Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load

2013 Addendum and Five-Year Review

(Hydrologic Unit Code 17060202)

DRAFT

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Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load

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Cover photo of the Pahsimeroi River courtesy of the Idaho Department of Environmental Quality's Idaho Falls Regional Office 2008 Beneficial Use Reconnaissance Program crew.

Table of Contents

Abbreviations, Acronyms, and Symbols xi
Executive Summary xiii
Regulatory Requirements xiii
Subbasin at a Glance xiii
Key Findings xv
Listing History xvii
Temperature xviii
Sediment/siltation xix
Bacteria xix
Other Listings xx
Introduction 1
Regulatory Requirements 1
1 Subbasin Assessment—Subbasin Characterization 2
1.1 Physical and Biological Characteristics 2
1.1.1 Climate and Hydrology 2
1.1.2 Subbasin Characteristics 3
1.2 Cultural Characteristics 5
1.2.1 Landownership and Population 5
1.2.2 Economics 7
2 Subbasin Assessment—Water Quality Concerns and Status 7
2.1 Water Quality Limited Assessment Units Occurring in the Subbasin 7
2.2 Applicable Water Quality Standards and Beneficial Uses 11
2.2.1 Existing Uses 11
2.2.2 Designated Uses 12
2.2.3 Presumed Uses 12
2.2.4 Beneficial Uses in the Subbasin 12
2.2.5 Water Quality Criteria to Support Beneficial Uses 14
2.3 Summary and Analysis of Existing Water Quality Data 16
2.3.1 Discharge Characteristics 16
2.3.2 Assessment Units Impaired by Pollution 21
2.3.3 Water Column Data 22
2.3.4 Biological and Other Data 27
2.3.5 Assessment Unit Summary 32
3 Subbasin Assessment—Pollutant Source Inventory 38
3.1 Point Sources 38
3.2 Nonpoint Sources 38

4 Monitoring and Status of Water Quality Improvements and Five-Year TMDL Review 39
4.1 Ongoing Sediment Monitoring 39
4.2 Water Quality Improvements 41
4.2.1 Project Details from IDWR 43
4.2.2 Stream Habitat and Shade Improvements in the Pahsimeroi River Subbasin 46
5 Total Maximum Daily Loads 50
5.1 Temperature TMDLs 51
5.1.1 Instream Water Quality Targets 51
5.1.2 Load Capacity 57
5.1.3 Estimates of Existing Pollutant Loads 58
5.1.4 Load and Wasteload Allocation 75
5.2 Sediment TMDLs 78
5.2.1 Instream Water Quality Targets 78
5.2.2 Load Capacity 80
5.2.3 Estimates of Existing Pollutant Loads 81
5.2.4 Load and Wasteload Allocations 81
5.3 Bacteria TMDL 94
5.3.1 Instream Water Quality Targets 101
5.3.2 Load Capacity 101
5.3.3 Estimates of Existing Pollutant Loads 101
5.3.4 Load and Wasteload Allocations 101
5.4 Construction Stormwater and TMDL Wasteload Allocations 103
5.4.1 Municipal Separate Storm Sewer Systems 103
5.4.2 Industrial Stormwater Requirements 103
5.4.3 Construction Stormwater 104
5.5 Implementation Strategies 105
5.5.1 Time Frame 106
5.5.2 Approach and Responsible Parties 106
5.5.3 Implementation Monitoring Strategy 106
5.5.4 Reasonable Assurance 107
5.5.5 Pollutant Trading 107
6 Conclusions 108
References Cited 115
Glossary 119
Appendix A. Data Sources 129
Appendix B. Water Quantity and Quality Actions in the Pahsimeroi River Subbasin 131
Upper Salmon Basin Watershed Program 131
Bonneville Power Administration 133

Appendix C. Sediment Data—DEQ Idaho Falls Regional Office ... 137
Streambank Erosion Inventory ... 138
Appendix D. Salmon-Challis National Forest Sediment, Temperature and Fish Data for the Pahsimeroi River Subbasin ... 153
Sediment Data ... 155
Temperature Data for Impaired Waters Listed in Category 5 of the 2010 Integrated Report 157
Fish Data ... 159
Appendix E. Bureau of Land Management Challis Field Office Temperature, Habitat and Sediment Data for the Pahsimeroi River Subbasin ... 161
Temperature Data for Impaired Waters Listed in Category 5 of the 2010 Integrated Report 161
Appendix F. Beneficial Use Reconnaissance Program Monitoring Index Scores—DEQ Idaho Falls Regional Office ... 171
Appendix G. Bacteria Data—Idaho Falls Regional DEQ Office ... 173
Appendix H. Field Notes ... 181
Appendix I. Pahsimeroi River TMDL Implementation Plan Update ... 185
Appendix J. Potential Natural Vegetation Shade Curves ... 187
Appendix K. Public Comments/Public Participation ... 195
Appendix L. Distribution List ... 197

List of Tables

Table A. Streams and pollutants for which TMDLs were developed. ... xv
Table B. Summary of assessment outcomes and recommended changes to the next integrated report. ... xvi
Table 1. Current landownership in the Pahsimeroi River subbasin. ... 5
Table 2. Pahsimeroi River subbasin assessment units reported in Category 5 of the 2010 Integrated Report. ... 9
Table 3. Pahsimeroi River subbasin assessment units reported in Category 4c of the 2010 Integrated Report. ... 10
Table 4. Pahsimeroi River subbasin assessment units reported in Category 4a of the 2010 Integrated Report. ... 10
Table 5. Water bodies and pollutants for which TMDLS were developed. ... 11
Table 6. Beneficial uses of assessment units listed in Category 5 of the 2010 Integrated Report for the Pahsimeroi River subbasin. ... 13
Table 7. Beneficial uses of unlisted but impaired assessment unit that received a temperature TMDL. ... 13
Table 8. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards (IDAPA 58.01.02.250–251). ... 14
Table 9. Summary of discharge data at historic US Geological Survey stream gaging stations. . 17

Table 10. Summary of discharge data at Idaho Power stream gaging stations............................ 18
Table 11. Salmon-Challis National Forest instream temperature data summary. 22
Table 12. Salmon-Challis National Forest sediment data summary, 2001–2010........................ 23
Table 13. Cumulative record of seasonal maximum and maximum 7-day average maximum stream temperatures (°F)—2006 to 2011. 25
Table 14. BLM Multiple Indicator Monitoring (MIM) streambank and sediment data.............. 26
Table 15. Bioassessment results and bacteria data for assessment units with available data that are listed in Category 5 of the 2010 Integrated Report. 31
Table 16. Streambank erosion inventory summary—2009 data.. 40
Table 17. McNeil sediment core results. 41
Table 18. Pathfinder results. 54
Table 19. Bank-full width estimates based on regional hydrology curves. 56
Table 20. Plant communities for shade targets for the various streams...................................... 57
Table 21. Existing and target solar loads for Sulphur Creek (ID17060202SL002_02)................ 60
Table 22. Existing and target solar loads for Trail Creek (ID17060202SL002_02). 61
Table 23. Existing and target solar loads for Pahsimeroi River (ID17060202SL002_05). 62
Table 24. Existing and target solar loads for Pahsimeroi River (ID17060202SL001_05). 63
Table 25. Existing and target solar loads for upper Pahsimeroi River (ID17060202SL022_03, 020_03 and 018_04). 64
Table 26. Total solar loads and average lack of shade for all waters. 76
Table 27. Locations to monitor for sediment trends in the Pahsimeroi River subbasin. 80
Table 28. McNeil sediment core results summary for the Pahsimeroi River. 81
Table 29. Current sediment loads from nonpoint sources within the Pahsimeroi River subbasin. 81
Table 30. Sediment current loads, load capacity (allocations) and necessary reductions within the Pahsimeroi River subbasin based on 2009 data... 82
Table 31. Allocations for sediment load reductions. 85
Table 32. Flow duration allocations for sediment load reduction for Sulphur Creek (ID17060202SL002_02)... 87
Table 33. Flow duration allocations for sediment load reduction for Trail Creek (ID17060202SL002_02)... 89
Table 34. Flow duration allocations for sediment load reduction for North Fork Lawson Creek (ID17060202SL004_02)... 91
Table 35. Flow duration allocations for sediment load reduction for Short Creek (ID17060202SL026_02)... 93
Table 36. Bacteria monitoring results in the Pahsimeroi River subbasin. 95
Table 37. Bacteria load allocation for Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02) (geometric mean of number of colonies per 100 milliliter sample). 102
Table 38. Summary of assessment outcomes. 110

Table 39. Summary of necessary temperature load reductions. 112
Table 40. Summary of necessary sediment load reductions. 113
Table 41. Summary of necessary bacteria (E. coli) load reductions. 113
Table 42. Recommended future monitoring. 114
Table C1. McNeil sediment core sampling form. 138
Table D1. Sediment data recorded on the Salmon-Challis National Forest, 1993–2012. 155
Table E1. Stream temperature monitoring history—Pahsimeroi River subbasin. 161
Table E2. BLM MIM streambank and sediment data. 170
Table E3. BLM MIM habitat data. 170

List of Figures

Figure A. Impaired waters listed in the 2010 Integrated Report. xiv
Figure 1. Pahsimeroi River subbasin in east-central Idaho. 4
Figure 2. Landowner distribution (BLM 2010). 6
Figure 3. Steps and criteria for determining support status of beneficial uses. 15
Figure 4. Daily discharge in the Pahsimeroi River near Ellis, Idaho. 18
Figure 5. Extent of alluvium and geologic features in the Pahsimeroi River valley. Source: (Meinzer 1924). 20
Figure 6. Instream temperature at US Geological Survey gage 13302005 (Pahsimeroi River near Ellis, Idaho)—1998, 2001 and 2005. 24
Figure 7. Idaho Department of Environmental Quality bioassessment monitoring locations. 28
Figure 8. Bioassessment monitoring locations resulting in a not fully supporting status determination. 29
Figure 9. P-9 ditch removal project area on Patterson Big Springs Creek. 43
Figure 10. Patterson Big Springs Creek transaction and the PBSC9 canal. 44
Figure 11. Change in water rights and water banking in Sulphur Creek. 45
Figure 12. Map identifying locations for comparison of exclosure effects. 46
Figure 13. Reference Section I with arrows added to indicate and highlight areas of changing vegetation density before and after fence development. 47
Figure 14. Reference Section II with arrows added to indicate and highlight areas of changing vegetation density before and after fence development. 48
Figure 15. Reference Section III with arrows added to indicate and highlight areas of changing vegetation density before and after fence development. 49
Figure 16. Bank-full width as a function of drainage area. 55
Figure 17. Target shade for Sulphur and Trail Creeks (ID17060202SL002_02). 66
Figure 18. Existing shade estimated for Sulphur and Trail Creeks (ID17060202SL002_02) by aerial photo interpretation. 67

Figure 19. Lack of shade (difference between existing and target) for Sulphur and Trail Creeks (ID17060202SL002_02). 68
Figure 20. Target shade for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05). 69
Figure 21. Existing shade estimated for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05) by aerial photo interpretation. 70
Figure 22. Lack of shade (difference between existing and target) for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05). 71
Figure 23. Target shade for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04). 72
Figure 24. Existing shade estimated for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04) by aerial photo interpretation. 73
Figure 25. Lack of shade (difference between existing and target) for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04). .. 74
Figure 26. Assessment unit segments requiring sediment reductions. 84
Figure 27. Flow duration curve for the ungaged stream segment in Sulphur Creek (ID17060202SL002_02). 86
Figure 28. Flow duration curve for the ungaged stream segment in Trail Creek (ID17060202SL002_02). 88
Figure 29. Flow duration curve for the ungaged stream segment in the North Fork Lawson Creek (ID17060202SL004_02). 90
Figure 30. Flow duration curve for the ungaged stream segment in Short Creek (ID17060202SL026_02). 92
Figure 31. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL002_02 (Sulphur and Trail Creeks). 96
Figure 32. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL006_02 (Meadow Creek). 98
Figure 33. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL030_02 (Goldburg Creek and tributaries). 100
Figure D1. AU ID17060202SL022_03—2009 data. 157
Figure D2. AU ID17060202SL022_03—2010 data. 157
Figure D3. AU ID17060202SL022_03—2010 data. 158
Figure D4. AU ID17060202SL022_03—2011 data. 158
Figure D5. Cutthroat trout distribution on the southern portion of the Challis Ranger District. 159
Figure D6. Bull trout distribution on the southern portion of the Challis Ranger District. 160
Figure E1. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2005 data. 162
Figure E2. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2006 data. 162
Figure E3. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2007 data. 163

Figure E4. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2008 data. 163
Figure E5. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2009 data. 164
Figure E6. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2010 data. 164
Figure E7. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2011 data. 165
Figure E8. Compilation of select data with PACFISH criteria—Big Creek. 165
Figure E9. Compilation of select data with PACFISH criteria—Burnt Creek. 166
Figure E10. Compilation of select data with PACFISH criteria—Ditch Creek. 166
Figure E11. Compilation of select data with PACFISH criteria—Goldburg Creek. 167
Figure E12. Compilation of select data with PACFISH criteria—Pahsimeroi River above Burnt Creek. 167
Figure E13. Compilation of select data with PACFISH criteria—Pahsimeroi River above Mahogany Creek. 168
Figure E14. Compilation of select data with PACFISH criteria—Patterson Creek. 168
Figure E15. Compilation of select data with PACFISH criteria—Short Creek. 169
Figure E16. Compilation of select data with PACFISH criteria—Tater Creek. 169
Figure J1. Geyer willow/sedge shade curve. 189
Figure J2. Drummond willow/sedge shade curve. 190
Figure J3. Mountain alder shade curve. 191
Figure J4. Quaking aspen shade curve. 192
Figure J5. Dry Douglas-fir without ponderosa pine shade curve. 193
Figure J6. Graminoid shade curve. 194

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Abbreviations, Acronyms, and Symbols

§	section (usually a section of federal or state rules or statutes)
§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
ADB	US Environmental Protection Agency's Assessment Database
AU	assessment unit
BAG	basin advisory group
BLM	US Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
CGP	Construction General Permit
CSWCD	Custer Soil and Water Conservation District
CW	cold water
DEQ	Idaho Department of Environmental Quality
DMR	discharge monitoring report
DWS	domestic water supply
EPA	US Environmental Protection Agency
F	Fahrenheit
GIS	geographic information systems
IDAPA	refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
kWh	kilowatt-hour
LA	load allocation
lb	pounds
LC	load capacity
m	meter
mi	mile
mg/L	milligrams per liter
mL	milliliter
MIM	multiple indicator monitoring
MOS	margin of safety
MPN	most probable number
MS4	municipal separate storm sewer systems
MSGP	Multi-Sector General Permit
NB	natural background
NPDES	National Pollutant Discharge Elimination System

NREL	National Renewable Energy Laboratory
NRCS	Natural Resources Conservation Service
OSC	Idaho Governor's Office of Species Conservation
PCR	primary contact recreation
PNV	potential natural vegetation
SBA	subbasin assessment
SCR	secondary contact recreation
SFI	DEQ's stream fish index
SHI	DEQ's stream habitat index
SMI	DEQ's stream macroinvertebrate index
SS	salmonid spawning
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
USBWP	Upper Salmon Basin Watershed Program
USFS	US Forest Service
USGS	US Geological Survey
WAG	watershed advisory group
WLA	wasteload allocation

Executive Summary

This total maximum daily load (TMDL) document presents an addendum to the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001)—approved by the US Environmental Protection Agency (EPA) in 2001—by addressing additional assessment units (AUs) in Category 5 (i.e., impaired waters) of the 2010 Integrated Report. This document also provides information that satisfies the requirements of a 5-year review of the original TMDL.

Regulatory Requirements

This document has been prepared in accordance with federal and state regulations. The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to §303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act 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 of impaired waters. Currently this list must be published every 2 years and is included 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.

Subbasin at a Glance

The Pahsimeroi River subbasin (hydrologic unit code 17060202) is located in east-central Idaho above the confluence of the Pahsimeroi and Salmon Rivers. The subbasin is southeast of the town of Salmon and northeast of Challis. The Pahsimeroi River subbasin is divided between Lemhi and Custer Counties along the main stem of the Pahsimeroi River and Big Creek. The Pahsimeroi River flows northwest between the Lemhi Range and the Big Lost Mountains until its confluence with the Salmon River near the town of Ellis, Idaho.

Features of the Pahsimeroi River subbasin, the tributary watersheds, and individual streams are detailed in the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001). Comprehensive biological and instream water quality data were presented and analyzed in the 2001 subbasin assessment and TMDL. This TMDL addendum summarizes pertinent subbasin characteristics and any additional data that affect water quality and beneficial uses in the Pahsimeroi River subbasin.

This document addresses the 19 AUs listed in Category 5 for impaired waters in *Idaho's 2010 Integrated Report* (Figure A). The subbasin assessment portion of this document (sections 1–4) examines water quality and use status for these AUs and summarizes completed or ongoing watershed improvement projects in the subbasin. The TMDL analyses (section 5) quantify pollutant loads, and then allocate load reductions needed to return impaired waters to a condition meeting water quality standards.

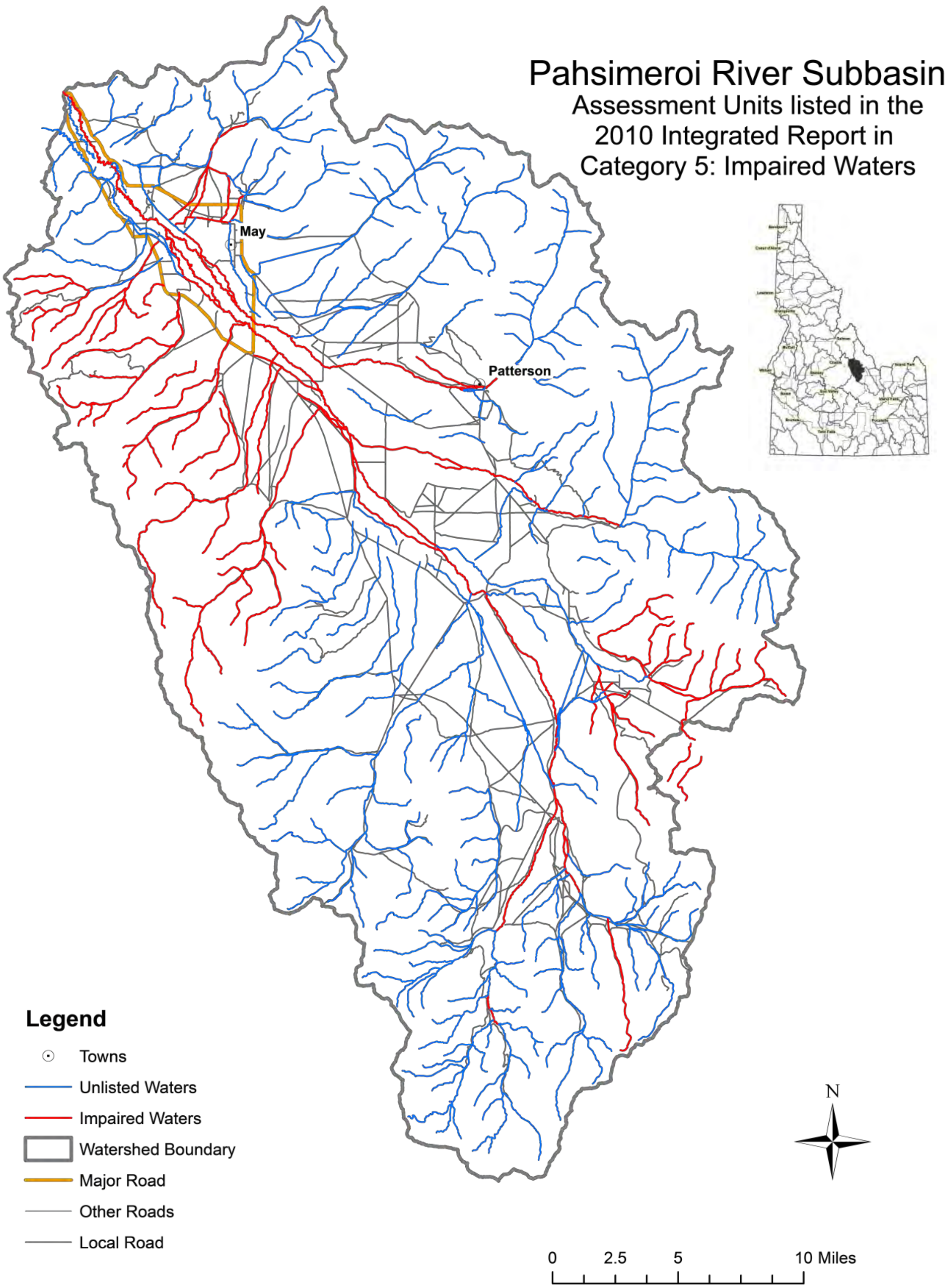

Figure A. Impaired waters listed in the 2010 Integrated Report.

Key Findings

Idaho's 2010 Integrated Report lists AUs in Category 5 for suspected water quality impairments (DEQ 2011). This document presents a determination of the status of these AUs as an addendum to the 2001 TMDL (DEQ 2001). In addition, the results of ongoing monitoring and watershed improvement projects are reported in this document and serve as a 5-year review of the original TMDL.

Temperature was determined to be impairing water quality in the 2 listed AUs, and temperature load allocations are provided in this document. In addition, 3 AUs received updated TMDLs using the current Idaho Department of Environmental Quality (DEQ) method for estimating shade and an additional AU added for a temperature TMDL that was not previously listed as being impaired. Sediment was found to be impairing beneficial uses in 3 AUs, and allocations for sediment load reductions are provided in this document. *Escherichia coli* (*E. coli*) was determined to be impairing water quality in 1 AU, and a bacteria TMDL is provided for restoring beneficial uses to this AU. In total, 8 AUs received new or updated TMDLs, with one of those AUs receiving multiple TMDLs (i.e., for temperature, sediment, and bacteria) (Table A). A summary of assessment outcomes for AUs listed in the 2010 Integrated Report is given in Table B. The "TMDL Completed" column refers to new or updated TMDLs in this addendum based on current determinations of watershed conditions.

Table A. Streams and pollutants for which TMDLs were developed.

Water Body	Assessment Unit Number	Pollutants
Pahsimeroi River—Patterson Creek to mouth	ID17060202SL001_05	Temperature—updated
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	ID17060202SL002_02	Temperature, sediment, and bacteria (*E. coli*)
Pahsimeroi River—Sulphur Creek to Patterson Creek	ID17060202SL002_05	Temperature
North Fork Lawson Creek—Source to Mouth	ID17060202SL004_02	Sediment
Pahsimeroi River—Mahogany Creek to Burnt Creek	ID17060202SL018_04	Temperature—updated
Pahsimeroi River—Confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	ID17060202SL020_03	Temperature
East Fork Pahsimeroi River—Source to Mouth	ID17060202SL022_03	Temperature—updated
Short Creek—Source to Mouth	ID17060202SL026_02	Sediment

Table B. Summary of assessment outcomes and recommended changes to the next integrated report.

Assessment Unit/ Water Body Segment	Listed Pollutant(s) (in Category 5 unless otherwise noted)	New/Updated TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060202SL001_05 Pahsimeroi River—Patterson Creek to mouth	Listed in Category 4a for sediment/siltation; temperature	Updated	Remain listed in 4a for sediment and temperature	Temperature TMDL updated to potential natural vegetation (PNV), excess solar load from a lack of existing shade
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	Combined biota/habitat bioassessments; fecal coliform; sediment/siltation; temperature	Yes	Delist for combined biota/habitat bioassessments and fecal coliform; move to 4a for *Escherichia coli*, sediment, and temperature	*E. coli* TMDL based on geometric mean; sediment TMDL completed based on streambank stability; and PNV temperature TMDLs completed, excess solar load from a lack of existing shade
ID17060202SL002_04 Pahsimeroi River—Meadow Creek to Patterson Creek	Particle distribution (embeddedness); listed in Category 4a for sediment	No	Delist for embeddedness; retain in 4a for sediment	Sediment/siltation TMDL from 2001 addresses embeddedness listing
ID17060202SL002_05 Pahsimeroi River—Meadow Creek to Patterson Creek	Cause unknown (nutrients suspected); temperature; listed in Category 4a for sediment	Yes	Delist for cause unknown; move to 4a for temperature; retain in 4a for sediment	No source or pathways for nutrients; PNV temperature TMDL completed, excess solar load from a lack of existing shade
ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; list in 4c	Low flow alterations are sole cause for impairment
ID17060202SL004_02 North Fork Lawson Creek—source to mouth	Combined biota/habitat bioassessments	Yes	Delist combined biota/habitat bioassessments; list in 4a for sediment	Sediment determined to be impairment; sediment TMDL completed based on streambank stability
ID17060202SL005_02 South Fork Lawson Creek—source to mouth	Combined biota/habitat bioassessments	No	Retain in Category 5	Insufficient data to identify causal pollutant or stressor
ID17060202SL006_02 Meadow Creek—source to mouth	Combined biota/habitat bioassessments; fecal coliform; listed in Category 4c	No	Delist combined biota/habitat bioassessments and fecal coliform	Listed in Category 4c for low flow alterations; when water present, *E. coli* below threshold
ID17060202SL007_04 Pahsimeroi River—Furey Lane (T15S, R22E) to Meadow Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist cause unknown; retain in 4a for sediment and 4c	No source or pathways for nutrients; low flow alterations are primary cause for impairment; banks potentially erodible when water present
ID17060202SL008_04 Pahsimeroi River—Big Creek to Furey Lane (T15S, R22E)	Listed in Category 4a for sediment	No	Retain in 4a for sediment	From 2001 TMDL
ID17060202SL009_02 Grouse Creek—source to mouth	Combined biota/habitat bioassessments; listed in Category 4c	No	Delist combined biota/habitat bioassessments; retain in 4c	Low flow alterations are sole cause for impairment
ID17060202SL010_03 Pahsimeroi River—Goldburg Creek to Big Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment	No	Delist for cause unknown, retain in 4a for sediment	No source or pathway for nutrients
ID17060202SL010_04 Pahsimeroi River—Goldburg Creek to Big Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist for cause unknown; retain in 4a for sediment and 4c	No source or pathway for nutrients; has low flow alterations

Assessment Unit/ Water Body Segment	Listed Pollutant(s) (in Category 5 unless otherwise noted)	New/Updated TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060202SL010_05 Pahsimeroi River—Goldburg Creek to Big Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment	No	Delist for cause unknown; retain in 4a for sediment	No sources or pathways for nutrients
ID17060202SL011_04 Pahsimeroi River—Unnamed Tributary (T12N, R23E, Sec. 22) to Goldburg Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment	No	Delist cause unknown; list in 4c; retain in 4a for sediment	Low flow alterations are primary cause for impairment; banks potentially erodible when water present; no source or pathway for nutrients
ID17060202SL017_04 Pahsimeroi River—Burnt Creek to Unnamed Tributary (T12N, R23E, Sec. 22)	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist cause unknown; retain in 4a for sediment and 4c	Low flow alterations are primary cause for impairment; banks potentially erodible when water present; no source or pathway for nutrients
ID17060202SL018_04 Pahsimeroi River—Mahogany Creek to Burnt Creek	Sediment/siltation; temperature	Updated	Retain in 4a for sediment and temperature	From 2001 TMDL; temperature TMDL updated using PNV method
ID17060202SL020_03 Pahsimeroi River, Confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	No 2010 impaired listing	Yes	List in 4a for temperature	Identified as shade deficient while calculating adjacent AU temperature/heat loads using PNV method
ID17060202SL022_03 East Fork Pahsimeroi River—source to mouth	Sediment/siltation; temperature	Updated	Retain in 4a for sediment and temperature	From 2001 TMDL; temperature TMDL updated using PNV method
ID17060202SL023_03 Burnt Creek—Long Creek to mouth	Combined biota/habitat bioassessments	No	Retain in Category 5	Not impaired for sediment or nutrients; has existing habitat; recommend examining for temperature and BURP monitoring
ID17060202SL026_02 Short Creek—source to mouth	Combined biota/habitat bioassessments	Yes	Delist combined biota/habitat bioassessments; move to 4a for sediment	Sediment determined to be impairment; sediment TMDL completed based on streambank stability
ID17060202SL029_02 Donkey Creek -source to mouth	Combined biota/habitat bioassessments	No	Delist	Listed in error, based upon non-applicable discharge and BURP score
ID17060202SL030_02 Goldburg Creek—source to Donkey Creek	Fecal coliform	No	Delist for fecal coliform	*E. coli* geometric mean below threshold; land use changes include alternate water sources, changes in livestock use patterns, and increased fencing
ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creeks to mouth	Cause unknown (nutrients suspected); sedimentation/siltation; listed in 4c	No	Delist cause unknown and sediment and retain in 4c	No source or pathway for nutrients or sediment; low flow alterations are sole cause for impairment

Listing History

In 1998, the Pahsimeroi River was added to the §303(d) list for nutrients and sediment for two segments: Dowton Lane to the Salmon River and Mahogany Creek to Dowton Lane. Additional stream segments added to the 1998 §303(d) list include Patterson Creek (Inyo Creek to Pahsimeroi River) for sediment and flow alteration; Morse Creek (forest boundary to Pahsimeroi River) for sediment, nutrients, and flow alteration; and Big Creek (forest boundary to Pahsimeroi River) for sediment and nutrients.

Since 1998, there have been several additions to the §303(d) list. The original TMDL (DEQ 2001), approved in 2001, allocated load reductions for temperature and sediment for the main stem Pahsimeroi River. The 2001 TMDL included sediment targets to decrease the fine sediment to less than 28% of the substrate. Sediment load estimates were developed for the main stem Pahsimeroi River, with loads totaling 2,838 tons per year. The TMDL recommended decreasing sediment loads by approximately 80%, with the greatest decreases needed in the upper reaches of the river. However, the upper reaches are subject to the natural variability in seasonal stream discharge and dewatering for irrigation. Based on EPA approval of these TMDLs, and after conversion of the stream segments into AUs for the Integrated Report, the 2010 Integrated Report lists these sediment TMDLs as applying to 12 AUs, currently listed in Category 4a for having completed and approved TMDLs. Temperature targets were also developed in the 2001 TMDL to meet salmonid spawning and bull trout temperature criteria in the basin.

Further investigation by DEQ found that some listed AUs have been historically dewatered year-round except for overflow put back in the channel when it was not required for irrigation. These AUs should more appropriately be listed in Category 4c for low flow alteration. At this time, the land uses of these streams are becoming increasingly driven by the restoration efforts of the Upper Salmon Basin Watershed Program (USBWP) to re-establish discharge in the old channels and reconnect the streams with the Pahsimeroi River.

The Salmon-Challis National Forest and the Bureau of Land Management Challis Field Office have collected data—including instream temperature, percent bank stability, and subsurface fine sediment—for key streams on their managed lands in the Pahsimeroi River subbasin.

Temperature

Idaho's 2010 Integrated Report has 2 AUs listed in Category 5 for temperature impairments: (1) the Pahsimeroi River—Meadow Creek to Patterson Creek (Sulphur and Trail Creek tributaries) (ID17060202SL002_02) and (2) the Pahsimeroi River—Sulphur Creek to Patterson Creek (ID17060202SL002_05). An additional 3 AUs with EPA-approved temperature TMDL in 2001 (DEQ 2001) were updated using the potential natural vegetation (PNV) temperature TMDL methodology: (1) Pahsimeroi River—Patterson Creek to mouth (ID17060202SL001_05), (2) Pahsimeroi River—Mahogany Creek to Burnt Creek (ID17060202SL018_04) and, (3) East Fork Pahsimeroi River—source to mouth (ID17060202SL022_03). This document addresses these 5 AUs and one unlisted AU: Pahsimeroi River—Confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek (ID17060202SL020_03). This unlisted AU is included for load source purposes and was deemed shade deficient when updating adjacent AUs with existing temperature TMDLs.

Effective target shade levels were established for the 6 AUs based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation that was partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02).

All streams examined had excess heat loads as a result of lack of shade. Generally, shade loss has occurred most dramatically in the lower-elevation cottonwood riparian zone. Upper Pahsimeroi River and upper Sulphur Creek appear to be in relatively good condition, whereas upper Trail Creek lacks shade, likely due to limited water availability. The Pahsimeroi River is surrounded by an agricultural area and lacks shade on many reaches.

All streams require some rehabilitation to achieve shade targets. 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. Loading tables and figures showing lack of shade can be used to prioritize implementation efforts in key areas.

Sediment/siltation

Idaho's 2010 Integrated Report lists 3 AUs for sediment-related impairments; however, one listing included particle distribution (embeddedness) for an AU that is already in Category 4a for sediment/siltation (Pahsimeroi River—Meadow Creek to Patterson Creek [ID17060202SL002_04]). Since these impairments are currently assessed in the same manner, this duplicate listing will be removed, retaining the sediment/siltation listing. The other 2 AUs with sediment listings are the Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02)—and Big Creek, source to mouth (ID17060202SL031_03).

Streambank stability measurements in Big Creek (by DEQ and also by the US Forest Service) indicated no need for a sediment TMDL in the AU as the banks were stable. However, Sulphur and Trail Creeks in the AU Pahsimeroi River – Meadow Creek to Patterson Creek (tributaries) – ID17060202SL002_02 require a TMDL for sediment, which is developed in this document.

Assessment units with Category 5 listings for either "combined biota/habitat bioassessment" or "cause unknown" were examined for streambank stability to identify the impairment source. It was determined by DEQ that two AUs were impaired by sediment/siltation: North Fork Lawson Creek (ID17060202SL004_02) and Short Creek (ID17060202SL026_02). Allocations for sediment load reductions are developed in this document. However, 2 AUs listed for either combined biota/habitat bioassessment or cause unknown were determined to have banks above the 80% stability level. Therefore, no TMDLs were developed for Donkey Creek (ID17060202SL029_02) or Lawson Creek main stem (ID17060202SL003_03).

Bacteria

Idaho's 2010 Integrated Report listed 3 AUs were for fecal coliform (currently determined by *E. coli*). Sulphur and Trail Creeks in the Pahsimeroi River – Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02) required a TMDL for bacteria, as *E. coli*, load allocations are developed in this document. Due to land use management changes, the Goldburg Creek (ID17060202SL010_05) was not found to have a bacteria impairment and should be delisted for fecal coliform. Meadow Creek – source to mouth (ID17060202SL006_02) was found to meet the water quality standard for *E. coli.* The development of an in-holding surrounded by US Bureau of Land Management-managed lands was presumed to be the causal factor in meeting the standard. These two AUs should be delisted for fecal coliform.

Other Listings

Several AUs listed for “cause unknown (nutrients suspected)” were sampled for nitrogen and phosphorus concentrations; no samples had concentrations indicating any additional necessary monitoring, as concentrations were at or near the detection limit. Additionally, DEQ visited every AU with suspected nutrients and observed no instream exceedance of the narrative nutrient standard. No locations had a source or pathway for nutrients (Table B). Remediation/restoration efforts have moved or removed at least three feedlots in the Pahsimeroi River subbasin to limit potential hydrologic connection to the surface waters.

Of the examined AUs, 2 should remain in their current listing of Category 5 with no identifiable cause for either the listing or the impairment. This lack of positive identification could indicate a return to a stable state and natural recovery or a lack of water caused impairment that could not be confirmed. Therefore the South Fork Lawson Creek (ID17060202SL005_02) and Burnt Creek (ID17060202SL023_03) shall remain in Category 5.

Donkey Creek (ID17060202SL029_02) appears to have been listed based on a data entry error, which compounds the error of Beneficial Use Reconnaissance Program (BURP) monitoring in a stream below the 1 cubic foot per second threshold for data interpretation. Donkey Creek exhibited no indications of other impairments; therefore, it is recommended that this AU be delisted from the combined biota/habitat bioassessment listing. Two other AUs should be moved to Category 4c for flow alterations, as both AUs have been dewatered by irrigation withdrawals: Lawson Creek—confluence of North and South Fork Lawson Creek to mouth (ID17060202SL003_03)—and Pahsimeroi River, unnamed tributary (T12N, R23E, Sec. 22) to Goldburg Creek (ID17060202SL011_04).

Introduction

This total maximum daily load (TMDL) document presents an addendum to the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (Pahsimeroi River TMDL) (DEQ 2001)—approved by the US Environmental Protection Agency (EPA) in 2001—and addresses 19 assessment units (AUs) currently listed in Category 5 (i.e., impaired waters) of *Idaho's 2010 Integrated Report* (DEQ 2011). The purpose of this TMDL addendum is to characterize and document pollutant loads within the Pahsimeroi River subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present monitoring and water quality improvements (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate. The results of ongoing monitoring and watershed improvement projects are also provided as a 5-year review of the original TMDL.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Pahsimeroi River subbasin. 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 Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

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

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act 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 Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

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

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

1 Subbasin Assessment—Subbasin Characterization

Features of the Pahsimeroi River subbasin, the tributary watersheds, and individual streams are detailed in the 2001 TMDL. Comprehensive biological and instream water quality data were also presented and analyzed in the original subbasin assessment and TMDL (DEQ 2001). This TMDL addendum summarizes pertinent subbasin characteristics and any additional data that affect water quality and beneficial uses in the Pahsimeroi River subbasin.

1.1 Physical and Biological Characteristics

1.1.1 Climate and Hydrology

During the period of record from August 1, 1948 through December 31, 2005, the Western Regional Climate Center weather station operating in May, Idaho, recorded the following annual averages (WRCC 2012).

- Average maximum temperature = 58.5 ºF
- Average minimum temperature = 26.9 ºF
- Average total precipitation = 7.77 inches
- Average total snowfall = 19.2 inches

Agriculture has long been established in the Pahsimeroi River valley. Since the region is semiarid, averaging less than 8 inches of rain per year, surface water is extensively diverted for agricultural irrigation (Williams et al. 2006). However, the highly porous alluvium causes many nonappropriated streams to become "lost" to infiltration to the ground water, where it then re-emerges as springs or recharge near the Pahsimeroi River (Meinzer 1924, Young and Harenberg

1973, Maser 2005). In progressively higher elevations up the slopes of the subbasin, precipitation increases to approximately 30 inches per year (Young and Harenberg 1973).

1.1.2 Subbasin Characteristics

The Pahsimeroi River subbasin (hydrologic unit code [HUC] #17060202) is located in east-central Idaho between the Pahsimeroi Mountains of the Lost River Range and the Lemhi Range (Figure 1). The Pahsimeroi River originates near the highest peak in Idaho, Borah Peak, within the Lost River Range. The river flows northward and joins the Salmon River near the town of Ellis. The Pahsimeroi River subbasin is somewhat unique in Idaho in that streams from the mountains disappear into the gravel-filled valley and feed the base flow of the Pahsimeroi River from primarily subsurface flow (Young and Harenberg 1973).

The Lost River Range and Lemhi Range parallel the sediment-filled Pahsimeroi River valley. Both ranges are part of the Basin and Range fault block complex of eastern and central Idaho formed nearly 17 million years ago (Alt and Hyndman 1989).

Agricultural management methods can impact water quality due to cropland runoff or livestock trampling, which can cause streambanks to become unstable and allow an excess sediment load. These activities also have the potential to remove vegetative cover that would normally stabilize streambanks and provide shade. Large herds of elk also congregate in the small streams and can destabilize streambanks and add to bacteria loads.

Irrigation withdrawals for cropland have been extensive throughout the Pahsimeroi River subbasin. Even though DEQ has no jurisdiction over water rights and does not provide load allocations for flow alteration, the Idaho Governor’s Office of Species Conservation (OSC) has been active in negotiating for more discharge in the tributaries, ultimately contributing to fish passage in the Pahsimeroi River (OSC, personal communication, December 2012).

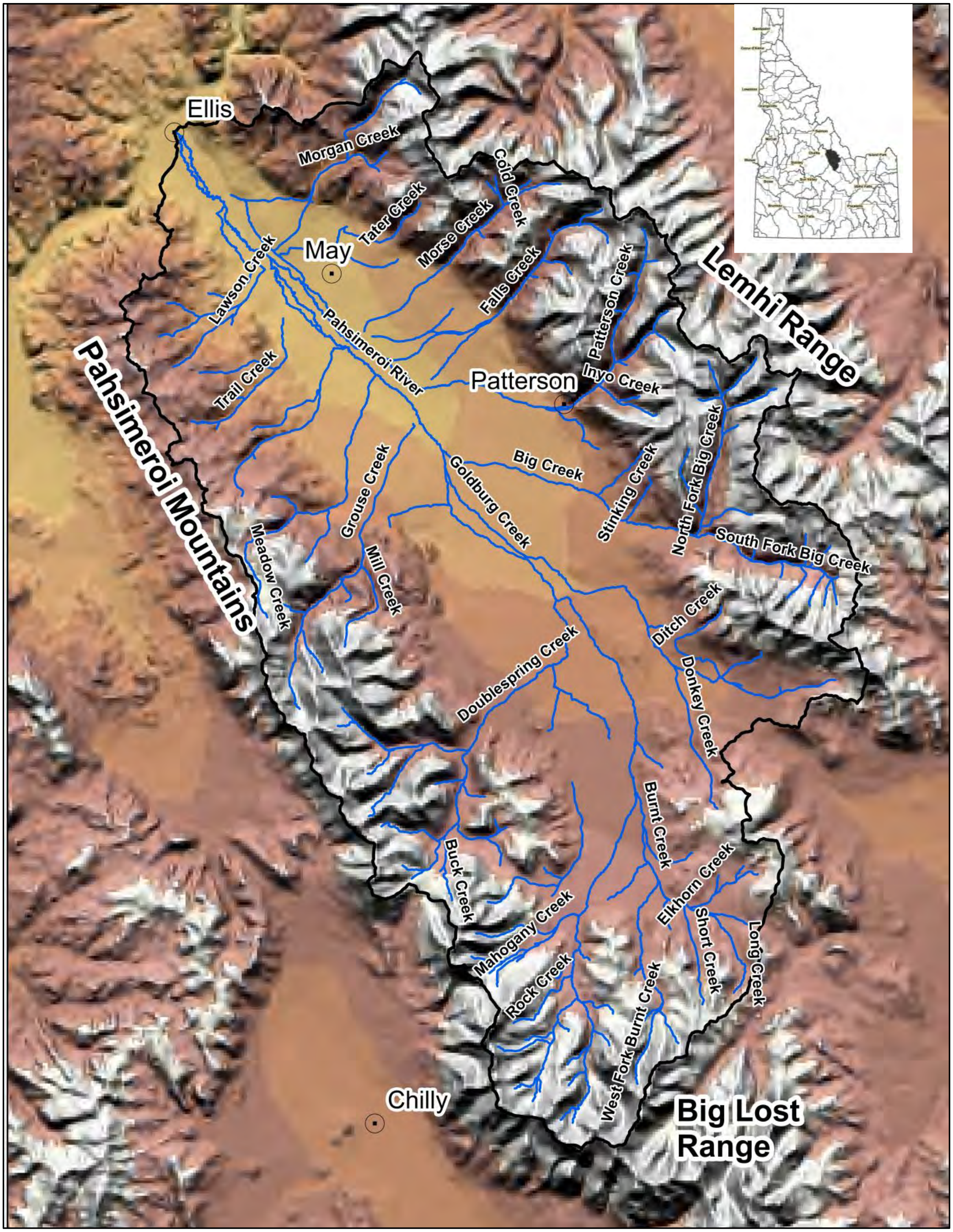

Figure 1. Pahsimeroi River subbasin in east-central Idaho.

Elevation ranges from approximately 7,000 feet on the slopes—where higher-gradient streams flow swiftly with the highest rainfall in the subbasin—to about 4,600 feet in the valley bottom, where the streams decrease in velocity and energy in response to the gentler gradient. The highest elevation is near Borah Peak (12,662 feet), which is near the headwaters of the Pahsimeroi River. Unconsolidated sediments that are associated with the Pahsimeroi River and its tributaries created geologic alluvial fans on the margins of the valley at the mouths of gulches and streams. These alluvial deposits are extensive, with a long history of silt deposition where the tributaries slow at lower gradients. Many tributaries in the subbasin are disconnected from the Pahsimeroi River, sinking into these unconsolidated sediments before they can flow as surface water into the river. Additionally, diversions from the Pahsimeroi River and its tributaries—which irrigate nearly 5% of the basin or approximately 30,000 acres of cropland May through September—remove additional surface flow. However, much of the diverted water returns to the river by ground water flow through these unconsolidated alluvial sediments (Young and Harenberg 1973, Maser 2005).

1.2 Cultural Characteristics

Details regarding the cultural characteristics of the subbasin are provided in the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001). The following sections provide a summary of updated information on Custer and Lemhi Counties and the unincorporated area of May, the primary community in this region.

1.2.1 Landownership and Population

Since the original TMDL (DEQ 2001), many watershed delineations have been altered by a cooperative effort among the Idaho Department of Water Resources (IDWR), the Natural Resources Conservation Service (NRCS), and various state and local agencies. The Idaho Watershed Boundary 5th and 6th Field Delineation Project (IDWR 2008) implemented changes in many Idaho watershed boundaries to coordinate with surrounding states and more accurately reflect drainage patterns. Consequently, the total acreage, landownership proportions, and other land area characteristics for the Pahsimeroi River subbasin may differ from the original TMDL analysis and implementation plan (Table 1; Figure 2).

Table 1. Current landownership in the Pahsimeroi River subbasin.

Landowner	Acreage	Percent of Total
Private	45,418	9%
Public		
Bureau of Land Management	220,019	41%
State of Idaho	19,292	4%
US Forest Service	246,319	46%
Total	531,048	100%

This subbasin contains more than 90% public lands. The Salmon-Challis National Forest manages the upland regions on the shrubland and forested slopes. The river valley adjacent to the river is primarily privately owned. The land between the upland and the river bottom is typically managed by the Challis Field Office of the Bureau of Land Management (BLM).

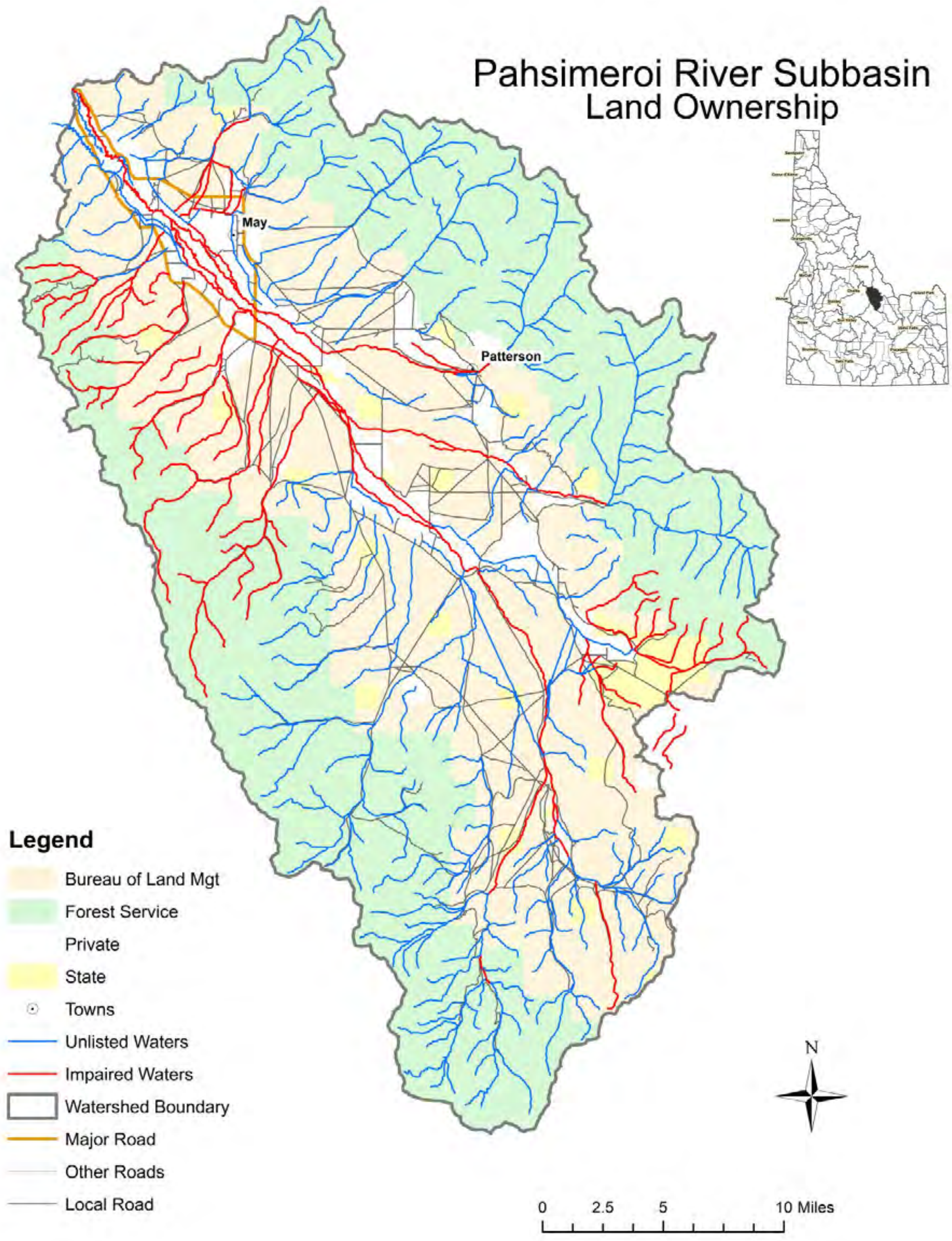

Figure 2. Landowner distribution (BLM 2010).

The population base within the Pahsimeroi River valley is very small and associated with private agricultural lands in the valley bottom. The land area in this subbasin is almost all rural. The Pahsimeroi River subbasin is split between Custer and Lemhi Counties, with the Pahsimeroi River and Big Creek forming the boundary between the two counties. The 2010 population of 7,930 residents in Lemhi County increased from 6,899 in 2000. The county is sparsely populated, with less than 2 residents per square mile (US Census Bureau 2012). The 2010 population of 4,368 residents in Custer County increased from 4,133 in 2000. Custer County is also sparsely populated, with less than 1 resident per square mile (US Census Bureau 2012). Challis, the nearest large town (approximately 20 miles from the Salmon River–Pahsimeroi River confluence), had 1081 residents in 2010, up from 909 in 2000 (US Census Bureau 2012).

The Pahsimeroi River valley was settled during the late 1800s and early 1900s (Meinzer 1924). By 1920, the valley's population had increased to 569 people and 8,277 acres of irrigated crop and pasture land (Meinzer 1924). The population has probably decreased from these early levels. In 1990, the US Census Bureau reported 60 people living in May and 4 people in Patterson. Most of the roads within the valley are associated with agricultural lands. Two main roads travel the length of the valley on either side of the Pahsimeroi River. Numerous primitive roads travel perpendicular to the valley bottom up through the BLM land to the national forest boundaries.

1.2.2 Economics

Employment in Lemhi County is predominantly in the service industries and state and local government. Since most of the land area in Lemhi County is publicly owned, land management agencies like the US Forest Service (USFS), BLM, and Idaho Department of Fish and Game (IDFG) employ many of the county's workers. Historically, mining supported a thriving economy in this area, but mine closures have reduced the number of highly paid workers (Idaho Department of Labor 2012b). Over half of the employment in Custer County is composed of either government or natural resources positions, with mining positions boosting the per capita wage to above the state average (Idaho Department of Labor 2012a). Both counties have had significant increases in unemployment since 2007.

2 Subbasin Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Idaho complies with this and other federal rules by publishing an Integrated Report that lists all the surface waters of Idaho and categorizes them into five categories:

- Category 1—waters wholly within a designated wilderness or inventoried roadless area and presumed to be fully supporting all beneficial uses
- Category 2—waters fully supporting those beneficial uses that have been assessed. The use attainment of the remaining beneficial uses has not been determined due to insufficient data (or no data) and information.

- Category 3—waters have insufficient data (or no data) and information to determine if beneficial uses are being attained
- Category 4—waters do not support one or more beneficial uses, but they do not require the development of a TMDL
- Category 5—waters do not meet applicable water quality standards for one or more beneficial uses due to one or more pollutants; therefore, an EPA-approved TMDL is needed. Category 5 water bodies make up the §303(d) list of impaired waters.

Category 4 includes three subcategories: Category 4a for water bodies with EPA-approved TMDLs; Category 4b for waters with pollution control requirements in place, other than a TMDL; and Category 4c for waters impaired by pollution, rather than pollutants. Streams with human-induced flow and habitat alteration are impaired by pollution instead of specific pollutants according to §502(6) and §502(19) of the Clean Water Act. TMDLs are not required for flow alteration and habitat alteration (i.e., pollution) consistent with EPA guidance. Impaired waters listed in Category 5 require TMDLs to allocate pollutant loads that will restore the water bodies to full support status (DEQ 2011). AUs can be listed in more than one category (e.g., Category 5 for a pollutant such as bacteria and Category 4c for flow alteration).

The current DEQ reference for water quality limited segments in Idaho is the 2010 Integrated Report. The AUs currently listed in Category 5 of the 2010 Integrated Report for the Pahsimeroi River subbasin are listed in Table 2.

Table 2. Pahsimeroi River subbasin assessment units reported in Category 5 of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Impaired Stream Miles	Pollutants	Listing Basis
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	ID17060202SL002_02	50.12	Combined biota/habitat bioassessments; fecal coliform; sedimentation/siltation; temperature	2002 §303(d) list
Pahsimeroi River—Meadow Creek to Patterson Creek	ID17060202SL002_04	3.04	Particle distribution (embeddedness)	2006 §303(d) list
	ID17060202SL002_05	10.21	Temperature; cause unknown (nutrients suspected)	1994 §303(d) list
Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	ID17060202SL003_03	1.82	Combined biota/habitat bioassessments	2002 §303(d) list
North Fork Lawson Creek—source to mouth	ID17060202SL004_02	11.83	Combined biota/habitat bioassessments	2002 §303(d) list
South Fork Lawson Creek—source to mouth	ID17060202SL005_02	11.91	Combined biota/habitat bioassessments	2002 §303(d) list
Meadow Creek—source to mouth	ID17060202SL006_02	28.51	Combined biota/habitat bioassessments; fecal coliform	2002 §303(d) list
Pahsimeroi River—Furey Lane (T15S, R22E) to Meadow Creek	ID17060202SL007_04	1.56	Cause unknown (nutrients suspected)	2002 §303(d) list
Grouse Creek—source to mouth	ID17060202SL009_02	35.96	Combined biota/habitat bioassessments	2002 §303(d) list
Pahsimeroi River—Goldburg Creek to Big Creek	ID17060202SL010_03	5.32	Cause unknown (nutrients suspected)	1994 §303(d) list
	ID17060202SL010_04	6.64		
	ID17060202SL010_05	0.1		
Pahsimeroi River—unnamed tributary (T12N, R23E, Sec. 22) to Goldburg Creek	ID17060202SL011_04	2.54	Cause unknown (nutrients suspected)	1994 §303(d) list
Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec. 22)	ID17060202SL017_04	10.34	Cause unknown (nutrients suspected)	1994 §303(d) list
Burnt Creek—Long Creek to mouth	ID17060202SL023_03	5.06	Combined biota/habitat bioassessments	2002 §303(d) list
Short Creek—source to mouth	ID17060202SL026_02	5.83	Combined biota/habitat bioassessments	2002 §303(d) list
Donkey Creek—source to mouth	ID17060202SL029_02	13.56	Combined biota/habitat bioassessments	2002 §303(d) list
Goldburg Creek—source to Donkey Creek	ID17060202SL030_02	37.62	Fecal coliform	2002 §303(d) list
Big Creek—confluence of North and South Fork Big Creeks to mouth	ID17060202SL031_03	13.56	Sedimentation; cause unknown (nutrients suspected)	1994 §303(d) list

The AUs that are impaired by pollution and listed in Category 4c of the 2010 Integrated Report are listed in Table 3 (DEQ 2011). No TMDLs were developed for the AUs in Category 4c.

Table 3. Pahsimeroi River subbasin assessment units reported in Category 4c of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Impaired Stream Miles	Pollution
Meadow Creek—source to mouth	ID17060202SL006_02	28.51	Low flow alterations
Pahsimeroi River—Furey Lane (T15S, R22E) to Meadow Creek	ID17060202SL007_04	1.56	Low flow alterations
Grouse Creek—source to mouth	ID17060202SL009_02	35.96	Low flow alterations
Pahsimeroi River—Goldburg Creek to Big Creek	ID17060202SL010_04	6.64	Low flow alterations
Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec. 22)	ID17060202SL017_04	10.34	Low flow alterations
Big Creek—confluence of North and South Fork Big Creeks to mouth	ID17060202SL031_03	13.56	Low flow alterations
Patterson Creek—Inyo Creek to mouth	ID17060202SL034_03	14.97	Other flow regime alterations
	ID17060202SL034_04	12.05	
Morgan Creek—source to mouth	ID17060202SL039_03	14.07	Low flow alterations

The AUs with existing load allocations from the original *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001) are listed in Table 4. These AUs are listed in Category 4a of the 2010 Integrated Report.

Table 4. Pahsimeroi River subbasin assessment units reported in Category 4a of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Impaired Stream Miles	Pollutants
Pahsimeroi River—Patterson Creek to mouth	ID17060202SL001_05	14.22	Sedimentation/siltation; temperature, water
Pahsimeroi River—Meadow Creek to Patterson Creek	ID17060202SL002_04	3.04	Sedimentation/siltation
	ID17060202SL002_05	10.21	
Pahsimeroi River—Furey Lane (T15S, R22E) to Meadow Creek	ID17060202SL007_04	1.56	Sedimentation/siltation
Pahsimeroi River—Big Creek to Furey Lane (T15S, R22E)	ID17060202SL008_04	3.18	Sedimentation/siltation
Pahsimeroi River—Goldburg Creek to Big Creek	ID17060202SL010_03	5.32	Sedimentation/siltation
	ID17060202SL010_04	6.64	
	ID17060202SL010_05	0.1	
Pahsimeroi River—unnamed tributary (T12N, R23E, Sec. 22) to Goldburg Creek	ID17060202SL011_04	2.54	Sedimentation/siltation
Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec. 22)	ID17060202SL017_04	10.34	Sedimentation/siltation
Pahsimeroi River—Mahogany Creek to Burnt Creek	ID17060202SL018_04	6.17	Sedimentation/siltation; temperature, water
East Fork Pahsimeroi River—source to mouth	ID17060202SL022_03	1.42	Sedimentation/siltation; temperature, water

Idaho's Integrated Report is a guide for developing and implementing water quality improvement plans to protect water quality and achieve federal and state water quality standards. The findings of this TMDL addendum and ongoing assessment in the subbasin will be reported in the 2014 Integrated Report.

A summary of the water bodies and pollutants for which TMDLs were developed in this addendum is presented in Table 5.

Table 5. Water bodies and pollutants for which TMDLS were developed.

Water Body	Assessment Unit Number	Pollutants
Pahsimeroi River—Patterson Creek to mouth	ID17060202SL001_05	Temperature—updated
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	ID17060202SL002_02	Temperature, sediment, and bacteria (*E. coli*)
Pahsimeroi River—Sulphur Creek to Patterson Creek	ID17060202SL002_05	Temperature
North Fork Lawson Creek—Source to Mouth	ID17060202SL004_02	Sediment
Pahsimeroi River—Mahogany Creek to Burnt Creek	ID17060202SL018_04	Temperature—updated
Pahsimeroi River—Confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	ID17060202SL020_03	Temperature
East Fork Pahsimeroi River—Source to Mouth	ID17060202SL022_03	Temperature—updated
Short Creek—Source to Mouth	ID17060202SL026_02	Sediment

2.2 Applicable Water Quality Standards and Beneficial Uses

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

Beneficial uses include the following:

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

2.2.1 Existing Uses

Existing uses under 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.

