Mid Snake River/Succor Creek Tributaries Sediment Total Maximum Daily Load (HUC ID17050103)

2013 Addendum

State of Idaho
Department of Environmental Quality

October 2013

Printed on recycled paper, DEQ June 2013,
PID 9003, CA 42114. Costs associated with this
publication are available from the State of Idaho
Department of Environmental Quality in accordance
with Section 60-202, Idaho Code.

Mid Snake River/Succor Creek Tributaries Sediment Total Maximum Daily Load (HUC ID17050103)

2013 Addendum

October 2013

Prepared by
Troy Smith
Idaho Department of Environmental Quality
Boise Regional Office
1455 North Orchard
Boise, Idaho 83706

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

Table of Contents

List of Tables

List of Figures

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

Abbreviations, Acronyms, and Symbols

µ micro, one-one thousandth

ADB assessment database

AWS agricultural water supply

BOR United States Bureau of Reclamation

cfu colony forming units

cm centimeters

CWA Clean Water Act

DMA Designated Management Agency

DO dissolved oxygen

DOI U.S. Department of the Interior

DWS domestic water supply

ESA Endangered Species Act

I.C. Idaho Code

IP implementation plan

IDFG Idaho Department of Fish and Game

IDWR Idaho Department of Water Resources

km kilometer

km^2 square kilometer

m meter

m^3 cubic meter

mi mile

mi^2 square miles

MBI Macroinvertebrate Biotic Index

MGD million gallons per day

MWMT maximum weekly maximum temperature

n.a. not applicable

NA not assessed

nd no data (data not available)

PCR primary contact recreation

PFC proper functioning condition

ppm part(s) per million

QA quality assurance

QC quality control

SBA subbasin assessment

SCR secondary contact recreation

SEI streambank erosion inventory

SFI DEQ's Stream Fish Index

SHI DEQ's Stream Habitat Index

SMI DEQ's Stream Macroinvertebrate Index

SRP soluble reactive phosphorus

SS salmonid spawning

SSC suspended sediment concentration

STATSGO State Soil Geographic Database

TDS total dissolved solids

TKN total Kjeldahl nitrogen

TP total phosphorus

TS total solids

t/y tons per year

U.S. United States

USDA United States Department of Agriculture

USFS United States Forest Service

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WQMP water quality management plan

WQS water quality standard

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

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

AU assessment unit

BLM United States Bureau of Land Management

BMP best management practice

BURP Beneficial Use Reconnaissance Program

C Celsius

CFR Code of Federal Regulations (refers to citations in the federal administrative rules)

cfs cubic feet per second

CGP Construction General Permit

COLD cold water aquatic life

DEQ Idaho Department of Environmental Quality

EPA United States Environmental Protection Agency

GIS geographic information systems

HUC hydrologic unit code

IASCD Idaho Association of Soil Conservation Districts

IDAPA refers to citations of Idaho administrative rules

IDL Idaho Department of Lands

SWCC Idaho Soil and Water Conservation Commission

ISDA Idaho State Department of Agriculture

LA load allocation

LC load capacity

mg/L milligrams per liter

mL milliliter

mm millimeter

MOS margin of safety

MS4 municipal separate storm sewer systems

MSGP Multi-Sector General Permit

NB natural background

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

NTU nephelometric turbidity unit

RMS resource management system

SEV severity of ill effects

SWMP stormwater management program

SWPPP stormwater pollution prevention plan

TMDL total maximum daily load

TSS total suspended solids

USC United States Code

USGS United States Geological Survey

WAG watershed advisory group

WLA wasteload allocation

Executive Summary

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

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. 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 five water bodies (seven assessment units [AUs]) in the Mid Snake River/Succor Creek subbasin that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2011a). This document is an addendum to the *Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Load* (Mid Snake River/Succor Creek TMDL) (DEQ 2003b).

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Mid Snake River/Succor Creek subbasin, located in southwest Idaho. For more detailed information about the subbasin and previous TMDLs, see the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and the Mid Snake River/Succor Creek subbasin 5-year review (DEQ 2011b).

This TMDL addendum also quantifies sedimentation/siltation pollutant sources and allocates responsibility for load reductions needed for Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash AUs to meet water quality standards.

Subbasin at a Glance

The Mid Snake River/Succor Creek subbasin is located in southwest Idaho. This addendum addresses the following AUs:

- Birch Creek (ID17050103SW021_03 and _04)
- Hardtrigger Creek (ID17050103SW008_02)
- McBride Creek (ID17050103SW004_02 and _03)
- Pickett Creek (ID17050103SW016_03)
- Vinson Wash (ID17050103SW023_03)

The impaired beneficial use in the subbasin is cold water aquatic life. Sedimentation/siltation pollution sources include natural background contributions, livestock, wild horses, and wildlife, roads, cultivated agriculture, and irrigation projects. Figure A shows the §303(d)-listed water bodies and the Mid Snake River/Succor Creek subbasin boundaries.

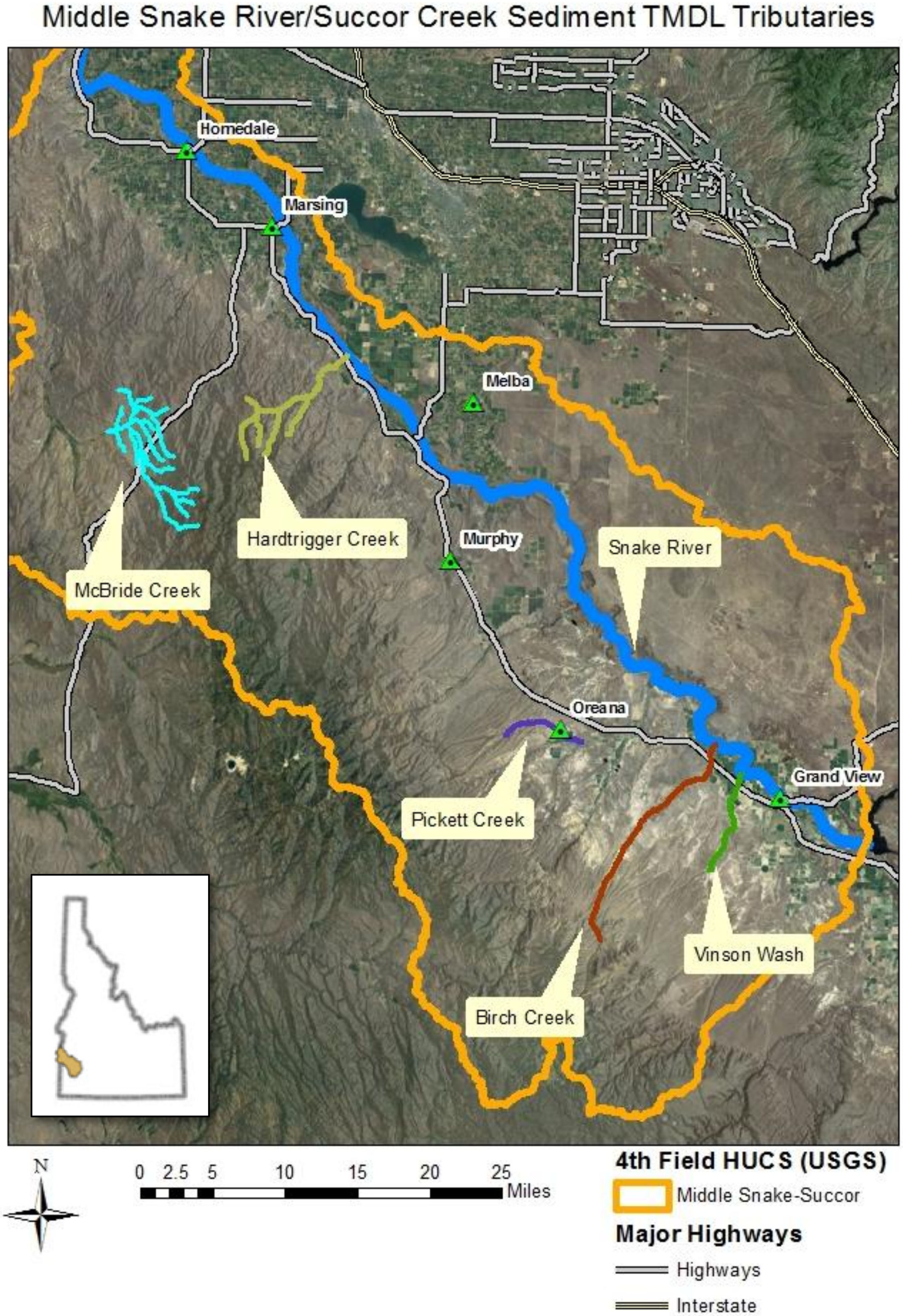


Figure A. Mid Snake River/Succor Creek subbasin, hydrologic unit code (HUC) 17050103, and the tributaries included in this TMDL addendum.

Key Findings

Data analysis for a 5-year review of the Mid Snake River/Succor Creek TMDL was completed in 2011 (DEQ 2011b). This document is available at: *http://www.deq.idaho.gov/media/699532-snake-river-succor-creek-sba-tmdl-five-year-review-0911.pdf*. The identified pollutants in this subbasin are exclusively nonpoint source in nature. Tributaries are generally low-volume, rangeland streams that have a combination of geographic and geologic features, land uses, low flow volume, and flow alteration that can lead to exceeding the Idaho water quality standard for sediment that is necessary to support the cold water aquatic life beneficial use. Irrigated agriculture is the likely primary source of sediment loading in Birch Creek and Vinson Wash. Therefore, the target was established as 20 milligrams per liter (mg/L) as a rolling 4-month average sediment concentration throughout the critical irrigation season (April 1–September 30). Instream channel erosion is the likely primary source of sediment loading in Hardtrigger, McBride, and Pickett Creeks. As a result, 80% bank stability was selected as a target to fully support the cold water aquatic life beneficial use in these creeks.

The Mid Snake River/Succor Creek §303(d)-listed water bodies are shown in Figure A. Table A displays the impaired AUs and recommended actions for the next Integrated Report based on this TMDL analysis.

This report is available at: *http://www.deq.idaho.gov/media/725927-2010-integrated-report.pdf*.

Table A. Summary of 303(d)-listed assessment units and outcomes in this TMDL.

Water Body	Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to the Next Integrated Report	Justification
Birch Creek—upstream of Castle Creek Road to Snake River	ID17050103SW021_03 ID17050103SW021_04	Sediment	Yes	Move to Category 4a	TSS TMDL completed
Hardtrigger Creek—headwaters to Snake River	ID17050103SW008_02	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
McBride Creek—headwaters to Oregon line	ID17050103SW004_02 ID17050103SW004_03	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
Pickett Creek—Bates Creek confluence to Browns Creek confluence	ID17050103SW016_03	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
Vinson Wash—Poison Creek confluence to mouth	ID17050103SW023_03	Sediment	Yes	Delist for Combined Biota/Habitat Bioassessments--Move to Category 4a	Sediment determined causal pollutant; TSS TMDL completed

TSS – Total Suspended Solids

Public Participation

The Mid Snake River/Succor Creek Watershed Advisory Group (WAG), other agencies, nongovernment organizations, and the public played a significant role in the current and previous

TMDL development processes. The WAG and other stakeholders were involved in developing the allocation processes, and their continued participation will be critical during and after the July 24 – August 23, 2013 public comment period, and in implementing the TMDL.

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

Introduction

This document addresses five water bodies (seven assessment units [AUs]) in the Mid Snake River/Succor Creek subbasin that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2011a). The purpose of this total maximum daily load (TMDL) addendum is to characterize and document pollutant loads within the Mid Snake River/Succor Creek subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Mid Snake River/Succor Creek subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

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

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

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

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

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

1 Subbasin Assessment—Subbasin Characterization

This document presents an addendum to the 2003 *Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Load* (Mid Snake River/Succor Creek TMDL) (DEQ 2003b) and addresses water bodies in the subbasin that are on Idaho's current §303(d) list for sedimentation/siltation.

1.1 Physical, Biological, and Cultural Characteristics

A thorough discussion of the physical, biological, and cultural characteristics of the Mid Snake River/Succor Creek subbasin is provided in the Mid Snake River/Succor Creek TMDL approved by EPA in 2003 (DEQ 2003b) and the Mid Snake River/Succor Creek TMDL 5-year review (DEQ 2011b).

1.2 Subwatershed Characteristics

This addendum addresses five subwatersheds within the subbasin (Figure 1).

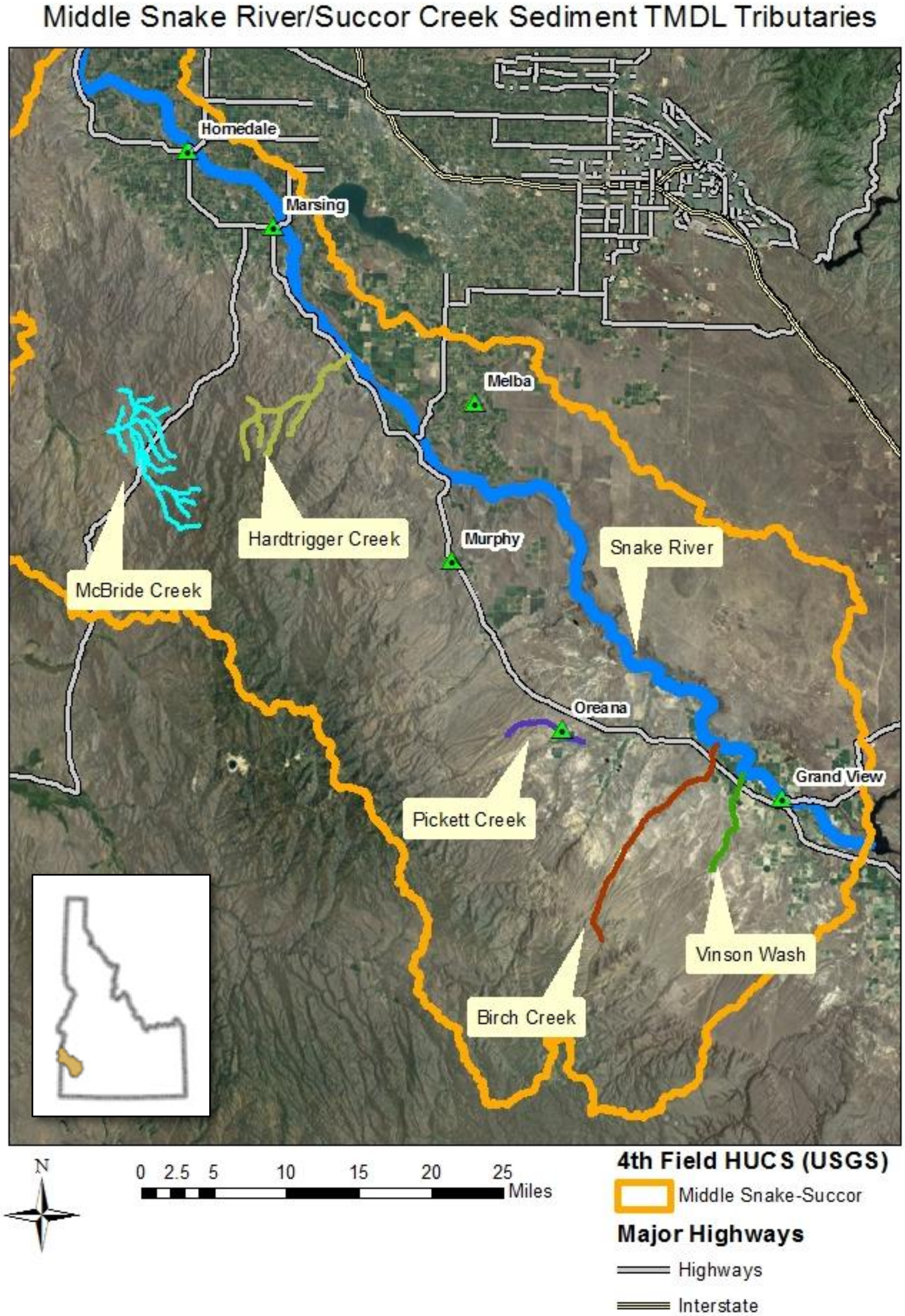


Figure 1. Mid Snake River/Succor Creek subbasin, hydrologic unit code (HUC) 17050103, and the tributaries included in this TMDL addendum.

1.2.1 Birch Creek (ID17050103SW021_03 and _04)

The Birch Creek subwatershed drains approximately 78 square miles. The creek generally follows a northeasterly direction. The upper main stem of Birch Creek leaves the Owyhee front range at an elevation near 7,050 feet. AU ID17050103SW021_03 is an ephemeral, dry, sandy wash (part of which is used as a motorized route) as it and passes through sagebrush habitat and managed rangelands for approximately 15 miles. The lower Birch Creek AU (ID17050103SW021_04) then enters irrigated agricultural land and flows intermittently/ perennially for approximately 1.7 of the final 2.5 miles before entering the Snake River at an elevation of 2,340 feet. The impaired 3rd-order AU (021_03) is approximately 15 miles, while the impaired 4th-order AU (021_04) comprises the final 2.5 miles.

The upper, dry, sandy wash (AU 021_03) is ephemeral and exhibits some natural entrenchment and unstable banks due to episodic rain events and the friable nature of the soils. Other erosion and sedimentation problems result from anthropogenic influences such as use of the wash channel by off-highway and 4-wheel drive vehicles and livestock.

The lower, intermittent/perennial segments of the creek exhibit some entrenchment and unstable banks due to natural soil conditions. In addition, anthropogenic influences on the streambank stability and sediment loading likely result from irrigated agricultural practices. Irrigated agriculture appears to be contributing elevated levels of sediment to Birch Creek and ultimately to the Snake River. The primary source of suspended sediment likely comes from these irrigated lands as evidence by the following:

- The upper wash segments typically flow only in response to direct precipitation events and rarely reach the lower segments.
- Sediment delivery in the lower segment appears to correspond with irrigation patterns and does not correspond well to streamflow throughout the irrigation season. That is, throughout the irrigation season, flows generally range from approximately 15 to 24 cfs, with relatively high corresponding total suspended solid (TSS) concentrations of 217 to 742 mg/L, and greatly-elevated June values (2,720 mg/L). Conversely, at the end of the irrigation season, in October, flows nearly double to 32.3 cfs, while TSS concentration drops to 10 mg/L, less than 5% of the lowest irrigation season value (see sections 2.4.1 and 5.4.1).

Figure 2 shows the stream status and landownership patterns within the subwatershed. Approximately 95% of the Birch Creek subwatershed is rangeland, while the lower segment near the Snake River is primarily irrigated agriculture (<4%). While some private lands exist in the upper part of the watershed, this watershed is primarily US Bureau of Land Management (BLM) - and state-owned. Other private holdings in the area are irrigated agriculture near the Snake River between the towns of Oreana and Grand View.

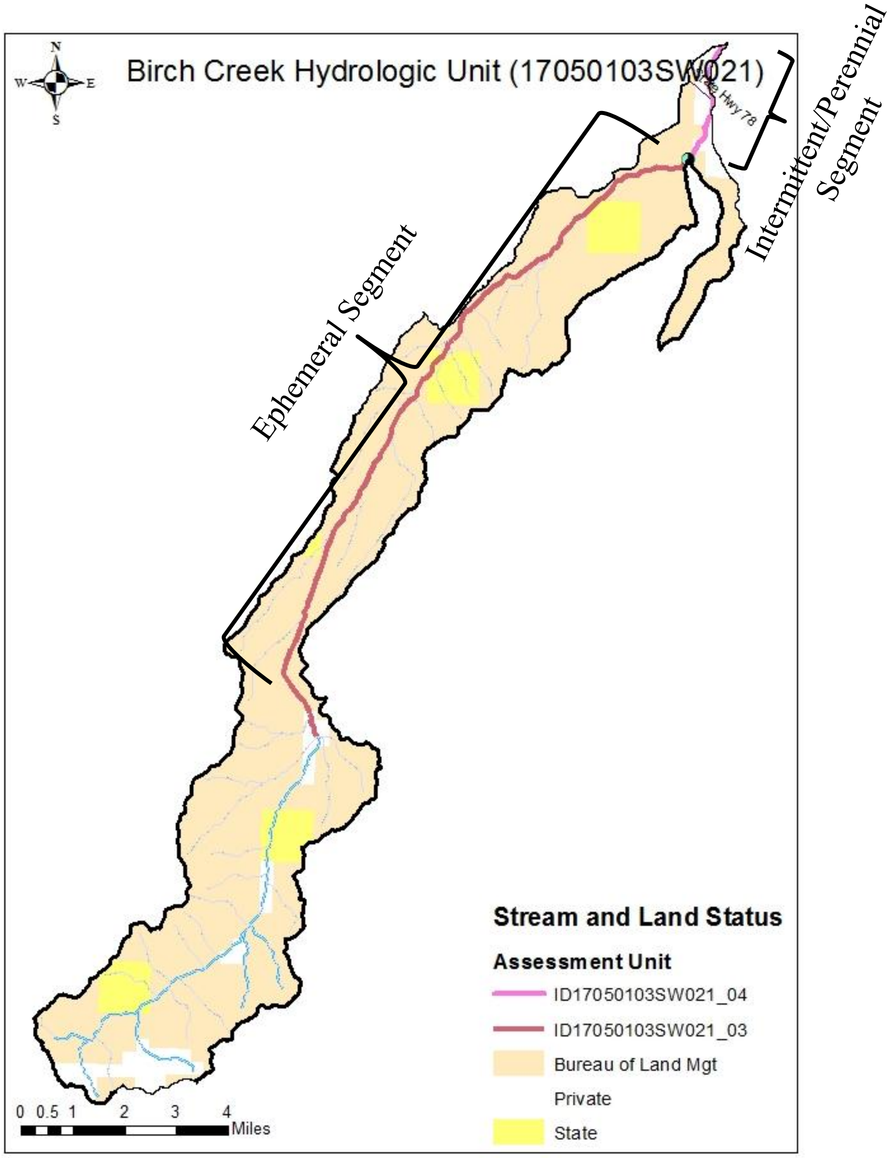


Figure 2. Stream status and landownership in the Birch Creek subwatershed.

1.2.2 Hardtrigger Creek (ID17050103SW008_02)

The Hardtrigger Creek subwatershed drains approximately 20 square miles and generally flows in a northeasterly direction. This 2nd-order creek begins at approximately 6,010 feet and joins the Snake River at around 2,230 feet. The main stem of Hardtrigger Creek is approximately 12.7 linear miles, exiting the Owyhee front through rangeland and then rural-developed and pastureland areas for the final 0.75 miles before its confluence with the Snake River. However, approximately 4.5 miles of Hardtrigger Creek between Stewart Gulch and the confluence with the Snake River is ephemeral and only flows in direct response to precipitation. Hardtrigger Creek also has two intermittent/perennial tributaries that join in the upper rangeland portions, Middle Fork Hardtrigger and Little Hardtrigger. The unnamed northwest channel and Stewart Gulch, however, are dry and ephemeral, and only flow in direct response to precipitation.

This creek exhibits some unstable banks throughout various segments of the subwatershed, likely due in part to the friable nature of some of the soils but also due to anthropogenic influences such as 4-wheel use and dirt roads adjacent to the creek, BLM wild horse herds, and active livestock grazing. However, certain places also have well-established riparian vegetation consisting of willows, wild roses, and grasses.

Figure 3 shows the stream status and landownership patterns within the subwatershed. Approximately 90% of the Hardtrigger Creek subwatershed is rangeland, while the lower reach near the Snake River is rural development and irrigated pasture (approximately 5%). While some private lands exist in the upper part of the watershed, most of the upper watershed is BLM-and state-owned. Most of the private holdings in the area are closest to the Snake River.

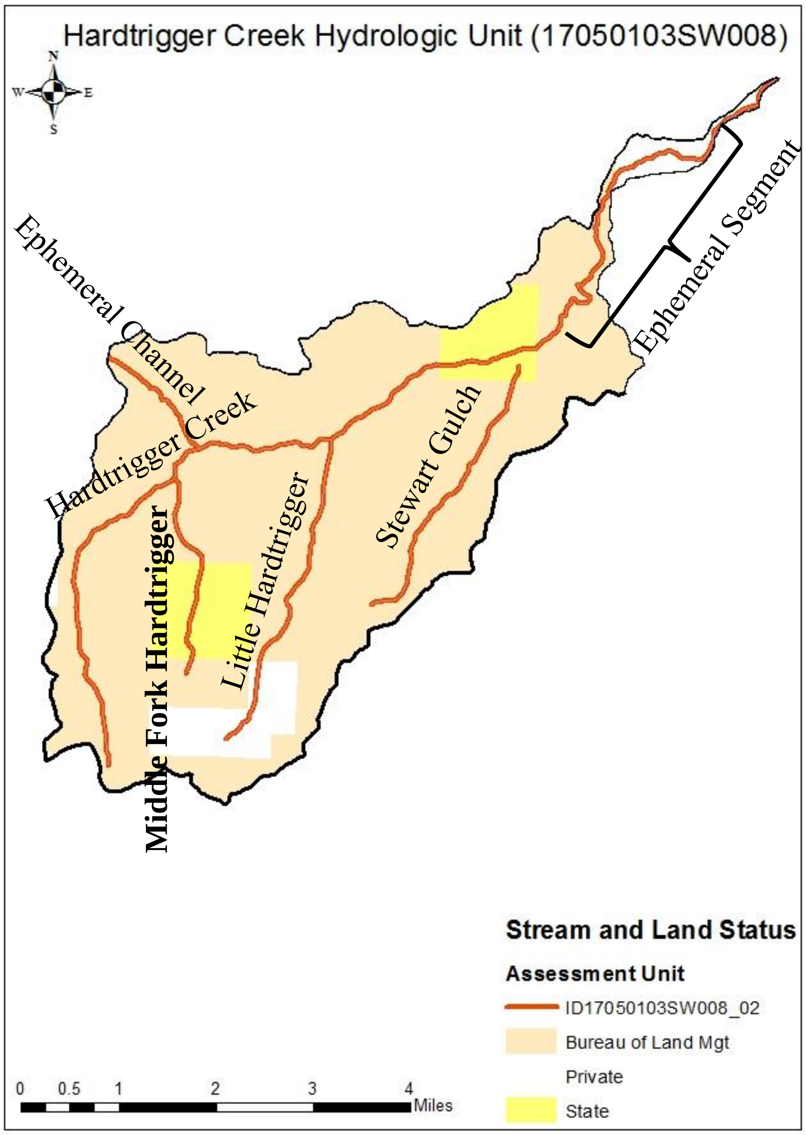


Figure 3. Stream status and landownership in the Hardtrigger Creek subwatershed.

1.2.3 McBride Creek (ID17050103SW004_02 and _03)

The McBride Creek subwatershed drains approximately 38 square miles and generally follows a northwesterly and westerly direction. These 2nd- and 3rd-order tributaries begin at approximately 6,740 feet in elevation and cross into Oregon at around 3,850 feet. The main stem of McBride Creek, along with major tributaries, Little McBride Creek and Willow Fork, flow intermittently/perennially for approximately 17.4 linear miles from the Owyhee front, primarily through rangeland, until crossing the Oregon border. From there, it continues westward and joins Succor Creek. Numerous unnamed ephemeral channels, which join the main stem of McBride Creek throughout the watershed, are dry throughout the year, except in direct response to precipitation. The lower main stem (AU ID17050103SW004_03) is approximately 2.5 linear miles and is also intermittent, particularly during the summer months.

The upper portion of the subwatershed (main stem McBride Creek, Little McBride Creek, and Willow Fork) has some well-established riparian vegetation but also exhibits signs of bank instability and erosion, likely due to anthropogenic influences such as adjacent roads, culverts, and livestock grazing. Conversely, in the lower segments of the watershed, bank instability appears to be more directly related to a combination of the friable nature of some of the soils, episodic high flow events, adjacent roads, and culverts. This lower portion also exhibits signs of current and previous lateral channel movement and recovery through formation of new channel floodplains and banks.

Figure 4 shows the stream status and landownership patterns within the subwatershed. Approximately 90% or more of the McBride Creek subwatershed is rangeland, while about 6% is forested and less than 2% is irrigated agriculture. Although considerable private land exists throughout the watershed, the majority of land is BLM- and state-owned. Most of the private holdings are along the middle to upper segments of McBride Creek and along the Little McBride and Willow Fork segments.

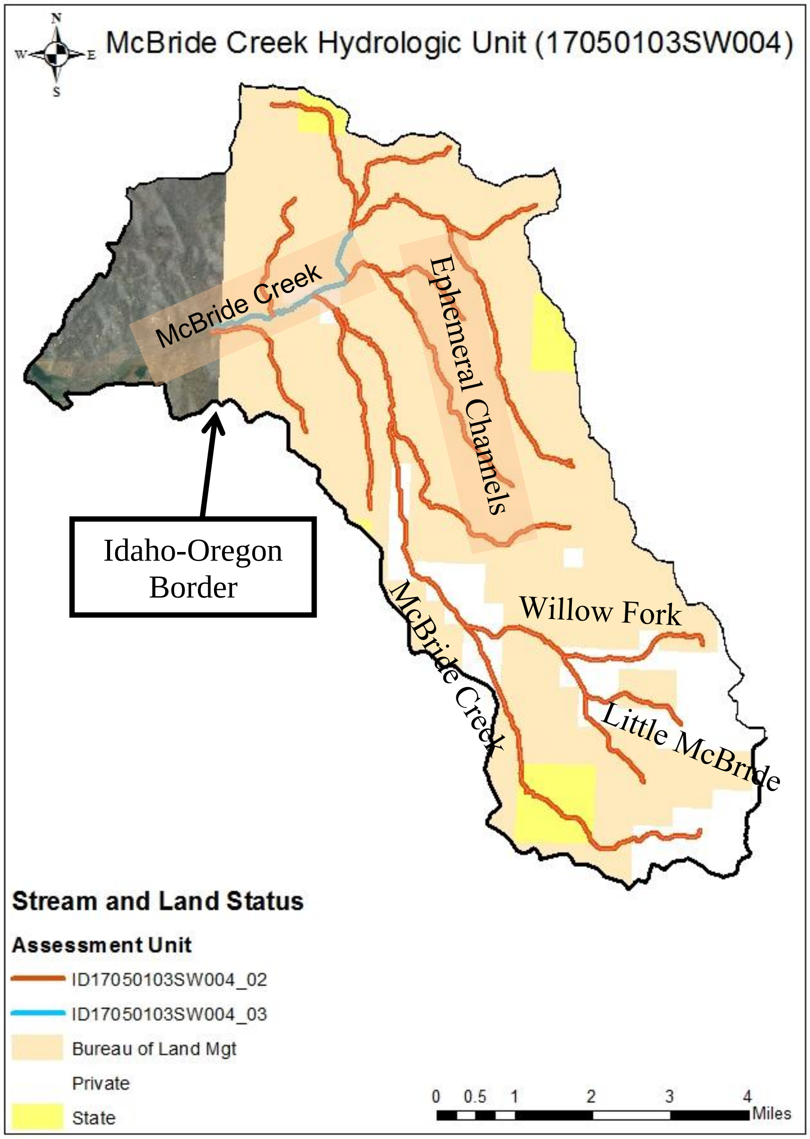


Figure 4. Stream status and landownership in the McBride Creek subwatershed.

1.2.4 Pickett Creek (ID17050103SW016_03)

The Pickett Creek subwatershed drains approximately 63 square miles until its confluence with Brown Creek and generally flows in a northeasterly direction. The creek begins at approximately 8,410 feet elevation and drops to approximately 2,680 feet where it joins Catherine Creek and then Brown Creek. Beyond the scope of this AU and TMDL, Catherine Creek then continues on to join Castle Creek, which joins the Snake River.

The Pickett Creek AU pertaining to this TMDL only contains approximately 6.4 linear stream miles. It begins upstream at the confluence with Bates Creek, where it flows intermittently/perennially downstream for approximately 2.6 miles and joins Catherine Creek. It then continues downstream for approximately 3.8 miles where it joins Brown Creek.

