# North Fork Payette River Subbasin Assessment and Total Maximum Daily Load

**Final**

**Department of Environmental Quality**

**July 2005**

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# Acknowledgments

Many hours have been expended in the preparation of this document by volunteers, state and federal agency personnel and many others. We gratefully acknowledge the time and effort that have been dedicated by so many individuals and organizations.

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Finally, we thank the citizens of Idaho for their support of water quality in the North Fork Payette River and mainstem Payette River area and their participation in its restoration.

Cover photo by Jessica Dombrowski.

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# Abbreviations, Acronyms, and Symbols

| | |
|---|---|
| **§303(d)** | Refers to Section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section |
| **µ** | micro, one-one thousandth |
| **§** | Section (usually a section of federal or state rules or statutes) |
| **ADB** | assessment database |
| **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 |
| **EPA** | United States Environmental Protection Agency |
| **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 |

**km** kilometer

**km$^2$** square kilometer

**LA** load allocation

**LC** load capacity

**m** meter

**m$^3$** cubic meter

**mi** mile

**mi$^2$** square miles

**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

**NFPR** North Fork Payette River

**NFS** not fully supporting

**NPDES** National Pollutant Discharge Elimination System

**NRCS** Natural Resources Conservation Service

**NTU** nephlometric turbidity unit

**PCR** primary contact recreation

**PFC** proper functioning condition

**ppm** part(s) per million

**RHCA** riparian habitat conservation area

**RMI** DEQ's river macroinvertebrate 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

**SSC** suspended sediment concentration

**STATSGO** State Soil Geographic Database

**TMDL** total maximum daily load

**TP** total phosphorus

**TSS** total suspended solids

**U.S.** United States

**U.S.C.** United States Code

**USDA** United States Department of Agriculture

**USFS** United States Forest Service

**USGS** United States Geological Survey

**WAG** Watershed Advisory Group

**WBAG** *Water Body Assessment Guidance*

**WLA** wasteload allocation

**WQLS** water quality limited segment

**WQS** water quality standard

# 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 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 of impaired waters, currently 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.

This document addresses water bodies in the North Fork and Main Stem Payette River Subbasins that have been placed on what is known as the "§303(d) list."

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the North Fork Payette River Subbasin located in southwestern Idaho. The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current §303(d) list of water quality limited water bodies.

The subbasin assessment portion of this document examines the current status of §303(d) listed waters and defines the extent of impairment and causes of water quality limitation throughout the subbasin (Table A). The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

## Subbasin at a Glance

The Payette River Watershed (Figures A and B) lies entirely in southwestern Idaho and comprises about 3,240 square miles. Its headwaters originate in the Sawtooth and Salmon River mountains at elevations over 10,000 feet. The drainage flows in a southwesterly direction for over 175 miles where it empties into the Snake River near Payette at an elevation of 2,125 feet.

This TMDL lies within parts of two Hydrologic Unit Codes (HUCS) (17050122 and 17050123) and actually encompasses several geographically distinct subwatersheds (Figure A). This TMDL addresses 303(d) listed tributaries to the North Fork Payette River above Payette Lake and to Payette Lake itself; the North Fork Payette River and tributaries from Cascade Dam to the confluence with the South Fork Payette River; and, finally, the Main Payette River up to and including Black Canyon Reservoir (Figure C). This TMDL refers collectively to these sections as the *North Fork Payette River TMDL*.

**Table A. Idaho 1998 §303(d) listed Water Bodies, Water Body Description, Miles of Impaired Water Bodies, and Pollutant of Concern, North Fork Payette River Watershed.**

| Water Body | Assessment Units | 1998 §303(d)[1] Boundaries | Basis for Listing | Pollutant(s) | Miles/Acres of Impaired Water Bodies |
|---|---|---|---|---|---|
| **Payette River (HUC 17050122)** | | | | | |
| Black Canyon Reservoir | SW002-06 | Black Canyon Reservoir | 305(b), Append. D | Nutrients, Oil/Grease and Sediment | 6 |
| Soldier Creek | SW012-02 | Headwaters to Squaw Creek | Boise Nat. Forest Plan | Sediment | 8.96 |
| **North Fork Payette River (HUC 17050123)** | | | | | |
| North Fork Payette River | SW001-06 | Clear Creek to Smith's Ferry | 305(b), Append. D | Flow alteration, Habitat alteration, Nutrients, Sediment and Temperature | 9.53 |
| Round Valley Creek | SW002-03 | Headwaters to North Fork Payette River | 305(b), Append. D | Sediment | 5.66 |
| Clear Creek | SW003-03 | Headwaters to North Fork Payette River | Salmonid Spawning, Nat. Forest Service | Sediment | 17.78 |
| Big Creek | SW004-03 | Horsethief Creek to North Fork Payette River | US Forest Service | Sediment | 6.50 |
| Tripod Creek | SW001-02 | Headwaters to North Fork Payette River | BURP | Unknown | 5.40 |
| **North Fork Payette River (at or above Big Payette Lake) (HUC 17050123)** | | | | | |
| Box Creek | SW018-02 | Headwaters to North Fork Payette River | Added by EPA, April 2000 | Temperature | 4.5 |
| Brown's Pond | SW014-02 | Brown's Pond | 305(b), Append. D | Habitat Alteration | <1 |
| Brush Creek | SW018-02 | Headwaters to North Fork Payette River | Salmonid Spawning, Nat. Forest Service | Unknown | 5.06 |
| Elip Creek | SW017-02 | Headwaters to Lemah Creek | Salmonid Spawning, Nat. Forest Service | Unknown | 3.00 |
| Fall Creek | SW017-03 | Headwaters to Big Payette Lake | Added by EPA, April 2000 | Temperature | 4.8 |
| Landing Creek | SW017-02 | Headwaters to Deadhorse Creek | BURP | Unknown | 2.42 |

[1]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under Section 303 subsection "d" of the Clean Water Act.

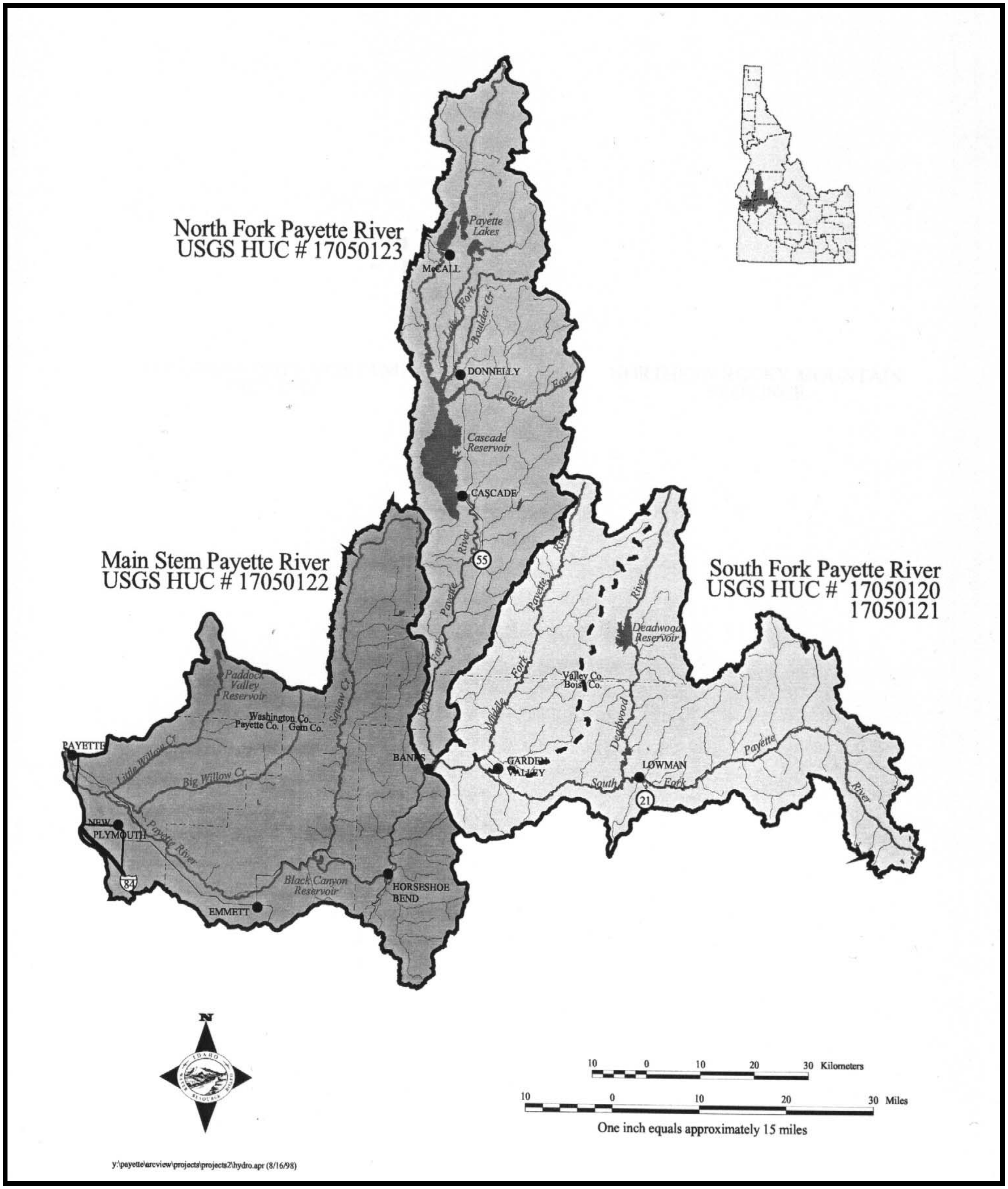


**Figure A. Location of the North Fork Payette River and Payette River Subbasins. Figure appears courtesy of Idaho Department of Water Resources (IDWR), Comprehensive State Water Plan, Payette River Basin, 1998.**

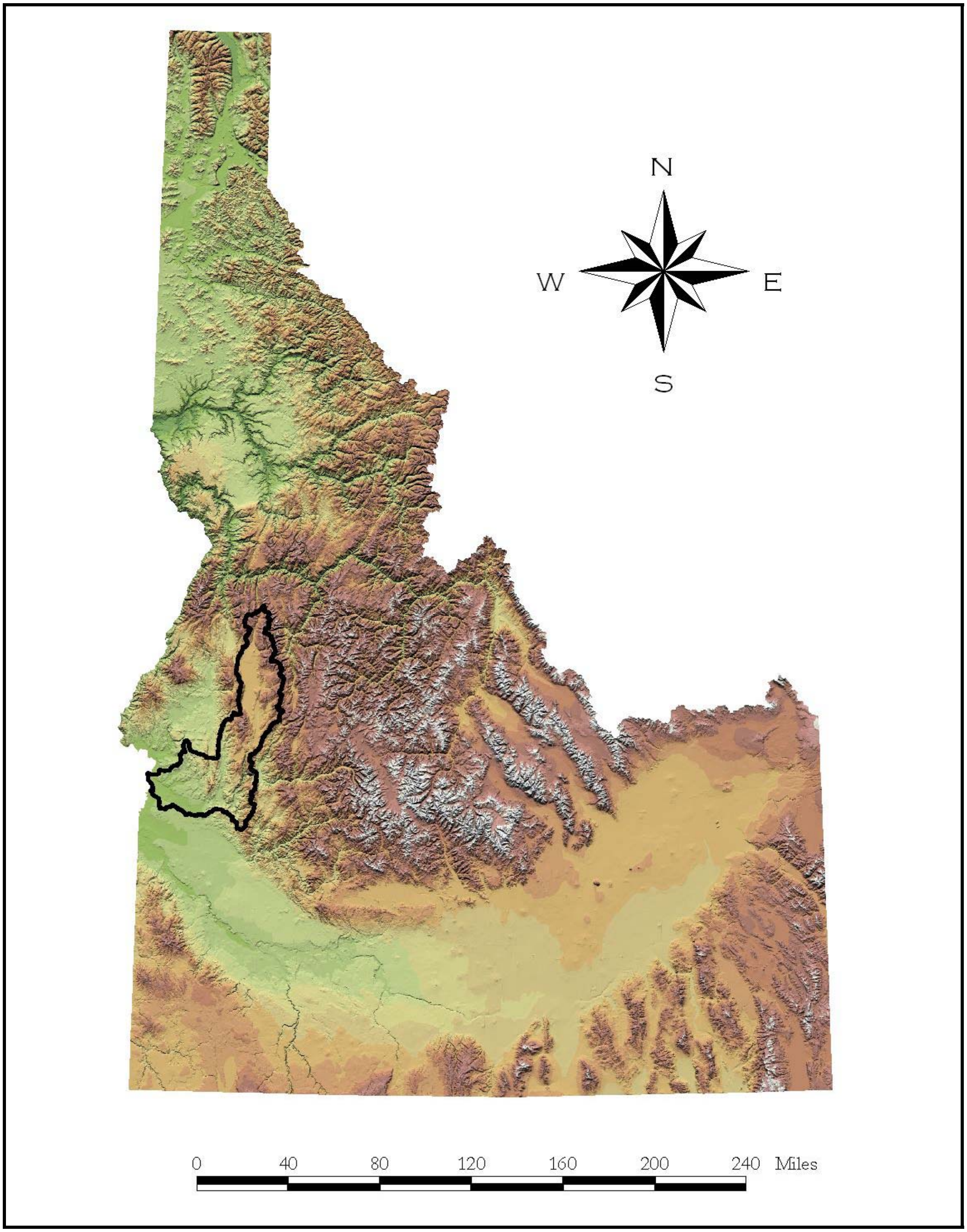


**Figure B. Location of North Fork Payette River Watershed and Main Stem Payette River Watershed Relative to the state of Idaho.**

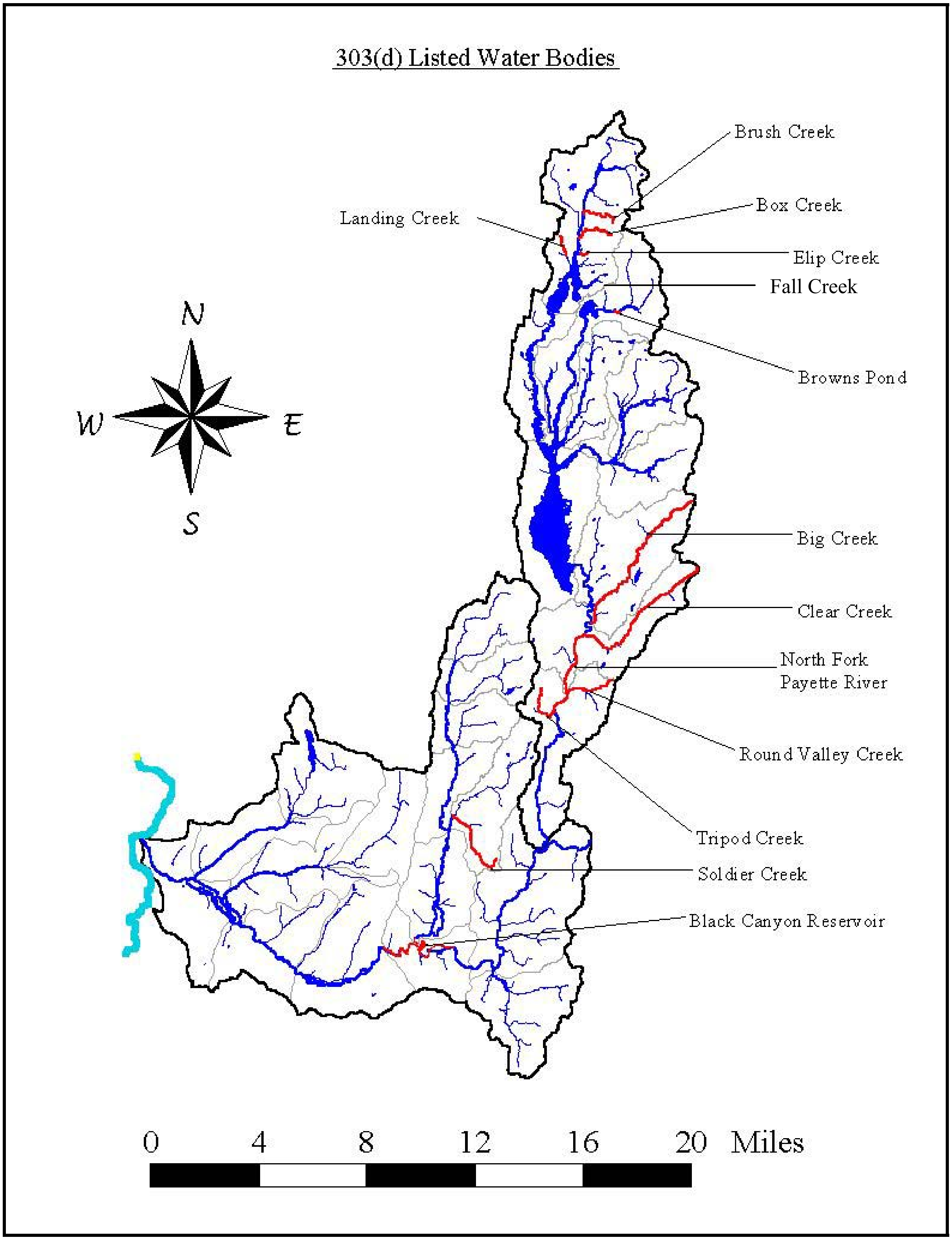


**Figure C. 303(d) Listed Streams in the North Fork Payette River TMDL Watershed**

## Key Findings

This section discusses the outcomes for the 303(d) listed water bodies shown in Figure C. TMDLs were developed for six 303(d) listed streams/rivers: Big Creek, Box Creek, Clear Creek, Fall Creek, North Fork Payette River, and Round Valley Creek (Table B). Other subbasin assessment outcomes are shown in Table C. Squaw Creek, which is not on the 303(d) list, is also discussed.

Nutrients, oil/grease and sediment were investigated as possible pollutants impairing beneficial uses in **Black Canyon Reservoir**. In-reservoir oil and grease concentrations were below the 5 mg/L target set for oil/grease and this pollutant is recommended for delisting from the 303(d) list. Nutrient concentrations in the reservoir met TMDL targets and no algal blooms or excessive macrophyte growths were detected during sampling. Nutrients are recommended for de-listing. Black Canyon Reservoir acts as a sediment trap due to its shape. Sediment is filling up the upper end of the reservoir and has changed the morphology of the North Fork Payette River near Montour. However, sediment from the North Fork Payette River and Main Payette River (Banks to Montour) are not contributing sediment at high levels. The bulk of sediment loading is from the South Fork Payette River and the majority of that load occurs naturally from *mass wasting* events. A sediment TMDL is not recommended.

The **North Fork Payette River** from Clear Creek to Smiths Ferry is listed for nutrients, sediment and temperature. Beneficial uses are not impaired by nutrients, and nutrients are recommended for delisting from the 303(d) list. Temperatures do exceed the temperature standard, but this is primarily due to warm water exiting Cascade Reservoir. Canopy cover in the listed stream segment meets target levels and thus, a TMDL is not recommended. Suspended sediment is not impairing beneficial uses, but the effects of *bedload* sediment entering that reach from the Cascade to Clear Creek reach is impairing beneficial uses. A TMDL for sediment with an allocation based on bank erosion was determined for this reach.

**Big Creek** is listed as impaired by sediment. DEQ water body assessment data showed that beneficial uses were impaired. Banks are stable in some sections but actively eroding in others. Bank erosion surveys were conducted in the Big Creek watershed and used to determine a TMDL to restore beneficial uses. A load allocation was developed based an 80% bank stability target. Since implementation of water quality objectives in the lower reach will rely upon riparian improvements, water quality objectives may take from 5-15 years to achieve.

**Brush Creek** is proposed for de-listing from the 303(d) list. The stream's beneficial uses were impacted as a result of the Blackwell Fire in 1994 but beneficial uses are not impaired. Temperature TMDLs were developed for **Box Creek** and **Fall Creek** in order to achieve salmonid spawning criteria. All three subwatersheds were affected by the 1994 Blackwell Fire. Recovery has occurred over the last ten years and the streams support beneficial uses. However, Box and Fall Creeks which are both listed for temperature, meet the cold water aquatic life standard during the summer but not the salmonid spawning standard.

**Browns Pond** is listed as impaired by 'habitat alteration,' which is not a pollutant. TMDLs are only developed for pollutants. Since Browns Pond supports a coldwater fishery, and the incoming waters from Lake Fork Creek fully support beneficial uses, a TMDL is not necessary.

In **Clear Creek**, beneficial uses are not supported in the lower reach due to excess sediment delivery from upstream as well in-stream channel erosion. In the upper reaches of Clear Creek, beneficial uses are presently fully supported but are vulnerable to not being supported due to excess sediment. An allocation was set for the upper watershed to improve habitat in the lower reaches. The middle and upper reaches of Clear Creek were evaluated using the BOISED model, and a sediment TMDL was established to ensure protection of beneficial uses. For sediment from in-stream channel erosion, a load allocation was developed based an 80% bank stability target. Since implementation of water quality objectives in the lower reach will rely upon riparian improvements, water quality objectives may take from 5-15 years to achieve.

**Elip Creek**, an *intermittent* stream, does not have impaired beneficial uses when there is water in the creek. A TMDL is not necessary for Elip Creek because lack of water rather than a specific pollutant precludes the support of beneficial uses at certain times of the year.

**Landing Creek** showed impairment due to excess sediment in the mid-90s, possibly as a result of timber harvest and associated skid trail and road building activity. Since then recovery has occurred and Landing Creek does not have impaired beneficial uses. Landing Creek is proposed for de-listing for an unknown pollutant.

In **Round Valley Creek**, beneficial uses are impaired due to excess sediment from instream channel erosion. The creek exhibits high percent fines and low bank stability as well as water body assessment scores that indicate that beneficial uses are not supported. A TMDL was developed for sediment based on channel erosion rates. A sediment load was developed using an 80% bank stability target. Implementation will probably hinge upon riparian improvements rather than structural stabilization and thus achievement of water quality objectives may take from 5-15 years to achieve.

**Soldier Creek** was listed for sediment on the 303(d) list. Bank erosion surveys were conducted and the upper and middle reaches of Soldier Creek are proposed for delisting. Soldier Creek is intermittent and beneficial use impairment in these sections is likely due to lack of water not a pollutant. DEQ was unable to evaluate the 3$^{rd}$ order section of Soldier Creek and proposes that this section remains on the 303(d)list until an assessment can be made.

**Squaw Creek** violates the state standard for bacteria near the mouth and also has elevated nutrient concentrations at the mouth. Squaw Creek is proposed for listing for bacteria and nutrients on the 303(d) list.

**Tripod Creek** was found to be unimpaired and a TMDL is not recommended at this time. In-stream channel erosion was ruled out as a causal factor in habitat impairment.

### Table B. Streams and Pollutants for Which TMDLs Were Developed

| Stream | Pollutant(s) |
|---|---|
| Big Creek | Sediment |
| Box Creek | Temperature |
| Clear Creek | Sediment |
| Fall Creek | Temperature |
| Round Valley Creek | Sediment |
| North Fork Payette River | Sediment |

## Table C. Summary of Assessment Outcomes

| Water Body Segment (assessment unit) | Pollutant | TMDL(s) Completed | Recommended Changes to §303(d) List |
|---|---|---|---|
| Black Canyon Reservoir (SW002-06) | Nutrients, sediment, oil/grease | None | Delist nutrients, oil/grease<br>List for habitat alteration |
| Big Creek (SW012-02) | Sediment | Sediment | None |
| Box Creek (SW018-02) | Temperature | Temperature: Salmonid Spawning | None |
| Browns Pond (SW014-02) | Habitat alteration | None | None |
| Brush Creek (SW018-02) | Unknown | None | Delist for an unknown pollutant |
| Elip Creek (SW017-02) | Unknown | None | Delist for an unknown pollutant |
| Fall Creek (SW017-03) | Temperature | Temperature: Salmonid Spawning | None |
| Landing Creek (SW017-02) | Unknown | None | Delist for an unknown pollutant |
| North Fork Payette River (Cascade Dam to Clear Creek) | Sediment | Sediment | Delist temperature |
| Round Valley Creek (SW002-003) | Sediment | TMDL for sediment | None |
| Soldier Creek (SW012-02) | Sediment | None | Delist sediment from Upper/Middle Soldier Creek; sediment remains on 303(d) list for SW012-03 |
| Squaw Creek (SW010-05) | Bacteria | None | List bacteria and nutrients in 5$^{th}$ order assessment unit (2006 303(d) list) |
| Tripod Creek (SW01-02) | Unknown | None | Delist for an unknown pollutant |

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# 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 necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the 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 of impaired waters, currently 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. This document addresses the water bodies in the North Fork Payette River Subbasin that have been placed on what is known as the "§303(d) list."

The overall purpose of this subbasin assessment and TMDL is to characterize and document pollutant loads within the North Fork Payette River Subbasin. The first portion of this document, the subbasin assessment, 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 (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the North Fork Payette River Subbasin (Chapter 5).

## 1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. 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 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, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set 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 water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for each water body on the §303(d) list. The North Fork Payette River Subbasin Assessment and TMDL provide this summary for the currently listed waters in the North Fork Payette River Subbasin.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the North Fork Payette 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 amount that can be present in a water body and still allow that water body to meet water quality standards (water quality planning and management, 40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for waterbodies impaired by pollution, but not specific pollutants. 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.

### Idaho's Role

Idaho adopts water quality standards 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 antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- 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 habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

## 1.2 Physical and Biological Characteristics

The Payette River watershed lies in southwestern Idaho and comprises about 3,240 square miles. Its headwaters originate in the Sawtooth and Salmon River mountains at elevations over 10,000 feet. The drainage flows in a southwesterly direction for over 175 miles where it empties into the Snake River near Payette at an elevation of 2,125 feet.

Principal tributaries are the North and South Forks of the Payette River. The North Fork Payette River drains about 950 square miles and the South Fork about 1,200 square miles. The Middle Fork of the Payette River is a tributary to the South Fork Payette. The Payette River has an average annual discharge into the Snake River of 2,192,000 acre-feet of water.

This TMDL covers several tributaries in the North Fork Payette watershed above Big Payette Lake and the North Fork Payette watershed from Cascade Dam to Black Canyon Dam. Elevations in this watershed range from 8,000 feet at Fitsum Peak to 2,400 feet at Black Canyon Dam.

Figure 1 shows the entire Payette River watershed.

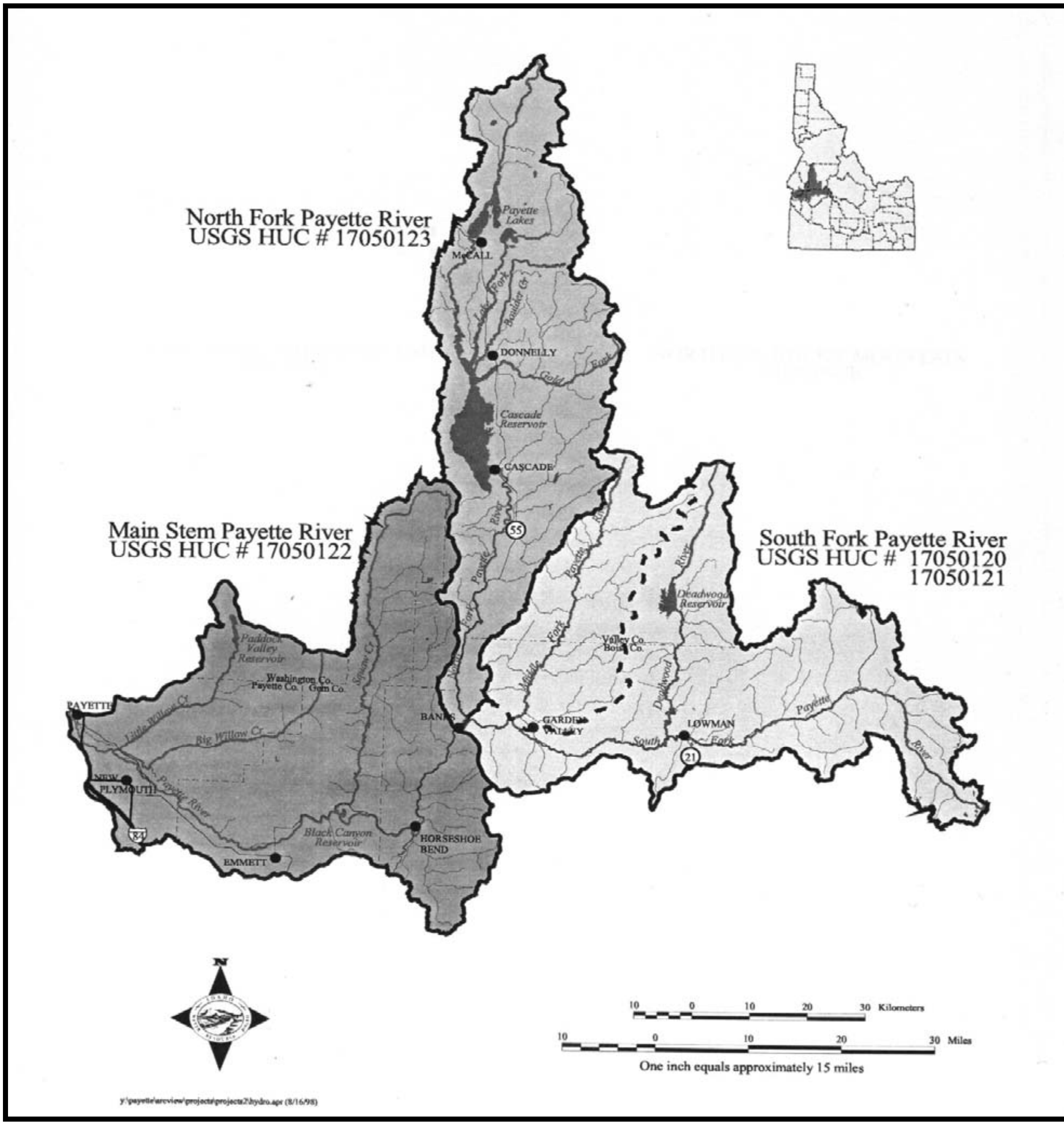


**Figure 1. Location of the North Fork Payette River and Payette River Subbasins. (IDWR, 1999).**

<u>Climate</u>

The climate in the North Fork Payette River Subbasin is characterized by warm, dry summers and cold, wetter winters. The general aridity and the relatively wide temperature range between winter and summer temperatures are largely due to the influence of the Cascade Range in Oregon and Washington which acts as a barrier to maritime air masses. Almost all of the precipitation comes from prevailing westerly winds from the Pacific. Within the basin, differences in elevation influence the temperature and precipitation regimes. The lower basin near Montour is characterized as semi-arid while the mountainous region is classified as sub-humid. The wettest months are generally

November, December and January. Near Cascade, in the northern region of the subbasin, precipitation averages 22 inches, most of which falls as snow (95 inches annually) (Figure 2). In the southern region of the subbasin near Emmett, annual precipitation averages 13.1 inches, little of which falls as snow (18 inches annually) as shown in Figure 4 (WRCC 2004).

Maximum summer (July) air temperature in the northern region of the subbasin (near Cascade) averages 82 °F with minimum summer air temperatures of 44 °F (Figure 3). Maximum winter (January) air temperature in this region averages 29 °F with minimum winter air temperatures of 11 °F. The extreme high summer temperature measured in this region (1961 through 1990) was 100 °F. The extreme low winter temperature measured over this same time frame was -36 °F (IDWR 1999). The growing season in this region averages 68 days.

Maximum summer (July) air temperature in the southern region of the subbasin (near Emmett) averages 92 °F with minimum summer air temperatures of 55 °F (Figure 5). Maximum winter (January) air temperature in this region averages 37 °F with minimum winter air temperatures of 21°F. The extreme high summer temperature measured in this region (1961 through 1990) was 109 °F. The extreme low winter temperature measured over this same time frame was -27 °F (IDWR 1999). The growing season in this region averages 143 days.

High volume run-off occurs during spring snowmelt and as a result of significant rain-on-snow events.

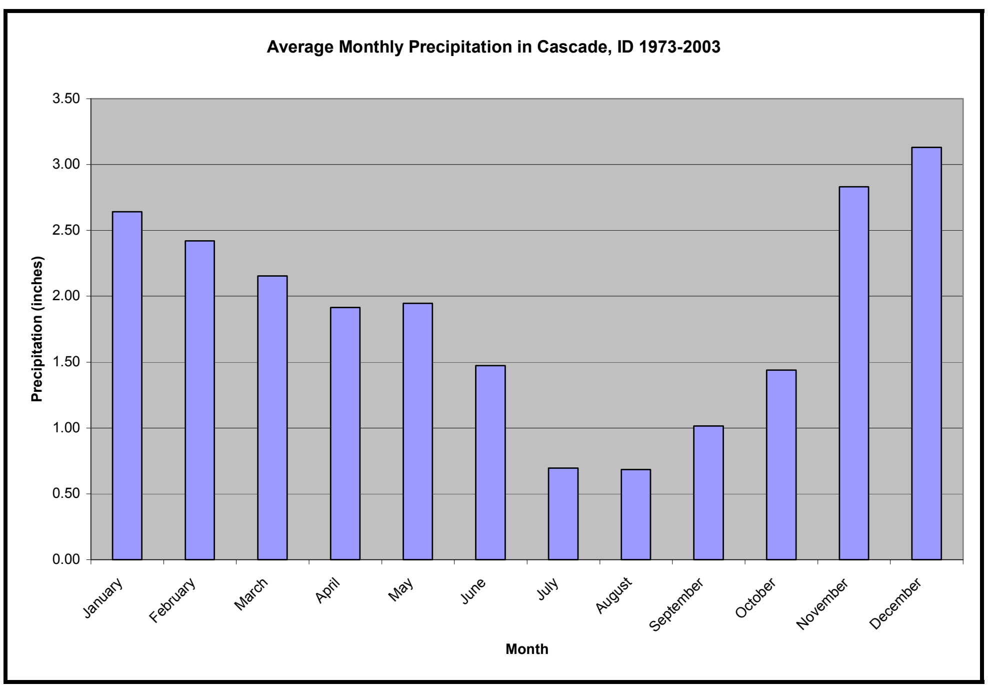


**Figure 2. Average Precipitation for Cascade, Idaho**

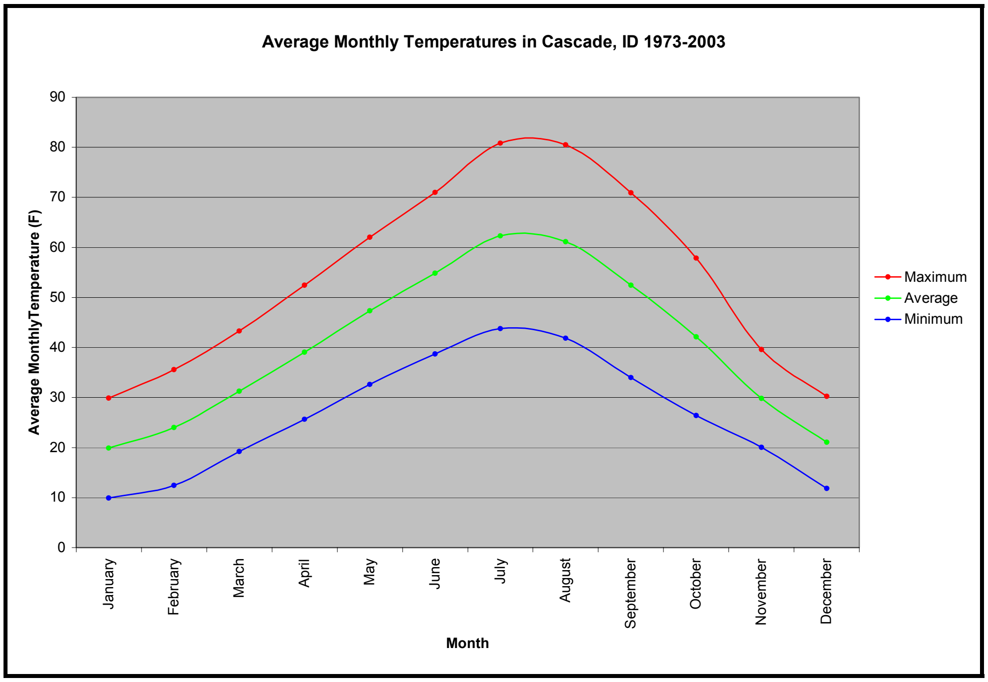


Figure 3. Average Monthly Temperatures for Cascade, Idaho

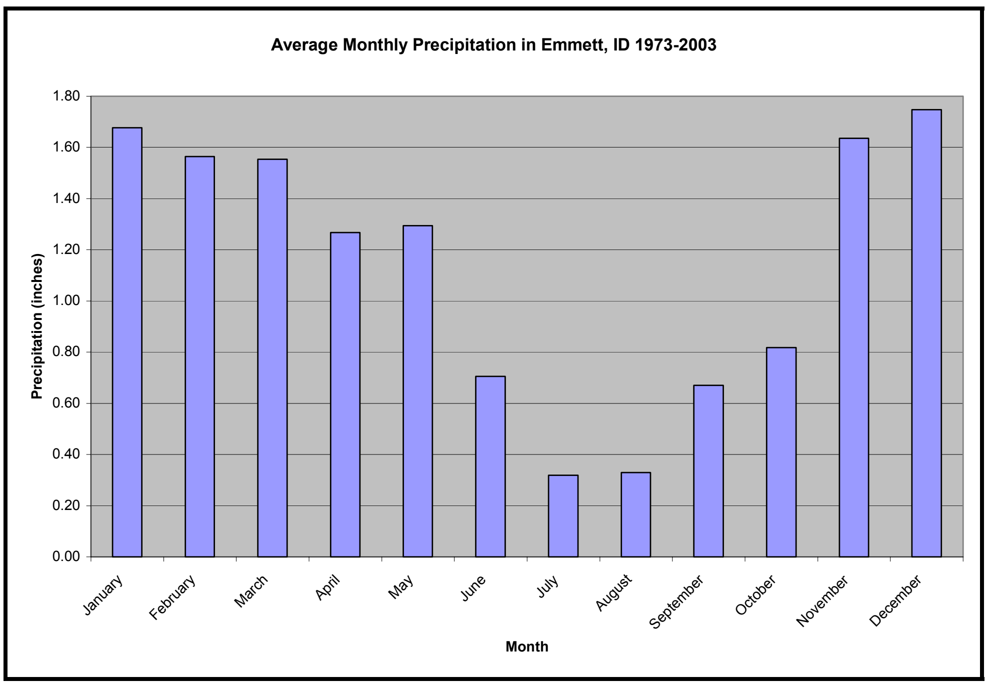


Figure 4. Average Precipitation for Emmett, Idaho

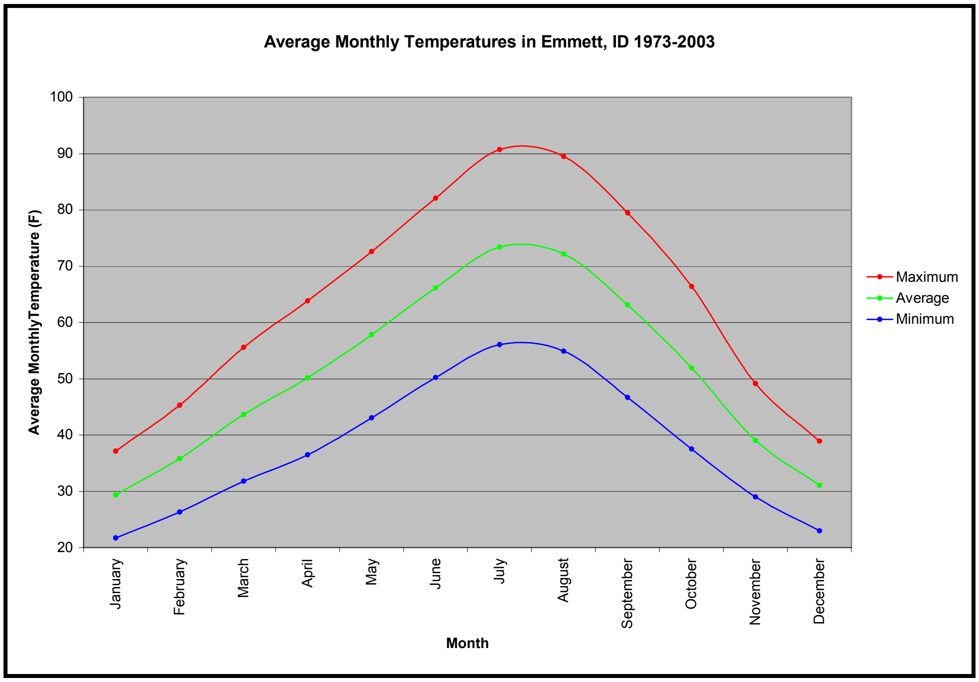


**Figure 5. Average Daily Temperatures for Emmett, Idaho**

## Subbasin Characteristics

The North Fork Payette River TMDL includes part of the North Fork Payette River (downstream of Cascade Dam and upstream of Big Payette Lake), the mainstem Payette River (from upstream of Black Canyon Dam), and Black Canyon Reservoir (Figures 6-7). The section of the North Fork Payette River that flows from Big Payette Lake to Cascade Reservoir was addressed in the Cascade Reservoir TMDL (IDEQ 1996). The North Fork Payette and mainstem Payette Rivers are located in Valley, Boise and Gem counties in southwest Idaho (Figure 1). The mainstem Payette River is a major tributary to the Snake River (confluence at Snake River mile 365.6).

The North Fork Payette River drains about a third of the Payette River Basin, originating in the numerous mountain lakes and snowfields surrounding Big Payette Lake (elevation 8,000 feet). Exiting the lake, the river runs nearly due south for approximately 30 miles before entering Lake Cascade and exiting through Cascade Dam. Below the dam, the river continues south over a fairly level course through Long Valley (elevation approximately 5,000 feet) before entering a narrow, steep gorge extending approximately 25 miles to its confluence with the South Fork Payette River at Banks, Idaho and becoming the Main Payette River. Below Banks, the river flows generally south on a gentle slope to Horseshoe Bend, Idaho, a distance of approximately 15 miles, where it turns to the west, moving toward Black Canyon Reservoir, near Emmett, Idaho. Black Canyon Reservoir covers about 1,100 surface acres (BOR 2004).

Within the TMDL reach, the Payette River has a general hydrological flow from north to south (Figure 6). The Payette River starts in the Blue Mountain Ecoregion and drains into the Snake River-High Desert Ecoregion of southwest Idaho. The Payette River has an average annual discharge into the Snake River of 2,192,000 acre-feet of water. Significant tributaries to the Payette River are Squaw Creek and Big and Little Willow Creeks. Squaw Creek headwaters originate at approximately 8,000 feet elevation and Big and Little Willow Creeks headwaters originate at approximately 4,000 feet elevation (IDWR 1999).

There are five major impoundments in the Payette basin: Black Canyon, Sagehen, Paddock Valley, Cascade, and Deadwood reservoirs. There are also several small impoundments and natural lakes with increased storage, such as the three Payette Lakes (Big Payette Lake, Little Payette Lake and Upper Payette Lake). Although the reservoirs act to control runoff and minimize flooding, their primary purpose is for irrigation water storage.

Black Canyon dam is maintained at a nearly constant elevation throughout the irrigation season and spills from a gated overflow spillway. The 1,100 surface acre reservoir impounds approximately 29,300 acre-feet of water and is about 6 miles long. The reservoir has had active storage capacity reduced from approximately 44,800 acre-feet to its current volume due to sediment deposition. Sediment in the upper end of the reservoir has filled the original river bed in the area, impeding the normal flow of water into the reservoir and resulting in a significant extension of the 100 year floodplain at the confluence of the Payette River and Black Canyon Reservoir (BOR 2004).

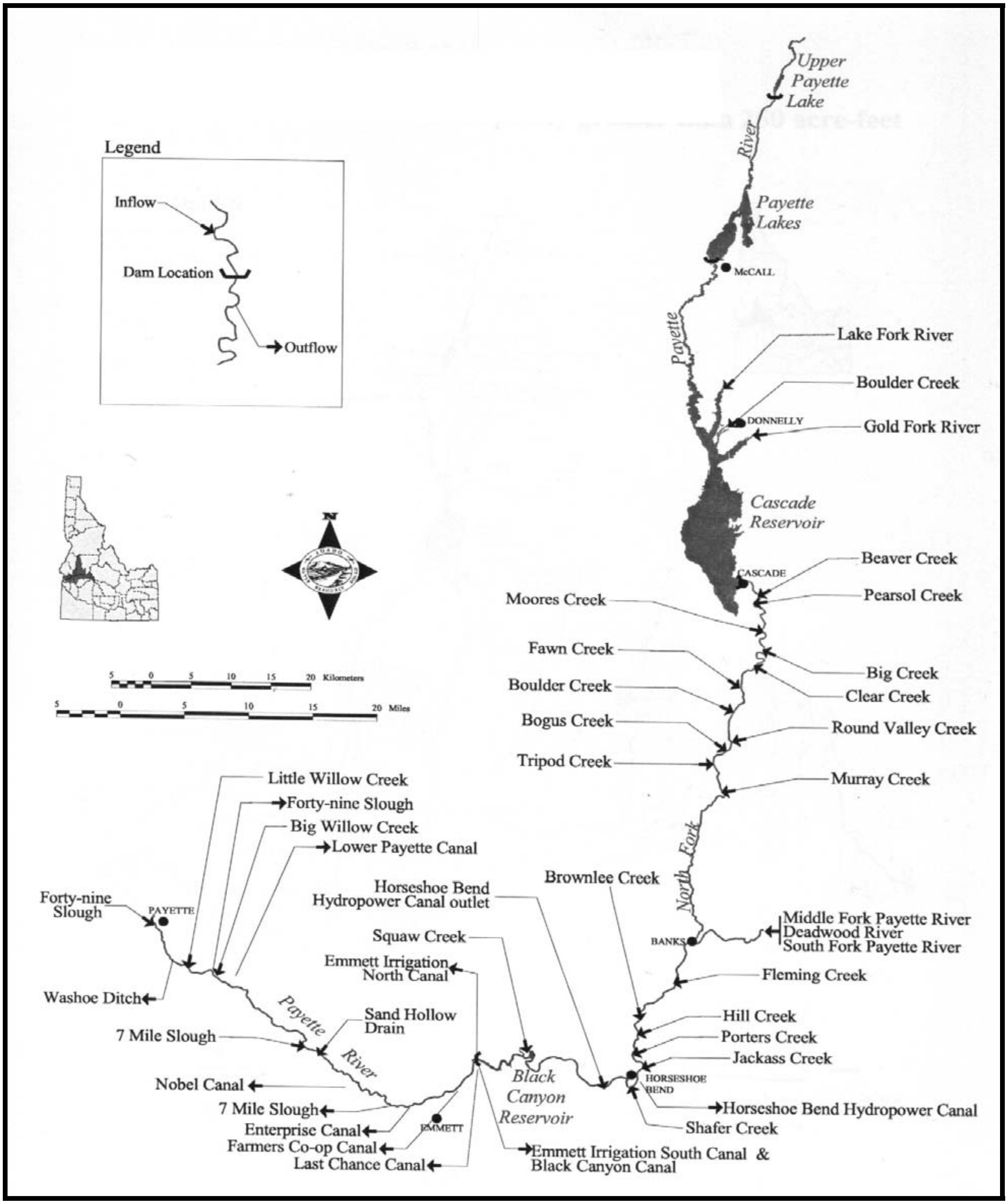


**Figure 6. Hydrology of the North Fork Payette River TMDL Reach. Figure appears courtesy of IDWR, Comprehensive State Water Plan, Payette River Basin, 1998.**

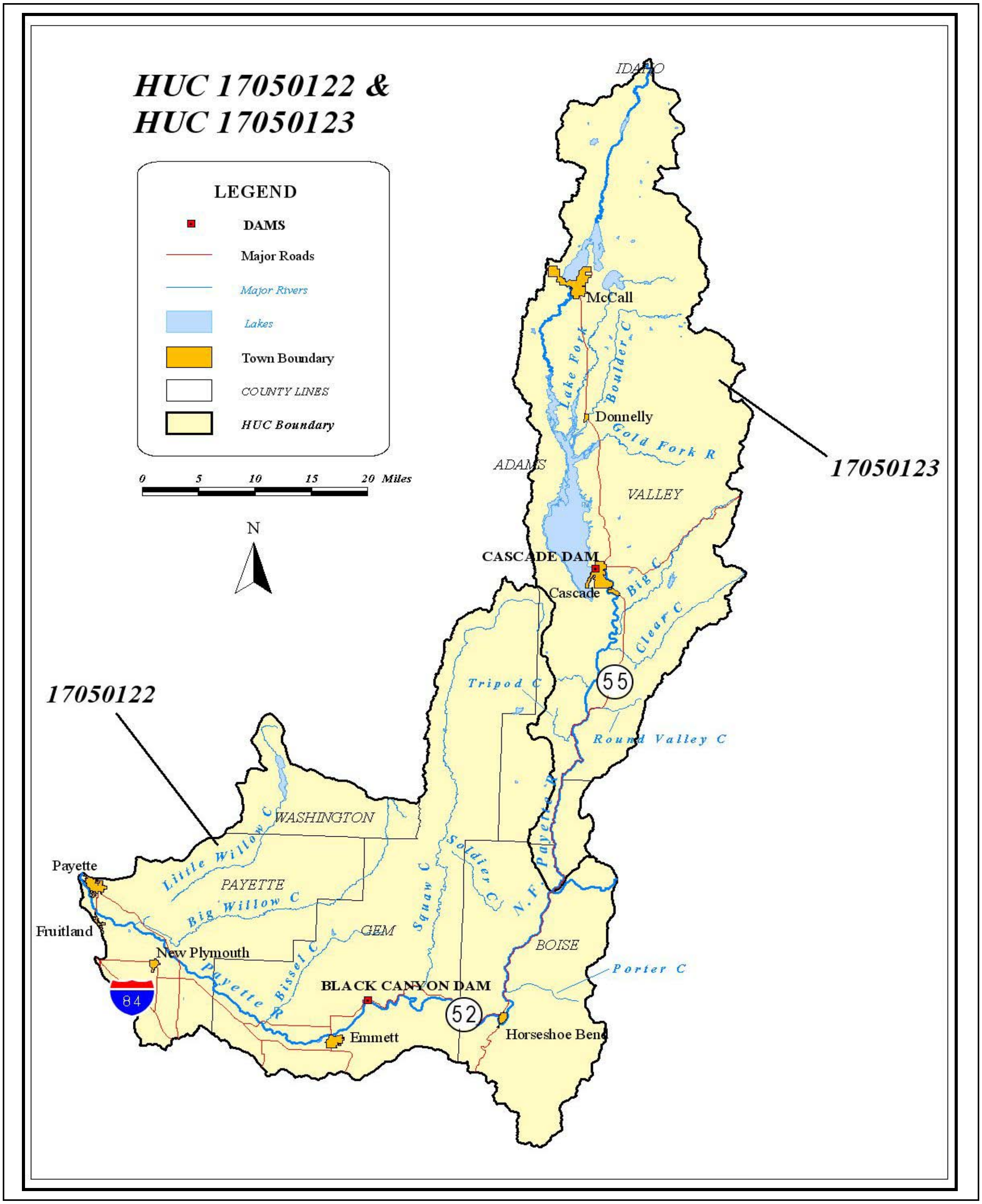


Figure 7. North Fork Payette River TMDL HUCs 17050122 and 17050123.

## Geology

The entire Payette River basin lies primarily within the Idaho *Batholith,* a formation of crystalline igneous rock of volcanic origin although at the lower end of the watershed near Black Canyon Reservoir there are basalt flows from the Columbia River Basalt Group (Figure 8). The upper portion of the watershed is predominantly granite with some basalt. Major rock outcroppings are composed of highly weathered, decomposing material that is highly erodible and easily transported. The primary geomorphic processes that have shaped the landscape include faulting, *fluvial* actions, frost churning, and glaciation.

Long Valley is a major tectonic and structural feature of west central Idaho. Formed by block faulting and erosion of the Idaho Batholith, Long Valley is filled with alluvium. The West Mountain escarpment is a high ridge formed along the west side of the Long Valley fault. West Mountain and Long Valley are part of a group of linear north-south ranges and valleys formed by block faulting during the late *Tertiary* and *Quaternary* Periods. The *Miocene* Columbia River Basalt overlies the gneissic and granitic rocks of the Idaho Batholith's west border and is commonly tilted 15°-30° west.

The broad, high elevation region north of McCall was mostly buried by an ice cap during Pleistocene glaciations. At the same time, cirque and small valley glaciers formed on West Mountain. During at least three periods of glaciation, major valley glaciers flowed from ice caps into the north end of Long Valley and formed large moraines.

The terrain in the Columbia River Basalt section of the Columbia Intermontane province is characterized by rolling hills and terraced alluvial valleys. Closely bordering the northern and southern sides of the Montour valley are low terraces composed of older alluvial deposits of silt, sand, and gravel. The gray to brown colored hills and ridges to the east and in some scattered places to the south and southwest of the valley are composed of granite from the Idaho batholith, which was formed during the late Cretaceous period approximately 65 to 85 million years ago (BOR 2004).

High mountain peaks and ridges to the northeast and southwest of the Montour valley rise more than 1,500 feet above the valley floor. These high ridges and peaks consist of basalt flows that overlay the granitic rocks. The basalt flows dip gently westward and are part of the Columbia River basalt flows, which erupted across most of eastern Washington and Oregon and parts of western Idaho between 14 and 17 million years ago. At the downstream end of Montour Valley, the river enters Black Canyon, a deep, narrow gorge composed of dark basalt flows. These basalt flows are the Black Canyon member of the Weiser lobe of the Columbia River Basalt flows. Black Canyon is apparently made up of a single large volcanic flow, up to 330 feet thick. The rocks throughout the Montour area have been folded and faulted parallel to a northwesterly line by the Paddock Valley Fault System. This belt of activity is approximately 30 to 50 miles wide, and the Black Canyon fault zone is a southeasterly extension of this system. The faulting occurred at about the same time as the Columbia River Basalts were emplaced, and some faults occurred after the volcanic activity. The faults in the Black Canyon zone are not active (BOR 2004).

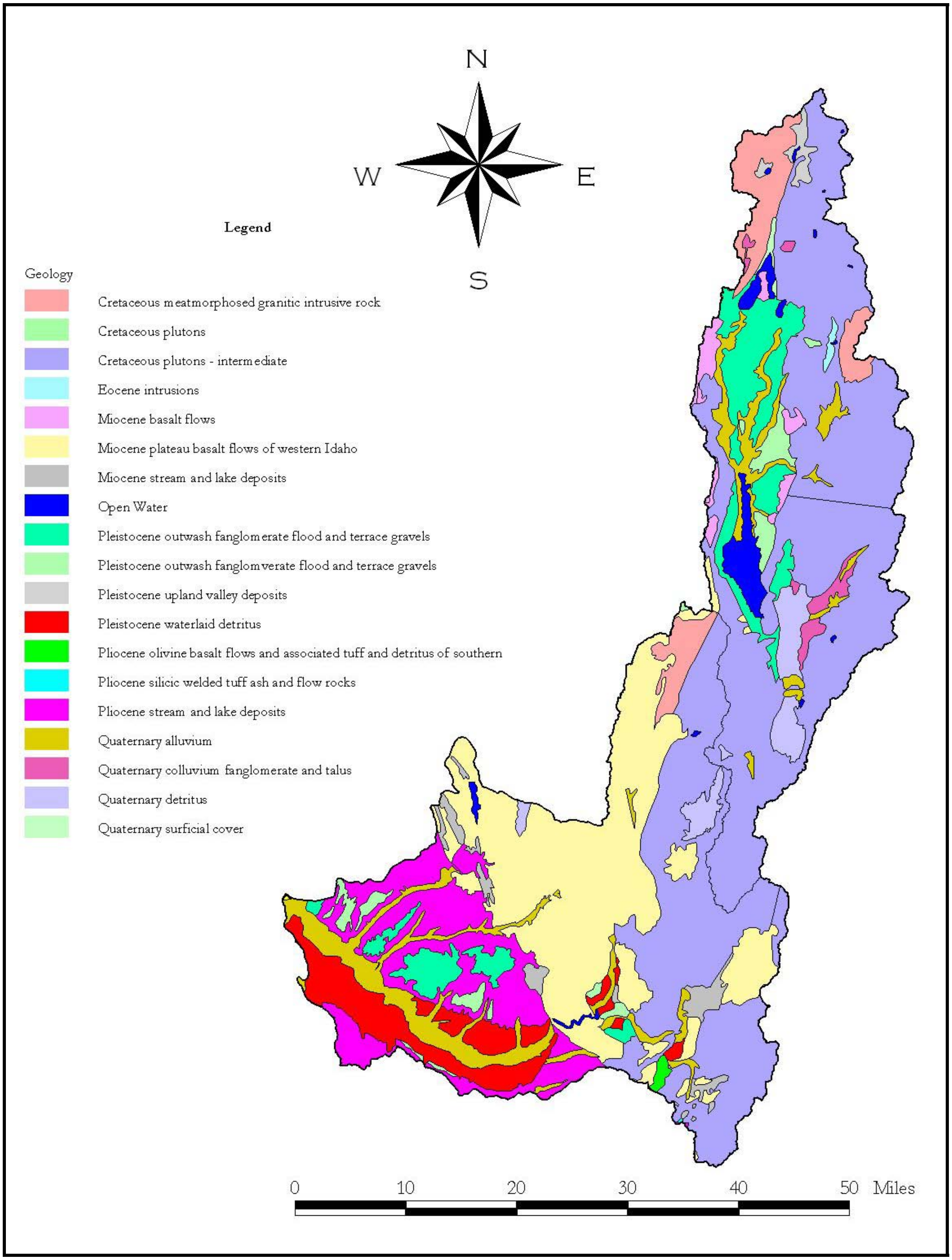


**Figure 8. Geology of the Payette and North Fork Payette River Watershed**

## Soils

The soils in the upper watershed are derived from disintegrated granite, which typically forms coarse-grained, gray to yellowish-gray soils. These soils are inceptisols and the predominant soil types are:

1. Archbal, a deep well drained strongly acid *loam* formed in alluvium;
2. Donnel, a deep, well-drained, medium-acid, sandy loam formed in alluvium and;
3. Roseberry, a deep, poorly drained, medium acid, sandy-loam formed in alluvium.

Soil depths are highly variable, ranging from 30-40 inches for Donnel and Roseberry soils and from 5-8 feet for Archbal soil types.

Soils in the lower elevation portions of the watershed are primarily mollisols: soils that have dark colored, friable, organic-rich surface horizons and which are high in bases, occurring in areas with a cold sub-humid and semi-arid climate. These soils are derived from silica rich ash, clay, silt and arkose of the Idaho formation. Many of the soils are characterized by long periods of dryness and subsurface clay horizons.

In the Black Canyon Area, the predominant soil series are Bakeoven and Lickskillet (extremely rocky soils), Gem (stony clay loam), and Haw (loam) in the steep slope uplands, with Black Canyon (silty clay loam) and Moulton (fine sandy loam) on the flatter slopes adjacent to the Payette River (BOR 2004).

Soil depth varies across the Black Canyon area, but most soils are shallow above bedrock or sand/gravel horizons. Depth to loose sand and gravel ranges from 36 to 55 inches, mostly in those soils arising from alluvium along the river. For those shallow soils underlain by basaltic bedrock, the depth of soil ranges from as shallow as 4 inches to as deep as 36 inches. A few soil series have a hardpan at 35 to 50 inches composed of weakly cemented lime and silica. Soils vary from deep, fine sandy loams (low landscape positions) to extremely rocky, shallow soils (steeper upland positions) (BOR 2004).

## Ground Water, Springs and Geothermal Water

Ground water within this watershed can be divided into two major categories: natural ground water and irrigation recharge. Natural ground water refers to ground water that is present due to geological and hydrological processes, generally located from 30-400 feet below the ground surface. Irrigation recharge refers to sub-surface water present due to practices such as flood or sub-flood irrigation. This water is often found ‘perched’ between the soil and one of several existing clay layers (hard-pan). These layers are found at various depths, from 2-10 or more feet below the surface. Since clay is relatively impermeable, it prohibits infiltration of the water to lower levels and results in an artificially raised *water table*. This water moves toward low-lying areas, eventually discharging into streams and reservoirs (DEQ 1996).

This watershed has mainly unconsolidated depositional aquifers. The aquifers in the higher elevations of the watershed are part of the Northern Rockies Intermontane Basin regional aquifer system. These aquifers yield between 20-50 gallons/minute. Recharge to these aquifers is through downward percolation of snowmelt, runoff from uplands and leakage from natural rivers and reservoirs.

Springs are located throughout the watershed, mainly along river/stream corridors and mountain bases where fractures allow ground water to discharge. Springs are important water sources for domestic and livestock uses, particularly in the Ola Valley (IDWR 1999).