2.2.2 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.

2.2.3 Presumed Uses

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

2.2.4 Beneficial Uses in the Subbasin

Table 6 lists the designated, existing, or presumed beneficial uses for AUs listed in Category 5 of the 2010 Integrated Report for the Pahsimeroi River subbasin.

Table 6. Beneficial uses of assessment units listed in Category 5 of the 2010 Integrated Report for the Pahsimeroi River subbasin.

Assessment Unit Name	Assessment Unit Number	Designated, Existing, or Presumed Beneficial Uses[a]
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	ID17060202SL002_02	CW, SS, PCR, DWS
Pahsimeroi River—Meadow Creek to Patterson Creek	ID17060202SL002_04 ID17060202SL002_05	CW, SS, PCR, DWS
Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	ID17060202SL003_03	CW, SCR
North Fork Lawson Creek—source to mouth	ID17060202SL004_02	CW, SCR
South Fork Lawson Creek—source to mouth	ID17060202SL005_02	CW, SCR
Meadow Creek—source to mouth	ID17060202SL006_02	CW, SCR
Pahsimeroi River—Furey Lane Road (T15S, R22E) to Meadow Creek	ID17060202SL007_04	CW, SS, PCR, DWS
Grouse Creek—source to mouth	ID17060202SL009_02	CW, SCR
Pahsimeroi River—Goldburg Creek to Big Creek	ID17060202SL010_03 ID17060202SL010_04 ID17060202SL010_05	CW, SS, PCR, DWS
Pahsimeroi River—unnamed tributary (T12N, R23E, Sec. 22) to Goldburg Creek	ID17060202SL011_04	CW, SS, PCR, DWS
Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec. 22)	ID17060202SL017_04	CW, SS, PCR, DWS
Burnt Creek—Long Creek to mouth	ID17060202SL023_03	CW, SCR
Short Creek—source to mouth	ID17060202SL026_02	CW, SCR
Donkey Creek—source to mouth	ID17060202SL029_02	CW, SCR
Goldburg Creek—source to Donkey Creek	ID17060202SL030_02	CW, SCR
Big Creek—confluence of North and South Fork Big Creeks to mouth	ID17060202SL031_03	CW, SCR

[a] Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)

An additional AU not listed in Idaho's Integrated Report has been given a load allocation for temperature impairment in this TMDL addendum. The beneficial uses for this "unlisted but impaired" AU are given in Table 7.

Table 7. Beneficial uses of unlisted but impaired assessment unit that received a temperature TMDL.

Assessment Unit Name	Assessment Unit Number	Designated, Existing, or Presumed Beneficial Uses[a]
Pahsimeroi River—confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	ID17060202SL020_03	CW, SS, PCR, DWS

[a] Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), domestic water supply (DWS)

2.2.5 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250–251). Table 8 includes the numeric criteria referenced in this TMDL.

Table 8. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards (IDAPA 58.01.02.250–251).

Water Quality Parameter	Designated and Existing Beneficial Uses			
	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Bacteria	Less than 126 *E. coli* /100 mL[b] as a geometric mean of 5 samples over 30 days; no single sample greater than 406 *E. coli* /100 mL	Less than 126 *E. coli* /100 mL as a geometric mean of 5 samples over 30 days; no single sample greater than 576 *E. coli* /100 mL		
Temperature[c]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* organisms 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.

Figure 3 outlines of the stream assessment process from DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002) for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation. When any AU is assessed as "not fully supporting" its beneficial use, it is listed in Category 5 of the IR and receives a pollutant load allocation in a TMDL.

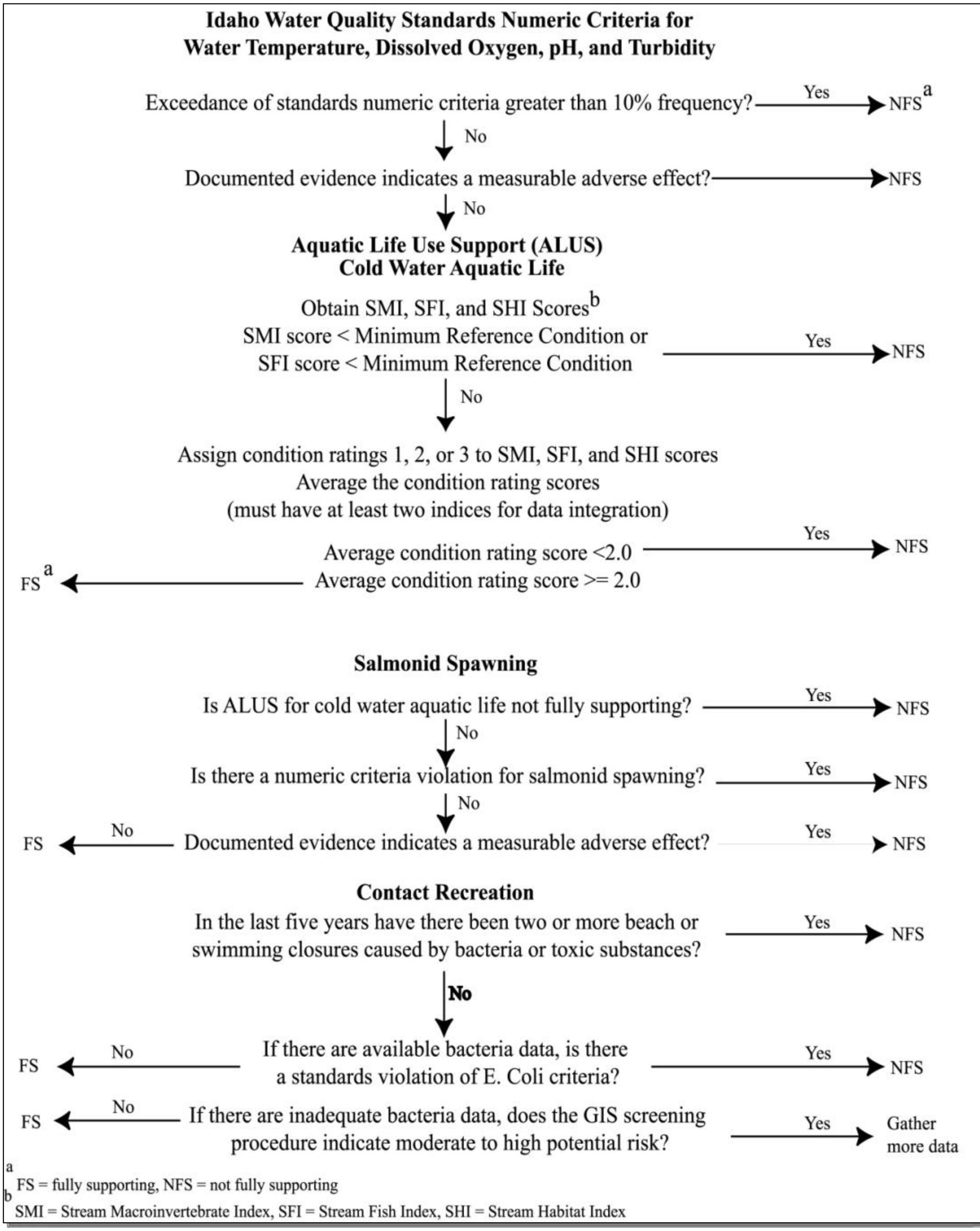

Figure 3. Steps and criteria for determining support status of beneficial uses.

2.2.5.1 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 DEQ is generally from March 15 to July 15 each year (Grafe et al. 2002). Fall spawning can occur from September 1 and continue with incubation into the following spring up to June 1. The water quality criteria that need to be met during spawning and incubation periods are listed in (Table 8).

For the purposes of a temperature TMDL, the highest recorded water temperature in a recorded data set (excluding any high water temperatures that may have occurred 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.

2.2.5.2 Natural Background Provisions

For potential natural vegetation (PNV) TMDLs, it is assumed that natural temperatures may exceed the water quality criteria during hot periods. If PNV 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. According to IDAPA 58.01.02.200.09:

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

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

2.3 Summary and Analysis of Existing Water Quality Data

This section provides additional data collected since the Pahsimeroi River TMDL (DEQ 2001) was approved by EPA in 2001. A summary of data sources used in this analysis is provided in Appendix A.

2.3.1 Discharge Characteristics

Historically, the US Geological Survey (USGS) has operated various stream gaging stations on tributaries of the Pahsimeroi River. The minimum, average, and maximum daily discharge values for the period of record at each stream gage are listed in Table 9.

Table 9. Summary of discharge data at historic US Geological Survey stream gaging stations.

Gaging Station		Daily Discharge (cfs)[a]			Period of Record[b]
		Minimum	Average	Maximum	
13302005	Pahsimeroi River at Ellis ID	131	230	301	1984–2012
13302000	Pahsimeroi River nr May ID	74	212	796	1929–1972
13299500	Pahsimeroi River abv Burnt Creek nr Goldburg ID	0.35	48	345	1910–1913
13300000	Pahsimeroi River bl Sinks nr Goldburg ID	2	15	104	May–Sep 1913
13300500	Goldburg Creek nr Goldburg ID	2	6	29	Jan–May 1910
13301000	Goldburg Creek nr Patterson ID	12	19	30	Jun–Sep 1913
13301500	Big Creek ab Div nr Patterson ID	24	68	406	1910–1913
13301620	Falls Creek nr May ID (seasonal)	4.9	17	102	2002–2004
13301900	Pahsimeroi River at Dowton Lane nr May ID	52	193	411	1985–1987
13301990	Pahsimeroi River at Burstead Lane nr Ellis ID	95	239	364	1985–1987

[a] cfs = cubic feet per second
[b] dates are for the data available at time of developing this TMDL

Currently, the USGS operates one real-time stream gaging station in the Pahsimeroi River subbasin on the main stem of the river. USGS gaging station number 13302005 (Pahsimeroi River at Ellis ID) is at 4,635 feet in elevation, records flow from an area that drains 830 square miles, and recorded 230 cubic feet per second (cfs) daily mean discharge during the period of record from water years 1985 through 2012 (Figure 4). The largest daily discharges typically occur between October and March; whether this is due to climate, alluvial return flows, or the lack of irrigation withdrawals during the winter period was not examined.

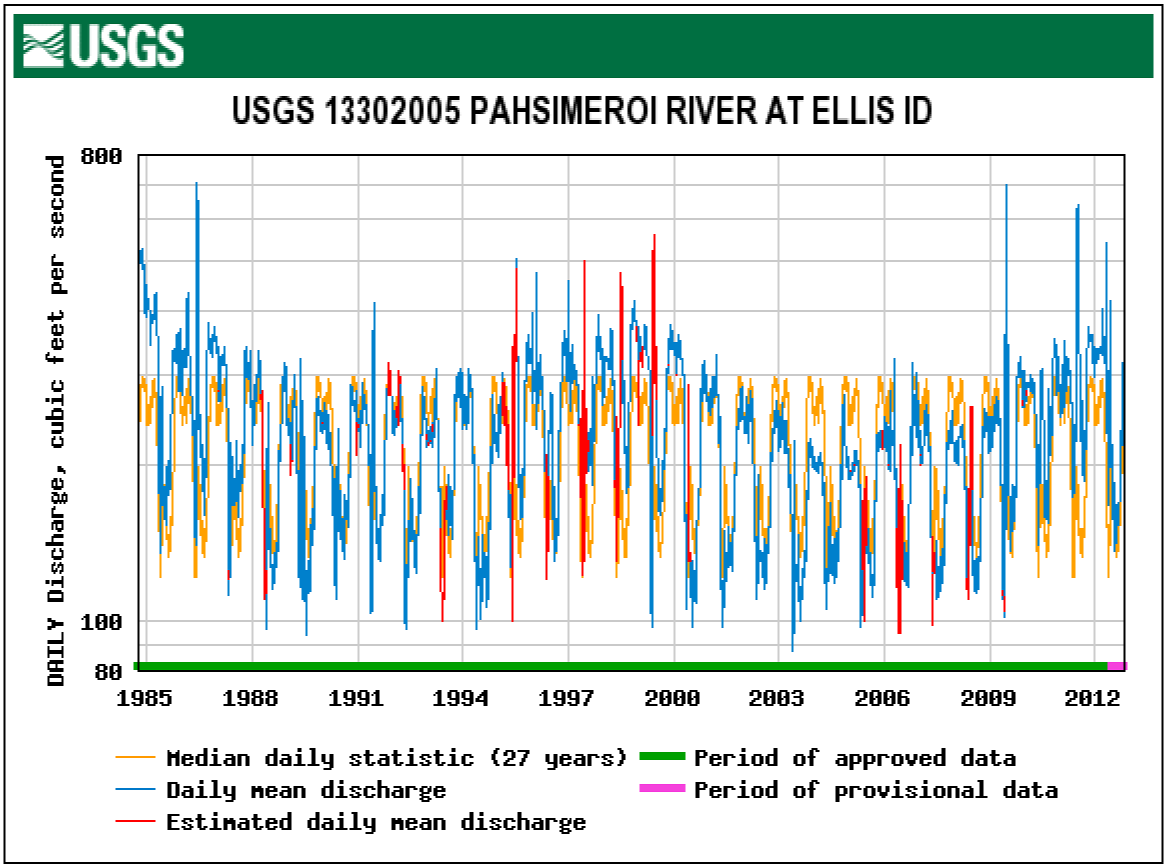

Figure 4. Daily discharge in the Pahsimeroi River near Ellis, Idaho.

Idaho Power also operates stream gages in the Pahsimeroi River subbasin. Three are currently active and two were discontinued in 2008 (Table 10).

Table 10. Summary of discharge data at Idaho Power stream gaging stations.

Gaging Station		Daily Discharge (cfs)[a]			Period of Record[b]
		Minimum	Average	Maximum	
13301895	Pahsimeroi R at P9 Diversion near May, ID	0.38	55	379	2005–2012
13301515	Pahsimeroi R at Furey Ln near May, ID	0	22	204	2004–2012
13301700	Pahsimeroi Big Spring near May, ID	17	46	158	2008–2012
13301860	Little Morgan Ck near May, ID	4	16	118	2005–2008
13301620	Falls Ck near May, ID	5	10	43	2008

[a] cfs = cubic feet per second
[b] dates are for the data available at time of developing this TMDL

At the middle elevations in the subbasin, tributaries to the Pahsimeroi River decrease in velocity in response to lower gradients. Where velocity slows, extensive alluvial sediments have been deposited at the mouths of gulches and streams throughout the valley. Many tributaries come directly out of canyons from the Big Lost Range and Lemhi Range onto alluvial fans in the river valley. These areas have historically been used as rangeland with the streams appropriated for irrigation in the lower valley. Subsequently, the tributaries in the alluvial areas are extensively flow-altered. The irrigation water withdrawals from the Pahsimeroi River and tributaries exacerbate diminished water volumes because of the loose-grained and highly transmissive alluvial deposits. However, recent restoration activities being administered by the OSC are restoring some historic connections between currently dewatered portions of tributaries and the Pahsimeroi River.

A survey of the ground water and the relationship between surface water, ground water, and the geology in the Pahsimeroi River subbasin noted the rapid infiltration in the coarse gravel/alluvium and subsequent transmission of ground water (Meinzer 1924). The extent of the coarse gravel/alluvium can be identified in two distinct areas: (1) the alluvial fans at the mouths of the canyons and gulches spreading out into the valley and (2) the valley fill composed of the coarse gravel deposited by streams (Meinzer 1924). This alluvium is prevalent along the valley walls and near the modern day Furey Lane, near the N 44° 30’ line on Figure 5.
A reconnaissance by Young and Harenberg (1973) described this location as the “sinks,” and the depth of the fill material is estimated at approximately 3,000 feet. The Pahsimeroi River is often dry at this location. However, near the mouth of the Pahsimeroi River, the depth to bedrock is estimated at 30 feet (Young and Harenberg 1973). More details on the geology, topography, and vegetation are available in the Pahsimeroi River TMDL (DEQ 2001).

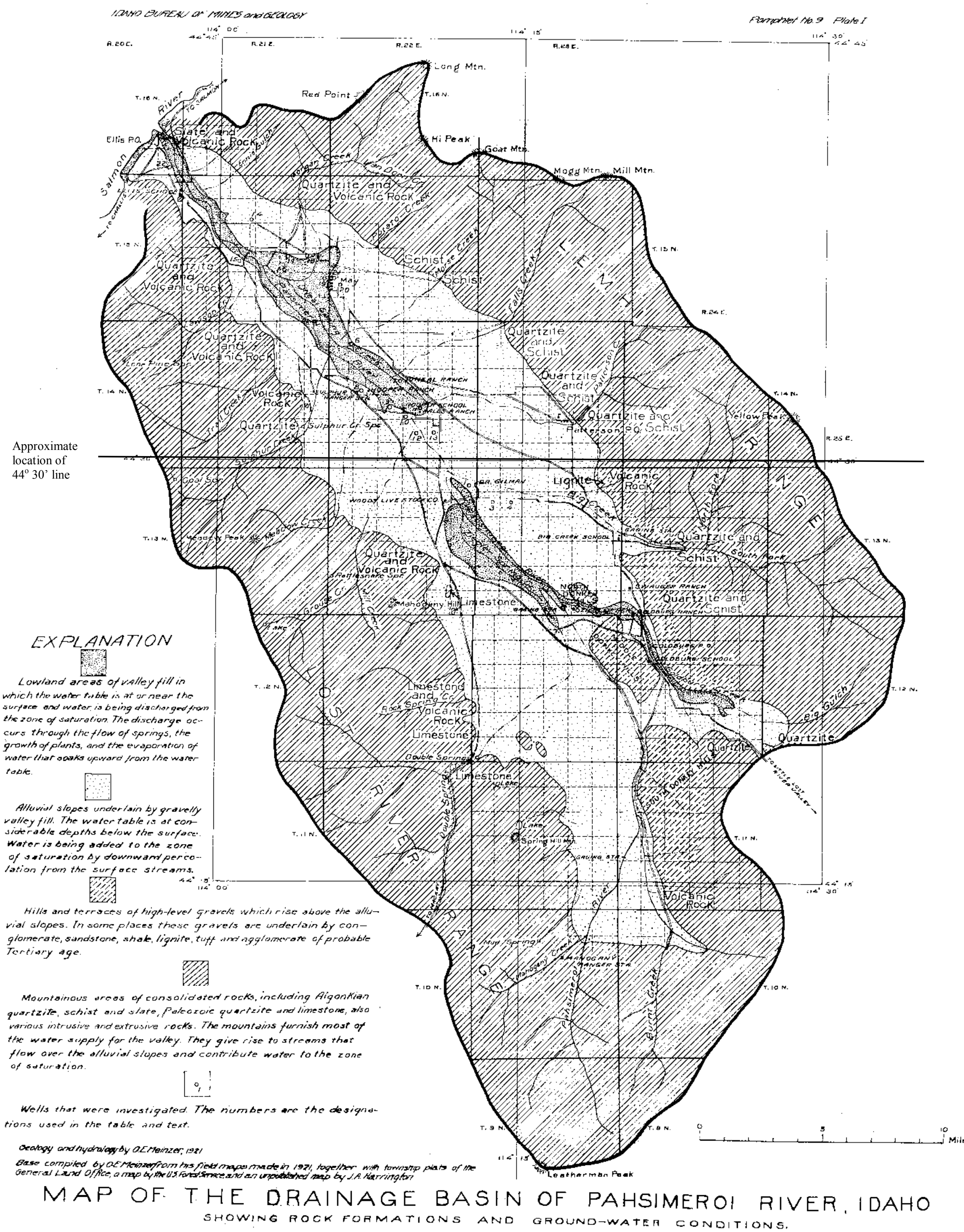

Figure 5. Extent of alluvium and geologic features in the Pahsimeroi River valley. Source: (Meinzer 1924).

2.3.2 Assessment Units Impaired by Pollution

The following section details AUs that are currently listed in Category 5 for impaired water quality but should be listed in Category 4c for flow alteration. DEQ's current multimetric biological indices are not appropriate for intermittent streams. These indices were developed based on community composition and function typical of an expected reference condition. Reference conditions are persistent aquatic habitats that allow full development of aquatic communities. Temporary waters will never have similar composition and function as perennial waters (Grafe et al. 2002). DEQ does not have a specific protocol for monitoring or assessing intermittent waters, especially waters where there are legally allowed low flow alterations in effect.

ID17060202SL003_03, Lawson Creek—Confluence of North and South Fork Lawson Creek to mouth

Lawson Creek from the confluence of the north and south forks to the mouth is currently listed in Category 5 for "combined biota/habitat bioassessments." Instead, it should be listed in Category 4c for "low flow alterations" as it exhibited no other impairments. This AU lies entirely in an alluvial fan as it exits a canyon. At this point, the surface water discharge becomes diverted for irrigation per a 1917 priority for Water Right 73-79. The diversion is located approximately 375 meters below the confluence of the north and south forks of Lawson Creek and remains in a canal (ID17060202SL002_03) for approximately 1,770 meters to where it is used for irrigation. The water right is for 3.2 cfs (April 1–October 31) where the "quantity of this right is all of the flow of Lawson Creek" (partial decree pursuant to I.R.C.P. 54(b) for Water Right 73-00079, in RE SRBA case no. 39576).

Therefore, below this diversion any riparian habitat composed of obligate wetland vegetation (if any) is due to ground water seepage, not surface water flows. Any surface flows are insufficient during the growing season to promote functional macroinvertebrate populations and insufficient during the winter months, if water were to flow, to promote a functional habitat. Above the diversion, water quantity is limited and surface water is lost to the ground water on this porous alluvial fan. Based on visual estimates, discharge is typically less than 1 cfs; therefore, the 1997 BURP score (at site 1997SIDFM040 on July 1, 1997) indicating impairment was inappropriately applied to this stream reach (1997 was a wet year with a measured discharge of 2.5 cfs). EPA's Assessment Database (ADB) notes that the impaired assessment designation is based only on the single BURP score.

Bacteria monitoring results for *E. coli* were examined and are below the threshold of concern for secondary contact recreation (discussed in section 2.3.4). Grazing management changes have occurred in the watershed along with stock water modifications that developed from reconnecting waters in the P-9 canal (see section 4.2 and Appendix B). Streambank erosion was examined in 2009 using the streambank erosion inventory method. Results and discussion are presented in section 5.2 and Appendix C. The erosion rate was 41 tons/year with a load capacity of 42 tons/year.

ID17060202SL011_04, Pahsimeroi River—Unnamed Tributary (T12N, R23E, Sec. 22) to Goldburg Creek

This AU is appropriately listed in Category 4a for "sedimentation/siltation" and is also listed in Category 5 for "cause unknown (nutrients suspected)." The connecting upstream AU (ID17060202SL017_04) is listed in Category 4c and also in Category 5 for cause unknown (nutrients suspected). The unnamed tributary (T12N, R23E, Sec. 22) is believed to be Doublesprings Creek; however, this stream is dewatered from upstream diversions and/or losses to the aquifer. Documentation for a 2001 water rights transfer of 73-175, 73-176, 73-7044,73-7076, 73-7093, and 73-2002 details these losses. Therefore, flows from Doublesprings into the Pahsimeroi River are not suspected as a source of nutrients. Based on the number of water right diversions in the land surrounding the AU, there may be ground water recharge/seepage into the channel; however, these rights suggest that surface water flows are extremely limited until the surface water/ground water interactions begin to be recharged by Goldburg Creek.

This AU is susceptible to erosion if water were to flow in the channel; therefore, maintaining the current TMDL for sediment/siltation is appropriate to protect downstream beneficial uses. No indications of nutrients impairing the beneficial use in this dry channel and no significant sources of nutrients in the 2.54-mile long reach were identified by DEQ. The sole source of impairment (besides sediment/siltation) is "low flow alterations," which means this AU should be listed in Category 4c and delisted from Category 5 for "cause unknown." Additionally, this AU is often naturally dewatered due to the underlying geology, and upstream irrigation canal reconnections have had limited success in returning water to the stream channel. This AU has also seen significant improvements in the livestock and farming best management practices (BMPs) (K. Bragg, Custer Soil and Water Conservation District, personal communication, January 2013).

2.3.3 Water Column Data

DEQ examined water column data from the USFS, USGS, BLM, and IDFG. These data are summarized below.

2.3.3.1 United States Forest Service

The Salmon-Challis National Forest has collected data—including instream temperature, percent bank stability, and subsurface fine sediment—for key streams on forest land in the Pahsimeroi River subbasin (Appendix D). Pertinent temperature and sediment data are summarized in Tables 11 and 12 for streams listed in Category 5.

Table 11. Salmon-Challis National Forest instream temperature data summary.

Stream	Year	Absolute Maximum Temperature (ºC)	Maximum 7-day Moving Maximum Temperature (ºC)
East Fork Pahsimeroi above West Fork	2009	13.0	11.5
	2010	11.6	10.7
Pahsimeroi River Below East Fork and West Fork	2010	11.6	10.9
	2011	12.1	11.2

Both river reaches met the cold water aquatic life temperature criterion of 19 ºC maximum daily average in the 2 years of data available. It is currently unknown whether this constitutes sufficient data to delist, and this process should be further examined in the next TMDL/assessment cycle for AU ID17060202SL022_03, if PNV metrics are met.

The USFS monitored sediment on certain streams. Appendix D presents those sediment data; Table 12 summarizes mean percent bank stability and percent subsurface fine sediment since 2001. No data were collected in 2011 and 2012 for the listed streams in the Pahsimeroi River subbasin.

Table 12. Salmon-Challis National Forest sediment data summary, 2001–2010.

Summary Streambank Stability Measurements Recorded on the Salmon-Challis National Forest from 2001 through 2010

Pahsimeroi			Percent Bank Stability									
Station	**Latitude**	**Longitude**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Big Creek_PAH_ 1R	44°26'30.542"N	113°36'0.445"W	94.0	91.5	92.0	95.5						
NF Big Creek 1R	44°26'31.5"N	113°35'58.7"W	97.0	99.0		99.5						
Pahsimeroi River 1R	44°9'25.918"N	113°42'14.111"W							99.0		93	97
SF Big Creek 1R	44°26'29.669"N	113°35'57.18"W	85.5	73.0	93.0	97.5			99.0			

Summary of Depth Fines Measurements Recorded on the Salmon-Challis National Forest from 2001 through 2010

Pahsimeroi			Mean Percent Fines <.25" at Depth									
Station			**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Big Creek_PAH_ 1R	44°26'30.542"N	113°36'0.445"W	25.6	28.2	25.8	27.1						
NF Big Creek 1R	44°26'31.5"N	113°35'58.7"W	19.7	22.5		21.7						
Pahsimeroi River 1R	44°9'25.918"N	113°42'14.111"W							26.7		20.6	9.8
SF Big Creek 1R	44°26'29.669"N	113°35'57.18"W	23.6	30.0	28.1	31.2			8.8			

FOOTNOTES

1,2,3 Stations on a stream in downstream to upstream order

A or R -Designates whether a stream has Anadromous or Resident Fish

PAH=Pahsimeroi River Subbasin

Empty cells denote date/locations without monitoring

These portions of listed streams on USFS land all meet the sediment targets of at least 80% streambank stability and no more than 28% subsurface fine sediments, when accounting for different methods. These targets have been established in many of DEQ's EPA-approved sediment TMDLs, including the 2001 Pahsimeroi River TMDL (DEQ 2001). Sediment targets based on subsurface fine sediments are protective of salmonid spawning habitat, and increasing streambank stability is a means to reducing subsurface fine sediment.

2.3.3.2 United States Geological Survey

The USGS gaging station in the Pahsimeroi River near Ellis, Idaho, recorded instream water temperature March–September for 3 years (1998, 2001 and 2005). The daily maximum and daily average temperatures, calculated over the period of record, are shown in Figure 6.

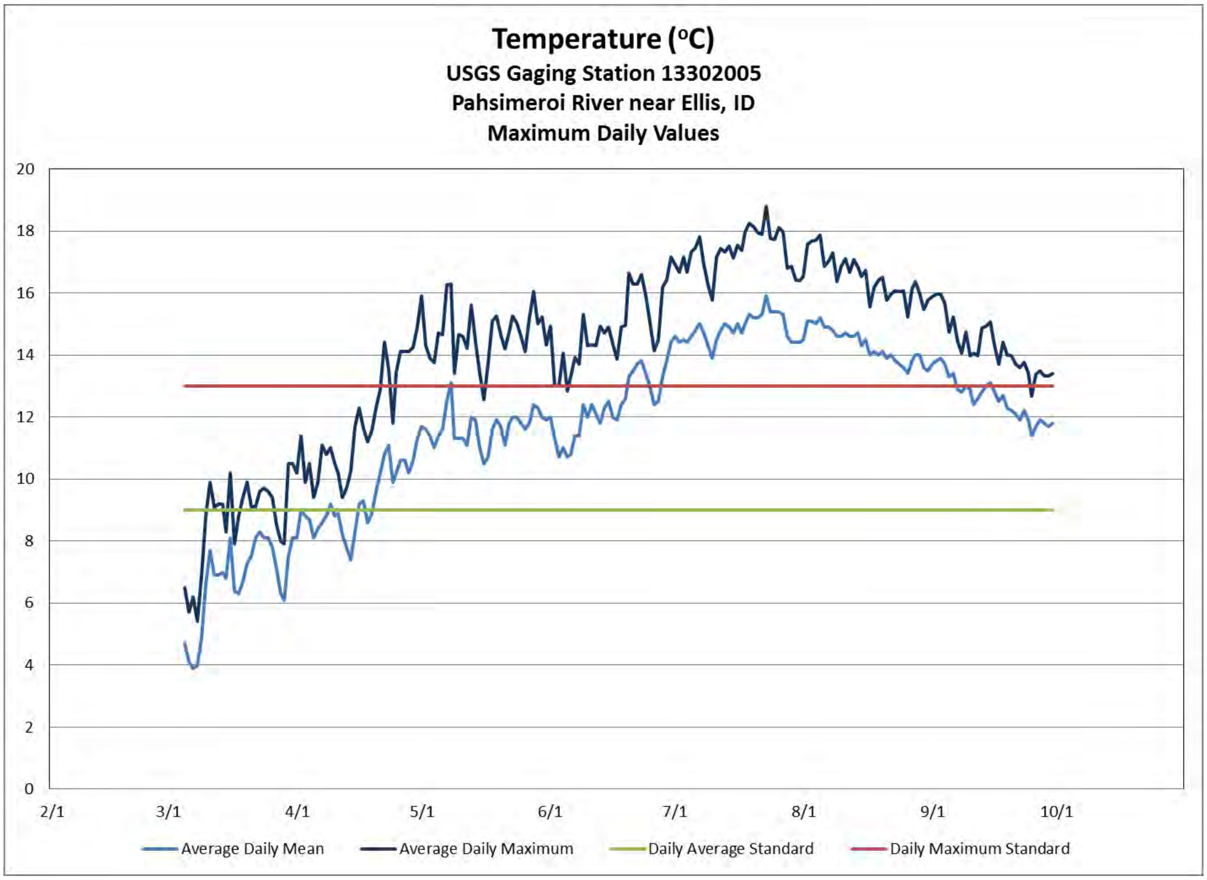

Figure 6. Instream temperature at US Geological Survey gage 13302005 (Pahsimeroi River near Ellis, Idaho)—1998, 2001 and 2005.

Temperature criteria from Idaho's water quality standards to support salmonid spawning as a beneficial use include 13 ºC as a daily maximum water temperature and 9 ºC as a daily average. As detailed in section 2.2.5.1, the spawning and incubation period that applies to these standards is March 15–July 15 and after September 1. From the Pahsimeroi River USGS temperature data near Ellis, Idaho, the daily maximum temperature typically exceeded 13 ºC during salmonid spawning periods from mid-April to July 15 and again from September 1 through September 30. The daily average temperature shows some exceedances during the salmonid spawning period after April 15, after which the average temperature typically exceeds the 9 ºC criterion.

However, these data were collected prior to implementing the *Pahsimeroi River Subbasin Total Maximum Daily Load Agricultural Implementation Plan* (Maser 2005). These implementation activities are detailed in section 4.2. Therefore, analysis of the temperature data prior to the implementation plan does not represent current conditions and is included in the document for historical purposes detailing available data.

2.3.3.3 Bureau of Land Management

The BLM Challis Field Office has collected data—including instream temperature, percent bank stability, and subsurface fine sediment—for key streams on BLM land in the Pahsimeroi River subbasin (Appendix E). Pertinent temperature data are summarized in Table 13; data collection dates are listed in Appendix E.

Table 13. Cumulative record of seasonal maximum and maximum 7-day average maximum stream temperatures (°F)—2006 to 2011.

CUMULATIVE RECORD OF SEASONAL MAXIMUM and MAXIMUM 7-DAY AVERAGE MAXIMUM STREAM TEMPERATURES (°F)

BLM CHALLIS FIELD OFFICE, IDAHO	2006		2007		2008		2009		2010		2011	
Stream Name and Site	Max	Max 7-Day Ave Max	Max	Max 7-Day Ave Max	Max	Max 7-Day Ave Max	Max	Max 7-Day Ave Max	Max	Max 7-Day Ave Max	Max	Max 7-Day Ave Max
Big At BLM/USFS Boundary	15.6	14.4	15.2	14.3	14.8	14.0	13.8	12.7	*	*	12.7	12.0
Burnt (1) Site 2; At BRN-KA-1	19.1	17.6	18.2	16.8	16.4	15.7	15.3	14.6	15.2	14.4	15.3	14.8
Burnt (2) Upper; Site 4; Exclosure 6; Above "West Trib"	17.2	15.4	17.0	16.4	14.7	14.4	13.4	13.0	13.6	13.0	14.0	13.5
Burnt (3) Site 5; In Exclosure 7 Spring Channel							7.0	6.9	7.3	7.0	7.0	6.9
Burnt In Exclosure 7 Main Channel					11.0	10.3						
Ditch At DC-KA-1											10.0	9.7
Falls At FC-KA-1											13.1	12.5
Falls On USFS Above East or West Ditch POD's	10.3	10.0			*	*	9.9	9.5	*	*	9.6	9.4
Goldburg At GOLD-KA-02											16.5	15.6
Goldburg At Lower Diversions On BLM							19.1	18.2	18.4	17.5	-	-
Goldburg At Pahsimeroi HWY Crossing	19.1	18.6	19.8	18.2	17.9	16.6	19.2	18.1	18.5	17.7	18.1	16.6
Little Morgan Above Diversion at Mouth of Canyon	15.3	15.0	14.8	14.2	13.3	12.8	13.4	12.7	12.5	12.2	12.5	12.0
East Fork Little Morgan At Mouth											10.2	9.8
Long At LNG-KA-1							20.1	17.5	18.3	16.8	19.4	17.6
Mahogany At Mouth					13.3	12.6	12.5	12.1	12.4	11.3	12.0	11.4
Mahogany At MGY-KA-1	malf	malf	malf	malf			↓	↓	12.3	10.8	11.8	11.0
Morse Above Diversion At BLM/USFS Boundary	12.9	12.5	12.9	12.4	11.7	11.3	11.7	11.0	12.1	11.6	10.8	10.5
Pahsimeroi At Mouth	20.2	19.7	20.9	19.4	24.8	21.9	19.8	19.2	19.2	18.5	20.9	19.7
Pahsimeroi Above Grouse Cr At BLM/PVT Below Big Cr	21.3	20.1	23.2	21.6	22.9	21.2	20.1	19.2	20.8	19.5	↓19.5	↓18.3
Pahsimeroi Above Burnt Creek At Culvert					malf	malf	14.6	13.4	13.6	12.4	13.2	12.8
Pahsimeroi Above Mahogany Creek At Confluence	15.4	13.9			~	~	15.0	13.2	13.6	12.2	13.3	12.5
Pahsimeroi At PAH-KA-04											13.0	12.0
Patterson Above Diversion at Mouth of Canyon	12.2	11.3	12.2	11.6	11.0	10.6	~	~	10.6	10.3	10.7	10.4
Short At SHC-KA-1							16.8	15.8	16.4	15.3	16.9	15.9
Tater At TATE-KA-1											7.8	7.7

Symbol	Meaning
-	site discontinued
(blank)	not deployed
*	thermo lost
↓	thermo found buried in substrate
malf	thermo malfunction
~	thermo found floating or up on bank
!	thermo found damaged

Table 13 indicates some exceedances. However, additional examination of the complete dataset and contributing factors is necessary to accurately determine beneficial use support and timing of salmonid spawning. Select thermographs are compiled in Appendix E. Complete thermograph data will need to be examined to confirm beneficial uses are being met for all streams in the Pahsimeroi River subbasin.

The BLM Multiple Indicator Monitoring (MIM) data for streambank and sediment are located in Table 14. Additional habitat data are in Appendix E. Several AUs have streambank stability levels below the 80% threshold used by DEQ; however, most are in AUs listed for sedimentation/siltation. For example, the Pahsimeroi River – Meadow Creek to Patterson Creek (Sulphur and Trail Creeks tributaries) (ID17060202SL002_02) is listed in Category 5 for sediment and has a stability rating below the 80% threshold. BLM data support decisions and interpretations of impairment in many of these waters and imply that streambank stability in some areas has not reached the level necessary for delisting.

Table 14. BLM Multiple Indicator Monitoring (MIM) streambank and sediment data.

AU	Allotment:	DESIGNATED MONITORING AREA:			Downstream Marker		Streambanks			Substrate:			
		DMA ID	STREAM	DATE	Latitude	Longitude	*Streambank Alteration (%)*	*Streambank stability(%)*	*Streambank cover (%)*	*Percent fines*	*D16 Particle Size (mm)*	*D50 Particle Size (mm)*	*D84 Particle Size (mm)*
ID17060202SL002_02	Grouse Creek	SULP-KA-02	Sulphur Creek	10/5/2011	44.538832	-113.9228	16%	67%	77%	31%	1.2	22.63	50
	Grouse Creek	SULP-KA-01	sulphur creek	9/8/2011			7%	79%	73%	8%	8.3	20.19	40
		KA-1	Trail Creek	10/13/2010	44.5333	-113.9807	17%	56%	76%	43%	0.8	6.45	25
ID17060202SL006_02	Meadow Creek	MEADKA01	MEADOW CREEK	6/23/2011	44.457719	-113.922128	14%	72%	94%	39%	1.2	7.80	27
ID17060202SL008_04	County Line	PAR 01	Pahsimeroi River	9/29/2010	44.49982	-113.8222	4%	23%	29%	36%	0.9	16.33	37
ID17060202SL010_03	Lower Goldburg	GOLD-KA-02	Goldburg	7/20/2011			1%	85%	73%	22%	1.8	23.63	55
ID17060202SL010_04	GROUSE CREEK	PAR-KA-02	PAHSIMEROI RIVER	9/18/2012			2%	87%	73%	33%	1.0	20.69	53
ID17060202SL017_04	Donkey Hills	PAR-KA-01	Pahsimeroi River	9/28/2010	44.3139	-113.6536	9%	51%	51%	8%	11.3	23.65	50
ID17060202SL018_04	Upper Pahsimeroi	PAR-KA03	Pahsimeroi River	9/30/2010	44.2666	-113.6618	0%	79%	75%	17%	3.9	35.41	111
ID17060202SL023_03	PINES-ELKHORN	BRN-KA-05	BURNT CREEK	9/19/2012			12%	39%	34%	84%	0.4	1.20	5
ID17060202SL026_02	Dry Creek	SHC-KA-01	Short Creek	9/27/2010	44.19296	-113.6058	6%	69%	81%	34%	2.5	7.33	38
	Dry Creek	SHC-KA-02	Short Creek	9/28/2010	44.166475	-113.5993	7%	84%	92%	34%	1.4	12.32	47
ID17060202SL029_02	donkey hills	dh ka1	donkey creek	9/2/2010			4%	95%	99%	21%	2.4	27.30	70
ID17060202SL031_03	Big Creek	BGC-KA-02	Big Creek	9/30/2010	44.4473983	-113.622326	0%	67%	66%	8%	18.2	53.15	134

2.3.3.4 Idaho Department of Fish and Game

The Pahsimeroi Fish Hatchery and Rearing Ponds operates under the general permit is a National Pollutant Discharge Elimination System (NPDES) permitted discharger in the Pahsimeroi River subbasin (IDG-131000), with data reported monthly to DEQ. The hatchery and rearing ponds are owned by Idaho Power Company and operated by IDFG in tandem. The November 2012 discharge monitoring report (DMR) had no indications of exceedances of the permit levels. Monthly data are kept on file at DEQ. Further information is available in the General Permit for Cold Water Aquaculture Facilities in Idaho (currently under revision). It is expected that multiple permits and numbers are available and will be changed as the NPDES General Permit is updated. The permit structure was confirmed and no changes were expected in the near future (D. Helder, EPA, personal communication, March 2013).

2.3.4 Biological and Other Data

The ADB contains a compilation of bioassessment data that have been collected statewide from 1994 through 2011. Analyzing the habitat condition and populations of macroinvertebrates and fish is the most efficient and cost-effective means of determining long-term water quality in streams. Diversity of species, existence of species with a low tolerance to water quality impairments, and size of populations are just a few of the measures that demonstrate support status of beneficial uses. See Barbour et al. (1999) for more information about bioassessment protocols that identify water quality characteristics. The Pahsimeroi River subbasin has been extensively monitored for beneficial use support status through these bioassessment protocols (i.e. BURP monitoring) (Figure 7).

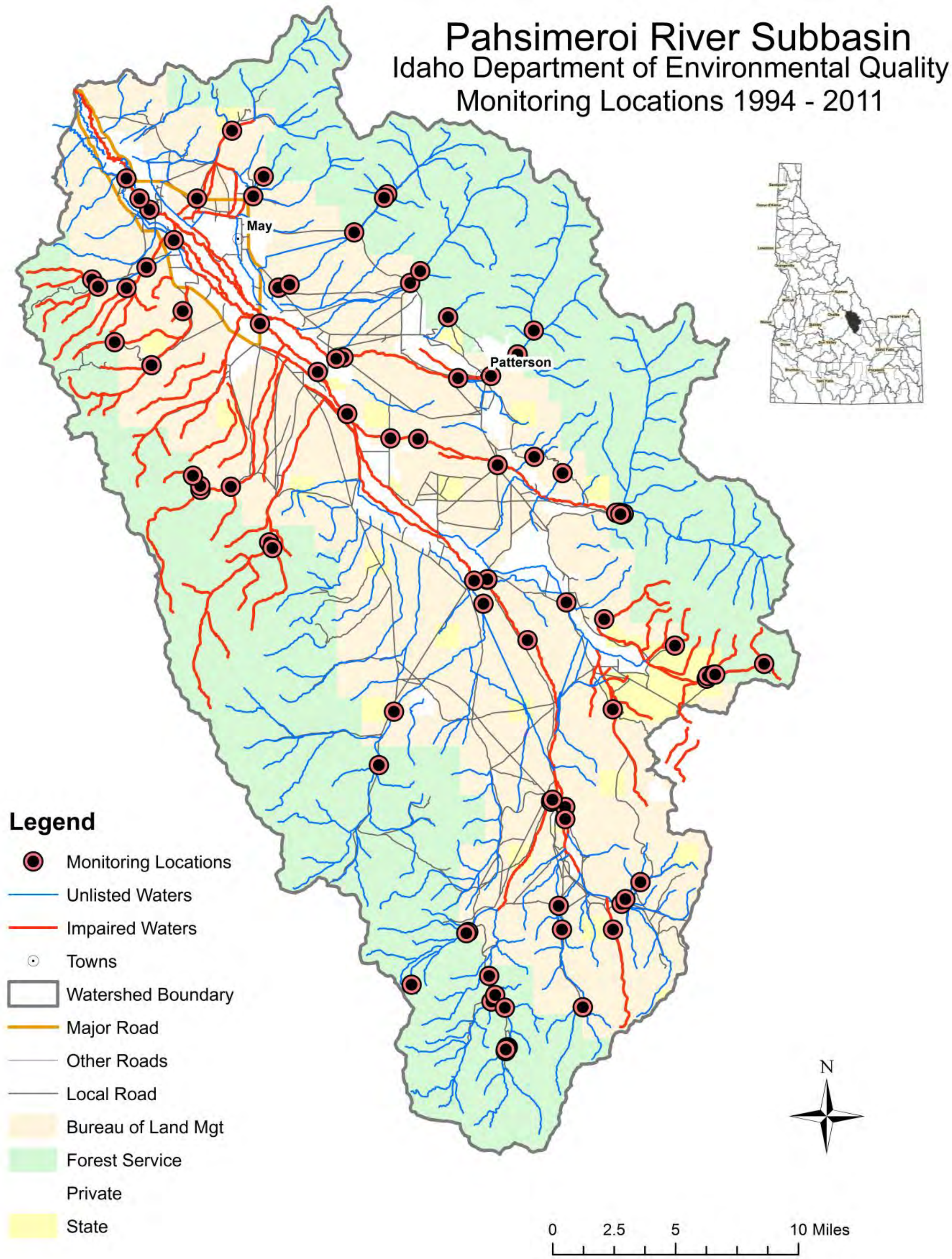

Figure 7. Idaho Department of Environmental Quality bioassessment monitoring locations.

The BURP data for the Pahsimeroi River subbasin (Appendix F) were used to identify support status for the cold water aquatic life beneficial use. While a total of 101 locations were identified for beneficial use measurements, many sites were either inaccessible or dry; therefore, only 71 sites have data. Of 71 locations monitored, 46 sites fully supported the use and 25 sites did not. Of the 25 sites that did not, 10 had high scores for one index but lower scores for others (typically high for the Stream Macroinvertebrate Index). Out of 6 sites monitored with a specific designated beneficial use of salmonid spawning, 4 had fully supporting index scores and 2 did not. The monitoring locations with not fully supporting scores in an AU currently listed in Category 5 of the 2010 Integrated Report are shown in Figure 8.

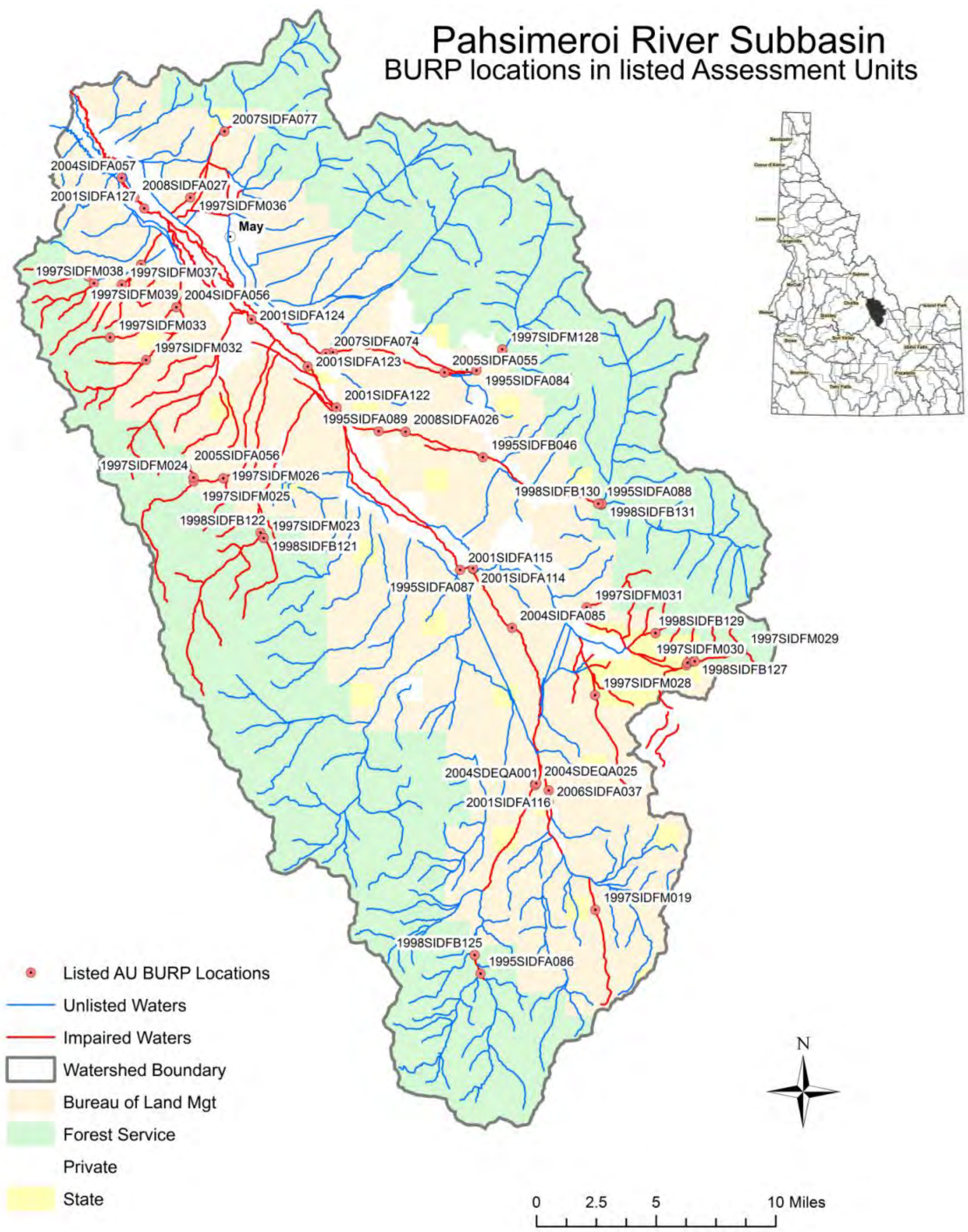

Figure 8. Bioassessment monitoring locations resulting in a not fully supporting status determination.

Pertinent BURP data and DEQ bacteria data are presented in Table 15. Where the stream fish index (SFI) is blank (—), a fishing effort was not made and only the macroinvertebrate (SMI) and habitat (SHI) scores are available. If the average score of the indices is greater than or equal to 2, the AU is fully supporting cold water aquatic uses; if the average score is less than 2, the AU is not fully supporting. The 2009 bacteria data summarized in Table 15 are presented in full in Appendix G.

Table 15. Bioassessment results and bacteria data for assessment units with available data that are listed in Category 5 of the 2010 Integrated Report.

BURP ID	Date	Index Ratings				Flow (cubic feet/second)	Temperature (°C)
		SMI[a]	SHI[b]	SFI[c]	Average Score		
ID17060202SL002_02, Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)							
1997SIDFM032	6/30/1997	52	49	—	2	1.13	12
1997SIDFM033	6/30/1997	41	52	—	1	0.1	12
2004SIDFA056	8/2/2004	No discharge					
Notes: DEQ: Jul/Aug 1999—Five bacteria (*E. coli*) samples with geometric mean of 504 organisms/100 milliliters (mL) (Trail Creek) DEQ: Jul 1999—One sample from Blind Fork of Trail Creek (1997SIDFM033) with 330 organisms/100 mL DEQ: Aug/Sep 2009—Five bacteria (*E. coli*) samples with geometric mean of 171organisms/100 mL (Trail Creek) DEQ: Aug 2009—Nutrient sampling—Total Kjeldahl nitrogen <0.5 milligrams/liter (mg/L); total phosphorus 0.05 mg/L (Trail Creek)							
ID17060202SL003_03, Lawson Creek—confluence of North and South Forks Lawson Creek to mouth							
1997SIDFM040	7/1/1997	41	43	—	1	2.5	15
Notes: DEQ: Aug 2009—Nutrient sampling—Total Kjeldahl nitrogen <0.5 mg/L; total phosphorus 0.03 mg/L DEQ: Aug 1999—One bacteria (*E. coli*) sample with 290 organisms/100 mL near 1997SIDFM040							
ID17060202SL004_02, North Fork Lawson Creek—source to mouth							
1997SIDFM038	7/1/1997	22	46	94	n/a	0.4	11
1997SIDFM039	7/1/1997	19	36	—	n/a	0.5	11
Notes: SMI score falls below the threshold; therefore calculating an average score is not valid.							
ID17060202SL005_02, South Fork Lawson Creek—source to mouth							
1997SIDFM037	7/1/1997	43	98	44	1.67	1.1	11
ID17060202SL006_02, Meadow Creek—source to mouth							
1997SIDFM024	6/24/1997	43	44	—	1	7.7	2
1997SIDFM025	6/24/1997	49	63	—	2.5	2.8	5
1997SIDFM026	6/24/1997	60	36	—	2	16.7	7
2005SIDFA056	7/20/2005	No discharge					
Notes: DEQ: Jul/Aug 1999—Five bacteria (*E. coli*) samples with geometric mean of 199 organisms/100 mL at 1997SIDFM026 DEQ: Jul/Aug 1999—Five bacteria (*E. coli*) samples with geometric mean of 298 organisms/100 mL at 1997SIDFM025 DEQ: Aug/Sep 2009—Five bacteria (*E. coli*) samples with geometric mean of 10 organisms/100 mL near 1997SIDFM026 DEQ: Aug 2009—Nutrient sampling—Total Kjeldahl nitrogen <0.5 mg/L; total phosphorus 0.05 mg/L							
ID17060202SL009_02, Grouse Creek—source to mouth							
1997SIDFM023	6/24/1997	28	56	—	n/a	5.8	5
1998SIDFB121	8/12/1998	30	48	—	n/a	1.26	4.7
1998SIDFB122	8/12/1998	23	29	—	n/a	1.16	8.2
Notes: SMI score falls below the threshold; therefore calculating an average score is not valid.							

BURP ID	Date	Index Ratings				Flow (cubic feet/second)	Temperature (°C)
		SMI[a]	SHI[b]	SFI[c]	Average Score		
ID17060202SL011_04, Pahsimeroi River—unnamed tributary (T12N, R23E, Sec. 22) to Goldburg Creek							
2001SIDFA115	8/29/2001	No discharge					
ID17060202SL017_04, Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec. 22)							
1995SIDFA087	8/15/1995	No discharge					
2001SIDFA114	8/29/2001	No discharge					
2004SIDFA085	8/10/2004	No discharge					
ID17060202SL023_03, Burnt Creek—Long Creek to mouth							
1998SIDFB136	8/17/1998	44	24	—	1.5	0.68	14
2006SIDFA037	7/11/2006	No discharge					
ID17060202SL026_02, Short Creek—source to mouth							
1997SIDFM019	6/23/1997	43	46	80	1.67	1.8	10
ID17060202SL029_02, Donkey Creek—source to mouth							
1997SIDFM028	6/25/1997	48	33	—	1	1	12
ID17060202SL030_02, Goldburg Creek—source to Donkey Creek							
1997SIDFM029	6/25/1997	85	83	94	3	0.8	9
1997SIDFM030	6/25/1997	82	59	—	2.5	5.21	9
1997SIDFM031	6/25/1997	59	37	—	2	4.6	9
1998SIDFB126	8/12/1998	44	37	—	1.5	0.03	20
1998SIDFB127	8/12/1998	91	55	61	2	2.72	12.3
1998SIDFB128	8/12/1998	84	41	85	2.33	0.7	12
1998SIDFB129	8/17/1998	78	65	—	3	1.14	7
Notes: DEQ: Jul/Aug 1999—Five bacteria (*E. coli*) samples with geometric mean of 210 organisms/100 mL at 1997SIDFB126 (Snowslide Creek) DEQ: Aug/Sep 2009—Five bacteria (*E. coli*) samples with geometric mean of 21 organisms/100 mL near 1997SIDFM031 (Ditch Creek) DEQ: Aug 2010—One bacteria (*E. coli*) sample with 61 organisms/100 mL near 1997SIDFM030 (Goldburg Creek)							
ID17060202SL031_03, Big Creek—confluence of North and South Fork Big Creeks to mouth							
1995SIDFB046	7/19/1995	29	30	—	n/a	75	n/a
1995SIDFA088	8/15/1995	81	55	—	2	61.2	n/a
1995SIDFA089	8/15/1995	No discharge					
2008SIDFA026	5/20/2008	Inaccessible					

[a] SMI = stream macroinvertebrate index
[b] SHI = stream habitat index
[c] SFI = stream fish index

2.3.5 Assessment Unit Summary

A summary of the data analysis, literature review, field investigations and a list of conclusions for AUs included in Categories 3, 4 and 5 of the 2010 Integrated Report for the Pahsimeroi River subbasin 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. The field notes for these investigations are presented in Appendix H.

ID17060202SL001_05: Pahsimeroi River—Patterson Creek to mouth

- This AU is listed in Category 4a for approved sediment and temperature TMDLs.
- Temperature TMDL was updated using PNV method.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Leave in Category 4a for sediment and temperature.

ID17060202SL002_02: Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)

- This AU is listed for temperature, sediment, fecal coliform and combined biota/habitat assessments.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Move to Category 4a for EPA-approved temperature TMDLs.
- Data indicate sediment loads are not met and allocations for load reductions are set in section 5.2.
- Move to Category 4a for EPA-approved sediment TMDLs.
- Delist from Category 5 for total coliform (TMDL developed for *E. coli* in section 5.3).
- Move to Category 4a for EPA-approved *E. coli* TMDLs. Monitoring will continue for *E. coli* as designated in the current water quality standards.
- Delist for combined biota/habitat bioassessments. Nutrients were at or below detection levels. TMDLs for *E. coli* and sediment adequately protect and better explain impairment than the combined biota/habitat bioassessment listing.

ID17060202SL002_04: Pahsimeroi River—Meadow Creek to Patterson Creek

- This AU is listed for particle distribution (embeddedness).
- This AU is listed in Category 4a for approved sediment TMDLs. Particle distribution listing was redundant since the current definition of sedimentation/siltation incorporates the impairments due to embeddedness.
- Delist for particle distribution (embeddedness).

ID17060202SL002_05: Pahsimeroi River—Meadow Creek to Patterson Creek

- This AU is listed for temperature and cause unknown (nutrients suspected).
- This AU is currently listed in Category 4a for approved sediment TMDLs.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Move to Category 4a for EPA-approved temperature TMDLs.
- Delist cause unknown from Category 5. Temperature TMDL and existing sediment TMDL sufficiently address the concerns with beneficial uses that are not being met. There are no known nutrient issues, sources or pathways.

ID17060202SL003_03: Lawson Creek—confluence of North and South Lawson Creek to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Delist combined biota/habitat bioassessments from Category 5.

- List in Category 4c for low flow alterations (see section 2.3.2) as sole reason for impairment.

ID17060202SL004_02: North Fork Lawson Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Data indicate sediment loads are not met; allocations for load reductions are set in section 5.2.
- Delist combined biota/habitat bioassessments from Category 5.
- Move to Category 4a for EPA-approved sediment/siltation TMDLs.

ID17060202SL005_02: South Fork Lawson Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Evidence indicates that water exists in this reach infrequently and sinks rapidly into the alluvium when present.
- Listed based on a single Beneficial Use Reconnaissance Program (BURP) score in 1997. The determining factor was a borderline SMI score. Natural water limitations appear to be the primary impairment; however, data identifying other potential impairments are lacking.
- Leave in Category 5 for combined biota/habitat bioassessments.
- Future monitoring will be required to identify potential stressors and/or pollutants.