The creek exhibits unstable banks throughout various segments of the AU, likely due in part to the friable nature of some of the soils but also due to anthropogenic influences such as irrigated agricultural practices and livestock grazing adjacent to the creek. Where the riparian area has not been disturbed or the channel is not downcut, the riparian area contains cottonwoods, willows, wild roses, and grasses.

Figure 5 shows the stream status and landownership patterns within the Pickett Creek subwatershed. Approximately 85% of the subwatershed is rangeland, while about 12% is forested and less than 2% is irrigated agriculture. Although considerable private land exists throughout the watershed, especially along the lower segments of Pickett and Catherine Creeks, the majority of land is BLM-and state-owned.

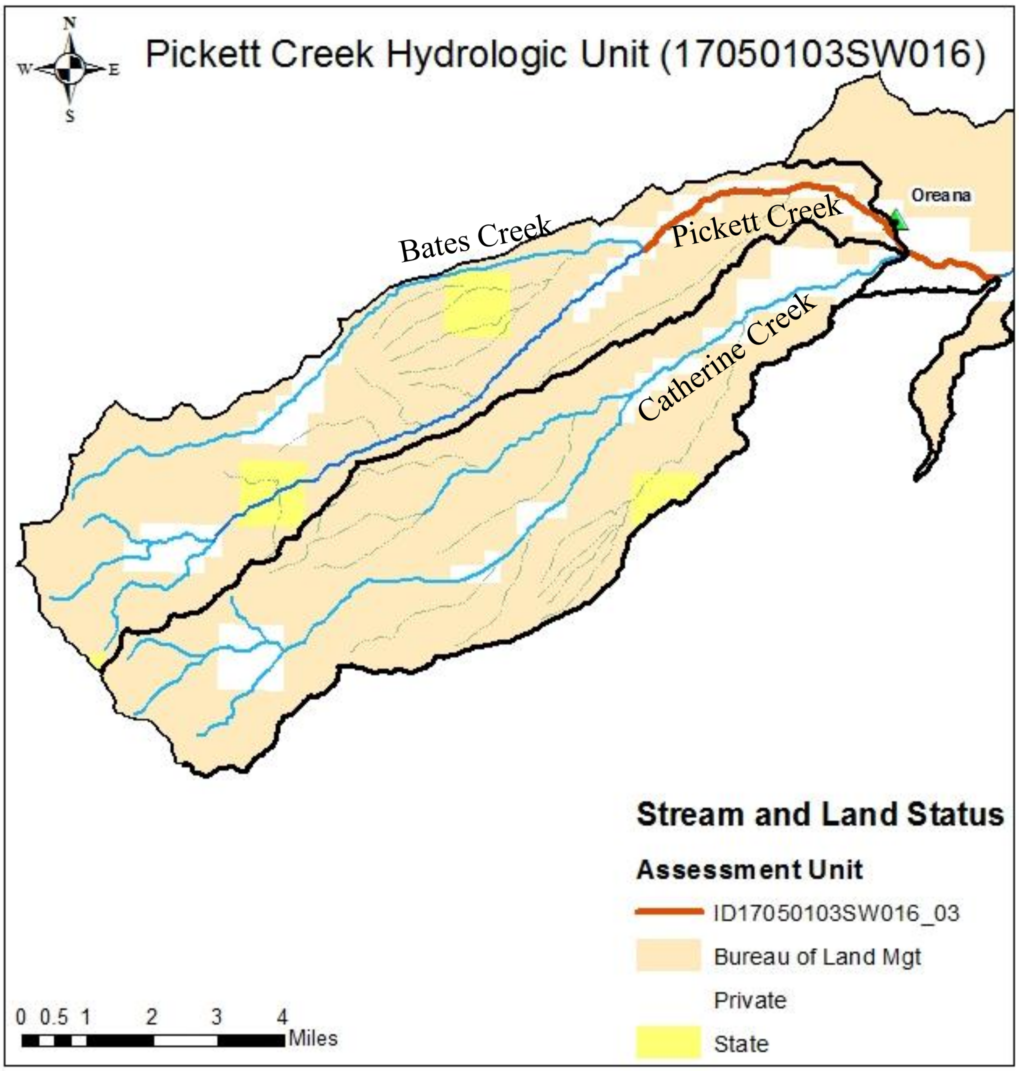


Figure 5. Stream status and landownership in the Pickett Creek subwatershed.

1.2.5 Vinson Wash (ID17050103SW023_03)

Vinson Wash drains approximately 48 square miles and generally flows in a northeasterly direction. The wash begins at close to 6,320 feet in elevation and reaches the Snake River at around 2,350 feet. The upper portion of the subwatershed consists of several washes, including Poison Creek, which join to form Vinson Wash. From there, the ephemeral, sandy, and dry Vinson Wash leaves the Owyhee front range and passes through sagebrush habitat and managed rangelands for approximately 4.5 miles. It then enters irrigated agricultural land and flows intermittent/perennially for approximately 3.5 miles before entering the Snake River.

Very similar to the conditions on Birch Creek, the upper, ephemeral portion of the wash exhibits some natural entrenchment and unstable banks due to episodic rain events and the friable nature of the soils. Other areas of erosion and sediment problems result from anthropogenic influences such as use of the wash channel by off-highway vehicles and other 4-wheel drive vehicles and livestock grazing.

The lower, intermittent/perennial segment of the creek exhibits sediment loading resulting primarily from irrigated agricultural practices and the friable nature of the soils and is the likely source of elevated sediment levels that reach the Snake River. The primary source of suspended sediment likely comes from these irrigated lands as evidenced by the following:

- The ephemeral upper wash segment flows only in response to direct precipitation events and rarely reaches the lower perennial segment.
- Judging from data collected in the very similar and nearby Birch Creek, sediment delivery in the lower perennial segment likely corresponds to irrigation patterns but does not correspond well to streamflow throughout the irrigation season. That is, throughout the irrigation season, flows generally range from approximately 15 to 24 cfs, with relatively high corresponding TSS concentrations of 217 to 742 mg/L, and greatly-elevated June values (2,720 mg/L). Conversely, at the end of the irrigation season, in October, flows nearly double to 32.3 cfs, while TSS concentration drops to 10 mg/L, less than 5% of the lowest irrigation season value (see sections 2.4.1 and 5.4.1).

Figure 6 shows stream status and landownership patterns within the Vinson Wash subwatershed (the figure only shows the watershed below the confluence with Poison Creek). Approximately 98% of the subwatershed is rangeland, while the lower segment near the Snake River is private land, primarily as irrigated agriculture (<2%). Aside from these private lands near the Snake River, the remaining watershed is virtually all BLM- and state-owned.

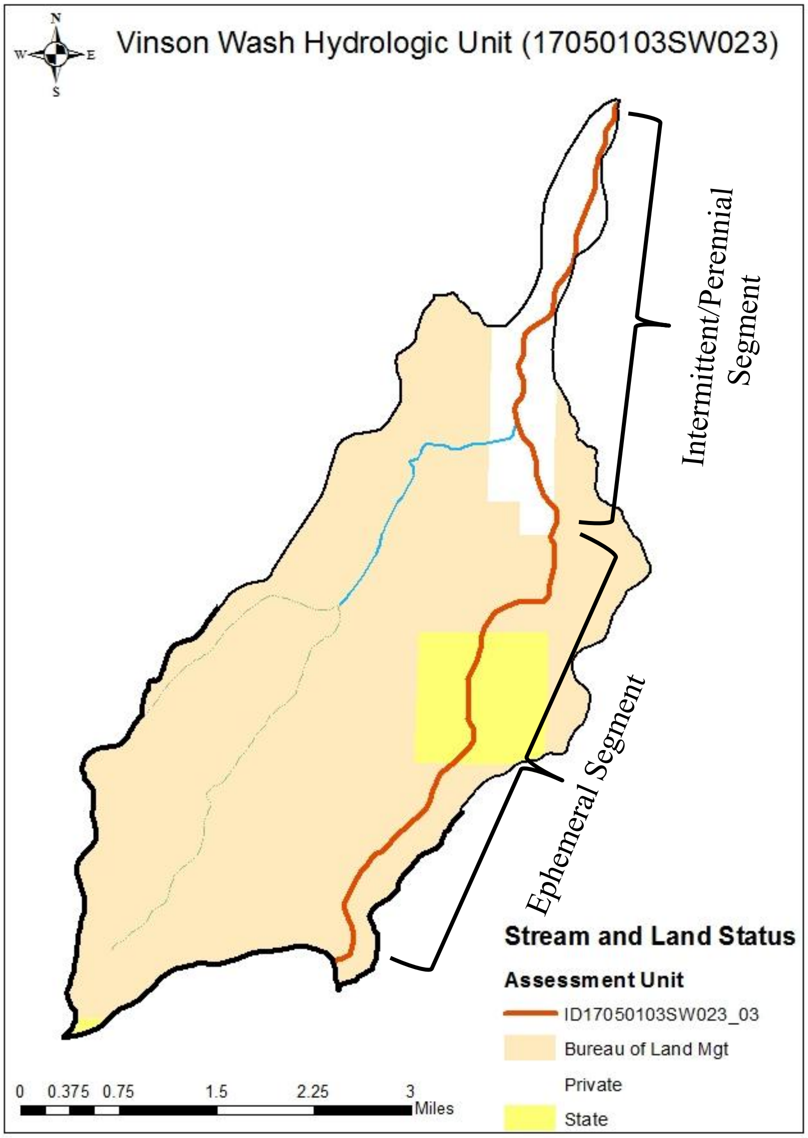


Figure 6. Stream status and landownership in the Vinson Wash subwatershed.

2 Subbasin Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

2.1.1 Assessment Units

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

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

2.1.2 Listed Waters

Table 1 shows the pollutants listed and the listing basis for each §303(d)-listed AU in the Mid Snake River/Succor Creek subbasin that are addressed in this TMDL and were not addressed in the Mid Snake River/Succor Creek TMDL that was approved by EPA in 2003.

Table 1. Mid Snake River/Succor Creek subbasin §303(d)-listed assessment units in the subbasin that are addressed in this TMDL and were not addressed in the 2003 Mid Snake River/Succor Creek TMDL.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Birch Creek—upstream of Castle Creek Road to Snake River	ID17050103SW021_03 ID17050103SW021_04	Sedimentation/ Siltation	Sediment listing on 1994 §303(d) list
Hardtrigger Creek—headwaters to Snake River	ID17050103SW008_02	Sedimentation/ Siltation	Sediment listing on 1994 §303(d) list
McBride Creek—headwaters to Oregon Line	ID17050103SW004_02 ID17050103SW004_03	Sedimentation/ Siltation	Sediment listing on 1994 §303(d) list
Pickett Creek—Bates Creek confluence to Browns Creek confluence	ID17050103SW016_03	Sedimentation/ Siltation	Sediment listing on 1994 §303(d) list
Vinson Wash—Poison Creek to Snake River	ID17050103SW023_03	Sedimentation/ Siltation	Combined biota/ habitat bioassessments listing on 2008 §303(d) list

A thorough investigation using the available data and the following rationale helped to determine the necessity for developing a TMDL. Each of the water quality limited segments addressed in this TMDL (except Vinson Wash) was first listed for sediment on the 1994 §303(d) list, which was promulgated by EPA as part of the first total maximum daily load lawsuit. EPA listed these waters because they were listed in Appendix D: Idaho Impaired Stream Segments Requiring Further Assessment in, *The 1992 Water Quality Status Report* (DEQ 1992). The original assessments were based on DEQ evaluations, which utilized best professional judgment indicating irrigated crop production and pastureland treatments as suspected sources of sediment to the creeks. The listings have since been carried forward to the current 2010 Integrated Report.

The Vinson Wash listing is based on assessments of macroinvertebrate data from Beneficial Use Reconnaissance Program (BURP) site 2001SBOIA026 collected near the mouth of Vinson Wash. The habitat score for this event was passing. Electrofishing was conducted but no fish were collected and no effort was recorded. The top five dominant (and only) taxa from BURP site 2001SBOIA026 were *Potamopyrgus antipodarum* (New Zealand mudsnail), Turbellaria, Nematoda, Sphaeriidae, and *Vorticifex effusa*. The New Zealand mudsnail made up 97% of the macroinvertebrate sample and are very tolerant of fine-grained sediment (Weatherhead and James 2001, Suren 2005). The reductions of taxa richness and loss of the EPT taxa and clingers and scrapers may be partially attributed to elevated levels of fine-grained sediment (Waters 1995, Rabeni et al. 2005, Carlisle et al. 2007) or water temperature (Huff et al. 2008). Riffles in Vinson Wash were observed to contain 47% surface fines and were rated as 50–75% embedded. These indicators suggest Vinson Wash is likely stressed by elevated levels of fine-grained sediment and potentially stream temperature.

2.2 Applicable Water Quality Standards and Beneficial Uses

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

Beneficial uses include the following:

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

2.2.1 Existing Uses

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

2.2.2 Designated Uses

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

2.2.3 Presumed Uses

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

2.2.4 Beneficial Uses in the Subbasin

Beneficial uses of the affected AUs are presented in Table 2.

Table 2. Mid Snake River/Succor Creek subbasin beneficial uses of §303(d)-listed streams.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Birch Creek	ID17050103SW021_03 ID17050103SW021_04	COLD, PCR/SCR	Presumed
Hardtrigger Creek	ID17050103SW008_02	COLD, PCR/SCR	Presumed
McBride Creek	ID17050103SW004_02 ID17050103SW004_03	COLD, PCR/SCR	Presumed
Pickett Creek	ID17050103SW016_03	COLD, PCR/SCR	Presumed
Vinson Wash	ID17050103SW023_03	COLD, PCR/SCR	Presumed

[a] COLD – cold water aquatic life; PCR/SCR – primary/secondary contact recreation

2.3 Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 3).

Table 3. Selected numeric criteria supportive of beneficial uses in Idaho water quality standards (IDAPA 58.01.02.250).

Water Quality Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life
Bacteria	Less than 126 *E. coli*/100 mL as a geometric mean of 5 samples over 30 days; no sample greater than 406 *E. coli*/100 mL	Less than 126 *E. coli*/100 mL as a geometric mean of 5 samples over 30 days; no sample greater than 576 *E. coli*/100 mL	—
pH	—	—	Between 6.5 and 9.0
Dissolved Oxygen	—	—	Exceeds 6.0 mg/L
Temperature[a]	—	—	22 °C or less daily maximum; 19 °C or less daily average
Turbidity	—	—	Turbidity shall not exceed background by more than 50 NTU instantaneously or more than 25 NTU for more than 10 consecutive days.
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.

Note: Escherichia coli (*E. coli*)*;* milliliters (mL); milligrams per liter (mg/L); nephelometric turbidity units (NTU)
[a] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

Narrative criteria for excess sediment are described in the water quality standards:

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

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 7).

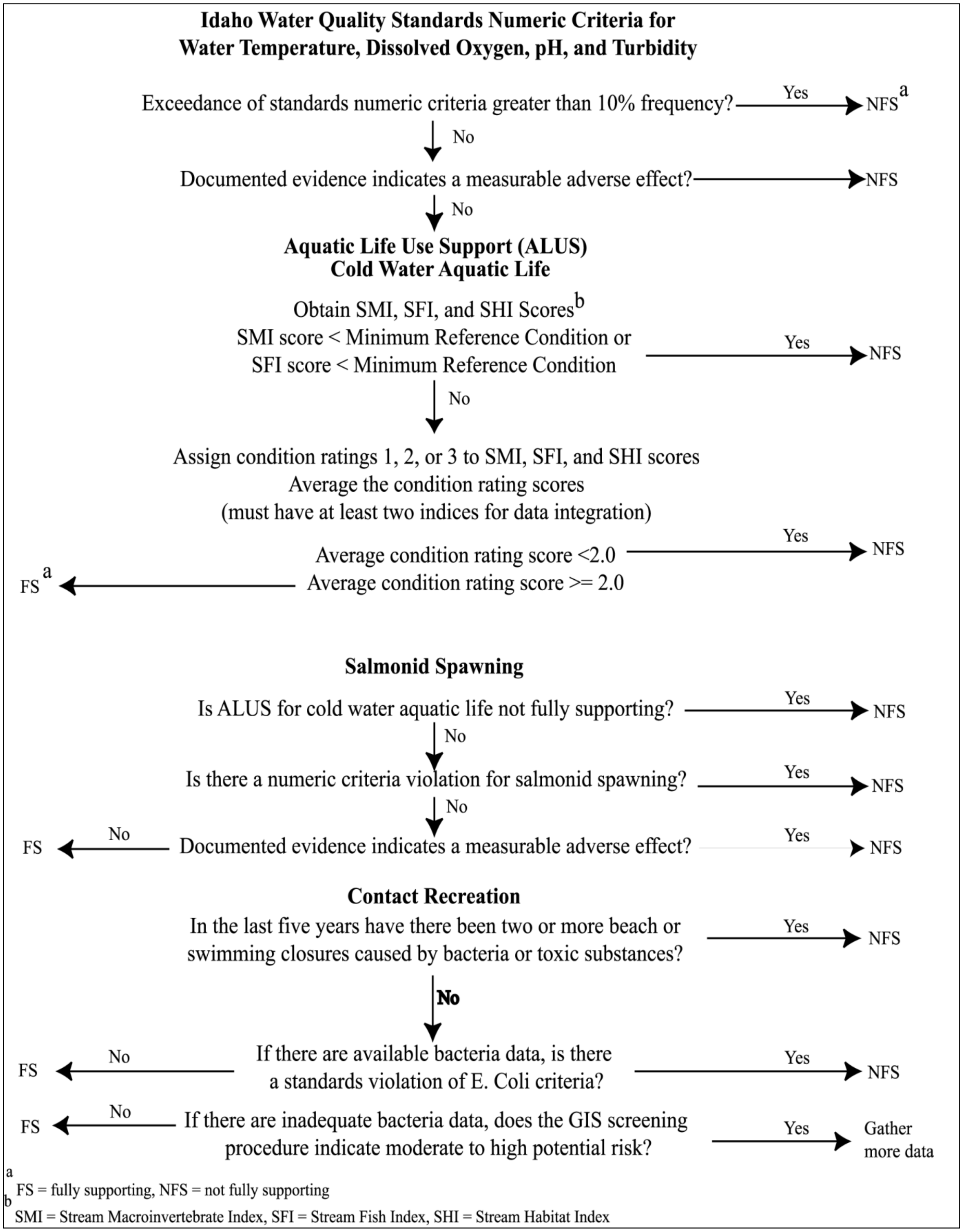


Figure 7. Steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.4 Summary and Analysis of Existing Water Quality Data

Since the Mid Snake River/Succor Creek TMDL (DEQ 2003b) was approved, DEQ has collected data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent water quality data. The results of that effort were compiled in the Mid Snake River/Succor Creek 5-year review (DEQ 2011b), and recommendations for impairment listings and TMDL development were made. This section will address water quality data (sedimentation/siltation) related to beneficial uses or impairments in the Mid Snake River/Succor Creek subbasin (specifically, Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash). Data sources are provided in Appendix A.

A detailed summary and analysis of existing water column data, flow characteristics, and biological and habitat assessment data for the Mid Snake River/Succor Creek subbasin is provided in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and 5-year review (DEQ 2011b). These reports are available at *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx*.

2.4.1 Birch Creek

Figure 8 shows the location of a BURP site in the lower portion of Birch Creek. Two attempts to collect data were made: in 2001 the channel was dry, and in 1995 the channel had a measured flow of 3.8 cubic feet per second (cfs). The 1995 data indicated the percentage of fines comprising the channel bottom substrate was only 5%, well within the 28% threshold recognized as supporting cold water aquatic life. The BURP data for Birch Creek are available at *http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW021_04*.

Idaho Power also collected data at the mouth of Birch Creek as part of its Snake River drain and tributary analysis (Knight and Naymik 2009). The data show that TSS were at 217 milligrams per liter (mg/L) in May, peaked at 2,720 mg/L in June, and declined to 10 mg/L in October. Flows throughout the sampling period remained between 15.3 and 18.8 cfs for the entire sampling duration with the exception of October, when flows reached their maximum of 32.3 cfs. This high flow corresponds to the lowest TSS levels recorded during the analysis. Table 4 is a summary of the sediment data provided in Idaho Power's 2009 report, while Figure 9 provides a visual representation of the same data.

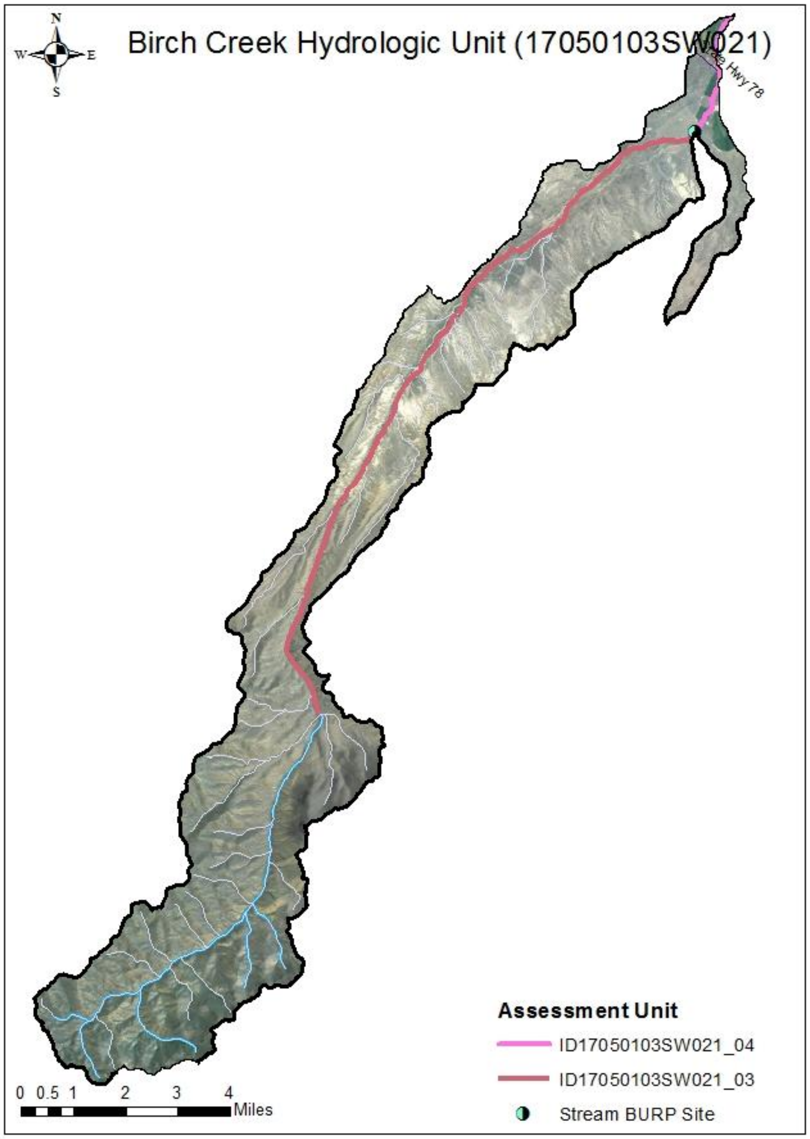


Figure 8. DEQ BURP monitoring location on Birch Creek. Data were collected in 1995 but not in 2001 because the channel was dry.

Table 4. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power.

Measure Date	Flow (cfs)	Suspended Solids (mg/L)	
		Total	Volatile
05/17/2007	15.4	217	18
06/19/2007	15.3	2,720	155
07/31/2007	18.8	742	56
08/29/2007	16.2	531	38
10/08/2007	32.3	10	3

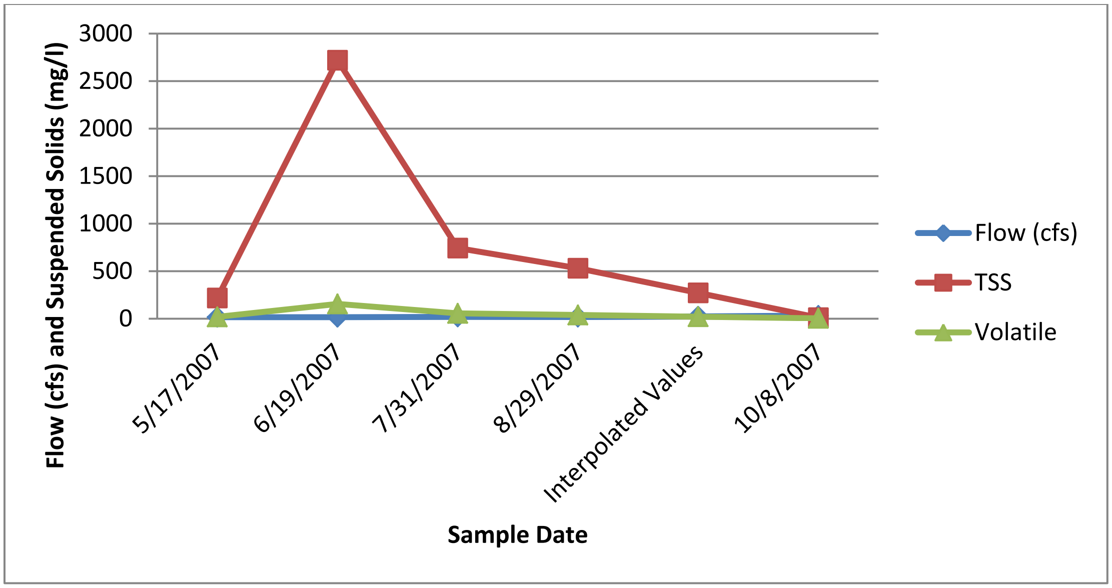


Figure 9. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power. (September values were interpolated since data were not available.)

2.4.2 Hardtrigger Creek

Figure 10 shows the location of two BURP sites in the Hardtrigger Creek subwatershed. Attempts were made to collect data in 1995, 1996, and 1998: the channel was dry in 1995 and 1996, but the creek was flowing enough at both sites in 1998 to collect data. The measured flow at each site was 3.9 and 5.1 cfs, and total fines for both sites were within the 28% threshold recognized as supporting cold water aquatic life (19.38 and 23.08%, respectively). The BURP data for Hardtrigger Creek are available at *http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW008_02*.

In 2013, DEQ personnel—along with members of the watershed advisory group (WAG), natural resources agency personnel, and the public—conducted streambank erosion inventories along sections of the impaired Hardtrigger Creek AU (Figure 10). The data indicate that Hardtrigger Creek has streambank stability levels of approximately 60%, with moderate lateral recession rates (0.12 feet/year) that contribute to sediment loads. The streambank inventory, which was conducted prior to livestock being released onto the range for the season, indicates that a substantial portion of the actively eroding banks appear to be the result of wild horse and/or wildlife trampling. (Additional measurements in the fall would be helpful in parsing out the relative impact of horses and wildlife versus seasonal livestock grazing.) The field crew noticed a considerable number of tracks (most of which appeared to be horse, but some were also deer) along the actively eroding banks. Additionally, a dirt road often parallels the creek at various distances (from tens of feet to tens of meters) and contributes to both the actively eroding banks and direct sediment contributions along the multiple road crossings.

The BLM also collected streambank stability data on Hardtrigger Creek between 2005 and 2012 (Table 5). During this time, streambank stability measurements varied from as low as 30% up to 94%. During 4 of the 8 years of data collection, streambank stability was greater than 80%, the streambank stability threshold widely recognized as supporting cold water aquatic life.

Conversely, streambank stability over the remaining 4 of 8 years was 72% or less. In 2012, the BLM also measured in-channel fines as comprising 36% of the total substrate.

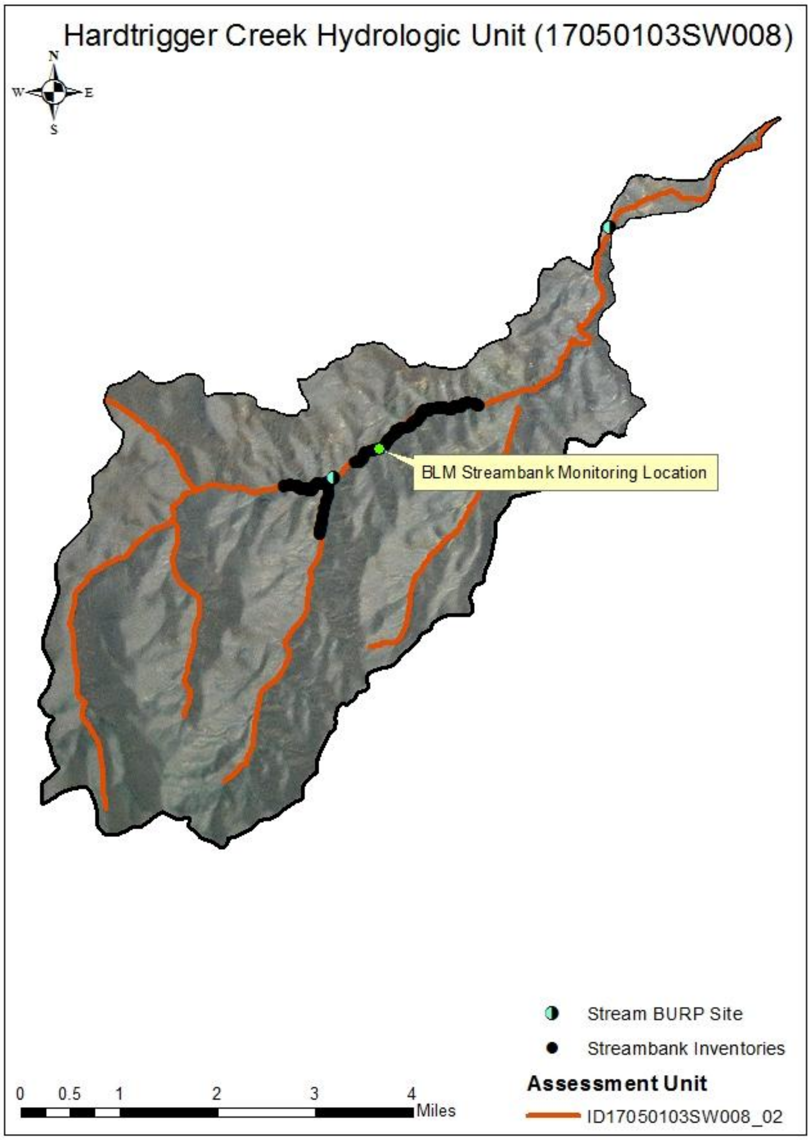


Figure 10. DEQ BURP monitoring locations (1995, 1996, 1998); DEQ streambank erosion inventories (2013); and BLM streambank monitoring location (2005–2012) in the Hardtrigger Creek subwatershed. BURP data were collected in 1998 but not in 1995 or 1996 because the channel was dry.

Table 5. BLM streambank stability data on Hardtrigger Creek (UTM: 4801645N, 517535E), 2005–2012.

Year	Streambank Stability
2005	68%
2006	94%
2007	91%
2008	72%
2009	46%
2010	30%
2011	88%
2012	81%

2.4.3 McBride Creek

Figure 11 shows the location of the BURP site in the McBride Creek subwatershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 0.2 cfs and channel-bottom substrate fines were estimated at 13%, within the 28% threshold. The BURP data for McBride Creek are available at *http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW004_02*.

In 2011, DEQ personnel conducted streambank erosion inventories along two sections of McBride Creek (Figure 11): (1) a lower elevation, intermittent section in AU ID17050103SW004_03 and (2) a higher elevation, intermittent/perennial section in AU ID17050103SW004_02. The data indicate that lower elevation segments of McBride Creek have streambank stability levels of approximately 61% but with rather high lateral recession rates (0.135 feet/year) that contribute significantly to sediment loads. Conversely, the higher elevation segments of McBride Creek have lower streambank stability rates (approximately 52%) but with considerably lower lateral recession rates (0.04 feet/year), resulting in lower sediment loading.

The BLM also collected streambank stability data on McBride Creek in 2011. This data identified streambank stability at 78%, below the 80% threshold believed to support cold water aquatic life.

