Lower Boise River Tributaries

2014 Addendum of the Sediment and E. Coli TMDLs

Hydrologic Unit Code 17050114

Image forthcoming

WAG DRAFT

(Technical Editing Will Be Done Before Public Comment)

State of Idaho
Department of Environmental Quality

DRAFT: Friday June 14 2013

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Acknowledgments

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Abbreviations, Acronyms, and Symbols

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

µ micro, one-one thousandth

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

ADB assessment database

AU assessment unit

AWS agricultural water supply

BAG Basin Advisory Group

BLM United States Bureau of Land Management

BMP best management practice

BOD biochemical oxygen demand

BOR United States Bureau of Reclamation

Btu British thermal unit

BURP Beneficial Use Reconnaissance Program

C Celsius

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

cfs cubic feet per second

cm centimeters

CWA Clean Water Act

CWAL cold water aquatic life

CWE cumulative watershed effects

DEQ Department of Environmental Quality

DO dissolved oxygen

DOI U.S. Department of the Interior

DWS domestic water supply

EMAP Environmental Monitoring and Assessment Program

EPA United States Environmental Protection Agency

ESA Endangered Species Act

F Fahrenheit

FPA Idaho Forest Practices Act

FWS U.S. Fish and Wildlife Service

GIS Geographical Information Systems

HUC Hydrologic Unit Code

I.C. Idaho Code

IDAPA Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL Idaho Department of Lands

IDWR Idaho Department of Water Resources

INFISH the federal Inland Native Fish Strategy

IRIS Integrated Risk Information System

km kilometer

km^2 square kilometer

LA load allocation

LC load capacity

m meter

m^3 cubic meter

mi mile

mi^2 square miles

MBI Macroinvertebrate Biotic Index

MGD million gallons per day

mg/L milligrams per liter
mm millimeter

MOS margin of safety

MRCL multiresolution land cover

MWMT maximum weekly maximum temperature

n.a. not applicable

NA not assessed

NB natural background

nd no data (data not available)

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

NTU nephelometric turbidity unit

ORV off-road vehicle

ORW Outstanding Resource Water

PACFISH the federal Pacific Anadromous Fish Strategy

PCR primary contact recreation

PFC proper functioning condition

ppm part(s) per million

QA quality assurance

QC quality control

RBP rapid bioassessment protocol

RDI DEQ’s River Diatom Index

RFI DEQ’s River Fish Index

RHCA riparian habitat conservation area

RMI DEQ’s River Macroinvertebrate Index

RPI DEQ’s River Physiochemical Index

SBA subbasin assessment

SCR secondary contact recreation

SFI DEQ's Stream Fish Index

SHI DEQ's Stream Habitat Index

SMI DEQ's Stream Macroinvertebrate Index

SRP soluble reactive phosphorus

SS salmonid spawning

SSOC stream segment of concern

STATSGO State Soil Geographic Database

TDG total dissolved gas

TDS total dissolved solids

T&E threatened and/or endangered species

TIN total inorganic nitrogen

TKN total Kjeldahl nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

U.S.C. United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WET whole effluence toxicity

WLA wasteload allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

WQS water quality standard

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Executive Summary

This document addresses the sediment and bacterial impairments of 23 assessment units in the Lower Boise watershed in southwest Idaho. The Lower Boise watershed incorporates the Boise River and its tributaries between the outflow of Lucky Peak dam and the Snake River. The assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the Lower Boise watershed, located in southwest Idaho.

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 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) establishes requirements for states and tribes to identify and prioritize water bodies that do not meet water quality standards. States and tribes must periodically publish a prioritized list (a "§303(d) list") of impaired waters. This list is currently published every 2 years as the list of Category 5 waters in the Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) of pollutants, set at a level to achieve water quality standards.

The starting point for this assessment was Idaho's current (2012) §303(d) list of water quality limited water bodies. The SBA examines the status of §303(d) listed waters and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The TMDL analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

Rather than address the entire catalog of impaired streams in the watershed, this document focuses on only the sediment and bacteria impairments. This will allow DEQ to address the waters listed in its TMDL settlement agreement in the most efficient manner.

Sediment and E. coli TMDLs were previously established for the mainstem of the Boise River. This document establishes nine new sediment and ten new E. coli TMDLs for the river's impaired tributaries (Table A).

The new load capacities and allocations take the form of flow-variable equations. There are similar flow-variable equations for wasteload allocations and reserve for growth.

Table A. Summary of new TMDLs.

Assessment Unit	Description	Pollutant
ID17050114SW001_02	Dixie Slough	E. coli
ID17050114SW002_04	Indian Creek downstream of Sugar Ave	Sediment
ID17050114SW002_04	Indian Creek downstream of Sugar Ave	E. coli
ID17050114SW003b_03	Indian Creek upstream of Mora	Sediment
ID17050114SW003d_03	Indian Creek upstream of Reservoir	Sediment
ID17050114SW003d_02	Indian Creek headwaters	Sediment
ID17050114SW003d_02	Indian Creek and Tributaries upstream of Indian Creek	E. coli
ID17050114SW006_02	Mason Creek entire watershed	Sediment
ID17050114SW006_02	Mason Creek entire watershed	E. coli
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth	Sediment
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth	E. coli
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth	Sediment
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth	E. coli
ID17050114SW010_02	Nine Mile Creek 1st and 2nd order tributaries to Five Mile Creek	E. coli
ID17050114SW010_03	Five Mile Creek 3rd order section	Sediment
ID17050114SW010_03	Five Mile Creek 3rd order section	E. coli
ID17050114SW012_02	Sand Creek	E. Coli
ID17050114SW015_03	Willow Creek 3rd order section (South Fork to mouth)	Sediment
ID17050114SW016_03	Sand Hollow Creek C-line Canal to I-84	Sediment
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road	Sediment
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road	E. coli
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River	Sediment
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River	E. coli

Sediment targets were established using a 1996 paper by Newcombe and Jensen (CITATION). Existing sediment levels were measured using data collected by several government agencies.

E. coli targets were based upon the Idaho water quality standards. Existing E. coli levels (in the format of 30 day geometric means) were measured using data collected by several government agencies.

To fully implement this TMDL, nonpoint sources must reduce their sediment and E. coli pollution. Point sources are presently meeting the pollutant targets.

Table B. Summary of assessment outcomes for the Lower Boise River subbasin.

Assessment Unit	Description	Pollutant	Recommended Changes to the next Integrated Report
ID17050114SW001_02	Dixie Slough	E. coli	Move to 4A – TMDL completed
ID17050114SW002_04	Indian Creek downstream of Sugar Ave		
ID17050114SW003d_02	Indian Creek headwaters		
ID17050114SW006_02	Mason Creek entire watershed		
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth		
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth		
ID17050114SW010_02	Nine Mile Creek 1st and 2nd order tributaries to Five Mile Creek		
ID17050114SW010_03	Five Mile Creek 3rd order section		
ID17050114SW012_02	Sand Creek		
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road		
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River		
ID17050114SW002_04	Indian Creek downstream of Sugar Ave	Sediment	Move to 4A – TMDL completed
ID17050114SW003b_03	Indian Creek upstream of Mora		
ID17050114SW003d_03	Indian Creek upstream of Reservoir		
ID17050114SW003d_02	Indian Creek headwaters		
ID17050114SW006_02	Mason Creek entire watershed		
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth		
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth		
ID17050114SW010_03	Five Mile Creek 3rd order section		
ID17050114SW015_03	Willow Creek 3rd order section (South Fork to mouth)		
ID17050114SW016_03	Sand Hollow Creek C-line Canal to I-84		
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road		
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River		

Watershed Overview

The Lower Boise River, Hydrologic Unit Code (HUC) 17050114, is located in southwest Idaho. The watershed drains 1290 square miles of rangeland, forests, agricultural lands, and urban areas. The lower Boise River itself is a 64-mile stretch that flows in a northwesterly direction through Ada and Canyon counties and the cities of Boise and Caldwell, Idaho. The lower Boise River originates at Lucky Peak Dam and flows into the Snake River near Parma, Idaho.

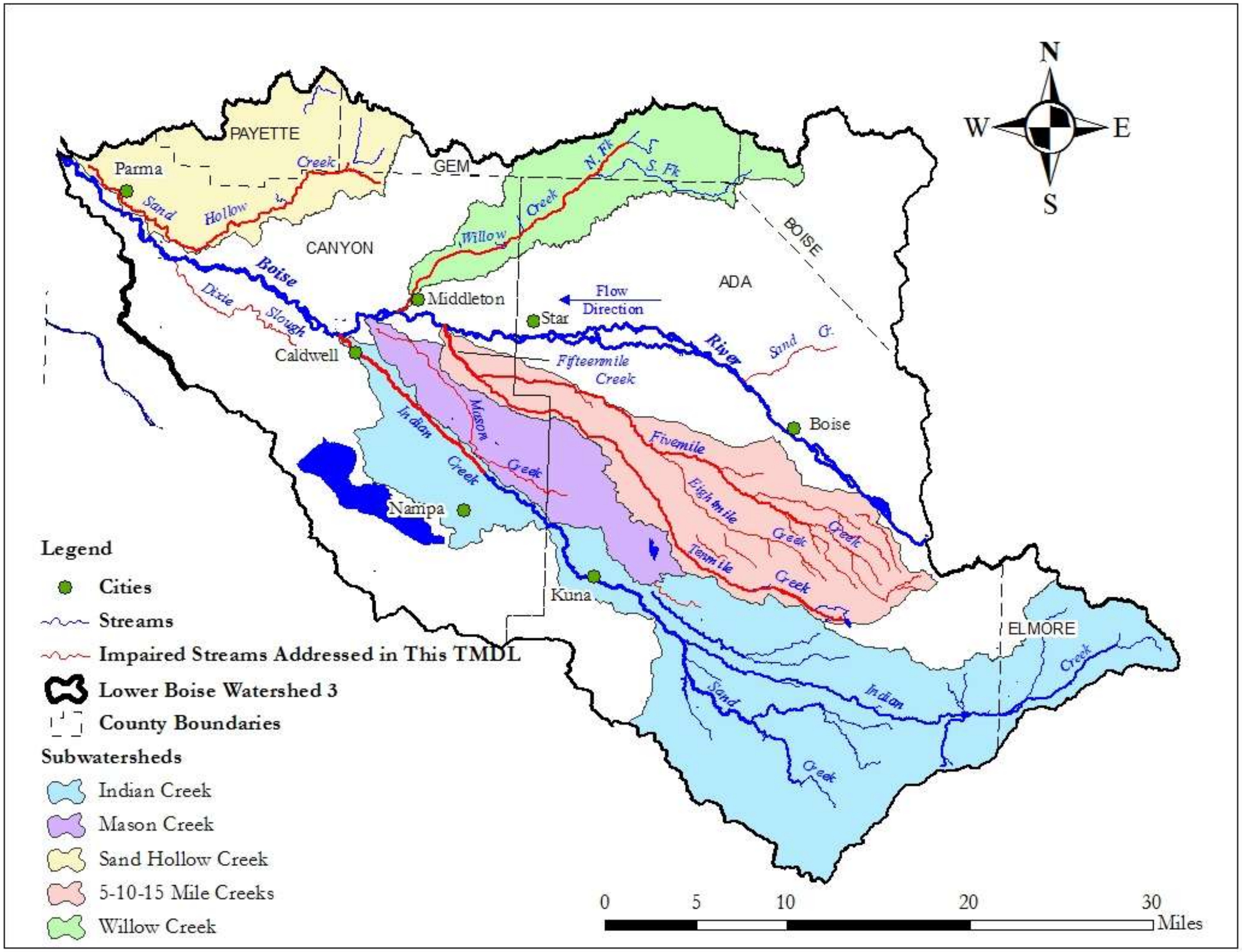
Impaired beneficial uses: Cold water aquatic life, secondary contact recreation

Pollutants addressed in this document: sediment, E. coli

Pollutant sources: stormwater, municipal wastewater treatment, agriculture

Impaired subwatersheds: Indian Creek, Mason Creek, Willow Creek, Sand Hollow Creek, Five Mile Creek, Ten Mile Creek, Fifteen Mile Creek

The Lower Boise River subbasin is shown in figure 1, with the individual subwatersheds indicated in figure 2.



PAYETTE
GEM
CANYON
ADA
BOISE
ELMORE
Parma
Middleton
Star
Caldwell
Boise
Nampa
Kuna
Sand Hollow Creek
Willow Creek
N. Fk
S. Fk
Boise River
Dixie Slough
Flow Direction
Fifteenmile Creek
Sand Cr.
Fivemile Creek
Eightmile Creek
Tenmile Creek
Mason Creek
Indian Creek
Sand Creek
N
S
W
E
Legend
Cities
Streams
Impaired Streams Addressed in This TMDL
Lower Boise Watershed 3
County Boundaries
Subwatersheds
Indian Creek
Mason Creek
Sand Hollow Creek
5-10-15 Mile Creeks
Willow Creek
0 5 10 20 30
Miles

Figure 2: Subwatershed MAP:.

Several assessment units were listed on Idaho's 2012 §303(d) list, not all of which are addressed by this TMDL. Table E shows the assessment units that will be addressed by this TMDL (DEQ 2012). Table F shows assessment units that are not listed as impaired on the 2012 303(d) list, but will be addressed in this TMDL. They may be listed as impaired in the pending 2014 303(d) list.

Table E. Assessment units on Idaho's 2012 §303(d) list.

AU	Description	Pollutant
ID17050114SW002_04	Indian Creek downstream of Sugar Ave	Sediment
ID17050114SW002_04	Indian Creek downstream of Sugar Ave	E. coli
ID17050114SW003b_03	Indian Creek above Mora	Sediment
ID17050114SW003d_02	Indian Creek headwaters	Sediment
ID17050114SW003d_02	Indian Creek headwaters	E. coli
ID17050114SW003d_03	Indian Creek above of Reservoir	Sediment
ID17050114SW006_02	Mason Creek entire watershed	Sediment
ID17050114SW006_02	Mason Creek entire watershed	E. coli
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth	E. coli
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth	Sediment
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth	Sediment
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth	E. coli
ID17050114SW010_02	1st and 2nd order tributaries to Five Mile Creek, including Nine Mile Creek	E. coli
ID17050114SW010_03	Five Mile Creek 3rd order section	E. coli
ID17050114SW010_03	Five Mile Creek 3rd order section	Sediment
ID17050114SW015_03	Willow Creek 3rd order section (South Fork to mouth)	Sediment
ID17050114SW016_03	Sand Hollow Creek C-line Canal to I-84	Sediment
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road	Sediment
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road	E. coli
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River	Sediment
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River	E. coli

Table F. Unlisted but impaired assessment units.

