with potential natural vegetation, is achieved natural background stream temperatures will also be achieved. If PNV targets are achieved, but stream temperatures are warmer than Idaho's temperature criteria, it is assumed the stream's temperature is natural (if

no point sources or human-induced ground water sources of heat exist). IDAPA 58.01.02.200.09 includes a provision that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLs, the natural level of shade and channel width become the TMDL target.

Existing and effective target shade levels were established for each Hatwai Creek AU. Shade targets were derived from effective shade curves developed for relevant vegetation types in Idaho. Effective shade curves have percent shade on the vertical axis and stream width on the horizontal axis. Existing shade was determined from aerial photo interpretation that was partially field verified with Solar Pathfinder measurements. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in IDAPA 58.01.02. Shade levels were converted to solar energy loads using solar load data collected on flat plate collectors at a nearby National Renewable Energy Laboratory (NREL) weather station. A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table B and Table C.

Table B. Summary of assessment outcomes for §303(d)-listed AUs.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDLs Completed	Recommended Changes to Next Integrated Report	Justification
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	Temperature	Yes	Retain in Category 4a for temperature, additional data to be collected	Measured temperatures did not exceed applicable criteria (cold water aquatic life)
Hatwai Creek—3rd order	ID17060306CL067_03	Temperature	Yes	Retain in Category 4a for temperature	Temperature TMDL completed based on PNV

Table C. Total solar loads and average lack of shade for AUs.

Water Body	Assessment Unit Number	Total Existing Load	Total Target Load	Excess Load (%Reduction)	Average Lack of Shade (%)
		(kWh/day)			
Hatwai Creek—1st and 2nd order	ID17060306CL067-02	130,000	64,000	66,000 (51%)	-36%
Hatwai Creek—3rd order	ID17060306CL067-03	120,000	95,000	28,000 (23%)	-8%

Both AUs addressed have existing solar loads that exceed target solar loads (Figure C). Segments with the most severe shade deficits are located along tributary streams flowing adjacent to roads and through agricultural land. Main stem Hatwai Creek is lacking shade primarily along lower segments near the mouth.

Although salmonid spawning temperature criteria do not apply within ID17060306CL067_02, water within the AU exceeds salmonid spawning temperature criteria and flows downstream into ID17060306CL067_03, contributing to salmonid spawning criteria exceedances. Excess heat loads within ID17060306CL067_02 must be addressed to achieve compliance with salmonid spawning temperature criteria in ID17060306CL067_03.

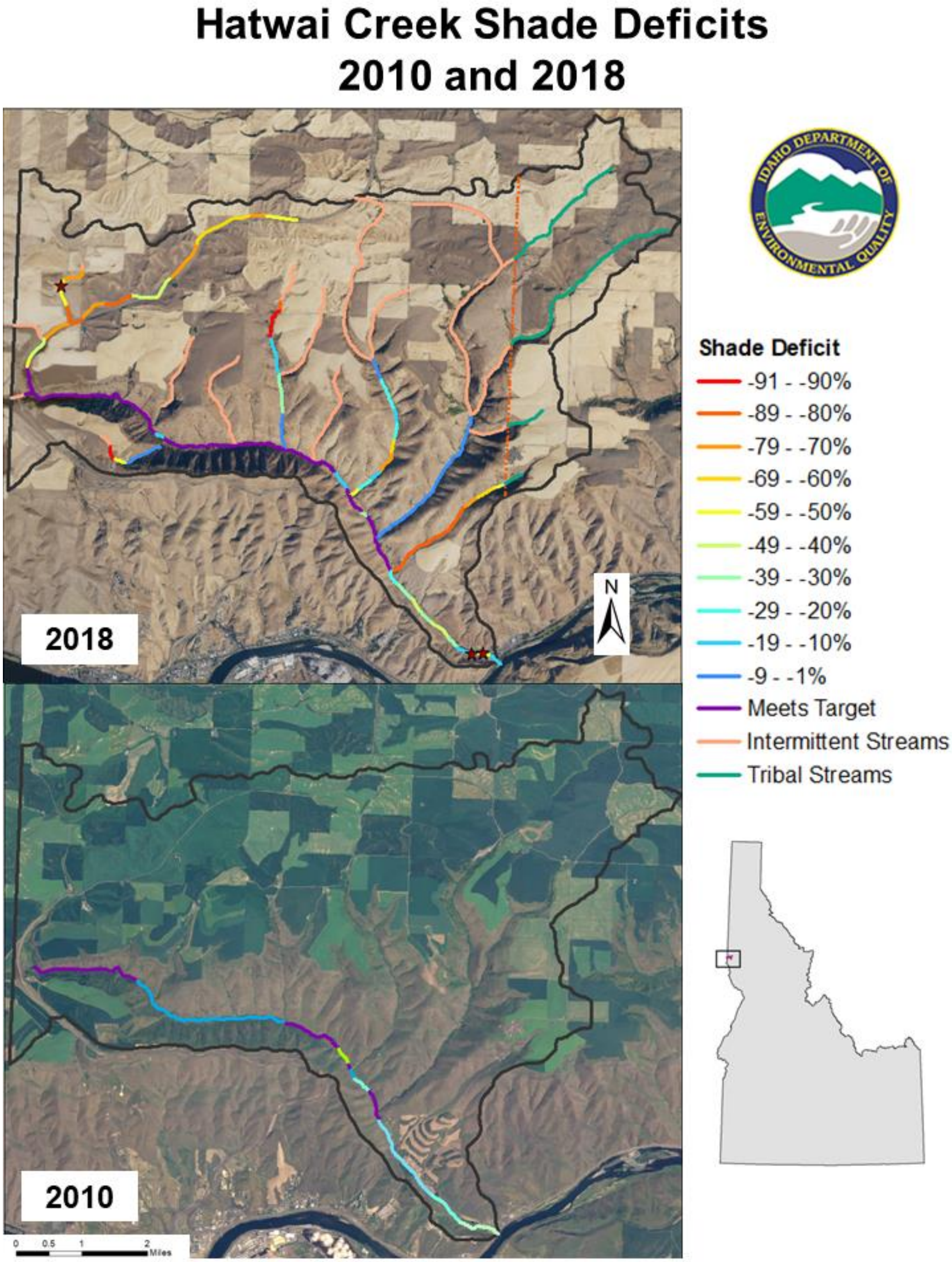

Figure C. Percent shade deficit estimated in the 2010 and 2018 temperature TMDLs. The 2010 TMDL used 2004 National Agriculture Imagery Program (NAIP) imagery and the 2018 TMDL used 2017 NAIP imagery.

Public Participation

This TMDL was developed with participation from the Hatwai Creek Watershed Advisory Group. The general public was able to comment on this draft document at public watershed advisory group meetings (Appendix F) and during the public comment period from May 13, 2019 to June 12, 2019.

Introduction

This document addresses two assessment units (AUs) in the Hatwai Creek watershed (Figure 1) in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2017). This temperature total maximum daily load (TMDL) characterizes and documents solar loads within the Hatwai Creek watershed. The first four sections of this document present key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up-to-date and accurate.

The watershed assessment is used to develop a temperature TMDL for the Hatwai Creek watershed. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant. Effective shade targets were established for two AUs based on the concept of maximum shading under potential natural vegetation (PNV) resulting in natural background temperatures.

Regulatory Requirements

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

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

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

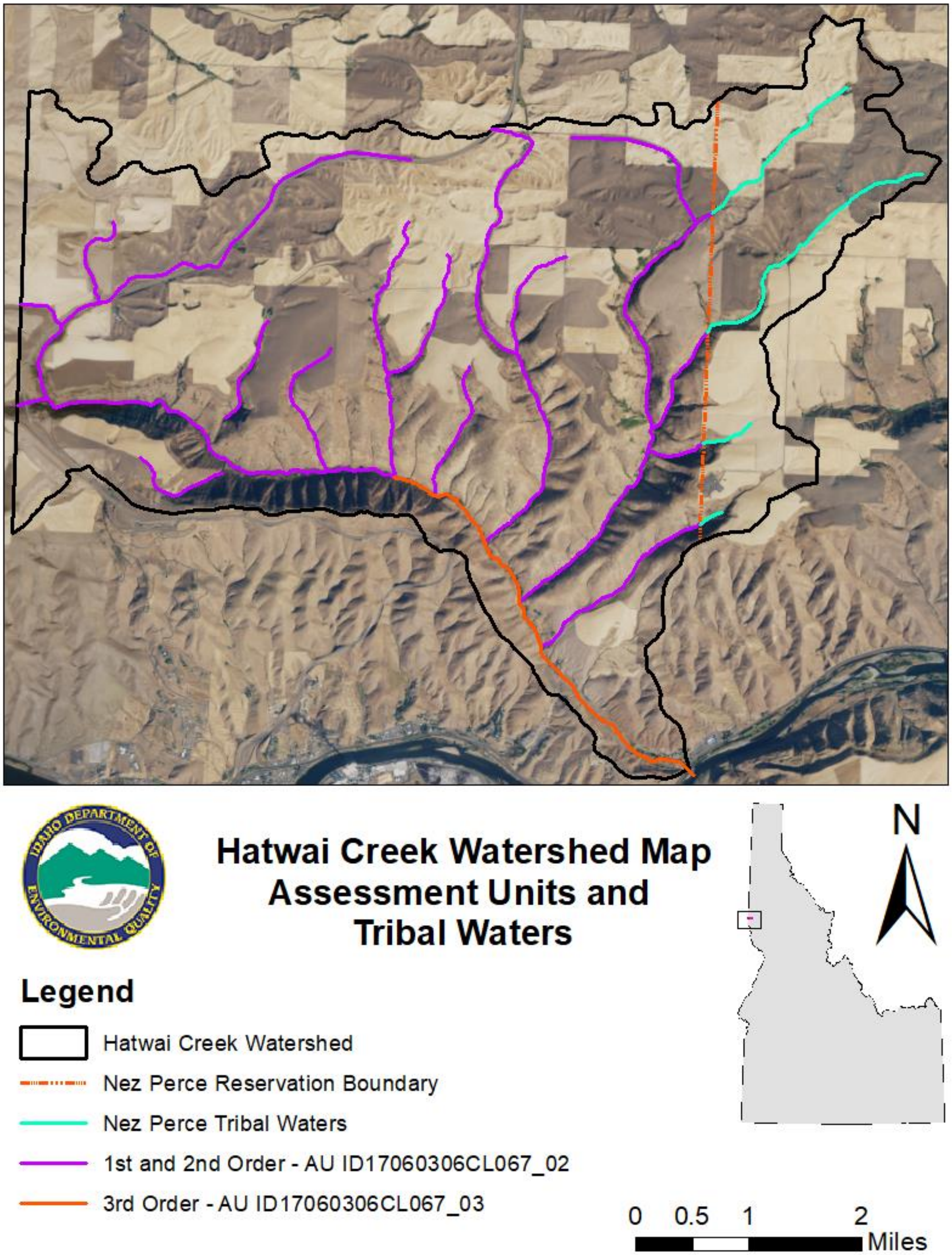

Figure 1. Hatwai Creek watershed and AUs.

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

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

1 Subbasin Characterization

The Hatwai Creek subbasin is a 32-square mile watershed located in Nez Perce County, Idaho. Hatwai Creek is a tributary of the Clearwater River (Figure 1). Its headwaters begin in the rolling cropland of the Palouse at an elevation of approximately 2,900 feet above mean sea level (MSL). Hatwai Creek tributaries flow through a steep canyon and ranchland where they converge and become a 3rd-order stream. At its mouth, Hatwai Creek flows through a culvert under US Highway 95 and converges with the Clearwater River at an elevation of 788 feet above MSL.