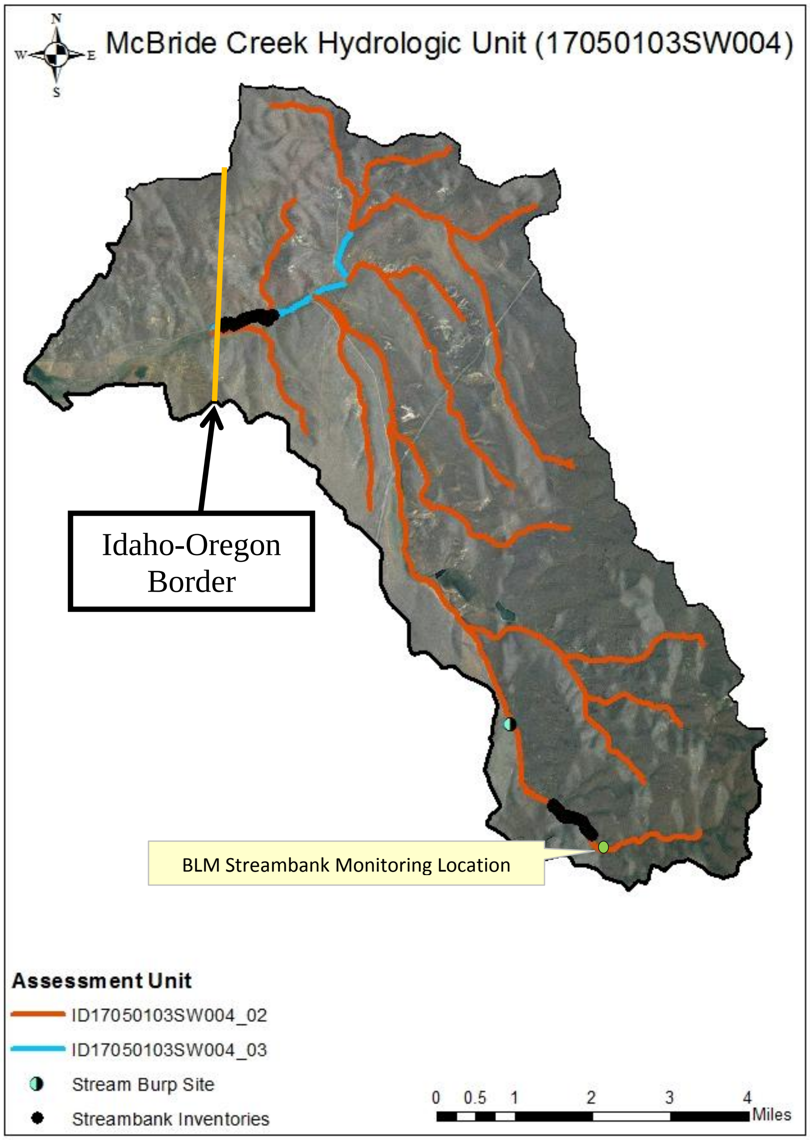


Figure 11. DEQ BURP monitoring location (1996, 2001) and streambank erosion inventories (2011) in the McBride Creek subwatershed. BURP data were collected in 1996 but not in 2001 because the channel was dry.

2.4.4 Pickett Creek

Figure 12 shows the location of BURP sites in the Pickett Creek subwatershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 6.1 and 7.4 cfs and channel-bottom substrate fines were estimated at 10% and 7%, well within the 28% threshold for supporting the cold water aquatic life beneficial use. The BURP data for Pickett Creek are available at *http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW016_03*.

In 2012, DEQ personnel conducted streambank erosion inventories along a section of Pickett Creek (Figure 12). The data indicate that Pickett Creek has streambank stability levels of approximately 80.5%, which is right at the threshold believed to support cold water aquatic life, but with rather high lateral recession rates (0.15 feet/year) that contribute significantly to sediment loads.

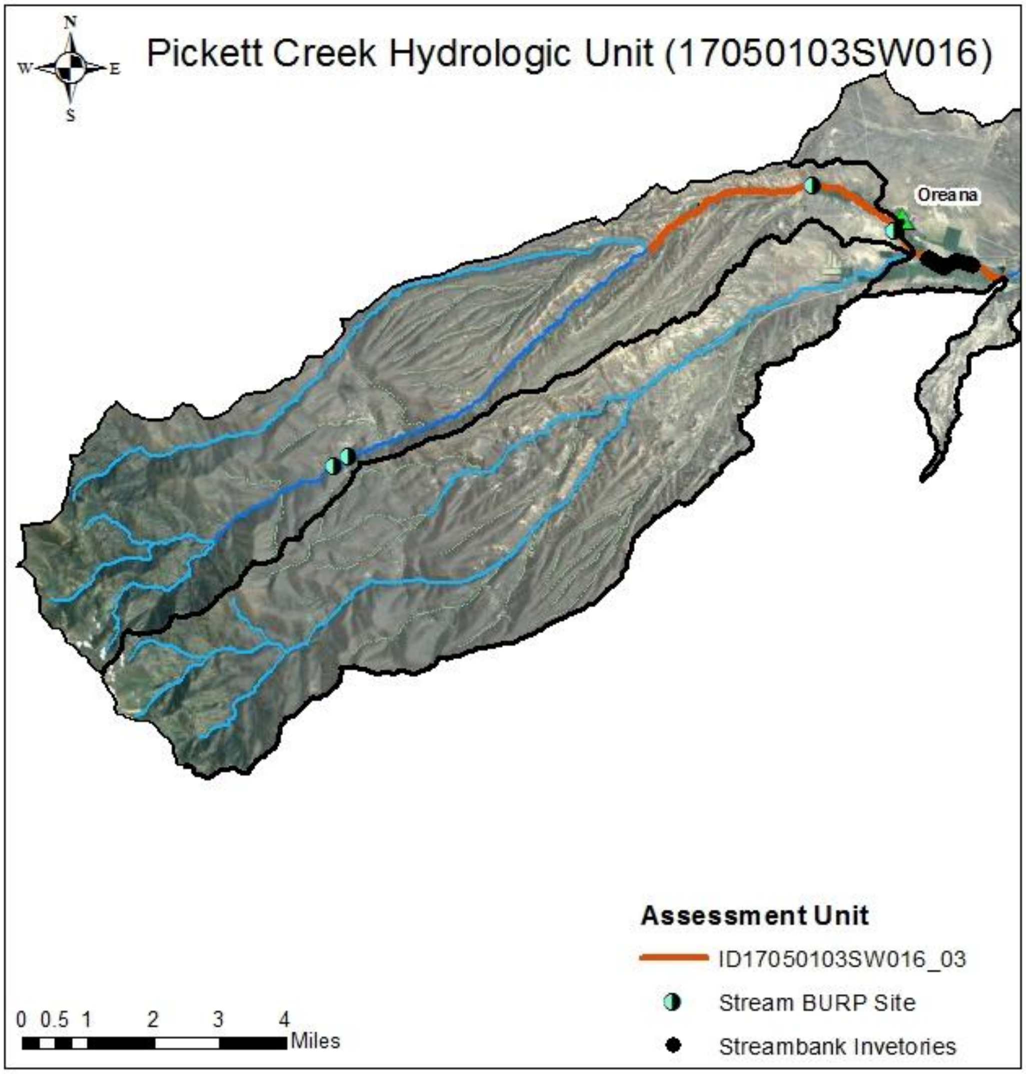


Figure 12. DEQ BURP monitoring locations (1996, 2001) and streambank erosion inventories (2012) in the Pickett Creek subwatershed. BURP data were collected in 1996 but not in 2001 because the channel was dry.

2.4.5 Vinson Wash

Figure 13 shows the BURP site in the impaired AU (ID17050103SW023_03) of Vinson Wash. In 2001, DEQ measured flow in the channel at 1.5 cfs. However, the percentage of fines comprising the channel bottom substrate was estimated at over 58%, well outside of the 28% threshold recognized as supporting cold water aquatic life. The BURP data for Vinson Wash are available at *http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW023_03*.

Idaho Power visually observed what is believed to be the mouth of Vinson Wash as part of its Snake River drain and tributary analysis (identified as river mile 483.1 in Knight and Naymik

2009). The site was visited on May 17, June 20, July 31, August 29, and October 9, 2007. The site had water flowing into the river during all site visits with the exception of the October 9 visit, suggesting that flow may be primarily comprised of drain returns (A. Knight, pers. comm., 2012).

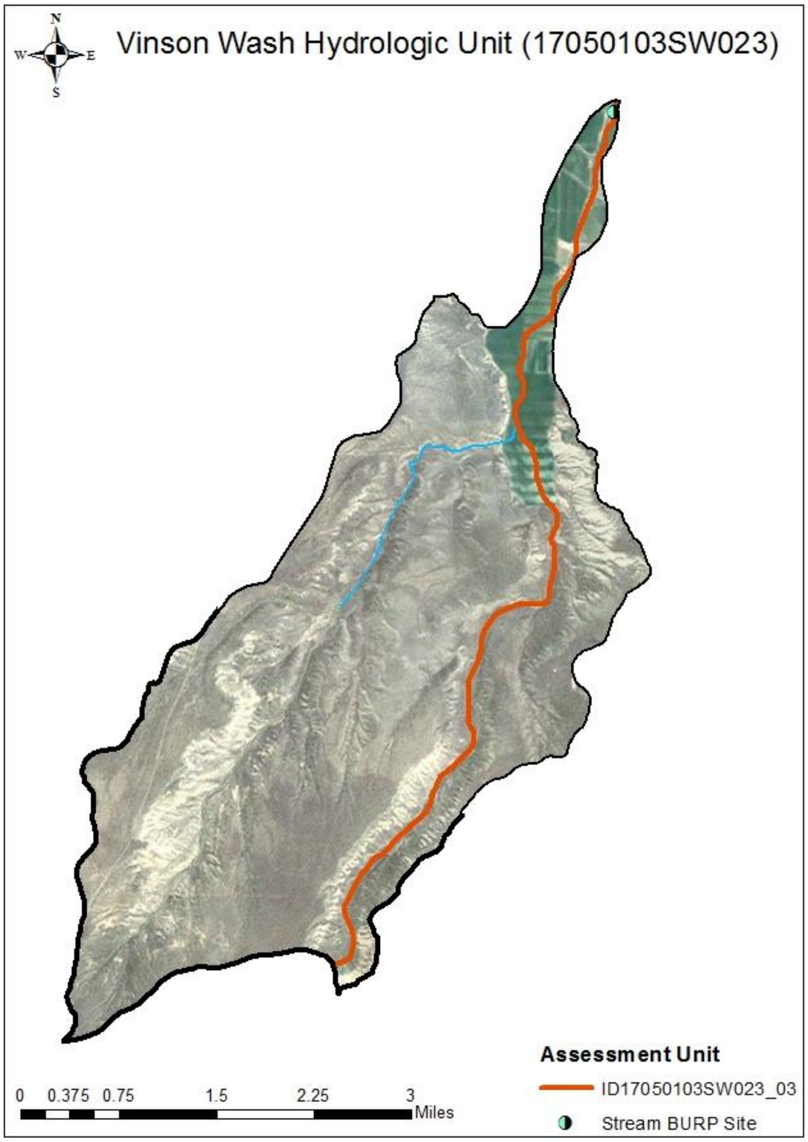


Figure 13. The DEQ BURP monitoring location (2001) on Vinson Wash.

2.5 Status of Beneficial Uses

Based on a thorough analysis of BURP data, streambank stability data collected by DEQ personnel in 2011–2013 and by the BLM in 2005–2012, and from the data and report produced by Idaho Power in 2009, it is evident that the cold water aquatic life beneficial is likely impaired by sediment in the specific AUs addressed for Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash. Further, it is evident that due to the absence of point sources, nonpoint sources are the most likely source of these impairments.

3 Subbasin Assessment—Pollutant Source Inventory

The pollutant of concern for this addendum is limited to sedimentation/siltation for which narrative criteria are established in the Idaho water quality standards. Sedimentation/siltation has been identified as a current or potential limiting factor for attaining designated, existing, or presumed beneficial uses in the Mid Snake River/Succor Creek subbasin.

3.1 Sources of Pollutants of Concern

A review of identified or observed sources of impairment to surface water in the subbasin—including permitted point sources, nonpoint sources, natural events, and documented or otherwise known accidental releases—was completed in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and included in the 5-year review (DEQ 2011b).

3.1.1 Point Sources

There are no individually permitted point sources in the Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, or Vinson Wash subwatersheds.

Several Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act sites do exist in the Mid Snake River/Succor Creek subbasin and are identified in the original TMDL (DEQ 2003b) and 5-year review (DEQ 2011b).

3.1.2 Nonpoint Sources

A detailed discussion of nonpoint sources in the subbasin is provided in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and 5-year review (DEQ 2011b). Because very little has changed in this subbasin since the 2003 TMDL and 2011 5-year review, the information provided in these documents is still accurate for these subwatersheds. Although the locations of agricultural diversions, dams, and drains can be indicated as specific points on the landscape, the Clean Water Act designates these as nonpoint sources due to the impact that widespread land use activities have on the water channeled through agricultural irrigation systems. Septic system leakage and paved and unpaved road surfaces are unquantified sources also likely to contribute sediment to surface waters. Contributions from these orphan sources are acknowledged data gaps (see section 3.2), and implementation plans could include details regarding future data collection from these sources.

Figure 14 through Figure 18 show the land use and habitat patterns within the Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash subwatersheds.

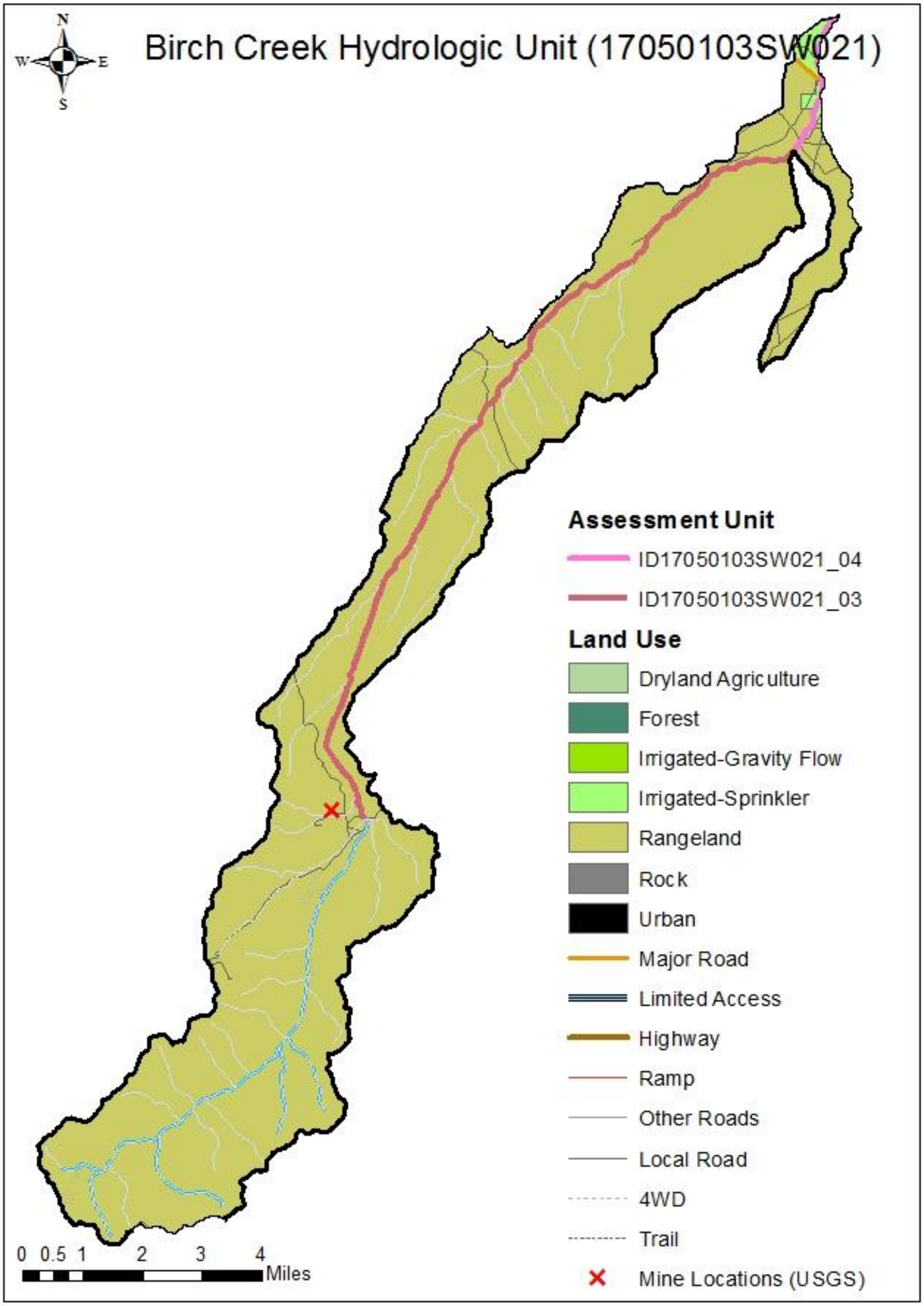


Figure 14. Land use in the Birch Creek subwatershed.

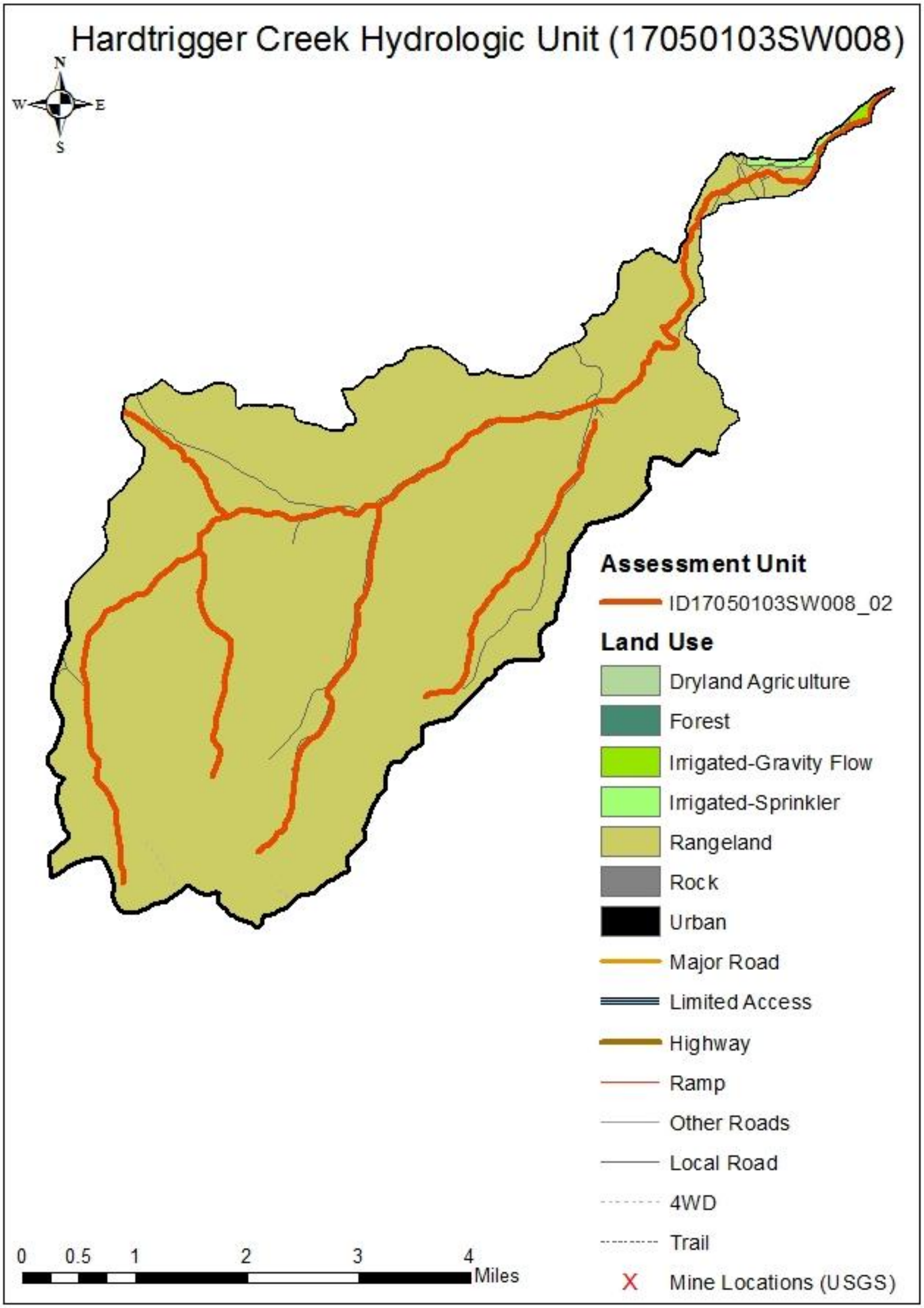


Figure 15. Land use in the Hardtrigger Creek subwatershed.

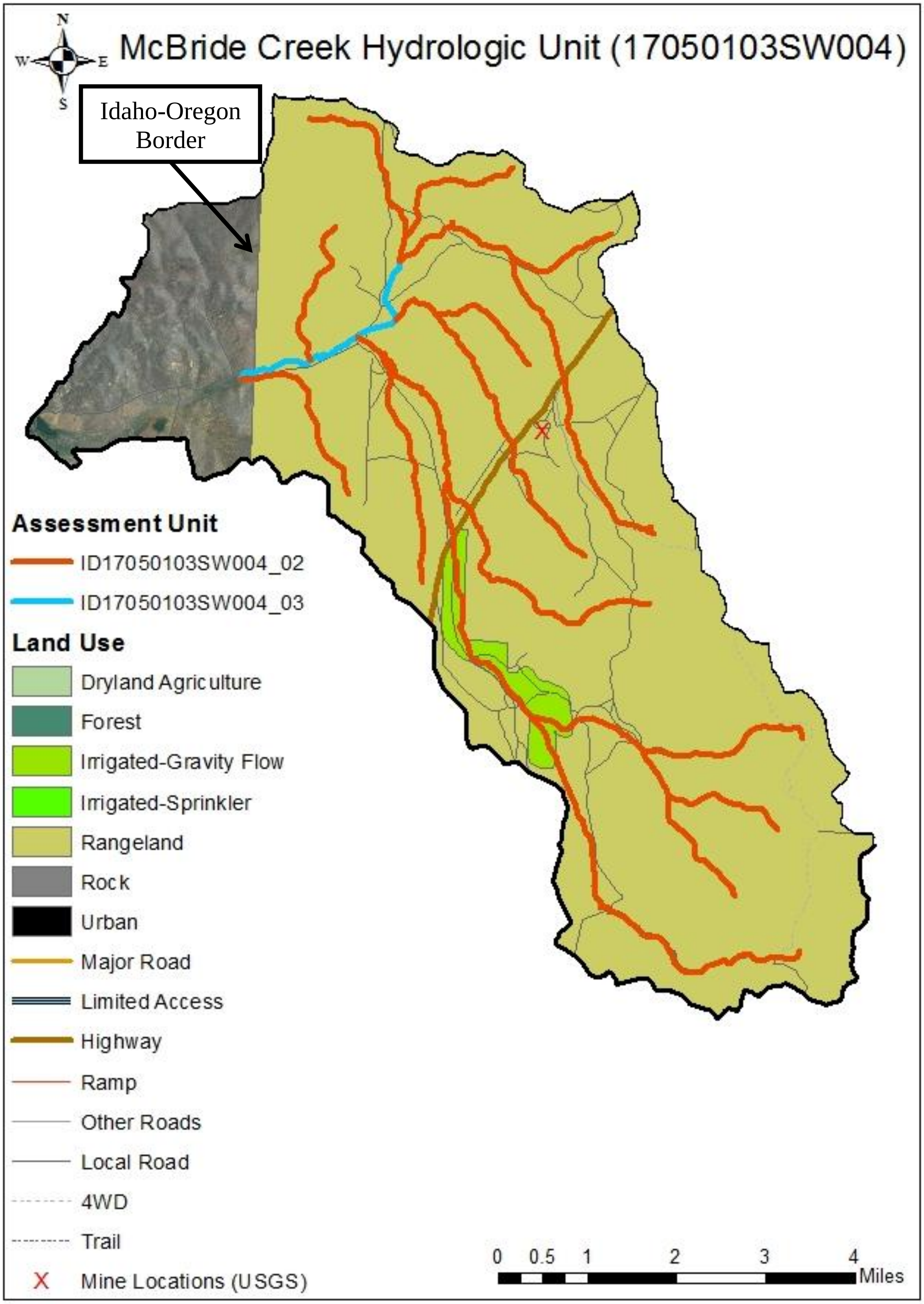


Figure 16. Land use in the McBride Creek subwatershed.

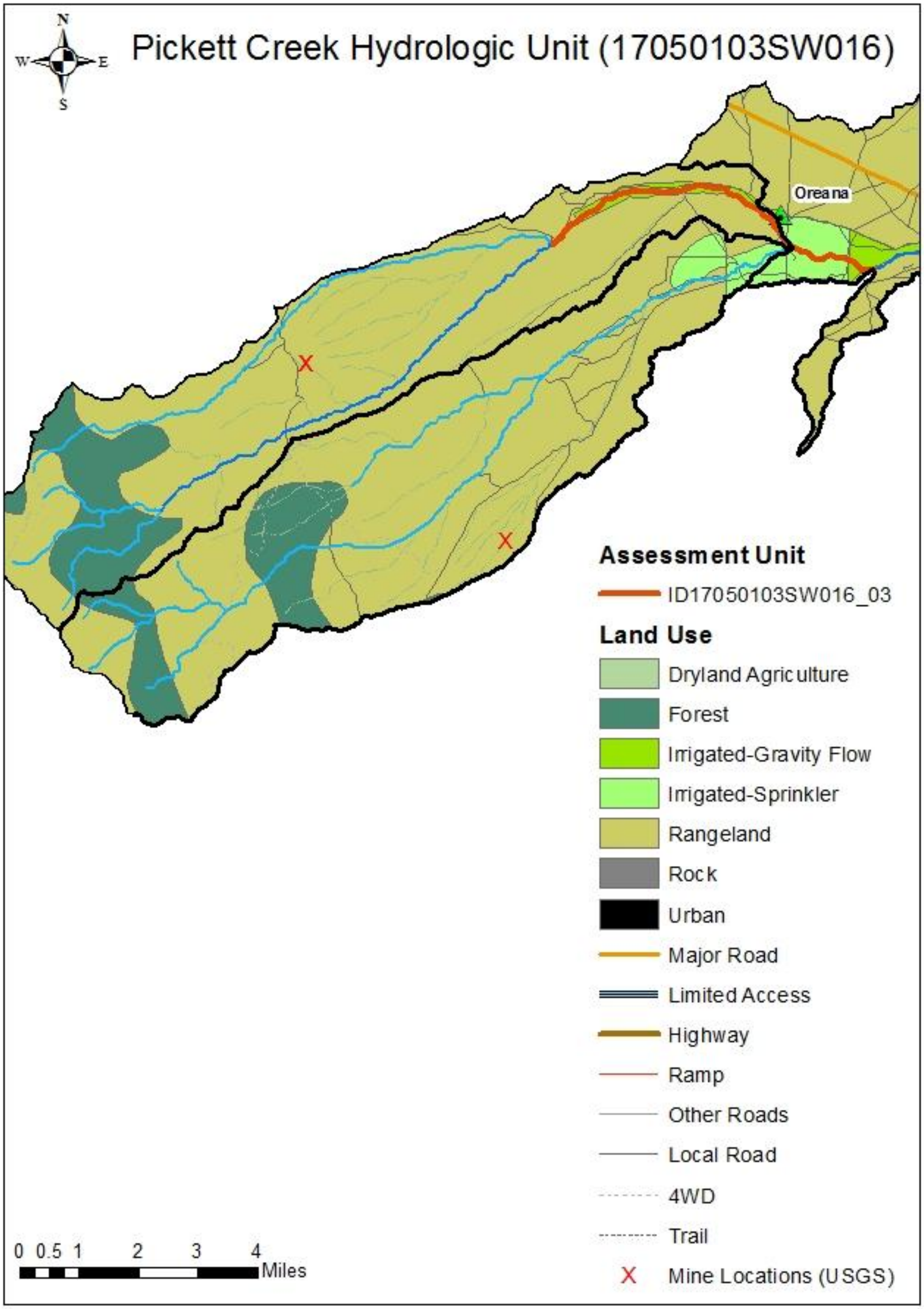


Figure 17. Land use in the Pickett Creek subwatershed.

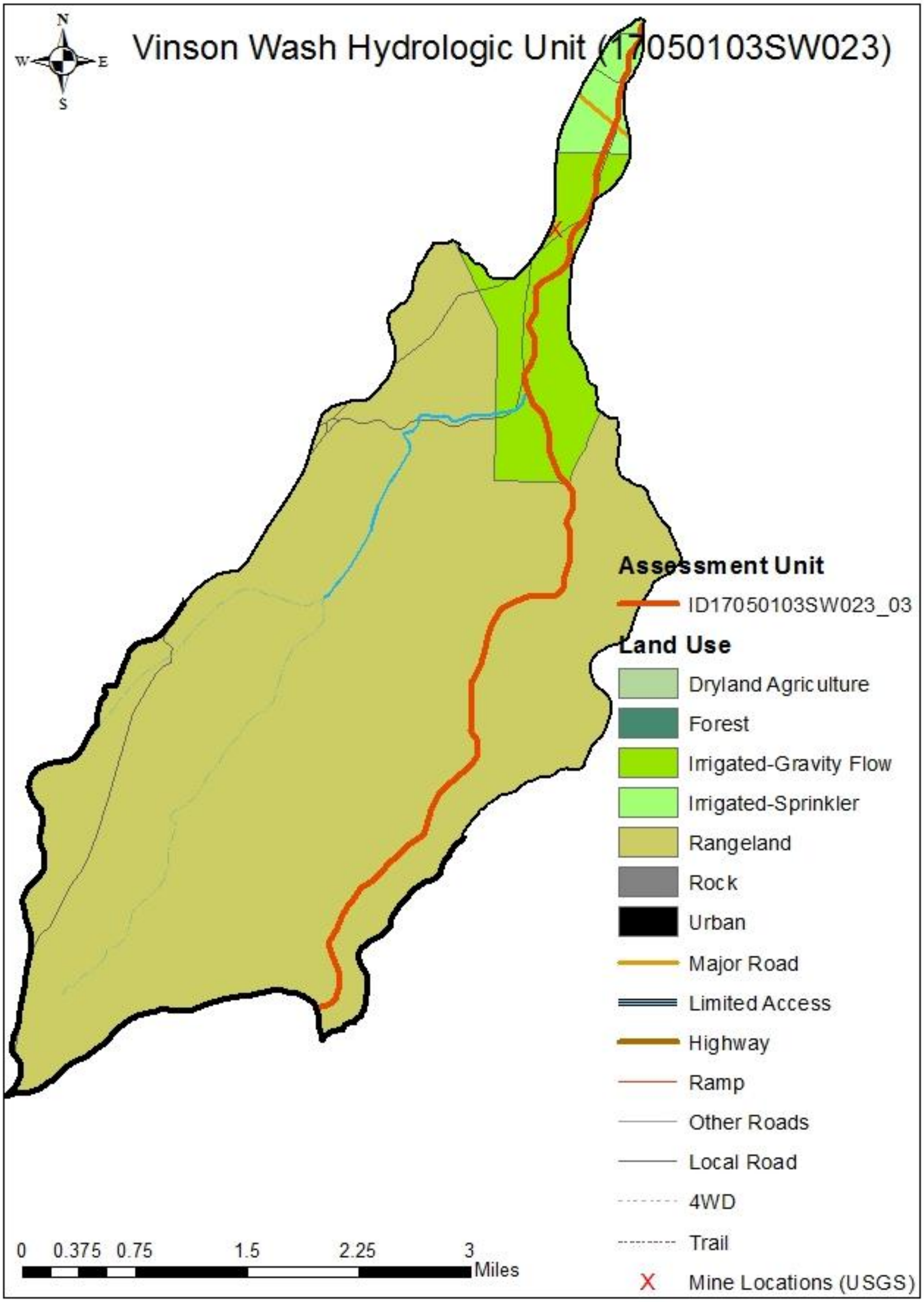


Figure 18. Land use in the Vinson Wash subwatershed.