Geothermal springs (temperature >85 degrees F) exist throughout the Payette River watershed. In the section covered by this TMDL there are only a few springs. Several are at the mouth of Squaw Creek and there are two others in the stretch from Cascade to Banks. One of the highest volume springs is the Cabarton Hot Spring which is on private property just north of the Cabarton Bridge at the southern end of Long Valley. This spring discharges at 140-160 degrees F at 60 gallons/minute.

### Topography

Elevations in the watershed range from over 8,000 feet in the mountains above Big Payette Lake, to 4,828 feet at Cascade dam, to the lowest elevation at 2,498 feet at Black Canyon Dam. The North Fork Payette River drops almost 1,800 feet in elevation between Cascade and Banks. Topography varies from steep-sloped forested mountains to low slopes in the wide valley bottoms to relatively flat terraces or benches associated with alluvial deposits. Large, north-south trending ridges characterize the watershed. The steep mountainous lands have slopes ranging from 20-65%.

In the lower watershed, the uplands are moderately steep and incised with smooth, rounded ridge tops. The topography of the Montour area is generally flat. In Black Canyon, the gradient continues to be shallow, ranging from 2,520 feet at the downstream edge of Montour Valley to 2,440 feet at the base of the dam (BOR 2004).

### Fisheries

Due to the wide range in elevation, this section of the Payette River has a variety of fish and fish habitats (Table 1). Some of the native fish in Table 1, such as Kokanee Salmon, are now stocked in lakes and rivers. The construction of Black Canyon Dam eliminated salmon and steelhead in the drainage by creating a fish barrier. Black Canyon Reservoir is considered a transition zone from a warm water type fishery to a cold water type fishery and provides only marginal fish habitat. Sand from upstream land *disturbances* has covered most habitat. Game species present in the reservoir include largemouth bass, smallmouth bass, black crappie, bluegill, channel catfish, and bullhead. All of these are nonnative species that are warm water tolerant and more water pollution tolerant than cold water species (BOR 2004). Tolerant species are defined as "fishes that tend to increase in abundance with human disturbances, particularly in relation to increased siltation, turbidity, and water temperature and lowered concentrations of dissolved oxygen" (BOR 2004).
Upstream from Black Canyon Dam, the gradient of the river increases and coldwater species increase in abundance. The North Fork of the Payette River in the high gradient Payette River canyon has been severely altered by railroad and highway construction, providing only a marginal fishery for salmonids. However, in unaltered sections such as the Cabarton reach, the North Fork is productive for salmonids, particularly redband trout. Alpine lakes within

the Payette River drainage are stocked with rainbow trout, cutthroat trout, rainbow-cutthroat hybrids, golden trout and arctic grayling.

**Table 1. Fish found in lakes/tributaries above Big Payette Lake and in the Payette Watershed below Cascade Dam (IDWR 1998)**

| Common Name | Scientific Name |
|---|---|
| NATIVE SPECIES | |
| Mottled Sculpin | *Cottus bairdi* |
| Shorthead Sculpin | *Cottus confuses* |
| Redband Trout | *Onchorhyncus mykiss* |
| Kokanee Salmon | *Onchorhyncus nerka kennerlyi* |
| Mountain Whitefish | *Prospopium williamsoni* |
| Bull Trout | *Salvelinus confluentus* |
| Northern Pike Minnow | *Ptychocheilus oregonensis* |
| Longnose Dace | *Rhinichthys cataractae* |
| Leopard Dace | *Rhinichthys falcatus* |
| Speckled Dace | *Rhinichthys osculus* |
| Redside Shiner | *Richardsonius balteatus* |
| Bridgelip Sucker | *Catostomus columbianus* |
| Largescale Sucker | *Catostomus macrocheilus* |
| Mountain Sucker | *Catostomus platyrhyncus* |
| INTRODUCED SPECIES | |
| Brook trout | *Salvelinus fontinalis* |
| Channel Catfish | *Ictalurus punctatus* |
| Rainbow Trout | *Onchorhyncus mykiss* |
| Cutthroat Trout | *Onchorhyncus clarkii* |
| White Crappie | *Pomoxis annularis* |
| Black Crappie | *Pomoxis nigromaculatus* |
| Yellow Perch | *Perca flavescens* |
| Bluegill | *Lepomis macrochirus* |
| Largemouth Bass | *Macropterus dolomieu* |
| Smallmouth Bass | *Micropterus dolomieu* |

## Threatened and Endangered Fish

Bull trout are present in isolated areas in the watershed as shown in Figure 9. Columbia River Basin bull trout (Salvelinus confluentus) were listed as threatened in 1998 (64 Federal Register 111, June 10, 1998). Bull trout require stable stream channels, complex and diverse cover, clean spawning gravel, unblocked migration routes, and cold water (<64° F). Bull trout are fall spawners, and there are specific bull trout temperature criteria that are discussed in Section 2.2. Bull trout habitat has been threatened by land use practices that result in degraded habitat due to loss of riparian cover, decreased water quality, and increased sedimentation. In addition, land management practices that result in barriers to migration (dams, impassable culverts) have also threatened populations. Finally, other non-native species, such as brook trout that are competitive to bull trout also pose a substantial threat.

There are three bull trout population watersheds within the Squaw Creek watershed: Squaw Creek, Third Fork Squaw Creek and Second Fork Squaw Creek. Existing populations occur in Third fork, Second Fork and Main Squaw Creek in the upper reaches. Historically, bull trout were found in the lower reaches of Squaw Creek, suggesting that Squaw Creek is also a migratory corridor.

Spawning habitat is lacking large woody debris, which may account for the lack of large pools. Third Fork Squaw Creek is at risk for excess fine sediment, which could also account for the lack of large pools. The Second Fork Squaw Creek has migration barriers as well as excess fine sediment, which hinder the development of the bull trout community.

Gold Fork drainage, which is not being addressed in this TMDL (Gold Fork was included in the Cascade Reservoir TMDL), is also a key bull trout watershed.

Bull trout are also found elsewhere in the watershed but populations are patchy in nature. In September of 2004, the US Fish and Wildlife Service designated areas of critical Bull Trout habitat. Neither the Squaw Creek nor Gold Fork Watersheds received critical designation.

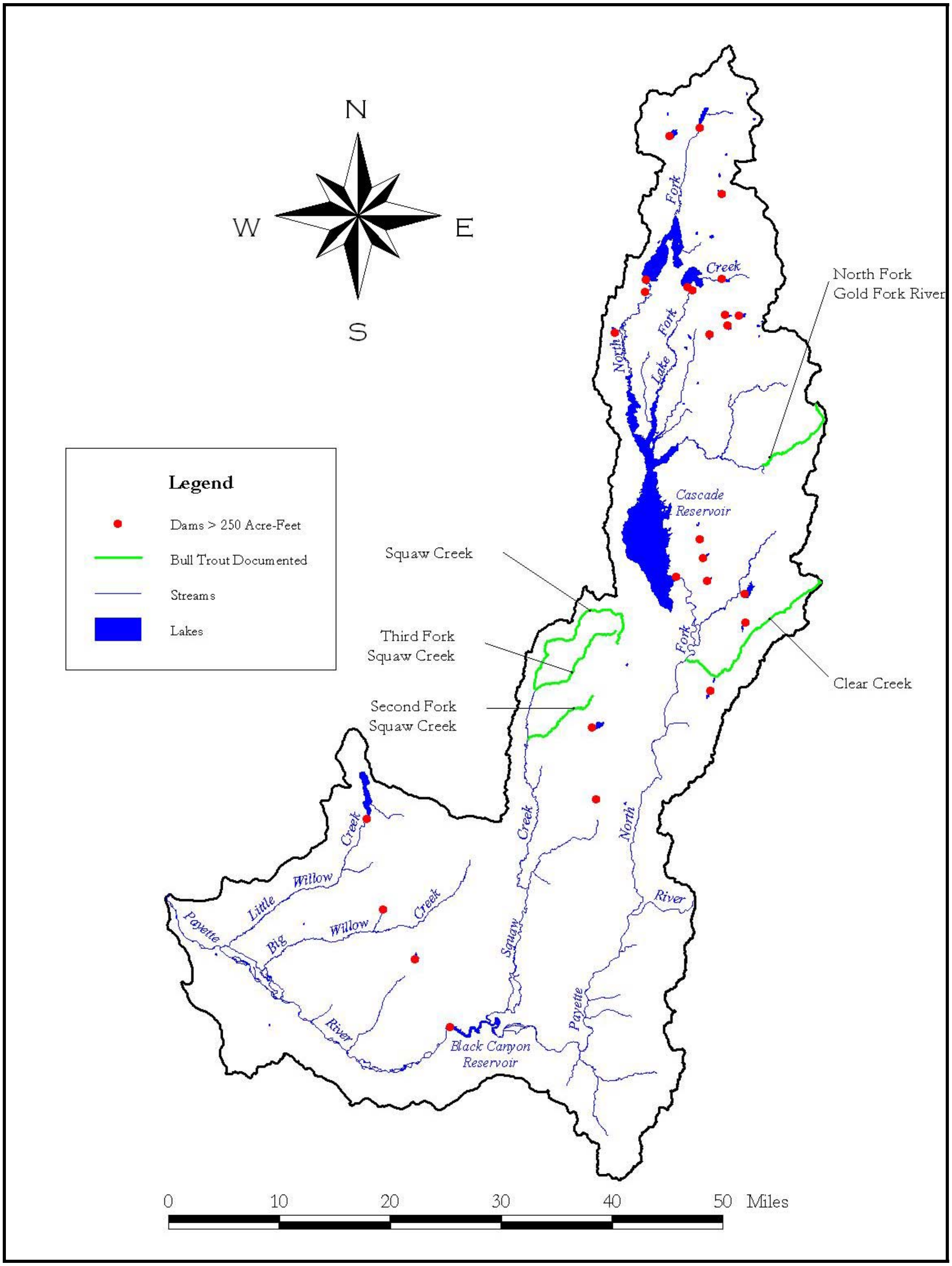


**Figure 9. Bull Trout Distribution in Payette Watershed.**

## Vegetation

The higher elevations in the watershed are dominated by subalpine fir with Douglas fir, lodgepole pine, spruce, tamarack, aspen and white bark pine species also present. The middle to high elevations are predominantly populated with Douglas and grand fir. Ponderosa pine is found mainly at lower elevations and Douglas fir is found on the north facing slopes. Low elevation shrub communities include sagebrush and bitterbrush intermixed with pasture grasses and bunch grasses.

Riparian plants include black cottonwood, willows, reed canary grass, horsetail, rushes, birch, dogwood, alder, wild rose, hawthorn, box elder, and sedges. Riparian habitat along the Payette River between Horseshoe Bend and Black Canyon dam is dominated by black cottonwood and the non-native black locust and silver maple. False indigo also occurs as an understory species at many locations with black locust. Some areas still have healthy stands of native species. Netleaf hackberry, peachleaf willow and sandbar willow, Douglas hawthorn, red-osier dogwood, and rose are the common native shrubs along the river (BOR 2004).

Eurasian milfoil, a nuisance aquatic weed, has been found in ponds in the Montour Wildlife Management Area, Big Payette Lake and Horseshoe Bend Mill Pond.

## Recreation

**Figure 10. Scenic Float Upstream of the Cabarton Bridge.**

The North Fork Payette River watershed is an important recreational resource and recreation has steadily increased over the last few decades. Activities focused on the river include camping, fishing, rafting, kayaking, and jet skiing/boating. There are four public campgrounds located between Cascade Dam and Black Canyon Dam along the North Fork Payette River. These are estimated to serve over 2,900 people per year. In addition to overnight campgrounds, there are numerous day use areas supervised by the Emmett Ranger District. Between October 22, 2002 and October 14, 2003, the ranger district estimates the following number of recreational visits: Beehive Bend, 7,000; Chief Parrish, 725; Banks Beach, 3,325; Banks Put-in, 9,850; Swinging Bridge, 1,100; Canyon, 340; Cold Springs, 200; Big Eddy, 720. These estimates are based on parking fees paid with an average of 3 persons per vehicle.

In the stretch from Banks to Horseshoe Bend, there are five licensed raft outfitters that are estimated to take approximately 4,000 persons per year down the river. The Cabarton stretch also has 5 outfitters licensed on it that are estimated to take 1,300 persons per year on trips. Whitewater recreation has steadily increased over the last two decades, with most activity concentrated between May-September. Between 1992 and 1996, boating increased almost 79% in the entire Payette watershed. In 1989 a boating study by the Idaho Department of Parks and Recreation estimated over 34,000 boaters used the North Fork/Main Payette River between Cabarton and Gardena (IDWR 1999). River use is estimated to be increasing on the North Fork Payette River between Cascade Dam and Cabarton Bridge (Harry Adams, personal communication, 2003). In addition, there is a tourist train that travels along the river corridor between Cascade and Horseshoe Bend.

There is limited information on angler use. A 1983 study showed that between May 24-October 10, there were 4,364 angler hours on the stretch between Smiths Ferry to a few miles below Banks.

Recreation data for Black Canyon Reservoir is limited, but from 1992 to 1993 an estimated 59,000 recreation visits occurred.

Recreational dredge mining is allowed in the North Fork Payette River Watershed from the headwaters to upper Payette Lake and from Cascade Dam to Cabarton Bridge. However, dredging in these sections is minimal to nonexistent.

## Subwatershed Characteristics

### Stream Characteristics

The North Fork Payette watershed has general stream characteristics associated with it, which are outlined below. Individual subwatershed characteristics are discussed in more detail in Section 2.4.

### Rosgen Stream Types

The Rosgen Stream Classification system is useful in describing general stream characteristics like channel shape, channel patterns (i.e. braided), valley types that a stream is found in, etc. Based on the geomorphological characteristics of streams, the Rosgen classification scheme delineates expected ranges for width/depth ratios, entrenchment, substrate materials, sinuosity, and gradient. When dealing with streams impaired by sediment, the Rosgen Stream Classification system is an important tool in determining whether a stream is stable or not and whether that instability is leading to contribution of excess sediment to the stream.

General stream classes are broken out by an A-G lettering scheme, which can be further subdivided in each letter grouping by numbers (i.e. C1, C2...C6). The following section is an overview of the geomorphic stream categories found throughout the watershed (Figure 11).

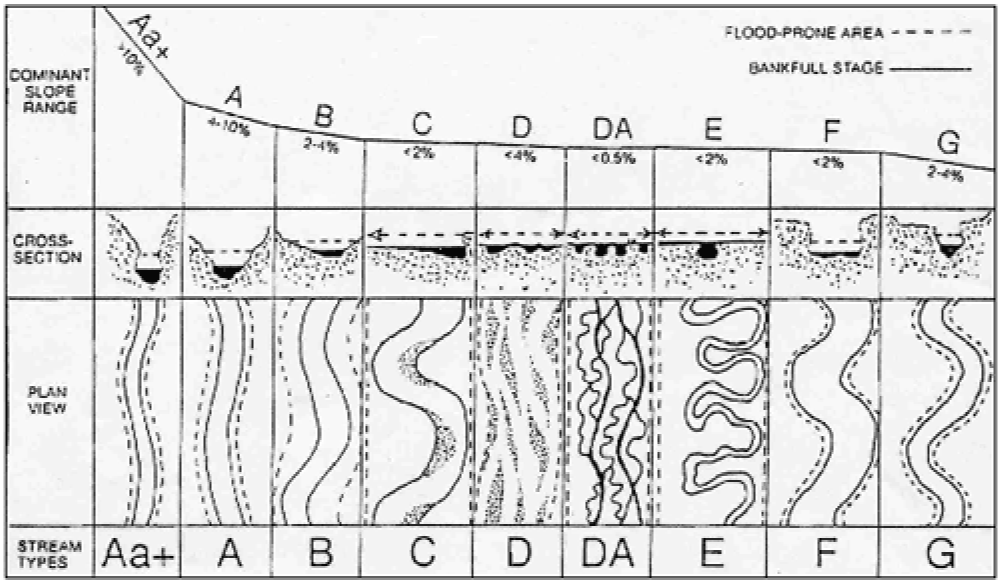


**Figure 11. Rosgen Stream Types (Rosgen 1996).**

Generally, the North Fork Payette watershed has type A streams in the steeper, mountainous parts of the watershed, type B streams (transport reaches) in the middle part of subwatersheds and type C streams (response reaches) in the lower portions of the watershed. However, depending upon terrain, exceptions to this generalization may occur. Type E streams have also been documented in the watershed.

At higher elevations in the watershed, the high gradient, straight, and moderately to very-well confined type A channels associated with high relief landforms in fluvial and glacial terrain are found. These streams are confined in gorges or steep sided slopes with a low sinuosity and low width to depth ratio. Channel gradients are greater than 4 percent and have a cascading, step/pool morphology. The notable exception to this description is the North Fork Payette River between Smiths Ferry and Banks. Confined by a canyon, highway, and railroad bed, the North Fork Payette River has a relatively low sinuosity channel associated with A and B types. The steep gradient and stable boulder lined channel is associated with type A streams. The river is more of type B in the sections where the rapids are less cascading due to the lower gradient. The canyon section has very few pools.

Type B streams generally occupy stable channels with moderately stable banks. These streams tend to occur in narrow, gently sloping valleys in areas of moderate relief. They are moderately entrenched in colluvial deposition channels. Channel gradients typically range from 2-4 percent, but may be lower or higher. Width-to-depth ratios are moderate and bed forms are predominantly *riffle* with infrequently spaced pools.

Moderate gradient and moderately to well confined type B channels are predominantly associated with mainstem and tributary reaches within moderate relief landforms. In fluvial terrain these landforms include steep stream valley segments and some portions of valley fill terraces. In glacial terrain the landforms include trough floors.

Low gradient, sinuous and relatively unconfined type C and E channels are predominantly associated with valley fill terrace landforms in fluvial terrain and with portions of trough floor and valley fill landforms in glacial terrain.

Type C streams typically occupy low gradient (less than 2 percent) alluvial channels with broad, well defined floodplains located in broad valleys. These streams are slightly entrenched within a well-defined meandering channel. Generally, they have a riffle-pool bed morphology with point bars typically developed at meander bends.

Type E streams occupy relatively unconfined alluvial channels in low elevation broad valleys or in slightly to moderately confined higher elevation mountain meadows. These are low gradient, meandering, riffle/pool streams with low width to depth ratio and little deposition. The channels are very sinuous with stable, well vegetated banks.

These reaches of the river system are depositional areas for coarse sediment. As a result of the low slope, coarse sediment transport capacity is limited. Large inputs of coarse sediment could result in aggradation, channel widening, and, eventually, a braided channel.

*Stream Characteristics from Banks to Montour*

The streams entering the Payette River below Banks are generally small volume, second order rangeland streams, which tend to dry up by mid-July due to natural low flow and/or diversion of water from the stream. Figures 12 and 13 show two typical tributary streams: Hill Creek and Porter Creek.

**Figure 12. Hill Creek near mouth, June 2004.**

Figure 13. Porter Creek: July 2004 (< 1cfs at mouth).

## 1.3 Cultural Characteristics

Water quality is influenced by both natural and human factors. This section provides an overview of the cultural characteristics that affect water quality. The economy, land use, infrastructure, and development history of an area all can affect water quality. The North Fork Payette River watershed has a long history of natural resource use, including mining, timber harvest, and farming/ranching activities that have influenced patterns of settlement and water resource activities.

### Land Use/Ownership/Population

Land ownership is diverse, with private and public lands (Figure 14). Population is steadily increasing in this rural watershed although the rate is difficult to determine because the watershed lies in portions of Valley, Gem and Boise counties. Population centers include Horseshoe Bend and Cascade. The population of Horseshoe Bend increased 43% between 1970-1996, while Cascade's population increased 20.8% during the same period (IDWR 1999). The watershed contains no recognized tribal lands. Land use is diverse and includes irrigated cropland, irrigated pasture, forested areas, dry land agriculture, upland rangeland, municipalities and flood prone river bottom riparian areas as shown in Figure 15.

## Water Resource Activities

Numerous small dams are present in the watershed on tributaries to the North Fork. For the reaches of the Payette River covered by this TMDL, Cascade Dam and Black Canyon Dam represent the two most significant dams (Figure 16). Black Canyon Dam was built in 1924 to supply Black Canyon canal (Figure 17). Cascade Dam was completed in 1949 with full storage reached by 1957. Both dams are operated by the US Bureau of Reclamation (BOR for irrigation, hydropower, flood control, recreation and wildlife habitat needs. Maximum storage capacity is 703,200 acre-feet in Cascade and 29,300 acre feet in Black Canyon. Black Canyon Reservoir was originally constructed to hold 44,800 acre-feet, but the capacity of the reservoir has been reduced by approximately 15,500 acre-feet due to the deposition of sediment from upstream sources.

Horseshoe Bend Power Plant diverts water from the Payette River in a flow-through canal to generate 9.5 megawatts of power. Idaho Power Company generates about 47,000 megawatts annually at their 12.5 megawatt capacity power plant at Cascade Dam (IDWR 1999). Idaho Power's power plant was constructed in 1984.

The city of Horseshoe Bend has diverted water from the Payette River since 1976 for a public drinking water supply. Horseshoe Bend is completing improvements to their wastewater treatment system. The wastewater treatment plant discharges directly into the river. The point of discharge is into a section of river that is not 303(d) listed.

Cascade has a wastewater treatment plant that only occasionally discharges into the North Fork Payette River (once in the last five years) because the city currently uses a rapid infiltration basin. However, Cascade is working on upgrading their system and one of the alternatives being considered involves discharging into the river. The point of discharge is upstream of the 303(d) listed section of the North Fork Payette River.

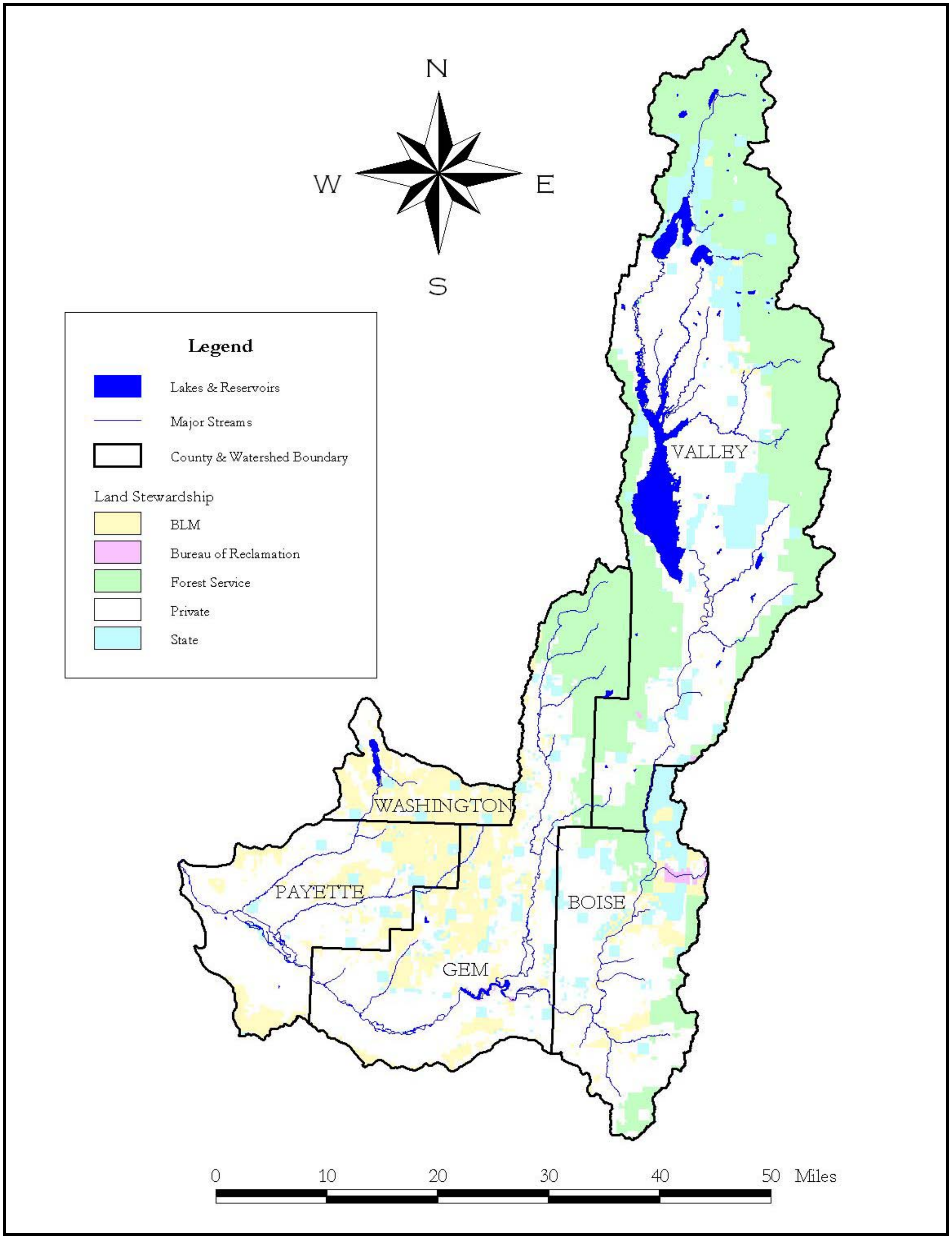


**Figure 14. Land Ownership in the Payette River Watershed.**

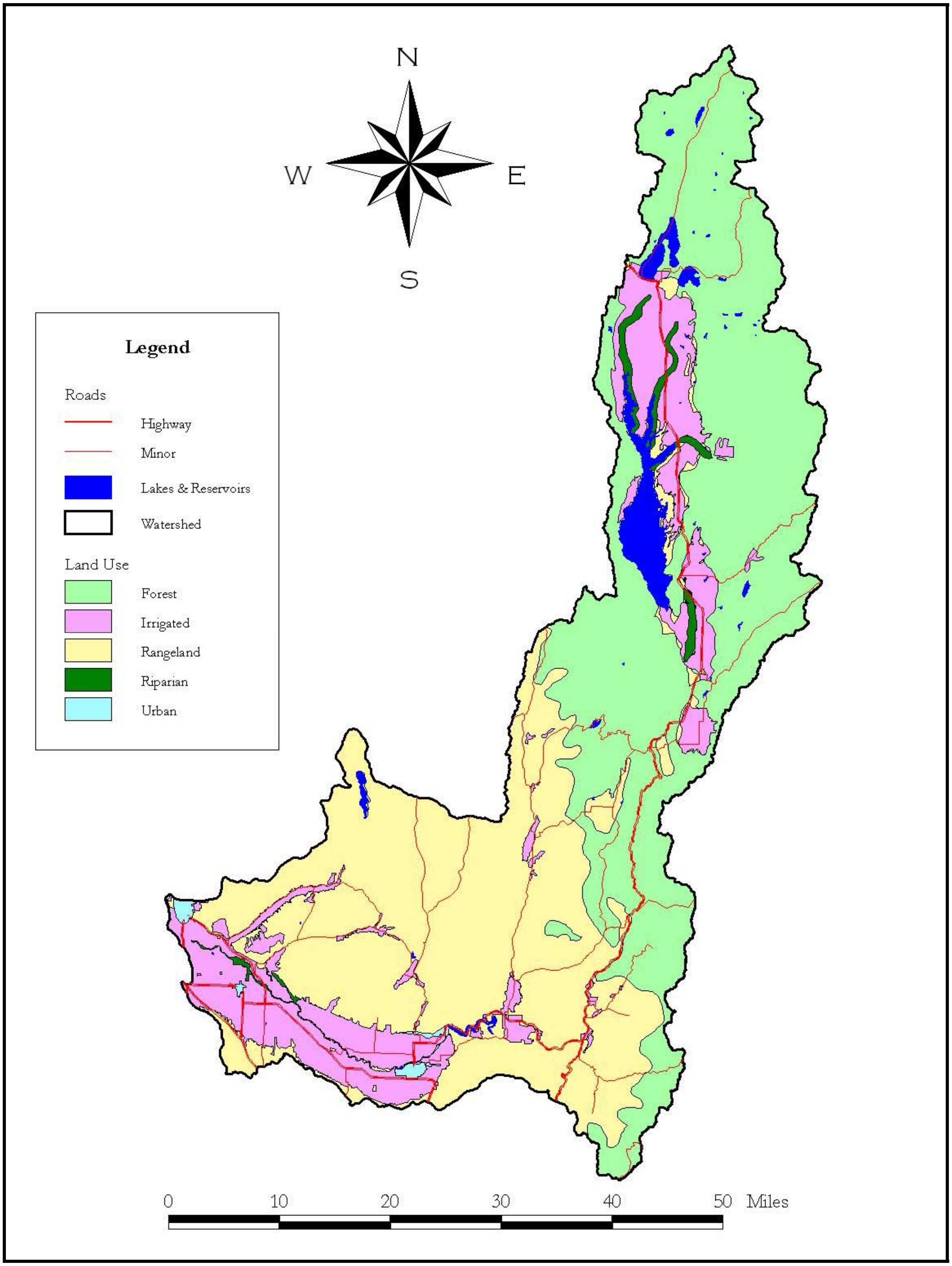


**Figure 15. Land Cover and Use in the Payette River Watershed.**

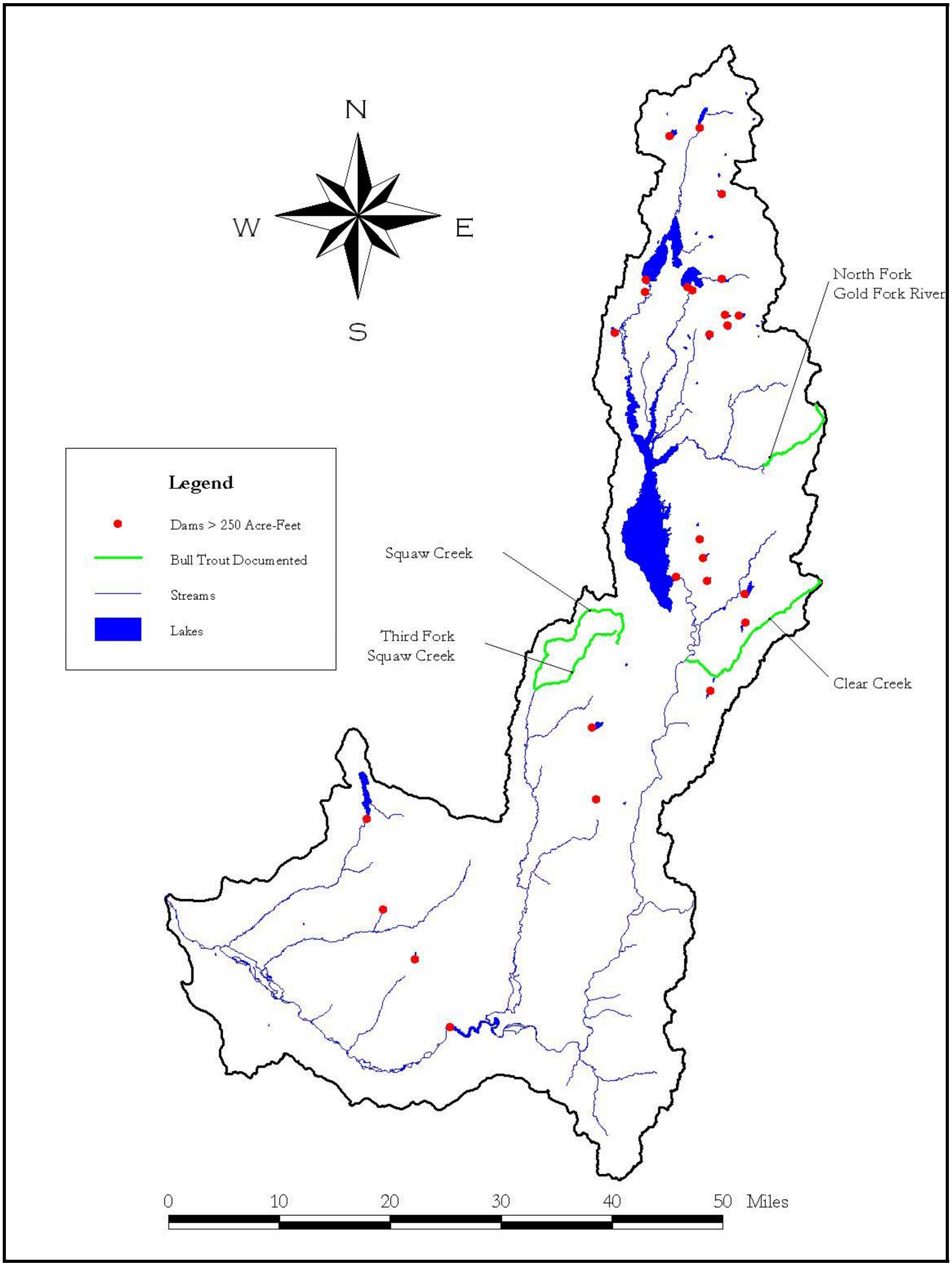


**Figure 16. Dams with Reservoir Capacity >250 acre-feet in Payette Watershed.**

**Figure 17. Black Canyon Dam Spillway.**

History and Economics

Evidence indicates the existence of aboriginal people in the subbasin over 10,000 years ago. Small aboriginal bands followed seasonal salmon migrations, foraged for berries, camas bulbs and other roots and hunted for small and large game. Timber Butte, southwest of Banks, was an important regional source of obsidian for making tools.

As early as 6,000 years ago, the Montour Valley was inhabited by Native Americans. Tribes known to have inhabited or utilized the area include Northern Shoshone, Northern Paiute and Nez Perce. The Northern Shoshone and Paiute families occupied winter camps in the lower Payette Valley, while the Nez Perce utilized Long Valley. Also present were the Tukudeka also referred to as the *Sheepheater Shoshoni*, who traveled in small bands throughout Long Valley in the summer and in the lower Payette Valley and Smiths Ferry in the winter. After the Nez Perce (1877) and Bannock Wars (1878), they were the only Native Americans in south and central Idaho not confined to a reservation. In 1907, the Tukudeka were forced to move to Fort Hall Reservation.

Prior to the gold rush in the 1860s, the only other inhabitants of the area were fur trappers who used the areas transiently. Fur trappers were in the area as early as 1818, and Alexander Ross, a trapper, explored Squaw Creek in 1824. The Payette River was named after the explorer Francois Payette. Prospectors and miners moved through Boise County in 1862, en route to the gold rush in the Boise Basin. Major routes through the Payette River Basin included the Brownlee Trail, Packer John Trail, and the Basin Trail. Horseshoe Bend was located on the shipping route between Umatilla Landing and Boise Basin. Around Horseshoe Bend, several underground mines existed, but gold extraction was not as important as it was in areas like Idaho City (Dobson and Drake 1990).

By 1863 irrigation began along the Payette River, and the Horseshoe Bend and Montour areas were settled by farmers. Besides farming, early watershed residents engaged in logging, mining, and ranching (BOR 2004). Long Valley was not permanently settled until the 1880s when livestock ranchers moved into the area.

The watershed has long been an important timber resource. Sawmills were constructed in the 1860s in the Horseshoe Bend area and annual log drives occurred on the river until the railroad provided an easier means of transport. The recently closed (January 2001) sawmill in Cascade was constructed in 1924 and operated continuously until its closing by Boise

Cascade Corporation. Logging occurred in the Squaw Creek drainage in the 1920s and 30s and on a larger scale after the 1960s (IDWR 1999).

In the late 1870s coal seams were found near Cottonwood and Shafer Creeks. The coal was of poor market value so coal mining never took off.

In 1912 the railroad came to Horseshoe Bend, and Horseshoe Bend became an important shipping center for livestock and timber. In 1926 the highway from Horseshoe Bend to Banks was constructed. In 1934 the road from Boise to Horseshoe Bend was paved and the concrete bridge on the southern edge of Horseshoe Bend was built (Dobson and Drake 1990).

Major industries are agriculture (farming and grazing), recreation/tourism and to a lesser extent timber harvest. Irrigated agriculture, mainly associated with hay production, is concentrated in the areas between McCall and Cabarton and the Squaw Creek drainage. Federal land management agencies are one of the largest employers in Valley County.

## Water Resource Activities

Groups working on water quality issues include the North Fork Payette River (NFPR) Watershed Advisory Group, the Cascade Reservoir Coordinating Council (the Watershed Advisory Group, or WAG, for the Cascade Reservoir Watershed), Lake Cascade Association, Big Payette Lake Water Quality Council, Payette Rivers Citizen Group, Idaho Rivers United, the Payette Watershed Council, Valley County Soil and Water Conservation District, Squaw Creek Soil Conservation District, and Gem County Soil and Water Conservation District.

The NFPR Watershed Advisory Group was formed to advise DEQ on development and implementation of this TMDL. The Cascade Reservoir Coordinating Council (the WAG for DEQ for the Cascade Reservoir watershed) and Lake Cascade Association have been very active in the Cascade Reservoir watershed in safeguarding water quality and implementing water quality improvement projects. The Big Payette Lake Water Quality WAG is focused on protecting Big Payette Lake.

Idaho Rivers United is a non profit river conservation group that works on river issues throughout Idaho. The soil and water conservation districts listed here as well are instrumental in implementing agricultural water quality improvement projects. The districts work closely with private landowners to fund these projects and develop conservation plans. The Payette Watershed Council is a consortium of water users and outfitters concerned with water use and flow issues affecting the Payette watershed. The Payette River Citizen group helped develop the Payette Watershed Planning document with the Idaho Department of Water Resources.

# 2. Subbasin Assessment – Water Quality Concerns and Status

## 2.1 Water Quality Limited Segments Occurring in the Subbasin

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

### About Assessment Units

The following discussion focuses on the new way that DEQ defines the waters of the state of Idaho. This identification methodology was not utilized in the 1998 303(d) list that this TMDL addresses. However, since AUs now define all the waters of the state of Idaho, the methodology is described in this section. These units and the methodology used to describe them can be found in the WBAGII (Grafe et al 2002). Assessment units (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—although ownership and land use can change significantly, the AU remains the same.

Using assessment units 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 EPA's 305(b) report, a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards 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 watershed scale (HUC), so that all the waters in the drainage 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 (delisted) from the 303(d) list (Section 5 of the Integrated Report).

## Listed Waters

Figure 18 shows the listed water bodies in the basin. Table 2 shows the 303 (d) pollutant listings in the basin. Not all of the water bodies will require a TMDL, as will be discussed later. However, a thorough investigation using the available data was performed before this conclusion was made. This investigation, along with a presentation of the evidence of non-compliance with standards is contained in the following sections for each water body.

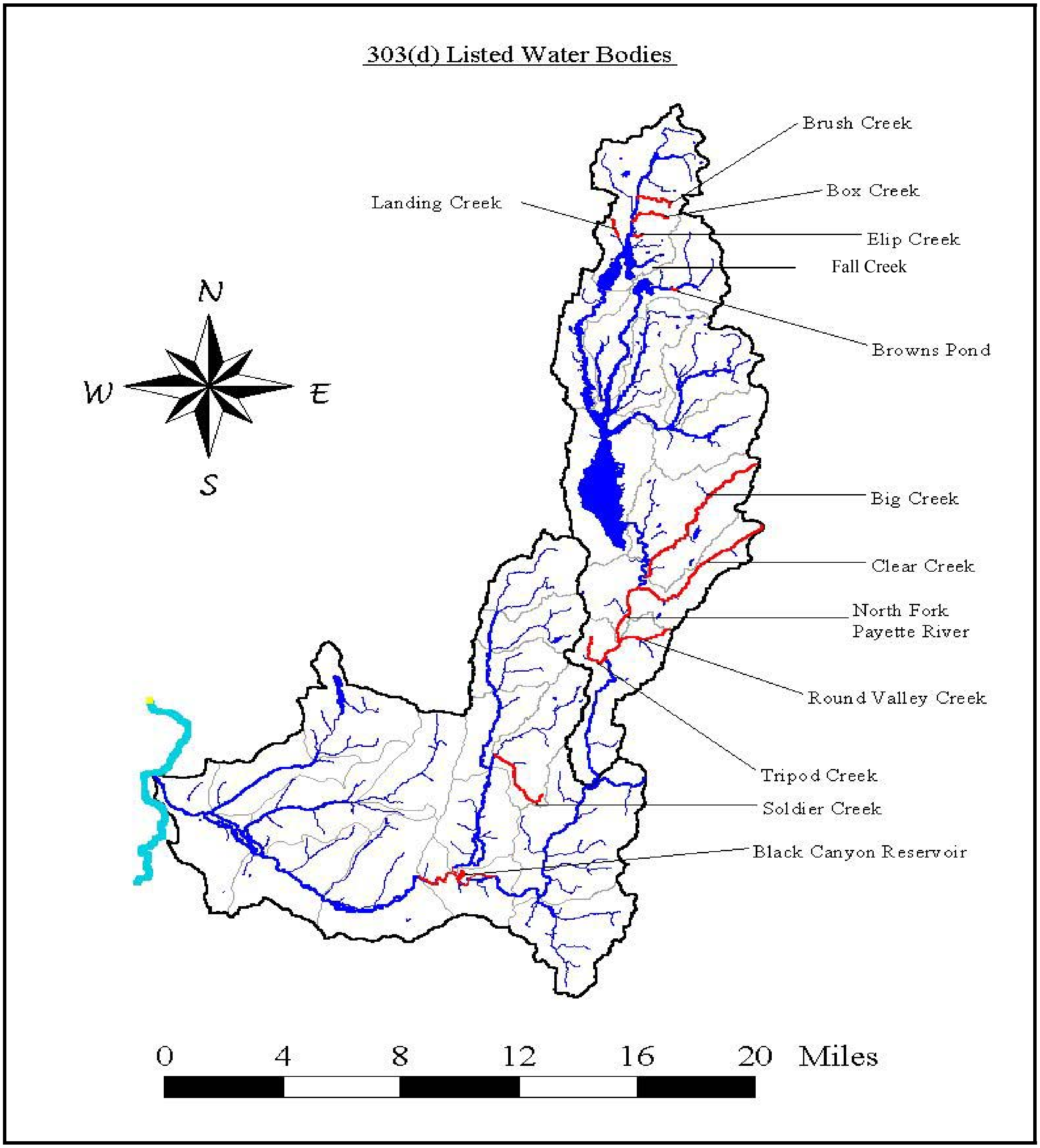


**Figure 18. 1998 Idaho 303(d) Listed Water Bodies.**

**Table 2. Idaho 1998 §303(d) list Water Bodies, Water Body Description, Miles of Impaired Water Bodies and Pollutant of Concern, North Fork Payette River Watershed.**

| Water Body | Assessment Units | 1998 §303(d)[1] Boundaries | Basis for Listing | Pollutant(s) | Miles/Acres of Impaired Water Bodies |
|---|---|---|---|---|---|
| **Payette River (HUC 17050122)** | | | | | |
| Black Canyon Reservoir | SW002-06 | Black Canyon Reservoir | 305(b), Append. D | Nutrients, Oil/Grease and Sediment | 6 |
| Soldier Creek | SW012-02 | Headwaters to Squaw Creek | US Forest Service | Sediment | 8.96 |
| **North Fork Payette River (HUC 17050123)** | | | | | |
| North Fork Payette River | SW001-06 | Clear Creek to Smith's Ferry | 305(b), Append. D | Flow alteration, Habitat alteration, Nutrients, Sediment and Temperature | 9.53 |
| Round Valley Creek | SW002-03 | Headwaters to North Fork Payette River | 305(b), Append. D | Sediment | 5.66 |
| Clear Creek | SW003-03 | Headwaters to North Fork Payette River | Salmonid Spawning, US Forest Service | Sediment | 17.78 |
| Big Creek | SW004-03 | Horsethief Creek to North Fork Payette River | US Forest Service | Sediment | 6.50 |
| Tripod Creek | SW001-02 | Headwaters to North Fork Payette River | BURP | Unknown | 5.40 |
| **North Fork Payette River (at or above BPL) (HUC 17050123)** | | | | | |
| Box Creek | SW018-02 | Headwaters to North Fork Payette River | Added by EPA, April 2000 | Temperature | 4.5 |
| Brown's Pond | SW014-02 | Brown's Pond | 305(b), Append. D | Habitat Alteration | <1 |
| Brush Creek | SW018-02 | Headwaters to North Fork Payette River | Salmonid Spawning, US. Forest Service | Unknown | 5.06 |
| Elip Creek | SW017-02 | Headwaters to Lemah Creek | Salmonid Spawning, US. Forest Service | Unknown | 3.00 |
| Fall Creek | SW017-03 | Headwaters to Big Payette Lake | Added by EPA, April 2000 | Temperature | 4.8 |
| Landing Creek | SW017-02 | Headwaters to Deadhorse Creek | BURP | Unknown | 2.42 |

[1]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under Section 303 subsection "d" of the Clean Water Act.

## 2.2 Applicable Water Quality Standards

Idaho adopts both narrative and numeric water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. By designating the beneficial use or uses for water bodies, Idaho has created a mechanism for setting criteria necessary to protect those uses and prevent degradation of water quality through *anti-degradation* provisions. According to IDAPA 58.01.02.050 (02)a "wherever attainable, surface waters of the state shall be protected for beneficial uses which includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic *biota*." Beneficial use support is determined by DEQ through its water body assessment process. Table 3 contains a listing of the designated beneficial uses for each listed segment. Table 4 is a summary of the water quality standards associated with the beneficial uses. For streams with no designated beneficial uses, cold water aquatic life and recreation are presumed to be uses. The following discussion focuses on beneficial uses and the water quality criteria, both narrative and numeric, that apply to each listed water body. A more detailed explanation of numeric water quality targets developed as an interpretation of the narrative standards for nutrients and sediment can be found later in this section.

**Table 3. Idaho 1998 §303(d)[1] list Water Bodies, Designated Uses and IDAPA Citation for the North Fork Payette River TMDL.**

| Water Body | Assessment Unit | Designated Uses[2] | IDAPA § |
|---|---|---|---|
| **Payette River** | | | |
| Black Canyon Reservoir | SW002-06 | CW; SS; PCR ; DWS; SRW | 58.01.02.140.16.SW-2 |
| Soldier Creek | SW012-02 | Undesignated | 58.01.02.140.16.SW-12 |
| Payette River (confluence of NF and SF to Black Canyon Reservoir) | SW002-06 | CW; SS; PCR ; DWS; SRW | 58.01.02.140.16.SW-3 |
| **North Fork Payette River** | | | |
| North Fork Payette River | SW001-06 | CW; SS; PCR ; DWS; SRW | 58.01.02.140.17.SW-1 |
| Round Valley Creek | SW002-03 | Undesignated | 58.01.02.140.17.SW-2 |
| Clear Creek | SW003-03 | Undesignated | 58.01.02.140.17.SW-3 |
| Big Creek | SW004-03 | Undesignated | 58.01.02.140.17.SW-4 |
| Tripod Creek | SW001-02 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-1 |
| **North Fork Payette River (at or above Big Payette Lake)** | | | |
| Box Creek | SW018-02 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-18 |
| Brown's Pond | SW014-02 | CW; SS; PCR ; DWS; SRW | 58.01.02.140.17.SW-14 |
| Brush Creek | SW018-02 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-18 |
| Elip Creek | SW017-02 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-18 |
| Fall Creek | SW017-03 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-18 |
| Landing Creek | SW017-02 | CW;SS;PCR;DWS;SRW | 58.01.02.140.17.SW-18 |

[1] Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under Section 303 subsection "d" of the Clean Water Act. [2] CW – Cold Water Aquatic Life, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply, SRW-Special Resource Water

## Table 4. Applicable Water Quality Criteria

| Pollutant & IDAPA Citation | Beneficial Use(s) | Applicable Water Quality Standard |
|---|---|---|
| Temperature<br>(58.01.02.250.02.b)<br>(58.01.02.200.09)<br><br>(58.01.02.250.02.e.ii)<br><br>Bull Trout Temperature Criteria<br>(58.01.02.250.02.f) | Cold Water Aquatic Life (CWAL)<br><br>Salmonid Spawning (SS) | Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C.<br>Natural Background Conditions. When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253 of the Idaho Administrative Rules, 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.<br>During salmonid spawning periods: Water temperatures of thirteen (13) degrees C or less with a maximum daily average no greater than nine (9) degrees C.<br>Water temperatures shall not exceed thirteen degrees Celsius (13C) maximum weekly maximum temperature (MWMT) during June, July and August for juvenile bull trout rearing, and nine degrees Celsius (9C) daily average during September and October for bull trout spawning. The bull trout temperature criteria shall apply to all tributary waters, not including fifth order main stem rivers, located within areas above 1400 meters elevation south of the Salmon River basin- Clearwater River basin divide, and above 600 meters elevation north of the Salmon River basin- Clearwater River basin divide, in the fifty-nine (59) Key Watersheds listed in Table 6, Appendix F of Governor Batt's State of Idaho Bull Trout Conservation Plan, 1996, or as designated under Sections 110 through 160 of this rule. |
| Dissolved Oxygen<br>(58.01.02.250.02.a)<br><br>Dissolved Oxygen Concentration below Existing Dam<br>(58.01.02.276.02) | CWAL<br><br>SS | **Cold Water**. Waters designated for cold water aquatic life are not to vary from the following characteristics due to human activities: **a.** Dissolved Oxygen Concentrations exceeding six (6) mg/l at all times. In lakes and reservoirs this standard does not apply to: i. The bottom twenty percent (20%) of water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less. (7-1-93) ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters. iii. Those waters of the hypolimnion in stratified lakes and reservoirs.<br><br>From June 15-October 15 waters below dams, reservoirs and hydroelectric facilities shall contain the following dissolved oxygen concentrations: 30- day mean of 6.0 mg/L; 7-day mean of 4.7 mg/L and an instantaneous minimum of 3.5 mg/L |
| Turbidity<br>(58.01.02.250.02.d) | CWAL | < 50 NTU[1] above background for any given sample or < 25 NTU for more than 10 consecutive days (below any applicable mixing zone set by DEQ) |
| Bacteria<br>(58.01.02.251.01.b,c) | Primary Contact Recreation (PCR)<br>Secondary Contact Recreations (SCR) | Waters designated for primary contact recreation are not to contain E.coli bacteria significant to the public health in concentrations exceeding: **a.** For areas within waters designated for primary contact recreation that are additionally specified as public swimming beaches, a single sample of two hundred thirty-five (235) E. coli organisms per one hundred (100) ml. **b.** For all other waters designated for primary contact recreation, a single sample of four hundred six (406) E.coli organisms per one hundred (100) ml; or **c.** A geometric mean of one hundred twenty-six (126) E.coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to five (5) days over a thirty (30) day period.<br>Waters designated for secondary contact recreation are not to contain E.coli bacteria significant to the public health in concentrations exceeding: **a.** A single sample of five hundred seventy-six (576) E.coli organisms per one hundred (100) ml; or **b.** A geometric mean of one hundred twenty-six (126) E.coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three to five days over a thirty day period. |

**Table 4. (continued)**

| | | |
|---|---|---|
| Floating, Suspended, or Submerged Matter (Nuisance Algae) (58.01.02.200.05) | PCR SCR CWAL | Surface waters shall be free from floating, suspended, or submerged matter of any kind in concentration causing nuisance or objectionable conditions or that impair designated beneficial uses and be free from oxygen demanding materials in concentrations that would result in an anaerobic water condition. |
| Excess Nutrients (58.01.02.200.06) | CWAL PCR SCR | 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. |
| Sediment (58.01.02.200.08) | CWAL SS | Sediment shall not exceed quantities specified in general surface water quality criteria (IDAPA 58.01.02.250 or 252) or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses |

[1]NTU = nephlometric turbidity unit

## Beneficial Uses

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

For the North Fork Payette River, the Mainstem Payette River and the associated listed tributaries, designated beneficial uses for which support status must be determined include; cold water aquatic life (CWAL), salmonid spawning (SS), primary contact recreation (PCR) or secondary contact recreation (SCR), domestic water supply and special resources water. The listed pollutants impairing these uses include nutrients, oil and grease, sediment, temperature, habitat alteration and flow alteration. Table 2 shows the state of Idaho 1998 §303(d) listed segments, the description of the water body, segment Water Quality Limited Segment ID, the miles of impaired water body, the pollutant of concern and the basis for listing the segment. More detailed citation of the water quality standards can be found in Appendix B. Figure 29 shows the Idaho 1998 §303(d) listed water bodies.

### 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 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water body could support salmonid spawning, but salmonid spawning is not yet occurring.

### Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include things like aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses.)

### Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. 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 criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., *intergravel dissolved oxygen*, temperature). However, if for example, cold water is not found to be an existing use, a 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 criteria. (IDAPA 58.01.02.101.01).

## Criteria to Support Beneficial Uses

As shown in Table 4, the above-mentioned 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 dissolved oxygen, pH, and turbidity (IDAPA 58.01.02.250).

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 Water Body Assessment Guidance (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations. Figure 19 provides an outline of the wadeable stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

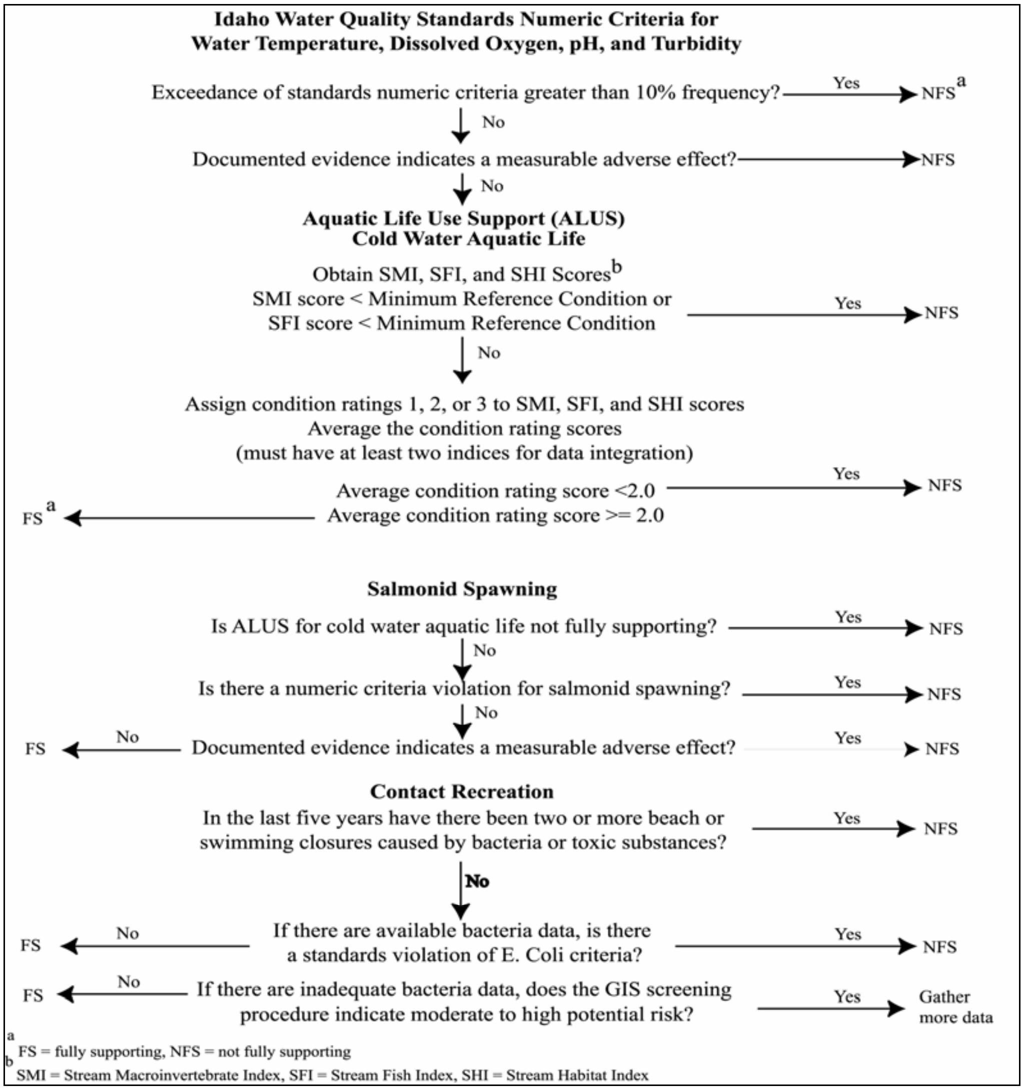


**Figure 19. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: *Water Body Assessment Guidance*, Second Edition (Grafe *et al*. 2002).**

## 2.3 Pollutant Beneficial Use Support Status Relationships

### Sediment

Sediment is the most common non-point source pollutant in the state. The dominant portion of sediment loads in southern Idaho is suspended sediment. Many fish species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental.

Elevated suspended sediment levels can interfere with feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, smother eggs and fry in the substrate, damage habitat, and in extreme cases eventually lead to death. Eggs, fry, and juveniles are especially sensitive to suspended sediment.

By smothering fish spawning and rearing grounds, sedimentation leads to a homogenization of available habitats. Additionally, sediment reduces the available habitat for the food organisms of the fish, as well as smothering the food organisms themselves. Aquatic insects (macroinvertebrates), which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is dominated by burrowing species, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community also diminishes due to the reduction of coarse substrate habitat.

In addition, increased sedimentation leads to a loss of juvenile rearing and over-wintering habitat. As water temperatures decline in the winter, juvenile salmonids seek interstitial spaces in the substrate where they become torpid. When sediment fills the interstitial spaces, it leaves the juvenile fish with no cover during this period of inactivity and makes them more vulnerable to predation (Georgia Conservancy 2004).

Newcombe and Jensen (1996) summarized 80 published reports on the effects of suspended sediments on fish in streams and estuaries. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days. Suggested limits for suspended sediment were developed by the European Inland Fisheries Advisory Commission and the National Academy of Sciences and adopted by the state of Idaho in previous TMDLs. A limit of 25 mg/L *suspended sediment concentration* (SSC) would provide a high level of protection of the aquatic organisms, 80 mg/L SSC moderate protection, 400 mg/L SSC low protection, and over 400 mg/L SSC very low protection (Thurston et al. 1979).

Bedload sediment also impairs the beneficial uses of some streams in the subbasin. Bedload consists of sediment particles too large or heavy to be suspended, but still transported by flowing water along the streambed. As sand and silt wash downstream, they can cover spawning gravels, increasing embeddedness in the streambed. If this occurs during incubation periods or while small fry are using the spawning gravels to develop, it may eliminate those areas and result in death. Bedload can also reduce inter-gravel dissolved oxygen levels by decreasing the critical re-oxygenating flow through the inter-gravel matrix. Organic suspended sediments can also settle to the bottom and, due to their high carbon content, lead to low inter-gravel dissolved oxygen.

Sediment levels that exceed a stream’s transport capacity often trigger stream morphology changes like excessive widening as the stream tries to stabilize. These processes themselves also result in accelerated erosion rates which further diminishes habitat diversity (i.e. pools, riffles) and impacts fisheries.

Sediments originating from the drainage basin are primarily *inorganic*, have a low carbon content, have high densities, and often increase in the water column during runoff events. Sediments originating instream (from primary production) are organic with a higher carbon content and lower density and often increase in association with algae blooms. The concentration of organic sediments can be underestimated because of their lower density.

Bedload sediment also adversely affects aquatic species, although the direct effects of bedload are difficult to gauge because bedload is largely a function of stream power, which is in most cases not a manageable condition. As sand and silt wash downstream, they can cover spawning gravels, increasing embeddedness in the streambed. If this occurs during incubation periods or while small fry are using the spawning gravels to develop, it may eliminate those areas and result in death. Bedload can also reduce intergravel dissolved oxygen (DO) levels by decreasing the critical re-oxygenating flow through the intergravel matrix.

As mentioned above, bedload is largely a function of stream power, which is driven by stream velocity. In smaller order water bodies, higher velocities are short duration events based on snow melt or storm events. Directly related to the size of the watershed, peaks in the hydrographs and base flow conditions can occur within a week of each other in smaller watersheds, with peak flows occur during a few days. While in the larger watersheds, peak flows and baseline flows may occur months apart, with peak flows lasting for weeks.

These short duration, high velocity flows may not offer the opportunity for complete removal of either the larger sediment particles or the smaller particles which may have entered the water body due to land use practice and/or natural erosion. The other consideration is the presence of fish that prefer slower velocities for refugia and spawning activity. Cold water species, such as trout prefer smaller tributaries for spawning, incubation and fry development, with rearing occurring in the larger water bodies.

Many studies have been conducted to determine the effects of sediments, both bedload and suspended, on cold water species. Suspended sediments or suspended solids usually affect sight-feeding capability, clogging of gills or related stress as mentioned above. Bedload sediment, especially fine sediment of less than 6 millimeters (mm) in diameter, can cause impairment of uses in a variety of ways. Bedload sediment can fill in gravels associated with salmonid spawning gravels, cover redds reducing intergravel dissolved oxygen levels, encase fry, fill in interstitial spaces required for fry development and salmonid food sources, reduce pool volume required for salmonid refugia areas, and cover substrate required for primary food (*periphyton*) production areas.