Land uses in the watershed include dryland agriculture, ranching, and rural residences. The watershed area is 66% agricultural land and less than 1% is covered by an impervious surface (USGS 2017). Anadromous Rainbow Trout (steelhead) spawn in Hatwai Creek (NPSWCD 2014; Joe DuPont, Idaho Department of Fish and Game [IDFG], personal communication August 28, 2018). The creek is also an important historical fishery for the Nez Perce Tribe. The eastern portion of the watershed lies within the Nez Perce Reservation boundary (Figure 1). For more information, see the *Hatwai Creek Subbasin Assessment and TMDLs* (DEQ 2010).

In 1989, the Idaho Department of Health and Welfare, Division of Environmental Quality, identified Hatwai Creek as impaired by nutrients, bacteria, temperature, and habitat modifications (IDHW 1989). In 1994, EPA placed Hatwai Creek on Idaho's §303(d) list, a biannual list of impaired state waters required by the CWA§303(d). Idaho's 1994 §303(d) list was created by EPA under a court order (EPA 1994). For waters identified a §303(d) list, states must develop TMDLs for each pollutant and submit TMDLs to EPA for approval. In 2010, DEQ developed Hatwai Creek TMDLs for four pollutants: nitrate plus nitrite nitrogen (NO_3+NO_2-N), total phosphorus (TP), bacteria (*Escherichia coli [E. coli]*), and stream temperature (DEQ 2010). EPA approved the Hatwai Creek TMDLs in 2010. The TMDLs were developed to restore and protect cold water aquatic life, salmonid spawning, and secondary contact recreation beneficial uses.

This document revises an existing temperature total maximum daily load (TMDL) for the two assessment units (AUs) in the Hatwai Creek watershed (Figure 1). Temperature TMDLs were developed for The 2010 TMDL did not address all perennial stream segments within the Hatwai

Creek watershed and developed solar energy loads only for the main stem of Hatwai Creek. This revised TMDL estimates solar energy loads for the main stem and perennial tributary segments, excluding those within the Nez Perce Reservation boundary (Figure 1 and Figure 2). In addition, the 2010 TMDL did not calculate solar energy loads separately for each Hatwai Creek AU; rather, it calculated loads for the Hatwai Creek main stem, including all of ID17060306CL067_03 and a portion of ID17060306CL067_02 (Figure 2). The revised TMDL estimates solar energy loads for each AU to be consistent with Idaho's Integrated Report. Finally, recent aerial imagery and field investigations suggest some changes are needed to stream riparian vegetation since the 2010 TMDL. Loads have been updated to reflect current stream vegetation and shade conditions. Both the 2010 TMDL and this TMDL use the most up-to-date PNV methodology (Shumar and de Varona 2009) to calculate solar energy loads.

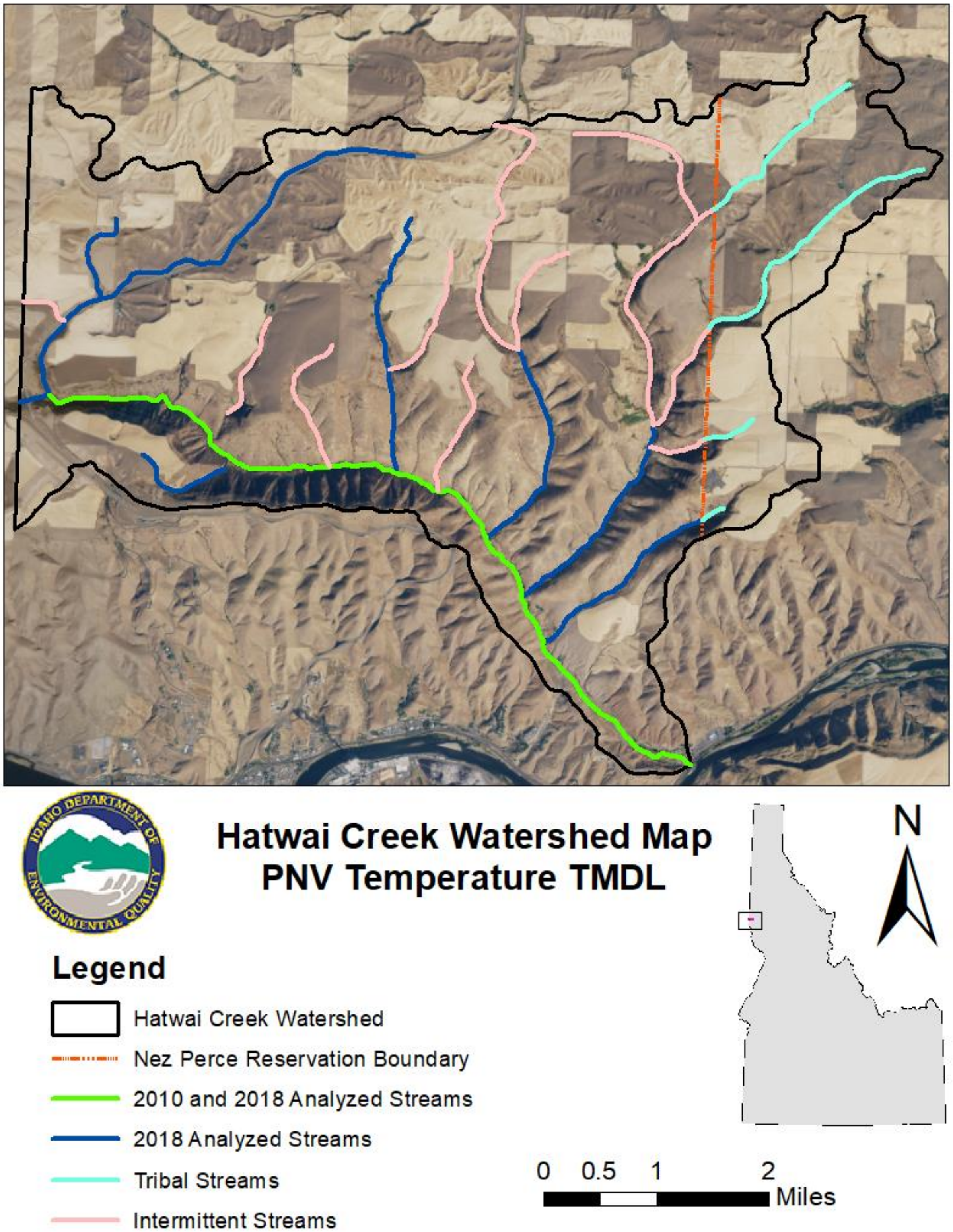

Figure 2. Hatwai Creek watershed. The 2018 analyzed streams are stream segments where new heat loads are presented in this document. The 2010 analyzed streams are stream segments addressed in the 2010 TMDL. Tribal stream segments were not analyzed in 2010 or 2018.

2 Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

2.1.1 Assessment Units

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

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

2.1.2 Listed Waters

Table 1 shows AU/pollutant combinations with an approved TMDL (i.e., AU/pollutant combinations in Category 4a of the Integrated Report).

Table 1. Hatwai Creek AU/pollutant combinations with an approved TMDL (in Integrated Report Category 4a).

Assessment Unit Name	Assessment Unit Number	Pollutants with an Approved TMDL
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	NO_3+NO_2-N,TP, temperature, and *E. coli*
Hatwai Creek—3rd order	ID17060306CL067_03	NO_3+NO_2-N, TP, temperature, and *E. coli*

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in Appendix A. The *Water Body Assessment Guidance* (WBAG) (DEQ 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

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

2.2.1 Beneficial Uses in the Subbasin

Beneficial uses in the Hatwai Creek watershed are provided in Table 2. DEQ presumes most waters in Idaho will support cold water aquatic life and primary or secondary contact recreation beneficial uses and therefore applies water quality criteria to protect cold water aquatic life and primary or secondary contact recreation in waters where uses are not designated (IDAPA 58.01.02.101.01). DEQ applies secondary contact recreation presumed use protection to both Hatwai Creek AUs. Secondary contact recreation activities are those where water immersion and ingestion are unlikely (wading and fishing). Primary contact recreation activities, those where immersion and ingestion are likely, such as swimming, have not been documented in Hatwai Creek and are unlikely considering Hatwai Creek is shallow. DEQ considers salmonid spawning to be an existing use in the main stem of Hatwai Creek (ID17060306CL067_03) but not in the tributaries (ID17060306CL067_02). Steelhead spawn in the main stem (NPSWCD 2014; Joe DuPont, personal communication, August 28, 2018). Steep canyon walls and slopes below ID17060306CL067_02 serve as a fish passage barrier (NPSWCD 2014), so DEQ does not consider salmonid spawning a beneficial use requiring protection in ID17060306CL067_02.

Table 2. Hatwai Creek beneficial uses.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses	Type of Use
Hatwai Creek—3rd order	ID17060306CL067_03	Cold water aquatic life	Presumed
		Salmonid spawning	Existing
		Secondary contact recreation	Presumed
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	Cold water aquatic life	Presumed
		Secondary contact recreation	Presumed

2.2.2 Water Quality Criteria to Support Beneficial Uses

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

Based on input from IDFG staff (Joe Dupont, IDFG, personal communication, August 28, 2018) and the *Geography* and *Timing of Salmonid Spawning in Idaho* (BioAnalysts 2014), DEQ applied salmonid spawning criteria from February 1 through August 15 in ID17060306CL067_03 (DEQ 2018).

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters when biological data are available, and is presented in detail in the *Water Body Assessment Guidance* (DEQ 2016). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations.

2.3 Summary and Analysis of Existing Water Quality Data

Data sources are provided in Appendix C. New temperature data were collected in 2018 at two locations in the Hatwai Creek watershed, one in a headwaters segment (ID17060306CL067_02) and one near the mouth (ID17060306CL067_03). Monitoring methods, locations, and results are described in detail in the *Hatwai Creek Surface Water Quality Monitoring Report: 2018* (DEQ 2018). Appendix B provides further discussion of water quality standards. DEQ reviewed Hatwai Creek nutrient and bacteria TMDLs in a separate document (DEQ 2019).

2.3.1 Stream Temperature Measurements

In ID17060306CL067_02, no temperature data were available prior to 2018. When the TMDL was developed, temperature impairment was assumed based on "visual evidence" of riparian vegetation "removed and replaced with agricultural crops, roads, and pasture lands" and stream banks "opened and the riparian canopy removed to an extent that excess heat load is reaching the stream" (DEQ 2010). From May–September 2018, DEQ deployed a temperature logger in a 1st-order headwaters stream segment in ID17060306CL067_02 and measured stream temperature at 15-minute intervals. Monitoring methods, results, and sample locations are described in detail in the *Hatwai Creek Surface Water Quality Monitoring Report: 2018* (DEQ 2018). Stream temperatures did not exceed Idaho's temperature criteria for protecting cold water aquatic life (19 ºC daily average, 22 ºC daily maximum, IDAPA 58.01.02.250.02b). Daily average and daily maximum temperatures ranged from 8.51–17.9 ºC and 9.58–21.5 ºC, respectively (Figure 3). Idaho's temperature criteria for protecting salmonid spawning do not apply within ID17060306CL067_02; steep slopes and canyon walls within the AU serve as a fish passage barrier (NPSWCD 2014). Measurements indicate applicable temperature criteria (cold water aquatic life criteria) are not exceeded in ID17060306CL067_02.

In ID17060306CL067_03, DEQ measured stream temperature at 15-minute intervals from March–September 2019. Duplicate temperature loggers were placed in the stream near the mouth of Hatwai Creek. Monitoring methods, results, and sample locations are described in detail in the *Hatwai Creek Surface Water Quality Monitoring Report: 2018* (DEQ 2018). Daily average and daily maximum temperatures ranged from 4.45–17.8 ºC and 4.51–22.2 ºC, respectively (Figure 4). The daily maximum criteria for protecting cold water aquatic life (22 ºC) was exceeded 1 day. Per Idaho's WBAG (DEQ 2016a), criteria exceedances that are "infrequent" (defined as <10% of measurements) and small (defined as conditions that avoid acute effects) do not constitute impairment. In this case, the daily maximum value was exceed only 1 day over a period of approximately 7 months, and the exceedance magnitude was small (0.2 ºC). DEQ does not consider this infrequent, small exceedance to constitute a temperature impairment of cold water aquatic life use. Stream temperatures did exceed criteria for protecting salmonid spawning use during most of the period salmonid spawning criteria were applied (February 1–August 15). Measurements confirm temperature still impairs salmonid spawning use in ID17060306CL067_03.