Assessment Unit	Description	Pollutant
ID17050114SW001_02	Dixie Slough	E. coli
ID17050114SW012_02	Sand Creek	E. coli

This subbasin assessment (SBA) and TMDL analysis have been developed to address the water bodies in the Lower Boise River subbasin that have been placed on Idaho's current §303(d) list.

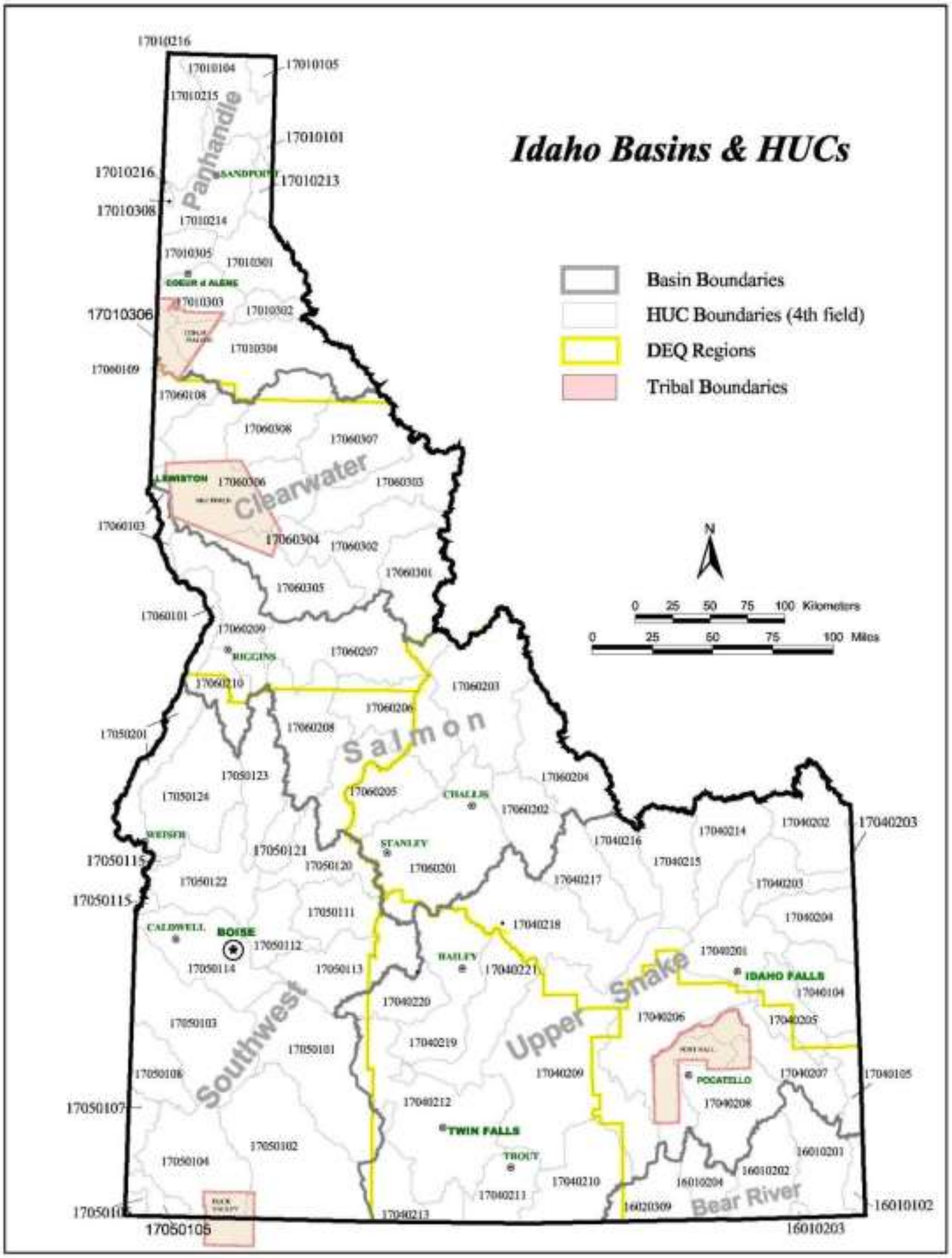


Figure 1. Location of the lower Boise watershed.
XXX Can we highlight 17050114 basin?

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The TMDL load capacities and allocations are flow-dependent. The water quality targets are year-round, and the monitoring points are generally at the bottom of each assessment unit.

Table G. Summary of Load Capacities

Pollutant	Water Quality Target			Load Capacity
Sediment	Levels that will produce effects no worse than SEV 8 on salmonids (Newcombe and Jensen 1996)	Five Mile Creek Ten Mile Creek	33 mg/L (92 day average)	Q (in cfs) × 80.9 kg/day
		Mason Creek Sand Hollow Creek Indian Creek	20mg/L (4 month average)	Q (in cfs) × 49.0 kg/day
		Fifteen Mile Creek Willow Creek	23mg/L (84 day average)	Q (in cfs) × 56.4 kg/day
E. Coli	126 CFU/100ml, averaged over 30 days			Q (in cfs) × 48.9 x 10^9 CFU/day

Subbasin Assessment – Watershed Characterization

This document addresses the sediment and bacterial impairments of 18 assessment units in the Lower Boise watershed in southwest Idaho. These impairments are identified on Idaho's most recent 303(d) list of impaired waters. This document is an addendum to the 1999 Lower Boise TMDL.

1.1. Introduction—Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements, as described in the following.

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. 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 is an addendum to an existing TMDL, and addresses the water bodies in the Lower Boise River subbasin that have been placed on Idaho's §303(d) list (DEQ 2014). This addendum establishes twelve new sediment and eleven new E. coli TMDLs.

1.2. Public Participation and Comment Opportunities

The development of this document included the following public participation:

September 2012: The technical advisory committee was invited to submit papers addressing the effect of elevated sediments on cold water aquatic life.

October 2012: The technical advisory committee debated E. coli targets, and recommended they be sent to the watershed advisory group. The WAG subsequently voted to approve the E. coli targets

November 2012: The technical advisory committee debated sediment targets and recommended another meeting. The WAG members were individually consulted about the strategy and direction of the TMDL, and about the pollutant targets.

December 2012: The technical advisory committee debated sediment targets and recommended another meeting.

January 2013: The WAG voted to approve the sediment targets

April 2013: The WAG members were individually consulted about the method for allocating the load capacity amongst the various sources.

June 2013: The technical advisory committee was provided a draft copy of the TMDL to review.

July 2013: Individual consultations with all members of the WAG regarding specific concerns or comments about the TMDL.

August 2013 – November 2014: Extended WAG comment and suggestion period.

1.3. Physical and Biological Characteristics

A detailed discussion of the physical and biological characteristics of the lower Boise watershed is provided in the Lower Boise River Subbasin Assessment and TMDL (pages 3-19). This document was approved by EPA in January 2000.

1.3.1. Climate

A detailed discussion of the climate characteristics of the Lower Boise River watershed is provided in the Lower Boise River Subbasin Assessment and TMDL (pages 3-19). This document was approved by EPA in January 2000.

The average maximum and minimum air temperature and average annual precipitation have changed slightly since the 2001 Subbasin Assessment. The most recent climate statistics are presented in Table 1 below, and originated from the Western Region Climate Center database.

Table 1. Air temperature and precipitation statistics.

Location	Average Summer Maximum Air Temperature (ºF)	Average Winter Minimum Air Temperature (ºF)	Average Annual Precipitation (inches)
Boise Airport (1976-2005)	90.5	22.3	11.76
Nampa (1976-2005)	91.1	21.5	11.2
Caldwell (1976-2005)	91.1	21.5	10.6

1.3.2. Subbasin Characteristics

A detailed discussion of the subbasin characteristics of the lower Boise watershed is provided in the Lower Boise River Subbasin Assessment and TMDL (pages 3-19).

The past decade has seen increased conversion of farmland into other uses.

- Update as necessary.

1.3.3. Subwatershed Characteristics

The Five Mile and Ten Mile Creek subwatersheds drain 83 and 74 square miles of rangeland, agricultural land and urban areas, respectively. Both streams are located in the southeast portion of the lower Boise River watershed. Five Mile and Ten Mile Creek flow in a northwesterly direction through Ada and Canyon Counties before they join together to form Fifteen Mile Creek, which discharges to the lower Boise River four miles upstream of Middleton.
Small tributaries to Five Mile Creek include Eight Mile and Nine Mile Creeks. Much of the system is maintained as an agricultural drain by Nampa Meridian and Pioneer Irrigation Districts.

The Mason Creek subwatershed drains 62 square miles of rangeland, agricultural land and urban areas. Mason Creek is located in the southern portion of the lower Boise River watershed. Mason Creek largely flows through Canyon County, but the headwaters are located in Ada County. The stream flows in a northwesterly direction from its origin at the New York Canal to its confluence with the lower Boise River in the city of Caldwell. Much of Mason Creek is maintained as an agricultural drain by Pioneer Irrigation District.

The Indian Creek subwatershed drains 295 square miles of rangeland, agricultural land and urban areas. Indian Creek is 55.68 mile long and is located in the southern portion of the lower Boise River watershed, which is located in southwest Idaho. The headwaters of Indian Creek are in Elmore County, but most of the stream flows through Ada and Canyon Counties. The stream flows in a southwesterly direction from its origin to where it intersects Interstate 84. From Interstate 84 to its confluence with the lower Boise River it flows in a northwesterly direction.

The Willow Creek subwatershed drains 84 square miles of rangeland, agricultural land and mixed rural farmstead. Willow Creek is located in the northern portion of the lower Boise River watershed. Willow Creek flows largely through Ada and Canyon Counties, with its headwaters in parts of Gem and Boise Counties. The stream flows in a southwesterly direction from its origin its confluence with the Boise River near Middleton.

The Sand Hollow Creek subwatershed drains 93 square miles of rangeland, agricultural land and mixed rural farmstead. Sand Hollow Creek is located in the northwest portion of the lower Boise River watershed, although it ultimately drains to the Snake River. Sand Hollow Creek largely flows through Canyon County, but the headwaters are located in Gem and Payette Counties. The stream flows in a southwesterly direction from its origin to Interstate 84, then in a northwesterly direction from the interstate to its confluence with the Snake River below Parma.
Even though it sources most of its water from the Payette system, and drains into the Snake River, Sand Hollow Creek is included in the Lower Boise TMDL because it is within the same USGS fourth-field HUC. It is also generally considered to be part of the Lower Boise system, and is covered by the Lower Boise WAG.

Detailed discussions of the subwatersheds within the Lower Boise River subbasin are provided in the following documents:

- Water in the Boise Valley: a History of the Nampa and Meridian Irrigation District (appendix I) (Stevens 2014)

- Estimates of impacts on Lower Boise Valley Drain Discharge with Elimination of Gravity Irrigation (ERO 2014)
- Five Mile and Ten Mile Creek Subbasin Assessment (December 2001).
- Mason Creek Subbasin Assessment (December 2001)
- Sand Hollow Creek Subbasin Assessment (December 2001)
- Indian Creek Subbasin Assessment (December 2001)

1.3.4. Stream Characteristics

Detailed discussions of the streams within the Lower Boise River subbasin are provided in the following documents:

Five Mile and Ten Mile Creek Subbasin Assessment (December 2001)

Mason Creek Subbasin Assessment (December 2001)

Sand Hollow Creek Subbasin Assessment (December 2001)

Indian Creek Subbasin Assessment (December 2001)Water in the Boise Valley: a History of the Nampa and Meridian Irrigation District (appendix I) (Stevens 2014)Estimates of impacts on Lower Boise Valley Drain Discharge with Elimination of Gravity Irrigation (ERO 2014)

In general, each stream slopes gently to its confluence with the Boise River (or the Snake River, in the case of Sand Hollow Creek). The stream channels have been classified as Rosgen ‘F’ types, which is a deeply entrenched, low gradient (<0.02) stream with a high width/depth ratio, and a riffle/pool morphology (Rosgen, 1994). The entrenched aspect of each channel has been amplified by the extensive deepening and widening that occurred in the early part of the century.

The streambeds ranges from silt-size (<1 mm) material to large cobble (128.1-256 mm), although silt and sand material comprise most of the substrate. Larger substrate material is highly dispersed in cobble and gravel areas and typically embedded. The banks are typically stable with vegetation.
In general, the numerous man-modified portions of each stream, along with the regulated irrigation flow have caused a narrowing and straightening of the stream channel. Braiding and sinuosity caused by divergent and out of bank flow events are largely absent.

Five Mile Creek is intermittent upstream from the Locust Grove/Franklin intersection. Ten Mile Creek is intermittent upstream of McDermott Road. The target analysis used later in this TMDL is designed to only apply to the perennial portions of each stream.
Above their confluence, Five and Ten Mile Creeks are fast-moving, straightened channels. Both have fish barriers (such as the Five Mile Feeder diversion), and are maintained as drainage facilities by the irrigation districts. Below the confluence, where the stream becomes known as Fifteen Mile Creek, the water slows down, and as the channel approaches the Boise river, it acquires several more ‘natural’ features, including sporadic riparian vegetation.

1.4. Cultural Characteristics

A detailed discussion of the cultural characteristics of the lower Boise watershed is provided in the Lower Boise River Subbasin Assessment and TMDL (pages 3-19).

Until the 2008 financial crisis, the cities in the Lower Boise River subbasin continued to experience the types of urban expansion described in the Subbasin Assessment. This has provided opportunities for municipal and industrial point sources to improve facilities and implement new technologies to prevent pollution. The city of Kuna recently began operating a wastewater treatment plant using membrane filtration technology that is capable of releasing Class A effluent expected to meet a total phosphorus target of 70µg/L. EPA has recently issued municipal storm water system National Pollutant Discharge Elimination System (NPDES) permits for several entities in the watershed. The storm water management activities required in the permits are consistent with the urban storm water pollution controls identified in the lower Boise River TMDL implementation plan (DEQ, 2003a).