3.1.3 Pollutant Transport

A discussion of pollutant transport in the subbasin is provided in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and 5-year review (DEQ 2011b).

3.2 Data Gaps

A detailed discussion of data gaps for the Mid Snake River/Succor Creek subbasin is provided in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and 5-year review (DEQ 2011b). These reports are available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx*.

Data gaps should ideally be addressed as restoration activities are undertaken in the watersheds. The details of how this could be accomplished will be included in the implementation plan.

Uncertainty in TMDLs is largely the result of insufficient or limited data. However, while it is easier to develop and refine load analyses and models with adequate data, sufficient data exist from Birch, Hardtrigger, McBride, and Pickett Creeks to identify likely pollution sources and develop reasonable load allocations to reduce pollutant loads. DEQ has limited streamflow and percent fines data and no sediment concentration data for Vinson Wash. However, because much of Vinson Wash is quite similar to Birch Creek (both in the upland, dry, sandy wash areas and the lower irrigated agricultural areas), DEQ expects comparable streamflow and sediment concentrations, thus enabling gross estimates of sediment loading.

Additional data gap issues in the Mid Snake River/Succor Creek subbasin include the following:

- Spatial data sets for land use, hydrology, and channel morphology are sparse.
- Detailed analyses of instream flow conditions, water column chemistry, and stream and riparian characteristics in some locations are difficult or not possible.
- Mass-balance and load calculations are based on low-resolution information.
- Statistically valid representations of natural, undisturbed, or background stream conditions are difficult to obtain.
- Dynamic or highly variable conditions are not evaluated.
- Small-scale processes are not evaluated.
- Water returns and withdrawals are not quantified or are oversimplified.

4 Summary of Past and Present Pollution Control Efforts

The goal of the *Mid Snake River/Succor Creek Watershed TMDL Implementation Plan for Agriculture* (SWCC and IASCD 2005) is to assist and/or compliment other watershed efforts to restore beneficial uses for the §303(d)-listed stream segments within the Mid Snake River/Succor Creek subbasin. The agricultural component of the implementation plan includes an adaptive management approach for implementing resource management systems (RMSs) and best management practices (BMPs) to meet the TMDL reductions. Agricultural RMSs and BMPs on privately owned land are developed and implemented on site with individual agricultural operators per the *Idaho Agricultural Pollution Abatement Plan* (Resource Planning Unlimited 2003).

Unfortunately, BMPs and RMSs have not been actively implemented in the Mid Snake River/Succor Creek subbasin because agricultural participation is voluntary and funding is limited. As a result, watershed implementation priorities and projects included in the 2005 implementation plan have not been updated. Additionally, DEQ is not the implementing agency; designated management agencies such as the Idaho Soil and Water Conservation Commission (SWCC) and BLM develop implementation plans through their own management plans.

The implementation plan can be accessed at *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx* and includes watershed implementation priorities, schedules, and milestones for meeting water quality standards.

5 Total Maximum Daily Load(s)

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

Load capacity can be summarized by the following equation:

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

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

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

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

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

5.1 Instream Water Quality Targets

Instream water quality targets are selected for the purpose of restoring beneficial uses to the water body. A detailed discussion of instream water quality targets is provided in the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and 5-year review (DEQ 2011b). For the five water bodies receiving sediment TMDLs in this addendum, two different targets were developed—sediment concentration or bank stability level—depending on the primary source of sediment in the AU.

5.1.1 Design Conditions

Design conditions are those methods used to determine load capacity, existing pollutant loads, wasteload allocations, and load allocations. Because these elements are variable for each pollutant and AU combination, design conditions are discussed separately for sediment concentration and bank stability measures. Load capacity is the calculated watershed sediment load that fully supports beneficial uses. The load capacity for a TMDL designed to address a sediment-caused limitation to use support is complicated by the fact that the state’s water quality standard is narrative rather than numerical.

Within the Mid Snake River/Succor Creek subwatersheds, the sediment interfering with the cold water aquatic life beneficial use is likely fine sediment (<6.35 millimeters [mm] in size). Adequate quantitative measurements of the effect of excess sediment on the aquatic life uses in the subwatersheds have not been fully developed. Given this limitation, a sediment load capacity has been developed using literature-based values from effects-based studies (empirical). The sediment load capacity values for these Mid Snake River/Succor Creek subwatersheds are based on the following assumptions:

- Natural background concentrations of suspended sediment and bank stability measures in similar watersheds and values identified in scientific literature are fully supportive of the cold water aquatic life beneficial use.
- The stream system has some finite ability to process (transport) suspended sediment at concentrations greater than background values without impairing beneficial uses.

- The beneficial use will respond positively to a concentration under which the finite ability of the stream system to process sediment is met.

5.1.2 Sediment Concentration Target Selection (Birch Creek and Vinson Wash)

The intermittent/perennial portions of Birch Creek and Vinson Wash likely contain elevated suspended solid concentrations as a result of agricultural return water, making a certain sediment concentration an appropriate target for these TMDLs. The TSS target and corresponding loading analyses account for the overall potential impacts to cold water aquatic life beneficial uses within the impaired assessment units. Therefore, the target and loading analyses focus on the intermittent/perennial stream segments, in which targets, subsequent management actions, and beneficial use support can be clearly identified, defensibly implemented, and scientifically measured.

Sediment conditions as they relate to water quality standards are assessed through interpretation of the narrative criteria based on impacts to aquatic life. Guidelines established by previous and developing TMDLs (e.g., the Lower Boise River sediment TMDL [DEQ 1999b], Little Willow Creek TMDL [in development], and Lower Boise River tributary sediment and bacteria TMDL [in development]) are based on the work of Newcombe and Jensen (1996). These established sediment concentrations likely to support beneficial uses are based on a severity of ill effects (SEV) score of 8, which Newcombe and Jensen identified as sublethal and DEQ and EPA (Martha Turvey, EPA, pers. comm., 2012) also identified as protective of aquatic life beneficial uses.

An SEV score results from specific combinations of sediment concentration and exposure duration. As identified in Newcombe and Jensen (1996), a constant SEV can be maintained by either increasing or decreasing the level of instream sediment concentration while doing the opposite with exposure duration (Figure 19). For example, juvenile salmonids are likely to experience an SEV of 8 under sediment concentrations of 403 mg/L over 2 days (a high dose over a short time period) but also under sediment concentrations of 20 mg/L over 4 months (a low dose over a long time period).

FISH RESPONSES TO SUSPENDED SEDIMENT

Juvenile Salmonids

Duration of exposure to SS ($\log_e$ hours)

(B) Average severity-of-ill-effect scores (calculated)

Concentration (mg SS/L)	0	1	2	3	4	5	6	7	8	9	10	($\log_e$ mg SS/L)
162755	9	10	11	11	12	13	14	14	-	-	-	12
59874	9	9	10	11	11	12	13	14	14	-	-	11
22026	8	9	9	10	11	11	12	13	13	14	-	10
8103	7	8	9	9	10	11	11	12	13	13	14	9
2981	6	7	8	9	9	10	11	11	12	13	13	8
1097	6	6	7	8	9	9	10	11	11	12	13	7
403	5	6	6	7	8	9	9	10	11	11	12	6
148	4	5	6	6	7	8	9	9	10	11	11	5
55	4	4	5	6	6	7	8	8	9	10	11	4
20	3	4	4	5	6	6	7	8	8	9	10	3
7	2	3	4	4	5	6	6	7	8	8	9	2
3	1	2	3	4	4	5	6	6	7	8	8	1
1	1	1	2	3	4	4	5	6	6	7	8	0
	1	3	7	1	2	6	2	7	4	11	30	
	Hours			Days			Weeks		Months			

Figure 19. Observed and expected responses of juvenile salmonids under varying sediment concentrations and periods of exposure (*Source:* Newcombe and Jensen 1996, p. 703).

Using the available site-specific data and scientific literature, a suspended sediment target value of 20 mg/L during any 4 continuous months (an SEV of 8) will be applied throughout the average irrigation season (April 1 through September 30) to ensure water quality standards are met and beneficial uses are fully supported in Birch Creek and Vinson Wash. The target will address TSS conditions in these AUs during the time of year when loads are believed to exceed the SEV 8 threshold. Spikes in TSS may certainly occur outside of the April 1–September 30 time period, but these are expected to be of short duration and not exceeding the SEV 8 duration threshold.

The target is linked to conditions that will ensure Idaho water quality standards are met and the cold water aquatic life beneficial use is returned to full support. The TSS target was derived from similar watersheds (Succor Creek, Bissel Creek, and Lower Boise River tributaries) and by referencing the extensive metadata analysis conducted by Newcombe and Jensen (1996). This value is very similar, yet even more supportive, than concentrations allocated to Succor Creek (22 mg/L) and Bissel Creek (22 mg/L) in EPA-approved TMDLs (DEQ 2003b, 2003a).

5.1.3 Streambank Stability Target Selection (Hardtrigger, McBride, and Pickett Creeks)

The primary source of sediment for the remaining AUs is likely instream erosional processes. For these tributaries where the largest amount of sediment is produced from instream erosion, a target of greater than 80% streambank stability is has been developed for intermittent/perennial stream segments of the Hardtrigger, McBride, and Picket Creek subwatersheds. The bank stability target and corresponding loading analyses account for the overall potential impacts to cold water aquatic life beneficial uses within the impaired AUs. Therefore, the target and loading analyses focus on the intermittent/perennial stream segments, in which targets, subsequent management actions, and beneficial use support can be clearly identified, defensibly implemented, and scientifically measured.

The target is linked to conditions that will ensure Idaho water quality standards are met and beneficial uses are returned to full support. This surrogate measure has been used in other EPA-approved TMDLs—including the Mid Snake River/Succor Creek TMDL (DEQ 2003b) and the Lemhi, Pahsimeroi, and Blackfoot TMDLs (DEQ 1999a, 2001c, 2001a)—and is based on findings by Overton et al. (1995). Using Natural Resources Conservation Service (NRCS)-derived equations and bank inventory ratings (1983), erosion rates and total tons of eroded sediment per year can be calculated. This 80% bank stability target has been linked to a 28% fines (<6.35 mm in diameter) target and has been shown to support salmonids and, by extension, other aquatic life.

Background sediment production from streambanks equates to the load at 80% streambank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types.

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. The sediment analysis characterizes loads using average annual or seasonal rates determined from empirical characteristics that develop over time within the influence of peak and base flow conditions. While deriving these estimates, it is difficult to account for seasonal and annual variation within a particular time frame; however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

Streambank erosion reductions are quantitatively linked to tons of sediment per year. The annual average sediment load is not distributed equally throughout the year. Annual erosion and sediment delivery are functions of climate, where wet water years typically produce the highest sediment loads. Additionally, most of the erosion typically occurs during a few critical months. For example, in the Mid Snake River/Succor Creek subbasin, most streambank erosion occurs during spring runoff. The sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bank-full discharge or the average annual peak flow event.

An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, a decrease in subsurface fine sediment will ultimately improve the status of beneficial uses. Streambank erosion load allocations are based upon the assumption that streambank erosion is the primary source of sediment. Reducing streambank erosion as prescribed within this TMDL is directly linked to improving riparian vegetation density and structure to armor streambanks, reduce lateral recession, trap sediment, and reduce the erosive energy of the stream, thus reducing sediment loading. In reaches that are down-cut or have vertical erosive banks, continued erosion may be necessary to re-establish a functional floodplain that would subsequently be colonized with stabilizing riparian vegetation, a process that often takes many years.

Although the bank inventory sampling methodology serves to develop representative estimates for each subwatershed, on-the-ground bank stability conditions at any particular site within a subwatershed may vary due to natural landscape variation and past and present land management practices. For example, individual stream segments within each subwatershed may have highly variable streambank stability depending on numerous factors, including proximity to roads, wildlife, wild horse and livestock density, channel type, soil type, and riparian vegetation. As a result, land managers should use the streambank stability data in this TMDL as one of the pieces of information to help determine appropriate land management practices on a subwatershed scale; site-specific monitoring and other data collection may be necessary to better understand site-specific land management implications.

5.1.4 Water Quality Monitoring Points

The monitoring locations for BURP and DEQ and BLM streambank stability data are illustrated in Figure 8 and Figure 10 through Figure 13. The monitoring locations for the Idaho Power flow and sediment data are available in Knight and Naymik (2009). Future data collection within these AUs should take place at locations and frequencies consistent with Idaho water quality standards for determining beneficial use support during the TMDL implementation phase.

5.2 Load Capacity

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

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions.

5.2.1 Sediment (Concentration)

The load capacity for sediment concentration is based on the instream load that would be present when a concentration of 20 mg/L is met. The load capacity for Birch Creek and Vinson Wash is based on maintaining 20 mg/L TSS average concentration during any 4 consecutive months during the critical irrigation season (April 1–September 30).

5.2.2 Sediment (Streambank Stability)

In those instances where the majority of sediment is generated 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 the remaining stream segments. The 80% streambank stability target is designed to meet the established instream water quality target of 28% or less fine sediment (<6.35 mm in diameter) in riffle areas.

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" (40 CFR 130.2(g)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed) but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

For Birch Creek and Vinson Wash, this TMDL analysis calculates existing loads based on recorded flow and TSS values from data collection efforts in 2007 (Knight and Naymik 2009), providing estimated average monthly rates based on empirical information.

For Hardtrigger, McBride, and Pickett Creeks, site-specific analyses were used to calculate existing loads based on DEQ streambank stability data in 2011–2013.

5.3.1 Sediment (Concentration and Bank Stability)

In instances where sediment was generated via agricultural or other nonpoint source activities (Birch Creek and Vinson Wash), the existing loads were calculated using measured water column data. In instances where the primary source of sediment is from bank erosion (Hardtrigger, McBride, and Pickett Creeks), existing sediment loads were determined using the bank erosion inventory process. This method provided direct measurement of erosion rates within the reach. This erosion rate was then used to calculate the current instream delivery of sediment within the system. Current loads are presented in Table 6.

Table 6. Current loads from nonpoint sources in Mid Snake River/Succor Creek subbasin.

Load Type	Assessment Unit	Current Load (tons/year)	Estimation Method	TMDL Required?
Sediment loading rate (4-month seasonal)	Birch Creek ID17050103SW021_03 and ID17050103SW021_04	7,320[a]	Instream concentration	Yes
Sediment loading rate (annual)	Hardtrigger Creek ID17050103SW008_02	435	Observed erosion rate calculated on target of >80% streambank stability	Yes
Sediment loading rate (annual)	McBride Creek ID17050103SW004_02	706	Observed erosion rate calculated on target of >80% streambank stability	Yes
Sediment loading rate (annual)	McBride Creek ID17050103SW004_03	239	Observed erosion rate calculated on target of >80% streambank stability	Yes
Sediment loading rate (annual)	Pickett Creek ID17050103SW016_03	217	Observed erosion rate calculated on target of >80% streambank stability	Yes
Sediment loading rate (4-month seasonal)	Vinson Wash ID17050103SW023_03	7,320[a]	Instream concentration	Yes

[a] The instream sediment concentration current load (tons/year) was calculated as: *irrigation season average daily load (40 tons/day) × total number of days (183) in the critical season April 1 – September 30*.

5.4 Load and Wasteload Allocation

Load allocations may take the form of required percentage reductions rather than actual loads. Each point source must receive a wasteload allocation, but no point sources are permitted in the subbasin. Nonpoint source load allocations may be allocated by subwatershed, land use, responsibility for actions, or a combination of sources and activities. It is not necessary to allocate a load reduction for all nonpoint sources so long as water quality targets can be met with the reductions that are specified. In developing load allocations, the total allocations must include a margin of safety to take into account seasonal variability and uncertainty. Uncertainty arises in selecting water quality targets, estimating load capacities, and estimating existing loads. The uncertainty is attributable, in part, to incomplete knowledge or understanding of the system, such as unknown assimilation processes, and variable data. It is also prudent to allow for growth by reserving a portion of the remaining available load (if any) for future sources.

5.4.1 Sediment (Concentration)

The targets for TSS in the intermittent/perennial segments of Birch Creek and Vinson Wash are 20 mg/L average concentration during any 4 continuous months throughout the critical irrigation season (April 1–September 30). The 20 mg/L target is intended to protect aquatic species that may inhabit the stream, including fish and macroinvertebrates.

Table 7 shows the load allocations for Birch Creek and Vinson Wash. The allocations are designed to meet the TSS goals of 20 mg/L with checkpoints near the end of each stream. The load in pounds/day is calculated using the standard pollutant mixing equation with a built-in conversion factor: $(conc_1 \times flow \times 5.4)$ (Hammer 1986); subsequent division by 2000 calculates loads in tons/day. Fixed load targets were selected because management practices that affect sediment loading to the streams are not expected to change on a day-to-day basis. Thus, the management practices should be developed to meet the load goals.

Because the load capacity for Birch Creek and Vinson Wash is based on maintaining the instream target throughout the critical irrigation period (April 1–September 30), the actual mass load capacity changes at any given time or location in the stream as flows increase or decrease.

Table 7. Gross total suspended sediment (TSS) load allocations (i.e., load capacities) for Birch Creek (AU ID17050103SW021_03 and ID17050103SW021_04) and Vinson Wash (AU ID17050103SW023_03). Data do not exist for Vinson Wash, so calculations are derived from Birch Creek due to watershed similarity, proximity, and sediment sourcing.

Month	Flow (cfs)	TSS		Average TSS	Load Capacity at 20 mg/L	Average Load Reduction	
		(mg/L)	(tons/day)	(tons/day)	(tons/day)	(tons/day)	(%)
April	No Data						
May	15.4	217	9.0	40.0	1.0	39.0	97.6%
June	15.3	2,720	112.4				
July	18.8	742	37.7				
August	16.2	531	23.2				
September[a]	24.3	271	17.8				
October	32.3	10	0.9	0.9	1.7	0.0[b]	0

Note: The existing loads and load allocations are calculated using a portion of the standard pollutant mixing equation with a built-in conversion factor: *(conc×flow×5.4)* (Hammer 1986); division by 2000 converts loading to tons/day.
[a] Interpolated flow and sediment concentration values; no data were available in September.
[b] Although no reduction is necessary because the existing load is equal to or less than the load capacity, no additional sediment should be discharged to the stream.

The analysis for Birch Creek and Vinson Wash shows that TSS loads must be reduced by an average 97.6% to maintain 20 mg/L in the stream throughout the irrigation season (April 1–September 30).

5.4.2 Sediment (Streambank Stability)

The remaining sediment-impaired intermittent/perennial stream segments in the Mid Snake River/Succor Creek subbasin are receiving allocations due to excess streambank erosion. Table 8 shows the load allocations for these segments. The worksheets used to derive these load allocations are located in Appendix B.

The current erosion rate is based on the bank geometry and lateral recession rate at each measured reach. The target erosion rate is based on the bank geometries and lateral recession rates of reference reaches used for the 2003 Mid Snake River/Succor Creek TMDL (DEQ 2003b). Reference reaches were chosen because they exhibited greater than 80% bank stability and less than 28% fine substrate material. The load capacity is the total load present when banks are at least 80% stable with a recession rate of 0.05 feet/year. As such, the load capacity and load allocations are the same. Note that these are the overall decreases necessary in the stream but only apply to areas where banks are less than 80% stable and/or the lateral recession rate exceeds 0.05 feet/year. The streambank stability target is intended to protect aquatic species that may inhabit the streams, including fish and macroinvertebrates.

Table 8. Streambank erosion load allocations for Hardtrigger, McBride, and Pickett Creeks.

Water Body[a]	Current Bank Stability	Current Load		Load Capacity		Necessary Load Reduction (tons/yr) (tons/day) (%)
		Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr) (tons/day)	Target Erosion Rate (tons/mile/yr)	Target Total Erosion (tons/yr) (tons/day)	
Hardtrigger Creek (AU 008_02)	60%	33	435 1.19	7	91 0.25	344 tons/year 0.94 tons/day 79%
McBride—Lower (AU 004_03)	61%	85	239 0.65	16	45 0.12	193 tons/year 0.53 tons/day 81%
McBride—Upper (AU 004_02)	52%	41	706 1.93	21	366 1.0	340 tons/year 0.93 tons/day 48%
Pickett Creek (AU 016_03)	80%[b]	34	217 0.6	12	74 0.2	143 tons/year 0.4 tons/day 66%

[a] All assessment units (AUs) begin with ID17050103 and all intermittent and perennial stream segments within each AU are included in the loading analyses.

Hardtrigger Creek (AU 008_02)
- Hardtrigger Creek – 6.75 miles (headwaters to 0.25 miles below confluence with Stewart Gulch)
- Hardtrigger Creek – 0.75 miles (confluence with Snake River upstream approximately 1 mile)
- Middle Fork Hardtrigger Creek – 2.2 miles (all)
- Little Hardtrigger Creek – 3.5 miles (all)

McBride Creek—Lower (AU004-03) – 2.8 miles (all)

McBride Creek—Upper (AU004-02)
- McBride Creek – 10.1 miles (all)
- Little McBride Creek – 5.1 miles (all)
- Willow Fork – 2.1 miles (all)

Pickett Creek (AU 016_03) – 6.4 miles (all)

[b] The Pickett Creek streambank inventory estimated bank stability at the 80% threshold. However, due to the estimated lateral recession rate of 8 (0.15 feet/year), falling just short of severe (8.25+), sediment reductions are likely necessary to fully support cold water aquatic life.

5.4.3 Margin of Safety

The margin of safety factored into all load allocations is implicit and includes the conservative assumptions used to determine existing sediment loads. Conservative assumptions made as part of the loading analysis are discussed below.

5.4.2.1. Sediment (Concentration)

TSS water column targets are used for lower Birch Creek and Vinson Wash. The TSS target is 20 mg/L over 4 months during the irrigation season (April 1–September 30). This target is even more stringent than reference segment targets for Succor Creek and Bissel Creek (22 mg/L) and likely the same as the lower Boise River tributaries and Little Willow Creek (probably 20 mg/L but still in development). An implicit margin of safety applies because the current target is lower than targets for Bissel and Succor Creeks, which are believed to be protective of aquatic life (DEQ 2003a, 2003b).

The 20 mg/L target over 4 months directly references work by Newcombe and Jensen (1996), which identified this combination as sublethal on juvenile salmonids (SEV of 8). Conversely, Newcombe and Jensen also identified that lethal effects (SEV of 9) would occur at sediment concentrations of 55 mg/L over 4 months. That is, during a 4-month exposure period, the resulting impact of sediment concentrations >20 but <55 mg/L on juvenile fish are rather uncertain, probably depending on a number of other environmental factors. Therefore, based on their data and the proposed target, reaching an SEV of 9 (lethal and paralethal impacts to juvenile salmonids) would either require increasing sediment concentrations by 2.5 times (55 mg/L) over the same 4-month time period *or* increasing the exposure period by nearly 3 times (11 months) at the same 20 mg/L concentration. Thus, using 20 mg/L for 4 months is a conservative target for Birch Creek and Vinson Wash.

5.4.2.2. Sediment (Streambank Stability)

An implicit margin of safety exists for the streambank stability targets due to a number of reasons:

- Desired bank erosion rates are representative of background conditions.
- Water quality targets for percent fines are consistent with values measured and as set by land management agencies based on stable salmonid production.
- Reference bank conditions in the watershed (Succor, Castle, and Sinker Creeks) used in the 2003 TMDL are based on banks that are >80% stable with 28% fines target.
- The load capacity includes a lateral recession rate ≤0.05 feet/year, which means that even streams with >80% bank stability (e.g., Pickett Creek) may need to further reduce erosional processes to meet the corollary sediment load capacity.
- The actual sediment loadings are likely conservative (lower) relative to estimates, due in part to these xeric streams being largely intermittent, with flows often being 0 cfs among stream segments and water years due to a combination of low precipitation and subsidence flows, thus reducing the overall movement of sediment throughout the system.

5.4.4 Seasonal Variation and Critical Period

Seasonal influences affect waters in the Mid Snake River/Succor Creek subbasin. In general, the spring and summer seasons have the highest sediment concentrations. However, it is not possible to definitively determine the seasonal variability of sediment in this subbasin based on available data. Seasonal variation is addressed in this TMDL by ensuring that loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations (Table 9).

Table 9. Critical periods for water bodies receiving TMDLs.

Water Body	Pollutant (Type of Target)	Critical Period (Time of Year Applicable)
Birch Creek (AU 021_03, and _04)	Sedimentation/siltation (concentration)	April 1–September 30
Hardtrigger Creek (AU 008_02)	Sedimentation/siltation (streambank stability)	Year round
McBride—Lower (AU 004_03)	Sedimentation/siltation (streambank stability)	Year round
McBride—Upper (AU 004_02)	Sedimentation/siltation (streambank stability)	Year round
Pickett Creek (AU 016_03)	Sedimentation/siltation (streambank stability)	Year round
Vinson Wash (AU 023_03)	Sedimentation/siltation (concentration)	April 1–September 30

Note: All assessment units (AUs) begin with ID17050103SW.

Sediment can be transported through the agricultural irrigation system and is easily transported through those systems when irrigation water is flowing across cropland during the growing season and when runoff from any source is delivered into the irrigation system in the dormant season. Because irrigation systems are permanent structures designed to transport water across the landscape, pollutants can be easily transmitted through the watershed during active irrigation periods, regardless of crop status. These structures are accessible to most community members and border and traverse grazed and cultivated agricultural lands.

Instream bank erosion in these subwatersheds, as measured through streambank erosion inventories, can happen any time of year due to the erosion source. Instream bank erosion can derive from multiple sources, including natural episodic events; road and culvert design, placement, and maintenance; off-highway vehicle use; wild horses; livestock; and wildlife. As such, erosional events in these subwatersheds can impact cold water aquatic life regardless of the direct period of erosion (for example, bank erosion on a dry streambank in summer/fall can lead to instream sediment loading during winter and springs flows by moving the eroded bank sediment and possibly leading to further erosive conditions).

5.4.5 Reasonable Assurance

Because land use is almost exclusively rangeland and agricultural, all reductions are directed at nonpoint sources. Idaho water quality standards assign specific agencies responsibility for implementing, evaluating, and modifying BMPs to restore and protect impaired water bodies. The State of Idaho is committed to developing implementation plans within 18 months of EPA TMDL approval. DEQ, the WAG, and designated management agencies will develop implementation plans, and DEQ will incorporate them into the state's water quality management plan. DEQ will periodically reassess the beneficial use support status of water bodies to determine support status. Implementation or revision of BMPs will continue until full beneficial use support status is documented and the TMDL is achieved.

5.4.6 Natural Background

Background sediment production from streambanks equates to the load at 80% streambank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types.

The sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment (<6.35 mm in diameter) in riffle areas. Streambank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Streambank erosion load allocations are based on the assumption that streambank erosion is the primary source of sediment.

5.4.7 Construction Stormwater and TMDL Wasteload Allocations

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

5.4.7.1 Municipal Separate Storm Sewer Systems

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

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

5.4.7.2 There are no MS4's in the Mid Snake River/Succor Creek HUC Industrial Stormwater Requirements

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

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

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

Although Idaho Concrete Nomad (permit no. IDR05C229) is an active facility near McBride Creek, DEQ is unable to quantify wasteload allocations for MSGPs. However, according to EPA (Jayne Carlin, pers. comm., 2013) this site, permitted under Idaho Sand & Gravel/Idaho Concrete, is below grade or otherwise controlled to prevent a discharge in all but extreme storm events. Therefore, there are no active point sources which need sediment wasteload allocations for McBride Creek at this time. Further, DEQ expects permittees to conduct any required monitoring under the permit and ensure BMPs appropriate to the site are applied and maintained to prevent water quality impairment.

None of the remaining mine claims that occur within the subwatersheds of this TMDL (Figures 14 through 18) are active at this time, and no discharge is anticipated (Forrest Griggs, pers. comm., 2013).

Table 10 displays a list of EPA-permitted NPDES active construction and industrial sources within the Mid Snake River/Succor Creek subbasin in Owyhee County. DEQ has reviewed all of these facilities which submitted notices of intent in Owyhee County under the NPDES stormwater permitting program, shown in this table. None of these facilities were found to discharge any of the pollutants into any of the impaired waters covered by this TMDL. This information is available from EPA at *http://cfpub.epa.gov/npdes/stormwater/noi/noisearch.cfm*.

Table 10. EPA-permitted NPDES active construction and industrial sources within the Mid Snake River/Succor Creek subbasin in Owyhee County. (Source: *http://cfpub.epa.gov/npdes/stormwater/noi/noisearch.cfm*)

TRACKING_NO.	NOI_SUBMITTED_DATE	DATE_OF_COVERAGE	APPLICATION_TYPE	ORGANIZATION_NAME	PROJECT_NAME	COUNTY	CITY	STATE	STATUS	ORIGIN
IDR10B652	August 30, 2006	September 06, 2006	Construction	BR MAIER PROPERTIES LLC	SANTA FE SUBDIVISION	Owyhee	Homedale	ID	Active	eNOI
IDR10BA68	January 16, 2007	January 23, 2007	Construction	HOMEDALE PLAZA PARTNERS, LLC	HOMEDALE MOTEL	Owyhee	Homedale	ID	Active	eNOI
IDR10BL45	October 19, 2007	October 26, 2007	Construction	PIPE INC	SNAKE RIVER RV PRESSURE SEWER	Owyhee	Homedale	ID	Active	eNOI
IDR10BP60	March 24, 2008	March 31, 2008	Construction	Kastera Development	Rivershore Subdivision	Owyhee	Homedale	ID	Active	eNOI
IDR10BQ24	April 16, 2008	April 23, 2008	Construction	Braman Lambdin Enterprises LLC	Rio and Bella Vista Estates Subdivision	Owyhee	Melba	ID	Active	eNOI
IDR10BR81	May 14, 2008	May 21, 2008	Construction	Michael Simmons	Leilani Estates	Owyhee	Marsing	ID	Active	eNOI
IDR05C217	May 19, 2009	July 18, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Becker	Owyhee	Grandview	ID	Active	eNOI
IDR05C229	May 28, 2009	June 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Nomad	Owyhee	Marsing	ID	Active	eNOI
IDR05C244	May 28, 2009	June 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Grandview	Owyhee	Grand View	ID	Active	eNOI
IDR05C263	May 19, 2009	July 27, 2009	Industrial	STAKER PARSON COMPANIES	Intl Stone Easy Running Horse	Owyhee	Homedale	ID	Active	eNOI
IDR05CS18	May 09, 2012	July 08, 2012	Industrial	Silver Falcon Mining Inc.	Diamond Creek Mill Inc.	Owyhee	Murphy	ID	Active	eNOI
IDR05CT27	May 31, 2012	July 30, 2012	Industrial	Silver Falcon Mining Inc.	Sinker Tunnel Mine Site	Owyhee	Murphy	ID	Active	eNOI
IDR05CT31	May 31, 2012	July 30, 2012	Industrial	Silver Falcon Mining Inc.	Belle Peck Adit	Owyhee	Murphy	ID	Active	eNOI
IDLEWC532	June 25, 2009	June 25, 2009	Low Erosivity	IDAHO TRANSPORTATION DEPT D3	SH-78, Jct SH-45 to Murphy Key 11044	Owyhee	Murphy	ID	Active	eNOI
IDLEWC535	June 26, 2009	June 26, 2009	Low Erosivity	CENTRAL PAVING CO., INC	SH-78 Jct Sh45 to Murphy	Owyhee	Murphy	ID	Active	eNOI
IDNOE0016	December 13, 2005	December 13, 2005	No Exposure	BAYER CROPSCIENCE	BAYER CROPSCIENCE	Owyhee	Marsing	ID	Active	NOI

Industrial Facilities Discharging to Impaired Water Bodies

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

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

TMDL Industrial Stormwater Requirements

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

5.4.7.3 Construction Stormwater

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

Construction General Permit and Stormwater Pollution Prevention Plans

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

TMDL Construction Stormwater Requirements

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

Postconstruction Stormwater Management

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

5.4.8 Reserve for Growth

Where applicable, states must include an allowance for future loading in their TMDL that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established. In the case of the Mid Snake River/Succor Creek TMDL addendum, an allowance for future growth is not recommended until such time as reductions indicate that beneficial uses have been restored or state water quality standards have been met. No point sources discharge to Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, or Vinson Wash. Any new point sources discharging to these water bodies would receive a wasteload allocation of zero. Therefore, the allowance for future growth is zero. Growth can only occur under the following auspices: (1) pollutant trading, (2) no net increase above the instream target parameters, and (3) no discharge where land application is the preferred option.