The particle size of the substrate directly affects the flow resistance of the channel, stability of the streambed, and the amount of aquatic habitat. If the substrate is composed of predominantly fines, 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. For spawning, a mix of gravel with a small amount of fine sediment and small rubble is optimal. When small fines (<6.35 mm) exceed 20-25% of the total substrate, embryo survival and emergence of swim-up fry is reduced by 50% (Bjornn and Reiser 1991).

## Temperature

Temperature is a component of water quality integral to the life cycle of fish and other aquatic species. Different temperature regimes result in varying aquatic community compositions. Water temperature dictates whether a warm, cool, or cold water aquatic community is present. Many factors, natural and anthropogenic (human caused), affect stream temperatures. Natural factors include but are not limited to altitude, aspect, climate, weather, geothermal sources, riparian vegetation (shade), and channel morphology (width and depth). Anthropogenic 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 such4 as low dissolved oxygen or poor food supply. 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. A rise of 1 degree C increases the metabolic rate of cold blooded aquatic organisms by 10%. This means that aquatic organisms end up respiring more and eating more in warmer waters than in colder ones. Acutely high temperatures can result in death if they persist for an extended length of time. If stream temperatures become too hot, fish die almost instantaneously due to denaturing of critical enzymes in their bodies (Hogan 1970). 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.

The upper lethal limits for salmonids range from 23-29° C, depending upon species, with the optimal temperature range lying between 12-14° C. In larger Idaho streams where summer maximum temperatures are 24-26 ° C and minimum temperatures are relatively high (15-16°C), most young salmonids move into tributaries with lower temperatures (Bjornn and Reiser 1991).

Appendix G discusses the role of riparian vegetation, channel condition and streamflow in stream cooling in more detail.

## Bacteria

Coliform bacteria are unicellular organisms found in feces of warm-blooded animals such as humans, domestic pets, livestock, and wildlife. Coliform bacteria are commonly monitored as part of point source discharge permits (*National Pollution Discharge Elimination System* [NPDES] permits), but may also be monitored in nonpoint source arenas. The human health effects from pathogenic coliform bacteria range from nausea, vomiting, diarrhea, acute respiratory illness, meningitis, ulceration of the intestines, and even death. Coliform bacteria do not have a known effect on aquatic life.

Coliform bacteria from both point and nonpoint sources impact water bodies, although point sources are typically permitted and offer some level of bacteria-reducing treatment prior to discharge. Nonpoint sources of bacteria are diffuse and difficult to characterize. Unfortunately, nonpoint sources often have the greatest impact on bacteria concentrations in water bodies. This is particularly the case in urban storm water, agricultural areas and where wildlife is abundant. Wildlife may account for a significant percentage of the bacteria in some water bodies, although the exact percentage is difficult to determine.

The state numeric standard for bacteria is < 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples AND no sample > 406 *E. coli* organisms/100 mL.

## Excess Nutrients

IDAPA 58.01.02.200.06 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." Nutrients in excess quantities often cause rapid *eutrophication* of aquatic systems. The primary production in an aquatic system is often limited by the available concentration of one of these micronutrients (Brochardt 1996). In the western United States, phosphorus is typically the nutrient that has the greatest limiting effect on the production of aquatic plants and algae. Nitrogen (N) to phosphorus (P) ratios are often used to determine the *limiting factor* in aquatic vegetation production and biomass.

Other factors, such as light or available substrates also may limit production of aquatic macrophytes. The algae that grow on the stream and river substrates are called periphytic or benthic algae. They typically consist of single celled organisms called diatoms. These diatoms are the primary food source for many pollution intolerant aquatic macroinvertebrates that scrape the diatoms from the substrate. Sestonic forms of algae are free floating algae cells. They may be dislodged diatoms or other types of colonial algae organisms. If nutrients are in excess of the physiological needs of the diatom community, other less palatable forms of algae grow causing a reduction in the intolerant aquatic community. These less palatable forms include filamentous and colonial algae. In addition to being less palatable, these organisms are considered by some to be aesthetically unpleasing and are what typify nuisance aquatic growths.

The principal nutrients limiting aquatic plant growth in the Payette River watershed are nitrogen and *total phosphorus* (TP). While nutrients are a natural component of the aquatic ecosystem, natural cycles can be disrupted by increased nutrient inputs from anthropogenic activities. The excess nutrients result in accelerated plant growth and can result in a eutrophic or enriched system. The nuisance aquatic growth caused by this enrichment is discussed in the following section.

The first step in identifying a water body's response to nutrient flux is to define which of the critical nutrients is limiting. A limiting nutrient is one that normally is in short supply relative to biological needs. The relative quantity affects the rate of production of aquatic biomass. Either nutrient (phosphorus or nitrogen) may be the limiting factor for algal growth, although phosphorus is most commonly the limiting nutrient in Idaho waters. Ecologically speaking, a resource is considered limiting if the addition of that resource increases growth (IDEQ 2003).

Total phosphorus is the measurement of all forms of phosphorus in a water sample, including all inorganic and organic particulate and soluble forms. In freshwater systems, typically greater than 90% of the TP present occurs in organic forms as cellular constituents in the biota or adsorbed to particulate materials (Wetzel 1983). The remainder of phosphorus is mainly soluble *orthophosphate*, a more biologically available form of phosphorus that consequently leads to a more rapid growth of algae than TP. In impaired systems, a larger percentage of the TP fraction is comprised of orthophosphate.

Nitrogen to phosphorus ratios (N:P) in the North Fork Payette River showed that phosphorus was the limiting nutrient the majority of the time. N:P ratios greater than seven are indicative of a phosphorus-limited system while those ratios less than seven are indicative of a nitrogen-limited system. When nitrogen is limiting, additions of the nutrient can increase vegetation biomass theoretically by 70 times the molecular weight of the nutrient. In contrast, with phosphorus additions the increase is closer to a 500-fold increase in biomass (Wetzel 1975). Because of this, a reduction in phosphorus can reduce the aquatic vegetation to a greater extent than reductions in nitrogen.

Nutrients primarily cycle between the water column and sediment through nutrient spiraling. Aquatic plants rapidly assimilate dissolved nutrients, particularly orthophosphate. If sufficient nutrients are available in either the sediments or the water column, aquatic plants will store an abundance of such nutrients in excess of the plants' actual need, a chemical phenomenon known as *luxury consumption*. When a plant dies, the tissue decays in the water column and the nutrients stored within the plant biomass are either restored to the water column or the detritus becomes incorporated into the river sediment.

As a result of this process, nutrients (including orthophosphate) that are initially released into the water column in a dissolved form will eventually become incorporated into the river bottom sediment. They are then available once again for uptake by yet another life cycle of rooted aquatic macrophytes and other aquatic plants. This cycle is known as nutrient spiraling. Nutrient spiraling results in the availability of nutrients for later plant growth in higher concentrations downstream.

### Floating, Suspended, or Submerged Matter (Nuisance Algae)

Algae are an important part of the aquatic food chain. However, when elevated levels of algae impact beneficial uses, those levels are considered nuisance aquatic growth. The excess growth of phytoplankton, periphyton, and/or macrophytes can adversely affect both aquatic life and recreational water uses. Algal blooms occur where adequate nutrients (nitrogen and/or phosphorus) are available to support growth. In addition to nutrient availability, velocities, water temperatures, and penetration of sunlight in the water column all affect algae (and macrophyte) growth. Low velocity conditions allow algae concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algae growth. When the aforementioned conditions are appropriate and nutrient concentrations exceed the quantities needed to support algae growth, excessive blooms may develop.

Algae blooms commonly appear as extensive layers or mats on the surface of the water. When present at excessive concentrations in the water column, blue-green algae often produce toxins that can result in skin irritation to swimmers, and illness or even death in animals ingesting the water. The toxic effect of blue-green algae is worse when an abundance of organisms die and accumulate in a central area. In 1993, 23 cows died after ingesting water from Cascade Reservoir that had high levels of blue green algae toxins.

Algae blooms also often create objectionable odors and coloration in domestic drinking water, and can produce intense coloration of both the water and shorelines as cells accumulate along the banks. In extreme cases, algae blooms can also result in impairment of agricultural water supplies due to toxicity. Water bodies with high nutrient concentrations that could potentially lead to a high level of algae growth are said to be eutrophic. The extent of the effect is dependent on both the type(s) of algae present and the size, extent, and timing of the bloom.

When algae die in low flow velocity areas, they sink slowly through the water column, eventually collecting on the bottom sediments. The biochemical processes that occur as the algae decompose remove oxygen from the surrounding water. Because most of the *decomposition* occurs within the lower levels of the water column, a large algae bloom can substantially deplete dissolved oxygen concentrations near the bottom. Low dissolved oxygen concentrations in these areas can lead to decreased fish habitat as fish will not frequent areas with low dissolved oxygen. Both living and dead (decomposing) algae can also affect the pH of the water due to the release of various acid and base compounds during *respiration* and photosynthesis. Additionally, low dissolved oxygen levels caused by decomposing organic matter can lead to changes in water chemistry and release of adsorbed phosphorus to the water column at the water/sediment interface.

Excess nutrient loading can be a water quality problem due to the direct relationship of high total phosphorus (TP) concentrations on excess algae growth within the water column, combined with the direct effect of the algal life cycle on dissolved oxygen and pH within aquatic systems. Therefore, the reduction of TP inputs to the system can act as a mechanism for water quality improvements, particularly in surface-water systems dominated by blue-green algae, which can acquire nitrogen directly from the atmosphere and the water column. Phosphorus management within these systems can potentially result in improvement in the following water quality parameters: nutrients (phosphorus), nuisance algae, dissolved oxygen and pH.

### Sediment – Nutrient Relationship

The linkage between sediment and sediment-bound nutrients is important when dealing with nutrient enrichment problems in aquatic systems. Phosphorus is typically bound to particulate matter in aquatic systems and, thus, sediment can be a major source of phosphorus to rooted macrophytes and the water column. While most aquatic plants are able to absorb nutrients over the entire plant surface via a thin cuticle (Denny 1980), bottom sediments serve as the primary nutrient source for most sub-stratum attached macrophytes. The US Department of Agriculture (USDA 1999) determined that other than harvesting and chemical treatment, the best and most efficient method of controlling macrophyte growth is by reducing surface erosion and sedimentation.

Sediment acts as a nutrient sink under aerobic conditions. However, when conditions become anoxic, sediments can release phosphorous into the water column.

Sediments can play an integral role in reducing the frequency and duration of phytoplankton blooms in standing waters and large rivers (Robertson 1999). In many cases there is an immediate response in phytoplankton biomass when external sources are reduced. In other cases, the response time is slower, often taking years. Nonetheless, the relationship is important and must be addressed in waters where phytoplankton is in excess.

## Dissolved Oxygen

Oxygen is necessary for the survival of most aquatic organisms and essential to stream purification. Dissolved oxygen (DO) is the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter (mg/L), parts per million, or percent of saturation. While air contains approximately 20.9% oxygen gas by volume, the proportion of oxygen dissolved in water is about 35%, because nitrogen (the remainder) is less soluble in water. Oxygen is considered to be moderately soluble in water. A complex set of physical conditions that include atmospheric and hydrostatic pressure, turbulence, temperature, and salinity affect the solubility.

Dissolved oxygen levels of 6 mg/L and above are considered optimal for aquatic life. When DO levels fall below 6 mg/L, organisms are stressed, and if levels fall below 3 mg/L for a prolonged period, these organisms may die; oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills. Dissolved oxygen levels below 1 mg/L are often referred to as hypoxic; anoxic conditions refer to those situations where there is no measurable DO.

Juvenile aquatic organisms are particularly susceptible to the effects of low DO due to their high metabolism and low mobility (they are unable to seek more oxygenated water). In addition, oxygen is necessary to help decompose organic matter in the water and bottom sediments. Dissolved oxygen reflects the health or the balance of the aquatic ecosystem. Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. Oxygen enters water from photosynthesis and from the atmosphere. Where water is more turbulent (e.g., riffles, cascades), the oxygen exchange is greater due to the greater surface area of water coming into contact with air. The process of oxygen entering the water is called *aeration*.

Water bodies with significant aquatic plant communities can have significant DO fluctuations throughout the day. Oxygen sags will typically occur once photosynthesis stops at night and respiration/decomposition processes deplete DO concentrations in the water. Oxygen will start to increase again as photosynthesis resumes with the advent of daylight. In many cases excess aquatic plants can cause supersaturation, whereby DO levels may reach unusually high levels during the daylight hours.

Temperature, flow, nutrient loading, and channel alteration all impact the amount of DO in the water. Colder waters hold more DO than warmer waters. As flows decrease, the amount of aeration typically decreases and the in-stream temperature increases, resulting in decreased DO. Channels that have been altered to increase the effectiveness of conveying water often have fewer riffles and less aeration. Thus, these systems may show depressed levels of DO in comparison to levels before alteration. Nutrient enriched waters have a *higher biochemical oxygen demand* (BOD) due to the amount of oxygen required for organic matter decomposition and other chemical reactions. This oxygen demand results in lower in-stream DO.

## 2.4 Summary and Analysis of Existing Water Quality Data

The amount of available data varied substantially between subwatersheds. Types of available data also ranged widely, but typically represent biological, chemical, and physical parameters. Data pertinent to the water quality issues being addressed are presented for each listed stream in this section (Table 5). The subwatershed characteristics and water quality data for each 303(d) listed streams, and also for Squaw Creek are summarized by water body.

The North Fork Payette River and mainstem Payette River have several historic and current USGS gauge sites as well as nutrient and sediment information collected by BOR and DEQ. Data for tributary steams, however, is sparse. Neither flow nor water chemistry information is available for most streams tributary to the TMDL reach with the exception of the South Fork Payette River. Limited summer season monitoring was undertaken by DEQ at the initiation of the TMDL process. This information is augmented by assessments completed as part of DEQ's Beneficial Use Reconnaissance Program (BURP).

**Table 5. Available Data for the North Fork Payette River TMDL.**

| Data Source | Type of Data | Sample Media | Years |
|---|---|---|---|
| Idaho Dept of Fish and Game | Fish Data | North Fork Payette River | Various Years |
| Idaho Dept. of Lands-Native Fish Advisory Group | Bull Trout Watershed Assessment | Smaller 2nd-3rd Order Water Bodies | 2001 |
| Idaho DEQ, Boise | Chemical and Bacteria Point Source Assessment | North Fork Payette River, Payette River and Point Source Effluent | Various Years |
| Idaho DEQ, Boise | Chemical, Biological, Temperature, DO, Bacteria | River (TMDL reach) | 2002-2004 |
| Idaho DEQ, Boise | Chemical, Biological, Temperature, DO, Bacteria | Upstream water quality (Cascade Reservoir Dam) | 1989-2003 |
| Idaho DEQ, Boise | Chemical, Biological, Temperature, DO, Bacteria | River (below Black Canyon Dam) | 1999 |
| US Bureau of Reclamation | Chemical, Biological, Temperature, DO, Bacteria | North Fork Payette River/Reservoir | Various Years |
| Idaho DEQ, BURP | Biological, Habitat, Erosion Inventories | Smaller 2nd-3rd Order Water Bodies | Various Years |
| US Fish and Wildlife Service | Bull Trout Recovery Plan | | |
| US Forest Service | Fish Data-Bull Trout, Temperature Data | Smaller 2nd-3rd Order Water Bodies | Various Years |
| USGS | Chemical, Flows, Biological, Bacteria, Physical | River, Some Tributaries | Various Years |

## Data Assessment Methods

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

### DEQ-Water Body Assessment Guidance – Second Edition (Grafe et al. 2002)

The Water Body Assessment Guidance (WBAG) describes DEQ's methods used to consistently evaluate data and determine the beneficial use support status of Idaho water bodies. The WBAG is not used to determine pollutant-specific impairment. Rather, it 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 Beneficial Use Reconnaissance Program (BURP) data are used in the assessment. The BURP program utilizes standardized procedures to collect aquatic insects, conduct fish surveys, measure water chemistry and document habitat conditions in streams and rivers. The surveys take place during the summer months.

In addition to BURP information, 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.

The multi-metric index approach measures biological, *physiochemical*, and physical habitat conditions within a stream. The indexes include several characteristics to gauge overall stream health. Three primary indexes are used, which include the *Stream Macroinvertebrate Index (SMI)*, the *Stream Fish Index (SFI*) and the *Stream Habitat Index (SHI)*. The SMI is a direct measure of cold water aquatic life health. The SFI is also a direct measure of cold water aquatic life health, but is specific to fish populations. The SHI is used to measure instream habitat suitability, although some of the measurements used to generate the SHI are linked to the riparian area.

A few of the habitat parameters measured by both the BURP *protocol* and also by US Forest Service and Idaho Fish and Game studies are briefly described below.

#### *Width Depth Ratio*

Width-to-depth ratio (W:D) provides a dimensionless index of channel morphology, and can be an indicator of change in the relative balance between sediment load and sediment transport capacity (MacDonald and others 1991). Large width to depth ratios are often a result of lateral bank excursion due to increased peak flows, sedimentation, and eroding banks (Overton et al. 1995). Aberrant width depth ratios can cause reduced pool numbers (Beschta and Platts 1986), increased stream temperature, increased bank erosion and thus direct sediment delivery, decreased riparian vegetation and associated diminished ability of riparian area to capture nutrients and sediment (MacDonald et al. 1991). In the Idaho batholith, width:depth ratios of <10 are not common in even wilderness streams (Overton et al. 1995).

#### *Bank Stability*

Bank stability is rated by observing existing or potential detachment of soil from upper and lower streambanks and its potential movement into the stream. Measurements of bank angle and bank height may also be taken. Generally, steeper banks are more subject to erosion and correspondingly streams with largely unstable banks will often have poor instream habitat. Eroding banks can result in sedimentation, excessively wide streams, decreased depth and lack of vegetative cover. Banks that are protected by plant root systems or boulder/rock material are less susceptible to erosion.

#### *Surface Fines*

Surface fines can impair benthic species and fisheries by limiting the interstitial space for protection and suitable substrate for nest or redd construction. Certain primary food sources for fish (Ephemeroptera, Plecoptera, and Tricoptera macroinvertebrate species [EPT]) respond positively to a gravel to cobble substrate (Waters 1995). Substrate surface fine targets are difficult to establish. However, as described by Relyea, Minshall, and Danehy (2000), macroinvertebrate (Plecoptera) intolerant to sediment are mostly found where substrate fines (<6mm) is less than 30%. More sediment tolerant macroinvertebrates are found where the substrate cover (<6mm) is greater than 30%. Work by Overton (1995) refines the surface fine targets even more by defining conditions found in pristine streams. This information is used when available for interpreting percent fines numbers.

### Cumulative Watershed Effects (CWE) Assessment Methodology

Idaho Code Section 38-1303 (17) defines cumulative watershed effects as "*. . .the impact on water quality and/or beneficial uses which result from the incremental impact of two (2) or more forest practices. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time*." The CWE methodology is designed, first, to examine conditions in the forest watershed surrounding a stream, and then in the stream itself. It then attempts to identify the causes of any adverse conditions. Finally, it helps to identify actions that will correct any identified adverse conditions. The CWE process is utilized for identifying general watershed problems and not as readily for estimating existing loads (quantities) of pollutants.

The CWE process consists of seven specific assessments:
A) Erosion and Mass Failure Hazards
B) Canopy Closure/Stream Temperature
C) Channel Stability
D) Hydrologic Risks
E) Sediment Delivery
F) Nutrients, and
G) Beneficial Uses/Fine Sediment

### Streambank Erosion Inventory

The streambank erosion inventory was used to estimate background and existing streambank and channel erosion in streams where excess sediment was determined to be primarily generated from instream channel erosion. The inventory follows methods outlined in the proceedings from the *Natural Resource Conservation Service* (NRCS) Channel Evaluation Workshop (1983). The NRCS streambank erosion inventory is a field-based method that measures bank and channel characteristics such as stability, length of eroding banks, and depth of eroding banks to calculate a long-term lateral recession rate, expressed in terms of the feet of streambank lost due to erosion per year (ft/year). The lateral recession rate can then be combined with the volumetric mass of the bank material and the length of the segment to determine the sediment load from the streambanks.

### BOISED

BOISED, a version of the Forest Service R1-R4 empirical sediment yield prediction model (WATSED), was developed to predict watershed scale responses to disturbance in the Boise and Payette National Forests for watersheds associated with the Idaho Batholith. Based on locally derived empirical streamflow and sediment yield data, BOISED uses stand properties and landscape units defined in terms of landform, lithology, and soil characteristics. Onsite surface and mass erosion estimates are adjusted for slope delivery based on topographic conditions, and downstream sediment delivery is adjusted on the basis of a watershed sediment delivery ratio. The model is sensitive to forest cutting and soil disturbance activities, including silvicultural practices, road construction practices, and wildfire.

### Evaluation of Intermittence for Selected Streams

The state of Idaho defines an intermittent stream as one that has a period of zero flow for at least one week during most years or has a 7Q2 (a measure of the annual minimum 7-day mean stream flow, based on a 2-year low) hydrologically based flow of less than 0.10 cfs (IDAPA 58.01.02.003.51). If a stream contains naturally perennial pools with significant aquatic life, it is not considered intermittent. The implication of this determination is that TMDLs with the intent of restoring local (in the intermittent segment) beneficial uses will not be performed for these stream segments because water is not present during the critical loading period (typically the growing season) or when aquatic life beneficial uses are expected to be fully supported based on life cycle (middle to late summer months). IDAPA 58.01.02.070.07 states that water quality standards shall only apply to intermittent waters during optimum flow periods sufficient enough to support the beneficial uses for which the water body has been designated. The optimum flow for contact recreation is equal to or greater than 5.0 cfs. The optimum flow for aquatic life is equal to or greater than 1.0 cfs. However, TMDLs developed for downstream, perennial segments may apply to these segments because of their potential to contribute pollutants when water is flowing. For example, if an intermittent segment is typified by unstable, eroding banks due to anthropogenic causes, the load created during flow periods would be subject to a TMDL.

## TMDL Target Analysis

The following is a discussion of targets selected for this TMDL. Table 6 shows the numerical targets used in evaluating pollutant impairment in specific 303 (d) listed water bodies. Some of the water bodies met the TMDL targets and thus a TMDL was not developed for the pollutant (i.e. nutrients and oil/grease for Black Canyon Reservoir).

However, the targets were used to evaluate beneficial use impairment.  For streams that have TMDLs developed, those TMDLs are based on the targets listed for the particular pollutant.

## Table 6. TMDL Water Body Specific Targets.

| Water Body | Pollutant | Target | TMDL Completed |
|---|---|---|---|
| Black Canyon Reservoir | Nutrients<br>Sediment<br>Oil and Grease | 0.025 mg/L total phosphorus/ 10 mg/L chlorophyll-*a*<br>Tributary loading target of 25 mg/L seasonal average suspended sediment<br>5 mg/L oil and grease | No TMDLs completed |
| North Fork Payette River | Nutrients<br>Sediment<br>Temperature | 0.1 mg/L total phosphorus<br>25 mg/L seasonal average suspended sediment/80% bank stability<br>19 degree Celsius average daily maximum temperature (surrogate target= 10% shade)<br>Natural Background Conditions. When natural background conditions exceed the temperature criteria, the temperature criteria will not apply; instead, pollutant levels shall not exceed the natural background conditions. | No TMDL completed<br>TMDL for sediment<br>No TMDL completed |
| Box Creek<br>Fall Creek | Temperature | 9 degree Celsius average daily maximum temperature<br>Natural Background Conditions. When natural background conditions exceed the temperature criteria, the temperature criteria will not apply; instead, pollutant levels shall not exceed the natural background conditions.<br>Box Creek surrogate target: 82% vegetative cover -shade or 1.15 kwh/m$^2$/day<br>Fall Creek surrogate target: 85% vegetative cover-shade or 0.957 kWh/m$^2$/day | TMDL completed<br>TMDL completed |
| Round Valley Creek, Clear Creek, Big Creek, Tripod Creek, Soldier Creek | Sediment | 80% bank stability (surrogate for sediment)<br>For the upper and middle reach of Clear Creek: 12% above natural background BOISED modeled sediment delivery (surrogate for sediment) | TMDLs completed for Round Valley, Clear Creek, Big Creek<br>No TMDL for Tripod or Soldier Creeks |

### Temperature

Temperature targets were based on numeric standards as shown in Table. In order to evaluate the North Fork Payette River from Clear Creek to Smiths Ferry, Box Creek and Fall Creek, potential vegetative canopy cover was used to develop shade targets as a surrogate for temperature. By using shade as a target, that means that as shade is increased, the amount of solar radiation reaching the stream and heating up the water is decreased. The effective shade surrogates address both the size of shade-producing features and stream width, thus entirely addressing solar radiation received by streams.

It is assumed that a stream that meets its potential natural vegetation condition would meet the water quality criteria unless background conditions or flow alteration preclude this attainment. The rules regarding natural background conditions state that 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. Exceptions to this rule may occur in relation to point source discharges. However, there are no point source discharges in the 303(d)listed stream reaches. Shading targets were estimated from shade curves for existing TMDLs that represented similar vegetative types. Shade curves are graphically plotted as % effective shade on the vertical axis versus near stream width on the horizontal axis. As a stream becomes wider, a given vegetation type loses its ability to shade wider and wider streams and thus the shading % number becomes lower. Using a combination of measured and estimated channel width, vegetative communities and the directional aspect for these water bodies, the percent effective shade or the solar radiation loading was estimated using information generated from shade curves from existing TMDLs. Shade results for a grand fir/Douglas fir community were averaged for each stream's average width from Northern California's Mattole (CRWQCB 2002), Oregon's Walla Walla (ODEQ 2004a) and Willamette (ODEQ 2004b) TMDLs and Idaho's South Fork Clearwater TMDL (IDEQ 2002). The TMDL shade curves for these TMDLs were fairly similar. Specifics on the potential vegetative types used are presented in the following water quality data sections for each of these water bodies.

Stream widths for Fall and Box Creek were obtained from pre and post Blackwell Fire BURP data (1994 and 2003). This information showed that channel width did not change significantly due to the fire. River widths were measured at mile intervals on the North Fork Payette River during summer 2004.

Shade is defined as the percent reduction of potential direct beam solar radiation load delivered to the water surface. Thus, the role of effective shade in this TMDL is to prevent or reduce heating by solar radiation. Because effective shade is a measure of energy, a load can be directly calculated from this value.

### Nutrients/Chlorophyll-a

The state of Idaho has narrative criteria for nutrients. A narrative standard for nutrients is appropriate given that the associated problems (excessive growth, low dissolved oxygen, etc.) can occur under a range of concentrations and are related to system characteristics such as flow, temperature, water column mixing, light penetration and water depth. Interpretation of the narrative standard on a site-specific basis is necessary to identify targets that will be protective of designated beneficial uses within the listed segment. Targets for Black Canyon Reservoir are based on chlorophyll-*a* and total phosphorus which are linked both directly and indirectly to beneficial use impairment. For example, indirect beneficial use impairment presents itself as low dissolved oxygen (DO) and high pH at or above these chlorophyll *a* levels. Beneficial use impairment is directly linked to the chlorophyll *a* indicators during nuisance algal blooms. EPA also suggests that chlorophyll-*a* is a desired endpoint because it can usually be correlated to loading conditions. Chlorophyll-*a* is the essential photosynthetic pigment found in aquatic plants. This TMDL utilizes the targets selected for the Cascade Reservoir TMDL because Black Canyon Reservoir is in the watershed directly downstream of the Cascade watershed. The Cascade Reservoir TMDL upstream of Black Canyon Reservoir used a 10 µg/L mean growing season chlorophyll- *a* target. The growing season is defined as the period from April through September.

Recently developed, EPA ecoregional reference criteria showed a 25$^{th}$ percentile reference concentration of 4.7 µg/L chlorophyll-*a* for lakes and reservoirs in this ecoregion (EPA 2000a).

While no state of Idaho standards exist for the numeric value of excess nutrients (phosphorus in this case), EPA has suggested guidelines to determine when phosphorus is in excess. General guidelines from 1986 suggested that to prevent the development of a biological nuisance and to control accelerated *cultural eutrophication*, total phosphorus (TP) on a monthly average should not exceed 0.05 milligrams per liter (mg/L) in streams that enter a lake or reservoir (EPA 1986). This target was used for the Payette River at Montour Bridge where the river flows into the reservoir to determine of nutrient loading was in excess of assimilative capacity. The EPA also suggested that TP on a monthly average not exceed 0.1 mg/L in any stream or other flowing water (EPA 1986). In reservoirs this guideline was set at 0.025 mg/L TP. These guidelines were used in the Cascade Reservoir TMDL (IDEQ 1996) and the efficacy of these guidelines was evaluated by reservoir modeling.

The 2000 EPA Ambient Water Quality Criteria Recommendations in Nutrient Ecoregion III (Xeric West) for both rivers and streams, and lakes and reservoirs reported sub-ecoregion 12 (Snake River Basin) reference conditions for total phosphorus in lakes and reservoirs to be 0.02 mg/L. This TMDL uses the 0.025 mg/L TP guideline because of the run-of-the-river characteristics of Black Canyon Reservoir and the utilization of this target for Cascade Reservoir (IDEQ, 1996). In other words, a retention time of 7-15 days results in Black Canyon Reservoir acting more like a river than a lake and nutrients tend to be transported through the system before they're utilized by aquatic plants. The 0.025 mg/L TP target is also assumed to be in the range of allowable conditions set by the ecoregional nutrient criteria.

The NFPR SBA and TMDL will use both chlorophyll *a* indicator guidelines and the EPA TP concentration guidelines to determine if beneficial use impairment has occurred. Black Canyon Reservoir is assessed using the 0.025 mg/L TP monthly average and the 10 µg/L chlorophyll *a* indicator. A comparison to EPA ecoregional criteria is also made. The rationale for this dual indicator is that elevated nutrient concentrations do not link directly to beneficial use impairment unlike chlorophyll-*a*. Other measures used to corroborate nutrient problems in these streams, such as low DO and elevated pH are also investigated.

### Water Column Sediment Targets for the North Fork Payette River

As shown in Table 12 (page 109), the standard for sediment is narrative. The standard says "*sediment shall not exceed quantities specified in general surface water quality criteria (IDAPA 58.01.02.250 or 252) or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses*." Since no specific sediment criteria exist for the North Fork Payette River, surrogate targets are used. Surrogates can be defined as alternative, numeric measures to narrative water quality standards. The surrogate targets are specifically designed to be protective of the designated aquatic life beneficial use (cold water aquatic life).

The acute criterion targets were first developed as part of the Lower Boise River sediment TMDL (IDEQ 1999) and are based on the extensive work of Newcombe and Jensen (1996). Newcombe and Jensen evaluated 80 published and adequately documented reports on fish response to suspended sediment concentration (SSC) in streams.

The result of their work was several species and age-specific dose-response matrices showing the expected effects of SSC on different species and ages of fish over different periods of exposure (duration). Using this concept, the durational targets shown below were developed (IDEQ 1999). The targets are designed to account for both chronic and acute exposure to excess water column sediment. The short-term target allows for natural variability due to storm and seasonal runoff events.

- a seasonal target of 25 mg/L suspended sediment
- a geometric mean of 50 mg/L suspended sediment for no longer than 30 consecutive days
- a geometric mean of 80 mg/L suspended sediment for no longer than 10 consecutive days

The targets shown above are expressed in terms of suspended sediment concentration. SSC is a protective (of aquatic life) measure of water column sediment because the laboratory analysis for SSC has the finite ability to capture sand size and smaller particles in the water column. These sized particles can be particularly dangerous to fish when in excess.

### Oil and Grease

In 1976, EPA produced the "Red Book" of national water quality criteria (EPA 1976) with the following criteria recommendations for oil and grease:

> For domestic water supply: Virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products.
>
> For aquatic life:
> (1) 0.01 of the lowest continuous flow 96-hour LC50 (LC=lethal concentration) to several important freshwater and marine species, each having a demonstrated high susceptibility to oils and petrochemicals.
> (2) Levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota should not be allowed.
> (3) Surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin, as well as petroleum-derived oils.

These same recommendations were repeated in EPA's "Gold Book" of quality criteria for water (EPA, 1986). Texts in these documents warn that petroleum products are very harmful to aquatic life. EPA indicates that sublethal effects are reported at concentrations from 10 to 100 µg/L (.01-0.1 mg/L). This wide range of criteria recommendations is because toxicity of oil and grease pollutants can be highly variable, depending upon whether the oil and grease is from petroleum products or animal or vegetable oils.

New analytical methods for measuring oil and grease and *non-polar material* (NPM) were adopted by EPA in 1999 (EPA 1999b). The method detection limit (MDL) cited by EPA for these methods is 1.4 mg/L and the minimum level of quantification (ML) is 5 mg/L. However, the Idaho State Bureau of Laboratories has established a MDL of 1 mg/L for Method 1664 and a ML of 1 mg/L.

Several states (WY, IN) and EPA Region 3 have used an oil and grease numerical criterion in their water quality standards of 10 mg/L (Buening 2001; EPA 2003; Wyoming Water Quality Standards, Chapter 1). This value is derived from the concentration where oil sheens or films do not appear on surface waters (EPA, 2003).

The Portneuf River TMDL in southeast Idaho used a 5 mg/L target for its oil and grease TMDL. In this case, DEQ looked to surrounding states for a numerical target and found Wyoming's 10 mg/L standard. DEQ then halved that value because, 1) it provides a margin of safety, and 2) sets the target at EPA's minimum quantification level (ML).

EPA's criteria documents and the NPS evaluation show that petroleum products can be harmful to aquatic life at levels well below 1 mg/L. But, it is also evident that oil and grease can be made of compounds, including animal and vegetable oils, that are not necessarily harmful to humans or aquatic life. In the past, higher targets have been used to address the aesthetic concerns of oil and grease, meaning standards have been developed at the much higher 10 mg/L level to avoid producing visible sheen while not necessarily being entirely protective of aquatic life.

For this TMDL, an average concentration of 5 mg/L will be used because this target level is both conservative and accounts for chronic toxic effects to aquatic life.

### Streambank Erosion Inventory

The streambank inventory was used to estimate background and existing streambank and channel erosion in streams where excess sediment was determined to be primarily generated from instream channel erosion. The streams inventoried included Big Creek, Clear Creek, Fall Creek, Round Valley Creek, Soldier Creek and Tripod Creek. Some streams received a more cursory inventory than others once overall bank stability was determined to be high.

The inventory follows methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (1983). The NRCS streambank erosion inventory is a field-based method that measures bank and channel characteristics such as stability, length of eroding banks, and depth of eroding banks to calculate a long-term lateral recession rate, expressed in terms of the feet of streambank lost due to erosion per year (ft/year). The lateral recession rate can then be combined with the volumetric mass of the bank material and the length of the segment to determine the sediment load from the streambanks.

Streambank erosion inventories are linked to bank stability, which is used as a surrogate for instream particle size distributions. Previous TMDLs (IDEQ 2001a, 2001b, 2003) have established a linkage between 80% streambank stability and less than 30% fine substrate material in riffles. This linkage allows for the restoration of beneficial uses to be assessed based on bank stability (i.e. streams with >80% bank stability will likely support cold water aquatic life beneficial uses). Of course, this linkage is based on sediment related use impairment only. If factors other than excess sediment are impairing uses, this method will not detect them and they must be addressed elsewhere.

For this TMDL, DEQ staff calculated the streambank erosion rates of stream types where banks are expected to be greater than 80% stable and the particle size distribution in riffles is expected to contain less than 30% fines (particles <6.0 mm in diameter) or more specifically the Overton (1995) mean reference condition for percent fines defined for that stream Rosgen type and geology. These erosion rates are then used as reference rates for similar morphological channel types on the §303(d) listed streams where banks are eroding and fine materials exceed 30% in riffles. The reference rates become the benchmark for the impaired stream and thus, the basis of load reductions.

BOISED Targets

BOISED was not developed specifically for TMDL analysis, and while not designed to predict absolute quantities of sediment delivered to a water body at a specific time, the model does produce quantified estimates of average annual sediment yield. However, for Clear Creek, the BOISED information currently provides the most comprehensive estimate of sediment delivery from roads and BOISED modeling done in the upper and middle reaches of Clear Creek is used for determining sediment allocations. The target selected is based on sediment delivery results for a watershed that has percent surface fines similar to that of streams in undisturbed watersheds. This target of 12% over natural background sediment delivery was then applied throughout the modeled watershed and used to determine an allocation based upon sediment delivery rate. This target links to an amount of surface fines indicative of no impairment.

Like all models, BOISED has a higher degree of sensitivity for some parts of the analysis than for others. BOISED is used by the Forest Service to determine the different sediment delivery rates over natural background presented by different timber management scenarios. Since road construction can result in significant sediment inputs to streams depending upon type of road constructed and location, BOISED is often used to evaluate road construction alternatives. BOISED does not examine the effects of management activities on landslides nor does it incorporate increases to sediment loads due to fire, range, or agricultural activities. The estimates provided by these models are based on current sediment sources during average climatic conditions. DEQ chose a very conservative target to account for the uncertainty in the model.

### North Fork Payette River

General North Fork Payette River subwatershed characteristics are covered in the Sub-basin Characteristics section, Section 1.2.

The North Fork Payette River from Clear Creek to Banks is in the Southern Forested Mountains ecoregion of the Idaho Batholith (McGrath et al., 2001). Open Douglas fir (*Psuedotsuga menziesii*) forests are common with grand fir (*Abies grandis*) and subalpine fir (*Abies lasiocarpa*) at higher elevations and Ponderosa pine (*Pinus ponderosa*) predominant in canyons.

From Banks to Black Canyon Reservoir, the landscape becomes markedly more arid as the river drops in elevation and moves into areas of Columbia River basalt.

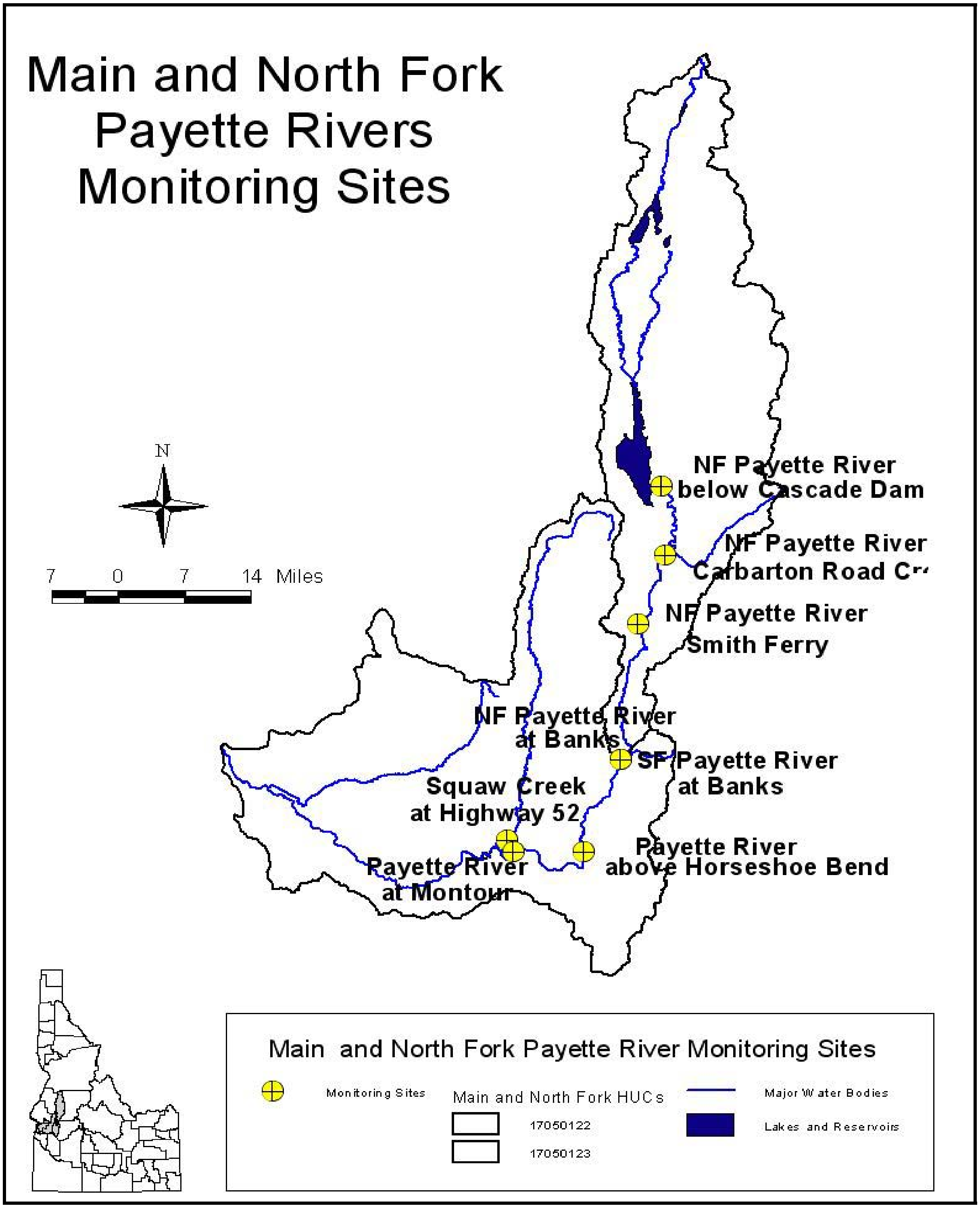


**Figure 20. Main and North Fork Payette River Monitoring Sites.**

Flow Characteristics
The North Fork Payette River is a hydrologically modified system with flow largely influenced by outflow from Cascade Dam and in the lower reach, inflow from the South Fork Payette River. Peak flow usually occurs in late May and June from both snowmelt runoff and release of water from Lake Cascade after the reservoir fills (Figures 21 and 22). The average annual runoff at Horseshoe Bend is about 2.35 million acre-feet of water per year. Base flow is usually in November. If the system were not hydrologically modified, base flows would probably occur in August. Prior to the reservoir filling, releases in winter and spring are generally around 200 cubic feet per second (cfs). The BOR informally operates Cascade and Deadwood to try and keep maximum flows below 12,000 cfs at the Horseshoe Bend gauge. During the summer months, flows are generally kept at between 2,100-2,600 cfs at the Horseshoe Bend gauge in order to meet the needs of downstream irrigators. Dam releases are from Cascade and Deadwood Reservoirs.

The floods of early 1997 changed the characteristics of some of the rapids as well as created a new class III rapid on the Main Payette due to landslides that dumped large amounts of debris into the river. As shown in Figure 23, rain-on-snow events caused flows to spike to almost 20,000 cfs around New Years day and then flows remained unseasonably high during January and February.

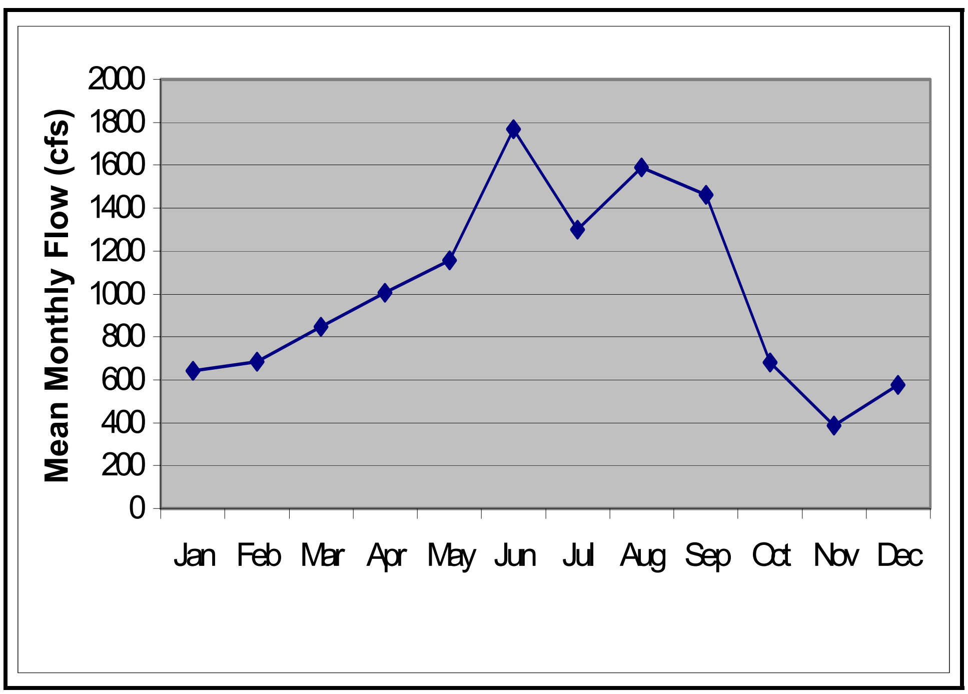


**Figure 21. North Fork Payette River Average Monthly Flows at Cascade Reservoir Dam: 1980-2002.**

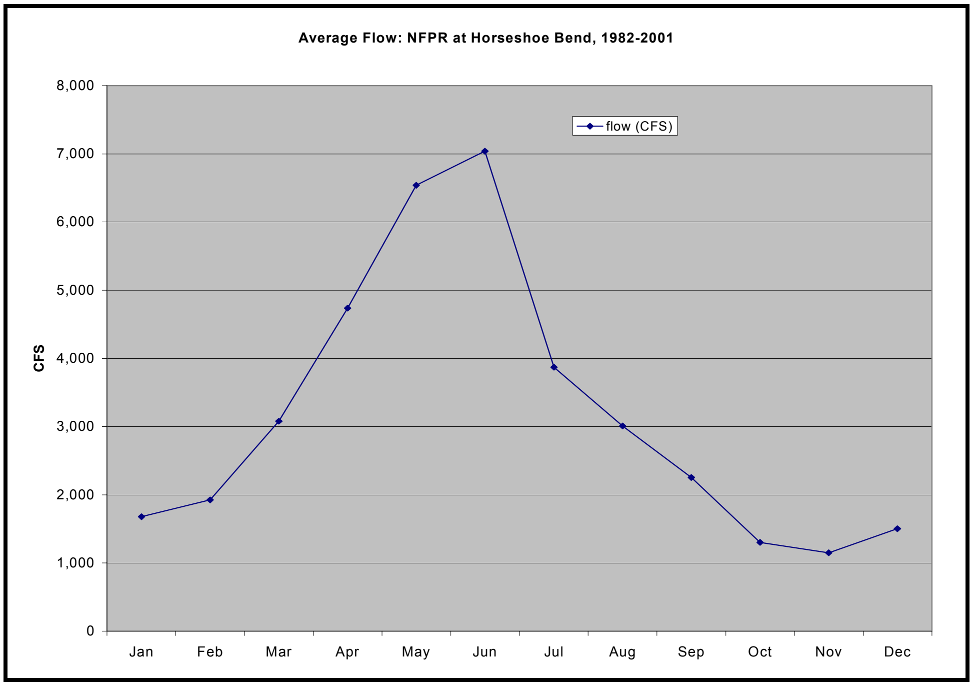


Figure 22. Average Flow: NFPR at Horseshoe Bend.

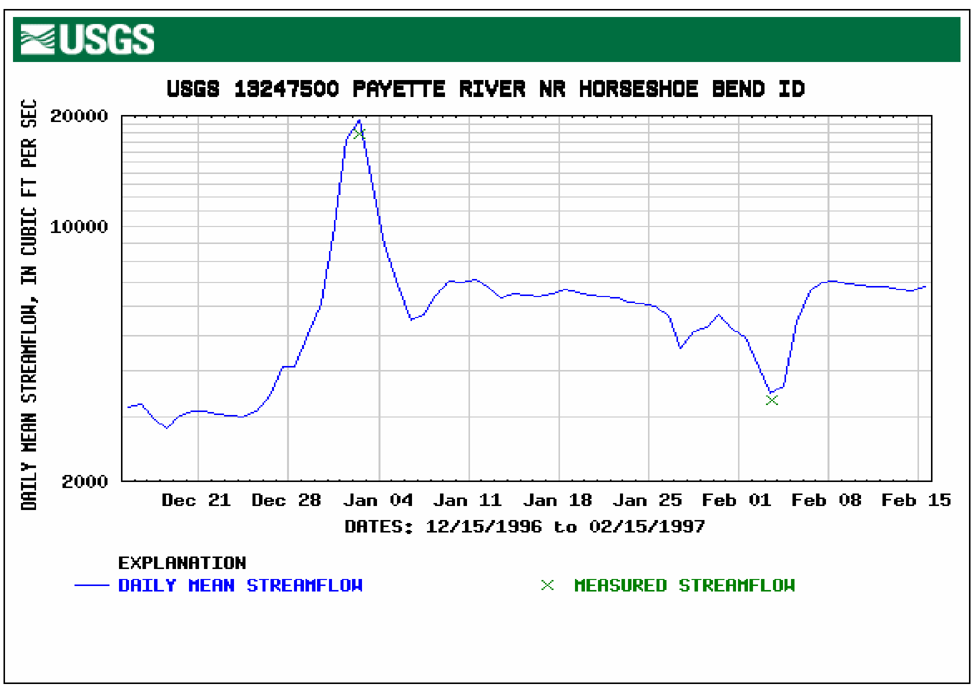


Figure 23. Daily Mean Streamflow: NFPR Winter 1996-97.

## Water Column Data

DEQ started collecting monthly water quality data in October 2002, on the North Fork and Main Payette River at stations located at Cascade Reservoir dam (CRD), the Cabarton Bridge south of Cascade (CB), the Smith's Ferry Bridge east of Highway 55 (SFB), the Highway 55

Bridge at Banks (BB), the Gardena Bridge west of Highway 55 (GB), near the Mill Pond intake pump at Horseshoe Bend (HSB), and the Montour Bridge south of Highway 52 (MB). In 2004, DEQ dropped the Gardena Bridge site, but started monitoring Squaw Creek, the mouth of the South Fork Payette River and Black Canyon Reservoir (Figure 20). Figures 23-30 display DEQ data.

### Nutrients: North Fork Payette River: Cascade Dam to Smiths Ferry

While there is aquatic plant growth in slow moving areas of the river, impairment to fisheries or recreation is not evident. Total phosphorus concentrations in the river at Smiths Ferry were less than 0.1 mg/L for all sampling events (Figure 24) which is below the EPA Gold Book target and also the Cascade Reservoir TMDL target of 0.1 mg/L for a river that discharges into another river (the North Fork Payette River discharges into the Main Payette River). The total phosphorus concentrations averaged 0.04 mg/L from April to September and 0.04 mg/L for the entire 2003 sampling season as shown in Figure 25. These concentrations were also below the 0.05 mg/L Cascade Reservoir TMDL and 1986 EPA Gold Book recommended criterion for total phosphorus for rivers that drain directly into reservoirs. The 2004 April to September data showed a 0.058 mg/L average total phosphorus concentration and 0.05 mg/L median total phosphorus concentration. Averaging the monthly data together for the 2003 and 2004 water years resulted in an annual average of 0.047 mg/L and an April to September average of 0.047 mg/L.

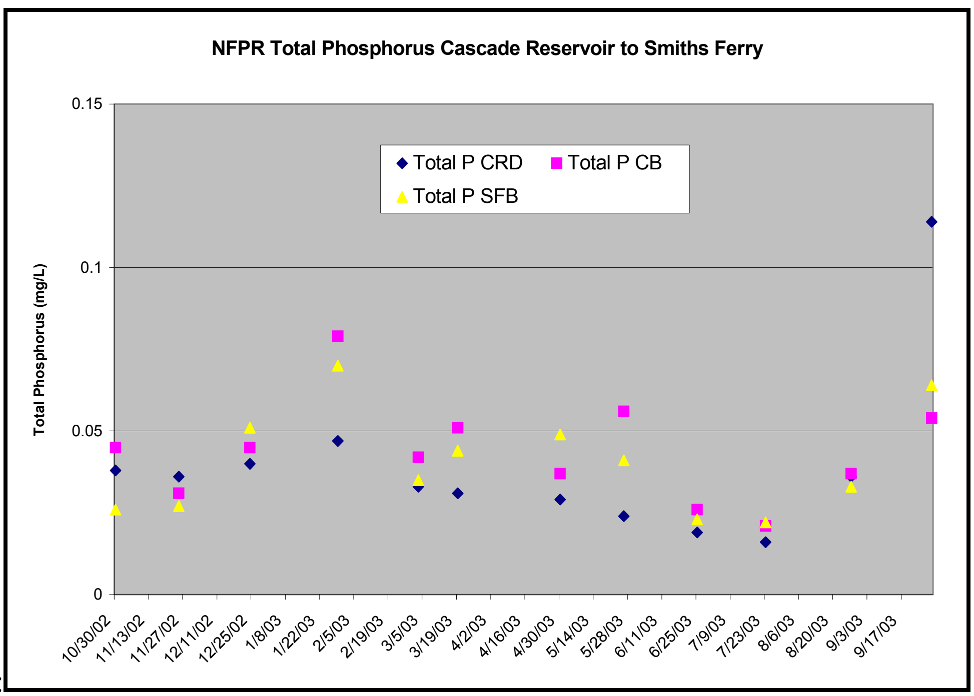


**Figure 24. Total Phosphorus Measurements: NFPR 2003.**

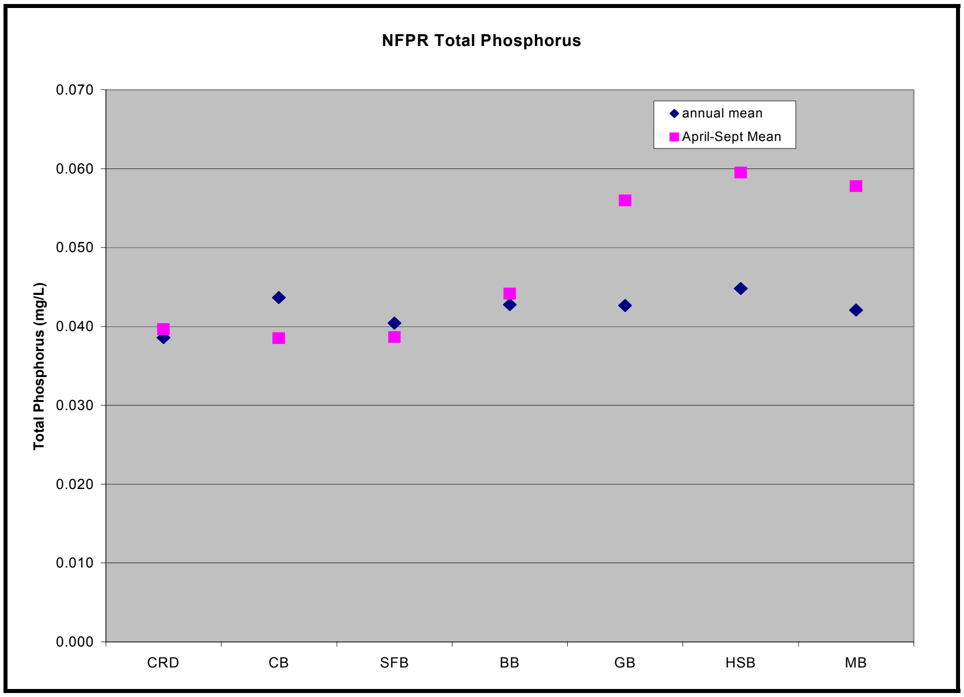


**Figure 25. 2003 Total Phosphorus Annual Mean and April-September Mean Concentrations.**

## Dissolved Oxygen

As shown in Figure 26, dissolved oxygen levels were generally above the standard of 6 mg/L with the exception of July, when dissolved oxygen levels in the water released from Cascade were below 6 mg/L. However, specific standards exist for waters discharged from dams, reservoirs, and hydroelectric facilities and the standard was not violated. Idaho Power records show that in the river, below the dam, dissolved oxygen levels were below 6 mg/L, 21 days out of 31 during July. Blowers, in place to help oxygenate the water, were activated for at least 12 of those days. The state water quality standards states that between June 15–October 15, the 30 day minimum shall be 6 mg/L or greater, the instantaneous minimum 3.5 mg/L or greater and the 7 day mean minimum shall be 4.7 mg/L or greater. Dissolved oxygen concentrations met these criteria during this time. Dissolved oxygen concentrations at Smiths Ferry remained above 6 mg/L for the entire sampling season.

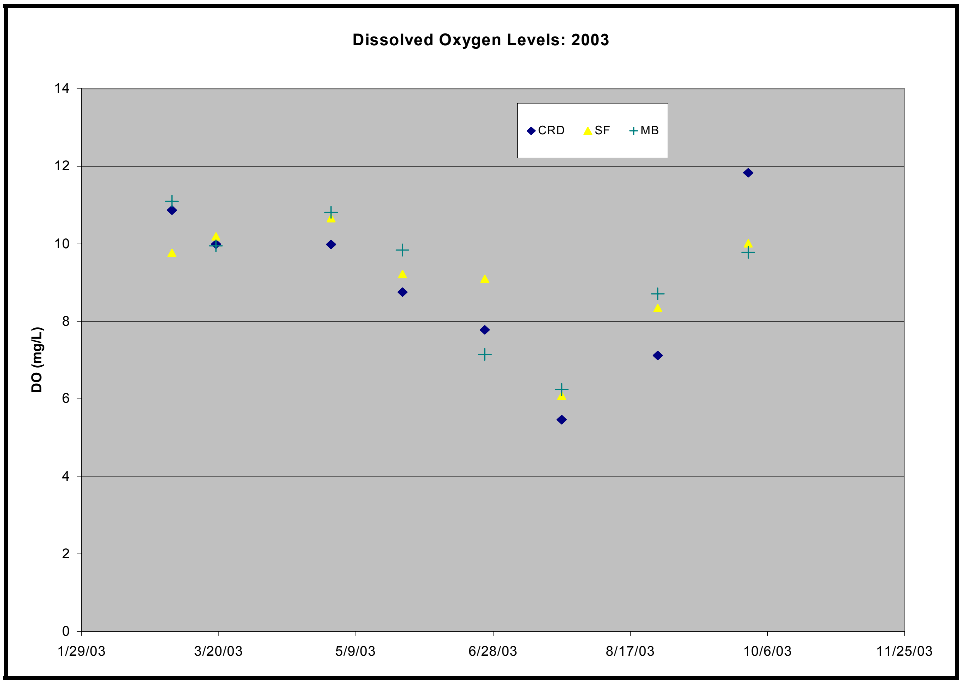


**Figure 26. Dissolved Oxygen Levels: 2003 Sampling Season.**

## Sediment: Cascade Dam to Smiths Ferry

Total suspended sediment concentrations were well below the 25 mg/L target and the 50 mg/L monthly average concentration recommended by the European Inland Fisheries Advisory Commission and the National Academy of Sciences and adopted by the state of Idaho in previous TMDLs (Figures 27 and 28).

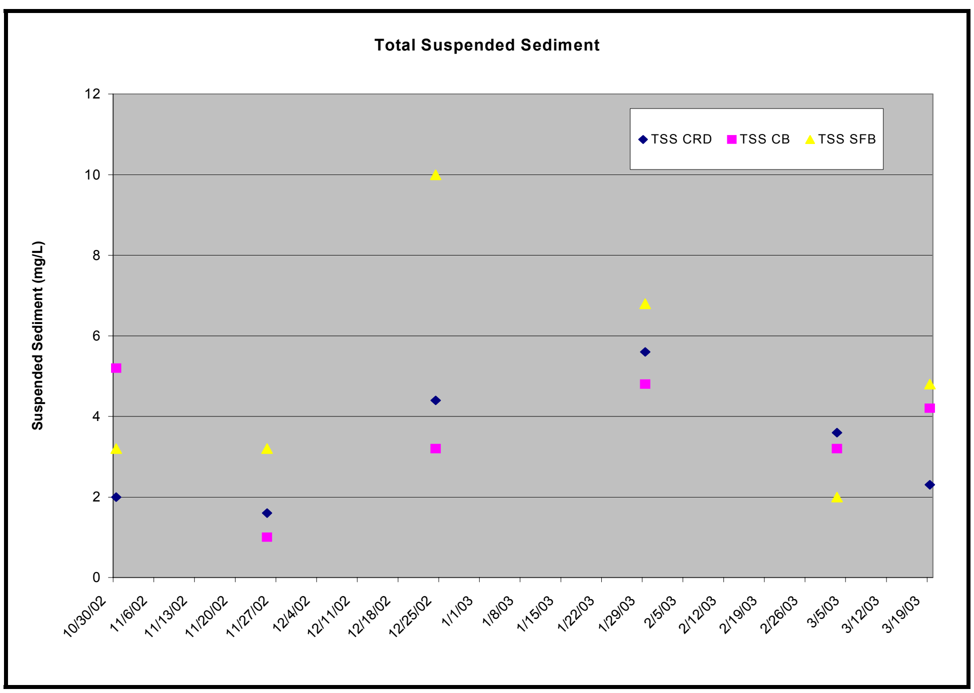


**Figure 27. 2003 TSS Concentrations NFPR: Cascade Dam to Smiths Ferry.**

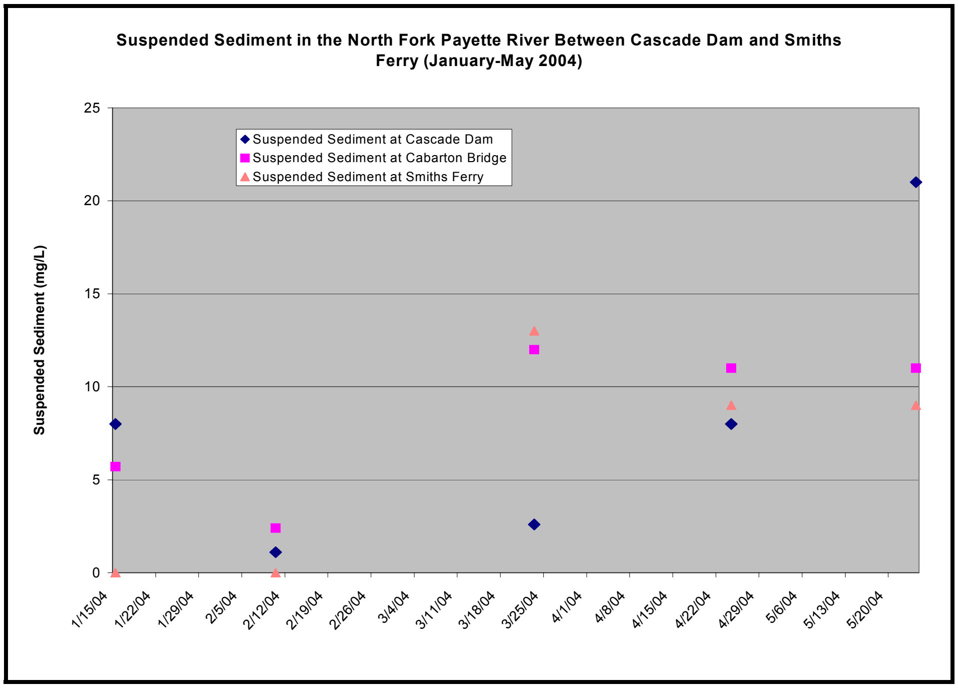


**Figure 28. 2004 SSC Concentrations NFPR: Cascade Dam to Smiths Ferry.**

However, bedload deposition is likely impairing beneficial uses in the Cabarton reach so a further investigation of sediment sources was undertaken. Suspended sediment sampling was not able to quantify the load of heavier particles, such as sand, that were being delivered into the Clear Creek to Smiths Ferry section.

