South Fork Boise River Subbasin Assessment, Total Maximum Daily Load, And Five-Year Review

Final

Department of Environmental Quality

December 2008

South Fork Boise River Subbasin Assessment,
Total Maximum Daily Load, And Five-Year Review

December 2008

Prepared by:
Boise Regional Office
Department of Environmental Quality
1445 North Orchard
Boise, ID 83706

and

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

Table of Contents

List of Tables

List of Figures

Abbreviations, Acronyms, and Symbols

§303(d) Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

μ micro, one one-thousandth

§ Section (usually a section of federal or state rules or statutes)

ADB assessment database

AU assessment unit

AWS agricultural water supply

BAG Basin Advisory Group

BLM United States Bureau of Land Management

BMP best management practice

BOD biochemical oxygen demand

BOR United States Bureau of Reclamation

Btu British thermal unit

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

cm centimeters

CWA Clean Water Act

CWAL cold water aquatic life

CWE cumulative watershed effects

DEQ Department of Environmental Quality

DO dissolved oxygen

DOI U.S. Department of the Interior

DWS domestic water supply

EMAP Environmental Monitoring and Assessment Program

EPA United States Environmental Protection Agency

ESA Endangered Species Act

F Fahrenheit

FPA Idaho Forest Practices Act

FWS U.S. Fish and Wildlife Service

GIS Geographical Information Systems

HUC Hydrologic Unit Code

I.C. Idaho Code

IDAPA Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
INFISH	the federal Inland Native Fish Strategy
IRIS	Integrated Risk Information System
km	kilometer
km^2	square kilometer
LA	load allocation
LC	load capacity
m	meter
m^3	cubic meter
mi	mile
mi^2	square miles
MBI	Macroinvertebrate Biotic Index
MGD	million gallons per day
mg/L	milligrams per liter
mm	millimeter
MOS	margin of safety
MRCL	multiresolution land cover
MWMT	maximum weekly maximum temperature
n.a.	not applicable
NA	not assessed
NB	natural background
nd	no data (data not available)
NFS	not fully supporting
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
ORV	off-road vehicle
ORW	Outstanding Resource Water
PACFISH	the federal Pacific Anadromous Fish Strategy
PCR	primary contact recreation
PFC	proper functioning condition
ppm	part(s) per million
QA	quality assurance
QC	quality control
RBP	rapid bioassessment protocol
RDI	DEQ’s River Diatom Index
RFI	DEQ’s River Fish Index
RHCA	riparian habitat conservation area
RMI	DEQ’s River Macroinvertebrate Index

RPI DEQ's River Physiochemical Index

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

SRP soluble reactive phosphorus

SS salmonid spawning
suspended sediment

SSOC stream segment of concern

STATSGO State Soil Geographic Database

TDG total dissolved gas

TDS total dissolved solids

T&E threatened and/or endangered species

TIN total inorganic nitrogen

TKN total Kjeldahl nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

U.S.C. United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WET whole effluence toxicity

WLA waste load allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section §303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section §303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. The United States Environmental Protection Agency (EPA) is the agency responsible for reviewing and approving TMDLs.

This document addresses the water bodies in the South Fork Boise River subbasin that were placed on Idaho's 2002 §303(d) list as well as the changes made in the draft 2008 Integrated Report. This subbasin assessment (SBA) and TMDL, have been developed to comply with Idaho's TMDL schedule.

The initial SBA for this watershed was completed in 2001 and describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the South Fork Boise River subbasin, located in southwest Idaho (Figure A). The SBA examines the current status of §303(d)-listed waters and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The starting point for this assessment was Idaho's 2002 §303(d) list of water quality limited water bodies. Fourteen AUs of the South Fork Boise River subbasin were on this list. Several changes were made to the list of water quality limited water bodies in the 2008 draft Integrated Report and are addressed in this document.

The TMDL quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards. In the South Fork Boise River subbasin, 10 assessment units (AUs) were found to be impaired by temperature, or contributing thermal loads to impaired streams, and TMDLs were developed for those AUs, as shown in Table C. While the TMDLs were in the development phase, Idaho approved legislation to implement a review process for SBAs and TMDLs. The South Fork Boise River subbasin was scheduled for review in 2008. Unlike TMDLs, these reviews are not reviewed or approved by EPA. To comply with the review schedule, this document also includes a five-year review.

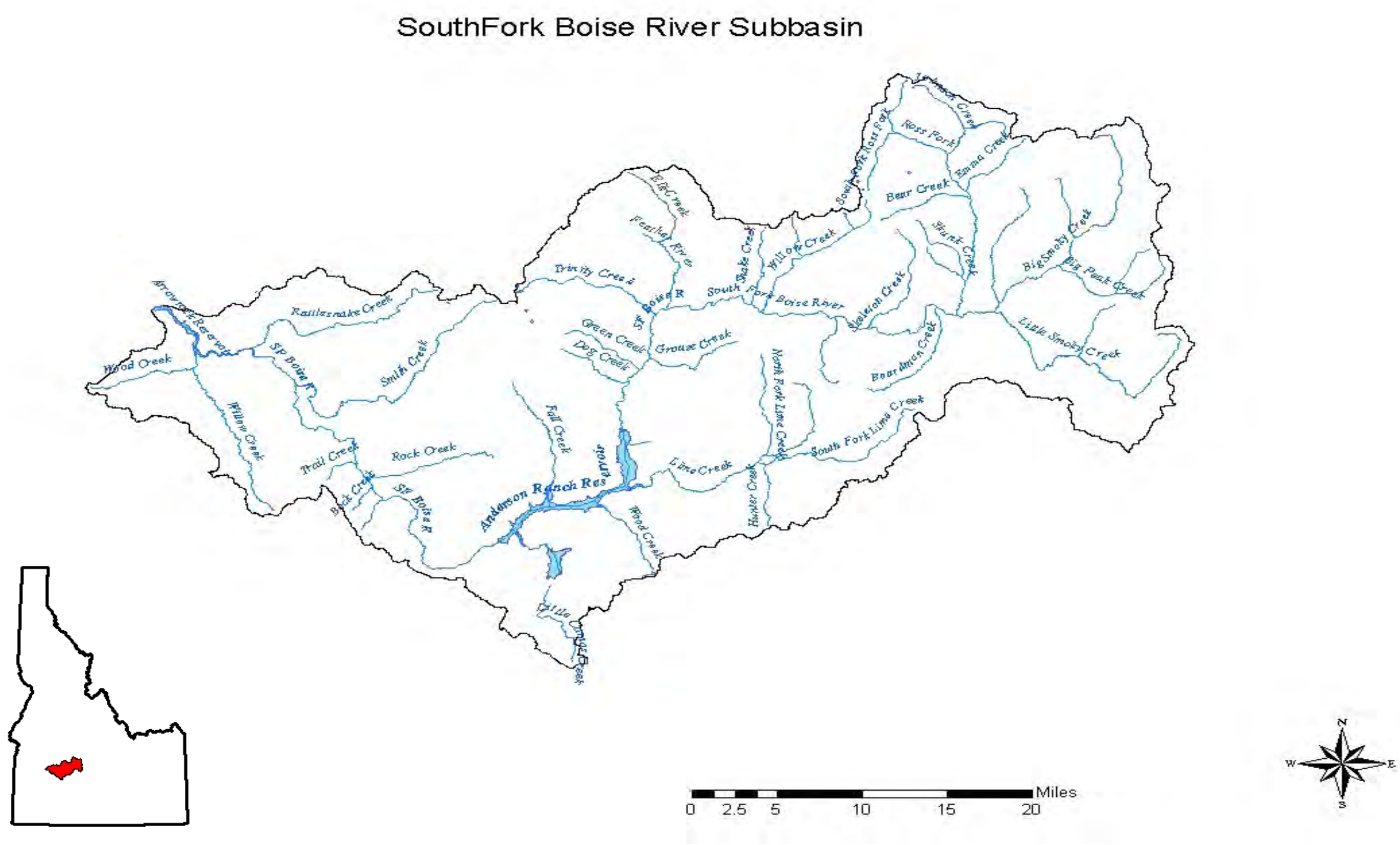


Figure A. South Fork Boise River Subbasin general location, streams and reservoirs.

Assessment Units

Prior to 2002, impaired waters were defined as stream segments with geographical descriptive boundaries. In 2002, DEQ modified the structure and format of Idaho's list of impaired waters, the 303(d) list, by combining it with the 305(b) report, required by the CWA to inform Congress of the state of Idaho's waters. This modification included identifying stream segments by assessment units (AUs) instead of non-uniform stream segments. This modification also included defining the use support of each stream AU as belonging in one of five categories, each of which is published as a section in the Integrated Report, in which section 5 lists all impaired waters. Assessment units (AUs) now define all the waters of the state of Idaho. These units and the methods used to describe them can be found in the WBAG II (Grafe, et al., 2002).

AUs are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs— even if ownership and land use change significantly, an AU remains the same. Because AUs are an extension of water body identification numbers, there is now a direct tie to the WQS for each AU, so that beneficial uses defined in the WQS are clearly tied to streams on the landscape.

To facilitate comparisons between the 1998 303 (d) list and the 2002 Section 5 "impaired waters" category in the Integrated Report, a crosswalk from the 1998 303 (d) list to the new AUs was included in the 2002 Integrated Report. A copy of the report is available from the DEQ website at http://www.deq.state.id.us/water/data_reports/surface_water/monitoring/2002.cfm#2002final. When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the 303(d) list (Section 5 of the integrated report).

This document addresses the AUs in the South Fork Boise River subbasin separately and develops a TMDL for listed AUs using potential natural vegetation (PNV) targets developed for western regions. In order to make this document more readable the AUs will be identified by abbreviated labels using the water body identification number (WBID), which is a suffix of the HUC (17050113) in the WQS, followed by the region of the state that includes the subbasin (SW for southwest) and a sequential numeral and a hyphenated Strahler (1957) stream order number. For example AU 17050113SW002a-02 will be abbreviated to AU 002a-02 in this report.

Five-Year Review

During the 2005 legislative session, the Idaho Legislature passed House Bill 145 (HB145), which amended several sections of Idaho Code (39-3601 et seq.) that relate to how the Department of Environmental Quality (DEQ) develops total maximum daily loads (TMDLs). HB145 codifies some existing practices and adds some new requirements. Many of the changes address the involvement of watershed advisory groups (WAGs) in TMDL development.

Every five years, DEQ will re-evaluate each SBA/TMDL and implementation plan, as well as the beneficial uses and water quality criteria relevant to the SBA/TMDL being evaluated, and examine new information and data. If a WAG believes the SBA, water quality standards, or implementation plan is unattainable or inappropriate based upon supporting water quality data, and the BAG agrees, DEQ may begin a process to determine whether the changes recommended by the WAG/BAG should be made. If the WAG/BAG advises that designated uses should be changed, DEQ may initiate a "use attainability analysis." The five-year reviews will begin in 2008; DEQ will begin reporting the results of those reviews to the legislature in 2009.

The five-year review may be a separate document from the SBA and TMDL, but in this instance the development of the TMDL was coincident with the schedule for the five-year review, so the review information and analysis is included in the SBA and TMDL document. In compliance with Idaho Code §39-3611, this document will present the findings of the SBA, the TMDL, and five-year review analysis.

The TMDLs are summarized in Table C, and a summary of the five-year review analysis and recommendations for the next Integrated Report are in Tables D and Table E. Based on the results of the five-year review, eight AUs are recommended for listing in Section 4c (Rivers Impaired by Flow or Habitat Alteration), 14 AUs are recommended for listing in Section 2 (Rivers Supporting All Uses), 10 AUs are recommended for listing in Section 4a—pending EPA approval (Rivers With EPA-Approved TMDLs), and two AUs are recommended for listing in Section 3 (Rivers Not Assessed) of the next Integrated Report. Rationale for recommendations is provided in the discussion of each AU in this sections' Summary of Decisions.

Point Sources and Waste Load Allocations

There is one known permitted point source, the Elk Valley subdivision wastewater treatment system, in Featherville, Idaho. The permit was approved in April 2005, for discharge into the South Fork Boise River via an unnamed tributary. Treatment of the wastewater at this facility consists of primary, secondary, and advanced treatment through two sequential batch reactors followed by sand filtration and ultraviolet disinfection. This point source does not require a waste load allocation (WLA) in the TMDL because it does not discharge to a stream that either requires or has a TMDL.

Implementation Projects

Private landowners, corporations, and federal and state agencies have cooperated to implement projects to improve water quality. A list of projects specific to the South Fork Boise River subbasin is summarized in Table A. This list is not exhaustive, and there may be projects on private land, without state/federal funding, that have not been included.

Table A. Recent stream or watershed enhancement and restoration projects.

Project Name	Subwatershed	Stream	Year
Beaver introductions	SF Lime-Hearn	SF Lime, Hunter Creek	2000>
Beaver introductions	Basalt	Basalt, Sawmill Creeks	2000>
Beaver introductions	Upper Little Smoky	Little Smoky Creek	2000>

Project Name	Subwatershed	Stream	Year
Road to trail conversion	Abbot-Shake	Shake Creek	2000
Noxious weed treatments	Most	Many	2000-present
Reduction in livestock grazing impacts	Most	Many	2000-present
Reduction in livestock grazing	Elk	Many	2000-present
Noxious Weed Treatments	Most	Many	2000-present
Trail Relocation/Decommissioning	Lower Willow	Many	2000-present
Trail Ford Rehabilitation	Lower Willow	Many	2000-present
Culvert Replacement for Fish Passage	Lower Trinity	Trinity, Johnson, Whiskey Jack Creek	2000
Culvert Replacement for Fish Passage	Wagontown-Schoolhouse	Green Creek	2000
Dispersed Campsite Rehabilitation	Cayuse-Rough	South Fork Boise River	2000-present
Dispersed Campsite Rehabilitation	Pierce-Mennecke	South Fork Boise River	2000-present
Reduction in livestock grazing	Feather River	Many	2000-present
Culvert Replacement for Fish Passage	Upper Trinity	Trinity Creek	2001
Boat Launch Restorations	Cayuse-Rough	South Fork Boise River	2002
Trail Relocation/Decommissioning	Wood	Wood & Bender Creek	2002-present
Trail Ford Rehabilitation	Wood	Many	2002-present
Beaver re-introductions	Black Canyon-Trail	Timber Gulch	2002
Bank Barbs @ Elks Flat	Dog-Nichols	South Fork Boise River	2003
Large woody debris placement for fish habitat	Upper Little Smoky	Little Smoky Creek	2003
Large woody debris placement for fish habitat	Carrie-Red Rock	Carrie Creek	2003
Logging trespass site rehabilitation	Carrie-Red Rock	Carrie Creek tributaries	2003
Dispersed Campsite Rehabilitation	Dog-Nichols	South Fork Boise River	2003
Trail Ford Rehabilitation	Upper Willow	Many	2002-present
Reduction in livestock grazing	Upper Rattlesnake	Many	2002-present
Reduction in livestock grazing	Upper Smith	Many	2002-present
Reduction in livestock grazing	Lower Smith	Many	2002-present
Reduction in livestock grazing	Cayuse-Rough	Many	2002-present
Reduction in livestock grazing	Pierce-Mennecke	Many	2002-present
Planted seedlings	Lower Fall	Mill & Lake Creeks	02-03
Beaver re-introductions	Lower Fall	Little Wilson & Lake Creeks	2000-2004
Riparian Plantings	Lower Fall	Little Wilson Creek	00/04

Project Name	Subwatershed	Stream	Year
Gully Restoration	Lower Fall	Little Wilson	03-04
Trail Relocation/Decommissioning	Big Fiddler-Soap	Many	2004
Trail Ford to Bridge	Wood	Wood Creek	2004
Road ford rehabilitation	Upper Little Smoky	Little Smoky Creek	2004
Trail ford rehabilitation	Basalt	Basalt, Sawmill Creeks	2004
Irrigation diversion fish passage improvement	Abbot-Shake	Shake Creek	2004
Trail rehabilitation/relocation	West Fork Big Smoky	West Fork Big Smoky tributaries	2004
Beaver re-introductions	Lower Trinity	Spring Creek	2005
Trail Relocation/Decommissioning	Lower Fall	Camp Creek	2005
Trail Ford to Bridge	Wood	Bender Creek	2005
Trail Ford Rehabilitation	Lower Fall	Camp Creek	2005
Riparian Plantings	Black Canyon-Trail	Timber Gulch	2005
Culvert placement to eliminate ford	Abbot-Shake	Log Chute Gulch	2005
Culvert removal for fish passage	Miller-Salt-Bowns	Salt Creek	2005
Developed campground riparian rehabilitation	Abbot-Shake	South Fork Boise River	2005
Trail rehabilitation/relocation	Boardman	Boardman Creek tributaries	2005-2006
Trail Ford Rehabilitation	Middle Fall	Tally Creek	2006
Trail Relocation/Decommissioning	Middle Fall	Tally Creek	2006
Trail Ford to Bridge	Wood	Flat Creek	2006
Beaver introduction	Upper Willow	Upper Willow, Worswick, Grindstone, Deer Creeks	2006
Culvert replacement for fish passage	Big Water-Virginia	Big Water Gulch	2006
Trail rehabilitation/relocation	Housman-Beaver	Beaver, Deadwood Creeks	2006-2007
Kelley Creek Flats dispersed recreation rehab	Big Water-Virginia	South Fork Boise River	2006-2007
Dispersed campsite rehabilitation	Worswick-Grindstone	Little Smoky Creek	2007
Dispersed campsite rehabilitation	Carrie-Red Rock	Little Smoky Creek	2007
Dispersed campsite rehabilitation	Upper Little Smoky	Little Smoky Creek	2007
Road ford rehabilitation	Emma-Axolotl	Emma Creek	2007
Unauthorized trail decommissioning	Abbot-Shake	Abbot Gulch	2007
Trail Ford to Bridge	Wood	Flat Creek	2007
Boat Launch Restorations	Pierce-Mennecke	South Fork Boise River	2007
Unauthorized road/trail decommissioning	Boardman	Boardman Creek tributaries	2008
Trail ford rehabilitation	Kelley	East Fork, West Fork, and mainstem Kelley Creek	2008
Unauthorized road/trail decommissioning	Miller-Salt-Bowns	Salt, Bowns, Miller Creek tributaries	2008

Subbasin at a Glance

The South Fork Boise River subbasin is located in southwestern Idaho. This watershed includes the South Fork Boise River upstream of the slack water of Arrowrock Reservoir, Anderson Ranch Reservoir, and all South Fork Boise River tributaries upstream to the headwaters. The subbasin area is approximately 835,645 acres and is situated east of

Boise, Idaho (Figure A). With the exception of 107,314 acres of private land and 28,620 acres of state land, the subbasin is federally owned and administered. The subbasin is located predominantly in Elmore and Camas counties, Idaho. Prairie, Pine, and Featherville are the only recognized communities in the watershed that have year-round residents; however, there are numerous sub-divided areas with second/summer/recreational homes located throughout the watershed. Access is provided by many miles of U.S. Forest Service-maintained roads and by county-owned or -maintained roads.

This watershed is identified in the National Hydrography Dataset (NHD) with Hydrologic Unit Code (HUC) ID17050113. There are 34 separate water body assessment units (AUs) described in detail in Section 2 and Appendix H of this document. Because all relevant AUs are within the same HUC, they will be discussed or referred to without the HUC prefix. In other words, the AU ID17050113SW001_02 will be abbreviated as 001_02, representing the water body unit ID (001) and the stream order (2) within HUC 17050113.

Table B summarizes the 14 AUs listed on the 2002 §303(d) list for the South Fork Boise River. Table C summarizes the beneficial uses of each listed segment. Figure B shows the South Fork Boise River subbasin, basic land uses, counties, major towns, and perennial streams.

Table B. Boundaries and pollutants of concern for §303(d)-listed water bodies in the South Fork Boise River subbasin (2002 §303(d) list).

Water Body Name	Assessment Unit ID Number	Listing Year	§303(d) Boundaries	Pollutant
Willow Creek	002a_02	2002	1st and 2nd order tributaries to upper Willow	Sediment
Willow Creek	002a_03	2002	Upper 3rd order	Sediment
Willow Creek	002b_03	2002	Lower 3rd order	Unknown
Willow Creek	002b_04	2002	Lower 4th order	Unknown
South Fork Boise River	004_02	2008	2nd order tributaries to S.F. Boise River	Unknown
South Fork Boise River	004_03	2002	3rd order – Dixie Creek	Unknown
South Fork Boise River	004_06	2002	6th order (mainstem of S. F. Boise River downstream of Anderson Ranch Dam to Arrowrock Reservoir)	Sediment
Anderson Ranch Reservoir	005_02	2002	1st and 2nd order tributaries – Goat and Lester Creeks	Unknown
Little Camas Creek Reservoir	007_0L	2008		Sediment
Moores Creek	010_03a	2002	3rd order	Unknown
Lime Creek	010_05	2002	5th order	Temperature
South Fork Boise River	015_02	2002	1st and 2nd order (tributaries to S.F. Boise River upstream of Anderson Ranch Dam)	Unknown
Little Smoky Creek	018_03	2008	3rd order	Unknown
Fall Creek	031_02	2002	1st and 2nd orders tributaries	Unknown
Smith Creek	032_02	2002	1st and 2nd orders tributaries	Temperature
Smith Creek	032_03	2002	3rd order	Unknown
Rattlesnake Creek	033_02	2002	1st and 2nd order tributaries	Sediment

Table C. South Fork Boise River Subbasin beneficial uses of §303(d)-listed streams.

Water Body Name	Assessment Unit ID Number	Beneficial Use[a]	Type of Use	IDAPA §
Willow Creek	002a_02 002a_03 002b_04 002b_03	Dry Stream Dry Stream CW, SS, PCR CW, SS, PCR	Designated	58.01.02.140.11.SW-2a 58.01.02.140.11.SW-2b
South Fork Boise River	004_03 004_06 015_02	CW, SS, PCR, DWS, SRW	Designated	58.01.02.140.11.SW-4, SW-13, SW-15 and SW-21
Anderson Ranch Reservoir tributaries	005_02	CW, SS, SCR, DWS, SRW	Designated	58.01.02.140.11.SW-5
Little Camas Creek Reservoir	007L_0L	SCR, PCR	Designated	58.01.02.140.11.SW-7
Lime Creek	010_03a 010_05	CW, PCR or SCR	Designated	58.01.02.101.01.a
Little Smoky Creek	018_03	CW, SS, SCR	Designated	58.01.02.140.11.SW-18
Fall Creek	031_02	CW, SS, PCR	Designated	58.01.02.140.11.SW-31
Smith Creek	032_03 032_02	CW, SS, PCR CW, SS, PCR	Designated	58.01.02.140.11.SW-32
Rattlesnake Creek	033_02	CW, SS, SCR	Designated	58.01.02.140.11.SW-33

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply

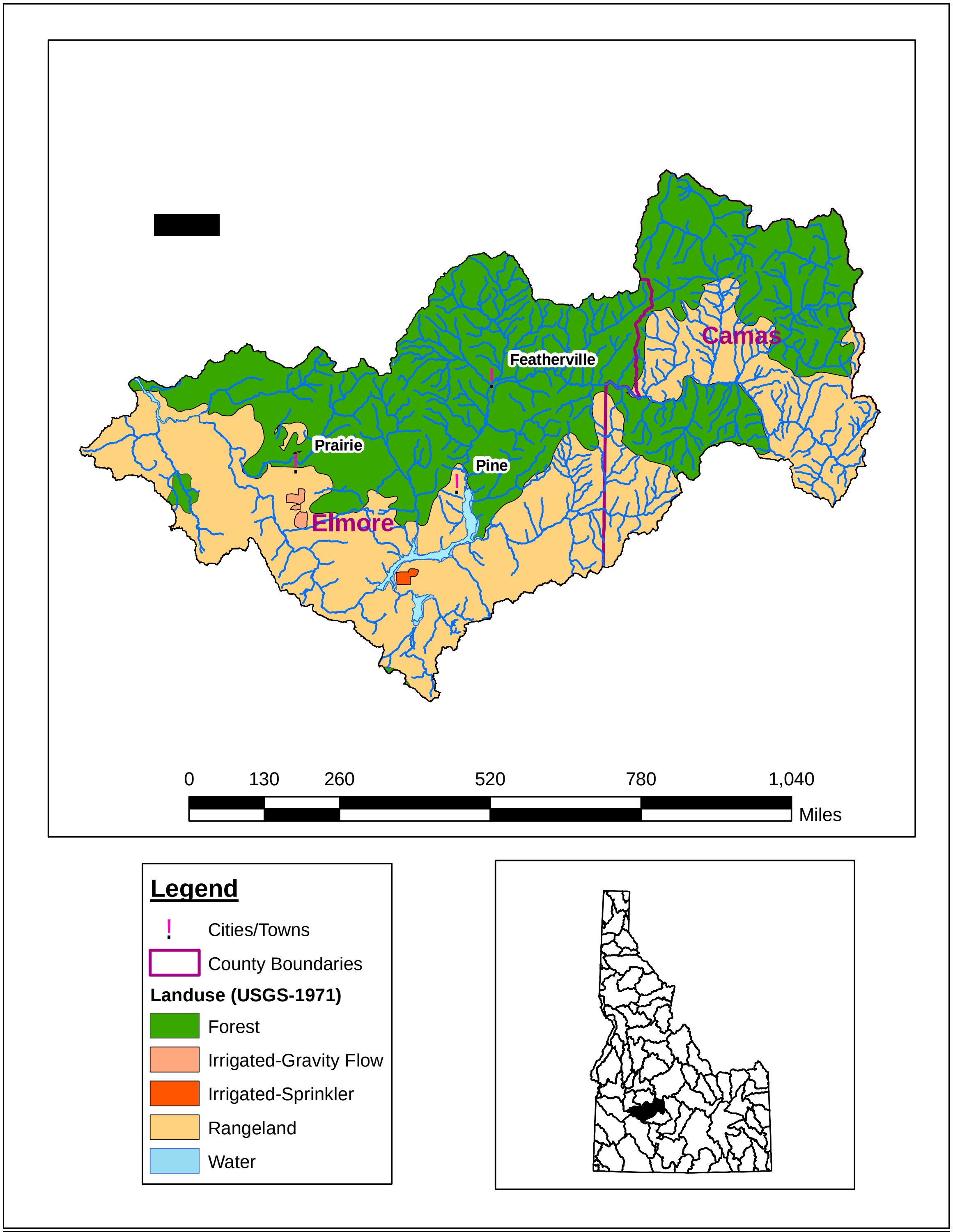


Figure B. South Fork Boise River Subbasin, Land Use, Counties, Major Towns, and Perennial Streams

Key Findings

During the analysis of the listed AUs, additional AUs not on the 2002 303 (d) list were identified as contributing thermal load to listed streams in the subbasin. Temperature TMDLs were written for Lime Creek and Smith Creek (Table D). Detailed subbasin analysis results are shown in Table E.

Many subbasin streams were not on the §303(d) list of impaired waters and did not require a TMDL. Determination of beneficial use support is based on evaluation of Beneficial Use Reconnaissance Program (BURP) surveys and other data, summarized in Table E.

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

Water Body Segment/ AU	Pollutant	Recommended Changes to §303(d) List	Justification
Smith Creek/ 032_03	Temperature	Move to Section 4a of integrated report.[1]	PNV
Lime Creek/ 010_02 010_04 010_05	Temperature	Move to Section 4a of integrated report.[1]	PNV
North Fork Lime Creek/ 010_02 010_03	Temperature	Move to Section 4a of integrated report.[1]	PNV
Middle Fork Lime Creek/ 010_02 010_03	Temperature	Move to Section 4a of integrated report.[1]	PNV
South Fork Lime Creek/ 011_02 011_03	Temperature	Move to Section 4a of integrated report.[1]	PNV

[1] Section 4a of Integrated Report, Rivers with EPA approved TMDLs

Table E summarizes current recommendations for AUs on the 2002 §303(d) and Section 5 Impaired Waters of the draft 2008 Integrated Report. The descriptions following Table E provide details regarding support status decisions.

Because the 2008 Integrated Report was not approved before completion of this document, the 2008 Integrated Report may not reflect recommendations made in this report. All recommendations for the next Integrated Report refer to the 2010 Integrated Report. Table E summarizes the AUs that are in Section 3 of the 2008 Integrated Report and recommendations for the 2010 Integrated Report.

Table E. Summary of assessment outcomes and recommended changes to the Integrated Report.

Water Body Segment AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Comments
Upper Willow Creek 002a_02	Sediment	None	Delist for Sediment. List for flow alteration Move to Section 4c.	Streams routinely go dry in mid-summer due to flow alteration.
Upper Willow Creek 002a_03	Sediment	None	Delist for Sediment. List for flow alteration Move to Section 4c.	Streams routinely go dry in mid-summer due to flow alteration.
Lower Willow Creek 002b_03	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Lower Willow Creek 002b_04	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
South Fork Boise River – 2nd order tributaries 004_02	Unknown	None	Delist for unknown. Move to Section 2.	Data indicates full support on perennial streams.
South Fork Boise River-Dixie Creek 004_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Natural events led to high sediment load in one stream segment.
South Fork Boise River - South Fork Boise River and Trail Creek 004_06	Sediment	None	Delist for Sediment. Move to Section 4c.	Listing status not supported by data. Flow is altered by reservoir management practices.
Anderson Ranch Reservoir – 1st and 2nd order tributaries –Goat, Lester, Wilson, Evans 005_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support on perennial streams.
Little Camas Creek Reservoir 007_0L	Sediment	None	Delist for Sediment. Move to Section 3.	Water body is Unassessed.
Moores Creek 010_03a	Unknown	None	Not Assessed	No Tier I data available
Lime Creek 010_05	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
South Fork Boise River - Jumbo Creek and Big Water Gulch 015_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Little Smoky Creek 018_03	Unknown	None	Delist for Unknown. Move to Section 2	Data indicates full support.
Fall Creek 031_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support
Smith Creek 032_02	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
Smith Creek 032_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Data indicates full support of beneficial uses. Nine constructed control points alter flow and habitat.
Rattlesnake Creek 033_02	Sediment	None	Delist for sediment. Move to Section 4c.	Natural fire activity/landslide led to flow and habitat alteration.

Table F. Assessment units whose status should be changed in the next Integrated Report.

Water Body Unit and AU	Recommended Changes to Integrated Report	Justification
Willow Creek 002a_02	Move from Section 3 to Section 4c	Flow altered
Willow Creek 002a_03	Move from Section 3 to Section 4c	Flow altered
Willow Creek 002b_03	Move from Section 3 to Section 2	Fully Supporting
Beaver Creek 016_02	Move from Section 3 to Section 2	Fully Supporting
Little Smoky Creek 018_04	Move from Section 3 to Section 2	Fully Supporting
Little Smoky Creek 018_05	Move from Section 3 to Section 2	Fully Supporting
Skeleton Creek 024_02	Move from Section 3 to Section 2	Fully Supporting
Willow Creek 025_02	Move from Section 3 to Section 2	Fully Supporting
Smith Creek 032_02	Move from Section 3 to Section 4a	Temperature TMDL developed
Rattlesnake Creek 033_02	Move from Section 3 to Section 4c	De-list for sediment and add for flow and habitat alteration

Summary of Decisions

The following paragraphs are brief explanations of the support status decisions shown in Table E and Table F above.

Upper Willow Creek - 002a_02

Four AUs of Willow Creek were listed on the 2002 §303(d) list. The 2nd order segment of upper Willow Creek was listed for sediment. The beneficial uses of this AU could not be determined from data collection because sites were dry at every attempt to survey. Upon further investigation, 16 constructed flow alterations were found in the AU. It was recommended that 2nd order upper Willow Creek be delisted for sediment, and listed for flow alteration. This segment was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report, and should be moved to Section 4c in the next version.

Upper Willow Creek - 002a_03

The 3rd order segment of upper Willow Creek was also listed for sediment and was also dry at each sampling attempt. In addition to the 16 flow alterations in the 2nd order AU, there are two constructed alterations in the 3rd order stream segment. Like the 2nd order segment, the 3rd order AU should be delisted for sediment, and listed for flow alteration. This segment was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report, and should be moved to Section 4c in the next version.

Lower Willow Creek – 002b_03

The 3rd order segment of lower Willow Creek was listed for unknown pollutants. BURP data indicates sediment is the likely cause of impairment; however, core sampling results of subsurface fine sediment are below the recommended maximum target or 27%. Based on expanded data collection results, sediment is not impairing the beneficial uses and no TMDL is necessary. This water body was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report and should be moved to Section 2 of the next version.

Lower Willow Creek – 002b_04

The 4th order segment of lower Willow Creek was listed for unknown pollutants on the 2002 §303(d) list. BURP data from 1997 report relatively high surface fine sediment (30%) and moderate bank stability (81.5%). The 4th order is a relatively short segment that flows into Arrowrock Reservoir. Downstream of the confluence of the two 3rd order streams, no tributaries flow into the 4th order before it meets the reservoir. Because additional data collection from 4th order lower Willow Creek could not be completed in 2008 due to high spring runoff, both 3rd order segments that flow into it (3rd order Willow and Wood Creeks) were sampled above the confluence for subsurface fine sediment. It is presumed that if both major tributaries to AU 002b_04 meet recommended standards for subsurface fine sediment, the 4th order segment will also meet standards. There have been no changes to the contributing drainage area in the past 11 years. Results of core sampling show that both 3rd order tributaries are below the recommended maximum for subsurface fine sediment. This AU should be moved to Section 2 of the next Integrated Report.

South Fork Boise River (2nd order tributaries) – 004_02

This AU was listed because of two sites with low BURP index scores. The first, Cayuse Creek, scored a zero because of a macroinvertebrate score of zero. Upon further analysis, it was determined that Cayuse Creek is intermittent, and the BURP score was not used to determine beneficial use support status. The second stream with a low BURP index score is Rough Creek. BURP data reported low streambank stability, which resulted in a low Habitat Index score. Upon further investigation, Rough Creek was found to have covered and stable banks for most of the reach, and subsurface fine sediment well below the recommended maximum of 27%. This AU should be delisted for unknown pollutants and moved to Section 2 of the next Integrated Report.

South Fork Boise River (Dixie Creek 3rd order) – 004_03

The 3rd order segment of Dixie Creek was listed for unknown pollutants. Data from a BURP survey in 1998 indicated that fine sediment might be the cause of impairment. Upon further investigation, it appears that the 1998 survey was conducted in a series of beaver ponds, which have naturally high levels of fine sediment. In addition, high flows in 2006 washed out a bridge crossing and part of a beaver dam downstream of the bridge. Core sample results for subsurface fine sediment collected between the old bridge and the beaver dam are 53%, which exceeds maximum recommended values of 27%, and the stream segment has unstable and severely eroding banks. Just downstream of the partially blown-out beaver dam the banks are generally stable and subsurface fines are below the recommended maximum (27%). Because the high sediment results in the BURP survey reach and the segment between the bridge and blown-out dam are due to natural events and flow and habitat alteration, no TMDL is necessary. This AU should be delisted for unknown pollutants , and listed in Section 4c of the next Integrated Report for habitat and flow alteration.

South Fork Boise River (6th order) – 004_06

This segment refers to the mainstem South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir and is a blue-ribbon trout fishery. This AU was originally listed as a Stream Segment of Concern, which is not an indicator of impairment. No data exists that indicate sediment impairment in this segment. Anderson Ranch Reservoir traps most of the sediment from the river and tributaries upstream and the segment of concern flows at high levels all summer as water is released from Anderson Ranch Reservoir. Flow conditions facilitate the transport of sediment that enters the AU from smaller tributaries into Arrowrock Reservoir. While no TMDL is necessary at this time, the segment should be listed in Section 4c of the next Integrated Report for flow alteration related to reservoir management practices.

Anderson Ranch Reservoir (2nd order tributaries) – 005_02

This AU was listed for unknown pollutants in 1st and 2nd order tributaries on the 2002 §303(d) list and carried over to the 2008 list. Goat and Lester Creeks are intermittent streams, which often dry up in the summer. These sites were not used in determination of beneficial use support status. Perennial streams were found to be fully supporting beneficial uses as documented in the 2008 South Fork Boise River TMDL/SBA and Five-Year Review and should be moved to Section 2 of the next Integrated Report.

Little Camas Creek Reservoir – 007L_0L

BURP surveys were conducted in 1998, 2000, and an attempt was made in 2004, but the site was listed as a marsh and the notes stated that the location was seepage from the reservoir that usually dries up in the summer. This AU should remain listed as Not Assessed and be moved to Section 3 of the next Integrated Report.

Moores Creek (3rd order) – 010_03a

This AU is listed for unknown pollutants on the 2002 §303(d) list. BURP information from 1998 shows high surface fine sediment and low bank stability indicating sediment may be the cause of impairment. Observations of the segment in May 2008 (Appendix I) confirmed the observations made in 1998; however these observations do not qualify as Tier I data. Streambank stabilization should be considered for this segment during implementation plan development, but it should be listed as Not Assessed until Tier I data is available.

Lime Creek (5th order) – 010_05

This was listed on the 2002 and 2008 §303(d) list for temperature. The impairment was confirmed and a temperature TMDL has been written and included in this document. This AU should be moved from Section 5 to Section 4a (pending approval of the temperature TMDL).

South Fork Boise River (2nd order tributaries) – 015_02

This AU was listed on the 2002 and 2008 §303(d) list for unknown pollutants. It was determined to be fully supporting beneficial uses as documented in this document and should be moved to Section 2 of the next Integrated Report.

Beaver Creek (2nd order) – 016_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Beaver Creek reports full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Little Smoky Creek – 018_03, 018_04, and 018_05

The 3rd order AU was added to the 2008 §303(d) list for unknown pollutants. It includes Grindstone, Liberal, Little Smoky, and Salt Creeks. Data for the 2004 BURP site is not consistent with the comments recorded or with the 2005 BURP survey upstream of the 2004 site. Percent surface fine sediment of 20% and bank stability of 89 and 86% are within recommended limits and canopy cover is adequate, however comments describe murky water with eroding banks and high embeddedness. The 2005 BURP site upstream of the 2004 site scored much higher in SHI. The 2004 BURP score should be reevaluated and no TMDL is necessary at this time.

The 4th and 5th AUs were listed in Section 3 (Unassessed Waters) on the 2008 Integrated Report. BURP surveys were conducted in 2007 for each of these AUs. The results of the macroinvertebrate samples collected during those surveys will not be available until fall 2008; however, it is presumed that both AUs are fully supporting all beneficial uses. This presumption is based on the habitat and fish data collected during the 2007 surveys as well as previous surveys completed in the water body unit, which report high macroinvertebrate scores. Both of these AUs should be moved to Section 2 of the next Integrated Report. See Section 2 for more data.

Skeleton Creek (2nd order) – 024_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Skeleton Creek reports full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Willow Creek (2nd order) – 025_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Edna Creek reports full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Fall Creek (2nd order) – 031_02

This AU was listed on the 2002 and 2008 §303(d) list and for unknown pollutants. It includes Camp and Meadow Creek. Meadow Creek was shown to be fully supporting beneficial uses in 2006. Camp Creek was shown to be dry in 2006, indicating that it is an intermittent stream. Perennial streams were found to be fully supporting beneficial uses and this AU should be moved to Section 2 of the next Integrated Report.

Smith Creek – 032_02 and 032_03

Smith Creek had two segments listed on the 2002 §303(d) list. The 2nd order segment of Smith Creek was listed for temperature. This segment was found to have beneficial uses impaired by temperature and a TMDL has been developed and is included in this document. This AU should be moved to Section 4a of the next Integrated Report (pending approval or the temperature TMDL).

The 3rd order segment of Smith Creek was listed for unknown pollutants. Data indicate that flow/habitat alteration is causing impairment of beneficial uses. There are nine constructed alterations in the 3rd order AU of Smith Creek. This includes eight reservoirs and one canal diversion being used to irrigate an agricultural field west of Prairie. The 3rd order AU of Smith Creek should be delisted for unknown pollutants and moved to Section 4c for flow and habitat alteration of the next Integrated Report.

Rattlesnake Creek (2nd order) – 033_02

Rattlesnake Creek was listed for sediment in the 2nd order segment. A wildfire burned much of the area in the Rattlesnake Creek watershed in 1992 (Idaho Bureau of Homeland Security website) and a rain-on-snow storm event caused landslides from Prairie to Garden Valley in late December 1996. These natural events increased sediment loads to the 2nd order segment of the Rattlesnake Creek drainage (Lawrence Donohoo, Mountain Home Ranger District, Personal Communication with Crystal Wolf (DEQ), March 2008). Terracing to prevent mass wasting of hill slopes until vegetation is re-established is evident on some of the hillsides surrounding Little Rattlesnake Creek. This AU should be moved to Section 4c of the next Integrated Report due to flow and habitat alteration from natural events.

Public Participation

DEQ has complied with the Technical Advisory Committee (TAC) consultation requirements in conformance with Idaho Code § 39-3611. A TAC for the South Fork Boise River TMDL was formed in October 2007 and recognized by DEQ in December 2007. DEQ provided the TAC with information concerning applicable WQS, water quality data, monitoring, assessments, reports, procedures, and schedules. The group met regularly over the course of the development of the TMDL in Boise. In 2007, the TAC met on November 19, and in 2008, the TAC met on January 14, March 5 and October 2.

EPA Report Form

The EPA has requested that a form be included with each TMDL submitted for approval. A copy of this form is included in Table G.

Table G. Data entry form submitted to TMDL with submission of this TMDL for approval by EPA.

Idaho TMDL Data Entry Form

Your Name: Susan Beattie
TMDL Document Name: South Fork Boise River Subbasin Assessment, Total Maximum Daily Load, and Five-Year Review
Submittal Date: Received Date: Established/Approved Date:
NTTS Data Entry Action (New or Edit):
Significant Tribal Involvement: Yes or No
9Revised TMDL *(Give title and approval date of previous TMDL that is partially or entirely revised by this TMDL):*
TMDL Web Address:
Pollutant or Surrogate[1]: _Temperature_____ (enter 1 pollutant here)
TMDL Type (NPS, NPS/PS, PS) NPS

Name of Water body	Assessment Unit #	Impairment[2]	Year Most Recently Listed
Smith Creek	17050113SW032_03	temperature	2002
Lime Creek	17050113SW010_02 17050113SW010_04 17050113SW010_05	temperature	2002
North Fork Lime Creek	17050113SW010_02 17050113SW010_03	temperature	na
Middle Fork Lime Creek	17050113SW010_02 17050113SW010_03	temperature	na
South Fork Lime Creek	17050113SW011-02 17050113SW011_03	temperature	na

Point Sources (If Applicable)

NPDES Permit Name and Number	Permit Number or Description[3]

Optional Information:

Other Comments: North Fork, Middle Fork, and South Fork of Lime Creek were not listed, but were identified as contributing thermal loads to listed streams during development of the SBA. A PNV TMDL was developed concurrently with the PNV TMDL for Smith and Lime Creeks.

[1] Pollutant or Surrogate: How is the TMDL allocations expressed (e.g. phosphorus, TSS etc)?
[2] Impairments: what pollutant(s) is the water body listed for (e.g. nutrients)?
[3] If the permit hasn't been issued (e.g. phase II stormwater permit), please include a description of the permit.

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section §303 of the CWA, are to adopt water quality standards (WQS) necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section §303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list must be published every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. 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.

This document addresses the water bodies in the South Fork Boise River subbasin that have been placed on Idaho's 2002 and draft 2008 §303(d) list.

Although not required, Idaho performs subbasin assessments (SBAs) in keeping with a subbasin-wide approach to TMDLs. This document includes an SBA and TMDL for the South Fork Boise Rir subbasin, along with the five-year review that is now required under House Bill 145 (HB145). One provision of HB145 is that every five years, DEQ will re-evaluate each SBA/TMDL and implementation plan, as well as the beneficial uses and water quality criteria relevant to the SBA/TMDL being evaluated, and examine new information and data.

The overall purpose of the SBA, TMDL, and five-year review is to characterize and document pollutant loads within the South Fork Boise River subbasin. The first portion of this document is the SBA, which is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Sections 1 – 4). This information will be used to develop a TMDL for each pollutant impairing the beneficial uses of water bodies in the South Fork Boise River subbasin (Section 5). Since the original SBA for this watershed was completed in 2001, the TMDL is based primarily on the 2002 §303(d) list. However, since the five-year review is scheduled to be completed in 2008, it is included in this document and addresses the 2008 §303(d) list.

1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act (CWA). The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Environment

Federation 1987, p. 9). The act and the programs it has generated have changed over the years, as experience and perceptions of water quality have changed.

The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section §303 of the CWA requires DEQ to adopt water quality standards (WQS) and to review those standards every three years. Idaho's water quality standards must be approved by EPA. Additionally, DEQ must monitor waters to identify those not meeting WQS. For waters not meeting standards, DEQ must establish a TMDL for each pollutant impairing the waters. Further, the agency must establish appropriate controls to restore water quality and allow the water bodies to meet their designated uses.

These requirements result in a list of impaired waters, called the "§303(d) list." This list describes water bodies not meeting WQS. Waters identified on this list require further analysis. An SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *Subbasin Assessment for Upper Boise River Watersheds* (IDEQ, 2000a) provides the initial summary for the 2002 303(d)-listed waters in the South Fork Boise River subbasin.

The SBA portion of this document (Sections 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the South Fork Boise River subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant that can be present in a water body and still allow that water body to meet WQS (Water quality planning and management, 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.

Some conditions that impair water quality do not receive TMDLs. The EPA does consider certain unnatural conditions, such as flow alteration, human-caused lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants to be "pollution." However, TMDLs are not required for water bodies that are impaired by pollution, but not by specific pollutants. A TMDL is only required when a pollutant can be identified and in some way quantified.

Idaho's Role

Idaho adopts WQS to protect public health and welfare, enhance the quality of water, 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 anti-degradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. The beneficial uses identified in Idaho Water Quality Standards (IDAPA 58.01.02) that pertain to the South Fork Boise River subbasin are:

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

The Idaho Legislature designates uses for water bodies. Industrial water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water aquatic life and primary contact recreation are used as additional default designated uses when water bodies are assessed.

An SBA entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, along with landscape data to address several objectives:

- Determine the status of support for designated beneficial uses of the water body (i.e., attaining or not attaining WQS).
- Determine the degree to which biological integrity is achieved.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

Assessment Units

Prior to 2002, impaired waters were defined as stream segments with geographical descriptive boundaries. In 2002, DEQ modified the structure and format of Idaho's list of impaired waters, the 303(d) list, by combining it with the 305(b) report, required by the CWA to inform Congress of the state of Idaho's waters. This modification included identifying stream segments by assessment units (AUs) instead of non-uniform stream segments. This modification also included defining the use support of each stream AUs as belonging in one of five categories, each of which is published as a section in the Integrated Report, in which section 5 lists all impaired waters. Assessment units (AUs) now define all the waters of the state of Idaho. These units and the methods used to describe them can be found in the WBAG II (Grafe, et al., 2002).

AUs are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs— even if ownership and land use change significantly, an AU remains the same. Because AUs are an extension of water body identification numbers, there is now a direct tie to the WQS for each AU, so that beneficial uses defined in the WQS are clearly tied to streams on the landscape.

To facilitate comparisons between the 1998 303 (d) list and the 2002 Integrated Report list of streams in the Section 5 “impaired waters” category, a crosswalk from the 1998 303 (d) list to the new AUs was included in the 2002 Integrated Report. A copy of the report is available from the DEQ website at http://www.deq.state.id.us/water/data_reports/surface_water/monitoring/2002.cfm#2002final. When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the 303(d) list (Section 5 of the integrated report).

This document addresses the AUs in the South Fork Boise River subbasin separately and develops a TMDL for temperature for each listed AU, and contributing waters, using potential natural vegetation (PNV) targets developed for western regions. To make this document more readable, the AUs will be identified by abbreviated labels using the water body identification number (WBID), which is a suffix of the HUC (17050113) in all cases in this document, followed by hyphenated stream order number (Strahler 1957). For example, AU 17050113SW002a-02 will be abbreviated to AU 002a-02 in this report.

1.2 Physical and Biological Characteristics

The subbasin for this SBA is located in southwestern Idaho, east of Boise, Idaho. It is comprised of the South Fork Boise River system upstream of Arrowrock Reservoir. The hydrologic cataloging unit (HUC) is identified on U.S. Geological Survey’s Hydrologic Unit Map (USGS 1974) as follows (Figure 1):

- ID17050113, South Fork Boise River - This watershed includes South Fork Boise River upstream from the slack water of Arrowrock Reservoir, Anderson Ranch Reservoir, the South Fork Boise River and all tributaries upstream to the headwaters.

The subbasin area is approximately 835,645 acres, of which 107,314 acres are private land and 28,620 acres are state land, with the remainder of the subbasin federally owned and administered. The Boise National Forest (BNF) and the Sawtooth National Forest (SNF) administer the federal lands. The subbasin is located in Elmore and Camas counties, Idaho. Prairie, Pine, and Featherville are the only recognized communities in the watershed that have year-round residents, with numerous sub-divided areas for second/summer/recreational homes located throughout the subbasin. Extensive access is provided by many miles of U.S. Forest Service-maintained roads, and by county-owned or -maintained roads.