Caldwell is actively developing and implementing plans to restore Indian Creek to an open channel through the city center and recently (2008) completed a three-block section of a seven-block master plan. This project exemplifies changing community attitudes regarding Indian Creek over the past 100 years; from using the stream as a communal wasteway and open sewer to a philosophy that the creek is a valuable asset to be protected and appreciated as a socially and economically beneficial natural resource.

2. Subbasin Assessment – Water Quality Concerns and Status

This section provides an overview of the assessment units addressed in this addendum, beneficial uses applicable to those assessment units, and the water quality criteria in place to protect those uses. This section also summarizes existing water quality data and identifies any data gaps found during the TMDL analysis.

2.1. Water Quality Limited Assessment Units Occurring in the Subbasin

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

The listing history since the original Subbasin Assessment was approved in 2001 is exceedingly complex, because of Idaho's conversion from a 'named stream' system to one using 'assessment units'. Table 2 identifies the stream segments that are on the 2012 303(d) list that will be addressed by this TMDL document.

Table 2. 2012 §303(d) Segments in the Lower Boise River Subbasin addressed by this TMDL addendum

Assessment Unit	Description	Pollutants	Listing Reason
ID17050114SW002_04	Indian Creek: downstream of Sugar Avenue in Nampa	Sediment	1988 303(d) list
		E. coli	2011 DEQ data (2012 draft IR)
ID17050114SW003b_03	Indian Creek above Mora	Sediment	1988 Evaluation
ID17050114SW003d_02	Indian Creek headwaters	E. coli	2012 DEQ data (2012 draft IR)
		Sediment	1988 Evaluation
ID17050114SW003d_03	Indian Creek above Reservoir	Sediment	1988 Evaluation
ID17050114SW006_02	Mason Creek: entire watershed	E. coli	2008 ISDA data
		Sediment	1988 303(d) list
ID17050114SW007_04	Fifteen Mile Creek: Five/Ten Mile confluence to mouth	Sediment	1988 303(d) list

Assessment Unit	Description	Pollutants	Listing Reason
		E. coli	2011 DEQ data
ID17050114SW008_03	Ten Mile Creek: Blacks Creek Reservoir to mouth	Sediment	1988 303(d) list
		E. coli	2011 DEQ data (2012 draft IR)
ID17050114SW010_02	1st and 2nd order tributaries to Five Mile Creek	E. coli	2011 DEQ data (2012 draft IR)
ID17050114SW010_03	Five Mile Creek: 3rd order section	Sediment	1988 303(d) list
		E. coli	2011 DEQ data
ID17050114SW015_03	Willow Creek: South Fork to mouth	Sediment	2001 ISDA data
ID17050114SW016_03	Sand Hollow Creek: C line Canal to I-84	Sediment	1988 303(d) list
ID17050114SW017_03	Sand Hollow Creek: I84 to Sharp Road	Sediment	1988 303(d) list
		E. coli	2010 DEQ data (2012 draft IR)
ID17050114SW017_06	Sand Hollow Creek: Sharp Road to Snake River	Sediment	1988 303(d) list
		E. coli	2010 DEQ data

The remaining impaired streams and pollutants on the 2012 303(d) list are not addressed by this TMDL addendum.

Table 3XX shows two assessment units that are proposed for listing on the 2014 303(d) list and that will be addressed by this TMDL:

Table 3XX

Assessment Unit	Description	Pollutants	Proposed Listing Reason
ID17050114SW001_02	Dixie Slough	E. coli	2013 DEQ data
ID17050114SW012_02	Sand Creek	E. coli	2014 DEQ data

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. Undesignated Surface Waters

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02 §110-160). The WQS have three sections that address nondesignated waters. Section 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most of Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to *presumed uses*, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Table 3. Beneficial uses of Section 303(d) listed streams addressed in this document

Assessment Unit	Description	Beneficial Uses[a]	Use Type[b]	Use Support[c]
ID17050114SW001_02	Dixie Slough	PCR	DESIG	NA[d]
ID17050114SW002_04	Indian Creek: downstream of Sugar Avenue in Nampa	CWAL SCR	DESIG DESIG	NFS NFS
ID17050114SW003b_03	Indian Creek above Mora	CWAL SCR	DESIG DESIG	NFS FS
ID17050114SW003d_02	Indian Creek headwaters	CWAL SCR	DESIG DESIG	FS NFS
ID17050114SW003d_03	Indian Creek above Reservoir	CWAL SCR	DESIG DESIG	NFS FS
ID17050114SW006_02	Mason Creek: entire watershed	CWAL SCR	PRES DESIG	NFS NFS
ID17050114SW007_04	Fifteen Mile Creek: Five/Ten Mile confluence to mouth	CWAL SCR	PRES DESIG	NFS NFS
ID17050114SW008_03	Ten Mile Creek: Blacks Creek Reservoir to mouth	CWAL SCR	DESIG DESIG	NFS NFS
ID17050114SW010_02	1st and 2nd order tributaries to Five Mile Creek	CWAL SCR	DESIG DESIG	NFS NFS
ID17050114SW010_03	Five Mile Creek: 3rd order section	CWAL SCR	DESIG DESIG	NFS NFS
ID17050114SW012_02	Sand Creek	SCR	EX	NA[d]
ID17050114SW015_03	Willow Creek: South Fork to mouth	CWAL	PRES	NFS

Assessment Unit	Description	Beneficial Uses[a]	Use Type[b]	Use Support[c]
ID17050114SW016_03	Sand Hollow Creek: C line Canal to I-84	CWAL SCR	EX DESIG	NFS FS
ID17050114SW017_03	Sand Hollow Creek: I84 to Sharp Road	CWAL SCR	EX DESIG	NFS NFS
ID17050114SW017_06	Sand Hollow Creek: Sharp Road to Snake River	CWAL SCR	EX DESIG	NFS NFS

[a] CWAL – cold water aquatic life, SCR – secondary contact recreation
[b] DESIG = designated, EX = existing, PRES = presumed use protection
[c] NFS = not fully supporting, FS = fully supporting NA = not assessed
[d] Dixie Slough and Sand Creek are impaired by E. coli, but were not assessed in time for the 2012 303(d) list. They are proposed for listing on the 2014 303(d) list.

2.2.4. Attainment of Beneficial Uses in the Subbasin

Designated uses must reflect existing uses, but also may include uses that do not currently exist if the uses can be attained in the future. (Idaho Code § 39-3604). The Dixie Slough, Indian Creek, Ten Mile Creek, and Five Mile Creek AUs are designated for cold water aquatic life and recreational uses. Mason Creek, Fifteen Mile Creek and Sand Hollow are designated for recreational uses, but are undesignated for aquatic life. Willow Creek and Sand Creek are not designated for any uses. Under section 101.01 (discussed above) Mason Creek, Fifteen Mile Creek, Sand Hollow Creek, Willow Creek and Sand Creek are presumed to support cold water aquatic life, and so are protected for this use through the application of the applicable cold water aquatic life criteria. Part of the purpose of a Subbasin Assessment is to review whether the uses that are designated are attainable uses. For the Lower Boise Subbasin, this means looking at whether cold water aquatic life and recreational uses are attainable uses in the AUs in table 3 above.

A designated use is attained if it actually occurs or exists, regardless of whether the use is currently fully supported. (Idaho Code §§39-3602(2) and (13); 39-3604). DEQ's review of relevant information establishes that cold water aquatic life and recreational uses are existing or attained uses in the AUs in table 3 below.

Further explanation of the uses:
Dixie Slough PCR: To determine whether a recreational use is existing, DEQ looks at (1) whether there are designated recreational facilities; (2) the size of the water body; and (3) accessibility. (WBAG2 at page 3-10). The slough is big enough for swimming, but it is fast and deep, which presents safety issues. The slough is almost entirely on private land, so accessibility is limited. Wetland bird hunting occurs on and near the creek. The slough is part of Boise River AU, which is designated for PCR.

Indian Creek lower CWAL: Trout and sculpin populations found upstream (above Sugar Avenue) and downstream (Boise River).; no reason why they could not exist in between, if the creek were cleaner. IDFG stocks Indian Creek in Caldwell (IDFG Website). Therefore, cold water aquatic life is an existing use in this creek.

Indian Creek lower SCR: Presence of trail pathway in Caldwell provides access which makes swimming likely. Daylighted is section used for kayaking and swimming. Primary Contact Recreation may be a more appropriate designation.

Mason Creek: CWAL: USGS found 7 trout here in October 2011. (Water-Quality and Biological Conditions in Selected Tributaries of the Lower Boise River, Southwestern Idaho, Water Years 2009–12, USGS 2014). The DEQ Beneficial Use Reconnaissance Program (BURP) has collected fish and macroinvertebrate data on Mason Creek. The data identify the presence of aquatic macroinvertebrates, and cool water fishes such as redside shiner, smallmouth bass, and northern pikeminnow. These fish assemblages indicate that cold water aquatic life may be an existing use in Mason Creek. Other uses (seasonal cold or modified) may also be appropriate.

Mason Creek: SCR. Creek passes through Lakeview Park in Nampa, where swimming is common. DEQ subbasin assessment (2001) asserts that 'many portions of Mason Creek are used for swimming and wading', although the managing irrigation districts discourage such activities. . Creek is certainly deep enough and accessible enough in Lakeview Park that it is highly likely that some recreation occurs. Therefore, contact recreation is an existing use.

Fifteen Mile Creek: CWAL. Native rainbow trout were found during an electrofishing survey in fall 2013. The creek is also directly connected to the Boise River, a reservoir of trout population. Other cool water species were also found in this creek. These fish assemblages indicate that cold water aquatic life may be an existing use in Mason Creek. Other uses (seasonal cold or modified) may also be appropriate.

Fifteen Mile Creek: SCR. Fifteen Mile Creek enters the Boise river on an IDFG access path. Thus, there is access for recreational uses. Campers were observed washing their laundry in the creek August 26 2014. Anglers and hunters frequent this area too. Boise River boaters start their float in Fifteen Mile Creek. The Boise River supports contact recreation, which is documented as an existing use via direct observation on float trips led by Idaho Mountain Recreation (2013) and Idaho Rivers United (2012 – 2014), and guides describing canoeing (Chelstrom 2009) and paddling (1999) of the lower Boise River.

Ten Mile Creek: CWAL. Native rainbow trout were found during an electrofishing survey in fall 2013. Cool water species were also found.   These fish assemblages indicate that cold water aquatic life may be an existing use in Ten Mile Creek. Other uses (seasonal cold or modified) may also be appropriate. Creek is tenuously connected to Boise River – fish barriers and high water velocities prevent juvenile fish from persisting in this creek, but larger fish are likely able to swim up. Upper part is intermittent.

Ten Mile Creek: SCR. In several places, the creek is accessible to recreation (for example, at the Idaho Hostel on Ten Mile and Can-Ada road). Report from a resident that children sometimes fish there.

Fivemile Creek: CWAL. Native rainbow trout , and other cool water species were found in nearby Tenmile Creek during an electrofishing survey in fall 2013. The hydrology, geology, land use and connectivity are the same between Five Mile and Ten Mile Creeks, and if CWAL is present in Ten Mile, then there is every reason to assume that the same biological community is present or at least attainable in Five Mile. These fish assemblages indicate that cold water aquatic life may be an existing use in Five Mile Creek. Other uses (seasonal cold or modified) may also be appropriate. The creek is tenuously connected to Boise River – fish barriers and high water velocities prevent juvenile fish from persisting in this creek, but larger fish are likely able to swim up. Upper part is intermittent.

Five Mile Creek: SCR. The creek is accessible to recreation along the trail in Meridian, and through a couple of subdivisions. Likely recreational access at low water.

Willow Creek: CWAL. Creek is directly connected to the Boise River, so is usable as a cold-water refuge for trout. Temperature data show that the creek generally varies from about 13C to 20C, making it an attractive refuge from the warmer Boise River. No fish data available, though. Unable to confirm existing use. Use is likely attainable based on temperature and connectivity.

Sand Hollow Creek: CWAL. Trout have been found in Sand Hollow Creek. The upper part of the watershed is intermittent (DEQ SBA). Clark, W.H and S.B. Bauer. 1983. Water Quality Status Report Lower Boise River Drains Canyon County, Idaho. Idaho Department of Health and Welfare: Water Quality Series #50 found rainbow trout. Also IDFG citizen reports.
The DEQ Beneficial Use Reconnaissance Program (BURP) collected macroinvertebrate data on Sand Hollow Creek in 1996. The data identify the presence of aquatic macroinvertebrates. The 2001 Sand Hollow Creek Subbasin Assessment identifies game, nongame, and trout fishes that have been collected in the creek (DEQ 2001d). These fish assemblages indicate that cold water aquatic life may be an existing use in Sand Hollow Creek. Other uses (seasonal cold or modified) may also be appropriate.

Sand Hollow Creek: SCR. IDFG preserve provides access at the lower end of the stream; boating and wading occur here. IDFG citizen reports document this access. The 2001 Sand Hollow Creek Subbasin Assessment (DEQ 2000d) mentions that during the summer, contact recreation occurs at several locations, although the managing irrigation districts discourage such activities.

Sand Creek: SCR. This creek flows, unfenced, through one side of Catalpa Park in Boise. The author has observed small children playing in the creek on numerous occasions. Although not deep enough for fishing, children build dams, float sticks and splash in the water.

Based upon the above described information, the AUs addressed by this Subbasin Assessment and TMDL are appropriately designated for aquatic life and recreational uses because these are existing or attained uses. The current fish data for some of the waters indicates the presence of both cold and cool water species, with a larger number of cool water species found.