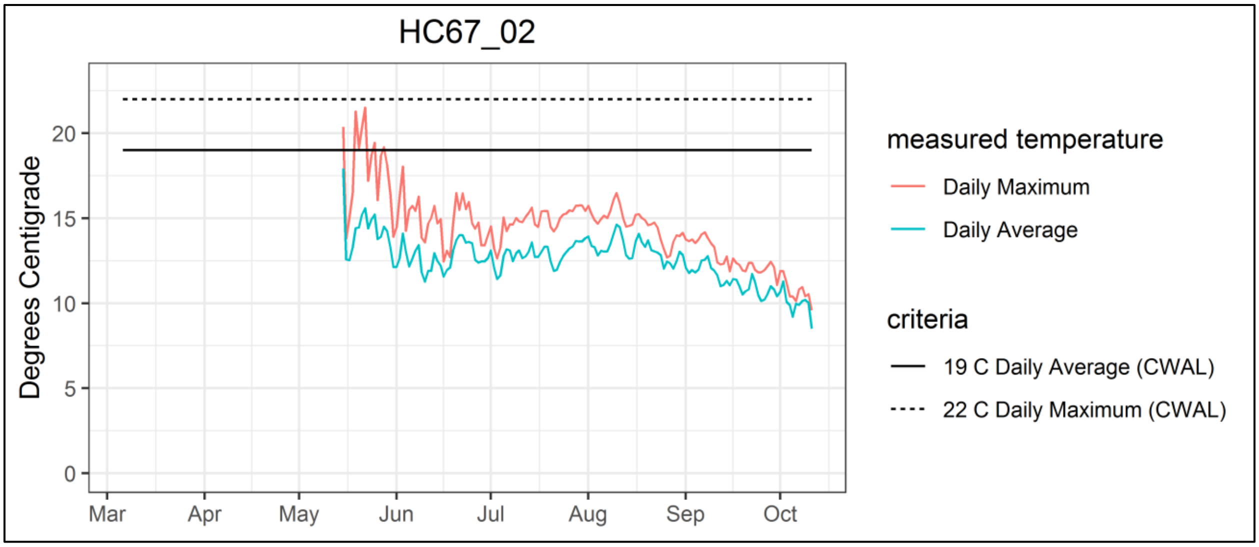

Figure 3. 2018 temperature logger results for Hatwai Creek headwaters stream segment ID17060306CL067_02. See DEQ (2018) for detailed location, methods, and results information.

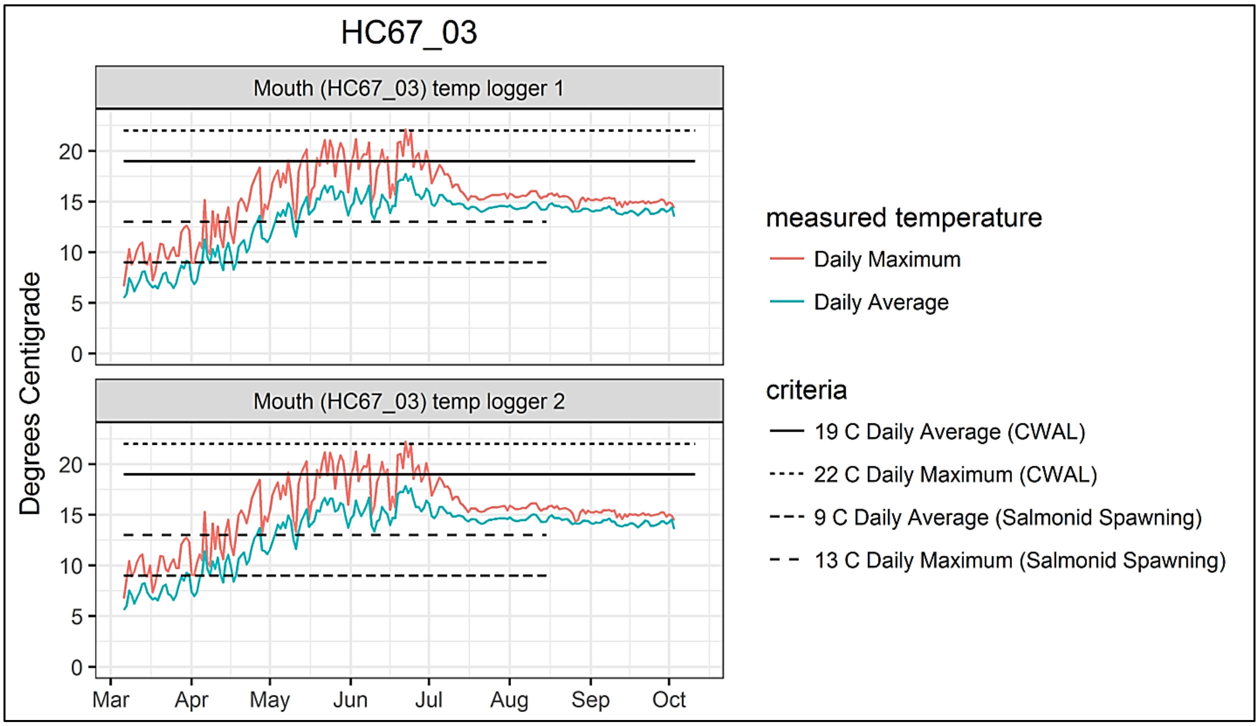

Figure 4. 2018 temperature logger results for Hatwai Creek main stem segment near mouth, ID17060306CL076_03. Duplicate temperature loggers were placed at the same location. See DEQ (2018) for detailed location, methods, and results information.

2.3.2 Potential Natural Vegetation Analysis

The 2010 TMDL analysis only included main stem segments. This 2018 analysis expands on that effort and includes all tributary streams in AUs with previously developed TMDLs (Figure 2). Ephemeral and intermittent stream segments identified using the National Hydrography Dataset were not analyzed because they were assumed to not contribute substantially to the daily solar

load of the impaired AUs within the Hatwai Creek subbasin. Likewise, stream segments within the Nez Perce Reservation were not analyzed as they are not within DEQ's jurisdiction. Based on a request from Indian tribes in Idaho, DEQ does not develop TMDLs for waters within reservation boundaries (DEQ 2017).

The 2010 Hatwai Creek analysis found that 6.4 of the 7.5 stream miles analyzed had a shade deficit. The average lack of shade was estimated at 10.6%, resulting in an excess solar load of 48,048 kWh/day (DEQ 2010). Analysis completed in 2018 was conducted on 21.6 stream miles and found an average lack of shade of 5% resulting in an excess solar load of 66,000 kWh/day for 2nd-order segments and 28,000 kWh/day for 3rd-order segments. Figure 5 shows a comparison between analysis years (section 5.4). Table 3 provides the Beneficial Use Reconnaissance Program (BURP) data related to the cold water aquatic beneficial use support collected for this review.

Table 3. BURP data for Hatwai Creek.

BURP Assessment Year	Assessment Unit Name	Assessment Unit Number	SMI	SFI	SHI	Average	Current Integrated Report Category
1996	Hatwai Creek—3rd order	ID17060306CL067_03	1	1	3	1.67	
1998	Hatwai Creek—3rd order	ID17060306CL067_03	1	2	2	1.67	4a, 4c —
2017	Hatwai Creek—3rd order	ID17060306CL067_03	3	3	3	3	

Notes: SFI = stream fish index; SHI = stream habitat index; SMI = stream macroinvertebrate index;.SMI, SFI, and SHI values were calculated using protocols detailed in Idaho Water Body Assessment Guidance (WBAG) 2nd edition (Grafe et al. 2002) for 1996 and 1998 data, and using WBAG 3rd edition (DEQ 2016) for 2017 data.

2.3.3 Assessment Unit Summary

A summary of the data analysis, field investigations, and a list of conclusions for AUs included in Category 4a of the Integrated Report (DEQ 2017) follows. This section includes changes that will be documented in the next Integrated Report once the TMDLs in this document have been approved by EPA.

Assessment Units Addressed in TMDLs

ID17060306CL067_02, Hatwai Creek—1st and 2nd order

- In Category 4a of Idaho's most recent Integrated Report for NO_3+NO_2-N, TP, temperature, and *E. coli*.
- Temperature data collected in 2018 found no exceedances of temperature criteria for protecting cold water aquatic life.
- Salmonid spawning temperature criteria do not apply to this AU.
- DEQ proposes retaining this AU in Category 4a, and collecting additional temperature logger data in 2019 at sites where DEQ has now gained property access through the WAG process. DEQ will reevaluate if cold water aquatic life temperature criteria are exceeded after collecting additional data. If data still show no temperature impairment

DEQ will propose to delist temperature as a cause of impairment in this AU in Idaho's next Integrated Report.

- Analysis demonstrates that shade conditions under PNV are not met.

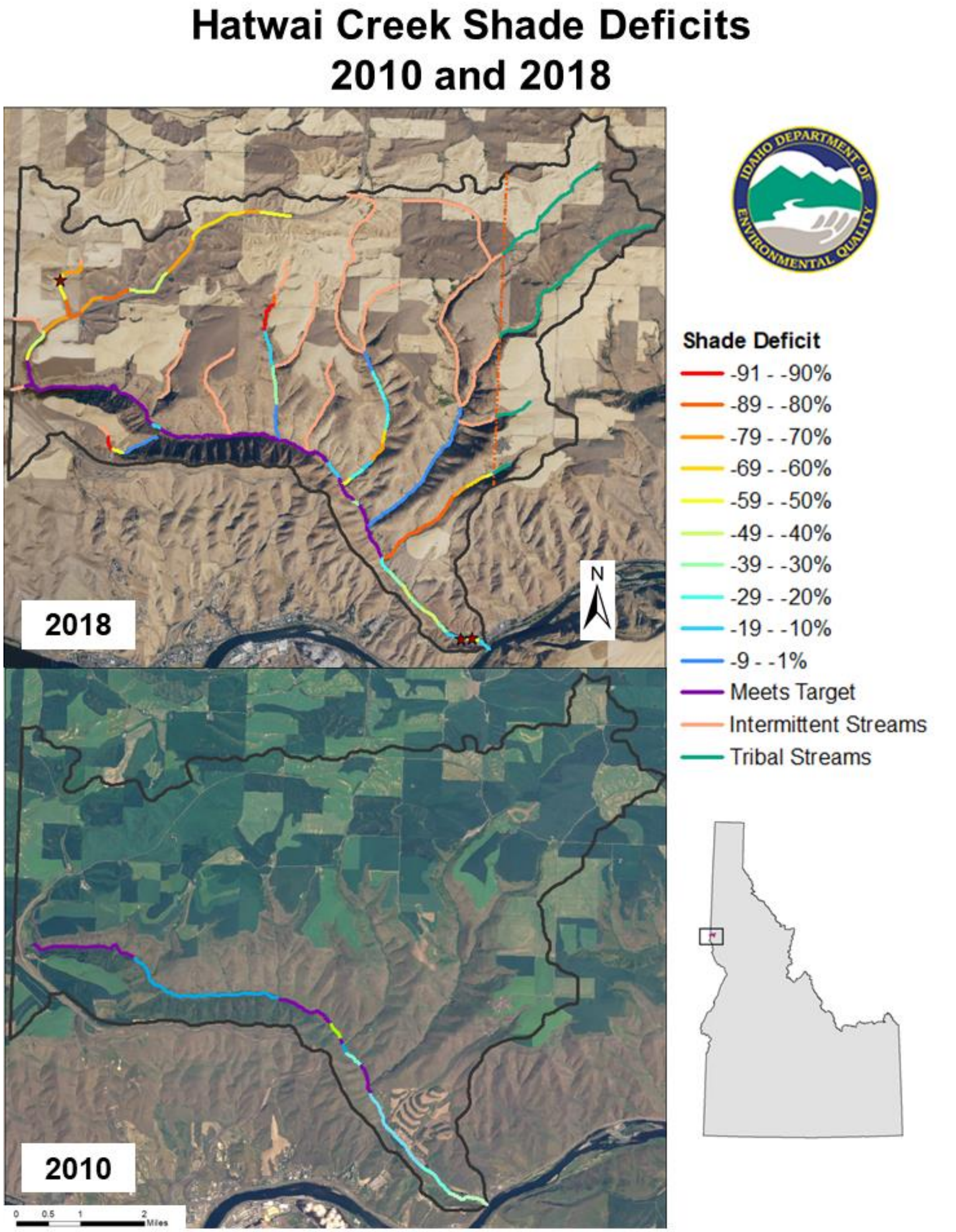

Figure 5. Percent shade deficit estimated in the 2010 and 2018 temperature TMDLs. The 2010 TMDL used 2004 National Agriculture Imagery Program (NAIP) imagery and the 2018 TMDL used 2017 NAIP imagery.