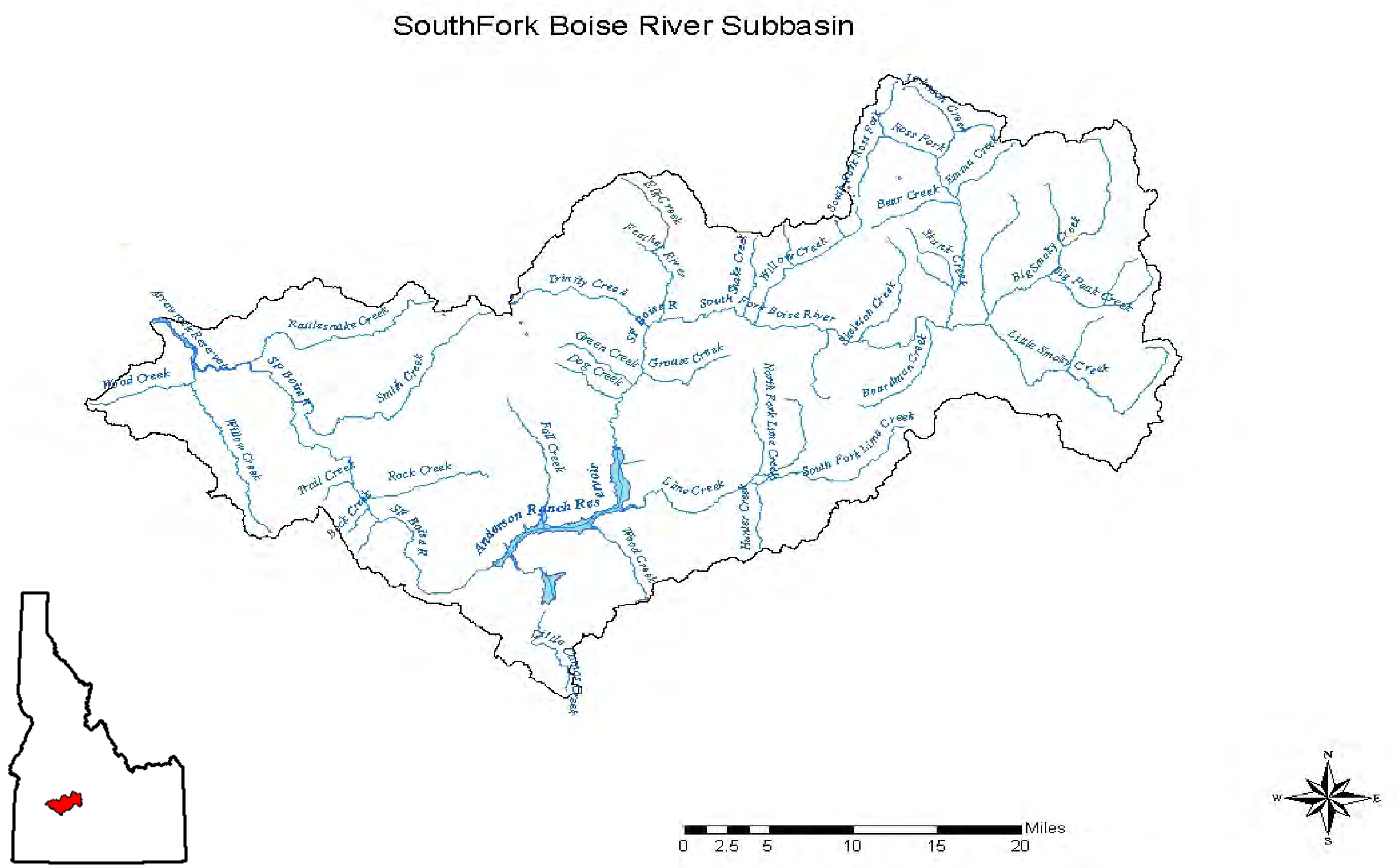


Figure 0. South Fork Boise River subbasin general location with streams and reservoirs.

Climate

The subbasin is located on the western/southern edge of the Sawtooth Mountain Range in Idaho, and has an upland continental climate. These forested watersheds drain south southwesterly from elevations above 10,000 feet (3,000 m) to 3,200 feet (975 m) along the South Fork Boise River. Surrounding mountains rise about 4,000 feet (1,220 m) above the valley floors. With this broad range of elevations, the subbasin experiences a wide range of air temperatures and precipitation types and amounts.

Winter months can be dominated by frequent heavy snowfall; however, season long snow cover is usually dependent on elevation. The majority of snow is usually melted by mid June in most of the watershed. Some year-round snowfields exist at higher elevations (Trinity and Steel Mountains, and Smoky Dome), but are dependent on winter accumulation and summer ambient air temperature. Mid-winter rapid snowmelts associated with rain-on-snow events are common at elevations below 5,000 feet. These natural events can contribute a considerable amount of sediment to surface waters in the subbasin. During summer months, air temperatures can warm rapidly and exceed 100 °F, but nighttime cooling can easily drop temperatures into the 30s and 40s even on the hottest days. Rapid uplifting of warmer air from the valley bottoms causes frequent late afternoon and evening thunderstorms. In the fall, the days are cooler and nighttime temperatures frequently drop below freezing. The first permanent snow generally occurs by mid-October.

The average annual precipitation in the Upper Boise River watersheds ranges from 20 to 50 inches annually (Figure 2). Based on data from Snow Telemetry (SNOTEL) stations around the basin, the greatest snowfall has been measured at more than 40 snow-water equivalent (SWE) inches in the mountains, and the smallest at less than 15 inches in the western part of the subbasin. Air temperatures within the Upper Boise River watersheds can fluctuate dramatically from month to month. Weather stations have recorded extremes as low as -32 ^{o}F (January) and as high as 109 ^{o}F (July, August). The mean monthly temperature ranges from 24.3 ^{o}F in January to 64.3 ^{o}F in August. Sunshine days range from 40-50% in winter to about 80% in summer (IDWR 1992). Table 1 shows basic climate data for the watershed. Figure 2 shows the average precipitation curves for the subbasin.

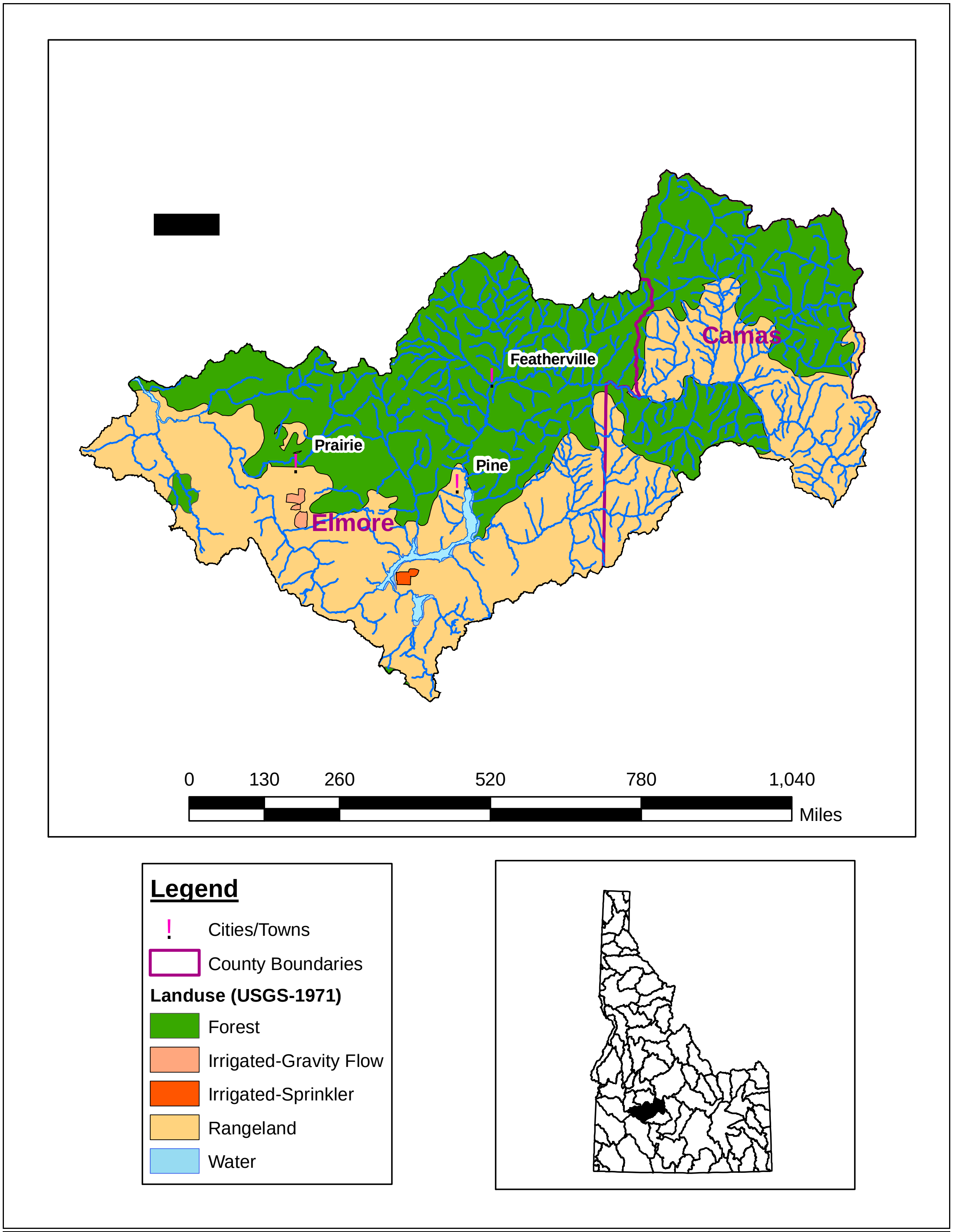


Figure 1. South Fork Boise River Subbasin, Land Use, Counties, Major Towns, and Perennial Streams

Table 1. Climate data for locations within the South Fork Boise River subbasin (Western Regional Climate Center, 2005).

Climate Factor	Anderson Dam	Arrowrock Dam
Elevation (feet)	4206.0	3216.0
Annual Precipitation (inches)	19.3	18.7
Annual Snowfall (inches)	55.6	41.3
Average January Precipitation (inches)	3.2	2.9
Average July Precipitation (inches)	0.4	0.3
Average January Minimum Temperature (°F)	19.0	19.7
Average January Maximum Temperature (°F)	34.6	34.0
Average July Minimum Temperature (°F)	55.8	56.5
Average July Maximum Temperature (°F)	91.0	90.6
Lowest Temperature (1948-2006) (°F)	-21	-20
Highest Temperature (1948-2006) (°F)	111	112

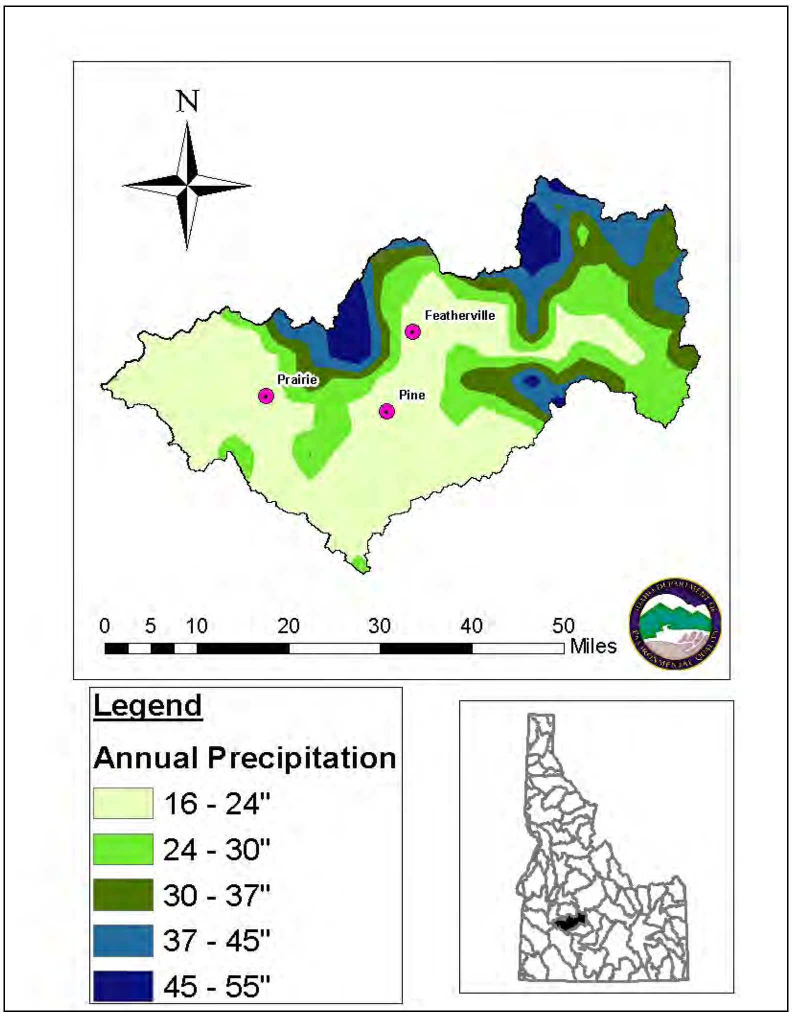


Figure 2. Annual Precipitation in the South Fork Boise River Subbasin

Geology/Landform

The geology of the South Fork Boise River subbasin is complex and is dominated by the Cretaceous Idaho Batholith and younger Tertiary granitic intrusions. Crosscutting the granitic formations are numerous Eocene dikes (igneous rock intrusions). Miocene basalt, interbedded with sedimentary rocks of the Payette Formation, cover the granite in places. These formations are subject to commercial mining activity. The area includes several major regional fault zones that have formed river canyons. The majority of the parent rock, Idaho Batholith, disaggregates easily on the steep slopes of the subbasin (Clayton, 1992).

The South Fork Boise River subbasin is dynamic in nature. The geomorphology of the watershed indicates an immature (relatively young) state. Most slopes are classified as steep, with stream channel morphology controlled by intermediate knick-points. Meadows are limited in number and extent. Steep landforms comprised of easily erodible granitic rock provides for naturally high erosion rates. The watershed is subject to rapid erosion and mass wasting with both chemical and mechanical weathering processes providing well-drained soils that enhance productivity for a forested ecosystem and commercial forest production and provide material for stream channels. In areas with intense land management activities, erosion rates are elevated above natural conditions. Mass wasting (blow-out) in the watershed is also a naturally occurring phenomenon. The watershed has recently experienced catastrophic fire and extreme weather conditions, which contribute to blow-outs.

The parent rock of the subbasin results in limited water-holding capability. Water transfer through rock and water-holding capacity of weathered rock near the surface suggest that fractures play a dominant role in flow rates and patterns. Intergranual porosity resulting from mineral grain weathering is very low. The rock materials with the greatest water holding capacity are the sedimentary rocks and alluvial sand and gravels located in the valley bottoms. This alluvium is critical to providing ground and surface water connectivity, which is critical for maintaining annual stream flow and low water temperatures.

Erosion provides soil and rock material necessary to support stream ecology and morphology. However, when excessive soil and rock materials are deposited in streams, water quality becomes impaired and aquatic life is negatively impacted. Mass wasting can be very destructive, but is usually a short-term effect. Mass wasting usually occurs in over-saturated soils on steepened slopes, and is enhanced in areas that have had recent fires and rain-on-snow events.

Although the geology in the subbasin is complicated, most of the rocks are similar in composition, which reduces the presence of waterfalls. Rocks of similar composition erode at similar rates, which minimizes knick-points and waterfalls. If waterfalls develop as a result of a catastrophic event, they are soon (on a geologic timescale) eliminated.

The east and northeast areas of the subbasin are composed of mountainous areas with sharp changes in elevation over relatively short distances. The western region of the watershed is characterized by less dramatic elevation changes. The town of Prairie is located on a large flat plain with rolling hills that mark the transition in the landscape from valley floor to rugged mountains. Figure 3 shows the basic topography of the watershed.

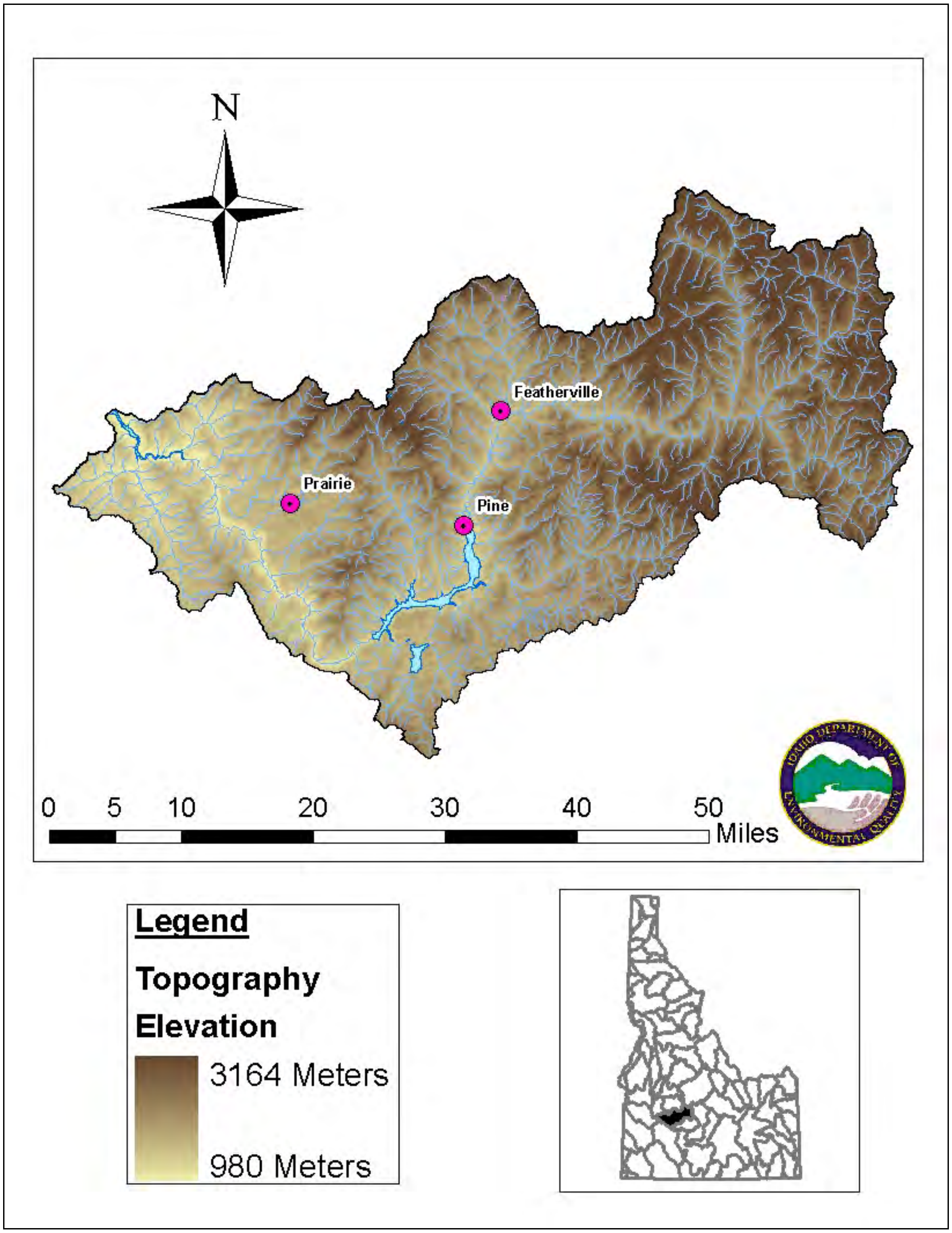


Figure 3. Topography of the South Fork Boise River Subbasin

Canopy Cover

Canopy cover, which is the vegetation that hangs directly over the stream, can be a surrogate for water temperature since vegetation influences the amount of sunlight reaching the stream (Platts et al. 1987). Canopy cover as it relates to the TMDL will be discussed in more detail in Section 5. Figure 4 indicates approximate percentages of canopy cover throughout the South Fork Boise River subbasin.

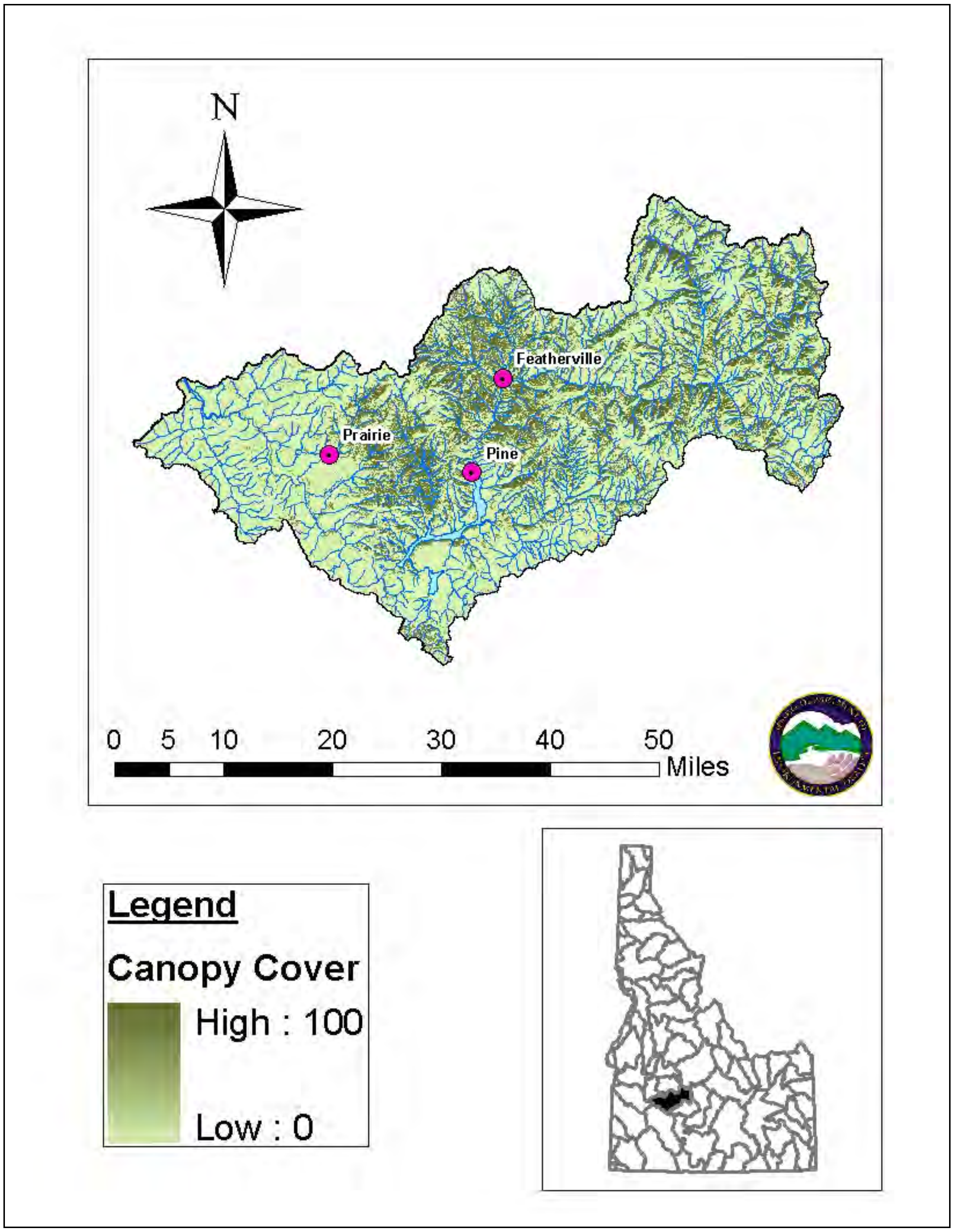


Figure 4. Canopy Cover in the South Fork Boise River Subbasin

Ecoregion

Ecoregions help stratify an environment based on its probable response to disturbance. Knowing the general ecoregion of an area can assist subbasin stakeholders in making informed decisions regarding management of the land (McGrath et al. 2001). Figure 5 shows the five main ecoregions of the South Fork Boise River subbasin, each of which is described in the following paragraphs.

Southern Forested Mountains

Major vegetation in the Southern Forested Mountains ecoregion includes Douglas-fir, lodgepole pine, aspen, and big sagebrush. Soil type is mainly derived from granitic geology.

Semiarid Foothills

The Semiarid Foothills ecoregion is typically rugged and unwooded. The soils are predominantly clay and support medusahead wild rye, cheatgrass, and other shrubs. Fire occurrence can be high in these areas as the shrubs and grasses tend to dry out in mid-summer. This ecoregion is commonly used for livestock grazing.

Foothill Shrublands-Grasslands

This ecoregion is often in the rain shadow of tall mountains. It is usually treeless, and as the name suggests, covered by shrubs and grasses and is commonly used for livestock grazing.

Dry Partly Wooded Mountains

Generally found in the rain shadow of tall mountains, major vegetation in the Dry Partly Wooded Mountains ecoregion includes mixed shrubland, Douglas-fir forest, and aspen. The soil is mainly derived from sedimentary and extrusive igneous rocks, with granite being less common than in the Southern Forested Mountains ecoregion. Winter precipitation is generally less than in the Southern Forested Mountain and the High Idaho Batholith ecoregions.

High Idaho Batholith

The High Idaho Batholith ecoregion is exposed to severe weather and temperatures and subject to greater precipitation than lower ecoregions. Major vegetation includes subalpine fir, lodgepole pine, whitebark pine, mountain hemlock, and alpine larch. At elevations above the tree line, tundra, meadows, and wetlands can occur. Terrain is described as having jagged, snowcapped peaks with soils being mostly stony.

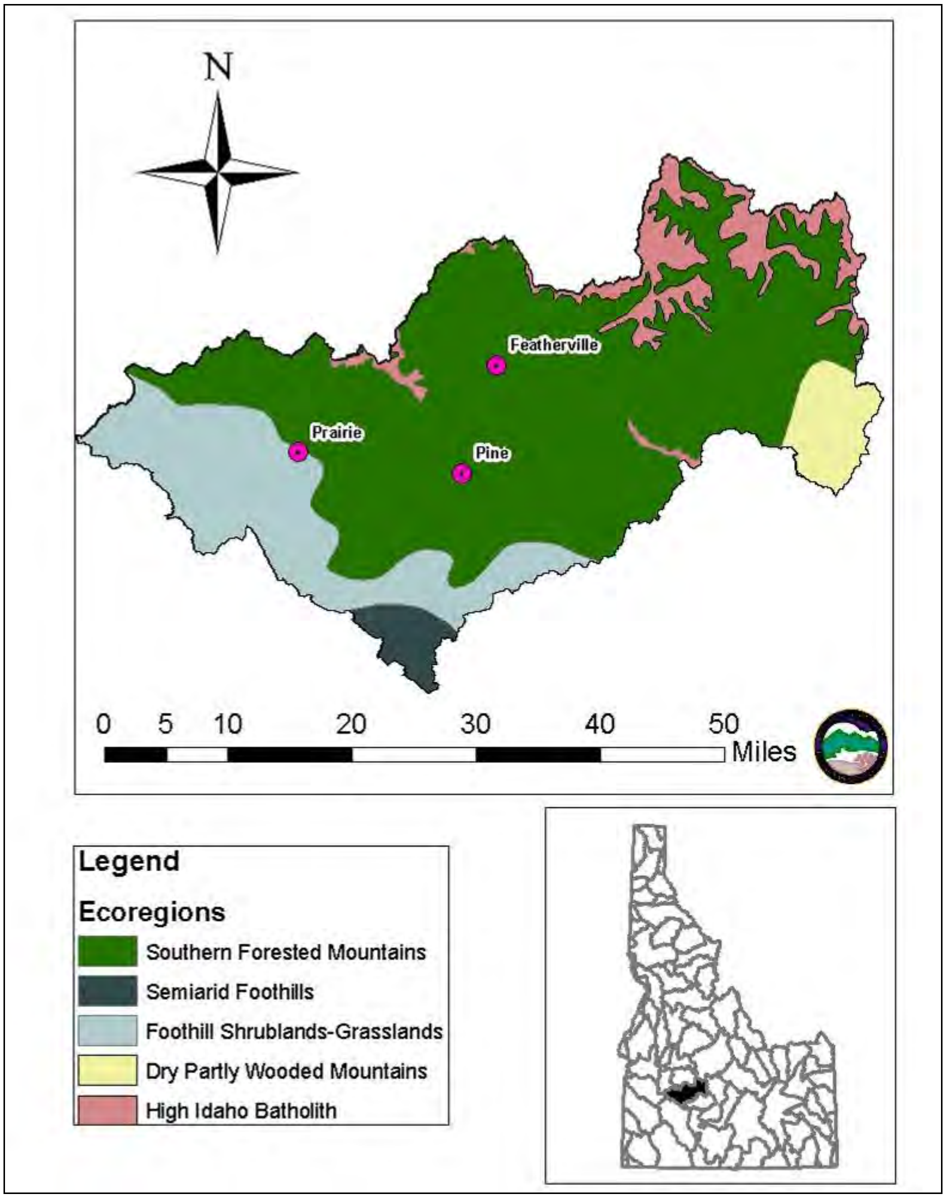


Figure 5. Ecoregions of the South Fork Boise River Subbasin

Aquatic Fauna

Ecosystems are maintained through the continuous flow of energy and constant recycling of nutrients. The subbasin's aquatic fauna are characterized by various algae (producers), aquatic macroinvertebrates, juvenile amphibians and fish (primary consumers), adult amphibians (secondary consumers), and other fish (tertiary consumers). Two species of native fish, bull trout (*Salvelinus confluentus*) and rainbow/redband trout (*Oncorhynchus mykiss*) are of special concern. Bull trout (*Salvelinus confluentus*) is listed as a "threatened" species under the Endangered Species Act. In mid-1996, Governor Batt and the State of Idaho issued an official conservation plan for bull trout (Batt 1996). The State of Idaho intends to restore this species by developing and implementing necessary conservation measures.

Algae

Beneficial algae are abundant and widely distributed throughout the subbasin. Although microscopic in size, their importance is immense, because they form the base of the aquatic food web. Periphyton algae assemblages have been sampled at 73 locations within the subbasin. Aquatic diatoms were identified and enumerated according to procedures outlined by Bahls (1993) and 274 separate species have been identified. The five most common species are *Achnanthes lanceolata*, *Fragilaria vaucheriae*, *Achnanthes minutissima*, *Cymbella minuta*, and *Rhoicosphenia curvata*. In the upper elevations of the watershed there are 36 different diatom species. Algae assessment methodologies followed procedures outlined by Horsburgh and Steed (1998) and while suspended algae in nuisance quantities have not been reported, isolated occurrences have been observed in small dredge ponds with stagnant water.

Aquatic Macroinvertebrates

From samples acquired through Beneficial Use Reconnaissance Program (BURP) monitoring, 362 different macroinvertebrate species were identified and enumerated by a professional laboratory.

Of these 362 different species, 34 were found to occur at 25% to 85% of the sites sampled. These species have been categorized as “common” and serve as indicators of water quality as summarized in the table below.

Table 2. Top 11 aquatic macroinvertebrates found in South Fork Boise River subbasin.

TAXON	ORDER	FAMILY	NAME
284	Diptera	Tipulidae	*Antocha*
622	Ephemeroptera	Ephemerellidae	*Drunella coloradensis/flavilinea*
43	Ephemeroptera	Ephemerellidae	*Drunella doddsi Needham*
35	Ephemeroptera	Heptageniidae	*Rhithrogena*
32	Ephemeroptera	Heptageniidae	*Epeorus grandis*
31	Ephemeroptera	Heptageniidae	*Epeorus longimanus*
26	Ephemeroptera	Heptageniidae	*Cinygmula*
110	Plecoptera	Perlidae	*Doroneuria*
121	Plecoptera	Perlodidae	*Megarcys*
173	Trichoptera	Glossosomatidae	*Glossosoma*
229	Trichoptera	Uenoidae	*Neothremma*

Fish

In the South Fork Boise River subbasin, headwater drainages tend to be populated by fish communities of low richness (i.e., few species). Following is a brief overview of the species and a discussion of bull trout.

Species Overview

These headwater fish communities generally consist of bull trout, rainbow/redband trout, and sculpin (*Cottus bairdi, C. confusus*).

Downstream fish communities (mainstem migration corridors, reservoir wintering areas) exhibit greater species diversity and include native species such as mountain whitefish (*Prosopium williamsoni*), northern pike minnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), and several sucker (*Catostomus spp*.) and dace (*Rhinichthys spp*.) species.

Bull Trout

Natural and human-induced factors can influence and limit the well-being of bull trout populations by affecting the short- and long-term habitat conditions of streams. Floods, debris torrents, landslides, de-watered channels, and wildfires are examples of disturbance factors that profoundly influence habitat conditions for bull trout in the subbasin. These occurrences can render headwater streams uninhabitable for bull trout over a period of years while other previously impacted streams may be improving in condition (Rieman and Clayton 1997). In such cases, channel recovery may take decades (Megahan 1991).

While bull trout are thought to be particularly sensitive to environmental change, their dispersal capabilities afford them the opportunity to re-colonize disturbed streams once conditions become suitable. However, stable bull trout populations require high quality habitat. Large rivers or lakes supporting migratory populations have the highest potential for supporting large, flourishing populations (Rieman and McIntyre 1993). Detailed discussions of general bull trout biology and life history can be found in Rieman and McIntyre (1993) and the State of Idaho's Conservation Plan (Batt 1996). Specific to the South Fork Boise River subbasin, bull trout have been observed throughout the subbasin and exhibit both the migratory and resident life history forms. A detailed study of bull trout life history within the South Fork Boise River subbasin was completed in 2001 (Partridge et al.). Bull trout have the capability to colonize all tributaries of the subbasin that do not contain impassable barriers. In almost all observations, bull trout coexisted with anadromous fish species.

Findings of federal and state biologists indicate most local populations of bull trout are strongly influenced by the resident form, but that the migratory form is also important. Migratory forms have been documented in two subbasin complexes. The first complex consists of Arrowrock Reservoir and the North Fork Boise River, Middle Fork Boise River, and lower South Fork Boise River. The second complex consists of Anderson Ranch Reservoir and the upper South Fork Boise River (Figure A, Figure 1). It is notable that migratory forms were historically fluvial in nature but apparently have adapted to an adfluvial lifestyle following construction of both Barber Dam (1904, outside the subbasin) and Arrowrock Dam (1915). Adult bull trout captured in the early spring from Arrowrock Reservoir have been measured at lengths up to 28 inches (700 mm) in length (Brian Flatter, IDFG, personal communication to Mike Ingham, DEQ).

Based on research by the Idaho Department of Fish and Game (Partridge, 2001), upstream migration of adult bull trout from Arrowrock Reservoir begins in early April and continues through early July. These fish enter spawning streams in the Middle and North Forks of the Boise River in late July or August. Spawning occurs in September and October when water temperatures are below 10 °C. Following spawning, adults reenter the main stems and migrate downstream to winter in Anderson Ranch and Arrowrock Reservoirs.

Bull trout have patchy distribution within the watersheds of the Boise River Basin. While distributions are probably influenced by habitat loss, dams, diversions, and exotic species, juvenile bull trout also appear to be naturally restricted to cold stream temperature conditions (Rieman and McIntyre 1993). Following the logic of Rieman and McIntyre (1995), suitable bull trout habitat was defined based on the observed relationship of fish distribution with elevation and watershed area. For the purposes of this subbasin assessment, 5,000 feet (1,524 meters) elevation is used as the necessary criteria for the first three life-history stages. Criteria for life history stages four and five (sub-adult migration/post-spawning maintenance) have not yet been developed.

Amphibians

Amphibians known or suspected to inhabit the watershed include the tailed frog (*Ascaphus truei*), northern leopard frog (*Rana pipiens*), western toad (*Bufo boreas*), pacific chorus frog (*Pseudacris regilla*), spotted frog (*Rana pretiosa*), and long-toed salamander (*Ambystoma macrodactylum*). Tailed frogs are present and abundant in many streams within the subbasin. Tadpoles of this species are an important food source for bull trout. Tailed frog tadpoles may grow several years in streams before transforming to adults. The young of other amphibian species may also be a food source for fish.

1.3 Sub-watershed and Stream Characteristics

Habitat condition and trend information is needed to assess aquatic life in the South Fork Boise River subbasin. Habitat variables include channel and flow stability, substrate size and relative composition, temperature and related variables, and barriers to migration.

Hydrology

The subbasin is located within the Idaho Batholith, which is a coarse-grained granitic intrusion. Geologic processes of uplifting, faulting, glaciation, and fluvial response to those processes resulted in landscapes characterized by steep slopes and deep canyons with strongly expressed drainages, gently rounded topography, and glacial and fluvial deposits such as river terraces. Typical drainage systems consist of steep headwater streams leading into steep and moderately steep main channels. Stream energy is generally high in the upper stream reaches with sediment readily transported downstream. Headwater channels have abundant boulders, cobbles, and rubble contained in their beds and banks. As the streams progress into the lower elevations with lower gradients, energy is reduced and sediment settles into the channel bottoms.

Stream hydrographs (flow regimes) peak from late March to May during snowmelt runoff, with south-facing aspects at lower elevations (below 4,500 feet) warming early with resulting peak flows occurring as early as late March. High elevation lands with deeper snowpack generate peak flows beginning in late April, which may last until mid-June. The runoff periods are followed by warm, dry summers, which result in decreased stream flows. Seeps and springs provide perennial flows to streams in higher elevations, while smaller streams in the lower elevations tend to become dry before the end of summer. Periodic localized summer thunderstorms can result in flash floods within small drainages. The fall climate reduces transpiration from plants and evaporation from streams, which results in slight increases in stream flows.

The stream flow regimes in the South Fork Boise River subbasin have been altered from historical conditions. Three dams (Barber, Anderson Ranch and Arrowrock) were built to control floodwaters and provide storage for irrigation water. Arrowrock and Barber dams impeded the natural migratory patterns of the native fish in the basin and blocked anadromous fish from migrating upstream. Remaining migrant fish species have adapted from a fluvial existence to an adfluvial and fluvial lifestyle, wintering in reservoirs. The major water body, the South Fork Boise River below Anderson Ranch Reservoir, has experienced major stream flow alteration with Anderson Ranch Dam controlling all discharge. In low water years, the discharge from Anderson Ranch Dam is regulated to irrigation (1,700 cfs), intermediate (600 cfs), and base flow conditions (300 cfs).

Channel and Hydrologic Stability

Many factors influence channel and flow stability. Some parts of the South Fork Boise River subbasin have experienced significant fine sediment inputs, hydrologic modification, and catastrophic wildfire at rates that exceed natural occurrence.

Land uses affecting channel and flow stability include, but are not limited to, road building, mining, logging, livestock grazing, recreation, and urban development. When the rate of delivery of fine sediment is accelerated, the hydrologic system responds with the filling of pools or other depositional zones, development of sand bars, braiding, and channel scour and simplification. An unstable stream channel is detrimental to aquatic life in the short term as it can fill living spaces with sediment, and destroy spawning habitats. In the long term, however, streambank instability and changes to the stream channel can contribute to beneficial habitat complexity.

Logging and road building can increase water runoff and sediment delivery to rivers and streams. Intensive logging can affect water transpiration rates in plants, and can change timing and total annual water yield. Roads and fire-hardened soils can result in more intensive runoff due to the abundance of impermeable road surfaces and hydrophobic soils. Large wildfires in high-density forest stands can result in severely unstable watershed conditions that affect water infiltration, soil stability, and vegetative communities.

Substrate Size and Relative Composition

Substrate, or the material that makes up the bed of a stream, is important to aquatic life. Sediment is categorized into different classes based on size, with the size class “fine sediment” being one of the smaller sizes. Various agencies use different standards to classify sediment size. In the South Fork Boise River subbasin, fine sediment is described by DEQ as particle sizes of less than or equal to 6.35 millimeters in diameter. Fine sediment is the most likely size to impair aquatic life. In the case of bull trout, preliminary assessment of data for sediment composition in focal (streams in the subbasin) and adjunct (streams near, but outside of, the subbasin) habitats of South Fork Boise River subbasin, fine sediments comprise a greater proportion of substrate composition in adjunct (median value = 39%) versus focal (median value = 23%) habitats (Burton 1997). The difference in fine sediment levels between focal and adjunct habitats was statistically significant (t-test, df = 120, P = 0.01). These numbers are based on data provided by BNF aquatic surveys, and are limited to federally managed lands (Burton 1996).

Although substrate composition is undoubtedly an important component of bull trout habitat, it remains difficult to predict how much particle size changes in substrate will affect their survival (Everest et al. 1987; Chapman 1988; Weaver and Fraley 1991). Some streams are more likely to accumulate fine sediment than others, and some aquatic populations probably are more sensitive than others. In the absence of detailed local information on population and habitat dynamics, any increase in the proportion of fine sediment in the substrate should be considered a risk to the productivity of an environment and to the persistence of associated aquatic life. High levels of fine sediment can reduce embryo survival by decreasing gravel permeability (therefore dissolved oxygen availability), slowing the rate of metabolic waste flushing, and by interfering with emergence by filling interstitial space through which the fry emerge (Weaver and Fraley 1991).

Stream Characteristics

Various methods are used to classify streams. Riparian vegetative cover, Rosgen stream type, and stream order (Strahler 1957) are discussed here as methods used to classify streams in the South Fork Boise River subbasin.

Riparian Vegetation

Trees, grasses, and other forms of vegetation in the riparian area around a stream can serve as important indicators of stream temperature. Heavily shaded streams are more protected from sunlight, which allows the water to remain cooler than streams that are not shaded. Riparian vegetation common to the South Fork Boise River subbasin includes varieties of willow, dogwood, alder, hawthorn, mixed sedges, rushes and grasses, wild rose, and currant.

Rosgen Stream Types

Streams in Idaho exhibit considerable variability in climate, hydrology, geology, landforms, and soils. Recognizing this, the BURP Technical Advisory Committee (TAC) elected to use Rosgen's (1996) Stream Classification System, Level I, as a means of characterizing streams for the sake of comparison. The following figure shows the basic characteristics used to determine Rosgen stream type.

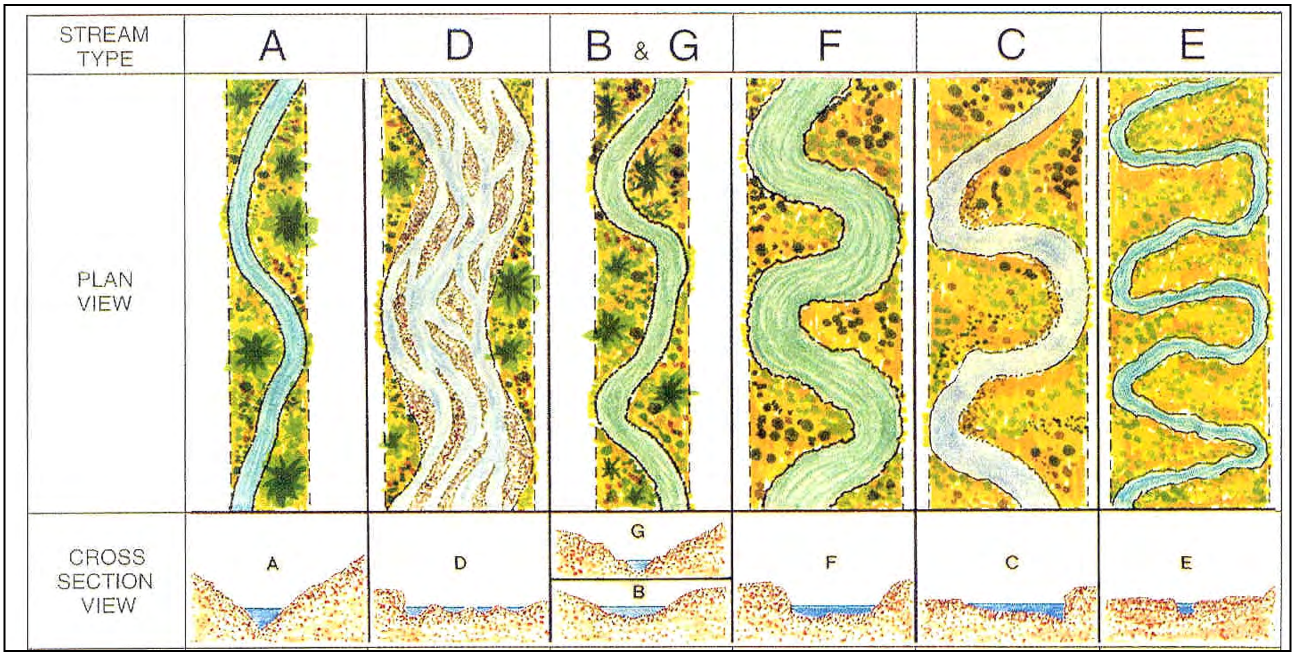


Figure 6. Determination of Rosgen Stream Type.

Table 3 gives a narrative description of each of the Rosgen stream types shown in Figure 6.

Table 3. Description of Rosgen stream types.

Stream Type	Gradient	Description
A	4-10%	Steep, entrenched, cascading, step/pool streams. High-energy debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	2-4%	Moderately entrenched, riffle dominated, with infrequently spaced pools. Very stable banks.
C	<2%	Low gradient, meandering, point-bar, riffle/pool, alluvial channel with broad, well-defined flood plain.
D	<4%	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks
E	<2%	Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.
F	<2%	Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.
G	2-4%	Deeply entrenched "gully" step/pool with low width/depth ratio.

Stream Order

Stream order is a hierarchical ordering of streams based on the degree of branching. A first-order stream is an un-forked or un-branched source stream. Two first-order streams flow together to form a second-order stream, two second–order streams combine to make a third-order stream, etc. (Strahler, 1957). Figure 7 shows a diagram of stream order determination.

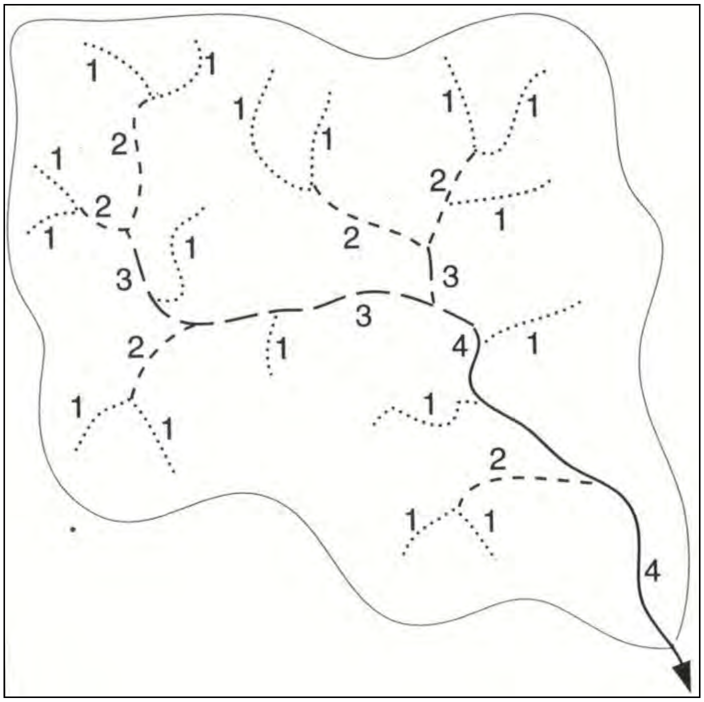


Figure 7. Stream Order Determination Adapted From Strahler, 1957.

Cultural Characteristics

The South Fork Boise River subbasin is characterized by many land uses and is a popular area for industrial and recreational activities. This section discusses the impacts of past and present land uses in the area.

Land Ownership

The South Fork Boise River subbasin is of mixed ownership (see Figure 8). A majority of the land within the subbasin is managed by federal agencies. Proportional land ownership and acreage information is presented in Table 4.

Table 4. Land management in the South Fork Boise River subbasin.

Managerial Responsibility	Acres	Percent of Total
U.S. Forest Service	687,166	82.2%
U.S. Bureau of Land Management	10,217	1.2%
U.S. Bureau of Reclamation	91	0.0%
State of Idaho (not including Fish and Game)	28,620	3.4%
State of Idaho, Dept. of Fish and Game	2,237	0.3%
Private	107,314	12.8%
TOTAL	**835,645**	100.0%

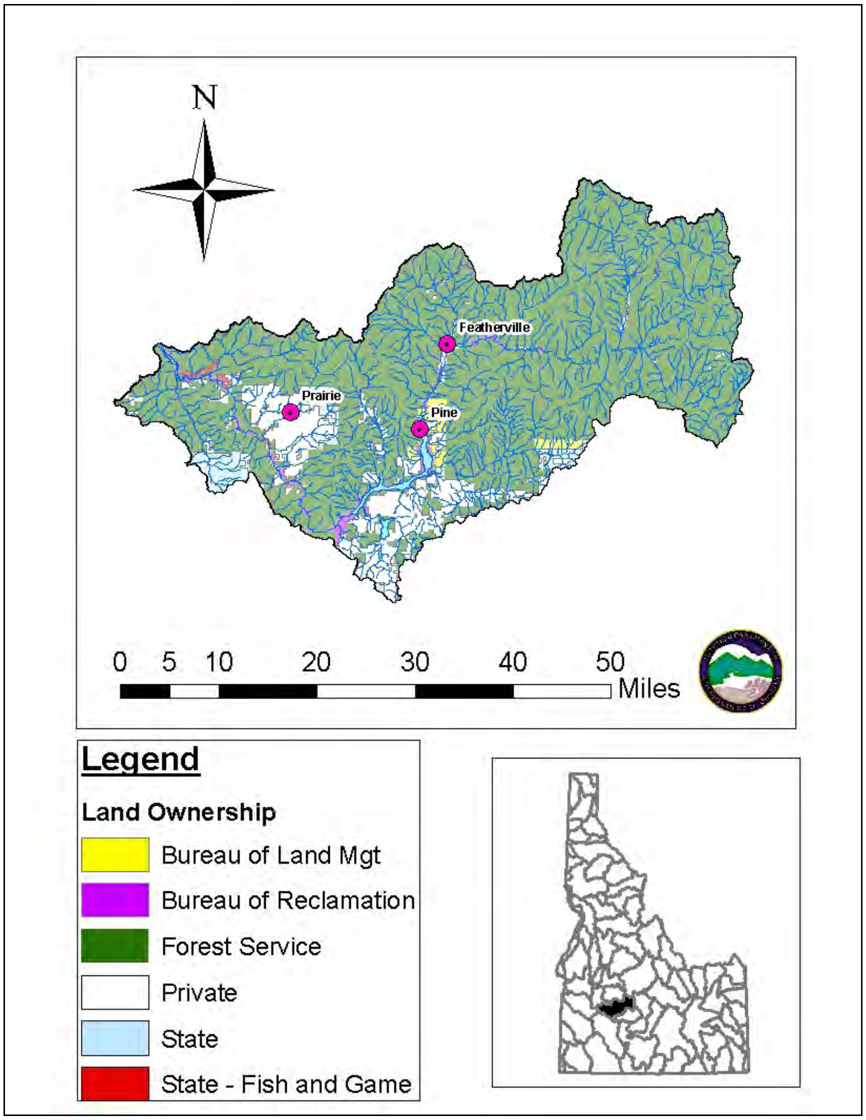


Figure 8. Land Ownership in the South Fork Boise River Subbasin

Land Use

There are seven major land uses within the South Fork Boise River subbasin. They are described in the following sections.