ID17060202SL006_02: Meadow Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments and fecal coliform.
- This AU is listed in Category 4c.
- The *E. coli* sampling produced a geometric mean below the threshold (10 organisms/100 mL). *E. coli* is Idaho's current water quality standard, having replaced fecal coliform.
- The combined biota/habitat bioassessments impairment was not identified and the stream appears to meet beneficial uses where and when water is present. Flow alterations explain habitat impairment.
- Delist from Category 5 for fecal coliform and combined biota/habitat bioassessments.
- Leave in Category 4c for low flow alterations.

ID17060202SL007_04: Pahsimeroi River—Furey Lane to Meadow Creek

- This AU is listed for cause unknown (nutrients suspected).
- This AU is listed in Category 4c.
- This AU is listed in Category 4a for approved sediment TMDL.
- Delist cause unknown from Category 5. Sediment TMDL and Category 4c low flow alterations sufficiently address the concerns with beneficial uses that are not being met.
- Leave in Category 4a for sediment and Category 4c for low flow alterations.

ID17060202SL008_04: Pahsimeroi River—Big Creek to Furey Lane

- This AU is listed in Category 4a for approved sediment TMDL.
- Leave in Category 4a for sediment.

ID17060202SL009_02: Grouse Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments.
- This AU is listed in Category 4c.
- The combined biota/habitat bioassessment impairment was not identified and the stream appears to meet beneficial uses where and when water is present. No pollutant sources were found. Flow alterations explain habitat impairment.
- Delist from Category 5 for combined biota/habitat bioassessments.
- Leave in Category 4c for low flow alterations.

ID17060202SL010_03: Pahsimeroi River—Goldburg Creek to Big Creek

- This AU is listed for cause unknown (nutrients suspected).
- This AU is listed in Category 4a for approved sediment TMDLs.
- No indications of nuisance algae or nutrients were observed.
- Delist from Category 5 for cause unknown.
- Leave in Category 4a for sediment.

ID17060202SL010_04: Pahsimeroi River—Goldburg Creek to Big Creek

- This AU is listed for cause unknown (nutrients suspected).
- This AU is listed in Category 4c.
- This AU is listed in Category 4a for approved sediment TMDLs
- No indications of nuisance algae or nutrients were observed; channel was dry from alterations.
- Delist from Category 5 for cause unknown.
- Leave in Category 4a for sediment.
- Leave in Category 4c.

ID17060202SL010_05: Pahsimeroi River—Goldburg Creek to Big Creek

- This AU is listed for cause unknown (nutrients suspected).
- This AU is listed in Category 4a for approved sediment TMDLs.
- No indications of nuisance algae or nutrients were observed.
- Delist from Category 5 for cause unknown.
- Leave in Category 4a for sediment.

ID17060202SL011_04: Pahsimeroi River—unnamed tributary (T12N, R23E, Sec.22) to Goldburg Creek

- This AU is listed for cause unknown (nutrients suspected).
- This AU is listed in Category 4a for approved sediment TMDLs.
- No indications of nuisance algae or nutrients were observed.
- Delist from Category 5 for cause unknown.
- Leave in Category 4a for sediment.
- List in Category 4c for low flow alterations (see section 2.3.2).

ID17060202SL017_04: Pahsimeroi River—Burnt Creek to unnamed tributary (T12N, R23E, Sec.22)

- This AU is listed for cause unknown (nutrients suspected).

- This AU is listed in Category 4c.
- This AU is listed in Category 4a for approved sediment TMDLs.
- No indications of nuisance algae or nutrients were observed; channel was dry from flow alterations.
- Delist from Category 5 for cause unknown.
- Leave in Category 4a for sediment.
- Leave in Category 4c for low flow alterations.

ID17060202SL018_04: Pahsimeroi River—Mahogany Creek to Burnt Creek

- This AU is listed in Category 4a for approved temperature and sediment/siltation TMDLs.
- Updated temperature TMDL was prepared using PNV method.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Leave in Category 4a for temperature and sediment.

ID17060202SL020_03: Pahsimeroi River—confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek

- This AU had no listings for impairments in the 2010 Integrated Report.
- This AU was examined using PNV method and shading was deficient.
- New temperature TMDL was prepared using PNV method.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Move to Category 4a for EPA-approved temperature TMDLs.

ID17060202SL022_03: East Fork Pahsimeroi River—source to mouth

- This AU is listed Category 4a for approved temperature and sediment/siltation TMDLs.
- Updated temperature TMDL was prepared using PNV method.
- Data indicate shade conditions under PNV are not met and load allocation is set in section 5.1.
- Leave in Category 4a for temperature and sediment.

ID17060202SL023_03: Burnt Creek—Long Creek to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Additional data are required to determine specific impairment(s).
- Leave in Category 5 until data gaps are filled.
- Above Burnt Creek, at least one property has changed ownership, which has led to a shift in the cropping and irrigation patterns. It is unknown how this will affect the water in creek.
- Recommend examining temperature. ADB notes that according to the BLM there are bull trout in the creek; the information is not specific to which AU of the creek. *E. coli* were below threshold of concern; bank stability was indeterminate (as there have been increased discharges altering bank-full interpretation—BLM Challis Field Office, personal communication, November 2012).

- Recommend BURP and other types of monitoring for next cycle, if irrigation and cropping patterns continue to be altered.

ID17060202SL026_02: Short Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Data indicate sediment loads are not met and allocations for load reductions are set in section 5.2.
- Eroding streambanks have undercut woody vegetation and stream has altered course away from willows causing habitat impairment. Streambank stabilization should improve habitat—when there is water in the channel.
- Delist from Category 5 for combined biota/habitat bioassessments.
- Sediment is sole pollutant of concern. Move to Category 4a for EPA-approved sediment/siltation TMDLs.

ID17060202SL029_02: Donkey Creek—source to mouth

- This AU is listed for combined biota/habitat bioassessments.
- Sediment survey performed; results were below the threshold of concern, meaning the streambank was stable (using NRCS streambank method). Willows were present along stream reaches that are protected (i.e. hills limit wind). Caddis fly nests on rocks. No indication of nuisance algae. Limited indications of grazing impacts.
- All evidence suggests that this stream was improperly listed. Stream discharge is typically below 1 cfs (during summer month BURP protocols); therefore, it cannot meet the current threshold for sampling and will not be examined by BURP crews. The 1997 BURP monitoring occurred on June 25 prior to the official July 1 season start date, in a year with high snowpack and had a discharge of 1.0 cfs, this was not a typical year or monitoring. Subsequent visits indicate that discharge is typically below this threshold. The analysis and comparative statistics used to list this stream were erroneously applied and results are (at best) suspect. Field observations suggest that the stream habitat and water quality are functioning to a high level based on the limitations of elevation (6,560 feet) and climate (e.g., wind and limited precipitation). All the available evidence and data (recent and applicable) suggest the stream is meeting its potential beneficial uses.
- Delist from Category 5 for combined biota/habitat bioassessments; stream was improperly listed.

ID17060202SL030_02: Goldburg Creek—source to Donkey Creek

- This AU is listed for fecal coliform.
- *E. coli* sampling produced a geometric mean (21 organisms/100 mL in 2009) and single sample (61 organisms/100 mL in 2010) both below the thresholds.
- The BLM Challis Field Office (personal communication, November 2012) reported changes in grazing management, including alternate water sources, changes in livestock use patterns, and increased fencing. Additional information is available in the Upper Pahsimeroi and Goldburg Ten Year Grazing Permit Renewal Environmental Assessment (#ID-330-2007-EA-3275).
- New exclosure fencing has been installed, limiting livestock access to the stream.
- Delist from Category 5 for fecal coliform.

ID17060202SL031_03: Big Creek—confluence of North and South Fork Big Creeks to mouth

- This AU is listed for cause unknown (nutrients suspected) and sediment/siltation.
- This AU is listed in Category 4c.
- Bank stability was confirmed by DEQ and BLM examinations; channels below dewatered area are cobble and not likely to erode.
- No indications of nuisance algae or nutrients were observed; channel was dry from flow alterations.
- Delist from Category 5 for cause unknown and for sediment/siltation.
- Leave in Category 4c for low flow alterations.

Any additional AUs that are not described above should retain their current status.

3 Subbasin Assessment—Pollutant Source Inventory

Pollution within the Pahsimeroi River subbasin is primarily from excess sediment, bacterial contamination, and elevated instream temperature. Load allocations for sediment and bacteria were established in the Pahsimeroi River TMDL (DEQ 2001).

3.1 Point Sources

Point sources are sources of pollutants from known discharge locations. There are two NPDES permit sites in the subbasin, according to the EPA permits compliance system database falling under the General Permit for Aquaculture (IDG-131000). The Pahsimeroi River fish hatchery and the Pahsimeroi River rearing ponds are owned by Idaho Power Company and operated by the IDFG. This permit probably relates to general provisions under a general permit for hatcheries (currently under review), as described in the 2001 TMDL:

> Given the site-specific conditions found at this facility, it is felt that the NPDES permit is adequately protective of water quality at and below the point of discharge of hatchery effluent and that more restrictive limitations are not required at this time. Additionally, there will be no net increase of effluent limitations to the Pahsimeroi River from the Pahsimeroi hatchery rearing ponds. (DEQ 2001)

These known permitted point sources in the watershed are in the process of renewing their permits. The wasteload allocation for this facility was fully discussed in the previous TMDL (DEQ 2001), and based upon that analysis, no wasteload allocations are discussed here for the Pahsimeroi River. The permit structure was confirmed and no changes were expected in the near future (D. Helder, EPA, personal communication, March 2013).

3.2 Nonpoint Sources

A detailed discussion of nonpoint sources is provided in the 2001 TMDL (DEQ 2001). In summary, all pollutants causing impairments are from nonpoint sources in this subbasin. Potential pollutants include sediment, bacteria, and temperature. Potential sources of these pollutants could include streambank modification and erosion, flow regulation and irrigation return water, road construction, pasture treatment, and mine tailings. Recreational activities may cause nonpoint sources of pollution where streambanks are becoming degraded by high use. Livestock grazing in riparian areas and erosion from roads and cultivated fields are common sources of excess sediment delivery to the streams. Destabilized streambanks also contribute to reducing riparian vegetation that would provide shade, which leads to excess solar load and increased instream water temperatures.

4 Monitoring and Status of Water Quality Improvements and Five-Year TMDL Review

This 5-year TMDL review complies with Idaho Statute 39-3611(7) to reevaluate the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001). This review describes current water quality status and recent pollution control efforts in the subbasin. The assessment of instream targets, pollutant allocations, and the original TMDL was conducted with input and support from the watershed advisory group (WAG) and basin advisory group.

4.1 Ongoing Sediment Monitoring

Percent bank stability and subsurface fine sediment percentages measure progress toward reaching surrogate sediment targets of at least 80% bank stability and no more than 28% subsurface fine sediment. These targets have been established in many of DEQ's EPA-approved sediment TMDLs, including the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (DEQ 2001). A sediment target based on subsurface fine sediments is protective of cold water aquatic life and salmonid spawning habitat. Increasing streambank stability is a means of reducing subsurface fine sediment.

In 2009, DEQ monitored sediment impairment to streams on BLM lands. Ongoing sediment monitoring is part of the 5-year review process for checking progress toward meeting the sediment targets identified in the original TMDL (DEQ 2001). A brief summary of sediment monitoring methods and all of the calculations and results of the streambank erosion inventories are provided in Appendix C. The results are summarized in Table 16, including the current sediment load calculated from the streambank erosion inventories and the load capacities, which are the natural background assimilative capacities of each monitored stream. DEQ does not issue additional sediment load allocations with this addendum for AUs with EPA-approved sediment TMDLs. The sediment load allocations in the original TMDL will remain in effect for those AUs.

Several water quality improvement projects have been administered by the BLM, such as road improvements and culvert replacements to enhance fish passage. These projects are described in section 4.2 and Appendix B. A listing of the 2005 implementation plan projects is in Appendix I.

Table 16. Streambank erosion inventory summary—2009 data.

Assessment Unit	Current Load (tons/year)	Load Capacity (tons/year)	Load Reduction Needed to Meet Load Capacity (tons/year)	Necessary Percent Reduction by AU[a]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Trail Creek[b]	747	165	581	73[c]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, main stem	450	165	286	
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, upper[b]	541	140	400	
ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth[d]	41	42	-1	0
ID17060202SL004_02 North Fork Lawson Creek—source to mouth[b]	2,748	217	2,531	92
ID17060202SL026_02 Short Creek—source to mouth[b]	224	143	80	36
ID17060202SL029_02 Donkey Creek—source to mouth	7	37	-30	0
ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creek to mouth	4	4	-1[e]	0

[a] Load reductions and allocations will be developed by AU segment.
[b] Requires streambank stabilization to 80% and a decreased bank erosion rate.
[c] Load reduction allocations are based upon hydrologic boundaries; therefore, the summed Sulphur Creek reductions are calculated separate from Trail Creek.
[d] Similar AUs to ID17060202SL003_03 include ID17060202SL004_03, and ID17060202SL005_02.
[e] Rounding errors are represented in the calculation of the percent load reduction.

The calculated capacity is not exceeded in 3 AUs, so TMDLs are not necessary for these locations, as they are exhibiting high levels of streambank stability (Table 16). Necessary sediment load reductions range from 36–92%, with the greatest reduction needed in the North Fork Lawson Creek and the lowest in Short Creek.

In 2009, DEQ collected subsurface fine sediment data via the McNeil sediment core sampling method. In streams with salmonid spawning habitat, a sediment core of the substrate is gathered and separated into 10 size classes. The volume displaced for each size class is measured. Fine sediments that impair salmonid spawning are those particles with a grain size less than 6.3 millimeters. Three samples are collected at each site for an average percentage of fine sediment particles. Table 17 provides the results of the subsurface fine sediment measurement in the Pahsimeroi River subbasin and serves as an indicator of future directions for examination within the subbasin.

Table 17. McNeil sediment core results.

Assessment Unit	Mean Percentage Fine Sediment
ID17060202SL001_05 Pahsimeroi River—Patterson Creek to mouth	28

The Pahsimeroi River AU from Patterson Creek to the mouth (ID17060202SL001_05) is currently at 28% fines, which is the target for the 2001 TMDL. However, this does not imply that this AU has met its TMDL requirements or that the habitat and streambanks are now meeting their beneficial uses. This measurement was at one location and may not be representative enough to justify removing this stream segment for sediment. It does suggest that the next 5-year review should examine this AU and nearby AUs for the fine sediment improvements that are indicative of streambank and channel stabilization and promoted by the development of cattle exclosures, instream flow improvements, and land-management practices (Maser 2005) that are leading to meeting the beneficial uses. Section 4.2 details improvements and activities in the basin developed to improve habitat and stability.

Other AUs with sediment load allocations in the original TMDL will be left in Category 4a of the next Integrated Report with the existing load allocations.

4.2 Water Quality Improvements

Many watershed improvement projects with diverse funding sources have been completed or are ongoing in the Pahsimeroi River subbasin. Land management agencies have worked together and with private landowners to implement BMPs that restore proper hydrologic functioning to impaired streams and prevent degradation in key salmonid migration corridors and spawning habitat. A listing of habitat projects funded by the Bonneville Power Administration, as compiled by IDFG, is located in Appendix B.

In the past 10 years, many projects to directly improve instream habitat and water quality/quantity have been implemented in the Pahsimeroi River subbasin. A summary of several of the restoration and improvement activities in the subbasin is included below. Many of the direct improvements are listed in Appendix B and Appendix I. Some of these improvements, along with BMP management changes, are described in this section. Much of the information below is from personal communication with individuals at the Custer Soil and Water Conservation District (CSWCD), USFS, IDFG, OSC, IDWR, and USBWP.

In the lower Pahsimeroi River, from the confluence with the Salmon River to Dowton Lane, two feedlots have been removed/relocated or improved to limit interactions with any of the streams and tributaries of the river, and easements have improved river habitat. Pasture management was improved and a shift in winter pasture timing improved the riparian corridor. The P-9 (or PBSC9) canal is offline (discussed more below) and the water returned to the Patterson Big Springs Creek/Duck Spring and Muddy Spring streams. One of the largest changes has been the addition of exclosures (jack/buck fencing) added along the Pahsimeroi River in this reach. Approximately 80% of the streambank has been protected with these exclosures.

In most (if not all) of the headgates on the Pahsimeroi River and tributaries, fish screens and measurement devices (such as a Parshall Flume) have been added to limit fish migrations that terminate in irrigation water and fields. Several canals are being combined to limit the number of headgates and transport losses to the ground water. Below Furey Lane, work is on-going to pipe and transport water to center-pivot irrigation sprinklers, which will increase irrigation efficiency and potentially maintain flows in the river channel.

Discussion is underway to improve the irrigation management of Sulphur Creek, with a final goal of establishing a year-round connection between the creek and Pahsimeroi River. This river connection is not currently maintained on a continuous basis. This reconnection would come from improved irrigation methods and shifting irrigated fields and source locations for water withdrawal. Additionally, the Pahsimeroi River Road bridge crossing Sulphur Creek has been improved so the natural streambed is maintained for fish passage in the watershed. A feedlot has also been removed from near the creek.

Along Goldburg Creek, new exclosure fencing has been installed, limiting livestock access to the stream. Various land management agencies in the subbasin have made a concerted effort to progress with restoration/improvement plans by slowly working up the river. However, due to bull trout habitat and other opportunities some restoration actions (but limited) have occurred in the upper subbasin.

Above Burnt Creek, ownership changes of at least one property have led to a shift in the cropping and irrigation patterns. It is unknown how this will affect the water in the creek overtime.

4.2.1 Project Details from IDWR

The P-9 Diversion removal project in 2008 (in partnership with CSWCD and IDFG) removed a major diversion on Patterson Big Springs Creek that dewatered the creek; diverted water across an alkali flat, warming the water and picking up sediment; intercepted Duck Springs; and was diverted into the Pahsimeroi River and subsequently diverted into the P-9 ditch. The P-9 ditch intercepted Muddy Springs Creek before delivering water to the irrigated fields. As a result of this project, 29.7 cfs of water rights are now left in Patterson Big Springs Creek, Duck Springs, Muddy Springs Creek, and the Pahsimeroi River. The water rights are now diverted out of the Pahsimeroi River downstream of the confluence with Patterson Big Springs Creek (Figure 9) for a term of 20 years.

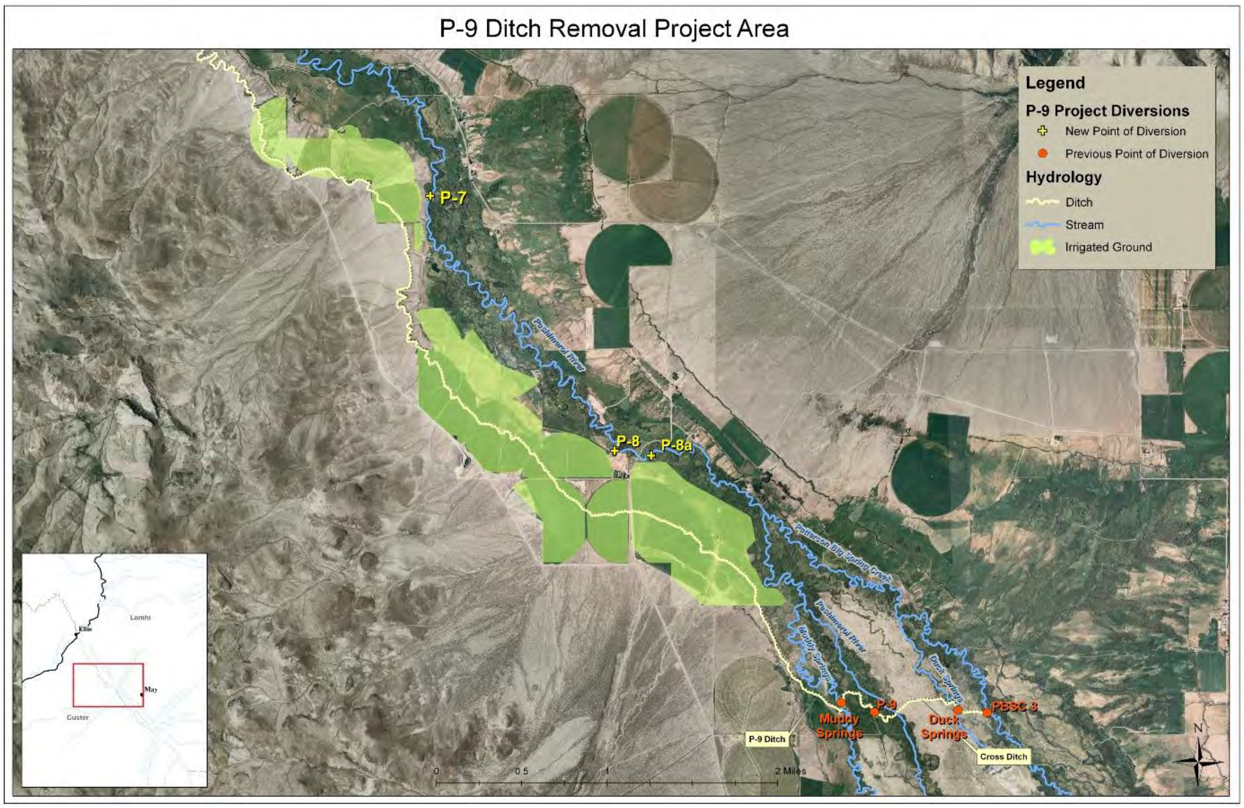

Figure 9. P-9 ditch removal project area on Patterson Big Springs Creek.

The Patterson Big Springs Creek PBSC9 diversion removal addressed upstream passage and low flow problems at the PBSC9 diversion, which diverts 6 cfs of water for the Big Springs Creek Ranch. The ranch worked with the CSWCD to secure funds to install a new irrigation system that will allow the water rights diverted out of PBSC9 to remain instream and instead exchanged with Mayrick Creek water, approximately 5 miles downstream of the original point of diversion. Mayrick Creek is a spring channel that is not currently connected to Patterson Big Springs Creek. The 6 cfs from PBSC9 will be spilled past the diversions between PBSC9 and the historic confluence with Mayrick Creek. While the new pump will divert only 2.2 cfs and leave 3.8 cfs in the system due to irrigation efficiency, those flows will not be protected downstream from the confluence with Mayrick Creek; however, flow is not limited in the reaches below this point (Figure 10). The term of this water right is 20 years.

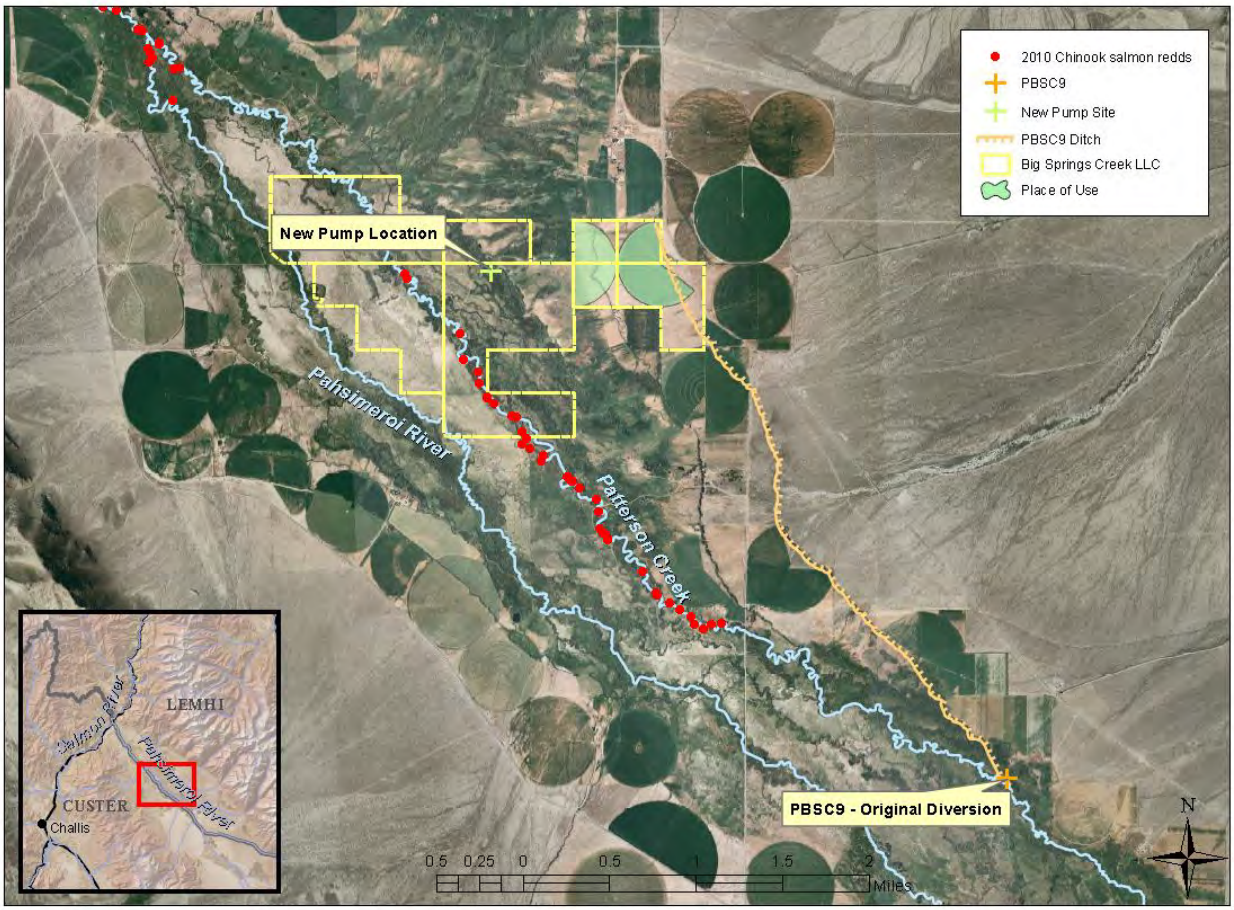

Figure 10. Patterson Big Springs Creek transaction and the PBSC9 canal.

The Nature Conservancy donated 1.07 cfs of water rights from Sulphur Creek, a tributary to the Pahsimeroi River, to the Idaho Water Resource Board. The board will lease those rights into the Water Supply Bank and deliver them to the minimum streamflow on the Pahsimeroi River (Figure 11). This water right change is permanent.

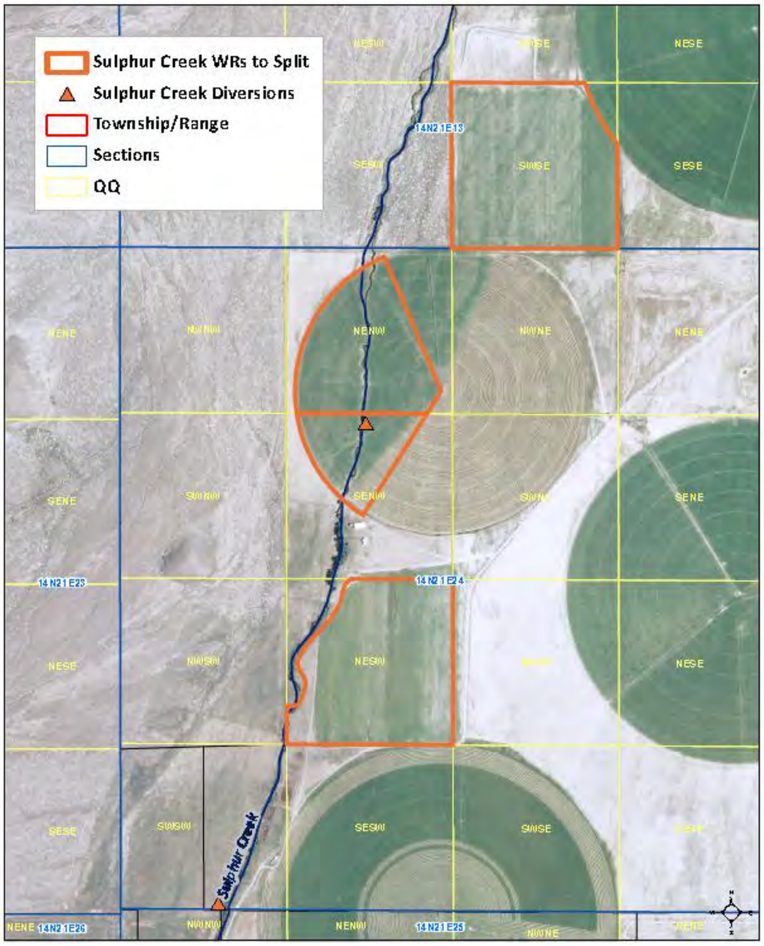

Figure 11. Change in water rights and water banking in Sulphur Creek.

4.2.2 Stream Habitat and Shade Improvements in the Pahsimeroi River Subbasin

Between Ellis Lane and Burdstedt Lane in the AU Pahsimeroi River - Patterson Creek to mouth ID17060202SL001_05 exclosures were added to limit cattle access to the vegetation and the river. Near-river vegetation has improved and become denser. Figure 12 is an aerial photo depicting the Pahsimeroi River subbasin upstream of the confluence with the Salmon River (north—off of photo) where exclosures were installed (NAIP 2011). Figures 13 to 15 depict the locations on a smaller scale and illustrate the before and after effects of the exclosures. The before photos were taken prior to the development of the 2001 TMDL.

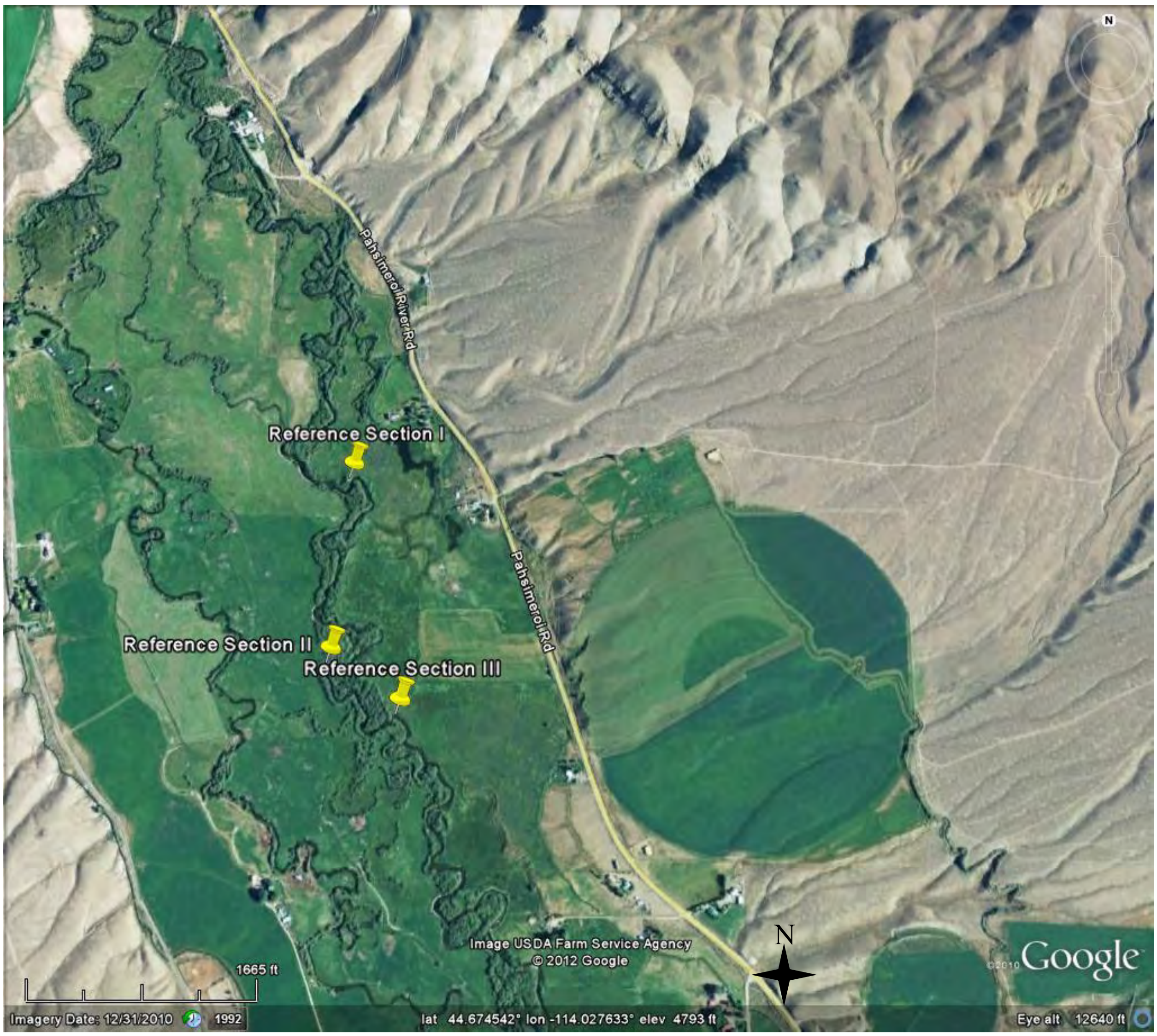

Figure 12. Map identifying locations for comparison of exclosure effects.

Figure 13. Reference Section I with arrows added to indicate and highlight areas of changing vegetation density before and after fence development.

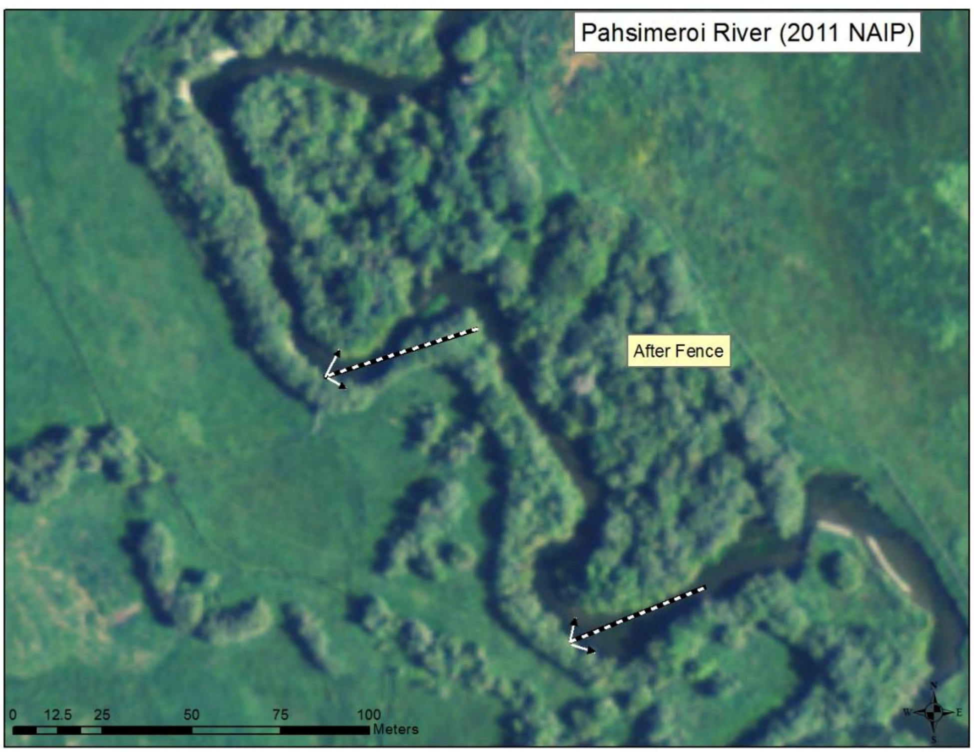

Figure 14. Reference Section II with arrows added to indicate and highlight areas of changing vegetation density before and after fence development.

Figure 15. Reference Section III with arrows added to indicate and highlight areas of changing vegetation density before and after fence development.

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (or load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. 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 broken out on their own because they represent a part of the load not subject to control. Because of uncertainties regarding load quantification and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be a part of the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

The load capacity can be represented by the following equation:

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

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation (nonpoint sources)
WLA = wasteload allocation (point sources)

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then, the load capacity is broken down into its components. After the necessary margin of safety and natural background (if relevant) are determined, the remaining load capacity is allocated among pollutant sources (i.e., 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 the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. However, loads must typically be expressed in terms of daily loading for most pollutants. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Temperature TMDLs

5.1.1 Instream Water Quality Targets

For the three AUs with new temperature TMDLs and the three AUs with updated temperature TMDLs, we used a PNV approach. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLS, the natural level of shade and channel width become the TMDL target. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria. See section 2.2.5 for further details regarding water quality standards and natural background provisions.

The PNV approach is described briefly below. The procedures and methodologies to develop PNV target shade and to estimate existing shade 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.

5.1.1.1 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.

5.1.1.2 Potential Natural Vegetation for Temperature TMDLs

PNV along a stream is that 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, wildlife grazing) or anthropogenically (e.g., domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar loading to the stream without any anthropogenic removal of shade-producing vegetation. Vegetation levels less than PNV (with the exception of natural levels of disturbance and age distribution) result in the stream heating up from anthropogenically created additional solar inputs.

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

Existing and PNV shade was converted to solar loads from data collected on flat-plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather stations collecting these data. In this case, we used the average of the Helena, Montana, and Pocatello, Idaho, stations. The difference between existing and target solar loads, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (see sections 2.2.5.1).

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.

5.1.1.2.1 Existing Shade Estimates

Existing shade was estimated for 6 AUs in the Pahsimeroi River subbasin from visual interpretation of aerial photos. Estimates of existing shade based on plant type and density were marked out as stream segments on a 1:100,000 or 1:250,000 hydrography taking into account natural breaks in vegetation density. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. Each segment was assigned a single value representing the bottom of a 10% shade class (adapted from the cumulative watershed effects process, IDL 2000). For example, if shade for a particular stream segment was estimated somewhere between 50% and 59%, we assigned a 50% shade class to that segment. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and stream width. Streams where the banks and water are clearly visible are usually in low shade classes (10%, 20%, or 30%). Streams with dense forest or heavy brush where no portion of the stream is visible are usually in high shade classes (70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (40%, 50%, or 60%).

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

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was partially field verified with a Solar Pathfinder at seven locations along the streams: three sites on Sulphur Creek, three on Trail Creek, and the remaining site on the Pahsimeroi River. The Solar Pathfinder is a device that allows one to trace the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a reach of stream, 10 traces were taken at systematic intervals along the length of the stream in question.

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

When possible, the sampler also measured bank-full widths, took notes, and photographed the stream at several unique locations. Special attention was given to changes in riparian plant communities and plant species composition (for large, dominant, shade-producing species). When possible, field staff also took densiometer readings at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream.

In general, the Solar Pathfinder results showed that the original aerial photo interpretation was on average within one 10% shade class of measured shade (Table 18). The average difference between original interpretation class and measured Solar Pathfinder class was 9% ± 6.7 (average ± 95% confidence interval). Two sites were different by two classes, two sites differed by one class, and three sites were accurate in their class estimate. These data were used to "calibrate our eyes" and to adjust the original aerial interpretation as needed.

Table 18. Pathfinder results.

aerial class	pathfinder actual	pathfinder class	delta		site
0	9.4	0	0		sulphur 1
80	60.3	60	20		sulphur 2
60	62	60	0		sulphur 3
60	55.7	50	10		trail 2
50	48.3	40	10		trail 3
40	43.1	40	0		trail 4
20	1.8	0	20		pahsimeroi
			9	average	
			9.00	std dev	
			6.67	95%CI	

5.1.1.3 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.

5.1.1.3.1 Natural Bank-Full Widths

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

Since, existing bank-full width may not be discernible from aerial photo interpretation and may not reflect natural bank-full widths, this parameter must be estimated from available information. We used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bank-full width (Figure 16).

For each stream evaluated in the load analysis, natural bank-full width was estimated based on the drainage area of the Upper Snake curve from Figure 16. Although estimates from other curves were examined (i.e., Salmon, Payette/Weiser), the Upper Snake curve was ultimately chosen because of its proximity to the Pahsimeroi River subbasin and because of similarity in climate and vegetation. Existing width data should also be evaluated and compared to these curve estimates if such data are available. However, for the Sulphur/Trail Creeks watershed, only a few BURP sites exist, and bank-full 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.

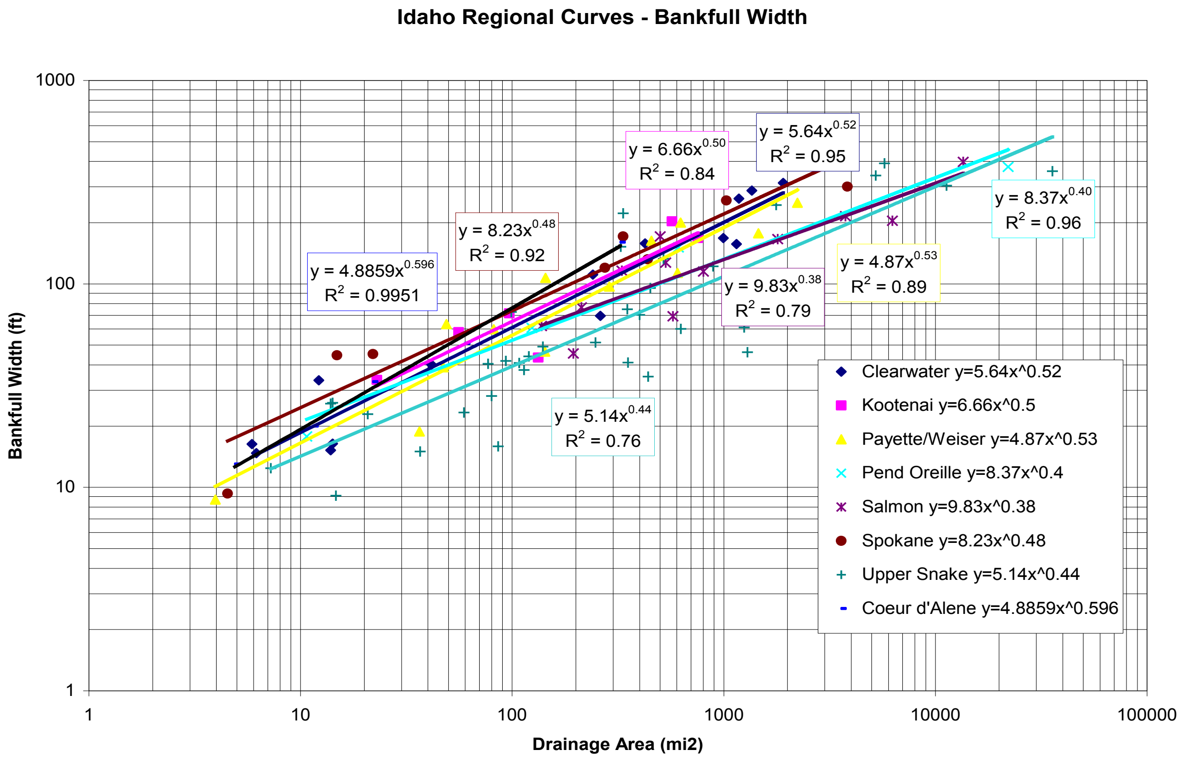

Figure 16. Bank-full width as a function of drainage area.

In general, we found BURP bank-full width data to agree with natural bank-full width estimates from the Upper Snake basin curve and chose not to make natural widths for Sulphur/Trail Creeks any smaller than these Upper Snake basin estimates. Natural bank-full width estimates for each stream in this analysis are presented in Table 19. However, geographic information systems (GIS) estimates of width for the Pahsimeroi River showed that the basin curve estimates greatly overestimated width. For the river, we used these GIS estimates for natural and existing width. The load analysis tables contain a natural bank-full width and an existing bank-full width for every stream segment in the analysis based on the bank-full width results presented in Table 19. Existing widths and natural widths are the same in load tables when there are no data to support making them differ.

Table 19. Bank-full width estimates based on regional hydrology curves.

Location	area (sq mi)	Upper Snake (m)	Salmon (m)	Payette/Weiser (m)	BURP or GIS (m)
Trail Creek ab Blind Fork	10.84	4	7	5	3.1
Trail Creek bl 2nd tributary	5.69	3	6	4	
Trail Creek ab 1st tributary	1.91	2	4	2	
Blind Fork @ 6280 ft	1.56	2	4	2	3.3
Blind Fork @ 6840 ft	0.72	1	3	1	
Sulphur Creek @ mouth	22	6	10	8	
Sulphur Creek @ 5500 ft	10.16	4	7	5	
Sulphur Creek @ 6000 ft	8.36	4	7	5	
Sulphur Creek @ 6300 ft	7.64	4	6	4	
Sulphur Creek bl 2nd tributary	6.11	3	6	4	
Sulphur Creek ab 1st tributary	1.57	2	4	2	
Pahsimeroi River bl Sulphur Cr	531.5	25	33	41	~6 to 8
Pahsimeroi River ab Patterson Cr	582.5	26	34	43	~7 to 8
left fork 002_05		0	0	0	~5
rt fork bl Patterson diversion		0	0	0	~8
rt fork ab Patterson diversion		0	0	0	~5
Pahsimeroi River bl Patterson Cr	727	28	37	49	~12
Pahsimeroi River @ mouth	830	30	39	52	~12
Pahsimeroi River ab Burnt Cr	58	9	14	13	11.2
Pahsimeroi River bl Mahogany Cr	53.7	9	14	12	
Pahsimeroi River ab Mahogany Cr	41.6	8	12	11	
Pahsimeroi River bl EF/WF	30.5	7	11	9	5.8
EF Pahsimeroi R. ab WF	17.54	6	9	7	
EF Pahsimeroi R. top of reach	17.46	6	9	7	

5.1.1.3.2 Design Conditions

The Pahsimeroi River valley is located within the Middle Rockies Level III Ecoregion of McGrath et al. (2001). The valley floor adjacent to the river is within the Dry Intermontane Sagebrush Valleys Level IV Ecoregion—terrain characterized by stream terraces, floodplains, saline areas, and alluvial fans. The terrain is dry due to the rain shadow of high mountains to the west and highly permeable valley fill deposits. The river's floodplain contains fine-textured soils that prevent the development of cottonwood riparian forests found in other river floodplains in Idaho and is instead dominated by various mid- to low-elevation willows (Bebb willow, Booth's willow, coyote willow, Geyer willow, and yellow willow) (Brunsfeld and Johnson 1985).

Upslope from the valley bottom is the Dry Gneissic-Schistose-Volcanic Hills Level IV Ecoregion—a shrub and grass-covered landscape underlain by Quaternary and Tertiary volcanics more rugged and slightly moister than the valley bottom. These shrub and grass rangelands often have riparian communities dominated by willows, alders, and other riparian shrubs when the alluvial aquifer has sufficient moisture.

Further upslope where the headwaters of Sulphur and Trail Creeks originate, the Barren Mountains Level IV Ecoregion contains quartzite and carbonate-rich rocks at elevations from 6,800 to 10,000 feet. The landscape may contain open canopied Douglas-fir/lodgepole pine-subalpine fir forests, aspen groves, sagebrush, mountain brush, and grasses. Forests are limited to a narrow elevation band and are generally restricted to north-facing slopes. Sulphur and Trail Creeks have only minor sections in forest types, with the majority of riparian communities in alder and willow.

5.1.1.3.3 Shade Curve Selection

To determine PNV shade targets for the Pahsimeroi River and associated tributaries, effective shade curves from the southern Idaho non-forest group and the Salmon-Challis National Forest types were examined (Table 20) (Shumar and De Varona 2009). These curves were produced using vegetation community modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Pahsimeroi River subbasin streams, curves for the most similar vegetation type were selected for shade target determinations.

Trail Creek begins in high-elevation willow communities represented here by the Drummond willow shade curve. Eventually Trail Creek transitions through alder to mid-elevation willows represented by the Geyer willow shade curve. The first tributary to Trail Creek runs through a patch of Douglas-fir forest and the Blind Fork tributary starts in mid-elevation willows. Sulphur Creek likewise transitions from high-elevation willows (Drummond) and alder to mid-elevation willows (Geyer). There appears to be a patch of aspen as well. The upper Pahsimeroi River and the Pahsimeroi River valley floor are dominated by a variety of mid- and low-elevation willows. The shade curve that best represents this mixture of willow species is the Geyer willow/sedge shade curve. Shade curves for these various riparian plant communities are described in Shumar and De Varona (2009) and are presented in Appendix J of this document.

Table 20. Plant communities for shade targets for the various streams.

Southern Idaho Non-forest Types	Salmon-Challis Forest Types
Quaking aspen	Dry Douglas-fir without ponderosa pine
Drummond willow/sedge	
Geyer willow/sedge	
Mountain alder	
Graminoid (grass)	

5.1.1.4 Monitoring Points

Effective shade monitoring can take place on any segment throughout the three AUs and be compared to existing shade. 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.

5.1.2 Load Capacity

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

We obtained solar load data from flat-plate collectors at the NREL weather stations in Pocatello, Idaho, and Helena, 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.

Shown in Tables 21 to 25 and in Figures 17, 20 and 23 are the PNV shade targets. The tables also show corresponding target summer loads (in kilowatt-hours per square meter per day [kWh/m^2/day] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segment channel width, which typically only has one or two significant figures, dictates the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce apparent rounding errors.

The AU with the largest target load (i.e., load capacity) was the Pahsimeroi River, Patterson Creek to mouth (ID17060202SL001_05) with 980,000 kWh/day (Table 24). The smallest target load was in the Sulphur and Trail Creeks AU (ID 17060202SL002_02) with 207,000 kWh/day (Tables 21 and 22 combined).

5.1.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a 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 two NPDES permit sites in the subbasin, according to the EPA permits compliance system database falling under the General Permit for Aquaculture (IDG-131000). The Pahsimeroi River fish hatchery and the Pahsimeroi River rearing ponds are owned by Idaho Power Company and operated by the IDFG. Pahsimeroi River—Patterson Creek to mouth (ID17060202SL001_05)—but they do not have thermal consequences on the receiving water body and do not contribute to the existing load. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather stations. Existing shade data are presented in Figure 18, Figure 21 and Figure 24 and in Table 21 through Table 25. Like load capacities (target loads), existing loads in Table 21 through Table 25 are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade) to be discussed next in the load allocation section and as depicted in the lack-of-shade figures (Figures 19, 22 and 25).

The AU with the largest existing load was the Pahsimeroi River, Patterson Creek to mouth (ID17060202SL001_05) with 1,200,000 kWh/day (Table 24). The smallest existing load was in the Sulphur and Trail Creeks AU (ID17060202SL002_02) with 283,000 kWh/day (Tables 21 and 22 combined).

Table 21. Existing and target solar loads for Sulphur Creek (ID17060202SL002_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
002_02	Sulphur Cr trib	1	410	alder	91%	0.53	1	400	200	90%	0.59	1	400	200	0	-1%
002_02	Sulphur Cr trib	2	610	alder	91%	0.53	1	600	300	90%	0.59	1	600	400	100	-1%
002_02	Sulphur Creek	1	700	grass	55%	2.67	1	700	2,000	50%	2.97	1	700	2,000	0	-5%
002_02	Sulphur Creek	2	610	drummond willow	76%	1.43	2	1,000	1,000	70%	1.78	2	1,000	2,000	1,000	-6%
002_02	Sulphur Creek	3	170	aspen	99%	0.06	2	300	20	90%	0.59	2	300	200	200	-9%
002_02	Sulphur Creek	4	150	drummond willow	76%	1.43	2	300	400	30%	4.16	2	300	1,000	600	-46%
002_02	Sulphur Creek	5	220	drummond willow	76%	1.43	2	400	600	70%	1.78	2	400	700	100	-6%
002_02	Sulphur Creek	6	610	drummond willow	86%	0.83	2	1,000	800	80%	1.19	2	1,000	1,000	200	-6%
002_02	Sulphur Creek	7	160	drummond willow	76%	1.43	2	300	400	30%	4.16	2	300	1,000	600	-46%
002_02	Sulphur Creek	8	220	alder	86%	0.83	2	400	300	70%	1.78	2	400	700	400	-16%
002_02	Sulphur Creek	9	1500	alder	72%	1.66	3	5,000	8,000	80%	1.19	3	5,000	6,000	(2,000)	0%
002_02	Sulphur Creek	10	570	alder	59%	2.44	4	2,000	5,000	70%	1.78	4	2,000	4,000	(1,000)	0%
002_02	Sulphur Creek	11	1000	alder	59%	2.44	4	4,000	10,000	70%	1.78	4	4,000	7,000	(3,000)	0%
002_02	Sulphur Creek	12	93	geyer willow	53%	2.79	4	400	1,000	30%	4.16	4	400	2,000	1,000	-23%
002_02	Sulphur Creek	13	810	geyer willow	53%	2.79	4	3,000	8,000	70%	1.78	4	3,000	5,000	(3,000)	0%
002_02	Sulphur Creek	14	1200	geyer willow	53%	2.79	4	5,000	10,000	60%	2.38	4	5,000	10,000	0	0%
002_02	Sulphur Creek	15	570	geyer willow	45%	3.27	5	3,000	10,000	20%	4.75	5	3,000	10,000	0	-25%
002_02	Sulphur Creek	16	180	geyer willow	45%	3.27	5	900	3,000	60%	2.38	5	900	2,000	(1,000)	0%
002_02	Sulphur Creek	17	290	geyer willow	45%	3.27	5	1,000	3,000	40%	3.56	5	1,000	4,000	1,000	-5%
002_02	Sulphur Creek	18	340	geyer willow	45%	3.27	5	2,000	7,000	20%	4.75	5	2,000	10,000	3,000	-25%
002_02	Sulphur Creek	19	260	geyer willow	45%	3.27	5	1,000	3,000	0%	5.94	5	1,000	6,000	3,000	-45%
002_02	Sulphur Creek	20	150	geyer willow	45%	3.27	5	800	3,000	30%	4.16	5	800	3,000	0	-15%
002_02	Sulphur Creek	21	250	geyer willow	45%	3.27	5	1,000	3,000	50%	2.97	5	1,000	3,000	0	0%
002_02	Sulphur Creek	22	180	geyer willow	45%	3.27	5	900	3,000	70%	1.78	5	900	2,000	(1,000)	0%
002_02	Sulphur Creek	23	1600	geyer willow	40%	3.56	6	10,000	40,000	0%	5.94	6	10,000	60,000	20,000	-40%
002_02	Sulphur Creek	24	220	geyer willow	40%	3.56	6	1,000	4,000	20%	4.75	6	1,000	5,000	1,000	-20%
002_02	Sulphur Creek	25	410	geyer willow	40%	3.56	6	2,000	7,000	0%	5.94	6	2,000	10,000	3,000	-40%
002_02	Sulphur Creek	26	1500	geyer willow	40%	3.56	6	9,000	30,000	0%	5.94	6	9,000	50,000	20,000	-40%
							Totals		160,000					210,000	44,000	

Note: All assessment unit (AU) numbers start with ID17060202SL in all load tables (Tables 21 to 25). Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table 22. Existing and target solar loads for Trail Creek (ID17060202SL002_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
002_02	1st to Trail Cr	1	320	dry DF w/o Ppine	94%	0.36	1	300	100	90%	0.59	1	300	200	100	-4%
002_02	Blind Fork	1	710	geyer willow	93%	0.42	1	700	300	70%	1.78	1	700	1,000	700	-23%
002_02	Blind Fork	2	360	geyer willow	93%	0.42	1	400	200	40%	3.56	1	400	1,000	800	-53%
002_02	Blind Fork	3	260	geyer willow	82%	1.07	2	500	500	70%	1.78	2	500	900	400	-12%
002_02	Blind Fork	4	140	geyer willow	82%	1.07	2	300	300	80%	1.19	2	300	400	100	-2%
002_02	Blind Fork	5	380	geyer willow	82%	1.07	2	800	900	50%	2.97	2	800	2,000	1,000	-32%
002_02	Trail Creek	1	230	grass	55%	2.67	1	200	500	40%	3.56	1	200	700	200	-15%
002_02	Trail Creek	2	460	drummond willow	87%	0.77	1	500	400	70%	1.78	1	500	900	500	-17%
002_02	Trail Creek	3	170	drummond willow	87%	0.77	1	200	200	40%	3.56	1	200	700	500	-47%
002_02	Trail Creek	4	180	drummond willow	87%	0.77	1	200	200	80%	1.19	1	200	200	0	-7%
002_02	Trail Creek	5	750	drummond willow	76%	1.43	2	2,000	3,000	50%	2.97	2	2,000	6,000	3,000	-26%
002_02	Trail Creek	6	450	alder	86%	0.83	2	900	700	50%	2.97	2	900	3,000	2,000	-36%
002_02	Trail Creek	7	1100	geyer willow	64%	2.14	3	3,000	6,000	40%	3.56	3	3,000	10,000	4,000	-24%
002_02	Trail Creek	8	410	geyer willow	64%	2.14	3	1,000	2,000	60%	2.38	3	1,000	2,000	0	-4%
002_02	Trail Creek	9	470	geyer willow	64%	2.14	3	1,000	2,000	40%	3.56	3	1,000	4,000	2,000	-24%
002_02	Trail Creek	10	160	geyer willow	64%	2.14	3	500	1,000	60%	2.38	3	500	1,000	0	-4%
002_02	Trail Creek	11	410	geyer willow	64%	2.14	3	1,000	2,000	70%	1.78	3	1,000	2,000	0	0%
002_02	Trail Creek	12	200	geyer willow	53%	2.79	4	800	2,000	40%	3.56	4	800	3,000	1,000	-13%
002_02	Trail Creek	13	400	geyer willow	53%	2.79	4	2,000	6,000	50%	2.97	4	2,000	6,000	0	-3%
002_02	Trail Creek	14	1200	geyer willow	53%	2.79	4	5,000	10,000	40%	3.56	4	5,000	20,000	10,000	-13%
002_02	Trail Creek	15	520	geyer willow	53%	2.79	4	2,000	6,000	60%	2.38	4	2,000	5,000	(1,000)	0%
002_02	Trail Creek	16	180	grass	16%	4.99	4	700	3,000	20%	4.75	4	700	3,000	0	0%
							Totals		47,000					73,000	25,000	

Table 23. Existing and target solar loads for Pahsimeroi River (ID17060202SL002_05).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
002_05	Pahsimeroi River	1	890	geyer willow	35%	3.86	7	6,000	20,000	40%	3.56	7	6,000	20,000	0	0%
002_05	Pahsimeroi River	2	380	geyer willow	35%	3.86	7	3,000	10,000	30%	4.16	7	3,000	10,000	0	-5%
002_05	Pahsimeroi River	3	400	geyer willow	35%	3.86	7	3,000	10,000	10%	5.35	7	3,000	20,000	10,000	-25%
002_05	Pahsimeroi River	4	160	geyer willow	35%	3.86	7	1,000	4,000	0%	5.94	7	1,000	6,000	2,000	-35%
002_05	Pahsimeroi River	5	140	geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
002_05	Pahsimeroi River	6	82	geyer willow	35%	3.86	7	600	2,000	30%	4.16	7	600	2,000	0	-5%
002_05	Pahsimeroi River	7	260	geyer willow	35%	3.86	7	2,000	8,000	10%	5.35	7	2,000	10,000	2,000	-25%
002_05	Pahsimeroi River	8	760	geyer willow	35%	3.86	7	5,000	20,000	30%	4.16	7	5,000	20,000	0	-5%
002_05	Pahsimeroi rt fk	1	800	geyer willow	45%	3.27	5	4,000	10,000	0%	5.94	5	4,000	20,000	10,000	-45%
002_05	Pahsimeroi rt fk	2	470	geyer willow	45%	3.27	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-35%
002_05	Pahsimeroi rt fk	3	230	geyer willow	45%	3.27	5	1,000	3,000	40%	3.56	5	1,000	4,000	1,000	-5%
002_05	Pahsimeroi rt fk	4	190	geyer willow	45%	3.27	5	1,000	3,000	20%	4.75	5	1,000	5,000	2,000	-25%
002_05	Pahsimeroi rt fk	5	230	geyer willow	45%	3.27	5	1,000	3,000	10%	5.35	5	1,000	5,000	2,000	-35%
002_05	Pahsimeroi rt fk	6	480	geyer willow	45%	3.27	5	2,000	7,000	0%	5.94	5	2,000	10,000	3,000	-45%
002_05	Pahsimeroi rt fk	7	360	geyer willow	45%	3.27	5	2,000	7,000	0%	5.94	5	2,000	10,000	3,000	-45%
002_05	Pahsimeroi rt fk	8	930	geyer willow	45%	3.27	5	5,000	20,000	50%	2.97	5	5,000	10,000	(10,000)	5%
002_05	Pahsimeroi rt fk	9	230	geyer willow	31%	4.10	8	2,000	8,000	20%	4.75	8	2,000	10,000	2,000	-11%
002_05	Pahsimeroi rt fk	10	960	geyer willow	31%	4.10	8	8,000	30,000	30%	4.16	8	8,000	30,000	0	-1%
002_05	Pahsimeroi rt fk	11	100	geyer willow	31%	4.10	8	800	3,000	20%	4.75	8	800	4,000	1,000	-11%
002_05	Pahsimeroi rt fk	12	79	geyer willow	31%	4.10	8	600	2,000	20%	4.75	8	600	3,000	1,000	-11%
002_05	Pahsimeroi rt fk	13	110	geyer willow	31%	4.10	8	900	4,000	0%	5.94	8	900	5,000	1,000	-31%
002_05	Pahsimeroi lft fk	1	100	geyer willow	45%	3.27	5	500	2,000	50%	2.97	5	500	1,000	(1,000)	0%
002_05	Pahsimeroi lft fk	2	54	geyer willow	45%	3.27	5	300	1,000	0%	5.94	5	300	2,000	1,000	-45%
002_05	Pahsimeroi lft fk	3	1100	geyer willow	45%	3.27	5	6,000	20,000	70%	1.78	5	6,000	10,000	(10,000)	0%
002_05	Pahsimeroi lft fk	4	190	geyer willow	45%	3.27	5	1,000	3,000	30%	4.16	5	1,000	4,000	1,000	-15%
002_05	Pahsimeroi lft fk	5	270	geyer willow	45%	3.27	5	1,000	3,000	20%	4.75	5	1,000	5,000	2,000	-25%
002_05	Pahsimeroi lft fk	6	170	geyer willow	45%	3.27	5	900	3,000	30%	4.16	5	900	4,000	1,000	-15%
002_05	Pahsimeroi lft fk	7	290	geyer willow	45%	3.27	5	1,000	3,000	0%	5.94	5	1,000	6,000	3,000	-45%
002_05	Pahsimeroi lft fk	8	420	geyer willow	45%	3.27	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-15%
002_05	Pahsimeroi lft fk	9	640	geyer willow	45%	3.27	5	3,000	10,000	0%	5.94	5	3,000	20,000	10,000	-45%
002_05	Pahsimeroi lft fk	10	430	geyer willow	45%	3.27	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-35%
002_05	Pahsimeroi lft fk	11	510	geyer willow	45%	3.27	5	3,000	10,000	0%	5.94	5	3,000	20,000	10,000	-45%
002_05	Pahsimeroi lft fk	12	210	geyer willow	45%	3.27	5	1,000	3,000	30%	4.16	5	1,000	4,000	1,000	-15%
002_05	Pahsimeroi lft fk	13	110	geyer willow	45%	3.27	5	600	2,000	20%	4.75	5	600	3,000	1,000	-25%
002_05	Pahsimeroi lft fk	14	970	geyer willow	45%	3.27	5	5,000	20,000	0%	5.94	5	5,000	30,000	10,000	-45%
002_05	Pahsimeroi River	1	120	geyer willow	31%	4.10	8	1,000	4,000	0%	5.94	8	1,000	6,000	2,000	-31%
002_05	Pahsimeroi River	2	520	geyer willow	31%	4.10	8	4,000	20,000	20%	4.75	8	4,000	20,000	0	-11%
002_05	Pahsimeroi River	3	140	geyer willow	31%	4.10	8	1,000	4,000	10%	5.35	8	1,000	5,000	1,000	-21%
002_05	Pahsimeroi River	4	510	geyer willow	31%	4.10	8	4,000	20,000	40%	3.56	8	4,000	10,000	(10,000)	0%
002_05	Pahsimeroi River	5	230	geyer willow	31%	4.10	8	2,000	8,000	30%	4.16	8	2,000	8,000	0	-1%
002_05	Pahsimeroi River	6	130	geyer willow	31%	4.10	8	1,000	4,000	10%	5.35	8	1,000	5,000	1,000	-21%
002_05	Pahsimeroi River	7	82	geyer willow	31%	4.10	8	700	3,000	30%	4.16	8	700	3,000	0	-1%
							Totals		340,000					400,000	61,000	

Table 24. Existing and target solar loads for Pahsimeroi River (ID17060202SL001_05).