ID17060306CL067_03, Hatwai Creek—3rd order

- In Category 4a of Idaho's most recent Integrated Report for NO_3+NO_2-N, TP, temperature, and *E. coli*.
- Temperature data collected in 2018 found sustained exceedance of temperature criteria for protecting salmonid spawning.
- Analysis demonstrates that shade conditions under PNV are not met and a load allocation is set in section 5.

3 Pollutant Source Inventory

Pollution within the Hatwai Creek watershed is primarily from bacteria, nutrients, and temperature. Load allocations were established and approved by EPA in the Hatwai Creek TMDLs (DEQ 2010).

3.1 Point Sources

No known point sources exist in the Hatwai Creek watershed. Industrial warehouses are located on both banks at the mouth of the stream, but no direct piping from either warehouse enters the creek.

3.2 Nonpoint Sources

Nonpoint sources within the Hatwai Creek watershed include agriculture, grazing, roads and septic systems. Large tracts of the watershed's grass lands have been converted to dry land (nonirrigated) agriculture. The Hatwai Creek watershed consists of 19,785 acres of cropland (56%), rangeland (31.5%), pasture/hayland (5%), riparian areas (2.5%), roads (2%), forestland (1%), mining (1%), and farms and suburban areas (1%). The majority of the acreage is privately owned, with industrial warehousing located on both banks at the mouth.

This TMDL is based on PNV-style riparian shade calculations, which are equivalent to background load, in an effort to achieve background conditions. To reach this objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Load allocations are stream-segment specific and depend on the target load for a given segment. This target load (i.e., load capacity) is necessary to achieve background conditions. Further shade cannot be removed from the stream by any activity without exceeding its load capacity. This TMDL depends on background conditions for achieving water quality standards, so all tributaries to the waters examined must reflect natural conditions to prevent excess heat loads to the stream.

4 Summary of Past and Present Pollution Control Efforts and Monitoring

Section 4 of the *Hatwai Creek Subbasin TMDL Five-Year Review* (DEQ 2019) describes watershed implementation plans and activities.

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

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

Where:

LC = load capacity; target solar load (kWh/day)
MOS = margin of safety; implicit in the PNV method, no separate allowance identified.
NB = natural background; existing solar load (kWh/day)
LA = load allocation; stream segment dependent based on existing and target solar loads.
WLA = wasteload allocation; no point sources in watershed, no separate allowance identified.

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

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

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant load in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate

predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Instream Water Quality Targets

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

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

5.1.1 Factors Controlling Water Temperature in Streams

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

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

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

5.1.2 Potential Natural Vegetation for Temperature TMDLs

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

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

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

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

5.1.2.1 Existing Shade Estimates

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

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

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at three sites (Table 4). The Solar Pathfinder is a device that traces the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a stream segment, 20 traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Twenty traces were taken following the manufacturer's instructions (i.e., orient to south and level). Systematic sampling was used because it is easiest to accomplish without biasing the sampling location. For each sampled segment, the sampler started at a unique location, such as 25 to 50 meters (m) from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 25 m, 25 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances.

When possible, the sampler also measured bankfull widths, took notes, and photographed the landscape of the stream at several unique locations while taking traces. Special attention was given to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) were present. Densiometer readings can also be taken at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream. Solar Pathfinder results demonstrate that aerial interpretation was correct at one of the three verification sites and was within one shade class at the other two sites.

Table 4. Solar Pathfinder field verification results for the Hatwai Creek watershed.

Solar Pathfinder Site	Assessment Unit Number	Aerial Classification	Solar Pathfinder Measurement	Solar Pathfinder Classification	Classification Difference[a]
Hatwai Creek	ID17060306CL067_02	40	54	50	-1
Hatwai Creek—downstream	ID17060306CL067_03	40	49	40	0
Hatwai Creek—wooded	ID17060306CL067_03	80	72	70	1

[a].mean = 0, standard deviation = 1.0, confidence level (95%) = 2.5.

Solar Pathfinder results demonstrate that aerial interpretation was correct at one of the three verification sites and was within one shade class at the other two sites.

5.1.2.2 Target Shade Determination

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

Natural Bankfull Widths

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

Since existing bankfull width may not be discernible from aerial photo interpretation and may not reflect natural bankfull widths, this parameter must be estimated from available information. We used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bankfull width (Shumar and de Varona 2009).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Clearwater curve shown in Figure 6. Although estimates from other curves were examined (i.e., Upper Snake, Payette/Weiser) the Clearwater curve was chosen because the Hatwai Creek watershed is located within the Clearwater River subbasin. Existing width data should also be evaluated and compared to these curve estimates if such data are available. However, for the Hatwai watershed, only a few BURP sites exist, and bankfull width data from those sites represent only spot data (e.g., only three measured widths in a reach just several hundred meters long) that are not always representative of the stream as a whole.

We found the bankfull widths determined using the Clearwater basin regional curve to generally be overestimates of the actual bankfull widths observed at BURP assessment locations, although there is good agreement at location 1996SLEWB024 (Table 5). Given the lack of physical width measurements, and to preserve an implicit MOS for solar load estimates (section 5.4.2), we chose not to make natural widths any different from these Clearwater basin estimates. Hatwai Creek may differ morphologically from other watershed in the Clearwater basin due to different underlying geology and land use characteristics surrounding the watershed. In some locations in the headwaters and near the mouth, the creek is channelized due to rip rap, adjacent development, or agricultural modifications, which may prevent widening and cause bankfull

widths to differ from other watersheds used to develop the Clearwater basin regional curve (Figure 6).

Natural bankfull width estimates for each stream in this analysis are presented in Table 5. The load analysis tables contain a natural bankfull width and an existing bankfull width for every stream segment in the analysis based on the bankfull width results presented in Table 5. Existing widths and natural widths are the same in load tables when there are no data to support making them differ.

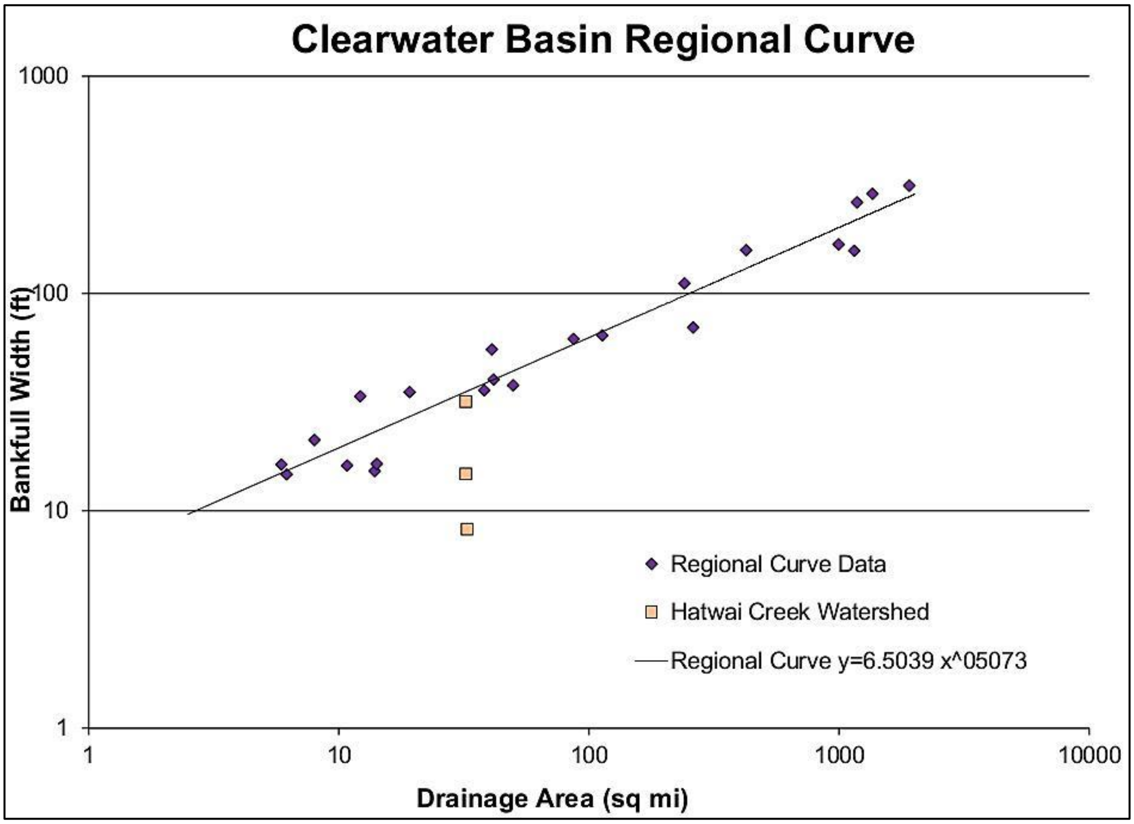

Figure 6. Bankfull width in the Clearwater basin as a function of drainage area.

Table 5. Bankfull width estimates for three locations within the Hatwai Creek watershed.

Location	Drainage Area[a] (mi^2)	Clearwater Basin Regional Curve Bankfull Width Estimate (ft)	Field Measurement (ft)
Hatwai Creek 2017SLEWA019	32.6	35.5	8.2
Hatwai Creek 1996SLEWB024	32.2	35.2	31.7
Hatwai Creek 1998SLEWB002	32.2	35.2	14.8

a. Estimated using USGS StreamStats delineation tool.

5.1.3 Design Conditions

The natural vegetation of the Hatwai Creek watershed is discussed in the Hatwai Creek TMDLs (DEQ 2010). Analysis in 2010 divided the watershed into three general riparian vegetation types:

Warm Dry Breaklands, Black Hawthorn, and *Black Cottonwood*. Analysis conducted in 2018 for this TMDL partitioned the watershed into four broad riparian vegetation types:

1. Warm Dry Breaklands—park-like stands of tall Ponderosa with an understory of ninebark, chokecherry and rose, found on the south facing break-lands of the subwatershed
2. Mountain Alder—dense growing thickets mixed with shrubs like Dogwood and Serviceberry, once found on midelevation prairie segments
3. Breaklands/Mountain Alder—mixed community of Breakland and Mountain Alder vegetation types and zones where Breaklands vegetation transitions to Mountain Alder
4. Black Cottonwood—tall cottonwoods dominating an understory of deciduous shrubs, found in the bottomlands of the subwatershed

After identifying the riparian vegetation community during the 2018 Solar Pathfinder field verification, the Black Hawthorn vegetation type used in the 2010 analysis was replaced with Mountain Alder to more accurately characterize riparian vegetation.