Forestry

Ponderosa pine and Douglas-fir stands occur over a large portion of the South Fork Boise River subbasin. Historically, ponderosa pine stands were dominant and evolved with frequent, low intensity fires. Years of fire suppression and forest management have resulted in a higher density of stands containing Douglas-fir and ponderosa pine in portions of the South Fork Boise River subbasin. A lack of low intensity fires has led to an increase in high density stands. This creates a situation conducive to fires of a moderate to high intensity. Such fires have occurred extensively within the Lower South Fork of the Boise River in the past 20 years. The SNF has revised management plans in the past few years to include prescribed burns and fire use (allowing natural wild fires to occur) management as integral components to fuel reduction plans in the subbasin.

Risks associated with active management may outweigh risks associated with large fires. It is possible to establish mosaics of fuel and forest conditions that reduce the risk of extremely large fires without the intensive treatment of every watershed. (Reiman et al. 1997). Because of fires, insect attacks, and nearby timber markets, the Upper Boise River subbasin has had a high number of forest practices applied. Forest practices include reforestation, fire management plans, harvesting, road building, and other activities associated with the harvest or improvement of forest tree species.

Pollutants such as sediment, dissolved chemicals, and increased water temperature are associated with the above forest practices and could threaten the persistence and diversity of aquatic life.

Roads

The development of road systems on public and private lands of the South Fork Boise River subbasin provide the transportation network that facilitates logging, mining, livestock grazing, land management activities, and recreation access for the public. It is well documented that water quality may be negatively affected by the number and location of forest roads in watersheds and the manner in which they are constructed and maintained (EPA et al. 1975). The risk to native fishes from road effects may be greater than those from fire. Of particular concern are the road systems typically associated with timber harvesting. Intensive forest management to restore degraded conditions should be applied where watersheds are already developed and aquatic conditions are coincidentally degraded (Rieman and Clayton 1997). Roads contribute more sediment to streams than any other land management activity (Meehan 1991). Roads can affect water quality through applied road chemicals and toxic spills (Lee et al. 1997 in Quigley and Arbelbide 1997; Furniss et al. 1991; Rhodes et al. 1994).

Sediment is typically identified as the most significant pollutant resulting from logging, specifically from roads. Sediments are produced from forest lands by surface erosion, mass wasting events, and channel erosion. Logging activities may contribute to all of these and accelerate the surface erosion and mass soil movement (EPA et al. 1975). Unfortunately, when most road systems in the South Fork Boise River subbasin were developed, little care or attention was given to the potential environmental effects.

Roads directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions within a watershed (Lee et al. 1997). Poor road location, concentration of surface and sub-surface water by cross slope roads, inadequate road maintenance, undersized culverts, and side cast materials can all lead to road-related mass movements (Lyons and Beschta 1983; Swanston 1971; Swanston and Swanson 1976; Wolf 1982; cited from Lee et al. 1997). Road construction causes the most severe disturbance to soils on slopes, far overshadowing fire and logging as a cause of accelerated erosion (Rieman and Clayton 1997). Based on available information, it appears that past road construction on timberlands has negatively affected bull trout populations. Generally, sub-watersheds with the highest road densities are areas where bull trout no longer exist (existing adjunct habitats) (Rieman and McIntyre,1993). Road densities in the South Fork Boise River subbasin range from 0 to 4.36 miles per square mile. Figure 9 depicts road locations within the subbasin. Roads have also provided access for fishing with possible over-exploitation of bull trout stocks, and have allowed the introduction of non-native species of fish, vegetation, and macroinvertebrates.

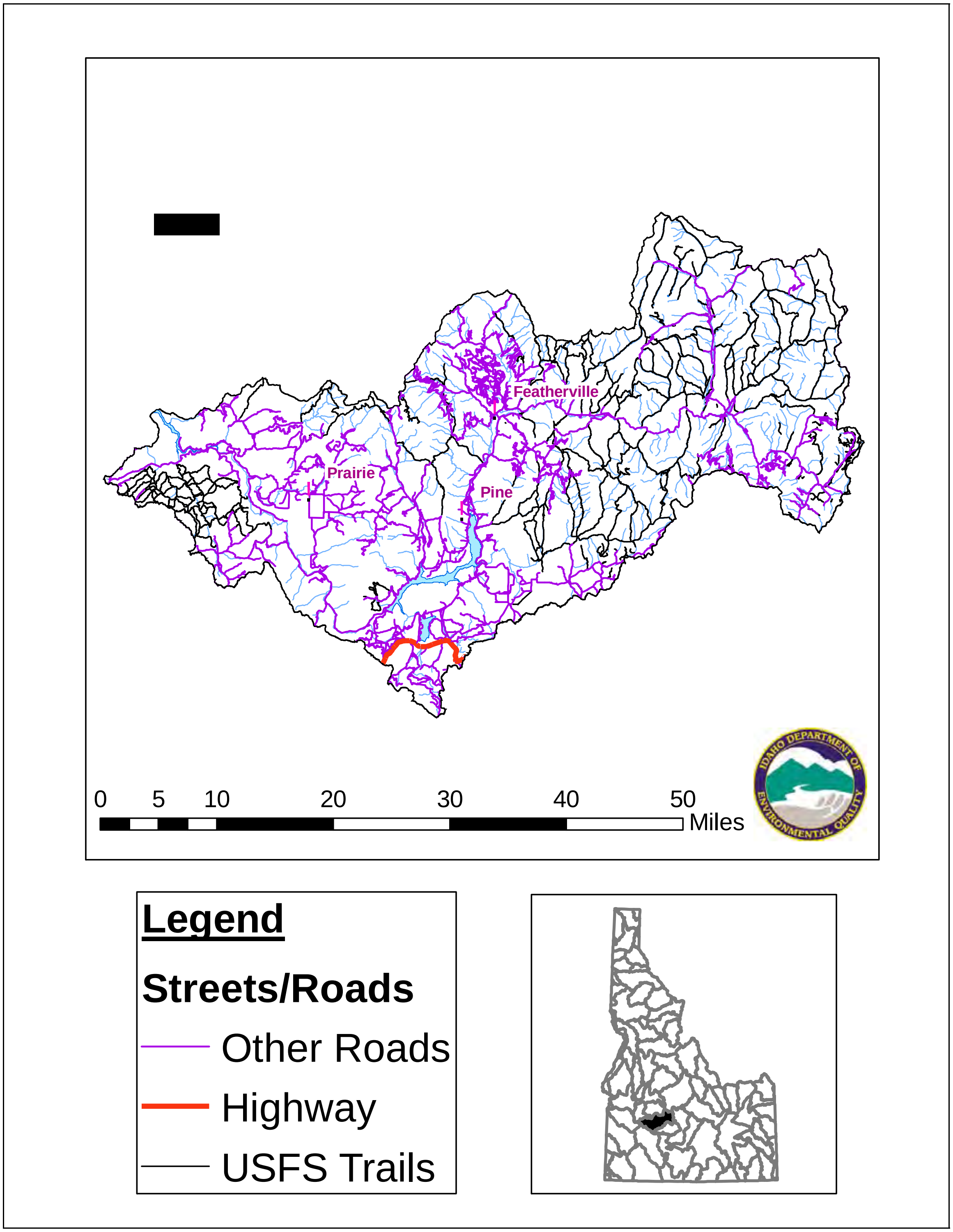


Figure 9. Roads in the South Fork Boise River Subbasin

Mining

Historical mining has affected a significant portion of the habitat of the South Fork Boise River subbasin. Dredge mining (commercial bucket) occurred on many segments of the

Middle Fork Boise River, South Fork Boise River, and North Fork Boise River. Much of the flood plain in these areas has been overturned and remains as piles of cobbles and dredge pools. In bucket dredge mining, a barge carrying excavating and processing equipment is floated up the stream. The barge (dredge) works its way from bank to bank dislodging all the material that it can reach. The dredge processes the materials, and then dumps the waste in piles behind it. These piles of waste, and stagnant pools resulting from dredging, can still be seen in some areas. Bucket dredge mining has not been performed for several decades and will probably never be performed in Idaho again. Lode and other forms of placer mining have also occurred. There are a few areas of older river gravels that form terraces high above the present river flood plain. Many of these high gravels, and the active river gravels, have been placer mined. Most of the historic mining occurred on the South Fork Boise River, in the Featherville-Rocky Bar area.

The gold-bearing quartz veins at Rocky Bar are upstream of Anderson Ranch Dam, but the mining process generated large placer deposits which are evident near Featherville. Commercial mining is still viable in these areas, with the Atlanta Lode being the most likely to be re-activated in the future. Mineralized material has been eroding into the streams of the subbasin for several million years and makes this area prime for recreational mining. Recreational mining, typically small suction dredges which may damage fish redds and spawning areas, is occurring in the South Fork Boise River subbasin. The Idaho Department of Water Resources (IDWR) manages recreational mining in Idaho and defines recreational dredge mining as:

> *"…those mining activities in which miners use power sluices, small recreational suction dredges with a nozzle 5 inches in diameter or less and equipment rated at a maximum of 15 horsepower."*

Suction dredges are motorized aquatic vacuums that suck gravel from the riverbed, pass it over a sluice and then re-deposit it back into the river channel near where it was removed. Operators are regulated by permits and rules issued by the IDWR.

It would be only speculative to evaluate the effects mining may have had on the aquatic species within the South Fork Boise River subbasin. Pre-mining conditions were never monitored, and actual accounts of management activities do not exist. Historic mining, unlike current mining practices, was unregulated and probably caused major modifications to the South Fork Boise River subbasin's ecology. Most mining in the subbasin occurred prior to Idaho adopting WQS and the CWA. Figure 10 shows the documented mining claim locations in the South Fork Boise River subbasin.

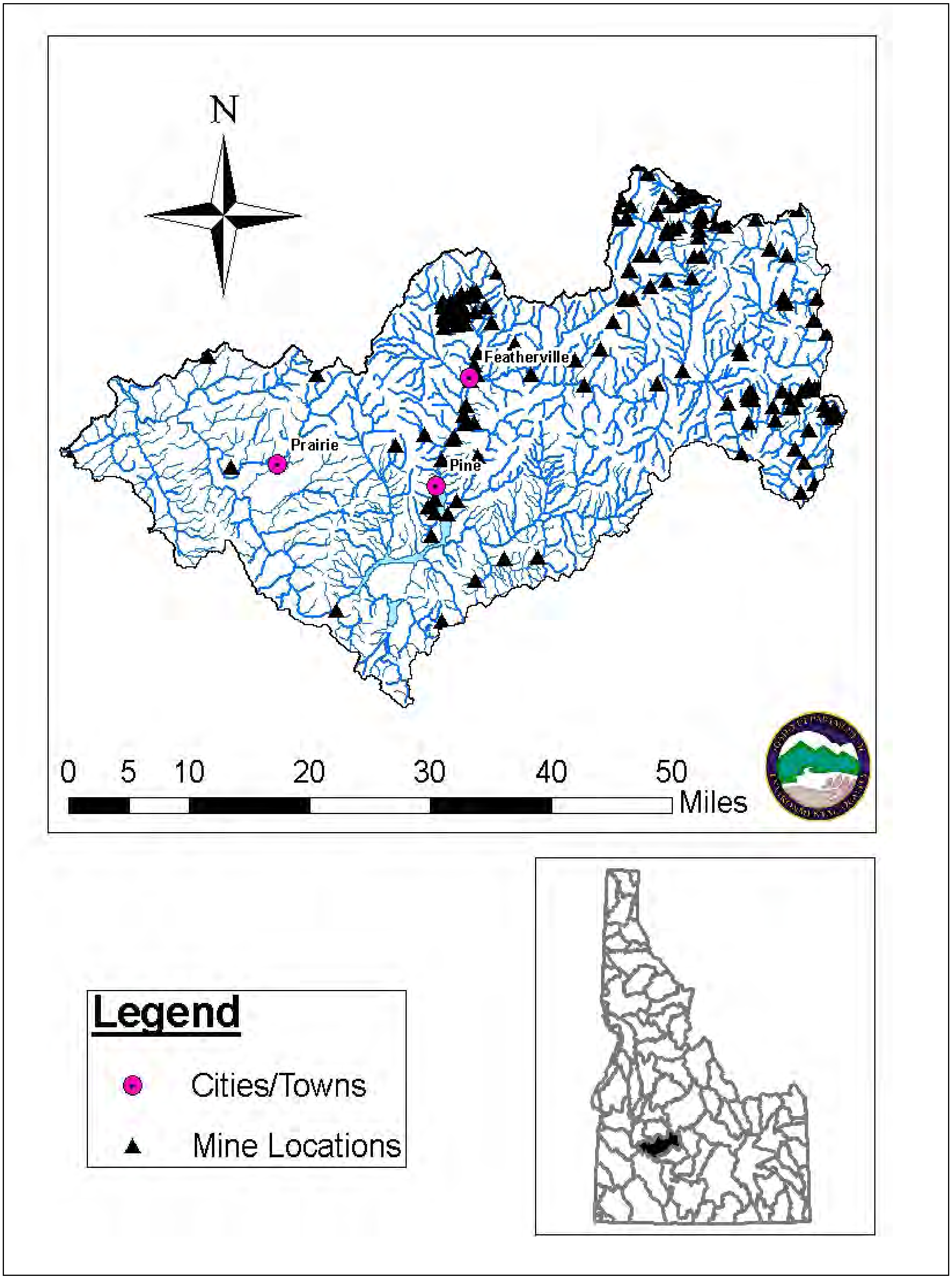


Figure 10. Documented Mining Claims in the South Fork Boise River Subbasin (Source: IDWR 1994).

Agriculture/Livestock

There are three agricultural uses in the South Fork Boise River subbasin that are economically important: water storage, crop production, and grazing.

Arrowrock Reservoir, and Anderson Ranch Reservoir store water used for irrigation of agricultural lands in the lower South Fork Boise River subbasin. These reservoirs are also used for recreation, flood control, and aquatic habitat. Crop production (mainly hay and grain) is limited to small privately owned areas in the South Fork Boise River subbasin. Crop production has the potential to modify hydrologic systems, accelerate erosion, and introduce chemical contaminants if managed improperly.

The primary agricultural use in the South Fork Boise River subbasin is grazing. Livestock grazing has occurred in the South Fork Boise River drainage for more than 100 years with a wide range of grazing intensities and impacts to the water resources. In the last 20 years, the majority of the grazed area has been used for sheep with only about 10 percent of the total area grazed by cattle. There is grazing on private, state, and federal lands. Federal cattle allotments are located on the southwestern part of the drainage and near Hunter and Little Smoky Creeks. Cattle have affected streams in the Fall and Little Smoky watersheds. Sheep allotments are generally on the remainder of the federal lands. While monitoring of grazing forage and riparian habitat in South Fork Boise River subbasin has been limited, research shows that "generally streams in grazed areas contain more fine sediment, stream banks are more unstable, banks are less under-cut, and summer water temperatures are higher than those of ungrazed streams" (Armour 1991, Behnke and Zarn 1976). Grazing studies comparing sheep and cattle grazing have shown that cattle grazing frequently does more damage to the riparian area and fishery habitat than sheep grazing (May and Somes 1981). This is not always the case as habitat degradation is largely dependent on the management intensity and best management practices (BMPs) in place. The overall quality of aquatic habitat is often visibly much better in sheep-grazed areas than areas grazed by cattle. Riparian vegetation is generally more abundant and of higher quality in the sheep use area (Corley 1997).

Fire

Severe drought and fire has occurred in the South Fork Boise River subbasin during the past two decades. High intensity wildfires, especially those in the Lower South Fork Boise River, have increased in recent years. Approximately 30% of the 5th field HUCs in the South Fork Boise River subbasin have experienced wildfires in the past 15 years. These large, high-intensity fires may have damaged the forest ecosystems, and fisheries habitats for many years to come. Monitoring by the BNF suggests that, in some areas, severe post-fire flooding had dramatic short-term effects on critical fish habitat of both small and large streams.

Large streams were heavily affected by sedimentation from the tributary debris floods. Deposition of sediments actually increased habitat complexity and diversity in the large rivers, but also increased the levels of substrate fines and embeddedness. Native fish abundance declined after debris floods in 1995. Declines were proportional to the severity of habitat alterations, with post-flooding abundance near zero in heavily impacted stream segments. The SNF uses prescribed burns to manage fuel loads on Forest lands and recent prescribed fires have taken place in the Lime Creek watershed. Obviously, healthy forests are important to aquatic ecosystems and there is a need to restore the natural structure and composition of degraded forests. However, researchers also admit that management to effect such restoration is largely experimental at this point in time. A general conclusion is that large fires can, in the short term, result in substantial mortality and even local extinctions (Rieman and Clayton, 1997).

The forest conditions that made the South Fork Boise River subbasin more susceptible to increased fire sizes and intensities are a result of shifts in forest density and composition. After many years of fire suppression, fire-resistant ponderosa pine stands have gradually been replaced by less fire-resistant dense stands of mixed ponderosa pine and Douglas-fir. Unlike ponderosa pine, Douglas-fir is not a fire-resistant species. The result is forest conditions that are unable to resist high fire intensities, especially during drought. The fuel loads and stand structures are such that flame lengths often carry into the crowns of the trees resulting in very large, stand-replacement fires. Where forest ecosystems are most at risk of experiencing these intense wildfires, the threat to at-risk native fish (i.e., bull trout) at least in the short-term is very real. The 2008 fire season included activity in the subbasin east of Featherville. The South Barker Fire was started by lightning on August 7, 2008 and was managed as a resource benefit fire. The acres burned are estimated at 37,800 in the Weeks Gulch, Burnt Log, Skeleton, Big Water, and Willow Creek watersheds. The fire burned with high intensity in some areas, but most of the intensity was low to moderate. Present-day risk in the South Fork Boise River drainage is greatest in the Fall Creek watershed and upstream of Anderson Ranch Reservoir (Fall, Grouse, Dog, and Wagontown Creeks watersheds).

Urban

The South Fork Boise River subbasin is predominantly uninhabited. There are several small communities (Pine, Prairie, and Featherville) experiencing growth. The Featherville region is experiencing the fastest growth, largely due to recreational development. There have been no documented impacts to aquatic life as a result of urban encroachment in the South Fork Boise River subbasin. Generally, the major impacts to water quality would result from development (building) on the flood plain. Levees and channelized streams prevent normal dissipation of hydrologic energy and transport of sediment. Other concerns include the loss of vegetation, road construction and culverts, flow alteration, household chemical use, and septic systems seepage. While there have been no documented impacts to date that would threaten beneficial uses, the potential for water quality impairment increases relative to human development.

Recreation

The lower South Fork Boise River has been managed as a special regulation trout fishery since the late 1970s and has received national attention from anglers. It is a very popular fishery and receives significant pressure since it is now open to harvest on a year-round basis. Creel surveys conducted by the Idaho Department of Fish and Game (IDFG) on the lower South Fork since the early 1960s have documented that bull trout consistently comprise a minor portion (less than 1-2 %) of the total angler catch (published and unpublished IDFG reports and files). Total catch includes fish harvested and those caught and released.

Recreational development within the South Fork Boise River subbasin is focused around Anderson Ranch Reservoir and the main river corridor upstream. Popularity of the area has led to an influx of "weekend residences" within the Pine-Featherville area and development of numerous recreational sites, most of which are managed by the United States Forest Service (USFS). Residences have also flourished on small parcels of private property along Big Smoky Creek, near Big Water Gulch, and on the upper South Fork Boise River within the Elk Valley subdivision (between Pine and Featherville). These areas are represented by green asterisks in Figure 11.

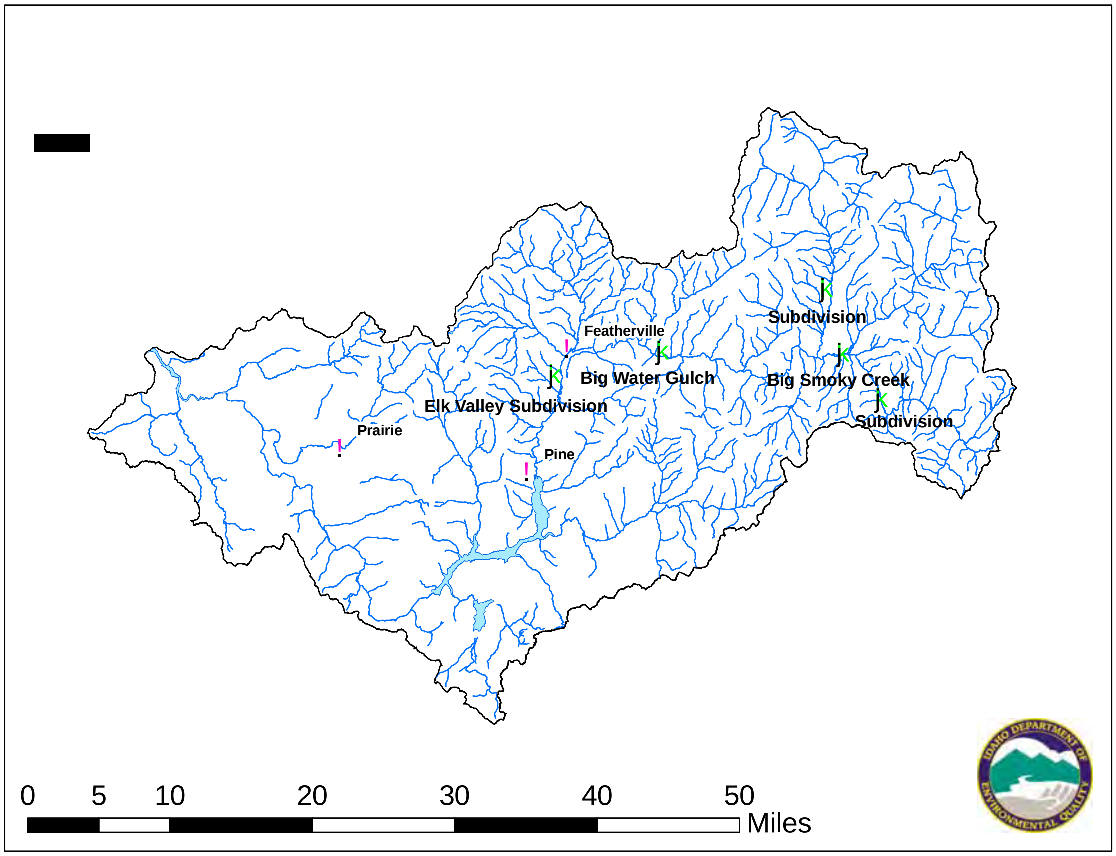


Figure 11. Residential Development Areas in the South Fork Boise River Subbasin

An overflow of recreationists onto undeveloped sites has affected riparian vegetation and streambank stability in isolated locations. Incidental angler counts indicate fishing pressure is moderate during most of the summer with increased angling pressure on weekends and holidays. Special regulations designed to protect wild fish populations and provide a quality fishing experience for anglers apply from Beaver Creek to the mouth of Big Smoky Creek. Terminal gear of artificial flies and lures are limited to single barbless hooks to minimize hooking mortality on bull trout and fish less than 14" (355 mm). These fish are required to be released.

Within the South Fork Boise River subbasin, recreational suction dredge activity is closed from Barker Gulch upstream. This includes all tributaries. Currently, there are several pending applications to use suction dredges to mine parts of Little Smoky Creek on patented mining claims. USFS, the U.S. Army Corps of Engineers, and IDWR are in the initial stages of permitting at the present time.

Camping, hiking, water sports, motorcycling, and four-wheeling are popular activities in the area. The BNF manages and maintains approximately 15 separate campsites and 1,300 miles of summer hiking trails, many of which are open to motorized vehicles, horses, and/or bicycles. The SNF also maintains 3 campgrounds and many miles of trails in the eastern area of the subbasin. Several trails are also maintained for winter snowmobiling, snowshoeing, and cross-country skiing. Popular water sports in the area include rafting, kayaking, water-skiing (in the reservoirs), and ice fishing.

Barriers to Migration

Barriers to migration affect many forms of aquatic life and the status of beneficial uses. The effect(s) of barriers are partially known for bull trout. The effects of barriers on other fish species need additional research. There are several types of migration barriers to bull trout (adults and juvenile) in South Fork Boise River subbasin including dams, culverts, severely degraded nodal habitats, and natural barriers such as waterfalls. The area has two major dams that block upstream migration and isolate populations. These are Arrowrock Reservoir Dam and Anderson Ranch Dam. While the reservoirs provide substantial benefits to recreation and agriculture, they pose some definite problems for aquatic species. Culverts may be less visible, but are a very significant form of migration barrier in this subbasin. Problem culverts typically pose velocity barriers to adult and juvenile fish movement, but perched culverts present an impassable jump. The BNF has developed a model for evaluating culverts for salmonids. This model may be a useful tool to assess the potential for individual culverts to be migration barriers for fish (adult and juvenile) movement. Natural migration barriers such as waterfalls also exist. An example is a recently documented waterfall on Fall Creek.

Water management for irrigation in lower Smith Creek watershed has caused the watershed to become isolated from the South Fork Boise River. Although Smith Creek may have been periodically isolated under natural conditions because of the abrupt gradient between lower Smith Creek and the South Fork Boise River, long-term persistence of aquatic species depends on genetic interchange, which is no longer occurring in Smith Creek.

2. Subbasin Assessment – Water Quality Concerns and Status

This section discusses water quality data and the relationship to beneficial use support in more detail for each of the 34 assessment units (AUs) in this subbasin. Since assessment units often encompass several streams, individual streams and their associated watersheds may be discussed separately from the rest of the AU. The uniform use of AUs began in mid-2004 and further explanation of AUs is provided below. This report presents all information that DEQ was able to gather regarding water bodies in the subbasin, because this information allows the reader to gain a good understanding of the subbasin as a whole.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

About Assessment Units

All the waters of the state of Idaho are now defined by AUs. These units and the methodology used to describe them can be found in the Water Body Assessment Guidance Second Edition (WBAGII) (Grafe et al. 2002). AUs are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs because, unlike ownership, stream order never changes.

Using AUs to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of the 305(b) report, which is required by the EPA as a component of the CWA, wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, which is the identification scheme used in the WQS, there is now a direct tie to the WQS for each AU, so that beneficial uses defined in the WQS are clearly tied to streams on the landscape.

However, the new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of §303(d)-listed streams. Due to the nature of the court-ordered 1994 §303(d) listings, and the subsequent 1998 §303(d) list, all segments were added with boundaries from "headwater to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the subbasin (HUC) scale, so that all the waters in the subbasin are and have been considered for TMDL purposes since 1994.

The boundaries from the 1998 §303(d)-listed segments have been transferred to the new AU framework, using an approach quite similar to how DEQ has been writing SBAs and

TMDLs. All AUs contained in the listed segment were carried forward to the 2002 §303(d) listings in Section 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the §303(d) list. This was necessary to maintain the integrity of the 1998 §303(d) list and to maintain continuity with the TMDL program. These new AUs will lead to better assessment of water quality listing and de-listing.

When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the §303(d) list (Section 5 of the Integrated Report.).

Listed Waters

Table 5 shows the pollutants listed for each 2002 and/or 2008 §303(d)-listed AU in the South Fork Boise River subbasin.

Table 5. §303(d) Assessment Units in the South Fork Boise River subbasin.

Water Body Name	AU ID Number*	Pollutants
Willow Creek	002a_02 002a_03 002b_04 002b_03	Sediment Sediment Unknown Unknown
South Fork Boise River	004_02 004_03 004_06 015_02	Unknown Unknown Sediment Unknown
Tributaries to Anderson Ranch Reservoir	005_02	Unknown
Little Camas Creek Reservoir	007L_0L	Sediment
Lime Creek	010_03a 010_05	Unknown Temperature
Little Smoky Creek	018_03	Unknown
Fall Creek	031_02	Unknown
Smith Creek	032_03 032_02	Unknown Temperature
Rattlesnake Creek	033_02	Sediment

* These assessment units (AUs) are all within HUC 17050113

2.2 Applicable Water Quality Standards

This section describes the beneficial uses and WQS pertaining to the watersheds within the South Fork Boise River subbasin.

Beneficial Uses

Idaho WQS require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as briefly described in the following paragraphs. The WBAGII (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not water quality conditions believed to fully support the uses exist. A practical application of this concept would be to apply the existing use of salmonid spawning to a water body where water quality could support salmonid spawning, but salmonid spawning is not occurring due to other factors such as dams blocking migration.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are 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. Water quality must be sufficiently maintained to meet the most sensitive beneficial use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho WQS (IDAPA 58.01.02.003.27 and .02.109-.02.160 in addition to citations for existing uses given above).

Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the WQS do not yet have specific use designations. 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 will apply the numeric cold water aquatic life criteria and primary or secondary contact recreation criteria to undesignated waters.

If, in addition to these presumed uses, an additional use exists, then because of the requirement to protect water quality for existing uses, the additional numeric criteria for that use would additionally apply. For example, if salmonid spawning is an existing use, then numeric criteria for salmonid spawning would apply, such as intergravel dissolved oxygen and temperature. However, if for example, cold water aquatic life is not an existing use, use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water aquatic life criteria (IDAPA 58.01.02.101.01).

Table 6 shows the beneficial uses for the AUs listed on the §303(d) list for the South Fork Boise River subbasin as well as the source of listing in the Idaho Administrative Procedures Act (IDAPA). Table 7 shows the beneficial uses for some of the other streams in this subbasin. These beneficial uses have been assessed, but were not shown to be impaired and are not listed on the §303(d) list.

Table 6. South Fork Boise River Subbasin beneficial uses of §303(d)-listed streams.

Water Body	Assessment Unit ID#	Beneficial Use[a]	Type of Use	IDAPA §
Willow Creek	ID17050113SW002a_02 ID17050113SW002a_03 ID17050113SW002b_04 ID17050113SW002b_03	Dry Stream Dry Stream CW, SS, PCR CW, SS, PCR	Designated	58.01.02.140.11.SW-2a 58.01.02.140.11.SW-2b
South Fork Boise River	ID17050113SW004_03 ID17050113SW004_06 ID17050113SW015_02	CW, SS, PCR, DWS, SRW	Designated	58.01.02.140.11.SW-4, SW-13, SW-15 and SW-21
Anderson Ranch Reservoir tributaries	ID17050113SW005_02	CW, SS, SCR, DWS, SRW	Designated	58.01.02.140.11.SW-5
Little Camas Creek Reservoir	ID17050113SW007L_0L	SCR, PCR	Designated	58.01.02.140.11.SW-7
Lime Creek	ID17050113SW010_03a ID17050113SW010_05	CW, PCR or SCR	Designated	58.01.02.101.01.a
Little Smoky Creek	ID17050113SW018_03	CW, SS, SCR	Designated	58.01.02.140.11.SW-18
Fall Creek	ID17050113SW031_02	CW, SS, PCR	Designated	58.01.02.140.11.SW-31
Smith Creek	ID17050113SW032_03 ID17050113SW032_02	CW, SS, PCR CW, SS, PCR	Designated	58.01.02.140.11.SW-32
Rattlesnake Creek	ID17050113SW033_02	CW, SS, SCR	Designated	58.01.02.140.11.SW-33

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply

Table 7. South Fork Boise River Subbasin beneficial uses of assessed, non-§303(d)-listed streams.

Water Body	Uses[a]	Type of Use
Arrowrock Reservoir	CW, SS, PCR, DWS, SRW	Designated
Wood Creek	CW, SS, PCR	Designated
Anderson Ranch Reservoir	CW, SS, PCR, DWS, SRW	Designated
Little Camas Creek	Not designated[b]	Not Designated
South Fork Lime Creek	Not designated[b]	Not Designated
Deer Creek	CW, SS, SCR	Designated
Grouse Creek	CW, SS, PCR	Designated
Beaver Creek	CW, SS, SCR	Designated
Boardman Creek	CW, SS	Designated
Big Smoky Creek	CW, SS, PCR	Designated
Paradise Creek	CW, SS, SCR	Designated
Johnson Creek	Not designated[b]	Not Designated
Ross Fork	CW, SS, PCR	Designated
Skeleton Creek	CW, SS, PCR	Designated
Shake Creek	CW, SS, PCR	Designated
Feather Creek	CW, SS, PCR	Designated
Trinity Creek	CW, SS, PCR	Designated
Green Creek	CW, SS, SCR	Designated
Dog Creek	CW, SS, PCR	Designated

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply
[b]Nondesignated surface water (IDAPA 58.01.02.101)

Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of 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) (Table 8).

Excess sediment is described by narrative criteria (IDAPA 58.01.02.200.08): “Sediment shall not exceed quantities specified in Sections 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.”

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06, which states: “Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.”

Narrative criteria for floating, suspended, or submerged matter are described in IDAPA 58.01.02.200.05, which states: “Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.”

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the WBAGII, (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations.

Table 8 includes the most common numeric criteria used in TMDLs. Figure 12 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 8. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses Water Quality Standards: IDAPA 58.01.02.250				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods)**
Bacteria, ph, and Dissolved Oxygen	Less than 126 *E. coli*cfu/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a 1-day minimum and 6.0 mg/L for a 7-day average
Temperature[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in Sept. and Oct.
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.	
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature				7 day moving average of 10 °C or less maximum daily temperature for June – Sept.

[a] *Escherichia coli* colony forming units per 100 milliliters of sample water
[b] dissolved oxygen
[c] milligrams per liter
[d] 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 seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather station.
[e] Nephelometric turbidity units

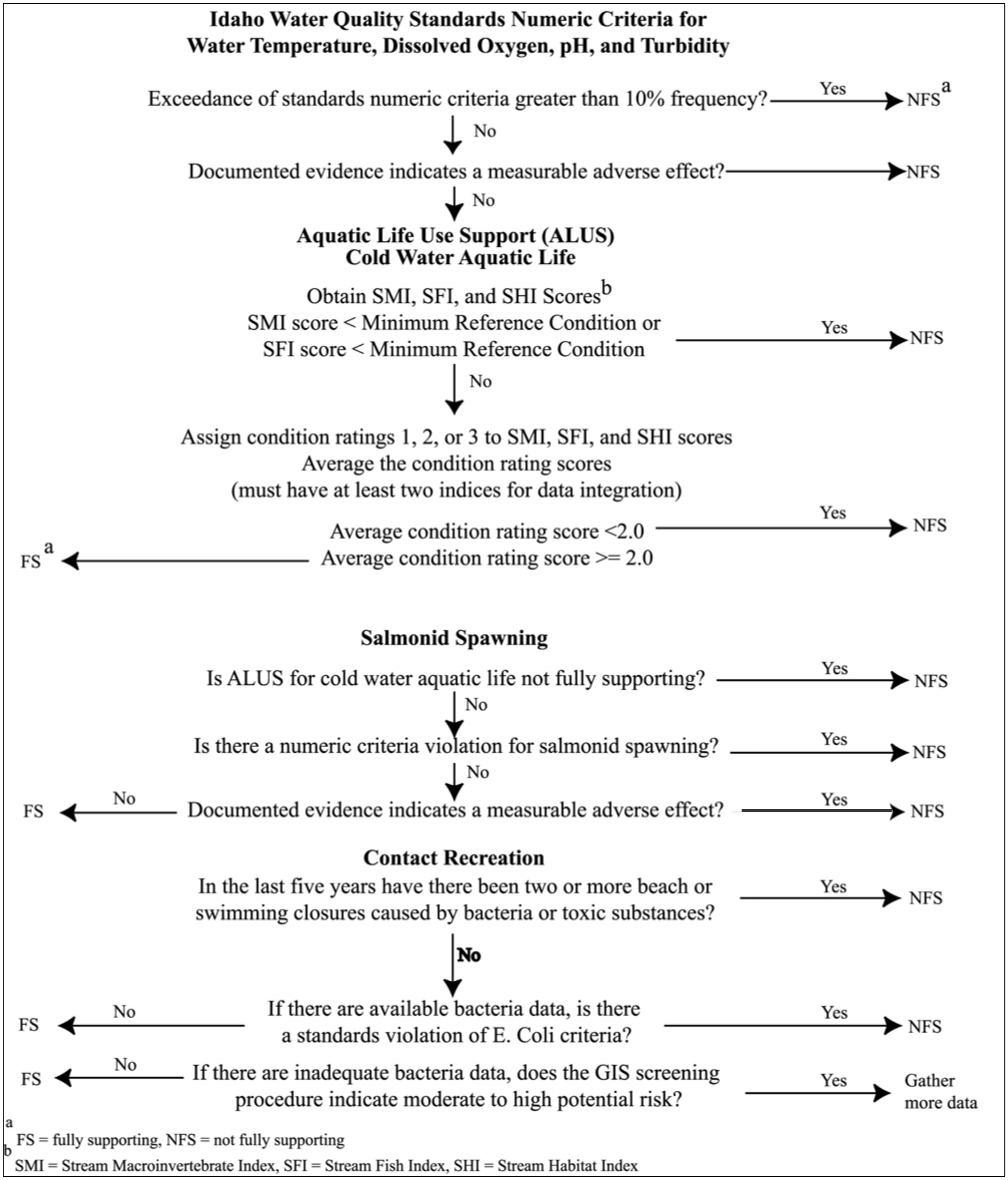


Figure 12. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: *Water Body Assessment Guidance,* Second Edition (Grafe *et al*. 2002)

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when anthropogenic sources cause these to reach unnatural levels, they are considered “pollutants” and can impair the beneficial uses of a stream.

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or cold water aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human-influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated stream temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold-water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of effects may occur to aquatic invertebrates, amphibians, and mollusks, although less is known about them.

2.4 Summary and Analysis of Existing Water Quality Data

This section presents the most recent data for §303(d)-listed streams/AUs. There is a brief summary of non-§303(d)-listed streams/AUs in the subbasin; more details for these AUs can be found in Appendix H. A TMDL to restore beneficial uses is required if data shows that beneficial uses are impaired by a pollutant.

Data Assessment Methods

Several methods were used to evaluate the data for this subbasin assessment. A brief description of each method is located below.

Numeric Criteria

For pollutants that have numeric criteria, such as temperature, the data were initially assessed by comparing monitoring results to the numeric standard.

DEQ-Water Body Assessment Guidance

The Water Body Assessment Guidance (WBAGII) describes DEQ's methods used to consistently evaluate data and determine the beneficial use support status of Idaho water bodies. The WBAGII utilizes a multi-index approach to determine overall stream support status. The methodology addresses many reporting requirements of state and federal rules, regulations, and policies. For the most part, DEQ BURP data are used in the assessment. However, where available, other data are integrated into the assessment process.

An assessment entails analyzing and integrating multiple types of water body data such as biological, physical/chemical, and landscape data to address multiple objectives. The objectives are as follows:

1. Determine beneficial use support status of the water body (i.e., fully supporting versus not fully supporting).
2. Determine biological integrity using biological information or other measures.
3. Compile descriptive information about the water body and data used in the assessment.

Assessment Three primary assessment indices are used: the stream macroinvertebrate index (SMI), the stream fish index (SFI) and the stream habitat index (SHI). The SMI is a direct measure of aquatic life. The SFI is also a direct measure of aquatic life, but it is specific to fish populations. The SHI is used to measure in-stream habitat, although some of the measurements used to generate the SHI are linked to the riparian area.

The primary habitat parameters discussed in this report, are described below:

Bank Cover and Stability

Streambank cover and stability are important measures of a stream's overall ability to resist erosion and provide stable fish cover. Human impacts and natural disturbances can negatively affect stream banks by reducing bank vegetation and structural stability. BURP surveys include bank cover and stability measurements. Both the left and right stream banks are surveyed and categorized according to DEQ (2007) BURP protocol as follows:

- **Covered –** Perennial ground cover greater than 50%. Roots of vegetation cover greater than 50% of the bank. At least 50% of the bank is covered by rocks of cobble size (150 mm) or greater. At least 50% of the bank is covered by some combination of the above.
- **Uncovered –** Perennial ground cover less than 50%. Roots of vegetation cover less than 50% of the bank. No more than 50% of the bank is covered by rocks of cobble size (150 mm) or greater. No more than 50% of the bank is covered by some combination of the above.
- **Stable –** No breaking banks, slumping, cracking/fracturing, or vertical erosion is present.
- **Unstable –** Breaking banks, slumping, cracking/fracturing, and/or vertical erosion is present.

Using the above criteria, the banks are then classified as one of the following: Covered and Stable, Covered and Unstable, Uncovered and Stable, or Uncovered and Unstable.

Once the banks have been classified, the sampled reach is divided into equal distance sections and evaluated for percent stability. The percent stability of the entire sampled reach is then calculated as a cumulative percent stability for the sections. Other TMDLs written for watersheds in Idaho with similar morphologic and hydrologic characteristics have used a target bank stability of 80% or higher. The same target will be used for the South Fork Boise subbasin.

Subsurface Fines

The particle size of the substrate directly affects the flow resistance of the channel, the stability of the streambed, and the amount of aquatic habitat. If the substrate is predominantly composed of fine sediment, then the spaces between the particles are too small to provide refuge for most organisms. The greatest number of species, and thus the greatest diversity, is found with a complex substrate of boulders, stone, gravels, and sand. Coarse materials such as gravels provide a variety of small niches for juvenile fish and benthic invertebrates. Because salmonids have adapted to the natural size distributions of substrate materials, no single sized particle class will provide the optimum conditions for all life stages of salmonids. A mix of gravel with a small amount of fine sediment and small rubble creates optimal conditions for fish spawning. When small fines (< 6.35 mm) exceed 27% of the total substrate, embryo survival and emergence of swim-up fry is reduced by 50% (Bjornn and Reiser 1991).

Data for the percentage of subsurface fines is collected using a sampling protocol similar to that described by Nelson et al. (2002) for the Salmon River watershed. In this method, a core cylinder is worked into the substrate of a riffle or pool tailout. A core of substrate material to a depth of approximately six inches is then removed. The substrate is then strained through a series of sieves with decreasing mesh sizes to separate particles that are 6.35 mm or larger from smaller particles (fine sediment). Burton and Harvey (1990) showed that a 27% target for subsurface fine sediment (< 6.35 mm) is applicable for central and southern Idaho streams.

Biological, Habitat, and Temperature Data

DEQ collected biological, habitat, and temperature data through the BURP. Stream integrity and water quality are characterized by analyzing BURP data. Along with physical habitat assessment, the BURP also monitors biological data to determine support of beneficial uses.

Water body units are used to describe subsections of the South Fork Boise River subbasin. Water body units are further subdivided into assessment units (AUs), which are groupings of streams that have the same stream order and other similar characteristics. There are 34 water body units in the South Fork Boise River subbasin, most of which are broken down into at least two AUs. Water body units that contain AUs listed on the §303(d) list will be discussed in the following section. Water body units that do not contain AUs listed on the §303(d) list are summarized in this section, and detailed information regarding them can be found in Appendix H.

The WBAG II directs that Tier I data should not be older than 5 years for assessment and TMDL calculation purposes. Data older than 5 years is presented here for informational purposes, but only Tier I data is used to determine beneficial use support status. Since impaired waters are identified based on the 2002 §303(d) list, data used in this assessment will only go back to 1998, which is five years before the 2002 §303(d) list was established.

Macroinvertebrates collected during a BURP visit are statistically evaluated and reported as an SMI score. Likewise, fish are reported as a SFI score. Habitat data is condensed into an SHI score. The value for each index is then classified as having a condition rating score of 1, 2, or 3, with 1 representing greatest impairment and 3 representing least impairment. The condition ratings are then averaged into an overall score for the site. If the average score is less than 2, the site is not fully supporting beneficial uses. If the average score is greater than or equal to 2, the site is considered fully supporting beneficial uses. The tables in this section show the assessments based on available BURP data. Note that not all assessed streams have data for the SFI. Average scores in these cases are based on the scores for the SMI and SHI.

Flow data for the South Fork Boise River subbasin is limited. Several USGS gauging stations regularly record flow for the South Fork Boise River, but continuous flow data for other streams in the subbasin are not available. Graphs of historical flow are shown in Appendix G. Note that BURP flow measurements represent just one location at one time and can be influenced by the time of year the measurement was recorded, weather conditions on a single sample day, and overall water availability of that year. When interpreting flow measurements gathered by BURP, one must note that measurements recorded in the spring and early summer during snowmelt runoff are generally higher than measurements recorded in late summer or fall when flows are lower.

Like flow data, temperature data for this region is limited. The majority of the temperature information presented here comes from BURP surveys. BURP measures one instantaneous water temperature per survey and the measured temperature is largely dependent on air temperature, time of year, flow, and other factors. Water temperatures fluctuate with air temperatures; therefore, a measurement recorded early in the morning may be significantly lower than a measurement recorded during the hottest part of the day.

Status of Beneficial Use Support

The following two subsections identify the water bodies that are fully supporting beneficial uses, and those that are not. For those that are not, further description, analysis, and conclusions are provided.

Fully Supporting

Many of the water body units in the South Fork Boise River subbasin are currently supporting all beneficial uses and are not listed on the §303(d) list. These water body units are shown in Figure 13 and Table 9. Data indicate there is no need to calculate TMDLs for AUs within these water body units. The BURP data to support these beneficial use status decisions is available in Appendix H.

Table 9. Water body units fully supporting beneficial uses and not listed on the 2002 303(d) list or in the 2008 draft Integrated Report.

Name & Description	AU ID*	Comments
Arrowrock Reservoir (tributaries to the Boise River)	001_02 001_03	
Wood Creek (Source to mouth)	003_02 003_03	2nd & 3rd order AUs approved as full support status by EPA in 2000
Tributaries to Anderson Ranch Reservoir	005_03	
Little Camas Creek (Little Camas Res.	006	
Little Camas Creek (Source to Little Camas Creek Res.)	008	
Wood Creek (Source to Anderson Ranch Res.)	009	
Lime Creek (Source to Anderson Ranch Reservoir)	010_02 010_03 010_04 010_04a	
South Fork Lime Creek (Source to mouth)	011_02 011_03	
Deer Creek (Source to Anderson Ranch Res.)	012_02 012_03	
South Fork Boise River (Willow Creek to Anderson Ranch Res.)	013_02 013_05	
Grouse Creek (Source to mouth)	014_02	
Beaver Creek (Source to mouth)	016	
Boardman Creek (Source to mouth)	017_03	
Big Smoky Creek (Source to mouth)	019_02 019_04	
Paradise Creek (Source to mouth)	020_02	
South Fork Boise River (Confluence of Ross Fork & Johnson Creeks to Little Smoky Creek)	021_02 021_03 021_04	EPA approved full support status in 2000
Johnson Creek (Source to mouth)	022	
Ross Fork (Source to mouth)	023_02 023_03	
Skeleton Creek (Source to mouth)	024_03	EPA approved full support status in 2000 for 3rd order AU
Willow Creek (Source to South Fork Boise River)	025_03	
Shake Creek (Source to mouth)	026_02	EPA approved full support status in 2000
Feather Creek (Source to mouth)	027_02 027_03	
Trinity Creek (Source to mouth)	028-02 028_03 028_04	EPA approved full support status in 2000 for 2nd and 4th order AUs
Green Creek (Source to mouth)	029_02	EPA approved full support status in 2000
Dog Creek (Source to mouth)	030_02	EPA approved full support status in 2000
Fall Creek (Source to Anderson Ranch Reservoir – 3rd order)	031_03	

Name & Description	AU ID*	Comments
Rattlesnake Creek (Source to Arrowrock Reservoir – 3rd order)	033_03	

* These assessment units (AUs) are all within the South Fork Boise River subbasin, HUC 17050113

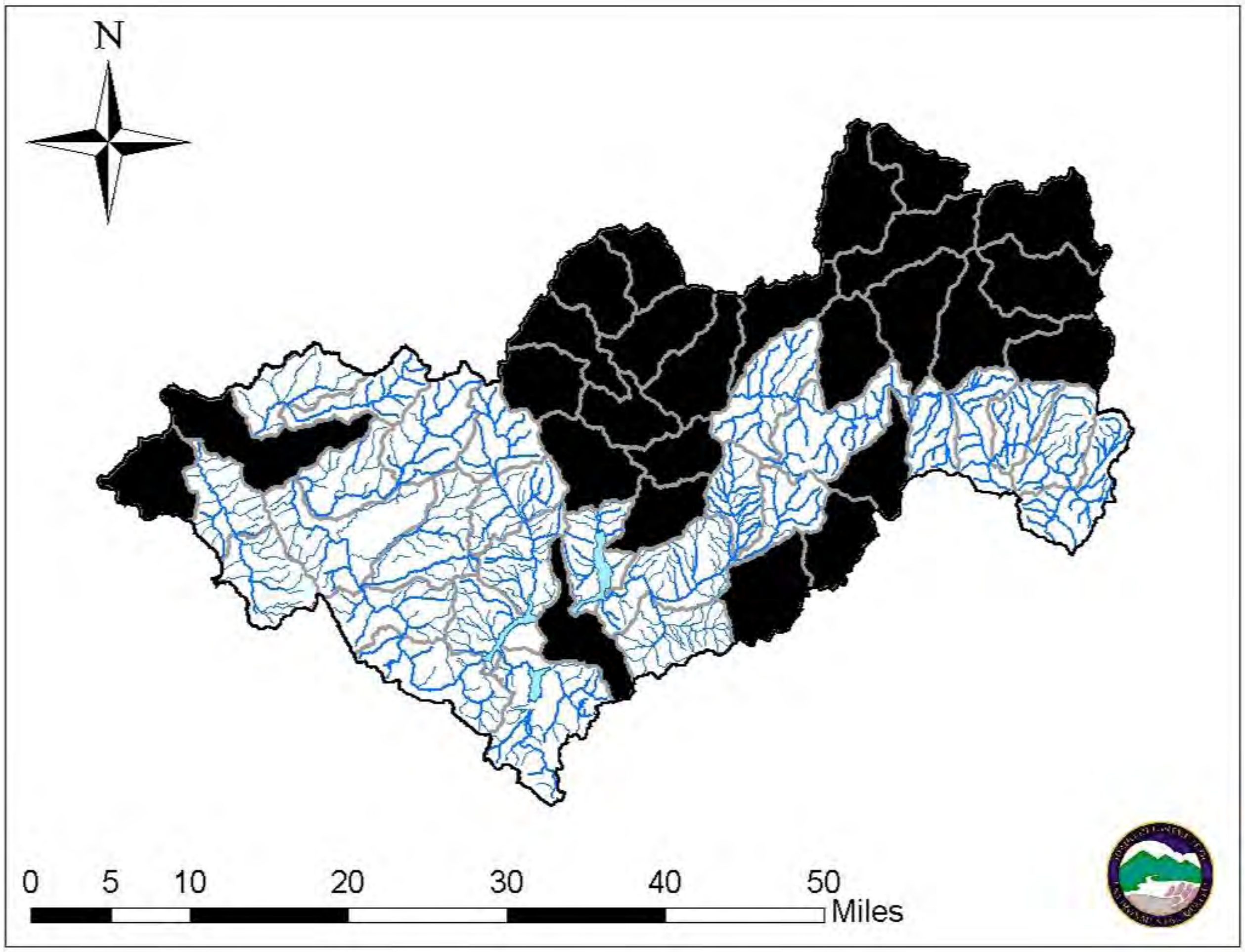
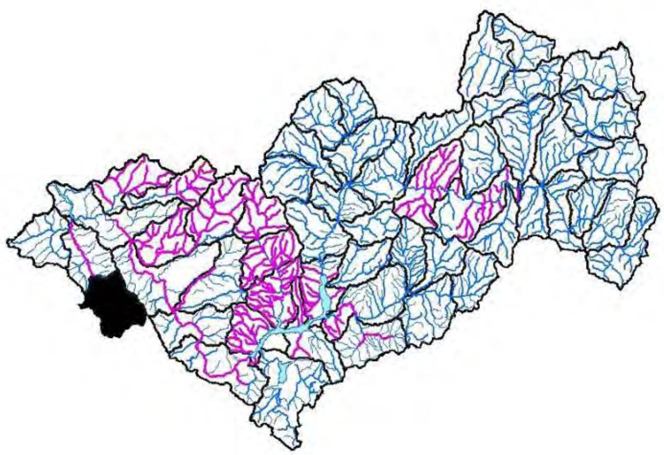


Figure 13. Water Body Units Fully Supporting Beneficial Uses (in black).