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
001_05	Pahsimeroi River	1	220	geyer willow	22%	4.63	12	2,600	12,000	10%	5.35	12	2,600	14,000	2,000	-12%
001_05	Pahsimeroi River	2	480	geyer willow	22%	4.63	12	5,800	27,000	20%	4.75	12	5,800	28,000	1,000	-2%
001_05	Pahsimeroi River	3	330	geyer willow	22%	4.63	12	4,000	19,000	10%	5.35	12	4,000	21,000	2,000	-12%
001_05	Pahsimeroi River	4	690	geyer willow	22%	4.63	12	8,300	38,000	0%	5.94	12	8,300	49,000	11,000	-22%
001_05	Pahsimeroi River	5	140	geyer willow	22%	4.63	12	1,700	7,900	10%	5.35	12	1,700	9,100	1,200	-12%
001_05	Pahsimeroi River	6	370	geyer willow	22%	4.63	12	4,400	20,000	0%	5.94	12	4,400	26,000	6,000	-22%
001_05	Pahsimeroi River	7	140	geyer willow	22%	4.63	12	1,700	7,900	10%	5.35	12	1,700	9,100	1,200	-12%
001_05	Pahsimeroi River	8	70	geyer willow	22%	4.63	12	840	3,900	0%	5.94	12	840	5,000	1,100	-22%
001_05	Pahsimeroi River	9	150	geyer willow	22%	4.63	12	1,800	8,300	10%	5.35	12	1,800	9,600	1,300	-12%
001_05	Pahsimeroi River	10	740	geyer willow	22%	4.63	12	8,900	41,000	0%	5.94	12	8,900	53,000	12,000	-22%
001_05	Pahsimeroi River	11	86	geyer willow	22%	4.63	12	1,000	4,600	20%	4.75	12	1,000	4,800	200	-2%
001_05	Pahsimeroi River	12	410	geyer willow	22%	4.63	12	4,900	23,000	0%	5.94	12	4,900	29,000	6,000	-22%
001_05	Pahsimeroi River	13	420	geyer willow	22%	4.63	12	5,000	23,000	20%	4.75	12	5,000	24,000	1,000	-2%
001_05	Pahsimeroi River	14	910	geyer willow	22%	4.63	12	11,000	51,000	0%	5.94	12	11,000	65,000	14,000	-22%
001_05	Pahsimeroi River	15	300	geyer willow	22%	4.63	12	3,600	17,000	10%	5.35	12	3,600	19,000	2,000	-12%
001_05	Pahsimeroi River	16	810	geyer willow	22%	4.63	12	9,700	45,000	0%	5.94	12	9,700	58,000	13,000	-22%
001_05	Pahsimeroi River	17	82	geyer willow	22%	4.63	12	980	4,500	10%	5.35	12	980	5,200	700	-12%
001_05	Pahsimeroi River	18	110	geyer willow	22%	4.63	12	1,300	6,000	0%	5.94	12	1,300	7,700	1,700	-22%
001_05	Pahsimeroi River	19	130	geyer willow	22%	4.63	12	1,600	7,400	10%	5.35	12	1,600	8,600	1,200	-12%
001_05	Pahsimeroi River	20	82	geyer willow	22%	4.63	12	980	4,500	0%	5.94	12	980	5,800	1,300	-22%
001_05	Pahsimeroi River	21	280	geyer willow	22%	4.63	12	3,400	16,000	10%	5.35	12	3,400	18,000	2,000	-12%
001_05	Pahsimeroi River	22	1200	geyer willow	22%	4.63	12	14,000	65,000	0%	5.94	12	14,000	83,000	18,000	-22%
001_05	Pahsimeroi River	23	80	geyer willow	22%	4.63	12	960	4,400	10%	5.35	12	960	5,100	700	-12%
001_05	Pahsimeroi River	24	280	geyer willow	18%	4.87	15	4,200	20,000	0%	5.94	15	4,200	25,000	5,000	-18%
001_05	Pahsimeroi River	25	120	geyer willow	18%	4.87	15	1,800	8,800	10%	5.35	15	1,800	9,600	800	-8%
001_05	Pahsimeroi River	26	3600	geyer willow	18%	4.87	15	54,000	260,000	0%	5.94	15	54,000	320,000	60,000	-18%
001_05	Pahsimeroi River	27	95	geyer willow	22%	4.63	12	1,100	5,100	10%	5.35	12	1,100	5,900	800	-12%
001_05	Pahsimeroi River	28	490	geyer willow	22%	4.63	12	5,900	27,000	0%	5.94	12	5,900	35,000	8,000	-22%
001_05	Pahsimeroi River	29	360	geyer willow	22%	4.63	12	4,300	20,000	10%	5.35	12	4,300	23,000	3,000	-12%
001_05	Pahsimeroi River	30	91	geyer willow	22%	4.63	12	1,100	5,100	0%	5.94	12	1,100	6,500	1,400	-22%
001_05	Pahsimeroi River	31	250	geyer willow	22%	4.63	12	3,000	14,000	10%	5.35	12	3,000	16,000	2,000	-12%
001_05	Pahsimeroi River	32	67	geyer willow	22%	4.63	12	800	3,700	0%	5.94	12	800	4,800	1,100	-22%
001_05	Pahsimeroi River	33	100	geyer willow	22%	4.63	12	1,200	5,600	10%	5.35	12	1,200	6,400	800	-12%
001_05	Pahsimeroi River	34	420	geyer willow	22%	4.63	12	5,000	23,000	0%	5.94	12	5,000	30,000	7,000	-22%
001_05	Pahsimeroi River	35	300	geyer willow	22%	4.63	12	3,600	17,000	10%	5.35	12	3,600	19,000	2,000	-12%
001_05	Pahsimeroi River	36	160	geyer willow	22%	4.63	12	1,900	8,800	0%	5.94	12	1,900	11,000	2,200	-22%
001_05	Pahsimeroi River	37	76	geyer willow	22%	4.63	12	910	4,200	10%	5.35	12	910	4,900	700	-12%
001_05	Pahsimeroi River	38	130	geyer willow	22%	4.63	12	1,600	7,400	0%	5.94	12	1,600	9,500	2,100	-22%
001_05	Pahsimeroi River	39	630	geyer willow	22%	4.63	12	7,600	35,000	10%	5.35	12	7,600	41,000	6,000	-12%
001_05	Pahsimeroi River	40	500	geyer willow	22%	4.63	12	6,000	28,000	0%	5.94	12	6,000	36,000	8,000	-22%
001_05	Pahsimeroi River	41	160	geyer willow	22%	4.63	12	1,900	8,800	10%	5.35	12	1,900	10,000	1,200	-12%
001_05	Pahsimeroi River	42	290	geyer willow	22%	4.63	12	3,500	16,000	0%	5.94	12	3,500	21,000	5,000	-22%
001_05	Pahsimeroi River	43	160	geyer willow	22%	4.63	12	1,900	8,800	10%	5.35	12	1,900	10,000	1,200	-12%
							Totals		980,000					1,200,000	220,000	

Table 25. Existing and target solar loads for upper Pahsimeroi River (ID17060202SL022_03, 020_03 and 018_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
022_03	EF Pahsimeroi River	1	47	Geyer willow	40%	3.56	6	300	1,000	20%	4.75	6	300	1,000	0	-20%
022_03	EF Pahsimeroi River	2	53	Geyer willow	40%	3.56	6	300	1,000	40%	3.56	6	300	1,000	0	0%
022_03	EF Pahsimeroi River	3	140	Geyer willow	40%	3.56	6	800	3,000	20%	4.75	6	800	4,000	1,000	-20%
022_03	EF Pahsimeroi River	4	63	Geyer willow	40%	3.56	6	400	1,000	40%	3.56	6	400	1,000	0	0%
022_03	EF Pahsimeroi River	4	200	Geyer willow	40%	3.56	6	1,000	4,000	30%	4.16	6	1,000	4,000	0	-10%
022_03	Pahsimeroi River	1	66	Geyer willow	35%	3.86	7	500	2,000	40%	3.56	7	500	2,000	0	0%
022_03	Pahsimeroi River	2	160	Geyer willow	35%	3.86	7	1,000	4,000	20%	4.75	7	1,000	5,000	1,000	-15%
022_03	Pahsimeroi River	3	50	Geyer willow	35%	3.86	7	400	2,000	30%	4.16	7	400	2,000	0	-5%
022_03	Pahsimeroi River	4	220	Geyer willow	35%	3.86	7	2,000	8,000	20%	4.75	7	2,000	10,000	2,000	-15%
022_03	Pahsimeroi River	5	90	Geyer willow	35%	3.86	7	600	2,000	30%	4.16	7	600	2,000	0	-5%
022_03	Pahsimeroi River	6	73	Geyer willow	35%	3.86	7	500	2,000	20%	4.75	7	500	2,000	0	-15%
022_03	Pahsimeroi River	7	94	Geyer willow	35%	3.86	7	700	3,000	10%	5.35	7	700	4,000	1,000	-25%
022_03	Pahsimeroi River	8	37	Geyer willow	35%	3.86	7	300	1,000	10%	5.35	7	300	2,000	1,000	-25%
022_03	Pahsimeroi River	9	48	Geyer willow	35%	3.86	7	300	1,000	30%	4.16	7	300	1,000	0	-5%
022_03	Pahsimeroi River	10	340	Geyer willow	35%	3.86	7	2,000	8,000	20%	4.75	7	2,000	10,000	2,000	-15%
022_03	Pahsimeroi River	11	360	Geyer willow	35%	3.86	7	3,000	10,000	10%	5.35	7	3,000	20,000	10,000	-25%
022_03	Pahsimeroi River	12	170	Geyer willow	35%	3.86	7	1,000	4,000	20%	4.75	7	1,000	5,000	1,000	-15%
022_03	Pahsimeroi River	13	65	Geyer willow	35%	3.86	7	500	2,000	10%	5.35	7	500	3,000	1,000	-25%
020_03	Pahsimeroi River	14	210	Geyer willow	35%	3.86	7	1,000	4,000	30%	4.16	7	1,000	4,000	0	-5%
020_03	Pahsimeroi River	15	59	Geyer willow	35%	3.86	7	400	2,000	10%	5.35	7	400	2,000	0	-25%
020_03	Pahsimeroi River	16	160	Geyer willow	35%	3.86	7	1,000	4,000	20%	4.75	7	1,000	5,000	1,000	-15%
020_03	Pahsimeroi River	17	190	Geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
020_03	Pahsimeroi River	18	180	Geyer willow	35%	3.86	7	1,000	4,000	30%	4.16	7	1,000	4,000	0	-5%
020_03	Pahsimeroi River	19	350	Geyer willow	35%	3.86	7	2,000	8,000	40%	3.56	7	2,000	7,000	(1,000)	0%
020_03	Pahsimeroi River	20	72	Geyer willow	35%	3.86	7	500	2,000	30%	4.16	7	500	2,000	0	-5%
020_03	Pahsimeroi River	21	49	Geyer willow	35%	3.86	7	300	1,000	10%	5.35	7	300	2,000	1,000	-25%
020_03	Pahsimeroi River	22	69	Geyer willow	35%	3.86	7	500	2,000	20%	4.75	7	500	2,000	0	-15%
020_03	Pahsimeroi River	23	180	Geyer willow	35%	3.86	7	1,000	4,000	20%	4.75	7	1,000	5,000	1,000	-15%
020_03	Pahsimeroi River	24	100	Geyer willow	31%	4.10	8	800	3,000	30%	4.16	8	800	3,000	0	-1%
020_03	Pahsimeroi River	25	100	Geyer willow	31%	4.10	8	800	3,000	0%	5.94	8	800	5,000	2,000	-31%
020_03	Pahsimeroi River	26	200	Geyer willow	31%	4.10	8	2,000	8,000	20%	4.75	8	2,000	10,000	2,000	-11%
020_03	Pahsimeroi River	27	77	Geyer willow	31%	4.10	8	600	2,000	10%	5.35	8	600	3,000	1,000	-21%
020_03	Pahsimeroi River	28	120	Geyer willow	31%	4.10	8	1,000	4,000	30%	4.16	8	1,000	4,000	0	-1%
020_03	Pahsimeroi River	29	280	Geyer willow	31%	4.10	8	2,000	8,000	10%	5.35	8	2,000	10,000	2,000	-21%
020_03	Pahsimeroi River	30	30	Geyer willow	31%	4.10	8	200	800	30%	4.16	8	200	800	0	-1%
020_03	Pahsimeroi River	31	98	Geyer willow	31%	4.10	8	800	3,000	30%	4.16	8	800	3,000	0	-1%
020_03	Pahsimeroi River	32	310	Geyer willow	31%	4.10	8	2,000	8,000	50%	2.97	8	2,000	6,000	(2,000)	0%

Table 25 (cont.). Existing and target solar loads for upper Pahsimeroi River (ID17060202SL022_03, 020_03 and 018_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
020_03	Pahsimeroi River	33	96	Geyer willow	31%	4.10	8	800	3,000	30%	4.16	8	800	3,000	0	-1%
020_03	Pahsimeroi River	34	310	Geyer willow	31%	4.10	8	2,000	8,000	20%	4.75	8	2,000	10,000	2,000	-11%
020_03	Pahsimeroi River	35	270	Geyer willow	31%	4.10	8	2,000	8,000	30%	4.16	8	2,000	8,000	0	-1%
020_03	Pahsimeroi River	36	120	Geyer willow	31%	4.10	8	1,000	4,000	40%	3.56	8	1,000	4,000	0	0%
020_03	Pahsimeroi River	37	120	Geyer willow	31%	4.10	8	1,000	4,000	20%	4.75	8	1,000	5,000	1,000	-11%
020_03	Pahsimeroi River	38	200	Geyer willow	31%	4.10	8	2,000	8,000	30%	4.16	8	2,000	8,000	0	-1%
020_03	Pahsimeroi River	39	260	Geyer willow	31%	4.10	8	2,000	8,000	20%	4.75	8	2,000	10,000	2,000	-11%
020_03	Pahsimeroi River	40	300	Geyer willow	31%	4.10	8	2,000	8,000	30%	4.16	8	2,000	8,000	0	-1%
020_03	Pahsimeroi River	41	270	Geyer willow	31%	4.10	8	2,000	8,000	20%	4.75	8	2,000	10,000	2,000	-11%
018_04	Pahsimeroi River	1	230	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
018_04	Pahsimeroi River	2	290	Geyer willow	29%	4.22	9	3,000	10,000	20%	4.75	9	3,000	10,000	0	-9%
018_04	Pahsimeroi River	3	240	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
018_04	Pahsimeroi River	4	140	Geyer willow	29%	4.22	9	1,000	4,000	20%	4.75	9	1,000	5,000	1,000	-9%
018_04	Pahsimeroi River	5	570	Geyer willow	29%	4.22	9	5,000	20,000	40%	3.56	9	5,000	20,000	0	0%
018_04	Pahsimeroi River	6	170	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
018_04	Pahsimeroi River	7	520	Geyer willow	29%	4.22	9	5,000	20,000	40%	3.56	9	5,000	20,000	0	0%
018_04	Pahsimeroi River	8	69	Geyer willow	29%	4.22	9	600	3,000	20%	4.75	9	600	3,000	0	-9%
018_04	Pahsimeroi River	9	950	Geyer willow	29%	4.22	9	9,000	40,000	30%	4.16	9	9,000	40,000	0	0%
018_04	Pahsimeroi River	10	280	Geyer willow	29%	4.22	9	3,000	10,000	40%	3.56	9	3,000	10,000	0	0%
018_04	Pahsimeroi River	11	340	Geyer willow	29%	4.22	9	3,000	10,000	40%	3.56	9	3,000	10,000	0	0%
018_04	Pahsimeroi River	12	750	Geyer willow	29%	4.22	9	7,000	30,000	30%	4.16	9	7,000	30,000	0	0%
018_04	Pahsimeroi River	13	570	Geyer willow	29%	4.22	9	5,000	20,000	50%	2.97	9	5,000	10,000	(10,000)	0%
018_04	Pahsimeroi River	14	190	Geyer willow	29%	4.22	9	2,000	8,000	0%	5.94	9	2,000	10,000	2,000	-29%
018_04	Pahsimeroi River	15	240	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
018_04	Pahsimeroi River	16	490	Geyer willow	29%	4.22	9	4,000	20,000	40%	3.56	9	4,000	10,000	(10,000)	0%
018_04	Pahsimeroi River	17	140	Geyer willow	29%	4.22	9	1,000	4,000	20%	4.75	9	1,000	5,000	1,000	-9%
018_04	Pahsimeroi River	18	180	Geyer willow	29%	4.22	9	2,000	8,000	0%	5.94	9	2,000	10,000	2,000	-29%
018_04	Pahsimeroi River	19	280	Geyer willow	29%	4.22	9	3,000	10,000	10%	5.35	9	3,000	20,000	10,000	-19%
018_04	Pahsimeroi River	20	260	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
018_04	Pahsimeroi River	21	420	Geyer willow	29%	4.22	9	4,000	20,000	40%	3.56	9	4,000	10,000	(10,000)	0%
018_04	Pahsimeroi River	22	120	Geyer willow	29%	4.22	9	1,000	4,000	20%	4.75	9	1,000	5,000	1,000	-9%
018_04	Pahsimeroi River	23	410	Geyer willow	29%	4.22	9	4,000	20,000	40%	3.56	9	4,000	10,000	(10,000)	0%
018_04	Pahsimeroi River	24	130	Geyer willow	29%	4.22	9	1,000	4,000	10%	5.35	9	1,000	5,000	1,000	-19%
018_04	Pahsimeroi River	25	140	Geyer willow	29%	4.22	9	1,000	4,000	30%	4.16	9	1,000	4,000	0	0%
018_04	Pahsimeroi River	26	280	Geyer willow	29%	4.22	9	3,000	10,000	10%	5.35	9	3,000	20,000	10,000	-19%
018_04	Pahsimeroi River	27	410	Geyer willow	29%	4.22	9	4,000	20,000	20%	4.75	9	4,000	20,000	0	-9%
018_04	Pahsimeroi River	28	98	Geyer willow	29%	4.22	9	900	4,000	30%	4.16	9	900	4,000	0	0%
018_04	Pahsimeroi River	29	180	Geyer willow	29%	4.22	9	2,000	8,000	10%	5.35	9	2,000	10,000	2,000	-19%
018_04	Pahsimeroi River	30	400	Geyer willow	29%	4.22	9	4,000	20,000	30%	4.16	9	4,000	20,000	0	0%
018_04	Pahsimeroi River	31	120	Geyer willow	29%	4.22	9	1,000	4,000	20%	4.75	9	1,000	5,000	1,000	-9%
018_04	Pahsimeroi River	32	310	Geyer willow	29%	4.22	9	3,000	10,000	40%	3.56	9	3,000	10,000	0	0%
							Totals		580,000					600,000	26,000	

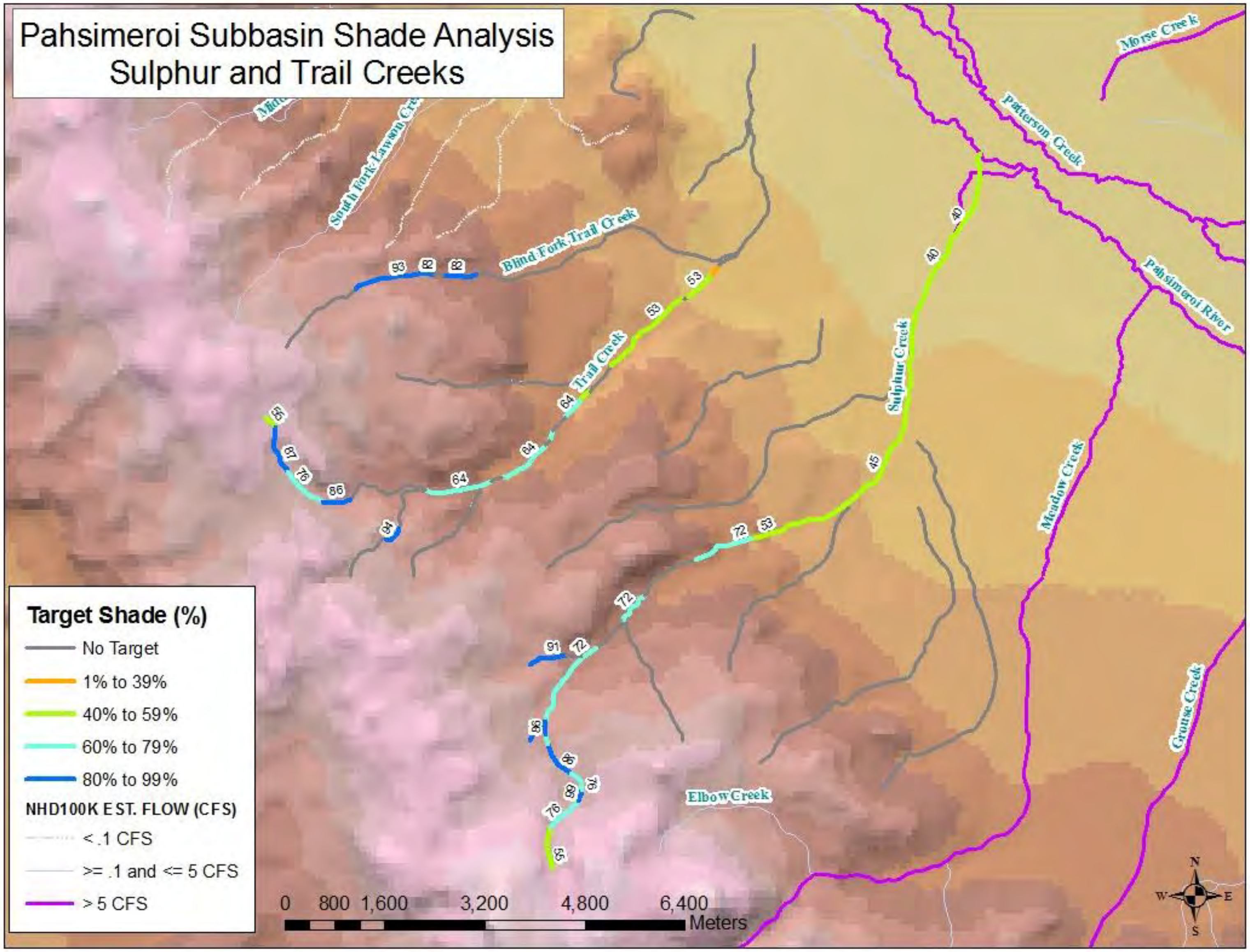

Figure 17. Target shade for Sulphur and Trail Creeks (ID17060202SL002_02).

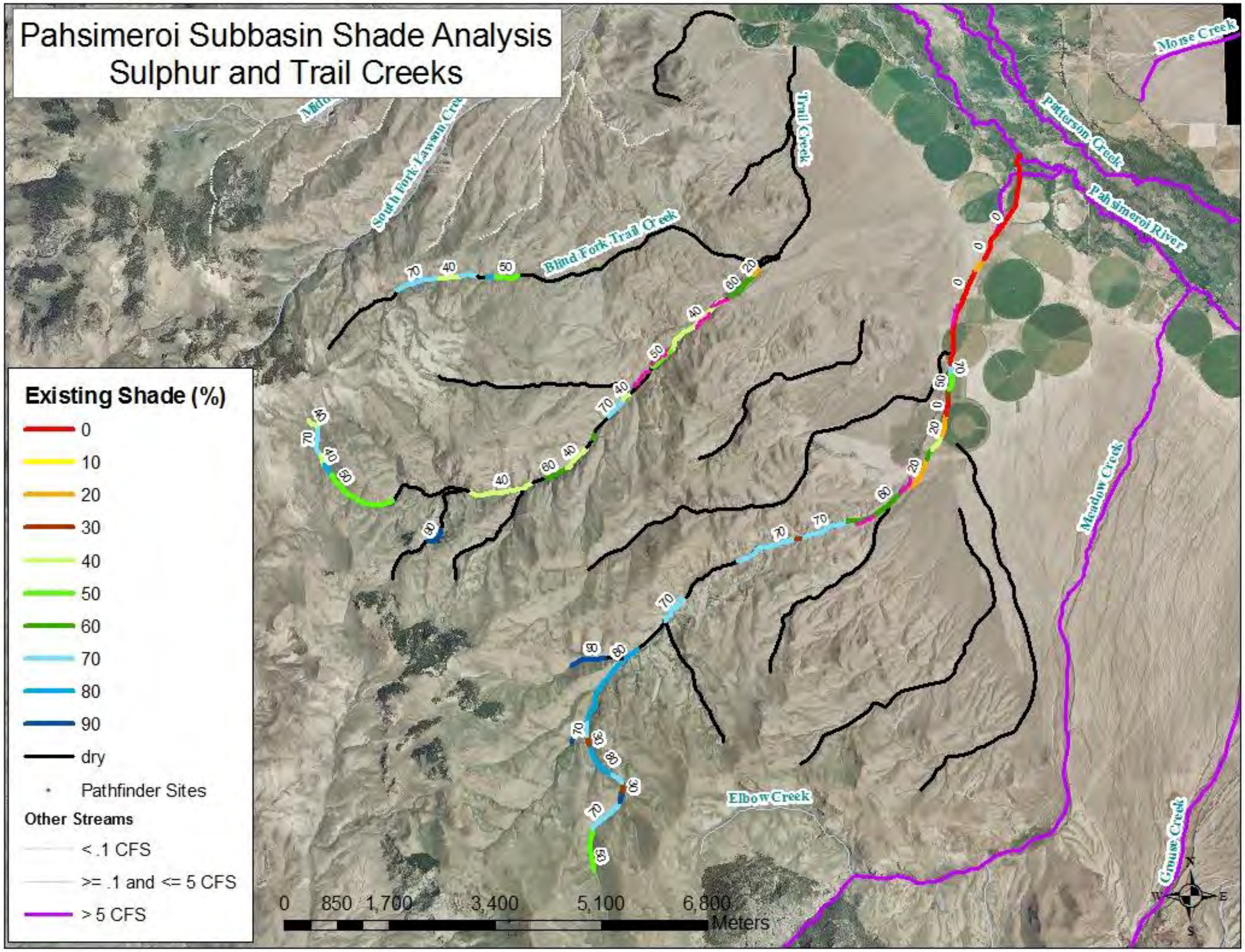

Figure 18. Existing shade estimated for Sulphur and Trail Creeks (ID17060202SL002_02) by aerial photo interpretation.

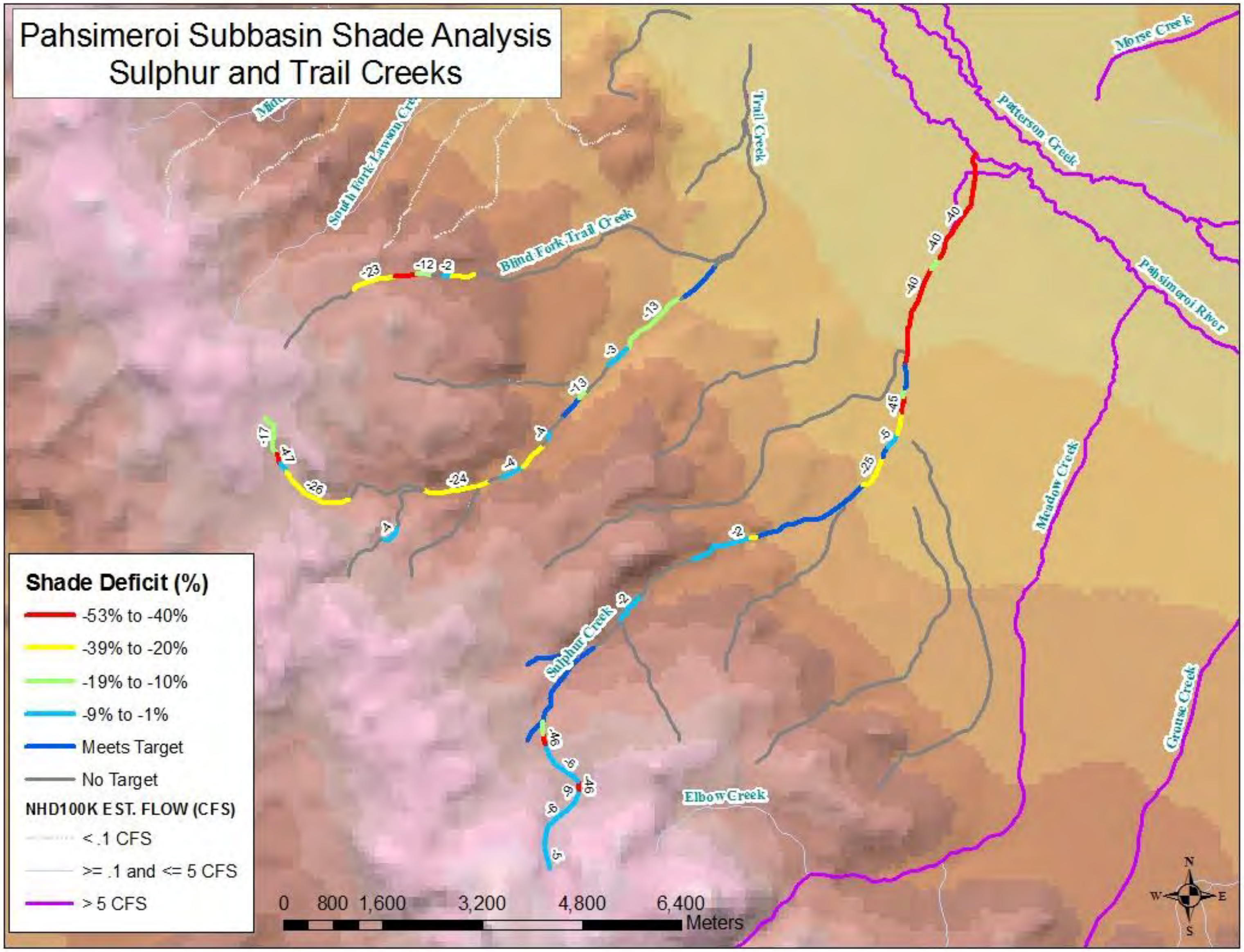

Figure 19. Lack of shade (difference between existing and target) for Sulphur and Trail Creeks (ID17060202SL002_02).

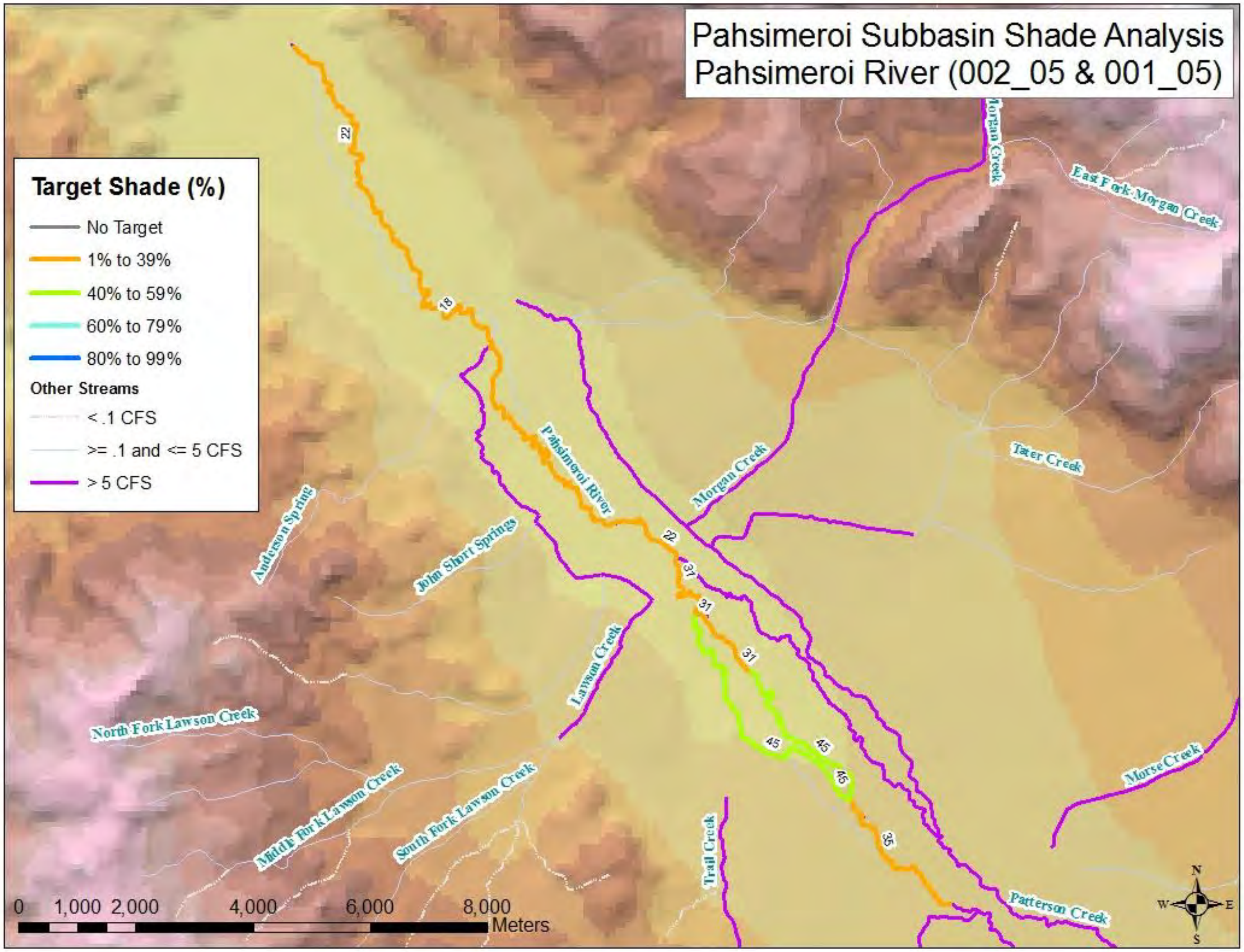

Figure 20. Target shade for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05).

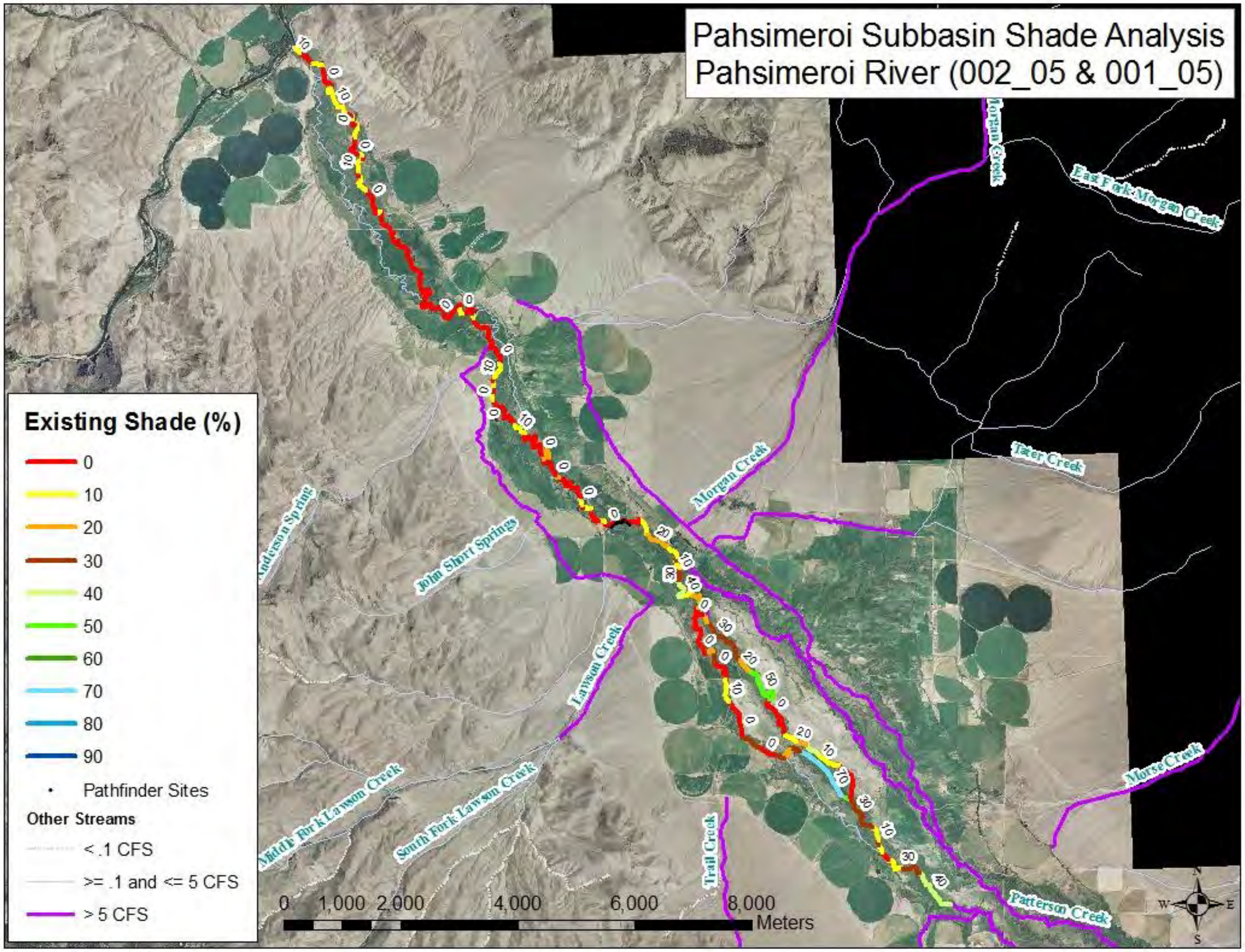

Figure 21. Existing shade estimated for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05) by aerial photo interpretation.

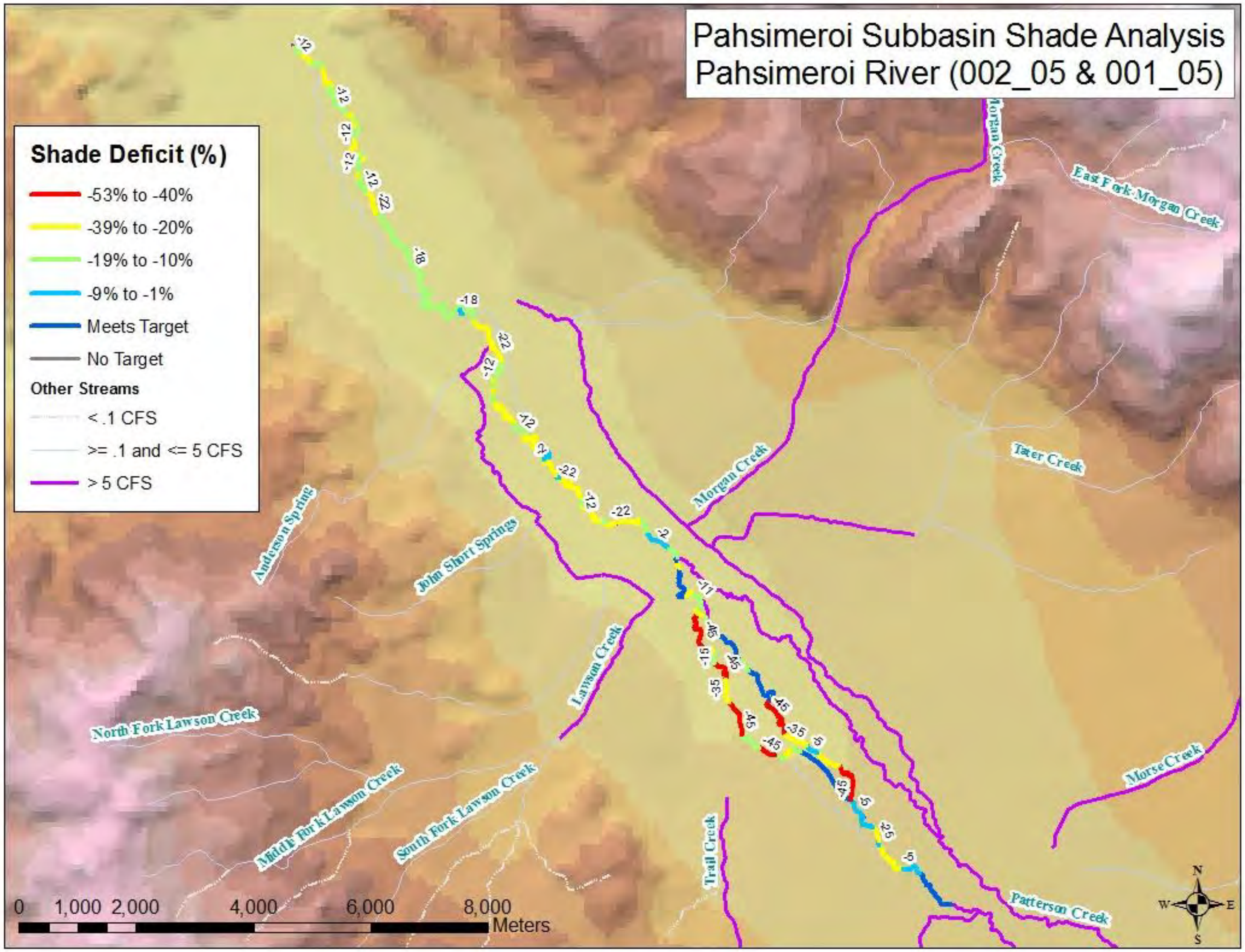

Figure 22. Lack of shade (difference between existing and target) for the Pahsimeroi River (ID17060202SL002_05 and ID17060202SL001_05).

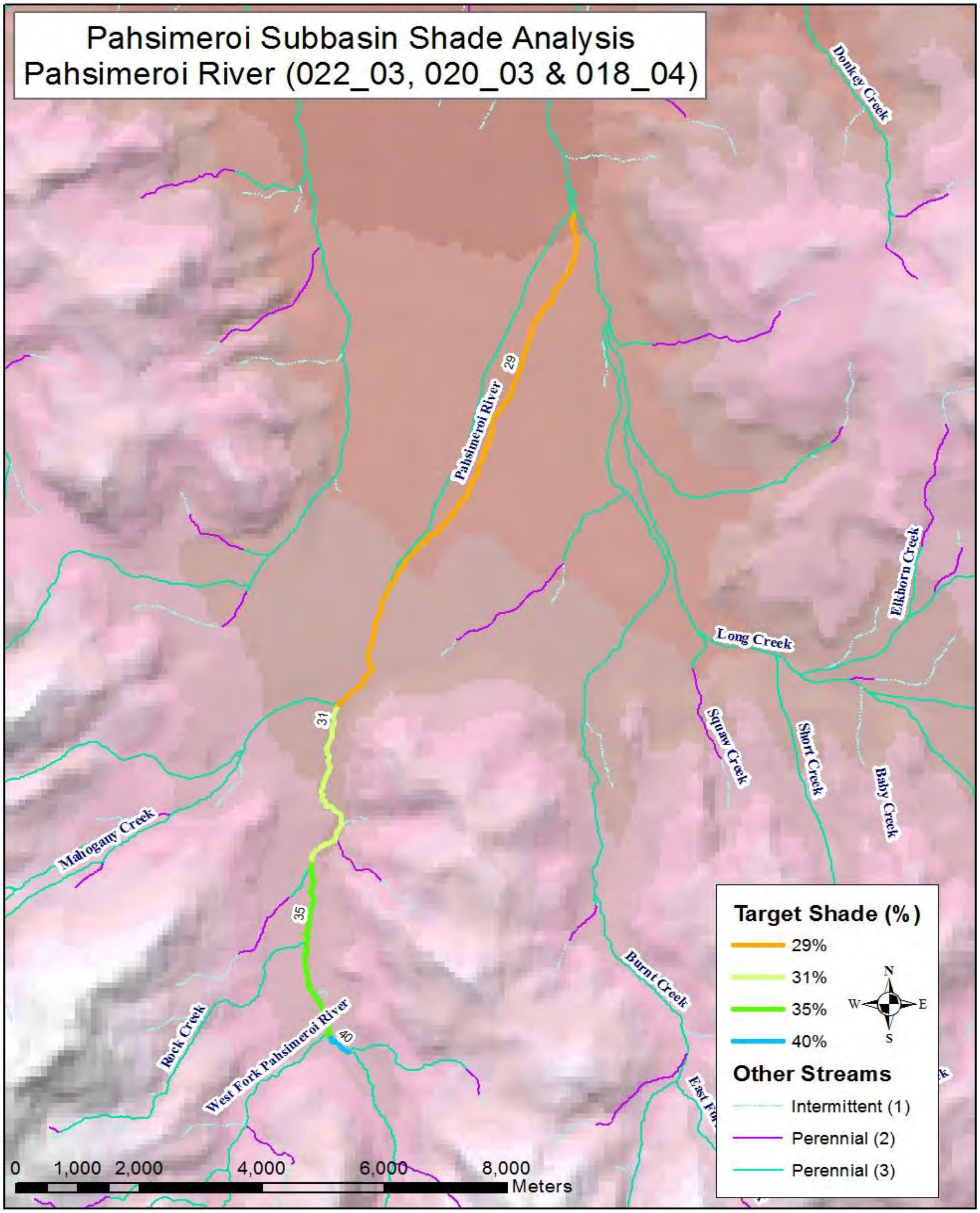

Figure 23. Target shade for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04).

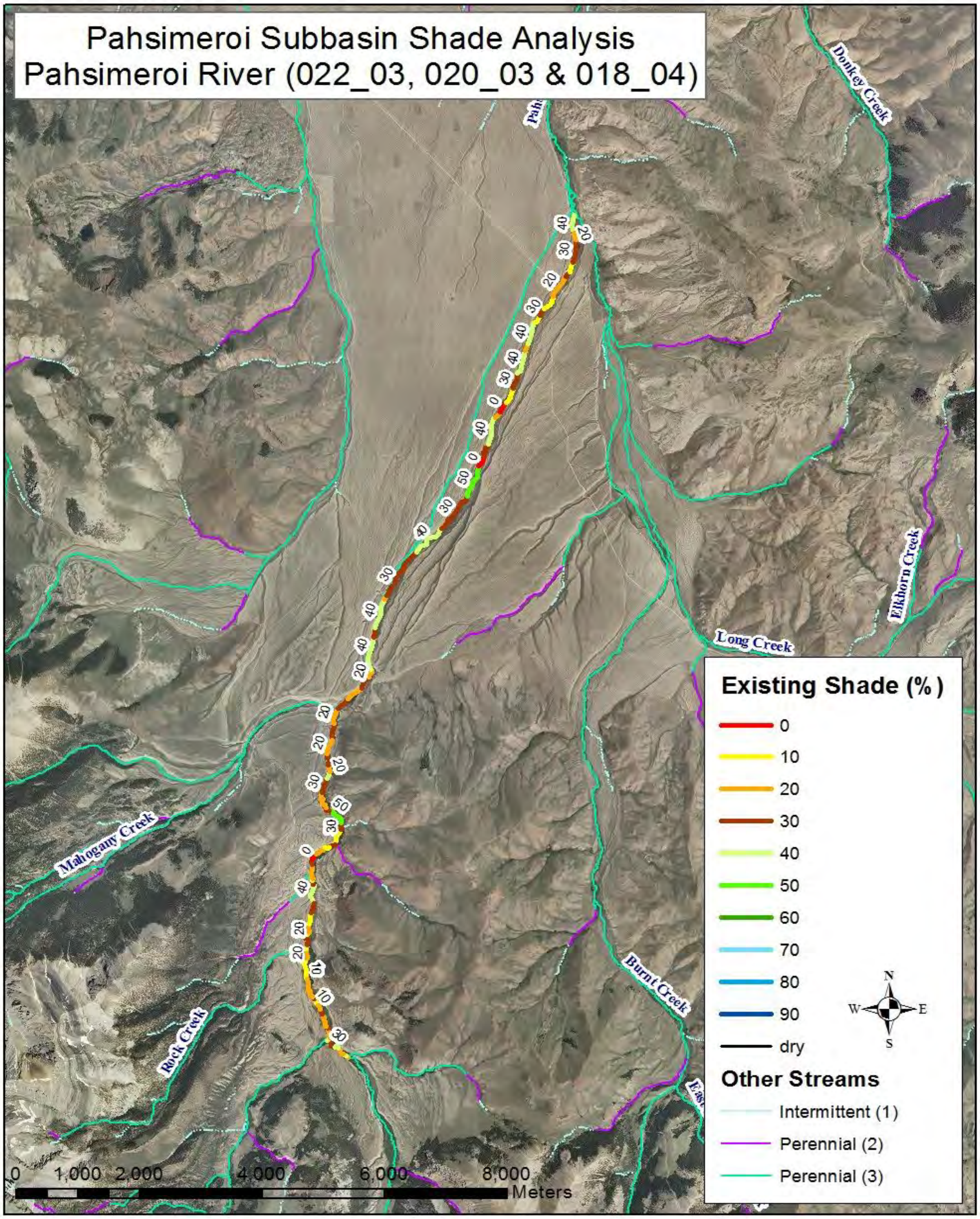

Figure 24. Existing shade estimated for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04) by aerial photo interpretation.

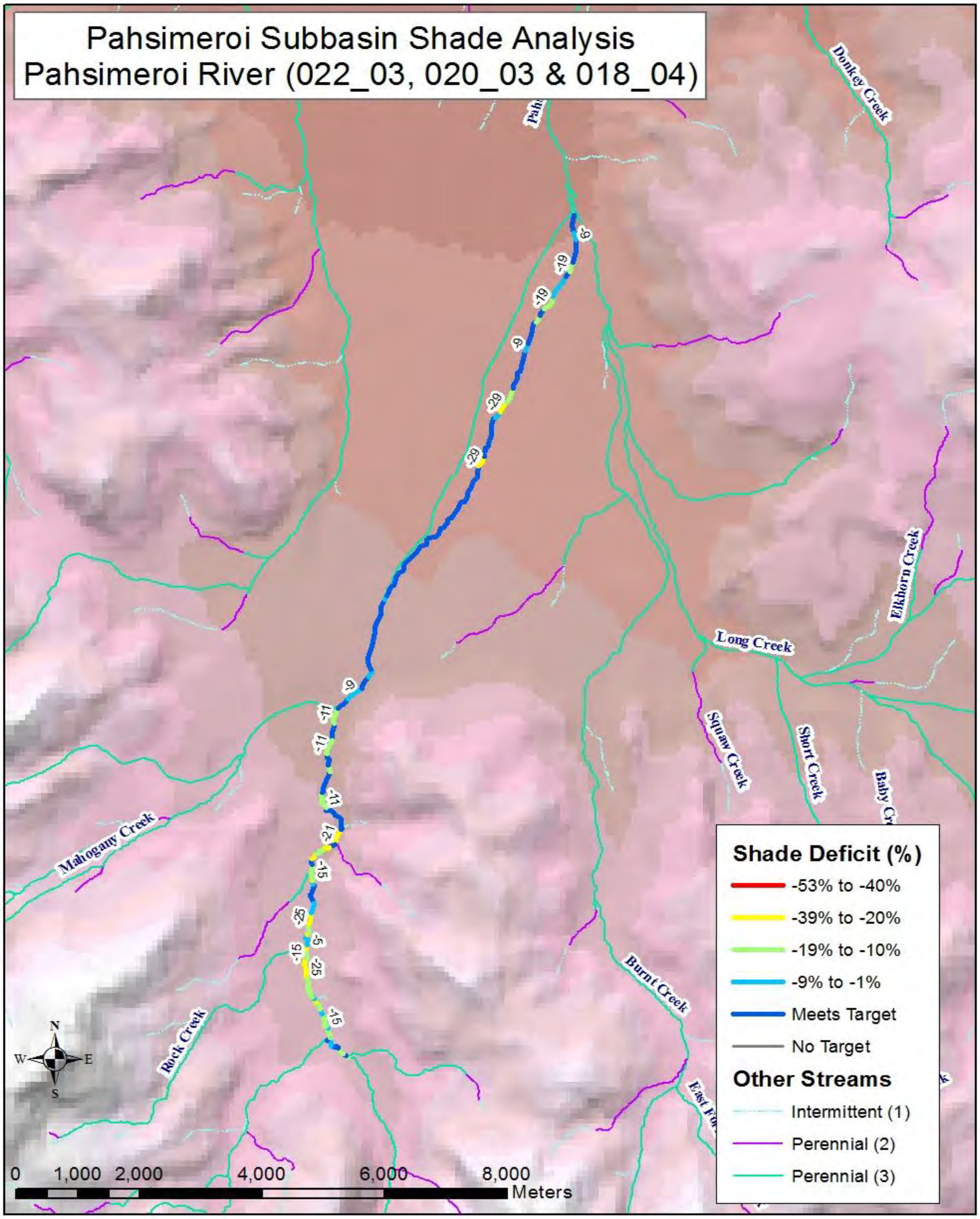

Figure 25. Lack of shade (difference between existing and target) for the upper Pahsimeroi River (ID17060202SL022_03, ID17060202SL020_03 and ID17060202SL018_04).

5.1.4 Load and Wasteload Allocation

Because this TMDL is based on PNV, which is equivalent to background loading, the load allocation is essentially the desire to achieve background conditions. However, in order to reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Therefore, load allocations are stream segment specific and dependent upon the target load for a given segment. The target shade and corresponding target summer loads are shown in Tables 21 to 25. This target load (i.e., load capacity) is necessary to achieve background conditions. There is no opportunity to further remove shade from the stream by any activity without exceeding its load capacity. Additionally, because this TMDL is dependent upon background conditions for achieving water quality standards, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system.

The total existing, target, and excess loads and the average lack of shade for each water body examined are shown in Table 26. The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of their larger channel widths.

Although this TMDL analysis focuses on total solar loads, it is important to note that differences between existing and target shade, as depicted in the lack-of-shade figures (Figures 19, 22 and 25), are the key to successfully restoring these waters to achieving water quality standards. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each load analysis table contains a column that lists the lack of shade on the stream segment. This value is derived from subtracting target shade from existing shade for each segment. Thus, stream segments with the largest lack of shade are in the worst shape. The average lack of shade derived from the last column in each load analysis table is also listed in Table 26 and provides a general level of comparison among streams.

Table 26. Total solar loads and average lack of shade for all waters.