5.1.4 Shade Curve Selection

To determine PNV shade targets for Hatwai Creek, effective shade curves from the Clearwater basin region were examined (Table 6) (Shumar and de Varona 2009). These curves were produced using vegetation community modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For Hatwai Creek, curves for the most similar vegetation type were selected for shade target determinations.

Tributaries and lower elevation main stem segments of Hatwai Creek occur primarily in deciduous tree and shrub riparian cover. Upper segments of the main stem are dominated by a mixed vegetation community of conifer trees and deciduous trees and shrubs. We use Mountain Alder, Warm Dry Breaklands, and a mixture of the two vegetation types in the mid to higher elevations. At lower elevations on Hatwai Creek main stem near the mouth, Black Cottonwood vegetation type is used.

Table 6. Shade curves used for target selection based on PNV types in analysis.

Clearwater National Forest Type	Nonforest and Transitional Types
Warm Dry Breaklands	Mountain Alder (*Alnus tenufolia*)
	Black Cottonwood (*Populus trichocarpa*)
	Breaklands/Mountain Alder

5.2 Load Capacity

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

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

Table 7, Table 8, and Figure 7 provide the PNV shade targets. The tables provide corresponding target summer loads (in kilowatt-hours per square meter per day [kWh/m^2/day] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segments' channel widths, which typically only have one or two significant figures, dictate the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce apparent rounding errors.

The AU with the largest target load (i.e., load capacity) was 3rd-order Hatwai Creek (ID17060306CL067_03) with 95,000 kWh/day (Table 7). The smallest target load was in 2nd-order Hatwai Creek (ID17060306CL067_02) with 64,000 kWh/day (Table 8).

5.3 Estimates of Existing Pollutant Loads

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

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. There are currently no permitted point sources in the affected AUs. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather station. Existing shade in the Hatwai Creek watershed is shown in Figure 8, and existing shade data are presented in Table 7 and Table 8. Like load capacities (target loads), existing loads in Table 7 and Table 8 are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade) to be discussed next in the load allocation section and as depicted in the lack-of-shade figure (Figure 9).

The AU with the largest existing load was 2nd-order Hatwai Creek (ID17060306CL067_02) with 130,000 kWh/day (Table 8). The smallest existing load was in 3rd-order Hatwai Creek (ID17060306CL067_03) with 120,000 kWh/day (Table 7).

Table 7. Existing and target solar loads for 3rd-order Hatwai Creek (ID17060306CL067_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
067_03	Hatwai Creek	21	450	Breakland	71%	1.77	5	2,000	4,000	90%	0.61	5	2,000	1,000	(3,000)	19%
067_03	Hatwai Creek	22	221	Breakland	71%	1.77	5	1,000	2,000	80%	1.22	5	1,000	1,000	(1,000)	9%
067_03	Hatwai Creek	23	481	Breakland/Alder	52%	2.93	5	2,000	6,000	80%	1.22	5	2,000	2,000	(4,000)	28%
067_03	Hatwai Creek	24	443	Alder	50%	3.05	5	2,000	6,000	40%	3.66	5	2,000	7,000	1,000	-10%
067_03	Hatwai Creek	25	136	Alder	50%	3.05	5	700	2,000	70%	1.83	5	700	1,000	(1,000)	20%
067_03	Hatwai Creek	26	150	Alder	50%	3.05	5	800	2,000	70%	1.83	5	800	1,000	(1,000)	20%
067_03	Hatwai Creek	27	255	Alder	50%	3.05	5	1,000	3,000	60%	2.44	5	1,000	2,000	(1,000)	10%
067_03	Hatwai Creek	28	148	Alder	50%	3.05	5	700	2,000	20%	4.88	5	700	3,000	1,000	-30%
067_03	Hatwai Creek	29	499	Alder	50%	3.05	5	2,000	6,000	80%	1.22	5	2,000	2,000	(4,000)	30%
067_03	Hatwai Creek	30	165	Alder	50%	3.05	5	800	2,000	70%	1.83	5	800	1,000	(1,000)	20%
067_03	Hatwai Creek	31	578	Alder	50%	3.05	5	3,000	9,000	50%	3.05	5	3,000	9,000	0	0%
067_03	Hatwai Creek	32	284	Alder	43%	3.48	6	2,000	7,000	20%	4.88	6	2,000	10,000	3,000	-23%
067_03	Hatwai Creek	33	443	Alder	43%	3.48	6	3,000	10,000	10%	5.49	6	3,000	20,000	10,000	-33%
067_03	Hatwai Creek	34	317	Alder	43%	3.48	6	2,000	7,000	0%	6.10	6	2,000	10,000	3,000	-43%
067_03	Hatwai Creek	35	275	Alder	43%	3.48	6	2,000	7,000	10%	5.49	6	2,000	10,000	3,000	-33%
067_03	Hatwai Creek	36	459	Alder	43%	3.48	6	3,000	10,000	0%	6.10	6	3,000	20,000	10,000	-43%
067_03	Hatwai Creek	37	283	Alder	43%	3.48	6	2,000	7,000	10%	5.49	6	2,000	10,000	3,000	-33%
067_03	Hatwai Creek	38	455	Cottonwood	92%	0.49	6	3,000	1,000	80%	1.22	6	3,000	4,000	3,000	-12%
067_03	Hatwai Creek	39	286	Cottonwood	92%	0.49	6	2,000	1,000	40%	3.66	6	2,000	7,000	6,000	-52%
067_03	Hatwai Creek	40	268	Cottonwood	92%	0.49	6	2,000	1,000	80%	1.22	6	2,000	2,000	1,000	-12%
							Totals		95,000					120,000	28,000	

Table 8. Existing and target solar loads for 2nd-order Hatwai Creek (ID17060306CL067_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
067_02	Hatwai Creek	1	610	Breakland/Alder	91%	0.55	1	600	300	40%	3.66	1	600	2,000	2,000	0%
067_02	Hatwai Creek	2	335	Breakland/Alder	91%	0.55	1	300	200	20%	4.88	1	300	1,000	800	-71%
067_02	Hatwai Creek	3	1263	Breakland/Alder	91%	0.55	1	1,000	500	30%	4.27	1	1,000	4,000	4,000	-61%
067_02	Hatwai Creek	4	858	Breakland/Alder	91%	0.55	1	900	500	20%	4.88	1	900	4,000	4,000	-71%
067_02	Hatwai Creek	5	991	Breakland/Alder	87%	0.79	2	2,000	2,000	40%	3.66	2	2,000	7,000	5,000	-47%
067_02	Hatwai Creek	6	533	Breakland/Alder	87%	0.79	2	1,000	800	0%	6.10	2	1,000	6,000	5,000	-87%
067_02	Hatwai Creek	7	599	Breakland/Alder	87%	0.79	2	1,000	800	10%	5.49	2	1,000	5,000	4,000	-77%
067_02	Hatwai Creek	8	243	Breakland/Alder	87%	0.79	2	500	400	0%	6.10	2	500	3,000	3,000	-87%
067_02	Hatwai Creek	9	618	Breakland/Alder	74%	1.59	3	2,000	3,000	0%	6.10	3	2,000	10,000	7,000	-74%
067_02	Hatwai Creek	10	507	Breakland/Alder	74%	1.59	3	2,000	3,000	30%	4.27	3	2,000	9,000	6,000	-44%
067_02	Hatwai Creek	11	167	Breakland/Alder	74%	1.59	3	500	800	20%	4.88	3	500	2,000	1,000	-54%
067_02	Hatwai Creek	12	537	Breakland/Alder	74%	1.59	3	2,000	3,000	90%	0.61	3	2,000	1,000	(2,000)	16%
067_02	Hatwai Creek	13	1908	Breakland	79%	1.28	4	8,000	10,000	90%	0.61	4	8,000	5,000	(5,000)	11%
067_02	Hatwai Creek	14	1025	Breakland	79%	1.28	4	4,000	5,000	90%	0.61	4	4,000	2,000	(3,000)	11%
067_02	Hatwai Creek	15	156	Breakland	79%	1.28	4	600	800	60%	2.44	4	600	1,000	200	-19%
067_02	Hatwai Creek	16	1126	Breakland	79%	1.28	4	5,000	6,000	80%	1.22	4	5,000	6,000	0	1%
067_02	Hatwai Creek	17	412	Breakland	79%	1.28	4	2,000	3,000	90%	0.61	4	2,000	1,000	(2,000)	11%
067_02	Hatwai Creek	18	554	Breakland	79%	1.28	4	2,000	3,000	90%	0.61	4	2,000	1,000	(2,000)	11%
067_02	Hatwai Creek	19	261	Breakland	79%	1.28	4	1,000	1,000	80%	1.22	4	1,000	1,000	0	1%
067_02	Hatwai Creek	20	191	Breakland	79%	1.28	4	800	1,000	90%	0.61	4	800	500	(500)	11%
067_02	Hatwai Creek_Trib 01	1	443	Breakland/Alder	91%	0.55	1	400	200	20%	4.88	1	400	2,000	2,000	-71%
067_02	Hatwai Creek_Trib 01	2	581	Breakland/Alder	91%	0.55	1	600	300	40%	3.66	1	600	2,000	2,000	-51%
067_02	Hatwai Creek_Trib 01	3	349	Breakland/Alder	91%	0.55	1	300	200	10%	5.49	1	300	2,000	2,000	-81%
067_02	Hatwai Creek_Trib 02	1	170	Breakland	87%	0.79	2	300	200	90%	0.61	2	300	200	0	3%
067_02	Hatwai Creek_Trib 03	1	289	Breakland/Alder	91%	0.55	1	300	200	0%	6.10	1	300	2,000	2,000	-91%
067_02	Hatwai Creek_Trib 03	2	210	Breakland/Alder	91%	0.55	1	200	100	40%	3.66	1	200	700	600	-51%
067_02	Hatwai Creek_Trib 03	3	772	Breakland	95%	0.31	1	800	200	90%	0.61	1	800	500	300	-5%
067_02	Hatwai Creek_Trib 04	1	201	Alder	91%	0.55	1	200	100	10%	5.49	1	200	1,000	900	-81%
067_02	Hatwai Creek_Trib 04	2	587	Alder	91%	0.55	1	600	300	0%	6.10	1	600	4,000	4,000	-91%
067_02	Hatwai Creek_Trib 04	3	787	Alder	91%	0.55	1	800	400	80%	1.22	1	800	1,000	600	-11%
067_02	Hatwai Creek_Trib 04	4	752	Alder	91%	0.55	1	800	400	60%	2.44	1	800	2,000	2,000	-31%
067_02	Hatwai Creek_Trib 04	5	756	Alder	91%	0.55	1	800	400	90%	0.61	1	800	500	100	-1%