Not Fully Supporting

This section details the water body units that contain AUs that are not fully supporting all of their beneficial uses.

Upper Willow Creek (Cottonwood Creek to Arrowrock Reservoir) - ID17050113SW002a



Assessment Units Included

This water body unit consists of six named streams in addition to 18.0 miles of unnamed tributaries. There are two §303(d)-listed AUs in this water body unit (002a_02 and 002a_03). The 2nd order AU consists of Case Creek, Cottonwood Creek, Long Gulch Creek, Salt Creek, and Willow Creek. The 3rd order AU consists of the 3rd order upper Willow Creek. There is no BURP data currently available for this water body unit. Attempts to survey all sites in the AU between 1995 and 2007 were unsuccessful due to dry creek beds.

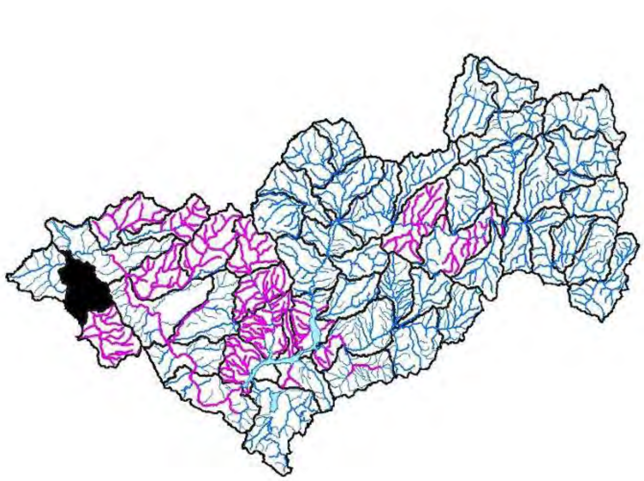
Restoration Activities

The USFS completed trail ford rehabilitation on many of the trail crossings on Upper Willow Creek in 2003.

Conclusions

An appendix to the 2000 subbasin assessment for the Upper Boise River subbasins presents the discussion of the determination that tributaries to Willow Creek are not able to attain the cold water aquatic life beneficial use (IDEQ 2000b). The tributaries are intermittent or dry for a majority of each year. The subbasin assessment found 21stream channels that are dry and listed as not fully supporting beneficial uses. Satellite imagery shows 16 constructed flow alterations on the 2nd order AU and two flow alteration structures on the 3rd order AU. These two AUs should be delisted for sediment, and listed for flow alteration (moved to Section 4c of the next Integrated Report). Streams listed for flow alteration and discovered to be flow-altered for significant portions of the year do not have a reasonable potential to support beneficial uses. The EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since there is no requirement to establish TMDLs for water bodies impaired by pollution but not pollutants, no TMDLs will not be developed for these AUs.

Lower Willow Creek (Cottonwood Creek to mouth) - ID17050113SW002b



Assessment Units Included

This water body unit consists of eight named streams in addition to 12.9 miles of unnamed tributaries. There are two §303(d)-listed AUs in this water body unit (002b_03 and 002b_04). Both of the 303(d) AUs are listed for unknown pollutants. BURP data collection sites associated with these AUs are shown in Table 10. The 3rd order AU consists of the 3rd order Willow Creek, and the 4th order AU consists of the 4th order Willow Creek.

Table 10. Streams and available BURP data for Willow Creek from the source to Cottonwood Creek- ID17050113SW002b.

Stream and BURP Site ID	Date	Approx. Stream Miles	Water Temp (°C)	Flow (cfs)	SMI	SFI	SHI	Average Score
Willow Creek – 3rd order (2006SBOIA029)	7/5/2006	7.43	18.8	0.23	3		3	3
Willow Creek- 3rd order (1999SBOIA004)	7/12/1999	7.43	15.7	0.23	3	1	1	1.67
Willow Creek-4th order (1997SBOIA017)	6/26/1997	0.33	21.5	3.4	1	0	1	0

Data Analysis

Both of the listed AUs in this water body unit are listed for unknown pollutants. Based on prior BURP samples, it appeared that sediment is the most likely cause of impairment to beneficial uses. Surface fine sediment of 30% was measured in the 4th order segment. The 3rd order segment (002b_03) had very low bank stability, indicating high erosion rates.

Sampling of subsurface fine sediment in the 3rd order segment of lower Willow Creek shows an average of 16.7% fine sediment. This is well below the recommended limit for subsurface fines of 27%. There are several trail crossings on this segment with high sedimentation at the point of crossing, but the overall percentage of fine sediment in this segment was well within recommended limits.

Sampling of subsurface fine sediment in the 4th order segment of lower Willow Creek could not be completed in 2008 due to high spring runoff flows. The 4th order segment is a relatively short segment that flows into Arrowrock Reservoir shortly after the confluence of Wood Creek and 3rd order lower Willow Creek. Since no recent major construction has taken place in the area and no other major tributaries contribute sediment load to the segment, it is presumed that if subsurface fine sediment are below the recommended limit in both 3rd order tributaries to the 4th order lower Willow Creek, that it will also be within recommended limits in the 4th order segment. Results of core sampling above the confluence on both 3rd order lower Willow Creek and 3rd order Wood Creek showed fine sediment to be below the recommended limit of 27%. The average subsurface fine sediment results for 3rd order lower Willow Creek (16.7%) and 3rd order Wood Creek (25.8%) indicate that the 4th order segment below the confluence would be below 27%.

Restoration Activities

The USFS has completed several improvement projects in this AU since 2000. Several trails have been either relocated or decommissioned, and many trail crossings have been rehabilitated.

Conclusions

Data indicate the 3rd order segment of lower Willow Creek is fully supporting beneficial uses and no TMDL is necessary at this time. The 3rd order AU should be moved to Section 2 of the next Integrated Report.

Based on core sampling data from tributaries to 4th order lower Willow Creek, it is presumed that the 4th order segment is not impaired by sediment and beneficial uses are fully supported. This segment should be moved to Section 2 of the next Integrated Report.

South Fork Boise River (Anderson Ranch Dam to Arrowrock Reservoir) - ID17050113SW004

Assessment Units Included

This water body unit consists of 28 named streams in addition to 82.1 miles of unnamed tributaries. There are three §303(d)-listed AUs in this water body unit (004_02, 004_03 and 004_06). The 2nd order AU consists of over 20 1st and 2nd order tributaries to the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir. The 3rd order AU includes Dixie Creek, Deer Creek, Dry Buck Creek, and Rock Creek. The only available BURP data in this AU is on Dixie Creek. The 6th order AU is the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir. This AU has not yet been assessed by BURP because most of it is not wadeable. Assessment using the protocol for rivers instead of wadeable streams is necessary for future use determinations. Table 11 shows the BURP data available for this water body unit.

Table 11. Streams and available BURP data for the South Fork Boise River from Anderson Ranch Dam to Arrowrock Reservoir- ID17050113SW004.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Cayuse Creek- 2nd order (1998SBOIA006)	6/15/1998	3.24	0.8	13.5	0		1	0
Cow Creek- 2nd order (1998SBOIA052)	7/27/1998	Not Available	0.3	16.7	3		1	2
Dixie Creek- 3rd order (1998SBOIA054)	7/27/1998	9.85	0.5	23.3	1		1	1
Granite Creek- 2nd order (1998SBOIA010)	6/17/1998	3.36	3.3	10.0	1		3	2
Pierce Creek- 2nd order (1998SBOIA015)	6/22/1998	4.89	3.2	10.5	2		3	2.5
Rough Creek- 2nd order (1998SBOIA053)	7/27/1998	Not Available	0.3	22.7	2		1	1.5

Data Analysis

The 2nd order AU (004_02) was listed on the 2008 Integrated Report as impaired by unknown pollutants. The data from 1998 BURP surveys for two streams in this AU Cayuse Creek and Rough Creek, resulted in scores below 2.0. Rough Creek had a low canopy cover score and a low bank stability percentage, indicating that sediment may be the cause of impairment. Rough Creek was sampled for subsurface fine sediment in 2008, with results showing 7% subsurface fine sediment, which is well below the recommended limit of 27% subsurface fines. In addition, the banks appeared to be mostly covered and stable with a well-developed riparian community and adequate canopy cover consisting mainly of willow and mixed grasses (see photos 11 and 12 in Appendix I). Cayuse Creek was determined to be intermittent, meaning that it usually dries up for a portion of the summer. When the scores from the 1998 Cayuse Creek sample are omitted, the average scores for the other BURP sites (Rough Creek) indicate full support of beneficial uses.

The 3rd order AU (004_03) was listed due to a low BURP score for Dixie Creek in 1998. The surveyed segment of Dixie Creek was completed within a beaver complex (see photo 9 in Appendix I). Data from this survey indicate high surface fine sediment, which is a natural condition in areas that have been flow-altered by beavers. This site was visited in 2008 and found to have high levels of fine sediment and severely eroding banks downstream of the 1998 BURP site (photo 8 in Appendix I). It is believed that high spring runoff flows in 2006 washed out a bridge crossing near the 1998 site (photo 6) as well as a portion of a downstream beaver dam (photo 10). The segment of stream found to have high surface fine sediment (53%) and eroding banks is the segment between the bridge location and the blown-out beaver dam (photos 6 and 7). Downstream of the partially destroyed beaver dam, the bank stability increases substantially and subsurface fine sediment decreases to 24%, which is within recommended limits

Restoration Activities

The USFS has completed many habitat improvement projects in this water body unit since 2000. These projects include several dispersed campsite rehabilitations, boat launch restorations, and reductions in livestock grazing.

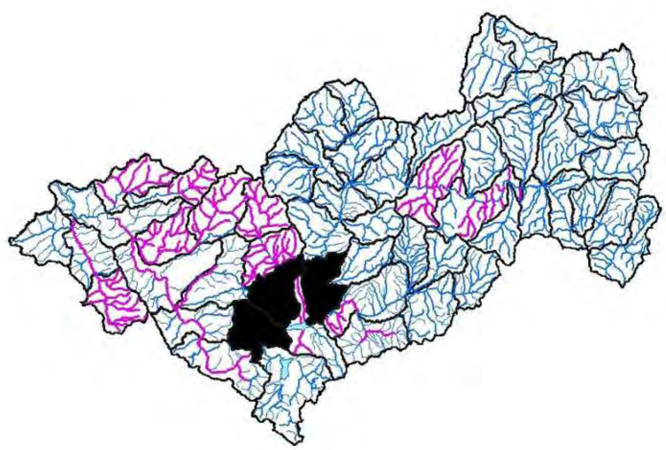
Conclusions

The perennial streams in the 2nd order AU (004_02) are currently supporting beneficial uses and no TMDL is necessary at this time.

For AU 004_03, since it is believed that this blow-out is a natural event, due to high flows, and because the 1998 survey was done in a beaver complex, this AU should be delisted for unknown pollutants and listed instead for habitat and flow alteration and moved to Section 4c of the next Integrated Report. It is also recommended that fences be constructed to exclude grazing animals from the riparian area so that the blown-out portions can restabilize. Research stakes were planted during the 2008 visit to track the recession of the streambanks in the actively eroding sections.

The 6th order segment is the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir. This was listed for sediment; however, no recent information regarding sediment on this segment is available. This segment was originally listed via the Stream Segment of Concern (SSOC) process, which is not necessarily an indicator of impairment. Anderson Ranch Dam, upstream of this segment, prevents high levels of sedimentation from occurring in the mainstem South Fork Boise River between Anderson and Arrowrock dams. This AU should be delisted for sediment and be listed as Not Assessed until appropriate data can be collected.

Anderson Ranch Reservoir (Boise River) - ID17050113SW005



Assessment Units Included

This water body unit consists of twelve named streams in addition to 52.2 miles of unnamed tributaries. There is one §303(d)-listed AU in this water body unit (005_02), which includes 1st and 2nd order tributaries to the Anderson Ranch Reservoir. BURP sites associated with this AU are shown in bold in Table 12 below.

Table 12. Streams and available BURP data for Anderson Ranch Reservoir, South Fork Boise River- ID17050113SW005.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Water Temp (°C)	SMI	SFI	SHI	Average Score
Castle Creek-3rd order (1998SBOIA017)	6/22/1998	1.39	3.3	12.5	3	2	3	2.67
Evans Creek- 2nd order (1998SBOIA011)	6/17/1998	4.74	6.9	12.0	3	2	3	2.67
Evans Creek- 2nd order (2007SBOIAA141)	9/6/2007	4.74	0.2	15.7		3	2	
Goat Creek- 2nd order (1998SBOIA012)	6/17/1998	3.86	0.8	16.5	1		1	1
Lester Creek- 2nd order (1998SBOIA016)	6/22/1998	4.67	0.9	13.0	1		1	1
Wilson Creek- 2nd order (1998SBOIA018)	6/23/1998	3.92	2.5	10.5	3	3	3	3

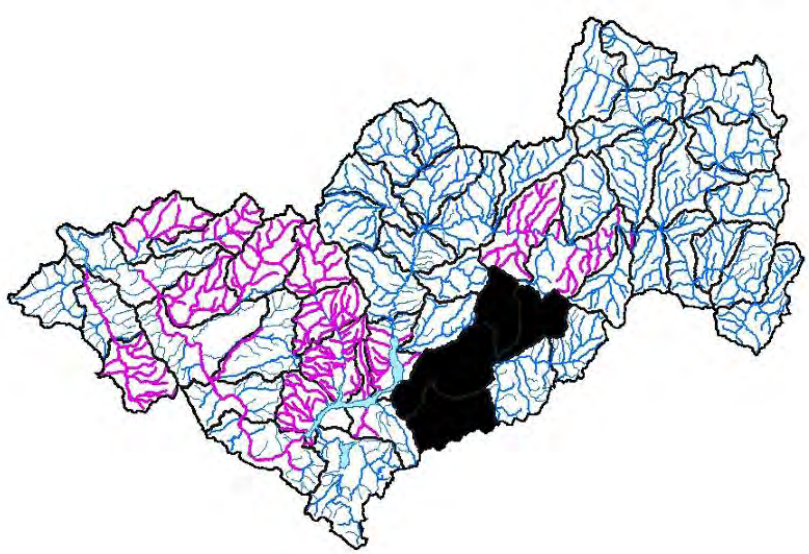
Restoration Activities

The USFS has completed several habitat improvement projects in this water body unit since 2000. These include seedling planting along the riparian zone of several sites, beaver re-introductions, gully restorations, and trail relocation and/or decommissioning.

Conclusions

Goat and Lester Creeks are intermittent streams and usually dry up in the summer. Because beneficial uses cannot be attained in these stream segments. only the data from Evans and Wilson Creeks will be used to assess the status of this AU. Evans Creek was sampled in 1998 and 2007. Although the macroinvertebrate sampling results from the 2007 sample will not be available until the fall of 2008, it is presumed that the result will not alter the overall conclusion of this assessment. According to the BURP data, this AU is fully supporting beneficial uses and no TMDL is necessary at this time. This AU will be reassessed during the next five-year review and the support status will be changed if necessary.

Lime Creek (Source to Anderson Ranch Reservoir) - ID17050113SW010



Assessment Units Included

This water body unit consists of 21 named streams in addition to 106.0 miles of unnamed tributaries. There are two §303(d)-listed AUs in this water body unit (010_03a and 010_05). Streams associated with these AUs are shown in Table 13. The 3rd order AU includes Big Springs Creek and Moores Creek. The 5th order AU consists of the 5th order of Lime Creek. Table 13 shows the applicable BURP data available for this water body unit.

Table 13. Streams and available BURP data for Lime Creek from the source to Anderson Ranch Reservoir- ID17050113SW010.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Buckhorn Creek- 2nd order (1998SBOIA061)	7/30/1998	2.10	9.9	2.8	3		3	3
Lime Creek- 4th order (1993SBOIA002)	7/22/1993	7.13	25.24	NA	3		1	2
Lime Creek- 4th order (1995SBOIC003)	7/19/1995	7.13	50.7	NA	3		3	3
Lime Creek- 4th order (1997SBOIB018)	6/30/1997	7.13	77.74	12	3		1	2
Lime Creek- 4th order (1998SBOIA059)	7/29/1998	7.13	38.6	14.2	3		3	3
Lime Creek- 4th order (1999SBOIA039)	9/8/1999	7.13	19.01	6.9	3		2	2.5
Lime Creek- 4th order (2001SBOIA032)	7/25/2001	7.13	4.91	20	3		3	3
Lime Creek- 4th order (2002SBOIA001)	7/1/2002	7.13	24	14.7	3		2	2.5
Lime Creek- 4th order (2003SBOIA028)	8/11/2003	7.13	7.9	16.5	1		2	1.5
Lime Creek- 4th order (2004SBOIA088)	8/3/2004	7.13	8.5	14.1	1		3	2
Lime Creek- 5th order (1993SBOIA001)	7/23/1993	4.07	33.43	NA	3		1	2
Lime Creek- 5th order (1995SBOIC004)	7/20/1995	4.07	41.4	NA	3		3	3
Lime Creek- 5th order (1996SBOIB038)	7/2/1996	4.07	89.8	17	1		3	2
Lime Creek- 5th order (1997SBOIB019)	6/30/1997	4.07	58	13	3		2	2.5
Lime Creek- 5th order (1998SBOIA062)	7/30/1998	4.07	43.7	17.8	3		3	3
Lime Creek- 5th order (1999SBOIA040)	9/30/1999	4.07	25.58	5	3		3	3
Lime Creek- 5th order (2001SBOIA034)	7/27/2001	4.07	10	13.7	3		2	2.5
Lime Creek- 5th order (2001SBOIV004)	9/5/2001	4.07	8.93	13.1	3		3	3
Lime Creek- 5th order (2002SBOIA039)	8/21/2002	4.07	7.5	13.2	3	1	3	2.3
Lime Creek- 5th order (2002SBOIV006)	7/11/2002	4.07	13.26	16.3	3	1	3	2.3
Lime Creek- 5th order (2003SBOIA020)	7/28/2003	4.07	16.5	24	3	2	3	2.7
Lime Creek- 5th order (2004SBOIA087)	8/2/2004	4.07	5.1	22.7	3	2	3	2.7
Lime Creek- 5th order (2005SBOIA038)	8/3/2005	4.07	25.59	14.4	3		3	3
Middle Fork Lime Creek- 3rd order (1998SBOIA057)	7/28/1998	4.63	9.9	17.4	3		1	2
Moores Creek- 3rd order (1998SBOIA007)	6/16/1998	3.29	5.9	9.0	1		1	1
Moores Creek- 4th order (1998SBOIA008)	6/16/1998	2.69	12.4	13.0	3		1	2
NF Lime Creek- 3rd order (2007SBOIA130)	8/21/2007	4.12	1.46	15.6			3	

The 3rd order segment of North Fork Lime Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. This AU will be reassessed during the next five-year review and its support status will be changed if necessary.

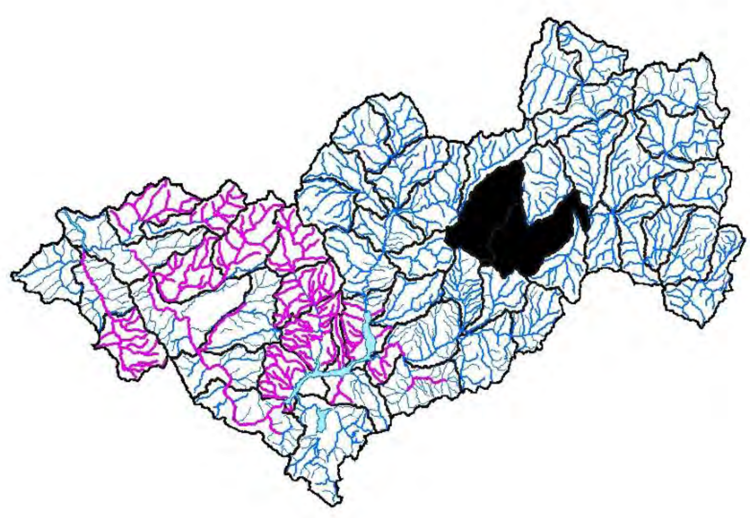
Data Analysis

The BURP survey conducted on Moores Creek (3rd order) in 1998 showed a high percentage of fine sediment (54%) and a low percentage of stable banks (59%). This suggested that beneficial uses might be impaired by sediment. An attempt to sample subsurface fine sediment using a core sampling method was made in May 2008; however, it could not be completed due to inaccessibility. Personal observations during that visit confirmed the high fine sediment load in the stream as well as a high percentage of unstable and eroding banks (see photos 3-5 in Appendix I). While it is likely that sediment is impairing the beneficial uses of this segment, Tier I data is not available to support such a determination.

Conclusions

The 3rd order segment of Moores Creek appears to be impaired by sediment; however, there is no Tier I data available to support a beneficial use support decision at this time. Bank stabilization projects should be considered during the development of the implementation plan to decrease bank erosion and bedload fine sediment. The AU should be listed as Not Assessed until Tier I data is available. The 5th order Lime Creek AU is listed for temperature, and a temperature TMDL has been prepared (see Section 5).

South Fork Boise River (Little Smoky Creek to Willow Creek) - ID17050113SW015



Assessment Units Included

This water body unit consists of seven named streams in addition to 46.4 miles of unnamed tributaries. This water body unit contains one §303(d)-listed AU (015_02) which includes the 1st and 2nd order tributaries to the South Fork Boise River, including Big Water Gulch, Jumbo Creek, Deadwood Creek, Myrtle Creek, and West Fork Kelley Creek. The BURP data available for this water body unit is shown in Table 14.

Table 14. Streams and available BURP data for the South Fork Boise River from Little Smoky Creek to Willow Creek- ID17050113SW015.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Big Water Gulch- 2nd order (1998SBOIA013)	6/18/1998	NA	14.5	7.5	2		1	1.5
Jumbo Creek- 2nd order (1998SBOIA009)	6/16/1998	3.14	6.4	8.5	3		2	2.5
Kelley Creek- 3rd order (2007SBOIA043)	7/18/2007	0.64	0.23	17.8			3	
West Fork Kelley Creek- 2nd order (2006SBOIA108)	8/30/2006	3.71	0.75	9.6	3		3	3

Data Analysis

The 3rd order segment of Kelley Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. This AU will be reassessed during the next five-year review and its support status will be changed if necessary.

The average BURP survey score for the 2nd order AU is 2.0, indicating full support of beneficial uses.

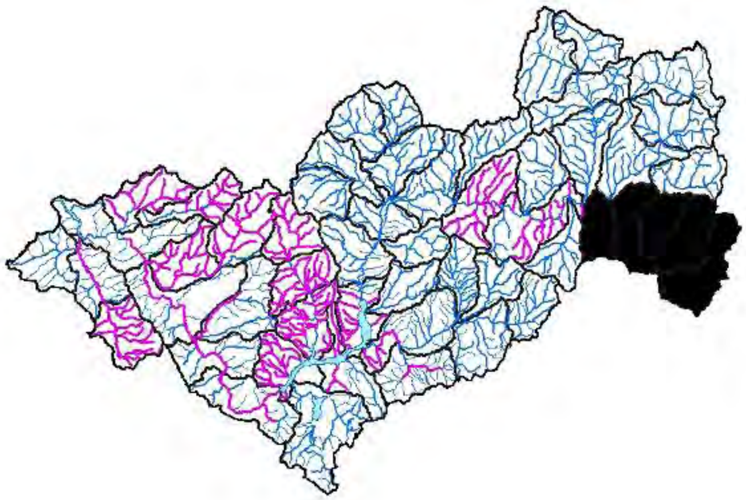
Restoration Activities

The USFS has completed several habitat improvement projects in this water body unit since 2000. These include culvert replacements for fish passage, trail ford rehabilitation, and dispersed recreation rehabilitation.

Conclusions

BURP data suggests that this water body unit is fully supporting beneficial uses. No TMDL is necessary at this time.

Little Smoky Creek (Source to mouth) - ID17050113SW018



Assessment Units Included

This water body unit consists of four named streams. The AU was not listed on the 2002 §303(d) list and was not addressed in the 2008 TMDL/SBA. This water body unit contains one 2008 §303(d)-listed AU (018_03) which includes Grindstone Creek, Liberal Creek, Little Smoky Creek, and Salt Creek. These are shown in bold in Table 15 below with the BURP data available for this water body unit.

Data Analysis

The USFS has completed many habitat improvement projects in these AUs since 2000. These include beaver introductions, large woody debris placements, logging site rehabilitations, road and trail ford rehabilitations/decommissioning, culvert removals, and campsite rehabilitations.

Table 15. Streams and BURP data for Little Smoky Creek from the source to the mouth- ID17050113SW018.

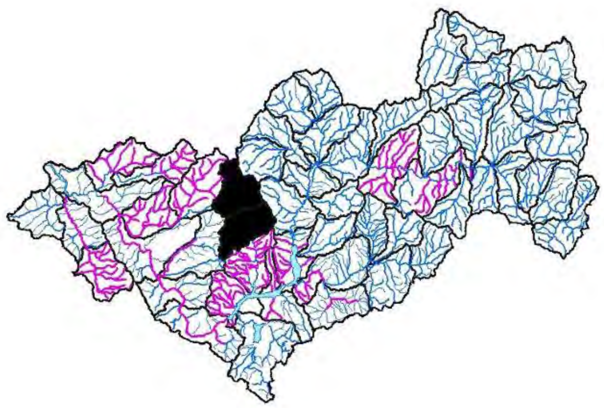
Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Basalt Creek- 2nd order (1997STWFA051)	8/18/1997	4.30	1.27	13.0	3		3	3
Blackhorse Creek- 2nd order (1997STWFA050)	8/18/1997	4.65	1.1	13.0	3		3	3
Cannonball Creek- 2nd order (1997STWFA049)	8/18/1997	3.03	0.1	3.2	3		2	2.5
Five Points Creek- 2nd order (1997STWFA059)	8/21/1997	2.74	0.9	12.0	3		3	3
Grindstone Creek- 3rd order (2004STWF034)	7/26/2004	1.28	0.2	13.1	2		1	1.5
Grindstone Creek-3rd order (2005STWF011)	7/20/2005	1.28	0.24	9.6	3	3	3	3
King of the West Creek- 2nd order (1997STWFA052)	8/18/1997	2.21	0.3	13.0	3		3	3
Lick Creek- 2nd order (1997STWFA057)	8/21/1997	4.48	0.7	9.0	3		3	3
Liberal Creek- 3rd order (1997STWFB048)	8/18/1997	5.13	0.1	14	3		1	2
Miller Creek- 2nd order (1997STWFA055)	8/21/1997	3.71	0.6	9.0	3		3	3
Placer Creek- 2nd order (1997STWFA058)	8/21/1997	3.33	0.1	9.0	3		3	3
Salt Creek- 3rd order (1997STWFB054)	8/2/1997	3.41	0.1	9.0	3		3	3
Little Smoky Creek- 4th order (2007SBOIA127)	8/20/2007	9.29	1.11	13.1		3	2	
Big Smoky Creek- 5th order (2007SBOIA128)	8/21/2007	2.79	46.35	12.2		2	3	

Conclusions

Although Grindstone Creek (2004STWF034) had data that produced low scores in 2004, data from that survey did show low fine sediment, high bank stability, and adequate canopy cover. The survey done in 2005 (2005STWF011) was done upstream of the 2004 sample and scored very high in SMI, SHI, and SFI. Other 3rd order streams in the area had scores that suggest full support of beneficial uses. No TMDL is necessary at this time.

The 4th and 5th order AUs were listed as not assessed (Section 3) in the 2008 Integrated Report. These AUs were sampled in 2007 and Macroinvertebrate sampling results will not be available until the fall of 2008; however, it is presumed that beneficial uses are supported in this AU based on the fish and habitat index scores listed in Table 15. Both the 4th and 5th order AU should be moved from Section 3 to Section 2 of the next Integrated Report. These AUs will be reassessed during the next five-year review and support status will be changed if necessary.

Fall Creek (Source to Anderson Ranch Reservoir) - ID17050113SW031



Assessment Units Included

This water body unit consists of 23 named streams in addition to 30.2 miles of unnamed tributaries. There is one §303(d)-listed AU in this water body unit (031_02). Streams with BURP data associated with this AU are shown in Table 16.

Table 16. Streams and BURP data for Fall Creek from the source to Anderson Ranch Reservoir- ID17050113SW031.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Camp Creek- 2nd order (1998SBOIA021)	6/25/1998	3.68	1.0	9.5	2		1	1.5
Fall Creek- 3rd order (2006SBOIA035)	7/7/2006	3.65	43.63	8.7	3		3	3
Fall Creek- 4th order (2006SBOIA036)	7/7/2006	4.99	56.9	14.5	3		3	3
Meadow Creek- 2nd order (2006SBOIA034)	7/7/2006	4.70	1.56	16.0	3		3	3

Data Analysis

Camp Creek was dry in 2006, indicating that it is an intermittent stream. Streams discovered to be dry for significant portions of the year do not have a reasonable potential to support beneficial uses. The EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). The 1998 survey of Camp Creek survey will not be used in this assessment. Meadow Creek, a perennial stream, was shown to be fully supporting beneficial uses in 2006.

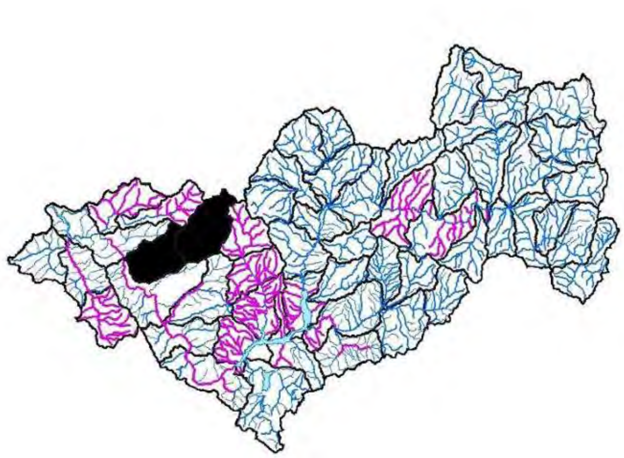
Restoration Activities

The USFS has completed several habitat improvement projects to this water body unit since 2000. These include trail relocation/decommissioning and trail ford rehabilitation.

Conclusions

Perennial streams in the 2nd order AU for Fall Creek are fully supporting beneficial uses. No TMDL is necessary at this time. This AU should be moved to Section 2 of the next Integrated Report.

Smith Creek (Source to mouth) - ID17050113SW032



Assessment Units Included

This water body unit consists of 11 named streams in addition to 15.2 miles of unnamed tributaries. There is one §303(d)-listed AU in this water body unit (032_03), Smith Creek. Sites associated with this AU are shown in bold on Table 17 with BURP data available for this water body unit.

Table 17. Streams and available BURP data for Smith Creek from the source to the mouth- ID17050113SW032.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Smith Creek- 3rd order (1994SBOIA023)	6/30/1994	16.45	18.8	10.0	3		2	2.5
Smith Creek- 3rd order (1994SBOIA024)	6/30/1994	16.45	1.6	25.0	3		1	2
Smith Creek- 3rd order (1995SBOIC001)	7/18/1995	16.45	46.1	NA	3		2	2.5
Smith Creek- 3rd order (1995SBOIC002)	7/17/1995	16.45	53.9	NA	3		3	3
Smith Creek- 3rd order (1996SBOIA038)	7/25/1996	16.45	68.5	9.0	3	2	3	2.7
Smith Creek- 3rd order (1996SBOIA062)	7/9/1996	16.45	19.1	16.0	0		3	0
Smith Creek- 3rd order (1999SBOIA038)	9/7/1999	16.45	0.59	20.3	2		1	1.5
Smith Creek- 3rd order (2006SBOIA031)	7/5/2006	16.45	12.56	15.7	3		2	2.5
Smith Creek- 3rd order (2007SBOIA097)	8/9/2007	16.45	5.69	15.3		1	3	

The 3rd order segment of Smith Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The 2007 sample was not used to assess the current beneficial use support status of Smith Creek even though scores for the habitat and fish indices are shown in Table 17.

Data Analysis

Smith Creek is listed for unknown pollutants in the 3rd order stream segment. Some non-Tier I BURP scores indicate that sediment may be a pollutant of concern for this segment. Core sampling of subsurface fine sediment showed an average of 24% fine sediment, which is below the recommended limit of 27%. BURP assessments of 3rd order Smith Creek show relatively high values of bank stability (84% in 1999, 97% in 2006). Sediment does not appear to be impairing the beneficial uses of 3rd order Smith Creek. Satellite imagery shows nine constructed flow and habitat alterations on the 3rd order AU of Smith Creek. Much of lower Smith Creek is dewatered for several months each summer.

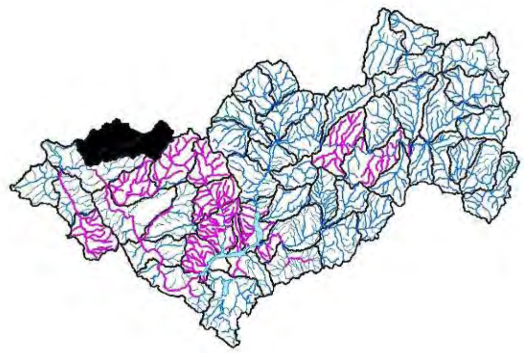
Restoration Activities

The USFS began projects in several areas of this water body unit in 2003 to reduce the amount of livestock grazing.

Conclusions

Beneficial uses in 2nd order Smith Creek are impaired by temperature and a temperature TMDL has been prepared for this AU. Bank stability and subsurface fine sediment for the 3rd order AU of Smith Creek are within the recommended limits, and a sediment TMDL is not necessary at this time. Flow and habitat alteration structures are present within the 3rd order Smith Creek and this AU should be listed for flow and habitat alteration. The EPA does not believe that flow or habitat alterations are pollutants as defined by the Clean Water Act. Since TMDLs are not required for water bodies impaired by pollution but not pollutants, a TMDL was not developed for this AU. It should be moved to Section 4c of the next Integrated Report for flow and habitat alterations.

Rattlesnake Creek (Source to Arrowrock Reservoir) - ID17050113SW033



Assessment Units Included

This water body unit consists of eight named streams in addition to 15.9 miles of unnamed tributaries. There is one §303(d)-listed AU in this water body unit (033_02) which includes Corral, Elk, Grape, Little Rattlesnake, Rattlesnake, Slater, and Tipton Creeks.

Table 18. Streams and BURP data for Rattlesnake Creek from the source to Arrowrock Reservoir- ID17050113SW033.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Little Rattlesnake Creek- 2nd order (2006SBOIA032)	7/6/2006	6.08	1.29	19.3	3		2	2.5
Rattlesnake Creek- 3rd order (1995SBOIB025)	6/26/1995	10.88	64.4	14.5	3		3	3
Rattlesnake Creek- 3rd order (1995SBOIB026)	6/27/1995	10.88	60.4	8.0	1		3	2
Rattlesnake Creek- 3rd order (1995SBOIB027)	6/27/1995	10.88	65.1	13.0	1		3	2
Rattlesnake Creek- 3rd order (1997SBOIB016)	6/26/1997	10.88	40.7	13.0	3		1	2
Rattlesnake Creek- 3rd order (1997SBOIB017)	6/26/1997	10.88	44.2	17.0	2		1	1.5
Rattlesnake Creek- 3rd order (2006SBOIA033)	7/6/2006	10.88	27.8	13.0	3		3	3

Data Analysis

Tier I data collected in 2006 indicate full support of beneficial uses. Non-tier I data may have been affected by natural events. In 1992, a large wildfire burned the hillsides surrounding Rattlesnake Creek and most of its tributaries. A large rain-on-snow event in December 1996 caused landslides from Prairie to Garden Valley. Rattlesnake Creek and Little Rattlesnake Creek were both severely impacted by these events. Satellite images show that some flood-control terracing has been completed on approximately 450 acres on the hillsides around Little Rattlesnake Creek to mitigate effects to the soil resulting from the 1992 fire.

Restoration Activities

The USFS began a project in 2003 to reduce the amount of livestock grazing in this AU.

Conclusions

Tier I data indicates that beneficial uses for the listed AU are fully supported despite natural event impacts to the area around Little Rattlesnake Creek. Because the landslide and fire were both natural events and recent BURP scores are greater than 2.0, the 2nd order AU should be delisted for sediment and moved to Section 4c of the next Integrated Report and a TMDL is not necessary at this time.

2.5 Summary

In summary, Table 19 indicates the changes that should be made to the §303(d) list and the TMDLs that should be prepared based on the analyses in this assessment.

Table 19. Actions taken for the assessment units listed on the 2002 and 2008 §303(d) list.

Water Body Segment AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Comments
Upper Willow Creek 002a_02	Sediment	None	Delist for Sediment. List for flow alteration. Move to Section 4c.	Streams routinely go dry in mid-summer due to flow alteration.
Upper Willow Creek 002a_03	Sediment	None	Delist for Sediment. List for flow alteration. Move to Section 4c.	Streams routinely go dry in mid-summer due to flow alteration.
Lower Willow Creek 002b_03	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Lower Willow Creek 002b_04	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
South Fork Boise River – 2nd order tributaries 004_02	Unknown	None	Delist for unknown. Move to Section 2.	Data indicates full support on perennial streams.
South Fork Boise River-Dixie Creek 004_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Natural high flows led to high sediment load.
South Fork Boise River - South Fork Boise River and Trail Creek 004_06	Sediment	None	Delist for Sediment. Move to Section 4c.	Listing status not supported by data. Flow is altered by reservoir management practices.
Anderson Ranch Reservoir – 1st and 2nd order tributaries –Goat, Lester, Wilson, Evans 005_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support on perennial streams.
Little Camas Creek Reservoir 007_0L	Sediment	None	Delist for Sediment. Move to Section 3.	Waterbody is Unassessed.
Moores Creek 010_03a	Unknown	None	Not Assessed	No Tier I data available.

Water Body Segment AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Comments
Lime Creek 010_05	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
South Fork Boise River - Jumbo Creek and Big Water Gulch 015_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Little Smoky Creek 018_03	Unknown	None	Delist for Unknown. Move to Section 2	Data indicates full support.
Fall Creek 031_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support
Smith Creek 032_02	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
Smith Creek 032_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Data indicates full support of beneficial uses. Nine constructed control points alter flow and habitat.
Rattlesnake Creek 033_02	Sediment	None	Delist for sediment. Move to Section 4c.	Natural fire activity/landslide led to sediment impacts.

3. Subbasin Assessment–Pollutant Source Inventory

This section of the SBA introduces possible sources for the pollutants listed on the §303(d) list for the South Fork Boise River subbasin.

3.1 Sources of Pollutants of Concern

This section describes the point and nonpoint pollutant sources within the South Fork Boise River subbasin. There is one known permitted point source in the area and recreational dredge mining. The nonpoint source descriptions are not intended to be specific. Rather, they are descriptions of the general processes whereby pollutants are delivered to the water bodies of concern.

Point Sources

A point source is defined as a source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into receiving water. Known point sources in the South Fork Boise River subbasin are discussed here.

Superfund and RCRA Sites

There are currently no Superfund or Resource Conservation Recovery Act (RCRA) sites in the subbasin.

NPDES Permits

There is one privately owned National Pollutant Discharge Elimination System (NPDES) permitted point source in the subbasin, the Elk Valley Subdivision wastewater treatment system. The permit was approved in April 2005 for the treatment facility located in Featherville, Idaho, discharging into the South Fork Boise River via an unnamed tributary approximately three miles in length. Treatment of the wastewater at this facility consists of primary, secondary, and advanced treatment through two sequential batch reactors followed by sand filtration and ultraviolet disinfection. The permit specifies monitoring requirements for criteria summarized in Table 20.

Table 20. Monitoring Requirements for Elk Valley Subdivision Wastewater Treatment System

Parameter	Sample Location	Sample Frequency	Sample Type
Flow	Effluent	1/week	Measure
Biochemical Oxygen Demand (BOD)	Influent and Effluent	1/month	Grab
Total Suspended Solids (TSS)	Influent and Effluent	1/month	8-hour composite
E. coli	Effluent	5/month	Grab
Total Phosphorous	Effluent	1/quarter	Grab
Total Inorganic Nitrogen	Effluent	1/quarter	Grab
Total Ammonia as N	Effluent	1/quarter	Grab
pH	Effluent	1/week	Grab

The permit also specifies that surface water monitoring, upstream of the facility's discharge point, shall be conducted quarterly for a minimum of three years. All surface water samples will be grab samples.

Table 21 summarizes the general permit information for the Elk Valley Subdivision.

Table 21. Elk Valley Subdivision Wastewater Treatment Permit Information

Source and Permit #	Service Area Population	Expiration Date	Permit Limits	Discharge Volume
Elk Valley Subdivision ID-0027970-9	78	5/31/2010	• BOD (30 mg/L 30 day average, 45 mg/L 7 day average) • TSS (30 mg/L 30 day average, 45 mg/L 7 day average) • E. coli (126 CFU/100 ml 30 day average, 406 CFU/100 ml instantaneous maximum)	0.0093 mgd (million gallons per day)

Other Point Sources

Motorized dredges disturb streambeds and can remove fish eggs and destroy spawning habitat. DEQ will consider recreational dredgers to be in compliance with any TMDLs so long as they adhere to all required state and federal regulations and permit conditions. These permits are administered by the Idaho Department of Water Resources (IDWR) based on applicable regulations, which may prohibit this activity in some or all Idaho waters during certain periods of time as determined by IDWR. The IDWR Web page for recreational dredge mining is at http://www.idwr.idaho.gov/water/stream_dam/sca/sca4.htm

Beaver ponds have been identified as common in several watersheds in the subbasin and are known to widen streams and slow or impound water. This activity can affect temperature and sediment concentration of receiving waters and is not considered to be an anthropogenic source of pollutants. There are documented observations of beaver ponds on the North, Middle, and South Forks of Lime Creek (SNF, personal communication from D. Kenney to S. Beattie (DEQ), 2008) and these sources do not receive load allocations or reduction targets in the TMDL.

Nonpoint Sources

Some conditions that impair water quality do not receive TMDLs. The EPA considers anthropogenic impacts that prevent the attainment of beneficial uses, such as flow alteration, or habitat alteration, as "pollution" even though they are not "pollutants." However, TMDLs are only required when pollution (as defined above) can be identified and in some way quantified.

Temperature

Anthropogenic modifications to the riparian zone of Smith Creek and Lime Creek have increased the solar load to the surface water system, resulting in increased water temperatures. The modifications addressed by the TMDL are anthropogenic alterations related to roads, farming, grazing, mining, timber harvest, community or domestic development, or other activities, that reduced stream shade or altered the stream in a way that resulted in increased stream temperatures. Events that are naturally-occurring, such as beaver dams, wild land fire, etc. may also reduce stream shade or alter the stream in a manner that results in increased stream temperatures, but those events are not addressed by TMDLs, for reasons previously stated. DEQ acknowledges that tributaries are likely contributors to temperature impairment and future assessments may include temperature loads for tributaries, which may require additional TMDLs. In order for this temperature TMDL to be effective in restoring support of beneficial uses to the subbasin, all tributary streams must also be at natural background conditions. The most critical timeframe for water temperature is in the summer months when stream flows are naturally at the lowest levels. Dewatered streams and un-shaded impoundments increase the solar load to the surface water system. Without adequate riparian vegetation, surface waters are unprotected from excess solar radiation.

Flow and Habitat Alteration

Numerous flow controls have been constructed in the watershed, some of which serve to augment the periodic high-energy flows, which occur naturally in the watershed as a function of ecoregion and terrain. The current stream morphology limits the natural function of the streams and floodplains by increasing flow velocity and redirecting flow away from the stream channels and the floodplain. Irrigation diversions and impoundments result in dewatered channels, which also contribute to loss of aquatic habitat and riparian vegetation. Without year-round channel flow and an adequate functional flood plain, beneficial uses are likely to remain impaired.

3.2 Data Gaps

DEQ makes every possible effort to use the most current data available for each watershed and collects additional data if possible. However, DEQ acknowledges that additional data would be helpful to increase the accuracy of the analysis. The data gaps that have been identified are discussed below:

Point Sources

While it is believed that recreational dredge mining causes minimal environmental degradation when all permit rules and regulations are adhered to, little or no information exists for this subbasin as to the effects of these activities. There is no data regarding pre-mining conditions for the area.

Nonpoint Source

There is little to no data available for natural background conditions for the water bodies in the South Fork Boise River subbasin. For this reason, WQS criteria is used to determine the beneficial use attainment status of streams in the subbasin. Streams that are identified as exceeding WQS criteria are listed as impaired as required by the CWA.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

The Elk Valley subdivision wastewater treatment facility treats the wastewater from the Elk Valley subdivision and discharges effluent to the South Fork Boise River via a three-mile stretch of an unnamed tributary. The facility is federally regulated as part of the NPDES program. The current permit is effective from June 1, 2005, through May 31, 2010. As part of its discharge monitoring responsibility under the NPDES permit, the facility is required to monitor the effluent to ensure compliance with the permit effluent limits. Effluent limits are set to levels at which it has been determined that violations of the state WQS will not occur as a result of effluent discharge. The permit for the Elk Valley subdivision facility sets limits for effluent BOD, TSS, and *E. coli*. Regular monitoring is also required for flow, total phosphorus, total inorganic nitrogen, and total ammonia (as nitrogen). If permit violations occur, the facility is required to notify EPA and DEQ and to resolve the problem. The monthly discharge monitoring reports are required to be sent to EPA and DEQ and to be kept on file at the facility.

Numerous private landowners have implemented conservation projects with the intent to improve water quality. These projects include fencing, riparian improvements, grazing management plans, and streambank stabilization. Private landowners, corporations and state agencies have also cooperated to implement projects to improve water quality. A list of projects specific to the South Fork Boise River subbasin is summarized in Table 22. This list is not exhaustive, and there may be projects on private land, without state or federal funding, that have not been included.

Table 22. Recent stream or watershed enhancement and restoration projects.