2.3. Criteria to Support Beneficial Uses

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

The sediment criterion is narrative, and in this case, applies to the Cold Water Aquatic Life beneficial use:

08. Sediment. 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)

The E. coli criterion is numeric, and in this case, applies to the Secondary Contact Recreation beneficial use:

> **a.** Geometric Mean Criterion. Waters designated for primary or secondary contact recreation are not to contain E. coli bacteria in concentrations exceeding a geometric mean of one hundred twenty-six (126) E. coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to seven (7) days over a thirty (30) day period. (IDAPA 58.01.02.251.01a)

There is no instantaneous maximum value of E. coli that constitutes a violation of water quality criteria. Single sample values are used as 'trigger values' for measuring the geometric mean:

> **b.** Use of Single Sample Values. A water sample exceeding the E. coli single sample maximums below indicates likely exceedance of the geometric mean criterion, but is not alone a violation of water quality standards. If a single sample exceeds the maximums set forth in Subsections 251.01.b.i., 251.01.b.ii., and 251.01.b.iii., then additional samples must be taken as specified in Subsection 251.01.c.: (4-11-06)
>
> i. For waters designated as secondary contact recreation, a single sample maximum of five hundred seventy-six (576) E. coli organisms per one hundred (100) ml; or (4-11-06)
>
> ii. For waters designated as primary contact recreation, a single sample maximum of four hundred six (406) E. coli organisms per one hundred (100) ml; or (4-11-06)

(parts biii and c not shown)

Figure 2 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

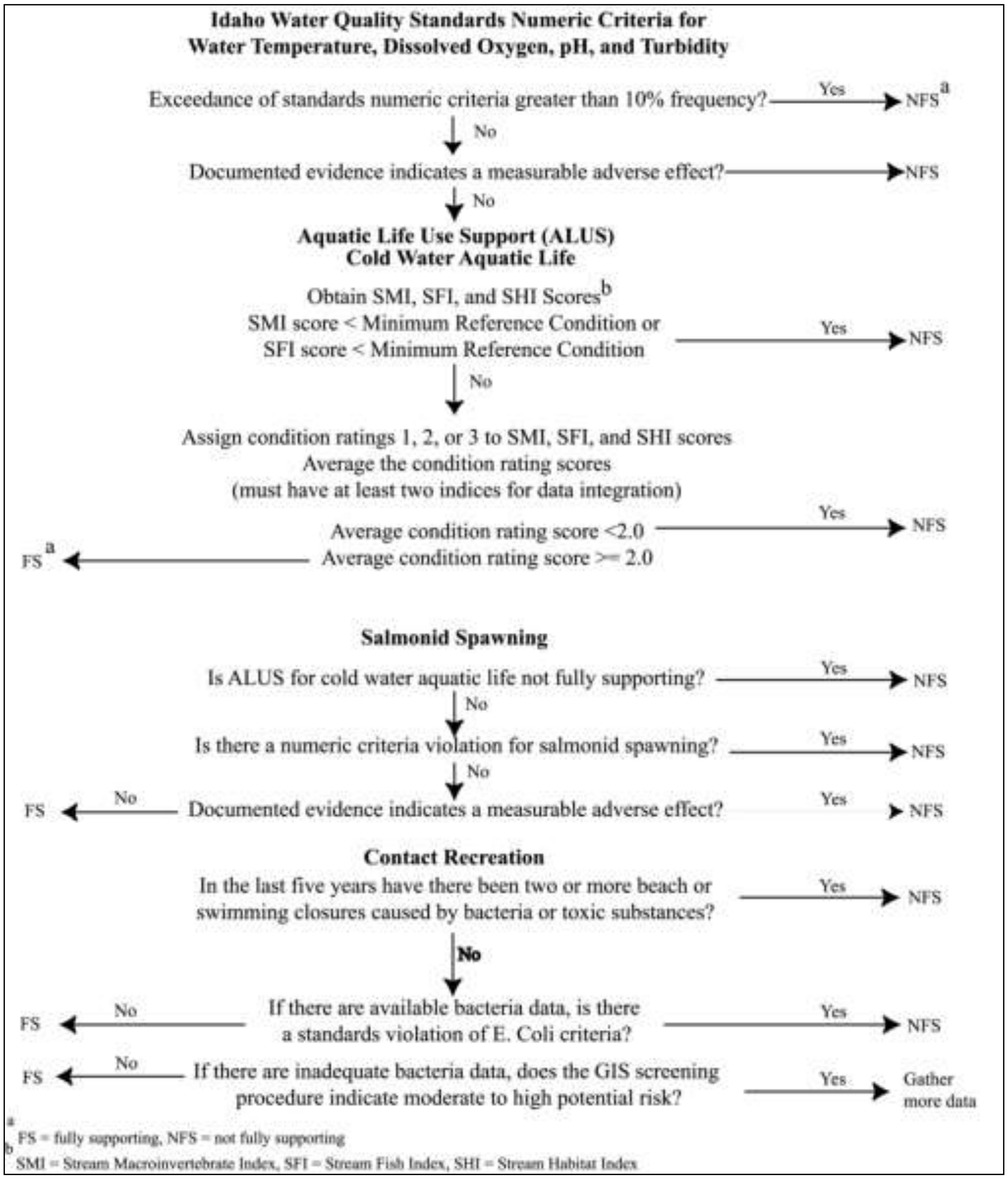

Figure 2. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: *Water Body Assessment Guidance*, Second Addition (Grafe *et al*. 2002)

2.4. Summary and Analysis of Existing Water Quality Data

A detailed summary and analysis of existing water quality data prior to 1999 is contained within the Lower Boise River Subbasin Assessment and TMDL.

There has been a large quantity of water quality data collected since 1999, and so for brevity, only data pertaining directly to one of the impaired assessment units is identified here.

New sediment, discharge and E. coli data collected since 1999 on the Boise River tributaries are summarized in table 5x.

Table 5x. Data collected since 1999.

Creek	Description	Assessment Unit (all begin ID17050114SW…)	Start Date	End Date	Frequency	Collector	TSS?	Q?	E. Coli?
Dixie	at Boise River Road	001_02	Aug-11	Sep-11	weekly	DEQ	n	n	y
Dixie	at Boise River Road	001_02	May-86	Sep-11	unknown	Boise	n	y	n
Dixie	at Boise River Road 13212890	001_02	Mar-13	Mar-13	one-time	USGS	n	y	n
Fifteen Mile	at Lincoln Road	007_04	Apr-08	Oct-08	biweekly	ISDA	y	y	y
Fifteen Mile	at mouth 13210815	007_04	May-05	Aug-05	monthly	USGS	y	y	y
Fifteen Mile	at mouth 13210815	007_04	Jan-00	May-00	monthly	USGS	y	y	y
Fifteen Mile	at mouth 13210815	007_04	Aug-12	Oct-12	bimonthly	USGS	y	y	y
Fifteen Mile	at mouth 13210983	007_04	Mar-13	Mar-13	one-time	USGS	y	y	y
Fifteen Mile	at mouth	007_04	Jun-11	Nov-11	biweekly	DEQ	y	y	n
Fifteen Mile	at mouth	007_04	Jul-11	Jul-11	weekly	DEQ	n	n	y

Fifteen Mile	at mouth	007_04	Nov -11	Nov -11	weekly	DEQ	n	n	y
Fifteen Mile	at mouth (fish)		Nov -13	Nov -13	one-time	DEQ	n	n	n
Five Mile	at Franklin Road 13210795	010_03	Apr -00	Sep-01	monthly	USGS	y	y	y
Five Mile	at Franklin Road 13210795	010_03	May -05	Aug -05	monthly	USGS	y	y	y
Five Mile	at Franklin Road 13210795	010_03	Nov -08	Nov -08	one-time	USGS	y	y	y
Five Mile	at Franklin Road 13210795	010_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Five Mile	at Franklin Road 13210795	010_03	Aug -12	Aug -12	one-time	USGS	y	y	y
Five Mile	at Franklin Road 13210795	010_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Five Mile	at Eagle Road	010_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Five Mile	at Eagle Road	010_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Five Mile	at Victory Road	010_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Five Mile	at Victory Road	010_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Five Mile	upstream of Meridian WWTP	010_03	Jun-09	Jun-09	daily	Meridian	n	y	n
Five Mile	at Meridian Road	010_03	Oct-03	Oct-03	one-time	BURP	n	y	y
Five Mile	at Franklin Road	010_03	Jun-11	Nov -11	biweekly	DEQ	y	y	n
Five Mile	at Franklin Road	010_03	Jul-11	Jul-11	weekly	DEQ	n	n	y
Five Mile	at Franklin Road	010_03	Nov -11	Nov -11	weekly	DEQ	n	n	y
Five Mile	at Meridian WWTP (fish)		Nov -13	Nov -13	one-time	DEQ	n	n	n

Five Mile	various		Mar-11	Oct-11	storm events	ACHD	y	y	y
Indian	at Broadmore Street in Nampa	002_04	May-10	Nov-10	bimonthly	USGS	y	y	y
Indian	at Sparrow Ave in Caldwell	002_04	May-10	Nov-10	bimonthly	USGS	y	y	y
Indian	at 21st Avenue in Caldwell	002_04	May-10	Nov-10	bimonthly	USGS	y	y	y
Indian	at Simplot Blvd 13211441	002_04	May-10	Nov-10	bimonthly	USGS	y	y	y
Indian	at Simplot Blvd 13211441	002_04	Aug-12	Aug-12	one-time	USGS	y	y	y
Indian	at Caldwell	002_04	Nov-11	Sep-12	15 minutes	Caldwell	n	y	n
Indian	at mouth 13211445	002_04	May-10	Mar-13	bimonthly	USGS	y	y	y
Indian	upstream of WWTP	002_04	Jan-03	Jun-09	weekly	Nampa	y	y	n
Indian	downstream of WWTP	002_04	Jan-03	Jun-09	weekly	Nampa	y	y	n
Indian	at mouth	002_04	May-98	Feb-99	biweekly	ISDA	y	n	n
Indian	at mouth	002_04	Mar-99	Mar-00	biweekly	ISDA	y	y	n
Indian	at mouth	002_04	Jan-00	Sep-01	monthly	USGS	y	y	y
Indian	at mouth	002_04	May-05	Aug-05	monthly	USGS	y	y	y
Indian	at Kings Road	003a_04	May-08	Dec-08	monthly	DEQ	y	y	y
Indian	at Robinson Road	003a_04	Oct-03	Oct-03	one-time	BURP	n	y	y
Indian	at Robinson Road	003a_04	May-10	Nov-10	bimonthly	USGS	y	y	y
Indian	at Stroebel Road	003b_04	Feb-99	Sep-99	monthly	BOR	y	n	y

Indian	at Reservoir inlet	003d_03	Mar -99	Sep-99	monthly	BOR	y	n	n
Mason	at Marble Front Road	006_02	Apr -98	Mar-00	biweekly	ISDA	y	y	y
Mason	at Polk Road	006_02	Apr -08	Oct-08	biweekly	ISDA	y	y	y
Mason	at Lakeview Park	006_02	Oct-03	Oct-03	one-time	BURP	n	y	y
Mason	at Polk Road 13210983	006_02	Apr -99	Sep-01	monthly	USGS	n	n	y
Mason	at Polk Road 13210983	006_02	Mar -11	Mar-12	monthly	USGS	n	n	y
Nine Mile	at Ustick Road	010_02	Jun-11	Nov -11	biweekly	DEQ	y	y	n
Nine Mile	at Ustick Road	010_02	Jul-11	Jul-11	weekly	DEQ	n	n	y
Nine Mile	at Ustick Road	010_02	Nov -11	Nov -11	weekly	DEQ	n	n	y
Nine Mile	at mouth (fish)		Nov -13	Nov -13	one-time	DEQ	n	n	n
Sand Creek	at Catalpa Park		Oct-14	Oct-14	weekly	DEQ	n	n	y
Sand Hollow	at Oasis Road	016_03	May -08	Dec-08	monthly	DEQ	y	y	y
Sand Hollow	at Market Road	017_03	Jun-10	Jul-10	weekly	DEQ	n	y	y
Sand Hollow	at Market Road	017_03	May -08	Dec-08	monthly	DEQ	y	y	y
Sand Hollow	at Old Fort Boise Road	017_06	Apr -08	Oct-08	biweekly	ISDA	y	y	y
Sand Hollow	at Old Fort Boise Road	017_06	Jun-10	Jul-10	weekly	DEQ	n	y	y
Sand Hollo	at I-84 4348211164443	017_03	Aug	Oct-	bimont	USG	y	y	y

w	00		-12	12	hly	S			
Sand Hollow	near Parma 13213072	017_03	Aug -12	Oct-12	bimonthly	USGS	y	y	y
Sand Hollow	at mouth 13213080	017_06	Aug -12	Oct-12	bimonthly	USGS	y	y	y
Sand Hollow	at I-84 434821116444300	017_03	Mar -13	Mar-13	one-time	USGS	y	y	y
Sand Hollow	near Parma 13213072	017_03	Mar -13	Mar-13	one-time	USGS	y	y	y
Sand Hollow	at mouth 13213080	017_06	Mar -13	Mar-13	one-time	USGS	y	y	y
Slater	at Indian Creek Road	003d_02	May -12	May -12	weekly	DEQ	n	n	y
Ten Mile	at Franklin Road 13210660	008_03	Apr -00	Sep-01	monthly	USGS	y	y	y
Ten Mile	at Franklin Road 13210660	008_03	May -05	Aug -05	monthly	USGS	y	y	y
Ten Mile	at Franklin Road 13210660	008_03	Nov -08	Nov -08	one-time	USGS	y	y	y
Ten Mile	at Franklin Road 13210660	008_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Ten Mile	at Franklin Road 13210660	008_03	Aug -12	Aug -12	one-time	USGS	y	y	y
Ten Mile	at Franklin Road 13210660	008_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Ten Mile	at S Coverdale Road	008_03	Nov -08	Nov -08	one-time	USGS	y	y	y
Ten Mile	at S Coverdale Road	008_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Ten Mile	at S Coverdale Road	008_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Ten Mile	at Eagle Road	008_03	Nov -08	Nov -08	one-time	USGS	y	y	y

Ten Mile	at Eagle Road	008_03	Apr -09	Apr-09	one-time	USGS	y	y	y
Ten Mile	at Eagle Road	008_03	Jul-09	Jul-09	one-time	USGS	y	y	y
Ten Mile	below Blacks Creek Reservoir	008_03	Jun-97	Jun-97	one-time	BURP	n	y	n
Ten Mile	at Franklin Road	008_03	Jun-11	Nov -11	biweekly	DEQ	y	y	n
Ten Mile	at Franklin Road	008_03	Jul-11	Jul-11	weekly	DEQ	n	n	y
Ten Mile	at Franklin Road	008_03	Nov -11	Nov -11	weekly	DEQ	n	n	y
Ten Mile	at Can-Ada Road (fish)		Nov -13	Nov -13	one-time	DEQ	n	n	n
Ten Mile	various		Mar -11	Oct-11	storm events	ACHD	y	y	y
Various	various	n/a	Jun-08	Sep-08	many	USEPA	y	n	n
Willow	at mouth	015_03	Apr -08	Oct-08	biweekly	ISDA	y	y	y
Willow	in Middleton	015_03	Apr -00	Mar-01	biweekly	ISDA	y	y	y
Willow	at mouth	015_03	Apr -08	Oct-08	biweekly	ISDA	y	y	y
Willow	in Middleton 13210835	015_03	Apr -99	Sep-99	biweekly	USGS	y	y	y
Willow	in Middleton 13210835	015_03	Oct-99	May -00	monthly	USGS	y	y	y
Willow	in Middleton 13210835	015_03	Aug -01	Aug -01	one-time	USGS	y	y	y
Willow	in Middleton 13210835	015_03	May -05	Aug -05	one-time	USGS	y	y	y
Willow	in Middleton 13210835	015_03	Aug -12	Oct-12	bimonthly	USGS	y	y	y
Willow	in Middleton 13210835	015_03	Mar -13	Mar-13	one-time	USGS	y	y	y

2.4.1. Flow Characteristics

In each case, year-round discharge data can be quite dated. However, recent data points (for example, DEQ 2011 in Five Mile and Ten Mile Creeks) tend to confirm the general trend.