5.5 Implementation Strategies

The purpose of this implementation strategy is to outline the pathway by which the larger, more comprehensive 2005 implementation plan will be updated by the SWCC and Idaho Association of Soil Conservation Districts (IASCD) within 18 months after TMDL approval. The updated implementation plan will provide details of the actions needed to achieve load reductions (set forth in this TMDL), a schedule of those actions, and the monitoring needed to document actions and progress toward meeting state water quality standards.

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.

An implementation plan was created by the Idaho Soil Conservation Commission (now the Idaho Soil and Water Conservation Commission), IASCD, BLM, and the Idaho Department of Lands (IDL) in 2005 following completion of the 2003 TMDL (SWCC and IASCD 2005).

Planned activities in the 2005 implementation plan include:

- DEQ was to track annually the accomplishments that land management agencies have had toward achieving water quality standards.
- DEQ, BLM, IDL, and IASCD were to meet each year to document any projects that occurred over the previous field season.

- On private lands, IASCD, SWCC, and the NRCS (with help from BLM and IDL) were responsible for the following tasks:
    1. Developing conservation plans with private agricultural landowners
    2. Assisting private agricultural landowners to implement conservation plan components
    3. Monitoring conservation implementation progress and evaluating effects on vegetation, channel shape, and riparian area
    4. Installing “reference reach” transects on Castle and Succor Creeks to define potential natural shading of stream channels
- On federal lands, BLM was responsible for the following tasks:
    1. Completing 16 allotment assessments for grazing allotments
    2. Preparing water quality restoration plans for §303(d)-listed streams on all grazing allotments within the Mid Snake River/Succor Creek subbasin by December 2009
    3. Issuing new grazing permits that include BMPs identified to improve/restore the water quality of streams within BLM grazing allotments by December 2009
    4. Monitoring livestock use levels of riparian herbaceous vegetation and woody shrubs on §303(d)-listed streams on BLM grazing allotments at least biannually, at the end of the grazing season
    5. Monitoring effectiveness every 5 years of BMPs implemented to improve/restore water quality of §303(d)-listed streams on BLM grazing allotments
    6. Evaluating compliance every 5 years with State of Idaho water quality criteria in streams on BLM grazing allotments (with support from DEQ)
- On State of Idaho lands, IDL was responsible for the following tasks:
    1. Preparing or revising grazing management plans on State allotments every 4–10 years so that water quality standards will be met within a reasonable length of time
    2. Implementing grazing management plans on state grazing allotments
    3. Monitoring and reviewing state grazing leases
    4. Developing and implementing short- and long-term monitoring in state grazing allotments
- The Marsing and Homedale Wastewater Treatment Plants were supposed to write a nutrient reduction plan (DEQ 2007, p. 176).

Many of these original implementation measures could also be appropriate to the current TMDL addendum, understanding the need to expand and revise the focus to appropriately address the specific needs of the water bodies in this document.

5.5.1 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. Timelines may vary for different subwatersheds, which 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 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, designated management agencies, and other interested publics. In the meantime, implementation planning will begin immediately (2013). The goal is to attain the water quality standards and return beneficial uses to full support in the shortest time possible. DEQ expects full TMDL implementation and beneficial use recovery to take upwards of 20 years. Some subwatersheds may take less time and some may take more, depending on the complexity of the system.

5.5.2 Approach

DEQ will continue to use the same adaptive management approach outlined in the original TMDL (DEQ 2003).

5.5.3 Responsible Parties

The final implementation plan for this TMDL addendum will be developed under the existing practice established for the state of Idaho. The plan will be cooperatively developed by DEQ, the Snake River/Succor Creek WAG, the affected private landowners, and other designated management agencies with input from the established public process. The WAG will act as the integral part of the implementation planning process to identify appropriate implementation measures. Other individuals may also be identified to assist in developing site-specific implementation plans as their areas of expertise are identified as beneficial to the process.

Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those resources for which they have regulatory authority or programmatic responsibilities:

- **Idaho Department of Lands (IDL)** for timber harvest, oil and gas exploration and development, and mining—IDL will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **Idaho Soil and Water Conservation Commission (SWCC)** for grazing and agriculture—working in cooperation with local soil and water conservation districts, the Idaho State Department of Agriculture (ISDA), and the NRCS, the SWCC will provide technical assistance to agricultural landowners. These agencies will help landowners design BMPs appropriate for their property and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **Idaho Transportation Department** for public roads—The Idaho Transportation Department will ensure appropriate BMPs are used for construction and maintenance of public roads.

- **Idaho State Department of Agriculture (ISDA)** for aquaculture, animal feeding operations, and concentrated animal feeding operations—ISDA will work with aquaculture facilities to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, ISDA also inspects animal feeding operations, concentrated animal feeding operations, and dairies to ensure compliance with NPDES requirements.
- **DEQ** for all other activities—DEQ will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.

To the maximum extent possible, the implementation plan will be developed with participation from federal partners and land management agencies (e.g., NRCS, BLM, Bureau of Reclamation, etc.). In Idaho, these agencies, and their federal and state partners, are charged by the Clean Water Act to lend available technical assistance and other appropriate support to local efforts for water quality improvements.

All stakeholders in the Mid Snake River/Succor Creek subbasin have a responsibility for implementing the TMDL addendum. DEQ and the designated management agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers.

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

- Develop BMPs to achieve load allocations.
- Provide reasonable assurance that management measures will meet load allocations through both quantitative and qualitative analysis of management measures.
- Adhere to measurable milestones for progress.
- Develop a timeline for implementation, with reference to costs and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, load allocations and wasteload allocations are being met, and water quality standards are being met.

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

5.5.4 Implementation Monitoring Strategy

DEQ will continue to follow the same monitoring strategy outlined in the original TMDL (DEQ 2003).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.

Monitoring 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 in section 5.5.2.

5.5.4.1 Watershed 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. Watershed monitoring measures the success of the implementation measures in accomplishing the overall TMDL goals and includes instream monitoring. Implementation plan monitoring will also supplement the watershed information available during development of associated TMDLs and filling of data gaps. In this TMDL addendum, 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 main stem and/or tributaries.
- Gather information and fill data gaps to more accurately determine pollutant loading.

5.5.4.2 BMP Monitoring

The designated management agencies have primary responsibility for BMP monitoring. BMP monitoring measures the success of individual pollutant reduction projects. 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 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.

5.5.5 Pollutant Trading

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

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

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

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2010).

5.5.5.1 Trading Components

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

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

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

5.5.5.2 Watershed-Specific Environmental Protection

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

5.5.5.3 Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. While water quality trading opportunities have not been identified by DEQ or the WAG in the watershed, authorization has been included in the event future opportunities present themselves. The elements of a trading framework are described in DEQ’s pollutant trading guidance (DEQ 2010).

The elements of a trading document are described in DEQ’s Pollutant Trading Guidance: *http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf*.

6 Conclusions

Data analysis for a 5-year review of the Mid Snake River/Succor Creek TMDL was completed in 2011 (DEQ 2011b). This document is available at: *http://www.deq.idaho.gov/media/699532-snake-river-succor-creek-sba-tmdl-five-year-review-0911.pdf*. The identified pollutants in this subbasin are exclusively nonpoint source in nature. Tributaries are generally low volume rangeland streams whose geography, geology, land use, low flow volume, and flow alteration can lead to exceeding the Idaho water quality standard for sediment that is necessary to support cold water aquatic life. Irrigated agriculture is the probable primary source of sediment loading in Birch Creek and Vinson Wash. The target was established as 20 mg/L sediment concentration over a rolling 4-month average throughout the critical irrigation season (April 1–September 30). Instream channel erosion is the probable primary source of sediment loading in Hardtrigger, McBride, and Pickett Creeks. As a result, 80% bank stability was selected as a target to fully support cold water aquatic life beneficial uses in these creeks. A summary of assessment outcomes, including recommendations for changes to the next Integrated Report, is provided in Table 11.

This document was prepared with input from the public, as described in Appendix C. Following the public comment period, comments and DEQ responses will also be included in this appendix, and a distribution list will be included in Appendix D.

Table 11. Summary of assessment outcomes.

Water Body	Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to the Next Integrated Report	Justification
Birch Creek—upstream of Castle Creek Road to Snake River	ID17050103SW021_03 ID17050103SW021_04	Sediment	Yes	Move to Category 4a	TSS TMDL completed
Hardtrigger Creek—headwaters to Snake River	ID17050103SW008_02	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
McBride Creek—headwaters to Oregon line	ID17050103SW004_02 ID17050103SW004_03	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
Pickett Creek—Bates Creek confluence to Browns Creek confluence	ID17050103SW016_03	Sediment	Yes	Move to Category 4a	Bank Stability TMDL completed
Vinson Wash—Poison Creek confluence to mouth	ID17050103SW023_03	Sediment	Yes	Delist for Combined Biota/Habitat Bioassessments--Move to Category 4a	Sediment determined causal pollutant; TSS TMDL completed

References Cited

Carlisle, D.M., M.R. Meador, S.R. Moulton II, and P.M. Ruhl. 2007. "Estimation and Application of Indicator Values for Common Macroinvertebrate Genera and Families of the United States." *Ecological Indicators* 7:22–33.

CFR (Code of Federal Regulation). 1977. "Guidelines Establishing Test Procedures for the Analysis of Pollutants." 40 CFR 136.

CFR (Code of Federal Regulation). 1983. "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." 40 CFR 122.

CFR (Code of Federal Regulation). 1983. "Water Quality Standards." 40 CFR 131.

CFR (Code of Federal Regulation). 1995. "Water Quality Planning and Management." 40 CFR 130.

DEQ (Idaho Department of Environmental Quality). 2001a. *Blackfoot River TMDL: Waterbody Assessment and Total Maximum Daily Load*. Pocatello, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2001c. *Pahsimeroi River Subbasin Assessment and Total Maximum Daily Load*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2003a. *Bissel Creek Subbasin Assessment and Total Maximum Daily Load*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2003b. *Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Load*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2005. *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties*. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/wastewater/stormwater.aspx*.

DEQ (Idaho Department of Environmental Quality). 2007. *Addendum to the Mid-Snake/Succor Subbasin Assessment TMDL: South Fork Castle Creek Bacteria Analysis and Succor Creek and Castle Creek Temperature Total Maximum Daily Loads*. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx*

DEQ (Idaho Department of Environmental Quality). 2010. *Water Quality Pollutant Trading Guidance*. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/pollutant-trading.aspx*.

DEQ (Idaho Department of Environmental Quality). 2011a. *Idaho's 2010 Integrated Report*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2011b. *Mid Snake River/Succor Creek Subbasin: Five-Year Review of 2003 and 2007 Total Maximum Daily Loads*. Boise, ID: DEQ.

DEQ (Idaho Division of Environmental Quality). 1999a. *Lemhi River Watershed TMDL: An Allocation of Nonpoint Source Pollutants in the Water Quality Limited Watersheds of the Lemhi River Valley*. Boise, ID: DEQ.

DEQ (Idaho Division of Environmental Quality). 1999b. *Lower Boise River TMDL: Subbasin Assessment, Total Maximum Daily Loads*. Boise, ID: DEQ.

DEQ (Idaho Division of Environmental Quality). 1992. *The 1992 Idaho Water Quality Status Report*. Boise, ID: DEQ.

Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, and D.T. Mosier. 2002. *Water Body Assessment Guidance*, 2nd ed. Boise, ID: Department of Environmental Quality.

Hammer, M.J. 1986. *Water and Wastewater Technology*, 2nd ed. Englewood Cliffs, NJ: Prentice Hall, Inc.

Huff, D.D., S.L. Hubler, Y. Pan, and D.L. Drake. 2008. *Detecting Shifts in Macroinvertebrate Assemblage Requirements: Implicating Causes of Impairment in Streams*, version 1.1. Hillsboro, OR: Oregon Department of Environmental Quality, Laboratory and Environmental Assessment Division.

IDAPA. 2012. "Idaho Water Quality Standards." Idaho Administrative Code. IDAPA 58.01.02.

Knight, A. and J. Naymik. 2009. "Evaluation of Drain and Tributary Pollutant Sources to C.J. Strike-Swan Falls Reach, Snake River, Idaho." Boise, ID: Idaho Power Corporation. Swan Falls, FERC Project No. 503.

Newcombe, C.P. and J.O.T. Jensen. 1996. "Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact." *North American Journal of Fisheries Management* 16(4):693–727.

NRCS (Natural Resources Conservation Service). 1983. "Erosion and Sediment Yield." In: Proceedings from the Channel Evaluation Workshop. Ventura, CA.

Overton, C.K., J.D. McIntyre, R. Armstrong, S.L. Whitwell, and K.A. Duncan. 1995. *User's Guide to Fish Habitat: Descriptions that Represent Natural Conditions in the Salmon River Basin, Idaho*. Ogden, UT: Forest Service, Intermountain Research Station. INT-GTR-322.

Rabeni, C.F., K.E. Doisy, and L.D. Zweig. 2005. "Stream Invertebrate Community Functional Responses to Deposited Sediment." *Aquatic Sciences* 67:395–402.

Resource Planning Unlimited. 2003. *Idaho Agricultural Pollution Abatement Plan*. Available at *http://www.scc.idaho.gov/pdf/AgPlan.pdf*.

Strahler, A.N. 1957. "Quantitative Analysis of Watershed Geomorphology." *Transactions American Geophysical Union* 38:913–920.

Suren, A.M. 2005. "Effects of Deposited Sediment on Patch Selection by Two Grazing Stream Invertebrates." *Hydrobiologia* 549:205–218.

SWCC and IASCD (Idaho Soil Conservation Commission and Idaho Association of Soil Conservation Districts). 2005. *Mid Snake River/Succor Creek Watershed TMDL Implementation Plan for Agriculture*. Available at *http://www.deq.idaho.gov/media/453827-snake_river_succor_creek_plan_entire.pdf*.

US Congress. 1972. Clean Water Act (Federal Water Pollution Control Act). 33 USC §1251–1387.

Waters, T.F. 1995. *Sediment in Streams: Sources, Biological Effects, and Control*. American Fisheries Society Monograph 7. Bethesda, MD.

Weatherhead, M.A. and M. R. James. 2001. "Distribution of Macroinvertebrates in Relation to Physical and Biological Variables in the Littoral Zone of Nine New Zealand Lakes." *Hydrobiologia* 462:115–129.

GIS Coverages

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

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

Glossary

§303(d)

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

Assessment Unit (AU)

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Ephemeral Waters

A stream, reach, or water body that flows naturally only in direct response to precipitation in the immediate watershed and whose channel is at all times above the water table.

Exceedance

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

Fully Supporting

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

Intermittent Waters

A stream, reach, or water body which naturally has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based unregulated flow of less than one-tenth (0.1) cubic feet per second

	(cfs) is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load Capacity (LC)	How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.
Margin of Safety (MOS)	An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.
Nonpoint Source	A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.
Not Fully Supporting	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).

Point Source

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

Pollutant

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

Pollution

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

Stream Order

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

Total Maximum Daily Load (TMDL)

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

Wasteload Allocation (WLA)

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

Water Body

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

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of

	pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.
Water Quality Standards	State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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

Appendix A. Data Sources

Table A1. Major data sources for the Mid Snake River/Succor Creek subbasin assessment and TMDL addendum.

Water Body	Data Source[a]	Type of Data[b]	Collection Date
Birch Creek	Idaho Power Company	Flow, TSS concentration	2007
	DEQ	BURP	1995, 2001
Hardtrigger Creek	BLM	Streambank stability	2005–2012
	DEQ	BURP	1995, 1996, 1998
	DEQ	Streambank erosion inventory	2013
McBride Creek	BLM	Streambank stability	2011
	DEQ	BURP	1996, 2001
	DEQ	Streambank erosion inventory	2011
Pickett Creek	DEQ	BURP	1996, 2001
	DEQ	Streambank erosion inventory	2012
Vinson Wash	Idaho Power Company	Visual (flow)	2007
	DEQ	BURP	2001

[a] Idaho Department of Environmental Quality (DEQ), US Bureau of Land Management (BLM)
[b] Total suspended solids (TSS), Beneficial Use Reconnaissance Program (BURP)

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

Appendix B. Streambank Erosion Inventory Methodology and Results

The streambank erosion inventory used to estimate background and existing streambank erosion followed methods outlined in the proceedings from the Natural Resources Conservation Service (NRCS) Channel Evaluation Workshop (NRCS 1983). Using the direct volume method, subsections of §303(d)-listed streams were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

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

Bank Stability:

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

Bank Condition:

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

Vegetation/Cover On Banks:

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

Bank/Channel Shape:

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

Channel Bottom:

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

Deposition:

- No evidence of recent deposition—1
- Evidence of recent deposits, silt bars—0

Cumulative Rating

- Slight (0–4), Moderate (4.25–8), Severe (8.25–11.75), Very Severe (12+)
- From the cumulative rating, the lateral recession rate is assigned as follows:
  - 0.01–0.05 feet per year—**Slight**
  - 0.0525–0.15 feet per year—**Moderate**
  - 0.1525–0.47 feet per year—**Severe**
  - 0.5+ feet per year—**Very Severe**

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

Site Selection

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

Because it is often unrealistic to survey every stream segment, sample reaches were used and bank erosion rates were extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability, where stream segments with highly variable channel types need a large sample and segments with uniform gradient and consistent geometry need less. Typically >10% of a streambank should be inventoried. Often, the location of some stream inventory reaches is more dependent on landownership than watershed characteristics. For example, private landowners are sometimes unwilling to allow access to stream segments within their property.

Stream reaches are subdivided into sites with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry, there may be only one site per stream reach, whereas an area with variable conditions may have several sites. Subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

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

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

Bank Erosion Calculations

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

The direct volume method is summarized in the following equations:

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

where:

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

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

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

where:

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

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

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

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

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

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

References

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. *Fluvial Processes in Geomorphology*. San Francisco, CA: Freeman.

Lohrey, M.H. 1989. “Stream Channel Stability Guidelines for Range Environmental Assessment and Allotment Management Plans.” US Forest Service, Northwest Region (unpublished).

NRCS (Natural Resources Conservation Service). 1983. “Erosion and Sediment Yield.” In: Proceedings from the Channel Evaluation Workshop. Ventura, CA.

Pfankuch, D.J. 1975. *Stream Reach Inventory and Channel Stability Evaluation*. Missoula, MT: US Forest Service, Northern Region.

Rosgen, D.L. 1996. *Applied River Morphology*. Pagosa Springs, CO: Wildland Hydrology.

Stevenson, T.K. 1994. USDA-NRCS, Idaho. Channel erosion condition inventory description. Memorandum to Paul Shelton, District Conservationist, Montpelier FO, Idaho, 5/24/94: describing estimation of streambank, road and gully erosion.

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Hardtrigger Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Above canyon to above LHT confluence	*Upstream: N*	LHT = 43.354605; HT = 43.361491	3594; 3517
Assessment Unit:	ID17050103SW008_02	*W*	LHT = -116.79497; HT = -116.802522	
	Analysis includes approximately 13 AU miles	*Downstream: N*	43.3748	3088
Date Collected:	March 26 and 27, 2013	*W*	-116.763010	
Field Crew:	Troy Smith & Josh Schultz	**Notes:** 3 segments were inventoried for approximately 15630 ft along Hardtrigger and Little Hardtrigger Creeks within the AU_03.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	15630.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	31260.00	ft	"
Erosive Bank Length	6233.81	ft	"
Erosive Bank to Bank Length	12467.62	ft	"
Percent Eroding Bank	39.9	%	"
Bank to Bank Eroding Area (AE)	15024.02	ft^2	"
Lateral Recession Rate (RLR)	0.12		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	99.16	tons/year	"
Bank Erosion Rate (ER)	33.50	tons/mile/year	Reach and Segment
Length of Similar Stream	53010	ft	Total Reach
Total Streambank Erosion	435.46	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	1.75	1
Bank Erosion (0-3)	1.25	1
Vegetative/cover on Banks (0-3)	1.5	1
Bank/Channel Shape - downcutting (0-3)	0.75	1
Channel Bottom (0-2)	1.75	0
Deposition (0-1)	0	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	7	4
Recession Rate	0.12	0.05

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	7533.93	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	20.72	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	7.00	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	90.99	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction	Total Erosion (tons/yr) Reduction
33	435	7	91	79%	344

Stream Name: Hardtrigger Creek
Segment: Above Confluence
Date: 3/26/2013

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.3	16.4	5.4	
0.0	0.0	0.0	
0.3	6.6	2.2	
1.0	6.6	6.5	
0.3	3.3	1.1	
0.3	3.3	1.1	
0.5	13.1	6.5	
1.0	0.0	0.0	
1.0	8.5	8.4	
1.3	14.8	19.4	
0.3	23.0	7.5	
0.3	29.5	9.7	
1.6	2.6	4.3	
1.0	6.6	6.5	
0.3	10.2	3.3	
0.3	17.1	5.6	
2.0	4.6	9.0	
3.3	4.9	16.1	
0.7	16.1	10.5	
1.0	9.2	9.0	
0.3	7.9	2.6	
0.7	28.9	18.9	
1.0	19.7	19.4	
2.3	5.2	12.1	
0.7	3.9	2.6	
0.7	3.0	1.9	
2.6	6.2	16.4	
0.3	17.4	5.7	
1.0	27.2	26.8	
1.0	5.9	5.8	
1.0	5.2	5.2	
0.7	4.3	2.8	
0.3	13.1	4.3	
0.3	7.9	2.6	
0.3	24.0	7.9	
1.0	15.4	15.2	
1.0	3.6	3.6	
1.6	4.9	8.1	
1.0	5.2	5.2	
1.0	16.4	16.1	
1.0	6.6	6.5	
0.7	11.5	7.5	
0.7	12.5	8.2	
0.7	7.9	5.2	
1.3	4.3	5.6	
0.3	14.8	4.8	
0.7	5.6	3.7	
2.6	19.0	49.9	
1.3	54.1	71.0	
2.0	3.6	7.1	

Stream Name: Little Hardtrigger Creek
Segment: Above Confluence
Date: 3/26/2013

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.7	12.1	7.9	
0.3	36.4	11.9	
1.0	4.3	4.2	
1.6	17.4	28.5	
0.7	7.9	5.2	
0.7	22	14.4	
1.3	5.9	7.7	
1.3	9.8	12.9	
0.3	16.1	5.3	
0.3	19.7	6.5	
0.7	3.9	2.6	
0.7	5.9	3.9	
0.7	21.7	14.2	
1.3	17.1	22.4	
1.0	19.7	19.4	
0.3	5.6	1.8	
0.7	5.9	3.9	
0.3	12.5	4.1	
2.3	2.3	5.3	
2.0	1.6	3.1	
3.3	13.1	43.0	
0.0	0	0.0	
0.7	15.1	9.9	
0.7	16.7	11.0	
0.7	24.9	16.3	
1.3	2	2.6	
0.3	8.5	2.8	
1.0	10.5	10.3	
0.7	2	1.3	
1.0	3.9	3.8	
1.0	3.3	3.2	
1.0	3	3.0	
0.7	3.9	2.6	
1.3	17.4	22.8	
0.7	5.2	3.4	
0.7	6.2	4.1	
1.0	19.7	19.4	
0.0	0	0.0	
1.3	11.2	14.7	
1.0	11.2	11.0	
1.0	5.6	5.5	
0.7	2	1.3	
0.7	10.8	7.1	
1.3	10.8	14.2	
1.3	4.9	6.4	
1.3	5.2	6.8	
1.3	3.6	4.7	
Total	468.5	416.7	3275.0
			14.31%

1.6	11.8	19.4	
1.0	5.6	5.5	
1.6	5.9	9.7	
1.3	4.9	6.5	
0.7	11.5	7.5	
0.7	20.0	13.1	
0.3	10.8	3.6	
1.3	13.1	17.2	
0.3	11.5	3.8	
0.7	8.5	5.6	
1.0	2.3	2.3	
1.0	2.6	2.6	
1.6	1.6	2.7	
1.0	7.9	7.8	
1.0	5.6	5.5	
1.3	6.2	8.2	
2.0	14.4	28.4	
1.0	7.5	7.4	
4.3	11.8	50.4	
3.0	59.1	174.4	
1.6	9.5	15.6	
1.0	16.7	16.5	
0.3	98.4	32.3	
0.7	5.6	3.7	
0.3	19.7	6.5	
0.3	4.9	1.6	
1.0	32.8	32.3	
0.7	29.2	19.2	
2.0	3.0	5.8	
0.7	12.5	8.2	
1.3	41.7	54.7	
0.3	5.9	1.9	
0.7	4.6	3.0	
2.0	4.3	8.4	
0.7	22.3	14.6	
1.0	7.9	7.8	
1.3	24.0	31.4	
1.0	3.0	2.9	
0.7	3.9	2.6	
1.0	51.5	50.7	
1.0	5.9	5.8	
1.6	14.4	23.7	
Total	1205.7	1215.0	3095.0
			38.96%

Stream Name: Hardtrigger Creek
Segment: Above Canyon & Below Confluence
Date: 3/27/2013

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
3.9	3.6	14.2	
1.3	21	27.6	
1.6	11.5	18.9	
1.6	11.5	18.9	
1.3	2	2.6	
1.3	3	3.9	
0.7	4.3	2.8	
0.7	3.6	2.4	
1.3	3.3	4.3	
1.6	32.2	52.8	
0.0	0	0.0	
1.0	26.2	25.8	
1.0	6.6	6.5	
1.0	58.1	57.2	
4.3	5.9	25.2	
0.7	2.6	1.7	
0.7	6.2	4.1	
1.0	7.2	7.1	
0.7	7.5	4.9	
1.0	19.7	19.4	
0.3	11.8	3.9	
0.3	6.2	2.0	
0.7	56.1	36.8	
1.0	3.9	3.8	
1.3	2.3	3.0	
1.3	3	3.9	
1.3	3	3.9	
1.0	1.6	1.6	
2.0	4.9	9.6	
1.0	3.9	3.8	
0.7	8.2	5.4	
0.7	4.3	2.8	
4.9	30.8	151.6	
1.6	16.4	26.9	
1.3	3.9	5.1	
1.3	5.6	7.3	
0.7	54.8	36.0	
0.7	7.2	4.7	
0.7	13.1	8.6	
1.0	14.1	13.9	
1.0	6.9	6.8	
1.0	3.9	3.8	
1.3	14.1	18.5	
1.6	5.6	9.2	
0.7	16.1	10.6	
1.6	5.9	9.7	
0.0	0	0.0	
2.0	3.6	7.1	
2.0	3	5.9	
1.3	52.5	68.9	

0.7	18.4	12.1
3.3	4.9	16.1
1.3	4.9	6.4
1.3	2	2.6
1.0	3.9	3.8
1.3	18.4	24.1
1.0	24.6	24.2
0.7	7.2	4.7
1.0	32.8	32.3
4.3	11.8	50.3
1.0	19.7	19.4
0.7	23.3	15.3
0.7	7.5	4.9
0.7	8.9	5.8
0.7	2	1.3
0.7	4.6	3.0
1.0	6.6	6.5
1.0	10.8	10.6
1.0	6.6	6.5
1.6	19.7	32.3
0.7	5.9	3.9
0.7	11.2	7.3
1.0	5.2	5.1
1.0	19.7	19.4
1.6	4.3	7.1
0.7	6.6	4.3
1.0	11.8	11.6
0.7	18	11.8
1.6	3	4.9
1.6	3.3	5.4
1.3	17.4	22.8
1.6	8.9	14.6
1.3	2	2.6
2.0	3.6	7.1
1.6	16.7	27.4
1.0	4.6	4.5
3.6	11.8	42.6
0.3	13.8	4.5
1.0	3.9	3.8
1.3	23.6	31.0
4.6	10.2	46.9
1.6	6.2	10.2
1.3	16.4	21.5
1.3	5.6	7.3
1.6	6.6	10.8
1.6	26.2	43.0
1.3	15.7	20.6
1.3	44.9	58.9
0.3	22.3	7.3
1.3	4.9	6.4
0.3	59.1	19.4
0.7	17.7	11.6
1.6	4.9	8.0
1.6	9.5	15.6
1.3	6.6	8.7
1.0	4.3	4.2
3.3	3	9.8

1.0	3.6	3.5
1.3	9.5	12.5
1.3	18	23.6
1.3	46.6	61.2
1.3	121.1	158.9
1.3	2	2.6
0.3	17.1	5.6
0.7	16.7	11.0
1.3	10.2	13.4
1.6	16.7	27.4
3.0	10.8	31.9
0.7	9.8	6.4
1.6	24	39.4
1.0	3.6	3.5
1.0	76.1	74.9
1.6	26.9	44.1
1.6	12.1	19.8
1.0	65.6	64.6
1.3	13.1	17.2
2.0	12.1	23.8
1.3	19.4	25.5
0.0	0	0.0
2.3	4.3	9.9
1.3	27.2	35.7
1.6	115.8	190.0
3.0	3.3	9.7
1.0	14.4	14.2
1.0	9.5	9.4
0.7	15.7	10.3
2.3	40.4	92.8
1.0	31.2	30.7
2.0	45.9	90.4
1.0	10.8	10.6
1.6	17.7	29.0
0.3	16.4	5.4
1.3	6.2	8.1
1.3	4.3	5.6
1.3	5.9	7.7
1.6	15.4	25.3
1.0	24.6	24.2
1.3	24.3	31.9
1.0	10.2	10.0
1.0	99.1	97.5
1.0	52.5	51.7
1.0	26.2	25.8
0.7	17.4	11.4
1.6	43.6	71.5
1.0	17.1	16.8
1.6	28.9	47.4
1.0	33.1	32.6
1.3	70.5	92.5
0.7	24.3	15.9
1.3	29.2	38.3
0.7	44.6	29.3
1.0	117.8	115.9
0.7	24	15.7
0.7	32.5	21.3

0.7	102.4	67.2
0.7	24.3	15.9
6.6	14.8	97.1
0.7	33.5	22.0
0.7	40	26.2
1.0	11.5	11.3
0.7	23.3	15.3
0.3	12.1	4.0
1.0	10.2	10.0
1.3	6.6	8.7
0.3	42.7	14.0
1.0	32.5	32.0
0.7	25.3	16.6
1.6	16.7	27.4
1.0	45.3	44.6
1.0	6.2	6.1
2.6	42.7	112.1
1.0	12.1	11.9
1.6	7.2	11.8
1.0	19	18.7
1.3	19.7	25.9
1.0	22	21.7
0.7	21.7	14.2
1.0	28.9	28.4
1.3	4.6	6.0
0.7	14.1	9.3
3.0	45.9	135.5
0.0	0	0.0
2.0	19.4	38.2
1.0	18.7	18.4
1.3	65	85.3
1.3	24	31.5
1.0	17.1	16.8
0.7	11.2	7.3
2.0	23	45.3
1.6	13.1	21.5
0.7	8.9	5.8
1.3	13.5	17.7
1.0	7.2	7.1
1.0	7.2	7.1
1.3	16.4	21.5
0.7	16.1	10.6
1.3	8.5	11.2
0.3	15.1	5.0
0.7	4.9	3.2
1.0	14.8	14.6
1.0	10.5	10.3
1.0	21	20.7
0.7	6.2	4.1
0.3	5.2	1.7
0.7	25.3	16.6
1.0	13.5	13.3
1.0	3.9	3.8
0.3	3.6	1.2
0.7	4.3	2.8
1.3	4.6	6.0
1.3	5.2	6.8