Project Name	Subwatershed	Stream	Year
Beaver introductions	SF Lime-Hearn	SF Lime, Hunter Creek	2000
Beaver introductions	Basalt	Basalt, Sawmill Creeks	2000
Beaver introductions	Upper Little Smoky	Little Smoky Creek	2000
Road to trail conversion	Abbot-Shake	Shake Creek	2000
Noxious weed treatments	Most	Many	2000
Reduction in livestock grazing impacts	Most	Many	2000
Reduction in livestock grazing	Elk	Many	2000
Noxious Weed Treatments	Most	Many	2000
Trail Relocation/Decommissioning	Lower Willow	Many	2000
Trail Ford Rehabilitation	Lower Willow	Many	2000
Culvert Replacement for Fish Passage	Lower Trinity	Trinity, Johnson, Whiskey Jack Creek	2000
Culvert Replacement for Fish Passage	Wagontown-Schoolhouse	Green Creek	2000
Dispersed Campsite Rehabilitation	Cayuse-Rough	South Fork Boise River	2000
Dispersed Campsite Rehabilitation	Pierce-Mennecke	South Fork Boise River	2000
Reduction in livestock grazing	Feather River	Many	2000
Culvert Replacement for Fish Passage	Upper Trinity	Trinity Creek	2001
Boat Launch Restorations	Cayuse-Rough	South Fork Boise River	2002

Project Name	Subwatershed	Stream	Year
Trail Relocation/Decommissioning	Wood	Wood & Bender Creek	2002>
Trail Ford Rehabilitation	Wood	Many	2002>
Beaver re-introductions	Black Canyon-Trail	Timber Gulch	2002
Bank Barbs at Elks Flat	Dog-Nichols	South Fork Boise River	2003
Large woody debris placement for fish habitat	Upper Little Smoky	Little Smoky Creek	2003
Large woody debris placement for fish habitat	Carrie-Red Rock	Carrie Creek	2003
Logging trespass site rehabilitation	Carrie-Red Rock	Carrie Creek tributaries	2003
Dispersed Campsite Rehabilitation	Dog-Nichols	South Fork Boise River	2003
Trail Ford Rehabilitation	Upper Willow	Many	2003>
Reduction in livestock grazing	Upper Rattlesnake	Many	2003>
Reduction in livestock grazing	Upper Smith	Many	2003>
Reduction in livestock grazing	Lower Smith	Many	2003>
Reduction in livestock grazing	Cayuse-Rough	Many	2003>
Reduction in livestock grazing	Pierce-Mennecke	Many	2003>
Planted seedlings	Lower Fall	Mill & Lake Creeks	02-03
Beaver re-introductions	Lower Fall	Little Wilson & Lake Creeks	2000-2004
Riparian Plantings	Lower Fall	Little Wilson Creek	00/04
Gully Restoration	Lower Fall	Little Wilson	03-04
Trail Relocation/Decommissioning	Big Fiddler-Soap	Many	2004
Trail Ford to Bridge	Wood	Wood Creek	2004
Road ford rehabilitation	Upper Little Smoky	Little Smoky Creek	2004
Trail ford rehabilitation	Basalt	Basalt, Sawmill Creeks	2004
Irrigation diversion fish passage improvement	Abbot-Shake	Shake Creek	2004
Trail rehabilitation/relocation	West Fork Big Smoky	West Fork Big Smoky tributaries	2004
Beaver re-introductions	Lower Trinity	Spring Creek	2005
Trail Relocation/Decommissioning	Lower Fall	Camp Creek	2005
Trail Ford to Bridge	Wood	Bender Creek	2005
Trail Ford Rehabilitation	Lower Fall	Camp Creek	2005
Riparian Plantings	Black Canyon-Trail	Timber Gulch	2005
Culvert placement to eliminate ford	Abbot-Shake	Log Chute Gulch	2005
Culvert removal for fish passage	Miller-Salt-Bowns	Salt Creek	2005
Developed campground riparian rehabilitation	Abbot-Shake	South Fork Boise River	2005
Trail rehabilitation/relocation	Boardman	Boardman Creek tributaries	2005-2006
Trail Ford Rehabilitation	Middle Fall	Tally Creek	2006
Trail Relocation/Decommissioning	Middle Fall	Tally Creek	2006
Trail Ford to Bridge	Wood	Flat Creek	2006
Beaver introduction	Upper Willow	Upper Willow, Worswick, Grindstone, Deer Creeks	2006
Culvert replacement for fish passage	Big Water-Virginia	Big Water Gulch	2006
Trail rehabilitation/relocation	Housman-Beaver	Beaver, Deadwood Creeks	2006-2007
Kelley Creek Flats dispersed recreation rehab	Big Water-Virginia	South Fork Boise River	2006-2007
Dispersed campsite rehabilitation	Worswick-Grindstone	Little Smoky Creek	2007

Project Name	Subwatershed	Stream	Year
Dispersed campsite rehabilitation	Carrie-Red Rock	Little Smoky Creek	2007
Dispersed campsite rehabilitation	Upper Little Smoky	Little Smoky Creek	2007
Road ford rehabilitation	Emma-Axolotl	Emma Creek	2007
Unauthorized trail decommissioning	Abbot-Shake	Abbot Gulch	2007
Trail Ford to Bridge	Wood	Flat Creek	2007
Boat Launch Restorations	Pierce-Mennecke	South Fork Boise River	2007
Unauthorized road/trail decommissioning	Boardman	Boardman Creek tributaries	2008
Trail ford rehabilitation	Kelley	East Fork, West Fork, and mainstem Kelley Creek	2008
Unauthorized road/trail decommissioning	Miller-Salt-Bowns	Salt, Bowns, Miller Creek tributaries	2008

This page left intentionally blank for correct double-sided printing.

5. Total Maximum Daily Loads

A TMDL prescribes an upper limit on discharge of a pollutant from all sources to ensure that WQS are met. It further allocates a load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation (WLA); and nonpoint sources, each of which receives a load allocation (LA). Natural background (NB), when present, is considered part of the LA, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of WQS, the rules regarding TMDLs (Water quality planning and management, 40 CFR Part 130) require that a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the LC that is available for allocation to pollutant sources. The NB load is also effectively a reduction in the LC available for allocation to anthropogenic pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First, the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation are completed, the result is a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. The LC must be based on critical conditions – the conditions when WQS are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary. These “other measures” must still be quantifiable, and relate to WQS, 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 LA where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 In-stream Water Quality Targets

The goal of a TMDL is to restore "full support of designated beneficial uses" (Idaho Code 39.3611, 3615). In order to do so, appropriate water quality targets for pollutants must be used. These targets must be quantifiable in order to determine the LC of a water body. For example, the narrative WQS for sediment is translated into a measurable water quality target designed to support beneficial uses.

The goal of this TMDL is to establish a declining temperature load in the appropriate water bodies. Monitoring of pollutant loads and beneficial use support will occur as part of the implementation phase of the TMDL. In the case of temperature impairment, improvement can be attained by many methods, including increased vegetative buffers.

Temperature

For the South Fork Boise River subbasin temperature TMDLs, DEQ utilized a potential natural vegetation (PNV) approach. For PNV temperature TMDLs, it is understood that natural temperatures may sometimes exceed numeric water quality criteria. If stream temperatures are warmer than numeric criteria even when PNV targets are have been achieved, it is assumed that the stream's temperature is at natural background conditions (provided there are no point sources or human -induced non point or ground water sources of heat) and natural background provisions of Idaho WQS apply, as per 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, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increase above natural background conditions when allowed under Section 401."

See Appendix B for further discussion of WQS and background provisions. The PNV approach and the procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in this section. For a more complete discussion of shade and its effects on stream water temperature, refer to the South Fork Clearwater Subbasin Assessment and TMDL (IDEQ, 2004).

Potential Natural Vegetation for Temperature TMDLs

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 likely to be controlled or manipulated. The parameters that affect or control 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 affects how closely riparian vegetation grows together and water storage in the alluvial aquifer. Streamside vegetation and channel morphology are factors influencing shade, which are most likely to have been influenced by anthropogenic activities, and which can most readily be corrected and addressed by a TMDL.

Depending on how much vertical elevation surrounds the stream, vegetation further away from the riparian corridor can provide shade; however, riparian vegetation provides a substantial amount of shade to a stream by virtue of its proximity. We can measure the amount of shade a stream receives in a number of ways. One way is to measure effective shade, which is the shade provided by all objects that intercept the sun as it makes its way across the sky, can be measured in a given spot with a solar pathfinder (or 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. A second way is to measure canopy cover, which is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream. Canopy cover can be measured using a densiometer or estimated either with on-site visual observation or from aerial photography interpretation. All of these methods provide information about how much of the stream is shaded or covered and how much of it is exposed to direct solar radiation.

PNV along a stream is the riparian plant community that has grown to an overall mature state, although some level of natural disturbance is usually included in our development and use of shade targets. The PNV can be removed by disturbance either naturally (wildfire, disease/old age, wind-blown, wildlife grazing) or anthropogenically (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. Anything less than PNV results in the stream heating up from anthropogenically created additional solar inputs. We can estimate PNV from models of plant community structure (shade curves for specific riparian plant communities), and we can measure existing vegetative cover or shade. Comparing the two allows us to calculate how much excess solar load the stream is receiving, and what potential there is to decrease solar gain. Streams disturbed by wildfire require their own time to recover. Streams that have been disturbed by human activity may require additional restoration beyond natural recovery.

Existing shade was estimated for two waterbodies in the South Fork Boise River Subbasin from visual observations of aerial photos. These estimates were field-verified by measuring shade with a solar pathfinder at systematically located points along the streams (see below for methodology). PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in other TMDLs. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, the shade decreases as the vegetation has less ability to shade the center of wide streams. As the vegetation gets taller, the plant community is able to provide more shade at any given channel width. Existing and PNV shade was converted to solar load from data collected on flat plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather station collecting these data. In this case, the Boise station was used. The difference between existing and potential solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with WQS (see Appendix B). PNV shade and loads are assumed to be the natural condition, thus stream temperatures under

PNV conditions are assumed to be natural (so long as there are no point sources or any other anthropogenic sources of heat in the subbasin), and are considered to be consistent with the Idaho WQS, even though they may exceed numeric criteria.

Pathfinder Methodology

The solar pathfinder is a device that allows the user to trace the outline of shade-producing objects on specialized charts (monthly solar path charts). The percentage of the sun's path covered by these objects is the effective shade on the stream at the spot where the tracing is made. In order to adequately characterize the effective shade on a reach of stream, ten traces should be taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the solar pathfinder is placed in the middle of the stream about the bankfull water level. The manufacturer's instructions for taking traces are followed (orient to true south and level). Systematic sampling is easiest to accomplish and still not bias the location of sampling. The user starts at a unique location such as 100 meters from a bridge or fence line and then proceeds upstream or downstream stopping to take additional traces at fixed intervals (e.g., every 100m, every 100 paces, every degree change on a GPS, every 0.1 mile change on an odometer, etc.). The user could instead randomly locate points of measurement by generating random numbers to be used as interval distances.

While taking Solar Pathfinder traces, the user should measure and record bankfull widths and take notes and photographs documenting the presence or absence of shade-producing species. Special attention should also be paid to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade producing ones) are present. Additionally or as a substitute, the user may record densiometer readings at solar pathfinder trace locations. This provides the potential for later developing relationships between canopy cover and effective shade for a stream.

Aerial Photo Interpretation

To estimate canopy coverage or shade expectations based on plant type and density, natural breaks in vegetation density are marked out on a 1:100K or 1:250K hydrography. Each resulting stream segment (interval) is then assigned a single value representing the bottom of the respective 10% cover (canopy coverage) or shade class from the list of classes below (adapted from the CWE process, IDL, 2000*)*. For example, if estimated canopy cover for a particular stretch of stream is between 50% and 59%, we assign the value of 50% to that section of stream. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and the width of the stream. The typical vegetation type specified in the list below shows the kind of landscape a particular shade class usually falls into for a stream 5m wide or less. For example, if a section of a 5m-wide stream is identified as 20% cover class, it is usually because it is in agricultural land, meadows, open areas, or clearcut areas. However, that does not mean that the 20% cover class cannot occur in shrublands and forests, because it does on wider streams.

Shade (canopy cover) class	Typical vegetation type on 5m-wide stream
0 = 0 – 9% cover	agricultural land, denuded areas
10 = 10 –19%	ag land, meadows, open areas, clearcuts
20 = 20 – 29%	ag land, meadows, open areas, clearcuts
30 = 30 – 39%	ag land, meadows, open areas, clearcuts
40 = 40 – 49%	shrublands/meadows
50 = 50 – 59%	shrublands/meadows, open forests
60 = 60 – 69%	shrublands/meadows, open forests
70 = 70 – 79%	forested
80 = 80 – 89%	forested
90 = 90 –100%	forested

It is important to note that the visual estimates made from the aerial photos are strongly influenced by canopy cover. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. We assume that canopy coverage and shade are similar based on research conducted by Oregon DEQ (OWEB, 2001). The visual estimates of shade in this TMDL were field-verified with a solar pathfinder. The pathfinder measures effective shade and accounts for other physical features that block the sun from hitting the stream surface (e.g. hillsides, canyon walls, terraces, man-made structures). The estimate of shade made visually from an aerial photo does not always take into account topography or shading that may occur from physical features other than vegetation. However, research has shown that shade and cover measurements are remarkably similar (OWEB, 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade.

Stream Morphology

Measures of current bankfull width or near-stream disturbance zone width may not reflect widths that were present under PNV. As impacts to streams and riparian areas occur, width-to-depth ratios tend to increase such that streams become wider and shallow. Shadow length 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 been eroded away.

The only factor not developed from the aerial photo work described previously is channel width. This parameter is estimated from available information. We use regional curves for the major basins in Idaho, data compiled and graphs produced by Diane Hopster of Idaho Department of Lands (Figure 14), to estimate natural bankfull width.

For each stream evaluated in the loading analysis, bankfull width was estimated based on drainage area of the upper Snake River Basin curve shown in Figure 14. Separately, existing bankfull width was determined from available data. If the stream’s existing width is wider than the curve-based estimate, then the curve-based estimate of bankfull width is used in the loading analysis for natural width. If existing width is smaller, then existing width is used in the loading analysis for natural width. In most cases, existing widths are about the same as the predicted widths so existing data are used for natural widths in these areas.

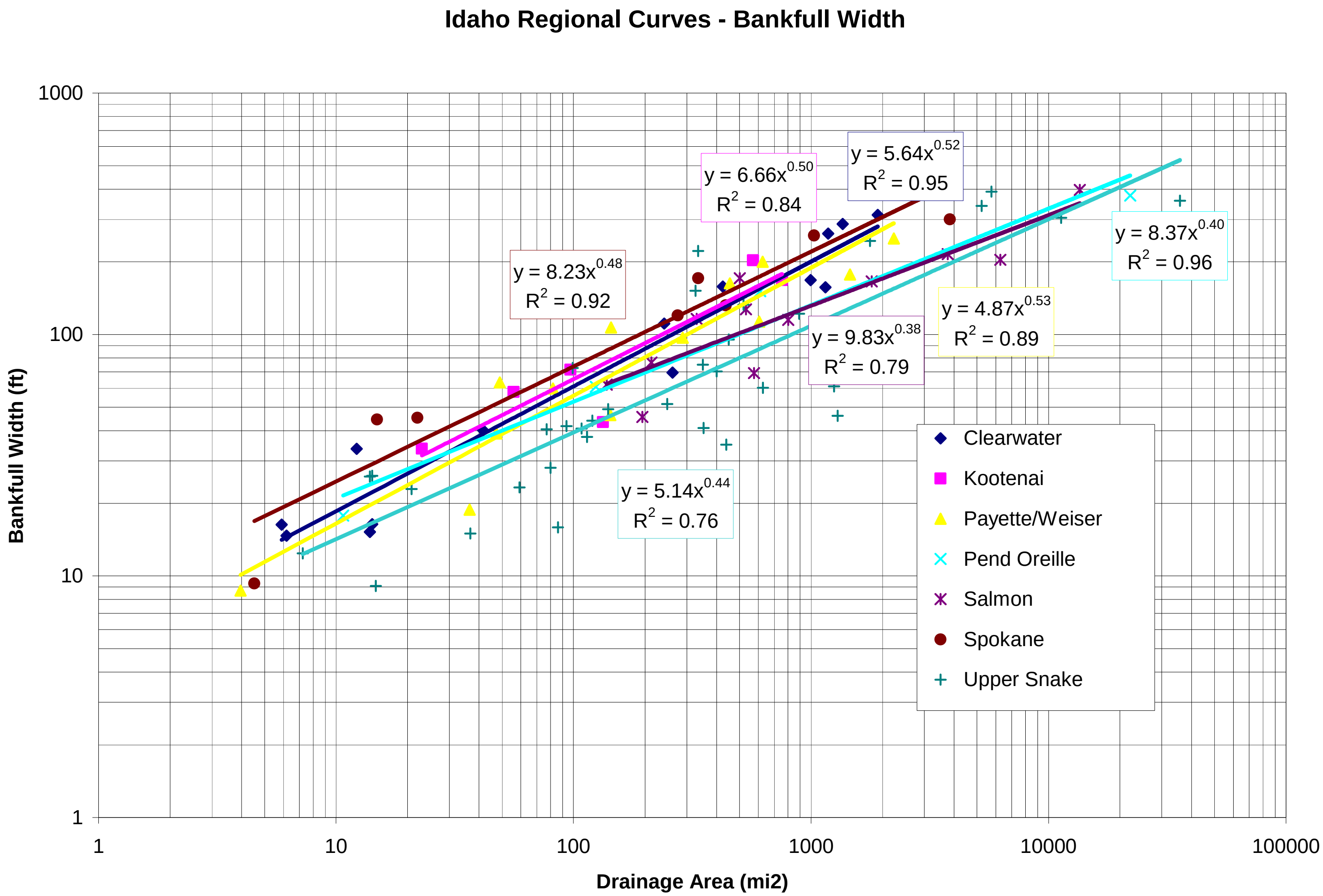


Figure 14. Bankfull Width as a Function of Drainage Area, From Idaho Department of Lands, 2000.

Table 23. Bankfull widths estimated based on the upper Snake River Basin regional curve and existing measurements of bankfull width.

Location	Drainage Area (square miles)	Curve-based estimate (upper Snake River Basin curve) (m)	Existing (m)
Lime Creek at mouth	133.4	13	13.5
Lime Creek Below Trail Creek	96.66	12	11.8
Lime Creek above Trail Creek	94.7	12	12.2
Lime Creek above Slickear Creek	87.91	11	Unknown
Lime Creek below Sprout Creek	37.6	8	Unknown
NF Lime Creek at mouth	17.2	5	Unknown
MF Lime Creek at mouth	17.15	5	5.5
SF Lime Creek at mouth	45.85	8	Unknown
SF Lime Creek above Hunter Creek	36.2	8	8.8
Smith Creek at mouth	51.64	9	6.5
Smith Creek below Graves Creek	51.64	9	6.5
Smith Creek above Spring Creek	43.58	8	8
Smith Creek above Aden Creek	25.94	7	6.7
Smith Creek below Washboard Creek	21.95	6	7.6
Smith Creek above Tiger Creek	17.18	5	4.5
Smith Creek above Mule Gulch	8.37	4	5

Design Conditions

The South Fork Boise subbasin lies in the Southern Forested Mountains Ecoregion (McGrath et al., 2001). This region is characterized by droughty soils resulting from the granite rocks common in the region. Open Douglas-fir is common with grand fir and subalpine fir found at higher elevations and ponderosa pine in the canyons. Mountain sagebrush is also present in the southern parts of the ecoregion.

Smith Creek originates in the Trinity Mountain Range and Lime Creek originates in the Soldier Mountains just west of Smoky Dome. Smith Creek begins in a conifer/meadow vegetation type with a few grass-dominated areas. The three forks of Lime Creek begin in meadows near the tree line and go into a conifer/meadow type soon after. The lower portions of the three forks alternate between conifer/shrub and deciduous shrub vegetation types. Lime Creek, North Fork Lime Creek, and Middle Fork Lime Creek all have several segments that pass through conifer-dominated areas, mainly on the upper portions of the streams. Lime Creek begins where the North and Middle Fork Lime Creek meet in an area dominated by alternating and mixed patches of shrub and conifer forests. South Fork Lime Creek empties into Lime Creek at a point below the conjunction of the north and middle forks. The majority of Lime Creek is within the deciduous shrub vegetation type.

The mixed conifer vegetation type is largely comprised of ponderosa pine and Douglas-fir forests. Willow, alder, dogwood and aspen are also present. The meadow vegetation type, occurring at higher elevations near the tops of the watersheds, consists of various grasses along with lower statured willows and graminoids. The deciduous shrub mix type is mainly willows and mountain alder. The conifer/shrub and conifer/meadow types are similar forest species at lower gradient, broader valley locations where a shrub or grass understory flanks the stream with conifers a short distance from or lightly dispersed around the stream.

Target Selection

To determine PNV shade targets for the South Fork Boise River subbasin, effective shade curves from several existing temperature TMDLs were used, as described earlier in this section. Because no two landscapes are exactly the same, shade targets were derived using an average of the various shade curves available to represent the range of shade conditions of the riparian community specific to this TMDL.

Shade Curves

To develop shade targets for the mixed conifer vegetation type (Table 24), shade curves for Ponderosa pine and Douglas-fir types were averaged. The shade curves for Ponderosa pine and Douglas-fir came from the Salmon-Chamberlain (Crooked Creek) TMDL (IDEQ 2002). The Ponderosa pine shade curve has an average canopy density of 58% and an average height of 59 feet and includes green ash and common chokecherry. The Douglas-fir shade curve has an average canopy density of 64% and an average height of 83 feet and includes red-osier dogwood, common chokecherry, quaking aspen, and narrowleaf and black cottonwood. Based on the BNF potential vegetation groups (USDA, 2003), Ponderosa pine and Douglas-fir are found in mixed patches along specific stream segments, none of which are separable into segments dominated by either conifer type.

Table 24. Shade targets for the conifer vegetation type at various stream widths.

Mixed Conifer	1m	2m	3m	4m	5m	6m	7m	8m	9m
ponderosa pine (IDEQ, 2002)	84	80	77	75	73	72	69	65	62
Douglas fir (IDEQ, 2002)	91	89	86	85	84	82	80	79	77
Average	87.5	84.5	81.5	80.0	78.5	77.0	74.5	72.0	69.5
Target (%)	**88**	**85**	**82**	**80**	**79**	**77**	**75**	**72**	**70**

To create shade targets for the conifer/shrub vegetation type (Table 25), the same Douglas-fir shade curve used in the conifer type is blended with a mid-elevation (4,500' to 6,500') willow/alder shade curve from the Trout Creek Mountains Ecological Provence of the Alvord Lake TMDL (ODEQ, 2003). The willow/alder shade curve has an average canopy density of 75% and an average height of 24 feet.

Table 25. Shade targets for the conifer/shrub vegetation type at various stream widths.

Conifer/Shrub	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m
willow/alder - Trout (ODEQ, 2003)	90	86	79	70	65	57	51	50	44	40	36	33
Douglas fir (IDEQ, 2002)	91	89	86	85	84	82	80	79	77	75	73	71
Average	90.5	87.5	82.5	77.5	74.5	69.5	65.5	64.5	60.5	57.5	54.5	52.0
Target (%)	**91**	**88**	**83**	**78**	**75**	**70**	**66**	**65**	**61**	**58**	**55**	**52**

To create shade targets for the conifer/meadow vegetation type (Table 26), the same Douglas-fir shade curve used in the conifer vegetation type is blended with a tufted hairgrass shade curve from the Salmon-Chamberlain (Crooked Creek) TMDL (IDEQ, 2002). The tufted hairgrass shade curve has an average canopy density of 42% and an average height of 2 feet.

Table 26. Shade targets for the conifer/meadow vegetation type at various stream widths.

Conifer/Meadow	1m	2m	3m	4m	5m
tufted hairgrass (IDEQ, 2002)	43	30	17	15	12
Douglas fir (IDEQ, 2002)	91	89	86	85	84
Average	67	59.5	51.5	50.0	48
Target (%)	**67**	**60**	**52**	**50**	**48**

Shade targets for the meadow vegetation type (Table 27) were developed by averaging the shade curve for graminoid/willow from the Trout Creek Mountains Ecological Provence of the Alvord Lake TMDL (ODEQ, 2003) and the same shade curve for tufted hairgrass used to describe the conifer/meadow vegetation type. The graminoid/willow shade curve has an average canopy density of 10% and an average height of 8.5 feet.

Table 27. Shade targets for the meadow vegetation type at various stream widths.

Meadow	1m	2m	3m	4m	5m
tufted hairgrass (IDEQ, 2002)	43	30	17	15	12
graminoid/willow-Trout (ODEQ, 2003)	39	26	18	14	10
Average	41	28.00	17.5	14.5	11.00
Target (%)	**41**	**28**	**18**	**15**	**11**

The shade curve used to create the shade targets for the shrub vegetation type (Table 28) is the same willow/alder shade curve used for the conifer/shrub vegetation type.

Table 28. Shade targets for the shrub vegetation type at various stream widths.

Deciduous Shrub Mix	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m	13m
willow/alder - Trout (ODEQ, 2003)	90	86	79	70	65	57	51	50	44	40	36	33	30
Target (%)	**90**	**86**	**79**	**70**	**65**	**57**	**51**	**50**	**44**	**40**	**36**	**33**	**30**

Monitoring Points

Accuracy of the aerial photo interpretations used to estimate shade was field-verified with a solar pathfinder at six locations on Smith Creek. Figures 16 shows the Smith Creek shade estimates based on aerial photo interpretation. Of the six sites field-verified by solar pathfinder, the shade class (10% interval) matched the photo-based estimate of shade class (10% interval) for the respective stream segment at five locations. For the remaining site, the measured shade was only one 10% class interval greater than estimated for the stream segment it was verifying.

For monitoring effective shade, field verification can take place on any reach throughout the South Fork Boise River Subbasin and be compared to estimates of existing shade displayed on Figures 16 (Smith Creek) and 19 (Lime Creek) and described in Tables 30 through 34. Areas with the greatest disparity between existing shade estimates and shade targets should be monitored with solar pathfinders to verify existing shade levels and measure progress toward meeting shade targets. It is important to note that many existing shade estimates have not been field-verified, and may require adjustment during the implementation process. Field verification of stream segments for the TMDL requires the selection of representative stream segments for study. For instance, stream segments with active beaver colonies and correlated reductions in riparian vegetation and increases in stream width should not be the focus of representative field-verification studies, as these segments do not have load allocations or temperature reduction targets in the TMDL.

Stream segments for which existing shade has been estimated are varied in length, depending on land use or landscape that has affected that natural shade level. It is appropriate to monitor any existing stream segment to see if that segment has achieved target levels. Solar pathfinder measurements taken at ten equally-spaced distances within any given segment and averaged together should suffice to determine new shade levels in the future.

5.2 Load Capacity

The LC is the "greatest loading a waterbody can receive without violating water quality standards" [40 CFR $130.2]. This must be at a level to meet "…water quality standards with season variations and an MOS that takes into account any lack of knowledge…" (Clean Water Act §303(d) (c)). Likely sources of uncertainty include the lack of knowledge of assimilative capacity, uncertain relation of selected target(s) to beneficial use(s), lack of data regarding NB conditions, and variability in target measurement.

The LC for a stream under PNV is essentially the solar loading allowed under the shade targets specified for the reaches within that stream. These load capacities are determined by multiplying the solar load to 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 1-percent shade). In other words, if a shade target is 60% (or 0.6), then the maximum solar load hitting the stream under that target is 40% of the load hitting the flat plate collector under full sun.

Late July and early August typically represent a period of highest stream temperatures. Solar gains can begin early in the spring and affect the highest temperatures reached later on in the summer and salmonids spawning temperatures in spring and fall. Therefore, solar loading in these streams is evaluated from spring (April) to early fall (September). DEQ obtained solar load data for flat plate collectors from the National Renewable Energy Laboratory (NREL) weather station in Boise, ID. The solar loads used in this TMDL are spring/summer averages, thus, we use an average load for the six-month period from April through September. These months coincide with time of year that stream temperatures are increasing and when deciduous vegetation is in leaf. Tables 30 through 34 show the PNV shade targets (identified as Target or Potential Shade) and the corresponding potential summer load for each (in kWh/m2/day and kWh/day) that serve as the loadi capacities for the streams.

The effective shade calculations are based on the same time period as solar load data, for the same reasons as previously mentioned. Total target loads for the streams evaluated in the South Fork Boise River Subbasin range from 55,739 kWh/day for the Middle Fork of Lime Creek to 830,364 kWh/day for Lime Creek. The total target load for Smith Creek, at 626,911 kWh/day, is less than for Lime Creek.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR §130.2(I)). An estimate must be made for each point source. Loads from 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 land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads. Table 29 summarizes the point source permitted discharge in the South Fork Boise River subbasin. Note that while there is one permitted point source, it does not discharge into a §303(d) listed stream. The Elk Valley Subdivision Wastewater Treatment facility discharges into the South Fork Boise River above Anderson Ranch Reservoir. This source will not be included in load calculations for §303(d) listed AUs.

Table 29. Current waste loads from the single point source in the South Fork Boise River subbasin.

Waste load Type	Load	NPDES[a] Permit Number
Elk Valley Subdivision Wastewater Treatment	• BOD (30 mg/L 30 day average, 45 mg/L 7 day average) • TSS (30 mg/L 30 day average, 45 mg/L 7 day average) • E. coli (126 CFU/100 ml 30 day average, 406 CFU/100 ml instantaneous maximum)	ID-0027970-9

[a] National Pollutant Discharge Elimination System

Existing loads in this temperature TMDL come from aerial photo-based estimates of existing shade. Like target shade, each existing shade estimate was converted to a solar load by multiplying the fraction of open stream by the amount of solar radiation, as measured on a flat plate collector at the NREL weather station in Boise. Existing shade data (by proportion and kWh/m2/day) and existing loads (by proportion and kWh/m2/day) are presented in Tables 30 through 34 by stream area.

Existing and potential (target) loads in kWh/day can be summed for the entire stream or for the portion of stream examined in a single loading table. These total loads are shown at the bottom of their respective columns in each table. The difference between potential load and existing load is also summed for the entire table. If existing load exceeds potential load, the amount of the difference becomes the excess load that is discussed next in the load allocation section. The percent reduction shown in the lower right corner of each table represents how much total excess load there is in relation to total existing load.

Total existing loads for the streams evaluated in the South Fork Boise River subbasin range from 90,251 kWh/day for the Middle Fork of Lime Creek to 986,833 kWh/day for Lime Creek. The total existing load for Smith Creek, at 911,900 kWh/day, is less than that of Lime Creek.

Table 30. Existing and potential solar loads for Smith Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Smith Creek
AU# ID17050113SW032_02														
220	0.5	3.19	0.67	2.1054	-1.08	1	1	220	701.8	220	463.188	-238.612	-17	Conifer/Meadow
340	0.4	3.828	0.67	2.1054	-1.7226	1	1	340	1301.52	340	715.836	-585.684	-27	
240	0.5	3.19	0.67	2.1054	-1.0846	1	1	240	765.6	240	505.296	-260.304	-17	
180	0.3	4.466	0.41	3.7642	-0.7018	1	1	180	803.88	180	677.556	-126.324	-11	Meadow
800	0.5	3.19	0.67	2.1054	-1.0846	1	1	800	2552	800	1684.32	-867.68	-17	Conifer/Meadow
290	0.4	3.828	0.67	2.1054	-1.7226	1	1	290	1110.12	290	610.566	-499.554	-27	
860	0.5	3.19	0.67	2.1054	-1.0846	1	1	860	2743.4	860	1810.644	-932.756	-17	
320	0.4	3.828	0.28	4.5936	0.7656	2	2	640	2449.92	640	2939.904	489.984	0	Meadow
250	0.6	2.552	0.6	2.552	0	2	2	500	1276	500	1276	0	0	Conifer/Meadow
410	0.4	3.828	0.28	4.5936	0.7656	2	2	820	3138.96	820	3766.752	627.792	0	Meadow
770	0.6	2.552	0.88	0.7656	-1.7864	2	2	1540	3930.08	1540	1179.024	-2751.056	-28	Conifer/Shrub
2640	0.7	1.914	0.83	1.0846	-0.8294	3	3	7920	15158.88	7920	8590.032	-6568.848	-13	
950	0.6	2.552	0.78	1.4036	-1.1484	4	4	3800	9697.6	3800	5333.68	-4363.92	-18	
							Subtotal	**18,150**	**45,630**	**18,150**	**29,553**	**-16,077**		
AU# 17050113SW032_03														
1190	0.6	2.552	0.78	1.4036	-1.1484	4	4	4760	12147.52	4760	6681.136	-5466.384	-18	
430	0.3	4.466	0.65	2.233	-2.233	5	5	2150	9601.9	2150	4800.95	-4800.95	-35	Shrub
510	0.4	3.828	0.65	2.233	-1.595	5	5	2550	9761.4	2550	5694.15	-4067.25	-25	
300	0.6	2.552	0.75	1.595	-0.957	5	5	1500	3828	1500	2392.5	-1435.5	-15	Conifer/Shrub
670	0.4	3.828	0.65	2.233	-1.595	5	5	3350	12823.8	3350	7480.55	-5343.25	-25	Shrub
1490	0.3	4.466	0.57	2.7434	-1.7226	6	6	8940	39926.04	8940	24525.996	-15400.044	-27	
980	0.2	5.104	0.51	3.1262	-1.9778	7	7	6860	35013.44	6860	21445.732	-13567.708	-31	
150	0	6.38	0.51	3.1262	-3.2538	7	7	1050	6699	1050	3282.51	-3416.49	-51	
3870	0.1	5.742	0.51	3.1262	-2.6158	7	7	27090	155550.78	27090	84688.758	-70862.022	-41	
830	0.3	4.466	0.51	3.1262	-1.3398	7	7	5810	25947.46	5810	18163.222	-7784.238	-21	
1710	0.2	5.104	0.51	3.1262	-1.9778	7	7	11970	61094.88	11970	37420.614	-23674.266	-31	
420	0	6.38	0.5	3.19	-3.19	8	8	3360	21436.8	3360	10718.4	-10718.4	-50	
1010	0.3	4.466	0.5	3.19	-1.276	8	8	8080	36085.28	8080	25775.2	-10310.08	-20	
1720	0.2	5.104	0.5	3.19	-1.914	8	8	13760	70231.04	13760	43894.4	-26336.64	-30	
270	0.6	2.552	0.5	3.19	0.638	8	8	2160	5512.32	2160	6890.4	1378.08	0	
1280	0.4	3.828	0.5	3.19	-0.638	8	8	10240	39198.72	10240	32665.6	-6533.12	-10	
280	0	6.38	0.5	3.19	-3.19	8	8	2240	14291.2	2240	7145.6	-7145.6	-50	
1440	0.2	5.104	0.5	3.19	-1.914	8	8	11520	58798.08	11520	36748.8	-22049.28	-30	
290	0.4	3.828	0.5	3.19	-0.638	8	8	2320	8880.96	2320	7400.8	-1480.16	-10	
1910	0.6	2.552	0.61	2.4882	-0.0638	9	9	17190	43868.88	17190	42772.158	-1096.722	-1	Conifer/Shrub
160	0.5	3.19	0.61	2.4882	-0.7018	9	9	1440	4593.6	1440	3583.008	-1010.592	-11	
430	0.6	2.552	0.61	2.4882	-0.0638	9	9	3870	9876.24	3870	9629.334	-246.906	-1	
210	0.5	3.19	0.61	2.4882	-0.7018	9	9	1890	6029.1	1890	4702.698	-1326.402	-11	
760	0.6	2.552	0.61	2.4882	-0.0638	9	9	6840	17455.68	6840	17019.288	-436.392	-1	
1250	0.4	3.828	0.44	3.5728	-0.2552	9	9	11250	43065	11250	40194	-2871	-4	Shrub
2850	0.3	4.466	0.44	3.5728	-0.8932	9	9	25650	114552.9	25650	91642.32	-22910.58	-14	
							Subtotal	**197,840**	**866,270**	**197,840**	**597,358**	**-268,912**		
							Total	**215,990**	**911,900**	**215,990**	**626,911**	**-284,989**		

Table 31. Existing and potential solar loads for Lime Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Lime Creek
AU# ID17050113SW010_04														
200	0.5	3.19	0.5	3.19	0.00	8	8	1600	5104	1600	5104	0	0	Shrub
350	0.6	2.552	0.65	2.233	-0.319	8	8	2800	7145.6	2800	6252.4	-893.2	-5	Conifer/Shrub
200	0.7	1.914	0.72	1.7864	-0.1276	8	8	1600	3062.4	1600	2858.24	-204.16	-2	Conifer
110	0.5	3.19	0.5	3.19	0	8	8	880	2807.2	880	2807.2	0	0	Shrub
550	0.7	1.914	0.72	1.7864	-0.1276	8	8	4400	8421.6	4400	7860.16	-561.44	-2	Conifer
60	0.5	3.19	0.5	3.19	0	8	8	480	1531.2	480	1531.2	0	0	Shrub
720	0.7	1.914	0.7	1.914	0	9	9	6480	12402.72	6480	12402.72	0	0	Conifer
250	0.5	3.19	0.44	3.5728	0.3828	9	9	2250	7177.5	2250	8038.8	861.3	0	Shrub
200	0.2	5.104	0.44	3.5728	-1.5312	9	9	1800	9187.2	1800	6431.04	-2756.16	-24	
160	0.3	4.466	0.44	3.5728	-0.8932	9	9	1440	6431.04	1440	5144.832	-1286.208	-14	
470	0.2	5.104	0.44	3.5728	-1.5312	9	9	4230	21589.92	4230	15112.944	-6476.976	-24	
180	0.1	5.742	0.4	3.828	-1.914	10	10	1800	10335.6	1800	6890.4	-3445.2	-30	
170	0.2	5.104	0.4	3.828	-1.276	10	10	1700	8676.8	1700	6507.6	-2169.2	-20	
160	0.1	5.742	0.4	3.828	-1.914	10	10	1600	9187.2	1600	6124.8	-3062.4	-30	
170	0.2	5.104	0.4	3.828	-1.276	10	10	1700	8676.8	1700	6507.6	-2169.2	-20	
370	0	6.38	0.4	3.828	-2.552	10	10	3700	23606	3700	14163.6	-9442.4	-40	
120	0.2	5.104	0.4	3.828	-1.276	10	10	1200	6124.8	1200	4593.6	-1531.2	-20	
320	0.5	3.19	0.55	2.871	-0.319	11	11	3520	11228.8	3520	10105.92	-1122.88	-5	Conifer/Shrub
990	0.4	3.828	0.55	2.871	-0.957	11	11	10890	41686.92	10890	31265.19	-10421.73	-15	
250	0.3	4.466	0.36	4.0832	-0.3828	11	11	2750	12281.5	2750	11228.8	-1052.7	-6	Shrub
260	0.1	5.742	0.36	4.0832	-1.6588	11	11	2860	16422.12	2860	11677.952	-4744.168	-26	
630	0.4	3.828	0.52	3.0624	-0.7656	12	12	7560	28939.68	7560	23151.744	-5787.936	-12	Conifer/Shrub
110	0.2	5.104	0.33	4.2746	-0.8294	12	12	1320	6737.28	1320	5642.472	-1094.808	-13	Shrub
200	0.1	5.742	0.33	4.2746	-1.4674	12	12	2400	13780.8	2400	10259.04	-3521.76	-23	
410	0.2	5.104	0.33	4.2746	-0.8294	12	12	4920	25111.68	4920	21031.032	-4080.648	-13	
2900	0.3	4.466	0.33	4.2746	-0.1914	12	12	34800	155416.8	34800	148756.08	-6660.72	-3	
170	0.1	5.742	0.33	4.2746	-1.4674	12	12	2040	11713.68	2040	8720.184	-2993.496	-23	
280	0.3	4.466	0.33	4.2746	-0.1914	12	12	3360	15005.76	3360	14362.656	-643.104	-3	
480	0.2	5.104	0.33	4.2746	-0.8294	12	12	5760	29399.04	5760	24621.696	-4777.344	-13	
							Subtotal	**121,840**	**519,192**	**121,840**	**439,154**	**-80,038**		
AU# 17050113SW010_05														
150	0.2	5.104	0.33	4.2746	-0.8294	12	12	1800	9187.2	1800	7694.28	-1492.92	-13	
270	0.1	5.742	0.33	4.2746	-1.4674	12	12	3240	18604.08	3240	13849.704	-4754.376	-23	
110	0.2	5.104	0.33	4.2746	-0.8294	12	12	1320	6737.28	1320	5642.472	-1094.808	-13	
650	0.2	5.104	0.3	4.466	-0.638	13	13	8450	43128.8	8450	37737.7	-5391.1	-10	
170	0.3	4.466	0.3	4.466	0	13	13	2210	9869.86	2210	9869.86	0	0	
90	0.2	5.104	0.3	4.466	-0.638	13	13	1170	5971.68	1170	5225.22	-746.46	-10	
50	0.3	4.466	0.3	4.466	0	13	13	650	2902.9	650	2902.9	0	0	
720	0.1	5.742	0.3	4.466	-1.276	13	13	9360	53745.12	9360	41801.76	-11943.36	-20	
240	0.2	5.104	0.3	4.466	-0.638	13	13	3120	15924.48	3120	13933.92	-1990.56	-10	
180	0.1	5.742	0.3	4.466	-1.276	13	13	2340	13436.28	2340	10450.44	-2985.84	-20	
850	0.2	5.104	0.3	4.466	-0.638	13	13	11050	56399.2	11050	49349.3	-7049.9	-10	
310	0.1	5.742	0.3	4.466	-1.276	13	13	4030	23140.26	4030	17997.98	-5142.28	-20	
540	0.2	5.104	0.3	4.466	-0.638	13	13	7020	35830.08	7020	31351.32	-4478.76	-10	
710	0.1	5.742	0.3	4.466	-1.276	13	13	9230	52998.66	9230	41221.18	-11777.48	-20	
160	0.2	5.104	0.3	4.466	-0.638	13	13	2080	10616.32	2080	9289.28	-1327.04	-10	
330	0.1	5.742	0.3	4.466	-1.276	13	13	4290	24633.18	4290	19159.14	-5474.04	-20	
540	0.3	4.466	0.3	4.466	0	13	13	7020	31351.32	7020	31351.32	0	0	
80	0.1	5.742	0.3	4.466	-1.276	13	13	1040	5971.68	1040	4644.64	-1327.04	-20	
270	0.3	4.466	0.3	4.466	0	13	13	3510	15675.66	3510	15675.66	0	0	
380	0	6.38	0.3	4.466	-1.914	13	13	4940	31517.2	4940	22062.04	-9455.16	-30	
							Subtotal	**87,870**	**467,641**	**87,870**	**391,210**	**-76,431**		
							Total	**209,710**	**986,833**	**209,710**	**830,364**	**-156,469**		

Table 32. Existing and potential solar loads for North Fork Lime Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Lime Creek**
AU# ID17050113SW010_02														
230	0.5	3.19	0.41	3.7642	0.57	1	1	230	733.7	230	865.766	132.066	0	Meadow
260	0.7	1.914	0.67	2.1054	0.1914	1	1	260	497.64	260	547.404	49.764	0	Conifer/Meadow
430	0.6	2.552	0.67	2.1054	-0.4466	1	1	430	1097.36	430	905.322	-192.038	-7	
190	0.7	1.914	0.67	2.1054	0.1914	1	1	190	363.66	190	400.026	36.366	0	
90	0.6	2.552	0.67	2.1054	-0.4466	1	1	90	229.68	90	189.486	-40.194	-7	
450	0.8	1.276	0.88	0.7656	-0.5104	1	1	450	574.2	450	344.52	-229.68	-8	Conifer
160	0.7	1.914	0.67	2.1054	0.1914	1	1	160	306.24	160	336.864	30.624	0	Conifer/Meadow
180	0.8	1.276	0.88	0.7656	-0.5104	1	1	180	229.68	180	137.808	-91.872	-8	Conifer
1740	0.6	2.552	0.6	2.552	0	2	2	3480	8880.96	3480	8880.96	0	0	Conifer/Meadow
640	0.7	1.914	0.85	0.957	-0.957	2	2	1280	2449.92	1280	1224.96	-1224.96	-15	Conifer
240	0.6	2.552	0.6	2.552	0	2	2	480	1224.96	480	1224.96	0	0	Conifer/Meadow
1580	0.8	1.276	0.83	1.0846	-0.1914	3	3	4740	6048.24	4740	5141.004	-907.236	-3	Conifer/Shrub
							Subtotal	**11,970**	**22,636**	**11,970**	**20,199**	**-2,437**		
AU# ID17050113SW010_03														
770	0.8	1.276	0.83	1.0846	-0.1914	3	3	2310	2947.56	2310	2505.426	-442.134	-3	
190	0.6	2.552	0.79	1.3398	-1.2122	3	3	570	1454.64	570	763.686	-690.954	-19	Shrub
290	0.7	1.914	0.78	1.4036	-0.5104	4	4	1160	2220.24	1160	1628.176	-592.064	-8	Conifer/Shrub
220	0.4	3.828	0.7	1.914	-1.914	4	4	880	3368.64	880	1684.32	-1684.32	-30	Shrub
210	0.6	2.552	0.7	1.914	-0.638	4	4	840	2143.68	840	1607.76	-535.92	-10	
460	0.7	1.914	0.7	1.914	0	4	4	1840	3521.76	1840	3521.76	0	0	
450	0.6	2.552	0.7	1.914	-0.638	4	4	1800	4593.6	1800	3445.2	-1148.4	-10	Shrub
120	0.6	2.552	0.78	1.4036	-1.1484	4	4	480	1224.96	480	673.728	-551.232	-18	Conifer/Shrub
550	0.6	2.552	0.7	1.914	-0.638	4	4	2200	5614.4	2200	4210.8	-1403.6	-10	Shrub
230	0.6	2.552	0.78	1.4036	-1.1484	4	4	920	2347.84	920	1291.312	-1056.528	-18	Conifer/Shrub
360	0.5	3.19	0.7	1.914	-1.276	4	4	1440	4593.6	1440	2756.16	-1837.44	-20	Shrub
130	0.6	2.552	0.65	2.233	-0.319	5	5	650	1658.8	650	1451.45	-207.35	-5	
330	0.5	3.19	0.65	2.233	-0.957	5	5	1650	5263.5	1650	3684.45	-1579.05	-15	
530	0.6	2.552	0.75	1.595	-0.957	5	5	2650	6762.8	2650	4226.75	-2536.05	-15	Conifer/Shrub
150	0.5	3.19	0.65	2.233	-0.957	5	5	750	2392.5	750	1674.75	-717.75	-15	Shrub
470	0.6	2.552	0.75	1.595	-0.957	5	5	2350	5997.2	2350	3748.25	-2248.95	-15	Conifer/Shrub
130	0.7	1.914	0.75	1.595	-0.319	5	5	650	1244.1	650	1036.75	-207.35	-5	
1000	0.5	3.19	0.65	2.233	-0.957	5	5	5000	15950	5000	11165	-4785	-15	Shrub
							Subtotal	**28,140**	**73,300**	**28,140**	**51,076**	**-22,224**		
							Total	**40,110**	**95,936**	**40,110**	**71,275**	**-24,661**		

Table 33. Existing and potential solar loads for Middle Fork Lime Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	MF Lime Creek
AU# ID17050113SW010_02														
220	0.4	3.828	0.41	3.7642	-0.06	1	1	220	842.16	220	828.124	-14.036	-1	Meadow
680	0.5	3.19	0.67	2.1054	-1.0846	1	1	680	2169.2	680	1431.672	-737.528	-17	Conifer/Meadow
2640	0.9	0.638	0.88	0.7656	0.1276	1	1	2640	1684.32	2640	2021.184	336.864	0	Conifer
2270	0.8	1.276	0.88	0.7656	-0.5104	2	2	4540	5793.04	4540	3475.824	-2317.216	-8	Conifer/Shrub
							Subtotal	**8,080**	**10,489**	**8,080**	**7,757**	**-2,732**		
AU# ID17050113SW010_03														
330	0.8	1.276	0.83	1.0846	-0.1914	3	3	990	1263.24	990	1073.754	-189.486	-3	
1760	0.7	1.914	0.83	1.0846	-0.8294	3	3	5280	10105.92	5280	5726.688	-4379.232	-13	
1450	0.6	2.552	0.78	1.4036	-1.1484	4	4	5800	14801.6	5800	8140.88	-6660.72	-18	
1830	0.7	1.914	0.78	1.4036	-0.5104	4	4	7320	14010.48	7320	10274.352	-3736.128	-8	
2090	0.4	3.828	0.65	2.233	-1.595	5	5	10450	40002.6	10450	23334.85	-16667.75	-25	Shrub
							Subtotal	**29,840**	**80,184**	**29,840**	**48,551**	**-31,633**		
							Total	**37,920**	**90,673**	**37,920**	**56,307**	**-34,365**		

Table 34. Existing and potential solar loads for South Fork Lime Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	SF Lime Creek
AU# ID17050113SW011_02														
120	0.4	3.828	0.41	3.7642	-0.06	1	1	120	459.36	120	451.704	-7.656	-1	Meadow
240	0.7	1.914	0.67	2.1054	0.1914	1	1	240	459.36	240	505.296	45.936	0	Conifer/Meadow
1110	0.4	3.828	0.41	3.7642	-0.0638	1	1	1110	4249.08	1110	4178.262	-70.818	-1	Meadow
320	0.6	2.552	0.67	2.1054	-0.4466	1	1	320	816.64	320	673.728	-142.912	-7	Conifer/Meadow
270	0.7	1.914	0.67	2.1054	0.1914	1	1	270	516.78	270	568.458	51.678	0	
1540	0.8	1.276	0.86	0.8932	-0.3828	2	2	3080	3930.08	3080	2751.056	-1179.024	-6	Shrub
1110	0.9	0.638	0.88	0.7656	0.1276	2	2	2220	1416.36	2220	1699.632	283.272	0	Conifer/Shrub
1220	0.8	1.276	0.83	1.0846	-0.1914	3	3	3660	4670.16	3660	3969.636	-700.524	-3	
							Subtotal	**11,020**	**16,518**	**11,020**	**14,798**	**-1,720**		
AU# ID17050113SW011_03														
2980	0.8	1.276	0.83	1.0846	-0.1914	3	3	8940	11407.44	8940	9696.324	-1711.116	-3	
2180	0.6	2.552	0.75	1.595	-0.957	5	5	10900	27816.8	10900	17385.5	-10431.3	-15	
350	0.4	3.828	0.65	2.233	-1.595	5	5	1750	6699	1750	3907.75	-2791.25	-25	Shrub
240	0.6	2.552	0.75	1.595	-0.957	5	5	1200	3062.4	1200	1914	-1148.4	-15	Conifer/Shrub
420	0.4	3.828	0.57	2.7434	-1.0846	6	6	2520	9646.56	2520	6913.368	-2733.192	-17	Shrub
490	0.5	3.19	0.7	1.914	-1.276	6	6	2940	9378.6	2940	5627.16	-3751.44	-20	Conifer/Shrub
1920	0.4	3.828	0.57	2.7434	-1.0846	6	6	11520	44098.56	11520	31603.968	-12494.592	-17	Shrub
1110	0.5	3.19	0.66	2.1692	-1.0208	7	7	7770	24786.3	7770	16854.684	-7931.616	-16	Conifer/Shrub
400	0.3	4.466	0.51	3.1262	-1.3398	7	7	2800	12504.8	2800	8753.36	-3751.44	-21	Shrub
340	0.6	2.552	0.66	2.1692	-0.3828	7	7	2380	6073.76	2380	5162.696	-911.064	-6	Conifer/Shrub
300	0.4	3.828	0.51	3.1262	-0.7018	7	7	2100	8038.8	2100	6565.02	-1473.78	-11	Shrub
1530	0.5	3.19	0.66	2.1692	-1.0208	7	7	10710	34164.9	10710	23232.132	-10932.768	-16	Conifer/Shrub
710	0.4	3.828	0.5	3.19	-0.638	8	8	5680	21743.04	5680	18119.2	-3623.84	-10	Shrub
540	0.6	2.552	0.65	2.233	-0.319	8	8	4320	11024.64	4320	9646.56	-1378.08	-5	Conifer/Shrub
720	0.4	3.828	0.5	3.19	-0.638	8	8	5760	22049.28	5760	18374.4	-3674.88	-10	Shrub
380	0.5	3.19	0.5	3.19	0	8	8	3040	9697.6	3040	9697.6	0	0	
470	0.6	2.552	0.65	2.233	-0.319	8	8	3760	9595.52	3760	8396.08	-1199.44	-5	Conifer/Shrub
							Subtotal	**88,090**	**271,788**	**88,090**	**201,850**	**-69,938**		
							Total	**99,110**	**288,306**	**99,110**	**216,648**	**-71,658**		

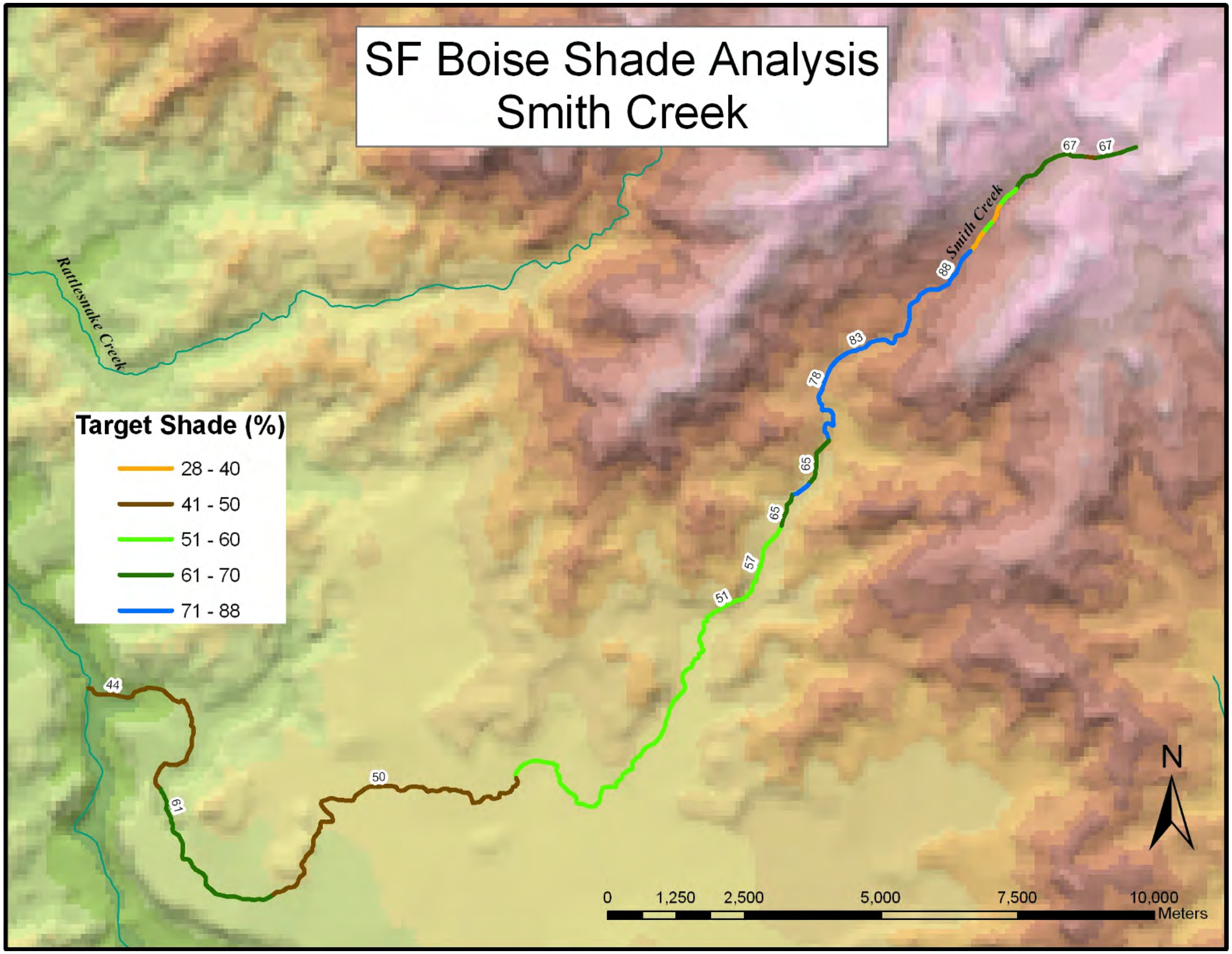


Figure 15. Target Shade for Smith Creek.