Table 8 (continued). Existing and target solar loads for 2nd-order Hatwai Creek ID17060306CL067_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
067_02	Hatwai Creek_Trib 05	1	435	Alder	91%	0.55	1	400	200	90%	0.61	1	400	200	0	-1%
067_02	Hatwai Creek_Trib 05	2	638	Alder	91%	0.55	1	600	300	70%	1.83	1	600	1,000	700	-21%
067_02	Hatwai Creek_Trib 05	3	283	Alder	91%	0.55	1	300	200	80%	1.22	1	300	400	200	-11%
067_02	Hatwai Creek_Trib 05	4	340	Alder	91%	0.55	1	300	200	70%	1.83	1	300	500	300	-21%
067_02	Hatwai Creek_Trib 05	5	270	Alder	86%	0.85	2	500	400	20%	4.88	2	500	2,000	2,000	-66%
067_02	Hatwai Creek_Trib 05	6	447	Alder	86%	0.85	2	900	800	10%	5.49	2	900	5,000	4,000	-76%
067_02	Hatwai Creek_Trib 05	7	217	Alder	86%	0.85	2	400	300	70%	1.83	2	400	700	400	-16%
067_02	Hatwai Creek_Trib 05	8	357	Alder	86%	0.85	2	700	600	60%	2.44	2	700	2,000	1,000	-26%
067_02	Hatwai Creek_Trib 05	9	195	Alder	86%	0.85	2	400	300	30%	4.27	2	400	2,000	2,000	-56%
067_02	Hatwai Creek_Trib 06	1	90	Alder	91%	0.55	1	90	50	60%	2.44	1	90	200	200	-31%
067_02	Hatwai Creek_Trib 06	2	172	Alder	91%	0.55	1	200	100	40%	3.66	1	200	700	600	-51%
067_02	Hatwai Creek_Trib 06	3	339	Alder	91%	0.55	1	300	200	30%	4.27	1	300	1,000	800	-61%
067_02	Hatwai Creek_Trib 06	4	323	Alder	91%	0.55	1	300	200	20%	4.88	1	300	1,000	800	-71%
067_02	Hatwai Creek_Trib 06	5	2016	Alder	91%	0.55	1	2,000	1,000	10%	5.49	1	2,000	10,000	9,000	-81%
067_02	McGuire Creek	1	344	Alder	91%	0.55	1	300	200	90%	0.61	1	300	200	0	-1%
067_02	McGuire Creek	2	1197	Alder	86%	0.85	2	2,000	2,000	80%	1.22	2	2,000	2,000	0	-6%
067_02	McGuire Creek	3	1743	Alder	72%	1.71	3	5,000	9,000	70%	1.83	3	5,000	9,000	0	-2%
							Totals		64,000					130,000	66,000	

Note: All assessment unit (AU) numbers start with ID17060306CL in all load tables (Table 7 and Table 8). Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

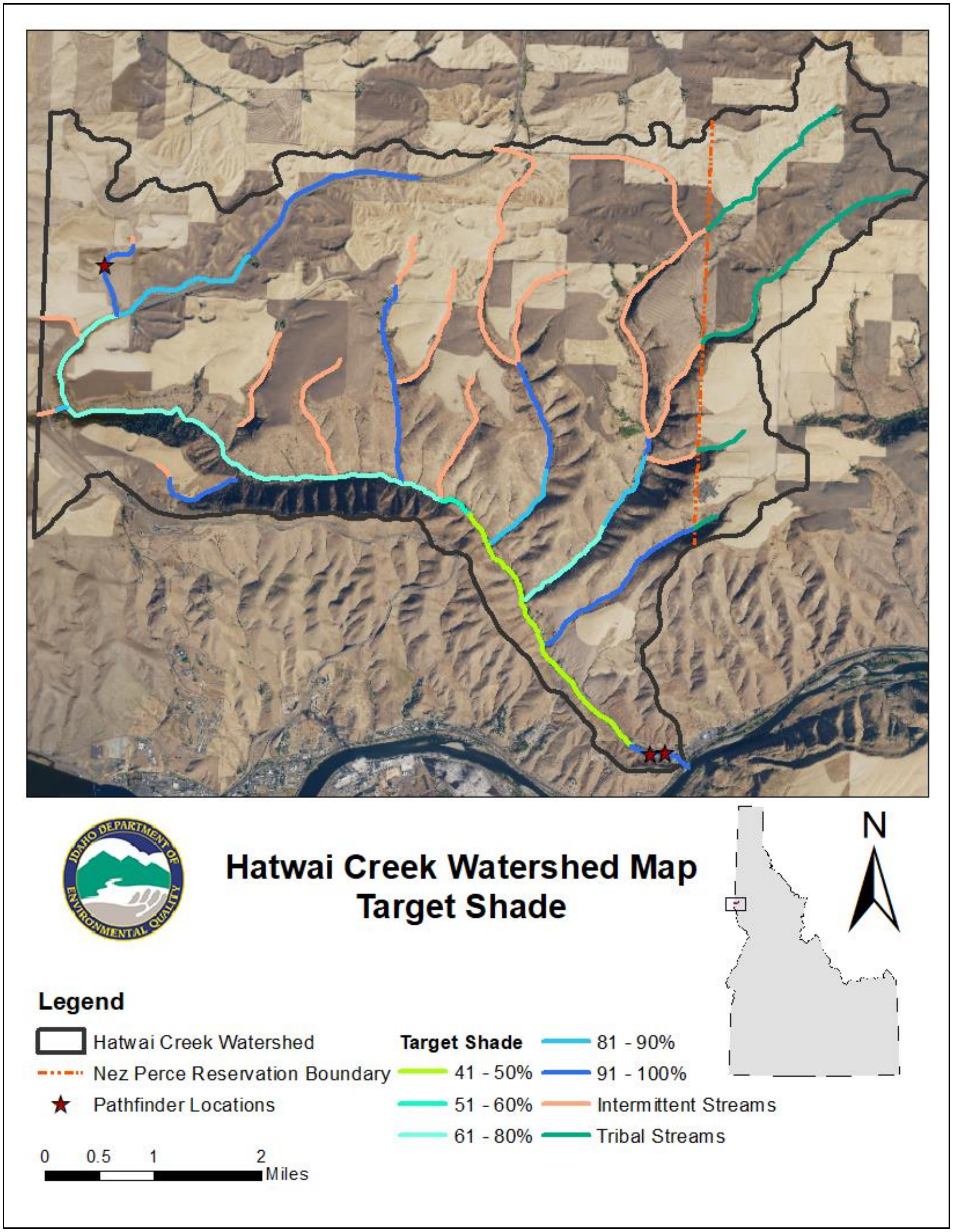

Figure 7. Target shade for Hatwai Creek watershed. Target shade was not estimated for intermittent or tribal waters.

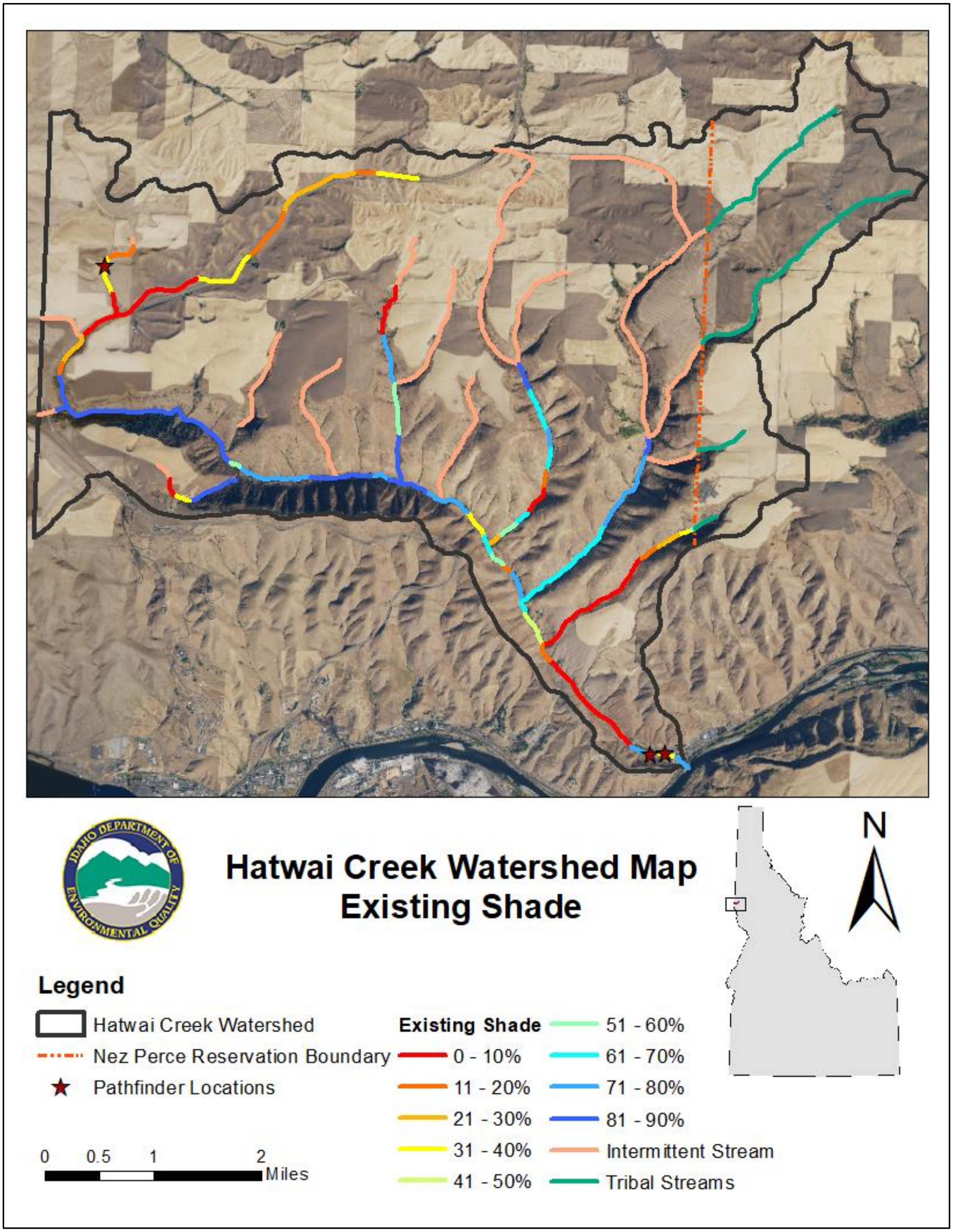

Figure 8. Existing shade estimated for Hatwai Creek watershed by aerial photo interpretation. Existing shade was not estimated for intermittent or tribal waters.

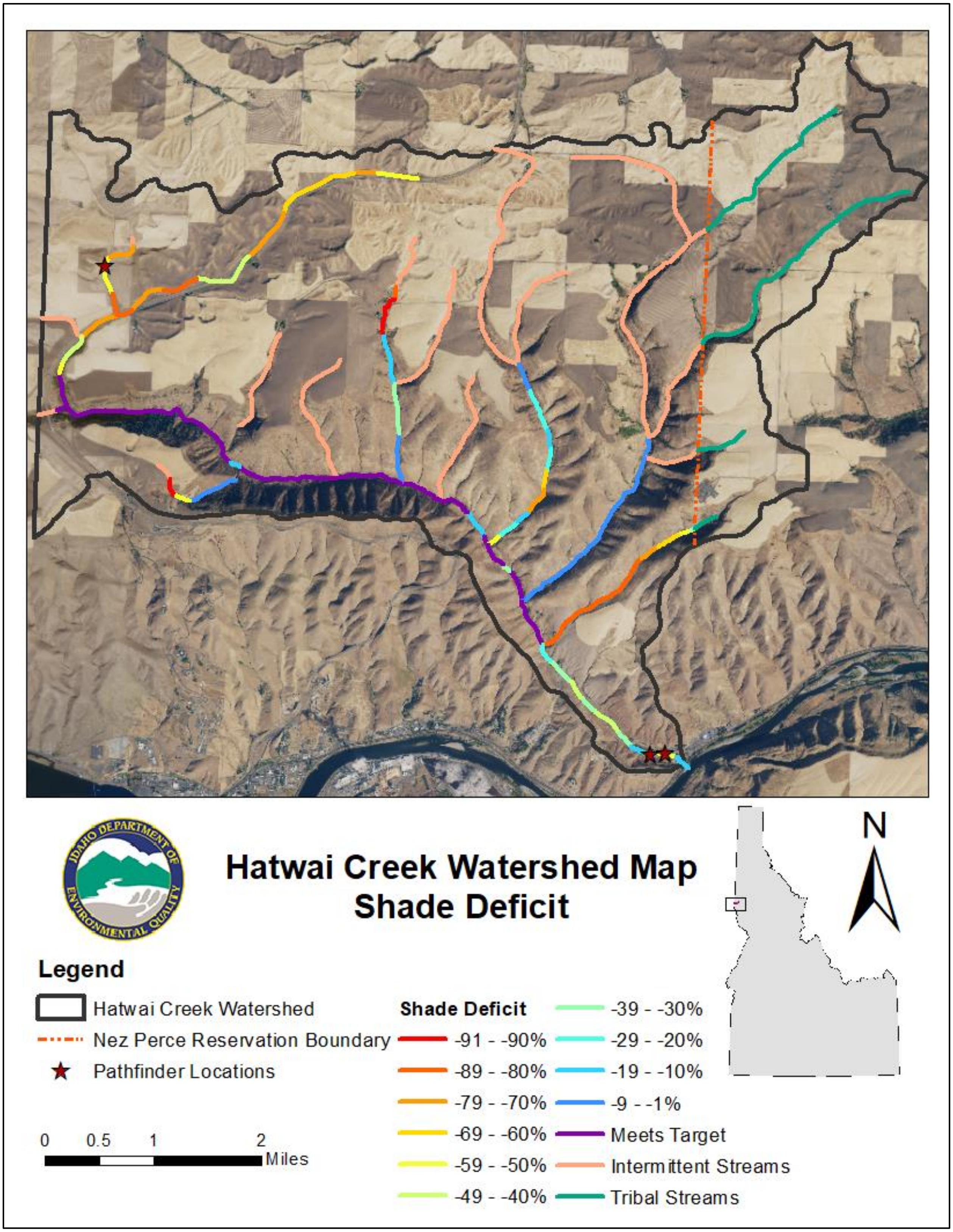

Figure 9. Lack of shade (difference between existing and target) for Hatwai Creek watershed. Lack of shade was not estimated for intermittent or tribal waters.