Water Body/ Assessment Unit	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)		
Pahsimeroi River—Patterson Creek to mouth (ID17060202SL001_05)	1,200,000	980,000	220,000 (18%)	-16
Pahsimeroi River—Meadow Creek to Patterson Creek (Sulphur Creek) (ID17060202SL002_02)	210,000	160,000	44,000 (21%)	-15
Pahsimeroi River—Meadow Creek to Patterson Creek (Trail Creek) (ID17060202SL002_02)	73,000	47,000	25,000 (34%)	-16
Pahsimeroi River—Sulphur Creek to Patterson Creek (ID17060202SL002_05)	400,000	340,000	61,000 (15%)	-21
Upper Pahsimeroi River (ID17060202SL022_03, 020_03 and 018_04)	600,000	580,000	26,000 (4%)	-9

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

All streams examined lacked shade. Upper Pahsimeroi River appears to be in the best condition overall, with some reaches meeting shade targets and others within 9% of the target level (Figure 25). Upper Sulphur Creek is in a similar good condition; however, once Sulphur Creek reaches the valley floor with its significant agricultural land uses, the creek begins to lack substantial shade (Figure 19). Trail Creek and its Blind Fork, on the other hand, are drier systems than Sulphur Creek, and the Trail Creek watershed tends to lack shade at higher elevations—likely due to a lack of water to support riparian communities. Trail Creek lacks sufficient water to have surface flow to the valley floor.

The Pahsimeroi River valley contains both pasture grazing lands and some irrigated agriculture. As a working landscape, it contains some reaches that lack shade. The upstream AU (ID17060202SL002_05) from Sulphur Creek to Patterson Creek has anastomosed channels and several reaches that are thick with willows meeting shade targets. Other reaches, especially along the left fork, are devoid of shade. The lower Pahsimeroi River—Patterson Creek to mouth AU (ID17060202SL001_05) has lower shade targets due to wider channels but also lacks a consistent amount of shade relative to those targets (Figure 22).

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

5.1.4.1 Water Diversion

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

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

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

Additionally, Idaho water quality standards indicate the following:

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

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

5.1.4.2 Margin of Safety

The margin of safety in this TMDL is considered implicit in the design. Because the target is essentially background conditions, loads (shade levels) are allocated to lands adjacent to these streams at natural background levels. Because shade levels are established at natural background or system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the loading analysis. Although the loading 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.

5.1.4.3 Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to be inclusive of the 6-month period from April through September. This time period is when the combination of increasing air and water temperatures 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.

5.1.4.4 Wasteload Allocation

There are two known NPDES-permitted point source facilities in the affected watersheds: Idaho Power Company's Pahsimeroi River Rearing Ponds and the Pahsimeroi River Hatchery. The Pahsimeroi River Hatchery, operated by IDFG, consist of two earthen, single-pass rearing ponds with a large quiescent zone over the lower third of the ponds due to the nature of the pond design and the species of fish cultured (Chinook salmon). The wasteload allocation for this facility was discussed in the previous TMDL (DEQ 2001), neither the circumstances or conclusions have changed therefore no wasteload allocations are discussed here. Should another 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 (see sections 2.2.5.1 and 2.2.5.2).

5.2 Sediment TMDLs

To restore full support of beneficial uses that have been impaired by excess sediment, TMDL load allocations were determined using the best available data and field verification. DEQ collected subsurface fine sediment and streambank stability data and measurements in 2009. Calculations, maps, photographs, and field notes documenting this work are provided in Appendix C.

5.2.1 Instream Water Quality Targets

Sediment load capacities necessary to meet the narrative criterion for sediment and to fully support beneficial uses are determined by streambank erosion rates. DEQ has determined that excess erosion is more significant in this subbasin from unstable streambanks than from overland and hillslope erosion, as the semi-arid climate and porous soils limit overland flow.

5.2.1.1 Design Conditions

See the 2001 TMDL for a detailed discussion of design conditions (DEQ 2001). In summary, excess streambank erosion generally occurs during spring runoff when bank-full discharge occurs. Therefore, the stability characteristics of streambanks are measured at bank-full widths to determine the rate of excess erosion above natural background during peak flows.

5.2.1.2 Target Selection

In the original Pahsimeroi River TMDL, instream sediment targets were established at 80% streambank stability and less than 28% of the total streambed particle volume for subsurface fine sediment (particles <6.35 millimeters) (DEQ 2001). Methods for determining streambank stability from field observations are based on modified NRCS methods, Rosgen stream classification systems, and other applicable literature (Pfankuch 1975; Lohrey 1989; Rosgen 1996). The 28% subsurface fine sediment target is based on research of salmonid spawning success as it relates to particle size of spawning bed materials (Hall 1986; McNeil and Ahnell 1964; Reiser and White 1988). The methods DEQ uses for determining bank stability are summarized in Appendix C.

5.2.1.3 Monitoring Points

The DEQ monitors streambank stability by conducting streambank erosion inventories. When bioassessments indicate impairment and sediment is suspected as a pollutant, DEQ staff identify homogenous reaches of AUs to monitor for streambank stability by examining existing data and aerial photos. In the field, DEQ staff measure the length of the streambanks that are completely stable and the length, bank height, and condition of streambanks that are eroding. Recession rates (feet per year) of the eroding streambanks are determined in the field according to their condition. The percentage of stable and eroding streambanks are extrapolated to similar stream types in the AU. The bank erosion volume is then calculated using the following equation:

$$E = [AE \times RLR \times \_B]/2{,}000 \text{ (lb/ton)}$$

Where:

E = bank erosion over sampled stream reach (tons/year/sample reach)
AE = eroding area (square feet)
RLR = lateral recession rate (feet per year)
_B = bulk density of bank material (pounds per cubic feet)

This calculation for both the eroding and stable streambanks determines the load capacity at 80% streambank stability and the current load of the eroding areas. The load capacity is the natural, minimally erosive state one would expect of a covered, stable streambank. The current load is the tons of sediment per year calculated for the eroding streambanks at their current condition. The difference between the current load and the load capacity is the load reduction. Since the sediment impaired streams in the Pahsimeroi River subbasin are impaired from nonpoint sources (i.e. streambank erosion) wasteload allocations are of limited assistance in improving stream quality to the natural background load capacity. Therefore, this TMDL will allocate sediment load reductions that are necessary to meet the load capacities on a seasonal basis. Allocating load reductions is useful in identify the erosion magnitude and timing to needed to improve land management and the application of BMPs.

The DEQ conducted streambank erosion inventories at the locations indicated in Table 27, based on some of the AUs that were listed in Category 5 of the 2010 Integrated Report for sediment or combined biota/habitat bioassessments. The locations in Lawson Creek (main stem) (ID17060202SL003_03), Donkey Creek (ID17060202SL029_02) and Big Creek (ID17060202SL031_03) were meeting their sediment water quality targets. Three AUs in the

Pahsimeroi River subbasin exhibited impairment from sediment according to calculations from the field measurements. The streambank erosion inventory data are located in Appendix C. The AUs exhibiting sediment impairment should be monitored as watershed improvement projects proceed to confirm that streambanks are becoming more stable and salmonid spawning habitat is improving.

Table 27. Locations to monitor for sediment trends in the Pahsimeroi River subbasin.

Water Body	Assessment Unit Number	Monitoring Location
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Trail Creek)	ID17060202SL002_02	N 44.53933 W 113.97121
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Sulphur Creek, main stem)		N 44.53742 W 113.92347
Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Sulphur Creek, upper)		N 44.51238 W 113.93415
Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	ID17060202SL003_03	N 44.58623 W 113.99132
North Fork Lawson Creek—source to mouth	ID17060202SL004_02	N 44.57683 W 114.02853
Short Creek—source to mouth	ID17060202SL026_02	N 44.20216 W 113.60892
Donkey Creek—source to mouth	ID17060202SL029_02	N 44.31857 W 113.60600
Big Creek—confluence of North and South Fork Big Creek to mouth	ID17060202SL031_03	N 44.442997 W 113.610107

5.2.2 Load Capacity

The sediment load capacity is the sediment loading rate at which beneficial uses are supported, and reductions will be determined to meet those loads. The assumption is that this rate will be achieved at 80% streambank stability and possibly in combination with decreasing the streambank erosion rate. Monitoring will determine the individual load capacity for each impaired reach. Progress toward the load capacity will be made through trail and road maintenance, land management, and improvement of riparian vegetative cover and stream channel condition.

Although the load capacity is calculated in this TMDL in terms of the surrogate sediment target of 80% streambank stability, the proportion of subsurface fine sediment is another indicator of meeting the sediment load capacity. Appendix C provides specific literature references for the subsurface fine sediment target of 28% for supporting salmonid spawning. Field methods for measuring subsurface fine sediment and the sampling results are also given in Appendix C. DEQ measured 28% fine sediment in AU ID17060202SL001_05 (Table 28).

Table 28. McNeil sediment core results summary for the Pahsimeroi River.

Assessment Unit	Mean Percentage Fine Sediment
ID17060202SL001_05 Pahsimeroi River—Patterson Creek to mouth	28

5.2.3 Estimates of Existing Pollutant Loads

Federal regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR § 130.2(g)). The volume of eroding streambank at bank-full condition was calculated by measuring eroding bank height and length and evaluating the bank condition to estimate lateral recession rate during periods of high discharge, taking erodibility of the soil type into consideration. Detailed results are in Appendix C. As a result of these survey results and calculations, the current loads estimated for the Pahsimeroi River subbasin are shown in Table 29.

Table 29. Current sediment loads from nonpoint sources within the Pahsimeroi River subbasin.

Load Type	Assessment Unit	Current Load (tons/year)	Estimation Method	TMDL Required?
Annual sediment	ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Trail Creek)	747[a]	Observed erosion rate calculated on target of 80% streambank stability	Yes
	ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Sulphur Creek, main stem)	450[a]		Yes
	ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (Sulphur Creek, upper)	541[a]		Yes
	ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	41		No
	ID17060202SL004_02 North Fork Lawson Creek—source to mouth	2,748		Yes
	ID17060202SL026_02 Short Creek—source to mouth	224		Yes
	ID17060202SL029_02 Donkey Creek—source to mouth	7		No
	ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creek to mouth	4		No

[a] AU ID17060202SL002_02 had three sediment surveys; estimations of loading were developed for representative stream lengths.

5.2.4 Load and Wasteload Allocations

Sediment load allocations are estimated targets in the process of improving water quality until beneficial uses of cold water aquatic life and salmonid spawning are fully supported. Table 30 lists the difference between the current sediment load and the load capacity of the impaired AUs. This difference equals the load reduction.

The load capacity is the natural, minimally erosive state in a vegetated and stable streambank. The load capacity is the natural background condition, currently targeted to be 80% stable streambanks. The current load is the tons of sediment per year calculated for the eroding streambanks at their current condition based on field measurements. The difference between the current load and the load capacity is the necessary load reduction. The load allocation is the amount of sediment that can be discharged to the stream and still meet the water quality standards, which in this case is the same as the load capacity. However, as sediment in these AUs are solely from nonpoint sources, the allocation required to meet load capacity will be based on the necessary load reductions, rather than the allocation of allowable loads. This method better directs the implementation to times of greatest loads. Table 30 lists the sediment reductions necessary to achieve the load capacity of the AU.

Table 30. Sediment current loads, load capacity (allocations) and necessary reductions within the Pahsimeroi River subbasin based on 2009 data.

Assessment Unit	Current Load (tons/year)	Load Capacity (tons/year)	Load Reduction Needed to Meet Load Capacity (tons/year)	Necessary Percent Reduction by AU[a]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Trail Creek[b]	747	165	581	
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, main stem	450	165	286	73[c]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, upper[b]	541	140	400	
ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth[d]	41	42	-1	0
ID17060202SL004_02 North Fork Lawson Creek—source to mouth[b]	2,748	217	2,531	92
ID17060202SL026_02 Short Creek—source to mouth[b]	224	143	80	36
ID17060202SL029_02 Donkey Creek—source to mouth	7	37	-30	0
ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creek to mouth	4	4	-1[e]	0

[a] Load reductions and allocations will be developed by AU segment.
[b] Requires streambank stabilization to 80% and a decreased bank erosion rate.
[c] Load reduction allocations are based upon hydrologic boundaries; therefore, the summed Sulphur Creek reductions are calculated separate from Trail Creek.
[d] Similar AUs to ID17060202SL003_03 include ID17060202SL004_03, and ID17060202SL005_02.
[e] Rounding errors are represented in the calculation of the percent load reduction.

Three AUs require load reductions (Figure 26), one of which (Pahsimeroi River—Meadow Creek to Patterson Creek [tributaries] ID17060202SL002_02) which was divided into two watersheds for calculating the annual hydrograph. This AU is inclusive of several tributaries, with Trail Creek and Sulphur Creek having the largest and most continuous discharges. Erosion rate estimates and load calculations are based on two monitoring locations in Sulphur Creek with the sum of those calculated loads used to identify the overall sediment load capacity and reduction required for Sulphur Creek. A combined flow duration curve is used to allocate the sediment reduction (EPA 2007) in Sulphur Creek since there were scale restrictions (i.e. the subwatersheds were too small to individually estimate discharges in StreamStats and subsequent allocations). This single Sulphur Creek load was then added to the calculated load reduction for Trail Creek to sum the required load reduction for Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02). Sulphur Creek and Trail Creek have site-specific allocations within the same AU.

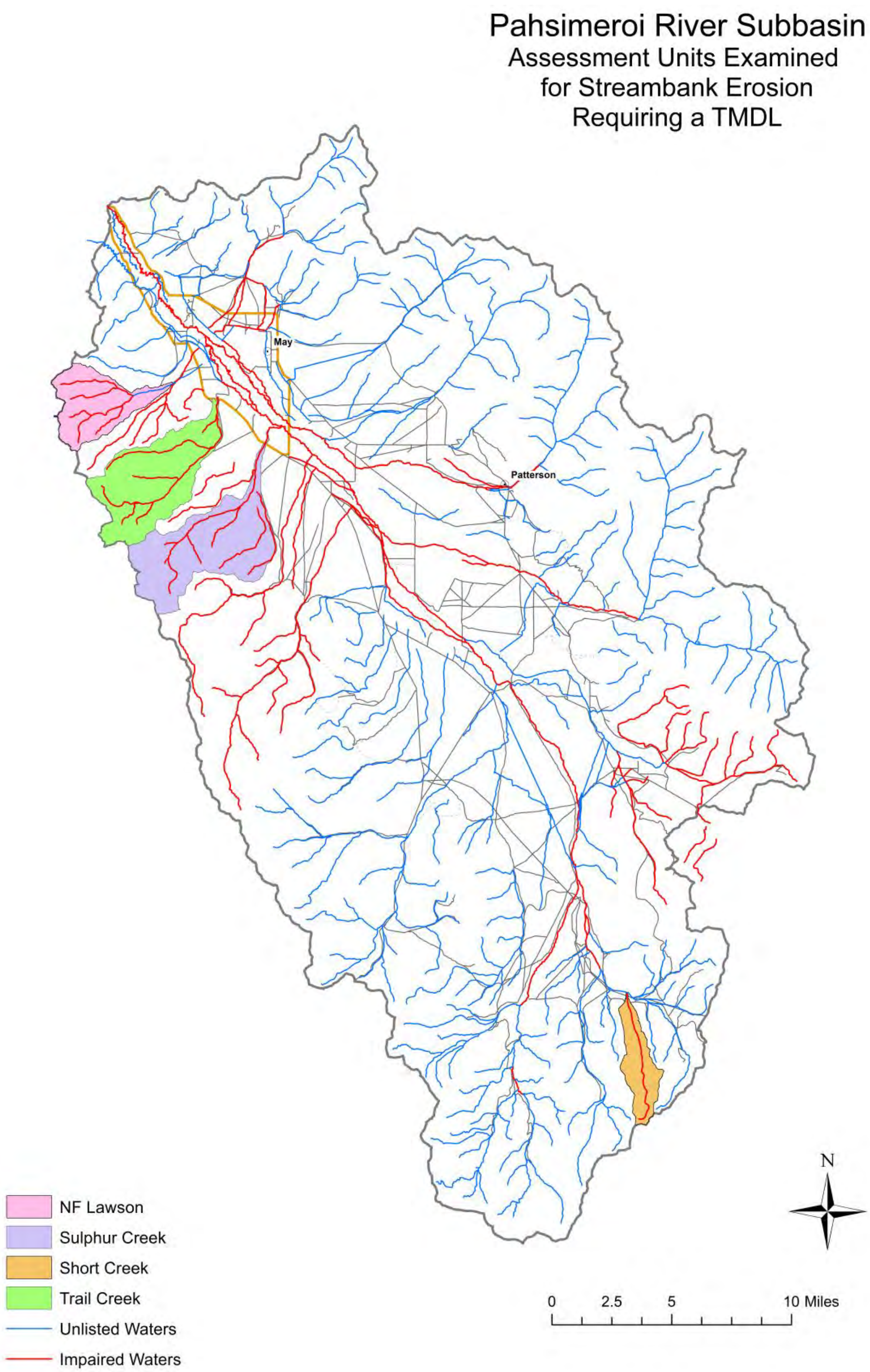

Figure 26. Assessment unit segments requiring sediment reductions.

The Pahsimeroi River—Meadow Creek to Patterson Creek (ID17060202SL002_04) has an EPA-approved TMDL for sedimentation/siltation. However, the current Category 5 listing for particle distribution (embeddedness) is incorporated into the current definition of sedimentation/siltation. The embeddedness listing is redundant and does not further protect the beneficial uses. Therefore, this AU was not further examined for sediment in this TMDL and should be removed from the particle distribution (embeddedness) listing.

Peak discharges in these sediment-impaired streams occur during spring snowmelt. The largest proportion of sediment is eroded from the streambanks during spring discharge. The daily sediment load is allocated based on discharge. Flow duration intervals summarize the cumulative frequency of historic discharge data over the period of record for which discharge data have been recorded. No gages are located in the AUs of concern; therefore, USGS StreamStats was used to estimate monthly discharges. However, since these are estimates with assumptions that may not be met in the AUs (i.e., area or forest cover), the USGS StreamStats estimations were corrected with BURP-collected discharge data.

The EPA describes an approach for using load duration curves in the development of TMDLs and specifies calculating the cumulative frequency distribution using discharge records (EPA 2007). Extrapolations from this EPA guidance were used to adapt the data from the USGS StreamStats discharge estimations. The zero to 20th percentile discharges are designated as high discharges, 20th to 50th percentiles as midrange discharges, 50th to 80th as dry conditions and 80th to 100th as low flow conditions.

Results of the flow duration curve allocating sediment load reductions are summarized in Table 31. Details about methods and assumptions used in calculating and allocating the load reductions follow.

Table 31. Allocations for sediment load reductions.

Assessment Unit	Current Load (tons/year)	Load Reduction (tons/year)	Load Allocation
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), (Trail Creek)	747	581	May 1–May 31—16.9 tons/day June 1–April 30—0.174 tons/day
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), (Sulphur Creek)	991	686	May 1–June 15—12.2 tons/day June 16–April 30—0.429 tons/day
ID17060202SL004_02 North Fork Lawson Creek—source to mouth	2,748	2,531	May 1–June 25—39.1 tons/day June 26–April 30—1.225 tons/day
ID17060202SL026_02 Short Creek—source to mouth	224	80	May 1–May 31—2.5 tons/day June 1–April 30—0.012 tons/day

In AU ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek allocation of the load reduction using the StreamStats modified flow duration curve were developed separately from Trail Creek. Flow duration intervals of the monthly discharge estimations were developed for Sulphur Creek (Figure 27).

- High discharges (0–20th percentile) occur between 2.3 and 4.3 cfs.
- Middle range discharges (20th–50th percentile) occur between 1.1 and 2.2 cfs.

- Dry conditions (50th–80th percentile) occur between 0.6 and 1.0 cfs.
- Low flows (80th–100th percentile) occur between 0 and 0.6 cfs.

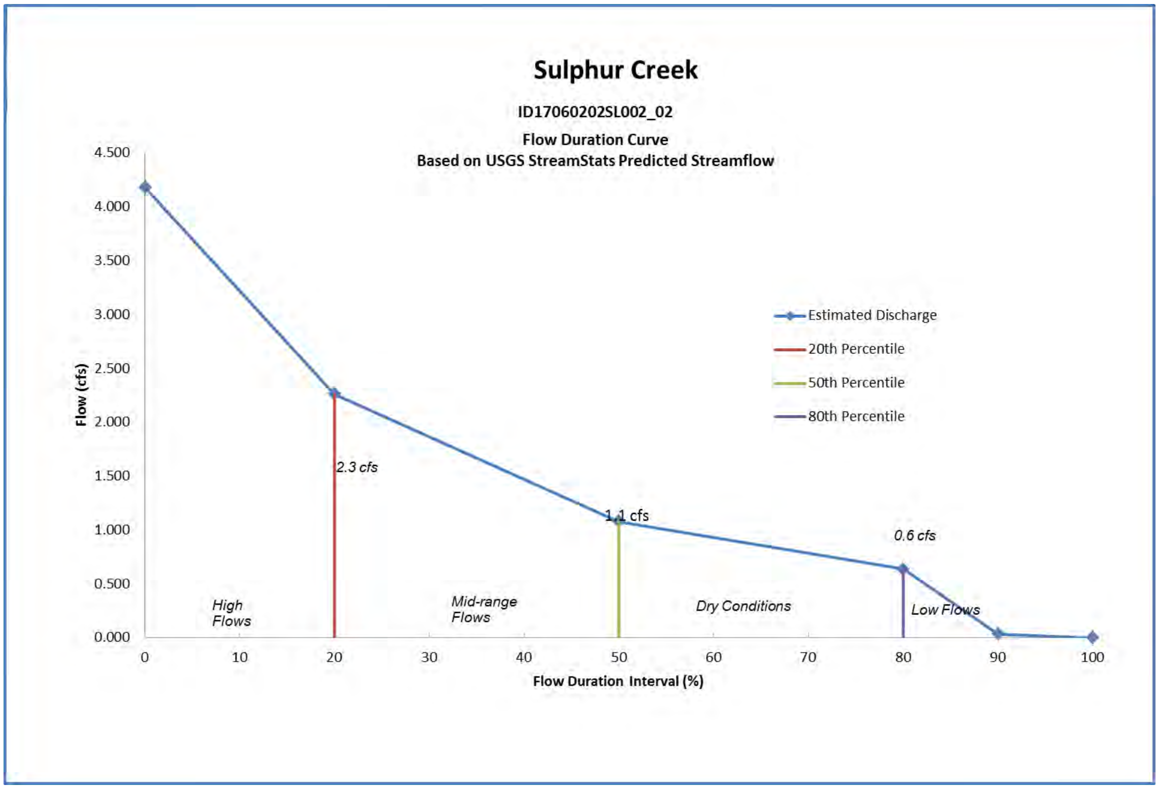

Figure 27. Flow duration curve for the ungaged stream segment in Sulphur Creek (ID17060202SL002_02).

Unlike many nearby tributaries to the Pahsimeroi River, this stream typically is not dry during the late-summer months, but it may be flow altered below the road for irrigation purposes. Allocated sediment load reductions is 12.2 tons per day at high discharges, above 2.3 cfs, for 45 days beginning May 1, when the spring snowmelt results in greater discharges. For calculation purposes, it is assumed that snowmelt discharges transport an estimated 80% of the sediment load. For the remaining portion of the year (June 16–April 30), the allocation is 0.429 tons per day (Table 32).

Included in the analysis is the expectation that Sulphur Creek will require streambank stabilization in combination with a decreased erosion rate. The calculations used an assumed erosion rate below the threshold of severe erosion (Appendix C).

Table 32. Flow duration allocations for sediment load reduction for Sulphur Creek (ID17060202SL002_02).

Ungaged Stream Flow Duration Curve
and Sediment Load Reduction Allocation

Location Name	Sulphur Creek	
AU:	ID17060202SL002_02	
Minimum expected Q	0	
AU Sediment Capacity:	305	(informational only - tons)
Sediment Load Reduction:	686	(tons of load reduction to be allocated)
Percent load at High Discharge	0.8	(enter as a decimal)
Days of high discharge	45	(judgement determination)
	548.8	Tons during high % loading
	137.2	Remaining load allocation

Reduction Allocation:
12.2 tons per day at High Q
0.429 tons per day at low Q

Notes/Assumptions:
Sulphur is mostly perennial, an exception to many of the nearby waters, therefore the USGS Q estimate is accepted at face value
Also 45 days was selected as the period for the majority of sediment load 80% of load during those 45 days, flow is mostly continuous during year therefore allocation for 1 May to 15 June

Load is additive of both locations monitored for streambank erosion

BURP Estimates using
No BURP Q available

RAW Data - Stream Stats

Statistic	Flow (ft^3/s)	Correlating Q Data BURP data	Proportional Difference
QA	5.04		1.0
JAND20	1.76		
JAND50	0.86		
JAND80	0.63		
FEBD20	1.89		
FEBD50	0.87		
FEBD80	0.6		
MARD20	2.51		
MARD50	1.31		
MARD80	0.64		
APRD20	4.18		
APRD50	3.47		
APRD80	2.18		
MAYD20	1.49		
MAYD50	0.52		
MAYD80	0.11		
JUND20	1.92		
JUND50	0.44		
JUND80	0.0316		
JULD20	3.11		
JULD50	1.23		
JULD80	0.54		
AUGD20	1.66		
AUGD50	0.59		
AUGD80	0.42		
SEPD20	1.42		
SEPD50	0.54		
SEPD80	0.42		
OCTD20	2.62		
OCTD50	1.01		
OCTD80	0.62		
NOVD20	2.57		
NOVD50	1.13		
NOVD80	0.78		
DECD20	2.02		
DECD50	0.95		
DECD80	0.68		

Flow duration intervals of the monthly discharge estimations were developed for Trail Creek (Figure 28).

- High discharges (0–20th percentile) occur between 1.9 and 3.3 cfs.
- Middle range discharges (20th–50th percentile) occur between 1.0 and 1.8 cfs.
- Dry conditions (50th–80th percentile) occur between 0.6 and 0.9 cfs.
- Low flows (80th–100th percentile) occur between 0 and 0.5 cfs.

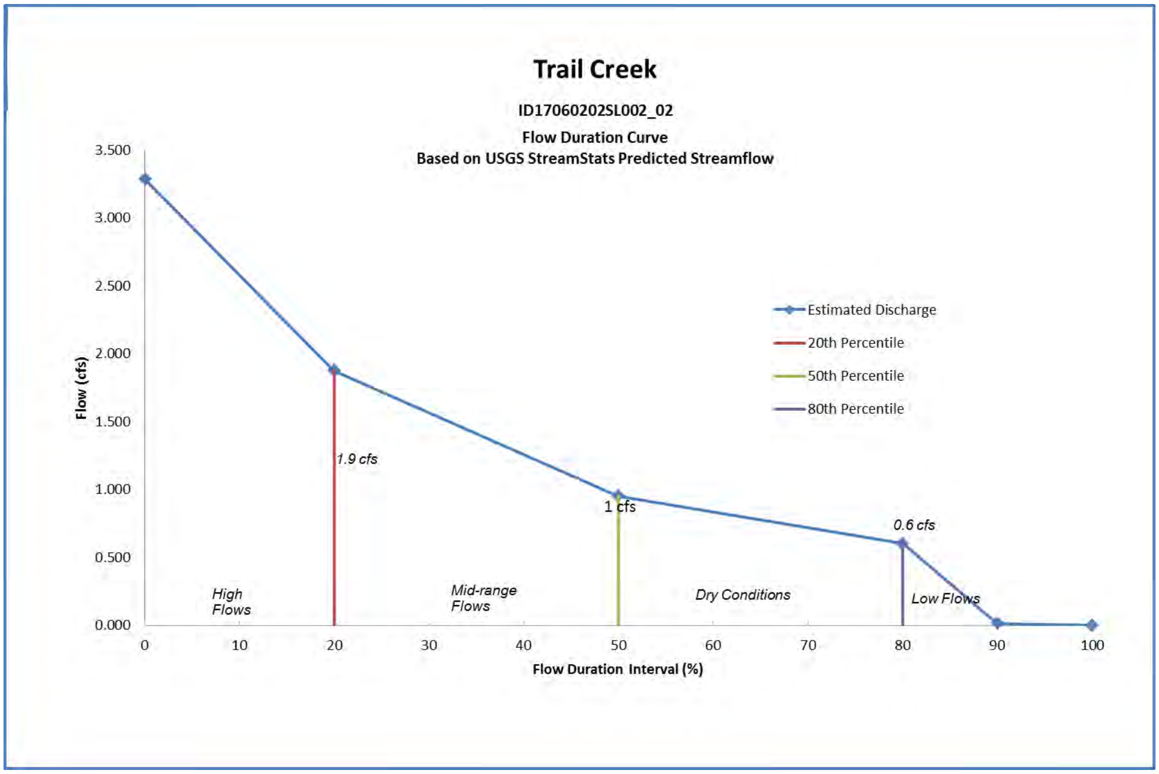

Figure 28. Flow duration curve for the ungaged stream segment in Trail Creek (ID17060202SL002_02).

Like many nearby tributaries to the Pahsimeroi River, this stream typically does dry out during the late-summer months due to the porous alluvial fan geology combined with limited precipitation. Allocations of the sediment load reduction are designated at 16.9 tons per day at high discharges, above 1.9 cfs, for 31 days beginning May 1 when the spring snowmelt results in greater discharges. For calculation purposes, it is assumed that snowmelt discharges transport an estimated 90% of the sediment load. For the remaining portion of the year (June 1–April 30), the allocation is 0.174 tons per day (Table 33).

Included in the analysis is the expectation that Trail Creek will require streambank stabilization in combination with a decreased erosion rate. The calculations incorporated an assumed erosion rate below the threshold of severe erosion (Appendix C).

Table 33. Flow duration allocations for sediment load reduction for Trail Creek (ID17060202SL002_02).

Ungaged Stream Flow Duration Curve and Sediment Load Reduction Allocation

Location Name	Trail Creek	
AU:	ID17060202SL002_02	
Minimum expected Q	0	
AU Sediment Capacity:	165	(informational only - tons)
Sediment Load Reduction:	581	(tons of load reduction to be allocated)
Percent load at High Discharge	0.9	(enter as a decimal)
Days of high discharge	31	(judgement determination)
	522.9	Tons during high % loading
	58.1	Remaining load allocation

Reduction Allocation:

16.9 tons per day at high discharges
0.174 tons per day at lower discharges

Notes/Assumptions:
Assume 90% sediment load moved during higher Q of snowmelt
assume this is all of May for 31 days

BURP Estimates using	cfs
: 1997SIDFM032 - Trail Creek	1.13

RAW Data - Stream Stats

Statistic	Flow (ft^3/s)	Correlating Q Data BURP data	Proportional Difference
QA	5.23		
JAND20	1.82		
JAND50	0.96		
JAND80	0.72		
FEBD20	1.94		
FEBD50	0.97		
FEBD80	0.69		
MARD20	2.52		
MARD50	1.39		
MARD80	0.72		
APRD20	3.72		
APRD50	3.22		
APRD80	2.17		
MAYD20	1.24		
MAYD50	0.42		
MAYD80	0.0895		
JUND20	1.28	1.1	0.88
JUND50	0.27		
JUND80	0.0153		
JULD20	2.82		
JULD50	1.13		
JULD80	0.53		
AUGD20	1.46		
AUGD50	0.57		
AUGD80	0.41		
SEPD20	1.28		
SEPD50	0.53		
SEPD80	0.42		
OCTD20	2.73		
OCTD50	1.18		
OCTD80	0.72		
NOVD20	2.61		
NOVD50	1.26		
NOVD80	0.89		
DECD20	2.08		
DECD50	1.06		
DECD80	0.78		

In the North Fork Lawson Creek—source to mouth (ID17060202SL004_02), allocating the load reduction using the StreamStats modified flow duration curve were developed for both the North Fork (inclusive of the Middle Fork) Lawson Creek (Figure 29).

- High discharges (0–20th percentile) occur between 1.1 and 2.1 cfs.
- Middle range discharges (20th–50th percentile) occur between 0.5 and 1.0 cfs.
- Dry conditions (50th–80th percentile) occur between 0.3 and 0.4 cfs.
- Low flows (80th–100th percentile) occur between 0 and 0.2 cfs.

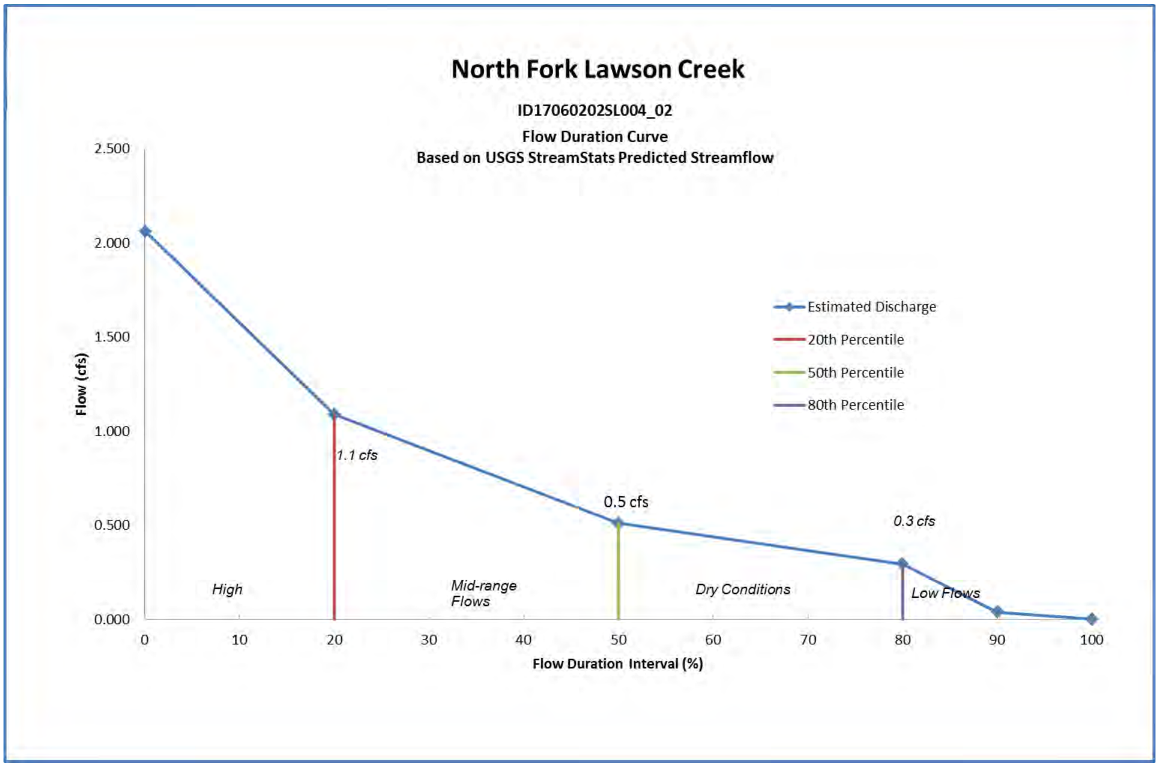

Figure 29. Flow duration curve for the ungaged stream segment in the North Fork Lawson Creek (ID17060202SL004_02).

Like many nearby tributaries to the Pahsimeroi River, the North Fork Lawson Creek typically does dry out during the late-summer months due to the porous alluvial fan geology combined with limited precipitation. Allocations of the sediment load reduction are designated at 39.1 tons per day at high discharges, above 1.1 cfs, for 55 days beginning May 1 when the spring snowmelt results in greater discharges. For calculation purposes, it is assumed that snowmelt discharges transport an estimated 85% of the sediment load. For the remaining portion of the year (June 26–April 30), the allocation is 1.225 tons per day (Table 34).

There are indications that the channel is beginning to stabilize, with willows and water birches in the gully that contains the current channel. However this channel is not stable, and a TMDL load reduction is required until the streambanks stabilize and/or an equilibrium is reached. Included in the analysis is the expectation that the North Fork Lawson Creek will require streambank stabilization in combination with a decreased erosion rate. The calculations incorporated an assumed erosion rate below the threshold of severe erosion (Appendix C).

Table 34. Flow duration allocations for sediment load reduction for North Fork Lawson Creek (ID17060202SL004_02).

Ungaged Stream Flow Duration Curve
and Sediment Load Reduction Allocation

Location Name	North Fork Lawson Creek	
AU:	ID17060202SL004_02	
Minimum expected Q	0	
AU Sediment Capacity:	217	(informational only - tons)
Sediment Load Reduction:	2531	(tons of load reduction to be allocated)
Percent load at High Discharge	0.85	(enter as a decimal)
Days of high discharge	55	(judgement determination)
	2151.35	Tons during high % loading
	379.65	Remaining load allocation

Reduction Allocation:

39.1 tons per day at high discharges
1.225 tons per day at lower discharges

Notes/Assumptions:

Mostly perennial Q in entire NF (including MF)
Water right in Main stem (including SF) is for all flow … 3.2 cfs max
1Jul97 Q mainstem 2.5 cfs, SF 1.1 cfs
therefore Q NF adapted to 1.4 cfs and USGS estimated reduced proportionally
Higher erosion Q for estimate of 15% of year moving 85% load therefore allocation for 1 May to 25 June

BURP Estimates using	cfs
: 1997SIDFM039 - NF Lawson	0.5
: 1997SIDFM040 - Lawson Main Stem	2.5
: 1997SIDFM037 - SF Lawson	1.1
: 1997SIDFM038 - MF Lawson	0.4

RAW Data - Stream Stats

Statistic	Flow (ft^3/s)	Correlating Q Data BURP data	Proportional Difference
QA	3.28		
JAND20	1.09		
JAND50	0.59		
JAND80	0.44		
FEBD20	1.16		
FEBD50	0.58		
FEBD80	0.42		
MARD20	1.5		
MARD50	0.83		
MARD80	0.44		
APRD20	3.15		
APRD50	2.11		
APRD80	1.27		
MAYD20	2.18		
MAYD50	0.8		
MAYD80	0.2		
JUND20	2.27		
JUND50	0.59		
JUND80	0.0574		
JULD20	2.14	1.4	0.65
JULD50	0.88		
JULD80	0.44		
AUGD20	1.11		
AUGD50	0.45		
AUGD80	0.33		
SEPD20	0.91		
SEPD50	0.39		
SEPD80	0.31		
OCTD20	1.65		
OCTD50	0.74		
OCTD80	0.45		
NOVD20	1.56		
NOVD50	0.76		
NOVD80	0.54		
DECD20	1.24		
DECD50	0.65		
DECD80	0.48		

In Short Creek—source to mouth (ID17060202SL026_02) allocations of the load reduction using the StreamStats modified flow duration curve were developed for Short Creek (Figure 30).

- High discharges (0–20th percentile) occur between 0.6 and 1.8 cfs.
- Middle range discharges (20th–50th percentile) occur between 0.3 and 0.6 cfs.
- Dry conditions (50th–80th percentile) occur between 0 and 0.5 cfs.
- Low flows (80th–100th percentile) occur for several summer months with zero discharge.

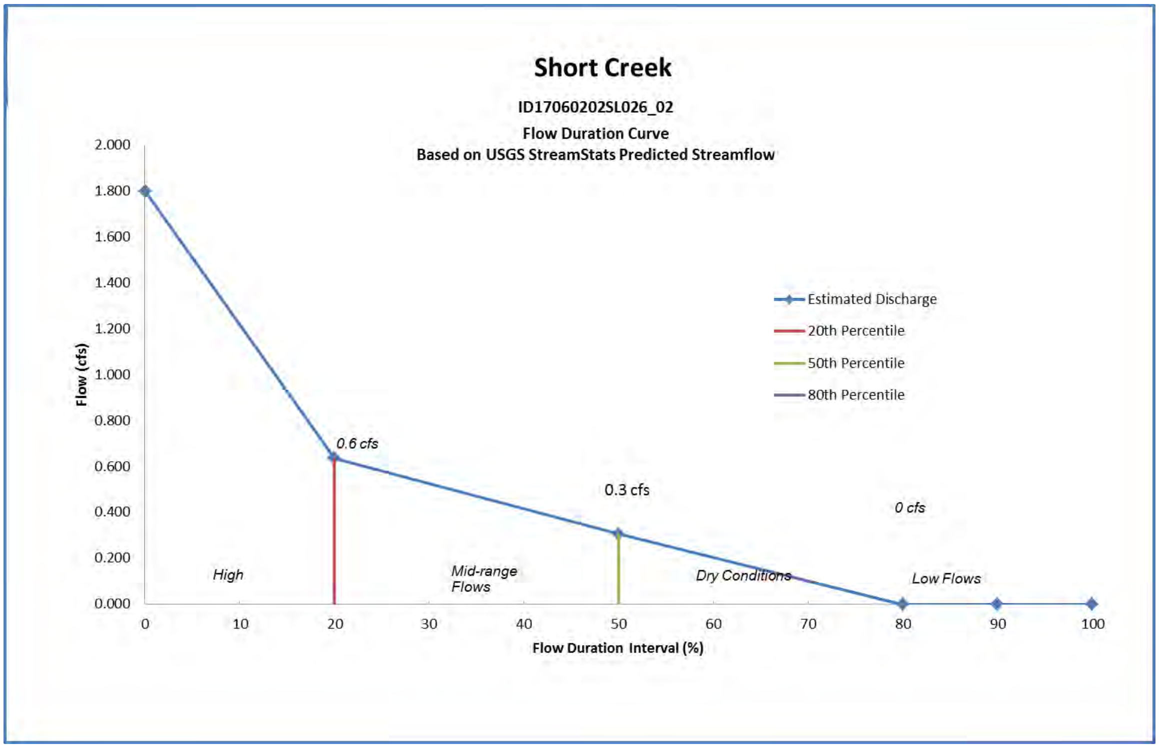

Figure 30. Flow duration curve for the ungaged stream segment in Short Creek (ID17060202SL026_02).

Like many nearby tributaries to the Pahsimeroi River, Short Creek typically does dry out during the late-summer months due to the porous alluvial fan geology combined with limited precipitation. Allocations of the sediment load reduction are designated at 2.5 tons per day at high discharges, above 0.6 cfs, for 31 days beginning May 1 when the spring snowmelt results in higher discharges. For calculation purposes, it is assumed that snowmelt discharges transport an estimated 95% of the sediment load. For the remaining portion of the year (June 1–April 30), the allocation is 0.012 tons per day (Table 35).

Included in the analysis is the expectation that Short Creek will require streambank stabilization in combination with a decreased erosion rate. The calculations incorporated an assumed erosion rate below the threshold of severe erosion (Appendix C).

Table 35. Flow duration allocations for sediment load reduction for Short Creek (ID17060202SL026_02).

Ungaged Stream Flow Duration Curve
and Sediment Load Reduction Allocation

Location Name	Short Creek	
AU:	ID17060202SL026_02	
Minimum expected Q	0	
AU Sediment Capacity:	143	(informational only - tons)
Sediment Load Reduction:	80	(tons of load reduction to be allocated)
Percent load at High Discharge	0.95	(enter as a decimal)
Days of high discharge	31	(judgement determination)
	76	Tons during high % loading
	4	Remaining load allocation

Reduction Allocation:
2.5 tons per day at high discharges
0.012 tons per day at lower discharges

Notes/Assumptions:
Wet year BURP measured 1.8 cfs, used this to correct for estimated Q
Hardwired to have 0 cfs at 80-100 percentile
Assume most sediment moves during snowmelt
(approximately all of May - 31days)

BURP Estimates using	cfs
: 1997SIDFM019 - Short Creek	1.8

RAW Data - Stream Stats

Statistic	Flow (ft³/s)	Correlating Q Data BURP data	Proportional Difference
QA	2.56		
JAND20	0.83		
JAND50	0.51		
JAND80	0.4		
FEBD20	0.86		
FEBD50	0.5		
FEBD80	0.37		
MARD20	1.07		
MARD50	0.64		
MARD80	0.38		
APRD20	2.76		
APRD50	1.49		
APRD80	0.88		
MAYD20	7.23		
MAYD50	3.06		
MAYD80	1.03		
JUND20	7.73	1.8	0.23
JUND50	2.96		
JUND80	0.64		
JULD20	4.96		
JULD50	2.56		
JULD80	1.41		
AUGD20	2.41		
AUGD50	1.25		
AUGD80	0.89		
SEPD20	1.59		
SEPD50	0.9		
SEPD80	0.67		
OCTD20	1.27		
OCTD50	0.7		
OCTD80	0.41		
NOVD20	1.14		
NOVD50	0.65		
NOVD80	0.48		
DECD20	0.92		
DECD50	0.56		
DECD80	0.43		

Although the allocations of the sediment load reduction are expressed in terms of daily amounts, progress toward meeting the natural background load capacity is measured through the surrogate targets of 80% streambank stability and 28% subsurface fine sediment.

5.2.4.1 Wasteload Allocation

The Pahsimeroi Fish Hatchery and Rearing Ponds operate under the NPDES general permit for aquaculture (IDG-131000. The hatchery and rearing ponds are owned by Idaho Power Company and operated by IDFG in tandem. They operate in tandem and do not discharge effluent of concern, to the listed impairments, into the Pahsimeroi River. Therefore, the point source discharges will not be included in a wasteload allocation for this TMDL. No potential impact on beneficial uses has been identified in any listed waters by permitted dischargers. The permit structure was confirmed and no changes were expected in the near future (D. Helder, EPA, personal communication, March 2013).

5.2.4.2 Margin of Safety

Conservative assumptions implicit in the development of existing sediment loads ensure a margin of safety. These conservative assumptions include the following:

- Evaluating desired bank erosion rates as natural background conditions
- Using a target of subsurface fine particles based on literature values that support fry survival providing for a stable salmonid population

5.2.4.3 Seasonal Variation

The field method for determining instream sediment impairment by measuring streambank erosion takes seasonal variation into account by deriving sediment load capacity from bank-full conditions. Erosion rates are based on runoff events and peak and base discharge conditions. Therefore, bank condition at bank-full level is measured and evaluated in the field to calculate current rates of erosion and sediment delivery. In addition, the daily sediment load allocations are flow-weighted values based on flow season.

5.2.4.4 Natural Background

As described in the 2001 TMDL (DEQ 2001), natural background loading rates are assumed to be the natural sediment load capacity of 80% or greater streambank stability and 28% or less subsurface fine sediment. Therefore, natural background is accounted for in the load capacity calculations.

5.3 Bacteria TMDL

Three AUs are listed for *E. coli* bacteria (or fecal coliform) in the 2010 Integrated Report and had 5-sample geometric means calculated from 2009 monitoring data (Table 36). Idaho's current water quality standards list criteria for *E. coli* for both primary and secondary contact recreation. Historically, Idaho monitored for fecal coliform, but the standard changed in 2006 to *E. coli*, a common intestinal bacteria found in warm-blooded animals and therefore considered more directly pathogenic to humans.

The listed AUs include the Pahsimeroi River–Meadow Creek to Patterson Creek (tributaries, including Sulphur and Trail Creeks) (ID17060202SL002_02); Meadow Creek, source to mouth (ID17060202SL006_02); and Goldburg Creek, source to Donkey Creek (ID17060202SL030_02). These AUs are designated for the beneficial use of secondary contact recreation. Thus, the number of *E. coli* colonies shall not exceed either the single instantaneous measure of 576 colonies/100 mL or the geometric mean of 126 colonies/100 mL for 5 samples collected in a 30-day period every 3 to 7 days.

Table 36. Bacteria monitoring results in the Pahsimeroi River subbasin.

AU	Stream	Site ID	Date	*E. coli* (colonies/100 mL)
ID17060202SL002_02	Trail Creek	Below 1997SIDFM032	July 1999	504 geomean[a]
	Blind Fork of Trail Creek	1997SIDFM033	July 1999	330 single sample
	Trail Creek	Below 1997SIDFM032	August 2009	171 geomean
ID17060202SL006_02	Meadow Creek	1997SIDFM026	Jul/Aug 1999	199 geomean
	Meadow Creek	1997SIDFM025	Jul/Aug 1999	298 geomean
	Meadow Creek	Below 1997SIDFM026	August 2009	10 geomean
ID17060202SL030_02	Snowslide Creek	1998SIDFB126	Jul/Aug 1999	210 geomean
	Ditch Creek	1997SIDFM031	August 2009	21 geomean
	Goldburg Creek	Near 1997SIDFM030	August 2010	61 single sample

[a] The “geomean” is the geometric mean calculated from 5 samples collected in a 30-day period every 3–7 days.

The Pahsimeroi River – Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02) (Figure 31) consists of 1st- and 2nd-order tributaries, the primary being Sulphur and Trail Creeks. Data collected in 1999 and 2009 indicated an exceedance of the geometric mean criterion; thus, a load allocation is set forth in this addendum. Historic monitoring in 1999 found *E. coli* geometric mean exceedances in Trail Creek (504 organisms /100 mL); however, a single sample in the Blind Fork of Trail Creek had 330 organisms /100 mL, which is below the threshold to trigger a 5-sample geometric mean calculation. This AU also has a TMDL developed for temperature (see section 5.1) and sediment (see section 5.2). This portion of the Pahsimeroi River subbasin is semiarid with porous and permeable alluvial fans below canyon mouths. The primary land use is grazing, with indication of cattle use in the area. Additionally, this region is the territory of a large elk herd, as indicated by scat and carcasses and visually confirmed by DEQ employees in the Trail Creek drainage. The *E. coli* allocations will account for the heavy grazing pressure by wildlife, as these streams are perennial and subsequently serve as a watering area for all nearby wildlife.

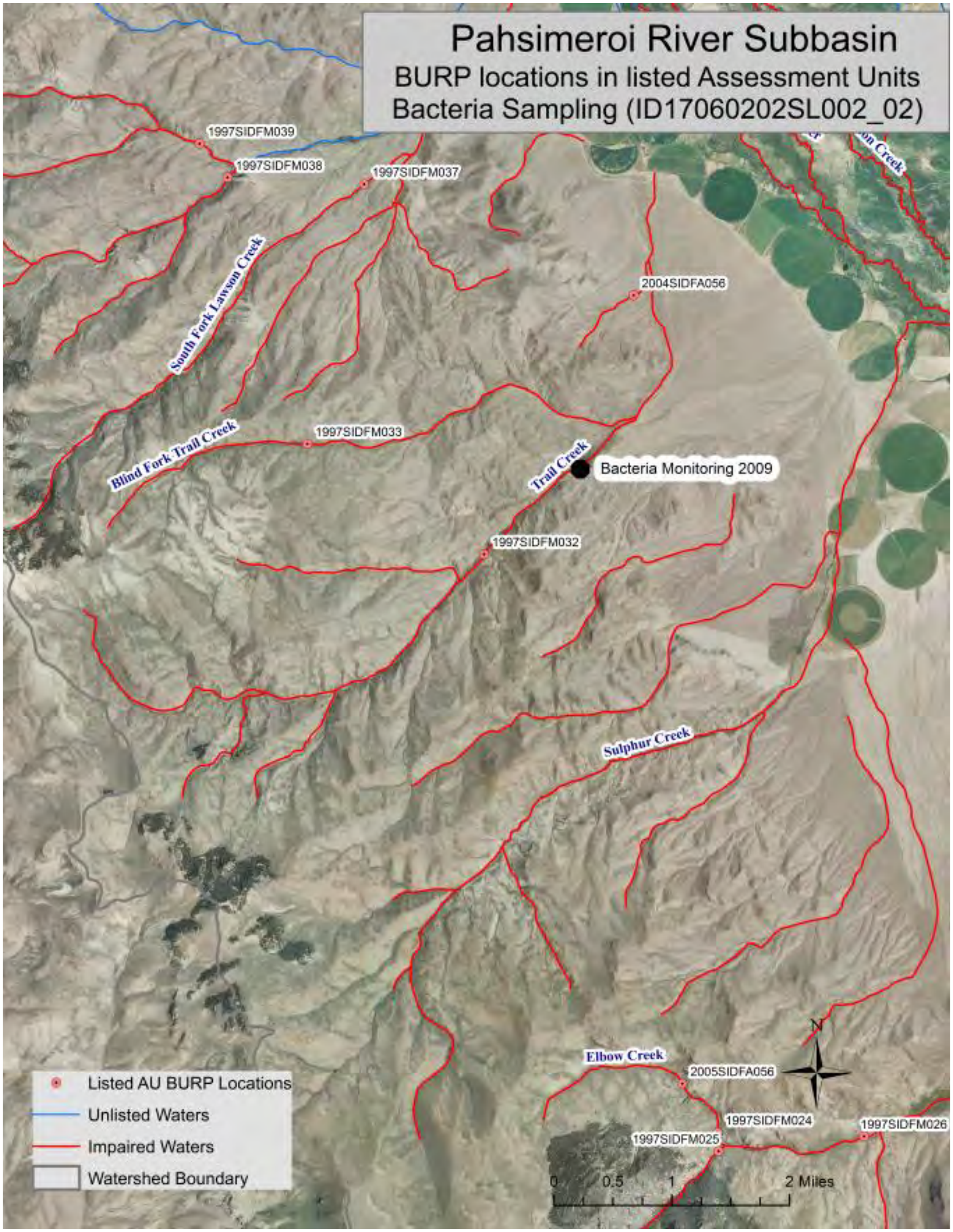

Figure 31. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL002_02 (Sulphur and Trail Creeks).

The Meadow Creek – source to mouth (ID17060202SL006_02) (Figure 32) consists of 1st- and 2nd-order tributaries, including Meadow and Grouse Creeks. The current *E. coli* geometric mean for this AU is within the State of Idaho standard. This AU is listed at Category 4c as there are in-holdings within the BLM lands. The 2009 *E. coli* monitoring below this in-hold, when water was present, found that the number of organisms was within the acceptable limits. This in-holding has been improved and further developed since 2001, as indicated by alterations in the road around the property. Of the 5 samples collected, none exceeded 25 organisms/100 mL; the geometric mean was 10 organisms/100 mL in August 2009 (Table 36). As such, this AU does not need a bacteria TMDL, but DEQ recommends that monitoring be conducted to confirm the on-going land use modifications.

Figure 32. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL006_02 (Meadow Creek).

The Goldburg Creek – source to Donkey Creek (ID17060202SL030_02) (Figure 33) consists of multiple 1st- and 2nd-order tributaries, for example Meadow and Grouse Creeks. The *E. coli* geometric mean of 21 organisms/100 mL in 2009 for this AU is within the State of Idaho standard (Table 36). As such, this AU does not need a bacteria TMDL developed. These streams cross BLM land and State of Idaho land. The BLM has made concerted efforts to modify grazing allotments when stream reaches are listed in the Integrated Report and these modifications have been incorporated into the Upper Pahsimeroi and Goldburg Ten Year Grazing Permit Renewal EA (#ID-330-2007-EA-3275) (BLM Challis Field Office, personal communication, November 2012). Exclosure fences have also been installed to limit livestock access to the stream and limit bacteria pollution (K. Bragg, CSWCD, personal communication, January 2013).

Figure 33. Bacteria monitoring—first- and second-order tributaries in AU ID17060202SL030_02 (Goldburg Creek and tributaries).

5.3.1 Instream Water Quality Targets

Instream water quality targets for AU ID17060202SL002_02 for the tributaries of the Pahsimeroi River (Sulphur and Trail Creeks) were set from the Idaho water quality standards. The water quality standards relate beneficial use impairment to a numeric standard (IDAPA 58.01.02.251.01). The target developed for bacteria impairment is the *E. coli* water quality standard of 126 organisms/100 mL as a geometric mean.

5.3.1.1 Design Conditions

Bacteria affect the streams throughout the summer months and into the fall during baseflow conditions. The critical period for recreational beneficial use is from May through October. With no known sources of human-caused bacteria loading, it is assumed that the observed *E. coli* levels are caused by a combination of wildlife, waterfowl, and livestock. To protect the beneficial use, the design conditions include the critical period when the bacteria contamination is most likely to occur.

5.3.1.2 Target Selection

The State of Idaho water quality standards prescribe *E. coli* criteria for both primary and secondary contact recreation. The likely public uses of the rural Sulphur and Trail Creeks region would be secondary contact recreation. To support the beneficial use of secondary contact recreation, the number of *E. coli* colonies may not exceed either a single instantaneous sample of 576 organisms/100 mL or a geometric mean of 126 organisms/100 mL for 5 samples collected every 3 to 7 days within a 30-day period.

5.3.1.3 Monitoring Points

AU ID17060202SL002_02 should be monitored for compliance with the *E. coli* bacteria secondary contact recreation criteria at the locations where exceedances were last identified:

- Trail Creek below 1997SIDFM032—N 44.54011° W -113.96899°

5.3.2 Load Capacity

In bacteria TMDLs, the water quality standard is the load capacity of a system.

5.3.3 Estimates of Existing Pollutant Loads

Monitoring in 2009 found *E. coli* geometric mean exceedances in Trail Creek (171 organisms /100 mL). Historic monitoring in 1999 found *E. coli* geometric mean exceedances in Trail Creek (504 organisms /100 mL); however, a single sample in the Blind Fork of Trail Creek had 330 organisms /100 mL, which is below the threshold to trigger a 5-sample geometric mean calculation.

5.3.4 Load and Wasteload Allocations

Even though potential sources and pathways of bacteria are limited, DEQ is allocating a load reduction for *E. coli* based on historic data so that ongoing monitoring will occur in this AU (Table 37). By using a percentage of the target or “load capacity,” the calculations become unitless percentages, which overcome the inherent problem of calculating loads from a parameter that does not lend itself to load calculations. Allocations can then be made from this percentage of the load and must be met at all times. Grazing accounts for 60% of the load allocation. The remaining 40% is distributed between the margin of safety (10%) and the wildlife (natural background) component (30%), set at 30% because of the identified elk herd within the watershed.

Table 37. Bacteria load allocation for Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02) (geometric mean of number of colonies per 100 milliliter sample).

Assessment Unit	Load Capacity	Natural Background	Margin of Safety	Load Allocation	Existing Load	Load Reduction	Percent Reduction
ID17060202SL002_02	126	38	13	100%	171	45	27%

Bacterial concentrations vary from one sample to the next due to the short lifespan of bacteria and unpredictable source discharge. Therefore, ongoing monitoring should be performed to determine if beneficial uses are supported at an average 27% reduction of *E. coli*.

To support the beneficial use of secondary contact recreation, the number of *E. coli* colonies must not exceed either a single instantaneous sample of 576 organisms/100 mL or a geometric mean of 126 organisms/100 mL for 5 samples collected in a 30-day period 3 to 7 days apart. Since this target is not seasonal, it is applied as a daily load allocation.

5.3.4.1 Wasteload Allocation

There are two point source dischargers in the Pahsimeroi River subbasin: the Pahsimeroi River Rearing Ponds and the Fish Hatchery, which are NPDES-permitted dischargers (IDG131000). Data are reported monthly to the DEQ and kept on file at DEQ. Further information is available in the General Permit for Cold Water Aquaculture Facilities in Idaho (currently under revision). The permitted fish hatchery is not affecting water quality in the AU. No other permitted point sources exist within the Pahsimeroi River valley, so no wasteload allocation is established.

5.3.4.2 Margin of Safety

For the Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02) bacteria TMDL, an explicit margin of safety is set at 10% (13 organisms/100 mL), and an additional 30% is allocated to the natural background bacterial population contributed by wildlife (38 organisms/100 mL) (Table 37). In addition, any conservative approaches used in the various calculations required by a TMDL will be included as an implicit component of the margin of safety.