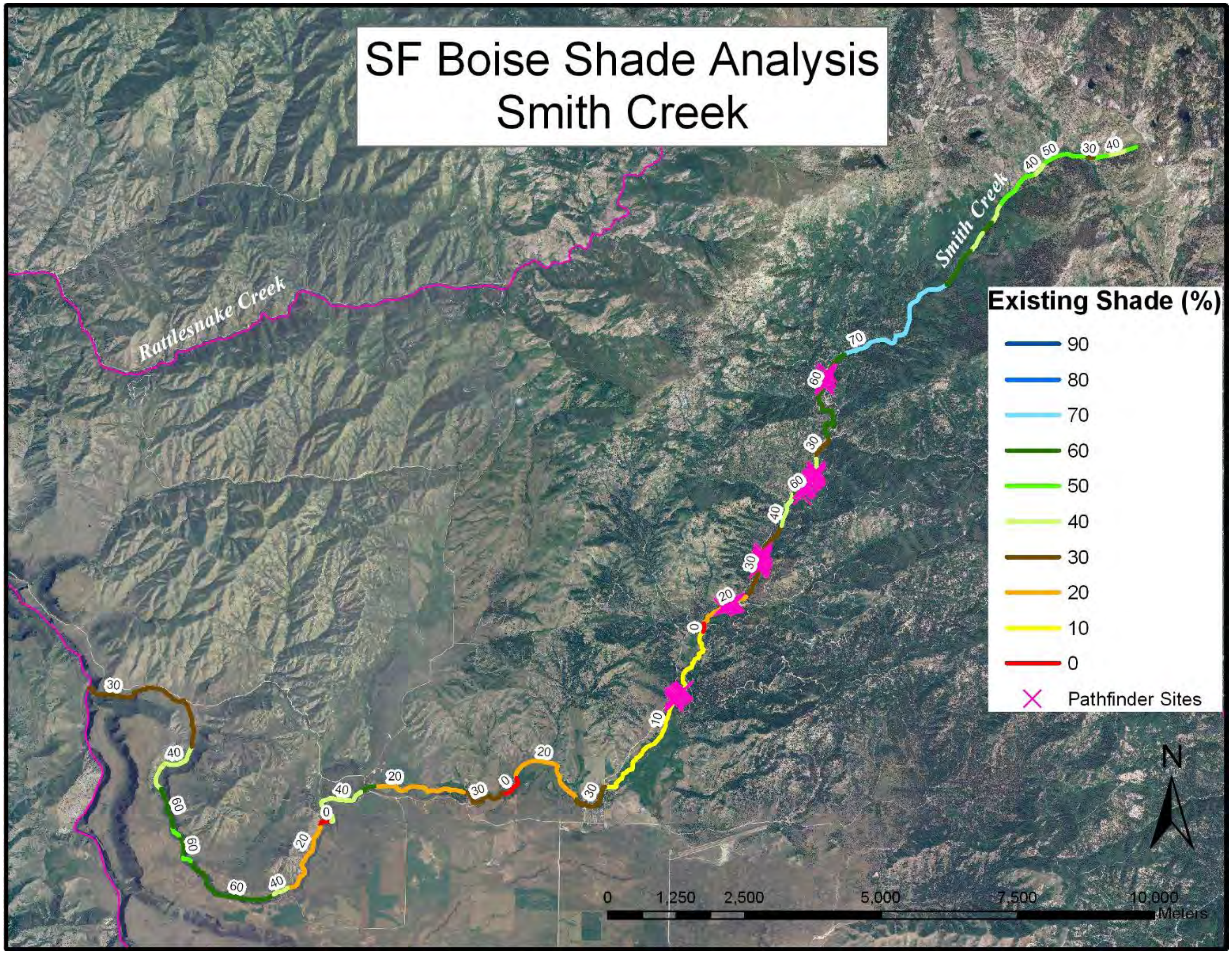


Figure 16. Existing Shade Estimated for Smith Creek by Aerial Photo Interpretation.

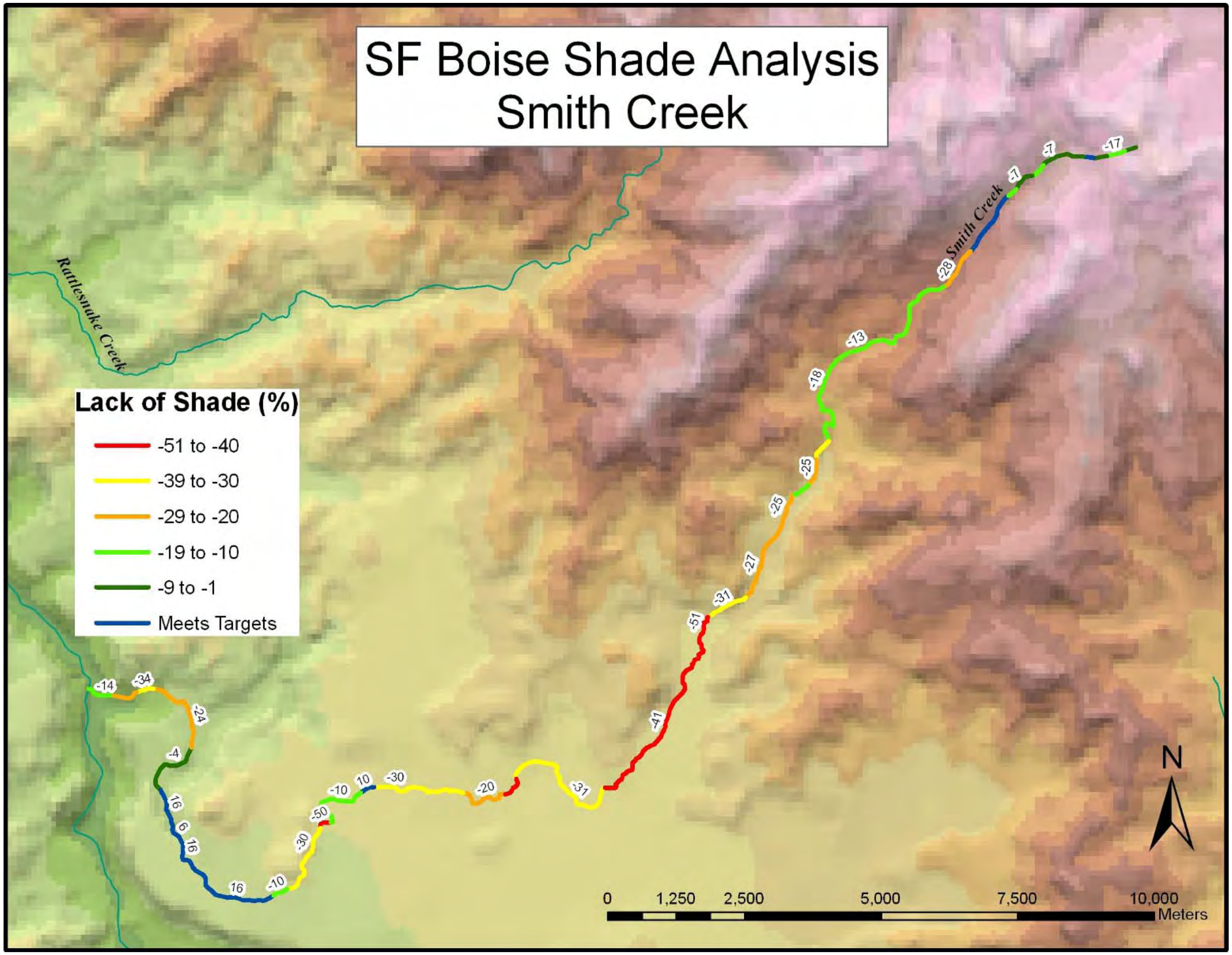


Figure 17. Lack of Shade (Difference Between Existing and Target) for Smith Creek.

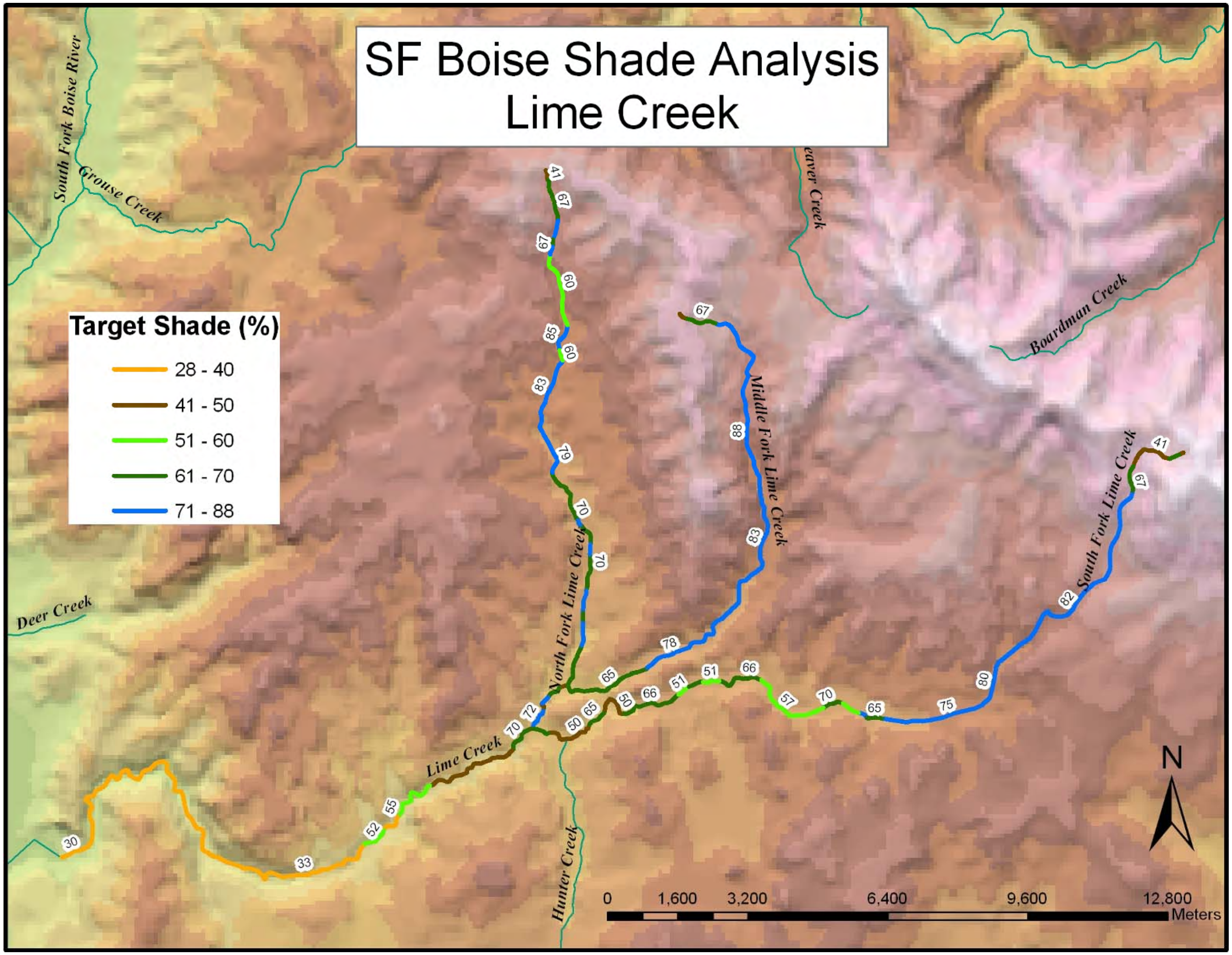


Figure 18. Target Shade for Lime Creek, including North Fork, Middle Fork, and South Fork.

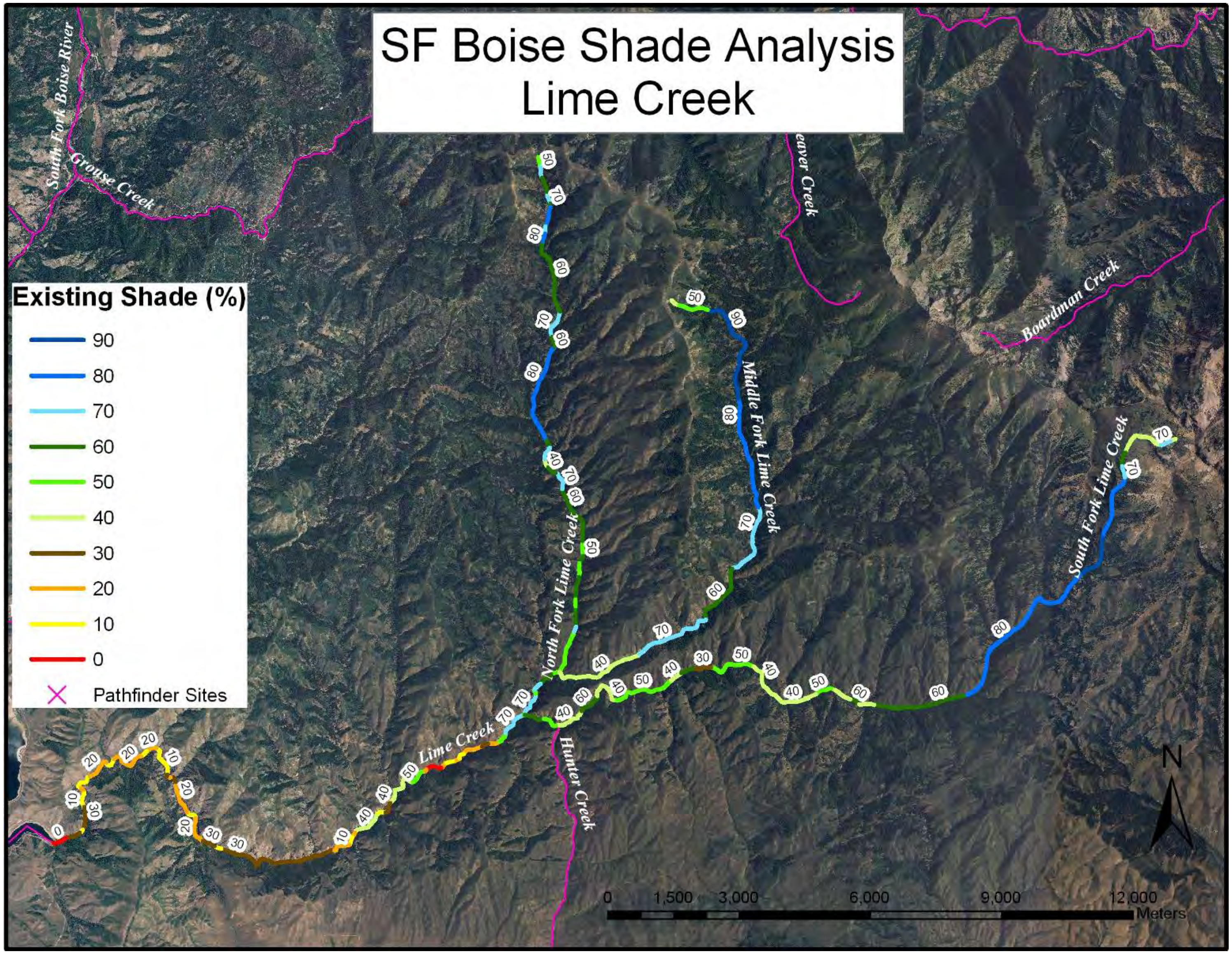


Figure 19. Existing Shade Estimated for Lime Creek by Aerial Photo Interpretation.

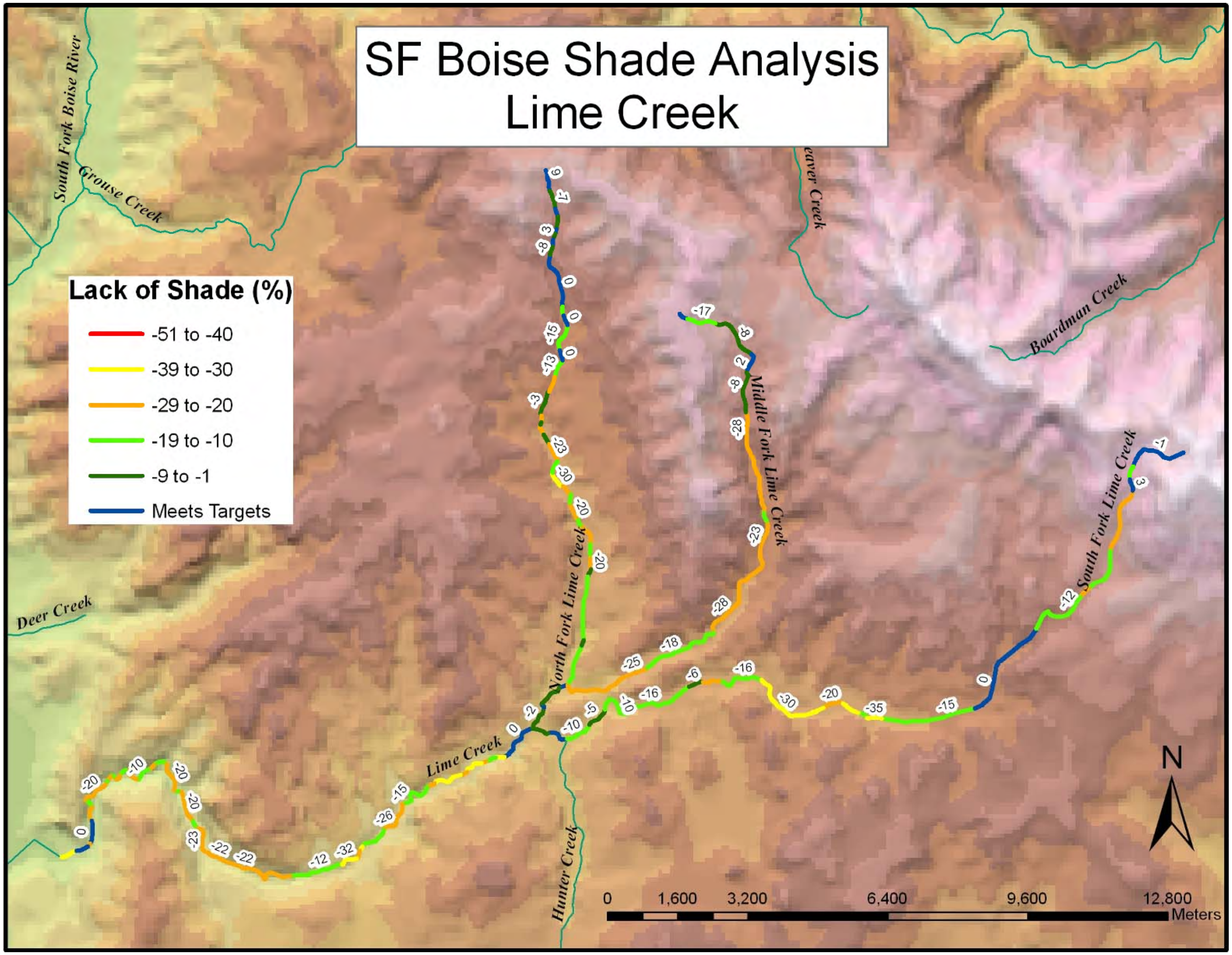


Figure 20. Lack of Shade (Difference Between Existing and Target) for Lime Creek

5.4 Load Allocation

Because this TMDL is based on loading that does or would occur under PNV, which is equivalent to background load, the load allocation is essentially the target 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. Load allocations are therefore stream reach-specific and are dependent upon the target load for a given reach. Tables 30 through 34 show the target or potential shade, converted to a potential summer load by multiplying the inverse fraction (1.0 minus the shade fraction) by the average loading measured on a flat plate collector during the months of April through September. That is the LC of the stream and limiting the load to that amount is necessary to achieve background conditions. There is no opportunity to remove shade from the streams covered in this TMDL, by any activity, without exceeding its LC. Additionally, because this TMDL is dependent upon background conditions for achieving WQS, all tributaries to the waters examined here need to be at NB conditions in order to prevent excess heat loads to the system.

Table 35 shows the total existing, total target, and the percent shade reduction required for each water body examined. The size of a stream influences the size of the excess load. Large streams have greatest existing and target loads by virtue of larger channel widths compared to smaller streams. Table 35 lists the tributaries in order of excess loads, from greatest to least. Therefore, large tributaries are listed first and small tributaries are listed last.

Although the following analysis dwells on total heat loads for streams in this TMDL, it is important to note that differences between existing shade and target shade, as depicted in Lack of Shade figures (Figures 17 and 20), are the keys to successfully restoring these waters and achieving WQS. Achieving target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the areas with the largest differences between existing and target shade as places to prioritize implementation efforts. Each loading table contains a final column that lists the excess load (kWh/day) per linear meter of stream. It is derived from dividing the excess load for each segment by the length of each segment. Stream segments with the largest excess load per meter are in the worst condition regarding shade.

Table 35. Excess solar loads and percent reductions for all tributaries.

Assessment Unit	Total Existing Load (kWh/day)	Total Target Load (kWh/day)	Excess Load (kWh/day)	Range of percent lack of shade
Smith Creek 032_02	45,630	29,553	16,077	0-28%
Smith Creek 032_03	866,270	597,358	268,912	0-51%
Lime Creek 010_04	519,192	439,154	80,038	0-40%
Lime Creek 010_05	467,641	391,210	76,431	0-30%
South Fork Lime Creek 011_02	16,518	14,798	1,720	0-7%

Assessment Unit	Total Existing Load (kWh/day)	Total Target Load (kWh/day)	Excess Load (kWh/day)	Range of percent lack of shade
South Fork Lime Creek 011_03	271,788	201,850	69,938	0-25%
Middle Fork Lime Creek 010_02	10489	7757	2732	0-17%
Middle Fork Lime Creek 010_03	80,184	48,551	31,633	3-25%
North Fork Lime Creek 010_02	22,636	20,199	2,437	0-15%
North Fork Lime Creek 010_03	73,300	51,076	22,224	0-30%

A certain amount of the calculated excess load may be only the result of a difference between existing shade and target shade that is inherent in the loading analysis. Because existing shade is reported as a class with a 10% range and target shade is reported as a unique integer, there is always a difference between them. For example, if a particular stretch of stream has a target shade of 86%, based on its vegetation type and natural bankfull width, and existing shade on that stretch of stream was at target level, it would be recorded as 80% existing shade in the loading analysis because 86% falls into the 80% class for existing shade. Additionally, sometimes the existing shade is slightly greater than the target (e.g., a reach with 90% existing shade and an 86% shade target) resulting in a positive load excess, which should be ignored. These examples show that undefined errors in the calculations can result in the appearance of “excess” shade. This result reflects the level of uncertainty in the model, which can mask problem areas where the shade curve and the model do not fit well when the shade table is summarized to the percent value. Stream segments that yield results with positive differences between existing and potential/target shade are essentially at target and have zero excess load per linear meter.

Waste Load Allocation

Because there are no known NPDES-permitted point sources in the §303(d) listed AUs, there are no WLAs. Should a point source be proposed or discovered that may have thermal consequences in these waters, then background provisions addressing such discharges in Idaho WQS (IDAPA 58.01.02.200.09 & IDAPA 58.01.02.401.03) would apply (see Appendix B).

Margin of Safety

The MOS in this TMDL is considered implicit in the design. Because the target is natural background conditions, loads (shade levels) are allocated to lands adjacent to the stream 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. Although the loading analysis used in this TMDL involves estimations that are likely to have some variance, there are no load allocations that have been determined to benefit or suffer from that variance.

Seasonal Variation

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

Reasonable Assurance

There is reasonable assurance that implementation, as the next step of the water body management process, will occur. Idaho's WQS identify designated agencies that are responsible for implementing, evaluating and modifying BMPs to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of EPA approval of TMDL documents. DEQ, the Technical Advisory Group (TAG), and the designated agencies will develop implementation plans, and DEQ will incorporate them into the state's water quality management plan. In measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been achieved, then further implementation will be necessary and further reassessment performed until full support status is reached. Monitoring will be done at least every 5 years. When full support status is reached, then the requirements of the TMDL will be considered completed.

Background

NB conditions for temperature can exceed numeric criteria if specific alternative narrative criteria are met. This is supported by documented conditions in wilderness waters that are relatively unaffected by human impacts. As research accumulates on NB temperature for flowing water within the South Fork Boise River subbasin, the TMDL may be adjusted, or site-specific criteria may be developed.

Reserve

If it is determined that full beneficial use support is achieved and standards are in fact being met at temperature loading rates higher than those set forth in this TMDL then the TMDL will be revised accordingly. Similarly, within a reasonable time after full implementation of BMPs, if it is determined that full beneficial use support is not forthcoming and/or standards are not being met, additional BMPs may be required.

Construction Storm Water and TMDL Waste Load Allocations

Construction Storm Water

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

The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land (or is part of larger common development that will disturb more than one acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan.

Storm Water Pollution Prevention Plan (SWPPP)

In order to obtain the Construction General Permit (CGP), operators must develop a site-specific Storm Water Pollution Prevention Plan (SWPP). The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the BMPs through the life of the project.

Construction Storm Water Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ now incorporates a gross WLA for anticipated construction storm water activities. TMDLs developed in the past that did not have a WLA for construction storm water activities will be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate BMPs.

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

5.5 Pollution Trading

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

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

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

Pollutant trading is recognized in Idaho's WQS at IDAPA 58.01.02.054.06. Currently, DEQ's policy is to allow pollutant trading as a means to meet TMDLs and restoring water quality limited water bodies to compliance with WQS. The Pollutant Trading Guidance document sets forth the procedures to be followed for pollutant trading:

http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf

Trading Components

The major components of pollutant trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Additionally, 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 through the Idaho Clean Water Cooperative, Inc.

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

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the WLA.
- Nonpoint sources create credits by implementing approved BMPs that reduce the amount of pollutant run-off. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for the BMPs they implement, 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 that the nonpoint source is already assumed to be achieving to meet the water quality goals of the TMDL.

Watershed-Specific Environmental Protection

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

Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. If trading is included in the EPA-approved TMDL DEQ, in concert with the appropriate watershed advisory group (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 Pollutant Trading Guidance:

http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf.

5.6 Public Participation

House Bill 145 (HB145) has brought about changes in how WAGs are involved in TMDL development and review. The basic process for developing TMDLs and implementation plans is as follows:

1. BAG members for each of Idaho’s basins are appointed by DEQ’s director.
2. An “integrated report” is developed by DEQ every two years that identifies which water bodies in Idaho appear to be degraded.
3. DEQ prepares to begin the SBA and TMDL process for individual degraded watersheds.
4. A WAG is formed by DEQ (with help from the BAG) for a specific watershed/TMDL.
5. With the assistance of the WAG, DEQ develops an SBA and any necessary TMDLs for the watershed.
6. The WAG comments on the SBA/TMDL.
7. WAG comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
8. The public comments on the SBA/TMDL.
9. Public comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
10. DEQ sends the document to the U.S. Environmental Protection Agency (EPA) for approval.
11. DEQ and the WAG develop and implement a plan to reach the goals of the TMDL.

DEQ will provide the WAG with all available information pertinent to the SBA/TMDL, when requested, such as monitoring data, water quality assessments, and relevant reports. The WAG will also have 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, after WAG comments have been considered and incorporated, a WAG is not in agreement with an SBA/TMDL, the WAG’s position and the basis for it will be documented in the public notice of public 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

In the case of the South Fork Boise River TMDL, the WAG was referred to as a Technical Advisory Committee (TAC) that functioned in lieu of a WAG because no private interest groups chose to participate in its development.

5.7 Implementation Strategies

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 strategies for TMDLs produced using PNV-based shade and solar loading should incorporate the loading tables presented in this TMDL. These tables need to be updated, first to field-verify the reported existing shade levels that have not yet been field-verified, and secondly to monitor progress toward achieving reductions and the goals of the TMDL. Using a 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 between measured shade levels and reported existing shade levels used in the loading analysis tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include solar pathfinder monitoring to simultaneously field-verify the TMDL and mark progress toward achieving desired reductions in solar loads.

Time Frame

The expected time frame for attaining WQS and restoring beneficial use is dependent upon the intensity of management practices, climate, ecological potential, and natural variability of environmental conditions. If implementation of BMPs is embraced enthusiastically, some improvements may be seen in as little as several years. Even with aggressive implementation, however, some natural processes required for satisfying the requirements of this TMDL may not be seen for many years to come. The deleterious effects of historic land management practices have accrued for many years and recovery of natural systems may take longer than administrative needs allow for.

Approach

It is expected that by improving riparian vegetation and land use management practices, overall riparian zone recovery will increase canopy cover and lower stream temperatures. This will improve stream morphology and habitat and contribute to beneficial use attainment.

Responsible Parties

Development of the implementation plan for the South Fork Boise River TMDL will proceed under the existing practice established for the state of Idaho. DEQ, the South Fork Boise River TAC, affected private landowners, and other watershed stakeholders, with input through the established public process, will cooperatively develop the plan. Other individuals whose areas of expertise are identified as beneficial to the process may be asked to assist in the development of site-specific implementation plans.

The Bureau of Land Management (BLM), United States Forest Service (USFS), Idaho Department of Water Resources (IDWR), Idaho Department of Lands (IDL), Idaho Fish and Game (IDFG), United States Bureau of Reclamation (BOR), and individual land owners may all have responsibilities regarding future implementation programs to improve the water quality of this subbasin. Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those sources for which they have regulatory authority or programmatic responsibilities. Idaho's designated state management agencies are:

- Idaho Department of Lands (IDL): timber harvest, oil and gas exploration and development, mining
- Idaho Department of Water Resources (IDWR): recreational dredge mining, drilling of water wells, development of dams, water rights
- Idaho Soil Conservation Commission (ISCC): grazing and agriculture
- Idaho Department of Transportation (ITD): public roads

- Idaho Department of Agriculture (IDA): agriculture, aquaculture, animal feeding operations (AFOs), confined animal feeding operations (CAFOs)
- Idaho Department of Environmental Quality: all other activities

To the maximum extent possible, the implementation plan will be developed with the participation of federal partners and land management agencies (i.e., USFS, BLM, etc.). In Idaho, these agencies and their federal and state partners are charged by the CWA to lend available technical assistance and other appropriate support to local efforts/projects for water quality improvements.

All stakeholders in the subbasin have responsibility for implementing the TMDL. DEQ and the “designated agencies” in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. Their general responsibilities are outlined below.

- **DEQ** will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.
- **IDL** will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **ISCC**, working in cooperation with local Soil and Water Conservation Districts and the Natural Resources Conservation Service (NRCS), along with IDA, will provide technical assistance to agricultural landowners. These agencies will help landowners design BMP systems appropriate for their property, and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **ITD** will be responsible for ensuring appropriate BMPs are used for construction and maintenance of public roads.
- **IDA** will be responsible for working with agriculture and aquaculture to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, IDA also inspects AFOs, CAFOs, and dairies to ensure compliance with NPDES requirements.

The designated agencies, TAC, and other appropriate public process participants are expected to:

- Develop BMPs to achieve LAs.
- Give reasonable assurance, through both quantitative and qualitative analysis of management measures, that management measures will meet LAs.
- Adhere to measurable milestones for progress.
- Develop a timeline for implementation that includes estimated costs and anticipated funding.

- Develop a monitoring plan to determine whether BMPs are being implemented, individual BMPs are effective, and LA, WLA, and WQS are being met.

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

Monitoring Strategy

Existing loads in the temperature TMDLs come from estimates of existing shade as determined from aerial photo interpretations. Those areas with the largest disparity between existing shade estimates and shade targets should be monitored with solar pathfinders to verify the existing shade levels and to determine progress towards meeting shade targets. It is important to note that many existing shade estimates have not been field-verified, and may require adjustment during the implementation process. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Solar pathfinder measurements taken at ten equally-spaced distances within any given segment and averaged together should suffice to determine new shade levels in the future.

Alternatively, remote sensing technologies, such as thermal infrared (TIR), may offer efficient and cost-effective opportunities to acquire longitudinal thermal profiles of all water bodies in the subbasin during critical time periods. Data collection such as this, repeated every few years, could prove useful in trend monitoring as resource restoration efforts progress throughout the subbasin.

The next five-year review of this TMDL is scheduled for 2013. Effort should be made during that process to include any sampling or monitoring results that could help characterize the support status of the affected stream segments. This could involve a number of data sources including BURP surveys, streambank erosion inventories, sediment core sampling results, and solar pathfinder monitoring.

5.8 Conclusions

This TMDL is a starting point for restoring beneficial uses in the watershed. Because many factors influence water quality, implementation should be organized within an adaptive management framework. Through the efforts of both private and public entities, water quality in impaired streams can be greatly improved. The determinations established in this TMDL regarding water quality in the South Fork Boise River subbasin are summarized in Table 36.

Table 36. Summary of assessment outcomes for five-year review from 2002 and draft 2008 303(d) lists.

Water Body Segment AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Comments
Upper Willow Creek 002a_02	Sediment	None	Delist for Sediment. List for flow alteration. Move to Section 4c.	Streams routinely go dry in mid-summer due to flow alteration.
Upper Willow Creek 002a_03	Sediment	None	Delist for Sediment. List for flow alteration. Move to Section 4c.	Streams routinely go dry in mid summer due to flow alteration.
Lower Willow Creek 002b_03	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Lower Willow Creek 002b_04	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
South Fork Boise River – 2nd order tributaries 004_02	Unknown	None	Delist for unknown. Move to Section 2.	Data indicates full support in perennial streams.
South Fork Boise River-Dixie Creek 004_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Natural events led to high sediment load in one stream segment.
South Fork Boise River - South Fork Boise River and Trail Creek 004_06	Sediment	None	Delist for Sediment. Move to Section 4c.	Listing status not supported by data. Flow is altered by reservoir management practices.
Anderson Ranch Reservoir – 1st and 2nd order tributaries –Goat, Lester, Wilson, Evans 005_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support on perennial streams.
Little Camas Creek Reservoir 007_0L	Sediment	None	Delist for Sediment. Move to Section 3.	Waterbody is Unassessed.
Moores Creek 010_03a	Unknown	None	Not Assessed	No Tier I data available.
Lime Creek 010_05	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
South Fork Boise River - Jumbo Creek and Big Water Gulch 015_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support.
Little Smoky Creek 018_03	Unknown	None	Delist for Unknown. Move to Section 2	Data indicates full support.
Fall Creek 031_02	Unknown	None	Delist for Unknown. Move to Section 2.	Data indicates full support
Smith Creek 032_02	Temperature	Temperature	Move to Section 4a.	Data indicates temperature impairment.
Smith Creek 032_03	Unknown	None	Delist for Unknown. List for flow and habitat alteration. Move to Section 4c.	Data indicates full support of beneficial uses. Nine constructed control points alter flow and habitat.
Rattlesnake Creek 033_02	Sediment	None	Delist for sediment. Move to Section 4c.	Natural fire activity/landslide led to flow and habitat alteration.

Several AUs were moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report that were either moved in error, or moved to a section other than what is recommended in this report. Table 37 shows the AUs that were moved to Section 3 of the 2008 Integrated Report and the recommendation for the next (2010) Integrated Report.

Table 37. Assessment units for which status should be changed in the 2010 Integrated Report.

Water Body Unit and AU	Recommended Changes to Integrated Report	Justification
Willow Creek 002a_02	Move from Section 3 to Section 4c	Flow altered
Willow Creek 002a_03	Move from Section 3 to Section 4c	Flow altered
Willow Creek 002b_03	Move from Section 3 to Section 2	Fully Supporting
Beaver Creek 016_02	Move from Section 3 to Section 2	Fully Supporting
Little Smoky Creek 018_04	Move from Section 3 to Section 2	Fully Supporting
Little Smoky Creek 018_05	Move from Section 3 to Section 2	Fully Supporting
Skeleton Creek 024_02	Move from Section 3 to Section 2	Fully Supporting
Willow Creek 025_02	Move from Section 3 to Section 2	Fully Supporting
Smith Creek 032_02	Move from Section 3 to Section 4a	Temperature TMDL developed
Rattlesnake Creek 033_02	Move from Section 3 to Section 4c	Alteration due to natural occurrence.

Summary of Decisions

The following paragraphs are brief explanations of the support status decisions shown in Tables 36 and 37 above.

Upper Willow Creek - 002a_02

Willow Creek had four streams listed on the 2002 §303(d) list of impaired waters.

The 2nd order segment of upper Willow Creek was listed for sediment. The beneficial uses of this assessment unit could not be determined from data collection because sites were dry at every attempt to survey. Upon further investigation, 16 constructed flow alterations were found in the assessment unit. It is recommended that 2nd order upper Willow Creek be delisted for sediment and listed for flow alteration (moved to section 4c of the next Integrated Report). This segment was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report, and should be moved to Section 4c in the next report.

Upper Willow Creek - 002a_03

The 3rd order segment of upper Willow Creek was also listed for sediment and was dry upon each sampling attempt. In addition to the 16 flow alterations in the 2nd order AU, there are two additional constructed alterations in the 3rd order stream segment. Like the 2nd order segment, the 3rd order AU should be delisted for sediment and listed for flow alteration (moved to section 4c of the Integrated Report). This segment was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report and should be moved to Section 4c in the next report.

Lower Willow Creek – 002b_03

The 3rd order segment of lower Willow Creek was listed for unknown pollutants. BURP data indicates sediment is the likely cause of impairment; however, subsurface percent fine sediment sampling results are below the recommended maximum target. Based on expanded data collection results, sediment is not impairing the beneficial uses and no TMDL is necessary. This water body should be moved to Section 2 of the Integrated Report. It was moved to Section 3 (Unassessed Waters) in the 2008 Integrated Report and should be moved to Section 2 of the next report.

Lower Willow Creek – 002b_04

The 4th order segment of lower Willow Creek was listed for an unknown pollutant on the 2002 §303(d) list. BURP data from 1997 indicate relatively high surface fine sediment (30%) and moderate bank stability (81.5%). Although monitoring of 4th order lower Willow Creek could not be completed in 2008 due to high spring runoff, both 3rd order segments that flow into it (3rd order Willow and Wood Creeks) were sampled above the confluence for subsurface fine sediment. It is presumed that if both major tributaries to 4th order lower Willow meet recommended standards for subsurface fine sediment that the 4th order segment will also meet standards. The 4th order is a relatively short segment that flows into Arrowrock Reservoir. After the confluence of the two 3rd order streams, there are no tributaries to the 4th order before it meets the reservoir. There have been no major construction or changes to the drainage area of the 4th order segment. Results of core sampling show that both 3rd order tributaries are below the recommended maximum for subsurface fine sediment.

South Fork Boise River (2nd order tributaries) – 004_02

This AU was listed based on data from two sites with low BURP scores. The first, Cayuse Creek, scored a zero because of a macroinvertebrate score of zero. Upon further analysis, it was determined that Cayuse Creek is intermittent, and thus the BURP score should not be used to determine beneficial use support status. The second stream with a low BURP index score in this AU is Rough Creek. BURP crew reported low streambank stability, which resulted in a low Habitat Index score. Upon further investigation, Rough Creek was found to have covered and stable banks for most of the reach, and subsurface fine sediment was well below the recommended maximum. This AU should be delisted for an unknown pollutant and moved to Section 2 of the next Integrated Report.

South Fork Boise River (Dixie Creek 3rd order) – 004_03

The 3rd order segment of Dixie Creek was listed for an unknown pollutant. Data from a BURP survey in 1998 indicate that fine sediment may be the cause of impairment. Upon further investigation, it appears that the 1998 survey was conducted in a series of beaver ponds, which have naturally high levels of fine sediment. In addition, high flows in 2006 washed out a bridge crossing and part of a beaver dam downstream of the bridge. Core sampling results of 53% subsurface fines and severely eroding banks have been recently documented in the stream segment between the old bridge and the beaver dam. Immediately downstream of the partially blown-out beaver dam the banks are stable and subsurface fines (25%) are below the recommended maximum. Because the sediment in the BURP surveyed reach and the stream segment between the bridge and blown-out dam are due to natural habitat and flow alteration, no TMDL is necessary. This AU should be delisted for unknown pollutants and listed for habitat and flow alteration. It should be moved to Section 4c of the next Integrated Report.

South Fork Boise River (6th order) – 004_06

This AU refers to the mainstem South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir and was listed as part of the Stream Segment of Concern process, which is not an indicator of impairment. This is a blue-ribbon trout fishery. No data exists that indicates sediment impairment in this segment. Anderson Ranch Reservoir traps most of the sediment from the river and upstream tributaries, and the segment of concern flows at unwadeable levels all summer as water is released from Anderson Ranch Reservoir. The flow dynamics facilitate the transport of sediment entering the AU from smaller tributaries into Arrowrock Reservoir. No TMDL is necessary at this time and this AU should be moved to Section 4c of the next report, because of the effect of reservoir operations to flow and habitat.

Anderson Ranch Reservoir (2nd order tributaries) – 005_02

This was listed on the 2002 §303(d) list and was carried over onto the 2008 list. It was listed for an unknown pollutant in 1st and 2nd order tributaries. Goat and Lester Creeks are intermittent streams and often dry up in the summer. Perennial streams were found to be fully supporting beneficial uses as documented in the 2008 South Fork Boise River TMDL/SBA and should be moved to Section 2 of the next Integrated Report.

Little Camas Creek Reservoir – 007L_0L

BURP surveys were conducted in 1998, 2000, and an attempt was made in 2004, but the site was listed as a marsh and the notes stated that the location was seepage from the reservoir that usually dries up in the summer. This AU should remain listed as not assessed and be moved to Section 3 of the Integrated Report.

Moores Creek (3rd order) – 010_03a

This AU is listed for an unknown pollutant on the 2002 §303(d) list. BURP information from 1998 reports high surface fine sediment and low bank stability indicating sediment may be impairing beneficial uses. Observations of the segment in May 2008 confirmed the observations made in 1998 but there is no access to the stream to collect samples. Because qualitative observations do not qualify as Tier I data, no listing determination can be made at this time. Streambank stabilization should be considered for this segment during implementation plan development, but it should be listed as Not Assessed on the next report until Tier I data is available.

Lime Creek (5th order) – 010_05

This was listed on the 2002 §303(d) list for temperature and was carried over to the 2008 §303(d) list. Temperature impairment was confirmed and a temperature TMDL was written and is included in this document. This AU should be moved from Section 5 to Section 4a (Lakes and Rivers with Approved TMDLs) in the next report.

South Fork Boise River (2nd order tributaries) – 015_02

This AU was listed on the 2002 §303(d) list and was carried over to the 2008 §303(d) list. It was found to be fully supporting beneficial uses as documented in this document and should be moved to Section 2 of the next Integrated Report.

Beaver Creek (2nd order) – 016_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Beaver Creek shows full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Little Smoky Creek – 018_03, 018_04, and 018_05

The 3rd order AU was added to the 2008 §303(d) list for unknown pollutants. It includes Grindstone, Liberal, Little Smoky, and Salt Creeks. Data for the 2004 BURP site is not consistent with the comments reported for the survey or with the 2005 BURP survey upstream of the 2004 site. Percent fine sediment of 20% and bank stability of 89 and 86% are well within recommended limits and canopy cover is adequate, however comments describe murky water, eroding banks, and high embeddedness. The 2005 BURP site upstream of the 2004 site scored much higher in SHI. The 2004 score should be reevaluated and no TMDL is necessary at this time.

The 4th and 5th AUs were listed in Section 3 (Unassessed Waters) on the 2008 Integrated Report. BURP surveys were conducted in 2007 for each of these AUs. The results of the macroinvertebrate samples collected during those surveys will not be available until fall 2008, however it is presumed that both AUs are fully supporting all beneficial uses. This presumption is based on the habitat and fish data collected during the 2007 surveys and previous surveys completed in the water body unit that show historically high macroinvertebrate scores. Both of these AUs should be moved to Section 2 of the next Integrated Report. See Section 2 for more data.

Skeleton Creek (2nd order) – 024_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Skeleton Creek shows full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Willow Creek (2nd order) – 025_02

This AU was listed in Section 3 (Unassessed Waters) of the 2008 Integrated Report. A 2006 BURP survey on 2nd order Edna shows full support of beneficial uses. This AU should be moved to Section 2 of the next Integrated Report. See Appendix H for supporting data.

Fall Creek (2nd order) – 031_02

This AU was listed on the 2002 and 2008 §303(d) list. It includes Camp and Meadow Creek. Meadow Creek was shown to be fully supporting beneficial uses in 2006. Camp Creek was shown to be dry in 2006 indicating that it is an intermittent stream. Perennial streams were found to be fully supporting beneficial uses as documented in this report, and this AU should be moved to Section 2 of the next Integrated Report.

Smith Creek – (032_02 and 032_03)

Smith Creek had two AUs listed on the 2002 §303(d) list.

The 2nd order segment of Smith Creek was listed for temperature. This segment was found to have beneficial uses impaired by temperature and a TMDL has been developed and is included in this document. This AU should be moved to Section 4a the next Integrated Report.