An aerial photograph analysis of bank stability was done for the banks of the North Fork Payette River from Cascade Dam to Smiths Ferry, because excess bedload was surmised to come from both tributary loading and instream bank erosion from <80% stable streambanks. Streambank erosion was used as a surrogate for bedload sediment.

This analysis showed that the overall average bank stability was 70%, which is below the 80% bank stability target. Thus, excess sediment is being delivered to the river from bank erosion. Bank heights were estimated from the photographs and these values were used to calculate the bank erosion rate.

## Temperature

As shown in Figure 29, water exiting Cascade Reservoir is above the state cold water aquatic life temperature criteria in July and early August. The water cools down by the time it reaches Black Canyon Reservoir, primarily due to the cold water influence of the South Fork Payette River. During July and August, the tributaries to the river, with the exception of the South Fork Payette, are generally very small volume streams (<5 cfs) whose input for thermal cooling is negligible (< 5% of total instream flow-calculated over 57 miles of river from Cascade to Horseshoe Bend).

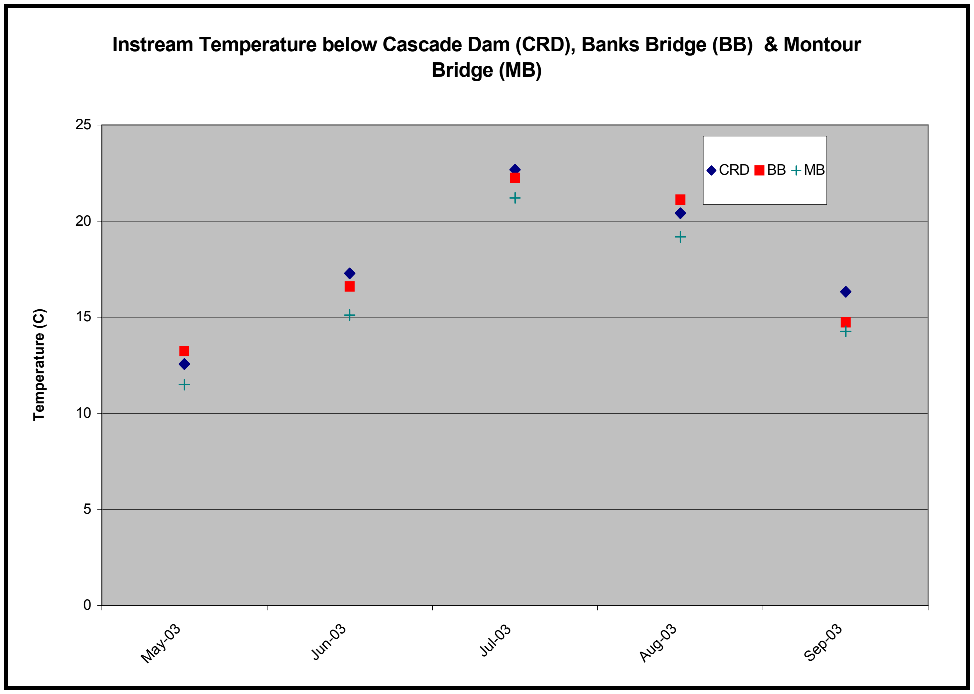


**Figure 29. Instantaneous Temperature Measurements: NFPR 2003 (DEQ Data).**

The 303 (d) listed stretch of the North Fork Payette River from Clear Creek to Smiths Ferry has historically been managed for timber and, to a lesser extent, for livestock. Several miles of this stretch near the highway are constrained by both the highway on one side and the railroad bed on the other. Both sides have been impacted by the railroad tracks that cross from one side to the other about halfway down the reach. However, as viewed on recent aerial photographs, none of these impacts appear to have affected streamside forest vegetation.

After the North Fork Payette River leaves Cascade Reservoir it weaves its way through an open valley south of the city of Cascade. Clear Creek joins the river near the bottom of the valley (4800 feet) just before the river plunges through a forested canyon known locally as the Cabarton Run. The river runs north to south so the west side of the canyon faces east. The west side is less steep than the west-facing east side. The forest on the west side is more open due to access for forest thinning activities provided by the Cabarton-High Valley Road and because Ponderosa pine is predominant, whereas, the steeper east side tends to have higher density of conifers and slightly more Douglas fir.

Figure 30 shows the difference in instream temperatures between the North Fork Payette River at Cabarton Bridge and at Smiths Ferry. The Smiths Ferry temperatures were warmer until late summer. The cooler Cabarton Bridge temperatures at the end of the summer is likely attributable to the fact that the Cabarton Bridge logger ended up buried in over a foot and half of sand during that time while the Smiths Ferry logger was above the substrate.

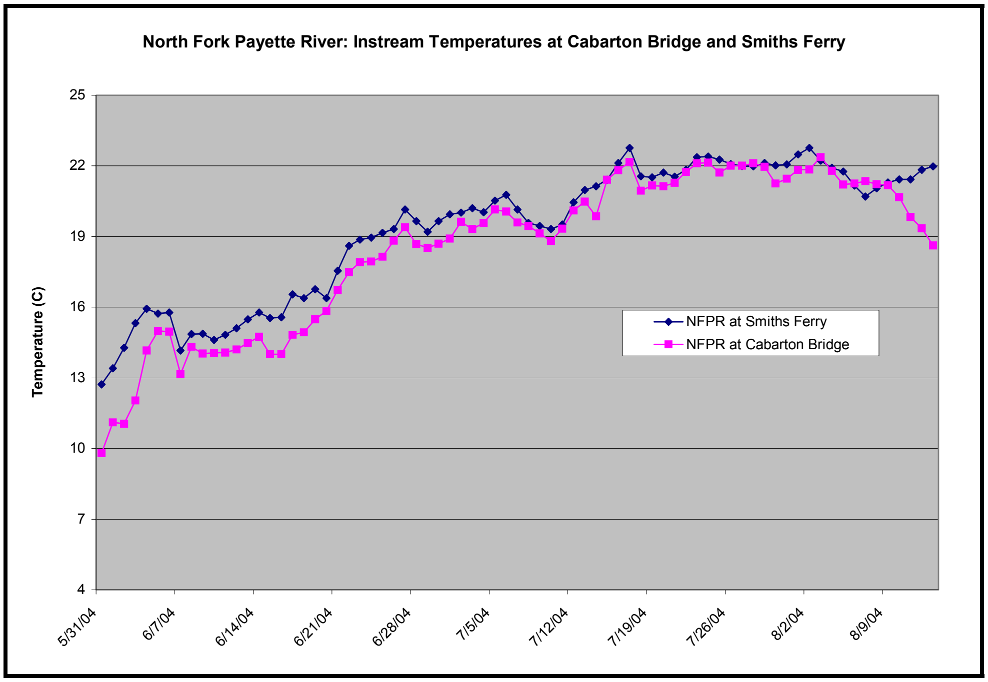


**Figure 30. North Fork Payette River Instream Temperatures (DEQ Data).**

Since the inflows from tributary streams are negligible in relationship to the volume of water that exits Cascade Dam and the larger tributaries meet the cold water aquatic life standard, DEQ evaluated potential shade to see if temperature were elevated due to anthropogenic effects. Solar pathfinder data and vegetative shading curves were used to evaluate whether increases in temperature in this 10 mile stretch of 303(d) listed river between Cabarton Bridge and Smiths Ferry were greater than those expected if optimal shading conditions existed. Heat inputs from tributaries in this section were estimated to be negligible. Two streams (Fawn and Brush Creek) had temperature logging devices installed during Summer 2004, and both streams met the cold water aquatic life standard indicating that cool water is entering the river.

Shade curves (effective shade and solar radiation versus near stream disturbance zone or stream width) for a Ponderosa pine dominated riparian community and a Douglas fir dominated riparian community were adapted to the North Fork Payette River watershed from the Crooked Creek TMDL (DEQ 2002). Since the riparian communities are a mix of Ponderosa pine and Douglas fir communities, a shade target of 10%, or halfway between the two individual shade curve estimates, was used to represent optimal shading conditions for the river corridor.

**In-stream Targets**

In the Crooked Creek TMDL (DEQ 2002), a temperature TMDL in the Middle Salmon – Chamberlain Subbasin, shade curves were developed by EPA using computer software developed by the Oregon Department of Environmental Quality. Shade curves (effective shade and solar radiation versus near stream disturbance zone or stream width) were developed for a Ponderosa pine dominated riparian community and a Douglas fir dominated riparian community. This shade curve was adapted to the North Fork Payette River TMDL. The Ponderosa pine community had a weighted average canopy cover of 58%, a weighted average height of 59 feet, and an estimated overhang of 5.9 feet, whereas the Douglas fir community had a weighted average canopy cover and height of 64% and 83 feet, and an estimated overhang of 8.3 feet. Although the curves in that TMDL only extended to a stream width of about 49 feet (15m), extrapolating the curves out to 174 feet (the average width of the NF Payette reach in question, see Table 8) would produce an effective shade of about 20% from the Douglas fir community and close to 0% from the Ponderosa pine community. The Ponderosa pine community on the west bank of the Payette River would produce some shade given the height of those trees, however because of its low density and the width of the river, the resulting shade would be negligible.

Since the forested community on the banks of the North Fork Payette River is a mixture of Ponderosa pine and Douglas fir, shade may be lower than the 20% estimated from shade curves for a Douglas fir community, and yet higher than the negligible amount of shade produced by the Ponderosa pine shade curves. Therefore, for this TMDL a shade target of 10%, or halfway between the two shade curve estimates will be used.

**Loading Capacity**

Solar Radiation for flat-plate collectors facing south was measured at a National Renewable Energy Lab (NREL) station in Boise, Idaho. Average monthly solar radiation for the six summer months (April through September) as measured by a flat-plate collector with zero tilt ranged from 5.1 kWh/m$^2$/day in September to 7.6 kWh/m$^2$/day in July (Table 7). These values correspond to 100% solar input on a flat surface near ground level or 0% shade. Because our shade target is 10% shade, then solar radiation inputs to the river would be 90% of these values or 4.6 kWh/m$^2$/day in September and 6.8 kWh/m$^2$/day in July (Table 7).

**Table 7. Average Solar Radiation (kWh/m$^2$/day) for Summer Months at 0% Shade and the 10% Target Shade Levels.**

| Month | April | May | June | July | August | September | Average |
|---|---|---|---|---|---|---|---|
| 0% Shade | 5.3 | 6.5 | 7.2 | 7.6 | 6.6 | 5.1 | 6.4 |
| 10% Shade | 4.8 | 5.9 | 6.5 | 6.8 | 5.9 | 4.6 | 5.7 |

**Existing Conditions**

During the summer of 2004, effective shade was measured using a solar pathfinder at one-mile intervals on the North Fork Payette River from the mouth of the Cabarton canyon (just below Clear Creek) to the meadow opening above Smiths Ferry (Table 8). Additionally, stream widths were measured at every half-mile interval through the same stretch. The average river width was 174 feet and average summer (April – September) shade as measured by the pathfinder varied from 38% to 0%, with the overall average for the reach equaling 13% shade during the six months. Because summer shade is more important from a river temperature standpoint, the average shade during the months of April through September was calculated. Table 8 also presents the average solar radiation to the stream as a result of the shade levels for each month and the summer average.

**Table 8. Existing Average Shade, Average Solar Radiation, and River Widths for the NF Payette River Cabarton Reach.**

| Distance Down stream (miles) | River Width (feet) | April Ave. Shade (%) | May Ave. Shade (%) | June Ave. Shade (%) | July Ave. Shade (%) | Aug. Ave. Shade (%) | Sept. Ave. Shade (%) | Summer (Apr. – Sept.) Ave. Shade (%) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 222 | 41 | 33 | 20 | 20 | 35 | 79 | 38 |
| 0.5 | 126 | - | - | - | - | - | - | - |
| 1.0 | 234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.5 | 246 | - | - | - | - | - | - | - |
| 2.0 | 180 | 25 | 22 | 16 | 22 | 26 | 36 | 24.5 |
| 2.5 | 102 | - | - | - | - | - | - | - |
| 3.0 | 132 | 27 | 15 | 14 | 15 | 24 | 32 | 18.7 |
| 3.5 | 216 | - | - | - | - | - | - | - |
| 4.0 | 171 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.5 | 255 | - | - | - | - | - | - | - |
| 5.0 | 114 | 22 | 22 | 19 | 22 | 28 | 20 | 22.2 |
| 5.5 | 114 | - | - | - | - | - | - | - |
| 6.0 | 192 | 2 | 2 | 0 | 0 | 3 | 1 | 1.3 |
| 6.5 | 129 | - | - | - | - | - | - | - |
| 7.0 | 162 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 174 | 14.6 | 11.8 | 8.6 | 9.9 | 14.5 | 21 | 13 |
| Solar Radiation ($kWh/m^2$/day) | | 4.5 | 5.7 | 6.6 | 6.8 | 5.6 | 4.0 | 5.6 |

Pathfinder data taken on the North Fork Payette River (Cabarton reach) show that the riparian forest is essentially at its target level. Although the west bank is influenced by the railroad corridor and the logging activities in the forest, it is not likely that any additional shade could be obtained from a Ponderosa pine dominated forest on such a wide river reach.

## Conclusions

The reach from Clear Creek to Smiths Ferry does not appear to be impaired by nutrients or suspended sediment and a TMDL is not necessary. Using the Cascade Reservoir nutrient target of 0.1 mg/L for total phosphorus for a river system that discharges into a river, this section will be delisted for nutrients. Similarly, suspended sediment concentrations were far below the suspended sediment targets and suspended sediment will be recommended for delisting from the 303(d) list.

However, there appears to be a large amount of bedload that is being transported downstream into the Cabarton reach (the reach from Clear Creek to Smiths Ferry). Several streams were assessed by the BURP process in the Cabarton reach and all the streams (Fawn Creek, Bogus

Creek, Boulder Creek, Phillips Creek) showed unimpaired beneficial uses and streams in this reach are not suspected to be sediment loaders to the North Fork Payette River. While DEQ was unable to monitor for bedload due to time and sampling constraints, an aerial photograph analysis of bank stability for the North Fork Payette River was completed, showing that bank stability was 70%. This is below the target of 80% stability and a TMDL will be completed for bedload sediment in order to improve sediment conditions downstream. TMDLs recommended for Clear Creek and Round Valley Creek will reduce bedload sediment loading to this section of river.

Instream temperatures are high in the summer months, but these higher temperatures are attributable to warm water released from Cascade Reservoir. While a TMDL might be warranted, it would not be practicable. The water in Cascade Reservoir, the primary source of the heat load, warms up due to the ponding effect of the water body. Since the waters stratify, cooler water is found at lower depth. While a solution to the warmer temperatures might be to release water from the bottom depths, complications would arise from changing the pollution dynamics within the reservoir. Water released from lower depths might be colder but would also likely have lower dissolved oxygen levels and higher nutrient levels due to hypolimnetic conditions near the bottom.

Since temperatures violate the water quality standards, the North Fork Payette River will remain on the 303(d) list for temperature. A determination of natural background temperature needs to be made for Cascade Reservoir, the main instream heat source, to properly evaluate whether the North Fork Payette River system is actually meeting temperature criteria. That evaluation was not within the scope of this TMDL. However, a TMDL is not necessary for the listed reach between Clear Creek and Smiths Ferry because shade targets are met in this reach. In other words, anthropogenic factors in this listed reach are not contributing to higher instream temperatures.

#### Big Creek

Originating at 6,577 feet near Big Creek summit off of the Warm Lake Highway near Cascade, Big Creek (Figure 32) drains 45,976 acres before entering the North Fork Payette River below Cascade Dam at 4,723 feet. Land uses include timber harvest and pasture as shown in Figure 34. Forestry is currently practiced on 17,442 acres of the Big Creek watershed (Figure 31). The area of canopy removed through timber harvest and road construction is estimated to be 1,511 acres (IDL 2002). The watershed is primarily public land managed by the USFS with about 20% private landholdings in the middle and lower portions of the watershed.

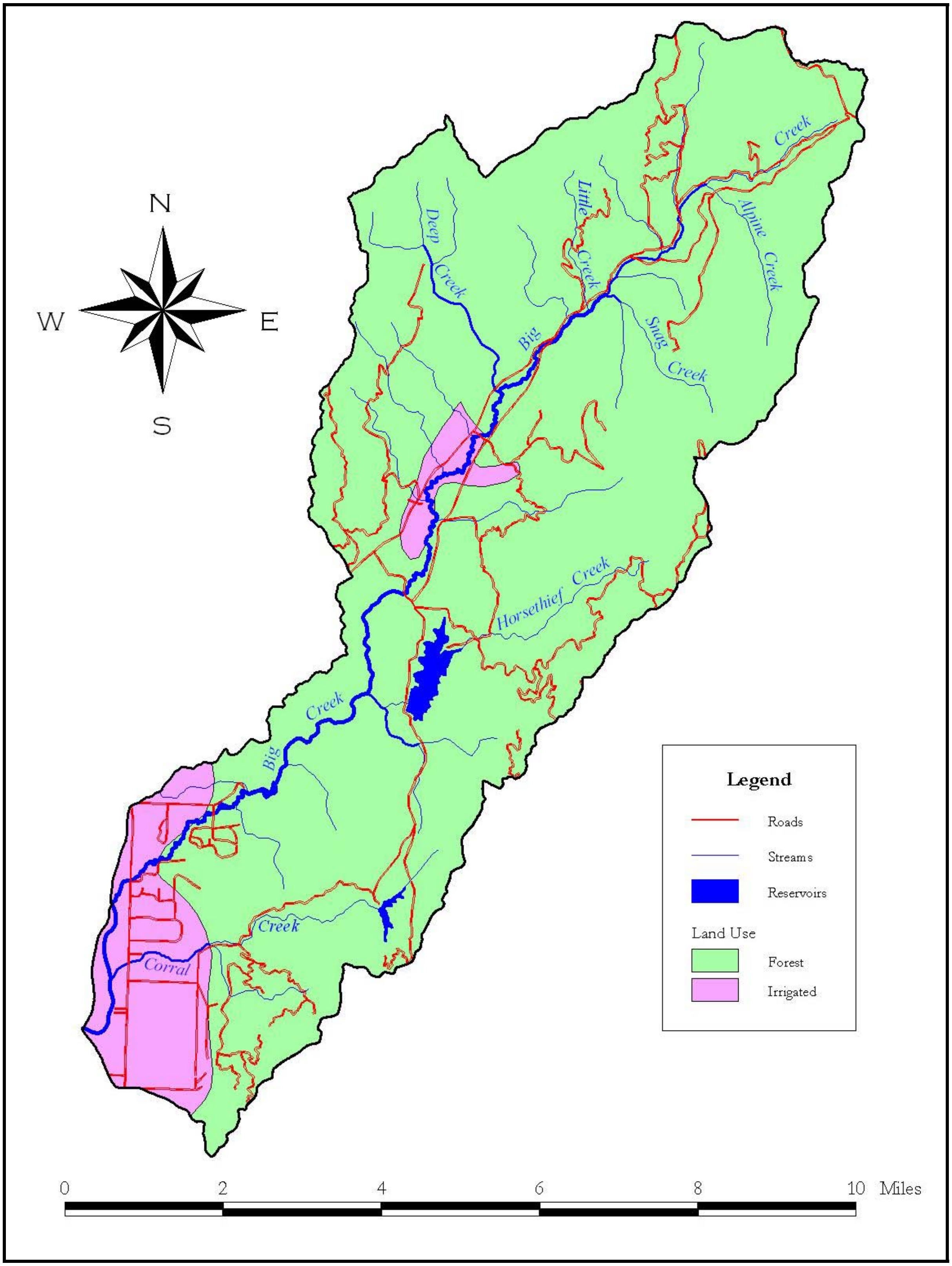


**Figure 31. Big Creek Hydrology and Land Use.**

**Figure 32. Big Creek-Upper Reach.**

Horsethief Reservoir, fed by Horsethief Creek, is located in this watershed and is a popular fishery for recreationists. Idaho Fish and Game owns and operates this reservoir, managing it primarily as a trout fishery. Constructed in 1963, the reservoir stores 4900 acre-feet at full pool, which Idaho Fish and Game tries to maintain year round. In 1994 an estimated 30,000 angler hours occurred on the reservoir from May 1 to July 30 and in the same period 7,400 tents/campers were counted (IDWR 1999). The 275-acre reservoir is maintained by the Idaho Department of Fish and Game (IDFG) as a hatchery supported fishery due to high angler use. Species found in the coldwater reservoir include rainbow trout, trout hybrids, brook trout, brown trout, yellow perch and splake.

Big Creek is a third order stream with a dendritic pattern. A Rosgen type A stream in the headwaters, Big Creek shows mainly Rosgen B and C characteristics in the lower gradient reaches. Floodplain widths vary from six to fifty feet in the Rosgen B and C channel areas. The stream channels are slightly entrenched.

Vegetation in this subwatershed varies with elevation and aspect. On north slopes and with increasing elevation, forest stands become denser with a larger number of coniferous species. At lower elevations and on southeast to northwest facing slopes, ponderosa pines, forbs and grasses are prevalent (IDL 2002).

The geology in the area predominantly consists of highly and weakly weathered granitics. Highly weathered material is found mainly in the mainstem and lower tributary floodplains (IDL 2002).

In response to the threat of the Cold War in the early 1950s, the lower portion of Big Creek was dredged for monazite which is a radioactive phosphate. While this dredging operation only occurred for a few years, 7,085 short tons were removed and the tailing piles are still present. This legacy activity has influenced the morphology of the lowermost reaches near the mouth of Big Creek.

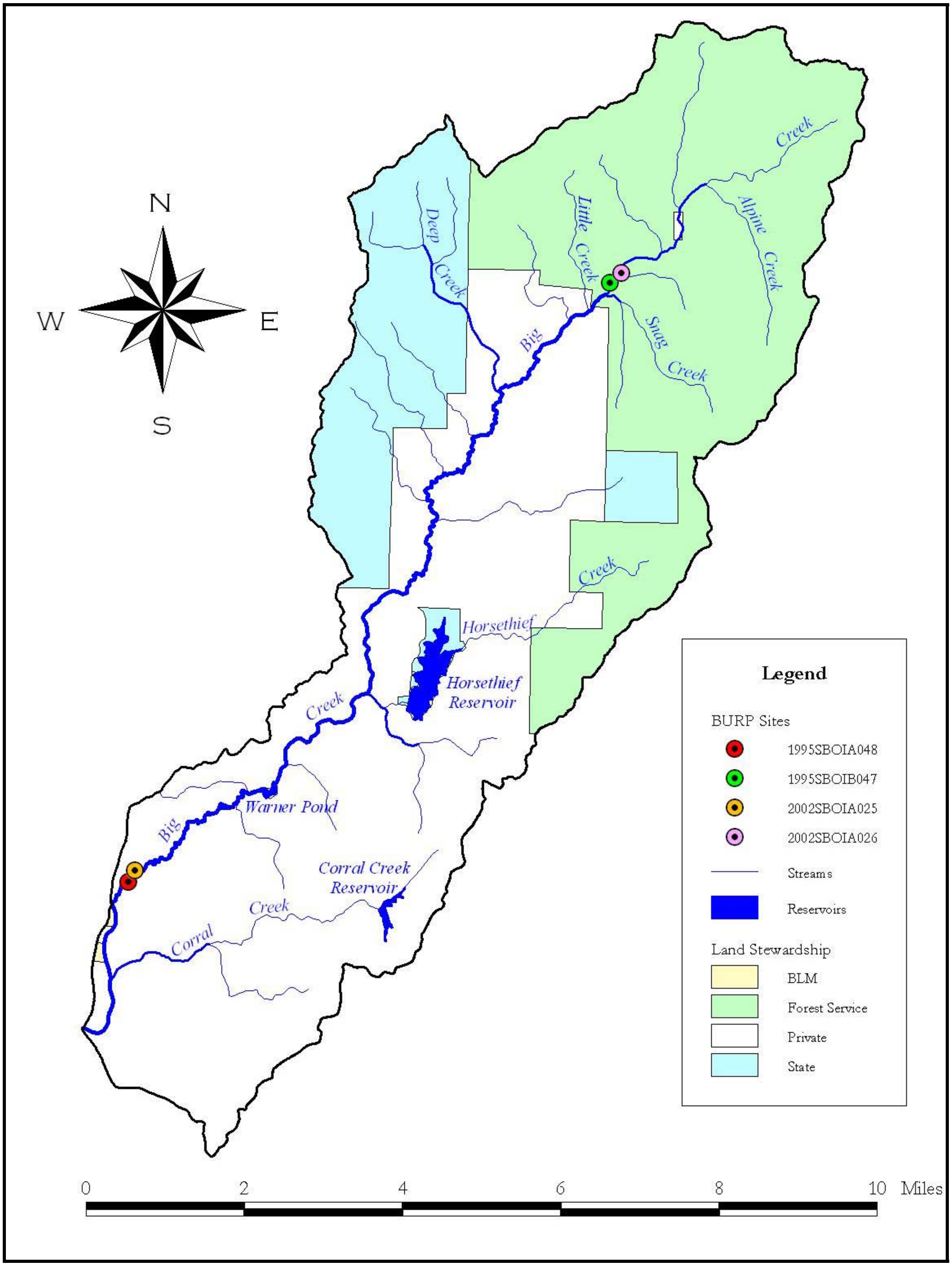


**Figure 33. Big Creek Monitoring Locations.**

### Flow Characteristics

Very little hydrology information is available for Big Creek. However, Big Creek typically peaks in May as a result of snowmelt. High flows near the mouth of Big Creek typically go over the banks in above average water years. Base flows are less than 5 cfs near the mouth and generally occur in late summer and fall.

### Biological/Habitat Data

DEQ stream inventory results showed that beneficial uses were supported in the upper reaches but not in the lower reaches (Table 9). Monitoring locations are shown in Figure 33. DEQ found high percent fines in the lower reaches of Big Creek (Table 10). The Idaho Department of Lands evaluated 38.7 miles of forest roads in the watershed, which was more than a third of all forest roads. The road inventory and mass failure inventory of the Big Creek watershed showed a low sediment delivery rating. However, sediment delivery from skid trails showed a high potential. There are no actively used or new skid trails in the stream protection zone. However, historically, skid trails were located in the stream protection zone. The mass failure hazard rating was moderate (IDL 2002). The lack of roads adjacent to the stream and upstream sources of sediment (i.e. timber harvest and associated road building), led DEQ to investigate instream channel erosion as the primary source of excess sediment. The other source of sediment may be historic sediment delivery from the dredging operations.

**Table 9. Big Creek: DEQ Water Body Assessment Scores.**

| Stream ID | Stream Name (reach) | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|---|
| 2002SBOIA025 | BIG CREEK (LOWER) | 0 | 1 | No data | <1 | Not Full Support |
| 2002SBOIA026 | BIG CREEK (UPPER) | 3 | 3 | No data | 3 | Full Support |
| 1995SBOIA048 | BIG CREEK (LOWER) | 1 | <Min | No data | <1 | Not Full Support |
| 1995SBOIB047 | BIG CREEK (UPPER) | 2 | 3 | No data | 2.5 | Full Support |

**Table 10. Percent Surface Fines in Lower Reaches of Big Creek.**

| Stream ID | Stream | Percent Fines |
|---|---|---|
| 2002SBOIA025 | Big Creek | 49 |
| 1995SBOIA048 | Big Creek-Lower Reach | 78 |

DEQ attempted to do channel erosion inventories in the section of Big Creek below Horsethief Creek during Summer 2004. Unfortunately, DEQ was unable to gain access to a *representative sample* of the section of river at and above the tailings piles. The middle reaches of Big Creek (upstream of Highway 55 but below Warner Pond) appeared to have stable banks in some sections and excessive erosion in others. 2002 DEQ stream inventory bank stability scores for Big Creek in the lower reach showed banks that were 90% stable. DEQ was able to characterize the lower portion of Big Creek below Highway 55 and determine that bank erosion was not a significant source of sediment to the stream. Banks were greater than 85% stable throughout the reach, and, in many portions of the lower section, the stream dissipates energy by overflowing its banks. DEQ extrapolated the data acquired in a stretch of the creek between Highway 55 and Warner Pond to areas in the reach that appeared <80% stable in aerial photos. Aerial photos were also used to determine areas that were >80% stable. If additional information becomes available, the erosion inventory will be refined, which would be reflected in the TMDL allocation.

#### Conclusions

Big Creek is listed on the 1998 303(d) list for sediment from Horsethief Creek to the Mouth. The watershed above Horsethief Creek does not show impairment of beneficial uses nor does it appear to be a source of excess sediment to downstream waters. The beneficial uses in the lower reaches of Big Creek are impaired, and a TMDL is necessary to restore these beneficial uses.

Part of the sediment delivery is attributable to changes in morphology resulting from historic dredging and the discharge of tons of fine material to the stream which resulted in over widening of the stream channel. DEQ will also take a closer look at land use practices within the watershed to rule out other sources of sediment. A TMDL will be developed for sediment that takes into account the unique morphological characteristics of Big Creek.

### Black Canyon Reservoir

Black Canyon Reservoir is a run-of-the-river reservoir that impounds up to 29,300 acre-feet of water and is six miles long (Figures 34 and 35). In general, the reservoir is managed so that reservoir levels remain fairly static. Located at an elevation of about 2,900 feet in Gem County, the reservoir is surrounded by an arid, butte-studded landscape. The upper end of the reservoir is very shallow due to sedimentation.

Currently, sediment fills approximately 35% of the reservoir, reducing the total active storage capacity from approximately 44,800 acre-feet originally to 29,300 acre-feet (BOR 2004). Since water slows in velocity as it enters the reservoir, the bulk of the deposition occurs at the upper end of the reservoir. This action effectively filled the original channel and impedes the normal flow of water into the reservoir, resulting in a significant extension of the 100-year floodplain at the confluence of the Payette River and Black Canyon Reservoir.

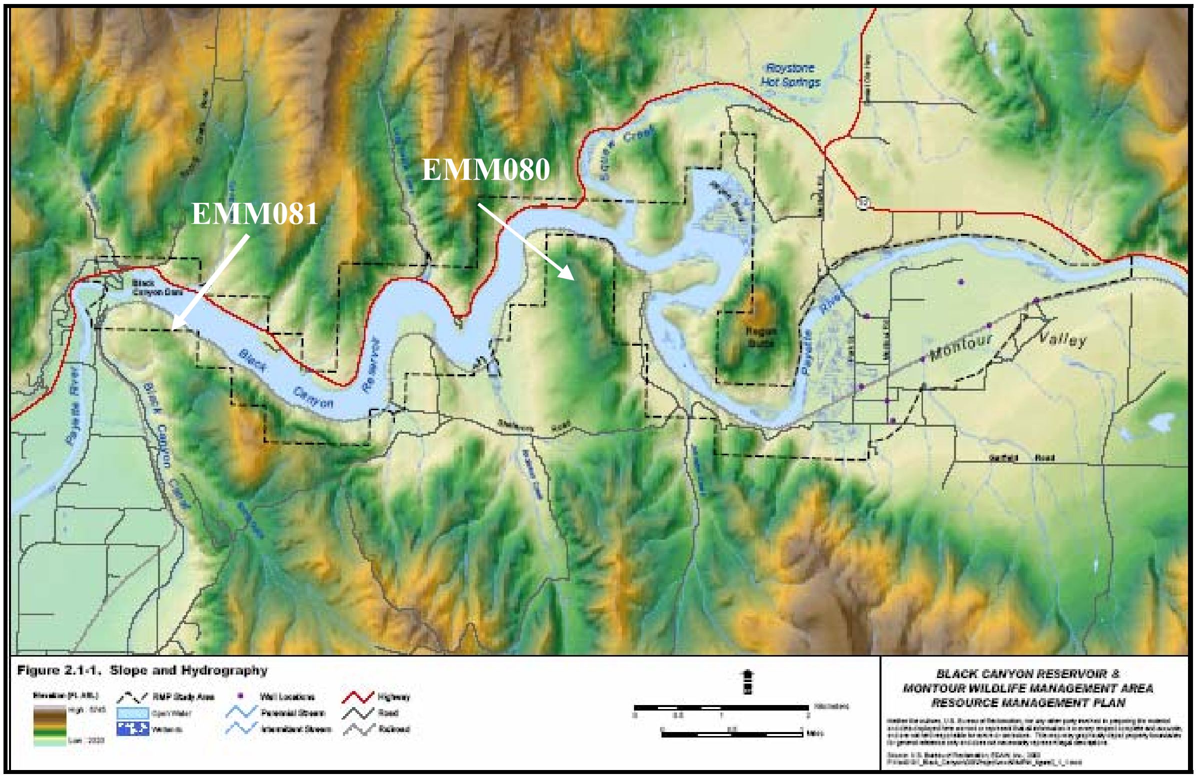


Figure 34. Slope, Hydrography and Approximate Location of Monitoring Sites in Black Canyon Reservoir Area (Figure appears courtesy of BOR)

Figure 35. Black Canyon Reservoir.

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The water level of Black Canyon Reservoir is typically maintained within 0.1 feet of full pool (2,497.5 feet) during the irrigation season to ensure full diversion capability. The irrigation season coincides with the growing season for riparian vegetation, and the constant full pool has resulted in a fairly consistent band of riparian vegetation along much of the reservoir shoreline. Many species that occur for the Payette River also occur along the reservoir. The dominant riparian species growing along the reservoir shoreline is the exotic false indigo (*Amorpha fruticosa)*. This species is quite aggressive and in many areas has completely displaced native willows and other native species along the reservoir shoreline (BOR 2004).

The reservoir receives heavy recreational use between Memorial Day and Labor Day. Current recreational use numbers were not available but between October 1992 and September 1993, there were approximately 59,000 recreational visits, primarily for picnicking, water skiing and swimming. The BOR operates several parks and the county maintains several boat ramps. Recreational use includes boating, lake kayaking, fishing, swimming and jet skis.

Measurable oil and grease concentrations during periods of high reservoir use are predicted in shallower waters, which could result in slightly reduced spawning and feeding success by fish. The oil and grease is likely attributable to the use of two stroke engines on the reservoir. Recreational use also can increase turbidity levels.

### *Characteristics of Reservoir Zonation*

In order to provide a clearer explanation of the water column data, reservoir characteristics are described in the following sections. Reservoirs combine qualities of both rivers and lakes, separating into zones called riverine, transitional, and lacustrine (lake-like) according to the reservoir basin shape and velocity of streamflow. Black Canyon is a run-of-the-river reservoir, meaning that it is dominated by riverine and transitional areas. The lacustrine zone is adjacent to Black Canyon dam.

The zones control the abundance and metabolism of algae and the way the system processes nutrients. The riverine zone is dominated by flow and mixing. In the riverine zone, algal abundance is more dependent on flushing than on in-reservoir nutrient concentrations. In the transitional zone, the inflow velocity slows, rapid sedimentation begins and water clarity increases. The lacustrine zone has thermal *stratification* and a higher probability of nutrient limitation of algal growth (Wetzel 2001). Thermal stratification is shown in Figure 36.

### *Characteristics of Reservoir Stratification*

In the lacustrine zone of deep reservoirs, surface waters warm in the summer while bottom waters remain cool. Cold water is denser than warm water so the surface waters and bottom waters do not mix. The surface waters (epilimnion) continue to be mixed by wind, while the bottom waters (hypolimnion) do not mix with the upper layers of water. The middle layer is the area with the most rapid temperature change is termed the metalimnion or thermocline. This stratification is overturned by temperature and/or winds that cause mixing of the layers.

Generally, Black Canyon Reservoir does not stratify and when it does the stratification is for short periods, mainly in the lacustrine portion near the dam.

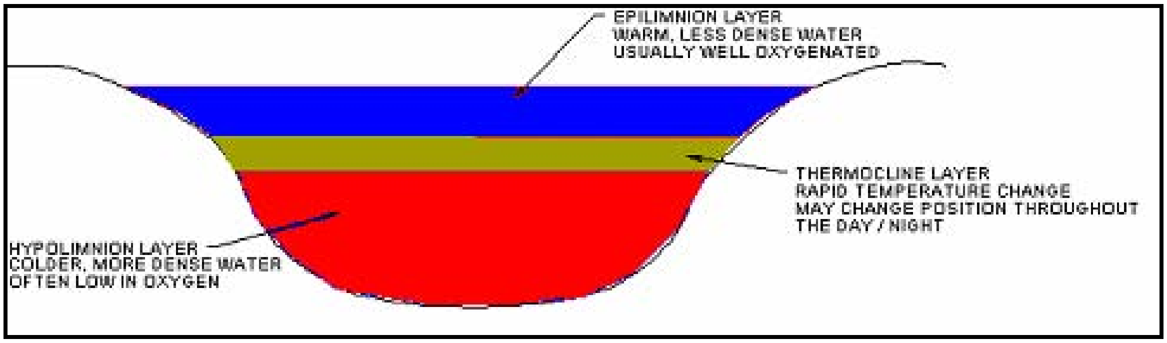


**Figure 36. Depiction of a stratified lacustrine zone (summer condition).**

*Trophic Classification*

Another tool for looking at reservoirs is trophic classification (Table 11). Trophic state refers to the overall level of nutrients and related algal and plant growth in the system. Eutrophication is the artificial increase in the trophic state of a system by human activities. The four major trophic classes are as follows:

- Oligotrophic-systems that have low supplies of nutrients
- Mesotrophic-systems with intermediate nutrient supplies
- Eutrophic-systems with a large supply of nutrients
- Hypertrophic-systems that have excessively large supplies of nutrients.

The following section on reservoir data shows that Black Canyon Reservoir is mesotrophic, indicating that Black Canyon Reservoir does not have excessive loading of nutrients.

**Table 11. Lake/Reservoir Trophic Classification.**

| Classification | Average Planktonic Algal Chlorophyll (µg/L) | Average Secchi Depth (m) | Average In-Lake Total P (mg P/L) |
|---|---|---|---|
| Oligotrophic | < 2 | > 4.6 | <.00 79 |
| Oligotrophic-mesotrophic | 2.1-2.9 | 4.5-3.8 | .008-.011 |
| Mesotrophic | 3.0-6.9 | 3.7-2.4 | .012-.027 |
| Mesotrophic-eutrophic | 7.0-9.9 | 2.3-1.8 | .028-.039 |

(Lee, 19

## Water Column Data

*Nutrients*

Historic Black Canyon Reservoir data on nutrient impairment is sparse. Additional reservoir nutrient, chlorophyll-*a,* and dissolved oxygen information were collected by both DEQ and

BOR in 2004 to determine current nutrient loading and whether nutrient loading is impairing beneficial uses. DEQ and BOR monitored below where Squaw Creek enters the reservoir (station EMM080) and just north of the spillway (station EMM081). The reservoir below Squaw Creek is fairly shallow and consequently EMM080 is a more riverine site. The site at the spillway, EMM081, is the deepest and most lacustrine (lake-like) site.

Black Canyon Reservoir is a run-of- the -river reservoir and hydraulic retention time is short. Because the water flows through the system relatively quickly (i.e. the water volume is changed in the lake every 7 to 15 days) there is usually insufficient time for nutrients to be used for algae growth - the nutrients simply flow downstream to some other water body.

DEQ 2004 monitoring data showed an average concentration in the euphotic zone of 0.024 mg/L total phosphorus, which is below the 0.025 mg/L total phosphorus target. No algal blooms or excessive macrophyte growth was observed.

The 2004 chlorophyll *a* data from Black Canyon Reservoir at the spillway site (EMM081) falls within the range for mesotrophic water bodies (Table 8). Mesotrophic water bodies are biologically productive and slightly green. These water bodies can be said to have moderate amounts of nutrients. Chlorophyll-*a* concentrations at EMM081 ranged between 1.7 μg/L to 6.5 μg/L which are below the 10 μg/L target. The average chlorophyll-*a* concentration from late April through September was 3.51 μg/L which is also below the EPA reference condition of 4.7 μg/L.

Beneficial uses, particularly cold water aquatic life and recreational uses, are not impaired due to nutrients.

The Idaho temperature standard for lakes and reservoir states: 'temperature in lakes shall have no measurable change from natural background conditions. Reservoirs with mean detention times of greater than fifteen days are considered lakes for this purpose.' Black Canyon's low hydraulic retention time (<15 days) means that the numeric temperature criteria for rivers/streams apply rather than temperature standards for lakes and reservoirs (No greater than 22 degrees Celsius AND no greater than 19 degrees Celsius maximum daily average). For this TMDL, temperature will be averaged in the livable space (in the meters of habitat where there is greater than 6.0 mg/L of dissolved oxygen). This method takes into account the fact that even though surface temperature may be high, livable space and refuge for fish may exist in deeper water. Using this approach, temperature was below the state standard until late July at the more lacustrine station, EMM081, but met criteria at the more riverine station, EMM080. Throughout the summer, livable space existed in the upper portion of the reservoir.

In late July, temperature violations were seen in part of the water column at EMM081. pH measurements met the state standard but showed an increase from the bottom of the water column (6.68) to the surface (8.10). This increase could be tied to algal activity in the euphotic zone (light penetration zone). Figure 37 is a schematic of the reservoir during the summer sampling months.

Throughout spring and through mid-July, dissolved oxygen levels met state water quality standards at both stations. On July 21 temperatures were above the 22° C standard in the top

6.7 meters of the water column and dissolved oxygen concentrations were below 6 mg/L in the bottom 6 meters of the water column. Between 6.7 and 7.7 meters on that sampling date, there was a thermocline (the demarcation zone between the warmer and colder layers of water). In other words, between 6.7 meters and 7.7 meters there was a change in temperature of 1° C. The colder water is denser than warmer water causing the two layers to remain distinct until either wind or cooler ambient temperatures causes mixing.

Since Idaho standards state that the 6 mg/L dissolved oxygen criterion does not apply to the hypolimnion of stratified lakes and reservoirs, no violation of dissolved oxygen standards occurred on July 21.

By mid-August (the next sampling event), temperatures were below the state standard and dissolved oxygen violations occurred in the bottom seven meters but were above 6 mg/L throughout the rest of the water column. Stratification was no longer present. By the following week, dissolved oxygen levels and temperature both met the state standard. Thus, portions of the reservoir may be vulnerable to not supporting cold water fisheries in mid-summer particularly during periods of high ambient air temperatures. The lacustrine section of the reservoir near the dam was likely in violation of state standards for temperature periodically during a three week window of high ambient temperatures. However, the more riverine portion of the reservoir met the temperature standard, providing suitable fisheries habitat.

In mid-August, evening and pre-dawn dissolved oxygen monitoring was initiated to investigate the occurrence of dissolved oxygen sags. This monitoring showed that while oxygen levels decreased at night, they did not fall below the state standard. This is further evidence that nutrients are not in excess because dissolved oxygen sags, driven by plant production and die-off, are not evident.

August 2003 monitoring showed violations of the dissolved oxygen and temperature standards. However, there was a band of several meters of habitat with temperature and oxygen levels that met the state standard.

The station below Squaw Creek did not show temperature or dissolved oxygen violations at any time during the sampling season. This section is much shallower and more riverine than the lakelike station just north of the dam and does not stratify.

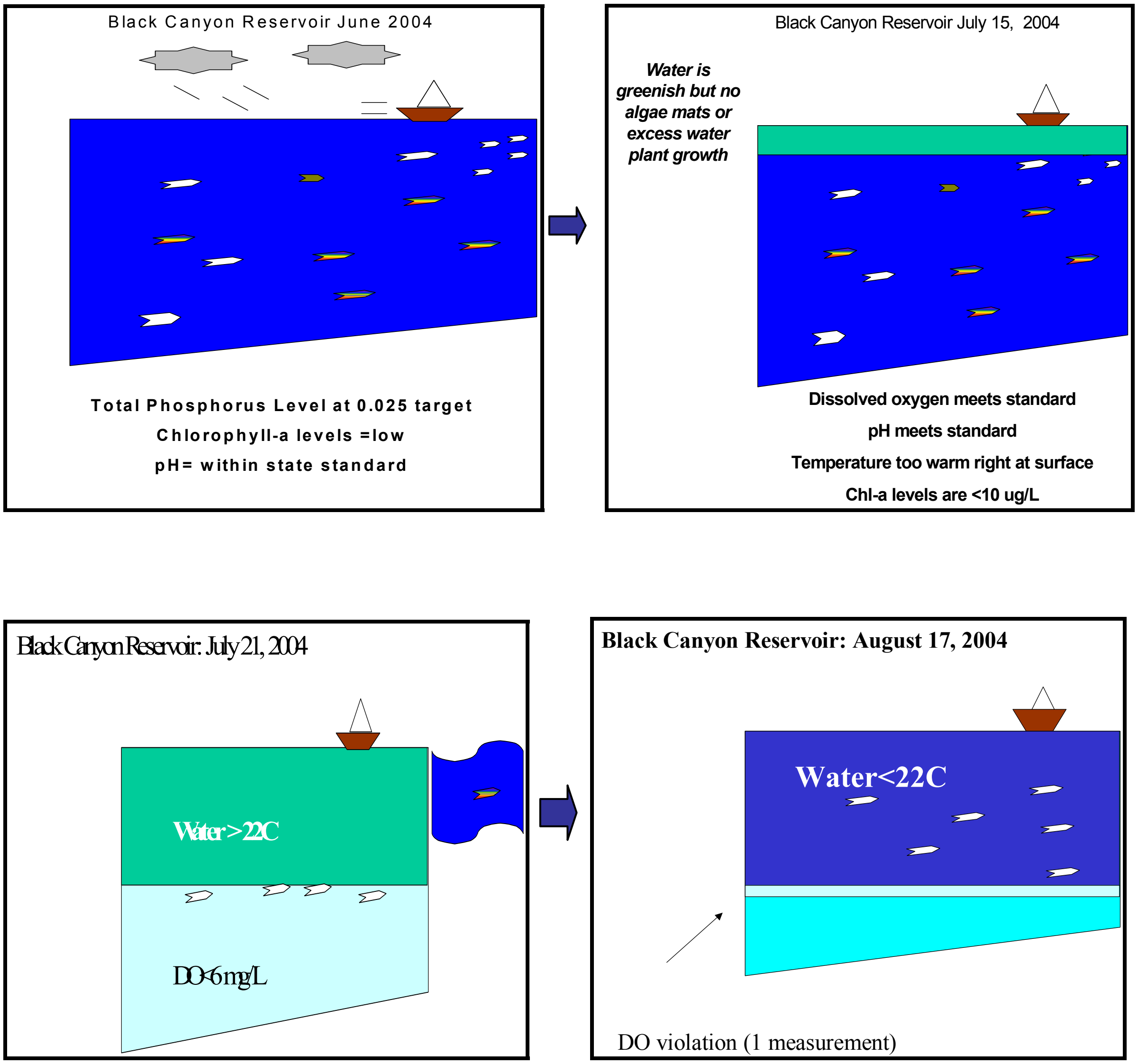


**Figure 37. Schematic of Reservoir Conditions Near Dam.**

Water clarity is reduced in Black Canyon Reservoir and phytoplankton are evident, but nuisance algal growth as manifested by floating mats or thick macrophyte colonies are not present. Average Secchi depth, a measurement of water clarity, was 2.1 m over the 2004 sampling season, indicating mesotrophic-eutrophic conditions.

Black Canyon Reservoir does not have habitat for salmonid spawning. Reservoirs typically do not contain salmonid spawning habitat due to depth and reduced water velocity. However, tributaries within the watershed are available for fish spawning. No fish kills were reported during the 2004 sampling season.

### *North Fork Payette River Nutrient Loading*

Reservoir nutrient loading was investigated to determine if nutrient concentrations were above target levels in the Payette River. During 2004, March through September total phosphorus concentrations in the North Fork Payette River at Montour Bridge (the closest river monitoring site to Black Canyon Reservoir) averaged 0.04 mg/L (Figure 38). November 2003-September 2004 concentrations averaged 0.033 mg/L. Not only are these concentrations below the EPA Gold Book criterion of 0.05 mg/L, but also they are below the ecoregional nutrient reference condition criteria for subecoregion 12 of 0.043 mg/L (EPA 2000a), meaning that concentrations are comparable to those seen in minimally impacted rivers. The highest total phosphorus concentrations were seen during the first spring runoff events with the highest total phosphorus concentrations and loading attributable to the South Fork Payette River (Figure 39).

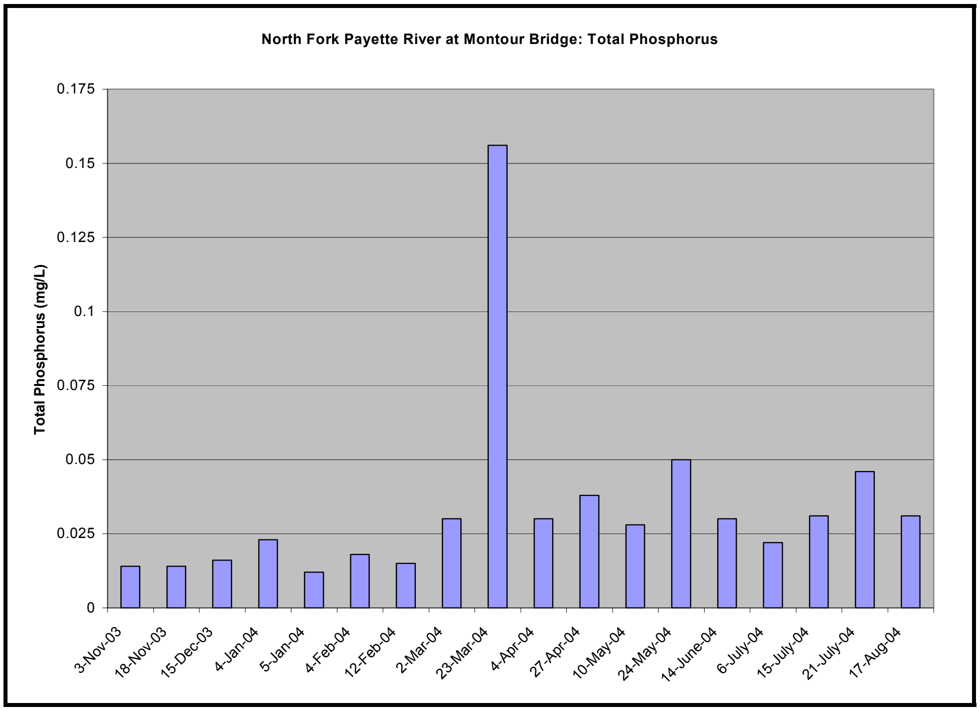


**Figure 38. Total Phosphorus Concentrations: Montour Bridge, NFPR 2004.**

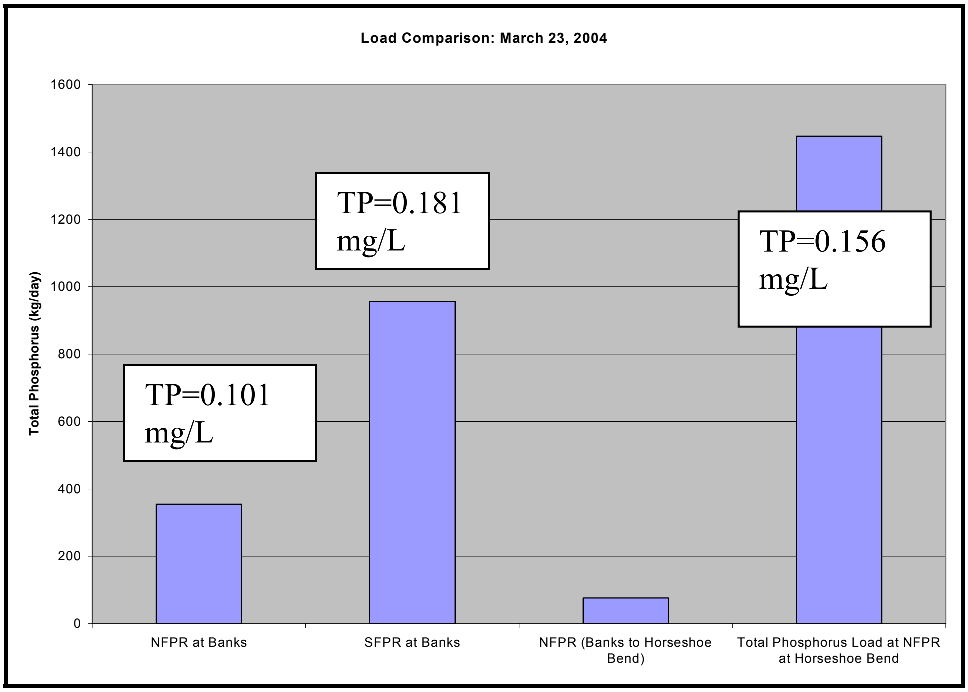


**Figure 39. Phosphorus Load: N. Fork Payette River and S. Fork Payette River, 2004.**

*Sediment*

The geometry of Black Canyon reservoir causes water velocity to decrease and sediment to fall out of the water column. Sediment is of particular concern in reservoirs if heavy metal/*pesticide* accumulation or nutrients attached to sediment are a problem in the reservoir system. Black Canyon reservoir does not appear to have nutrient problems associated with the sediment. Data from 1991 and 1997 did not detect mercury, lead or arsenic. No organochlorine or other pesticide data was available. Agricultural activity is mainly centered around pastureland with a small percentage of cropland. Pesticide contamination is not expected to be impairing beneficial uses.

While Black Canyon Reservoir has shown the effects of sedimentation in terms of decreased cold water fishery habitat and changes in reservoir depth, actual sediment loading from the North Fork Payette River is minimal when compared to the South Fork Payette River. However, mass wasting events do occur in the North Fork Payette drainage on an infrequent basis and these events may contribute large amounts of sediment to the reservoir. The Horseshoe Bend Hydroelectric company annually removes a large quantity of sediment from their flow through diversion (i.e. the water reenters the river), which also decreases the amount of sediment entering the reservoir.

The 2004 BOR Resource Management Plan discussed sedimentation of the reservoir due to localized sediment contribution but did not quantify sediment contribution from bank erosion. The plan stated that soils in the watershed just upstream of the reservoir show negligible erosion; however, a few soil series have a slight to moderate risk of water erosion, although this problem is not widespread. Erosion is most prevalent along the Black Canyon Reservoir shoreline from boat wake generated wave action. The only location with an ongoing erosion problem is the shoreline at Black Canyon Park. BOR has attempted to protect the shoreline from additional erosion using rock riprap, but erosion continues on the north and south ends of the riprap area. In the future, trees growing above the eroding area may fall into the reservoir because of bank failure (BOR 2004).

Black Canyon Reservoir is designated for salmonid spawning. The reservoir due to its deeper water, low velocity, and sandy substrate does not provide spawning habitat. However, spawning habitat exists upstream of the reservoir and this can be utilized by salmonids. The issue is not that of a pollutant impairing salmonid spawning, but instead reservoirs simply do not provide the habitat conditions necessary for salmonid spawning.

### Sediment Loading: North Fork Payette River below Smiths Ferry

Suspended sediment concentrations averaged less than 25 mg/L over the monitoring season as measured at the inflow location to Black Canyon Reservoir at Montour Bridge, thus, meeting the sediment target (Figure 40). Figure 41 shows the suspended sediment contribution that the South Fork Payette River makes to the Main Payette River. The bulk of sediment loading comes from the South Fork Payette River watershed. This loading is visually represented in Figure 42 below. While both the North and South Fork Payette Rivers are subject to mass wasting events, these events occur more frequently in the South Fork Payette drainage. The North Fork Payette River drainage meets suspended sediment targets and thus does not load excess suspended sediment to Black Canyon Reservoir. Even when mass wasting events occur, concentrations over a 30-day period likely meet the 50 mg/L suspended sediment concentration target. A sediment TMDL was determined for the North Fork Payette River to prevent excess bedload sediment from being delivered to the Cabarton Reach.

The South Fork Payette River Subbasin Assessment determined that bedload sediment did not adversely affect the South Fork Payette River due to velocities that would transport bedload out of the system. The bedload delivered to the Main Payette was deterimined to be from natural sources and a TMDL was not developed (IDEQ 2004a).

The South Fork Payette River is estimated to be a significantly higher contributor of bedload sediment to Black Canyon Reservoir than the North Fork Payette River.