5.3.4.3 Seasonal Variation

In the Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02), the summer growing season is when concentrations of bacteria are the highest. This season is also when water flow is lowest. With lower water flow, bacteria increase due to a combination of agricultural diversion, cattle grazing and limited water sources for wildlife. Seasonal variation as it relates to development of this TMDL is addressed by ensuring that loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations.

5.4 Construction Stormwater and TMDL Wasteload Allocations

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 Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

5.4.1 Municipal Separate Storm Sewer Systems

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

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

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program (SWMP), and use BMPs to control pollutants in stormwater discharges to the maximum extent practicable.

5.4.2 Industrial Stormwater Requirements

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

5.4.2.1 Multi-Sector General Permit and Stormwater Pollution Prevention Plans

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

5.4.2.2 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 (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. EPA anticipates issuing a new MSGP in December 2013. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

5.4.2.3 TMDL Industrial Stormwater Requirements

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

5.4.3 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.

5.4.3.1 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.

5.4.3.2 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.

5.4.3.3 Postconstruction Stormwater Management

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

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites. In the past, stormwater was treated as a nonpoint source of pollutants. However, because stormwater can be managed on-site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires an NPDES permit.

5.5 Implementation Strategies

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

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (addressed in section 5.5.4) for the TMDL to meet water quality standards is based on the implementation strategy. There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land use activities (e.g., logging, grazing, and mining). It is important that existing shade for each stream segment be field verified to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

Similar requirements to the temperature implementation are necessary for the implementation of streambank stability and bacteria. Meaning that improvements in riparian communities will both help stabilize the streambank and limit bacteria pathways into the stream channel. This presumes that the Pahsimeroi River and tributaries will receive changes in land management which may be coupled with additional exclosure fencing that has proven effective at improving riparian density (see section 4.2.2 for aerial photos of exclosures). Implementation of the bacteria TMDL is already in effect with the current management of grazing allotments limiting cattle access to riparian habitat. Grazing management will continue to improve the condition of the Sulphur Creek and Trail Creek watersheds.

5.5.1 Time Frame

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that the TMDL goals are not being met or significant progress is not being made toward achieving the goals.

Implementation of the temperature TMDL relies on riparian area management practices that will provide a mature canopy cover to shade the stream and prevent excess solar loading. Because implementation is dependent 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 bank-full widths, smaller streams may reach targets sooner than larger streams

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

5.5.2 Approach and Responsible Parties

Lead agencies and landowners of key riparian habitat are working cooperatively to increase streambank stability and vegetative cover and improving grazing practices. Practices dictated by the latest scientific knowledge and technology are being implemented that will lead to a reduction in solar loading that may currently be impairing beneficial uses such as salmonid spawning. Federal, state, and local funding sources have provided the means to implement targeted BMPs. The USBWP collaborates to improve habitat for salmonids while providing for the needs of irrigated agriculture and local economy.

5.5.3 Implementation Monitoring Strategy

Effective shade monitoring can take place on any segment throughout the six AUs and be compared to existing shade estimates. 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. Monitoring locations for sediment are included in Table 27 and should be re-examined for the next review. Use of the Streambank Erosion Inventory is recommended to maintain consistency and comparability in the results. Bacteria monitoring should remain consistent and a 5-sample geomean should be calculated.

5.5.4 Reasonable Assurance

After TMDL acceptance by DEQ, EPA, and stakeholders, the next step of the Idaho water body management process is implementation. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying BMPs to protect impaired water bodies. DEQ is committed to developing implementation plans within 18 months of EPA approval of a TMDL document. The WAG, DEQ, and other agencies will develop implementation plans, and DEQ will incorporate them into the state's water quality management plan.

Ongoing assessment of the support status of the water bodies with TMDLs will be reported in a 5-year review of the TMDL. If full support status has not been achieved, further implementation will be necessary and further reassessment performed until full support status is reached. Monitoring will be done at least every 5 years. If full support status is reached, the requirements of the TMDL will be considered complete.

5.5.5 Pollutant Trading

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

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

Pollutant trading is voluntary. Parties trade only if both benefit from the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. Currently, DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2010). No pollutant trading is currently planned for the watersheds in the Pahsimeroi River subbasin.

5.5.5.1 Trading Components

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

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

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

5.5.5.2 Watershed-Specific Environmental Protection

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

5.5.5.3 Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document as part of an implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ's *Water Quality Pollutant Trading Guidance* (DEQ 2010).

6 Conclusions

Significant changes in land use management and water availability have begun to improve the water quality in the Pahsimeroi River subbasin (hydrologic unit code 17060202); however, many areas are still impaired or have not yet recovered. Continued implementation of BMPs and water right alterations will be required, along with monitoring to confirm changes in years to come. A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table 38.

Certain AUs currently listed in the 2010 Integrated Report for various causes have been determined to be impaired solely due to flow alteration (and thus not require a TMDL). Lawson Creek (ID17060202SL003_03) has irrigation withdrawals that remove all the water from the channel. The Pahsimeroi River (ID17060202SL011_04) is also impacted by upstream water removal, and the upstream AU (ID17060202SL017_04) is currently listed in Category 4c for low flow alterations. This dewatering adequately explains many of the impairments, except where sediment TMDLs exist, as the channel bed and banks are prone to erosion if/when water is present.

Table 38. Summary of assessment outcomes.

Assessment Unit/ Water Body Segment	Listed Pollutant(s) (in Category 5 unless otherwise noted)	New/Updated TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060202SL001_05 Pahsimeroi River—Patterson Creek to mouth	Listed in Category 4a for sediment/siltation; temperature	Updated	Remain listed in 4a for sediment and temperature	Temperature TMDL updated to potential natural vegetation (PNV), excess solar load from a lack of existing shade
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries)	Combined biota/habitat bioassessments; fecal coliform; sediment/siltation; temperature	Yes	Delist for combined biota/habitat bioassessments and fecal coliform; move to 4a for *Escherichia coli*, sediment, and temperature	*E. coli* TMDL based on geometric mean; sediment TMDL completed based on streambank stability; and PNV temperature TMDLs completed, excess solar load from a lack of existing shade
ID17060202SL002_04 Pahsimeroi River—Meadow Creek to Patterson Creek	Particle distribution (embeddedness); listed in Category 4a for sediment	No	Delist for embeddedness; retain in 4a for sediment	Sediment/siltation TMDL from 2001 addresses embeddedness listing
ID17060202SL002_05 Pahsimeroi River—Meadow Creek to Patterson Creek	Cause unknown (nutrients suspected); temperature; listed in Category 4a for sediment	Yes	Delist for cause unknown; move to 4a for temperature; retain in 4a for sediment	No source or pathways for nutrients; PNV temperature TMDL completed, excess solar load from a lack of existing shade
ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; list in 4c	Low flow alterations are sole cause for impairment
ID17060202SL004_02 North Fork Lawson Creek—source to mouth	Combined biota/habitat bioassessments	Yes	Delist combined biota/habitat bioassessments; list in 4a for sediment	Sediment determined to be impairment; sediment TMDL completed based on streambank stability
ID17060202SL005_02 South Fork Lawson Creek—source to mouth	Combined biota/habitat bioassessments	No	Retain in Category 5	Insufficient data to identify causal pollutant or stressor
ID17060202SL006_02 Meadow Creek—source to mouth	Combined biota/habitat bioassessments; fecal coliform; listed in Category 4c	No	Delist combined biota/habitat bioassessments and fecal coliform	Listed in Category 4c for low flow alterations; when water present, *E. coli* below threshold
ID17060202SL007_04 Pahsimeroi River—Furey Lane (T15S, R22E) to Meadow Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist cause unknown; retain in 4a for sediment and 4c	No source or pathways for nutrients; low flow alterations are primary cause for impairment; banks potentially erodible when water present
ID17060202SL008_04 Pahsimeroi River—Big Creek to Furey Lane (T15S, R22E)	Listed in Category 4a for sediment	No	Retain in 4a for sediment	From 2001 TMDL
ID17060202SL009_02 Grouse Creek—source to mouth	Combined biota/habitat bioassessments; listed in Category 4c	No	Delist combined biota/habitat bioassessments; retain in 4c	Low flow alterations are sole cause for impairment
ID17060202SL010_03 Pahsimeroi River—Goldburg Creek to Big Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment	No	Delist for cause unknown, retain in 4a for sediment	No source or pathway for nutrients
ID17060202SL010_04 Pahsimeroi River—Goldburg Creek to Big Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist for cause unknown; retain in 4a for sediment and 4c	No source or pathway for nutrients; has low flow alterations
ID17060202SL010_05 Pahsimeroi River—Goldburg	Cause unknown (nutrients suspected);	No	Delist for cause unknown; retain in 4a	No sources or pathways for nutrients

Assessment Unit/ Water Body Segment	Listed Pollutant(s) (in Category 5 unless otherwise noted)	New/Updated TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
Creek to Big Creek	listed in Category 4a for sediment		for sediment	
ID17060202SL011_04 Pahsimeroi River—Unnamed Tributary (T12N, R23E, Sec. 22) to Goldburg Creek	Cause unknown (nutrients suspected); listed in Category 4a for sediment	No	Delist cause unknown; list in 4c; retain in 4a for sediment	Low flow alterations are primary cause for impairment; banks potentially erodible when water present; no source or pathway for nutrients
ID17060202SL017_04 Pahsimeroi River—Burnt Creek to Unnamed Tributary (T12N, R23E, Sec. 22)	Cause unknown (nutrients suspected); listed in Category 4a for sediment and 4c	No	Delist cause unknown; retain in 4a for sediment and 4c	Low flow alterations are primary cause for impairment; banks potentially erodible when water present; no source or pathway for nutrients
ID17060202SL018_04 Pahsimeroi River—Mahogany Creek to Burnt Creek	Sediment/siltation; temperature	Updated	Retain in 4a for sediment and temperature	From 2001 TMDL; temperature TMDL updated using PNV method
ID17060202SL020_03 Pahsimeroi River, Confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	No 2010 impaired listing	Yes	List in 4a for temperature	Identified as shade deficient while calculating adjacent AU temperature/heat loads using PNV method
ID17060202SL022_03 East Fork Pahsimeroi River—source to mouth	Sediment/siltation; temperature	Updated	Retain in 4a for sediment and temperature	From 2001 TMDL; temperature TMDL updated using PNV method
ID17060202SL023_03 Burnt Creek—Long Creek to mouth	Combined biota/habitat bioassessments	No	Retain in Category 5	Not impaired for sediment or nutrients; has existing habitat; recommend examining for temperature and BURP monitoring
ID17060202SL026_02 Short Creek—source to mouth	Combined biota/habitat bioassessments	Yes	Delist combined biota/habitat bioassessments; move to 4a for sediment	Sediment determined to be impairment; sediment TMDL completed based on streambank stability
ID17060202SL029_02 Donkey Creek -source to mouth	Combined biota/habitat bioassessments	No	Delist	Listed in error, based upon non-applicable discharge and BURP score
ID17060202SL030_02 Goldburg Creek—source to Donkey Creek	Fecal coliform	No	Delist for fecal coliform	*E. coli* geometric mean below threshold; land use changes include alternate water sources, changes in livestock use patterns, and increased fencing
ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creeks to mouth	Cause unknown (nutrients suspected); sedimentation/siltation; listed in 4c	No	Delist cause unknown and sediment and retain in 4c	No source or pathway for nutrients or sediment; low flow alterations are sole cause for impairment

Effective shade targets were established for the AU containing both Sulphur and Trail Creeks based on the concept of maximum shading under PNV resulting in natural background temperature levels. In the Pahsimeroi River shade targets were established for two AUs, while three additional AUs had temperature TMDLs updated, and another AU had shade targets established while updating adjacent PNV targets. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation and partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02). A summary of necessary temperature load reductions is presented in Table 39.

All streams examined lacked shade and require some rehabilitation to achieve shade targets. Upper Sulphur Creek appears to be in relatively good condition, whereas upper Trail Creek lacks shade, likely due to low water. The Pahsimeroi River valley flow is an agricultural area that lacks shade on many reaches.

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 39. Summary of necessary temperature load reductions.

Water Body/ Assessment Unit	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
		(kWh/day)		
Pahsimeroi River—Patterson Creek to mouth (ID17060202SL001_05)	1,200,000	980,000	220,000 (18%)	-16
Pahsimeroi River—Meadow Creek to Patterson Creek (Sulphur Creek) (ID17060202SL002_02)	210,000	160,000	44,000 (21%)	-15
Pahsimeroi River—Meadow Creek to Patterson Creek (Trail Creek) (ID17060202SL002_02)	73,000	47,000	25,000 (34%)	-16
Pahsimeroi River—Sulphur Creek to Patterson Creek (ID17060202SL002_05)	400,000	340,000	61,000 (15%)	-21
Upper Pahsimeroi River (ID17060202SL022_03, 020_03 and 018_04)	600,000	580,000	26,000 (4%)	-9

Allocations for sediment loads reductions were developed for three AUs, with one AU having two allocations for separate tributaries: Sulphur Creek and Trail Creek (Table 40). Load reductions are necessary to meet the need for less than 28% fines in the streambed. The TMDL is based upon reaching an 80% streambank stability, as streambanks have been identified as the most likely source of sediment. Sulphur and Trail Creeks are subject to grazing impacts (both by cattle and elk populations) and water limitations, which affect the vegetation growth that will stabilize the banks. This AU also has PNV-based temperature TMDLs. North Fork Lawson Creek has an allocated load reduction; however, there has been some natural restabilization in the gulley that has formed in this watershed. If water availability is maintained on a continual basis, natural redevelopment of a new stable-state equilibrium will likely promote a decrease in erosion. Short Creek is often a dry channel, but like Sulphur and Trail Creeks, multiple factors need to be limited for effective implementation and decreases in sediment load.

Table 40. Summary of necessary sediment load reductions.

Assessment Unit	Current Load (tons/year)	Load Capacity (tons/year)	Load Reduction Needed to Meet Load Capacity (tons/year)	Necessary Percent Reduction by AU[a]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Trail Creek[b]	747	165	581	73[c]
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, main stem	450	165	286	
ID17060202SL002_02 Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries), Sulphur Creek, upper[b]	541	140	400	
ID17060202SL003_03 Lawson Creek—confluence of North and South Fork Lawson Creek to mouth[d]	41	42	-1	0
ID17060202SL004_02 North Fork Lawson Creek—source to mouth[b]	2,748	217	2,531	92
ID17060202SL026_02 Short Creek—source to mouth[b]	224	143	80	36
ID17060202SL029_02 Donkey Creek—source to mouth	7	37	-30	0
ID17060202SL031_03 Big Creek—confluence of North and South Fork Big Creek to mouth	4	4	-1[e]	0

[a] Load reductions and allocations will be developed by AU segment.
[b] Requires streambank stabilization to 80% and a decreased bank erosion rate.
[c] Load reduction allocations are based upon hydrologic boundaries; therefore, the summed Sulphur Creek reductions are calculated separate from Trail Creek.
[d] Similar AUs to ID17060202SL003_03 include ID17060202SL004_03, and ID17060202SL005_02.
[e] Rounding errors are represented in the calculation of the percent load reduction.

Although grazing is being managed for minimum impact to water quality in the entire Pahsimeroi River subbasin, a bacteria TMDL is provided for one AU, Pahsimeroi River—Meadow Creek to Patterson Creek (tributaries) (ID17060202SL002_02, Sulphur and Trail Creeks). Due to continued and historic exceedances of the secondary contact recreation *E. coli* standard (Table 41) it is recommended that bacteria monitoring continue.

Table 41. Summary of necessary bacteria (*E. coli*) load reductions.

Assessment Unit	Load Capacity	Natural Background	Margin of Safety	Load Allocation	Existing Load	Load Reduction	Percent Reduction
ID17060202SL002_02	126	38	13	100%	171	45	27%

Six AUs should be slated for a more comprehensive examination for the next TMDL 5-year review. The recommended future monitoring listed in Table 42 is inclusive of the AUs that are exhibiting improvements or alterations that may lead to delisting or a better understanding of what the actual (if any) stressor might be. Since streams and rivers are dynamic, the period between listing as impaired and development of this TMDL may have been sufficient to allow for natural recovery to some degree. Additionally, with land use changes (such as in Burnt Creek) these changes could promote natural recovery as well. In the upper Pahsimeroi River

AUs, habitat and shading appear to be improving and increasing; therefore, numeric data should be collected before the next review to determine if the expected habitat improvement is reflected in stream temperatures in these three AUs.

Table 42. Recommended future monitoring.

Assessment Unit	Listed Pollutant(s)/ Pollution	Idaho's 2010 Integrated Report Status (or recommended for 2014)	Status	Recommended Action
ID17060202SL005_02 South Fork Lawson Creek—source to mouth	Combined biota/habitat bioassessments	Category 5	Insufficient data to identify causal pollutant or stressor	Examine temperature or other cause
ID17060202SL023_03 Burnt Creek—Long Creek to mouth	Combined biota/habitat bioassessments	Category 5	Not impaired for sediment or nutrients, has existing habitat; recommend examining for temperature	Examine temperature and upstream land use management changes
ID17060202SL034_03 Patterson Creek—Inyo Creek to mouth	Other flow regime alterations	Category 4c	Hydrologic reconnections are occurring; once reestablished, habitat monitoring required	BURP monitoring and/or habitat examination
ID17060202SL018_04 Pahsimeroi River—Mahogany Creek to Burnt Creek	Sediment/siltation; temperature	Category 4a for sediment and temperature	Updated TMDL using PNV method; indications in 2011 of improving habitat	Deploy temperature data logger
ID17060202SL020_03 Pahsimeroi River—confluence of Rock Creek and East Fork Pahsimeroi River to Mahogany Creek	No 2010 impaired listing	Recommend Category 4a for temperature in 2014	Identified as shade deficient while calculating adjacent AU temperature/heat loads using PNV method	Deploy temperature data logger
ID17060202SL022_03 East Fork Pahsimeroi River—source to mouth	Sediment/siltation; temperature	Category 4a for sediment and temperature	Updated TMDL using PNV method; indications in 2011 of improving habitat	Deploy temperature data logger

The development of this Pahsimeroi River subbasin TMDL addendum will include a public comment period on this draft document. After all interested parties have an opportunity to review and comment on the water quality issues impacting this subbasin, DEQ will respond to the comments by amending the document or clarifying issues as necessary. Details of public participation are included in Appendix K and the distribution list is provided in Appendix L.

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Glossary

§303(d)

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

Algae

Nonvascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.

Alluvium

Unconsolidated recent stream deposition.

Anthropogenic

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

Antidegradation

Refers to the US Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be (1) a measurable change, (2) a change adverse to a use, and (3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.61).

Aquatic

Occurring, growing, or living in water.

Aquifer

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

Assessment Database (ADB)

The ADB is a relational database application designed for the US Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Assessment Unit (AU)

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

Assimilative Capacity

The ability to process or dissipate pollutants without ill effect to beneficial uses.

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Best Management Practices (BMPs)

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

Biota

The animal and plant life of a given region.

Clean Water Act (CWA)

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

Coliform Bacteria

A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria, *E. coli*, and Pathogens).

Criteria

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

Cubic Feet per Second (cfs)

A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, 1 cfs is equal to 448.8 gallons per minute and 1.984 acre-feet per day.

Depth Fines

Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. The depth sampled varies but is typically about 1 foot (30 centimeters).

Designated Uses

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

Discharge

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

Disturbance

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

E. coli

Short for *Escherichia coli*, *E. coli* are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans, but their presence in water is often indicative of fecal contamination. *E. coli* are used by the State of Idaho as the indicator for the presence of pathogenic microorganisms.

Environment

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

Exceedance

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

Existing Beneficial Use or Existing Use

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

Fecal Coliform Bacteria

Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria, *E. coli*, and Pathogens).

Flow

See Discharge.

Fully Supporting

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

Fully Supporting Cold Water

Reliable data indicate functioning, sustainable coldwater biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions.

Geographic Information Systems (GIS)

A georeferenced database.

Gradient

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

Ground Water

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

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Unit

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

Hydrologic Unit Code (HUC)

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

Hydrology

The science dealing with the properties, distribution, and circulation of water.

Intermittent Stream

(1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available discharge. (2) A stream that has a period of zero flow for at least one week during most years.

Irrigation Return Flow

Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Load Allocation (LA)

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

Load(ing)

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

Load(ing) Capacity (LC)

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

Macroinvertebrate

An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500 micrometer mesh (U.S. #30) screen.

Margin of Safety (MOS)

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

Mean

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

Median

The middle number in a sequence of numbers. For example, 4 is the median of 1, 2, 4, 14, 16. If there are an even number of numbers, the median is the average of the two middle numbers (e.g., 6 is the median of 1, 2, 5, 7, 9, 11).

Metric

A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon).

Milligrams per Liter (mg/L)

A unit of measure for concentration. In water, it is essentially equivalent to parts per million (ppm).

Monitoring

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

Mouth

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

National Pollutant Discharge Elimination System (NPDES)

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

Natural Condition

The condition that exists with little or no anthropogenic influence.

Nonpoint Source

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

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

Nuisance

Anything that is injurious to public health or an obstruction to the free use, in the customary manner, of any waters of the state.

Nutrient

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

Organic Matter

Compounds manufactured by plants and animals that contain principally carbon.

Parameter

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

Pathogens

A small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa) that can cause sickness or death. Direct measurement of pathogen levels in surface water is difficult. Consequently, indicator bacteria that are often associated with pathogens are assessed. *E. coli*, a type of fecal coliform bacteria, are used by the State of Idaho as the indicator for the presence of pathogenic microorganisms.

Perennial Stream

A stream that flows year-around in most years.

pH

The negative $\log_{10}$ of the concentration of hydrogen ions, a measure that ranges from very acidic (pH = 1) to very alkaline (pH = 14) for water. A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phosphorus

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

Point Source

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

Pollutant

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

Pollution

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

Population

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

Potential Natural Vegetation (PNV)

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

Qualitative

Descriptive of kind, type, or direction.

Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference Condition	(1) A condition that fully supports applicable beneficial uses with little effect from human activity and represents the highest level of support attainable. (2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
River	A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to create streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Species	(1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. (2) An organism belonging to such a category.
Stream	A natural water course containing flowing water at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-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.
Stormwater Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds, the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Subbasin

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

Subbasin Assessment (SBA)

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

Subwatershed

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

Surface Fines

Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff

Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants to rivers, streams, and lakes. Surface runoff is also called overland flow.

Surface Water

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

Total Maximum Daily Load (TMDL)

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

Tributary

A stream feeding into a larger stream or lake.

Wasteload Allocation (WLA)

The portion of receiving water's 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 Column

Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.

Water Pollution

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

Water Quality

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

Water Quality Criteria

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

Water Quality Limited

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

Water Quality Limited Segment (WQLS)

Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."

Water Quality Standards

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

Water Table

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

Watershed

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

Wetland

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

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Appendix A. Data Sources

Water Body	Data Source	Type of Data	Collection Date
Pahsimeroi River	US Geological Survey	Time series temperature data	3/5/1998–9/30/2005
Pahsimeroi River (various)	US Geological Survey	Discharge	1910–present
Big Creek, Pahsimeroi River	Salmon-Challis National Forest	Percent bank stability and mean percent fines less than 0.25 inches at depth	1993–2012
Pahsimeroi River, East Fork Pahsimeroi River	Salmon-Challis National Forest	Instream temperature	2009–2011
Various locations	Bureau of Land Management, Challis Field Office	Instream temperature	2006–2010
Various locations	Bureau of Land Management, Challis Field Office	Percent bank stability	2010–2012
Various locations	Bureau of Land Management, Challis Field Office	Streambank/vegetation health and habitat (MIM)	2010–2012
Various locations	Idaho Power	Discharge	2004–2008
Pahsimeroi River	Idaho Department of Fish and Game	Water quality—hatchery discharge monitoring reports	2012
Donkey Creek, Lawson Creek, Short Creek, Sulphur Creek, Trail Creek, Big Creek	DEQ Idaho Falls Regional Office	Sediment	July 2009, September 2012
Trail Creek, Meadow Creek, Ditch Creek	DEQ Idaho Falls Regional Office	*E. coli* bacteria	Aug/Sep 2009
Sulphur Creek, Trail Creek, Pahsimeroi River	DEQ Idaho Falls Regional Office	Solar Pathfinder effective shade and stream width	September 2009
Sulphur Creek, Trail Creek, Pahsimeroi River	DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation	February 2012
Pahsimeroi River HUC (17060202)	DEQ IDASA Database	Temperature	1994–2011
Pahsimeroi River HUC (17060202)	DEQ IDASA Database	Physical habitat and biological assessments	1994–2011

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Appendix B. Water Quantity and Quality Actions in the Pahsimeroi River Subbasin

Upper Salmon Basin Watershed Program

The Upper Salmon Basin Watershed Program (USBWP) was formed in 1992 to protect and restore the condition of streams in the Upper Salmon Basin, which includes the following subbasins:

- Lemhi
- Middle Salmon-Panther
- Pahsimeroi River
- East Fork Salmon
- Upper Salmon minus East Fork Salmon

The following tables details the goals for USBWP involvement in the Pahsimeroi River subbasin.

A. Fish habitat improvement:	Fish habitat improvement projects are primarily of two types; *riparian habitat improvement* , and *instream habitat improvement* .
1. Riparian habitat improvement (fencing)	Examples of riparian habitat improvement include protecting stream side vegetation by excluding livestock from stream banks with fences, changing grazing management systems, removing structures such as roads from near streams, riparian plantings.
2. Instream habitat improvement (structures)	Examples of *instream habitat improvement* includes (both hard and soft solutions) restoring natural stream channel features and increasing stream channel complexity – and therefore fish habitat quality - by reintroducing large woody debris, adding rock structures to facilitate development of pools, removing stream bank armoring such as "rip-rap", facilitating the natural stream channel meander, diversion dam improvements, water management improvements, side channel habitat creation, and diversion consolidation.
B. Fish migration enhancement:	Fish migration enhancement projects are primarily of two types; *fish migration barrier removal* , and *irrigation diversion screening* .
3. Fish migration barrier removal (diversion dams)	Examples of *fish migration barrier removal* may include redesigning irrigation diversion dams to allow fish passage, installation of siphons where canals cross streams, and removing impassable culverts under roads crossing streams.
4. Irrigation diversion fish screening (screens)	Examples of *irrigation diversion screening* include installation of any of a number of fish screen designs generally near the head of an irrigation diversion that allows water to flow through the screen mesh and down the diversion, but effectively returns even the smallest fish back to the river. Screening actions also often include an effort to redesign the water intake structure so that is less likely to entrain fish into the diversion in the first place. Also, the creation of barriers in irrigation ditches to prevent fish from entering into irrigation facilities and becoming entrained (backdoor barriers).
C. Water quality and quantity improvement:	Water quality and quanity enhancement efforts are primarily of two types; *instream flow enhancement* , and *water quality improvement* .
5. Instream flow enhancement (water purchases, donations)	Examples of *instream flow enhancement* include working with irrigators to improve their water use efficiency (i.e. divert less water from the stream) which may include: conversion to sprinkler irrigation systems, consolidation of irrigation diversions, decreasing water loss in ditches with pipelines, so that less water is lost to the ground in transmission, and buying or renting water from irrigators to leave in-stream for fish.
6. Water quality improvement (CAFO's plus)	Examples of *water quality improvement* include reducing sediment and animal waste movement from confined animal feeding operations (CAFO's), installation of off-stream stockwater systems, protecting eroding stream banks to reduce sediment delivery, and improving road design to reduce sediment delivery.
* Stream dewatering can be considered a fish migration barrier, but efforts to address stream dewatering were captured in the projects database under the *instream flow enhancement* action category.	
1. Riparian Habitat Improvement-	XX stream miles (XX miles fenced)
2. Instream Habitat Improvement-	XX stream miles
3. Fish Migration Barrier Removal-	XX barriers (XXX miles of habitat)
4. Irrigation Diversion Screening-	XXX screens (XXX cfs of flow)
5. Instream Flow Enhancement-	XXX cfs of flow restored (ann. avg?)
6. Water Quality Improvements-	XX projects (XX miles/acres)

The total number of projects tallied under each conservation action is XXX projects. This exceeds the XXX total number of projects because many projects include more than one type of conservation action. In fact, any one habitat conservation project could theoretically include all six types of conservation actions. For example, work at an irrigation diversion site could result in the installation of a fish screen (4), removal of a diversion dam fish migration barrier (3), improvement of instream habitat conditions (2), restoration of riparian vegetation (1), an enhancement in stream flow (5) because less water is diverted to meet irrigation needs, and an improvement in water quality (6) because of increased stream bank stabilization and elimination of the need to plow up a stream gravel diversion dam every spring season.

Many more projects in the database included only one conservation action. For example, most fencing projects included only riparian habitat improvement (1) as the conservation action for that project. In the database tracking these projects, from one to three conservation actions were identified for each of the XXX projects.

More than one habitat improvement project may be implemented in the same reach of stream over time. For example, a fish screening project may be implemented at an irrigation diversion one year, and then in another year a riparian fence may be constructed to protect riparian vegetation. Therefore, the total amount of stream miles affected by conservation actions may exceed the total miles for that stream if multiple projects are implemented to address multiple, overlapping habitat protection needs over a period of years.

Because water diverted for irrigation - but not consumed by plants or evaporated - often returns to the river from which it was diverted, the amount of cubic feet per second (cfs) of water flow that is treated (screened or restored to the stream channel) can be more than the average flow for that stream. For example, the average summer flow for a stream may be 5 cfs, but three irrigation diversions on that stream each remove 2 cfs – for a total of 6 cfs - because return flow from the first irrigator reaches the stream before the third irrigator removes it again. In addition, high springtime flows in excess of summer flows are often diverted by irrigators, and these high flows are screened to protect fish. Finally, some instream flow enhancement projects occur on an annual basis and are tallied as such annually, and not just once. Therefore, the amount of water documented as screened in a stream or returned to the stream channel can, and often does, exceed the average amount of summer flow in that stream.

Bonneville Power Administration

The following table lists Bonneville Power Administration funded projects in the Pahsimeroi River subbasin, typically with USBWP involvement. This listing is not comprehensive of activities in the subbasin either by the USBWP or by other groups with or without affiliation with the USBWP.

Population	Code	Assessment Unit	2012 Standardized Limiting Factor	2009 Limiting Factor	Action	Metric	Plan Value	Plan Comment	Actual Value	Actual Comment	Status	Work Element (In Progress / Planned)
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	IDFG Diversion Replacement		14 miles improved access for juvenile rearing	PBSC01,03,04,07 /08- 07-09 actions provided adult access	7.5 mi	60 (#4324, #4400, #4410, #4426- 9.6 mi (Hooper Lane includes access upstream from BSC 7/8 included in the original 14 mi estimate) 4 was done w/Mitchell Act funds 44098 IDFG- 6 was done also Other 6.5 mi captured by other culvert and bridge projects	Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	No Action							
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	Patterson BSC #2 Closure		0.75 miles				In Progess / Planned	85. Remove/Breach Fish Passage Barrier
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	PBSC # 9 Closure		0.5 miles		5 mi (included in other projects)	62 49324	Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	Muddy Springs culverts				3.8 mi	#4431 49324 IDFG 49134 Custer SWCD	New and Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers / Fish Passage	Pahsimeroi bridge/Access Projects				10.88 mi	#4389 Hooper Ln 49324 - IDFG 0.08 mi - PBSC Bridge #1 4.5 mi - Connector Channel Bridge #2 3.7 mi - Patterson/Little Spgs Ck Bridge #3 2.6 mi - Pahsimeroi Bridge #4	New and Completed	

Population	Code	Assessment Unit	2012 Standardized Limiting Factor	2009 Limiting Factor	Action	Metric	Plan Value	Plan Comment	Actual Value	Actual Comment	Status	Work Element (In Progress / Planned)
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	2.3: Injury and Mortality: Mechanical Injury	Entrainment	No Action				PBSC #5 1 screen installed		New and Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	2.3: Injury and Mortality: Mechanical Injury	Entrainment	Sulphur Creek Fish Screens		3 Screens to be installed				In Progess / Planned	69. Install Fish Screen
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	7.2: Sediment Conditions: Increased Sediment Quantity	Sediment	Compromise Creek- restoration		2,500 ft				In Progess / Planned	40. Install Fence
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	7.2: Sediment Conditions: Increased Sediment Quantity	Sediment	Duck Creek Enhancement		3000 ft		1.3 mi	64 49705 CusterSWCD reconnected upper to lower by eliminating cross ditch; IDFG instream habitat improvements on upper section This project did not affect sediment	Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	7.2: Sediment Conditions: Increased Sediment Quantity	Sediment	Irrigation system/willow planting on IDFG property				1 mi	easement transfer on former Moen property	New and Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	7.2: Sediment Conditions: Increased Sediment Quantity	Sediment	Morse-Big Spring + Patterson		1 mi	2 miles of fence (total- both sides of stream) to limit livestock access			In Progess / Planned	40. Install Fence
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	7.2: Sediment Conditions: Increased Sediment Quantity	Sediment	Riparian Fencing		2 miles/3 years		5.84 mi	65 44134 CSWCD- 2 mi- Joe Clark's 49324- IDFG 1.59 mi- Moen? 49384 SBT 2.25 mi- Page (Little Pahsimeroi)	Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	8.1: Water Quality: Temperature	Temperature	No Action							

Population	Code	Assessment Unit	2012 Standardized Limiting Factor	2009 Limiting Factor	Action	Metric	Plan Value	Plan Comment	Actual Value	Actual Comment	Status	Work Element (In Progress / Planned)
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	8.1: Water Quality: Temperature	Temperature	No Action				Duck Cr. enhancement 1.3 miles Moen 1 mi fencing Clarks/Moen/Page 5.84 stream miles fenced 12 cfs flow added PBSC #1/#9 during hot summer season	Increased shading promotes long term temp changes	New and Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	8.1: Water Quality: Temperature	Temperature	No Action							
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	9.2: Water Quantity: Decreased Water Quantity	Stream Flow	PBSC # 1 Water Conservation		5 cfs		5 cfs	67 49324 CSWCD	Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	9.2: Water Quantity: Decreased Water Quantity	Stream Flow	PBSC # 9 Closure				7 cfs	ditch closure improved streamflow in 6 miles of Big Springs Creek	New and Completed	
Pahsimeroi River	PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	9.2: Water Quantity: Decreased Water Quantity	Stream Flow	No Action				PBSC #3 1.2 cfs improved by moving POD 10 miles downstream		New and Completed	
Pahsimeroi River	PRC2	Pahsimeroi River and tributaries upstream from the mouth of Big Ck. Including the Big Ck. Drainage	1.1: Habitat Quantity: Anthropogenic Barriers	Migration Barriers	PBSC #3 sprinkler					DELETE 39168 Custer SWCD -	New and Completed	
Pahsimeroi River	PRC2	Pahsimeroi River and tributaries upstream from the mouth of Big Ck. Including the Big Ck. Drainage	2.3: Injury and Mortality: Mechanical Injury	Entrainment	Remove PBSC #4 Diversion				2 screens	37919 Custer SWCD CHANGE TO 1 SCREEN FOR PBSC#5 IN PRC1 SCREEN ON PBSC 4 DONE 15 YRS AGO	New and Completed	
Pahsimeroi River	PRC2	Pahsimeroi River and tributaries upstream from the mouth of Big Ck. Including the Big Ck. Drainage	9.2: Water Quantity: Decreased Water Quantity	Stream Flow	PBSC #3 sprinkler				1.2 cfs	39168 Custer SWCD DELETE- BELONGS IN PRC1	New and Completed	

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Appendix C. Sediment Data—DEQ Idaho Falls Regional Office

The Idaho Department of Environmental Quality (DEQ) collected sediment data in 2009 to evaluate progress toward the surrogate sediment targets for instream erosion of at least 80% bank stability and no more than 28% subsurface fine sediment. The literature supporting these surrogate sediment targets, the streambank erosion inventory methods of determining bank stability, and the McNeil sediment core method of determining percent subsurface fine sediment are presented in detail in the *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load* (TMDL) (DEQ 2001) approved by the US Environmental Protection Agency (EPA) in 2001 (McNeil and Ahnell 1964).

In summary, the streambank erosion inventories are used to estimate background and existing streambank erosion derived from Natural Resources Conservation Service (NRCS) methods (a summary of the methods are included at the end of this appendix). DEQ measures the extent of eroding streambanks in key reaches of listed assessment units (AUs). Direct volume calculations of the excess sedimentation delivered by the eroding streambank area and lateral recession rate of the streambanks result in a measure of streambank stability. These calculations provide the current sediment load based on existing conditions and the natural background erosion rate, which is assumed to occur at 80% bank stability. The natural background erosion rate is considered the assimilative capacity, or load capacity, of the stream. The difference between the current load and the load capacity is the load reduction necessary for meeting the sediment TMDL (Table C1).

McNeil sediment core samples measure percent subsurface fine sediment, which is a direct measure of beneficial use support status of salmonid spawning. The McNeil sediment core results summary, with the sediment core sampling forms, are included (Tables C2 and C3). Data summarizing the findings of the DEQ streambank erosion inventories and copies of the completed worksheets follow.

Table C1. McNeil sediment core sampling form.

McNeil Sediment Core Sampling Form					
Stream	Pahsimeroi River (ID17060202SL001_05)				
Date	7/29/2009				
Location:	approx. 130 meter upstream of Dowton Lane				
Lat/Lon:	N: 44.61866				
	W: -113.97955				
Site Desc:					
Personnel:	A.S., J.R., R.R.				
Rosgen Channel:	E				
Reach Gradient:					
Geology: (Q G V S)					
Target Species					
Sample Number	1	2	3		
Seive Size (inches)	ML	ML	ML		
2.5	580	560	460		
1	3400	2300	2420		
0.5	1280	800	1020		
0.25	880	50	800		
1.0 - 0.25" Subtotal	5560	3150	4240		
#4	330	220	250		
#8	720	480	410		
#20	770	600	250		
#70	600	650	130		
#270	50	60	20		
<0.25" Subtotal	2470	2010	1060		
Sample Total W/O 2.5"	8030	5160	5300	Mean	Std. Dev.
% Fines W/O 2.5"	0.3075965	0.3895349	0.2	0.2990438	0.0950565
Sample Total W 2.5"	8610	5720	5760	Mean	Std. Dev.
% Fines W 2.5"	0.286876	0.351399	0.184028	0.274101	0.084414

Streambank Erosion Inventory

The streambank erosion inventory used to estimate background and existing streambank erosion followed methods outlined in the proceedings from the Channel Evaluation Workshop (SCS 1983). Using the direct volume method, subsections of 1996 §303(d) watersheds were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

The NRCS Streambank Erosion Inventory is a field-based methodology that measures streambank/channel stability, length of active eroding banks, and bank geometry (Stevenson 1994). The streambank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating from 0 to 3. The categories and rating scores are as follows:

Bank Stability:

- Do not appear to be eroding—0
- Erosion evident—1
- Erosion and cracking present—2
- Slumps and clumps sloughing off—3

Bank Condition:

- Some bare bank, few rills, no vegetative overhang—0
- Predominantly bare, some rills, moderate vegetative overhang—1
- Bare, rills, severe vegetative overhang, exposed roots—2
- Bare, rills and gullies, severe vegetative overhang, falling trees—3

Vegetation / Cover On Banks:

- Predominantly perennials or rock-covered—0
- Annuals/perennials mixed or about 40% bare—1
- Annuals or about 70% bare—2
- Predominantly bare—3

Bank / Channel Shape:

- V-shaped channel, sloped banks—0
- Steep V-shaped channel, near-vertical banks—1
- Vertical banks, U-shaped channel—2
- U-shaped channel, undercut banks, meandering channel—3

Channel Bottom:

- Channel in bedrock/noneroding—0
- Soil bottom, gravels or cobbles, minor erosion—1
- Silt bottom, evidence of active downcutting—2

Deposition:

- No evidence of recent deposition—0
- Mobile material deposited, readily entrained—1
- Evidence of stable deposits, channel is aggrading—(-1)

Cumulative Rating

- Slight (0–4), Moderate (5–8), Severe (9+)
- From the cumulative rating, the lateral recession rate is assigned as follows:
    - 0.01–0.05 feet per year—**Slight**
    - 0.06–0.15 feet per year—**Moderate**
    - 0.16–0.49 feet per year—**Severe**
    - 0.5+ feet per year—**Very Severe**

Streambank stability can also be characterized through the following definitions. The corresponding streambank erosion condition rating from above is included in italics. Streambanks are considered stable if they do not show indications of any of the following features:

- **Breakdown—**Obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*
- **Slumping or False Bank—**Bank has obviously slipped down; cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*
- **Fracture—**A crack is visibly obvious on the bank indicating that the block of bank is about to slump or move into the stream. *Bank Stability Rating 2*
- **Vertical and Eroding—**The bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Streambanks are considered covered if they show any of the following features:

- Perennial vegetation ground cover is greater than 50%. *Vegetation/Cover Rating 0*

- Roots of vegetation cover more than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
- At least 50% of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*
- At least 50% of the bank surfaces are protected by logs of 4-inch diameter or larger. *Vegetation/Cover Rating 1*

Streambank stability is estimated using a simplified modification of Platts et al. (1983) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton 1993). The modification allows for measuring streambank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

- **Mostly covered and stable (nonerosional).** Streambanks are over 50% covered as defined above. Streambanks are stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0–4 (slight erosion) with a corresponding lateral recession rate of 0.01–0.05 feet per year.*
- **Mostly covered and unstable (vulnerable).** Streambanks are over 50% covered as defined above. Streambanks are unstable as defined above. Such banks are typical of “false banks” observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5–8 (moderate erosion) with a corresponding lateral recession rate of 0.06–0.2 feet per year.*
- **Mostly uncovered and stable (vulnerable).** Streambanks are less than 50% covered as defined above. Streambanks are stable as defined above. Uncovered, stable banks are typical of streambanks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5–8 (moderate erosion) with a corresponding lateral recession rate of 0.06–0.2 feet per year.*
- **Mostly uncovered and unstable (erosional).** Streambanks are less than 50% covered as defined above. They are also unstable as defined above. These are bare eroding streambanks and include **all** banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Streambanks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to be used for TMDL development.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Streambank erosion tends to increase as a function of watershed area (NRCS 1983). As a result, the lower stream segments of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches (Rosgen B and C channel types) (Rosgen 1996).

Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates were extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability, where stream segments with highly variable channel types need a large sample and segments with uniform gradient and consistent geometry need less. Typically between 10 and 30% of a streambank needs to be inventoried. Often, the location of some stream inventory reaches is more dependent on landownership than watershed characteristics. For example, private landowners are sometimes unwilling to allow access to stream segments within their property. Stream reaches are subdivided into *sites* with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry, there may be only one site per stream reach, whereas an area with variable conditions may have several sites. Subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Streambank erosion or channel stability inventory field methods were originally developed by the USFS (Pfankuch 1975). Further development of channel stability inventory methods are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods were made and are documented.

Field crews typically consist of two to four people and are trained as a group to ensure quality control and consistent data collection. Field crews survey selected stream reaches measuring bank length, slope height, bank-full width and depth, and bank content. In most cases, a GPS device is used to locate the upper and lower boundaries of inventoried stream reaches. Additionally, field crews photograph key problem areas while surveying.

Bank Erosion Calculations

The direct volume method was used to calculate average annual erosion rates for a given stream segment based on bank recession rates determined in the survey (NRCS 1983). The erosion rate (tons/mile/year) was used to estimate the total bank erosion of the selected stream corridor.

The direct volume method is summarized in the following equations:

$$E = [A_E \times R_{LR} \times \_{B}]/2{,}000 \text{ (lb/ton)}$$

Where:

E = bank erosion over sampled stream reach (tons/yr/sample reach)
A_E = eroding area (ft^2)
R_{LR} = lateral recession rate (ft/yr)
$\_{B}$ = bulk density of bank material (lb/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:

E_R = bank erosion rate (tons/mile/year)
E = bank erosion over sampled stream reach (tons/yr/sample reach)
L_{BB} = bank-to-bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are a function of soil moisture and stream discharge (Leopold et al. 1964). Because channel erosion events typically result from above-average flow events, the annual average bank erosion value should be considered a long-term average. For example, a 50-year flood event might cause 5 feet of bank erosion in 1 year, and over a 10-year period, this event accounts for the majority of bank erosion. These factors have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding (e.g., the bank on the outside of a meander). However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS 1983). Several techniques are available to quantify bank erosion rates (e.g., aerial photo interpretation, anecdotal data, bank pins, and channel cross sections).

To facilitate consistent data collection, the NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates.

The *bulk density* (B) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

Streambank Erosion Inventory Worksheets

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Sulphur Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem	*Upstream: N*	44.53933	
Assessment Unit:	ID17060202SL002_02	*W*	113.92267	
		Downstream: N	44.53742	
Date Collected:	29-Jul-09	*W*	113.92347	
Field Crew:	JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	984.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	1968	ft	"
Erosive Bank Length	538.05	ft	"
Erosive Bank to Bank Length	1076.1	ft	"
Percent Eroding Bank	54.68%		"
Bank to Bank Eroding Area (AE)	2210.3658	ft^2	"
Lateral Recession Rate (RLR)	0.09		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	10.44	tons/year	"
Bank Erosion Rate (ER)	56.04	tons/mile/year	Reach and Segment
Length of Similar Stream	41441	ft	Total Reach
Total Streambank Erosion	450.29	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	1	1
Bank Condition (0-3)	1	1
Vegetative/cover on Banks (0-3)	2	1
Bank/Channel Shape - downcutting (0-3)	0	1
Channel Bottom (0-2)	1	1
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	6	6
Recession Rate	**0.09**	**0.09**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	808.4750292	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	3.82	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	20.49779982	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	164.70	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
56	**450**	**20**	**165**	**63**	**286**

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Sulphur Creek (Upper reach)	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Forks	*Upstream: N*	44.51305	
Assessment Unit:	ID17060202SL002_02	*W*	113.93296	
		Downstream: N	44.51238	
Date Collected:	29-Jul-09	*W*	113.93415	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	886.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	1772	ft	"
Erosive Bank Length	639.76	ft	"
Erosive Bank to Bank Length	1279.52	ft	"
Percent Eroding Bank	0.72	%	"
Bank to Bank Eroding Area (AE)	1857.674	ft^2	"
Lateral Recession Rate (RLR)	0.16		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	15.60	tons/year	"
Bank Erosion Rate (ER)	92.99	tons/mile/year	Reach and Segment
Length of Similar Stream	29811	ft	Total Reach
Total Streambank Erosion	540.64	tons/year	"

ecession Rate Calculation Workshee		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	1
Bank Condition (0-3)	2	2
Vegetative/cover on Banks (0-3)	2	1
Bank/Channel Shape - downcutting (0-3)	0	1
Channel Bottom (0-2)	2	2
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	9	8
Recession Rate	**0.16**	**0.15**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	514.5364399	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	4.05	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	24.14720674	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	140.39	tons/year	"

Requires streambank stabilization to 80% and a decreased bank erosion rate

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**		Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)		
93	**541**	**24**	**140**	**74**	**400**

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Trail Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem	*Upstream: N*	44.54011	
Assessment Unit:	ID17060202SL002_02	*W*	113.96899	
		Downstream: N	44.53933	
Date Collected:	29-Jul-09	*W*	113.97121	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	951.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	1902	ft	"
Erosive Bank Length	477.39	ft	"
Erosive Bank to Bank Length	954.78	ft	"
Percent Eroding Bank	50.20%		"
Bank to Bank Eroding Area (AE)	1756.2428	ft^2	"
Lateral Recession Rate (RLR)	0.27		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	24.89	tons/year	"
Bank Erosion Rate (ER)	138.22	tons/mile/year	Reach and Segment
Length of Similar Stream	27577	ft	Total Reach
Total Streambank Erosion	746.79	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	3	1
Bank Condition (0-3)	2	2
Vegetative/cover on Banks (0-3)	2	1
Bank/Channel Shape - downcutting (0-3)	0	1
Channel Bottom (0-2)	2	2
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	10	8
Recession Rate	**0.27**	**0.15**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	699.7159148	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	5.51	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	30.59325735	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	165.30	tons/year	"

Requires streambank stabilization to 80% and a decreased bank erosion rate

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
138	**747**	**31**	**165**	**78**	**581**

STREAMBANK EROSION INVENTORY WORKSHEET

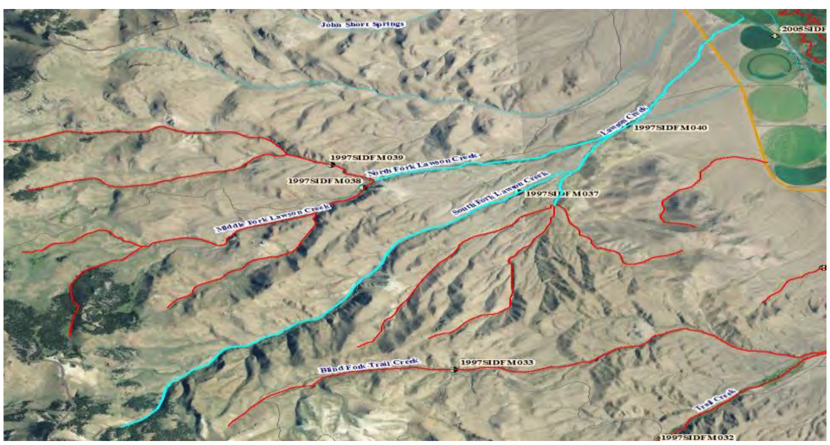
Stream (AU):	Lawson Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem	*Upstream: N*	44.58717	
Assessment Unit:	ID17060202SL003_03	*W*	113.99068	
		Downstream: N	44.58623	
Date Collected:	28-Jul-09	*W*	113.99132	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	663.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	1326	ft	"
Erosive Bank Length	131.24	ft	"
Erosive Bank to Bank Length	262.48	ft	"
Percent Eroding Bank	0.20	%	"
Bank to Bank Eroding Area (AE)	454.3916	ft^2	"
Lateral Recession Rate (RLR)	0.12		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	2.86	tons/year	"
Bank Erosion Rate (ER)	22.80	tons/mile/year	Reach and Segment
Length of Similar Stream	8891	ft	Total Reach
Total Streambank Erosion	41.25	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	2
Bank Condition (0-3)	1	1
Vegetative/cover on Banks (0-3)	2	2
Bank/Channel Shape - downcutting (0-3)	1	1
Channel Bottom (0-2)	2	2
Deposition (0-1)	-1	-1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	7	7
Recession Rate	**0.12**	**0.12**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	459.1003212	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	2.89	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	23.03395639	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	41.68	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
23	**41**	**23**	**42**	**-1**	**0**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Lawson Creek (North and Middle Forks)	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Middle Fork	*Upstream: N*	44.57731	
Assessment Unit:	ID17060202SL004_02	*W*	114.02787	
		Downstream: N	44.57683	
Date Collected:	28-Jul-09	*W*	114.02853	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	230.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	460	ft	"
Erosive Bank Length	229.65	ft	"
Erosive Bank to Bank Length	459.3	ft	"
Percent Eroding Bank	99.85%		"
Bank to Bank Eroding Area (AE)	1265.739	ft^2	"
Lateral Recession Rate (RLR)	0.38		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	25.25	tons/year	"
Bank Erosion Rate (ER)	579.69	tons/mile/year	Reach and Segment
Length of Similar Stream	24802	ft	Total Reach
Total Streambank Erosion	2748.24	tons/year	"

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	254	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	2.00	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	45.83	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	217.30	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	3	2
Bank Condition (0-3)	3	2
Vegetative/cover on Banks (0-3)	2	2
Bank/Channel Shape -	0	0
Channel Bottom (0-2	2	1
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	11	8
Recession Rate	**0.38**	**0.15**

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
580	**2748**	**46**	**217**	**92**	**2531**

Requires streambank stabilization to 80% and a decreased bank erosion rate

STREAMBANK EROSION INVENTORY WORKSHEET

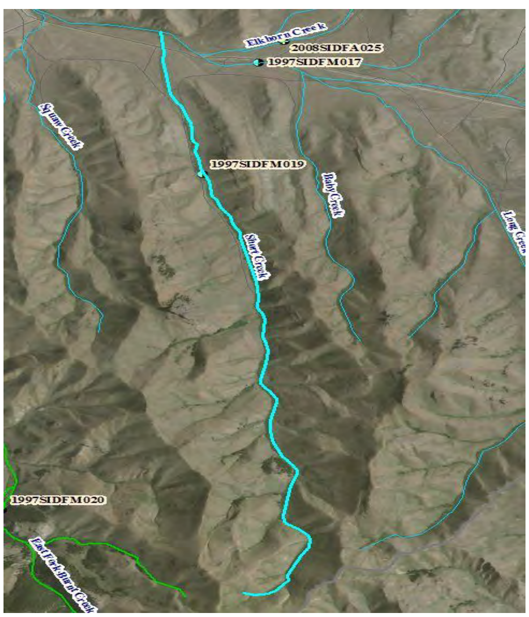
Stream (AU):	Short Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem	*Upstream: N*	44.20572	
Assessment Unit:	ID17060202SL026_02	*W*	113.60993	
		Downstream: N	44.20216	
Date Collected:	28-Jul-09	*W*	113.60892	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	1578.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	3156	ft	"
Erosive Bank Length	460.94	ft	"
Erosive Bank to Bank Length	921.88	ft	"
Percent Eroding Bank	0.29	%	"
Bank to Bank Eroding Area (AE)	1702.8842	ft^2	"
Lateral Recession Rate (RLR)	0.16		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	14.30	tons/year	"
Bank Erosion Rate (ER)	47.86	tons/mile/year	Reach and Segment
Length of Similar Stream	23083	ft	Total Reach
Total Streambank Erosion	223.55	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	3	2
Bank Condition (0-3)	2	2
Vegetative/cover on Banks (0-3)	1	1
Bank/Channel Shape - dow ncutting (0-3)	1	1
Channel Bottom (0-2)	1	1
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	9	8
Recession Rate	**0.16**	**0.15**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	1165.944057	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	9.18	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	30.72240423	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	143.49	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
48	**224**	**31**	**143**	**36**	**80**



STREAMBANK EROSION INVENTORY WORKSHEET

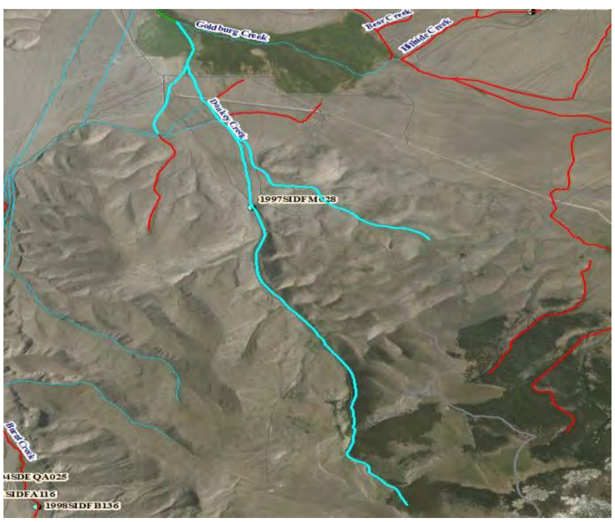
Stream (AU):	Donkey Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem	*Upstream: N*	44.32214	
Assessment Unit:	ID17060202SL029_02	*W*	113.60499	
		Downstream: N	44.31857	
Date Collected:	29-Jul-09	*W*	113.60600	
Field Crew:	AS, JR, RR	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		**Unit**	**Area Applied**
Bank Length	1640.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	3280	ft	"
Erosive Bank Length	59.04	ft	"
Erosive Bank to Bank Length	118.08	ft	"
Percent Eroding Bank	0.04	%	"
Bank to Bank Eroding Area (AE)	110.6672	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	0.23	tons/year	"
Bank Erosion Rate (ER)	0.75	tons/mile/year	Reach and Segment
Length of Similar Stream	45439	ft	Total Reach
Total Streambank Erosion	6.67	tons/year	"

Recession Rate Calculation Workshee		**Load Capacity**
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	1	1
Bank Condition (0-3)	0	0
Vegetative/cover on Banks (0-3)	1	1
Bank/Channel Shape - downcutting (0-3)	0	0
Channel Bottom (0-2)	0	0
Deposition (0-1)	1	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	3	3
Recession Rate	**0.04**	**0.04**

Streambank Erosion Reduction Calculations		**Unit**	**Area Applied**
Bank to Bank Eroding Area With Load Reductions (AE)	614.8177778	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	1.29	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	4.156768	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	37.06	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
1	**7**	4	**37**	**-456**	**-30**



STREAMBANK EROSION INVENTORY WORKSHEET

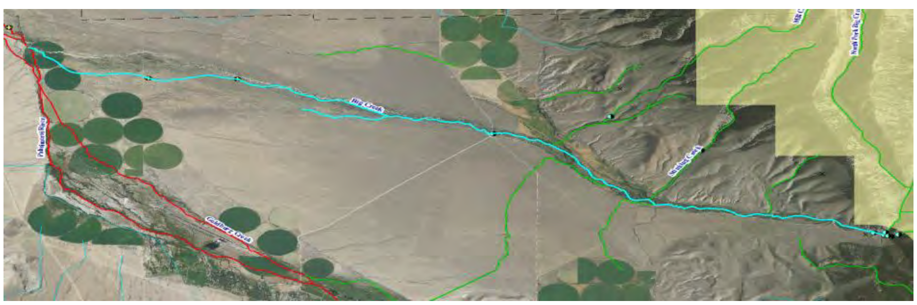
Stream (AU):	Big Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Main Stem @ canyon mouth	*Upstream: N*	44.443402	
Assessment Unit:	ID17060202SL031_03	*W*	113.608715	
		Downstream: N	44.442997	
Date Collected:	27-Sep-12	*W*	113.610107	
Field Crew:	CAC, PH, JH	**Notes:**		
Data Reduced By:	CAC			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	492.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	984	ft	"
Erosive Bank Length	84.00	ft	"
Erosive Bank to Bank Length	168	ft	"
Percent Eroding Bank	0.17	%	"
Bank to Bank Eroding Area (AE)	151.2	ft^2	"
Lateral Recession Rate (RLR)	0.02		"
Bulk Density (DB)	105	lb/ft^2	"
Total Bank Erosion (E)	0.16	tons/year	"
Bank Erosion Rate (ER)	1.70	tons/mile/year	Reach and Segment
Length of Similar Stream	11408	ft	Total Reach
Total Streambank Erosion	3.84	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	1	1
Bank Condition (0-3)	0	0
Vegetative/cover on Banks (0-3)	0	0
Bank/Channel Shape - downcutting (0-3)	0	0
Channel Bottom (0-2)	0	0
Deposition (0-1)	0	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	1	1
Recession Rate	**0.02**	**0.02**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	177.12	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	0.19	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	1.99584	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	4.50	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
2	4	2	4	**-17**	**-1**



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Appendix D. Salmon-Challis National Forest Sediment, Temperature and Fish Data for the Pahsimeroi River Subbasin

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Sediment Data

Table D1. Sediment data recorded on the Salmon-Challis National Forest, 1993–2012.

Summary Streambank Stability Measurements Recorded on the Salmon-Challis National Forest from 1993 through 2012.