The 3rd order segment of Smith Creek was listed for unknown pollutants. Data indicates that flow/habitat alteration is causing impairment of beneficial uses. There are nine constructed flow alterations in the 3rd order of Smith Creek. This includes eight reservoirs and one canal diversion being used to irrigate an agricultural field west of Prairie. The 3rd order AU of Smith Creek should be delisted for unknown pollutants and moved to Section 4c of the next Integrated Report because of flow and habitat alteration.

Rattlesnake Creek (2nd order) – 033_02

Rattlesnake Creek was listed for sediment in the 2nd order segment. A wildfire burned much of the area in the Rattlesnake Creek watershed in 1992 (Idaho Bureau of Homeland Security website) and a rain on snowstorm event caused landslides from Prairie to Garden Valley in late December 1996. These natural events increased sediment loads to the 2nd order segment of the Rattlesnake Creek drainage (Lawrence Donohoo, Mountain Home Ranger District, Personal Communication, March 2008). Terracing to prevent mass wasting of hill slopes until vegetation is re-established is evident on some of the hillsides surrounding Little Rattlesnake Creek. This AU should be moved to Section 4c of the next Integrated Report due to flow and habitat alteration from natural events.

Temperature-Specific Outcomes

Of the streams examined and found to have excess heat loads as a result of lack of shade Smith Creek had the highest excess load, followed, in order of decreasing load, by Lime Creek, South Fork Lime Creek, Middle Fork Lime Creek, and North Fork Lime Creek. Although Lime Creek is larger than Smith Creek, Smith Creek had almost double the load of Lime Creek. The North and Middle Fork Lime Creek are of similar size and had the smallest excess loads. South Fork Lime Creek is the third largest stream and had the third largest excess load. Smith Creek and Lime Creek had excess loads per linear meter that range from 0 to approximately 26 kWh/day/m. The South, Middle, and North Forks of Lime Creek had excess loads per linear meter from 0 to approximately 10 kWh/day/m.

The excess loads can also be evaluated in terms of a lack of shade, by percent, for stream segment lengths as identified in Figures 17 and 20 and Tables 30-34 (Section 5.3). When evaluated in these terms, Smith Creek has the greatest lack of shade, ranging from 0 to 51%; followed by Lime Creek, ranging from 0 to 40% lack of shade. Of the remaining temperature-impaired streams, North Fork Lime Creek, ranging from 0 to 30%; is more shade-deficient than Middle and South Fork Lime Creek, both ranging from 0 to 25% shade deficient.

Loading tables and lack of shade figures (Section 5.3) can be used to identify segments of stream that lack the most shade and have the greatest excess load per linear meter. This information can be used to prioritize implementation of efforts to restore and enhance shade on the streams examined.

Table 38. Summary of assessment outcomes for temperature TMDLs.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Smith Creek/ 032_02 032_03	Temperature	Yes	Move to Section 4a of integrated report.[1]	PNV
Lime Creek/ 010_02 010_04 010_05	Temperature	Yes	Move to Section 4a of integrated report.[1]	PNV
North Fork Lime Creek/ 010_02 010_03	Temperature	Yes	Move to Section 4a of integrated report.[1]	PNV
Middle Fork Lime Creek/ 010_02 010_03	Temperature	Yes	Move to Section 4a of integrated report.[1]	PNV
South Fork Lime Creek/ 011_02 011_03	Temperature	Yes	Move to Section 4a of integrated report.[1]	PNV

[1] Section 4a of Integrated Report, Rivers with EPA approved TMDLs.

References Cited

American Geological Institute. 1962. Dictionary of Geological Terms. Doubleday and Company. Garden City, NY. 545 p.

American Public Health Association. 1998. Standard methods for the examination of water and wastewater, twentieth edition. Franson, M.A.H., L.S. Clesceri, A.E. Greenberg, and A.D. Eaton, editors. Washington, DC. 1,191 p.

Armantrout, N.B., compiler. 1998. Glossary of Aquatic Habitat Inventory Terminology. American Fisheries Society. Bethesda, MD. 136 p.

Armour, C.L., D.A. Duff, and W. Elmore. 1991. The effects of livestock grazing on riparian and stream ecosystems. Fisheries (16):7–11 pBahls, L. L. 1993. Periphyton bioassessment methods for Montana streams. Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena MT.

Batt, P.E. 1996. Governor Philip E. Batt's Idaho bull trout conservation plan. State of Idaho, Office of the Governor. Boise, ID. 20 p + appendices.

Behnke, R.J., and M. Zarn. 1976. Biology and Management of threatened and endangered western trout. USDA - Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. General Technical Report RM. 28.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in Streams. American Fisheries Society Special Publication. 19: 81-138 p.

Burton, T. A., and G. W. Harvey. 1990. Estimating intergravel salmonid living space using the cobble embeddedness sampling procedure. Idaho Department of Health and Welfare, Division of Environmental Quality, Water Quality Monitoring Protocols Report 2, Boise.

Burton, T. 1996. Boise National Forest Aquatic Survey Data Summary. Database. Boise National Forest. Boise, ID.

Burton, T. 1997. Proposed bull trout restoration – upper Middle Fork Boise River above Kirby Dam. Boise National Forest. Boise, ID.

Chapman, D.W. 1998. Critical review of variables used to define effects of fines in redds of large salmonids. Trans. Am. Fish. Soc. 177:1-21 p.

Clayton, J. L. 1992. Mechanical and Hydrological Properties of Granitic Rock Associated with Weathering and Fracturing in the Idaho Batholith. Proc. Decomposed Granite Soils Conference. Boise, ID. p40-50.

Clean Water Act (Federal water pollution control act), 33 U.S.C. § 1251-1387. 1972.

Corley, D. 1997. Upper South Fork Boise River key watershed assessment for bull trout. Boise National Forest, Boise, Idaho.

EPA. 1996. Biological criteria: technical guidance for streams and small rivers. EPA 822-B-96-001. U.S. Environmental Protection Agency, Office of Water. Washington, DC. 162 p.

EPA et al. 1975. Logging Roads and Protection of Water Quality. .EAP 910/9-75-007. March 1975. EPA Region 10. Seattle Washington. 308 p.

Everest, F.H., R.L. Beschta, J.C. Scrivner, K.V. Koski, J.R. Sedell, and C.J. Cederholm. 1987. Fine sediment and salmonid production: a paradox. In Streamside management: forestry and fishery interactions. E.O. Salo and T.W. Cundy editors. Contribution No. 57. College of Forest Resources, University of Washington, Seattle, WA: 98-142 p.

Furniss, M.J., T.D Roelofs and C.S. Yee. 1991. Road construction and maintenance. In Influences of forest and rangeland management on salmonid fishes and their habitat. W.R. Meehan, editor. Am. Fish. Soc. Spec. Pub 19: 297-323 p.

Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, and D.T. Mosier. 2002. The Idaho Department of Environmental Quality water body assessment guidance, second edition-final. Department of Environmental Quality. Boise, ID. 114 p.

Horsburgh, B. and R. Steed. 1998, updated August 1, 2000. Reconnaissance Monitoring of Algae Assemblages and Stream Conditions in Southwest Idaho. State of Idaho, Division of Environmental Quality. Boise, ID. 45 p.

Hughes, R.M. 1995. Defining acceptable biological status by comparing with reference condition. In: Davis, W.S. and T.P. Simon, editors. Biological assessment and criteria: tools for water resource planning and decision making. CRC Press. Boca Raton, FL: 31-48 p.

Idaho Bureau of Homeland Security. Website. Accessed March, 2008. http://www.bhs.idaho.gov/local/counties/elmore.htm#Maps

Idaho Code § 39.3611. Development and implementation of total maximum daily load or equivalent processes.

Idaho Code § 39.3615. Creation of watershed advisory groups.

IDAPA 58.01.02. Idaho water quality standards and wastewater treatment requirements.

IDEQ. 2000. Subbasin Assessment for the Upper Boise River Watersheds: Hydrologic Catalog Units 17050111 and 17050113, Southwest Idaho. Idaho Department of Environmental Quality. November 2000.

IDEQ. 2002. Middle Salmon River-Chamberlain Creek Subbasin Assessment and Crooked Creek Total Maximum Daily Load. Idaho Department of Environmental Quality. Final Revised December 2002.

IDEQ. 2004. South Fork Clearwater River Subbasin Assessment and TMDLs. Idaho Department of Environmental Quality, U.S. Environmental Protection Agency, and Nez Perce Tribe. March, 2004.

IDL. 2000. Forest Practices Cumulative Watershed Effects Process for Idaho. Idaho Department of Lands. March 2000.

Karr, J.R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications 1:66-84.

Lee DC, Sedell JR, Rieman BE, Thurow RF, Williams JE, Burns D, Clayton JL, Decker L, Gresswell R, House R, Howell P, Lee KM, Macdonald K, McIntyre J, McKinney S, Noel T, ’Connor JE, Overton CK, Perkinson D, Tu K, Van Eimeren P. 1997. Broadscale assessment of aquatic species and habitats. In An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins. Volume III, TM Quigley, SJ Arbelbide (eds) USDA Forest Service General Technical Report PNWGTR-405. Portland, OR: 1057–1713 p.

Lyons, J.K.; Beschta,'R.L.1983**.** Land use, floods and channel changes: Upper Middle Fork Willamette River, Oregon (1 936-1 980). Water Resources Research. 19(2): 463-471.

McGrath, C.L, Woods, A.J., Omernik, J.M., Bryce, S.A., Edmondson, M., Nesser, J.A., Shelden, J., Crawford, R.C., Comstock, J.A., and Plocher, M.D. 2001. Ecoregions of Idaho (color poster with map, descriptive text). U.S. Geological Survey Reston, VA. (map scale 1:1,350,000).

May, B.E. and W. L. Somes. 1981. Comparative effects of sheep and cattle grazing on the Marsh Creek drainage. Transactions of the Bonneville Chapter American Fisheries Society. 48-62 p.

Meehan, W.R., ed. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. Spec. Publ. 19. Bethesda, MD: American Fisheries Society. 751 p.

Megahan, W.F. 1991. Erosion and site productivity in western-montane forest ecosystems. In Harvey, A.E. and L.F. Neuenschwander (editors). Proceedings of the symposium on management and productivity of western montane forest soils. General Technical Report INT-280. April 10-12, 1990. Boise, ID. US Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT: 146-150 p.

Nelson, R. L., D. C. Burns, K. L. Ketchu, and D. D. Newberry. 2002. Deposition of fine sediment in the South Fork Salmon River and Chamberlain Creek watersheds, Payette and Boise National Forests, Idaho. Intragravel conditions in spawning areas. Report of sediment trends and monitoring efforts, 1966-2001. U.S. Forest Service, Payette National Forest and Boise National Forest, McCall and Boise, ID.

ODEQ. 2003. Alvord Lake Subbasin Total Maximum Daily Load (TMDL) & Water Quality Management Plan (WQMP). Oregon Department of Environmental Quality. December 2003.

OWEB. (2001). Addendum to Water Quality Monitoring Technical Guide Book: Chapter 14 Stream Shade and Canopy Cover Monitoring Methods. Oregon's Watershed Enhancement Board. 775 Summer St. NE., Suite 360, Salem, OR 97301-1290.

Northern/Intermountain Regions' inventory procedures for detecting differences in two differently managed watersheds. USFS Gen. Tech. Rept. INT-300. USFS Intermountain Forest and Range Experiment Station, Ogden, UT.

Forest Service Technical Report INT-GTR-322. USDA Forest Service, Intermountain Research Station, Ogden, UT. 142 p.

Partridge, F., Frank, K., Warren, C. 2001. Southwest Idaho Bull Trout Restoration (South Fork Boise River) Completion Report. Idaho Department of Fish and Game. Boise, ID.

Platts, W.S., C. Armour, G.D. Booth, M. Bryant, J.L. Bufford, P.Cuplin, S. Jensen, G.W. Lienkaemper, G.W. Minshall, S.B. Monson, R.L. Nelson, J.R. Sedell, J.S. Tuhy. 1987. Methods for evaluating riparian habitats with applications to management. Gen. Tech. Rpt. INT-221. USDA Forest Service, Ogden UT.

Poole, G.C. and C.H. Berman. 2001. An ecological perspective on in-stream temperature: natural heat dynamics and mechanisms of human-caused thermal degradation. Environmental Management 27(6):787-802.

Rieman, B., and Clayton, J., 1997. Wildfire and native fish: issues of forest health and conservation of sensitive species. Fisheries 22(11), 6-15 p.

Rieman, B. E., and J. D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S. Forest Service General Technical Report INT-302.

Rosgen, D., 1996. Applied River Morphology. Printed Media Companies, Minneapolis, MN. 345 p.

Strahler, A.N. 1957. Quantitative analysis of watershed geomorphology. Transactions American Geophysical Union 38:913-920 p.

Swanston, D.N.; 1971. Principle mass movement processes influenced by roadbuilding, logging, and fire. In proceedings of forest land uses and stream management symposium. Cont. Ed. Publ. Oregon State University, Corvalis, OR: 29-40 p.

Swanston, D.N.; Swanson, F.J. Timber harvesting, mass erosion, and steepland geomorphology in the Pacific Northwest. 1976. In: Coates, D.R., ed. Geomorphology and engineering. Stroudsburg, PA: Dowden, Hutchison, and Ross Publishing Co. 199-211 p.

USDA. 2003. Accuracy Assessment of Percent Canopy Cover, Cover Type, and Size Class. General Technical Report RMRS-GTR-108. Rocky Mountain Research Station. 16 p.

USGS. 1974. Hydrologic Unit Map – 1974. State of Idaho. Interior – Geological Survey, Reston, VA – 1975.

Water Environment Federation. 1987. The Clean Water Act of 1987. Water Environment Federation. Alexandria, VA. 318 p.

Water Quality Act of 1987, Public Law 100-4. 1987.

Water quality planning and management, 40 CFR Part 130.

Weaver, T. and Fraley, J., 1991. Fisheries Habitat and Fish Populations, Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program - Final Report. Flathead Basin Commission, Kalispell, MT: 53- 68 p.

Western Regional Climate Center. 2005. Climatological Data Summaries.

GIS Coverages

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

Glossary

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

§303(d)
Refers to section 303 subsection "d" of the Clean Water Act. §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 U.S. Environmental Protection Agency approval.

Aeration
A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.

Aerobic
Describes life, processes, or conditions that require the presence of oxygen.

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

Adjunct
In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin
A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.

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

Alluvium
Unconsolidated recent stream deposition.

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

Anadromous
Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the saltwater but return to fresh water to spawn.

Anaerobic
Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.

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

Anti-Degradation
Refers to the U.S. 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 of water to wells or springs.

Assemblage (aquatic)
An association of interacting populations of organisms in a given water body; for example, a fish assemblage or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).

Assessment Database (ADB)
The ADB is a relational database application designed for the U.S. 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.

Batholith
A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.

Bedload
Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.

Beneficial Use
Any of the various uses of water, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which 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

Benthic
Pertaining to or living on or in the bottom sediments of a water body

Benthic Organic Matter.
The organic matter on the bottom of a water body.

Best Management Practices (BMPs)
Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.

Biochemical Oxygen Demand (BOD)
The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

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

Biomass
The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.

Biota
The animal and plant life of a given region.

Biotic
A term applied to the living components of an area.

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 use 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).

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

Conductivity
The ability of an aqueous solution to carry electric current, expressed in micro (μ) mhos/centimeter at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.

Cretaceous
The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.

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 U.S. Environmental Protection Agency develops criteria guidance; states establish criteria.

Cubic Feet per Second
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, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Debris Torrent
The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition
The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.

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 one 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).

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

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

E. coli
Short for *Escherichia coli*, *E. coli* are a group of bacteria that 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.

Ecology
The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.

Ecological Indicator
A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.

Ecological Integrity
The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).

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

Effluent
A discharge of untreated, partially treated, or treated wastewater into a receiving water body.

Endangered Species
Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

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

Eocene
An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Ephemeral Stream
A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table (American Geological Institute 1962).

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

Eutrophic
From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.

Eutrophication
1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.

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 and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Exotic Species
A species that is not native (indigenous) to a region.

Fauna
Animal life, especially the animals characteristic of a region, period, or special environment.

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).

Feedback Loop
In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.

Fixed-Location Monitoring
Sampling or measuring environmental conditions continuously or repeatedly at the same location.

Flow
See *Discharge*.

Fluvial
In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.

Focal
Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.

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 cold-water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions.

Fully Supporting but Threatened
An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a “not fully supporting” status.

Geographical Information Systems (GIS)
A geo-referenced database.

Geometric Mean
A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.

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

Graminoids
Plants which are grass-like in appearance, but are not grasses in a taxonomical sense, such as sedges, reeds, cattails, and others.

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 stream flow.

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

Habitat
The living place of an organism or community.

Headwater
The origin or beginning of a stream.

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

Hydrologic Cycle
The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall,

runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

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.

Impervious
Describes a surface, such as pavement, that water cannot penetrate.

Influent
A tributary stream.

Inorganic
Materials not derived from biological sources.

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

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 stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters
Waters that flow across or form part of state or international boundaries, including boundaries with Native American nations.

Key Watershed
A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.

Limiting Factor
A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.

Limnology
The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.

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)
A determination of 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, and a margin of safety, it becomes a total maximum daily load.

Luxury Consumption
A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.

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

Macrophytes
Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS)
An implicit or explicit portion of a water body's loading capacity set aside to allow the 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.

Mass Wasting
A general term for the down slope movement of soil and rock material under the direct influence of gravity.

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. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; 6 is the median of 1, 2, 5, 7, 9, 11.

Metric
1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

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

Million Gallons per Day (MGD)
A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene
Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

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 Pollution 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.

Nitrogen
An element essential to plant growth, and thus is considered a nutrient.

Nodal
Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.

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

Not Assessed (NA)
A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

Not Attainable
A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

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).

Not Fully Supporting Cold Water
At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

Nuisance
Anything that is injurious to the 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.

Nutrient Cycling
The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Organic Matter
Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate
A form of soluble inorganic phosphorus most readily used for algal growth.

Oxygen-Demanding Materials
Those materials, mainly organic matter, in a water body that consume oxygen during decomposition.

Parameter
A variable, measurable property whose value is a determinant of the characteristics of a system, such as 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.

Periphyton
Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.

Pesticide
Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.

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

Phased TMDL
A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

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

Physiochemical
In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the term “physical/chemical.”

Plankton
Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

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, which alter the functioning of natural processes and produce undesirable environmental and health effects. This 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.

Protocol
A series of formal steps for conducting a test or survey.

Quality Assurance (QA)
A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training (Rand 1995). The goal of QA is to assure the data provided are of the quality needed and claimed (EPA 1996).

Quality Control (QC)
Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples (Rand 1995). QC is implemented at the field or bench level (EPA 1996).

Quantitative
Descriptive of size, magnitude, or degree.

Reach
A stream segment with fairly homogenous physical characteristics.

Reconnaissance
An exploratory or preliminary survey of an area.

Reference
A physical or chemical quantity whose value is known and thus is used to calibrate or standardize instruments.

Reference Condition
1) A condition that fully supports applicable beneficial uses with little affect 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).

Reference Site
A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.

Representative Sample
A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.

Resident
A term that describes fish that do not migrate.

Respiration
A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.

Riffle
A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

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

Riparian Habitat Conservation Area (RHCA)
A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:

- 300 feet from perennial fish-bearing streams
- 150 feet from perennial non-fish-bearing streams
- 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.

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 creates 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.

Settleable Solids
The volume of material that settles out of one liter of water in one hour.

Species
1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

Spring
Ground water seeping out of the earth where the water table intersects the ground surface.

Stagnation
The absence of mixing in a water body.

Stratification
A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).

Stream
A natural watercourse 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.

Storm Water 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.

Stream Segment of Concern
Stream segments about which the public has expressed significant concern.

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

Subbasin
A large watershed of several hundred thousand acres. This is the name commonly given to 4^{th} 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 6^{th} 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 605 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 in 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.

Suspended Sediments
Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Taxon
Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).

Tertiary
An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

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

Total Maximum Daily Load (TMDL)
A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + waste load 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.

Total Dissolved Solids
Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)
The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Franson et al. 1998) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants
Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary
A stream feeding into a larger stream or lake.

Trophic State
The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

Turbidity
A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.

Waste load Allocation (WLA)
The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load 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, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

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

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

Water Quality Limited
A label that describes water bodies for which one or more water quality criterion is 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 Management Plan
A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water Quality Modeling
The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.

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

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

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

Water Body Identification Number (WBID)
A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

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

Young of the Year
Young fish born the year captured, evidence of spawning activity.

Appendix A. Unit Conversion Chart

Table A-1. Metric - English unit conversions.

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

[a] 1 cfs = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 cfs.

[b] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix B. State and Site-Specific Standards and Criteria

Water Quality Standards Applicable to Salmonid Spawning Temperature

Water quality standards for temperature are specific numeric values not to be exceeded during the salmonid spawning and egg incubation period, which varies with species. For spring spawning salmonids, the default spawning and incubation period recognized by DEQ is generally from March 15 to July 1 each year (Grafe et al., 2002). Fall spawning can occur as early as August 15 and continue with incubation on into the following spring up to June 1. As per IDAPA 58.01.02.250.02.e.ii., the water quality criteria that need to be met during that time period are:

> 13 ^{o}C as a daily maximum water temperature,
>
> 9 ^{o}C as a daily average water temperature.

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

Natural Background Provisions

For potential natural vegetation (PNV) temperature TMDLs, it is assumed that natural temperatures may exceed these criteria during these time periods. If PNV targets are achieved yet stream temperatures are warmer than these criteria, the stream’s temperature is assumed to be natural (provided there are no point sources or human-induced ground water sources of heat) and natural background provisions of Idaho WQS apply. As per 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, pollutant levels shall not exceed the natural background conditions, except that temperature levels 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 is exceeded due to natural conditions, then a point source discharge cannot raise the water temperature by more than 0.3 ^{o}C (IDAPA 58.01.02.401.03.a.v.).

Appendix C. Data Sources

Table C-1. Data sources for South Fork Boise River Subbasin Assessment.

Water Body	Data Source[1]	Type of Data	Date Collected
Smith Creek Lime Creek	DEQ State Technical Services Office	Pathfinder effective shade and stream width	October 2007
Smith Creek Lime Creek	DEQ State Technical Services Office	Aerial Photo Interpretation of existing shade and stream width estimation	September – October 2007
Smith Creek Lime Creek	DEQ IDASA[2] Database	Temperature	Unknown
All	Western Regional Climate Center (www.wrcc.dri.edu)	Climate	Period of Record
All	DEQ Files	BURP[3] data	1998-2007
South Fork Boise River	USGS	Flow	1911-2007
All	IDWR	Mine locations	Period of record
South Fork Boise River	EPA	Elk Valley Subdivision NPDES[4] permit information	April 2005
Little Rattlesnake Creek	Mountain Home Ranger District – Lawrence Donohoo	Rain on Snow event date and description	March 2008
Smith Creek	DEQ – Hawk Stone and Crystal Woolf	McNeil core sample sediment data	January 2008
Rough Creek	DEQ – Hawk Stone and Crystal Woolf	McNeil core sample sediment data	April 2008
Dixie Creek Lower Willow Creek	DEQ – Susan Beattie and Crystal Woolf	McNeil core sample sediment data	May 2008

12. DEQ – Idaho Department of Environmental Quality; USGS – U.S. Geological Survey; IDWR – Idaho Department of Water Resources; EPA – U.S. Environmental Protection Agency
13. IDASA – DEQ database for tracking water quality
14. BURP – Beneficial Use Reconnaissance Program
15. NPDES – National Pollutant Discharge Elimination System

Appendix D. Distribution List

Copies of the final report will be provided to the Idaho Department of Environmental Quality State Office, U.S. Environmental Protection Agency Region 10, and the South Fork Boise River Technical Advisory Group participants, including:

Tim Kennedy
Idaho Department of Lands
8355 W. State St.
Boise, ID 83714

Dan Kenney
U.S. Forest Service, Fairfield R.D.
P.O. Box 189
Fairfield, ID 83327

Bruce Oshita
Mountain Home Air Force Base
960 North 5th East
Mountain Home, ID 83647

Clyde Lay
U.S. Bureau of Reclamation
1150 North Curtis Road, Suite 100
Boise, Idaho 83706-1234

Joe Samer
CH2M Hill
628 East Braemere
Boise, Idaho 83702

L.G. Davison and Sons, Inc.
1969 Prairie Rd
Prairie, ID 83647

Y-Stop General Store
1260 W Long Gulch Rd.
Prairie, ID 83647

Luther Cook
176 Smith Creek Rd
Prairie ID 83647

USEPA Region 10
Idaho Operations Office
1435 N. Orchard St.
Boise, ID 83706
ATTN: Bill Stewart

Camas County Public Library
519 1st St. West
Fairfield, ID 83327

City of Fairfield
P.O. Box 336
Fairfield, ID 83327

Mountain Home Public Library
790 N. 10 E
Mountain Home, ID 83647

Boise Public Library
715 S. Capital Blvd.
Boise, ID 83702

Appendix E. Public Comments

Source and Comments

Bill Stewart, USEPA Region 10, Boise, ID 83706

EPA1: Page 22. On page 22, in reference to the recreational dredge mining as defined by IDWR, is the definition quote correct? A five-inch nozzle and fifteen horsepower engine seems high to be considered recreational.

Response: As revised in 2008, Idaho defines equipment with a 5 inch nozzle and fifteen horsepower engine or less as recreational dredge mining. DEQ does not have the responsibility of regulating or permitting this activity on Idaho's streams and a copy of the permit application and instructions can be found at: http://www.idwr.idaho.gov/water/stream_dam/sca/RecDredgeInst2008.pdf.

EPA 2: Dredging. EPA believes that recreational dredging is an activity which is regulated by the Clean Water Act. Currently there is an NPDES general permit under development for recreational dredges.

Response: Recreational dredge mining in Idaho is regulated by the Idaho Stream Channel Protection Act, through the Idaho Department of Water Resources (IDWR). The purpose of this statute is to protect Idaho streams from "… alteration for the protection of fish and wildlife habitat, aquatic life, recreation, aesthetic beauty and water quality. This means IDWR must approve in advance any work being done within the beds and banks of a continuously flowing stream." BRO invites EPA to contact IDWR to address any concerns that may exist regarding this issue. The state welcomes collaborative inter-agency efforts to protect Idaho's resources.

EPA 3: Page 58. On page 58, in the data analysis discussion on Rattlesnake Creek, no mention of the possible role of roads in the watershed with regard to the landslides in 1996. Were roads looked at as a factor?

Response: Roads were reviewed as a potential source of sediment throughout the subbasin. Each subbasin listed for sediment was either inventoried to determine the contribution priority of each source for sediment or sampled and analyzed for depth fines percentages using the McNeil core sampling method. Based on the results of our analysis, including a review of the devegetation due to natural fire and flooding throughout the watershed, natural events were determined as the primary source of sediment delivery to streams in this watershed.

There is one ridge-top and one mid-slope road on the NF Rattlesnake Creek. The SF Rattlesnake Creek has greater road density than the NF, including a streamside road in the headwaters, and there is one road that intersects Rattlesnake Creek at the confluence with Grimes Creek.

The steep terrain in the Rattlesnake Creek watershed contributes to lower road density than the Feather River watershed, and the terrace contours have served to stabilize slopes and accelerate the regeneration of vegetation since the fire and flood events of the 1990s. This progress can be observed remotely through Google Earth at coordinates: 43^{o}49’21” lat. 116^{o}00’21”, NAD83.

Appendix F. Sediment Collection Data

Table F-1. Core sampling results for percent subsurface fine sediment.

Stream Name/AU	% Subsurface Fine Sediment (mean)	Sample Date	Method of Estimation
Smith Creek/ 032_03	24%	1/16/08	McNeil Core Samples
Lower Willow Creek/ 002b_03	17%	1/22/08	McNeil Core Samples
Wood Creek/ 003_03	26%	5/7/08	McNeil Core Samples
Lower Willow Creek/ 002b_04	22%[a]	5/7/08	McNeil Core Samples
Rough Creek/ 004_02	7%	4/22/08	McNeil Core Samples
Dixie Creek/ 004_03	39%	5/7/08	McNeil Core Samples

a. 4th order Lower Willow Creek's percentage was estimated by averaging the two 3rd order streams flowing into it (3rd order Lower Willow and Wood Creeks).

Appendix G. Flow Data

The United States Geological Survey (USGS) has measured stream flow in some streams flowing into Arrowrock and Anderson Ranch Reservoirs. Figure G-1 shows the locations of USGS stream gauging stations for streams contributing to Arrowrock Reservoir and Figures G-2 through G-6 show the daily mean stream flow for each period of record. Figure G-7 shows the locations of USGS stream gauging stations for streams contributing to Anderson Ranch Reservoir and Figures G-8 through G-6 show the daily mean stream flow for each period of record.

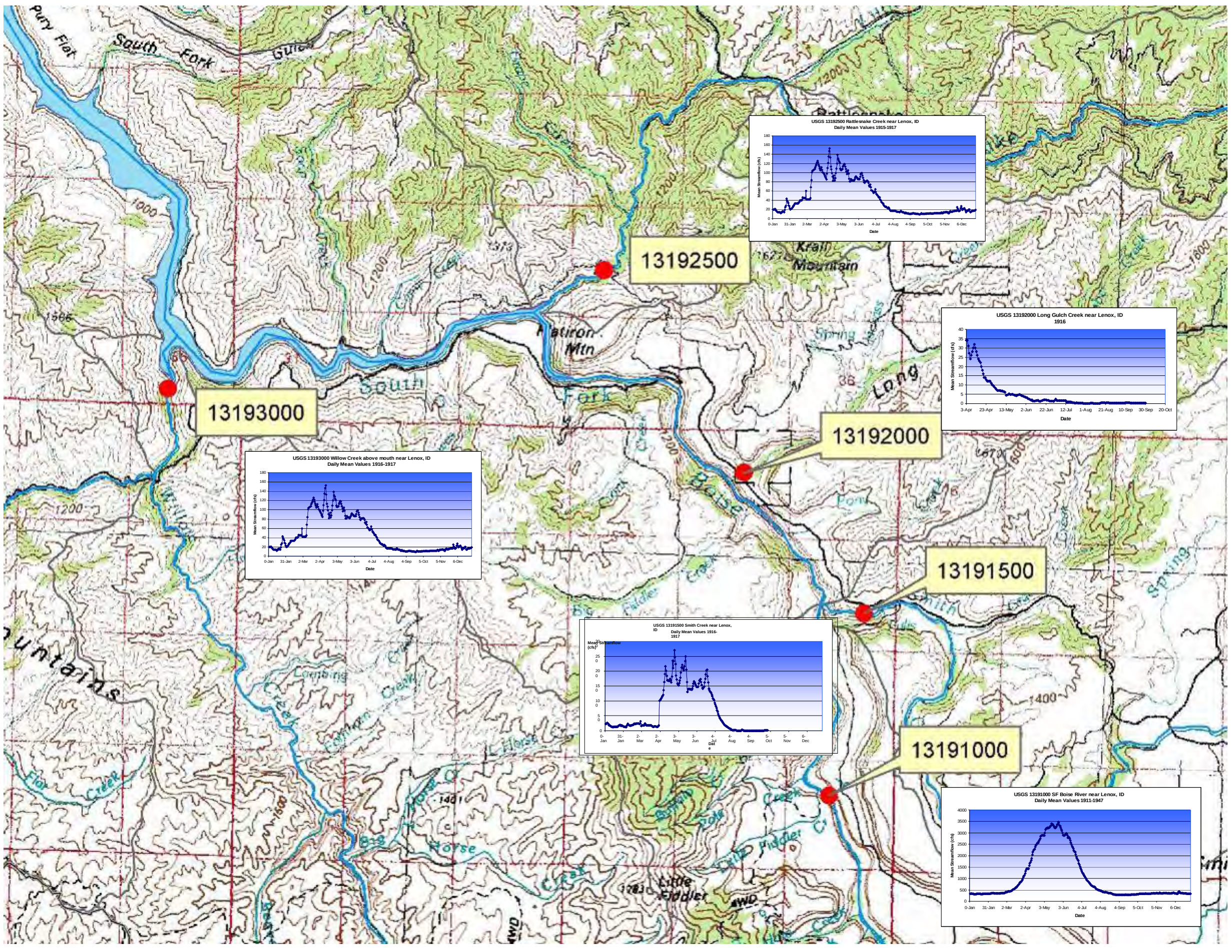


Figure G-1. Locations of USGS Gauging Stations on Tributaries to Arrowrock Reservoir With Hydrographs for the Period of Record for Each Gauge.

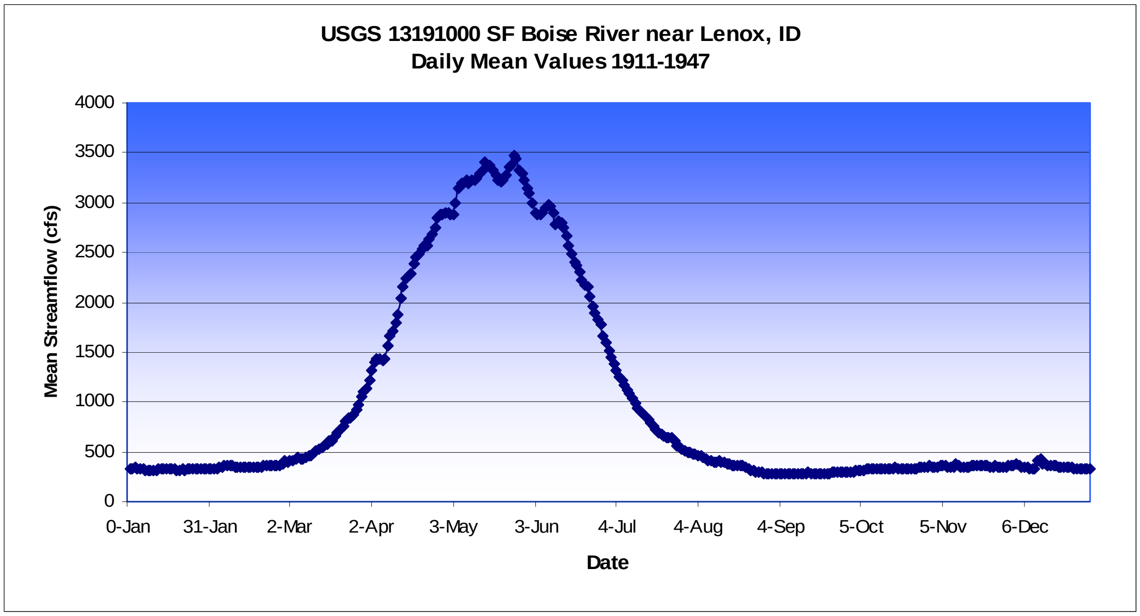


Figure G-2. Daily Mean Stream Flow in South Fork Boise River Measured From 1911 to 1947.

For the period of record, peak stream flow at USGS gauging station 13191000, South Fork Boise River is 9,550 cfs April 1, 1943 and the low flow is 100 cfs November 2, 1913.

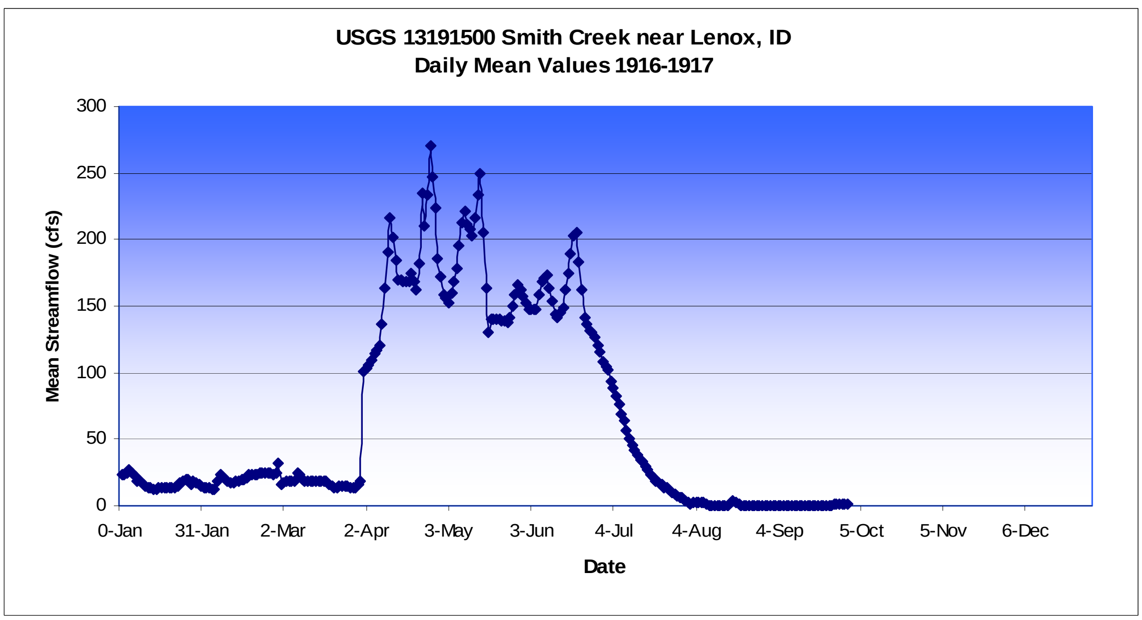


Figure G-3. Daily Mean Stream Flow in Smith Creek Measured From 1916 Through 1917.

For the period of record, peak stream flow at USGS gauging station 13191500, Smith Creek, is 401 cfs May 15, 1917 and low flow is 0.20 cfs on several days in July and August both years.

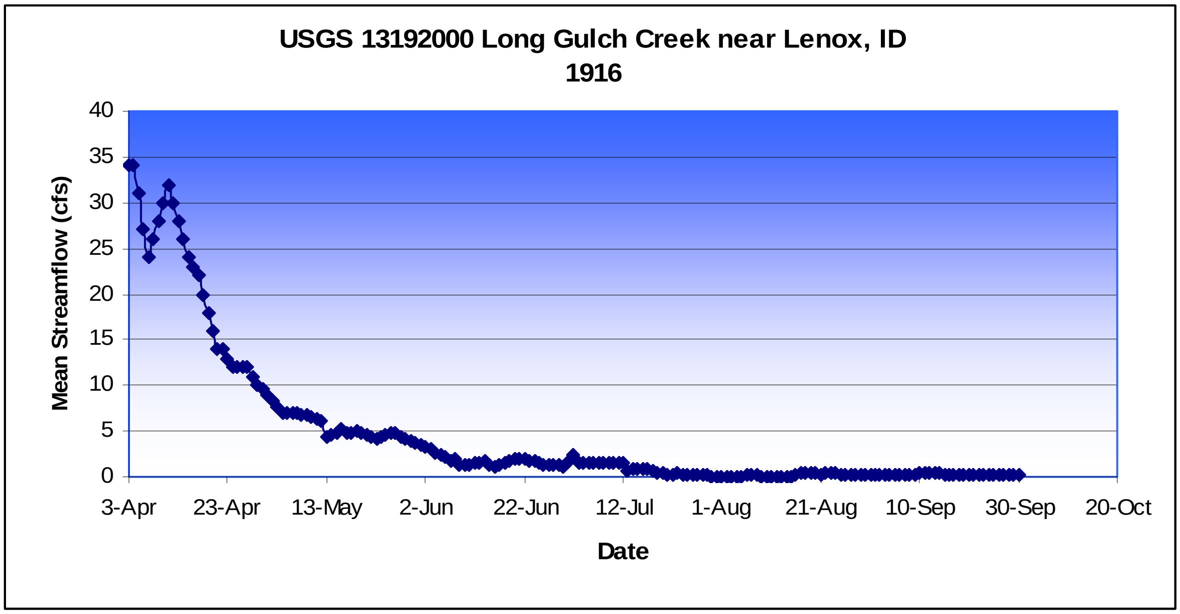


Figure G-4. Daily Mean Stream Flow in Long Gulch Creek Measured in 1916.
For the period of record, peak stream flow at USGS gauging station 13192000, Long Gulch Creek is 34 cfs April 1-4 and low flow is 0.10 cfs on many days in July and August.

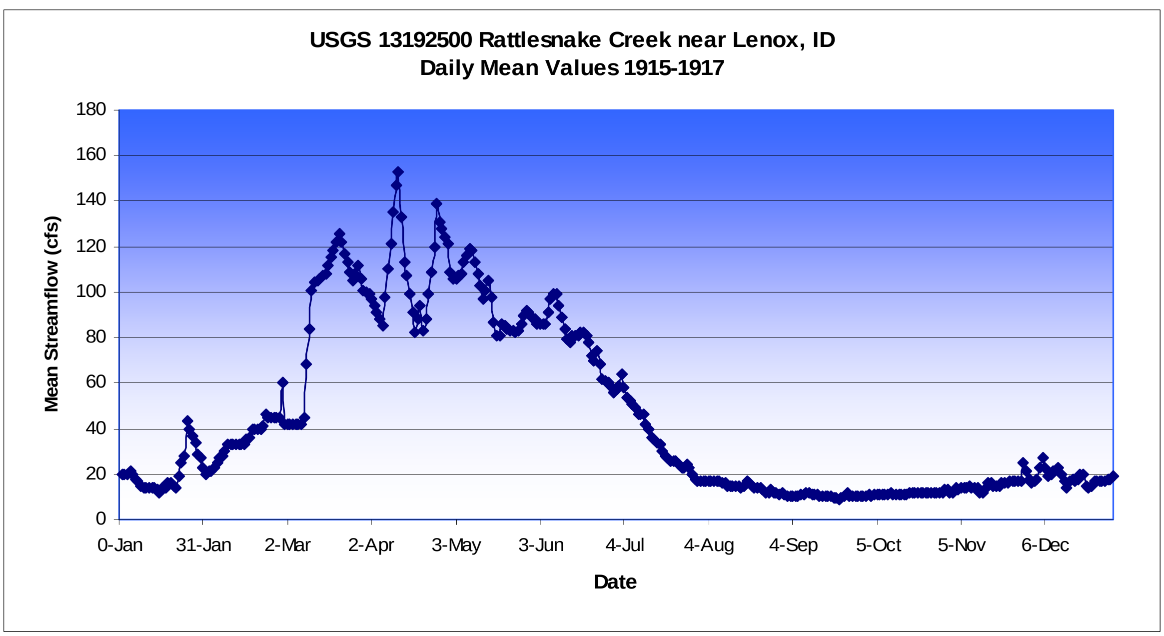


Figure G-5. Daily Mean Stream Flow in Rattlesnake Creek Measured From 1915 Through 1917.
For the period of record, peak stream flow at USGS gauging station 13192500, Rattlesnake Creek is 182 cfs March 21, 1916 and low flow is 6.0 cfs September 21, 1917.

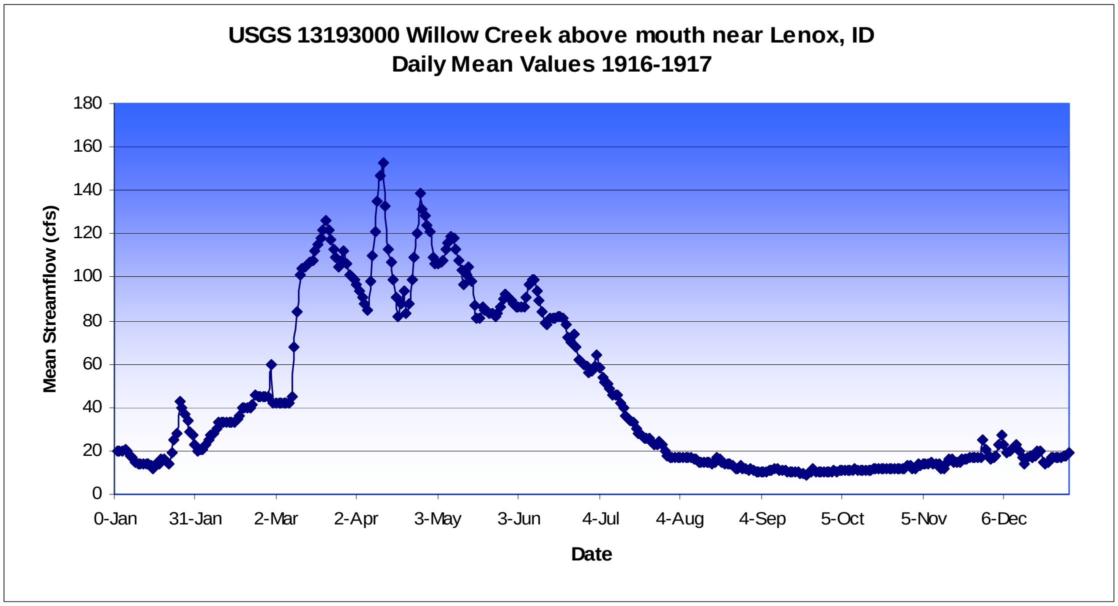


Figure G-6. Daily Mean Stream Flow in Willow Creek Measured From 1916 Through 1917.

For the period of record, peak stream flow at USGS gauging station 13193000, Willow Creek, is 234 cfs May 12, 1917 and low flow is 0.50 cfs August 25, 1917.

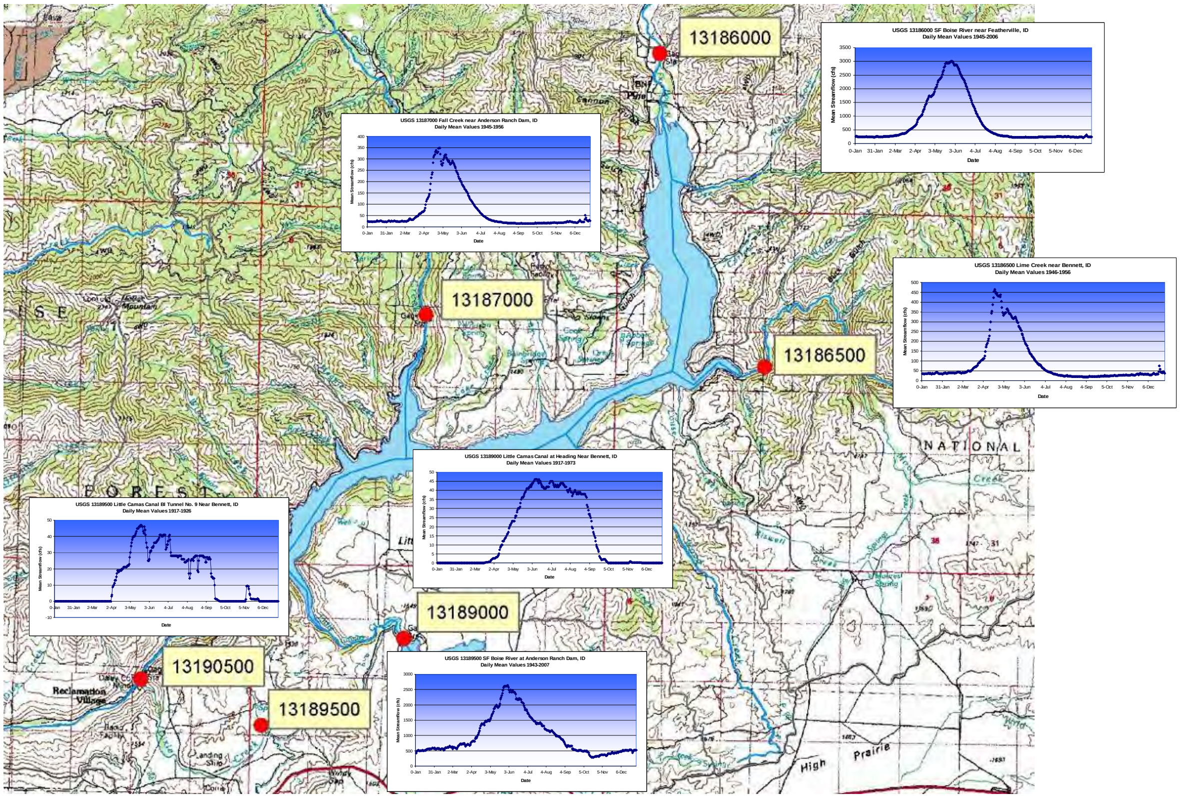


Figure G-7. Hydrographs of Tributaries to Anderson Ranch Reservoir with USGS Gauging Station Identification Numbers Indicated on the Map.

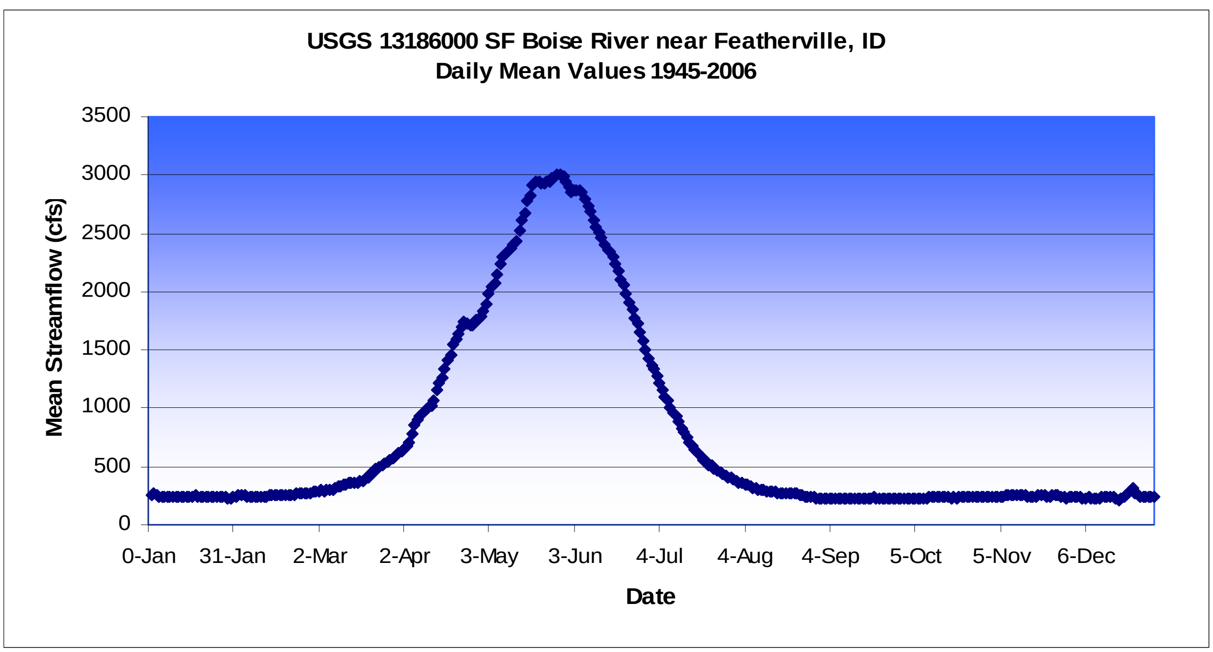


Figure G-8. Daily Mean Stream Flow in South Fork Boise River Near Featherville Measured From 1945 Through 2006.