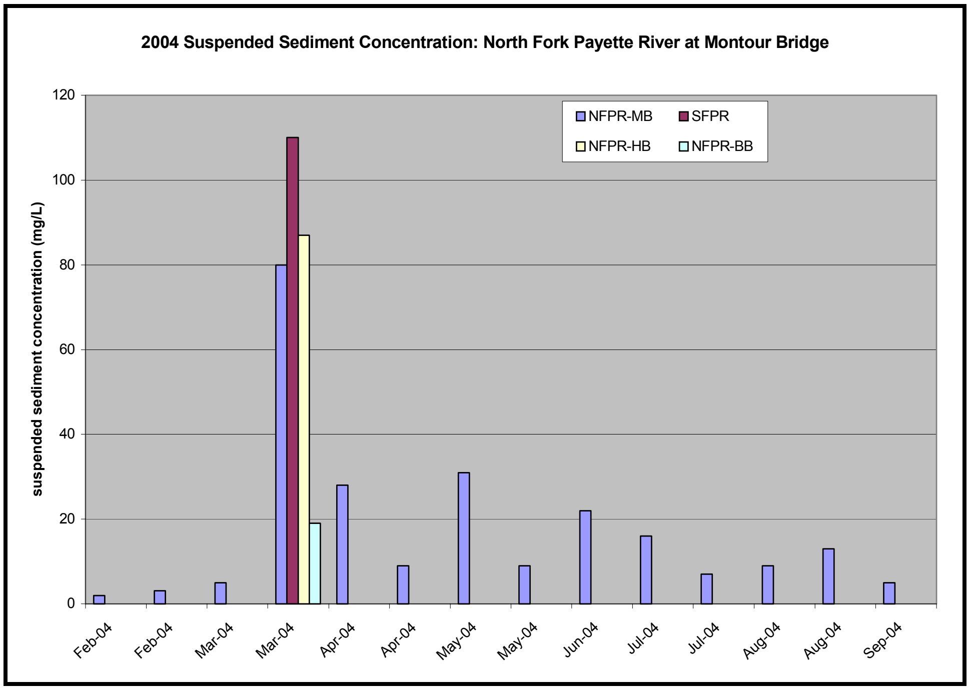


**Figure 40. 2004 Suspended Sediment Concentrations: North Fork Payette River at Montour Bridge .**

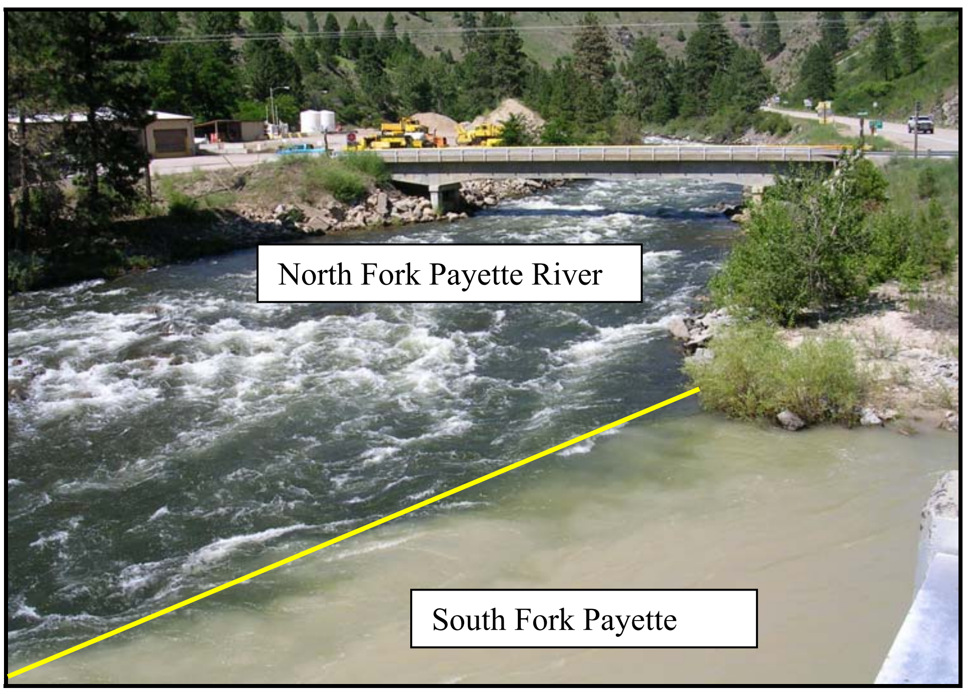


**Figure 41. Confluence of the North Fork and South Forks of the Payette River After a Mass Wasting Event along the South Fork Payette River, 2004.**

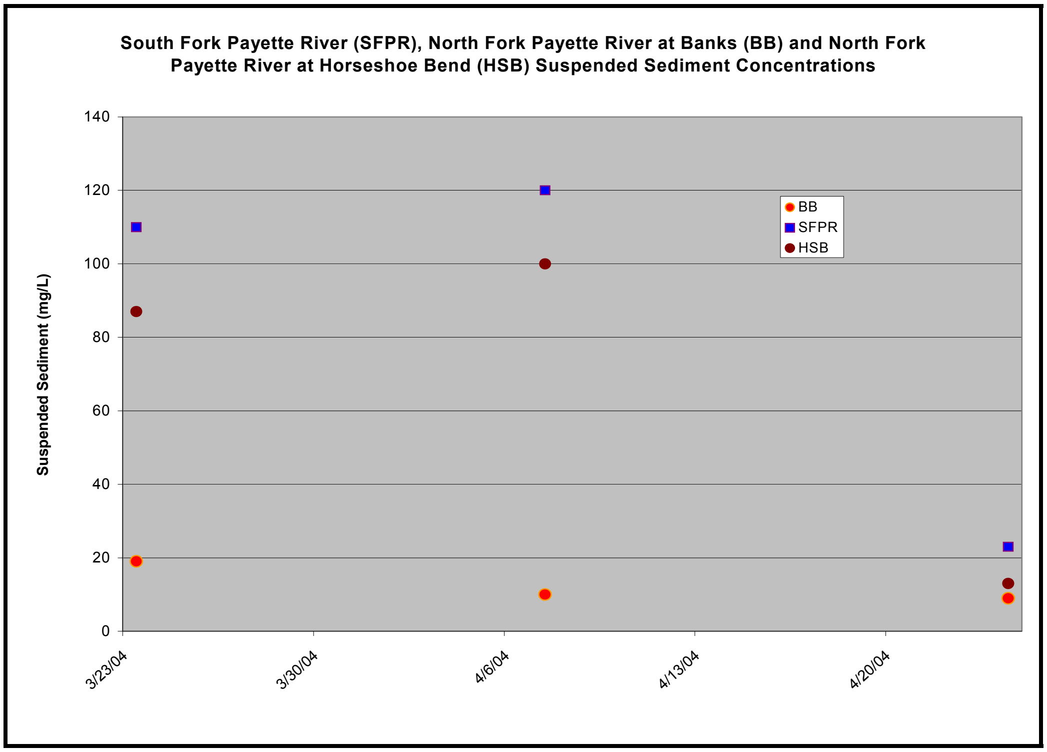


**Figure 42. 2004 Total Suspended Sediment Concentrations: North Fork Payette River and South Fork Payette River.**

Since suspended sediment concentrations from the North Fork Payette River meet TMDL targets for sediment in riverine systems, suspended sediment will be proposed for de-listing from the 303(d) list (Figure 42). The reservoir will be placed in Section 4.c.of the 303(d) list for habitat alteration caused by legacy sediment deposits.

### *Oil and Grease*

DEQ sampled twice for oil and grease in recreational areas (Black Canyon Park and Triangle Park) during July 2004 to determine if oil and grease were a problem, because those were the only areas where any sheen from oil and grease was noticeable. Of the two sample sets in July, one set came back below the detection the limits while the July 15$^{th}$ set showed oil and grease concentrations of 1.4 mg/L at Black Canyon Park and 9.9 mg/L at Triangle Park. The 9.9 mg/L result is above the 5 mg/L target. This 9.9 mg/L sample triggered another round of sampling.

The next sampling events were taken throughout the reservoir to avoid biasing the results by taking them at recreational areas where concentrations would be the highest. DEQ re-sampled for oil and grease in October by taking two measurements (one on the north side of the reservoir and one on the south side) every longitudinal mile in the reservoir. This sampling event was at the tail end of the recreational use period, so oil and grease may have been underestimated. However, if oil and grease concentration had accumulated in the reservoir over the course of the summer, the sample concentrations would reflect that accumulation. The results came back less than 1.3 mg/L, or below the 1 mg/L detection limit for all samples.

The results of the second round of oil and grease sampling showed in-reservoir concentrations that were all below 5 mg/L, oil and, thus, grease is recommended for de-listing.

### Conclusions

Black Canyon Reservoir is listed on the 1998 303(d) list for sediment, nutrients, and oil/grease. The inflow to the reservoir from the North Fork Payette River system meets nutrient and sediment TMDL targets. Although the reservoir is stressed during the hottest time of the year due to a combination of climactic and low flow conditions, overall, beneficial uses are not impaired. Warm summer temperatures rather than excess nutrients appear to be the main stressor on cold water fisheries. However, areas of cooler water exist in the upper portions of the reservoir during these times.

While a TMDL is not required at this time, if significant land use changes occur, monitoring needs to occur to ensure that the river system continues to meet nutrient/sediment targets and support beneficial uses. Nutrients are recommended for removal from the 303(d) list.

Oil and grease are not impairing the reservoir. The use of motorized watercraft on the reservoir can result in visible petroleum hydrocarbons on the surface. However, the distribution of the hydrocarbons is likely temporally and spatially highly variable. Oil and grease is recommended for de-listing.

Sediment deposition in Black Canyon Reservoir occurs due to the decrease in flow that occurs as a result of Black Canyon's geometry. The reservoir naturally functions as a sediment basin. Sedimentation has affected river morphology upstream resulting in changes in the floodplain near Montour. Currently, the Middle Fork Payette River has a sediment TMDL in place. Levels of sediment in the South Fork Payette River were determined to be at natural background levels and are expected to be at much higher loads than those from the North Fork Payette River. This is because the North Fork Payette River is hydrologically modified due to Cascade Dam and subsequently has dam controlled flows that prevent peak flushing flows from occurring in this section. A bedload TMDL has been determined for this section of the North Fork Payette River. With sediment TMDLs in place upstream, sediment is not being delivered to the reservoir over background levels. A TMDL is not necessary.

## Box Creek

Originating at 8,653 feet off of Beaverdam Peak, Box Creek flows approximately 4.5 miles before entering the North Fork Payette River at 5,020 feet, approximately 8 miles north of McCall, Idaho (Figures 43 and 44). Much of the upper portion of the drainage was burned in the Blackwell fire in the summer of 1994 (Figure 43). The 5,667-acre Box Creek watershed has several alpine lakes present in its headwater area with Box Lake being the largest in size. Land ownership is primarily state, managed by the Idaho Department of Lands (IDL), with some small areas of Bureau of Land Management and National Forest managed public land (IDL 2003a).

Box Creek is a 3rd order tributary, with a dendritic stream feeder pattern, to the North Fork Payette River. The upper reach is a Rosgen type A stream characterized by a narrow channel and a step/pool bed morphology. The drainage is oriented in a westerly direction with side tributaries entering mostly from the north and south. While Box Lake is a natural lake, it does have a dam on it for irrigation purposes. The lake impounds 1,300 acre-feet of water. Box Lake has not been stocked since 1971 but has a resident brook trout population. Rainbow trout are found in the lower reaches of Box Creek.

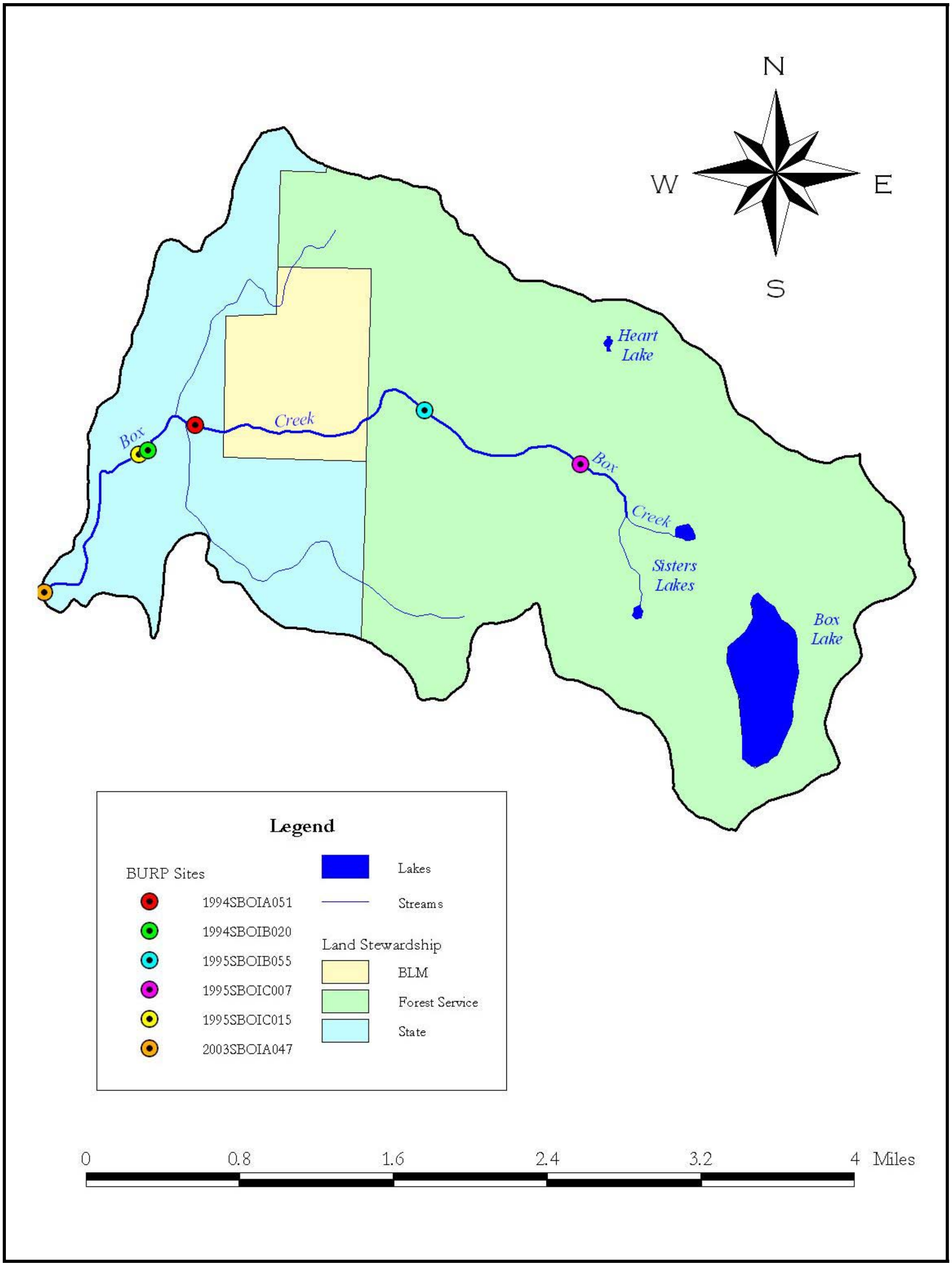


**Figure 43. Box Creek Land Stewardship and Monitoring Sites.**

**Figure 44. Box Lake.**

The Box Creek drainage is predominantly underlain by variously weathered granitic rocks of the Idaho Batholith. To a lesser extent the drainage is underlain by *loess*. These granite rocks are typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem flood plain and lower tributary flood plains. The weakly weathered material occupies the uplands and ridgelines. The headwater area has substantial amounts of exposed bedrock, cliffs and talus slopes (IDL 2003).

The area is characterized by an average annual precipitation of 50 inches at both the lower and higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. Lower elevations support a mixed conifer forest stand with Douglas fir, hemlock, western larch and tamarack, with inclusions of Englemann spruce near streams and wetter areas. The presence of lodgepole pine, subalpine fir and pockets of spruce increase with elevation (IDL 2003). The understory is primarily mallow ninebark, pine reedgrass and snowberry.

### Flow Characteristics

Peak flows in Box Creek usually occur in May or June and base flows by late October (Figure 45). Box Creek flows are managed for irrigation purposes and there is a dam at the outlet of Box Lake.

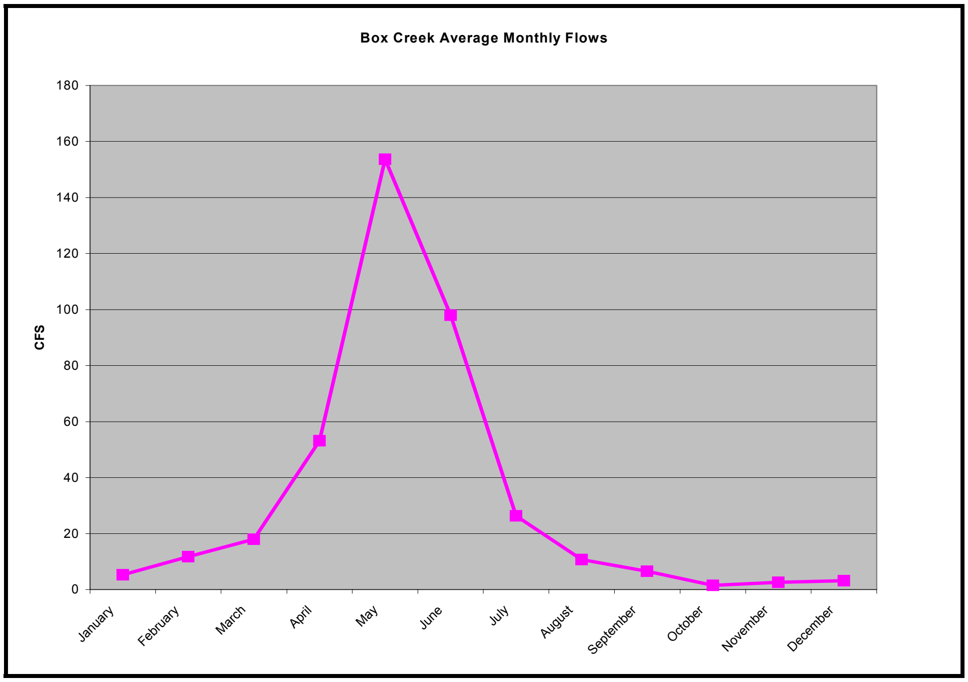


**Figure 45. Box Creek Average Monthly Flows (DEQ 1997).**

### Biological/Habitat Data

Box Creek was assessed as unimpaired in every reach sampled as part of DEQ's BURP process (Table 12). For the 1997 study of Big Payette Lake, the Box Creek macroinvertebrate metric scores were used as regional reference criteria for the Big Payette Lake watershed. DEQ macroinvertebrate (SMI), habitat (SHI) and fisheries (SFI) scores were all high (3 is the highest possible score), indicating that beneficial uses are not impaired. However, salmonid spawning is a designated use in Box Creek, so additional temperature monitoring was initiated to ensure that beneficial uses were not impaired during the salmonid spawning season. The results are discussed in the following temperature section.

**Table 12. Box Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1994SBOIA051 | 3 | 3 | No data | 3 | Full Support |
| 1994SBOIB020 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIC007 | 3 | 2 | No data | 2.5 | Full Support |
| 1995SBOIB055 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIC015 | 1 | 3 | No data | 2 | Full Support |
| 2003SBOIA047 | 3 | 3 | 3 | 3 | Full Support |

Box Creek is managed for timber harvest. Most historic tree harvest activity used ground-based tractor skidding and some of this occurred in stream protection zones. Old skid trails that were in stream protection zones have substantial vegetative recovery and cannot be used in the future under current *Idaho Forest Practices Act* (FPA) rules. New skid trails are outside stream protection zones, resulting in very little delivery of sediment to stream channels. Salvage logging occurred in 1995-96 after the fire.

A Cumulative Watershed Effects (CWE) analysis was done for Box Creek in 1995 by the Idaho Department of Lands. Two 1,000 feet stream reaches in the Box Creek drainage were evaluated for channel stability in June 1995 when stream flows were low. The results are summarized in Table 13. This channel stability assessment looks at bank cutting, bank rock content, bank sloughing, riparian zone bank protection, large woody debris and channel substrate characteristics.

The reach with the highest score is used for the CWE channel stability rating because this is the area most susceptible to disturbance from potential increases in peak flows. The assessment identified some bank sloughing, reduced vegetative bank protection, moderate bank rock content, some bank cutting, lack of large organic debris, channel bottom movement, and channel bottom rock shape/roundness all contributing to the moderate rating.

A roads analysis calculated that the entire Box Creek watershed contains approximately 8 miles of roads, all of which are within forestry land use areas. Approximately 0.6 miles of roads were evaluated using the CWE road assessment. The road evaluation emphasized roads that are close to streams and those considered to have a high potential to impact water quality. The average CWE road score for the Box Creek Watershed is in the low range and indicates that little additional sediment is being generated and delivered to the stream channel from the road segments evaluated. The individual road segments evaluated in the watershed all rated *Low*. After this analysis, the Box Creek-Brush Creek Road was closed off permanently and graveled to minimize sediment delivery. Other watershed roads and skid trails were closed or obliterated.

**Table 13. CWE Assessment Summary for Box Creek.**

| Surface Erosion Hazard | Mass Failure Hazard | Stream Temperature Rating | Hydrologic Risk Rating | Sediment Delivery Rating | Channel Stability Index Rafting |
|---|---|---|---|---|---|
| High | Moderate | High | Low | Low | Moderate |

In addition to the CWE analysis, DEQ (1997) reported that while landslides occurred in the Box Creek watershed, none of those events was associated with management activities such as road building or timber harvest. In addition the majority of the natural landslides delivered sediment in the Box Lake area. The landslide prone areas are in sections with steeper relief and decomposed granitic soils.

The 1995 BURP data in the upper and lower watersheds indicated high percent fines but that beneficial uses were still supported. The middle reach of Box Creek is a steep gradient, step pool character stream that appears to be a very efficient transport reach for sediment and, thus, percent fines were low. 2003 BURP data indicate that stream habitat is of high quality and that recovery has occurred since the 1994 fire.

The canopy closure survey by IDL showed that 6 of 43 stream segments investigated had low shading values. The IDL did not determine whether or not the canopy closure was a result of land management activities or were *natural conditions* for those particular stream segments. The CWE assessment was done a year after the Blackwell Fire.

### Temperature Data

Box Creek is listed on the 303(d) list for temperature. The upper Box Creek watershed was burnt in the Blackwell fire of 1994, decreasing riparian cover, increasing sediment delivery to the stream, and increasing instream temperatures. Although water quality impairment occurred as a result of this fire, these effects are natural and increased sedimentation, so increased water temperature is expected in the short term. Box Creek temperatures are also influenced by the release of water from Box Lake for irrigation purposes.

Box Creek did not violate the state cold water aquatic life standard in 2004 (Figure 46). Salmonid spawning temperatures were not met for the entire spawning period between March 15$^{th}$ and July 15$^{th}$ (Figure 47). 2004 temperatures from March 15$^{th}$-May 8$^{th}$ were below 6° C. The temperature logging device was replaced with another logger on May 9$^{th}$ but malfunctioned and data was not collected again until July 9$^{th,}$ close to the end of the salmonid spawning/incubation period. Temperatures were extrapolated by comparing data to Fall Creek. The daily average temperature during the period from July 9$^{th}$-July 15$^{th}$ exceeded the 9°C criteria and likely exceeded it starting in mid-June.

As shown in Figure 48, Box Creek did not violate the state cold water aquatic life standard during 1995. Data was not available for the entire salmonid spawning season. Box Creek is managed for irrigation purposes, which can influence temperature due to a low flow regime during the summer months. The delivery of water to Box Creek would likely only influence spawning and incubation temperatures in late June and early July.

Box Creek was determined to be below the riparian canopy target. Thus, a TMDL was determined for Box Creek to help achieve salmonid spawning temperature criteria.

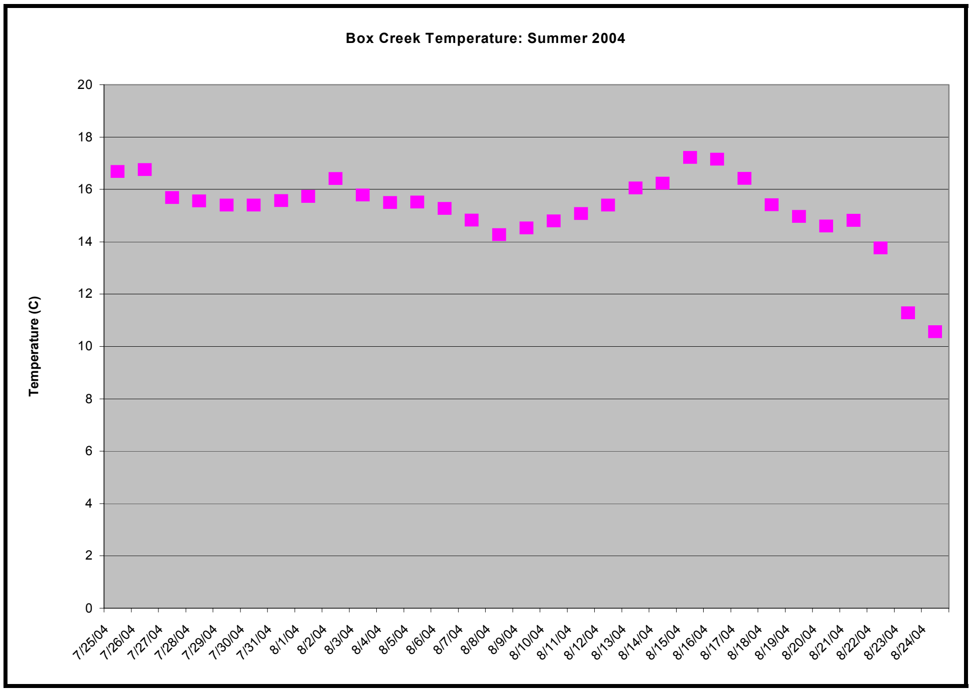


**Figure 46. Box Creek 2004 Average Daily Summer Instream Temperatures.**

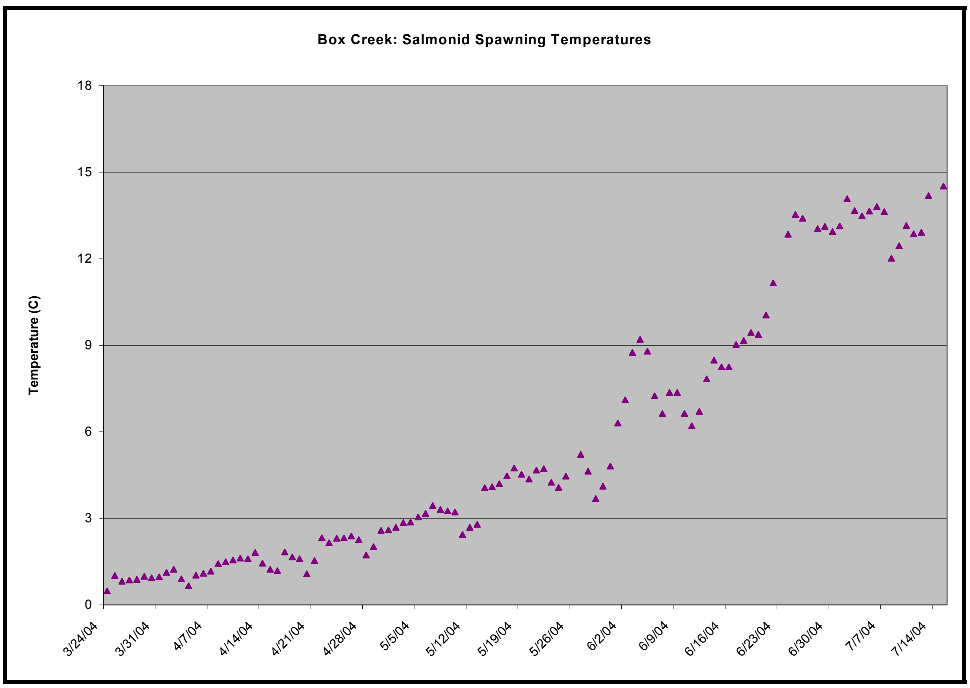


**Figure 47. Box Creek 2004 Average Daily Salmonid Spawning Temperatures.**

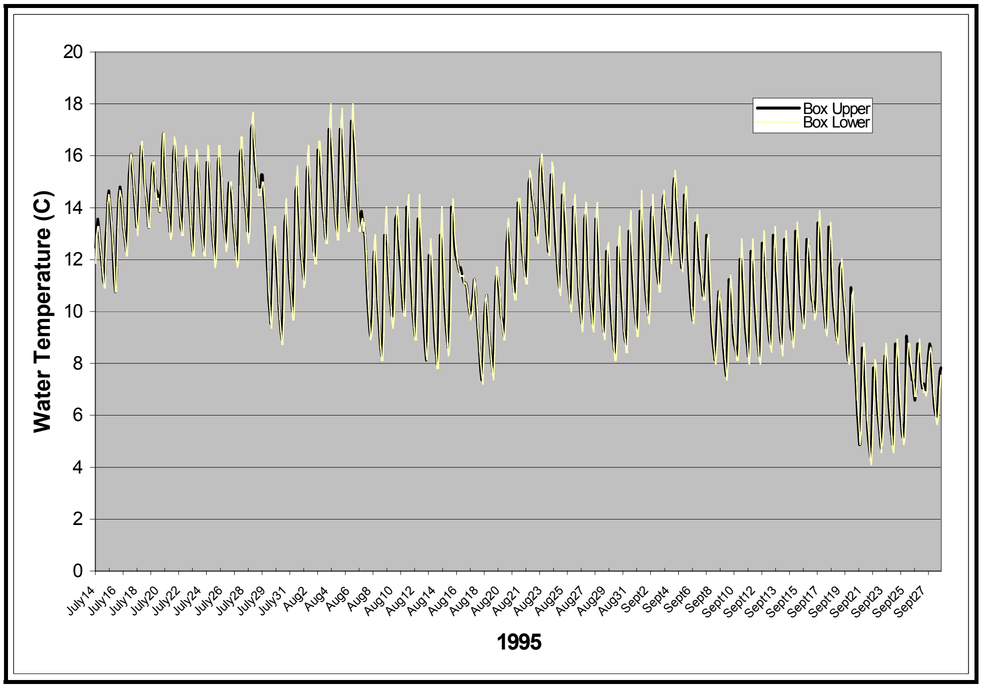


**Figure 48. Box Creek 1995 Average Daily Summer Instream Temperatures.**

### Conclusions

Box Creek is listed on the 1998 303(d) list for temperature. Elevated temperatures in Box Creek may be affecting beneficial uses during spawning season. Stream inventories by DEQ have shown that beneficial uses are not impaired during the summer months. The riparian zone is continuing to improve following the Blackwell Fire of 1994. During salmonid spawning season, the temperature regime may be affected by the drawdown of Box Lake, but the extent of this influence cannot be ascertained without further study. Using aerial photos, pre and post burn vegetative cover were compared. Stream widths pre and post fire appeared to have stayed the same. A shading target of 82% was developed using shade curves for similar Douglas Fir-Grand Fir vegetative community types by averaging results for streams of a similar width and aspect from these TMDLs: the Walla Walla (ODEQ 2004b), Willamette (ODEQ 2004a), Mattole (CRWQCB 2002) and South Fork Clearwater (IDEQ 2002) TMDLs. Since the riparian canopy is not yet at the target cover amount, a TMDL was established.

## Browns Pond

Browns Pond is a 98-acre pond that is used by Lake Fork Irrigation Company for irrigation water storage (Figure 50). At full pool, the pond stores between 1,600-1,800 acre-feet of water. The pond is fed by Lake Fork Creek and is a popular fishery that is stocked with rainbow trout. Located at 5,235' in the Lake Fork Creek subwatershed, the pond is upstream of Little Payette Lake (Figure 49). Browns Pond is surrounded by state land and the watershed is utilized for timber harvest.

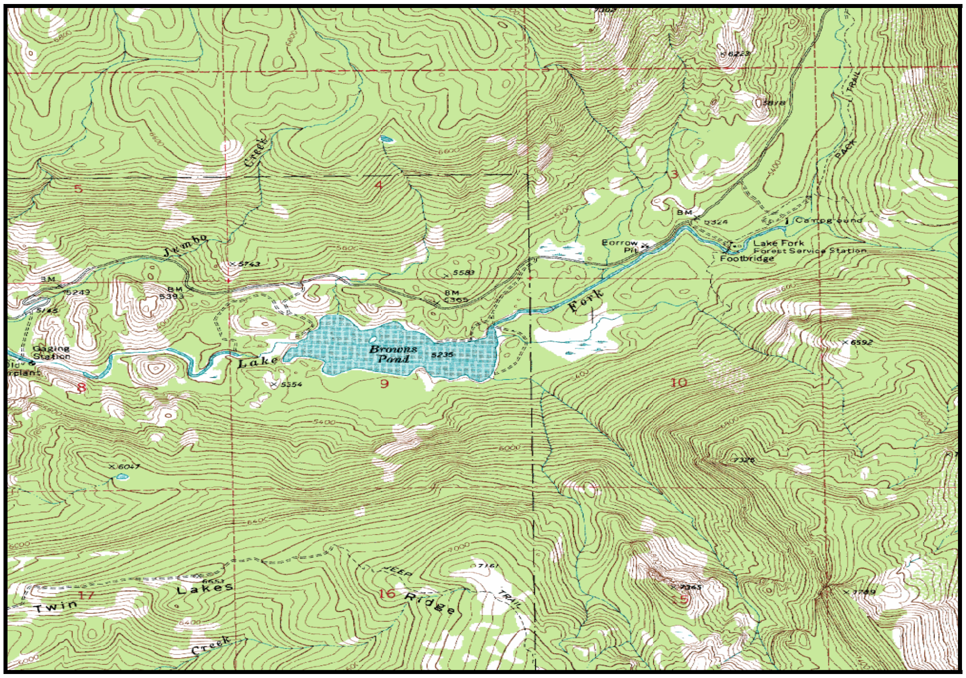


**Figure 49. Browns Pond Subwatershed.**

**Figure 50. Browns Pond.**

## Conclusions

Browns Pond is listed on the 1998 303(d) list for habitat alteration because the dam is a barrier for migration of fish from below Browns Pond to the upper reaches of Lake Fork Creek. Browns Pond water level is regulated by irrigation, but typical summer drawdown conditions still leave sufficient habitat for fish. 2004 site visits did not find nuisance algal growth or other evidence of beneficial use impairment. Browns Pond supports a rainbow trout fishery.

TMDLs are not done for habitat alteration because it is not a pollutant (see Section 5.1, Target Selection). Thus, a TMDL will not be done for Browns Pond.

### Brush Creek

Brush Creek (Figure 52) originates at approximately 7,200 feet at Brush Lake and then flows in a westerly direction for 5 miles before entering the North Fork Payette River above Payette Lake. The Brush Creek watershed is located entirely within state and USFS managed public land and is entirely forested (Figure 51). Upper Brush Creek has a steep gradient characterized by a boulder-lined channel and a step/pool, cascade morphology. Brush Lake is managed for a trout trophy fishery. The watershed was burned in the 1994 Blackwell Fire and salvage timber harvest occurred afterwards. Timber harvest and sheep grazing occur in this watershed.

The Brush Creek drainage is predominantly underlain by highly and weakly weathered granitic rocks of the Idaho Batholith. To a lesser extent the drainage is underlain by loess. These granitics are typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem flood plain and lower tributary flood plains. The weakly weathered material occupies the uplands and ridgelines. The headwater area has substantial amounts of exposed bedrock, cliffs and talus slope (IDL 2003a).

The area is characterized by warm, dry summers and cold, wet winters. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. Lower elevations support a mixed conifer forest stand with Douglas fir, hemlock, western larch and tamarack, with inclusions of Engleman spruce near streams and wetter areas. The presence of lodgepole pine, subalpine fir and pockets of spruce increases correspondingly with elevation and effective precipitation.

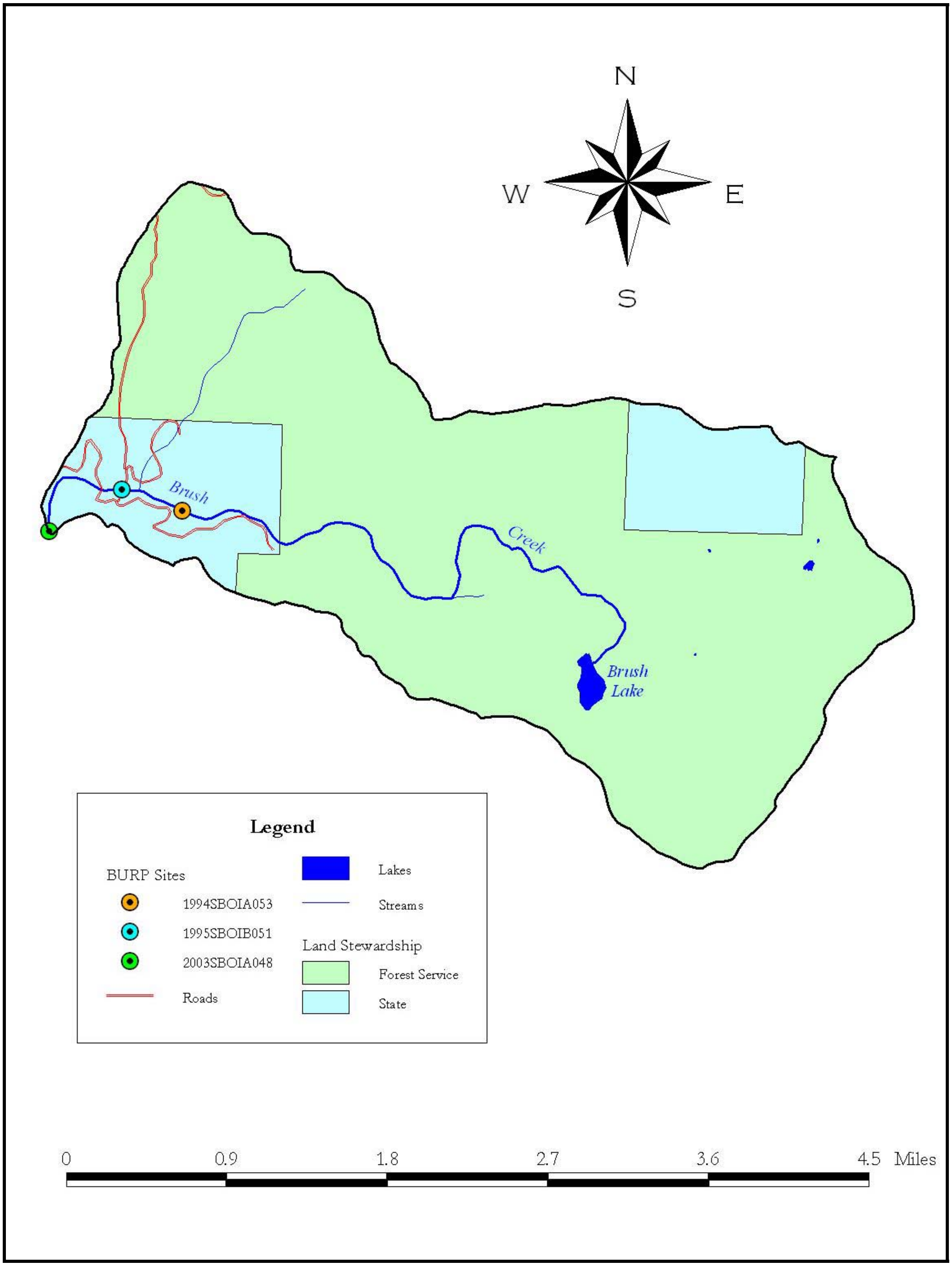


**Figure 51. Brush Creek Monitoring Sites and Land Stewardship.**

**Figure 52. Brush Creek.**

## Flow Characteristics

Brush Creek average monthly flows are shown in Figure 53. Brush Creek tends to peak between April and Mid-June and reach base flow in mid-October.

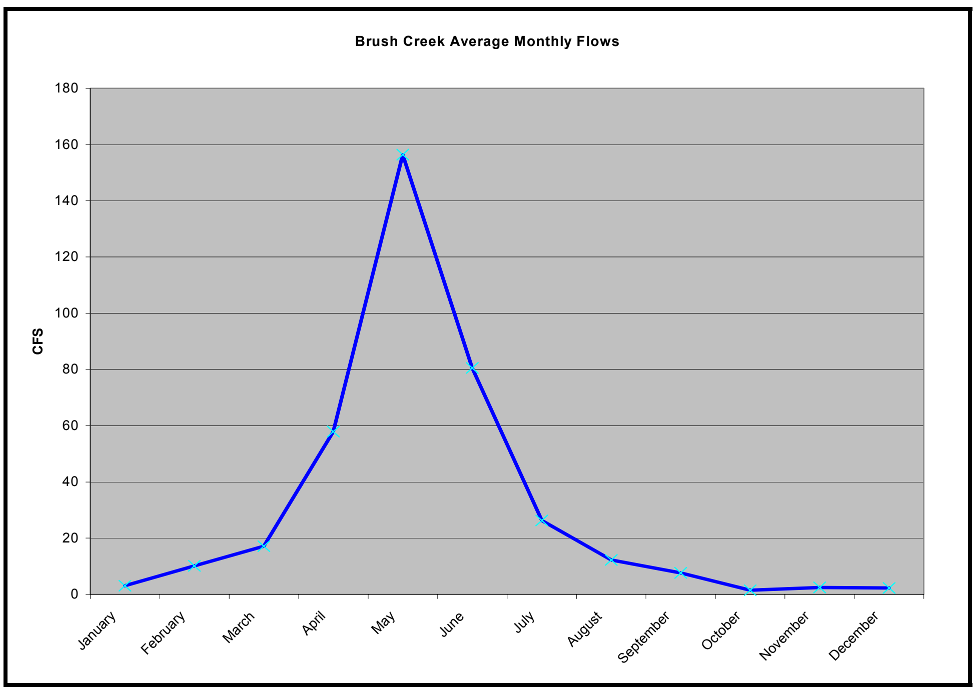


**Figure 53. Brush Creek Average Monthly Flows.**

## Biological/Habitat Data

The Brush Creek watershed was burned in the 1994 Blackwell Fire, and salvage logging occurred in 1995 and 1996. DEQ (1997) reported that sediment was delivered to streams due to timber harvest practices that took place within 50 feet of the stream, which was likely associated with salvage logging after the fire. The estimated amount of sediment delivered to the stream was 7 tons. As shown in the DEQ water body assessment scores, the habitat scores appear affected by the increased sedimentation of the stream and loss of riparian area due to fire (Table 14). The percent fines scores are shown because excess sediment delivery can adversely affect substrate composition and result in decreased diversity in the macroinvertebrate community, decreased pool quality and less robust fisheries. Percent fines remained low in each year measured (Table 15).

DEQ (1997) reported that no management caused landslides (i.e. associated with road building or timber harvest) have occurred in the Brush Creek watershed.

Over time, with a combination of road improvements/closures (Figure 54 shows an example) and riparian area regeneration, water quality has improved in the Brush Creek watershed. The 2003 DEQ BURP data shows that beneficial uses are not impaired. Electrofishing results showed more than three age classes of rainbow trout, including *young of the year,* which is indicative of a healthy fishery.

**Table 14. Brush Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1994SBOIA053 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIB051 | 1 | 2 | No data | 1.5 | Not Full Support |
| 2003SBOIA048 | 3 | 2 | 3 | 2.67 | Full Support |

**Table 15. Brush Creek: Percent fines*.**

| Stream ID | Stream | Percent Fines |
|---|---|---|
| 1994SBOIA053 | Brush Creek-lower reach | 11 |
| 1995SBOIB051 | Brush Creek-lower reach | 3 |
| 2003SBOIA048 | Brush Creek-lower reach | 1 |

*DEQ BURP data

**Figure 54. Brush Creek Road Closure.**

### Conclusions

Brush Creek is listed on the 1998 303(d) list for an unknown pollutant. Brush Creek was impacted from the 1994 Blackwell Fire and may also have shown impacts from historic logging practices and grazing, but in 2003, Brush Creek did not show impairment of beneficial uses and, thus, a TMDL is not necessary.

## Clear Creek

Originating at 7,425 feet, Clear Creek (Figure 56) drains 31,523 acres over the course of 18 miles before emptying into the North Fork Payette River below Cascade Dam at 4,720 feet. Peak flows generally occur in May or June. The watershed is primarily forested (Figure 55).

Highly and weakly weathered granitic rocks of the Idaho Batholith predominantly underlie the Clear Creek drainage. To a lesser extent, fine-textured alluvium and glacial drift/till underlie the drainage. These granite rocks are typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem floodplain and lower tributary floodplains. The weakly weathered material occupies the uplands and ridgelines (IDL 2003b).

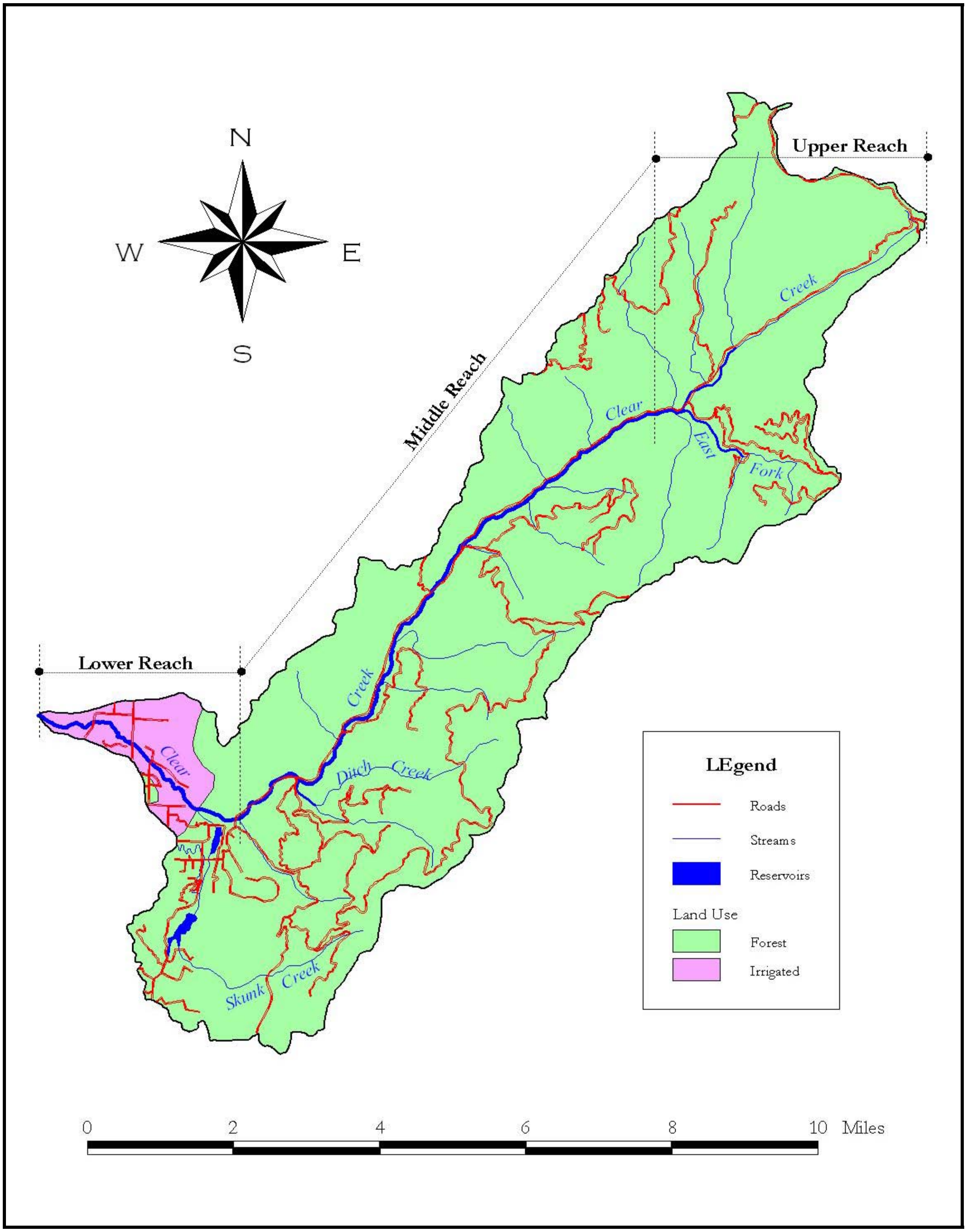


**Figure 55. Clear Creek Hydrology and Land Use.**

**Figure 56. Clear Creek-Upper Reach.**

Stream channels sampled on USFS managed land were mainly classed as Rosgen Type A5 and C5 (Rosgen 1996). Typically, A5 and C5 channels are incised in predominantly sandy materials, tend to have unstable bed and banks, and are very sensitive to induced changes in streamflow regime or in sediment supply (Rosgen 1996). Rosgen Type B channels sampled were classed as B4 and B5, which are considered relatively stable, and are not high sediment suppliers (Rosgen 1996). High bank stability at most sites, including type A channels, indicates factors are in place (large woody debris, riparian vegetation, sediment levels) that are conducive to stable streambanks.

Vegetation in the watershed varies with elevation and aspect. Southeast facing slopes at lower elevations are vegetated with forbs, grasses and ponderosa pine. On northwest slopes, and with increasing elevation, forest stands become denser with a greater number of coniferous species. The presence of Douglas fir, grand fir, western larch, and lodgepole pine increases with elevation and precipitation.

Clear Creek, a third order tributary, supports a cold water fishery of rainbow trout, mountain whitefish, and brook trout. Findings by the Idaho Fish and Game (IDFG) indicate remnant resident redband trout may be in the Clear Creek drainage. IDFG has determined that the wild rainbow trout found downstream in the Cabarton reach of the NF Payette River, 2-3 miles downstream of the mouth of Clear Creek, are spawning in Clear Creek in the spring (Anderson and others, 1987). Past surveys by district fisheries personnel have found rainbow trout in project area streams but brook trout are the predominant species in the watershed.

The lower and middle part of the reach is mainly private land with both active ranching and forestry being practiced as well as areas of rural residential subdivisions. Forest Capital Partners owns most of the middle portion (Boise Cascade previously owned the land). The headwaters are federally managed by the Boise National Forest (Figure 57).

Historically, Clear Creek was used as a route to take sheep to the South Fork Salmon River drainage. Sheep are still grazed near East Mountain during the summer. Approximately every third year, the sheep are brought down Forest Road 405, and held, sorted, and loaded at the junction of Forest Roads 405 and 409. In addition, timber harvest and cattle grazing (Figure 55) are still occurring in the drainage as well as recreational activities such as off-road vehicle use, camping, fishing, and hunting.

The majority of Forest Capital Partners lands (middle reach) have been harvested within the last 50 years. Records indicate that roughly 80 acres were harvested in 1950; 350 acres in 1968; 30 acres in 1970 or 1972; 1200 acres in 1980; and approximately 1800 acres in 1985. Harvest was accomplished using ground-based systems. Roughly 48 miles of road were constructed between 1940 to 1985 to facilitate this harvest (USFS 1999).

The USFS has also had several timber sales over the past 20 years. These are listed in Appendix H. The most recent sales are: 1. Summit Salvage Timber Sale - 1992 2. Clear Creek Summit Timber Sale - 1996 (274 acres; 0 miles road construction; 1.0 miles road reconstruction) 3. Far East Houselog Timber Sale - 1997 (Adjacent to East Mountain Lookout; 10 acres).

The Alpha Ditch Company operates the Alpha ditch, which diverts the majority of instream water from the lower end of Clear Creek during irrigation season. East Mountain and Herrick Reservoirs, two small impoundments, are located in this watershed.

### Flow Characteristics

Stream flow information is sparse. The lower reach of Clear Creek is de-watered by an irrigation diversion on private land, starting in early summer until late fall. An estimated 90% of the summer base flow of Clear Creek is diverted from the existing channel. This diversion is unscreened, meaning it has the potential to trap nearly all juvenile salmonids migrating downstream until the flow is diverted back into the mainstem channel (USFS 1999).

Summer stream flow to Clear Creek is not replaced downstream from the Skunk Creek drainage. Skunk Creek is hydrologically modified by two impoundments. Irrigation ditch lines divert more than 90% of the flow from the Skunk Creek stream channel. Groundwater seepage does provide some flow downstream of the Skunk Creek confluence (USFS 1999).

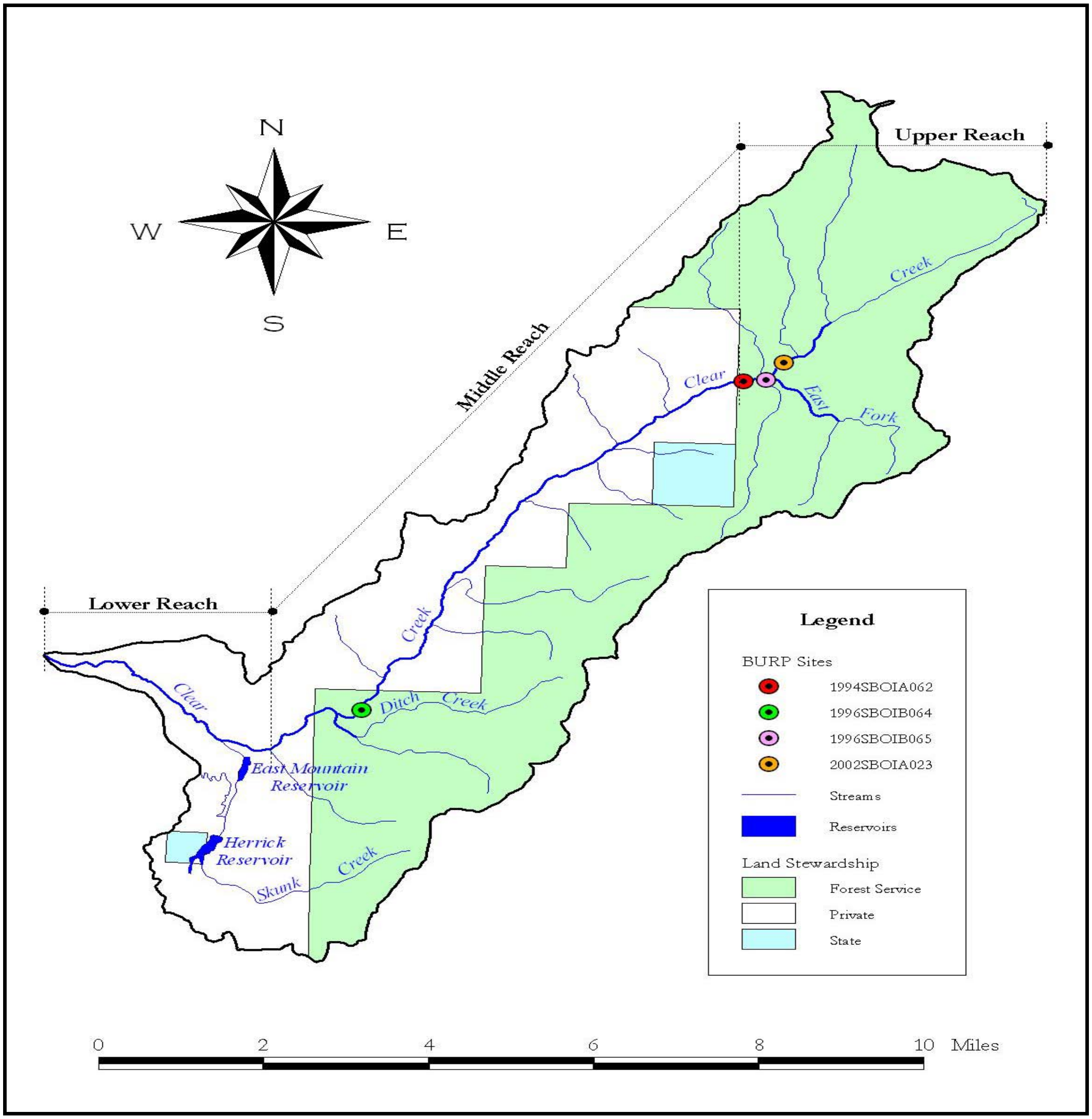


**Figure 57. Land Ownership & Monitoring Sites in the Clear Creek Watershed.**

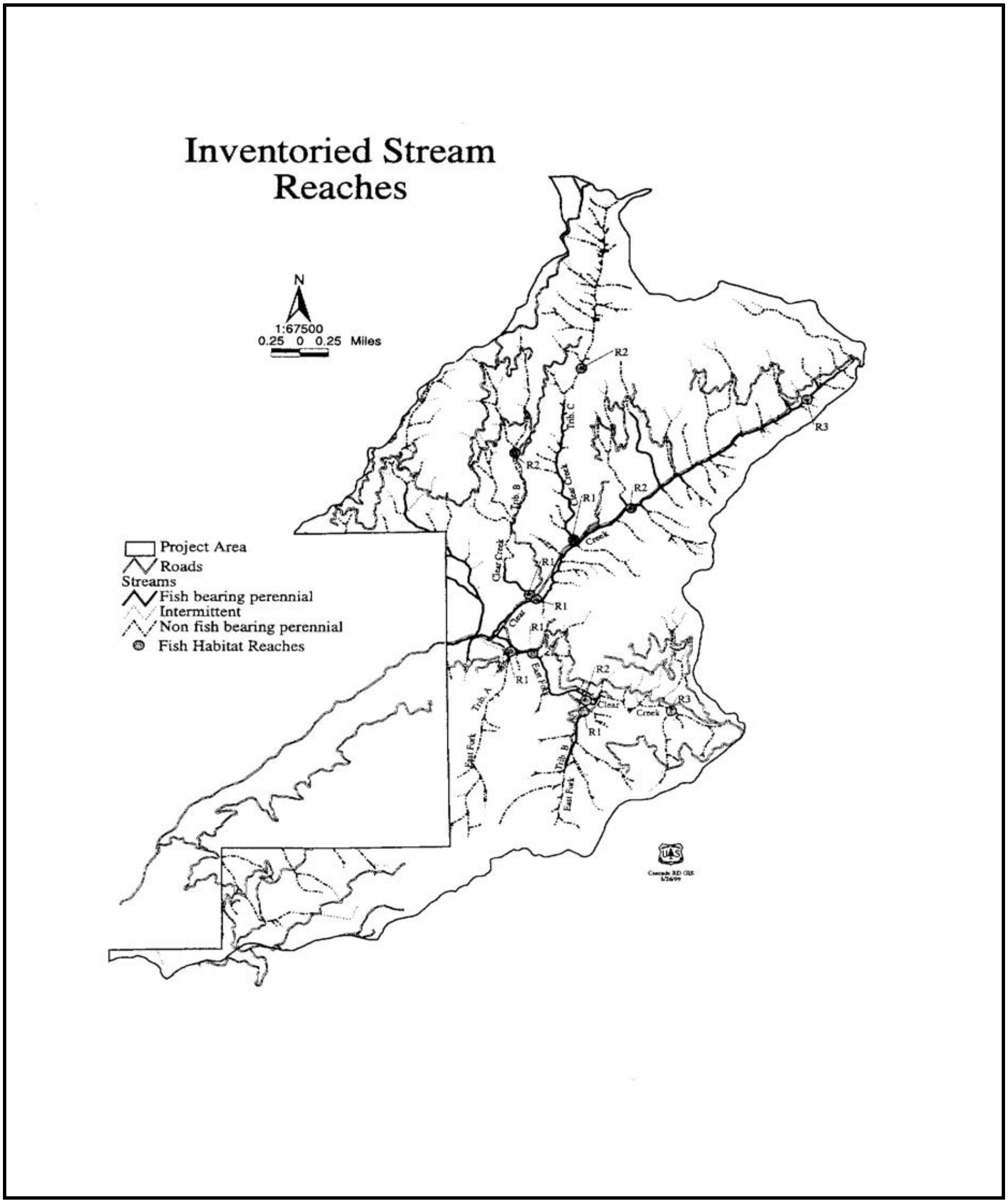


Figure 58. USFS Monitoring Sites in the Upper Clear Creek Watershed.

## Upper Reach

### Biological/Habitat Data

The User's Guide to Fish Habitat: Descriptions that Represent Natural Conditions in the Salmon River Basin (Overton, 1995) was used by the Boise National Forest to compare habitat data from comparable pristine streams to the conditions in the Clear Creek drainage (Figure 58). Streams are compared by Rosgen stream channel type.

For the purposes of this TMDL, the Upper Reach of Clear Creek is delineated as the USFS managed public land from Road 409 upstream (Figure 57). Currently beneficial uses do not appear impacted, but may be threatened by increasing sediment levels and conditions could be improved to further improve cold water fisheries. DEQ water body assessment scores showed that beneficial uses were not impaired in the upper reach.

#### *Sediment*

Elevated fines in pool tailouts at Clear Creek and Clear Creek tributary sites indicate sediment is impairing spawning habitat in that portion of the drainage (Tables 16-18). Lower pool tailout fines at sites in the East Fork Clear Creek watershed indicate spawning habitat to be in better condition there. Though field observation, width depth ratio, width max depth ratio, and bank stability site data indicated that the desired fish habitat conditions are currently being met, and channels are for the most part not degraded, consistently elevated percent fines in Clear Creek and tributary sites in all channel types (Table 16), and evidence of degradation in the sensitive C5 channel site, indicate sediment levels may be approaching those leading to channel degradation.

As shown in the tables below, Clear Creek has percent fines greater than the 37% mean typically found in C channel plutonic streams and the 23% found in B channel plutonic streams (Overton 1995) in undisturbed areas. Most of the Clear Creek surface fines measurements were taken in B channels.

Table 17 includes the relationship between percent fines and rainbow trout egg-to-fry survival. Elevated pool tail out fines at all Clear Creek and Clear Creek tributary sites indicate that sediment is impairing spawning habitat in these streams (Tables 16-18). Spawning fines at these sites range from 38 to 81% which equates to approximately 44% to 0% egg-to-fry survival, respectively. Conditions in the lower reaches of the East Fork of Clear Creek show spawning habitat comparable to pristine sites.

**Table 16. Median Percent fines score for Clear Creek Watershed (USFS 1999).**

| Stream | Median Percent Fines |
|---|---|
| Clear Creek | 43 |
| East Fork Clear Creek | 26 |
| Other Clear Creek Tributaries | 61 |

**Table 17. Wolman pebble count fines in spawning habitat (USFS 1999).**

| Stream/Reach | Percent Fines (particles <6mm) | Approximate Percent Egg to Fry Survival |
|---|---|---|
| Clear Creek reach 1-upper reach | 42 | <25 |
| Clear Creek reach 1-upper reach | 54 | 12 |
| Clear Creek reach 2-upper reach | 40 | <25 |
| Clear Creek reach 3-upper reach | 43 | <25 |
| Clear Creek reach 3-upper reach | 43 | <25 |
| Clear Creek trib B reach 1-upper reach | 38 | <25 |
| Clear Creek trib B reach 2-upper reach | 61 | 0 |
| Clear Creek trib B reach 2-upper reach | 52 | 16 |
| Clear Creek trib C reach 1-upper reach | 81 | 0 |
| Clear Creek trib C reach 1-upper reach | 48 | <25 |
| East Fork Clear Creek reach 1 | 26 | 68 |
| East Fork Clear Creek reach 3 | 76 | 0 |
| East Fork Clear Creek trib A | 30 | 60 |
| East Fork Clear Creek trib B | 18 | > 80 |
| East Fork Clear Creek trib B | 19 | >80 |

- approximate egg to fry survival determined using Tables A.1, E.2, E.3, and Figure II.C.23 in Chapman and McLeod (1987)

**Table 18. Percent Fines in Clear Creek Rosgen B Channel Type(DEQ).**

| Stream ID | Stream | Percent Fines |
|---|---|---|
| 2002SBOIA023 | Clear Creek –Upper Reach | 43 |
| 1996SBOIB065 | Clear Creek-Upper Reach | 37 |
| 1996SBOIB064 | Clear Creek-Middle Reach | 44 |

### *Bank Stability*

Unconsolidated bank material makes the stream vulnerable to sedimentation from channel erosion. The critical period for sediment delivery from channel erosion is during runoff and large precipitation events. While bank angles are fairly steep, the banks were all greater than 82% stable, indicating that bank erosion is likely not contributing excess sediment to this section. The majority of banks measured were 100% stable (Table 19). Notes from surveys in 1997 and 1998 also indicate little channel instability (USFS 1999).