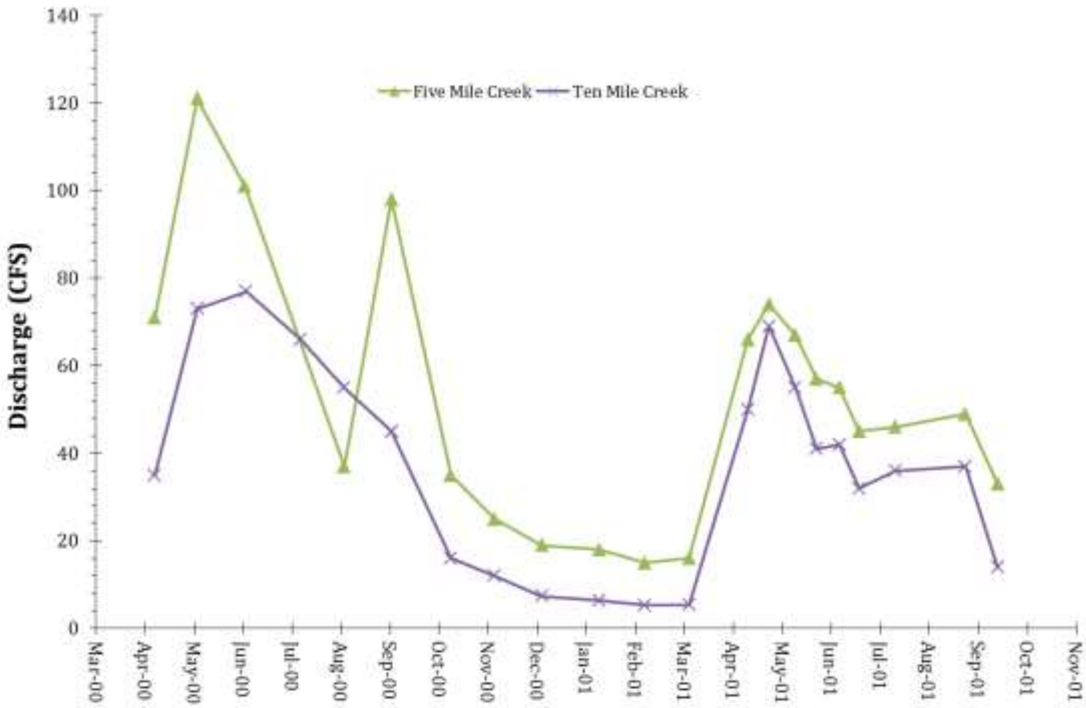

Figure 3 Discharge in Five Mile and Ten Mile Creeks (USGS 2000-2001)
These readings were taken at Franklin Road. Five Mile Creek is intermittent upstream of the Locust Grove/Franklin intersection, and Ten Mile Creek is intermittent upstream of McDermott Road.
Instantaneous velocity measurements were taken by DEQ at the Franklin Road crossing in August 2014. Five Mile Creek varied between 2.5 and 2.8 ft/s. Ten Mile Creek varied between 2.0 and 4.6 ft/s.

2011 DEQ discharge data were not used because discharge was only collected between July and November, less than a full season.

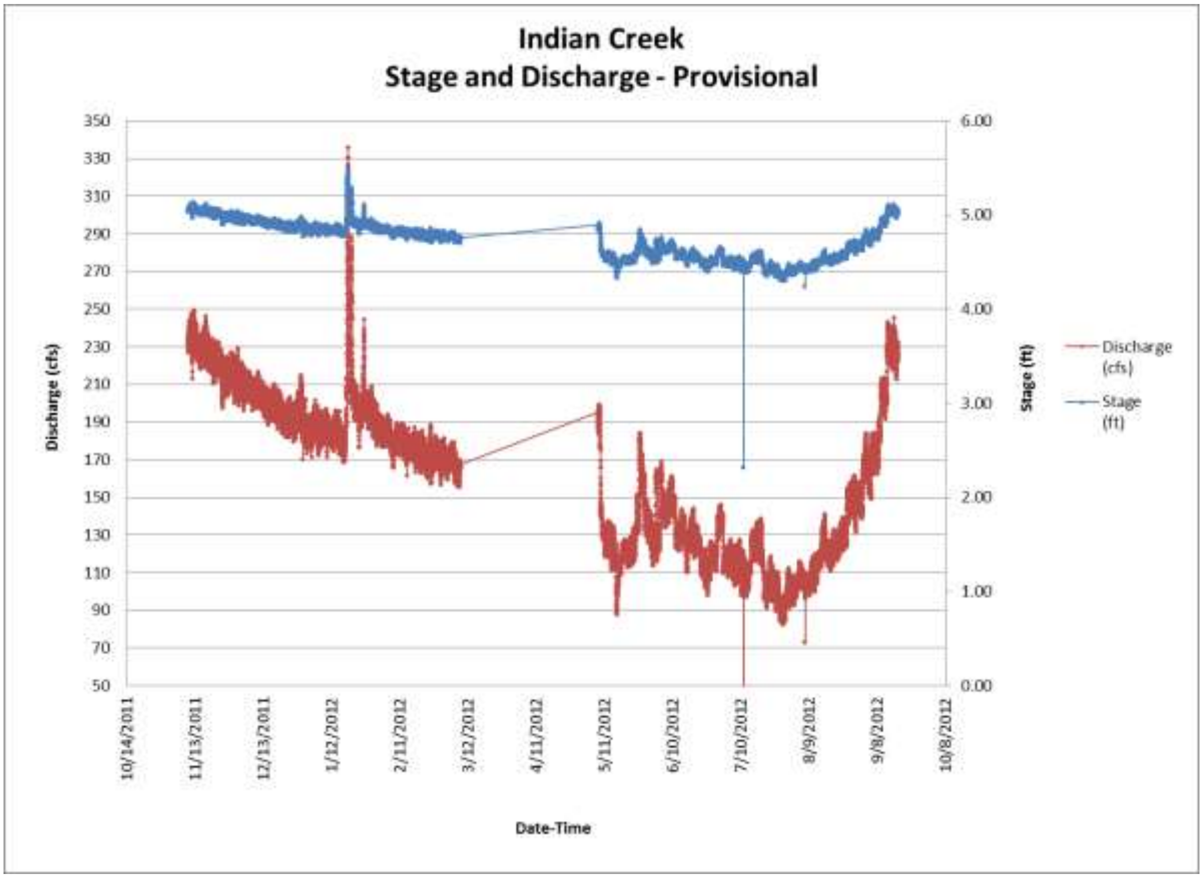

Figure 4 Discharge in Indian Creek at the mouth (City of Caldwell 2011-2012)

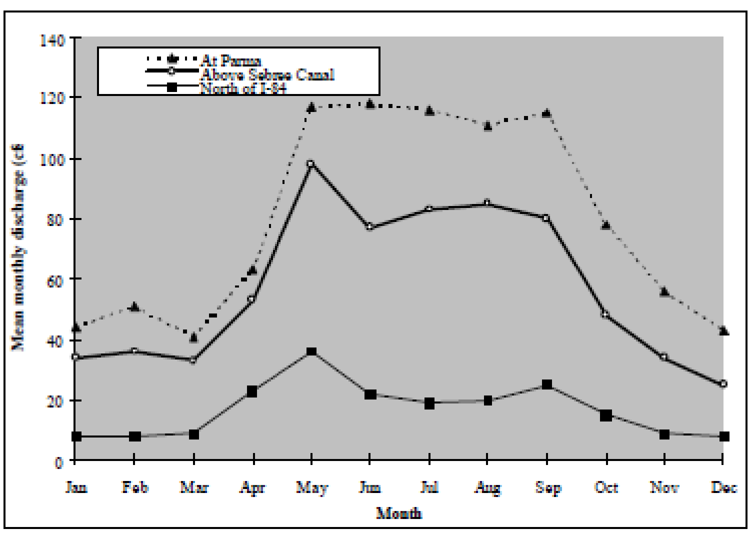

Figure 5 Discharge in Sand Hollow Creek (ISDA 1998-2000)

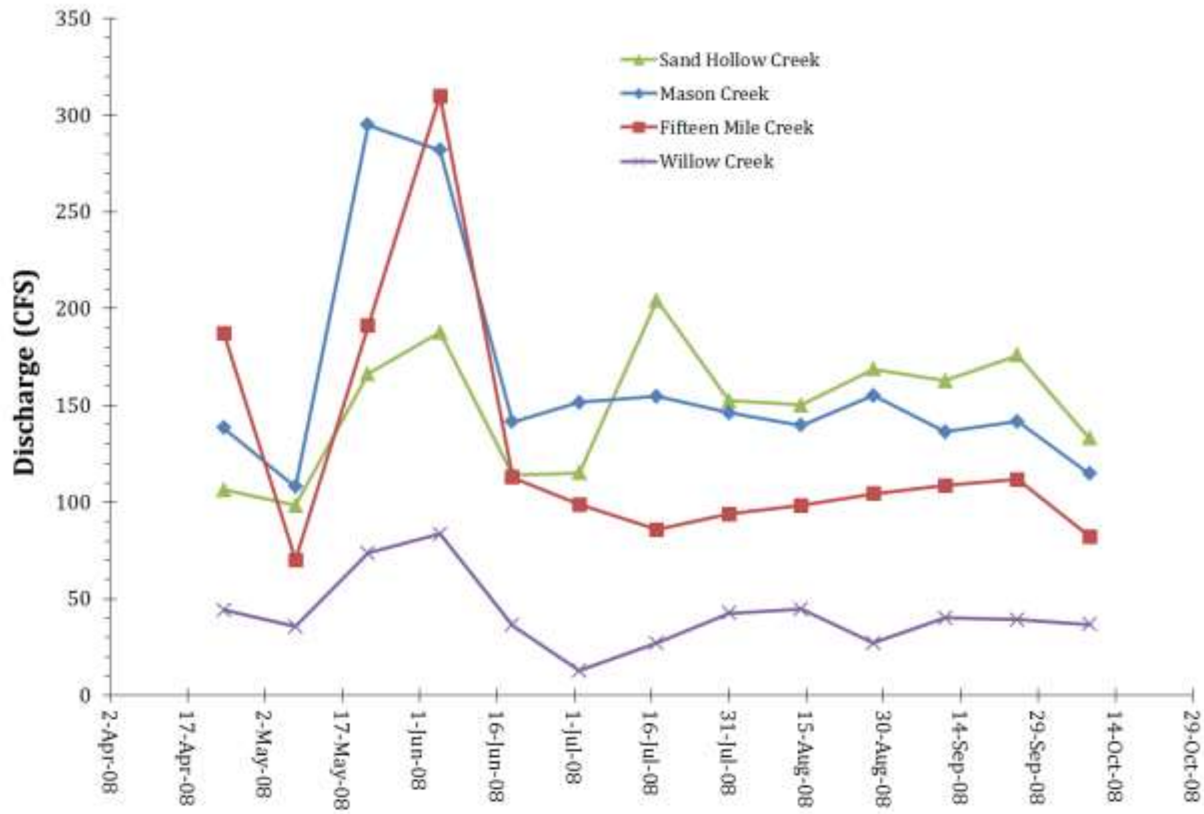

Figure 6A Discharge in Sand Hollow, Mason, Willow and Fifteen Mile Creeks (ISDA 2008) Instantaneous velocity measurements were taken by DEQ at the Franklin Road crossing in August 2014. Fifteen Mile Creek varied between 1.1 and 4.1 ft/s.

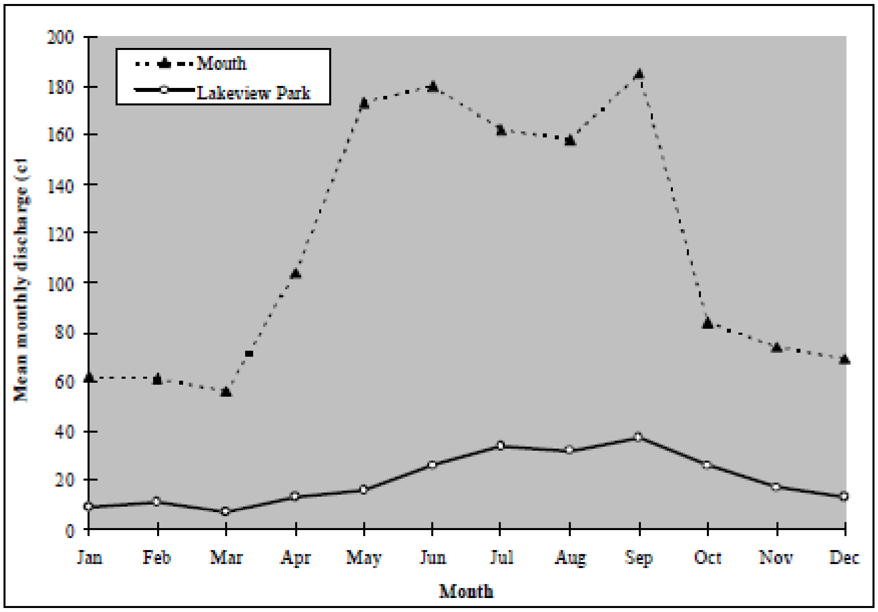

Figure 6 Discharge in Mason Creek (ISDA 1998-2000)

The most recent year-round discharge data for Fifteen Mile Creek were collected by USGS in 1996.