For the period of record, peak stream flow at USGS gauging station 13186000, South Fork Boise River Near Featherville, is 8,150 cfs on May 21, 2006 and low flow is 30 cfs February 10, 1949.

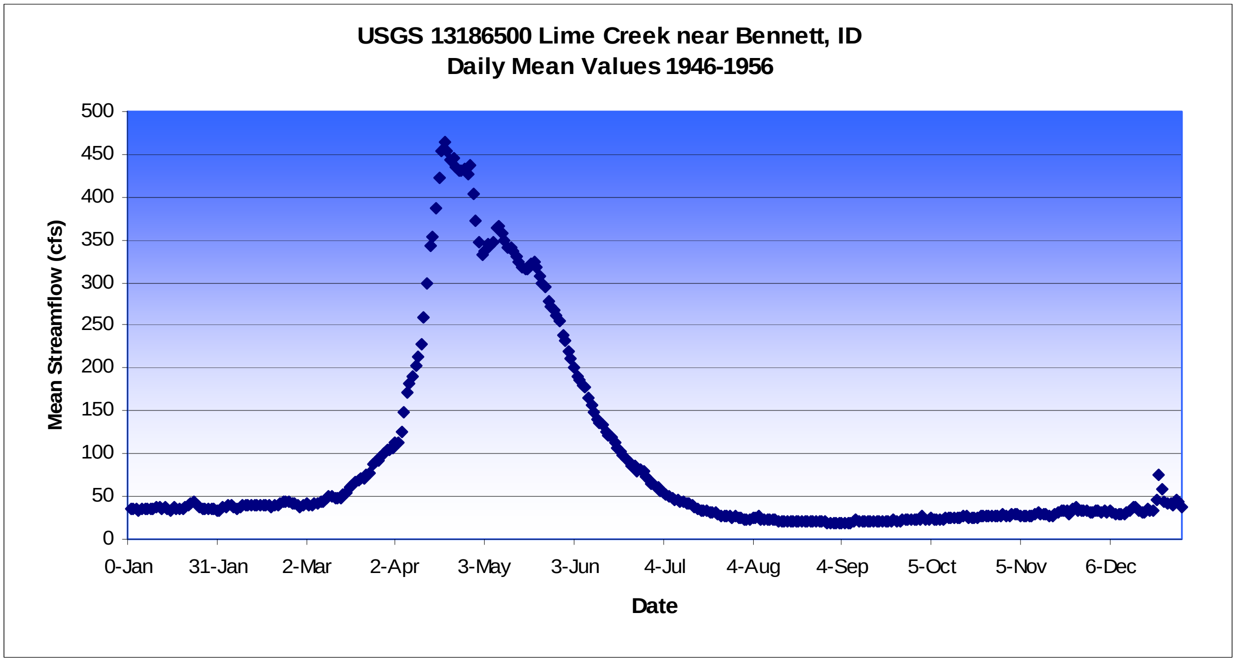


Figure G-9. Daily Mean Stream Flow in Lime Creek Measured From 1945 Through 1956.

For the period of record, peak stream flow at USGS gauging station 13186500, Lime Creek Near Bennett, is 1,020 cfs April 27, 1952 and low flow is 3.2 cfs February 11, 1949.

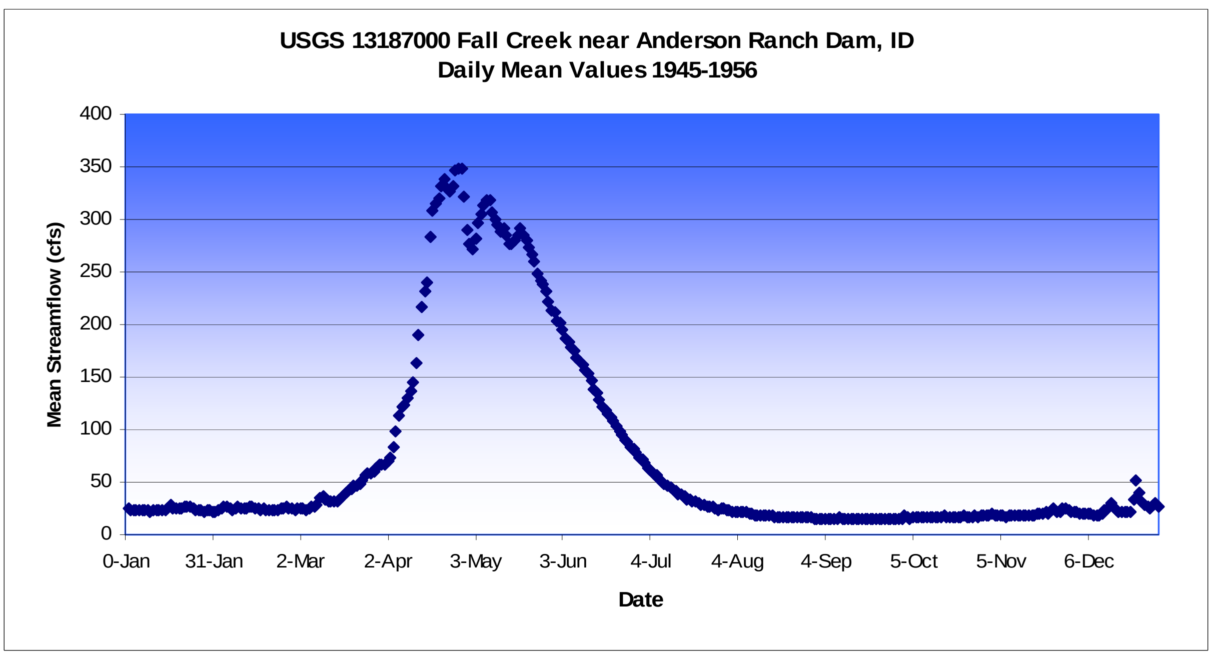


Figure G-10. Daily Mean Stream Flow in Fall Creek Measured From 1945 Through 1956.

For the period of record, peak stream flow USGS gauging station 13187000, Fall Creek Near Anderson Ranch Dam, is 824 cfs April 27, 1952 and low flow is 10 cfs during December 1954 and January 1955.

The canal hydrographs in Figures G-11 and G-12 are typical of flows managed as diversions for agricultural purposes and not representative of natural stream flows in the subbasin.

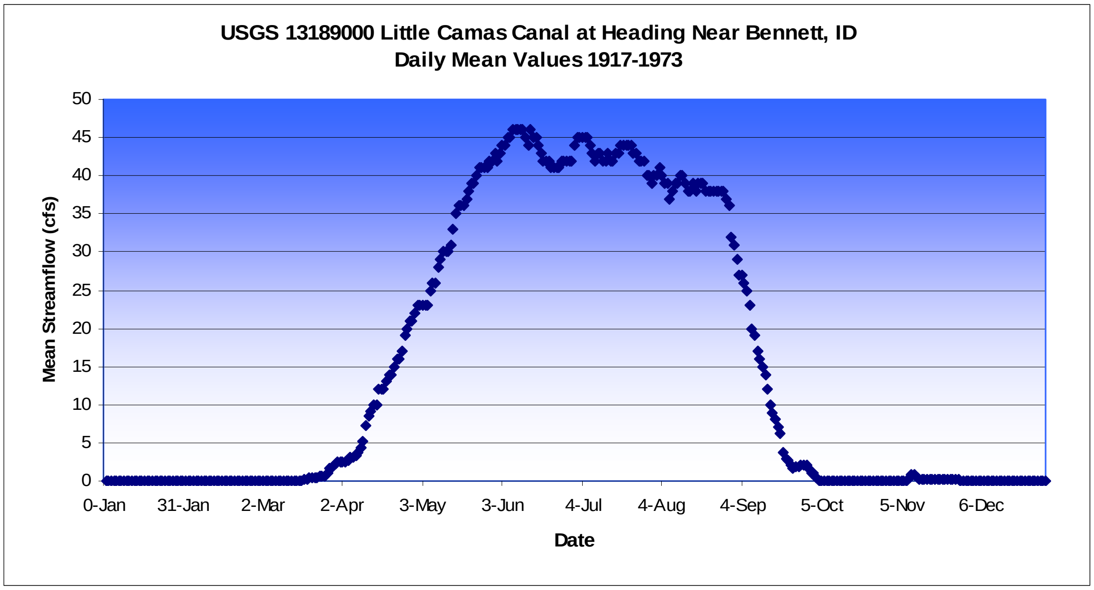


Figure G-11. Daily Mean Stream Flow in Little Camas Canal Measured From 1917 Through 1973.

For the period of record, stream flow peaked at 68 cfs several days in July 1917, and 0 cfs many times October through March, throughout the period of record.

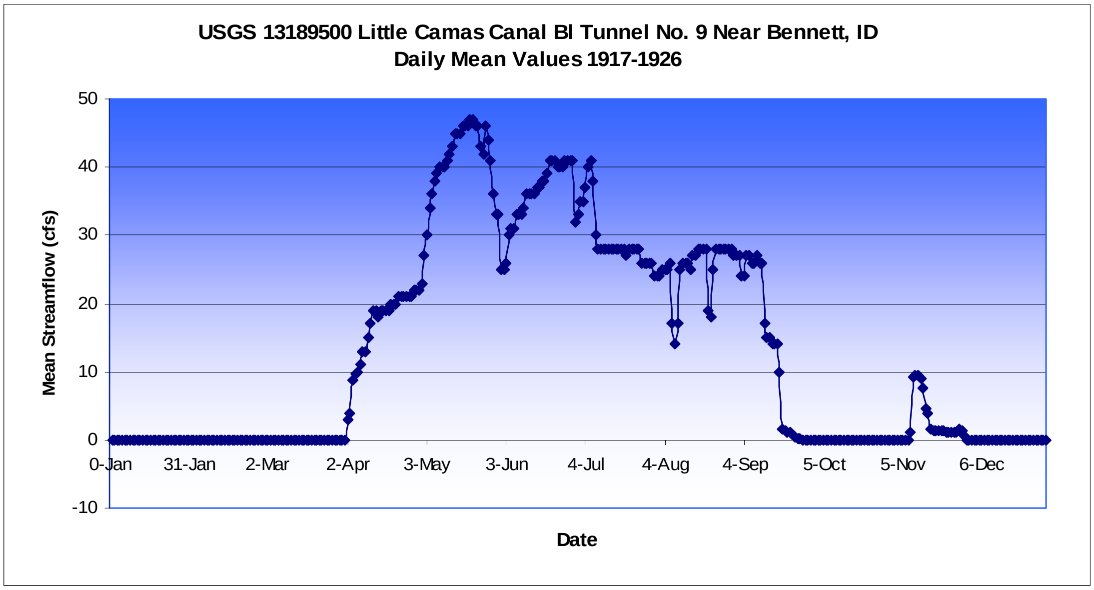


Figure G-12. Daily Mean Stream Flow in Little Camas Canal below tunnel number 9, Measured From 1917 Through 1926.

For the period of record, canal flow peaked at 66 cfs several days in May 1924 and was usually 0 cfs October through March.

The following figure shows historical flow averages for the South Fork Boise River approximately one mile downstream from Anderson Ranch Dam.

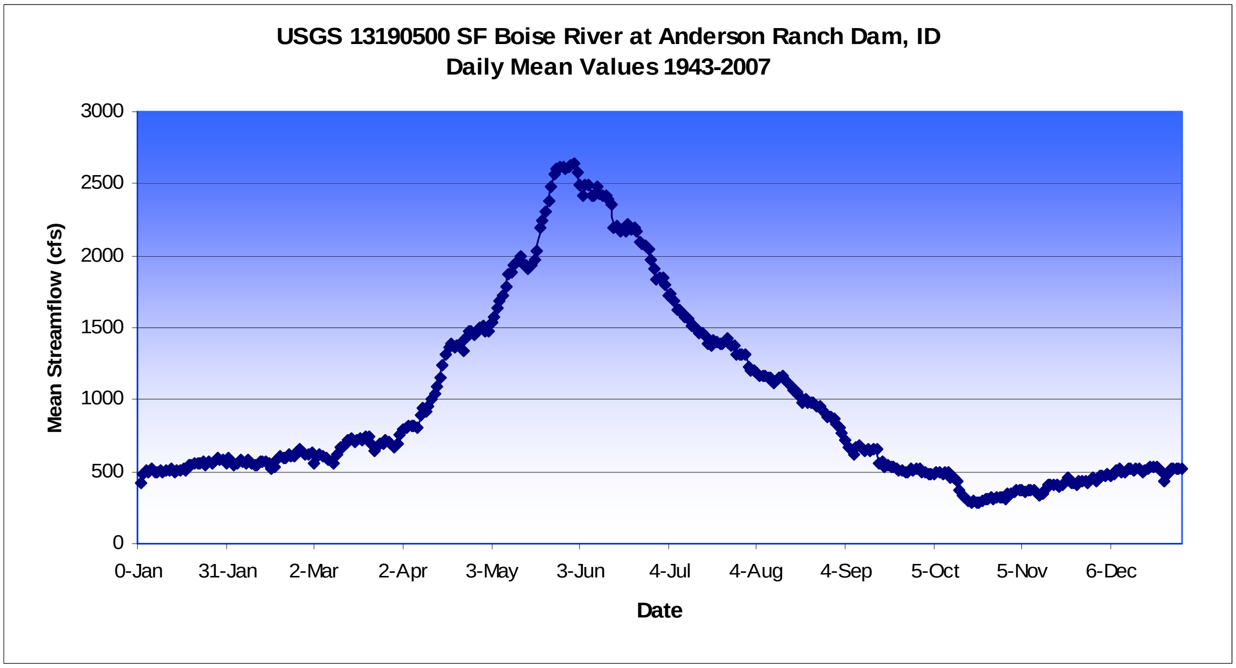


Figure G-13. Daily Mean Stream Flow in South Fork Boise River at Anderson Ranch Dam Measured From 1943 Through 2007.

For the period of record, peak stream flow at USGS gauging station 13190500, South Fork Boise River at Anderson Ranch Dam is 9,850 cfs May 25, 1956 and low flow is 0.10 cfs November 15, 1959.

Appendix H. BURP Data for Fully Supporting Water Body Units

Arrowrock Reservoir (Tributaries and the Boise River) - ID17050113SW001

Table H-1. Streams and available BURP data for Arrowrock Reservoir (Boise River) - ID17050113SW001.

Stream and BURP Site ID	Date	Approx. Stream Miles	Water Temp. (°C)	Flow (cfs)	SMI	SFI	SHI	Average Score
Rattlesnake Creek- 3rd order (1999SBOIA037)	9/7/1999	0.87	10.3	16.33	3		2	2.5

Wood Creek (Source to mouth) - ID17050113SW003

Table H-2. Streams and available BURP data for Wood Creek from the source to the mouth - ID17050113SW003.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Bender Creek- 2nd order (1998SBOIA048)	7/27/1998	4.34	0.4	19.6	3		3	3
Deadman Creek- 2nd order (1998SBOIA047)	7/27/1998	2.50	0.3	15.5	3		3	3
Wood Creek- 2nd order (1997SBOIA015)	6/26/1997	4.82	0.5	13.0	2	2	1	1.67
Wood Creek-3rd order (1997SBOIA016)	6/26/1997	2.02	3.0	14.0	1	2	2	1.67
Wood Creek-3rd order (2006SBOIA030)	7/5/2006	2.02	0.47	16.3	3		3	3.0

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The USFS has completed several trail ford rehabilitation and trail decommissioning projects in this AU since 2000.

Little Camas Creek (Little Camas Reservoir to Anderson Ranch Reservoir) - ID17050113SW006

There is currently no BURP data available for this water body unit.

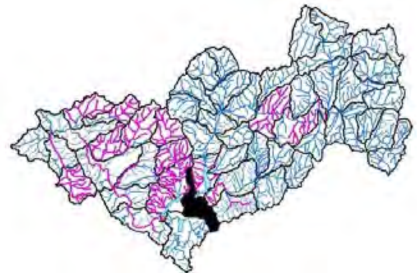
Little Camas Creek Reservoir - ID17050113SW007

There is currently no BURP data available for this water body unit.

Little Camas Creek (Source to Little Camas Creek Reservoir) - ID17050113SW008

There is currently no BURP data available for this water body unit.

Wood Creek (Source to Anderson Ranch Reservoir) - ID17050113SW009



There is currently no BURP data available for this water body unit.

South Fork Lime Creek (Source to mouth) - ID17050113SW011

Table H-3. Streams and available BURP data for the South Fork Lime Creek from the source to the mouth - ID17050113SW011.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Hunter Creek- 2nd order (1998SBOIA055)	7/28/1998	NA	0.2	11.8	3		2	2.5
Hunter Creek- 2nd order (1998SBOIA056)	7/28/1998	NA	1.0	16.9	3		1	2
Hunter Creek- 2nd order (2006SBOIA038)	7/8/2006	NA	0.26	18.0	2		3	2.5
South Fork Lime Creek- 3rd order (1998SBOIA058)	7/28/1998	9.37	16.0	21.4	3		1	2
South Fork Lime Creek-3rd order (2007SBOIA131)	8/21/2007	9.37	1.97	21.7			1	

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 3rd order segment of South Fork Lime Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI score is shown in Table H-3, but was not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS has completed several beaver reintroduction projects in this AU since 2000.

Deer Creek (Source to Anderson Ranch Reservoir) - ID17050113SW012

Table H-4. Streams and available BURP data for Deer Creek from the source to Anderson Ranch Reservoir - ID17050113SW012.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Deer Creek- 3rd order (1998SBOIA020)	6/24/1998	1.28	17.3	11.0	2		2	2
Deer Creek- 3rd order (1999SBOIA018)	8/2/1999	1.28	3.28	13.7	3		3	3
South Fork Deer Creek- 2nd order (1998SBOIA019)	6/24/1998	2.77	10.2	9.5	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

South Fork Boise River (Willow Creek to Anderson Ranch Reservoir) - ID17050113SW013

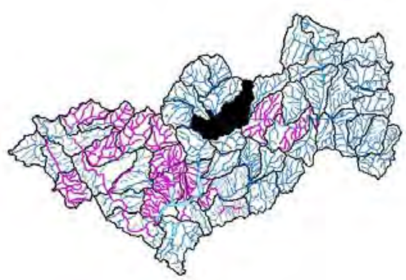


Table H-5. Streams and available BURP data for the South Fork Boise River from Willow Creek to Anderson Ranch Reservoir- ID17050113SW013.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Bird Creek- 2nd order (1997SBOIB058)	8/4/1997	2.10	0.12	12.0	3		3	3
Marsh Creek- 2nd order (1998SBOIA014)	6/18/1998	4.30	-0.01	9.0	2		1	1.5
Warbois Creek-2nd order (1997SBOIB059)	8/4/1997	1.75	1.8	13.0	2		3	2.5

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Grouse Creek (Source to mouth) - ID17050113SW014

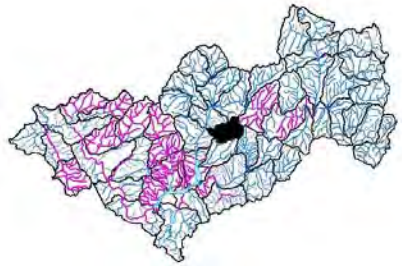


Table H-6. Streams and available BURP data for Grouse Creek from the source to the mouth - ID17050113SW014.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs	Temp. (°C)	SMI	SFI	SHI	Average Score
Grouse Creek- 2nd order (1997SBOIA066)	8/7/1997	7.13	1.9	12.0	3		3	3
Grouse Creek- 2nd order (1997SBOIA067)	8/7/1997	7.13	1.9	12.0	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Beaver Creek (Source to mouth) - ID17050113SW016

Table H-7. Streams and available BURP data for Beaver Creek from the source to the mouth - ID17050113SW016.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Beaver Creek- 2nd order (2006SBOIA110)	8/30/2006	6.22	4.5	11.3	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Boardman Creek (Source to mouth) - ID17050113SW017

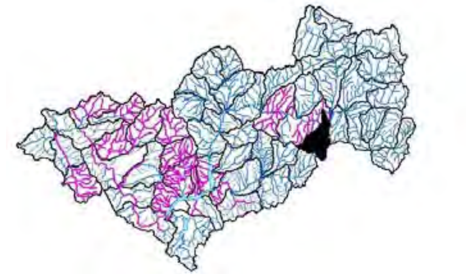


Table H-8. Streams and available BURP data for Boardman Creek from the source to the mouth - ID17050113SW017.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Boardman Creek- 3rd order (2004STWFA038)	7/27/2004	5.00	6.3	17.7	3		3	3
Boardman Creek- 3rd order (2005STWFF009)	7/14/2005	5.00	NA	NA		3		3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The USFS has completed several habitat improvement projects in this AU since 2000. These include unauthorized road/trail decommissioning and trail relocation/rehabilitation.

Big Smoky Creek (Source to mouth) - ID17050113SW019

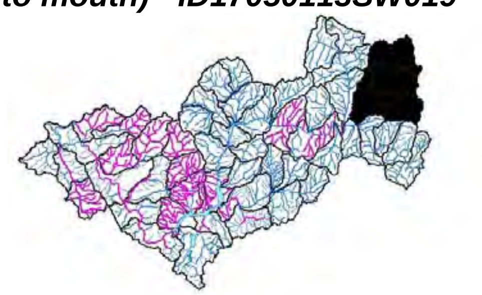


Table H-9. Streams and available BURP data for Big Smoky Creek from the source to the mouth - ID17050113SW019.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Barlow Creek- 2nd order (1997STWFA052)	8/20/1997	2.43	0.3	8.0	3		3	3
Big Smoky -4th order (1995STWFA056)	8/21/1995	14.3	102.4	10.0	3		3	3
Calf Creek- 2nd order (1997STWFA054)	8/19/1997	1.93	0.4	12.1	3		3	3
Poison Creek- 2nd order (1997STWFA055)	8/10/1997	2.16	0.4	12.0	3		3	3
Skillern Creek- 2nd order (1997STWFA053)	8/20/1997	4.50	1.7	13.0	3		3	3
Skillern Creek- 2nd order (2007SBOIA128)	8/20/2007	4.50	0.41	14.3			3	

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 2nd order segment of Skillern Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI score is shown in Table H-9, but was not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS has completed several trail relocation and rehabilitation projects in this AU since 2000.

Paradise Creek (Source to mouth) - ID17050113SW020

Table H-10. Streams and available BURP data for Paradise Creek from the source to the mouth - ID17050113SW020.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Paradise Creek- 2nd order (2004STWFA035)	7/26/2004	9.53	6.1	12.4	3		2	2.5
Paradise Creek- 2nd order (2005STWFF007)	7/14/2005	9.53	NA	NA		3		3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

South Fork Boise River (Confluence of Ross Fork and Johnson Creeks to Little Smoky Creek) - ID17050113SW021

Table H-11. Streams and available BURP data for the South Fork Boise River from the confluence of Ross Fork and Johnson Creek to Little Smoky Creek- ID17050113SW021.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Bear Creek- 2nd order (1997STWFA050)	8/19/1997	6.29	1.7	9.0	3		3	3
Elk Creek- 2nd order (1997STWFA053)	8/19/1997	2.60	1.2	12.0	3		3	3
Goat Creek- 2nd order (1997STWFB051)	8/19/1997	NA	3.7	10.5	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The USFS completed a stream ford rehabilitation on Emma Creek in this AU in 2007.

Johnson Creek (Source to mouth) - ID17050113SW022

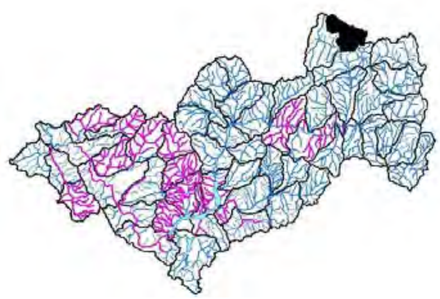


Table H-12. Streams and available BURP data for Johnson Creek from the source to the mouth - ID17050113SW022.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Johnson Creek- 3rd order (2004STWFA042)	8/2/2004	1.87	11.9	10.8	3		3	3
Johnson Creek- 3rd order (2005STWFF002)	7/13/2005	3.76	NA	NA		3		3
Johnson Creek- 3rd order (2006STWFA037)	8/3/2006	5.54	19.28	6.2	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Ross Fork (Source to mouth) - ID17050113SW023

Table H-13. Streams and available BURP data for Ross Fork from the source to the mouth - ID17050113SW023.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Gold Run Creek- 2nd order (2004STWFA044)	8/3/2004	4.71	0.3	12.3	3		1	2.0
Gold Run Creek-2nd order (2005STWFF001)	7/11/2005	3.70	NA	NA		2		2.0
Ross Fork- 3rd order (2004STWFA043)	8/2/2004	5.21	1.2	9.0	3	2	3	2.67

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Skeleton Creek (Source to mouth) - ID17050113SW024

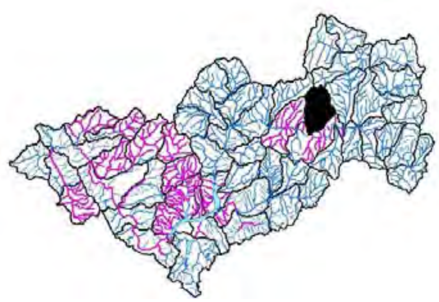


Table H-14. Streams and available BURP data for Skeleton Creek from the source to the mouth - ID17050113SW024.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Unnamed tributary to Skeleton Creek- 2nd order (2006SBOIA107)	8/30/2006	NA	1.50	8.7	3		3	3
Skeleton Creek- 3rd order (2006SBOIA109)	8/30/2006	5.83	5.25	13.4	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Willow Creek (Source to South Fork Boise River) - ID17050113SW025

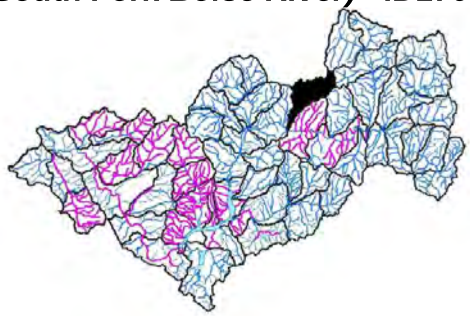


Table H-15. Streams and available BURP data for Willow Creek from the source to the South Fork Boise River- ID17050113SW025.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Edna Creek- 2nd order (2006SBOIA106)	8/29/2006	3.84	2.66	12.7	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

Shake Creek (Source to mouth) - ID17050113SW026

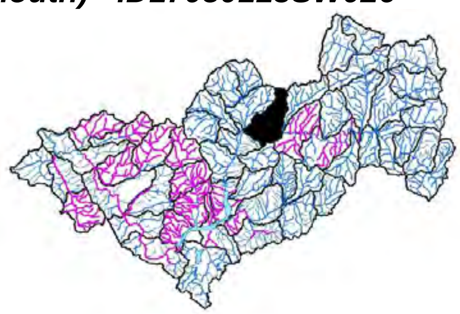


Table H-16. Streams and available BURP data for Shake Creek from the source to the mouth - ID17050113SW026.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Shake Creek-2nd order (2007SBOIA037)	7/18/2007	6.38	0.92	18.8			2	

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 2nd order segment of Shake Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI score is shown in Table H-16, but was not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS completed several habitat improvement projects in this AU since 2000. These include road trail conversions, irrigation diversions for fish passage, culvert placements, campground rehabilitation, and trail decommissioning.

Feather Creek (Source to mouth) - ID17050113SW027

Table H-17. Streams and available BURP data for Feather Creek from the source to the mouth - ID17050113SW027.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Cayuse Creek- 2nd order (1999SBOIA017)	7/29/1999	5.79	3.98	15.0	3		3	3
Cayuse Creek- 2nd order (2007SBOIA037)	7/16/2007	5.79	1.08	15.4		3	2	
Elk Creek- 3rd order (1999SBOIA041)	9/9/1999	2.77	.05	6.4	3		2	2.5
Elk Creek- 3rd order (2007SBOIA042)	7/18/2007	2.77	6.73	12.1			3	
Feather River- 4th order (2007SBOIA039)	**7/16/2007**	**6.01**	**14.46**	**15.4**		**2**	**2**	
Feather River- 4th order (2004SBOIA090)	**8/3/2004**	**6.01**	**5.2**	**18.1**	**3**	**1**	**1**	**1.67**
Lincoln Creek- 1st order (1997SBOIA060)	8/5/1997	4.72	0.13	12.0	2		3	2.5
Lincoln Creek- 2nd order (1997SBOIA061)	8/5/1997	4.72	0.14	11.0	3		2	2.5
Lincoln Creek-1st order (1998SBOIB014)	6/22/1998	4.72	1.0	9.0	3		2	2.5
Lincoln Creek-1st order (1998SBOIB015)	6/22/1998	4.72	3.0	8.0	3		1	2
Little Cayuse Creek- 1st order (1997SBOIA065)	8/6/1997	2.77	0.24	12.0	3		3	3
Little Cayuse Creek-1st order (1997SBOIA064)	8/6/1997	2.77	0.33	12.0	3		3	3
Little Cayuse Creek- 1st order (1998SBOIB016)	6/22/1998	2.77	0.9	9.0	3		1	2
Red Warrior Creek- 1st order (1997SBOIA063)	8/5/1997	3.30	0.2	14.0	3		2	2.5
Red Warrior Creek- 2nd order (1997SBOIA062)	8/5/1997	3.30	1.2	11.0	3		3	3

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 2nd order segment of Cayuse Creek, 3rd order segment of Elk Creek, and 4th order segment of Feather River were all surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI scores and available SFI scores are shown for this AU in Table H-17, but were not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS completed several livestock grazing reduction projects in this AU since 2000.

Trinity Creek (Source to mouth) - ID17050113SW028

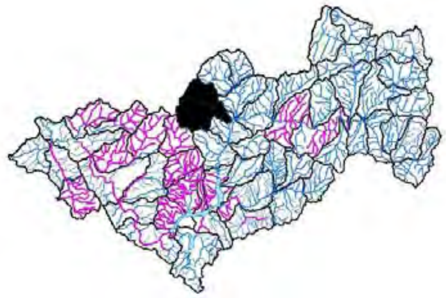


Table H-18. Streams and available BURP data for Trinity Creek from the source to the mouth - ID17050113SW028.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Parks Creek- 3rd order (2004SBOIA091)	8/3/2004	0.60	3.7	15.5	3	3	3	3
Rainbow Creek-2nd order (2007SBOIA040)	7/17/2007	5.05	4.64	15.0			3	
Trinity Creek-4th order (2007SBOIA041)	7/17/2007	4.76	14.23	22.0		2	2	

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 2nd order segment of Rainbow Creek and the 4th order segment of Trinity Creek were surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI scores and available SFI scores are shown in Table H-18, but were not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS completed several habitat improvement projects in this AU since 2000. These include culvert replacements and beaver reintroductions.

Green Creek (Source to mouth) - ID17050113SW029

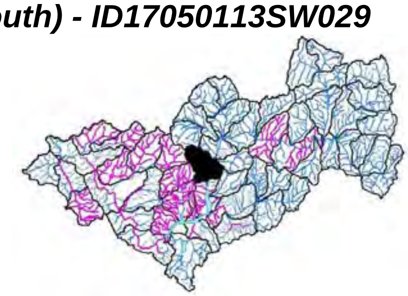


Table H-19. Streams and available BURP data for Green Creek from the source to the mouth - ID17050113SW029.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Green Creek- 2nd order (2004SBOIA089)	8/3/2004	5.92	1.0	13.3	3	2	3	2.67

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The USFS completed a culvert replacement project on Green Creek in 2000 to improve fish passage.

Dog Creek (Source to mouth) - ID17050113SW030

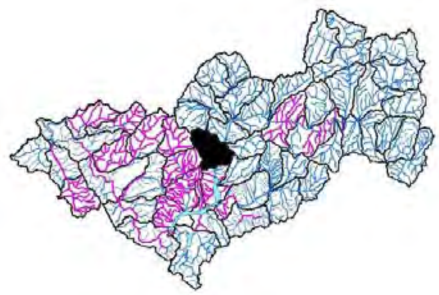


Table H-20. Streams and available BURP data for Dog Creek from the source to the mouth - ID17050113SW030.

Stream and BURP Site ID	Date	Approx. Stream Miles	Flow (cfs)	Temp. (°C)	SMI	SFI	SHI	Average Score
Dog Creek- 2nd order (1995SBOIB028)	6/27/1995	5.57	40.1	13.0	2		2	2
Dog Creek- 2nd order (2007SBOIA038)	7/17/2007	5.57	0.06	13.8			2	

cfs – cubic feet per second; SMI – stream macroinvertebrate index; SFI – stream fish index; SHI – stream habitat index

The 2nd order segment of Dog Creek was surveyed by BURP in 2007. Macroinvertebrate sampling results will not be available until the fall of 2008. The SHI score is shown in Table H-20, but was not used in the support status determination for the AU. This AU will be reassessed during the next five-year review process and its support status will be changed if necessary.

The USFS completed several habitat improvement projects in this AU since 2000. These include the installation of bank barbs at Elks Flat and dispersed campsite rehabilitation.

Appendix I. Photographs

Figure I-1. Tributary to Moores Creek. Facing downstream.

Figure I-2. Tributary to Moores Creek. Facing upstream.

Figure I-3. Moores Creek. Facing downstream.

Figure I-4. Uncovered eroding banks on Moores Creek.

Figure I-5. Slumping, uncovered banks on Moores Creek.

Figure I-6. Blown-out road crossing on Dixie Creek.


Figure I-7. Dixie Creek, just upstream of blown-out beaver dam.


Figure I-8. Dixie Creek between blown-out road crossing and blown-out beaver dam.

Figure I-9. Beaver dam on Dixie Creek. Upstream of old road crossing.

Figure I-10. Blown-out beaver dam on Dixie Creek. Downstream of old road crossing.

Figure I-11. Rough Creek.

Figure I-12. Rough Creek.

Appendix J. Implementation Plan and Accomplishments

The purpose of this appendix is to record an improvement strategy that will restore the potential natural vegetation along Smith Creek, Lime Creek, SF Lime Creek, MF Lime Creek and NF Lime Creek to an overall mature and natural condition.

The goal is to initiate and/or complement other water quality improvement projects in the watershed using specific management practices to improve potential natural vegetation and prevent further degradation.

Idaho Department of Lands **Smith Creek Implementation Tasks (2009)**	
Action Item	**Time Frame**
Establish priority for planting trees (and/or other vegetation recommended in the temperature TMDL for Smith Creek) on IDL land holdings upstream of Washboard Creek.	2010
Timber Harvests	
No logging is proposed along Smith Creek in the next 5 years. There is one active sale and one proposed sale along Aden Creek (a tributary of Smith Creek) in the next 5 years. No roads are proposed to be built at this time. At this time no specific mitigation measures are planned. Ensure that other possible sales in the watershed follow the BMPs outlined in the Forest Practices Act. See map of proposed timber sale on page179.	2009-2014
Monitor and implement changes IDL is considering for timber harvest practices.	2009-2011
Grazing	
Contact IDL range managers to discuss possibility of modifying grazing times and intensity within allotments containing Smith Creek riparian area. • Specifically request changes to grazing practices for IDL land held between Strawberry Creek and Aden Creek. Leases will expire in 12-31-2010 and leases will be re-negotiated to include the following: 1. Stubble height requirements 2. alteration of on/off dates 3. # of livestock • Improve grazing management practices in the area located between the bridge on the 175A road south to the state and private boundary line. • Document, on a regular basis, that existing shade is maintained (grazing activities must not decrease existing shade).	

Idaho Department of Lands Smith Creek Implementation Tasks (2009)	
Action Item	**Time Frame**
Document current conditions of grazing allotments: how many allotments affected by TMDL? #s of cattle (intensity); grazing period (duration). • Identify Planned Improvements to allotments in the Smith Creek drainage.	2009-2011
Contact John L. Thornton 208-373-4153 jlthornton@fs.fed.us to discuss impacts of grazing practices on BNF lands upstream of Washboard Creek.	2009
Data Collection and Coordination	
Using aerial photography or DEMs, locate and document canyons. Prepare rational for delisting at 5 year review. . • The lack of shade in the lower reach of Smith Creek is largely due to geologic constraints/volcanic rock	2009-2014
Contact NRCS (Elmore SWCD), Connie Holmquist, DC 587-3616 • Ask for assistance in working with private lands holders along Smith Creek. Encourage them to participate in the development of resource management plans. • Compile a list of additional private land holders along Smith Creek	2009-2011
Contact Steve Williams, Mountain Home Ranger District 587-7961, about forest Roads and Logging impacts to temperature/shading of Smith Creek.	2009-2010
Contact IDWR and the water district (63B- Randy Davison, 2019 Prairie RD, Prairie, ID 83647, 208-868-3241) to offer assistance in evaluating the possibility of developing a diversion plan that meets the user's needs without dewatering the creek? Identify streams in the Smith Creek watershed that have minimum stream flows, and monitor flows in those streams between April and September.	2009-2010

Sawtooth National Forest/Idaho Department of Lands Lime Creek Implementation Tasks (2009)	
Action Item	**Time Frame**
Using the “% Lack of Shade” map from the PNV TMDL, identify stream segments where % shade is lacking by more than 30%. Give preference to those areas for implementing improvement projects if funds should become available.	SNF/IDL 2009-2014
Recreation and Roads	
Assess and determine summer travel routes and designate preferred paths of travel in the Lime Creek Watershed. • IDL along with the Sawtooth National Forest initiated the study in 2008. The designations would limit motorized travel to only the selected paths. Develop a plan to revegetate decommissioned streamside roads.	SNF/IDL 2009-2011
Document existing road use in all forks of Lime Cr. using 2004 NAIP satellite imagery.	SNF 2009-2011
Grazing	
Identify areas where cattle and sheep are grazed; document impact with photo-monitoring. Look at past riparian grazing shade studies and evaluate the need for additional studies to monitor vegetation stage and improve trend data.	SNF/IDL 2009-2011
Data Collection and Coordination	
Work with DEQ to collect solar pathfinder data, bankfull width, hill slope, geology, way-points on beaver ponds and photos from Lime Creek and tributaries that will assist future PNV analysis.	SNF 2009-2011
Some tributaries to SF Lime Cr that come off the private, State and BLM lands have an anthropogenic impact likely influencing the SF Lime Creek water temperature. • Work with DEQ to identify locations at tributary mouths where thermographs can be placed to determine influence on instream temperature. 1. SF Lime Creek 2. MF Lime Creek, forest boundary to confluence	SNF 2009-2014

Sawtooth National Forest/Idaho Department of Lands **Lime Creek Implementation Tasks (2009)**	
Action Item	**Time Frame**
Fuels Projects	
Document the extent to which the burns may inadvertently affect riparian areas. (Document methods and success rate to prevent shade loss on TMLD streams (see pg. 84). • There will be broadcast burns on the North side of both the South and Middle Forks of Lime Creek.	SNF
Funding Opportunities	
§319 Grant funds are administered through the Department of Environmental Quality to support a wide variety of nonpoint source pollution management activities including agriculture, silviculture, mining and hydrologic and habitat modification and related activities. • Project assistance can be leveraged through non profit groups such as Trout Unlimited • USDA can provide special project funds to implement TMDLs. • RAC groups provide funding to maintain FS operations in local communities.	2009-2014

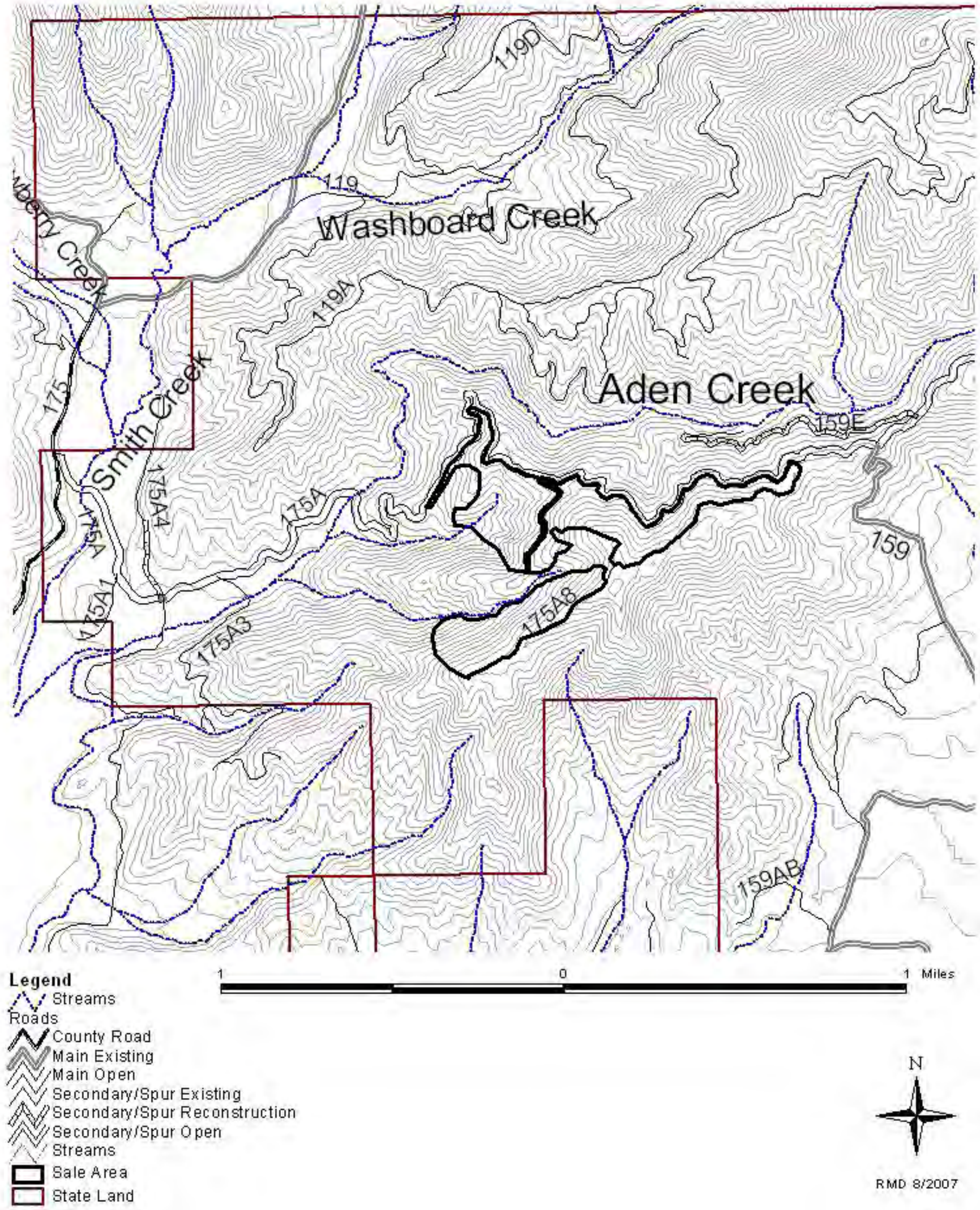
SOUTH FORK BOISE WATER QUALITY ACTIVITY OVERVIEW AND ACCOMPLISHMENTS

Project Name	Subwatershed	Stream	Year
Bank stabilization and willow planting project. At the bridge located on the 175A road	Smith Creek	Smith Creek	2008
Aerial survey of the SF Boise River: Mike Toalson (340-3895) and Leo Geis of Idaho Airships.	SF Boise River Watershed		2008
Trail rehabilitation/relocation	Housman-Beaver	Beaver, Deadwood Creeks	2006-2007
Kelley Creek Flats dispersed recreation rehab	Big Water-Virginia	South Fork Boise River	2006-2007
Trail rehabilitation/relocation	Boardman	Boardman Creek tributaries	2005-2006
Trail Relocation/Decommissioning	Wood	Wood & Bender Creek	2002-present
Trail Ford Rehabilitation	Wood	Many	2002-present
Trail Ford Rehabilitation	Upper Willow	Many	2002-present
Reduction in livestock grazing	Upper Rattlesnake	Many	2002-present
Reduction in livestock grazing	Upper Smith	Many	2002-present
Reduction in livestock grazing	Lower Smith	Many	2002-present
Reduction in livestock grazing	Cayuse-Rough	Many	2002-present
Reduction in livestock grazing	Pierce-Mennecke	Many	2002-present
Noxious weed treatments	Most	Many	2000-present
Reduction in livestock grazing impacts	Most	Many	2000-present
Reduction in livestock grazing	Elk	Many	2000-present
Noxious Weed Treatments	Most	Many	2000-present
Trail Relocation/Decommissioning	Lower Willow	Many	2000-present
Trail Ford Rehabilitation	Lower Willow	Many	2000-present
Dispersed Campsite Rehabilitation	Cayuse-Rough	South Fork Boise River	2000-present
Dispersed Campsite Rehabilitation	Pierce-Mennecke	South Fork Boise River	2000-present
Reduction in livestock grazing	Feather River	Many	2000-present

Project Name	Subwatershed	Stream	Year
Beaver re-introductions	Lower Fall	Little Wilson & Lake Creeks	2000-2004
Beaver introductions	SF Lime-Hearn	SF Lime, Hunter Creek	2000>
Beaver introductions	Basalt	Basalt, Sawmill Creeks	2000>
Beaver introductions	Upper Little Smoky	Little Smoky Creek	2000>
Riparian Plantings	Lower Fall	Little Wilson Creek	00/04
Gully Restoration	Lower Fall	Little Wilson	39876
Planted seedlings	Lower Fall	Mill & Lake Creeks	39847
Unauthorized road/trail decommissioning	Boardman	Boardman Creek tributaries	2008
Trail ford rehabilitation	Kelley	East Fork, West Fork, and mainstem Kelley Creek	2008
Unauthorized road/trail decommissioning	Miller-Salt-Bowns	Salt, Bowns, Miller Creek tributaries	2008
Dispersed campsite rehabilitation	Worswick-Grindstone	Little Smoky Creek	2007
Dispersed campsite rehabilitation	Carrie-Red Rock	Little Smoky Creek	2007
Dispersed campsite rehabilitation	Upper Little Smoky	Little Smoky Creek	2007
Road ford rehabilitation	Emma-Axolotl	Emma Creek	2007
Unauthorized trail decommissioning	Abbot-Shake	Abbot Gulch	2007
Trail Ford to Bridge	Wood	Flat Creek	2007
Boat Launch Restorations	Pierce-Mennecke	South Fork Boise River	2007
Trail Ford Rehabilitation	Middle Fall	Tally Creek	2006
Trail Relocation/Decommissioning	Middle Fall	Tally Creek	2006
Trail Ford to Bridge	Wood	Flat Creek	2006
Beaver introduction	Upper Willow	Upper Willow, Worswick, Grindstone, Deer Creeks	2006
Culvert replacement for fish passage	Big Water-Virginia	Big Water Gulch	2006
Beaver re-introductions	Lower Trinity	Spring Creek	2005
Trail Relocation/Decommissioning	Lower Fall	Camp Creek	2005
Trail Ford to Bridge	Wood	Bender Creek	2005
Trail Ford Rehabilitation	Lower Fall	Camp Creek	2005
Riparian Plantings	Black Canyon-Trail	Timber Gulch	2005
Culvert placement to eliminate ford	Abbot-Shake	Log Chute Gulch	2005

Project Name	Subwatershed	Stream	Year
Culvert removal for fish passage	Miller-Salt-Bowns	Salt Creek	2005
Developed campground riparian rehabilitation	Abbot-Shake	South Fork Boise River	2005
Trail Relocation/Decommissioning	Big Fiddler-Soap	Many	2004
Trail Ford to Bridge	Wood	Wood Creek	2004
Road ford rehabilitation	Upper Little Smoky	Little Smoky Creek	2004
Trail ford rehabilitation	Basalt	Basalt, Sawmill Creeks	2004
Irrigation diversion fish passage improvement	Abbot-Shake	Shake Creek	2004
Trail rehabilitation/relocation	West Fork Big Smoky	West Fork Big Smoky tributaries	2004
Bank Barbs @ Elks Flat	Dog-Nichols	South Fork Boise River	2003
Large woody debris placement for fish habitat	Upper Little Smoky	Little Smoky Creek	2003
Large woody debris placement for fish habitat	Carrie-Red Rock	Carrie Creek	2003
Logging trespass site rehabilitation	Carrie-Red Rock	Carrie Creek tributaries	2003
Dispersed Campsite Rehabilitation	Dog-Nichols	South Fork Boise River	2003
Boat Launch Restorations	Cayuse-Rough	South Fork Boise River	2002
Beaver re-introductions	Black Canyon-Trail	Timber Gulch	2002
Culvert Replacement for Fish Passage	Upper Trinity	Trinity Creek	2001
Road to trail conversion	Abbot-Shake	Shake Creek	2000
Culvert Replacement for Fish Passage	Lower Trinity	Trinity, Johnson, Whiskey Jack Creek	2000
Culvert Replacement for Fish Passage	Wagontown-Schoolhouse	Green Creek	2000
Surface Water Pollutant Loading Allocations and Improvement Plans			
South Fork Boise River: Subbasin Assessment, Total Maximum Daily Load, And Five-Year Review • Smith Creek and Lime Creek (including NF, MF and SF) Temperature TMDLs			2009

Proposed Timber Sale 2013
Sale Map
Twp. 2N, Rge. 8E



DEQ, December 2008, PID TM52, CA 42101
Costs associated with this publication are available from the State of Idaho, Department of Environmental Quality in accordance with Section 60-202, Idaho Code.

Printed on recycled paper