### *Width-to- Depth Ratio*

Width-to-depth (w:d) ratio provides a dimensionless index of channel morphology, and can be an indicator of change in the relative balance between sediment load and sediment transport capacity (see page 71 for a more detailed description). W:d values near or below natural condition values at all surveyed reaches in Clear Creek indicate that despite elevated fines, scour pool dimensions are similar to those seen in pristine streams (Table 19).

### *Pools Per Mile/Large Woody Debris*

Trees provide shade and streambank stability because of their large size and massive root systems. As trees mature and fall into or across streams, they not only create high-quality pools and riffles, but their large mass also helps to control the slope and stability of the channel (Platts 1983). This large woody debris (LWD) influences sediment transport in streams by forming depositional sites (Megahan and Nowlin 1976). In many aquatic habitats, if it were not for the constant entry of LWD into the streams, the channel would degrade and soon flow on bedrock, leaving insufficient spawning gravels and few high-quality rearing pools for fish (Platts et al. 1987). LWD is one of the most important sources of habitat and cover for fish populations in streams, as well as pool forming agent in small streams (MacDonald and others 1991).

Current habitat data indicate pool number and LWD levels in area streams exceed those seen in pristine streams (Table 19).

**Table 19. Fish Habitat Conditions: Upper Reach Clear Creek** (USFS 1999).

| Rosgen Channel Type A | | | | |
|---|---|---|---|---|
| **Stream Reach** | **Pools per mile** | **LWD/mile** | **Mean bank stability (%)** | **Mean Width/Depth Ratio** |
| **Overton (1995) Reference Conditions** | **10.8** | **225.2** | **96** | **19** |
| Clear Creek Tributary B | 159.5 | 669.7 | 99.8 | 21.5 |
| Rosgen Channel Type B | | | | |
| **Overton (1995) Reference Conditions** | **74.9** | **219.9** | **88** | **27** |
| Clear Creek Reach 2 | 173.3 | 409.7 | 100 | 16.5 |
| Clear Creek Tributary B, Reach 1 | 132.5 | 264.9 | 93.4 | 15 |
| Clear Creek Tributary C, Reach 1 | 231.4 | 231.4 | 100 | 16.5 |
| Clear Creek Tributary C, Reach 2 | 141.8 | 283.7 | 100 | 22.6 |
| East Fork Clear Creek, Reach 1 | 235 | 407.3 | 82.9 | 34 |
| East Fork Clear Creek Tributary B, Reach 1 | 237.3 | 533.9 | 100 | 25.5 |
| East Fork Clear Creek, Reach 3 | 147 | 368 | 100 | 12.1 |
| East Fork Clear Creek Tributary A, Reach 1 | 91.2 | 243.3 | 100 | 12.4 |
| East Fork Clear Creek Reach 2 | 110 | 94 | 99 | 15.8 |
| Rosgen Channel Type C | | | | |
| **Overton (1995) Reference Conditions** | **65.1** | **222.7** | **84** | **28** |
| Clear Creek Reach 1 | 170.8 | 264 | 0 | 13.7 |

### *Sediment Delivery from Roads*

Although all roads are potential sediment sources, those directly adjacent to streams are of the greatest concern. Roads that are located near meandering low gradient channels often disconnect the channel from its adjacent floodplain and result in bank cutting during higher flows. Roads in the Clear Creek watershed are close to the stream channel in several places and there are at least 30 road crossings in the watershed. Due to the proximity of roads to the stream channel, Clear Creek is vulnerable to excess sedimentation.

Table 20 shows estimates of the annual sediment contribution attributable to roads. Tables 21 and 22 show DEQ water body assessment scores and USFS summary information, respectively. BOISED modeling estimates that road-related sediment is currently being delivered to streams in the middle and upper watersheds at 21% over background rates.

A sediment TMDL for the middle and upper Clear Creek reaches will be developed by using BOISED results for the East Fork Clear Creek as reference conditions for the rest of the watershed. The tributaries to the East Fork and the lower East Fork Clear Creek reach had low percent fines and roads are within close proximity in these areas.

In the Fall, 2004, data was collected to provide ground truthed input to GEO WEPP, another sediment delivery model. However, permission from the main private landowner (Boise Cascade was the owner in 2004 and did not allow DEQ access for sediment delivery data collection) is needed to obtain important data on delivery distance and slope to the stream in order to accurately run the model. This modeling effort would provide more specific, detailed information for implementation on where to focus sediment delivery reduction efforts.

**Table 20. Clear Creek Sediment Yield (USFS 1999).**

| Stream Reach | Watershed Size | Percent over Natural Sediment Yield | Road Related Sediment (tons/year) |
|---|---|---|---|
| West Fork | 1327 | 35 | 32.4 |
| North Fork | 923 | 27 | 12.6 |
| Long Prong | 1346 | 10 | 13 |
| Upper Clear | 2811 | 14 | 29.1 |
| Upper Main Forest Service | 689 | 11 | 6.3 |
| East Fork | 3170 | 12 | 16.8 |
| Upper Main Boise Cascade | 5276 | 33 | 76.1 |
| Upper East Mountain | 571 | 12 | 2.7 |
| East Mountain | 581 | 45 | 11.9 |
| $6^{th}$ field watershed | | | |
| Upper Clear Creek | 16693 | 21 | 200.9 |

**Table 21. Clear Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1994SBOIA062 | 1 | 3 | No data | 2 | Full Support |
| 1996SBOIB065 | No data | 3 | No data | Not Assessed | Not Assessed |
| 2002SBOIA023 | 2 | 2 | 3 | 2.33 | Full Support |

**Table 22. 2002 Clear Creek Stream Summary Information (USFS 2003).**

| Stream | Reach | Sinuosity | Stream Density ($km/km^2$) | Riparian Road Density ($km/km^2$) | # road crossings |
|---|---|---|---|---|---|
| Clear Creek | 127-01-I-I1-02 | 1.2 | 1.34 | 0.6 | 30 |

### *Macroinvertebrate Data*

The River Invertebrate Prediction and Classification System (RIVPACS) Score describes the similarity of the invertebrate species composition at a site to the species composition found at similar *reference sites*. The model was developed using 112 reference sites and all values below a threshold of 0.78 have a high probability of being biologically impaired. As seen in Table 23, the RIVPAC score for Clear Creek is above the 0.78 threshold, indicating a low probability of impairment (USFS 2003).

**Table 23. Macroinvertebrate Data for Clear Creek (USFS 2003).**

| Taxa Richness | # Clinger Taxa | # Long Lived Taxa | # of Ephemeroptera Taxa | # of Plecoptera Taxa | # of Tricoptera Taxa | Community Tolerance Quotient | RIVPAC's Score of Observed / Expected |
|---|---|---|---|---|---|---|---|
| 47 | 23 | 6 | 14 | 6 | 8 | 61 | 1.05 |

### Riparian Vegetation

The Greenline Ratings in Table 24 below are calculated by looking at the percent cover of plant community types. The ratings in this table indicate that riparian cover is good for this particular reach of stream.

**Table 24. Greenline Riparian Monitoring Results for Clear Creek (USFS 2003).**

| Stream | Greenline wetland rating | Greenline Successional rating (% late seral) | Effective Ground Cover (%) |
|---|---|---|---|
| Clear Creek | 93 | 99 | 100 |

### Fisheries
The Idaho Department of Fish and Game has determined that the wild rainbow trout found downstream in the Cabarton reach of the North Fork Payette River, 2-3 miles downstream of the mouth of Clear Creek, spawn in Clear Creek in the spring (Anderson and others, 1987). However, brook trout are the predominant species in the watershed. DEQ data indicate that the upper watershed supports a healthy fishery. DEQ found mainly brook trout and sculpin in their 2002 stream inventory.

### Temperature Data
Upper Clear Creek does not exceed the cold water aquatic life temperature standard and also meets USFS guidelines for migratory and rearing temperatures (Table 25).

**Table 25. 2002 Clear Creek Temperature Data (USFS, unpublished data)**

| Stream | Reach ID | Daily Average Temperature >19°C | Daily Average Temperature Impairment | # of Days Reported | Daily Maximum Temperature Impairment |
|---|---|---|---|---|---|
| Clear Creek | 127-01-I-I1-02 (downstream end of Upper Reach) | 0 | Unimpaired | 43 | Unimpaired |

Spawning temperatures are likely met due to spring and fall spawning by rainbow and brook trout, respectively, and corresponding cool seasonal temperatures. Stream temperatures in upper reaches and tributaries, observed riparian shading, shade density data, and fish presence/absence surveys indicate areas of thermal refuge are available and may be used by resident fish species.

## Middle Reach

### Biological/Habitat Data
The middle reach is comprised of primarily private land from the Forest Service boundary at Road 409 to where the Clear Creek Road stops paralleling the stream (Figure 57). DEQ was denied access to the majority of this reach. USFS BOISED results were used to determine a TMDL sediment allocation based on reference conditions in the East Fork Clear Creek watershed. Table 20 has sediment delivery results for Upper Main Boise Cascade and East Mountain Roads which are located in this reach.

DEQ conducted a partial habitat inventory in 1996, which indicated that the stream had a diverse macroinvertebrate community (Table 26). USFS habitat inventories indicate that this reach has elevated fines and low amounts of woody debris (Table 27). This reach is located in a meadow area, which may contribute to the low amount of woody debris. Width/depth ratios, stream width, pool frequency, bank stability and temperature are all within acceptable ranges.

**Table 26. Middle Reach Clear Creek: DEQ Water Body Assessment Score.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1996SBOI064 | Not Assessed | 3 | Not Assessed | Not Assessed | Not Assessed |

**Table 27. Clear Creek: Sites Above and Below the Ditch Creek confluence (USFS 2002 unpublished data).**

| Habitat Parameter | Site Above | Site Below | Overton Reference Criteria |
|---|---|---|---|
| Stream Width | 21.5 ft | 22.4 ft | 25 ft |
| Pool frequency /mi | 46 | 62 | 47 |
| Water temp. (C)* | 17 | 17 | <15 C max.; < 9C avg. |
| LWD /mi | 0 | 0 | 220 |
| Bank Stability (%) | 92 (non-forested) | 83 (non-forested) | >80 |
| W:D ratio | 32 | 22 | 27 |
| WPC (%) fine sediment | -- | 66% | Rosgen 'B'; Plutonic Mean = 23% |

### Fisheries

Table 28 shows the fish found in a survey in the middle reach of Clear Creek. The combination of increased stream temperatures from highly reduced summer stream flows in the lower reach, and the unscreened irrigation headgate immediately downstream of national forest lands are maintaining losses to juvenile fish populations both upstream of this diversion and in the dewatered lower segment.

**Table 28. Fish Presence/Absence Snorkeling (USFS 2002)**

| Species | Clear Ck 'Above confluence with Ditch Creek' | | Clear Ck 'Below confluence with Ditch Creek' | | Ditch Ck. Mainstem | | Ditch Ck 'North Fork' | |
|---|---|---|---|---|---|---|---|---|
| | # fish | #/100m² | # fish | #/100m ² | # fish | #/100m ² | # fish | #/100m² |
| Rainbow Trout | 17 | 4.15 | 35 | 4.99 | 2 | 3.06 | 2 | 3.25 |
| Brook trout | 0 | 0 | 0 | 0 | 16 | 6.75 | 27 | 11.7 |
| Young-of-the Year | Present | | 44 | 6.28 | --- | | ---- | |

## Lower Reach

The lower reach is delineated as the section of Clear Creek from where the Clear Creek road no longer parallels the creek to the mouth (Figure 57). Channel erosion was surmised to be the greatest contributor of sediment in this reach because the road does not parallel or cross the creek as frequently as in the middle and upper reaches. Channel erosion inventories were done in the summer of 2004. The section between the upper end of the reach and Highway

55 was determined to be stable. Evidence of bank erosion during peak flow events is evident, but overall banks were >80% stable, and damaged areas appeared to be healing (USFS 1999).

Below Highway 55, banks were <80% stable with the exception of the reach at the mouth of the creek. Over-widened channels exist throughout most reaches, except at the upstream section of the lower reach. Excessive sand, past livestock over-utilization of riparian areas, and diverted flows seem to be the main causes of streambank instability. Regeneration of shrub species is limited within most of the reaches assessed. Flow alteration, erosion from roads, channelization, streambank damage by livestock, and low stream gradient areas that tend to allow settling all contribute to excess percent fines.

### Conclusions

Clear Creek is on the 303(d) list for sediment. In the upper reaches, elevated percent fines are present but do not appear to be degrading pool quality as shown in width maximum depth ratios that are similar to pristine streams in similar areas. Bank stability and riparian area measurements indicate that bank erosion is not a significant source of sediment. The percent fines exceed the Natural Conditions Database values found in suitable fish rearing and spawning habitats in pristine streams (Overton and others, 1995). Elevated percent fines in the stream channel, as well as ongoing activity in the watershed that could contribute excess sediment to the stream, necessitate the development of a TMDL to restore beneficial uses in lower Clear Creek and ensure that beneficial uses continue to be supported throughout the rest of Clear Creek.

The middle reach of Clear Creek is delineated as the section from just downstream of the USFS managed public land to where the road stops paralleling the creek below the Alpha Ditch. This area has grazing, timber, and road management activities associated with it. Sediment delivery from roads and channel erosion may both be factors in sediment delivery. DEQ focused on roads because the roads appeared to be the predominant source of erosion, but, also, DEQ was denied access to Clear Creek to evaluate the channel. Thus, contributions from channel erosion are not determined. BOISED modeling results show that a TMDL for sediment is necessary.

Channel erosion inventories were conducted in the lower reach of Clear Creek. The section from the lower boundary of the middle reach of Clear Creek to Highway 55 was greater than 80% stable. The section from Highway 55 downstream to the mouth of Clear Creek was predominantly <80% stable. Bank erosion is contributing excessive sediment to Clear Creek and a TMDL is necessary. Sediment allocations upstream will also improve the water quality in lower Clear Creek.

## Elip Creek

Elip Creek is an intermittent first order tributary to Twah Creek that flows into the North Fork Payette River above Big Payette Lake (Figures 59 and 60). Elip Creek originates in forested land at 5,800 feet and flows for less than 1.5 miles before emptying into Twah Creek in a meadowed area at approximately 5,100 feet. Twah Creek supports a brook trout fishery. Elip Creek is located entirely on state land. The creek shows Rosgen channel type A, B and C characteristics.

Twah Creek had a significant amount of timber harvested in the 1990's relative to the other subwatersheds found in the Upper North Fork Payette River area (1,355 acres). The Twah Creek watershed was not burned in the 1994 fires. Timber harvest was primarily by tractor skidding. A portion of this timber harvest was estimated to have occurred within 50 feet of Twah Creek. No management induced landslides have occurred in the Twah Creek watershed as a result of timber harvest or road building activity.

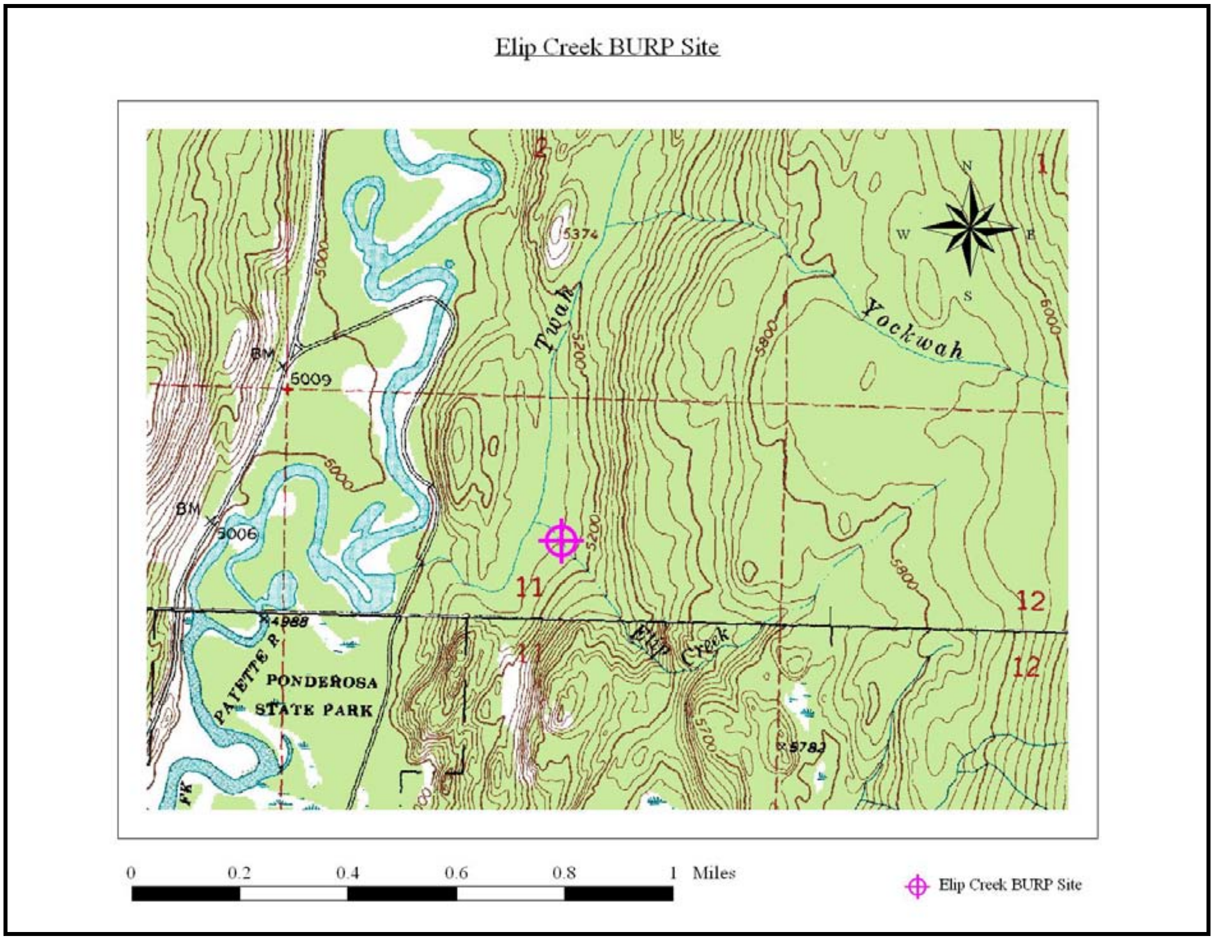


**Figure 59. Elip Creek Hydrology and Monitoring Sites.**


**Figure 60. Elip Creek.**

In the meadow area where Elip Creek enters Twah Creek, thistles are not only found throughout the meadow but also are encroaching into the riparian area. While this is not necessarily a water quality concern, the displacement of more desirable riparian species is of concern.

### Flow Characteristics

The flow in late July 1995 was 1.59 cfs. Elip Creek appears to flow through the summer in some years and not in others. Elip Creek was dry in 2003 when the DEQ stream inventory crew surveyed it. In early August 2004, DEQ staff found standing water but no significant flow in the meadow area. In late October 2004, DEQ staff noted flows < 1cfs in Elip Creek following a period of heavy rain.

### Biological/Habitat Data

In 1995, a DEQ stream inventory crew surveyed Elip Creek and found that beneficial uses were not impaired (the SMI and SHI ratings were both 3, the highest score; no electrofishing took place, so an SFI could not be calculated). The percent fines score was 10%, although the stream inventory crew noted that the substrate had a high percent embeddedness. Streambanks were 100% stable and riparian canopy closure was high.

### Conclusions

Elip Creek is listed for an unknown pollutant on the 1998 303(d) list. Lack of flow, not a specific pollutant, appears to limit stream habitat in Elip Creek. Beneficial uses were not impaired when Elip Creek was surveyed when flowing water was present and, thus, a TMDL is not necessary.

## Fall Creek

Originating at 7,809 feet, Fall Creek is in a 4,210 acre forested watershed in central Idaho managed for timber production (Figures 61 and 62). From its headwaters, Fall Creek flows 4.8 miles before entering Payette Lake at 4,990 feet approximately 3.5 miles outside of McCall, Idaho. A portion of Fall Creek originates as spillover from Blackwell Lake, a small regulated glacial lake located in the upper third of the watershed. Land ownership is public and is primarily managed by the U.S. Forest Service (Payette National Forest) and to a lesser extent by the Idaho Department of Lands (IDL).

Fall Creek is a 3rd order tributary to Payette Lake with a dendritic stream feeder pattern. The drainage is oriented in a southwest direction with side tributaries entering mostly from the east and north (IDL 2003d).

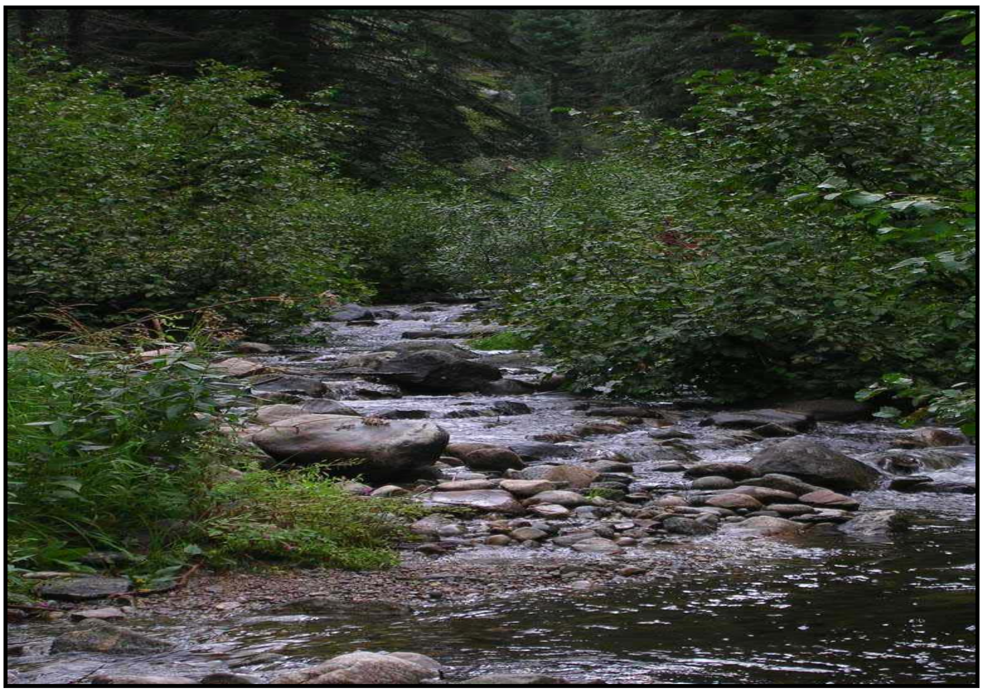

**Figure 61. Fall Creek: Lower Reach.**

The Fall Creek drainage is predominantly underlain by highly and weakly weathered granitic rocks of the Idaho Batholith. To a lesser extent, the drainage is underlain with loess at the mouth of Fall Creek. This granite rock is typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem floodplain and lower tributary flood plains. The weakly weathered material occupies the uplands and ridgelines (IDL 2003d).

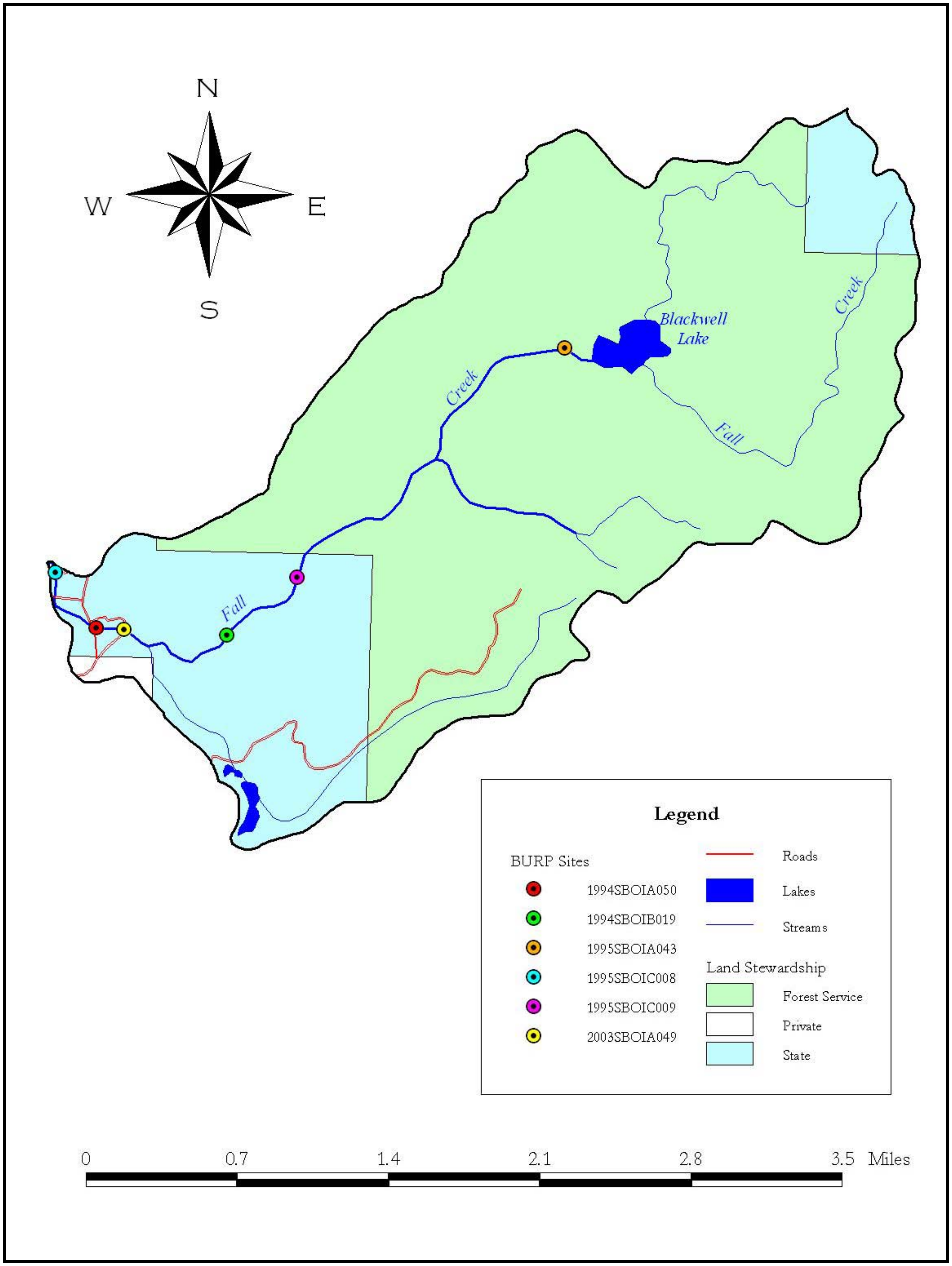


**Figure 62. Fall Creek Hydrology, Land Ownership and Monitoring Locations.**

Rainbow trout, brook trout, sculpin and cutthroat trout are found in Fall Creek. Kokanee salmon spawn in Fall Creek in the fall months.

Some recreational camping and off road vehicle riding occurs near the mouth of Fall Creek.

## Flow Characteristics

Fall Creek flows generally peak in May, corresponding to snowmelt, and remain high through mid-June (Figure 63). Base flows occur in October and November (IDEQ 1997).

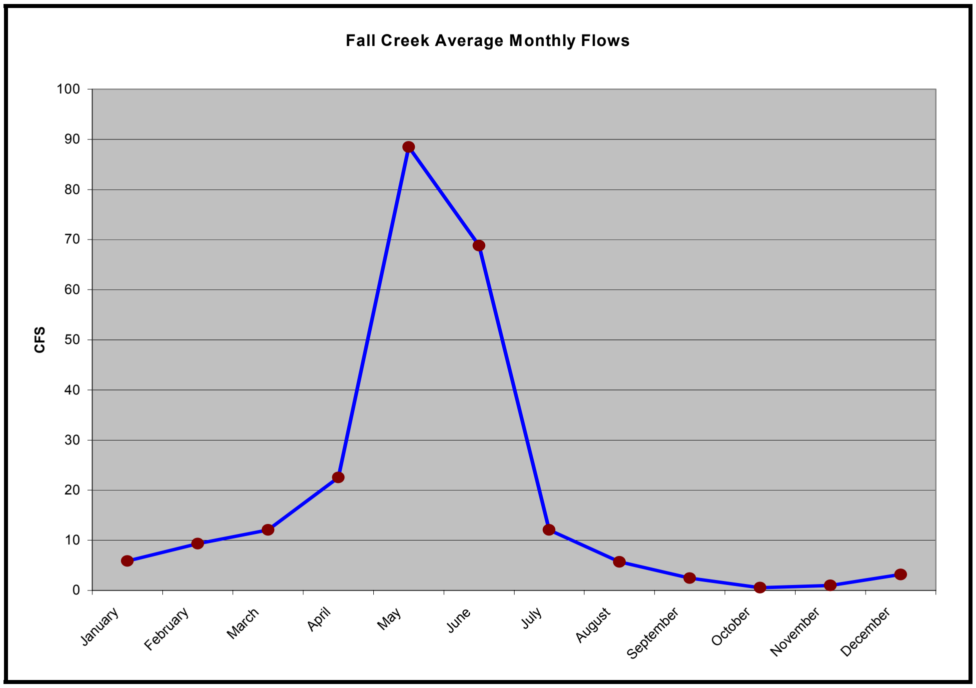


**Figure 63. Fall Creek Average Monthly Flows.**

## Water Column Data

Fires occurred in 1994 in the headwaters of Fall Creek. The fire caused extensive tree mortality and burned most of the ground cover. Field observations indicated that the riparian area burned and resulted in streambank destabilization (IDEQ 1997). Sediment delivery from overland flow sites was also evident throughout the headwaters. The first year after the wildfire, total phosphorus concentrations were very high during runoff (2.062 mg/L and 1.003 mg/L). By the second season, total phosphorus concentrations were only slightly higher than the similar and unburned Deadhorse Creek in the watershed (eighteen times lower than the year before) as shown in Figure 64. Sediment concentrations also decreased but not by as large a magnitude (Figure 65).

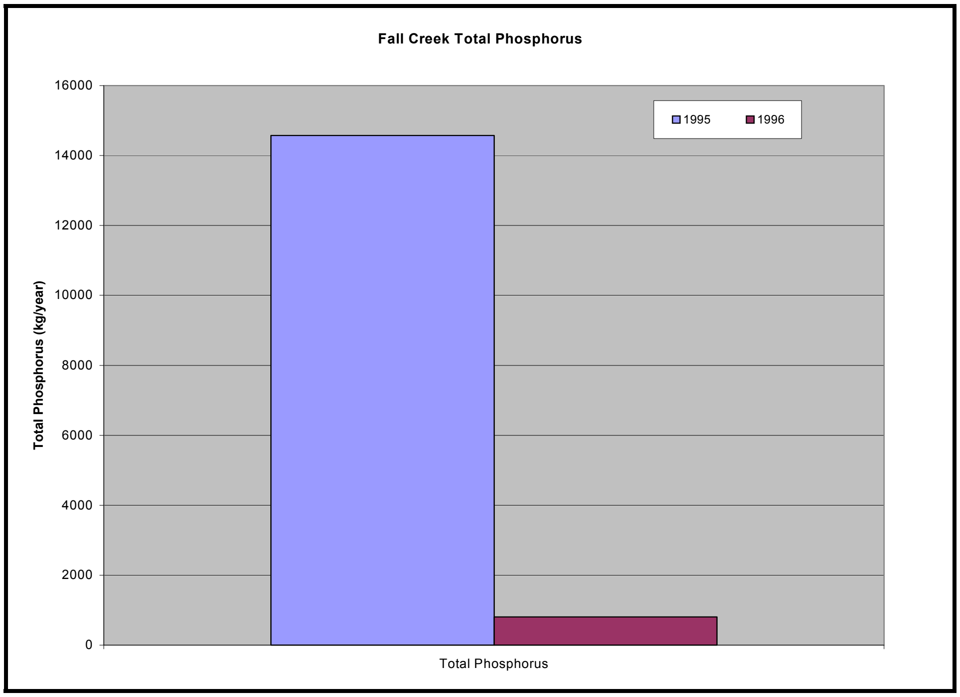


**Figure 64. Fall Creek 1995/1996 Total Phosphorus Concentrations.**

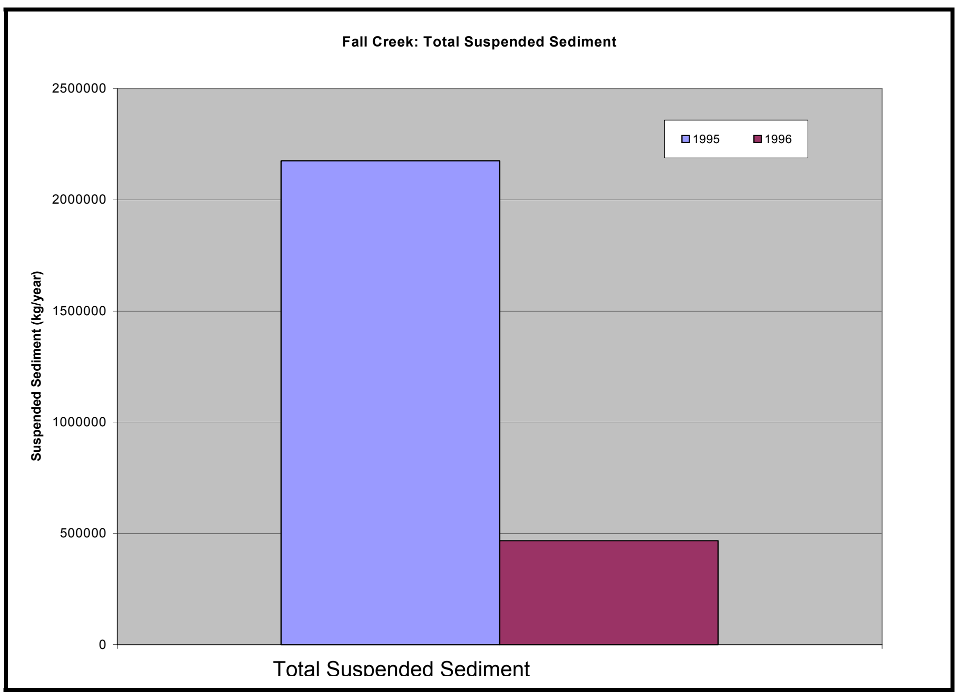


**Figure 65. Fall Creek 1995/1996 TSS Concentrations.**

## Biological/Habitat Data

The most recent DEQ stream inventory data shows that beneficial uses in Fall Creek are not impaired (Table 29). The 1995 inventory was taken a year after the Blackwell fire.

**Table 29. Fall Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1994SBOIA050 | 1 | 3 | 3 | 2 | Full Support |
| 1994SBOIB019 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIA043 | No data | 2 | 1 | 1.5 | Not Full Support |
| 1995SBOIC008 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIC009 | 2 | 2 | No data | 2 | Full Support |
| 2003SBOIA049 | 3 | 2 | 3 | 2.67 | Full Support |

A Cumulative Watershed Effects (CWE) assessment (IDL 2003d) identified some bank sloughing, reduced vegetative bank protection, moderate bank rock content, some bank cutting, lack of large organic debris, channel bottom movement and channel bottom rock shape/roundness, all contributing to the moderate rating (Table 30).

2004 DEQ channel erosion inventories of Fall Creek showed only slight erosion in the lower reach. Overall, banks were greater than 85% stable in the lower and middle reaches.

**Table 30. 1995 Fall Creek Channel Stability Index (CSI) Ratings (IDL 2003d).**

| Reach | CSI Rating |
|---|---|
| Fall Creek 1 | Moderate |
| Fall Creek 2 | Moderate |

A CWE study showed that roads had a low potential for sediment delivery to Fall Creek. Road closures have also occurred in this drainage, with most roads in the watershed permanently closed to vehicular traffic with the exception of snowmobiles, protecting the creek from excess sediment delivery. Skid trails have been obliterated.

Timber harvest has occurred and continues to occur in the Fall Creek drainage with the most recent harvest occurring in 2000 and 2001. However, stream buffers and erosion control measures on skid trails that are in compliance with the Forest Practices Act are effective in protecting the stream from excess sediment delivery (IDEQ 1997). DEQ (1997) estimated that during the 1980s timber harvest occurred within 50 feet of the stream and sediment was delivered to the stream. Fall Creek has also had one management caused landslide due to a road failure that delivered sediment to the stream.

## Temperature Data

Fall Creek is listed for temperature on the 303(d) list. Summertime temperatures in Fall Creek do not exceed the state standard of 19°C maximum daily average. Rainbow trout spawning and egg incubation occurs in the time period between March 15th-July 15th and is triggered by temperature and flow considerations. Kokanee spawning occurs in fall, usually after September 1st, and the spawning/incubation period is defined as the period between September 1st – May 1st. Spawning is generally triggered at temperatures above 6-9°C. In order to meet the salmonid spawning criteria, temperatures recorded during the March 15th-July 15th window must not exceed the 9° C daily average standard in more than 10% of the days in that period. As shown in Figure 66, the spawning criteria are not met during this time period.

There are both historic anthropogenic and natural factors that have limited the potential of the riparian area, particularly the Blackwell Fire. Currently, the Forest Practices Act is followed, and while there may be some sediment delivery and riparian degradation association with recreational vehicles, those effects are localized and appear minimal. Recovery is still occurring, and temperature does not appear to be greatly affected by anthropogenic influences at this time. Using aerial photos, pre and post burn vegetative cover were compared. A shading target of 85% was developed using shade curves for similar Douglas Fir-Grand Fir vegetative community types by averaging results for streams of a similar width and aspect from these TMDLs: the Walla Walla, Willamette, Mattole and South Fork Clearwater TMDLs. Since the riparian canopy is not yet at the target cover amount, a TMDL was established to help achieve salmonid spawning criteria.

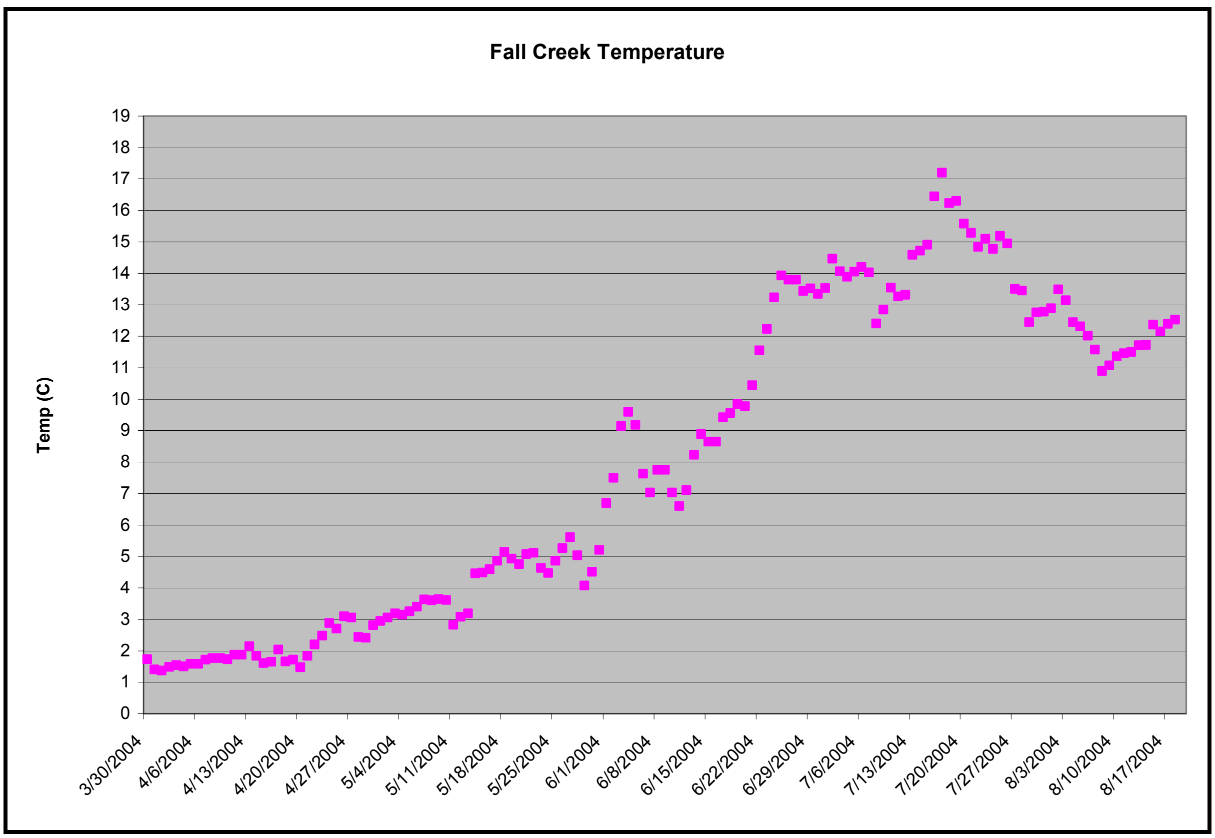


**Figure 66. Fall Creek Temperature 2004 (DEQ data).**

### Conclusions

Fall Creek is listed for temperature on the 1998 303(d) list. Recovery has occurred in this watershed and beneficial uses are not impaired with the exception of cold water aquatic life uses during salmonid spawning season. Instream temperatures during the salmonid spawning season do not meet the temperature criterion. Stream protection protocols are in place and the exceedances of the salmonid spawning criteria appear largely attributable to the results of the Blackwell Fire. Recovery continues to occur and should continue to contribute to lower temperatures. Using aerial photos, pre and post burn vegetative cover were compared. A shading target of 85% was developed using shade curves for similar Douglas Fir-Grand Fir vegetative community types by averaging results for streams of a similar width and aspect from these TMDLs: the Walla Walla (ODEQ 2004b), Willamette (ODEQ 2004a), Mattole (CRWQCB 2002) and South Fork Clearwater (IDEQ 2002) TMDLs. A TMDL was determined for Fall Creek for salmonid spawning temperatures.

## Landing Creek

Landing Creek is a 2nd order stream that flows into Deadhorse Creek, which is a tributary to Big Payette Lake (Figures 67 and 68). Originating at 6,500 feet, Landing Creek flows 2.42 miles entirely through forested land and shows Rosgen Channel Type A, B, and C characteristics. The predominant species of fish is brook trout.

The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Lower elevations support a mixed conifer forest stand with Douglas fir, hemlock, western larch and tamarack, with inclusions of Englemann spruce near streams and wetter areas. The presence of lodgepole pine, subalpine fir and pockets of spruce increases with elevation and effective precipitation (IDL 2003). Timber harvest occurs in this watershed.


**Figure 67. Landing Creek.**

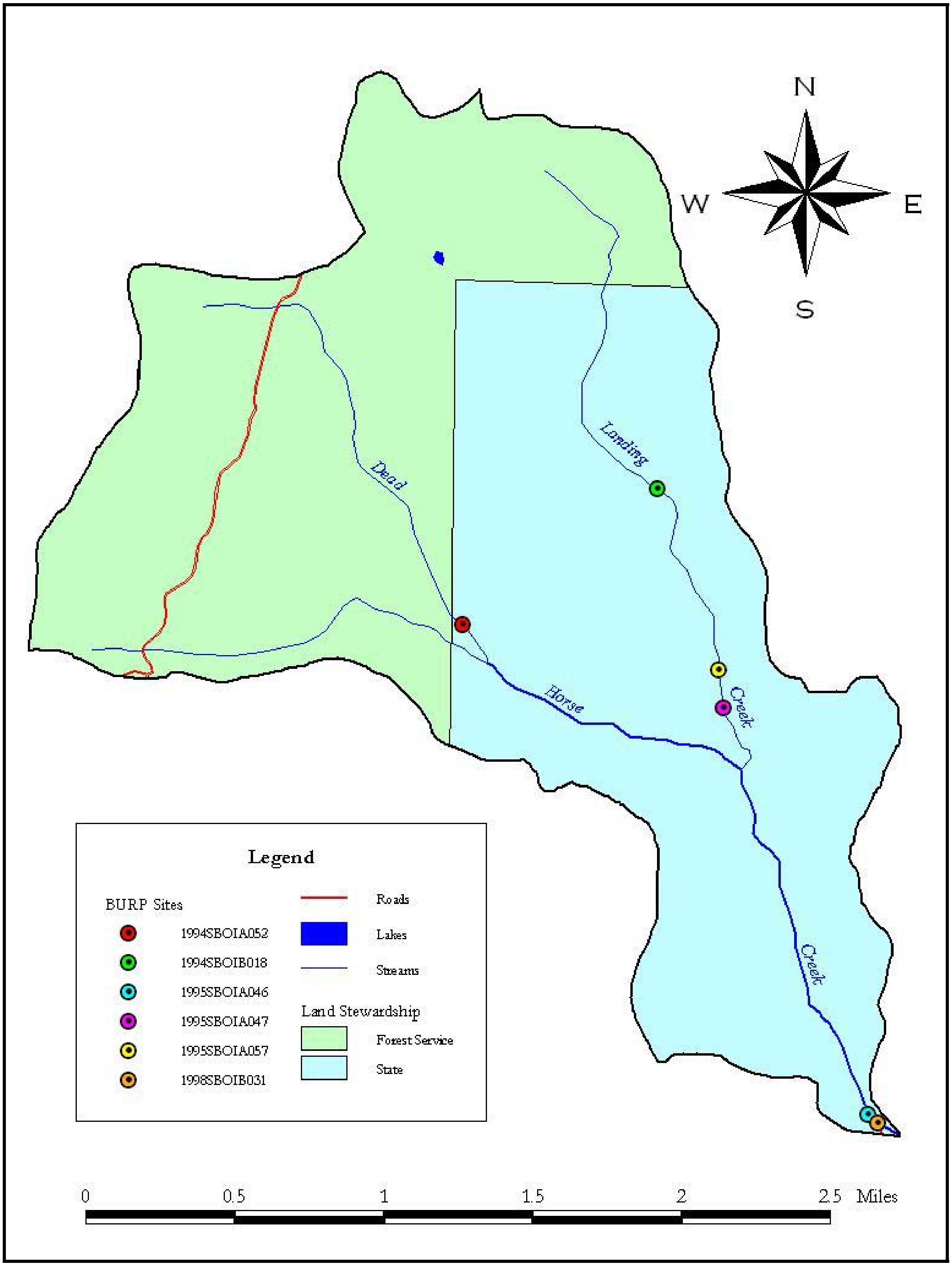


**Figure 68. Landing Creek Monitoring Sites.**

## Flow Characteristics

Hydrology information was not available for Landing Creek, but a hydrograph was available for Deadhorse Creek, which Landing Creek flows into (Figure 69). While flows are less in Landing Creek, the runoff pattern is likely similar (IDEQ 1997).

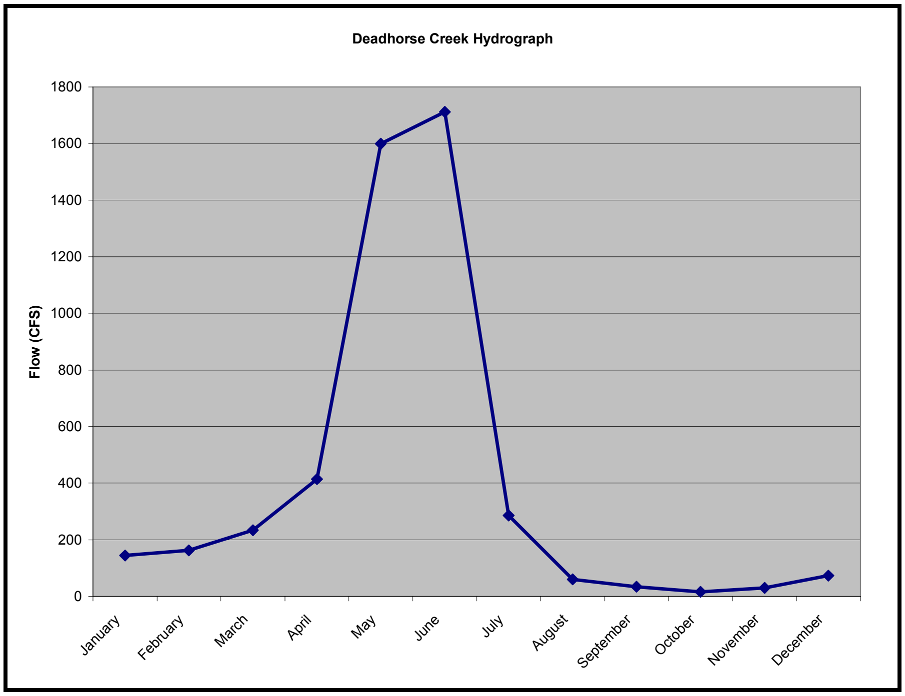


**Figure 69. Deadhorse Creek Average Monthly Flows.**

## Water Column Data

The Landing Creek watershed did not burn in the 1994 fires. However, large sediment loads were measured in 1995 in Deadhorse Creek, but these decreased in 1996 (Figure 70). Timber harvest that included road building occurred from 1997-99 and in 1993-94 in the Landing Creek watershed. Instream nutrient concentrations remained low both years (averaging <0.02 mg/L), which is consistent with the area being unburned. In terms of loading figures, Deadhorse Creek was estimated to have delivered 198 kg/TP to Big Payette Lake in 1995 while Fall Creek (burned watershed) was estimated to have delivered 14,571 kg/TP. Both watersheds were estimated to have delivered 2.17 million kg/suspended sediment to Big Payette Lake in 1995.

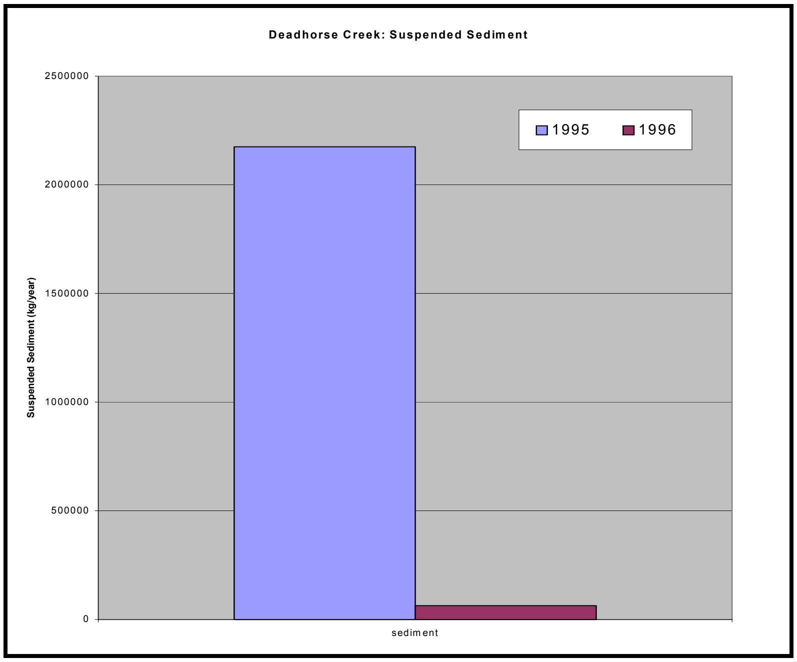


**Figure 70. Deadhorse Creek Sediment Concentrations: 1995/1996.**

## Temperature Data

A temperature logging device was installed in Landing Creek during the 2004 spring salmonid spawning season (Figure 71). The logger did not relaunch in July. However, instantaneous measurements were taken in the summer at the mouth of Deadhorse Creek. July 15th and August 24th measurements were below the 13 degree C instantaneous temperature standard for salmonid spawning. Thus, instream temperatures met cold water aquatic life temperature standards during spawning season and then throughout the summer.

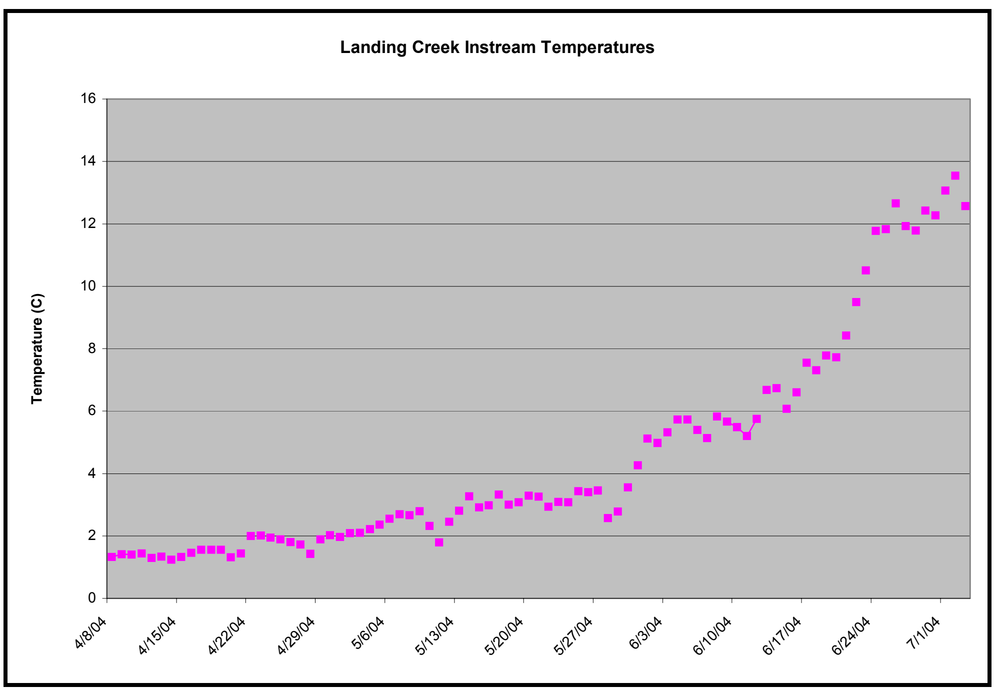


**Figure 71. Landing Creek Average Daily Temperature: Spawning Season 2004.**

### Biological/Habitat Data

Monitoring locations for DEQ are shown in Figure 67. Watershed assessment scores declined between 1994 and 1995, but appeared to rebound in 1998 (Table 31). Since timber harvest had occurred in the Landing Creek watershed after the last DEQ stream inventory was conducted in 1998 in Deadhorse Creek, DEQ staff investigated several habitat parameters related both directly and indirectly to excess sediment delivery. Percent fines, width-depth, large woody debris and bank stability were measured.

Timber harvest is evident throughout the watershed. However, no roads existed near the stream and skid trails were obliterated. Roads within the Deadhorse Creek watershed were graveled and a main access road is gated. Bank stability was typically >90%. The riparian area appeared vigorous. The most recent percent fines scores (Table 32) show percent fine that are close to the 23% reference conditions for a similar Rosgen type B stream as determined by Overton (1995). 2004 bank stability surveys showed greater >85% stable banks. Similarly, width-depth ratios and large woody debris were also within the desired range of conditions (<27 width/depth ratio and > 220 pieces of LWD/mile).

**Table 31. Landing and Deadhorse Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Use Support Status |
|---|---|---|---|---|---|
| 1994SBOIB018 | 3 | No data | No data | --- | Not assessed |
| 1995SBOIA047 | 1 | 3 | No data | 2 | Full Support |
| 1995SBOIA057 | 1 | 3 | < min | < minimum | Not Full Support |
| 1998SBOIB031 (Deadhorse Ck) | 3 | 2 | No data | 2.5 | Full Support |

**Table 32. Landing Creek Percent Fines (DEQ BURP Data).**

| Stream ID | Location | Percent Fines |
|---|---|---|
| 1994SBOIB018 | Landing Creek | 43 |
| 1995SBOIA057 | Landing Creek | 56 |
| 1995SBOIA047 | Landing Creek | 19 |
| 1998SBOIB031 | Deadhorse Creek | <1 |
| 2004 Landing Creek | Landing Creek | 17 |

### Conclusions

Landing Creek is listed for an unknown pollutant on the 1998 303(d) list. While anthropogenic activities have likely caused stream disturbance in the past, the stream now appears to be supporting beneficial uses. Sediment was investigated as the most likely pollutant of concern because the habitat parameters related to sediment showed possible impairment and Deadhorse Creek had shown excess sediment loading. Beneficial uses are not impaired in Deadhorse Creek and sediment does not impair beneficial uses in Landing Creek. DEQ recommends de-listing Landing Creek in the next 303(d) cycle. No TMDL is required.

## Round Valley Creek

Round Valley Creek is a 3rd order stream originating at 5,200 feet and flowing 6 miles through pastureland before tumbling down the Highway 55 Canyon to enter the North Fork Payette River above the Rainbow Bridge (Figures 72 and 73). Round Valley Creek is a low gradient, Rosgen type C channel where it flows through the meadow portion of Round Valley. Two small 2nd order streams, Chipps Creek and Bacon Creek, are tributaries to Round Valley Creek.

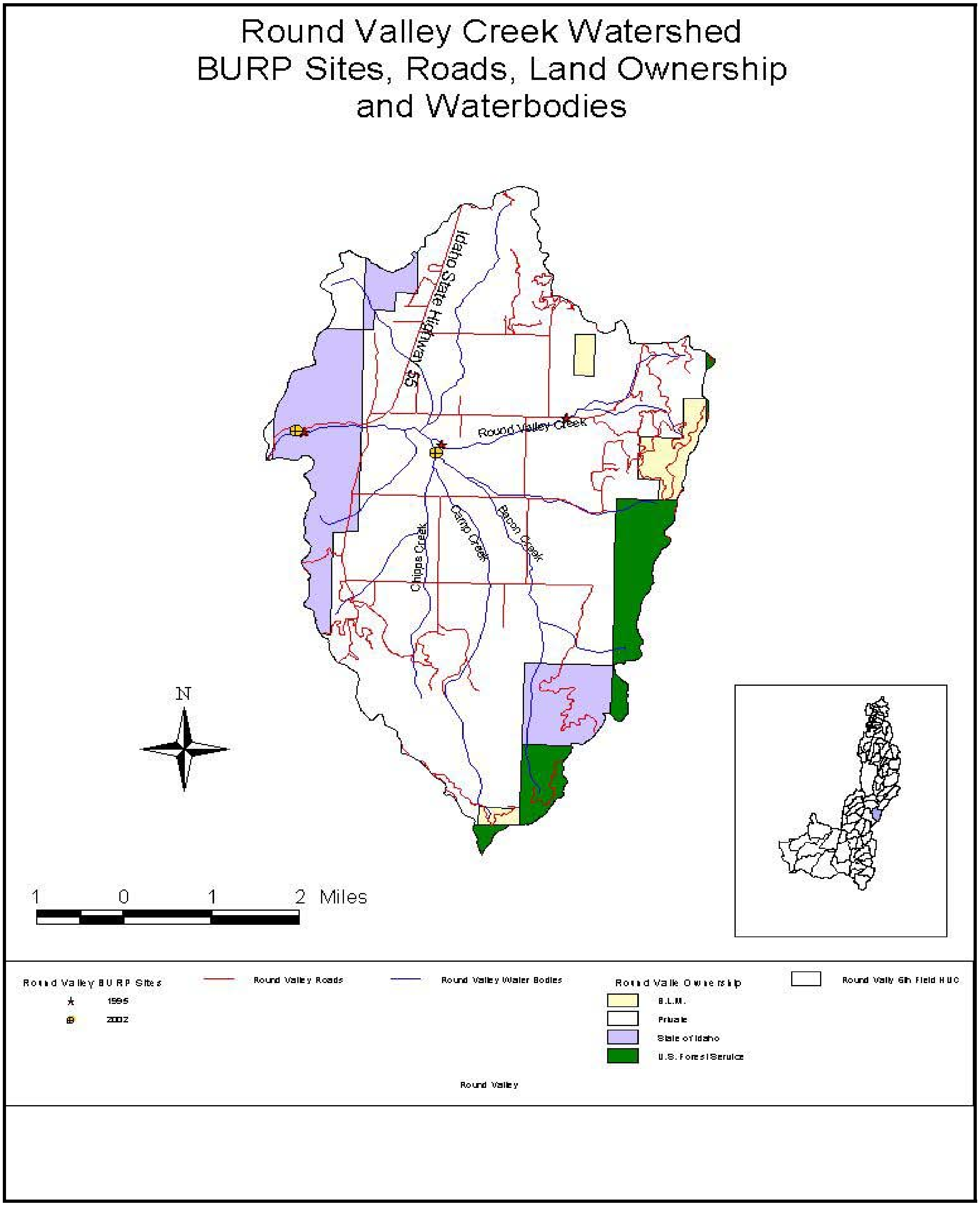


Figure 72. Round Valley Creek Monitoring Sites.