1.3	8.9	11.7	
1.0	4.6	4.5	
0.7	3.6	2.4	
0.0	0	0.0	
0.3	23.3	7.6	
0.7	7.5	4.9	
1.0	6.6	6.5	
1.0	2	2.0	
1.3	3.6	4.7	
0.7	3.6	2.4	
13.1	45.9	602.4	
1.0	11.8	11.6	
0.7	16.4	10.8	
1.3	32.5	42.7	
0.7	10.8	7.1	
0.7	10.2	6.7	
0.3	17.4	5.7	
1.3	15.7	20.6	
1.0	19.7	19.4	
1.3	12.8	16.8	
1.0	49.9	49.1	
0.7	27.9	18.3	
1.3	6.2	8.1	
0.7	19	12.5	
0.7	16.4	10.8	
0.7	105	68.9	
0.7	18.7	12.3	
0.7	4.6	3.0	
1.0	7.2	7.1	
1.0	15.1	14.9	
Total	4559.6	5880.3	9260.0
			49.24%

BANK STABILITY INVENTORY FIELD FORM

Surveyors: John Schutte, ~~Troy~~ Smith

Stream: Hardtrigger Reach: Above Confluence w/L.AT Date: 3/26/13 Page: 1 of 3

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
4		5	.1	35	road	1.3	.2
5				36	road	4	.1
6		2	.1	37		2.4	.1
7		2	.3	38		7.3	.1
8		1	.1	39		4.7	.3
9		1	.1	40		1.1	.3
10		4 ~~1.2~~	.15 ~~.2~~	41		1.5	.5
11		1.3	.3	42		1.6	.3
12		2.6	.3	43		5.0	.3
13		4.5	.4	44		2.0	.3
14	road	7	.1	45		3.5	.2
15		9 ~~8~~	.1	46		3.8	.2
16		.8	.5	47		2.4	.2
17		2	.3	48		1.3	.4
18		3.1	.1	49	road	4.5	.1
19		5.2	.1	50		1.7	.2
20		1.4	.6	51		5.8	.8
21		1.5	1.0	52		16.5	.4
22		4.9	.2	53		1.1	.6
23		2.8	.3	54		3.6	.5
24	animal crossing	2.4	.1	55		1.7	.3
25		8.8	.2	56		1.8	.5
26		6	.3	57		1.5	.4
27		1.6	.2	58		3.5	.2
28		1.2	.2	59		6.1	.2
29		.9	.2	60		3.3	.1
30		1.9	.8	61		4	.4
31		5.3	.1	62		3.5	.1
32		8.3	.3	63		2.6	.2
33		1.8	.3	64		.7	.3
34	road	1.6	.3	65		.8	.3

Bank erosion evidence	0 1 2 3	Lateral channel stability	0 1 2
Bank stability condition	0 1 2 3	Channel bottom stability	0 1 3
Bank cover/vegetation	0 1 2 3	In-channel deposition	-1 0 1

TOTAL SCORE

Typical Bank Material:

Notes:

left Bank

BANK STABILITY INVENTORY FIELD FORM

Surveyors: Smith/Schultz

Stream: Hardtrigger (at Hardtrigger) Reach: ~~Above Confluence Hardtrigger~~ Above Confluence L.H.T. Date: 3/26/13 Page: 2 of 3

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)	
66		.5	.5	96	Top LHT			
67		2.4	.3	97		3.7	.2	Begin L.H.T
68		1.7	.3	98		11.1	.1	
69		1.9	.4	99		1.3	.3	
70		4.4	.6	739		5.3	.5	
71		2.3	.3	853		2.4	.2	
72		3.6	1.3	854	6.7	~~7.7~~	.2	
73	con inf.	18	.9	855		1.8	.4	
74		2.9	.5	856		3	.4	
75		5.1	.3	857		4.9	.1	
76		30	.1	858		6.0	.1	L.H.T
77		1.7	.2	859		1.2	.2	
78	cond	6.0	.1	860		1.8	.2	
79		1.5	.1	861		6.6	.2	
80		10	.3	862		5.2	.4	
81		8.9	.2	863		6.0	.3	
82		.9	.6	864		1.7	.1	
83		3.8	.2	865		1.8	.2	
84		12.7	.4	866		3.8	.1	
85		1.8	.1	867		.7	.7	
86		1.4	.2	868		.5	.6	
87		1.3	.6	~~868~~	869	4.0	1.0	
88		6.8	.2	870				
89		2.4	.3	871		4.6	.2	
90		2.3	.4	872		5.1	.2	
91		.9	.3	873		7.6	.2	
92		1.2	.2	874		.6	.4	
93	cond, scr, x	15.7	.3	875		2.6	.1	
94		1.8	.3	876		3.2	.3	
confl. 95		4.4	.5	877		.6	.2	
—				878		1.2	.3	

Bank erosion evidence	0 1 2 3	Lateral channel stability	0 1 2
Bank stability condition	0 1 2 3	Channel bottom stability	0 1 3
Bank cover/vegetation	0 1 2 3	In-channel deposition	-1 0 1

TOTAL SCORE

Typical Bank Material:

Notes: Right bank L.H.T

BANK STABILITY INVENTORY FIELD FORM

Surveyors Smith/Schultz

Stream: LH/T Reach: Above Confluence w/ Hardtrigger Date: 3/26/13 Page: 3 of 3

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
879		1.8	.3				
880		.9	.3				
881		1.2	.2				
882		5.3	.4				
883	1.6	2.6	.2				
884		1.9	.2				
885		6.0	.3				
886	Fenceline						
887		3.4	.4				
888		3.4	.3				
889		1.7	.3				
890		.6	.2				
891		3.3	.2				
892		3.3	.4				
893		1.5	.4				
894		1.6	.4				
895		1.1	.4				
896	confluence						

Bank erosion evidence	0 1 2 3	Lateral channel stability	0 1 2
Bank stability condition	0 1 2 3	Channel bottom stability	0 1 3
Bank cover/vegetation	0 1 2 3	In-channel deposition	-1 0 1

TOTAL SCORE

Typical Bank Material:

Notes:

BANK STABILITY INVENTORY FIELD FORM

Surveyors Smith Schultz

Stream: Hardtrigger Reach: Below L.H.T. confluence Date: 3/27/13 Page: 1 of 5

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)	
897	Hardtrigger bottom of reach			928		2.5	.2	
898		~~1.2"~~	1.2	929		1.3	.2	
899		6.4	.4	930		9.4	~~.9~~	1.5
900		3.5	.5	931		5.0	.5	
901		3.5	.5	932		1.2	.4	
902		.6	.4	933		1.7	.4	
903		.9	.4	934		16.7	.2	✓ L.P.
904		1.3	.2	935		2.2	.2	
905		1.1	.2	936		4.0	.2	
906		1.0	.4	937		4.3	.3	
907		9.8	.5	938		2.1	.3	
908		—	—	939		1.2	.3	
909		8.0	.3	940		4.3	.4	
910		2.0	.3	941		1.7	.5	
911		17.7	.3 ~~.2~~	942		4.9	.2	
912		1.8	1.3	943		1.8	.5	
913		.8	.2	944		—	—	
914		1.9	.2	945		1.1	.6	
915		2.2	.3	946		.9	.6	
916		2.3	.2	947		16.0	.4	
917		6.0	.3	948		5.6	.2	
918		3.6	.1	949		1.5	1.0	
919		1.9	.1	950		1.5	.4	
920		17.1	.2	951		.6	.4	
921		1.2	.3	952		1.2	.3	
922		.7	.4	953		5.6	.4	
923 ~~93~~		.9	.4	954		7.5	.3	
924		.9	.4	955		2.2	.2	
925		.5	.3	956		10.0	.3	
926		1.5	.6	957		3.6	1.3	
927		1.2	.3	958		6.0	.3	

Bank erosion evidence 0 1 2 3 Lateral channel stability 0 1 2

Bank stability condition 0 1 2 3 Channel bottom stability 0 1 3

Bank cover/vegetation 0 1 2 3 In-channel deposition -1 0 1

TOTAL SCORE

Typical Bank Material:

Notes: ~~Left~~ Right Bank

BANK STABILITY INVENTORY FIELD FORM Surveyors Smith/Schultz

Stream: Hardtrigger Reach: Below L.H.T confluence Date: 3/27/13 Page: 3 of 5

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
959		7.1	.2	990		5.0	.4
960		2.3	.2	991		1.7	.4
961		2.7	.2	992		2.0	.5
962		.6	.2	993		8.0	.5
963		1.4	.2	994		4.8	.4
964		2.0	.3	995		13.7	.4
965		3.3	.3	996		6.8	.1
966		2.0	.3	997		1.5	.4
967	6.0	~~2.6~~	.5	998		18.0	.1
968		1.8	.2	999		5.4	.2
969		3.4	.2	1000		1.5	.5
970		1.6	.3	1001		2.9	.5
971		6.0	.3	1002		2.0	.4
972		1.3	.5	1003		1.3	.3
973		2.0	.2	1004		.9	1.0
974		3.6	.3	1005		1.1	.3
975		5.5	.2	1006		2.9	.4
976		.9	.5	1007		5.5	.4
977		1.0	.5	1008		14.2	.4
978		5.3	.4	1009		36.9	.4
979		2.7	.5	1010		.6	.4
980		.6	.4	1011		5.2	.1
981		1.1	.6	1012		5.1	.2
982		5.1	.5	1013		3.1	.4
983		1.4	.3	1014		5.1	.5
984		3.6	1.1	1015		3.3	.9
985	Road	4.2	~~4.2~~	1016		3.0	.2
986		1.2	.3	1017		7.3	.5
987		7.2	.4	1018		1.1	.3
988		3.1	1.4	1019		23.2	0.3
989		1.9	.5	1020		8.2	~~.6~~ .5

Bank erosion evidence	0 1 2 3	Lateral channel stability	0 1 2
Bank stability condition	0 1 2 3	Channel bottom stability	0 1 3
Bank cover/vegetation	0 1 2 3	In-channel deposition	-1 0 1

TOTAL SCORE

Typical Bank Material:

Notes:

BANK STABILITY INVENTORY FIELD FORM

Surveyors Smith/Schultz

Stream: Hardtrigger Reach: Below L.H.T. Confluence Date: 3/27/13 Page: 3 of 5

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
1021		3.7	.5	1052		5.2	.3
1022		20.0	.3	1053		8.8	.5
1023		4.0	.4	1054		10.1	.3
1024		3.7	.6	1055		21.5	.4
1025		5.9	.4	1056		7.4	.2
1026	—	—	—	1057		8.9	.4
1027		1.3	.7	1058		13.6	.2
1028		8.3	.4	1059		35.9	.3
1029		35.3	.5	1060		7.3	~~.1~~ .2
1030		1.0	.9	1061		9.9	.2
1031		4.4	~~.6~~ .3	1062		31.2	.2
1032		2.9	.3	1063		7.4	.2
1033		4.8	.2	1064		4.5	2.0
1034		12.3	.7	1065		10.2	.2
1035		9.5	.3	1066		12.2	.2
1036		14.0	.6	1067		3.5	.3
1037		3.3	.3	1068		7.1	.2
1038		5.4	.5	1069	Road	3.7	—
1039	Road	5.0	—	1070		3.1	.3
1040		1.9	.4	1071		2.0	.4
1041		1.3	.4	1072		13.0	.1
1042		1.8	.4	1073		9.9	.3
1043		4.7	.5	1074		7.7	.2
1044		7.5	.3	1075		5.1	.5
1045		7.4	.4	1076		13.8	~~.2~~ .3
1046		3.1	.3	1077		1.9	.3
1047		30.2	.3	1078		13.0	.8
1048		16.0	.3	1079		3.7	.3
1049		8.0	.3	1080		2.2	.5
1050		5.3	.2	1081		5.8	.3
1051		13.3	~~.4~~ .5	1082		6.0	~~.3~~ .4

Bank erosion evidence 0 1 2 3 Lateral channel stability 0 1 2

Bank stability condition 0 1 2 3 Channel bottom stability 0 1 3

Bank cover/vegetation 0 1 2 3 In-channel deposition -1 0 1

TOTAL SCORE

Typical Bank Material:

BANK STABILITY INVENTORY FIELD FORM

Surveyors Smith/Schultz

Stream: Hardtrigger Reach: Below L.H.T. Confluence Date: 3/27/13 Page: 4 of 5

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
1083		6.7	.3	1114		1.2	.3
1084		6.6	.2	1115		1.1	.1
1085		8.8	.3	1116		1.3	.2
1086		1.4	.4	1117		1.4	.4
1087		4.3	.2	1118		1.6	.4
1088	+9	14.0	.9	1119		2.7	.4
1089	———	———	———	1120		1.4	.3
1090		5.9	.6	1121		1.1	.2
1091		5.7	.3	1122	———	———	———
1092		19.8	.4	1123		7.1	.1
1093		7.3	.4	1124		2.3	.2
1094		5.2	.3	1125		2.0	.3
1095		3.4	.2	1126		.6	.3
1096		7.6	.6	1127		1.7	.4
1097		4	.5	1128		1.1	.2
1098		2.7	.2	1129		14.0	4.0
1099		4.1	.4	1130		3.6	.3
1100		2.2	.3	1131		5.6	.2
1101		2.2	.3	1132		4.9	.4
1102	5.0	~~17~~	.4	1133		3.3	.2
1103		4.9	.2	1134		3.1	.2
1104		2.6	.4	1135		5.3	.1
1105	road	4.6	—	1136		4.8	.4
1106		1.5	.2	1137		6.0	.3
1107	↑	4.5	.3	1138		3.9	.4
1108	animal [illegible]	~~2~~ 3.2	.3	1139		15.2	.3
1109		6.4	.3	1140		8.5	.2
1110		1.9	.2	1141		1.9	.4
1111		1.6	.1	1142		5.8	.2
1112		7.7	.2	1143		5.0	.2
1113		4.1	.3	1144		32	.2

Bank erosion evidence 0 1 2 3 Lateral channel stability 0 1 2

Bank stability condition 0 1 2 3 Channel bottom stability 0 1 3

Bank cover/vegetation 0 1 2 3 In-channel deposition -1 0 1

TOTAL SCORE

BANK STABILITY INVENTORY FIELD FORM

Surveyors Smith/Schultz

Stream: Hardtrigger Reach: Below L.H.T Confluence Date: 3/27/13 Page: 5 of 5

GPS point (start)	GPS Point (end)	Length (m or ft)	Avg Height (m or ft)	GPS point (start)	GPS Point (end)	Length (m or ft)	Avg height (m or ft)
1145		5.7	.2				
1146		1.4	.2				
1147		2.2	.3				
1148		4.6	.3				
1149	End	of	reach				

Bank erosion evidence 0 1 2 3 Lateral channel stability 0 1 2

Bank stability condition 0 1 2 3 Channel bottom stability 0 1 3

Bank cover/vegetation 0 1 2 3 In-channel deposition -1 0 1

TOTAL SCORE

Typical Bank Material:

Notes:

17050103SW008-02

Stream Erosion Condition Inventory Worksheet

DATE 3/26/13 Stream Name and AU Hard trigger Creek + L. Hard trigger Creek - above confluence w/ L. Hard trigger Creek

Location (upper and lower bounds)________ Surveyors T. Smith / J. Schultz

RATED FACTOR		RATING
1. BANK STABILITY		1.5
Does not appear to be eroding	0	
Erosion evident	1	
Erosion & cracking present	2	
Slumps & clumps sloughing off	3	
2. BANK CONDITION		0.5
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 & gullies, severe vegetative overhang, falling trees	3	
3. VEGETATION/COVER ON BANKS		1.5
Predominantly perennials or rock-covered	0	
Annuals/perennials mixed or about 40% bare	1	
Annuals or about 70% bare	2	
Predominantly bare	3	
4. BANK/CHANNEL SHAPE		0.5
V-shaped channel, sloped banks	0	
Steep V-shape channel, near vertical banks	1	
Vertical Banks, U-shaped channel	2	
U-shaped channel, undercut banks, meandering channel	3	
5. CHANNEL BOTTOM		1.5
Channel in bedrock/non-eroding	0	
Soil bottom, gravels or cobbles, minor erosion	1	
Silt bottom, evidence of active downcutting	2	
6. DEPOSITION		0
No evidence of recent deposition	1	
Evidence of recent deposits, silt bars	0	

SLIGHT (0-4) _____ MODERATE (5-8) 5.5 SEVERE (9+) _____

Is flow a contributing factor? Yes ~~NA~~ No ✓ (If yes, why?) _____

Any other contributing factors (animal access, return flows, etc.) evident? A lot of evident animal access - probably horses

Comments Thick w/ algae + aquatic veg

~~Streambank Stability %~~
~~Covered/Stable ___ Uncovered/Stable ___ Covered/Unstable ___ Uncovered/Unstable ___~~

17050103SW008_02

Stream Erosion Condition Inventory Worksheet

DATE 3/27/13 Stream Name and AU Hardtrigger Creek - Below confluence w/ L. Hardtrigger

Location (upper and lower bounds)________ Surveyors T. Smith / J. Schultz

RATED FACTOR		RATING
1. BANK STABILITY		(2)
Does not appear to be eroding	0	
Erosion evident	1	
Erosion & cracking present	2	
Slumps & clumps sloughing off	3	
2. BANK CONDITION		(2)
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 & gullies, severe vegetative overhang, falling trees	3	
3. VEGETATION/COVER ON BANKS		(1.5)
Predominantly perennials or rock-covered	0	
Annuals/perennials mixed or about 40% bare	1	
Annuals or about 70% bare	2	
Predominantly bare	3	
4. BANK/CHANNEL SHAPE		(1)
V-shaped channel, sloped banks	0	
Steep V-shape channel, near vertical banks	1	
Vertical Banks, U-shaped channel	2	
U-shaped channel, undercut banks, meandering channel	3	
5. CHANNEL BOTTOM		(2)
Channel in bedrock/non-eroding	0	
Soil bottom, gravels or cobbles, minor erosion	1	
Silt bottom, evidence of active downcutting	2	
6. DEPOSITION		(0)
No evidence of recent deposition	1	
Evidence of recent deposits, silt bars	0	

SLIGHT (0-4) ______ MODERATE (5-8) 8.5 SEVERE (9+) ______

Is flow a contributing factor? Yes ____ No ✓ (If yes, why?) ______

Any other contributing factors (animal access, return flows, etc.) evident? Evident animal use/tracks - horses

Comments Lots of aquatic veg & algae. Also, lots of apparent trampling by Horses & or wildlife (cattle were not yet released on this range)

Streambank Stability %

Covered/Stable ____ Uncovered/Stable ____ Covered/Unstable ____ Uncovered/Unstable ____

Representative Hardtrigger Creek SEI Photos – March 26 and 27, 2013

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	McBride Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Lower	*Upstream: N*	43.33842	3929
Assessment Unit:	ID17050103SW004_03	*W*	-117.01158	
	Analysis includes approximately 2.8 AU miles.	*Downstream: N*	43.33629	3894
Date Collected:	1-Aug-11	*W*	-117.024940	
Field Crew:	BRO BURP Crew	**Notes:** This segment was inventoried for approximately 3800 ft at the lower end of McBride Creek watershed.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	3800.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	7600.00	ft	"
Erosive Bank Length	1476.45	ft	"
Erosive Bank to Bank Length	2952.90	ft	"
Percent Eroding Bank	38.9	%	"
Bank to Bank Eroding Area (AE)	8287.33	ft^2	"
Lateral Recession Rate (RLR)	0.135		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	61.53	tons/year	"
Bank Erosion Rate (ER)	85.50	tons/mile/year	Reach and Segment
Length of Similar Stream	10931	ft	Total Reach
Total Streambank Erosion	238.54	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	3	1
Bank Erosion (0-3)	2	1
Vegetative/cover on Banks (0-3)	1.5	1
Bank/Channel Shape - downcutting (0-3)	2	1
Channel Bottom (0-2)	0	0
Deposition (0-1)	-1	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	7.5	4
Recession Rate	0.135	0.05

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	4265.89	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	11.73	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	16.30	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	45.48	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity		Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)		
85	239	16	45	81	193

Stream Name: McBride - Below Highway
Segment: 1 to 44
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
1.6	144.4	231.04	
6.6	39.4	260.04	
1	91.9	91.9	
0.7	82	57.4	
0.8	39.4	31.52	
0.8	88.6	70.88	
1.1	72.2	79.42	
4.6	236.2	1086.52	
1	52.5	52.5	
1.3	190.3	247.39	
5.6	157.5	882	
2	111.5	223	
1	39.4	39.4	
2.6	55.8	145.08	
1.6	26.2	41.92	
8.2	131.2	1075.84	
1.6	124.7	199.52	
1.3	45.9	59.67	
1	45.9	45.9	
2	42.7	85.4	
2	105	210	
3.9	203.4	793.26	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	1063.05	3004.80	2736.00
			38.9%

Stream Name: McBride - Below Highway
Segment: 45 to 60
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.8	59.1	47.28	
3.3	118.1	389.73	
1	45.9	45.9	
6.6	124.7	823.02	
1.3	98.4	127.92	
2.3	137.8	316.94	
2.3	85.3	196.19	
2.1	157.5	330.75	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	413.40	1138.87	1064.00
			38.9%

(Yellow) Values reduced by 1/2 because both sides of bank were sampled.

ERODING BANKS FIELD FORM

Stream: McBride Creek Reach: Lower Reach Date: 8/1/2011

	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)
	001	002	44	0.5				
	003	004	12	2.0				
	005	006	28	0.3				
	007	008	25	0.2				
	009	010	12	0.25				
	011	012	27	0.25				
	013	014	22	0.35				
L	015	016	72	1.4				
R	017	018	16	0.3				
R	019	020	58	0.9				
L	021	022	48	1.7				
R	023	024	34	0.4				
R	025	026	12	0.3				
L	027	028	17	0.8				
R	029	030	8	0.5				
L	031	032	40	2.5				
R	033	034	38	0.5				
R	035	036	14	0.4				
R	037	038	14	0.3				
L	039	040	13	0.6				
R	041	042	32	0.6				
L	043	044	62	1.2				

~100m

Bank erosion evidence	0 1 2 (3)	Lateral channel stability	0 1 (2)
Bank stability condition	0 1 (2) 3	Channel bottom stability	(0) 1 3
Bank cover/vegetation	0 1 (2) 3	In-channel deposition	(-1) 0 1

TOTAL SCORE: 8

Typical Bank Material: Sagebrush, Grass, Some Small Rock (~10-20mm)

Notes: Creek is dry other than pools.
1st 14 waypoints before road crossing of creek reach
started @ approx stationing

ERODING BANKS FIELD FORM

Stream: McBride Creek Reach: Lower Reach Date: 8/1/2011

	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)
R	045	046	18	0.25				
R	047	048	36	1.0				
L	049	050	14	0.3				
R	051	052	38	2.0				
L	053	054	30	0.4				
R	055	056	42	0.7				
L	057	058	26	0.7				
R	059	060	48	0.65				

~250 mm

Bank erosion evidence 0 1 2 (3) Lateral channel stability 0 1 (2)

Bank stability condition 0 1 (2) 3 Channel bottom stability (0) 1 3

Bank cover/vegetation 0 (1) 2 3 In-channel deposition (-1) 0 1

TOTAL SCORE 7

Typical Bank Material: Sagebrush, Grass, some small rock (~10-20 mm)

Notes:

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	McBride Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Upper	*Upstream: N*	43.243701	5070
Assessment Unit:	ID17050103SW004_02	*W*	-116.928147	
	Analysis includes approximately 17.4 AU miles.	*Downstream: N*	43.248887	4870
Date Collected:	1-Aug-11	*W*	-116.938253	
Field Crew:	BRO BURP Crew	**Notes:** This segment was inventoried for approximately 3684 ft in the upper watershed of McBride Creek, and includes Little McBride and Willow Fork.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	3684.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	7368.00	ft	"
Erosive Bank Length	1778.05	ft	"
Erosive Bank to Bank Length	3556.10	ft	"
Percent Eroding Bank	48.3	%	"
Bank to Bank Eroding Area (AE)	12844.64	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	28.26	tons/year	"
Bank Erosion Rate (ER)	40.50	tons/mile/year	Reach and Segment
Length of Similar Stream	88346	ft	Total Reach
Total Streambank Erosion	705.92	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	1
Bank Erosion (0-3)	1	1
Vegetative/cover on Banks (0-3)	1	1
Bank/Channel Shape - downcutting (0-3)	0	1
Channel Bottom (0-2)	0	0
Deposition (0-1)	-1	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	3	4
Recession Rate	**0.04**	**0.05**

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	5322.65	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	14.64	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	20.98	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	365.65	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		**Load Capacity**			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
41	**706**	**21**	**366**	**48**	**340**

Stream Name: McBride - Upper Watershed
Segment: 61 to 114
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
1.6	39.4	63.04	
0.7	19.7	13.79	
0.7	13.1	9.17	
0.8	19.7	15.76	
0.3	13.1	3.93	
2.6	45.9	119.34	
1.6	52.5	84	
3.3	16.4	54.12	
1.6	19.7	31.52	
1	26.2	26.2	
2	134.5	269	
1	49.2	49.2	
2	19.7	39.4	
2	32.8	65.6	
2.3	19.7	45.31	
2	78.7	157.4	
2.6	82	213.2	
1.1	26.2	28.82	
2	39.4	78.8	
1.3	16.4	21.32	
3	147.6	442.8	
1.6	32.8	52.48	
2	26.2	52.4	
2.3	32.8	75.44	
2	32.8	65.6	
2.6	45.9	119.34	
3.6	65.6	236.16	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	574.00	1216.57	1189.00
			48.3%

Stream Name: McBride - Upper Watershed
Segment: 115 to 186
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
3.9	95.1	370.89	
2.6	16.4	42.64	
3.9	32.8	127.92	
2.6	105	273	
7.9	75.5	596.45	
2	78.7	157.4	
3.3	42.7	140.91	
4.3	154.2	663.06	
4.9	32.8	160.72	
4.9	147.6	723.24	
1.3	39.4	51.22	
3.3	26.2	86.46	
3.3	42.7	140.91	
9.8	85.3	835.94	
2.3	85.3	196.19	
3.6	177.2	637.92	
2	26.2	52.4	
3.6	39.4	141.84	
3	19.7	59.1	
4.3	85.3	366.79	
2.6	121.4	315.64	
5.6	36.1	202.16	
4.3	78.7	338.41	
6.6	59.1	390.06	
6.9	42.7	294.63	
6.6	32.8	216.48	
5.9	32.8	193.52	
6.6	114.8	757.68	
2.6	75.5	196.3	
0.8	36.1	28.88	
8.2	42.7	350.14	
4.9	65.6	321.44	
2.3	26.2	60.26	
3	78.7	236.1	
4.9	131.2	642.88	
1.6	26.2	41.92	
Total	1204.05	5205.75	2495.00
			48.3%

(yellow) Values reduced by 1/2 because both sides of bank were sampled.

ERODING BANKS FIELD FORM

Stream: Mc Bride Creek Reach: Upper Reach Date: 8/1/2011

	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)
L	061	062	12	0.5				
L	063	064	6	0.2				
L	065	066	4	0.2				
R	067	068	6	0.25				
L	069	070	4	0.1				
R	071	072	14	0.8				
R	073	074	16	0.5				
L	075	076	5	1.0				
L	077	078	6	0.5				
L	079	080	8	0.3				
R	081	082	41	0.6				
L	083	084	15	0.3				
(L)	085	086	6	0.6				
L	087	088	10	0.6				
R	089	090	6	0.7				
R	091	092	24	0.6				
L	093	094	25	0.8				
L	095	096	8	0.35				
R	097	098	12	0.6				
L	099	100	5	0.4				
R	101	102	45	0.9				
L	103	104	10	0.5				
R	105	106	8	0.6				
L	107	108	10	0.7				
L	109	110	10	0.6				
R	111	112	14	0.8				
R	113	114	20	1.1				

Bank erosion evidence 0 1 (2) 3 Lateral channel stability (0) 1 2

Bank stability condition 0 (1) 2 3 Channel bottom stability (0) 1 3

Bank cover/vegetation 0 (1) 2 3 In-channel deposition (-1) 0 1

TOTAL SCORE 3

Typical Bank Material: Sage Brush, Grass, Small Rock, Deciduous Bushes

Notes:

ERODING BANKS FIELD FORM

Stream: McBRIDE CREEK Reach: UPPER REACH Date: 8/1/2011

	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)	GPS point (start)	GPS Point (end)	Length (m)	Average height (m)	
R	115	116	29	1.2	177	178	20	1.5	R
L	117	118	5	0.8	179	180	8	0.7	L
L	119	120	10	1.2	181	182	24	0.9	R
L	121	122	32	0.8	183	184	40	1.5	R
R	123	124	23	2.4	185	186	8	0.5	L
L	125	126	24	0.6					
R	127	128	13	1					
R	129	130	47	1.3					
L	131	132	10	1.5					
R	133	134	45	1.5					
L	135	136	12	0.4					
L	137	138	8	1					
L	139	140	13	1					
R	141	142	26	3					
L	143	144	26	0.7					
R	145	146	54	1.1					
L	147	148	8	0.6					
R	149	150	12	1.1					
L	151	152	6	0.9					
R	153	154	26	1.3					
L	155	156	37	0.8					
R	157	158	11	1.7					
R	159	160	24	1.3					
L	161	162	18	2.0					
R	163	164	13	2.1					
L	165	166	10	2					
R	167	168	10	1.8					
L	169	170	35	2					
R	171	172	23	0.8					
L	173	174	11	0.25					
R	175	176	13	2.5					

Bank erosion evidence 0 1 (2) 3
Bank stability condition 0 (1) 2 3
Bank cover/vegetation 0 (1) 2 3

Lateral channel stability (0) 1 2
Channel bottom stability (0) 1 3
In-channel deposition (-1) 0 1

TOTAL SCORE

3

Typical Bank Material: SAGEBRUSH, GRASS SMALL ROCKS, DECIDUOUS BUSHES

Notes:

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Pickett Creek/Catherine Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Bates Creek to Brown Creek	*Upstream: N*	43.044627	2748
Assessment Unit:	ID17050103SW016_03	*W*	-116.387984	
	Analysis includes approximately 6.4 AU miles	*Downstream: N*	43.043582	2718
Date Collected:	12-Oct-12	*W*	-116.376848	
Field Crew:	Darcy Sharp, TGS & ND	**Notes:** 1 segment was inventoried for approximately 5808 ft along Pickett and Catherine Creeks within the AU_03.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	5808.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	11616.00	ft	"
Erosive Bank Length	1130.20	ft	"
Erosive Bank to Bank Length	2260.40	ft	"
Percent Eroding Bank	19.5	%	"
Bank to Bank Eroding Area (AE)	4507.04	ft^2	"
Lateral Recession Rate (RLR)	0.15		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	37.18	tons/year	"
Bank Erosion Rate (ER)	33.80	tons/mile/year	Reach and Segment
Length of Similar Stream	28142	ft	Total Reach
Total Streambank Erosion	217.35	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	1
Bank Erosion (0-3)	2	1
Vegetative/cover on Banks (0-3)	2	1
Bank/Channel Shape - downcutting (0-3)	1	1
Channel Bottom (0-2)	1	0
Deposition (0-1)	0	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	8	4
Recession Rate	**0.15**	**0.05**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	4632.26	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	12.74	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	11.58	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	74.46	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction	Total Erosion (tons/yr) Reduction
34	217	12	74	66%	143

Stream Name: Pickett Creek
Segment: 853 to 942
Date: 10/12/2012

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
2	9.8	19.6	
1.3	13.1	17.03	
0.3	29.5	8.85	
0.3	49.2	14.76	
3.3	196.9	649.77	
3.3	9.8	32.34	
2	16.4	32.8	
3.3	26.2	86.46	
2	23	46	
1	19.7	19.7	
1.6	13.1	20.96	
1.6	6.6	10.56	
3.3	6.6	21.78	
1.6	19.7	31.52	
3.3	19.7	65.01	
2.6	29.5	76.7	
0.3	16.4	4.92	
0.3	16.4	4.92	
2.6	3.3	8.58	
0.3	16.4	4.92	
3	23	69	
0.3	16.4	4.92	
2	32.8	65.6	
3.3	16.4	54.12	
1.6	9.8	15.68	
1.3	3.3	4.29	
2.3	9.8	22.54	
3	6.6	19.8	
3.3	52.5	173.25	
0.3	16.4	4.92	
2	32.8	65.6	
1.6	19.7	31.52	
2	9.8	19.6	
1.3	19.7	25.61	
1.3	16.4	21.32	
1.3	16.4	21.32	
3.3	49.2	162.36	
1.3	42.7	55.51	
2.3	32.8	75.44	
3.3	16.4	54.12	
2.6	6.6	17.16	
0.3	9.8	2.94	
1.3	8.2	10.66	
1.6	32.8	52.48	
0.3	88.6	26.58	
		0	
Total	1130.20	2253.52	5808.00
			19.5%

Pickett Creek Bank Stabilization Survey

10/12/12
Darcy Sharp
+ Troy Smith, Nicole D.