5.4 Load Allocation

No permitted point sources discharge into the affected AUs, so no wasteload allocations are apportioned in this TMDL.

Because this TMDL is based on PNV, which is equivalent to background load, the load allocation needs to achieve background conditions. To reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Load allocations are stream segment specific and depend on the target load for a given segment. Table 7 and Table 8 show the target shade and corresponding target summer load. This target load (i.e., load capacity) is necessary to achieve background conditions. Further shade cannot be removed from the stream by any activity without exceeding its load capacity. This TMDL depends upon background conditions for achieving water quality standards, so all tributaries to the waters examined must be in natural conditions to prevent excess heat loads to the stream.

Table 9 shows the total existing, target, and excess loads and the average lack of shade for each water body examined. The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of their larger channel widths. Table 9 lists the AUs in order of their excess loads, from highest to lowest. Large AUs are listed first and small AUs last.

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

Table 9. Total solar existing loads, target loads (i.e., load capacity) and average lack of shade for all waters.

Water Body	Assessment Unit Number	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)			
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	130,000	64,000	66,000 (51%)	-36%
Hatwai Creek—3rd order	ID17060306CL067_03	120,000	95,000	28,000 (23%)	-8%

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

Tributaries and headwaters of Hatwai Creek suffer more from excess solar load than do main stem segments of the 3rd-order AU. Segments of the 1st- and 2nd-order AU have an overall average shade deficit of -36%, experience more than double their target solar load, and require a 51% reduction. While the general shade deficit of -8% on the main stem 3rd-order AU is a fraction of that on the lower order segments, it is still carrying a substantial excess solar load of 28,000 kWh/day and requires a 23% load reduction.

Table 10 presents excess load and average lack of shade data from the 2010 Hatwai Creek TMDLs and 2018 comparable stream segments.

Table 10. Comparison of total solar loads—2010 and 2018.

Water Body/ Assessment Unit Number	2018			2010		
	Total Existing Load	Total Target Load	Excess Load	Total Existing Load	Total Target Load	Excess Load
	(kWh/day)			(kWh/day)		
Main stem Hatwai Creek ID17060306CL067_02 ID17060306CL067_03	140,000	120,000	16,000	106,485	154,533	48,048

A complete and direct segment-by-segment comparison cannot be completed for the two analysis years due to the expanded scope of the 2018 analysis. Table 10 and Figure 5 illustrate comparable segments of the Hatwai Creek main stem; the more recent analysis estimates a greater existing solar load, lower target load, and lower excess load than the 2010 analysis. These differences may be attributed to changes in land use and riparian vegetation cover, the application of an updated vegetation type and accompanying shade curve for load calculations (Table 5 and sections 5.1.3 and 5.1.4), and use of more recent, higher resolution imagery for aerial interpretation of shade classes.

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

5.4.1 Water Diversion

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

Although these water temperature effects may occur, this TMDL does not supersede any water appropriation in the affected watershed. Section 101(g), the Wallop Amendment, was added to the CWA as part of the 1977 amendments to address water rights. It reads as follows:

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

Additionally, Idaho water quality standards indicate the following:

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

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

5.4.2 Margin of Safety

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

5.4.3 Seasonal Variation

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

5.4.4 Reasonable Assurance

The CWA §319 requires each state to develop and submit a nonpoint source management plan. The *Idaho Nonpoint Source Management Plan* was approved by EPA in March 2015 (DEQ 2015). The plan identifies programs to achieve implementation of nonpoint source best

management practices (BMPs), includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups and WAGs. The Hatwai/Lindsay WAG is the designated WAG for the Hatwai Creek watershed.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 11.

Table 11. State of Idaho's regulatory authority for nonpoint pollution sources.

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

Idaho uses a voluntary approach to address agricultural nonpoint sources; regulatory authority is found in IDAPA 58.01.02.350.01–03. IDAPA 58.01.02.055.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan) (SCC and DEQ 2003), which provides direction to the agricultural community regarding approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (soil conservation districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, the Ag Plan assigns the local soil conservation districts to assist the landowner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The Idaho water quality standards and wastewater treatment requirements specify if water quality monitoring indicates water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek

injunctive or other judicial relief against the operator of a nonpoint source activity according to the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated management agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; Idaho Soil and Water Conservation Commission for grazing and agricultural activities, Idaho Transportation Department for public road construction, Idaho State Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.010.24).

5.4.5 Construction Stormwater and TMDL Wasteload Allocations

There are no known National Pollutant Discharge Elimination System-permitted point sources in the affected watersheds and thus no wasteload allocations. Should a point source be proposed that would have thermal consequences on these waters, background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09; IDAPA 58.01.02.401.01) should be involved (Appendix B).

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for CWA purposes, including stormwater that is associated with municipal separate storm sewer systems, industrial stormwater covered under the Multi-Sector General Permit, and construction stormwater covered under the Construction General Permit. For more information about these permits and managing stormwater, see Appendix D.

5.4.6 Reserve for Growth

A growth reserve has not been included in this TMDL. The load capacity has been allocated to the existing sources in the watershed. Any new sources will need to obtain an allocation from the existing load allocation.

5.5 Implementation Strategies

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (section 5.4.4) for the TMDL to meet water quality standards is based on the implementation strategy.

Implementation strategies for TMDLs produced using PNV-based shade and solar loads should incorporate the load analysis tables presented in this TMDL (Table 7 and Table 8). These tables need to be updated, first to field verify the remaining existing shade levels and second to monitor progress toward achieving reductions and TMDL goals. Using the Solar Pathfinder to measure existing shade levels in the field is important to achieving both objectives. It is likely that further field verification will find discrepancies with reported existing shade levels in the load analysis tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include Solar

Pathfinder monitoring to simultaneously field verify the TMDL and mark progress toward achieving desired load reductions.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (section 5.4.4) for the TMDL to meet water quality standards is based on the implementation strategy. There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land-use activities (e.g., logging, grazing, and mining). Existing shade for each stream segment must be field verified to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

5.5.1 Time Frame

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

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

5.5.2 Approach

The Nez Perce Soil and Water Conservation District will work with landowners to identify appropriate BMPs to establish healthy riparian plant communities to increase shading to the streams that have been identified as temperature impaired. Given the expanded scope of this TMDL, this may require evaluation and revision of the existing agricultural implementation plan (NPSWCD 2012). Funding provided under the CWA §319 and other funds will be used to encourage voluntary projects to reduce nonpoint source pollution.

5.5.3 Responsible Parties

DEQ and the designated management agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. In Idaho, these agencies, and their federal and state partners, are charged by the CWA to lend available technical assistance and other appropriate support to local efforts for water quality improvements. Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those resources for which they have regulatory authority or programmatic responsibilities:

- Idaho Department of Lands for timber harvest, oil and gas exploration and development, and mining

- Idaho Soil and Water Conservation Commission for grazing and agricultural activities
- Idaho Transportation Department for public road construction
- Idaho State Department of Agriculture for aquaculture
- DEQ for all other activities

In addition to the designated management agencies, the public—through the WAG and other equivalent organizations or processes—will have opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (e.g., landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those developed with substantial public cooperation and involvement.

5.5.4 Implementation Monitoring Strategy

The objectives of a monitoring strategy are to demonstrate long-term recovery, better understand natural variability, track project and BMP implementation, and track the effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the reasonable assurance component of the TMDL implementation plan.

Monitoring will provide information on progress being made toward achieving TMDL allocations and water quality standards and will help in the interim evaluation of progress, including in the development of 5-year reviews and future TMDLs.

The implementation plan will be tracked by accounting for the numbers, types, and locations of projects, BMPs, educational activities, or other actions taken to improve or protect water quality. Implementation plan monitoring will include watershed monitoring and BMP monitoring.

Effective shade monitoring can take place on any segment throughout the Hatwai Creek watershed and be compared to existing shade estimates seen in Figure 8 and described in Table 7 and Table 8. Those areas with the largest disparity between existing and target shade should be monitored with Solar Pathfinders to verify existing shade levels and determine progress toward meeting shade targets. Since many existing shade estimates have not been field verified, they may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Ten equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

5.5.5 Pollutant Trading

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet

reductions called for in a TMDL where point and nonpoint sources both exist in a watershed. For additional information, see Appendix E.

6 Conclusions

The 2018 temperature measurements indicated applicable temperature criteria were not exceeded within ID17060306CL067_02 but were exceeded in ID17060306CL067_03. Stream temperatures exceed criteria for protecting salmonid spawning but did not exceed criteria for protecting cold water aquatic life. Salmonid spawning criteria only apply within ID17060306CL067_03 because cliffs, steep slopes, and canyon walls serve as a fish passage barrier in ID17060306CL067_02. DEQ received permission from landowners in the Hatwai Creek drainage for additional sampling sites and will collect additional temperature logger data to determine if there is temperature impairment in AU ID17060306CL067_02. In the next Integrated Report, DEQ will propose to delist temperature as a cause of impairment in ID17060306CL067_02 if the additional data also shows temperature criteria for protection of cold water aquatic life use are not exceeded.

Water in ID17060306CL067_02 exceeds salmonid spawning temperature criteria and flows downstream into ID17060306CL067_03, contributing to salmonid spawning criteria exceedances. Water in ID17060306CL067_02 did not exceed applicable temperature criteria (cold water aquatic life) in 2018, but temperatures did exceed salmonid spawning temperature criteria, and heat loads in ID17060306CL067_02 still need to be reduced to achieve compliance with salmonid spawning temperature criteria in ID17060306CL067_03. Analyses conducted in 2018 indicated shade deficits are greatest within ID17060306CL067_02 (Figure 5 and Figure 9).

Effective shade targets were established for both AUs in the Hatwai Creek watershed based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation and was partially field verified with Solar Pathfinder measurements. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in IDAPA 58.01.02. A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table 12.

Shade targets are being met in approximately 5.7 miles of 2nd- and 3rd-order main stem Hatwai Creek. Most of the tributaries are experiencing a shade deficit, except for two small segments on the far western margin of the watershed. Severe shade deficits of -70% and lower are found in the north and northwestern potion of the watershed, specifically stream segments along US Highway 95. Lower segments of main stem Hatwai Creek, close to the mouth, are also experiencing a shade deficit, although not quite as severe (Figure 9).

Target shade levels for individual stream segments should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts.