**Figure 73. Round Valley Creek.**

Riparian-wetland species include beaked sedge (*carex rostrata*), nebraska sedge (*carex nebrascensis*), baltic rush (*juncus balticus*), horsetail (*equisetum arvense*), watercress (*rorippa nasturtium-aquaticum*), red-osier dogwood (*cornus sericea*), brook grass (*catabrosa aquatica*), hardstem bulrush (*scirpus acutus*), fowl manna grass (*glyceria striata*), drummond willow (*salix drummondiana*), yellow willow (*salix lutia*), and geyers willow (*salix geyeriana*). In general, riparian zones were dominated by sedge/grass communities and to a lesser extent by willow/sedge communities.

### Flow Characteristics

Little flow information exists for Round Valley Creek. The creek has been redirected and channelized in sections, affecting the flow regime. The lack of sinuosity in parts of Round Valley Creek allows for higher, more erosive flow action. Round Valley Creek typically flows over its banks during peak flows as a result of snow melt, particularly rain-on-snow events. Round Valley Creek peaks earlier than other creeks in the area because it starts at a lower elevation. Base flows are less than 1 cfs and occur in late summer and fall.

### Biological/Habitat Data

DEQ BURP stream inventory results showed a wide range of percent fine results with very high percent fines found in the low gradient, meadow sections of Round Valley Creek and lower percent fines found in the section that runs parallel to Highway 55. The BURP scores showed a lack of diversity in the macroinvertebrate community and a corresponding lack of complexity in the habitat (Table 33).

A proper functioning condition assessment of Round Valley Creek was conducted during the summer of 2004. Eight different stream reaches were assessed by the Idaho Association of Soil Conservation Districts and the Soil Conservation Commission. Every section assessed was rated functional at risk. The upland watershed was determined to not be contributing to riparian degradation. Riparian cover was determined to be inadequate for protecting banks and Round Valley Creek was determined to be subject to excessive erosional and depositional forces. The Idaho Soil Conservation Commission report identified excess sand, over-utilization of the riparian area by livestock and diversions (addition of flows) as the main causes of channel instability (ISSC 2004).

Round Valley Creek consists primarily of pastureland. Since overland runoff was not considered to be a significant input of sediment, DEQ conducted channel erosion inventories in 2004 to determine bank erosion rates. Overall channel stability was evaluated and the results are presented in Figure 74. Not all properties on Round Valley Creek were inventoried and, thus, channel erosion rates were extrapolated from measured areas to similar areas that were not inventoried

Channel erosion was not excessive in Round Valley Creek downstream of where it enters the Highway 55 canyon. However, excessive erosion was found in sections in the meadow area upstream. Banks were less than 80% stable.

**Table 33. Round Valley Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1995SBOIA014 (lower Round Valley Creek) | 1 | 1 | No data | 1 | Not Full Support |
| 1995SBOIA015 (middle Round Valley Creek) | 1 | <minimum | No data | <1 | Not Full Support |
| 1995SBOIA016 (upper Round Valley Creek) | 1 | No data | No data | Not Assessed | Not assessed |
| 2002SBOIA024 (Chipps Creek-tributary to Round Valley Creek) | 1 | 0 | No data | 0.5 | Not Full Support |
| 2002SBOIA022 | 1 | 2 | No data | 1 | Not Full Support |

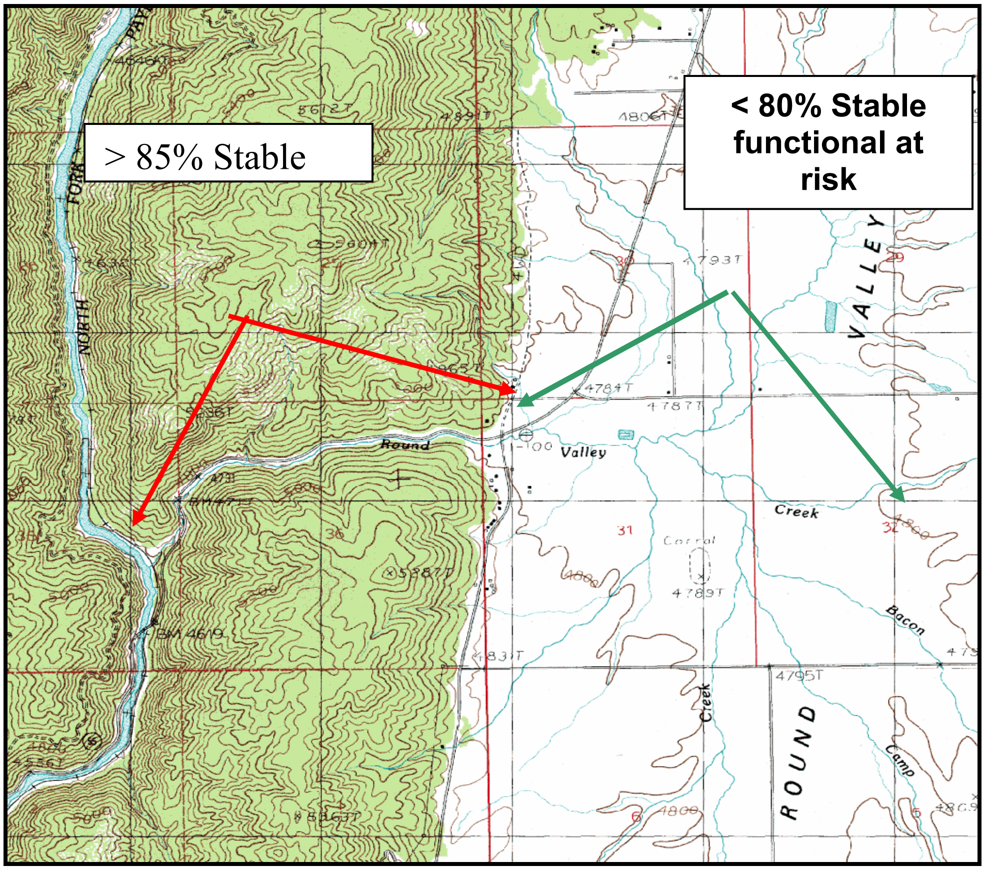


**Figure 74. Round Valley Channel Erosion Inventory Results.**

### Conclusions

Round Valley Creek is listed on the 1998 303(d) list for sediment. High percent fines found in the middle and upper reaches of Round Valley Creek indicated that sediment is impacting beneficial uses and a TMDL is necessary. Channel erosion inventories were conducted in 2004 to determine a sediment TMDL and the results of these inventories were used in the TMDL allocation.

## Soldier Creek

Soldier Creek originates at over 5,400 feet. A low volume rangeland stream that typically goes dry in July, Soldier Creek is a 3rd order tributary to Little Squaw Creek, which then drains into Squaw Creek. Draining 15,427 acres, the creek runs approximately 9 miles through Columbia basalt formations before entering Little Squaw Creek at approximately 3,000 feet (Figures 75 and 76). The creek shows Rosgen A and B characteristics.

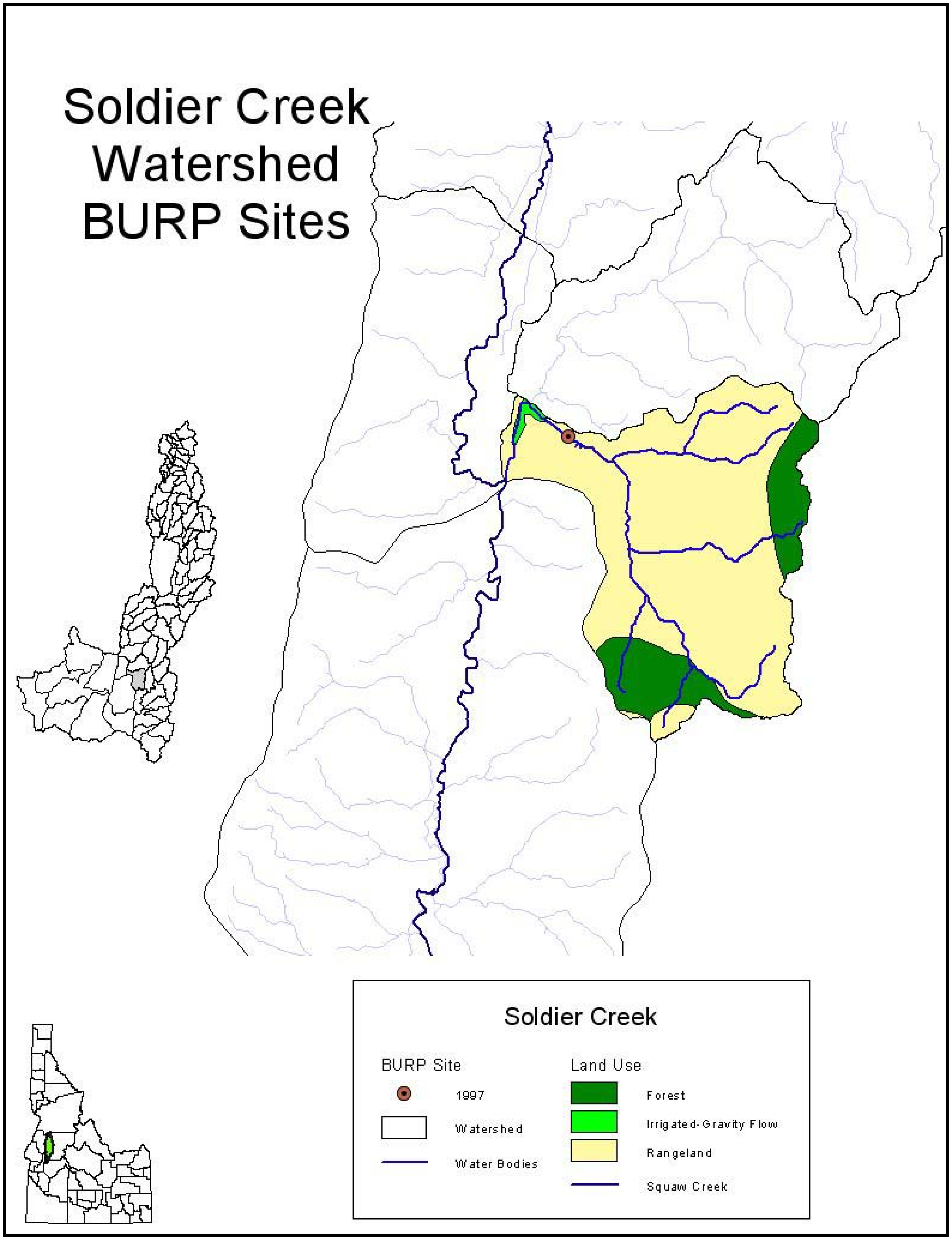

**Figure 75. Soldier Creek Monitoring Sites.**

**Figure 76. Soldier Creek: Middle Reach.**

### Flow Characteristics

Soldier Creek is a low volume rangeland stream. Little flow information exists for Soldier Creek. However, portions of Soldier Creek are intermittent and the creek is dry by early July in the lower elevation reaches.

### Biological/Habitat Data

DEQ water body assessment scores indicated that beneficial uses were impaired (Table 34). The DEQ monitoring sites are shown in Figure 75. Fisheries data showed one to two age classes of fish (dace and bridgelip suckers).

Soldier Creek flows through rangeland and is subject to sediment inputs from both roads and grazing activities. Channel erosion surveys were conducted in 2004 because in-stream channel erosion was surmised to be the biggest contributor of sediment. In the middle and upper reaches of Soldier Creek, the banks were >85% stable and sediment does not impair beneficial uses. Slightly elevated surface fines (32%) were also seen in 1997 DEQ stream inventory data in the lower reach, which has a low gradient where sediment is more likely to be deposited. As a comparison, reference conditions in similar streams of volcanic origin averaged 27% surface fines. Lack of flow late in the season adversely affects fisheries, but this appears to be a natural condition. Fish communities are not robust because lack of water precludes yearlong use of the stream.

**Table 34. Soldier Creek: DEQ Water Body Assessment Score.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 1997SBOIB009 | 1 | 2 | <minimum | < minimum | Not Full |

DEQ was unable to gain access to the lower reaches of Soldier Creek in 2004. This section was evaluated in 1997. While sediment is transported to this reach from the upper segments, these amounts are not excessive. Sediment inputs in this section would most likely be from streambank erosion and excess sediment delivery would most likely occur during high water events. This previously evaluated section is different from the sections analyzed in the erosion inventory because it includes irrigated pastureland.

#### Conclusion

Soldier Creek is listed on the 1998 303(d) list for sediment. DEQ proposes de-listing Soldier Creek from the headwaters to the confluence with North Fork Soldier Creek (17050122SW012-02). Assessment unit 17050122SW012-03 would remain on the 303(d) list) which encompasses the lower section of Soldier Creek that flows through irrigated pastureland. The Idaho Department of Agriculture will be sampling Squaw Creek biweekly above and below Soldier Creek in 2005. DEQ will use this data to determine whether sediment is impairing beneficial uses in the lower section by looking at the suspended sediment data. Lack of flow appears to be the primary driver that precludes a robust fishery from developing. The intermittent nature of Soldier Creek in the upper reaches prevents cold water aquatic life from being an existing use in the summer months.

### Squaw Creek

The Squaw Creek watershed drains approximately 218,900 acres with an estimated average runoff of 110,000 acre-feet/year, making it one of the largest tributaries to the Payette River (Figures 77 and 78). The headwaters of Squaw Creek originate in forested land at over 7,000 feet and it enters Black Canyon Reservoir at just over 2,500 feet. There are two wide valley types within the lower Squaw Creek drainage: Ola Valley and Sweet Valley. The lower 20 miles of Squaw Creek runs through about 7,000 acres that is under some form of surface irrigation. 180-acre Sage Hen reservoir is located in this watershed and is a popular fishery. Land use is predominantly rangeland with irrigated agriculture concentrated in the lower reaches. Agriculture represents over 50% of the economy in this watershed. The majority of irrigation is flood irrigation. Livestock use is primarily cattle.

**Figure 77. Squaw Creek at Mouth.**

Squaw Creek has resident redband trout and also bull trout in its upper reaches.
The second fork of Squaw Creek exhibits F4 Rosgen characteristics, which means that the stream is a deeply entrenched, low gradient, gravel dominated channel with a high width/depth ratio.

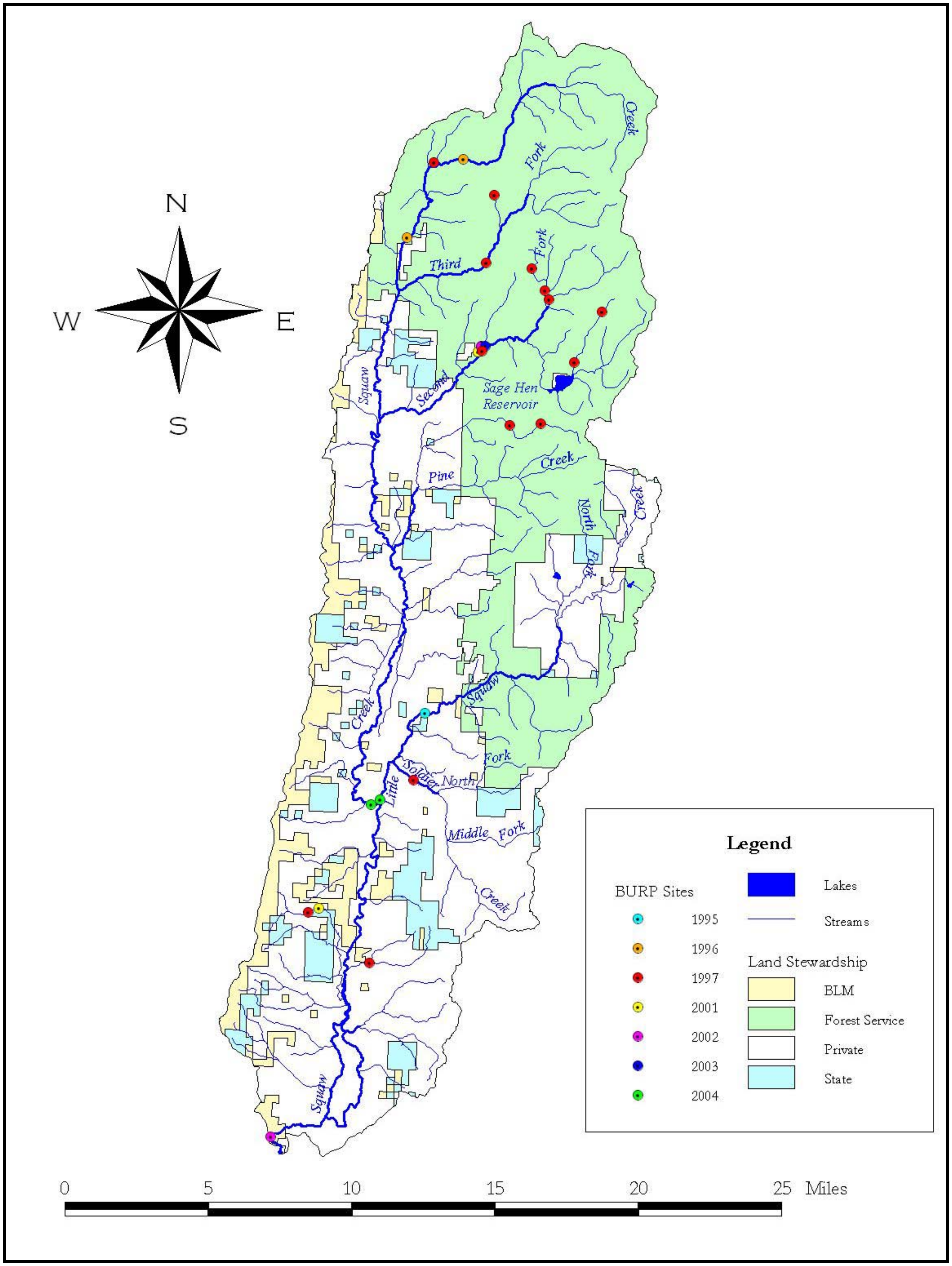


Figure 78. Squaw Creek Land Ownership and BURP Monitoring Sites.

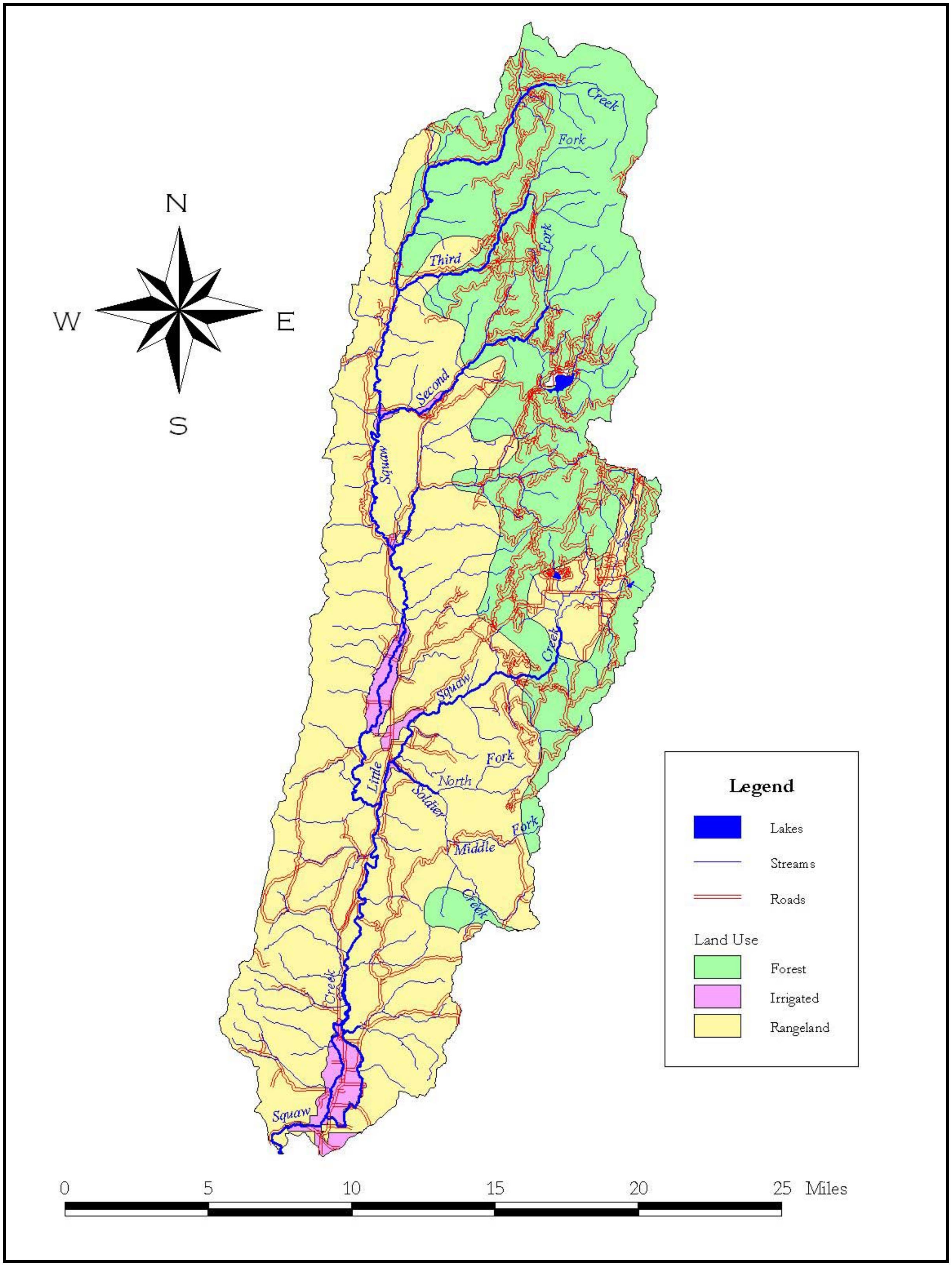


**Figure 79. Squaw Creek Land Use.**

## Flow Characteristics

Figure 80 shows the hydrograph for Squaw Creek near Sweet. Runoff begins in late March and flows can stay high through May and June.

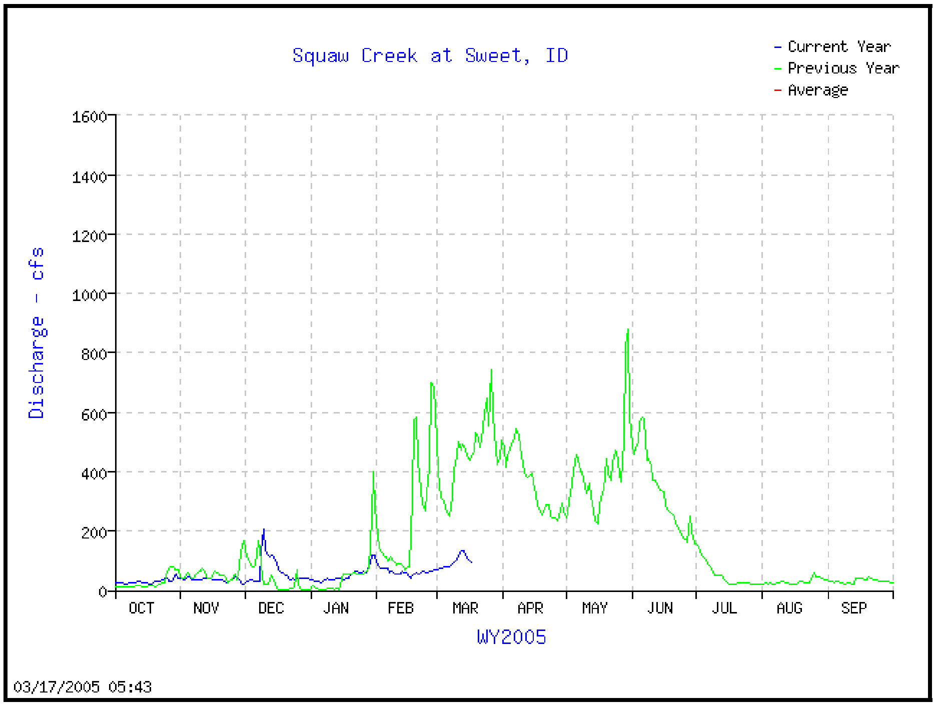


**Figure 80. Squaw Creek Flow at Sweet: Water Year 2004.**

## Water Column Data

DEQ collected 5 bacteria samples between July 30th and August 26th 2004. The geometric mean for the five samples was 325 organisms/100 ml, which violates the state standard for bacteria (geometric mean at or below 126 organisms/100 ml). The Idaho Department of Agriculture will sample Squaw Creek in several locations in 2005 in order to provide a better bacteria source assessment.

Total phosphorus samples were collected near the mouth of Squaw Creek during 2004 (Figure 81). While phosphorus levels were elevated over the EPA Gold Book target of 0.05 mg/L for total phosphorus for waters that directly discharge to a reservoir, because Black Canyon Reservoir is not impaired by excess nutrients a TMDL allocation is not necessary. Monthly averages (from biweekly monitoring) were all below 0.1 mg/L. EPA (1986) recommends that monthly average instream concentrations of total phosphorus be below 0.1 mg/L. However, additional monitoring will occur in 2005 by the Idaho Department of Agriculture to determine longitudinal trends in nutrient concentrations. DEQ will then use these results in conjunction with habitat data to assess whether excessive nutrient concentrations exist in Squaw Creek.

Suspended sediment concentration results were all below 50 mg/L and most samples were below 25 mg/L.

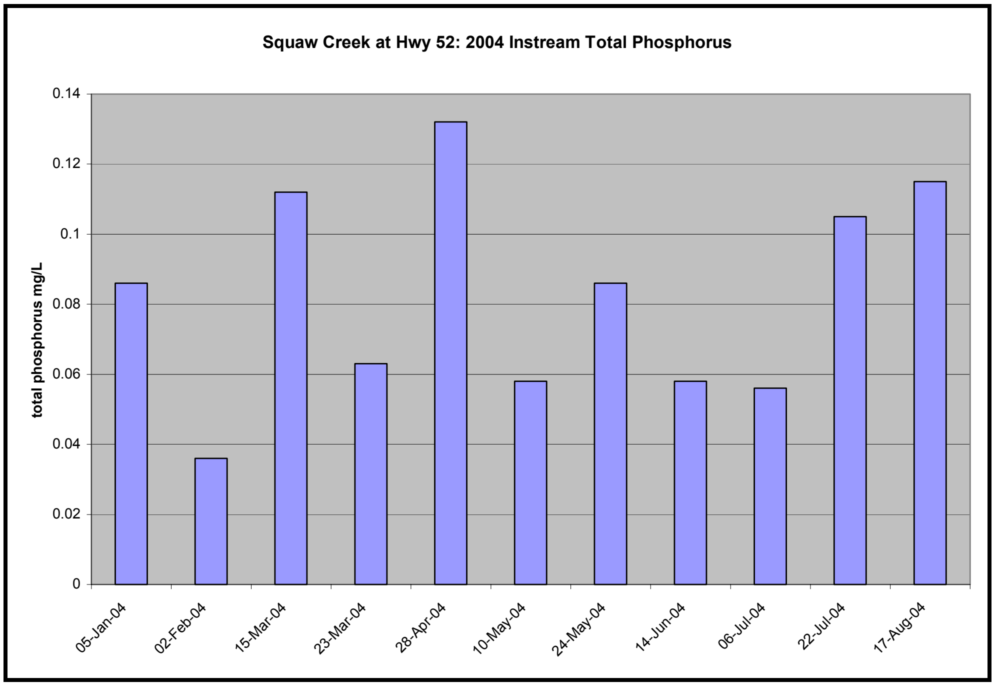


**Figure 81. 2004 Total Phosphorus Concentrations: Squaw Creek.**

### Temperature

Preliminary USFS temperature data showed exceedances of the Bull Trout temperature criteria in the upper elevations in the Squaw Creek watershed. However, the USFS had concerns about the validity of these monitoring results due to uncertainty on whether loggers were deployed correctly. A more comprehensive temperature monitoring program will be initiated in Summer 2005.

### Biological/Habitat Data

DEQ water body assessment shows that Second and Third Fork Squaw Creeks do not have impaired beneficial uses. Both Third and Second Fork Squaw Creeks met the riparian management objectives established by the USFS. 2004 DEQ BURP water body assessment scores from Squaw Creek upstream of the confluence with Little Squaw Creek and scores from Little Squaw Creek are not available yet.

**Table 35. Upper Squaw Creek Tributaries, Little Squaw Creek, Second Fork Squaw Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 2001SBOIA054 (Second Fork Squaw Creek) | 3 | 3 | 3 | 3 | Full Support |
| 2002SBOIV004 (Second Fork Squaw Creek) | 3 | 3 | No data | 3 | Full Support |
| 1997SBOIA18 (Third Fork Squaw Creek) | 3 | 3 | No data | 3 | Full Support |
| 1997SBOIA044 (Cold Springs Creek-Upper Squaw Creek Tributary) | 3 | 3 | No data | 3 | Full Support |
| 1997SBOIA045 (Mesa Creek-Upper Squaw Creek Tributary) | 3 | 3 | No data | 3 | Full Support |
| 1997SBOIA055 (Joes Creek-Second Fork Squaw Creek Tributary) | 3 | 3 | No data | 3 | Full Support |
| 1997SBOIA056 (Woody Creek-Second Fork Squaw Creek Tributary) | 2 | 3 | No data | 2.5 | Full Support |
| 1997SBOIA057 (Renwyck Creek-Second Fork Squaw Creek Tributary | 3 | 2 | No data | 2.5 | Full Support |
| 1997SBOIA058 (Antelope Creek-Second Fork Squaw Creek Tributary) | 3 | 3 | No data | 3 | Full Support |
| 1995SBOIB24 (Little Squaw Creek) | 3 | 3 | No data | 3 | Full Support |

### Fisheries

There are three bull trout population watersheds within the Squaw Creek watershed: Squaw Creek, Third Fork Squaw Creek, and Second Fork Squaw Creek. Existing populations occur in Third Fork, Second Fork, and Main Squaw Creek in the upper reaches. Historically, bull trout were found in the lower reaches of Squaw Creek, suggesting that Squaw Creek is also a migratory corridor.

Spawning habitat is lacking large woody debris, which may account for the lack of large pools. Third Fork Squaw Creek is at risk for excess fine sediment, which could also account for the lack of large pools. The Second Fork Squaw creek has migration barriers as well as excess fine sediment, which hinder the development of the bull trout community.

Idaho Fish and Game has found redband trout in the upper reaches of Squaw Creek.

### Conclusions

Squaw Creek is not listed on the 303(d) list, but 2004 sampling showed bacteria violations, and bacteria is proposed for listing on the 303(d) list. Nutrient levels are also above target concentrations, and nutrients are proposed for listing on the 303(d) list. This listing is for assessment unit 17050122SW010-05 that encompasses the fifth order portion or lowermost reaches of Squaw Creek below Second Fork Squaw Creek. The upper reaches do not have impaired beneficial uses. In 2005, more intensive sampling will take place in the lower Squaw Creek watershed below the Second Fork of Squaw Creek to determine nutrient and bacteria concentrations throughout the lower part of the drainage. In addition, temperature monitoring in bull trout habitat areas will be undertaken, and a temperature TMDL determined if necessary.

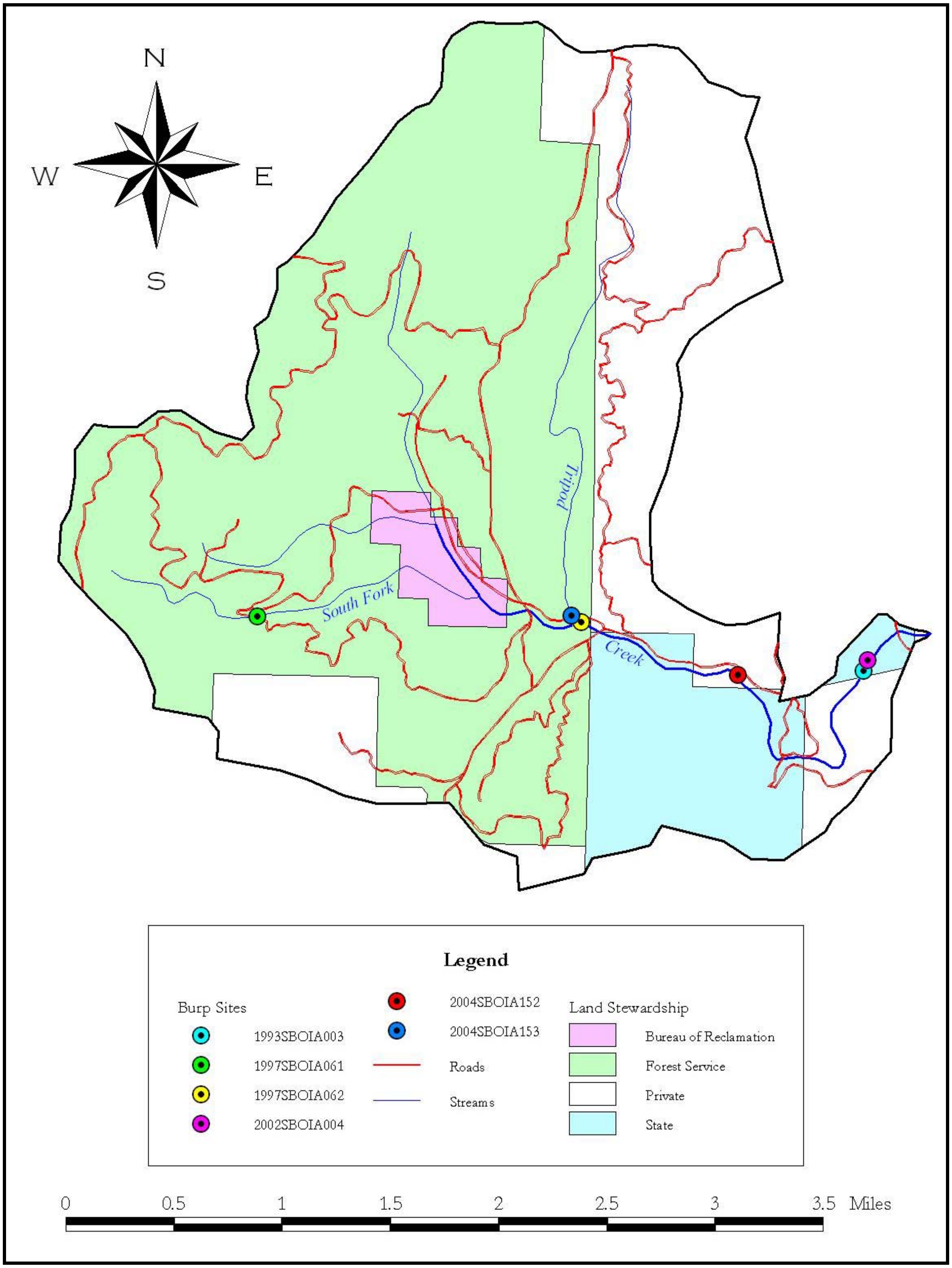


**Figure 82. Tripod Creek Hydrology, Land Use and Monitoring Sites.**

**Figure 83. Tripod Creek below Tripod Meadows.**

## Tripod Creek

Tripod Creek is a 3rd order stream that drains 8.63 square miles (Figure 82 and 83). Originating at approximately 6,000 feet in elevation, Tripod Creek flows through both forested and meadow areas before entering the North Fork Payette River at Smiths Ferry at 4,500 feet. The stream channel has both Rosgen B and C characteristics, depending upon gradient. Grazing, timber harvest and recreational activities all take place in the watershed. Tripod Reservoir, a five-acre impoundment, is located at 4,980 feet.

### Flow Characteristics

Very little hydrology information exists for Tripod Creek. Logging, grazing and recreational uses occur in this watershed. USGS measured flows intermittently between 1973 and 1980; flows ranged from 0.22 cfs in September to 43 cfs in May.

### Biological/Habitat Data

The most recent BURP data indicate that beneficial uses are not impaired in Tripod Creek (Table 36). Figure 82 shows the Tripod Creek monitoring sites. 2004 DEQ BURP water body assessment scores are not yet available.

**Table 36. Tripod Creek: DEQ Water Body Assessment Scores.**

| Stream ID | SHI | SMI | SFI | Water Body Assessment Score | Beneficial Use Support Status |
|---|---|---|---|---|---|
| 2002SBOIA004 | 1 | 3 | 2 | 2 | Full |
| 1997SBOIA062 | 1 | 3 | 2 | 2 | Full |
| 1993SBOIA003 | 1 | <min | 1 | <1 | Not Full |

Channel erosion inventories were conducted in Fall 2004 in the Tripod Meadows area (Figure 84) because grazing was reported to DEQ as potentially impacting stream health. Overall, banks were greater than 85% stable. Localized problem areas exist where cattle have access to the creek. These areas tended to be small in extent. The creek, although small in volume, has deep pools and steep banks that appear to keep cattle out of most areas. A riparian grazing exclosure installed in 1991 has shown that grazing is actually maintaining a meadow condition since lodgepole pine became established inside the exclosure. The riparian area is grazed outside of the maintained exclosure areas. 2004 electrofishing results showed that the meadows reach did not have an impaired fishery. Several age classes of salmonid were present.

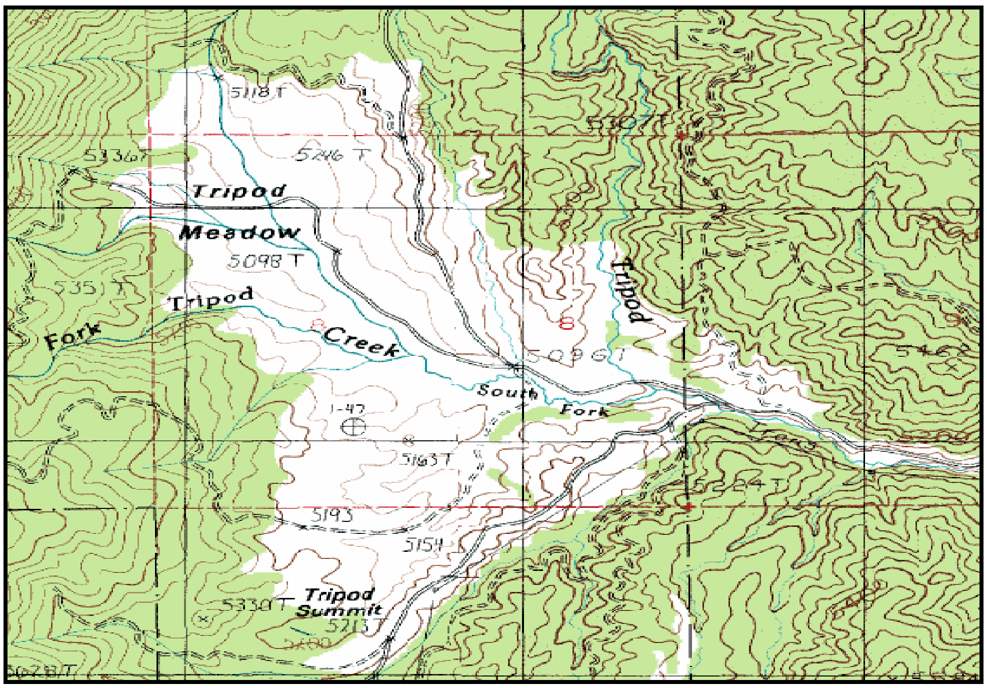


**Figure 84. Tripod Meadows Area.**

2004 electrofishing results showed four age classes of rainbow trout and three age classes of brook trout in both the Tripod Meadows area and farther downstream where the creek exits the meadow.

## Conclusions

Tripod Creek is listed for an unknown pollutant on the 1998 303(d) list and was proposed for delisting on the 2002 303(d) list. The most recent Tripod Creek water body assessment scores indicate that beneficial uses are supported in the lower, forested parts of the watershed. DEQ re-assessed Tripod Creek this year in order to ensure that the upper watershed continues to support beneficial uses. Recreation, roads and grazing occur in this area, and all of these have the potential to contribute sediment to the stream or adversely affect the riparian area. No impairment of beneficial uses was seen in the second order portion of Tripod Creek (the lower forested portion). 2004 water body assessment scores are unavailable at this time. However, beneficial uses do not appear impaired as supported by fisheries data. Tripod Creek is recommended for de-listing for an unknown pollutant.

## 2.5 Data Gaps

The best available data were used to develop the current subbasin assessment and TMDL. The data were used to reach conclusions of support status and to develop defensible TMDLs. However, DEQ acknowledges there are additional data that would be helpful to increase the accuracy of the analyses. The data gaps that have been identified are outlined in Table 37.

**Table 37. Data gaps Identified During TMDL Development.**

| Pollutant or Other Factor | Data Gap |
|---|---|
| Flow | Clear Creek, Big Creek, Round Valley Creek |
| Biological (fish and macroinvertebrates) | Landing Creek (fish), North Fork Payette River (fish/macroinvertebrates), |
| Bacteria | Longitudinal results for the Squaw Creek watershed |
| Sediment | North Fork Payette River (bedload sediment), Big Creek complete erosion inventory of creek |
| Dissolved Oxygen | Substrate/water interface dissolved oxygen measurements<br>Continuous dissolved oxygen measurements taken at the end of the river reach |
| Temperature | Box Creek during spawning season |
| Nutrients | Increased monthly sampling of nutrients, assessment of phosphorus recycling in system |

# 3. Subbasin Assessment – Pollutant Source Inventory

This chapter describes the point and nonpoint pollutant sources within the North Fork Payette River watershed. 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.

## 3.1 Sources of Pollutants of Concern

Pollutants can come from both natural and human caused sources. This section provides an inventory of pollutant sources. Pollutant sources in the watershed are both nonpoint and point sources. Land use can be an important factor in pollutant sources and land use is shown in Figure 85.

The point sources are the municipal discharges from wastewater treatment plants (WWTPs). The WWTPs are *National Permit Discharge Elimination System* (NPDES) permitted facilities (Table 38). The cities of Cascade and Horseshoe Bend have WWTPs that discharge directly or indirectly to the Payette River; neither of these facilities discharges directly into a 303 (d) listed segment of the Payette River. The communities of Smiths Ferry and Banks do not have municipal WWTPs; the residents of these areas have private treatment systems or septic systems, some of which may discharge directly or indirectly to the North Fork Payette River or mainstem Payette River.

### Point Sources

**Table 38. NPDES Point Sources.**

| Facility | Permit Number | Discharge Limit (million gallons/day) | Permit requirements | Notes |
|---|---|---|---|---|
| Cascade WWTP | ID 002316-7 | 0.72 | Suspended sediment | Rapid Infiltration |
| Horseshoe Bend WWTP | ID0021024 | 0.13 | Suspended sediment | Horseshoe Bend upgraded WWTP in 2003 |

### Nonpoint Sources

This description is not intended to be specific. Rather, it is a description of the general processes whereby pollutants are delivered to the water bodies of concern. A detailed description of locations and potential sites for improvement will be located in the final implementation plan.

### Phosphorus

Phosphorus is found naturally throughout the environment. It can be present as a constituent of certain rock types (silicous igneous rock) and in the mineral apatite. In the North Fork

Payette River drainage, it is also associated with monazite. The environment itself can also be a factor in the phosphorus levels occurring within a region, due to the climate, pH of natural waters, and the presence of other substances that may adsorb or release phosphorus. However, there are also anthropogenic nutrient sources that greatly increase phosphorus levels over those found naturally. Applied fertilizers in farming or landscaping, the duration and density of livestock grazing, the creation of artificial waterways and water levels through agricultural practices, and the presence of sewage and septic waste (treated and untreated) in the surface, subsurface, and ground water of a region can significantly elevate the phosphorus concentrations in an area.

### Nitrogen

Nitrogen occurs in the environment in a variety of sources and forms. It can be present as a mineral constituent of certain rock types; as a result of the decomposition of plant and other organic material; in rainfall, as a component of agricultural or urban/suburban runoff; and as a constituent in treated or untreated wastewater from industrial, municipal, or septic discharges. In addition, the air is composed of about 80% nitrogen gas. Blue-green algae can use atmospheric nitrogen at the surface-water interface or the nitrogen dissolved in the water as a source of nitrogen to support growth. Since algae can use atmospheric nitrogen, reducing nitrogen in the water is not often targeted as a factor to achieve water quality improvements in water systems dominated by blue-green algae. Since reducing watershed-based sources of nitrogen is not usually a successful treatment option in these systems, total phosphorus reductions are often sought.

### Sediment

Sediment may originate from natural cause, such as bank erosion, landslides, forest or brush fires, high flow events; or anthropogenic sources such as urban/suburban *stormwater runoff* or erosion from roadways, agricultural lands, and construction sites. Sediment loads within the system are highest in the spring when high flow volumes and velocities result from snowmelt in the higher elevations.

Surface erosion in forested terrain is predominantly a function of slope steepness, soil texture/structure, and the amount of root material in the top few inches of soil. Soil characteristics are generally related to the parent material (i.e. granitics).

Mass failures can be predicted by slope steepness and geologic material as well as other factors, such as whether the area has burned recently or been disturbed by land management activities, such as timber harvest. In general, a few mass failures occur every year, but the major contributors of sediment are the major episodes of mass failure that occur during large rain-on-snow events or during other high precipitation events when the soil mantle becomes supersaturated.

The contribution of mass wasting to sediment loading in the North Fork Payette River drainage has not been quantified but is potentially high in the canyon section of the river below Long Valley. An aerial photographic survey of the canyon did not detect any recent significant landslides.

Roads, depending upon their condition and location, can deliver large sediment loads to streams. In the NFPR watershed, the majority of sediment produced from the road prism is sand sized. The coarse grained granite and gneiss of the basin physically break down between the mineral grains in the rock, producing sand sized particles rather than silt or clay. In areas where basalt is the parent material, it breaks down into silt and clay sized particles.

Road erosion is directly influenced by road use including season of use, type of use (the heavier a vehicle, the greater the breakdown of the road tread into particles), road drainage patterns and road surfacing. Controlling these variables will affect the amount of sediment delivered to streams.

The road cut for Highway 55 in the North Fork Payette River canyon in conjunction with steep hillsides, particularly those slopes that have been burnt or are not heavily treed, has created an increased likelihood of mass wasting events. The sediment load from these events is hard to catch as is establishing the frequency of events. However, these events likely are the biggest single contributor of acute sediment loading to the system.

### Temperature

Increases and decreases in water temperature are due to changes in the amount of heat reaching the water. Several factors contribute to the amount of heat reaching the water in the North Fork Payette River watershed. The anthropogenic factors include agricultural return water, agricultural withdrawals, dams, and loss of riparian vegetation (shading). Natural factors include seasonal air temperature changes, natural dams, and naturally warm springs that feed water to the stream. In addition, at times riparian vegetation has been lost both to manmade (i.e. poor grazing practices, off-road vehicle use) and natural causes (i.e. rain-on-snow events). Only those anthropogenic sources that are directly controllable are addressed in this TMDL.

### Bacteria

Bacteria enter water bodies in a number of ways. Wastewater treatment plants and failing septic systems are the most common sources in watersheds that contain urban influences. Domestic pet waste can also be a significant source. In rural and agricultural areas the most common sources are domestic animals and wildlife, although failing septic systems can also be a significant source if they are situated adjacent to a water body. In the Payette River system, increased recreational use has created an additional human source of bacteria contamination to the water body due to a lack of bathroom facilities throughout the corridor. Watershed Advisory Group members who have lived in the area for more than 20 years noted that impacts due to recreational use have increased dramatically in the last 10 years. There are facilities at most major river put-ins and take-outs as well as campgrounds, but facilities were lacking in 2004 at the Horseshoe Bend Fish Ladder and the Climax take out.

### Oil and Grease

Oil and grease is most commonly found in stormwater runoff and also as a direct discharge from industrial sites. Oil and grease is a general measure of pollution from petroleum compounds. Idaho water quality criteria indicate oil and grease concentrations must be less than levels that impair beneficial uses.

## Pollutant Transport

### Nutrients

Consideration of flow is important in the evaluation of nutrient, phytoplankton, periphyton, and rooted macrophyte concentrations. In a riverine system, flow transports phytoplankton and nutrients from upstream to downstream in an advective or dispersive transport mode. In other words, riverine systems are dynamic systems in which nutrients are being continually cycled as the water moves downstream. The flow regimen is important in determining the result of this combination of component concentrations. High flows can flush dissolved nutrients downstream, replacing them with the lower concentrations in the high flows. Since nutrient concentrations are inversely related to flow, nutrient retentiveness is much lower in high flow years than in low flow years. High flows can also scour periphyton and rooted macrophytes, reducing their mass considerably. Finally, high flows can scour sediments, causing movement of the sediment downstream and increasing nutrient concentrations at the same time by releasing nutrients tied up in the sediments prior to scouring (IDEQ 2004).

### Sediment

While no *quantitative* information is available, it is recognized that a substantial amount of sediment can be generated and transported relatively long distances by extreme precipitation events, such as the January 1997 rain-on-snow event. It has been estimated these events can account for the movement of a greater volume of sediment in a single event than would be expected to occur in an entire water year under average conditions (BCC 1996). Sediment transport, and the transport and delivery of sediment-bound pollutants, are directly associated with increased flow volumes and high velocities. During peak flows, streams with unstable banks may have high sediment loads due to bank erosion.

### Bacteria

Bacteria are primarily transported from their point of origin during precipitation and irrigation activities. Bacteria can enter surface water via movement from manured fields, problem feedlots, and overgrazed pastures. Insufficient sewage management systems (septic tanks) may also transport bacteria, especially in areas where the water table is shallow and readily mixes with surface water. Bacteria may also be transported in storm water in areas where storm water is discharged directly to the water body.

### Oil and Grease

Oil and grease are transported in storm water runoff and as a result of direct discharge from engines/motors into water bodies.

## 3.2 Data Gaps

The best available data were used to develop the current subbasin assessment and TMDL. The data were used to reach conclusions of support status and to develop defensible TMDLs. However, DEQ acknowledges there are additional data that would be helpful to increase the accuracy of the analyses. The data gaps that have been identified are outlined in Table 39.

Point Sources

No data gaps.

Nonpoint Sources

**Table 39. Pollutant Source Data Gaps Identified During TMDL Development.**

| Pollutant or Other Factor | Data Gap |
|---|---|
| Sediment | Bedload sediment in North Fork Payette River |
| Temperature | Additional instream temperature information during salmonid spawning season |

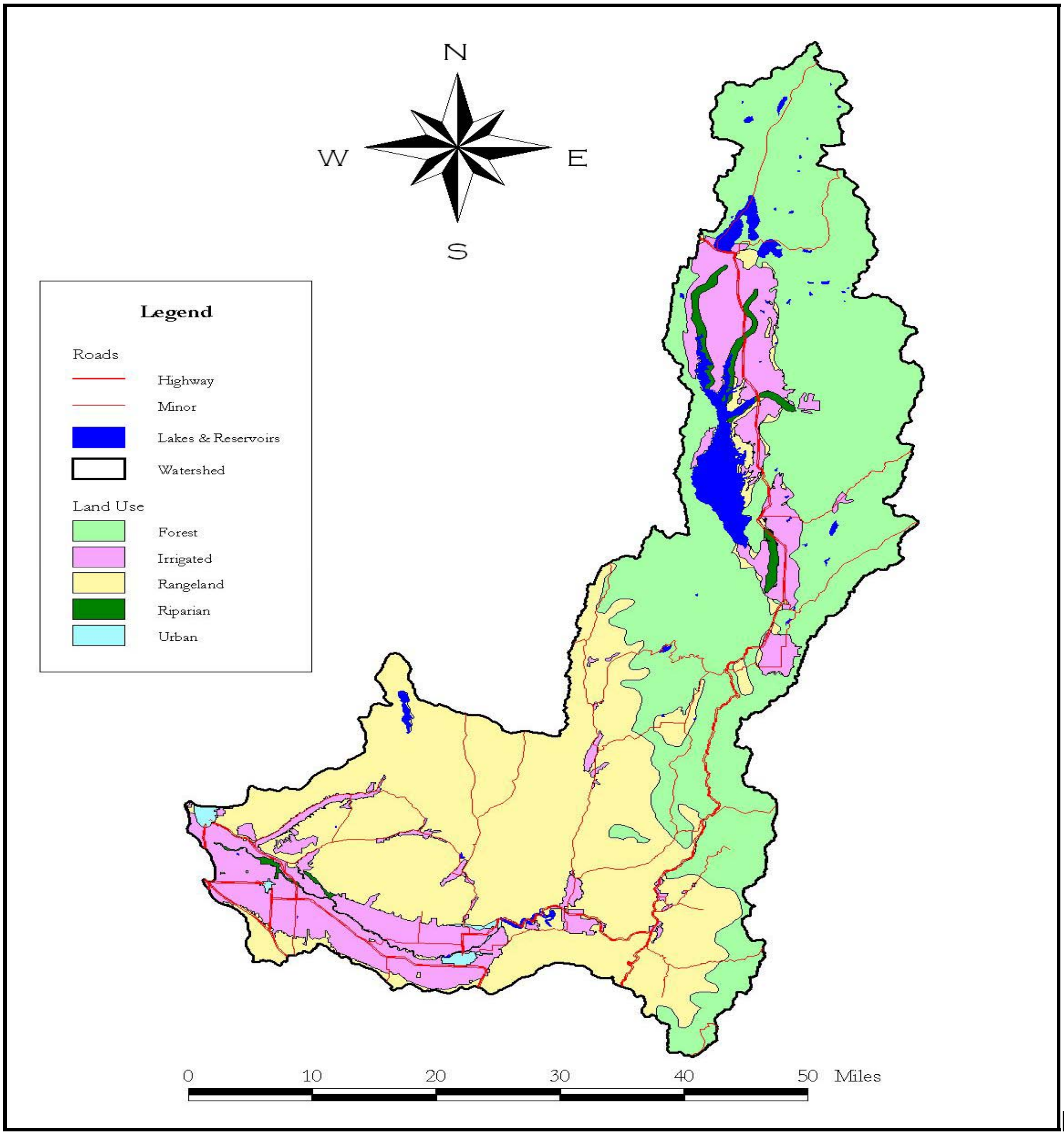


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**Figure 85. Land Cover and Land Use.**

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

## Point Sources

Two discrete point sources exist within the basin. The Horseshoe Bend and Cascade WWTPs treat the wastewater from each respective community and the immediate outlying area. Neither discharge into a 303(d) listed segment. Both facilities are federally regulated as part of the NPDES program. As part of the discharge monitoring report portion of their NPDES permits, the WWTPs are required to monitor their effluent to determine compliance with their permit effluent limits. Effluent limits are set to levels at which it has been certified that violations in the state water quality standards will not occur as a result of the effluent. If permit violations occur, the facility is required to notify the U.S. Environmental Protection Agency (EPA) and DEQ to find a solution. The monthly discharge monitoring reports are sent to EPA and DEQ and are kept on file at the facility.

## Nonpoint Sources

Numerous private landowners have implemented conservation projects that have resulted in water quality improvement. These projects include fencing, riparian improvements, grazing management plans and streambank stabilization. The forest service and Idaho Department of Lands have improved roads, implemented seasonal road closures, stabilized streambanks, and initiated other best management practices.

In the Round Valley, Big Creek and Clear Creek areas, there are fencing and streambank stabilization projects that are currently being developed using Environmental Quality Incentive Program (EQIP), Conservation Reserve Program (CRP), and other Natural Resource Conservation Service funds. As these are implemented, water quality should improve.

## Reasonable Assurance

The state has responsibility under Sections 401, 402, and 404 of the Clean Water Act to provide water quality certification. Under this authority, the state reviews dredge and fill, stream channel alteration, and NPDES permits to ensure that the proposed actions will meet Idaho's water quality standards.

Under Section 319 of the Clean Water Act, each state is required to develop and submit a nonpoint source management plan. Idaho's most recent nonpoint source management plan was finalized in December 1999. The plan was submitted to and approved by the EPA. Among other things, the plan identifies programs to achieve implementation of nonpoint source *Best Management Practices* (BMPs), includes a schedule of project milestones, outlines key agencies and agency roles, identifies available funding sources, and is certified by the state attorney general to ensure that adequate authorities exist to implement the plan.

Idaho's nonpoint source management plan describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, such as the formation of *Basin Advisory Groups* (BAGs) and *Watershed Advisory Groups* (WAGs). The WAGs are to be established in high priority watersheds to assist DEQ and other state agencies in formulating specific action needed to decrease pollutant loading from point and nonpoint sources that affect water quality limited water bodies. The *North Fork Payette River WAG* was established in 2004 and is the designated advisory group for the part of the basin affected by the North Fork TMDL. *The Cascade Reservoir Coordinating Counci*l is responsible for the watershed from downstream of Big Payette Lake up to and including Cascade Reservoir. The *Big Payette Lake WAG* is responsible for Big Payette Lake.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible state agencies are listed in Table 40.

**Table 40. State of Idaho's Regulatory Authority for Nonpoint Pollution Sources.**

| Authority | IDAPA Citation | Responsible Agency |
|---|---|---|
| Rules Governing Solid Waste Management | 58.01.02.350.03(b) | Idaho Department of Environmental Quality |
| Rules Governing Subsurface and Individual Sewage Disposal Systems | 58.01.02.350.03(c) | Idaho Department of Environmental Quality |
| Rules and Standards for Stream-channel Alteration | 58.01.02.350.03(d) | Idaho Department of Water Resources |
| Rules Governing Exploration and Surface Mining Operations in Idaho | 58.01.02.350.03(e) | Idaho Department of Lands |
| Rules Governing Placer and Dredge Mining in Idaho | 58.01.02.350.03(f) | Idaho Department of Lands |
| Rules Governing Dairy Waste | 58.01.02.350.03(g) | Idaho Department of Agriculture |

The state of Idaho uses a voluntary approach to address agricultural nonpoint sources. However, regulatory authority can be found in the water quality standards (IDAPA 58.01.02.350.01 through 58.01.02.350.03). IDAPA 58.01.02.054.07 refers to *the Idaho Agricultural Pollution Abatement Plan* (Ag Plan), which provides guidance to the agricultural community and includes a list of approved BMPs (IDHW and SCC 1993). A portion of the Ag Plan outlines responsible agencies or elected groups (*Soil Conservation Districts*-SCDs) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, it assigns the local SCDs to assist the landowner/operator with developing and implementing BMPs to abate nonpoint pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations that may be determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The *Idaho Water Quality Standards and Wastewater Treatment Requirements* specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses (IDAPA 58.01.02.52). If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity.

The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Soil Conservation Commission for grazing and agricultural activities, the Department of Transportation for public road construction, the Idaho Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.003).

# 5. Total Maximum Daily Loads

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a *wasteload allocation* (WLA); and nonpoint sources, which receive a load allocation (LA). *Natural background* (NB), when present, is considered part of the load allocation, 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 water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made 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 is completed we have 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.

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 water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

Browns Pond is listed on the 303(d) list for habitat alteration and the North Fork Payette River is listed on the 303(d) list from Clear Creek to Smiths Ferry for flow alteration. The North Fork Payette River is listed because of the flow alteration caused by the Cascade Dam upstream. While degraded habitat is evidence of impairment, the EPA does not consider a water body to be polluted if the pollution is not a result of the introduction or presence of a pollutant. Thus, alteration of habitat or flow is not considered pollutants. Since TMDLs are not required to be established for water bodies impaired by pollution but not pollutants, a

TMDL has not been established for Browns Pond for habitat alteration or for the North Fork Payette River for flow alteration.

## 5.1 Instream Water Quality Targets

Instream water quality targets were selected such that they will restore full support of designated beneficial uses. Important considerations in target selections were critical periods for target application, recovery time for the water body, and appropriateness of surrogates.

### Target Selection

Section 2.4 of the subbasin assessment (page 67) outlines the water quality targets/standards for each water body of concern. Accompanying each target is the justification for the target and a description of the linkage between meeting the target(s) and improving beneficial use support status. These targets and standard also serve as the targets for TMDL development. Table 41 summarizes the targets on which each respective TMDL is based. In other words, these values represent the condition(s) the water should be in when the TMDL(s) are met.

The following section describes the water quality targets used to develop TMDLs. In some cases, surrogates are used as the target. In the bank sediment TMDLs, bank stability is used as a surrogate for maintaining less than 30% fine material in the riffles or the reference condition as determined by Overton (1995) for fine material for that particular Rosgen Type stream. The sediment target for Upper and Middle Clear Creek were derived from Clear Creek subwatersheds with BOISED sediment delivery information and low overall percent fines. Shading was used as a surrogate for temperature in the Fall and Box Creek TMDLs.