(1)

h	l (m)		Proper hydrologic condition
0.6 m	3 m	(cut banks)	- mature riparian vegetation
0.4 m	5 m		
0.1 m	9 m	(point bar)	cropland not impinging on channel
0.1 m	15 m	(point bar)	
1.0 m	60 m	(chalk cliff)	
1.0 m	3 m (skipped GPS)		- note limited luxuriant algal growth
0.6 m	5 m		
	8 m	(chalk cliff)	
1.0	7 m	(chalk cliff)	- late seral stage willows, downcut
0.6			
0.3	6 m	(toe of slope)	3 m. to streambed, due to historic
0.5	4 m		erosion of
0.5	2 m	above root wad	chalky deposit

grazing

outlet right across from site 12

fish

- more clumping streambanks from grazing
- more evidence of nutrients
- more late seral riparian veg.

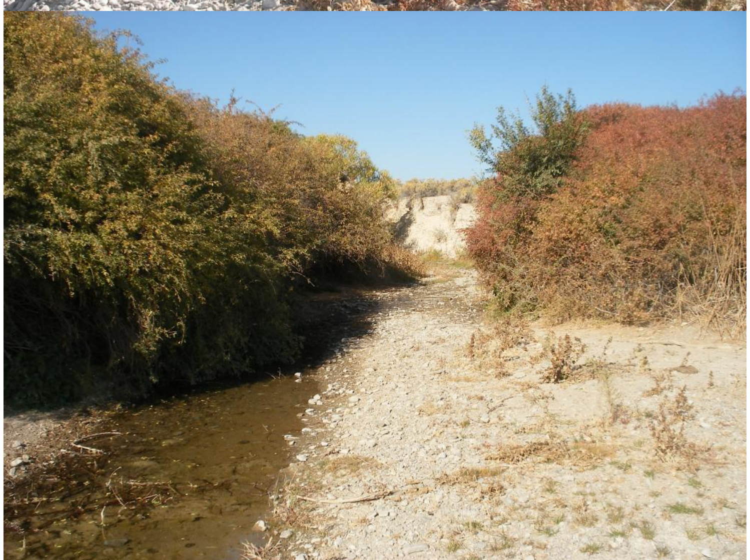
h(m)	l (m)	
		- major downcut - local willows & riparian shrubs 2 meters out of floodplain access [illegible] (2)
(13) 1.0	2.0	
(14) 0.5	6.0	
(15) 1.0	6.0	
(16) 0.8	9.0	
(17) 0.1	5.0	trampled depositional point bar
(18) 0.1	5.0	
(19) 0.8	1.0	water gap
(20) 0.1	5.0	- trampled depo. pt. bar water gap & slumping veg
(21) 0.9	7.0	
(22) 0.1	5.0	trampled depo. pt. bar
(23) 0.6	10.0	
(24) 1.0	5.0	undercut veg.
(25) 0.5	3.0	
(26) 0.4	1.0	water gap
(27) 0.7	3.0	water gap
(28) 0.9	2.0	water gap
(29) 1.0	16.0	chalk cliff
(30) 0.1	5.0	trampled point bar

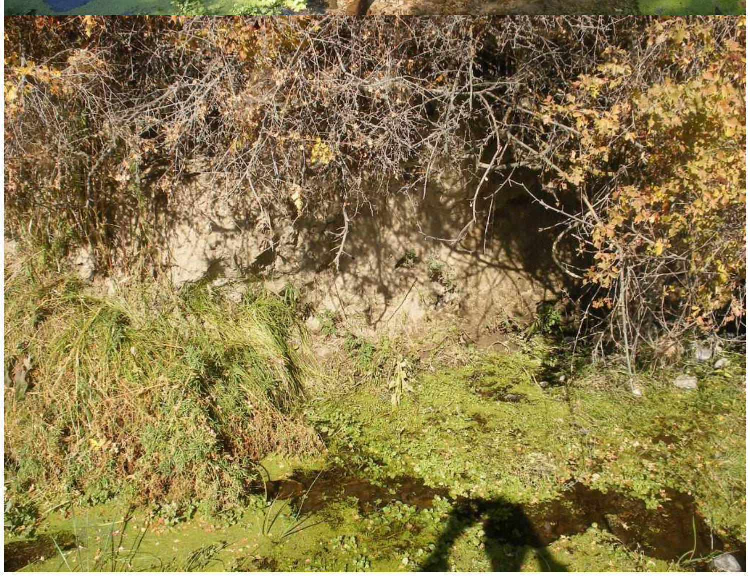
DAlkaif (3)

	h(m)	l(m)	
(31)	0.6	10.0	chalk cliff
(32)	0.5	6.0	water gap
(33)	0.6	3.0	trampled depo
(34)	0.4	6.0	gravel bar, trampled
(35)	0.4	5.0	water gap
(36)	0.4	5.0	gravelly ford
(37)	1.0	15.0	trampled depo trampled veg. bank
(38)	0.4	13.0	
(39)	0.7	10.0	tramp. depo.
(40)	1.0	5.0	chalk terrace
(41)	0.8	2.0	gravelly gap trampled depo.
(42)	0.1	3.0	
(43)	0.4	2.5	water gap
(44)	0.5	10.0	
(45)	0.1	27	tramp. depo

Bank Erosion Evidence	2
Bank Stability Condition	2
Bank cover/veg	2
Lateral channel stability	1
Channel Bottom Stability	1
In Channel deposition	0

Representative Pickett Creek SEI Photos – October 12, 2012





Appendix C. Public Comments/Public Participation

The Mid Snake River/Succor Creek TMDL addendum development process included the following public participation with the watershed advisory group (WAG) and others:

- October 31, 2012—WAG meeting, Marsing, Idaho
- December 28, 2012—Draft TMDL analysis provided to WAG (e-mail attachment and posted on Mid Snake River/Succor Creek WAG webpage)
- February 6, 2013—WAG meeting, Marsing, Idaho
- February 7, 2013—Post WAG meeting summary and supplemental information (e-mail)
- March 26–27, 2013—Hardtrigger Creek bank stability inventory with WAG members, agency personnel, and public stakeholders
- April 1, 2013—Draft TMDL provided to WAG (e-mail attachment and posted on Mid Snake River/Succor Creek WAG webpage)
- April 23, 2013—WAG meeting, Marsing, Idaho
- April 24, 2013—Post WAG meeting summary and supplementary information (e-mail)
- July 24, 2013—Draft TMDL 30-day public comment period

DEQ has provided the WAG with all available information pertinent to the addendum, such as monitoring data, water quality assessments, and relevant reports. The WAG also had the opportunity to actively participate in preparing the document as outlined above.

The general public had an opportunity to comment on this addendum during the 30-day public comment period (July 24 – August 23, 2013). Public comments and DEQ's response to those comments are included in this appendix for the final document.

Name: Robyn Thompson

Affiliation: Resident of Oreana, Idaho

Comment 1: "I find your methods of gathering data extremely flaud. Your data tests these creeks on only a few days and not every year. Your test period doesn't go back even 20 years."

The Streambank Erosion Inventory (SEI) methods have a long history of application and EPA approval in Idaho. Sediment TMDLs using SEI methods have been approved for numerous assessment units (AUs) in Idaho, including the Mid Snake River/Succor Creek TMDL (DEQ 2003b). The SEI methods and data are fully referenced in Appendix B. Additionally, as a part of further documenting TMDL analytical approaches, the SEI method was recently formalized in June 2013 as a DEQ Standard Operating Procedure (SOP).

The SEI sediment analysis relates beneficial use support to percent fine sediment that is retained in channel substrate to impact cold water aquatic life, including fish and macroinvertebrates. This method is only applicable where instream erosion is the predominant source of excess *sediment. Where overland runoff and other potential sediment sources are a concern, additional assessment tools must be used to identify those sources.*

The SEI is evaluated as one line of evidence in conjunction with DEQ BURP data and data from other land and natural resource management agencies (e.g. BLM, SWCC, IDL, Idaho Power, etc.) to help determine potential stream impairment and appropriate loading analyses.

The SEI methodology is a rapid-assessment data collection approach which provides reliable estimates of current streambank and sediment loading conditions. Longer term data collection methodologies are available, but require significantly more financial, labor, analytical, and temporal resources.

Comment 2: "Section 5.4.4 pg 42 you say off road and livestock etc are some of the probable causes of sediment. People have been in this area and livestock for around 150 yrs. Without a baseline that would start before people were here, you can't make that assumption."

Reference streambank conditions were previously identified for the subbasin in the Mid Snake River/Succor Creek TMDL (DEQ 2003b). Human influences have been an integral part of these desert streams and landscape for many years. However, it is also evident, locally, and through scientific literature, that human influences such as roads and culverts, off-highway vehicles, livestock grazing, wild horses, etc. can adversely impact these systems through increased streambank erosion and sediment loading. Conversely, focused land management practices can often help to effectively and rapidly stabilize and improve degraded conditions. Such potential management actions will likely be addressed in the upcoming Implementation Plan that will be written by the SWCC.

Comment 3: "It is obvious to anyone that flash floods are the cause of sediment in these creeks – see photos. You can see by the photo's that floods happened thousand of years ago and are still happening (2006)."

These desert streams and washes such as Birch and Pickett Creek are hydrologically flashy. However, SEI and sediment concentration data and photographs (now included in Appendix B) indicate that adjacent roads, culverts, irrigated agriculture, livestock grazing, and wild horses each may contribute to excess streambank erosion and sediment loading in streams of the Mid Snake River/Succor Creek Subbasin, depending on the specific location and activity.

Further, riparian ecosystems of the arid northwest provide many ecological functions, including streambank stability, sediment trapping, water quality improvement, and modulating hydrologic processes, such as flooding and sediment delivery (Pattern 1998). Some of these ecological functions have been altered by human activity in the Mid Snake River/Succor Creek Subbasin, including natural resource use, dam construction, ground-water withdrawal, grazing, agriculture, wild horse management, and introduction of non-native species.

Comment 4: "These creeks do not run year round. Birch Creek only runs about every other year. Pickett runs from a couple of weeks to a couple of months. See the photos, there is no aquatic life in either of these creeks. Lizards don't qualify as aquatic life."

As now more-clearly cited in the text (see Section 1.2 and subsections) the upper portion of Birch Creek addressed in this TMDL has been clarified as an ephemeral, dry, and sandy wash which rarely flows and only direct response to precipitation. The lower portion of Birch Creek, however, is intermittent/perennial, flowing primarily in response to irrigated agricultural activities.

It is unclear exactly where on Pickett Creek your photo was taken. DEQ concurs with your verbal description that Pickett Creek flows from a couple of weeks to a couple of months, which meets the Idaho water quality standards definition of intermittent (see the definition in Glossary section). Nevertheless, the TMDL must identify water quality targets and pollutant loading that will fully support cold water aquatic life, which includes plant and animal groups such as macroinvertebrates that can occupy these intermittent streams.

Comment 5: "These floods have been washing sediment in to the Snake River for thousands of years, and there are still fish in that river."

These desert streams and washes are hydrologically flashy. However, SEI and sediment concentration data and photographs (now included in Appendix B) indicate that adjacent roads, culverts, irrigate agriculture, livestock grazing, and wild horses each may contribute to excess streambank erosion and sediment loading in these streams, depending on the specific location.

Comment 6: "Leave our creeks, our ranchers, and farmers alone."

DEQ is completing its obligations for developing TMDLs as identified in the Clean Water Act. The lands in the subwatersheds of this TMDL are a mix of public lands (lands owned and managed by the United States government and in the public domain), Idaho's State Endowment Trust Lands (managed by the IDL to maximize long-term financial returns, mainly for public schools) *and private lands.*

Nonpoint sources (e.g. agricultural) meet their water quality obligations under the Clean Water Act through voluntary implementation of BMPs typically identified by the SWCC.

Further, Idaho Statute 39-3610(1) states:

> *"…nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis."*

Idaho Statute 39-3611(10) states:

> *"Nothing in this section* shall be interpreted as requiring best management practices for agricultural nonpoint source activities which are not adopted on a voluntary basis…"

Idaho water quality standards, IDAPA 58.01.02.055, identify that water bodies not fully supporting beneficial uses:

> *"…shall require the development of TMDLs or other equivalent processes, as described under Section 303(d)(1) of the Clean Water Act."*

Comment 7: "Only the All mighty can cause a flood…and only he can stop one!"

The soil-plant system is a dynamic component of watersheds that, when altered, can affect streamflow response to precipitation. The following paraphrased excerpts were taken from Brooks et al. 1991:

- *Removal of vegetation or conversion from plants with high to low annual transpiration and interception loss can increase stormflow volumes and the magnitude of peak flows. This can also expand the source areas of flow. After precipitation events, soil moisture and water tables will tend to be higher; consequently providing less storage to hold precipitation from another event.*
- *Activities that reduce the infiltration capacity of soils, such as intensive grazing, road construction, and logging, can increase the surface runoff and streamflows can respond more quickly to precipitation events, resulting in high peak discharges.*
- *The development of roads and alterations of the stream channel can change the overall conveyance system in a watershed. The effect usually results in increased peak discharge caused by a shortened travel time of flow to the watershed outlet.*
- *Increased erosion and sedimentation can reduce the capacity of stream channels at both upstream and downstream locations. Flows that would have remained within the streambanks previously may now flood.*

Name: Connie Brandau

Affiliation: WAG Participant

Comment 1: "We have found that our best long term history and understanding of the anthropogenic come from those who reside in the immediate areas and have long term direct association with the individual watersheds, usually making their living from the land and having on the ground familiarity with the area itself."

DEQ agrees with your comment, which is consistent with Idaho Statute 39-361:

"Each watershed advisory group shall generally be responsible for recommending those specific actions needed to control point and nonpoint sources of pollution within the watershed so that, within reasonable periods of time, designated beneficial uses are fully supported and other state water quality plans are achieved."

DEQ personnel have worked hard to meet the letter and intent of the law by regularly consulting and coordinating with the WAG throughout the TMDL development process, including:

- *Consulting with the WAG during 3 meetings (October 12, 2012; February 6, 2013, and April 23, 2013),*
- *Consulting with the WAG on data collection in the field on March 26 and 27, 2013,*
- *Consulting with the WAG on TMDL drafts and loading analyses beginning in December 2012,*
- *Providing the WAG a 30-day draft TMDL review and comment period from April 1 – May 1, 2013,*
- *Providing a 30-day draft TMDL public comment period from July 24 – August 23, 2013.*

Comment 2: "This entire process needs to change the focus of its priorities and start with the basic one of DESIGNATED USES so that we need not burden the process unnecessarily. This document (at page 13 2.2.2) clearly states "In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations." It further states "These undesignated waters ultimately need to be designated for appropriate uses" and that designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water and in that case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing)."

While not all uses are yet designated, DEQ on behalf of the State of Idaho has an obligation to protect existing uses under the Clean Water Act. All uses are ultimately required to be designated and DEQ is working to accomplish that task over time.

Comment 3: "Now we get to the issue of PRESUMED USES: At page 14 - 2.2.3 Presumed Uses In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated waters ultimately need to be designated for appropriate uses. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called presumed uses, DEQ applies the numeric cold-water criteria and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for existing uses. However, if for example, cold water aquatic life is not found to be an existing use, a use designation (rulemaking) to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01)."

Because Idaho has not yet designated uses it is presumed that all waters are capable of supporting cold water aquatic life and primary or secondary contact recreation. This presumption is consistent with the Clean Water Act requirements to be fishable and swimmable.

Comment 4: "Designated uses may be added or removed using specific procedures provided."

The specific process for adding or removing designated uses is handled through Negotiated Rulemaking initiated by DEQ. The rule, once adopted by the Board of Environmental Quality and subsequently approved by the Idaho Legislature, must also be approved by Region 10 EPA in order to be utilized for Clean Water Act purposes.

Comment 5: "The assumption that this normally dry channel will support cold water aquatic life and either primary or secondary contact recreation is wrong. Historic documentation, electrofishing and flow data show that Hardtrigger Creek has NEVER supported "swimmable and fishable" conditions. Many assumptions are said to be made on the "best available data". I know for a fact that there is data available for "eletrofishing" results and flow data for Hardtrigger."

The two beneficial uses that are presumed for these AUs are cold water aquatic life and primary/secondary contact recreation (which includes incidental wading and water contact).

Fish may not occupy Hardtrigger Creek and electrofishing data may exist; however, no such data was provided by any WAG participants or uncovered throughout the TMDL development process. DEQ BURP sampling in 1998 did not encounter any fish in Hardtrigger Creek. The data do indicate that aquatic macroinvertebrates (cold water aquatic life) were present at both BURP sites on Hardtrigger Creek in 1998, and that the low quantity of bugs and species composition are indicative of poorer water quality, resulting in a Stream Macroinvertebrate Rating of 0 at both sites. Flow at both sites in 1998 was estimated at 5.1 and 3.9 cfs. Additionally, as your photos show, Hardtrigger Creek was flowing in March 2013, and DEQ personnel (Troy Smith) identified flows in multiple sections of Hardtrigger Creek above Stewart Gulch in December 2012.

Comment 6: "Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable – emphasis added - (IDAPA 58.01.02.050.02). There are few beneficial uses attainable in Hardtrigger Creek."

The two beneficial uses that are presumed for these AUs are cold water aquatic life and primary/secondary contact recreation (which includes incidental wading and water contact).

Comment 7: "DEQ staff has told us, the members of this WAG, that several "definitions" have been changed. Just because DEQ changes the definition of a word does not mean that the factual definition changes. Specifically in the NEW WORLD DICTIONARY OF THE AMERICAN LANGUAGE definitions are as follows:

> **Stream is defined as 1. a current or flow of water or other liquid, especially one running along the surface of the earth. 2. a steady movement or flow of any fluid. Creek 1. a narrow or winding passage**
>
> **Ephemeral 1. lasting only one day 2. short lived**

> **Intermittent 1. stopping and starting again at intervals as a synonym applys to something that's stops and starts, or disappears and reappears, from time to time."**

DEQ staff (Troy Smith) told members of the WAG that intermittent and ephemeral waters are specifically defined in Idaho water quality standards. These definitions were provided to the WAG via email on February 7, 2013 and in a presentation to the WAG on April 23, 2013. Those definitions have been added to the Glossary section of this TMDL for reference.

Comment 8: "We were told the DEQ now considers a STREAM to be any drainage area within a watercourse that may possibly contribute at some time to a streambed. One of my biggest concerns during the compilation of the TMDL in 2003 was that if the DEQ showed the stream channels in blue (or green) future generations a hundred years from now might consider that those were flowing streams in 2003. Well we haven't had to wait that long because now DEQ itself has moved the cheese and is considering those dry washes to be a stream."

The USGS (Langbein and Iseri 1995) defines stream as a general term for a body of flowing water, and can be further defined as:

- *Perennial – one which flows continuously*
- *Intermittent or seasonal – one which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas.*
- *Ephemeral - one that flows only in direct response to precipitation, and whose channel is at all times above the water table.*

This corresponds closely with definitions in Idaho water quality standards. The TMDL has been revised to clarify which stream segments are intermittent/perennial vs. ephemeral (dry washes).

Comment 9: "Hardtrigger flows at best ephemerally or intermittently and only flows in any volume in direct response to a major weather event. Other than little HT the rest of the "tributaries" are dry washes that flow only in direct relationship to extreme weather conditions. They support absolutely no aquatic or riparian plant life due to lack of water. Large portions of Main HT and its main branches (the Middle Fork and Stewart Gulch) do not support aquatic or riparian plants due to lack of the continuous presence of water. This area usually receives 5 to 7 inches of moisture annually (ARS data collection). If there is adequate winter moisture creeks may flow from the time of melt off (usually Feb-March) until mid May. Main HT and Little HT are spring fed at their source (both springs are BLM authorized developments). The Middle Fork of Hardtrigger is usually a dry course that lies on State Lease land and has a few springs that sub up but do not flow. During a normal year the main courses of LHT and MHT dry up, and become intermittent, with the only water present coming from springs in the stream bed."

DEQ agrees that the Hardtrigger Creek subwatershed contains intermittent/perennial and ephemeral stream segments. Sections 1.2.2 and 5.4.2 (Table 8) of the TMDL have been revised to *clarify the intermittent/perennial stream segments vs. ephemeral channels and their application in the loading analyses.*

Comment 10: "According to Troy Smith, the only person on the "WAG team" who actually collected and analyzed the data, from the riparian areas (which do not flow) he extrapolated those findings to the entire length of stream - including the dry washes, which have now become part of "the stream". Mr. Smith seemed surprised and concerned when he could not replicate data (collected during a December 2011 run off in a time above normal moisture winter moisture) again in the springs of 2012 and 2013. This area usually receives 5 to 7 inches of moisture annually (ARS data collection). If there is adequate winter moisture creeks may flow from the time of melt off (usually Feb-March) until mid May. Main HT and Little HT are spring fed at their source (both springs are BLM authorized developments). The Middle Fork of Hardtrigger is usually a dry course that lies on State Lease land and has a few springs that sub up but do not flow.
During a normal year the main courses of LHT and MHT dry up, and become intermittent, with the only water present coming from springs in the stream bed."

Because the WAG had concerns that Troy Smith had not, himself, collected the August 2011 SEI data for Hardtrigger or McBride Creeks (this data had been collected by DEQ BURP personnel), he spot-checked the field data. The McBride Creek measurements corresponded well to the GPS points. However, because the Hardtrigger measurements did not appear to correspond well with the GPS coordinates, Troy felt it was better to re-sample Hardtrigger Creek and avoid any questions about the quality of the data. The subsequent Hardtrigger Creek data was collected on March 26 and 27, 2013 when water was flowing in Hardtrigger Creek.

The entire group of WAG participants was invited to help or observe the data collection. The following individuals came to the field on March 26, 2013:

- *Connie Brandau, self*
- *Richard Brandau, self*
- *Diane French, IDL*
- *Melissa Jayo, self*
- *Jason Miller, SWCC*
- *Daniel Richard, self*
- *Mike Spicer, BLM*
- *Peter Torma, BLM*

Troy Smith and Josh Schultz were the primary data collectors, and openly explained the data collection process and sought assistance from others in the field. After lunch on March 26, all of the non-DEQ participants had left except for Dianne French and Jason Miller. Dianne also joined Troy and Josh for the morning of March 27.

The data and spreadsheet used to calculate the loading analyses are presented in Appendix B of this TMDL. Some photos representative of the overall data collection have been added to Appendix B for reference. Additionally, the TMDL has been revised to clarify the *intermittent/perennial stream segments of Hardtrigger Creek for which the data was extrapolated vs. the ephemeral channels for which the data was not extrapolated.*

Comment 11: "Regarding the relationship of sedimentation, siltation and roads along side the creek channel: The road up Hardtrigger Creek is identified in the BLM Travel Plan and has Road designation. BLM provides maps for this road system to direct the public to horse viewing areas. This road goes directly up Main Hardtrigger Creek and crosses it numerous times (see attached photos). The road was originally dozed out in the 1960's as a firebreak. The BLM has continued to improve and widen it until now, in most places, two vehicles can pass each other without turning off of the road. The ground disturbance caused by the miles of road and creek crossings and related activity is a huge contributor to the perceived sedimentation. This road, in addition to use by the general public, sees use by hunters, mountain bikers, ATV's, allotment permittees and BLM personnel."

Section 1.2.2 of the TMDL identifies 4-wheel use, dirt roads adjacent to the creek, BLM wild horse herds, and active livestock grazing as likely contributors to bank erosion and increased sediment in the Hardtrigger Creek subwatershed.

Comment 12: "Hardtrigger Creek in contained in one pasture of a BLM allotment. The allotment has a grazing plan allowing livestock a limited duration of access to the pasture. During a court appointed mediation process between the BLM and the permittees several range improvements were identified that would help mitigate perceived water quality issues. Some of those improvements have been made and some need funding and proper NEPA documentation to move them forward. But the area that is beyond permittee control is Wild Horse Management."

DEQ appreciates range improvements that have been made to date. The SWCC is the agency responsible for writing the TMDL Implementation Plan and BLM is the agency responsible for wild horse management.

Comment 13: "Hardtrigger Creek also lies totally within the BLM Hardtrigger Wild Horse Herd Management Area (HMA). BLM regulations require that when livestock is NOT present gates in and HMA remain open allowing horses year round access. The March 2013 on site visit (see attached photos) with members of the WAG showed the only stream bank tracks to be those of unshod, wild horses. Because of budget constraints BLM has not gathered excess wild horses and they have increased dramatically to numbers far in excess of the 1999 ORMP defined appropriate management levels."

Section 1.2.2 of the TMDL identifies 4-wheel use, dirt roads adjacent to the creek, BLM wild horse herds, and active livestock grazing as likely contributors to bank erosion and increased sediment in the Hardtrigger Creek subwatershed. BLM is the agency responsible for wild horse management.

Comment 14: "Yes, Hardtrigger has beneficial uses, but they are limited seasonally; there are IDWR agricultural water rights in additional to water rights for wildlife and livestock. The waters of the creek also provide wildlife habitat and general aesthetics, but

Hardtrigger has never supported the beneficial use of fishing or swimming (cold water aquatic life and neither primary or secondary contact recreation) due to its seasonal, intermittent and ephemeral state. The only time there is enough water for fishing, swimming or secondary contact recreation would be during a flash flood when our Sheriffs office and emergency response personnel are warning people away because of the danger present."

The two beneficial uses that are presumed for these AUs are cold water aquatic life and primary/secondary contact recreation (which includes incidental wading and water contact).

DEQ agrees that the Hardtrigger Creek subwatershed contains intermittent/perennial and ephemeral stream segments. The TMDL has been revised to clarify the intermittent/perennial vs. ephemeral stream segments and their application in the loading analyses.

DEQ BURP sampling in 1998 indicates that aquatic macroinvertebrates (cold water aquatic life) were present at both BURP sites on Hardtrigger Creek in 1998, and that the low quantity of bugs and species composition are indicative of poorer water quality, resulting in a Stream Macroinvertebrate Rating of 0 at both sites. Flow at both sites in 1998 was estimated at 5.1 cfs and 3.9 cfs. Additionally, as your photos show, portions of Hardtrigger Creek above Stewart Gulch were flowing in March 2013. They were also verified as flowing during a site visit in December 2012 (Troy Smith, DEQ).

Name: Richard Brandau

Affiliation: WAG Participant

Comment 1: "I was born in 1948, am now 65 years old and have lived here in Owyhee County on the same place my whole life and run cows from Reynolds Creek to Squaw Creek as did my Father and Grandfather before me. Hardtrigger Creek has never been fishable or swimmable. This "stream" needs to have its uses designated before you apply any of these criteria."

The two beneficial uses that are presumed for these AUs are cold water aquatic life and primary/secondary contact recreation (which includes incidental wading and water contact). DEQ BURP sampling in 1998 indicates that aquatic macroinvertebrates (cold water aquatic life) were present at both BURP sites on Hardtrigger Creek in 1998, and that the low quantity of bugs and species composition are indicative of poorer water quality, resulting in a Stream Macroinvertebrate Rating of 0 at both sites. Existing beneficial uses must be protected whether designated or not, under the Clean Water Act and Idaho water quality standards.

Name: Ed Wilsey

Affiliation: Rancher

Comment 1: "I believe the data on McBride Creek is outdated, hastily done and biased."

The Streambank Erosion Inventory (SEI) methods have a long history of application and EPA approval in Idaho. Sediment TMDLs using SEI methods have been approved for numerous assessment units (AUs) in Idaho, including the Mid Snake River/Succor Creek TMDL (DEQ 2003b). The SEI methods and data are fully referenced in Appendix B. Additionally, as a part of further documenting TMDL analytical approaches, the SEI method was recently formalized in June 2013 as a DEQ Standard Operating Procedure (SOP).

The SEI sediment analysis relates beneficial use support to percent fine sediment that is retained in channel substrate to impact cold water aquatic life, include fish and macroinvertebrates. This method is only applicable where instream erosion is the predominant source of excess sediment. Where overland runoff and other potential sediment sources are a concern, additional assessment tools must be used to identify those sources.

The SEI is evaluated as one line of evidence in conjunction with DEQ BURP data and data from other land and natural resource management agencies (e.g. BLM, SWCC, IDL, Idaho Power, etc.) to help determine potential stream impairment and appropriate loading analyses.

The SEI methodology is a rapid-assessment data collection approach which provides reliable estimates of current streambank and sediment loading conditions. Longer term data collection methodologies are available, but require significantly more financial, labor, analytical, and temporal resources. For example, the Watershed Assessment of River Stability and Sediment Supply (WARSS) method for sediment production has also been developed (Rosgen 2006), but requires several seasons/years to develop the data to determine the sediment production. It also requires calibration curves to be developed to extrapolate between similar streams. Therefore the SEI or other similar assessment protocols better identify (potential) sediment production in a more cost-effective manner.

Comment 2: "The creek is at best a intermittent stream with a heavy spring run off in a normal year drying up usually in July and may start running again by the first of the year."

DEQ agrees that the McBride Creek subwatershed contains intermittent/perennial and ephemeral stream segments. Sections 1.2.3 and 5.4.2 (Table 8) of the TMDL has been revised to clarify the intermittent/perennal stream segments vs. ephemeral channels and their application in the loading analyses.

Comment 3: "When the creek in in somewhat of a normal flow 2-4 months of the year the water appears clear not much murkiness can be observed. From 18 years of observation the heavy sedimentation comes with large weather events, some years this occurs once a year in the spring runoff, some years it will take place 3-4 times a year and last for weeks. I **have followed the sediment flow up stream to find out where it is coming from, it is for the most part coming from the road system, the main road on upper McBride creek is not a maintained road or it is not a sloped road with ditches and culverts the water is funneled down the road and the road washes down to hard pan or rock dumping tons of dirt into the creek, at times washing the road out completely."**

These desert streams and washes such as those in the McBride Creek subwatershed are hydrologically flashy. However, SEI data (Appendix B) indicate that adjacent roads, culverts, irrigated agriculture, livestock grazing, and wild horses each may contribute to streambank erosion and sediment loading in streams of the Mid Snake River/Succor Creek Subbasin, depending on the specific location and activity.

Further, riparian ecosystems of the semi-arid northwest, including McBride Creek, provide many ecological functions, including streambank stability, sediment trapping, water quality improvement, and helping control or modulate hydrologic processes, such as flooding and sediment delivery (Pattern 1998). Some of these ecological functions have been altered by human activity in the Mid Snake River/Succor Creek Subbasin, including natural resource use, dam construction, ground-water withdrawal, grazing, agriculture, wild horse management, and introduction of non-native species.