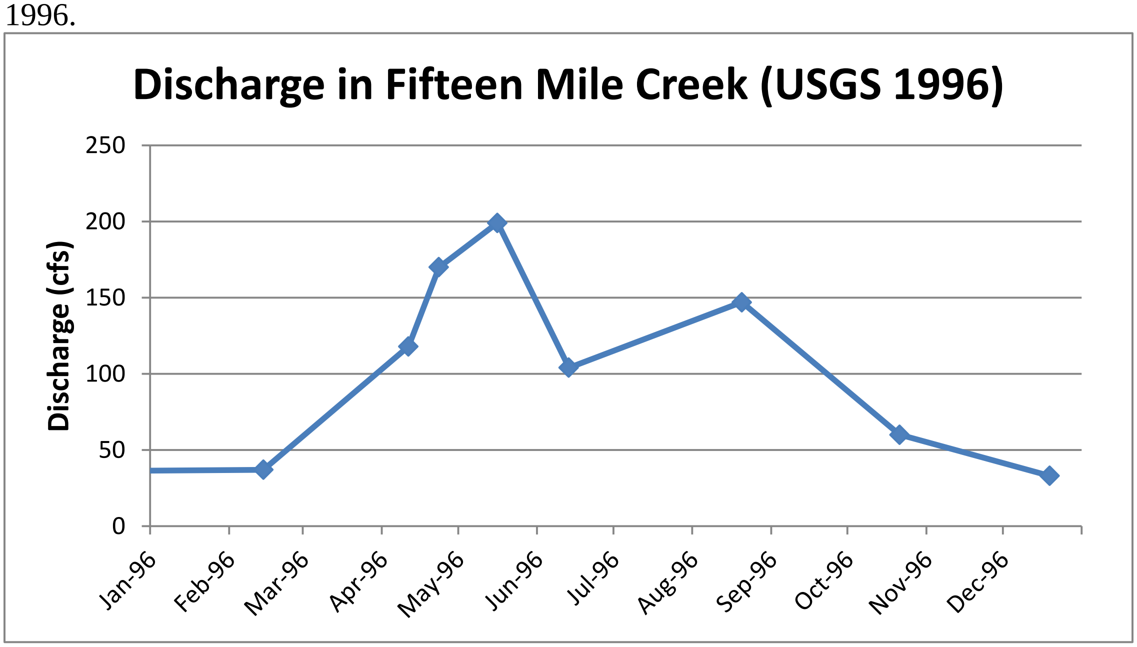

Figure 7 Discharge in Fifteen Mile Creek (1996 USGS)

The City of Boise provided discharge data from Dixie Slough between 1986 and 2011. The median flow was 200cfs:

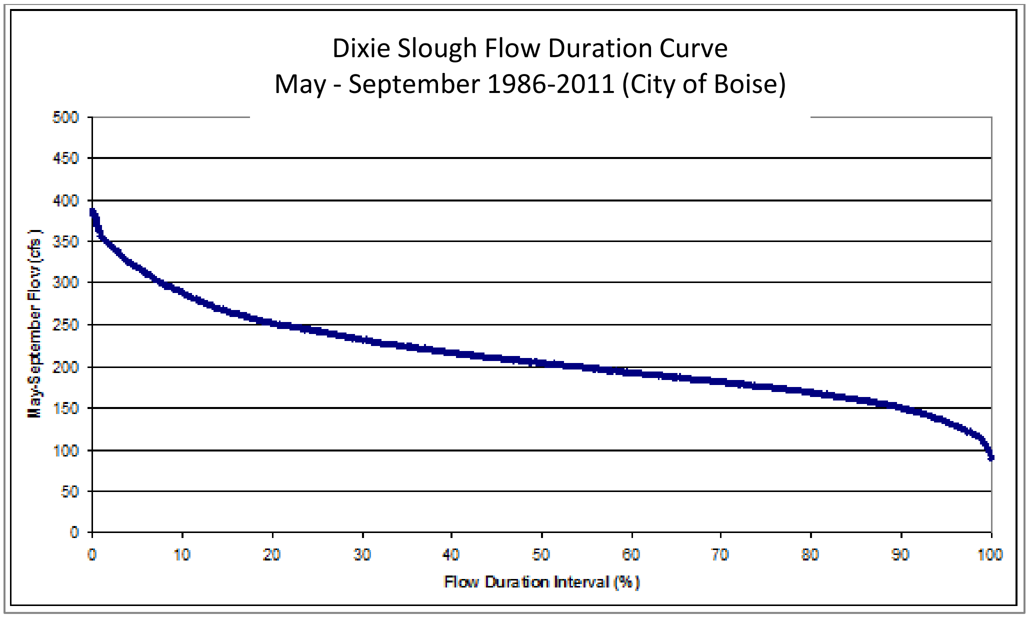

Figure xxz: Flows in Dixie Slough between May and September (City of Boise 1986-2011)

The USGS established a gauging station on upper Indian Creek, near Mayfield in 2011. The gauge report is found in appendix H, and the hydrograph is shown below in figure xxy:

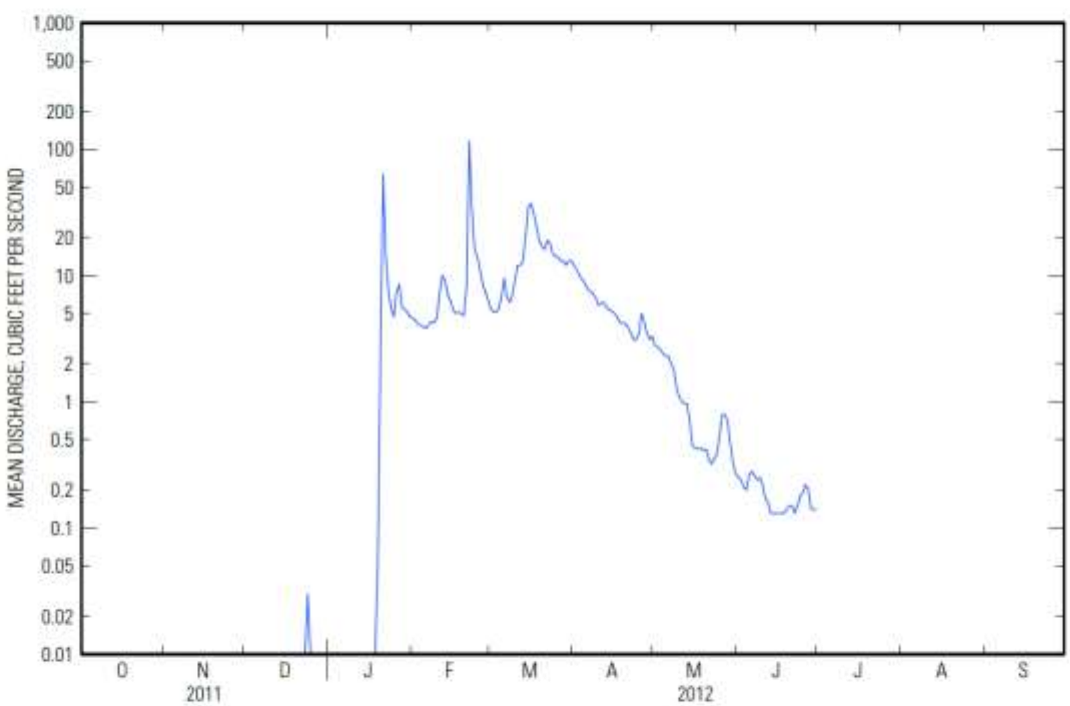

Figure xxy: gauge report for Indian Creek at Mayfield (USGS 2011)

No flow data were available for Nine Mile Creek or either of the upper Indian Creek assessment units, so the USGS 'Streamstats' model was used to estimate the flow (appendix

H). This is a very coarse approximation, and may not be suitable for such small, modified basins. Nine Mile Creek experiences its highest pollutant load in July, and so the July D50 (i.e. average July flow) was used. Much of upper Indian Creek is dry in July, so the April D50 was used to approximate the effect of spring runoff. Sand Creek was only monitored in October, so the corresponding flow has been used.

Creek	Assessment Unit	Estimated Flow	Statistic
Nine Mile Creek	010_02	10.0 cfs	July D50
Sand Creek at Catalpa Park	012_02	0.87 cfs	October D50
Indian Creek at Reservoir inlet	003d_03	16.5 cfs	April D50
Indian Creek above Mora	003b_03	15.5 cfs	April D50

Please see appendix H for the full StreamStats reports.

2.4.2. Water Column Data

– E. coli

Since 2000, DEQ has collected E. coli samples from each of the impaired tributaries to the Boise River except Mason Creek. These samples were all collected according to the 5-sample, 30-day geometric mean format of the Water Quality Standards.

USGS and ISDA both collected E. coli samples from the same location in Mason Creek in July 1999. Neither of these sample regimes alone met the frequency requirements for the water quality criterion, but together, a 5-sample, 30-day geometric mean can be calculated.

Creek	Five Mile		Nine Mile		Ten Mile		Fifteen Mile		Indian (lower)	Mason	Sand Hollow	Sand Hollow	Indian (upper)	Sand Creek	Dixie Slough
Location	Franklin Road		Ustick Road		Franklin Road		mouth		Simplot Boulevard	Marble Front Road	Old Fort Boise Road	Market Road	Indian Creek Road	Catalpa Park	River Road
Assessment Unit	010_03		010_02		008_03		008_04		002_04	006_02	017_06	017_03	003d_02	012_02	001_02
Date / Sample	Jul-11	Nov-11	Jul-11	Nov-11	Jul-11	Nov-11	Jul-11	Nov-11	Jul-11	Jul-99	Jul-10	Jul-10	May-12	Oct-14	Aug-11
1	933	75	488	1,120	988	75	579	84	960	700	717	1187	*172*	*548*	650
2	435	32	1,529	613	345	75	276	53	249	340	411	579	*1,986*	*461*	308
3	990	93	1,421	501	1,046	34	987	173	517	1,000	549	517	*2,420*	*238*	738
4	933	20	411	242	669	25	548	11	816	580	1,187	548	*2,420*	*365*	201
5	711	34	411	238	703	40	2,723	22	281	1,300	459	373	*2,143*	*488*	875
6											1,017	488			
Geometric Mean	*768*	*43*	*709*	*457*	*699*	*45*	*748*	*45*	*490*	*709*	*669*	*573*	*1,338*	*404*	*482*

SUMMARY

Each assessment is impaired by the following levels of E. coli, expressed as a 30-day, 5-sample geometric mean:

Creek	**AU**	**E. coli (CFU/100ml)**
Five Mile	010_03	768
Nine Mile	010_02	709
Ten Mile	008_03	699
Fifteen Mile	007_03	748
Indian Creek below Sugar	002_04	490
Indian headwaters	003d_02	1,338
Mason Creek	006_02	709
Dixie Slough	001_02	482
Sand Hollow	017_03	573
Sand Hollow	017_06	669
Sand Creek	012_02	404

SEDIMENT

TSS vs SSC

TSS (Total Suspended Solids) is a method of analysis originally developed for wastewater. It relies on the sediment being relatively uniform and neutrally buoyant. It is measured by subsampling, which can introduce error when the heavier particles raidly settle.

SSC uses a whole-volume sample, and so accounts for heavier particles. It is generally considered to be a more accurate measurement.

Analytical results used in this TMDL generally take the form of SSC, but are occasionally analyzed using the TSS method. In a stream with fairly homogeneous, fine sediment particles, the methods yield very similar results, and will be used interchangeably.

In 2008, ISDA collected sediment and discharge (Q) data from Willow, Mason, Sand Hollow and Fifteen Mile Creeks:

Creek	Sand Hollow	Willow	Fifteen Mile	Mason
AU	017_06	015_02	007_04	006_02

Date	Q (cfs)	SSC (mg/L)	Q (cfs)	SSC (mg/L)	Q (cfs)	SSC (mg/L)	Q (cfs)	SSC (mg/L)
4/24/2008	106.3	113	44.2	30.4	187.4	70.4	138.4	136
5/8/2008	98.3	76.3	35.7	25	70.1	56.5	108	71.2
5/22/2008	166.3	127	73.6	70.3	191.1	66	295	88.9
6/5/2008	187.7	66.5	83.5	22.2	309.8	37.1	282	71.5
6/19/2008	114.2	103	36.2	21.3	112.7	76.4	141.4	136
7/2/2008	115.1	112	12.9	14.4	98.7	91.4	151.6	106
7/17/2008	204.2	180	27.2	27.1	85.8	85	154.6	71.6
7/31/2008	152.5	117	42.5	27.4	93.7	80.7	146.2	87.4
8/14/2008	150.2	118	44.6	15	98.3	40.8	139.6	51.6
8/28/2008	168.8	62.1	27.1	15.3	104.2	29.7	155	39.2
9/11/2008	162.7	34	40	13.9	108.6	18.2	136.2	32.3
9/25/2008	176	30.9	39.2	30.9	111.8	27.8	141.6	26.1
10/9/2008	132.9	30.6	36.8	10.6	82.1	12.8	114.7	21.5

ISDA also collected sediment data for Willow Creek between April 2000 and March 2001.