**Table 41. TMDL Water Quality Targets.**

| Pollutant | Target | Application |
|---|---|---|
| Sediment | 80% Bank Stability | Big Creek, Round Valley Creek, Lower Clear Creek, North Fork Payette River |
| Sediment | 12% above Natural Background sediment delivery conditions as determined by BOISED modeling | Upper and Middle Clear Creek |
| Temperature | 85% vegetative cover for Fall Creek and 82% for Box Creek (9 degree C maximum average daily temperature during salmonid spawning season) | Fall Creek and Box Creek |

### Design Conditions

The North Fork Payette Watershed consists primarily of agricultural and forested land and there are few point sources. Runoff and low flow periods during summer are when these water bodies are most vulnerable to impairment. The most likely BMPs are vegetative in nature, and these are most efficient during the growing season. Thus, the critical period corresponds to the period of runoff until the end of irrigation season. This time period differs between the upper and lower elevation parts of the watershed. In the lower elevations, high flows as a result of lower elevation runoff may occur in March, whereas high elevation peak runoff may not take place until June.

For the temperature TMDLs for Fall and Box Creek, which are specifically for salmonid spawning season, the critical period is in the latter part of the salmonid spawning season (March 1-July 15$^{th}$), from mid-June to July 15, which coincides with both longer days and warmer temperatures.

#### Monitoring Points

Monitoring locations for each water body are discussed in Section 2.4, page 67. Refer to that section for the location of monitoring points for each water body. Bank erosion inventories are areal in extent and cannot be represented by monitoring points. An attempt was made to collect or use data from monitoring stations that were representative of the segments of interest. Aerial photointerpretation of the North Fork Payette River from Cascade Dam to Cabarton Bridge was used to determine a sediment TMDL.

## 5.2 Load Capacity

The *Load Capacity* (LC) is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a *Margin of Safety* (MOS) to account for any uncertainty are calculated within the LC. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The LC is based on existing uses within in the watershed. The LC for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment.

A required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both 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.

### Big Creek, Round Valley Creek, Lower Clear Creek, and North Fork Payette River (Cascade Dam to Cabarton Bridge)

Where sediment primarily results from streambank erosion, the load capacity is based on the load generated from banks that are greater than 80% stable. This load defines the load capacity for these streams (Table 43). This value represents the estimated quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial uses full support status.

### Upper and Middle Clear Creek

The load capacity for these reaches of Clear Creek is based on 12% over the BOISED determined natural sediment yield. This level corresponds to that seen in the East Fork subwatershed that shows target levels of % fines (Table 44). This value represents the estimated quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial uses full support status.

### Fall and Box Creeks

The load capacity for these creeks is based on optimal shading for the riparian vegetative community type (Table 45). This value represents the estimated quantity of pollutant (heat in kWh) the water body is believed to be able to assimilate and still maintain beneficial uses full support status.

## 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. 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 (Table 42). To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads. Uncertainty in estimating existing pollutant loads in Clear Creek from road sediment delivery is due to assumptions made in the modeling. Uncertainty in the sediment TMDLs for Big, Clear and Round Valley Creeks stems from using an erosion inventory that estimates the results based on current bank conditions. DEQ staff also extrapolated results from sampled segments to those segments they were unable to sample, which also introduces uncertainty, particularly for Big Creek. North Fork Payette River erosion inventory input numbers were estimated from 2004 aerial photographs. Uncertainty arises from estimating bank heights and stability from aerial photographs. Box Creek salmonid spawning temperatures were partially extrapolated from Fall Creek, where data was missing. Uncertainty also exists in the exact relationship between stream shading and temperature in these watersheds.

As more data becomes available, pollutant load targets and allocations will be refined to reflect a better dataset.

The existing load for stream bank erosion TMDLs was set by calculations that took into account erosion rates, bank height, and quantity of stream bank stability. These values represent the estimated existing loads of pollutant occurring in the water bodies. Existing heat loads took into account existing shade conditions and solar radiation.

**Table 42. Loads from Nonpoint Sources in North Fork Payette River Subbasin.**

| Wasteload Type | Location | Load | Estimation Method |
|---|---|---|---|
| Sediment | Big Creek | 410 Tons/year | NRCS Channel Erosion Inventory (1983) |
| Sediment | Round Valley Creek | 131 Tons/year | NRCS Channel Erosion Inventory (1983) |
| Sediment | Clear Creek | 1157 Tons/year | BOISED |
| Sediment | Clear Creek | 349 Tons/year | NRCS Channel Erosion Inventory (1983) |
| Sediment | North Fork Payette River | 547 Tons/year | NRCS Channel Erosion Inventory (1983) |
| Temperature | Box Creek | 62% (2.17kWh/$m^2$/day) | Solar Radiation Estimation |
| Temperature | Fall Creek | 50% existing shade (3.3 kWh/$m^2$/day | Solar Radiation Estimation |

## 5.4 Load Allocation

This section describes the load allocations for the North Fork Payette River watershed. The North Fork Payette River, Big Creek, Lower Clear Creek and Round Valley Creek are receiving sediment allocations due to excess streambank erosion. Middle and Upper Clear Creek are given load allocations based on sediment yield. Two different types of load allocations are given for Clear Creek due to the two different sources of sediment (instream erosion and road sediment delivery). Tables 43 and 44 show the load allocations for the representative segments.

- The current erosion rate is based on the bank geometry and lateral recession rate (as described in Appendix H) at each measured reach.
- The target erosion rate is based on the bank geometry of the measured reach and the lateral recession rate at a calculated reference reach.
- The reference reach is based on the hydrogeologic conditions for that stream that would result in greater than 80% bank stability and reference condition level fines material in riffles for streams of similar Rosgen and geologic type.
- The loading capacity is the total load present when banks are at least 80% stable. As such, the loading capacity and the load allocations are the same. Note that these are the overall decreases necessary in the stream but can only reasonably apply to areas where banks are less than 80% stable.

**Table 43. Big Creek, North Fork Payette River, Lower Clear Creek and Round Valley Creek Load Allocation.**

| Water Body | Current Erosion Rate (tons/mile / year) | Target Erosion Rate (tons/mile / year) | Current Total Erosion (tons/year) | Load Capacity & Load Allocation (tons/year) | % Decrease |
|---|---|---|---|---|---|
| Big Creek | 62.56 | 48.61 | 528 | 410 | 22 |
| Lower Clear Creek | 86 | 45 | 349 | 182 | 48 |
| Round Valley Creek | 33 | 26.67 | 131 | 107 | 18 |
| North Fork Payette River (Cascade Dam to Clear Creek) | 72 | 45 | 864 | 547 | 36 |

**Table 44. Middle and Upper Clear Creek Load Allocation.**

| Water Body | Current Sediment Yield (tons/year) | Natural Background (tons/year) | Load Capacity (tons/year) | Load Allocation (tons/year) | % Decrease |
|---|---|---|---|---|---|
| Middle Clear Creek | 1157 | 957 | 1081 | 124 | 38 |

Load allocations for Fall and Box Creeks are based on shade targets developed for these streams (Table 45). No Waste Load Allocations are made because there are no point sources of pollutants in the watershed nor are there expected to be any that would discharge heat to these creeks.

**Table 45. Fall and Box Creek Load Allocation.**

| Water Body | Existing Shade | Load Capacity (potential shade) | Load Allocation (% shade increase needed) |
|---|---|---|---|
| **Box Creek** | **62% (2.17 kWh/m$^2$/day)** | **82% (1.15 kWh/m$^2$/day)** | **20%** |
| **Fall Creek** | **50% (3.3 kWh/m$^2$/day)** | **85% (0.957 kWh/m$^2$/day)** | **35%** |

## Margin of Safety

The margin of safety for the North Fork Payette River, Big Creek, Round Valley Creek and lower Clear Creek sediment TMDLs are implicit due to several conservative factors used to determine the existing sediment loads. These factors include the following:

- the erosion rate of a reference reach with 80% bank stability is correlated with target rates of <30% percent fines or the percent fines found in similar Rosgen and geologic type reference condition reaches
- the desired bank erosion rates are representative of background conditions
- the water quality target for percent fines is consistent with values measured and set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production.

The upper and middle reaches of Clear Creek where BOISED modeling was done, incorporate the margin of safety in the target by using conservative sediment delivery targets. The sediment targets were chosen based on the East Fork Clear Creek watershed, which had low percent fines.

The Fall and Box Creek TMDLs incorporate potential vegetative shading as the target, which is based on optimal cover. Using optimal cover, which is the best cover that can be achieved given the plant communities and present channel width, is conservative and inherently employs a margin of safety.

### Seasonal Variation

This TMDL accounts for seasonal variation by recognizing that loading varies substantially by season and between years and impacts are felt over multi-year timeframes. Moreover, in contrast to pollutants that cause short-term beneficial use impacts, and are thus sensitive to seasonal variation and critical conditions, the sediment and nutrient impacts in these watersheds occur over much longer time scales. For these reasons, the longer timeframe (tons per year) used in this TMDL is appropriate.

Seasonal variation in the watershed is primarily driven by flow. Spring runoff flows represent the highest flow regimes. Pollutant delivery is associated primarily with runoff flows, including rain–on-snow events, which can result in significant peaks in the hydrograph.

The critical period for Big Creek, Round Valley Creek and Clear Creek is year round to account for rain- on-snow events, which may occur in fall, spring or winter, and heavy rainfall associated with microburst type events which can occur in summer. These creeks are the most vulnerable during high flow events.

The critical period for the North Fork Payette River for sediment is year round to account for sediment delivery from creeks like Round Valley and Clear Creek. For sediment generated by instream channel erosion within the large river system, the critical period is during May and June, which are the times of high flow in this dam controlled system that lead to transport of bedload downstream.

The critical period for Fall and Box Creeks is during salmonid spawning season. Seasonal variation occurs in large part due to changes in solar radiation loading and air temperature as the year progresses, with temperature peaking in mid-July and early August. The salmonid spawning temperatures are typically exceeded starting around the summer solstice (June 21st) and continuing through mid-July. The TMDL addresses the critical period and seasonal variation by developing shade targets that will be met during this time.

### Background

Background sediment levels for the North Fork Payette River, Big Creek, Round Valley Creek, and Clear Creek are accounted for in the 80% bank stability target, which allows for 20% of the bank to be less than stable, which is to be expected in a stream's naturally functioning state. Thus, background is considered but no adjustments are made to the allocation.

The BOISED modeling of the Upper and Middle Clear Creek watersheds determined natural sediment yield (natural background). For this particular watershed, natural background is 956 tons of sediment/year. BOISED uses soil creep (the slow downslope movement of soil resulting from gravitational forces.

It is difficult to determine natural background heat load, but it is assumed that by establishing and achieving the prescribed shade targets, any additional heat loading that results in temperatures above the standard is part of natural background heat loading. Otherwise, natural background is implicit in the state temperature standard and the potential canopy cover.

### Reserve

Big Creek, Round Valley Creek, North Fork Payette River and Clear Creeks do not include a reserve for growth. While growth may occur, the expectation is that no additional bank sediment will be discharged to the systems as a result of the growth. Bank stability can be maintained through forestry, agricultural, and urban/suburban best management practices.

Fall and Box Creeks lie entirely within state and federal land. No reserve for growth is included because no growth is expected, and timber harvest and other activities should be able to continue in the watershed and still meet the vegetative cover target.

### Remaining Available Load

The remaining available load is allocated as shown in Table 46.

**Table 46. Load Nonpoint Source Allocations for North Fork Payette River Subbasin.**

| Source | Pollutant | Allocation | Time Frame for Meeting Allocations |
|---|---|---|---|
| Big Creek | Sediment generated from bank erosion | 410 tons/year | 5-15 years |
| Clear Creek | Sediment from roads | 124 tons/year | 5 years |
| Clear Creek | Sediment generated from bank erosion | 182 tons/year | 5-15 years |
| Round Valley Creek | Sediment generated from bank erosion | 107 tons/year | 5-15 years |
| North Fork Payette River (Cascade Dam to Smiths Ferry) | Bedload sediment generated from bank erosion | 547 tons/year | |
| Box Creek | Temperature | 1.15 $kWh/m^2/day$ (82% available shade) | 5-15 years |
| Fall Creek | Temperature | 0.957 $kWh/m^2/day$ (85% available shade) | 5-15 years |

## Construction Storm Water and TMDL Waste Load Allocations

The following is general information on construction storm water and the significance of construction storm water to TMDLs.

### Construction Storm Water

The Clean Water Act 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 non-point source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires a *National Pollution Discharge Elimination System* (NPDES) Permit.

### The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land (or is part of a 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 operators must develop a site-specific Storm Water Pollution Prevention Plan. The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the best management practices (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 waste load allocation (WLA) for anticipated construction storm water activities. Due to the complexity of determining loads and the lack of data for doing so, a wasteload allocation for this TMDL is not determined. A construction activity that obtains a permit and follows BMPs will be considered in compliance with the TMDL. TMDLs developed in the past that did not have a WLA for construction storm water activities will also be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate Best Management Practices.

Typically there are specific requirements you must follow 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 best management practices 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 General Construction Permit, unless local ordinances have more stringent and site specific standards that are applicable.

## 5.5 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. DEQ also recognizes the importance of ensuring that a Best Management Practice (BMP) is suited for a particular watershed. As such, DEQ relies on designated agencies to use their expertise in assisting landowners and other agencies in determining BMPs that will not only work in reducing pollutants but will have longevity and be appropriate for the area.

### Time Frame

The implementation plan must demonstrate a strategy for implementing and maintaining the plan and the resulting water quality improvements over the long term. The final timeline should be as specific as possible and should include a schedule for BMP installation and/or evaluation, monitoring schedules, reporting dates, and milestones for evaluating progress. There may be disparity in timelines for different subwatersheds. This is acceptable as long as there is reasonable assurance that milestones will be achieved.

The implementation plan will be designed to reduce pollutant loads from sources to meet TMDLs, their associated loads, and water quality standards. DEQ recognizes that where implementation involves significant restoration, water quality standards may not be met for quite some time. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in some cases, in the development stages and will likely take one or more iterations to develop effective techniques.

A definitive timeline for implementing the TMDL and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the WAG, the designated agencies, and other interested publics. In the meantime, implementation planning will begin immediately (2005). The goal is to attain the water quality standards and return beneficial uses to full support in the shortest time possible. DEQ expects full implementation of the TMDL and recovery of the beneficial uses to take upwards of 20 years. Some subwatersheds may take less time and some may take more, depending on the complexity of the system. Vegetative BMPs may take between 5-15 years to reach maximum effectiveness. Thus, a phased approach with a feedback loop cycle of monitoring and reevaluation of BMP effectiveness, is essential in meeting TMDL pollutant reduction goals.

### Approach

The goal of the CWA and its associated administrative rules for Idaho is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in this watershed, particularly because nonpoint sources are the primary concern. To achieve this goal, implementation must commence as soon as possible.

The TMDL is a numerical loading that sets pollutant levels such that instream water quality standards are met and designated beneficial uses are supported. DEQ recognizes that the TMDL is calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical, and biological processes. Models and some other analytical techniques are simplifications of these complex processes and, while they are useful in interpreting data and in predicting trends in water quality, they are unlikely to produce an exact prediction of how streams and other water bodies will respond to the application of various management measures. It is for this reason that the TMDL has been established with a MOS.

For the purposes of the North Fork Payette River TMDL, a general implementation strategy is being prepared for EPA as part of the TMDL document. Following this submission, in accordance with approved state schedules and protocols, a detailed implementation plan will be prepared for pollutant sources. Implementation strategies will be decided upon by designated agencies and individual landowners to best suit the particular watershed. Implementation typically includes activities like bank stabilization, riparian improvements, grazing management plans, conservation planning, fencing, off-site watering, and road improvements.

For nonpoint sources, DEQ also expects that implementation plans be implemented as soon as practicable. However, DEQ recognizes that it may take some time, from several years to several decades, to fully implement the appropriate management practices. DEQ also recognizes that it may take additional time after implementation has been accomplished before the management practices identified in the implementation plans become fully effective in reducing and controlling pollution. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the development stages and will likely take one or more iterations to develop effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated targets and surrogates cannot be achieved as originally established. Nevertheless, it is DEQ's expectation that nonpoint sources make a good faith effort to achieving their respective load allocations in the shortest practicable time.

DEQ recognizes that expedited implementation of TMDLs will be socially and economically challenging. Further, there is a desire to minimize economic impacts as much as possible when consistent with protecting water quality and beneficial uses. DEQ further recognizes that, despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated targets and surrogates. Such events could be, but are not limited to floods, fire, insect infestations, and drought. Should such events occur that negate all BMP activities, the appropriateness of re-implementing BMPs will be addressed on a case by case basis. In any case, post event conditions should not be exacerbated by management activities that would hinder the natural recovery of the system.

For some pollutants, pollutant surrogates have been defined as targets for meeting the TMDLs. The purpose of the surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. It is the expectation, however, that the specific implementation plan will address how human activities will be managed to achieve the water quality targets and surrogates. It is also recognized that full attainment of pollutant surrogates (system potential vegetation, for example) at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the implementation plan should identify potential constraints, but it should also provide the ability to mitigate those constraints should the opportunity arise. If a nonpoint source that is covered by the TMDL complies with its finalized implementation plan, it will be considered in compliance with the TMDL.

DEQ intends to regularly review progress of the implementation plan. If DEQ determines the implementation plan has been fully implemented, that all feasible management practices have reached maximum expected effectiveness, but a TMDL or its interim targets have not been achieved, DEQ may reopen the TMDL and adjust it or its interim targets.

The implementation of TMDLs and the associated plan is enforceable under the applicable provisions of the water quality standards for point and nonpoint sources by DEQ and other state agencies and local governments in Idaho. However, it is envisioned that sufficient initiative exists on the part of local stakeholders to achieve water quality goals with minimal enforcement. Should the need for additional effort emerge, it is expected that the responsible agency will work with stakeholders to overcome impediments to progress through education, technical support, or enforcement. Enforcement may be necessary in instances of insufficient action towards progress. This could occur first through direct intervention from state or local land management agencies, and secondarily through DEQ. The latter may be based on departmental orders to implement management goals leading to water quality standards.

In employing an adaptive management approach to the TMDL and the implementation plan, DEQ has the following expectations and intentions:

- Subject to available resources, DEQ intends to review the progress of the TMDLs and the implementation plans on a five-year basis.
- DEQ expects that designated agencies will also monitor and document their progress in implementing the provisions of the implementation plans for those pollutant sources for which they are responsible. This information will be provided to DEQ for use in reviewing the TMDL.
- DEQ expects that designated agencies will identify benchmarks for the attainment of TMDL targets and surrogates as part of the specific implementation plans being developed. These benchmarks will be used to measure progress toward the goals outlined in the TMDL.
- DEQ expects designated agencies to revise the components of their implementation plan to address deficiencies where implementation of the specific management techniques are found to be inadequate.

If DEQ, in consultation with the designated agencies, concludes that all feasible steps have been taken to meet the TMDL and its associated targets and surrogates, and that the TMDL, or the associated targets and surrogates are not practicable, the TMDL may be reopened and revised as appropriate. DEQ would also consider reopening the TMDL should new information become available indicating that the TMDL or its associated targets and/or surrogates should be modified. This decision will be made based on the availability of resources at DEQ.

### Responsible Parties

Federal agencies include the US Forest Service, Bureau of Land Management (BLM), NRCS and BOR. State agencies include the Idaho Department of Agriculture, DEQ, Idaho Department of Lands, Idaho Department of Fish and Game and Soil Conservation Commission. The local Soil Conservation Districts will be integral in implementation.

### Monitoring Strategy

The objectives of a monitoring effort are to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and track effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the “reasonable assurance of implementation” for the TMDL implementation plan.

The implementation plan will be tracked by accounting for the numbers, types, and locations of projects, BMPs, educational activities, or other actions taken to improve or protect water quality. The mechanism for tracking specific implementation efforts will be annual reports to be submitted to DEQ.

The “monitoring and evaluation” component has two basic categories:

- Tracking the implementation progress of specific implementation plans; and
- Tracking the progress of improving water quality through monitoring physical, chemical, and biological parameters.

Monitoring plans will provide information on progress being made toward achieving TMDL allocations and achieving water quality standards, and will help in the interim evaluation of progress as described under the adaptive management approach.

Implementation plan monitoring has two major components:

- Watershed monitoring
- BMP monitoring.

While DEQ has primary responsibility for watershed monitoring, other agencies and entities have shown an interest in such monitoring. In these instances, data sharing is encouraged. The designated agencies have primary responsibility for BMP monitoring.

### Watershed Monitoring

Watershed monitoring measures the success of the implementation measures in accomplishing the overall TMDL goals and includes both in-stream and in-river monitoring. Monitoring of BMPs measures the success of individual pollutant reduction projects. Implementation plan monitoring will also supplement the watershed information available during development of associated TMDLs and fill data gaps.

In the North Fork Payette River TMDL, watershed monitoring has the following objectives:

- Evaluate watershed pollutant sources,
- Refine baseline conditions and pollutant loading,
- Evaluate trends in water quality data,
- Evaluate the collective effectiveness of implementation actions in reducing pollutant loading to the mainstem and/or tributaries, and
- Gather information and fill data gaps to more accurately determine pollutant loading.

### BMP/Project Effectiveness Monitoring

Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified, and will be the responsibility of the designated project manager or grant recipient. The objective of an individual project monitoring plan is to verify that BMPs are properly installed, maintained, and working as designed. Monitoring for pollutant reductions at individual projects typically consists of spot checks, annual reviews, and evaluation of advancement toward reduction goals. The results of these reviews can be used to recommend or discourage similar projects in the future and to identify specific watersheds or reaches that are particularly ripe for improvement.

### Evaluation of Efforts over Time

Annual reports on progress toward TMDL implementation will be prepared to provide the basis for assessment and evaluation of progress. Documentation of TMDL implementation activities, actual pollutant reduction effectiveness, and projected load reductions for planned actions will be included. If water quality goals are being met, or if trend analyses show that implementation activities are resulting in benefits that indicate that water quality objectives will be met in a reasonable period of time, then implementation of the plan will continue. If monitoring or analyses show that water quality goals are not being met, the TMDL implementation plan will be revised to include modified objectives and a new strategy for implementation activities.

## 5.6 Conclusions

This TMDL is a starting point for restoring beneficial uses in the watershed. Since many factors influence water quality, implementation is done within an adaptive management framework. Through the efforts of both private and public entities and community members, water quality in the streams requiring TMDLs can be greatly improved.

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**GIS Coverages:**

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# Glossary

**§305(b)** Refers to section 305 subsection "b" of the Clean Water Act. 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.

**Acre-Foot** A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.

**Adsorption** The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules

**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.

**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. 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 (Armantrout 1998, EPA 1996).

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

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| **Anaerobic** | Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen. |
| **Anoxia** | The condition of oxygen absence or deficiency. |
| **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 58.01.02.003.56). |
| **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). |
| **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 biota, 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 |

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| **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 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). |
| **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/cm 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. EPA 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.

**Cultural Eutrophication** The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).

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

**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. Their presence is often indicative of fecal contamination.

**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.

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| **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. |
| **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 Geologic 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. |
| **Extrapolation** | Estimation of unknown values by extending or projecting from known values. |
| **Fauna** | Animal life, especially the animals characteristic of a region, period, or special environment. |

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| **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). |
| **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 (EPA 1997). |
| **Geographical Information Systems (GIS)** | A georeferenced 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. |
| **Grab Sample** | A single sample collected at a particular time and place. It may represent the composition of the water in that water column. |
| **Gradient** | The slope of the land, water, or streambed surface. |
| **Ground Water** | Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as 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 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.

**Inorganic** Materials not derived from biological sources.

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

**Intergravel Dissolved Oxygen** The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

**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.

**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.

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| **Land Application** | A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge. |
| **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. |
| **Loading 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. |
| **Loam** | Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use. |
| **Loess** | A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible. |
| **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. |

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| **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; and 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, 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** | A condition indistinguishable from that without human-caused disruptions. |
| **Nitrogen** | An element essential to plant growth, and thus is considered a nutrient. |

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| **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 (EPA 1997). |
| **Nuisance** | Anything which 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). |
| **Oligotrophic** | The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity. |
| **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. |

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| **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. |
| **Partitioning** | The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment. |
| **Pathogens** | Disease-producing organisms (e.g., bacteria, viruses, parasites). |
| **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, wasteload 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 terms "physical/chemical" and "physicochemical." |
| **Plankton** | Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans. |

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| **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. |
| **Pretreatment** | The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant. |
| **Primary Productivity** | The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour. |
| **Protocol** | A series of formal steps for conducting a test or survey. |
| **Qualitative** | Descriptive of kind, type, or direction. |
| **Quantitative** | Descriptive of size, magnitude, or degree. |
| **Reach** | A stream section with fairly homogenous physical characteristics. |
| **Reconnaissance** | An exploratory or preliminary survey of an area. |
| **Reference** | A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments. |

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| **Reference Condition** | 1) A condition that fully supports applicable beneficial uses with little effect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995). |
| **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:<br>- 300 feet from perennial fish-bearing streams<br>- 150 feet from perennial non-fish-bearing streams<br>- 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 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. |

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| **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. |
| **Stratification** | A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata). |
| **Stream** | A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone. |
| **Stream Order** | Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order. |
| **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. |
| **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 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment. |

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| **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 loading 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 bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. 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 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 (Greenborg, Clescevi, and Eaton 1995) 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. |

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| **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. |
| **Wasteload Allocation (WLA)** | The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body. |
| **Water body** | A stream, river, lake, estuary, coastline, or other water feature, or portion thereof. |
| **Water 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." |

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| **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 EPA-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 which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body. |
| **Wetland** | An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes. |
| **Young of the Year** | Young fish born the year captured, evidence of spawning activity. |

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# Appendices

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

[1] 1 $ft^3$/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 $ft^3$/sec.
[2] 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

### Table B-2 State and Site-Specific Standards and Criteria

| Pollutant & IDAPA Citation | Beneficial Use(s) to Which Standard Applies | Applicable Water Quality Standard |
|---|---|---|
| Temperature<br>(58.01.02.250.02.b)<br><br>(58.01.02.250.02.e. ii)<br><br>Bull Trout Temperature Criteria<br>(58.01.02.250.02.f) | Cold Water Aquatic Life<br><br>Salmonid Spawning<br><br>Salmonid Spawning | No greater than 22 degrees Celsius AND no greater than 19 degrees Celsius maximum daily average<br>During salmonid spawning periods: no greater than 13 degrees Celsius AND no greater than 9 degrees C maximum daily average<br>Water temperatures shall not exceed 13 degrees Celsius maximum weekly temperature during June, July and August for juvenile bull trout rearing, and 9 degrees Celsius daily average during September and October for Bull Trout spawning. This criteria applies in all tributary waters not including fifth order mainstem rivers located within areas above 1400 meters elevation south of the Salmon River Basin /Clearwater River basin divide |
| Dissolved Oxygen<br>(58.01.02.250.02.a)<br>Dissolved Oxygen Concentration below Existing Dam<br>(58.01.02.276.02) | Cold Water Aquatic Life<br><br>Salmonid Spawning | Greater than 6.0 mg/L except in hypolimnion of stratified lakes and reservoirs<br>From June 15-October 15 waters below dams, reservoirs and hydroelectric facilities shall contain the following dissolved oxygen concentrations: 30- day mean of 6.0 mg/L; 7-day mean of 4.7 mg/L and an instantaneous minimum of 3.5 mg/L |
| Sediment<br>(58.01.02.200.08) | Cold Water Aquatic Life<br>Salmonid Spawning | Sediment shall not exceed quantities specified in general surface water quality criteria (IDAPA 58.01.02.250 or 252) or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses |
| Turbidity<br>(58.01.02.250.02.d) | Cold Water Aquatic Life | < 50 NTU[2] above background for any given sample or < 25 NTU for more than 10 consecutive days (below any applicable mixing zone set by DEQ) |
| Bacteria<br>(58.01.02.251.01.b, c) | Contact Recreation | < 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples AND no sample > 406 *E. coli* organisms/100 mL |
| Floating, Suspended, or Submerged Matter (Nuisance Algae)<br>(58.01.02.200.05) | Contact Recreation | Surface waters shall be free from floating, suspended, or submerged matter of any kind in concentration causing nuisance or objectionable conditions or that impair designated beneficial uses and be free from oxygen demanding materials in concentrations that would result in an anaerobic water condition |
| Excess Nutrients<br>(58.01.02.200.06) | Cold Water Aquatic Life<br>Contact Recreation | Surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses |

[1]NTU = nephlometric turbidity unit

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# Appendix C. Data Sources

### Table C-1. Data sources for North Fork Payette River Subbasin Assessment.

| Water Body | Data Source | Type of Data | When Collected |
|---|---|---|---|
| Round Valley Creek and Big Creek | Soil Conservation Commission | Riparian Survey | 2004 |
| Clear Creek | USFS | Sediment | 1998, 1999 |
| North Fork Payette River/Black Canyon Reservoir | DEQ/BOR<br>USGS | Nutrient, sediment<br>Flow | 2004<br>various years |
| Fall Creek, Box Creek | DEQ, USFS, | Temperature | 1995<br>2004 |
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# Appendix D. Distribution List

North Fork Payette River WAG
Harry Adams, NFPR WAG
Mary Hanson, NFPR WAG
Dean Sangrey, NFPR WAG
Melissa Yenko, Boise National Forest, NFPR WAG
Mike Frye, Squaw Creek Soil Conservation District, NFPR WAG
Donald Jensen, NFPR WAG
Tim Kennedy, Idaho Department of Lands, NFPR WAG
Forest Limited Partnership
Jeff Barry, CH2M Hill
Dave Zimmer, US Bureau of Reclamation
Boise Regional Office, DEQ
Marti Bridges, DEQ, Boise Idaho
IASCD, Cascade, Idaho
Keith Griswold, District Conservationist, Natural Resource Conservation Service, Cascade Idaho
Elt Hasbrouck, Cascade, Idaho

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# Appendix E. Public Comments

| From | Comment # | Comment | Response |
|---|---|---|---|
| Dick Rogers | **1** | On Page 37 please add large mouth bass to the list of fish species as there is a population in Black Canyon reservoir and in other coves and protected areas. | Largemouth bass was added |
| Dick Rogers | **2** | There are 2 contributing streams not mentioned in the report and both may be contributors of bacteria and nutrients. The first is immediately upstream from the mouth of Squaw Creek about 300 yards on the same side of the river as Squaw Creek. The other is the discharge from the Montour ponds as there is a discharge from the lower pond along the north side of the railroad tracks. | Thank you for bringing this to our attention. Black Canyon Reservoir does not show beneficial use impairment so these sources do not need to be documented in the subbasin assessment. However, DEQ will sample these sources to determine what nutrient and bacteria levels are present. |
| Dick Rogers | **3** | Squaw Creek needs to be listed for sediment as I have observed a continual increase in the area from the highway to the mouth. This is based on at least 10 years of observations. | 2003-4 DEQ and USBR data did not show elevated levels of suspended sediment. The Idaho Department of Agriculture has sampled after rain events this year, 2005, and also has not seen elevated suspended sediment (>50 mg/L). Sediment transport is a normal function of a stream and sediment is expected to be deposited when water velocity slows down. Previously, for either natural or anthropogenic reasons, excess sediment may have been transported in Squaw Creek and deposited near the mouth. However, unless current data shows there is an existing problem, a sediment TMDL will not be written for Squaw Creek. |
| Dick Rogers | **4** | Page 105 of the draft report needs to be modified to include a TMDL for sediment for Black Canyon | The majority of sediment is delivered by the South Fork Payette River which is not |

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| | | reservoir. There is a significant sediment load entering the reservoir as I have observed several years. I think it is wrong to depend on upstream sediment TMDL's to elevate (sic) this problem as I believe it will continue to exist probably at a lesser degree. | addressed in this TMDL. A separate Subbasin Assessment/TMDL for the SF Payette River has been submitted to EPA. The SF Payette River TMDL describes the sediment load coming from that waterbody as predominantly from unmanaged or natural sources. A TMDL was not developed for the SF Payette River TMDL. Sediment delivery from the North Fork Payette River system and Squaw Creek were at target levels. A TMDL is not necessary for these systems. |
| Dick Rogers | **5** | Black Canyon reservoir needs to be protected for nutrients because it is a flow through reservoir and there are many areas where water is allowed to stagnant and algae blooms are quite common in this area. Thus beneficial uses are impaired. In the Cda. Office of DEQ I have seen reports where similar areas in Lake Cda.are called nutrient hot spots. Black Canyon reservoir has several areas of nutrient hot spots. I would suspect these areas also have exceedances of bacteria standards. | Sampling by USBR and DEQ did not show violations of the primary contact recreation standard for bacteria.<br><br>See response below in regards to nutrient hot spots. |
| Dick Rogers | **6** | Because Black Canyon reservoir is listed for habitat alteration which should be retained the reservoir has a short detention time and it will continue to decrease as the reservoir continues to fill with sediment. There actually exist 2 specific areas that need water quality protection. The first area is channel where the river moves directly through the reservoir and the second is the areas where there is no current and the water is allowed to stagnant. There exists areas where there is good | The presence of algae or macrophytes does not necessarily indicate beneficial use impairment. Algae and macrophytic growth are expected to some degree where the water velocity is low. The presence of this growth does not necessarily constitute nuisance growth. Areas of macrophyte growth may provide habitat for certain fish species. Black Canyon Reservoir is mesotrophic |

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| | | mixing of the water through out the reservoir and then there are areas where little or no mixing occurs except for wind/wave action which I call stagnant areas. These stagnant areas need to be identified as they have significant algal growth and I suspect bacteria violations in the summer. | which means that primary productivity does occur and this may manifest itself in phytoplankton growth. However, chlorophyll-a concentrations were consistently below EPA ecoregional reference criteria, indicating that this reservoir is similar to waterbodies with limited human disturbance.<br><br>DEQ and USBR both sampled near Triangle Park in an area of shallow water. The results did not indicate impairment of beneficial uses. However, your point underlines the necessity of continued monitoring of the reservoir to keep track of trends in reservoir trophic status. |
| USBR | **7** | **Page 56, Table 4:**<br>To prevent misinterpretation, these criteria should be written as they appear in IDAPA 58.01.02. This change should also be made in other portions of the document where the criteria appear. | Table 4 was changed to more closely reflect what is written in IDAPA (some criteria are taken directly out of IDAPA, others, to retain clarity, are abridged or summarized but do not deviate from the administrative code). |
| USBR | **8** | **Page 72, fourth paragraph:**<br>Please define the months of the "growing season", during which the 10 µg/L chlorophyll-a target applies. Reclamation assumes the growing season is April-September. | Revised paragraph to reflect that the growing season is from April-September |
| USBR | **9** | **Page 78, second paragraph, seventh sentence:**<br>Please note in this sentence that the 12,000 cfs objective is at the Horseshoe Bend gauge and is for flood control purposes. | Revised sentence to reflect that the 12,000 cfs objective is at the Horseshoe Bend gauge and is for flood control purposes |
| USBR | **10** | **Page 78, second paragraph, eighth sentence:**<br>Please note in this sentence that the | Revised sentence to reflect that this objective is at the Horseshoe Bend gauge. |

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| | | 2,100 to 2,600 cfs objective is at the Horseshoe Bend gauge. | |
| USBR | **11** | **Pages 82 & 83:** Figure 27 reports the water column sediment data in terms of TSS while Figure 28 reports the data in terms of SSC, yet both are compared to the same sediment target. As a point of clarification, should these figures both report the data in terms of SSC? If not, additional justification as to why different measures of water column sediment apply to the same target should be included. | Figure 27 is supposed to report TSS since SSC sampling did not begin until the following year. The suspended sediment target is more appropriately applied to the SSC concentrations. However, 45 samples were taken that measured both TSS and SSC. These samples showed a correlation coefficient of .99 and a regression (r2) value of .90. This indicates that both values can be used to compare to the target because they are so similar. |
| USBR | **12** | **Page 99, fourth paragraph, first sentence:** The word "remained" should be changed to "were" to show that by mid-August, temperatures *were* below the state standards. | Changed the word 'remained' to 'were' to provide clarity. |
| USBR | **13** | **Page 99, fourth paragraph:** The fourth and last sentences in this paragraph appear to contain conflicting information. As written, the fourth sentence seems to suggest that the entire reservoir is vulnerable to not supporting fisheries in the mid-summer. However, the last sentence says that the more riverine portion of the reservoir met the standards, thereby providing suitable fisheries habitat. Reclamation suggests revising the fourth sentence to clearly state that only **portions** of the reservoir are vulnerable, not the entire reservoir. Furthermore, this statement should emphasize that the vulnerability is limited to cold water fishes. The Idaho Department of Fish and Game (IDFG) successfully manages the reservoir as a warm water fishery. | Revised paragraph to clear up ambiguity. |

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| USBR | **14** | **Page 106, second paragraph, third sentence:** Based on the data presented in the subbasin assessment, Reclamation does not agree with the assertion that beneficial uses are **impaired** [emphasis added] during the hottest part of the year. DEQ says on page 99, fourth paragraph that “the reservoir is **vulnerable** [emphasis added] to not supporting fisheries”, yet says on page 106, second paragraph that “….beneficial uses are not impaired except during the hottest part of the summer.” These sentences contain conflicting information. Reclamation does not feel that vulnerability alone is evidence of beneficial use impairment given the availability of refugia in the reservoir. Furthermore, it should again be noted that the fisheries being referred to are cold water species. The Idaho Department of Fish and Game (IDFG) successfully manages the reservoir as a warm water fishery. | Revised paragraph to clarify that beneficial uses are not impaired. |
| USBR | **15** | **Page 180, Table 43:** Due to excess sedimentation in Black Canyon Reservoir, Reclamation supports the development of these sediment TMDLs as well as any other sediment management activities that may occur in the watersheds above Black Canyon Reservoir. | Comment noted. |
| US EPA | **16** | Pages 55-58 In 2.2 “Applicable Water Quality Standards,” IDEQ provided the numeric water quality criteria for temperature. For the temperature TMDLs, IDEQ developed the TMDL shading target using shade curves of existing TMDLs that represented similar vegetative types | DEQ did not attempt to model the temperature regime of these rivers without hydrologic modification (Box Lake on Box Creek is irrigation controlled as is Blackwell Lake on Fall Creek). If the streams do not meet salmonid spawning criteria when they |

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| | | including Walla Walla in Washington and Willamette in Oregon. For most of their temperature TMDLs, Oregon and Washington use their natural condition water quality standard provisions. Is IDEQ using its natural condition water quality standard provisions? If so, IDEQ needs to describe its natural condition provision in 2.2 "Applicable Water Quality Standards." | have reached the shading targets, natural background will be investigated. The natural condition water quality standard language has been included in the target section. |
| US EPA | **17** | Page 71: Explain more clearly the relationship between temperature criteria and solar radiation and include the TMDL target for solar radiation (in kWh/m2/day) for the impaired creeks listed in Table 6 on page 71 since you develop a TMDL using solar radiation. | Added a sentence about the relationship between temperature criteria and solar radiation. When potential natural vegetation is reached either the temperature criteria will be met or DEQ will have to use the natural conditions provision from the standards. |
| US EPA | | Page 94: Existing data show that stream bank stability exceeds the 80% target for Big Creek and BURP shows that beneficial uses are impaired in the lower reaches of Big Creek; yet a TMDL is developed for Big Creek using 80% stability. Please explain the rationale for using stability as the surrogate for sediment when this target is already being met.<br><br>How was the sediment TMDL developed that took "into account the unique morphological characteristics of Big Creek" (pg 94)? | While BURP data showed stability a 2004 stream erosion inventory showed banks that were <80% stable. A sentence refers to the middle reach having areas of stability and areas of excess erosion. DEQ took a conservative approach in extrapolating the erosion inventory results to the entire middle reach. Percent fines are high in Big Creek in the middle and lower reaches. Beneficial uses are impaired by sediment.<br><br>The unique morphological characteristics means that while the percent fines can be linked to bank stability in the middle reach, this is not possible in the lower reach downstream of Highway 55 |

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| | | | due to the large amounts of sand and gravel that were discharged as a result of the dredging operation. Banks are stable in this reach although woody vegetation is not prevalent. This may be due to banks that largely consist of sand. |
| US EPA | **18** | Page 177 Table 41 shows the TMDL water quality target as 85% vegetative cover for Fall Creek and page 71 Table 6 shows the target for Fall Creek to be 86% shade. | This mistake has been corrected so that both tables show an 85% target. |
| US EPA | **19** | Pages 159, 162: For Squaw Creek, IDEQ states on page 159, "While phosphorus levels were elevated over the EPA Gold Book target of 0.05 mg/L for total phosphorus for waters that directly discharge to a reservoir, because Black Canyon Reservoir is not impaired by excess nutrients, a TMDL allocation is not necessary" and later on page 162, IDEQ states, "Nutrient levels are also above target concentrations, and nutrients are proposed for listing on the 303(d) list."<br><br>Please explain these apparently contradictory statements. | Squaw Creek did not receive a nutrient allocation because current nutrient loading is not impairing Black Canyon Reservoir. There is no data that indicates that the beneficial uses of Squaw Creek are themselves impaired.BURP data is available for the upper reaches of Squaw Creek and do not show impairment. The lower reach is not wadeable for most of the year due to channel shape which is part of the reason why beneficial use impairment has not been determined. Land use in the lower reaches is largely agricultural. The Idaho Department of Agriculture is sampling Squaw Creek longitudinally in 2005 to better determine nutrient concentrations and sources. This sampling will also lead to a beneficial use determination and to what longitudinal extent that beneficial uses are impaired.<br>Elevated nutrient concentrations above the |

| | | | |
|---|---|---|---|
| | | | nutrient target for the reservoir were the trigger for the proposed listing and subsequent Idaho Department of Agriculture study. The elevated nutrient concentrations raise concerns that beneficial uses in the lowermost reach may be impaired. |
| US EPA | **20** | Page 181-2: Temperature: IDEQ included a margin of safety (MOS) for shading and failed to include a MOS for heat. | The margin of safety for shading is for potential natural vegetation throughout the stream corridor which is inherently conservative since not all parts of the channel will be able to support 85% vegetative cover due to geology, channel shape etc. This MOS includes the MOS for heat. Oregon in their similar Walla Walla temperature TMDL noted the difficulty of calculating a numerical MOS for heat. |
| USEPA | **21** | Page xix Executive Summary (second sentence), "TMDLs were developed for five 303(d) listed streams..." What about the North Fork Payette River TMDL for sediment? Also IDEQ summarized all listed segments except Box Creek, Fall Creek and Soldier Creek. | The executive summary has been corrected. |
| US EPA | **22** | Page 71: To clarify that IDEQ did not develop TMDLs for all the waterbodies, pollutants and targets listed on Table 6, consider adding another column showing which waterbodies/pollutants/targets have TMDLs.<br><br>Explain how the targets have been/will be used for those waterbodies/pollutants/targets that do not have TMDLs. Also be consistent in noting which targets | Added column to Table 6 and amended table to reflect surrogate targets for Fall and Box Creek as well as sediment surrogates. Added information on Clear Creek sediment surrogate for upper and middle reaches.<br><br>Information on how targets are used in waterbodies that do not have TMDLs is included in the individual subsections on each |

| | | | |
|---|---|---|---|
| | | are surrogates (you noted the surrogate target of 10% shade for North Fork Payette River but did not note that percent shade for Box and Fall Creeks were also surrogates or that 80% bank stability was a surrogate, etc.).<br>Also you are missing the target of 12% above natural background for upper and middle Clear Creek.<br>Table 41 does provide a list of TMDL targets. | stream in Section 2. |

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# Appendix F. DEQ Water Body Assessment Guidance Document (WBAG) II

WBAG II (Grafe et al. 2000) is available in its entirety on DEQ's web page. The address is: http://www.deq.state.id.us/water/surface_water/wbag/WBAG2001.htm

The 10 major components of WBAG II are described in this technical appendix

This Water Body Assessment Guidance (WBAG) is intended as an analytical tool to guide individuals through a standardized assessment process. The WBAG describes Idaho Department of Environmental Quality (DEQ) methods used to evaluate data and determine beneficial use support of Idaho water bodies. This document is a revision of the 1996 WBAG (DEQ 1996).

A water body assessment entails analyzing and integrating multiple types of water body data to address three primary objectives.

1. Determine the beneficial use support of a water body.

2. Determine the degree of biological integrity.

3. Compile descriptive information about the water body.

The regulatory context of the assessment process and how these rules, regulations, and policies are related to DEQ reporting requirements are discussed in Section 1. The Clean Water Act and Idaho water quality standards drive the assessment process and DEQ reporting requirements for the 303(d) list, 305(b) report, subbasin assessments, and legislative reports.

Section 2 discusses how DEQ collects, analyzes, and manages DEQ data used in the assessment process. This section describes the Beneficial Use Reconnaissance Program (BURP) and trend monitoring network. This also includes the methods used to stratify (classify data by stream order and land use) and compare the data for use support determination. Additionally, Section 2 explains the Idaho Water Body Identification System (the scale used to define Idaho water bodies) and the DEQ method used to distinguish between streams and rivers (water body classes for bioassessment).

In Section 3, the WBAG provides guidance on how to identify beneficial uses for assessment purposes. For designated waters, the assessor simply looks to the Idaho water quality standards. However, for undesignated waters, DEQ identifies beneficial uses for assessment based on existing data. Actual subsequent use designations may be different, depending upon additional information that may be received following the procedures described in Idaho Code and water quality standards.

In Section 4, the DEQ policy concerning when and how data from sources other than BURP may be used in water body assessments is discussed. All data are evaluated based on scientific rigor and relevance criteria. Tier I data, that is BURP compatible, is incorporated directly into the appropriate aquatic life assessment index.

Non-BURP compatible Tier I data may also be used for 303(d) listing or delisting purposes, if it meets DEQ data policy requirements set forth in this section.

DEQ uses Tier II data for 305(b) reporting and subbasin assessments, and Tier III data for planning purposes.

The interpretation of numeric or narrative criteria exceedances is explained in Section 5. Narrative criteria are largely evaluated based on the DEQ bioassessment process. A violation of numeric criteria for dissolved oxygen, pH, turbidity, temperature, and total dissolved gas occurs when more than 10 percent of the measurements are above the numeric criteria. DEQ considers climatic conditions, natural background, and species-specific spawning time periods when evaluating whether 10 percent or more of the temperature measurements are above the numeric criteria.

Section 6 explains how DEQ uses multimetric indexes to determine aquatic life use support. DEQ uses different indexes depending on whether the water body is classified as a stream or river. The Stream Macroinvertebrate Index, Stream Habitat Index, and Stream Fish Index comprise the stream indexes; the river indexes consist of the River Macroinvertebrate Index, River Diatom Index, and River Fish Index. Supporting technical analyses for these documents are found in the *Idaho Stream Ecological Assessment Framework* (Grafe 2002b) and *Idaho River Ecological Assessment Framework* (Grafe 2002c) documents distributed separately from the WBAG.

DEQ uses the integrated results from the appropriate multi-metric indexes to evaluate subcategories (cold water aquatic life and salmonid spawning) of the aquatic life beneficial use. DEQ applies appropriate numeric criteria separately for cold water aquatic life and salmonid spawning before formulating a final aquatic life use support determination.

How DEQ uses bacteria and toxic data to assess contact recreation beneficial use support is described in Section 7. DEQ uses the geometric mean of bacteria data to determine if water quality standards for primary or secondary contact have been violated. When no data are available, DEQ may evaluate the potential risk for a violation in determining use support.

In Section 8, how DEQ uses toxics data to evaluate domestic, agricultural, and industrial water supplies is discussed. In general, DEQ presumes these uses are fully supporting unless there is evidence to the contrary. This policy is similarly applied for wildlife habitat and aesthetics, as explained in Section 9.

Section 10 attempts to further explain the assessment process through the use of an example. The policies and methods described in Sections 2 through 7 are illustrated in this example. In Section 11, how the public may appeal use support determinations is discussed. The public may petition against assessment determinations during appropriate 303(d) listing or subbasin assessment public comment periods. DEQ will review the appeal and respond accordingly.

# Appendix G. Thermal Role of Riparian Vegetation

South Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads (IDEQ 2003a)

Thermal Role of Riparian Vegetation

The role of near-stream land cover in maintaining a healthy stream condition and water quality is well documented and accepted in scientific literature (Beschta et al. 1987). Riparian vegetation plays an important role in controlling stream temperature changes. The list of significant impacts that near-stream land cover has upon the stream includes the following:

• Near-stream vegetation produces shadows, that when cast across a stream reduce solar radiant loading. The height, width, and density of the vegetation determine the extent of this effect..

• Near-stream land cover creates a thermal microclimate that generally maintains cooler air temperatures, higher relative humidity, and lower wind speeds along stream corridors.

• Near-stream vegetation affects bank stability. Specifically, channel morphology is often highly influenced by land cover type and condition, as they affect floodplain and instream roughness by contributing coarse woody debris and influencing sedimentation, stream substrate composition, and streambank stability.

The warming of water temperature as a stream travels and drops in elevation (longitudinal heating) is a natural process. However, rates of heating can be dramatically reduced when high levels of shade exist and solar radiation loading is minimized.

**Stream Surface Shade - Defined**

Stream surface shade is an important parameter that controls the stream heating derived from solar radiation. Solar radiation has the potential to be the largest heat transfer mechanism in a stream system. Human activities can degrade near-stream land cover and/or channel morphology, and in turn, decrease shade potentially causing significant increases in heat delivery to a stream system. Stream shade levels can also serve as indicators of near-stream land cover and channel morphology condition.

Shade is the amount of solar energy that is obscured or reflected by vegetation or topography above a stream. Shade is expressed in units of energy per unit area per unit time or as a percent of total possible energy. Canopy cover is the percent of the sky covered by vegetation or topography. Shade producing features will cast shadows on the water, while canopy cover may not.

Factors that affect Stream Temperature: Season/Time Date/Time, Stream Characteristics Aspect, **Channel Width,** Geographic Position Latitude, Longitude
**Vegetative Characteristics Near-Stream Land Cover Height, Width, and Density**
Solar Position Solar Altitude, Solar Azimuth
**Bold type** - influenced by human activities

**Microclimate - Surrounding Thermal Environment**

A secondary consequence of near-stream vegetation is its effect on the riparian microclimate.

Riparian corridors often produce microclimates that surround the stream and typically have cooler airtemperatures, higher relative humidity, and lower wind speeds. Riparian microclimates tend to moderate daily air temperatures. Relative humidity increases result from the evapotranspiration that is occurring by riparian plant communities. Wind speed is reduced simply by the physical blockage produced by riparian vegetation. Dong et al. (1998) analyzed microclimate data along 20 small streams in western Washington and found that riparian vegetation removal via timber harvests increased near stream air temperatures by up to 8 °F. Chen et al. (1995) detected that edge effects (i.e., atmospheric conditions outside of the near-stream buffer) penetrated to distances greater than 600 feet into a well-vegetated area. Riparian buffers commonly occur on both side of the stream, compounding the edge influence of the microclimate.

Brosofske et al. (1997) reported that a minimum stream buffer width of 150 feet was required to maintain soil temperatures that reflect those of a normal microclimate. Ground temperatures can be a source of heat energy to the stream. When the ground is warmer than the stream, heat will transfer from the streambank to the water column. In fact, ground surfaces can conduct heat to a stream hundreds of times faster than an air column surrounding the stream. Solids (ground surfaces) have conductivities on the order of 500 to 3,500 times greater than gases (air) (Halliday and Resnick 1988). Impoverished riparian areas that allow excessive streambank warming will introduce heat into the stream faster than cooler, highly vegetated streambanks.

**Thermal Role of Channel Morphology**

Changes in channel morphology, mainly channel widening, impact stream temperatures. As a stream widens, the surface area exposed to radiant sources and the ambient air temperature increases, resulting in increased energy exchange between the stream and its environment (Boyd 1996). Further, wide channels are likely to have relatively little shade due to the distance between the banks and the increased surface area to shade ratio. Conversely, narrow channels are more likely to receive a lot of shade.

An additional benefit inherent of narrow/deep channels is the higher frequency of pools that contribute to aquatic habitat. Channel widening is often related to degraded riparian conditions that allow increased streambank erosion and sedimentation of the streambed, both of which correlate strongly with streambank with its roots (rooting strength) and contributes to floodplain and streambank roughness that dissipates erosive energies associated with flowing water. Established or mature woody riparian vegetation provide the highest level of rooting strength and floodplain and streambank roughness. Annual (grassy) riparian vegetation communities offer less rooting strength and floodplain and streambank roughness.

Channel morphology is not solely dependent on riparian conditions. Sedimentation can deposit material in the channel, fill pools, and agrade the streambed, reducing channel depth and increasing channel width. High flow events play a major role in shaping the stream channel. Channel modification usually occurs during high flow events.

Naturally, land uses that affect the magnitude and timing of high flow events may negatively impact channel width and depth. Riparian vegetation conditions will affect the resilience of the streambanks and floodplain during periods of sediment introduction and high flow. Disturbance processes may have drastically differing results depending on the ability of riparian vegetation to shape and protect channels. Riparian vegetation composition and condition affect channel morphology by:

- **Building streambanks:** Vegetation traps suspended sediments, encourages deposition of sediment in the floodplain, and reduces incoming sources of sediment.
- **Maintaining stable streambanks:** High rooting strength and high streambank and floodplain roughness prevent streambank erosion.
- **Reducing flow velocity (erosive kinetic energy):** Vegetation supplies large woody debris to the active channel, creates high pool:riffle ratios, and adds channel complexity that reduces shear stress exposure to streambank soil particles.

**Thermal Role of Hydrology**

Brown (1969) proposed that water temperature change is a proportional function of heat exchange per unit volume:

*Volume*

*Energy Heat* $T_w$

Therefore, large volume streams are less responsive to temperature change than are low flow streams. Specifically, stream flow volume will affect the wetted channel dimensions (width and depth), flow velocity, travel time, and the stream assimilative capacity. Human-related reductions in flow volume can have a significant influence on stream temperature dynamics, most likely increasing diurnal variability in stream temperature.

**Thermal Role of Ground Water**

Ground water inflow has a cooling effect on summertime stream temperatures. Subsurface water is insulated from surface heating processes. Ground water temperatures fluctuate little and are generally cool unless from geothermal sources (45 $_o$F to 55 $_o$F). Many land use activities that disturb riparian vegetation and associated floodplain areas may affect the surface water connectivity to ground water sources. Ground water inflow not only cools summertime stream temperatures, but also augments summertime flows. Reductions in or elimination of ground water inflow has a compounding warming effect. The ability of riparian soils to capture, store and slowly release ground water is largely a function of floodplain/riparian area health.

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# Appendix H. Streambank Erosion Inventory

*Introduction*
The intent of this summary is to document the instream sediment measures and data assessment methods used to develop the gross sediment budget used in the Mid Snake River/Succor Creek TMDL. These data are intended to characterize the existing condition of the streambanks, estimate the desired level of erosion and sedimentation (define reference conditions), and provide baseline data that can be used in the future to track the effectiveness of TMDL implementation. For example, the streambank erosion inventories can be repeated after implementation and ultimately provide an adaptive management or feedback mechanism.

*Streambank Erosion Inventory*
The streambank erosion inventory is used to estimate background and existing streambank erosion following methods outlined in the proceedings from the NRCS Channel Evaluation Workshop (1983).

The NRCS streambank erosion inventory is a field based methodology that measures streambank/channel stability, length of active eroding banks, and bank geometry. The streambank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating ranging from 0 to 3. The categories of rating factors and rating scores are:

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

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

**Vegetation/Cover On Banks:**
- Predominantly perennials or rock-covered - 0
- Annuals / perennials mixed or about 40% bare - 1
- Annuals or about 70% bare - 2
- Predominantly bare - 3

**Bank/Channel Shape:**
- V - Shaped channel, sloped banks - 0
- Steep V - Shaped channel, near vertical banks - 1
- Vertical Banks, U - Shaped channel - 2
- U - Shaped channel, undercut banks, meandering channel - 3

**Channel Bottom:**
- Channel in bedrock / noneroding - 0
- Soil bottom, gravels or cobbles, minor erosion - 1

Silt bottom, evidence of active downcutting - 2

**Deposition:**

No evidence of recent deposition - 1

Evidence of recent deposits, silt bars - 0

Each measured stream segment, which is representative of a larger reach of stream, is rated based on the criteria above. Each category is rated and summed. For example, a stream segment may receive a weighted score of 7 based on bank stability = 1, bank condition = 1, vegetation/cover on banks = 1.5, bank/channel shape = 2.0, channel bottom = 0.5, deposition = 1. From a score of 7, the stream segment then receives a weighted cumulative rating based on the criteria below. A score of 7 receives a cumulative rating of moderate.

**Cumulative Rating:**

Slight (0-4) Moderate (5-8) Severe (9+)

From the cumulative rating, the weighted lateral recession rate is assigned. This lateral recession a rate defines the amount of bank being lost per year due to bank erosion.

| | |
|---|---|
| 0.01 - 0.05 feet per year | **Slight** |
| 0.06 - 0.15 feet per year | **Moderate** |
| 0.16 - 0.3 feet per year | **Severe** |
| 0.5+ feet per year | **Very Severe** |

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

*Site Selection*

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

Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates were extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need smaller sample.

Stream reaches are subdivided into sites with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. This is commonly defined by a corresponding change in land use. In a stream with uniform channel geometry there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites.

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

Field crews surveyed selected stream reaches measuring bank length, slope height and bank full width and depth. Additionally, while surveying field crews photograph key problem areas.

*Bank Erosion Calculations*
The direct volume method is used to calculate the average annual erosion rates for a given stream segment based on the bank recession rate determined in the survey (NRCS 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor. The direct volume method is summarized in the following equation:

$$E = [A_E * R_{LR} * \rho_B]/2000 \quad \text{(lbs/ton conversion)}$$

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

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

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

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

To facilitate consistent data collection, the NRCS developed rating factors to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates. For the Mid Snake River/Succor Creek TMDL, the NRCS measurement method is used (as described above). The lateral recession rates for each stream can be found in the worksheets in Appendix H.

The *bulk density* ($\rho_B$) of bank material is estimated ocularly in the field, then verified based on the data provided by NRCS. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

# Appendix I. Clear Creek USFS Timber Harvest Information

Clear Ditch TS - 1981 (2800 acre est. in this project area; 7.5 MMBF; 6.3 mi. road construction; 11.5 mi. road reconstruction), est. 12% soils disturbed; (4% maintained in road system)

East Clear TS - 1982 (East Fork Clear Creek drainage); 6.0MMBF; 560 acres; 2.9 mi. road construction; 3.5 mi. road reconstruction)

East Skunk TS - 1985 (Skunk Creek to East Mountain LO; 7.5 MMBF; 890 acres; 2.6 mi. road construction; 2.7 mi. road reconstruction)

Far Side Salvage TS (CE) - 1991 (near East Mountain Lookout; 119 acres; 750 MBF)

Eastside Salvage TS - 1991 (4.5 - 7.0 MMBF; 400-700 acres; 0 mile road reconstruction; 4-8 mile road reconstruction

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# Appendix J. RCRA and CERCLA Sites in HUCs 17050122 and 17050123

### Table J-1. List of EPA-regulated facilities in Envirofacts (Horseshoe Bend, ID 83629)

| Facility Name/Address | Permitted Discharges to Water | Toxic Releases Reported? | Hazardous Waste Handler? | Active or Archived Superfund Report? | Air Releases Reported ? |
|---|---|---|---|---|---|
| Boise Cascade Corporation Hwy. 55 | No | No | Yes | No | Yes |
| Horseshoe Bend Tudor Cys of Payette River West of City | Yes | No | No | No | No |
| Osborne Mine T17N R2E S33 NW1/4NE1/4 | No | No | No | Yes | No |
| US DOI BLM HWY 55 Materials Site | No | No | Yes | No | No |

**Table J-2. List of EPA-regulated facilities in Envirofacts (Cascade, ID 83611)**

| Facility Name/Address | Permitted Discharges to Water? | Toxic Releases Reported? | Hazardous Waste Handler? | Active or Archived Superfund Report? | Air Releases Reported ? |
|---|---|---|---|---|---|
| ABE Red Bluff Rocket Claims Valley County | No | No | Yes | No | No |
| Bear Valley Minerals Inc. Valley County | No | No | Yes | No | No |
| Boise Cascade Corporation 300 E Mill St. | No | No | Yes | No | No |
| City of Cascade (WWTP) 880 South Main | Yes | No | No | No | No |
| Southern Idaho TPA Smiths Ferry T11N R3E S10 BM NE Lot 6 | No | No | Yes | No | No |
| US DOI BOR WPR Cascade Dam East Highway 55 | No | No | Yes | No | No |
| US DOT FAA Radar Unit Cascade Cabarton Road | No | No | Yes | No | No |
| USDA FS Landmark RS FS Road 22 | No | No | Yes | No | No |
| Valley County Weed Control Highway 55 | No | No | Yes | No | No |