Comment 4: "The company that has the state lease on the rock pit also causes a lot of erosion from their road usage, dust in the summer and mud in the weather events all ending up in the creek. there are many unimproved road ways in the drainage that also erode real bad in the wet seasons with all the sediment ending up in the creek."

DEQ acknowledges that the road and other potential sources may directly or indirectly contribute sediment to McBride Creek. This TMDL estimates the sediment contributions and load allocations in the McBride Creek subwatershed that stem from excessive bank erosional processes regardless of the source.

Comment 5: "We have done everything we can to eliminate erosion on our deeded ground by replacing flood irrigation with sprinkler systems and gated pipe. We have also suggested to the BLM some ways to add water systems via developing a couple springs in out upper allotment for the stock to water in and fencing the creek off completely thus keeping our livestock completely off the creek in pasture 4 of our allotment.this was turned down when we asked about it. At this time we are working with the BLM to fix some watering sources lower McBride creek to help keep the livestock off the creek."

DEQ appreciates range improvements that have been made to date. The SWCC is the agency responsible for writing the TMDL Implementation Plan, while the BLM and IDL are the agencies responsible for managing livestock grazing and other activities on federal and state lands in the McBride Creek subwatershed.

Name: Jerry Hoagland, Kelly Aberasturi, Joe Merrick

Affiliation: Owyhee County Board of Commissioners

Comment 1: "The use made of the final TMDL by government agencies such as the Bureau of Land Management is of great concern to Owyhee County in that the restrictions imposed by that agency may well go beyond what is necessary to make a good faith effort to implement the TMDL."

The TMDL serves to identify appropriate sediment targets (concentration or streambank erosion) that fully support beneficial uses and identify some of the potential sources of those pollutants. The BLM and IDL manage federally- and state-owned lands. The TMDL should be utilized in helping to shape appropriate management of these public lands. DEQ helps facilitate the WAG and designated management agencies such as the SWCC in crafting an Implementation Plan that restores waterbodies and helps meet water quality standards and supports beneficial uses.

Comment 2: "The TMDL appears to treat intermittent and ephemeral watercourses in the same fashion as perennial streams. That approach runs counter to logic when considered against the two definitions cited above [*pollutant* and *pollution*]."

DEQ agrees that these subwatersheds contain intermittent/perennial and ephemeral stream segments. Although the loading calculations previously accounted for these differences, Sections 1.2.2 - 5 and 5.4.2 (Table 8) of the TMDL have now been revised to clarify the application of intermittent/perennial stream segments vs. ephemeral channels in the load allocations.

Comment 3: "If a "pollutant" is a "substance introduced into the environment…" and "pollution" is defined as "A very broad concept that encompasses human-caused changes in the environment…" then sediment in these watercourses does not meet the definitions cited. Sediment was not introduced in to the environment – it is part of the environment. It's movement, especially in the watercourses that are intermittent or ephemeral was not an act of man but rather a natural event. As is commonly cited by various environmental groups seeking removal of dams (see http:://glencanyon.org/glen_canyon/sediment as an example) rivers move sediment to the sea. In our high desert flash flood prone stream systems sediment is moved as a natural occurrence."

Although some sediment naturally occurs in these stream segments, chronic excess sediment (e.g. throughout the irrigation season or via excess streambank erosion) is not natural and is often attributable to human-induced alterations of the environment (e.g. roads and culverts, vegetation removal, dams and diversions, agriculture, livestock grazing, wild horse management, etc.). Additionally, excess sediment adversely affects the usefulness of resources, health of animals (e.g. macroinvertebrates), and ecosystems which result in undesirable environmental effects (e.g. reduced bank and soil water storage, reduced sediment and water infiltration, reduced flood modulation, etc.).

Comment 4: "To apply water quality standards to intermitten and ephemeral streams goes beyond the intent of the process and is not achievable. Yet, setting the standard in such a way may produce great harm in the implementation by various agencies."

The TMDL has been revised to clarify the loading analysis and application to intermittent/perennial streams. The EPA does not accept intermittency as a rationale to de-list stream segments or exempt them from needing a TMDL. Because intermittent/perennial streams do flow with some regularity (e.g. seasonally and not solely in direct response to precipitation events), they must meet conditions that fully support beneficial uses when they have flow. The dry *ephemeral channels within each of the AUs are addressed in the TMDL, but are not included in the analyses to develop load allocations.*

The TMDL serves to identify the appropriate sediment targets (concentration or streambank erosion) that fully support beneficial uses and identify some of the potential sources of those pollutants. DEQ helps facilitate the WAG and designated management agencies such as the SWCC in crafting an Implementation Plan that restores waterbodies and helps meet water quality standards and supports beneficial uses. The BLM and IDL manage federally- and state-owned lands and the TMDL should be utilized in helping to shape appropriate management of these public lands.

Comment 5: "Numerous references in the first part of the draft indicate that livestock grazing is causing the stream bank stability problem. Yet, here are no studies, instances, photos or amounts of damage per stream caused by livestock. There are references to the off-road use of the streams, but BLM has allows and encouraged OHV use of dry sand washes such as these. Wild horse management by the LBM in the area is inadequate to comply the provisions of the Wild Horse and Burro Act, which specifies management to prevent overpopulation and the resulting impact on resources in the herd area. BLM gathers are less frequent than necessary and the Hardtriger herd, as others in our county, are normally at levels well above the authorized number of animals. Wild horse grazing has a significant impact on vegetation and contributes significantly to streambank trampling. Until the public understands the wildhorse issue, there will always be detrimental effects to stream banks and vegetation. So, those stream channels will never meet a TMDL."

The TMDL identifies multiple potential contributors to increased streambank erosion, including the friable nature of some of the soils 4-wheel use, dirt roads, culverts, BLM wild horse herds, and active livestock grazing, depending on the site-specific location. Photos taken during the streambank erosion inventory on Pickett and Hardtrigger Creeks have now been included in Appendix B, for reference. The TMDL serves to identify appropriate sediment targets (concentration or streambank erosion) and some of the potential sources of those pollutants. DEQ helps facilitate the WAG and designated management agencies such as the SWCC in crafting an Implementation Plan that restores waterbodies and helps meet water quality standards and supports beneficial uses. The BLM and IDL manage federally- and state-owned lands and the TMDL should be utilized in helping to shape appropriate management of these public lands. BLM is the agency responsible for wild horse management and the TMDL may be used to help them meet appropriate horse management objectives in the Hardtrigger Creek subwatershed.

Comment 6: "Idaho WQS require that surface waters of the state be protected for beneficial uses wherever attainable. Most of the stream segments are rangeland with little or none existent water. This is desert with as little as 9 inches of annual precipitation or less with the exception of Hardtrigger and McBride Creek. There is no chance for vegetative treatment without water. The brief period when a flash event occurs is not enough to establish the necessary vegetation for the stability called for in the draft. The BLM in their

management will at this document and force closures to grazing in order to meet an unattainable TMDL."

Although the TMDL addresses each AU in entirety, load allocations are applied only to intermittent/perennial vs. ephemeral stream segments, for which such analyses, targets, and corresponding implementation is meaningful. Additionally, the TMDL does not call for any specific treatment as a result of the sediment concentration or streambank stability targets. Rather, the TMDL serves to identify the appropriate sediment targets (concentration or streambank stability) that fully support beneficial uses and identify some of the potential sources of those pollutants. DEQ helps facilitate the WAG and designated management agencies such as the SWCC in crafting an Implementation Plan that restores waterbodies and helps meet water quality standards and supports beneficial uses. The BLM and IDL will continue to manage federally- and state-owned lands. The TMDL should be utilized in helping to shape appropriate management of these public lands.

Comment 7: "When reviewing the BURP summaries for several of the dry streams, there was a note: "EPA's comment said that mere intermittency was not sufficient for delisting." Requiring IDEQ to relist those streams as impaired. We believe that one would have to have water to test to find out if it is actually water quality impaired."

Many of the BURP sites did not have data collected at some point because a channel was dry. However, the most of the subwatersheds did have successful BURP data collected, depending on the site-specific location and sample period. The BURP data is evaluated as one line of evidence in conjunction with other DEQ data (e.g. SEI) and data from other land and natural resource management agencies (e.g. BLM, SWCC, IDL, Idaho Power, etc.) to help determine potential stream impairment and appropriate loading analyses.

Comment 8: "There is insufficient data to make a call on whether these dry streams are worthy of a TMDL. We do believe that the lower segments in the agricultural grounds may be impaired and can respond to an implementation plan to meet the TMDLs as suggested. Data gaps need to be filled to make a more reasoned TMDL that can be achievable."

Each subwatershed has data to suggest that the water quality is impaired. For Birch Creek and Vinson Wash, BURP and Idaho Power data indicate that sediment concentrations are highly elevated during the irrigation season and water quality doesn't fully support cold water aquatic life (macroinvertebrates). Similarly, Hardtrigger, McBride, and Pickett Creeks each have BURP data that indicate impaired water quality and lack of support for cold water aquatic life (macroinvertebrates) and DEQ collected and provided streambank erosion inventory data indicating excess streambank erosion and sediment input.

Additionally, the TMDL does not call for any specific implementation as a result of the sediment concentration or streambank stability targets. Rather, the TMDL serves to identify the appropriate sediment targets (concentration or streambank stability) that fully support beneficial uses and identify some of the potential sources of those pollutants. DEQ personnel will assist the SWCC in drafting an Implementation Plan.

Comment 9: "The annual average sediment load is not distributed equally throughout the year." Especially when there is water flowing only in some years and then only briefly."

Section 5.1.3 of the TMDL recognizes the sediment analysis use empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bank-full discharge or the average annual peak flow event.

Comment 10: "We agree that social – economic challenges will occur. The best approach for the least economic impact is to delist those very intermittent segments of Pickett Creek, Birch Creek, and Vinson Wash (set in the Draft as an unachievable "…TSS loads must be reduced by an average 97.6%...") as BLM will impose grazing restrictions that will harm the ability to graze those allotments causing severe economic instability. In the eyes of the BLM, that is the only way to feasibly manage those allotments."

The 97.6% reduction is a gross estimate applied to the lower stream segments of Birch Creek and Vinson Wash where instream sediment concentrations are likely most attributable to irrigation runoff from agricultural practices. The TMDL does not assert that the upper dry, ephemeral channels contribute instream sediment to the agriculturally-fed segments near the confluence with the Snake River, except, during extreme precipitation events, which is the only time the ephemeral segments have surface flow, as they are always above the water table.

To meet the instream sediment reductions will require some effort and effective BMP implementation, however, by viewing the data, it is evident that instream concentrations are achieved in October when stream flow is almost double the May – September average. DEQ personnel will assist the SWCC as needed in drafting an Implementation Plan.

Nonpoint sources (e.g. agricultural) meet their water quality obligations under the Clean Water Act through voluntary implementation of BMPs typically identified by the SWCC Conservation Commission. Further, Idaho Statute 39-3610(1) states:

> *"…nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis."*

Idaho Statute 39-3611(10) states:

> *"Nothing in this section shall be interpreted as requiring best management practices for agricultural nonpoint source activities which are not adopted on a voluntary basis…"*

Idaho water quality standards, IDAPA 58.01.02.055, identify that water bodies not fully supporting beneficial uses:

"…shall require the development of TMDLs or other equivalent processes, as described under Section 303(d)(1) of the Clean Water Act."

Name: Karie Pappani and Jason Miller

Affiliation: SWCC

Comment 1: "The SWC wants to emphasize that the streams listed in the 2010 Integrated Report and in the Mid Snake Succor SBA-TMDL Addendum are ephemeral or intermittent. Further we propose re-considering specific sections of these streams for delisting. These specific sections may not correspond to the assessment unit (AU) delineations, so further refinement of AUs is encouraged."

The EPA does not accept intermittency as a rationale to de-list stream segments or exempt them from needing a TMDL. Because intermittent/perennial streams do flow with some regularity (e.g. seasonally and not solely in direct response to precipitation events), they must meet conditions that fully support beneficial uses when they have flow. The dry ephemeral channels within each of the AUs are addressed in the TMDL, but are not included in the analyses to develop load allocations.

"Some of the following information is already described in the SBA-TMDL Addendum. Most of the streams in the Mid Snake Succor Creek subbasin go dry by July or August with zero flow for those summer months.

- **Upper Birch Creek is ephemeral.**
- **Lower Birch Creek is intermittent for approximately 1.85 miles upstream from the confluence with Snake River which is above McKeeth Wash.**

(Please consider breaking the Assessment Unit at this location due to a significant difference in land use (irrigated cropland (Lower Birch Creek) vs. rangeland (Upper Birch Creek)) and land management."

Section 1.2.1 and Figure 2 of the TMDL now more clearly identifies the intermittent/perennial and ephemeral segments of the Birch Creek subwatershed.

- **"Upper Hardtrigger Creek is intermittent from Stewart Gulch to its headwaters.**
- **Lower Hardtrigger Creek is ephemeral 4.2 miles upstream from confluence with Snake River."**

Section 1.2.2 and Figure 3 of the TMDL now more clearly identifies the intermittent/perennial and ephemeral segments of the Hardtrigger Creek subwatershed.

- **"McBride Creek is intermittent for the length of the entire stream during summer months.**
- **Little McBride Creek and Willow Fork are also intermittent during the summer months. Other 2nd order tributaries to McBride Creek are ephemeral."**

Section 1.2.3 and Figure 4 of the TMDL now more clearly identifies the intermittent/perennial and ephemeral segments of the McBride Creek subwatershed.

- **"Similar to other streams in the subbasin, Pickett Creek was dry in the upper reaches in August 2013. However the substrate was dominated by cobbles rather than the fine, sandy material found in Birch Creek."**

Section 1.2.4 and Figure 5 of the TMDL now more clearly identifies the stream segments of the McBride Creek subwatershed. The Pickett Creek AU addressed in this TMDL is intermittent/perennial.

- **"Vinson Wash is intermittent."**

Section 1.2.5 and Figure 6 of the TMDL now more clearly identifies the intermittent/perennial vs. ephemeral segments of the Vinson Wash subwatershed.

Comment 2: "Data collected from one year with flowing water is not reflective of stream conditions as a whole. Sampling an intermittent stream in a wet year may not accurately describe the water quality. While seasonal variation has been considered in the TMDL, interannual variation has not."

Additional data collection can nearly always provide more insight into understanding ecosystem processes. The Streambank Erosion Inventory (SEI) methods have a long history of application and EPA approval in Idaho. Sediment TMDLs using SEI methods have been approved for numerous assessment units (AUs) in Idaho, including the Mid Snake River/Succor Creek TMDL (DEQ 2003b). The SEI methods and data are fully referenced in Appendix B. Additionally, as a part of further documenting TMDL analytical approaches, the SEI method was recently formalized in June 2013 as a DEQ Standard Operating Procedure (SOP).

The SEI sediment analysis relates beneficial use support to percent fine sediment that is retained in channel substrate to impact cold water aquatic life, include fish and macroinvertebrates. This method is only applicable where instream erosion is the predominant source of excess sediment. Where overland runoff and other potential sediment sources are a concern, additional assessment tools must be used to identify those sources.

The SEI methodology is a rapid-assessment data collection approach which provides reliable estimates of current streambank and sediment loading conditions. Longer term data collection methodologies are available, but require significantly more financial, labor, analytical, and temporal resources. For example, the Watershed Assessment of River Stability and Sediment Supply (WARSS) method for sediment production has also been developed (Rosgen 2006), but requires several seasons/years to develop the data to determine the sediment production. It also requires calibration curves to be developed to extrapolate between similar streams. Therefore the SEI or other similar assessment protocols better identify (potential) sediment production in a more cost-effective manner.

The SEI is evaluated as one line of evidence in conjunction with DEQ BURP data and data from other land and natural resource management agencies (e.g. BLM, SWCC, IDL, Idaho Power, etc.) to help determine potential stream impairment and appropriate loading analyses.

Birch Creek

-“DEQ field collection attempts in 1995 and 2001 for Birch Creek resulted in no data because the stream was dry.”

Section 2.4.1 of the TMDL identifies that the 1995 BURP data identifies the channel as having a measured flow of 3.8 cubic feet per second (cfs).

Hardtrigger Creek

-“Typically Hardtrigger Creek flows in the headwaters due to spring sources but the lower portion of Hardtrigger Creek doesn’t flow every year into the Snake River. The lower portion of Hardtrigger Creek is a dry, sandy salt desert shrub community. The flow pattern is very similar to Birch Creek and Vinson Wash.”

Section 1.2.1-5 and Figures 2-6 of the TMDL now more clearly identify the intermittent/perennial vs. ephemeral segments of the AUs addressed in this TMDL.

-“Pg.19 and 20-Please explain what data was used to list Hardtrigger Creek. In 1995 and 1996 the stream was dry. In 1998 percent fines indicated support of COLD. In 2012 percent fines exceeded 28%. In 2012 BLM streambank data showed that approximately half of the data had greater than 80% streambank stability and the other half had less than 80% streambank stability. In 2013 DEQ data had 60% streambank stability with moderate lateral recession. There is considerable variability in the data among years. It appears that Hardtrigger Creek meets beneficial uses in some years and not in others.”

Each of the water quality limited segments addressed in this TMDL (except Vinson Wash) was first listed for sediment on the 1994 §303(d) list, which was promulgated by EPA as part of the first total maximum daily load lawsuit. EPA listed these waters because they were listed in Appendix D: Idaho Impaired Stream Segments Requiring Further Assessment in, The 1992 Water Quality Status Report (DEQ 1992). The original assessments were based on DEQ evaluations, which utilized best professional judgment indicating irrigated crop production and pastureland treatments as suspected sources of sediment to the creeks. The listings have since been carried forward to the current 2010 Integrated Report.

As now more clearly identified in the TMDL, Hardtrigger Creek is has intermittent/perennial and ephemeral segments. As a result, it is reasonable to find the channel dry at times depending on the location, time of year, and year.

It is difficult to speak to the variability in the BLM data, as the older data were collected and analyzed by BLM personnel who were longer available (R. Jackson, pers. comm., 2012). The BLM data collected between 2009 and 2012 vary from 94% to 68% in 2012. The 68%, which is below bank stability believed to support cold water aquatic life and appears similar to the 60% bank stability DEQ observed in 2013.

-"In reference to the following statement on pg. 19 "Additional measurements in the fall would be helpful in parsing out the relative impact of horses and wildlife versus seasonal livestock grazing". Measurements taken in the fall would only represent one month of livestock grazing in addition to the impact of horses and wildlife throughout the entire year; livestock use is not exclusive of wildlife and/or horse use."

The SEI data for Hardtrigger Creek was collected in March 2013, prior to livestock being put on the subwatershed for the season. DEQ believes it is reasonable to investigate the immediate impacts on streambank erosion resulting from an additional potential stressor (livestock), in addition to horses, roads, and other human influences that may be present year-round.

<u>McBride Creek</u>

-"The stream had low flow (0.2 cfs) in 1996 and it was dry in 2001."

Correct.

-"Note: Private land on Upper McBride Creek is intermixed with BLM ground, so applying BMPs is not a viable option for landowners without installing fence to separate BLM ground."

The TMDL serves to identify appropriate sediment targets (concentration or streambank erosion) that fully support beneficial uses and identify some of the potential sources of those pollutants. The BLM and IDL manage federally- and state-owned lands. The TMDL should be utilized in helping to shape appropriate management of these public lands. DEQ helps facilitate the WAG and designated management agencies such as the SWCC in crafting an Implementation Plan that restores waterbodies and helps meet water quality standards and supports beneficial uses.

<u>Pickett Creek</u>

-"Pg. 22 and 40-Substrate fines data collected in 1996 indicate support of the COLD beneficial use. The creek was dry in 2001. Streambank stability data from 2012 are as stated in the TMDL, "right at the threshold" but the lateral recession rate was high. Pickett Creek meets the target of 80% streambank stability. What data was used to list Pickett Creek if the target is 80% streambank stability or ≤28% less fine sediment? Is a TMDL being written based on the high lateral recession rate only?"

Each of the water quality limited segments addressed in this TMDL (except Vinson Wash) was first listed for sediment on the 1994 §303(d) list, which was promulgated by EPA as part of the first total maximum daily load lawsuit. EPA listed these waters because they were listed in Appendix D: Idaho Impaired Stream Segments Requiring Further Assessment in, The 1992 Water Quality Status Report (DEQ 1992). The original assessments were based on DEQ evaluations, which utilized best professional judgment indicating irrigated crop production and pastureland treatments as suspected sources of sediment to the creeks. The listings have since been carried forward to the current 2010 Integrated Report.

Because Idaho water standards are narrative for sediment the key is support of the beneficial uses. The SEI target for this AU is 80% bank stability; however, additional lines of evidence should be used when excessive erosion rate indications are present, even if the 80% stability is or will be met. In this case, the lateral recession rate was 0.15 (which is the upper boundary of "moderate"), 3 times the 0.05 value typically used to set load allocations. As a result, the conservative approach is to develop a TMDL and help ensure cold water aquatic life beneficial uses would be supported, especially given that any agricultural BMP implementation is strictly voluntary.

Additionally, the two 1996 DEQ BURP sites within the Pickett Creek AU of this TMDL received low overall scores of 0 and 1. These included percentages of stable and covered banks ranging from only 33% up to 67%.

Vinson Wash

-"Pg. 12 and 31 and 54-DEQ data collected in 2001 was the basis for listing according to the TMDL addendum. Vinson Wash 1st and 2nd order segments were unassessed while the 3rd order segment was listed for combined biota/habitat bioassessments in the 2010 Integrated Report. Why was more recent data not collected for Vinson Wash to substantiate the sediment listing?"

The schedule for this TMDL when presented to the WAG in October 2012 was to complete a draft TMDL for WAG review in April 2013 and complete the final TMDL in May 2013. As a result, DEQ did not believe there was sufficient time to collect the additional irrigation season (April – September) instream concentration data.

Comment 3: "Pg. 4-Please clarify the following statement "Sediment delivery in the lower segment appears to correspond with irrigation patterns and does not correspond well to streamflow throughout the season." This statement is unclear."

This statement has been revised to clarify that although sediment concentrations peaked in June, while October flows (following the irrigation season) actually increased and sediment concentrations decreased.

Comment 4: "Pg. 37, Section 5.3- How did DEQ choose locations for site specific analyses for streambank stability? The location selected for the 2013 data collection on Hardtrigger Creek is not representative. It is a congregating area that is heavily used by livestock. In addition, the site chosen for McBride Creek is negatively influenced by the road location. Succor, Castle, and Sinker Creeks may not be suitable comparisons as reference reaches because they are mostly perennial streams whereas the streams in this TMDL are intermittent or ephemeral."

The Hardtrigger Creek monitoring locations that DEQ personnel selected: 1) occurred only within intermittent/perennial stream segments, as opposed to dry ephemeral channels, [this corresponds with the loading analysis], 2) were in lower stream segments which tend to be problem areas in larger watersheds [which in this instance may be related to the congregating livestock and adjacent road], helping to provide reliable but conservative estimates (NRCS

1983), 3) according to land ownership, as IDL had requested that a portion of the inventory include state lands, 4) comprised approximately 2.6 miles of inventoried stream, or nearly 20% of the 13-mile total stream distance analyzed in the subwatershed, which is nearly double the 10% inventory ratio recommended for obtaining reliable estimates, 5) included stream segments above the confluence with Hardtrigger and Little Hardtrigger Creeks, and 5) were readily accessible, as WAG participants expressed fervent interest in participating and observing the inventory process.

The Pickett Creek monitoring locations that DEQ personnel selected: 1) occurred only within intermittent/perennial stream segments, [this corresponds with the loading analysis], 2) were readily accessible according to land ownership, as much of Pickett Creek is private and DEQ received landowner permission to survey that portion of the creek, 3) comprised approximately 1.1 miles of inventoried stream, or 17% of the 6.4-mile total stream distance analyzed in the subwatershed.

The McBride Creek monitoring locations that DEQ personnel selected: 1) occurred only within intermittent/perennial stream segments, [this corresponds with the loading analysis], 2) were in upper and lower stream segments [which in this instance may be related to livestock and adjacent road], 3) were readily accessible according to land ownership, working only on public lands, 4) comprised approximately 1.4 miles of inventoried stream, or approximately 7% of the 20.2-mile total stream distance analyzed in the subwatershed.

Within the Mid Snake River/Succor Creek subbasin, Succor, Castle, and Sinker Creeks are suitable reference reaches as only intermittent/perennial stream segments were utilized in the SEI analysis and load allocations for the current TMDL.

Comment 5: "Pg. 39, Table 7-Load reductions are extremely high (avg. 97.6%) for Birch Creek and Vinson Wash. Load reductions in Table 6 are also high for Hardtrigger Creek and Lower McBride Creek. It will be very difficult to meet the reductions set in the TMDL. State and federal funding has decreased and staff resources have declined."

The 97.6% reduction is a gross estimate applied to the lower stream segments of Birch Creek and Vinson Wash where instream sediment concentrations are likely most attributable to irrigation runoff from agricultural practices. The TMDL does not assert that the upper dry, ephemeral channels contribute instream sediment to the agriculturally-fed segments near the confluence with the Snake River, except, during extreme precipitation events, which is the only time the ephemeral segments have surface flow, as they are always above the water table.

To meet the instream sediment reductions will require some effort and effective BMP implementation, however, by viewing the data, it is evident that instream concentrations are achieved in October when stream flow is almost double the May – September average. DEQ personnel will assist the SWCC, as needed, in drafting an Implementation Plan.

Nonpoint sources (e.g. agricultural) meet their water quality obligations under the Clean Water Act through voluntary implementation of BMPs typically identified by the SWCC. Further, Idaho Statute 39-3610(1) states:

"…nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis."

Idaho Statute 39-3611(10) states:

"Nothing in this section shall be interpreted as requiring best management practices for agricultural nonpoint source activities which are not adopted on a voluntary basis…"

Idaho water quality standards, IDAPA 58.01.02.055, identify that water bodies not fully supporting beneficial uses:

"…shall require the development of TMDLs or other equivalent processes, as described under Section 303(d)(1) of the Clean Water Act."

Comment 6: "Pg.42, Section 5.4.6 Natural Background-What are background sediment production estimates for stream channel types that are not A, B, or C channel types? Please check the stream channel types for the streams listed in this TMDL addendum."

DEQ BURP data indicate that McBride, Pickett, and Hardtrigger Creek are combinations of A, B, and F stream channel types. However, the Rosgen Stream channel designation method (Rosgen 1996) was not developed for and is not capable of being directly related to sediment production. Sediment production is more related to the soil-types, geology, land-use, land-use intensity, vegetation type, and percent and downstream factors. Rosgen's system promotes classification and grouping, but the broad-brush approach (e.g. A, B, C, etc.) cannot supply the range and depth of associated factors that lead to sediment production. Further, the system identifies physically based attributes but does not deal well with issues of process and structure or the dynamic nature of channels, which includes disturbance factors that often lead to sediment production.

Comment 7: "Pg. 50, Section 5.5.3 Responsible Parties-Load allocations, as mentioned above, are not achievable."

DEQ believes with time and active implementation, the reductions are achievable and the waters will support their beneficial uses.

Comment 8: "Please change the abbreviation from ISCC to SWCC on page viii, 31, 47, 48, and 56."

The spelling correction has been made in the final TMDL.

Comment 9: "Please correct the spelling of Ed Wilsey on page 102."

The spelling correction has been made in the final TMDL.

Name: Jayne Carlin

Affiliation: EPA

Comment 1: "As discussed, you agreed to include daily load analysis (load capacity, load allocations etc.) for Hardtrigger, Lower McBride, Upper McBride and Pickett Creeks."

Daily load analyses have been included in Table 8 section 5.2.2 of the TMDL. It is important to note that due to the seasonal and annual flow variability of these intermittent/perennial stream segments, daily estimates are a coarse representation of the overall average sediment loading that occurs per day over an entire year.

Comment 2: "In the July 2013 version of the TMDL, you noted that Idaho Concrete Nomad is an active facility near McBride Creek and that DEQ is unable to quantify wasteload allocations. Jayshika Ramrakha, TMDL Stormwater Coordinator, investigated further into Idaho Concrete Nomad's operations…The TMDL for McBride Creek addresses the sediment impairment through streambank stability and allocations are provided in terms of tons of sediment. Therefore, it appears that there are no active point sources which need sediment wasteload allocations for McBride Creek at this time."

This has been clarified in section 5.4.7.2 in the final TMDL.

Comment 3: "You included a table titled "EPA-Permitted NPDES active construction and **industrial sources within the Mid Snake River/Succor Creek subbasin in Owyhee County" in the July 2013 version of the TMDL. You may want to include text to explain the purpose of the table…without an explanation, people may assume that all of these facilities are covered by this TMDL document."**

This has been clarified section 5.4.7.2 in the final TMDL.

References Cited

Brooks, K.N., P.F. Ffolliott, H.M. Gregersen, and J.L. Thames. 1991. *Hydrology and the Management of Watersheds*, 1st ed. Ames, IA: Iowa State University Press.

Langbein, W.G. and K.T. Iseri. 1995. *Manual of Hydrology: Part 1. General Surface-Water Techniques*, Geological Survey Water-Supply Paper 1541, HTML Version: U.S. Geological Survey.

NRCS (Natural Resources Conservation Service). 1983. "Erosion and Sediment Yield." In: Proceedings from the Channel Evaluation Workshop. Ventura, CA.

Rosgen, D. 1996. *Applied River Morphology*, Pagosa Springs, CO: Wildland Hydrology.

Rosgen, D. 2006. *Watershed Assessment of River Stability and Sediment Supply (WARSS)*, Fort Collins, CO: Wildland Hydrology.

Pattern, D.T. 1998. "Riparian ecosystems of semi-arid North America: diversity and human impacts." *Wetlands* 18:498-512.

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

Appendix D. Distribution List

Although this list is certainly not fully inclusive, DEQ is grateful for the assistance of the watershed advisory group and other individuals who participated in the development of the Mid Snake River/Succor Creek TMDL addendum:

Mr. Ted Blackstock, Landowner/Farmer/Rancher

Ms. Connie Brandau, Landowner/Farmer/Rancher

Mr. Richard Brandau, Landowner/Farmer/Rancher

Mr. Brian Collett, Landowner/Farmer/Rancher

Mr. Jerry Hoagland, Landowner/Farmer/Rancher

Ms. Melissa Jayo, Landowner/Farmer/Rancher

Mr. Hans Jensen, Landowner/Farmer/Rancher

Mr. Ron Kiester, Landowner/Farmer/Rancher

Mr. James Nederend, Landowner/Farmer/Rancher

Mr. Daniel Richards, Landowner/Farmer/Rancher

Mr. Bill White, Landowner/Farmer/Rancher

Mr. Eddie Wilsey, Landowner/Farmer/Rancher

Mr. Mark Frost, Grand View Irrigation District

Mr. Randy Hipwell, Grand View Mutual Canal Company

Mr. Jerry Meyers, Grand View Mutual Canal Company

Mr. Charles Kiester, Owyhee Conservation District

Ms. Gina Millard, Owyhee Conservation District

Ms. Loretta Chandler, Bureau of Land Management

Mr. Rich Jackson, Bureau of Land Management

Mr. Mike Spicer, Bureau of Land Management

Mr. Peter Torma, Bureau of Land Management

Ms. Jayne Carlin, US Environmental Protection Agency

Mr. Leigh Woodruff, US Environmental Protection Agency

Ms. Diane French, Idaho Department of Lands

Ms. Rebecca Rutan, formerly with Idaho Department of Lands

Mr. Brian Hoelscher, Idaho Power Corporation

Mr. Andy Knight, Idaho Power Corporation

Mr. Jason Miller, Idaho Soil and Water Conservation Commission

Ms. Karie Pappani, Idaho Soil and Water Conservation Commission

Mr. Delwyne Trefz, Idaho Soil and Water Conservation Commission