Table 12. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Hatwai Creek—1st and 2nd order	ID17060306CL067_02	Temperature	Yes	Retain in Category 4a for temperature, additional data to be collected	Measured temperatures did not exceed applicable criteria (cold water aquatic life)
Hatwai Creek—3rd order	ID17060306CL067_03	Temperature	Yes	Retain in Category 4a for temperature	Temperature TMDL completed based on PNV

This document was prepared with input from the public, as described in Appendix F. Public comments and DEQ responses are included in Appendix F, and a distribution list is included in Appendix G.

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GIS Coverages

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USDA – FSA Aerial Photography Field Office - 2017 National Agricultural Imagery Program (NAIP) 1.0m imagery

Glossary

§303(d)

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

Assessment Unit (AU)

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Exceedance

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

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (DEQ 2016a).

Load Allocation (LA)

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

Load

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

Load Capacity (LC)

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

Margin of Safety (MOS)

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

Nonpoint Source

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

Not Assessed (NA)

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

Not Fully Supporting (NFS)

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (DEQ 2016a).

Point Source

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

Pollutant

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

Pollution

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

Potential Natural Vegetation (PNV)

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

Stream Order

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

Total Maximum Daily Load (TMDL)

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

Wasteload Allocation (WLA)

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

Water Body

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

Water Quality Criteria

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

Water Quality Standards

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

Appendix A. Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses.

Existing Uses

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

Designated Uses

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

Undesignated Surface Waters and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address nondesignated waters. Sections 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. Man-made waterways and private waters have no presumed use protections. Man-made waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called presumed uses, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to presumed uses, an additional existing use (e.g.,

salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Appendix B. State and Site-Specific Water Quality Standards and Criteria

Table B1. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

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

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

Water Quality Standards Applicable to Salmonid Spawning Temperature

Water quality standards for temperature are specific numeric values not to be exceeded during the salmonid spawning and egg incubation period, which varies by species. For spring-spawning salmonids, the default spawning and incubation period recognized by the Idaho Department of Environmental Quality (DEQ) is generally March 15 to July 15 (DEQ 2016a). In Hatwai Creek, however, DEQ applies salmonid spawning criteria from February 1 through August 15 in assessment unit ID17060306CL67_03 (DEQ 2018) based on input from Idaho Department of Fish and Game (IDFG) staff (Joe Dupont, IDFG, personal communication, August 28, 2018) on steelhead spawning in Hatwai Creek and the *Geography and Timing of Salmonid Spawning in Idaho* (BioAnalysts 2014). As per IDAPA 58.01.02.250.02.f.ii., 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

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

Natural Background Provisions

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

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

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

Appendix C. Data Sources

Table C1. Data sources for Hatwai Creek subbasin assessment.

Water Body	Data Source	Type of Data	Collection Date
Hatwai Creek	DEQ Lewiston Regional Office	Solar Pathfinder effective shade and stream width	August 2018
Hatwai Creek	DEQ State Office Technical Services	Aerial photo interpretation of existing shade and stream width estimation	August 2018
Hatwai Creek	DEQ IDASA Database	Temperature	2018

Appendix D. Managing Stormwater

Municipal Separate Storm Sewer Systems

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

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

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the US Environmental Protection Agency (EPA), implement a comprehensive municipal stormwater management program, and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

Industrial Stormwater Requirements

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

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

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

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (40 CFR 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. DEQ anticipates including specific requirements for impaired waters as a condition of the §401 certification. The MSGP will detail the specific monitoring requirements.

TMDL Industrial Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the total maximum daily load (TMDL) if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The next MSGP will have specific monitoring requirements that must be followed.

Construction Stormwater

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

Construction General Permit and Stormwater Pollution Prevention Plans

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

TMDL Construction Stormwater Requirements

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

Postconstruction Stormwater Management

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and*

Counties (DEQ 2005b) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

Appendix E. Pollutant Trading

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

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

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

Pollutant trading is recognized in Idaho's water quality standards (IDAPA 58.01.02.055.06). DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2016b).

Trading Components

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

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

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

Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL is protected. To do this, hydrologically based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent

or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the watershed advisory group, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ’s pollutant trading guidance (DEQ 2016b).

Appendix F. Public Participation and Public Comments

This TMDL was developed with participation from the Hatwai Cr/Lindsay Cr Watershed Advisory Group (WAG). Meeting dates relevant to this document were:

- February 12, 2019: Overview of the TMDL Review Process, WAG duties and procedures, Hatwai Creek Overview
- March 5, 2019: Hatwai Creek TMDL Review Summary, Overview of Hatwai Cr Temperature TMDL
- April 2, 2019: Hatwai Creek Temperature TMDL summary and discussion
- May 7, 2019: Summary of revisions to draft Hatwai Creek Temperature TMDL document based on WAG comments, WAG vote to post the draft document for public comment
- July 9, 2019: WAG review of public comments and draft DEQ response, WAG vote to approve DEQ's response to comments and submit the TMDL to EPA.

The general public had an opportunity to provide written comments on the Draft Hatwai Creek Temperature TMDL document between May 13 and June 12, 2019. DEQ provided notice to the public that the document was available for comment through a DEQ press release, a notice published in the *Lewiston Tribune,* and through the DEQ website. Copies of the document were available through the DEQ Lewiston Regional Office and were available for download on the DEQ website.

Matthew Nykiel of the Idaho Conservation League submitted one comment letter with two comments. The WAG reviewed the submitted comment and a draft version of DEQ's response at July 9, 2019 public WAG meeting, and voted to approve DEQ's response and finalize the TMDL document. Comments received and DEQ's responses are provided below.

ICL Comment #1

Temperature Reading Sites

We request DEQ include the coordinates and a map of each of the sites where DEQ recorded stream temperature data in the final version of the Hatwai Creek Subbasin Assessment and Total Maximum Daily Loads: 2018 Temperature TMDL ("2018 Hatwai Creek Temperature TMDL"). In addition, we request DEQ also identify the locations it plans to gather stream temperature data in 2019 in the Hatwai Subbasin. Readers of the current version have no way to tell whether DEQ's stream temperature data are representative of ID17060306CL067_02 or ID17060306CL067_03. Shade deficits vary dramatically in this subbasin, depending on what segment of each stream is being analyzed. So, while one stretch of stream may not exceed the criteria for cold water aquatic life or salmonid spawning, another stretch, even just 100 yards away, may present a heat barrier to fish movement because streamside vegetation can be so sparse or completely absent in this area.

We also request DEQ include a section in the final 2018 Hatwai Creek Temperature TMDL explaining why data from one temperature logger in ID17060306CL067_02 and two temperature loggers in ID17060306CL067_03 provide sufficient basis for DEQ determine whether the applicable temperature criteria are being exceeded throughout each of the assessment units. Given the shade deficit and geographic variability in this 32-square mile subbasin, three temperature reading sites will not allow DEQ determine with confidence the impairment status of the assessment units in this subbasin, especially since DEQ refuses to analyze the impacts of water diversion on stream temperature. Moreover, even though DEQ states stream temperatures in the 1st-order headwaters stream segment of ID17060306CL067_02 and downstream near the mount within ID17060306CL067_03 did not exceed criteria for protecting cold water aquatic life, temperatures approached breaching the daily maximum criteria at HC67_02 and temperatures approached breaching both the daily maximum and daily average at HC67_03.

We further request DEQ include in the final version of the 2018 Hatwai Creek Temperature TMDL a discussion of whether 2018 is a representative year from which DEQ can draw reasonably confident conclusions on the temperature impairment in the Hatwai Basin. As drafted, the TMDL provides the reader no explanation of whether the temperatures, rainfall, or snowpack (variables that could influence stream temperature) in 2018 in this region were typical of the conditions we can expect to see into the future.

With the imperiled circumstances of steelhead, it is critical we know with certainty whether the Hatwai can be counted on to fully support its role as a cold water refuge for salmonids and other aquatic life, which already suffer the temperature impairment in the Clearwater River.

If DEQ declines these requests, we further request DEQ explain its decision for not disclosing the locations where it collected stream temperature data and where it plans to collect data in 2019. Similarly, we would request DEQ explain how it can confidently issue impairment determinations in the Hatwai subbasin based on such limited data sets.

DEQ Response to ICL Comment #1

Locations for 2018 DEQ stream temperature measurements described in section 2.3.1 and Figure 4, including latitude and longitude values, are documented in a separate report, *Hatwai Creek Surface Water Quality Monitoring Report: 2018.* This report was referenced in section 2.3 and

included in the references section of the draft document. However, the report citation in the references section of the draft document did not include a hyperlink, so a hyperlink has been added. DEQ edited the executive summary and section 2.3.1 to more clearly reference the monitoring report. DEQ also edited the caption of Figure 4 to clarify that the two temperature graphs shown in Figure 4 for ID17060306CL67_03 are from duplicate temperature loggers placed at the same location.

Detailed methods and results for 2019 monitoring, including latitude and longitude of monitoring locations, will be documented in a monitoring report after monitoring is complete. When final, the report will be publically available through the DEQ website.

ICL expressed concern about whether 2018 data are sufficient for determining if applicable temperature criteria are exceeded throughout each assessment unit, and suggested DEQ add either add text explaining why 2018 data are sufficient or "explain how it can confidently issue impairment determinations" based on available data. DEQ has not added text to the document for two reasons. First, as stated in the draft document and recognized by ICL, DEQ is collecting additional temperature data in 2019 to further evaluate where applicable temperature criteria are exceeded. Second, DEQ did not make a final impairment determination in the TMDL document. If DEQ subsequently uses temperature data to determine that temperature no longer impairs cold water aquatic life use in ID17060306CL67_02, DEQ will provide a detailed justification in Idaho's next Integrated Report. In the draft TMDL document, DEQ recommended continuing to categorize both AUs as impaired by temperature in Idaho's next Integrated Report and collecting additional data (Table B), even though available data suggest temperature criteria for protection of cold water aquatic life were met. EPA requires states to propose and justify proposed delistings in the Integrated Report. Delisting justification text in the Integrated Rport would describe data used to justify delisting (temperature data and any other applicable data such as BURP data), and why they justify delisting. The public can review and comment on proposed delistings during the public comment period for the Integrated Report. EPA only reviews and approves or disapproves of proposed delistings in the Integrated Report.

ICL Comment #2

Water Diversions

At page 31, DEQ states: "Diversions notwithstanding, reaching shade targets as discussed in the TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature." Please provide any and all data and analysis that support this statement. It may be the case that particular streams in Idaho subject to water diversion can maintain sufficient cold temperatures when natural background shading is met, but this may not be the case in the Hatwai subbasin, given its unique geographic features, meteorology, and the overwhelming agricultural presence in the subbasin and the region in general. And, the 2018 Hatwai Creek Temperature TMDL provides no discussion of whether or how DEQ weighed the influence of these site specific factors in reaching the conclusion in the statement cited above. As drafted the statement cited above appears to be DEQ boilerplate.

DEQ Response to ICL Comment #2

Water diversions may affect stream temperatures. However, as stated in section 5.4.1, DEQ did not quantify what impact, if any, diversions have on stream temperature because the TMDL does not supersede water appropriations and Idaho water quality standards are not intended to interfere with rights of Idaho appropriators (IDAPA 58.01.02.050.01).

Achieving shade targets will lead to cooler water by achieving shade that would be expected in natural shade conditions and water temperatures resulting from that shade. The PNV approach assumes that if effective shading associated with potential natural vegetation is achieved, natural background stream temperatures will also be achieved. If PNV targets are achieved, but stream temperatures are warmer than Idaho's temperature criteria, it is assumed the stream's temperature is natural (if no point sources or human-induced ground water sources of heat exist). IDAPA 58.01.02.200.09 includes a provision that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards.

Appendix G. Distribution List

Hatwai Creek Watershed Advisory Group

Clearwater Basin Advisory Group

Idaho Department of Environmental Quality: DEQ State Office and Lewiston Regional Office

United States Environmental Protection Agency, Idaho Operations Office