Willow Creek Near Hwy. 44 in Middleton AU 015_03		
Date	Discharge (cfs)	TSS (mg/L)
4/4/2000	0	1
4/18/2000	36.5	49
5/3/2000	38.7	25
5/16/2000	54.5	27
5/31/2000	40.8	14
6/14/2000	48.6	27
6/27/2000	11.5	7
7/11/2000	17.2	10
7/25/2000	4.05	2
8/3/2000	27.6	15
8/22/2000	3.97	1
9/6/2000	38.5	7
9/19/2000	15.1	6
10/3/2000	4.88	6
10/18/2000	4.85	2
11/14/2000	1.1	4
12/14/2000	0.9	8
1/30/2001	0	0
2/21/2001	7.8	196
3/19/2001	0.66	4

In 2011, DEQ collected sediment data from Five and Ten Mile Creeks:

Date (2011)	Five Mile Cr. at Franklin Road		Ten Mile Cr. at Franklin Road	
	TSS (mg/L)	Discharge (cfs)	TSS (mg/L)	Discharge(cfs)
16-Jun	46	n/a	36	n/a
1-Jul	49	n/a	90	n/a
18-Jul	70	43.2	160	75.0
29-Jul	62	69.3	230	65.6
10-Aug	98	71.5	69	66.2
25-Aug	50	71.9	82	84.5
8-Sep	18	65.3	64	61.5
19-Sep	24	67.3	18	61.4
5-Oct	38	107.8	47	82.5
2-Nov	5	26.0	5	11.8
16-Nov	5	28.5	5	10.1

USGS collected sediment data from Indian, Five Mile and Ten Mile Creeks between 2008 and 2010:

Site	Date	SSC	Flow
Indian Creek at Robinson Rd	5/3/2010	47	8
Indian Creek at Robinson Rd	7/26/2010	64	14
Indian Creek at Robinson Rd	11/16/2010	6	10
Indian Creek at Broadmore St	5/3/2010	39	40
Indian Creek at Broadmore St	7/26/2010	90	23
Indian Creek at Broadmore St	11/16/2010	5	36
Indian Creek at Sparrow Ave	5/3/2010	87	94
Indian Creek at Sparrow Ave	7/26/2010	94	76
Indian Creek at Sparrow Ave	11/16/2010	14	61
Indian Creek at 21st St	5/4/2010	89	124
Indian Creek at 21st St	7/27/2010	93	135
Indian Creek at 21st St	11/17/2010	63	240

Indian Creek at Simplot Blvd	5/4/2010	85	142
Indian Creek at Simplot Blvd	7/27/2010	93	156
Indian Creek at Simplot Blvd	11/17/2010	61	255
Indian Creek at Mouth	5/4/2010	89	78
Indian Creek at Mouth	7/27/2010	94	65
Indian Creek at Mouth	11/17/2010	42	340
Five Mile Creek at Victory Rd	4/28/2009	92	0.5
Five Mile Creek at Victory Rd	7/29/2009	98	1.1
Five Mile Creek at Eagle Rd	4/28/2009	98	1.2
Five Mile Creek at Eagle Rd	7/29/2009	93	1.1
Ten Mile Creek at Cloverdale Rd	11/17/2008	73	0.07
Ten Mile Creek at Cloverdale Rd	4/28/2009	86	3.1
Ten Mile Creek at Cloverdale Rd	7/29/2009	89	1.8
Ten Mile Creek at Eagle Rd	11/17/2008	76	0.05
Ten Mile Creek at Eagle Rd	4/28/2009	45	1
Ten Mile Creek at Eagle Rd	7/29/2009	91	3.5
Ten Mile Creek at Franklin Rd	11/17/2008	85	9.2
Ten Mile Creek at Franklin Rd	4/29/2009	81	57
Ten Mile Creek at Franklin Rd	7/29/2009	89	55
Five Mile Creek at Franklin Rd	11/17/2008	93	22
Five Mile Creek at Franklin Rd	4/29/2009	86	45
Five Mile Creek at Franklin Rd	7/29/2009	98	54

DEQ collected sediment data from Indian Creek (at Kings Road) and Sand Hollow Creek (2 assessment units) between May and December 2008:

Date	Sand Hollow at	Sand Hollow at	Indian Creek at

	Oasis Road		Market road		Kings Road	
AU	016_03		017_03		003a_04	
	Q (cfs)	TSSC (mg/L)	Q (cfs)	TSSC (mg/L)	Q (cfs)	TSSC (mg/L)
5/13/2008	2.4	9	n/a	300	10.3	7
6/24/08	0.6 e	5.3	17 e	24	22 e	4.9
7/30/2008	0.45 e	4.9	45 e	460	15 e	5
9/4/2008	0.25 e	4.9	24 e	76	13 e	4.9
10/22/2008	n/a	n/a	9.89	53	38 e	4.9
12/1/2008	n/a	n/a	10	16	14 e	10.00

Note e on the Q column means 'estimate'.

The Bureau of Reclamation collected sediment data from Indian Creek at the Reservoir inlet between March and September 1999:

Date	SSC (mg/L)
3/15/1999	2
4/6/1999	14
5/17/1999	5
6/15/1999	7
7/12/1999	7
8/17/1999	8
9/21/1999	10

The City of Nampa collected sediment data from upstream and downstream of its wastewater treatment plant between January 2003 and June 2009. A summary graph is shown here:

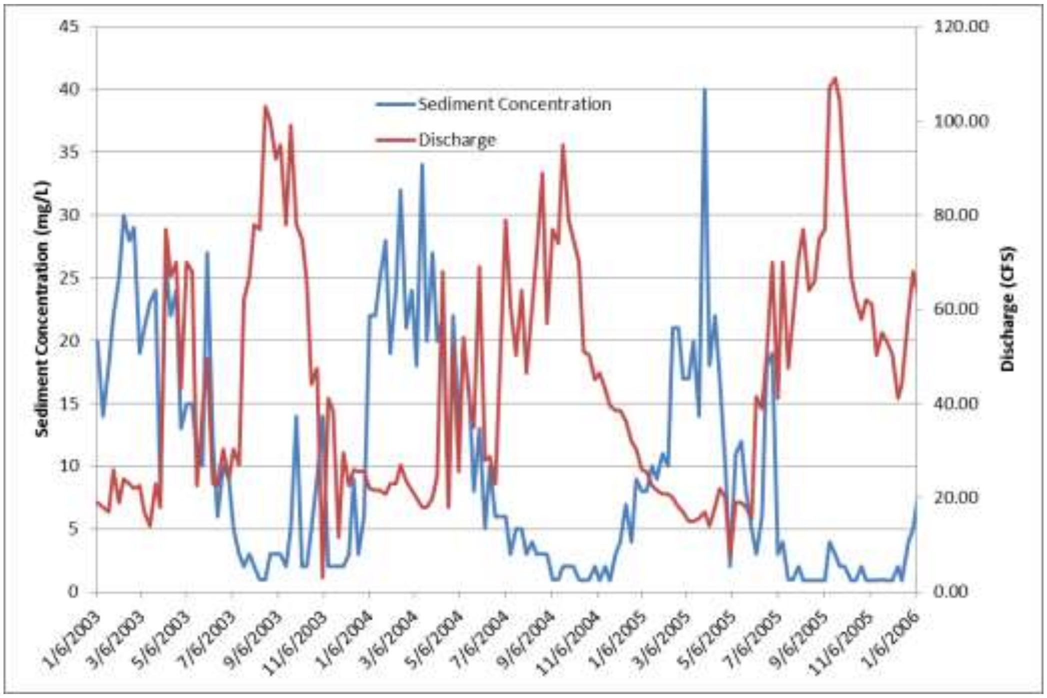

Figure XX. Indian Creek sediment and discharge upstream of Nampa WWTP (City of Nampa 2003-2006)

The City of Caldwell collects discharge data from a weir upstream of the riverside canal every fifteen minutes. (see page 41, figure 4)

USGS collected sediment data for Willow Creek, site 13210835, in August 2005.

13210835 Willow Creek at Middleton, Idaho AU 015_03		
Date	Discharge (cfs)	SSC (mg/L)
5/4/2005	21	16
6/8/2005	29	22
7/7/2005	30	24
8/10/2005	24	12
8/21/2012	32	22
10/30/2012	1.5	2
3/5/2013	0.35	5

2.4.3. Biological and Other Data

DEQ and USGS collected biological data at the following sites:

Site ID	Stream	Location	SMI	SFI	SHI	Determination

(Year)						
2011SBOIA036	Indian Creek 002_04	near Karcher Mall	0	0	1	Not supporting Cold Water Aquatic Life use
2003SBOIA050	Mason Creek 006_02	at Lakeview Park	0	0	1	Not supporting Cold Water Aquatic Life use
2003SBOIA052	Five Mile Creek 010_03	at Meridian Road	0	1	1	Not supporting Cold Water Aquatic Life use
2013LOWBOI01	Fifteen Mile 007_04	near mouth	Electrofishing only. Trout found.			
2013LOWBOI02	Five Mile 010_03	at Meridian WWTP	Electrofishing only. No trout found.			
2013LOWBOI03	Nine Mile 010_02	at mouth	Electrofishing only. No trout found.			
2013LOWBOI04	Ten Mile 008_03	at Can-Ada Road	Electrofishing only. Trout found.			
USGS Site13210976	Mason Creek 006_02	near Wells Road	Electrofishing only. Trout found.			

2.5. Data Gaps

The bulk of the data for Indian Creek were collected either at the Nampa wastewater treatment plant, or at the mouth. Neither location is ideal:

- The Nampa wastewater treatment plant is situated about midway through the assessment unit. A major tributary, Wilson Drain, enters Indian Creek downstream of this point, and so the data do not reflect all the sources of sediment.
- During the irrigation season, the water at the mouth of Indian Creek is largely comprised of spillover water from the Riverside Canal, which intercepts Indian Creek downstream of Simplot Boulevard. The data collected at the mouth of Indian Creek therefore do not represent the rest of the assessment unit. They are reflective of an uncertain mixture of Riverside Canal and Indian Creek water. The incoming water in the Riverside Canal is diverted from the Boise River, which is itself heavily influenced by the nearby confluence with Mason Creek.

- This data gap means that we cannot estimate the existing sediment load of Indian Creek in Caldwell (above the riverside canal). However, we do have very detailed flow data at this location, so load allocations can be set using a concentration target.
- The recommended location for future monitoring would be upstream of the Riverside Canal, probably at Simplot Boulevard in Caldwell.

Upper Indian Creek, particularly the section between Mora and the Reservoir, has no data available.

3. Subbasin Assessment–Pollutant Source Inventory

Detailed discussions of the pollutants within the Lower Boise River subbasin are provided in the following documents:

Five Mile and Ten Mile Creek Subbasin Assessment (December 2001)

Mason Creek Subbasin Assessment (December 2001)

Sand Hollow Creek Subbasin Assessment (December 2001)

Indian Creek Subbasin Assessment (December 2001)

3.1. Sources of Pollutants of Concern

3.1.1. Point Sources

The following point sources discharge to the impaired assessment units. Stormwater sources typically discharge through multiple outfalls, and wastewater treatment plants typically discharge through a single pipe.

Name	Permit Number	Receiving Water	Type	Monthly Ave (lb/day)	Weekly Ave (lb/day)	Monthly Ave TSS conc (mg/L)	Weekly Max TSS conc. (mg/L)
ACHD (and co-permittees) Phase 2	ID-028185	Five Mile, Ten Mile, Nine Mile	Stormwater	no numeric limits. Stormwater BMPs required			
ACHD (and co-permittees) Phase 1	IDS-027561	Five Mile, Ten Mile, Nine Mile	Stormwater	no numeric limits. Stormwater BMPs required			
City of Caldwell	IDS-028118	Indian, Mason	Stormwater	no numeric limits. Stormwater BMPs required			
Canyon HD #4	IDS-028134	Nampa Urbanized Area	Stormwater	no numeric limits. Stormwater BMPs required			
ITD #3	IDS-028177	Boise and Nampa Urbanized Areas	Stormwater	no numeric limits. Stormwater BMPs required			

City of Meridian	ID-002019-2	Five Mile Creek	WWTP	2550	3820	30mg/L	45mg/L
City of Middleton	IDS-028100	Willow Creek	Stormwater	no numeric limits. Stormwater BMPs required			
City of Nampa	ID-002206-3	Indian Creek	WWTP	4503	6755	30mg/L	45mg/L
Nampa HD #1	IDS-028142	Mason and Indian	Stormwater	no numeric limits. Stormwater BMPs required			
City of Nampa	IDS-028126	Mason and Indian	Stormwater	no numeric limits. Stormwater BMPs required			
City of Parma	ID-002177-6	Sand Hollow Creek	WWTP	255	369	45mg/L	65mg/L
Simplot Meat Products	ID-002696-4	Indian Creek	Industrial	no permitted sediment discharge - temperature only			
Sorrento-Lactalis	ID-002803-7	Mason Creek (via Purdum)	Industrial	53	106	13mg/L	25mg/L
City of Greenleaf	ID-002830 4	Dixie Slough	WWTP	60	90	30mg/L	45mg/L

3.1.2. Nonpoint Sources

Detailed discussions of the nonpoint source pollutants within the Lower Boise River subbasin are provided in the following documents:

Five Mile and Ten Mile Creek Subbasin Assessment (December 2001)

Mason Creek Subbasin Assessment (December 2001)

Sand Hollow Creek Subbasin Assessment (December 2001)

Indian Creek Subbasin Assessment (December 2001)

The following text is adapted from the Lower Boise TMDL:

Sediment enters the Boise River tributaries from point and nonpoint sources. The wastewater treatment plants that discharge to the streams are subject to sediment limits in NPDES permits, but are minor contributors. Nonpoint sources of sediment include agricultural activities, stormwater runoff, runoff from construction activities and bank erosion. The most significant sources of sediment from agricultural practices are likely surface irrigated land and streambank trampling due to unrestricted use of streamside areas by livestock. Construction activities on sites that exceed one acre are subject to a general NPDES permit that requires best management practices to limit sediment releases. Construction in the river channel is subject to stream alteration permits issued by the Idaho Department of Water Resources. These permits generally include requirements for best management practices (BMPs) to reduce sediment releases to the river. Agricultural activities are exempt from stream alteration permits. Agricultural activities that generate sediment include surface irrigated row crops and surface irrigated pastures. A substantial amount of the sediment that erodes from agricultural lands is deposited in drains and canals and may be removed or liberated during maintenance activities.

Most bacteria comes from nonpoint sources. Wastewater treatment plants are subject to effluent limits for bacteria. Nonpoint sources of bacteria include agricultural operations (primarily livestock), failed septic systems, and wildfowl populating the stream corridor. Generally, septic systems are designed to prevent any bacteria from reaching either ground water or surface water. However it is possible that there are some failed septic systems in the valley.

Most large confined animal feeding operations (CAFOs), confined feeding areas (CFAs) and dairies are subject to discharge limits under general NPDES permits. To be regulated under a general NPDES permit, CAFOs and CFAs must meet size criteria and be considered significant contributors of pollutants. All dairies that have a permit to sell milk are subject to the Idaho Department of Agriculture (IDA) dairy inspection program. Dairies are required to have adequate waste management practices subject to the Rules Governing Dairy Waste, IDAPA 16.01.02350.03.g and IDAPA 02.04.14. Smaller CAFOs and pasture grazing are not regulated. Animal waste that is removed from dairies, CAFOs and CFAs in liquid or solid form may be applied to agricultural lands as a soil amendment. Operators subject to an NPDES permit are required to land apply waste at agronomic rates and maintain adequate record keeping of waste management. The IDA has proposed draft rules to ensure proper management of land applied animal waste at other facilities, but these activities are currently unregulated. The extent to which land application of animal waste is a source of bacteria is unknown.