Pahsimeroi — **Percent Bank Stability**

Station	Latitude	Longitude	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Big Creek_PAH_ 1R	44˚26'30.542"N	113˚36'0.445"W			85.5			86.0	86.5	91.0	94.0	91.5	92.0	95.5								
NF Big Creek 1R	44˚26'31.5"N	113˚35'58.7"W			93.5			100.0	89.5	99.0	97.0	99.0		99.5								
Pahsimeroi River 1R	44°9'25.918"N	113°42'14.111"W			66.0												99.0		93	97		
SF Big Creek 1R	44˚26'29.669"N	113˚35'57.18"W			80.0			92.0	86.0	75.5	85.5	73.0	93.0	97.5			99.0					

Summary of Depth Fines Measurements Recorded on the Salmon-Challis National Forest from 1993 through 2012.

Pahsimeroi — **Mean Percent Fines <.25" at Depth**

Station			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Big Creek_PAH_ 1R	44˚26'30.542"N	113˚36'0.445"W			17.7			17.4	21.5	22.2	25.6	28.2	25.8	27.1								
NF Big Creek 1R	44˚26'31.5"N	113˚35'58.7"W			10.9			9.5	20.4	23.6	19.7	22.5		21.7								
Pahsimeroi River 1R	44°9'25.918"N	113°42'14.111"W			20.9												26.7		20.6	9.8		
SF Big Creek 1R	44˚26'29.669"N	113˚35'57.18"W			13.2			11.7	24.6	29.9	23.6	30.0	28.1	31.2			8.8					

FOOTNOTES
1,2,3 Stations on a stream in downstream to upstream order
A or R -Designates whether a stream has Anadromous or Resident Fish
PAH=Pahsimeroi River Subbasin
Empty cells denote date/locations without monitoring

Sediment data are from:

Forest Plan Monitoring and Evaluation Report: Salmon-Challis National Forest (FY06–FY10).
Available online at: *http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5362607.pdf*.

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Temperature Data for Impaired Waters Listed in Category 5 of the 2010 Integrated Report

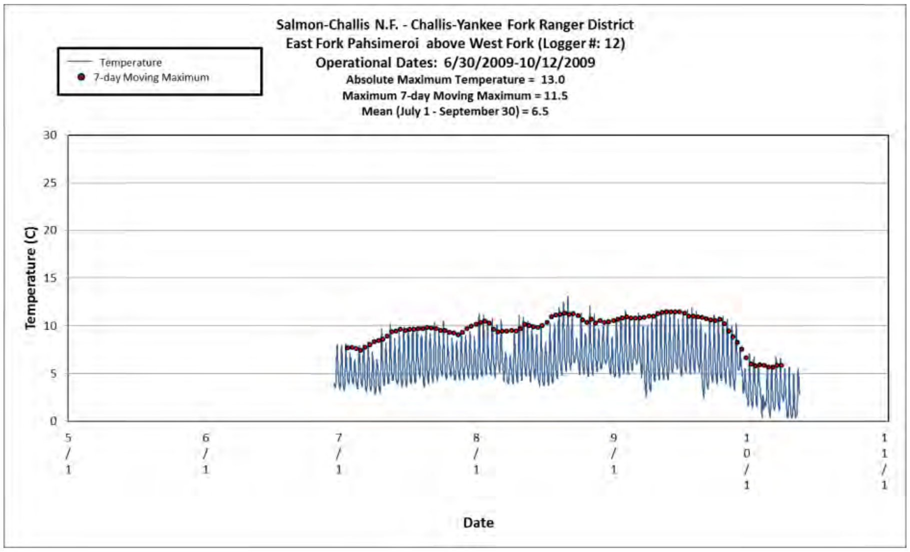

Figure D1. AU ID17060202SL022_03—2009 data.

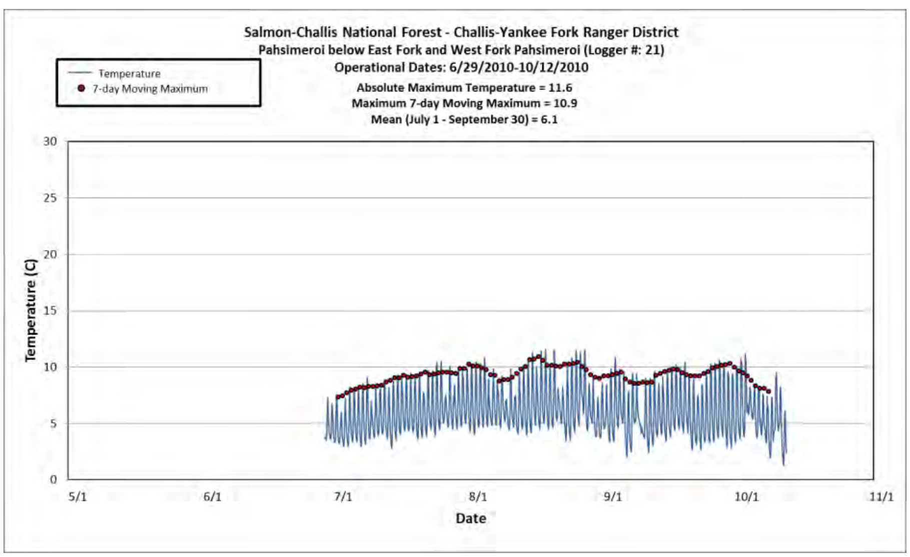

Figure D2. AU ID17060202SL022_03—2010 data.

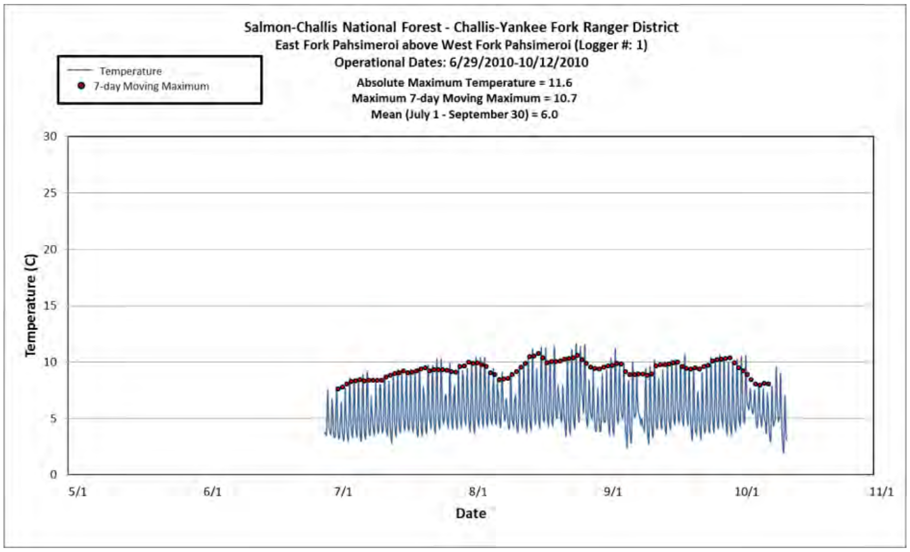

Figure D3. AU ID17060202SL022_03—2010 data.

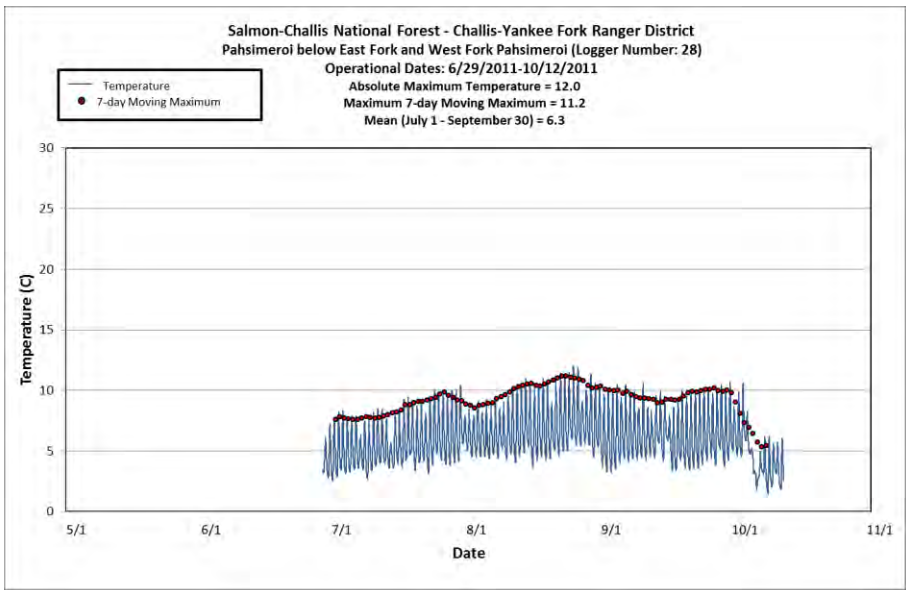

Figure D4. AU ID17060202SL022_03—2011 data.

Complete temperature data, locations, and reporting are available from the US Forest Service and include stream segments not currently listed by DEQ. See the following references:

South Zone Stream Temperature Monitoring Report Salmon-Challis National Forest 2001–2006. Prepared by J. Bartel, B. Gamett and J. Pyron. 2010.

South Zone Stream Temperature Monitoring Report Salmon-Challis National Forest 2009. Prepared by B. Gamett, J Bartel, and C. Wood. 2009.

South Zone Stream Temperature Monitoring Report Salmon-Challis National Forest 2010. Prepared by J. Bartel, B. Gamett, T. Brewer and C. Wood. 2011.

South Zone Stream Temperature Monitoring Report Salmon-Challis National Forest 2011. Prepared by C. Wood and B. Gamett. 2012.

Fish Data

Fish data are from:

US Forest Service. 2004 (revised 2009). *The Status of Fishes on the Challis Ranger District, Salmon-Challis National Forest (2001-2004)*. Zone Fish Program Lost River and Challis Ranger Districts Salmon-Challis National Forest. Prepared by J. Bartel, B. Gamett, and J. Pyron.

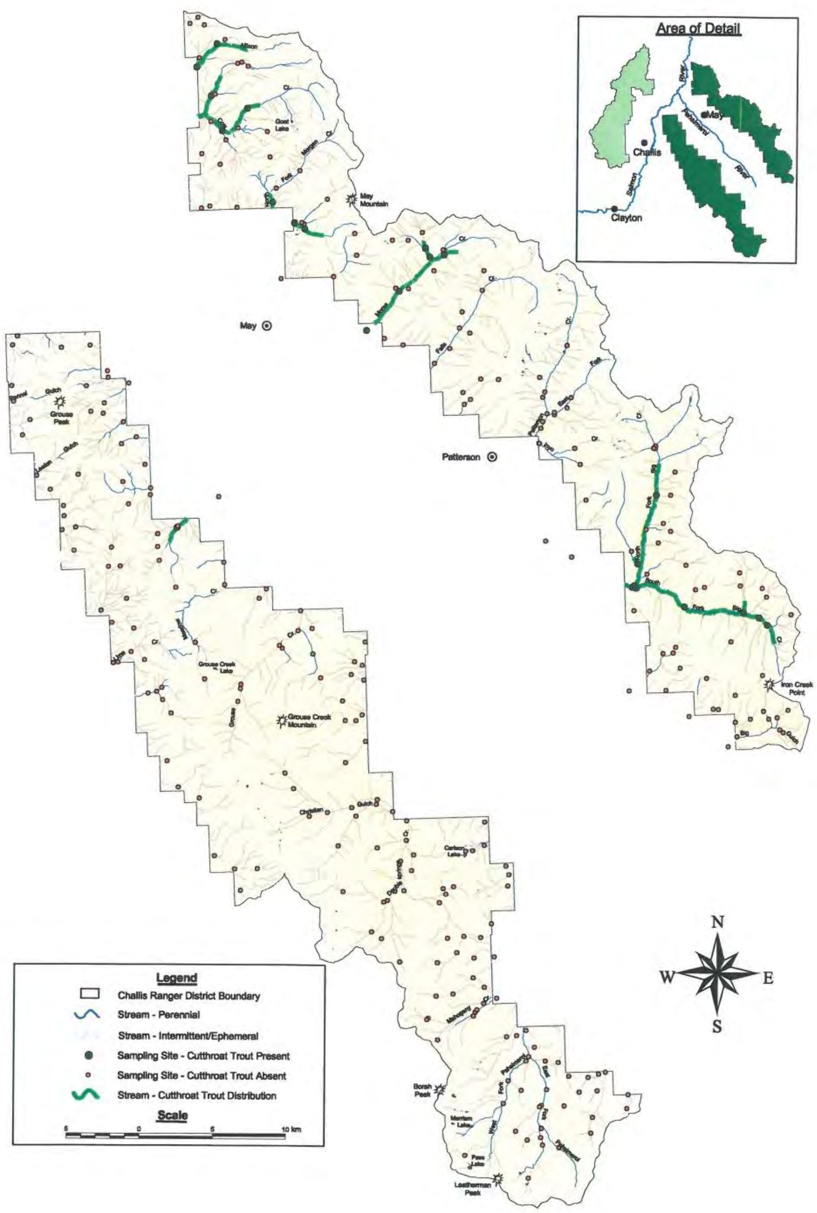

Figure D5. Cutthroat trout distribution on the southern portion of the Challis Ranger District.

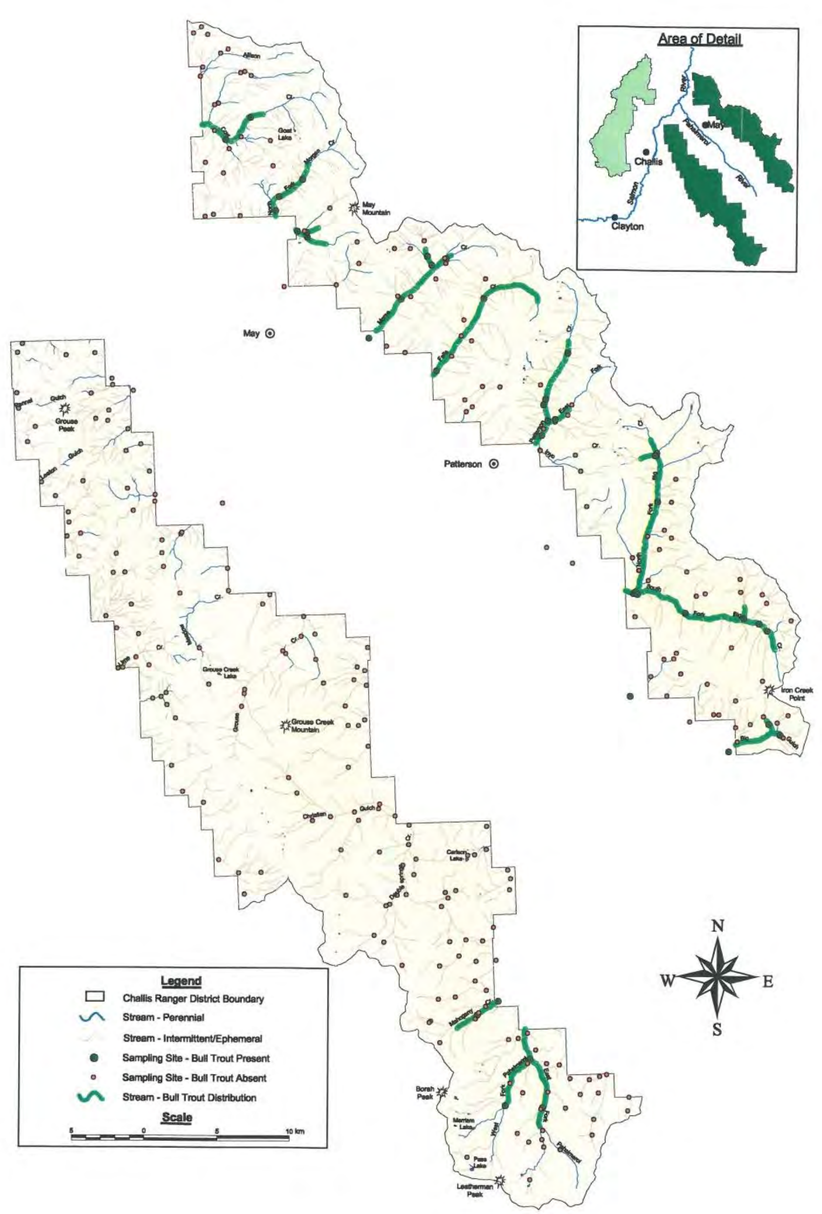

Figure D6. Bull trout distribution on the southern portion of the Challis Ranger District.

Appendix E. Bureau of Land Management Challis Field Office Temperature, Habitat and Sediment Data for the Pahsimeroi River Subbasin

Temperature Data for Impaired Waters Listed in Category 5 of the 2010 Integrated Report

Table E1. Stream temperature monitoring history—Pahsimeroi River subbasin.

BLM CHALLIS FIELD OFFICE **STREAM TEMPERATURE MONITORING HISTORY**

						NAD83 Zone 11						
Watershed	**Creek**	**Historic Thermograph Site Names/Locations**	**Township**	**Range**	**Section**	**UTM N**	**UTM E**	**2006**	**2007**	**2008**	**2009**	**2010**
Pahsimeroi River												
	Pahsimeroi	(1) At Mouth at the USGS Gauge	16N	20E	25	4952944	733965	7/19-9/25	6/20-10/31	6/24-10/31	6/25-10/31	6/8-10/31
	Pahsimeroi	(2) Lower; *above* Grouse Creek; At BLM/PVT below Big Creek Confluence	14N	22E	35	4931983	752748	7/21-9/25	6/25-10/31	6/20-10/31	6/19-10/31	6/8-10/31
	Pahsimeroi	(3) Upper; Above Burnt Creek At Confluence; Below Culvert	11N	24E	19	4907687	766899			$	6/19-10/31	6/10-10/31
	Pahsimeroi	(4) Above Mahogany Creek At Confluence	10N	23E	11	4900233	763508	7/20-10/12		~	6/19-10/31	6/15-10/31
	Pahsimeroi	At PAR-KA-04 [*2010 interim for BT spawn temps; 2011 permanent]*				4897761	763255					8/27-10/31
	Little Morgan	Above Diversions At Mouth of Canyon	15N	21E	11	4948875	743277	7/18-9/12	6/30-10/31	7/18-10/31	6/20-10/31	6/15-10/31
	Little Morgan, EFK	At BLM/Private Boundary [*2010 interim BT spawn temps; 2011 permanent*]				4951488	745701					8/26-10/31
	Morse	Above Diversion At BLM/USFS Boundary	15N	22E	26	4944424	752572	7/19-9/25	6/30-10/31	7/18-10/31	6/20-10/31	6/15-10/31
	Falls	Down low on big western diversion ditch ("Falls Creek" on USGS quad)	T14N	R22E	1	4940413	754810		6/20-10/31			
	Patterson	Above Diversions At Mouth of Canyon	14N	23E	23	4935168	761714	7/19-9/25	6/24-10/31	6/24-10/31	8/11-10/31	6/10-10/31
	Big Creek	Above Diversions at BLM/USFS Boundary; or just above on USFS	13N	24E	21 or 22	4926744	769888	7/19-9/25	6/24-10/31	7/17-10/31	6/25-10/31	*
	Goldburg	At Diversions on BLM				4921093	767030				6/25-10/31	6/10-10/31
	Goldburg	At Pahsimeroi Road below Goldburg Site	12N	24E	S5-8	4920414	767407	7/19-9/25	6/29-10/31	6/24-10/31	6/25-10/31	6/10-10/31
!	Burnt	(1) Site 2; At BRN-KA-1	10N	24E	8	4900354	767633	7/19-10/2	6/16-10/31	6/25-10/31	6/26-10/31	6/11-10/31
!	Burnt	(2) Upper; Site 4; Exclosure 6; "Exclosure 4"; Above "West Trib"	10N	24E	29	4896047	768185	7/21-10/5	6/16-10/31	6/25-10/31	6/26-10/31	6/11-10/31
!	Burnt	(3) Site 5; In Exclosure 7; Burnt Creek Spring Channel in Exclosure 7	10N	24E	32-33	4894000	769378				6/26-10/31	6/11-10/31
	Burnt	Burnt Creek Main Channel In Exclosure 7								6/25-10/31		
	Short	At SHC-KA-1			15	4898924	771233				6/26-10/31	6/10-10/31
	Long	At LNG-KA-1			25	4896874	775043				6/26-10/31	6/11-10/31
	Mahogany	At Mouth	10N	23E	11	4900258	763494			6/25-8/21	6/19-10/31	6/15-10/31
	Mahogany	1/2 Mile Up From Mouth; At or Above MGY-KA-1			10	4899725	762113	malf~	malf		buried 8"	6/15-10/31

^ Approximate survey ranges
! Use caution when comparing years on Burnt Creek - check the maps for HOBO locations - Site numbers and Exclosure numbers were confused
- Thermograph dropped from monitoring plan
* Thermograph lost
malf Thermograph malfunctioned
~ Thermograph found floating
$ Battery died early

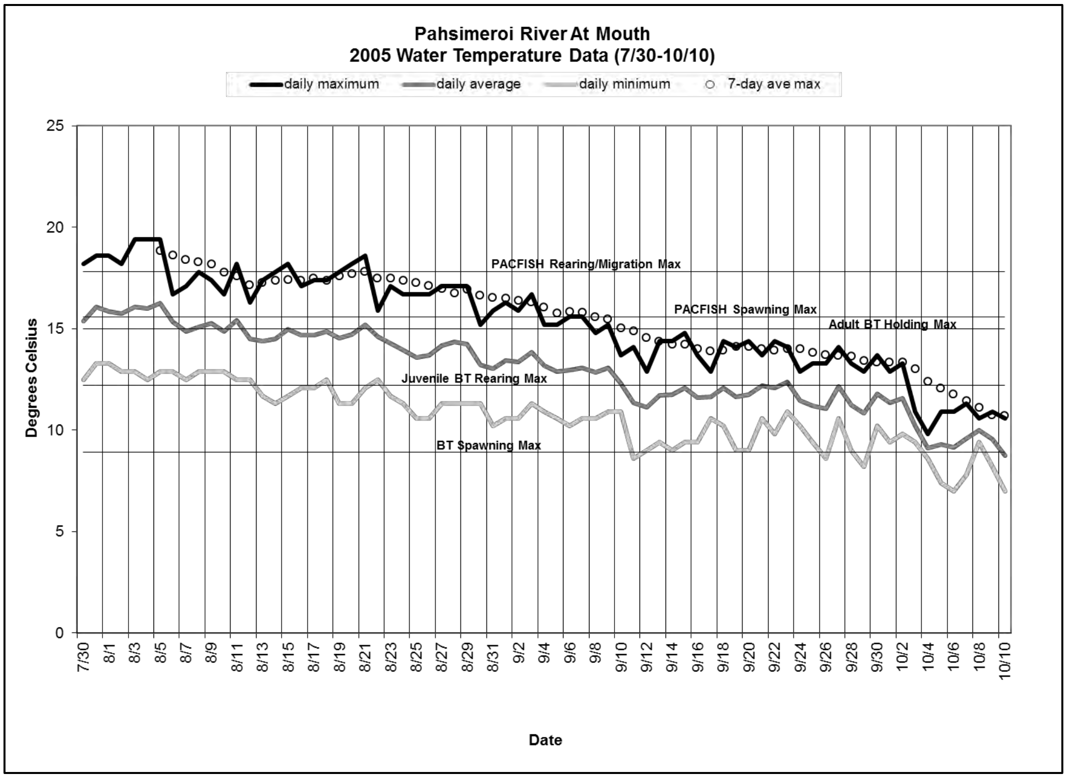

Figure E1. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2005 data.

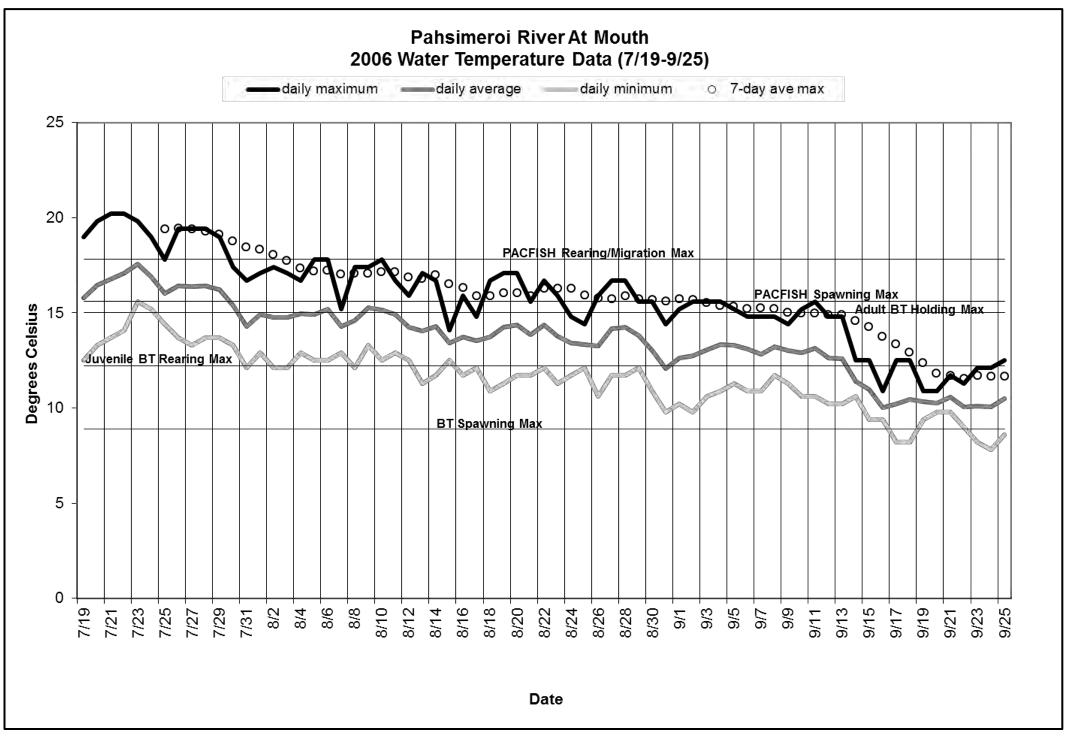

Figure E2. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2006 data.

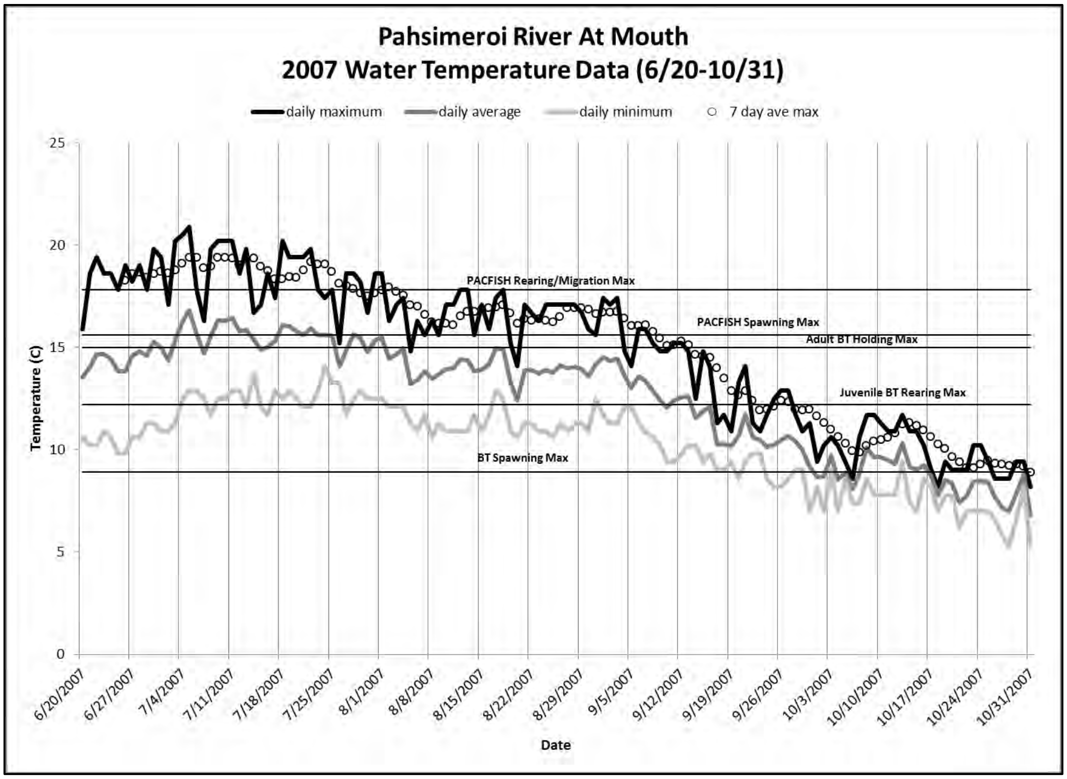

Figure E3. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2007 data.

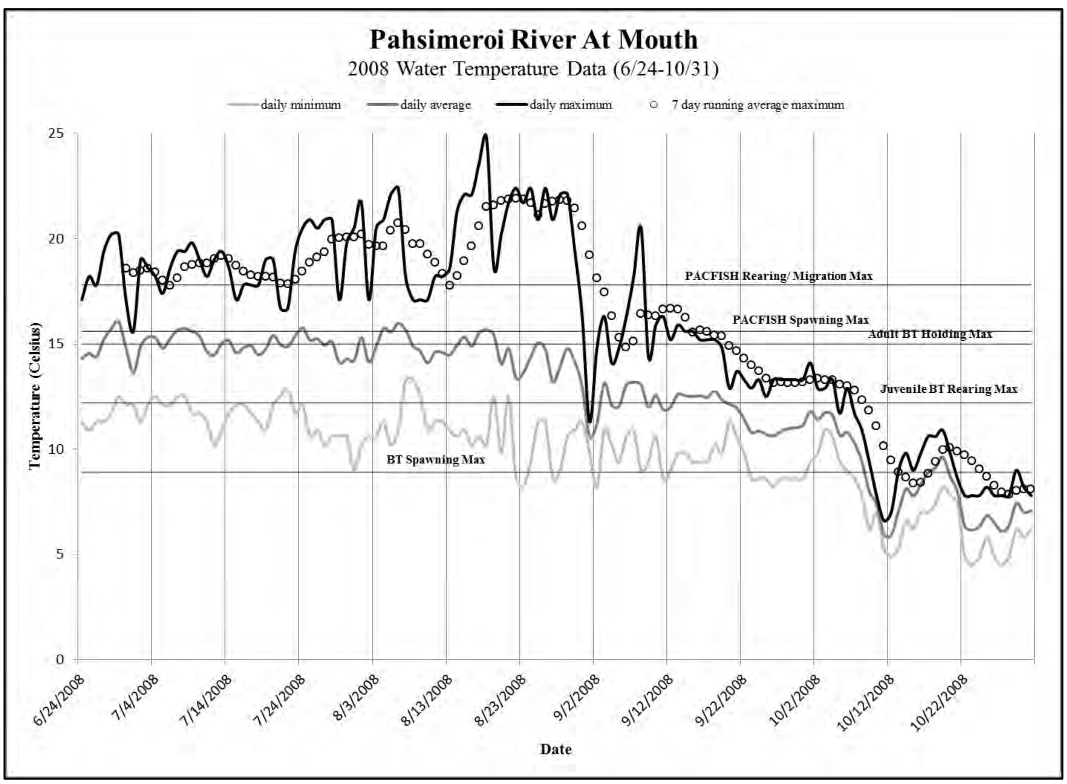

Figure E4. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2008 data.

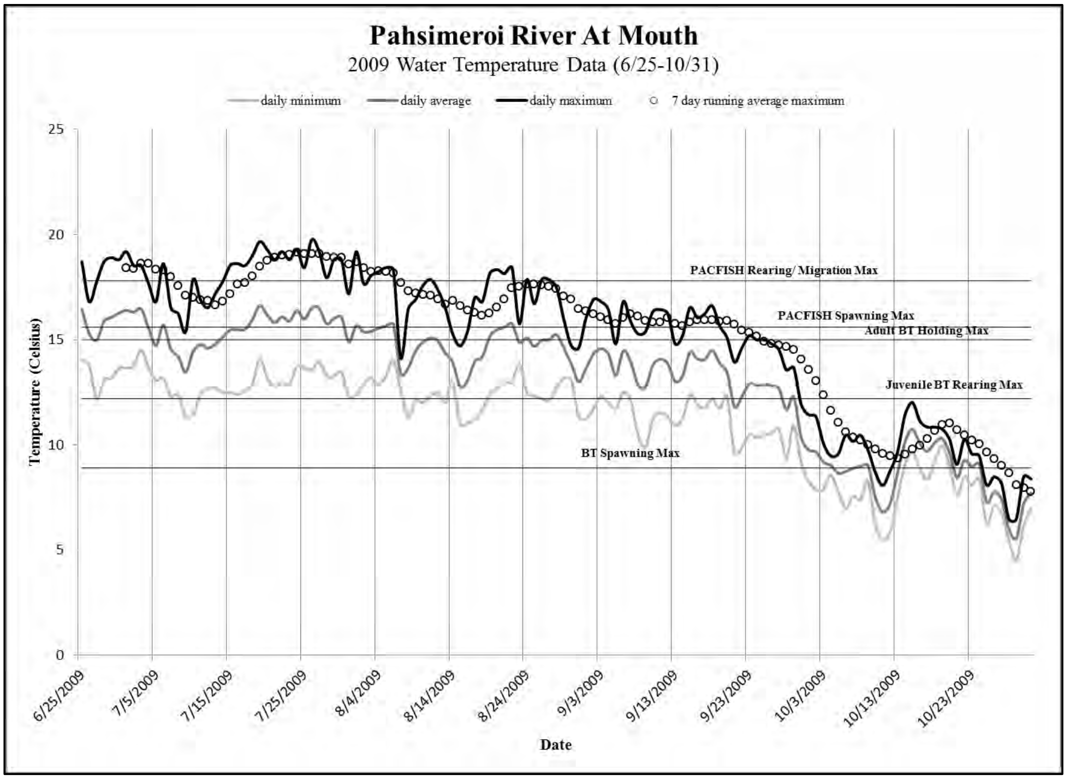

Figure E5. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2009 data.

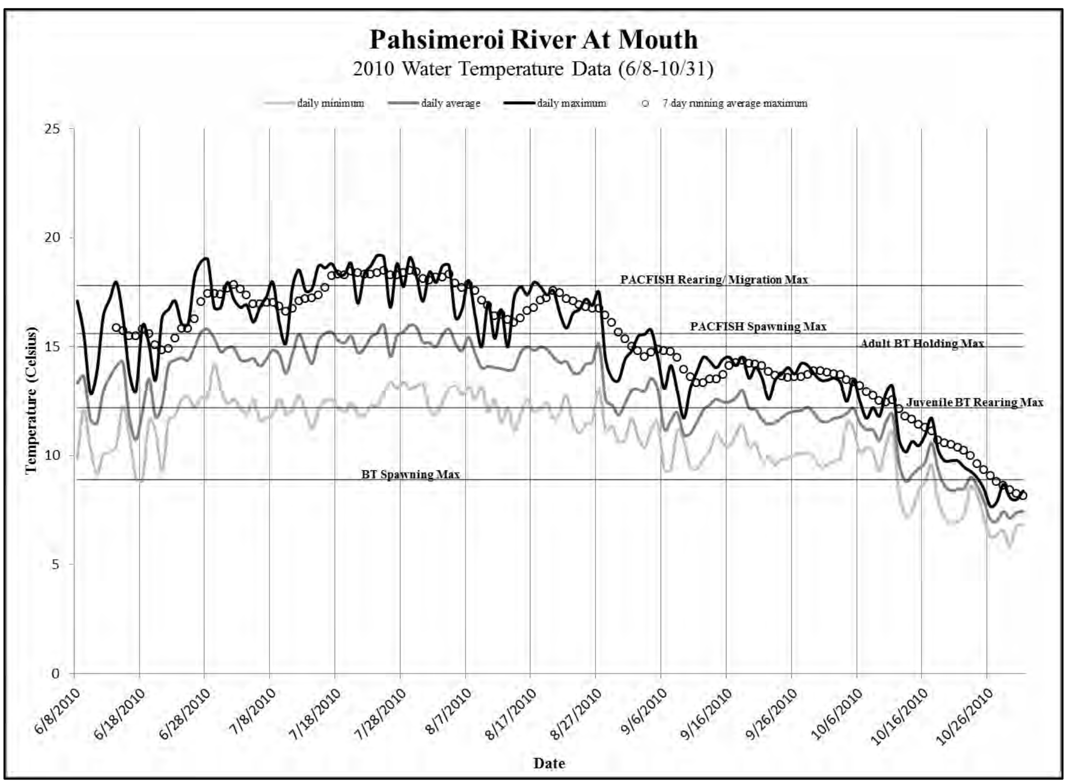

Figure E6. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2010 data.

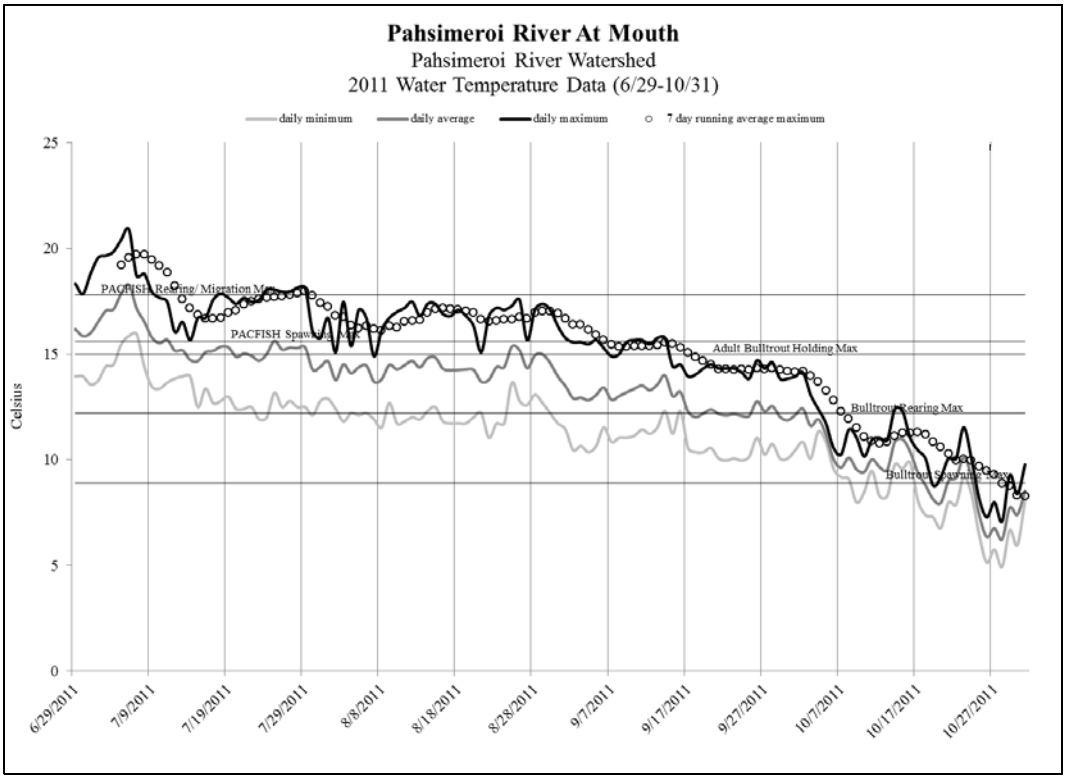

Figure E7. Annual temperature—Pahsimeroi River at mouth (AU ID17060202SL001_05)—2011 data.

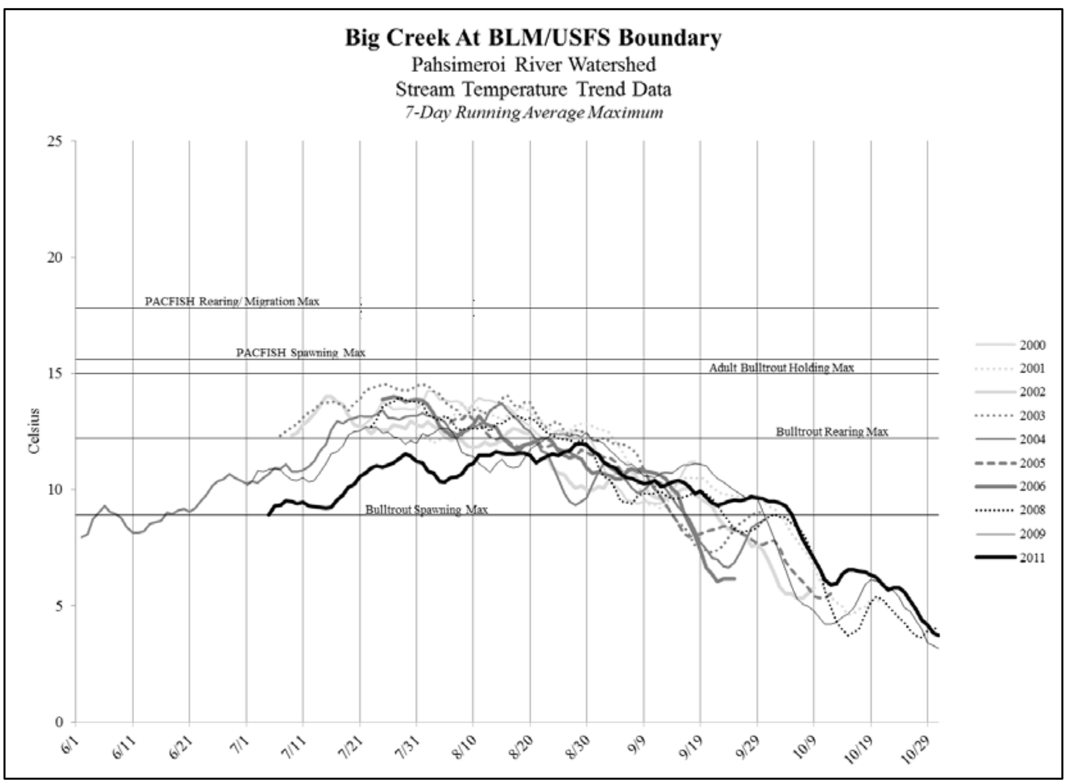

Figure E8. Compilation of select data with PACFISH criteria—Big Creek.

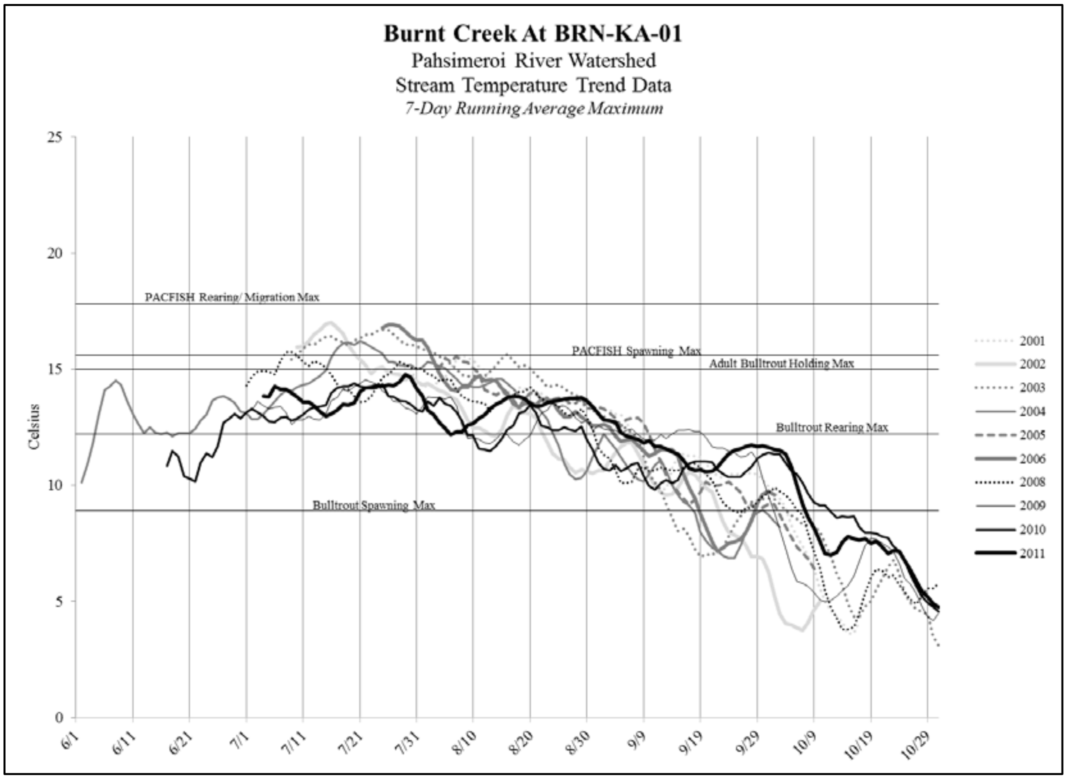

Figure E9. Compilation of select data with PACFISH criteria—Burnt Creek.

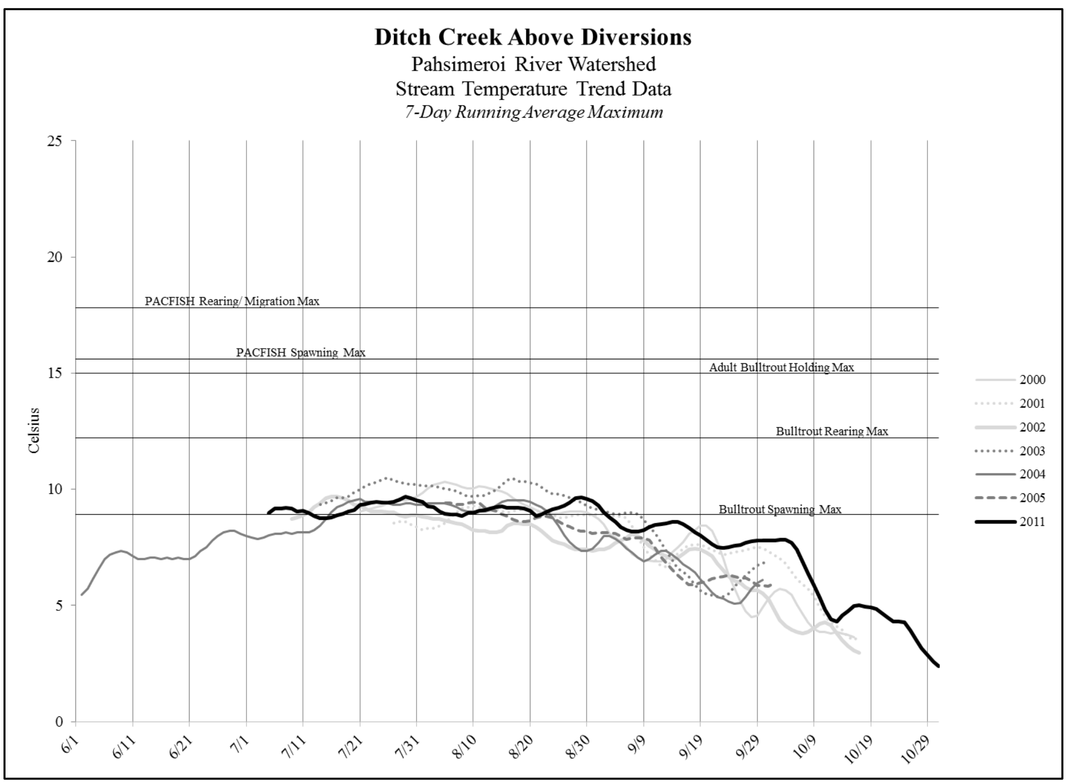

Figure E10. Compilation of select data with PACFISH criteria—Ditch Creek.

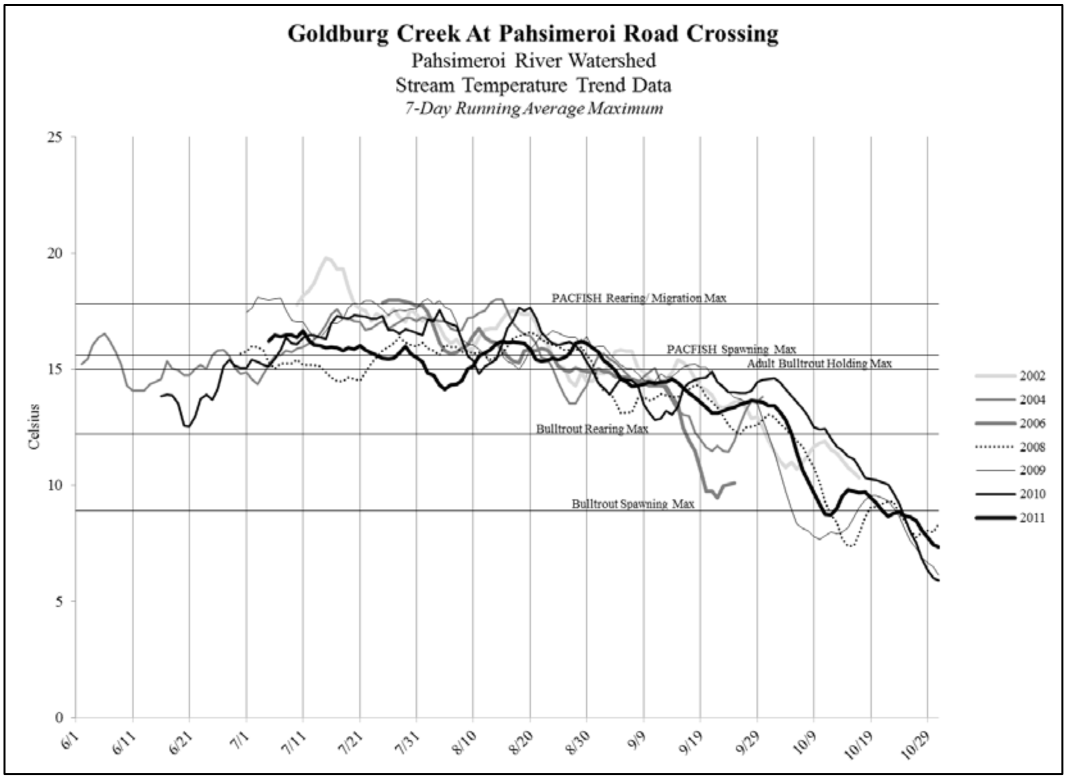

Figure E11. Compilation of select data with PACFISH criteria—Goldburg Creek.

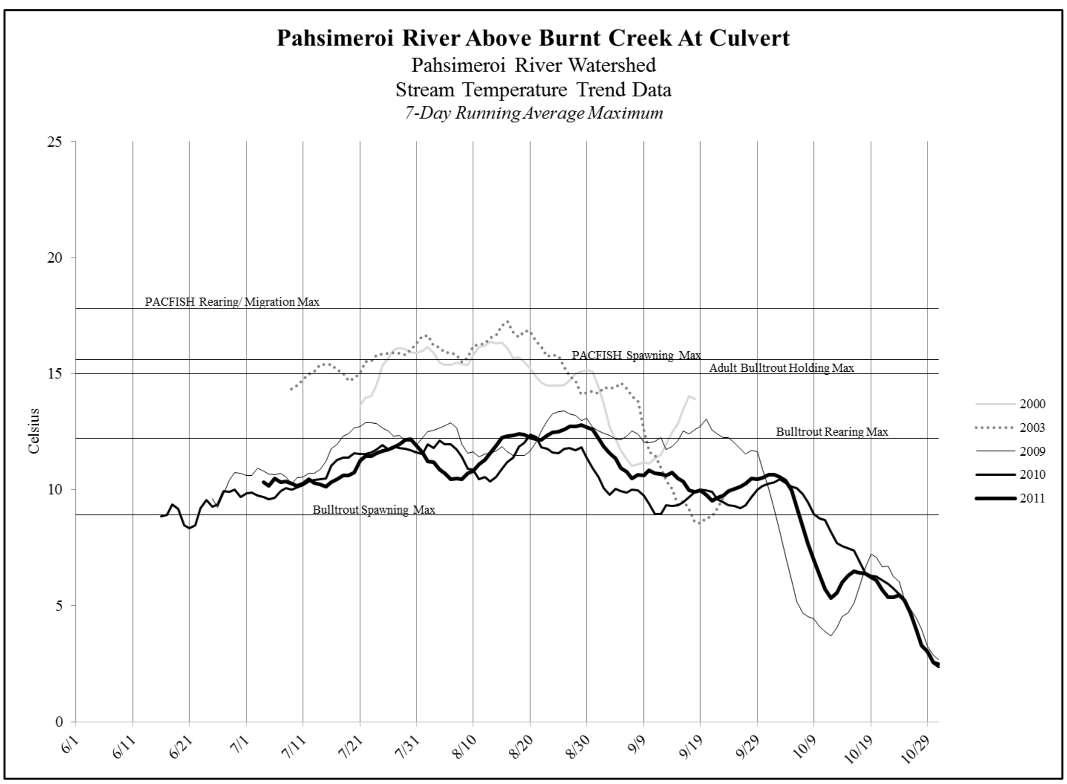

Figure E12. Compilation of select data with PACFISH criteria—Pahsimeroi River above Burnt Creek.

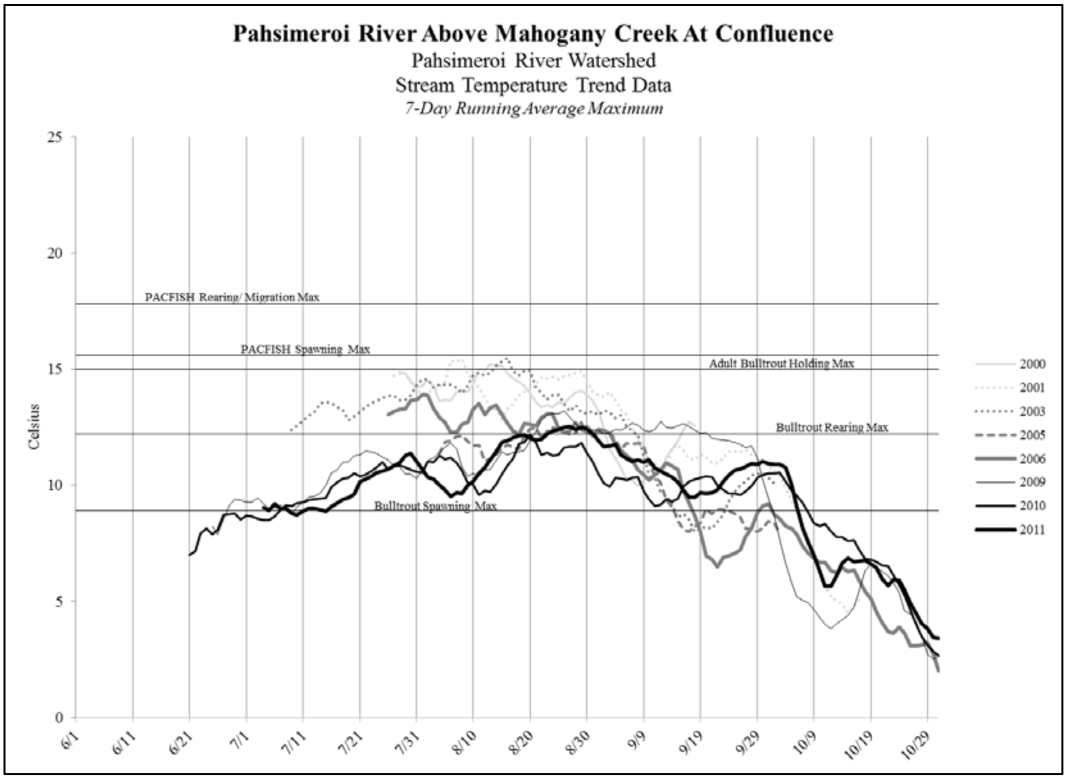

Figure E13. Compilation of select data with PACFISH criteria—Pahsimeroi River above Mahogany Creek.

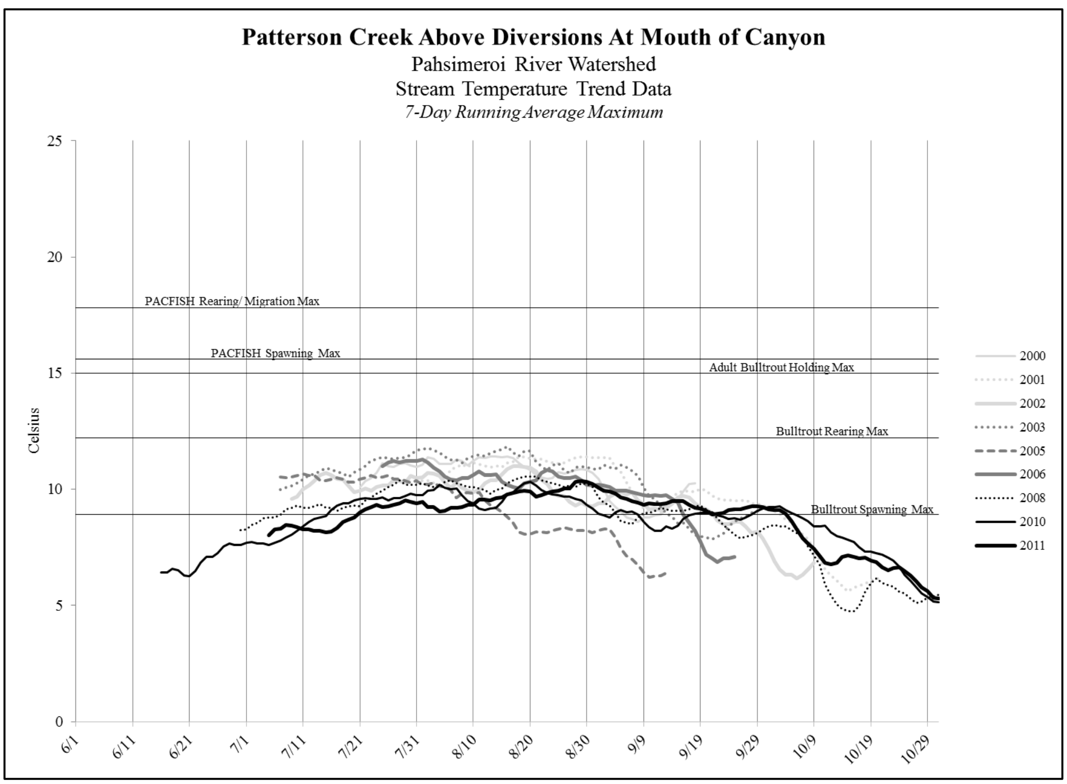

Figure E14. Compilation of select data with PACFISH criteria—Patterson Creek.

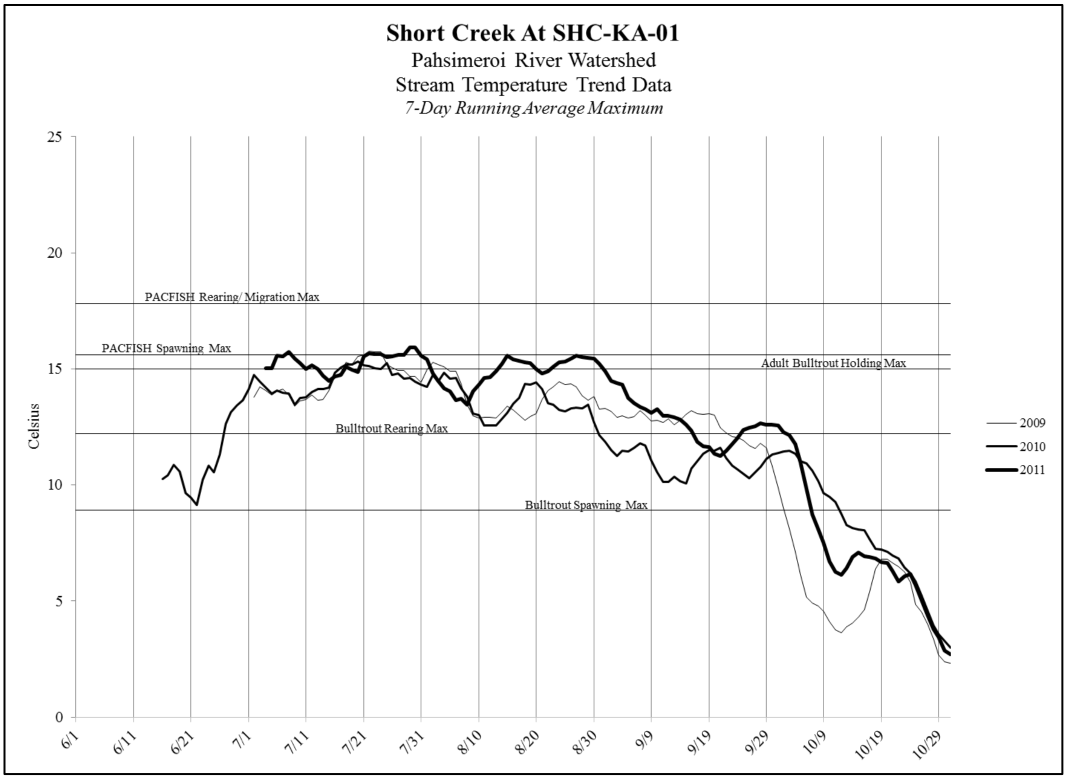

Figure E15. Compilation of select data with PACFISH criteria—Short Creek.

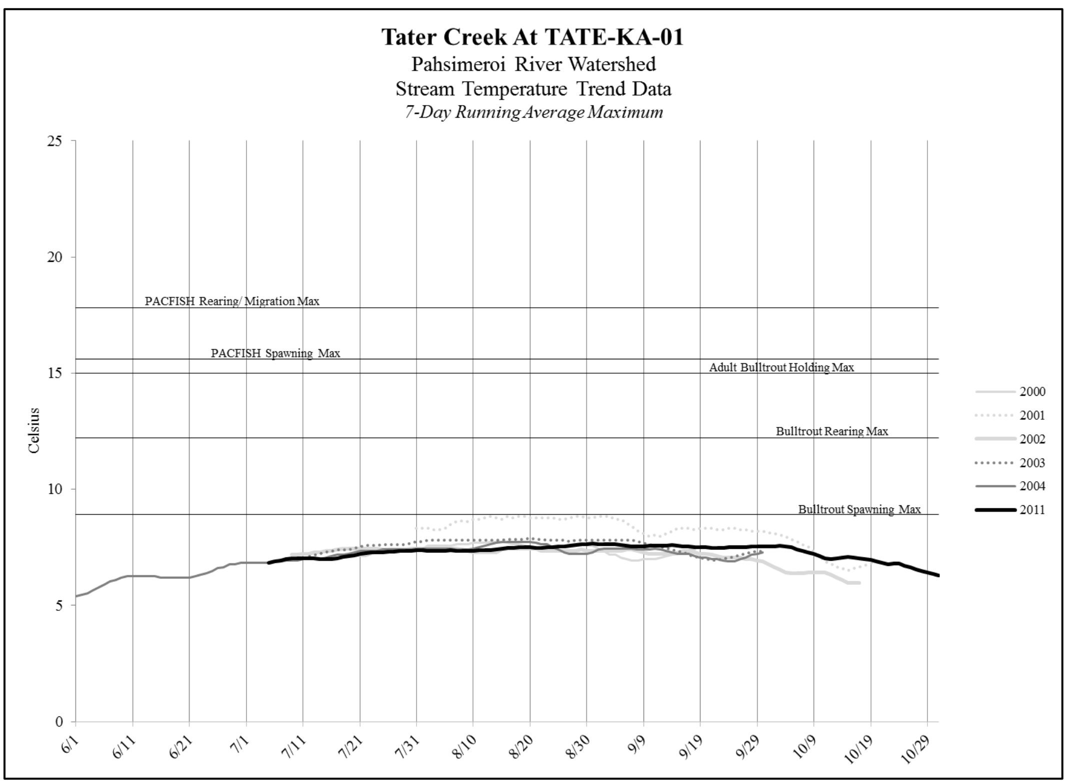

Figure E16. Compilation of select data with PACFISH criteria—Tater Creek.

Table E2. BLM MIM streambank and sediment data.

AU	Allotment:	DESIGNATED MONITORING AREA:			Downstream Marker		Streambanks			Substrate:			
		DMA ID	STREAM	DATE	Latitude	Longitude	Streambank Alteration (%)	Streambank stability(%)	Streambank cover (%)	Percent fines	D16 Particle Size (mm)	D50 Particle Size (mm)	D84 Particle Size (mm)
ID17060202SL002_02	Grouse Creek	SULP-KA-02	Sulphur Creek	10/5/2011	44.538832	-113.9228	16%	67%	77%	31%	1.2	22.63	50
	Grouse Creek	SULP-KA-01	sulphur creek	9/8/2011			7%	79%	73%	8%	8.3	20.19	40
		KA-1	Trail Creek	10/13/2010	44.5333	-113.9807	17%	56%	76%	43%	0.8	6.45	25
ID17060202SL006_02	Meadow Creek	MEADKA01	MEADOW CREEK	6/23/2011	44.457719	-113.922128	14%	72%	94%	39%	1.2	7.80	27
ID17060202SL008_04	County Line	PAR 01	Pahsimeroi River	9/29/2010	44.49982	-113.8222	4%	23%	29%	36%	0.9	16.33	37
ID17060202SL010_03	Lower Goldburg	GOLD-KA-02	Goldburg	7/20/2011			1%	85%	73%	22%	1.8	23.63	55
ID17060202SL010_04	GROUSE CREEK	PAR-KA-02	PAHSIMEROI RIVER	9/18/2012			2%	87%	73%	33%	1.0	20.69	53
ID17060202SL017_04	Donkey Hills	PAR-KA-01	Pahsimeroi River	9/28/2010	44.3139	-113.6536	9%	51%	51%	8%	11.3	23.65	50
ID17060202SL018_04	Upper Pahsimeroi	PAR-KA03	Pahsimeroi River	9/30/2010	44.2666	-113.6618	0%	79%	75%	17%	3.9	35.41	111
ID17060202SL023_03	PINES-ELKHORN	BRN-KA-05	BURNT CREEK	9/19/2012			12%	39%	34%	84%	0.4	1.20	5
ID17060202SL026_02	Dry Creek	SHC-KA-01	Short Creek	9/27/2010	44.19296	-113.6058	6%	69%	81%	34%	2.5	7.33	38
	Dry Creek	SHC-KA-02	Short Creek	9/28/2010	44.166475	-113.5993	7%	84%	92%	34%	1.4	12.32	47
ID17060202SL029_02	donkey hills	dh ka1	donkey creek	9/2/2010			4%	95%	99%	21%	2.4	27.30	70
ID17060202SL031_03	Big Creek	BGC-KA-02	Big Creek	9/30/2010	44.4473983	-113.622326	0%	67%	66%	8%	18.2	53.15	134

Table E3. BLM MIM habitat data.

AU	Alloment:	DESIGNATED MONITORING AREA:			Downstream Marker		Vegetation Ratings			Width and Shade			Pools		
		DMA ID	STREAM	DATE	Latitude	Longitude	Greenline Ecological Status Rating	Site Wetland Rating	Winward greenline stability rating	Greenline-greenline width (m)	Average Woody Plant Height (m)	Shade Index	Total number pools	Pool Frequency (#/mile)	Mean Residual Depth (m)
ID17060202SL002_02	Grouse Creek	SULP-KA-02	Sulphur Creek	10/5/2011	44.538832	-113.9228	6	41	2.43	3.15	1.2	0.09	2	113	0.15
	Grouse Creek	SULP-KA-01	sulphur creek	9/8/2011			5	49	2.26	1.57	1.2	0.08	25	349	0.09
		KA-1	Trail Creek	10/13/2010	44.5333	-113.9807	15	42	3.13	3.10	1.9	0.21			
ID17060202SL006_02	Meadow Creek	MEADKA01	MEADOW CREEK	6/23/2011	44.457719	-113.922128	3	28	2.10	3.11			10	185	0.09
ID17060202SL008_04	County Line	PAR 01	Pahsimeroi River	9/29/2010	44.49982	-113.8222	-2	51	2.47	6.98	2.0	0.08	5	63	0.58
ID17060202SL010_03	Lower Goldburg	GOLD-KA-02	Goldburg	7/20/2011			3	66	4.29	6.42	3.9	0.24	6	102	-0.22
ID17060202SL010_04	GROUSE CREEK	PAR-KA-02	PAHSIMEROI RIVER	9/18/2012			40	69	4.97	4.58	2.1	0.26	6	140	1.56
ID17060202SL017_04	Donkey Hills	PAR-KA-01	Pahsimeroi River	9/28/2010	44.3139	-113.6536	36	66	4.84	6.54	2.7	0.23	4	64	0.31
ID17060202SL018_04	Upper Pahsimeroi	PAR-KA03	Pahsimeroi River	9/30/2010	44.2666	-113.6618	100	93	8.17	5.18	4.8	0.70	8	115	0.41
ID17060202SL023_03	PINES-ELKHORN	BRN-KA-05	BURNT CREEK	9/19/2012			100	16	2.01	3.53	0.7	0.06	8	154	0.14
ID17060202SL026_02	Dry Creek	SHC-KA-01	Short Creek	9/27/2010	44.19296	-113.6058	74	74	6.19	1.83	2.1	0.31	15	309	0.13
	Dry Creek	SHC-KA-02	Short Creek	9/28/2010	44.166475	-113.5993	58	69	5.02	1.68	3.0	0.32	23	332	0.18
ID17060202SL029_02	donkey hills	dh ka1	donkey creek	9/2/2010			100	75	7.24	0.86	1.2	0.03	11	144	0.05
ID17060202SL031_03	Big Creek	BGC-KA-02	Big Creek	9/30/2010	44.4473983	-113.622326	44	60	5.83	10.65	2.2	0.10	4	45	0.38

Appendix F. Beneficial Use Reconnaissance Program Monitoring Index Scores—DEQ Idaho Falls Regional Office

BURP ID	Location Name	Date	Stream Macroinvertebrate Index	Stream Habitat Index	Stream Fish Index
1994SIDFA057	Morse Creek	08/02/1994	3	1	
1995SIDFA023		06/22/1995	3	2	
1995SIDFA024		06/22/1995	0	1	
1995SIDFA040		07/07/1995	3	3	
1995SIDFA083	Patterson Creek	08/09/1995	2	2	3
1995SIDFA084		08/10/1995	2	1	1
1995SIDFA086	Pahsimeroi River	08/14/1995	2	1	
1995SIDFA088	Big Creek	08/15/1995	3	1	
1995SIDFB046		07/19/1995	0	1	
1997SIDFM017	Long Creek	06/23/1997	0	1	
1997SIDFM018	Elkhorn Creek	06/23/1997	0	1	
1997SIDFM019	Short Creek	06/23/1997	2	1	2
1997SIDFM020	East Fork Burnt Creek	06/23/1997	0	1	3
1997SIDFM021	Burnt Creek	06/23/1997	3	1	1
1997SIDFM022	Mahogany Creek	06/24/1997	3	3	
1997SIDFM023	Mill Creek	06/24/1997	0	2	
1997SIDFM024	Elbow Creek	06/24/1997	1	1	
1997SIDFM025	Meadow Creek	06/24/1997	2	3	
1997SIDFM026		06/24/1997	3	1	
1997SIDFM027	Goldberg Creek	06/25/1997	3	2	
1997SIDFM028	Donkey Creek	06/25/1997	1	1	
1997SIDFM029	Goldburg Creek	06/25/1997	3	3	3
1997SIDFM030		06/25/1997	3	2	
1997SIDFM031	Ditch Creek	06/25/1997	3	1	
1997SIDFM032	Trail Creek	06/30/1997	3	1	
1997SIDFM033	Blind Fork Trail Creek	06/30/1997	1	1	
1997SIDFM034	Falls Creek	06/30/1997	3	1	2
1997SIDFM035	Tater Creek	06/30/1997	2	1	
1997SIDFM036	Morgan Creek	07/01/1997	0	1	
1997SIDFM037	South Fork Lawson Creek	07/01/1997	1	1	3
1997SIDFM038	Middle Fork Lawson Creek	07/01/1997	0	1	3
1997SIDFM039	North Fork Lawson Creek	07/01/1997	0	1	
1997SIDFM040	Lawson Creek	07/01/1997	1	1	
1997SIDFM128	Patterson Creek	08/26/1997	3	3	1
1998SIDFB121	Mill Creek	08/12/1998	0	1	
1998SIDFB122	Grouse Creek	08/12/1998	0	1	

BURP ID	Location Name	Date	Stream Macroinvertebrate Index	Stream Habitat Index	Stream Fish Index
1998SIDFB123	West Fork Pahsimeroi River	08/12/1998	3	2	2
1998SIDFB124	East Fork Pahsimeroi River	08/12/1998	3	1	2
1998SIDFB125	Pahsimeroi River	08/12/1998	3	2	1
1998SIDFB126	Snowslide Creek	08/12/1998	2	1	
1998SIDFB127	Goldburg Creek	08/12/1998	3	2	1
1998SIDFB128		08/12/1998	3	1	3
1998SIDFB129	Hillside Creek	08/17/1998	3	3	
1998SIDFB130	North Fork Big Creek	08/17/1998	3	3	2
1998SIDFB131	South Fork Big Creek	08/17/1998	3	3	3
1998SIDFB132	Stinking Creek	08/17/1998	1	1	
1998SIDFB133	Mill Creek	08/17/1998	3	3	2
1998SIDFB134	Inyo Creek	08/17/1998	3	3	2
1998SIDFB135	Mahogany Creek	08/17/1998	1	2	
1998SIDFB136	Burnt Creek	08/17/1998	2	1	
2001SIDFA116	Pahsimeroi River	08/29/2001	3	3	
2001SIDFA117	Burnt Creek	08/29/2001	3	1	2
2001SIDFA118	East Fork Pahsimeroi River	08/30/2001	3	3	1
2001SIDFA125	Morse Creek	09/05/2001	3	3	2
2001SIDFA127	Pahsimeroi River	09/06/2001	3	3	
2001SIDFV004	East Fork Pahsimeroi River	10/03/2001	2	3	
2002SIDFA050		08/12/2002	3	3	
2002SIDFV002		07/31/2002	3	3	
2003SIDFA129		09/02/2003	3	3	3
2004SDEQA001	Pahsimeroi River	07/01/2004	3	3	
2004SDEQA025		08/19/2004	3	3	
2004SDEQA026	East Fork Pahsimeroi River	08/20/2004	3	3	
2004SIDFA054		08/02/2004	3	2	3
2005SIDFA053		07/20/2005	3	3	
2005SIDFA071	South Fork Big Creek	07/27/2005	3	3	2
2006SIDFA035		07/11/2006	3	3	3
2006SIDFA071	East Fork Pahsimeroi River	07/31/2006	3	3	
2007SIDFA073	S Fk Big Creek	07/24/2007	3	3	3
2007SIDFA096	E Fk Pahsimeroi River	08/08/2007	3	3	
2008SIDFA134	Mahogany Creek	07/07/2008	3	3	1
2008SIDFA166	South Fork Big Creek	07/07/2008	3	3	3

Appendix G. Bacteria Data—Idaho Falls Regional DEQ Office

The Idaho water quality standard was revised from using fecal coliform to *E. coli* in 2006. Single *E. coli* sample values should not exceed 576 *E. coli* organisms/100 mL for waters designated for secondary contact recreation or 406 *E. coli* organisms/100 mL for waters designated for primary contact recreation. If the single sample value exceeds these limits, the geometric mean shall be determined.

The geometric mean should not exceed 126 *E. coli* organisms/100 mL based on a minimum of 5 samples taken every 3 to 7 days over a 30-day period (IDAPA 58.01.02.251.01.a.). This criterion supports both primary and secondary contact recreation.

Data sheets from the 2009 bacteria monitoring follow.

INTERMOUNTAIN ANALYTICAL SERVICES, INC.

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EnviroChem

INDUSTRIAL - WATER - WASTE - SOIL - GEOCHEMICAL - FIRE ASSAY - QA/QC

Idaho DEQ
Aaron Swift
900 N. Skyline Dr. Suite B
Idaho Falls, ID 83402

Date Submitted: 8/11/2009
Date Reported: 8/19/2009

Certificate of Analysis

Sample Description: Trail Cr.
Sampling Date: 08-11-2009
Sampling Time: 11:10
Date Received: 08-11-2009
Lab Tracking #: 108090927

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	224.7	MPN/100ml	Quantitray	08/11/09	BN
Total Kjeldahl Nitrogen:N mg/L	< 0.5	mg/L	351.2	08/13/09	RP
Total Phos:P mg/L	0.05	mg/L	365.2	08/12/09	RP

Sample Description: Meadow Cr.
Sampling Date: 08-11-2009
Sampling Time: 10:30
Date Received: 08-11-2009
Lab Tracking #: 108090928

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	4.1	MPN/100ml	Quantitray	08/11/09	BN
Total Kjeldahl Nitrogen:N mg/L	< 0.5	mg/L	351.2	08/13/09	RP
Total Phos:P mg/L	0.05	mg/L	365.2	08/12/09	RP

G. Ryan Pattie/la
Lab Director

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INDUSTRIAL · WATER · WASTE · SOIL · GEOCHEMICAL · FIRE ASSAY · QA/QC

Idaho DEQ
Aaron Swift
900 N. Skyline Dr. Suite B
Idaho Falls, ID 83402

Date Submitted: 8/11/2009
Date Reported: 8/19/2009

Certificate of Analysis

Sample Description: Main Stem Lawson Cr.
Sampling Date: 08-11-2009
Sampling Time: 11:35
Date Received: 08-11-2009
Lab Tracking #: 108090930

Analyte	Result	Units	Method	Analysis Date	Analyst
Total Kjeldahl Nitrogen:N mg/L	< 0.5	mg/L	351.2	08/13/09	RP
Total Phos:P mg/L	0.03	mg/L	365.2	08/12/09	RP

G. Ryan Pattie/la
Lab Director

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Idaho DEQ
Aaron Swift
900 N. Skyline Dr. Suite B
Idaho Falls, ID 83402

Date Submitted: 8/13/2009
Date Reported: 8/19/2009

Certificate of Analysis

Sample Description: Ditch Cr.
Sampling Date: 08-13-2009
Sampling Time: 8:45
Date Received: 08-13-2009
Lab Tracking #: 108091011

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	11.9	MPN/100ml	Quantitray	08/13/09	BN

Sample Description: Meadow Cr.
Sampling Date: 08-13-2009
Sampling Time: 9:55
Date Received: 08-13-2009
Lab Tracking #: 108091012

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	9.7	MPN/100ml	Quantitray	08/13/09	BN

Sample Description: Trail Cr.
Sampling Date: 08-13-2009
Sampling Time: 10:30
Date Received: 08-13-2009
Lab Tracking #: 108091013

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	32.7	MPN/100ml	Quantitray	08/13/09	BN

G. Ryan Pattie/la
Lab Director

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Idaho DEQ
Aaron Swift
900 N. Skyline Dr. Suite B
Idaho Falls, ID 83402

Date Submitted: 8/20/2009
Date Reported: 8/21/2009

Certificate of Analysis

Sample Description: Ditch Cr.
Sampling Date: 08-19-2009
Sampling Time: 11:00
Date Received: 08-20-2009
Lab Tracking #: 108091162

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	145.0	MPN/100ml	Quantitray	08/20/09	BN

Sample Description: Meadow Cr.
Sampling Date: 08-19-2009
Sampling Time: 11:45
Date Received: 08-20-2009
Lab Tracking #: 108091163

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	24.6	MPN/100ml	Quantitray	08/20/09	BN

Sample Description: Trail Cr.
Sampling Date: 08-19-2009
Sampling Time: 13:30
Date Received: 08-20-2009
Lab Tracking #: 108091164

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	> 2419.2	MPN/100ml	Quantitray	08/20/09	BN

G. Ryan Pattie/la
Lab Director

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Idaho DEQ
Aaron Swift
900 N. Skyline Dr. Suite B
Idaho Falls, ID 83402

Date Submitted: 8/27/2009
Date Reported: 9/1/2009

Certificate of Analysis

Sample Description: Ditch Cr.
Sampling Date: 08-26-2009
Sampling Time: 9:00
Date Received: 08-27-2009
Lab Tracking #: 108091271

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	23.1	MPN/100ml	Quantitray	08/27/09	BN

Sample Description: Meadow Cr.
Sampling Date: 08-26-2009
Sampling Time: 10:00
Date Received: 08-27-2009
Lab Tracking #: 108091272

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	5.2	MPN/100ml	Quantitray	08/27/09	BN

Sample Description: Trail Cr.
Sampling Date: 08-26-2009
Sampling Time: 10:30
Date Received: 08-27-2009
Lab Tracking #: 108091273

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	56.3	MPN/100ml	Quantitray	08/27/09	BN

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Aaron Swift
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Date Submitted: 9/3/2009
Date Reported: 9/8/2009

Certificate of Analysis

Sample Description: Ditch Cr.
Sampling Date: 09-03-2009
Sampling Time: 8:51
Date Received: 09-03-2009
Lab Tracking #: 109091448

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	7.4	MPN/100ml	Quantitray	09/03/09	BN

Sample Description: Meadow Cr.
Sampling Date: 09-03-2009
Sampling Time: 9:43
Date Received: 09-03-2009
Lab Tracking #: 109091449

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	19.9	MPN/100ml	Quantitray	09/03/09	BN

Sample Description: Trail Cr.
Sampling Date: 09-03-2009
Sampling Time: 10:14
Date Received: 09-03-2009
Lab Tracking #: 109091450

Analyte	Result	Units	Method	Analysis Date	Analyst
E. coli MPN/100ml	142.1	MPN/100ml	Quantitray	09/03/09	BN

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Data sheet from the 2010 bacteria monitoring follows:

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Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls ID, 83402

Date Submitted: 8/25/2010
Date Reported: 8/26/2010

Certificate of Analysis

Sample Description: Wildhorse 30-04
Sampling Date: 8/25/2010
Sampling Time: 09:45
Date Received: 8/25/2010
Lab Tracking #: I008191-01

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	3.0	MPN/100 mL	SM9223B	8/25/2010	MPH

Sample Description: Sage 22-02
Sampling Date: 8/25/2010
Sampling Time: 09:00
Date Received: 8/25/2010
Lab Tracking #: I008191-02

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	547.5	MPN/100 mL	SM9223B	8/25/2010	MPH

Sample Description: Goldburg 30-02
Sampling Date: 8/25/2010
Sampling Time: 11:30
Date Received: 8/25/2010
Lab Tracking #: I008191-03

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	60.1	MPN/100 mL	SM9223B	8/25/2010	MPH

Sample Description: Trail 02-02
Sampling Date: 8/25/2010
Sampling Time: 12:30
Date Received: 8/25/2010
Lab Tracking #: I008191-04

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	105.0	MPN/100 mL	SM9223B	8/25/2010	MPH

Sample Description: Lemhi 01-06
Sampling Date: 8/25/2010
Sampling Time: 13:30
Date Received: 8/25/2010
Lab Tracking #: I008191-05

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	547.5	MPN/100 mL	SM9223B	8/25/2010	MPH

Appendix H. Field Notes

Note on reconnaissance 26–28 September 2012: There were indications on the roadways (paved and dirt) of recent rains, additionally there were indications of soil surface crusts. Only recent animal tracks were apparent, and most of the soil was dry at the surface. Miscellaneous additions were added based on the 9 August 2012 reconnaissance.

ID17060202SL002_02: Pahsimeroi River – Meadow Creek to Patterson Creek *(tributaries)*

Trail Creek had minimal water flow in the streambed. The examined channel reach was confined by hills, which were arid with sagebrush as the dominant vegetation. Willows were spotted upstream and downstream of the channel reach.

Blind Creek was dry. This was an incised arroyo with the equivalent of a two-stage channel bed. There were no recent indications of in-arroyo channel flooding the entire bottom of the arroyo; therefore much of the bottom is above bank-full. Water appears confined to the channel with woody-vegetation (primarily sagebrush) stabilizing the arroyo bottom. There are signs of equilibrium returning to the channel.

A large herd of Elk were seen between Blind and Trail Creeks which is a contributing factor in to the *E. coli* exceedances. There were indications that elk were heavily using the area as it was the only water source for several miles.

Sulphur Creek was not visited at BURP or other monitoring locations, but in 2009 a streambank erosion survey identified sediment as a pollutant.

ID17060202SL002_04: Pahsimeroi River – Meadow Creek to Patterson Creek

At Hooper Road there were indications that this reach had some exclosures and that the willow populations were maturing. This AU should be fully re-examined in the next TMDL cycle for potential delisting.

ID17060202SL002_05: Pahsimeroi River – Meadow Creek to Patterson Creek

No indications of nuisance algae or nutrients.

ID17060202SL003_03: Lawson Creek – confluence of North and South Lawson Creek to Mouth

This segment was dewatered just below the confluence of the North Fork and the South Fork. No indications of erosion with the arroyo when water is present. This segment had some algae in the stream channel, not at nuisance levels impairing the beneficial uses. Algae appear to be related to low flows and stagnant portions of the stream. Previously entrenched, but woody-plants stabilizing the current channel at the bank-full width, there are sagebrush and other indicators that there is a terrace/inactive floodplain within that entrenchment.

ID17060202SL004_02: North Fork Lawson Creek – Source to mouth

Above the confluence with Middle Fork, the North Fork is dry. Indications of seeps as there was limited wet soil/stream bed with small willow groupings. Spacing between groupings had dry channel and lacked typical riparian vegetation. Middle Fork had springs and water in channel. There are surviving Water Birches, but exhibiting water stress, above the entrenched channel, which is now a remnant channel. There are indications that the Middle Fork is stabilizing as there were willows beginning to colonize the entrenched channel bottom, but currently insufficient to stabilize the channel. If there was a destabilizing event, the nick-point travelling up the channel would explain the currently stable mainstem channel and the Middle Fork channel erosion.

ID17060202SL005_02: South Fork Lawson Creek – Source to mouth

Channel was dry at the confluence with the North Fork, even with the recent rains. Wet soil and stagnant pool with algae at seep just above the confluence.

ID17060202SL006_02: Meadow Creek – Source to mouth

Meadow Creek is dewatered at an in-holding. Where access was available channel appeared to be stable from woody plants, if/when water were to flow.

ID17060202SL007_04: Pahsimeroi River – Furey Lane to Meadow Creek

River channel was dry. Channel bottom was composed of cobbles and gravels, no sign of bank erosion. Nor was there any sign of nuisance algae or mats of dry algae. There is no physical evidence to support suspicions of excess nutrients.

ID17060202SL009_02: Grouse Creek – Source to mouth

Channel was dry. Willows were visible upstream of examined reach, the upper basin was on an ATV compatible road impassible to the 4-Wheel drive vehicle. Based on the geology visible at the gap, it appears the willows were in a ground water seep controlled by the rock outcrops. There is not sufficient evidence to determine if beneficial uses of a dry channel are being met.

ID17060202SL010_03: Pahsimeroi River – Goldburg Creek to Big Creek

No indications of nuisance algae or nutrients. Willows were visible.

ID17060202SL010_04: Pahsimeroi River – Goldburg Creek to Big Creek

No indications of nuisance algae or nutrients. Willows were thick along visible bank. Fencing that could be exclosures were visible.

ID17060202SL010_05: Pahsimeroi River – Goldburg Creek to Big Creek

No indications of nuisance algae or nutrients. Willows were visible.

ID17060202SL011_04: Pahsimeroi River – Unnamed Tributary (T12N, R23E, Sec.22) to Goldburg Creek

Channel was dry on multiple visits (9 Aug 2012 and 26 Sep 2012). No indications of nuisance algae or nutrients.

ID17060202SL017_04: Pahsimeroi River – Burnt Creek to Unnamed Tributary (T12N, R23E, Sec.22)

Channel was dry on multiple visits (9 Aug 2012 and 26 Sep 2012). No indications of nuisance algae or nutrients. .

ID17060202SL023_03: Burnt Creek – Long Creek to mouth

Channel had become entrenched in past, but is currently stable. This fits the two-stage channel type used in stream channel restoration with a stable channel active floodplain at the bottom of the entrenchment. Some banks of the entrenched channel were not fully vegetated, but similar density to the vegetation existing on the semi-arid plains above. Recommend examining for temperature impairment next field season to rule out/identify potential impairments lumped in the combined biota/habitat. The 1998 BURP habitat score was low, may be indicative of lacking shade/cover or channel type/climate.

ID17060202SL026_02: Short Creek – Source to mouth

Channel was dry, but bank slumping, therefore it will be a sediment source when water flows. There is ample evidence of cattle.

ID17060202SL029_02: Donkey Creek – Source to mouth

Sediment survey performed, results were below the threshold of concern. Streambank was stable (using NRCS Streambank method), willows were present along stream reaches that are protected (i.e. hills to limit wind). Caddis fly nests on rocks. No indication of nuisance algae.

All the evidence suggests that this stream was improperly listed. The1997 BURP location is incorrectly listed in the integrated report for the ecoregion, thereby giving erroneous interpretation of condition for the macroinvertebrates. This data entry error may have led to inappropriate listing of the AU. Additionally, stream has discharge below 1 cfs, therefore will not be examined by BURP crews as it cannot meet the current threshold for sampling. This means that the analysis and comparative statistics used to list this stream were erroneously applied and results are (at best) suspect. My observations suggest that the stream habitat, water quality etc. are functioning to a high level based upon the limitations of elevation (~6560 ft), and climate (e.g. wind and limited precipitation). All the available evidence and data (recent and applicable) suggest that the stream is meeting its potential beneficial uses.

ID17060202SL030_02: Goldburg Creek – Source to Donkey Creek

Delist for Fecal Coliform, do not relist for E. coli as testing had a geometric mean at 21 MPN/100 ml.

ID17060202SL031_03: Big Creek – Confluence of North and South Fork Big Creeks to mouth

At canyon mouth the banks are stable. Below the canyon the stream is dewatered; channel is composed of cobbles and appears stable, if water were to flow.

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Appendix I. Pahsimeroi River TMDL Implementation Plan Update

Based on personal communication with Karma Bragg, Custer Soil and Water Conservation District (January 2013), DEQ determined that the implementation plan developed by Maser (2005) was essentially completed in full and that additional projects were completed that went beyond the scope of the 2005 implementation plan. Current on-going projects are often affiliated with the Upper Salmon Basin Watershed Program (see section 4.2 and Appendix B). The tables below are from the *Pahsimeroi River Subbasin Total Maximum Daily Load Agricultural Implementation Plan* (Maser 2005).

Type	**Extent**	**Total Cost**
Fence Riparian Exclusion	79,301 feet	$216,319
Diversion Modifications	7 projects	$616,802
Streambank Protection	2 projects	$33,853
Riparian Enhancement	1 project	$11,000
Total		**$877,974**

Descriptive Name	Project Description	Stream Reach	Stream Treated (ft)	Fencing Length (ft)	Water Saved (cfs)
Pahsimeroi River Riparian Enhancement	Fence was constructed to exclude grazing, enhance riparian vegetation, and protect critical spawning and rearing habitat	PR 16	5,280	5,808	0
Pahsimeroi River Riparian Enhancement	Fence was constructed to exclude grazing, enhance riparian vegetation, and protect critical spawning and rearing habitat	PR 16	4,382	4,382	0
Pahsimeroi River Flow Enhancement	Access was to be restored to 2.1 miles of the Pahsimeroi River and 5.7 miles of Patterson/Big Springs Creek for anadromous and resident fish	PR 6	0	0	6
Pahsimeroi River Riparian Enhancement	Fence was built to control grazing, enhance riparian vegetation, and protect critical spawning and rearing habitat on Patterson/Big Springs Creek	Pahsimeroi River and Tributaries	6,600	6,600	0
Pahsimeroi River P9 Diversion Enhancement	Reconstructed head gate for fish passage and water control	PR 6	0	0	0
Pahsimeroi River Riparian Enhancement	Fence was built to exclude grazing, enhance riparian vegetation, and protect critical spawning and rearing habitat on the Pahsimeroi River	PR 17	7,392	14,784	0
Pahsimeroi River Riparian Enhancement	Fence was constructed to exclude grazing, enhance riparian vegetation, and critical spawning and rearing habitat on the Pahsimeroi River	PR 13	4,224	7,709	0
Pahsimeroi River Riparian Enhancement	Established grazing system to improve riparian vegetation along the Pahsimeroi River	Pahsimeroi River and Tributaries	5,000	15,312	0
Pahsimeroi River Riparian Enhancement	Fence was constructed to protect the Pahsimeroi River	PR 6	5,808	5,808	0
Pahsimeroi River Stream Enhancement	Placed stream barbs to stabilize eroding streambanks and protect critical spawning habitat in the Pahsimeroi River	PR 13	2,640	0	0
Pahsimeroi River P8a Diversion Elimination	Eliminated unscreened diversion and maintained flows in Pahsimeroi River, Big Springs, Duck Springs, and Mud Springs creeks	PR 6	0	0	14
Lawson Creek, Pahsimeroi River Riparian Enhancement	Utilized Anderson Spring for livestock watering to eliminate grazing pressure from the Lawson Creek riparian area	Pahsimeroi River and Tributaries	0	0	0
Mahogany Creek, Pahsimeroi River Diversion Enhancement	Installed a livestock water pipeline to conserve water, improve fish passage, and improve livestock distribution	Pahsimeroi River and Tributaries	0	0	0
Pahsimeroi River Diversion Modification	Relocated diversion, eliminated 6 miles of ditch, conserved 6 cfs, and enhanced fish passage	PR 3	0	0	6
Pahsimeroi River Riparian Enhancement	Installed fence to protect the Pahsimeroi River	PR 8	4,382	4,382	0
Pahsimeroi River P12 Diversion Enhancement	Installed pipe to replace 2 miles of open ditch, installed sprinkler irrigation, and removed P11 diversion	PR 6	0	0	4
Pahsimeroi River Diversion Enhancement	Improved diversion for better water control and enhanced fish passage	PR 6	0	0	0
Pahsimeroi River Diversion Enhancement	Consolidated 2 ditches and installed 1 fish screen to eliminate fish barrier and excessive water loss	Pahsimeroi River and Tributaries	0	0	0
Muddy Springs, Pahsimeroi River Riparian Enhancement	Fence built to control grazing, enhance riparian vegetation, and protect critical spawning and rearing habitat on Muddy Springs and Pahsimeroi River	PR 7	10,560	14,516	0
Pahsimeroi River P11 Diversion Enhancement	Eliminate one diversion, consolidate remaining diversions, convert ditches to pipelines, convert flood to sprinkler irrigation, eliminate return flows, and save 7 to 10 cfs	PR 6	0	0	5
Pahsimeroi River Riparian Enhancement	Planted 2,100 willows on outside bends to stabilize streambanks as an Eagle Scout project	PR11	1,684		
		Total	57,176 FT or 10.8 Miles	79,301 FT or 15 miles	35 cfs

Appendix J. Potential Natural Vegetation Shade Curves

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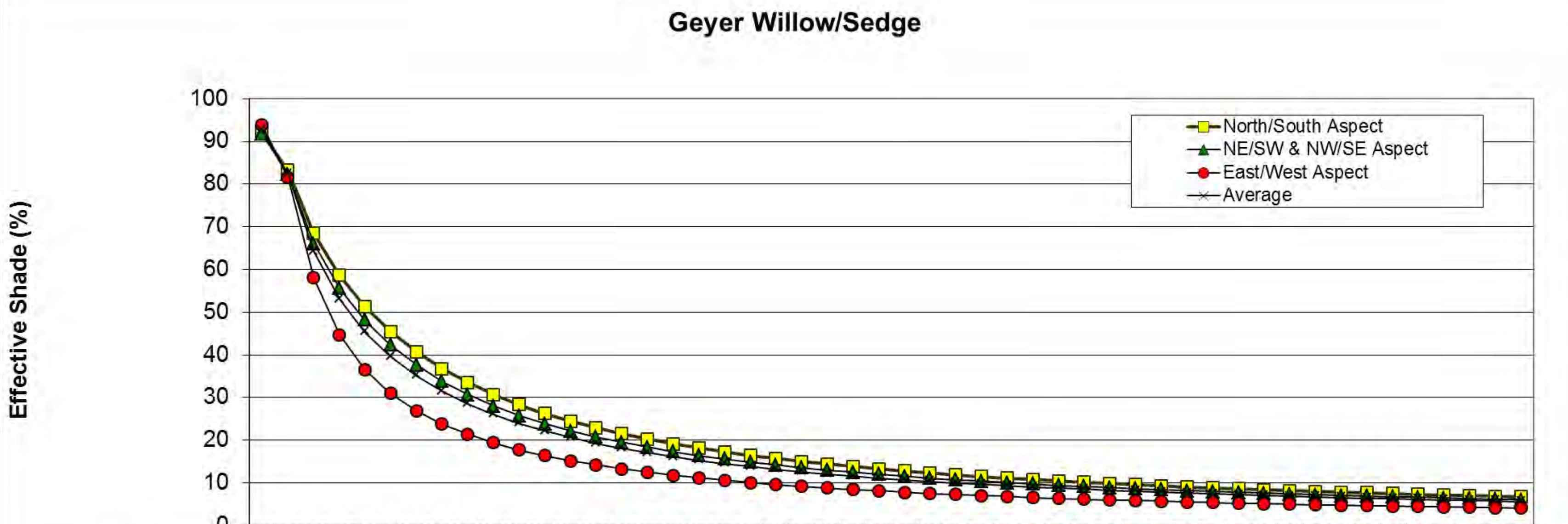

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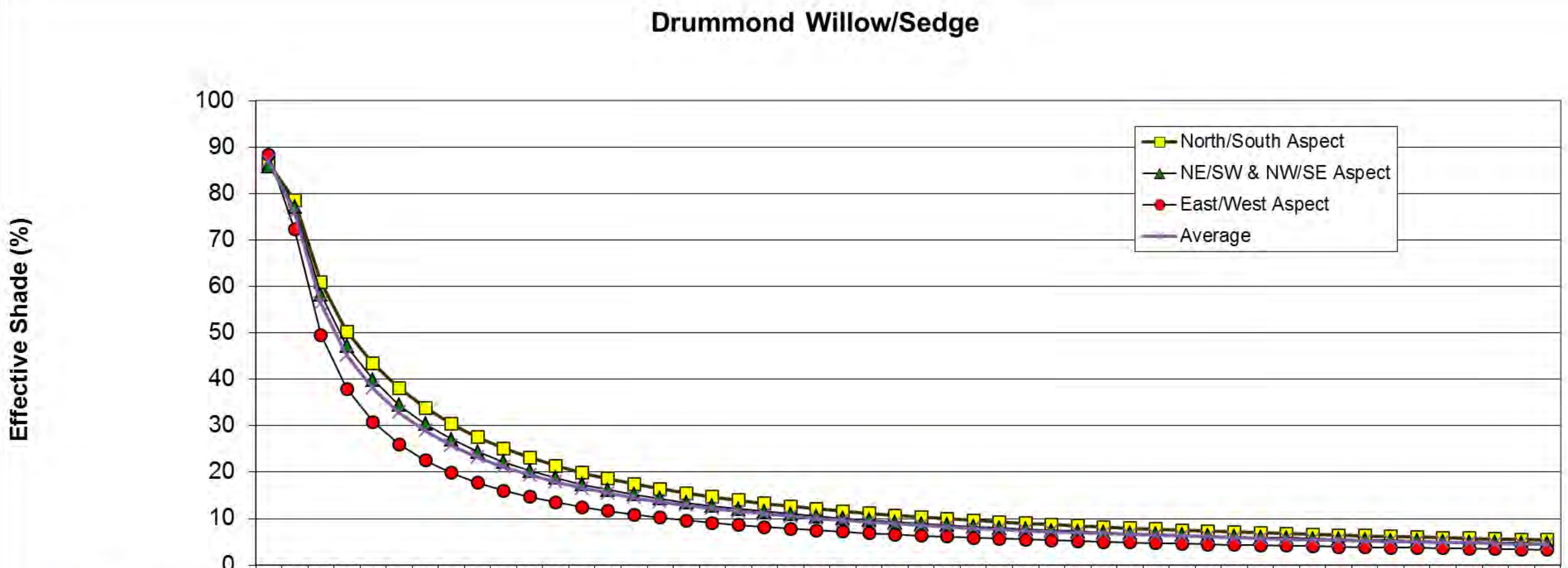
North/South Aspect	92	83	68	59	51	45	41	37	33	31	28	26	24	23	21	20	19	18	17	16	16	15	14	14	13
NE/SW & NW/SE Aspect	92	82	66	56	48	42	38	34	31	28	26	24	22	21	19	18	17	16	16	15	14	14	13	12	12
East/West Aspect	94	82	58	45	37	31	27	24	21	19	18	16	15	14	13	12	12	11	11	10	10	9	9	8	8
Average	93	82	64	53	45	40	35	31	29	26	24	22	21	19	18	17	16	15	14	14	13	13	12	12	11

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	13	12	12	11	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7
NE/SW & NW/SE Aspect	12	11	11	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6
East/West Aspect	8	8	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	4	4	4	4	4
Average	11	10	10	10	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	6

"Vegetation" Channel Width (meters)

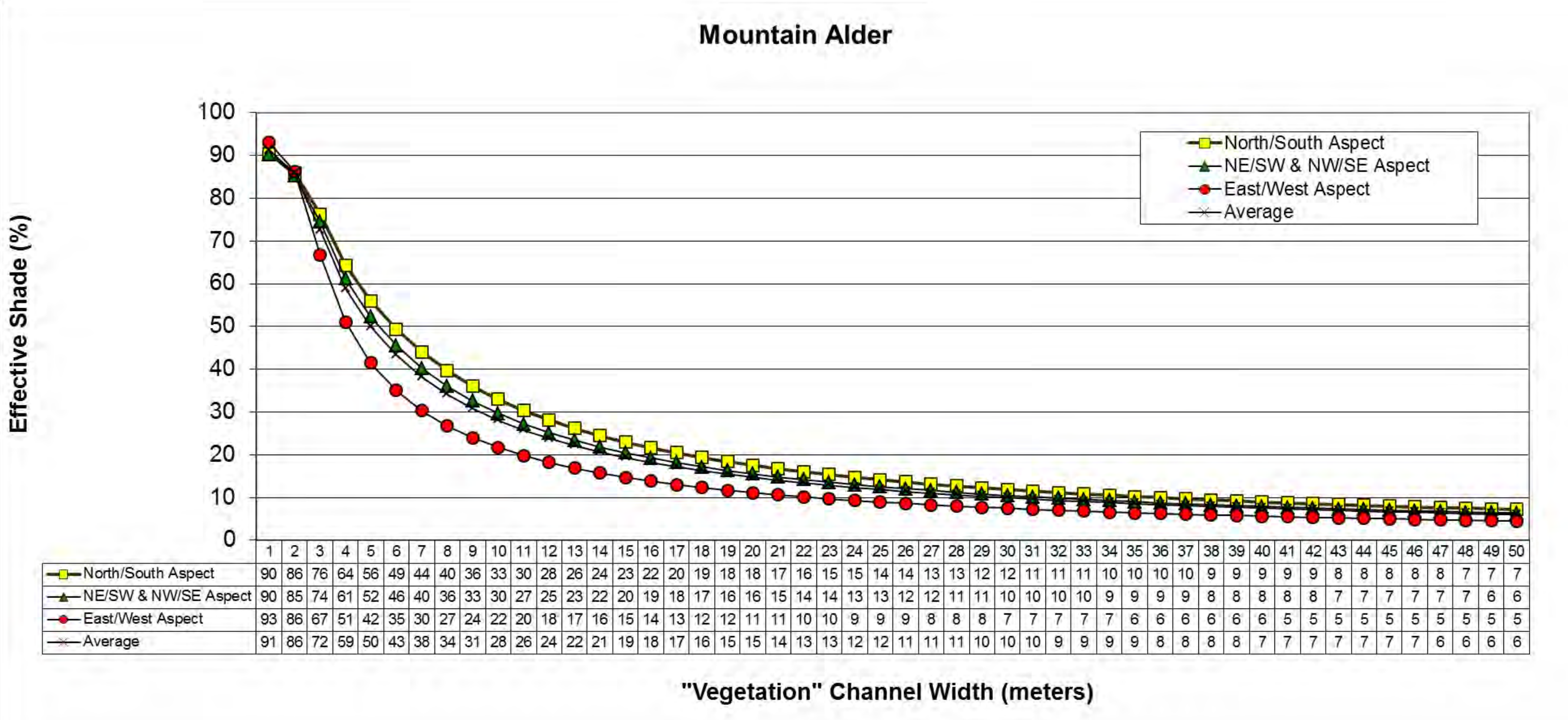
Figure J1. Geyer willow/sedge shade curve.



"Vegetation" Channel Width (meters)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	86	79	61	50	43	38	34	30	28	25	23	21	20	19	17	16	15	15	14	13	13	12	12	11	11
NE/SW & NW/SE Aspect	86	77	58	47	40	35	30	27	24	22	20	19	17	16	15	14	13	13	12	12	11	11	10	10	9
East/West Aspect	88	72	50	38	31	26	23	20	18	16	15	13	12	12	11	10	10	9	9	8	8	7	7	7	7
Average	87	76	56	45	38	33	29	26	23	21	19	18	17	15	14	14	13	12	12	11	10	10	10	9	9

"Vegetation" Channel Width (meters)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	10	10	10	9	9	9	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	6	6	5
NE/SW & NW/SE Aspect	9	9	8	8	8	8	7	7	7	7	6	6	6	6	6	6	6	5	5	5	5	5	5	5	5
East/West Aspect	6	6	6	6	6	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	3	3	3
Average	9	8	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	4

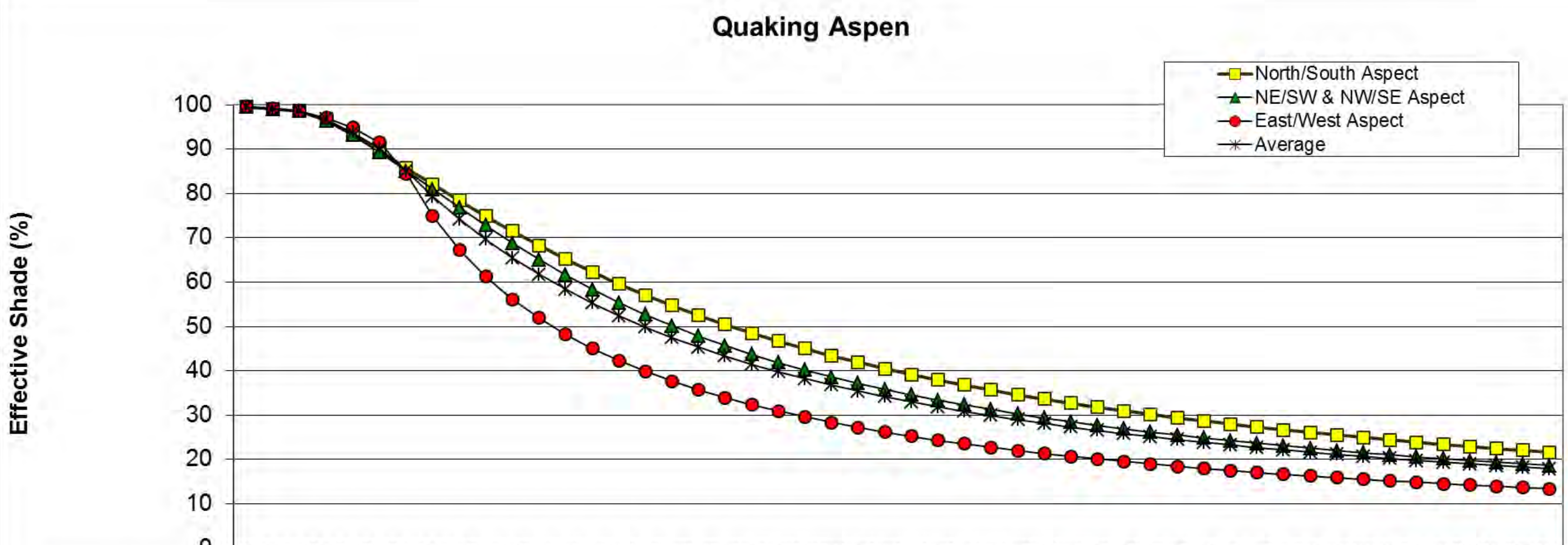
Figure J2. Drummond willow/sedge shade curve.



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

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	14	13	13	12	12	11	11	11	10	10	10	10	9	9	9	9	9	8	8	8	8	8	7	7	7
NE/SW & NW/SE Aspect	12	12	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6
East/West Aspect	9	8	8	8	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5
Average	11	11	11	10	10	10	9	9	9	9	8	8	8	8	7	7	7	7	7	7	7	6	6	6	6

Figure J3. Mountain alder shade curve.

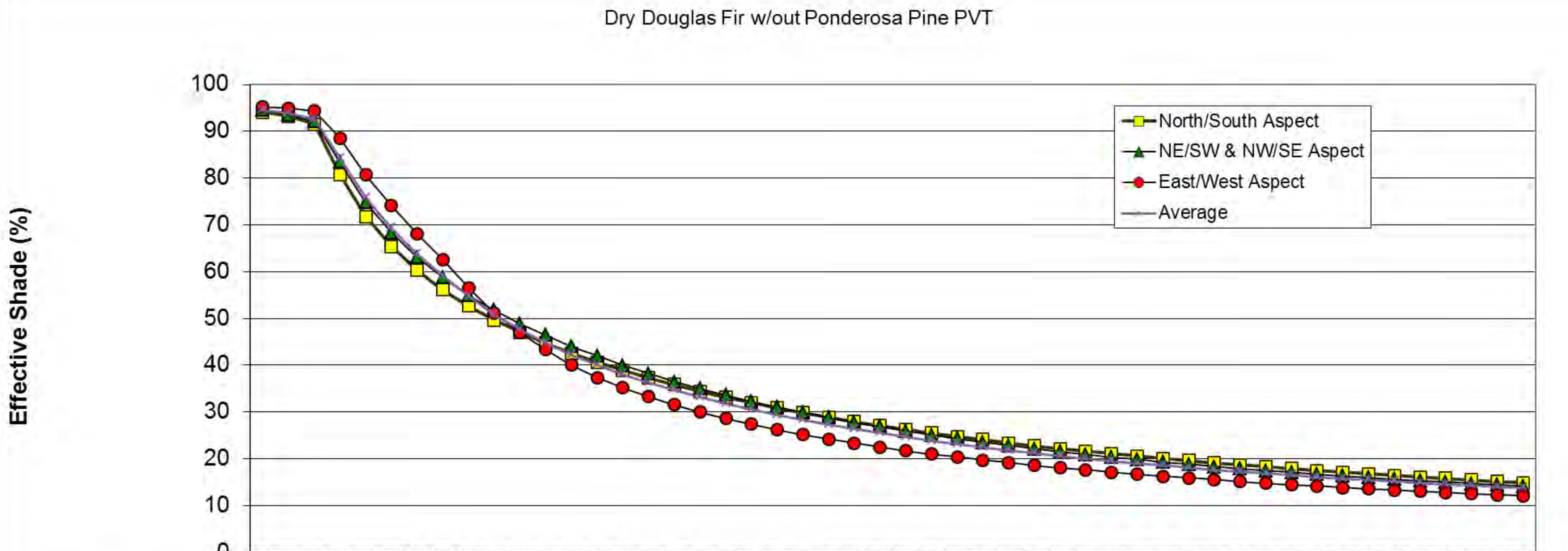


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	99	99	99	96	93	90	86	82	78	75	71	68	65	62	60	57	55	52	50	48	47	45	43	42	41
NE/SW & NW/SE Aspect	100	99	99	96	93	89	85	81	77	73	69	65	62	58	55	53	50	48	46	44	42	40	39	37	36
East/West Aspect	100	99	99	97	95	91	84	75	67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

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	39	38	37	36	35	34	33	32	31	30	29	29	28	27	27	26	26	25	24	24	23	23	22	22	22
NE/SW & NW/SE Aspect	35	33	32	31	30	29	29	28	27	26	26	25	24	24	23	23	22	22	21	21	20	20	19	19	19
East/West Aspect	25	24	24	23	22	21	21	20	20	19	18	18	18	17	17	16	16	16	15	15	15	14	14	14	13
Average	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22	22	21	21	20	20	19	19	19	18	18

"Vegetation" Channel Width (meters)

Figure J4. Quaking aspen shade curve.

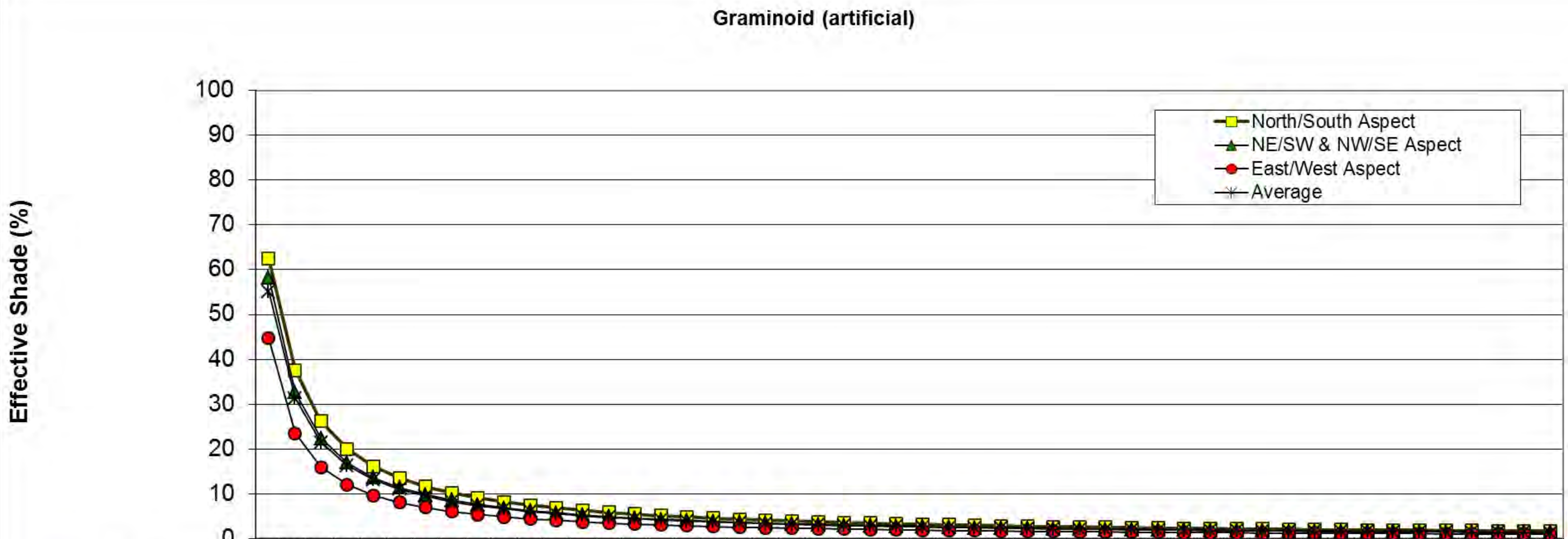


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	94	93	91	81	72	65	60	56	53	50	47	45	42	41	39	37	36	34	33	32	31	30	29	28	27
NE/SW & NW/SE Aspect	94	94	92	83	75	68	63	59	55	52	49	46	44	42	40	38	37	35	34	32	31	30	29	28	27
East/West Aspect	95	95	94	89	81	74	68	63	57	51	47	43	40	37	35	33	32	30	29	27	26	25	24	23	22
Average	95	94	93	84	76	69	64	59	55	51	48	45	42	40	38	36	35	33	32	31	29	28	27	26	25

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	26	25	25	24	23	23	22	22	21	21	20	20	19	19	18	18	17	17	17	16	16	16	15	15	15
NE/SW & NW/SE Aspect	26	25	24	24	23	22	22	21	20	20	19	19	18	18	17	17	17	16	16	16	15	15	15	14	14
East/West Aspect	22	21	20	20	19	19	18	18	17	17	16	16	16	15	15	14	14	14	14	13	13	13	13	12	12
Average	25	24	23	22	22	21	21	20	20	19	19	18	18	17	17	16	16	16	15	15	15	15	14	14	14

"Vegetation" Channel Width (meters)

Figure J5. Dry Douglas-fir without ponderosa pine shade curve.



"Vegetation" Channel Width (meters)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North/South Aspect	62	38	26	20	16	14	12	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	3	3
NE/SW & NW/SE Aspect	58	33	22	17	14	11	10	9	8	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	3
East/West Aspect	45	23	16	12	10	8	7	6	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2
Average	55	31	21	16	13	11	9	8	7	7	6	6	5	5	4	4	4	4	3	3	3	3	3	3	3

"Vegetation" Channel Width (meters)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE/SW & NW/SE Aspect	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
East/West Aspect	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Average	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1

Figure J6. Graminoid shade curve.

Appendix K. Public Comments/Public Participation

The watershed advisory group (WAG) and the public are key elements in total maximum daily load (TMDL) development. When requested, DEQ will provide the WAG with all available information pertinent to the subbasin assessment (SBA)/TMDL, such as monitoring data, water quality assessments, and relevant reports. The WAG also has the opportunity to actively participate in preparing the SBA/TMDL documents.

Once a draft SBA/TMDL is complete, it is reviewed first by the WAG, then by the public. If a WAG is not in agreement with an SBA/TMDL after WAG comments have been considered and incorporated, the WAG's position and the basis for it will be documented in the public notice of availability of the SBA/TMDL for review. If the WAG still disagrees with the SBA/TMDL after public comments have been considered and incorporated, DEQ must incorporate the WAG's dissenting opinion.

DEQ staff met with the Challis Experimental Stewardship Group, who acts as the Pahsimeroi River WAG, three times since the 2001 TMDL approval, prior to 2012. In 2012, the WAG was contacted and conferred with, including a November 2012 meeting in Challis, Idaho. On November 5, 2012, an initial meeting with the Challis Experimental Stewardship Program was held at the Challis BLM office. The TMDL strategy paper was distributed along with other information pertinent to the upcoming Pahsimeroi River subbasin TMDL. Comments and feedback were requested. None were filed at that time.

On December 5, 2012, the Pahsimeroi River Technical Workgroup (a subset of the USBWP) met at the Challis BLM office. The group received updated information and statistics on the Pahsimeroi River subbasin TMDL addendum. DEQ requested data, comments, and feedback; no comments or feedback were filed at that time. Data that were provided are included in the document.

The general public will have the opportunity to comment on this draft document during the public comment period. In the final version of this addendum, this appendix will include a summary of public comments.

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Appendix L. Distribution List

Both the draft and final version of this document are distributed to the following groups:

- Upper Salmon Basin Watershed Program
- Salmon Basin Advisory Group
- Challis Experimental Stewardship Group
- BLM and USFS Offices

These groups represent local landowners, producers, and federal and state agencies tasked with water quality improvements. In addition, the DEQ webpage makes all finalized TMDL addendums and 5-year reviews available here: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls.aspx.*

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