DNA Study of E. Coli

In 2003, CH2MHill prepared a report entitled ‘Lower Boise River Coliform Bacteria DNA Testing’. DNA analysis was done on approximately 120 samples from ten sites throughout the lower Boise River watershed.

Location	Human	Pets	Livestock	Avian / Waterfowl	Wildlife	Unknown
Mainstem Stations						
Glenwood Bridge	18%	17%	0%	27%	8%	31%
Parma Bridge	13%	6%	18%	25%	9%	29%
Drains and Tributaries						
Walnut Street	10%	29%	0%	29%	15%	17%
Ann Morrison	13%	14%	0%	26%	14%	34%
Americana	21%	35%	0%	13%	4%	28%
Eagle Island	13%	11%	2%	39%	13%	23%
Indian Creek	9%	13%	8%	20%	11%	39%
Dixie Slough	3%	8%	16%	23%	14%	36%

The report offered several conclusions:

1. The total human and pet contribution to bacteria appears to decrease as the river and tributaries flow from predominantly urban areas to more urban areas in the downstream direction.
2. In rural areas associated with agricultural sources, cow waste contributes the highest percentages.
3. Avian, waterfowl and wildlife contributions are consistently large, sometimes accounting for more than 50% of the total bacteria identified.
4. Concentrations of 'natural' bacteria (avian, waterfowl and wildlife) are higher than typically found in pristine environments.

3.1.3. Pollutant Transport

Virtually all of the monitoring data on each tributary stream have been collected at the mouth. This makes it difficult to evaluate how pollutants are transported through each system.

One exception is Indian Creek, where USGS conducted three synoptic sampling visits in May, July and November 2010. These data show that sediment loads increase significantly between Robinson Road and Simplot Boulevard. Please note that during the irrigation season, the site at the mouth is comprised of spillover from the Riverside Canal, and so is more representative of Boise River (and entrained Mason Creek) water.

	Date	SSC	Flow	Load
Site		mg/L	cfs	kg/day
Indian Creek at Robinson Rd	5/3/2010	47	8	921
Indian Creek at Broadmore St	5/3/2010	39	40	3,822
Indian Creek at Sparrow Ave	5/3/2010	87	94	20,036
Indian Creek at 21st St	5/4/2010	89	124	27,038
Indian Creek at Simplot Blvd	5/4/2010	85	142	29,572
Indian Creek at Mouth	5/4/2010	89	78	17,008
Indian Creek at Robinson Rd	7/26/2010	64	14	2,195

Indian Creek at Broadmore St	7/26/2010	90	23	5,072
Indian Creek at Sparrow Ave	7/26/2010	94	76	17,503
Indian Creek at 21st St	7/27/2010	93	135	30,760
Indian Creek at Simplot Blvd	7/27/2010	93	156	35,545
Indian Creek at Mouth	7/27/2010	94	65	14,970
Indian Creek at Robinson Rd	11/16/2010	6	10	147
Indian Creek at Broadmore St	11/16/2010	5	36	441
Indian Creek at Sparrow Ave	11/16/2010	14	61	2,092
Indian Creek at 21st St	11/17/2010	63	240	37,044
Indian Creek at Simplot Blvd	11/17/2010	61	255	38,110
Indian Creek at Mouth	11/17/2010	42	340	34,986

Wilson Drain terminates in Indian Creek a short distance upstream of 21st Street in Caldwell, and is the largest irrigation tributary to Indian Creek. Although it likely contributes sediment and E. coli pollution to Indian Creek, quantitative data have not been collected from the irrigation system.

4. Monitoring and Status of Water Quality Improvements

Watershed improvement projects in the subbasin have been directed at improving the water quality in the mainstem Boise River. Without sediment TMDLs in place, the tributaries were assigned reductions based solely on improving water quality in the River itself.

Nevertheless, many of the projects may have had beneficial effects on the tributaries themselves. Before listing the improvements to water quality, it is worth noting how bad water quality used to be. The quote below is excerpted from a 1959 report on Indian Creek:

> At stations 2 and 3, paunch manure and meat scraps were noted floating in the stream. At times, the stream was even reddish in color from the blood wastes. The bottom and sides of the creek were coated with black sludge deposits. A great deal of rat activity also was noted along the banks.

(Report on Pollution Problems in Indian Creek 1958-1959, State of Idaho Department of Health – Engineering and Sanitation Section).

WWTPs

The Boise River TMDL states that "...changes in loads from treatment plants have negligible effects on the Boise River …. Since most of the treatment plants in the valley already remove 85 percent or more of suspended solids, further treatment at this time would result in high costs with little tangible benefit to the river" (DEQ, 2000).

Discharge Monitoring Reports (DMRs) from each of the NPDES-permitted point sources in section 3.1.1 were examined. Even though most of the permits allow for a daily maximum of 45mg/L suspended sediment, typical discharge concentrations were less than 5mg/L.

STORMWATER

The following text was excerpted from the Boise River TMDL 5-Year Review:

The lower Boise River subbasin uses watershed-based permitting for stormwater NPDES permits. This allows for an integrated approach to a watershed-wide program. Based on the information provided by permitted point sources within the subbasin, permit holders are in compliance with permit conditions. Based on the information provided by the responsible agencies, stormwater and point source compliance monitoring in the Boise urban area is taking place as anticipated by the TMDL implementation plan.

Stormwater is regulated at the federal level and the implementation plan recognizes that when required BMPs are implemented through the federal permit system, stormwater contributions of pollutants to impaired waters in the subbasin will diminish. At the time of the TMDL 5-year review, stormwater dischargers anticipated meeting TMDL targets within 10 years of implementation.

Several agencies and organizations share responsibilities for the NPDES MS4 permit and information on meetings, responsibilities, budgets, and reports is available from the partnership internet site http://www.partnersforcleanwater.org/default.asp. An annual report is published and made available through ACHD's web site at: http://www.achd.ada.id.us/Departments/TechServices/Drainage.aspx. All of the required annual and five-year reports have been created and NPDES stormwater co-permittees make their reports available through a partnership internet site http://www.partnersforcleanwater.org/Annual%20Report.asp.

Other agencies and stakeholders in the subbasin are in the process of applying for stormwater NPDES permits and have yet to develop or implement the voluntary stormwater activities addressed in the plan. A multi-agency effort produced the *BMP Handbook of Best Management Practices for Idaho Rural Road Maintenance* (University of Idaho, 2005) and highway district personnel were trained in the methods through a training program funded with public funds through various agencies.

NPDES GENERAL PERMITS

Since the TMDL was approved, EPA has issued general stormwater permits for Confined Animal Feeding Operations (CAFOs), construction sites larger than one acre, and other industrial sectors. These permits intend to reduce, or eliminate, sediment discharges.

NON-POINT SOURCES

Nonpoint sources in the subbasin are primarily from agricultural operations. In Idaho, irrigated agriculture pollution control is voluntary and return flows from irrigated agriculture are specifically excluded from the definition of "point source" in the CWA. Idaho addresses nonpoint source pollution through industry/activity-specific BMP development. Watershed stakeholders developed the TMDL implementation plan to provide guidance and support to members of the agricultural community who choose to voluntarily reduce or prevent pollution from agricultural activities entering subbasin waters.

The TMDL implementation plan for agricultural lands identifies critical acres and prioritizes land for BMPs by identifying acres that have the greatest effect on pollutant delivery to the Boise River. For sediment pollutant reduction, priority acres are surface-irrigated croplands with the steepest slopes or closest to the Boise River, and riparian acres grazed by livestock. The highest priority watersheds for agricultural BMP implementation to reduce sediment pollution are Dixie Slough, Fifteen Mile Creek, Five Mile and Ten Mile Creeks, and Mason Creek.

Table includes TMDL implementation details for agricultural lands in the subbasin. The percent of producers implementing and maintaining BMPs is unknown at this time.

Table xx. Implementation activities in progress and planned for the Lower Boise River subbasin as of May 2008.

AU	Year	Target Pollutant	Activity	Completion Status
undetermined	2004	Sediment	Jerry Glen wetland construction	Completed
002_04	2004	Sediment	Indian Creek, Caldwell low impact development demonstration	Completed
011a_06	2004	Sediment, bacteria	Downtown Boise gray water recycling demonstration	Completed

AU	Year	Target Pollutant	Activity	Completion Status
011b_02	2005	Sediment, habitat and flow alteration	Boise River side channel reconstruction	Completed
011a_06	2004	Sediment	Barber Park Living Roof demonstration	Completed
undetermined		Sediment, bacteria	Canyon County Soil Conservation District (SCD), 19 BMPs including a total of 13,666 feet of streambank protected and 35 acres treated	Completed
001_02		Sediment, bacteria	Canyon SCD, Conway Gulch, 141 BMPs including a total of 99,138 linear feet of streambank protected and 29,462 acres treated	Completed
001_02		Sediment, bacteria	Canyon SCD, Dixie Slough, 75 BMPs including a total of 41,219 linear feet of streambank protected and 1,352 acres treated	Completed
007_04		Sediment, bacteria	Ada Soil and Water Conservation District (SWCD), Fifteen Mile Creek, 34 BMPs including a total of 14,125 linear feet of streambank protected and 983 acres treated	Completed

5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (or *load capacity*) on discharge of a pollutant from all sources to assure water quality standards are met. This load capacity (LC) can be represented by an equation:

LC = MOS + NB + WLA + LA

Where:

> Current load = the current concentration of the pollutant in the water body
>
> MOS = margin of safety. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, 40 CFR Part 130 requires a margin of safety, which is effectively a reduction in the load capacity available for allocation to pollutant sources.
>
> NB = natural background. When present, NB may be considered part of load allocation (LA), but it is often considered separately because it represents a part of the load not subject to control. NB is also effectively a reduction in the load capacity available for allocation to human-made pollutant sources.
>
> WLA = the wasteload allocation for all point sources
>
> LA = the load allocation for all nonpoint sources

A load is a quantity of a pollutant discharged over some period; numerically, it is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, federal rules allow for “other appropriate measures” to be used when necessary. These “other measures” must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates.

5.1. In-stream Water Quality Targets

5.1.1. Target Selection

E. COLI

The target for E. coli applies in each stream, and is simply the Idaho water quality criterion:

> 126 colony forming units (CFU) per 100ml, calculated as a geometric mean of 5 samples, collected 3 to 7 days apart, over 30 days (IDAPA 58.01.02.251.02).

It is important to note that there is *no instantaneous maximum* target concentration of E. coli. If five samples are unable to be collected (for example, the stream runs dry), the criterion is not violated.

SEDIMENT

Idaho's narrative sediment criterion appears in IDAPA 58.01.02.200.08 and states that:

> "Sediment shall not exceed quantities … which impair designated beneficial uses."

In this case, every assessment unit has Cold Water Aquatic Life as its most stringent designated or existing beneficial use. TMDL sediment targets must be based upon attainment of this use.

The targets for sediment are based on the paper "Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact" by Charles Newcombe and Jorgen Jensen (Newcombe and Jensen 1996). This paper makes the link between sediment levels and beneficial uses. It assigns a 'severity index' of impacts to trout associated with a given concentration and duration of sediment.

Severity Index (SEV) of '8' has been chosen as the target for protection of cold water biota. SEV 8 is the level of impact in which the beneficial use is still fully supported, and is congruent with the targets chosen for the Lower Boise River. It was supported by the WAG on 1/10/2013.

To translate this target into a concrete sediment concentration, Newcombe and Jensen's paper has two independent variables: duration of sediment and biological assemblage. Each creek has a slightly different duration of sediment, which may result in a different sediment target. Some of the more heavily modified streams have such high current velocities that the biological assemblage is restricted at certain times.

Newcombe and Jensen provide several durations in their matrices. For intermediate durations, they also provide an equation.

These combinations of factors yield the following sediment targets. It is important to note that these are all manifestations of the *same target* of SEV8, customized for each creek's unique combination of flow and sediment. Please see appendix X for further explanation:

Stream	Target	N&J Model	Duration	Concentration	Method
Five Mile Creek Ten Mile Creek	SEV 8	2	92 days	33 mg/L	Equation
Fifteen Mile Creek Willow Creek	SEV 8	1	84 days	23 mg/L	Equation
Sand Hollow Creek Mason Creek Indian Creek	SEV 8	1	4 months	20 mg/L	Matrix
All streams	SEV 8	1	<6 days	various	Matrix

The short-duration target is intended to protect against short, high-intensity sediment concentrations. This recognizes that streams naturally experience periods of high sediment during spring runoff, but that these events are infrequent and brief. Except for a single exceedence of the 6 day target on Ten Mile Creek (DEQ 2011), there is no evidence that the short-term targets are exceeded. This means that the sediment pollution of concern is the long-duration kind. Only pollutant sources that discharge sediment for a period of 84 days or longer will be subject to this TMDL and its loading allocations. Short-duration sediment sources, such as stormwater systems, will be addressed through the NPDES permitting system. Stormwater NPDES permits do not presently contain numeric targets, but if the permitting authority desired a target, it should use a short duration target commensurate with the length of a severe storm event (say, one day), and not the four month target.

The TMDL will be based upon the long-duration targets, because the data reliably indicate that they are consistently exceeded. The targets are expressed as an *average* of measurements over the time period. The TMDL applies at the downstream end of the perennial portion of each assessment unit.

5.1.2. Monitoring Points

The ideal monitoring point for each assessment unit is typically the most downstream road crossing. This integrates all the effects of the watershed and provides a convenient place to collect samples. It also enables the sample to be used to assess the creek's impact on the downstream receiving water. A bridge enables samples to be taken even during periods of very high flow.

Creek	**AU**	**Data Location**	**Ideal Location**
Five Mile	010_03	Franklin Road	Franklin Road
Ten Mile	008_03	Franklin Road	Franklin Road
Fifteen Mile	007_04	Lincoln Road and Mouth	Lincoln Road
Sand Hollow	016_03	Oasis Road	Old Hwy 30
Sand Hollow	017_03	Market Road	Sharp Road
Sand Hollow	017_06	Old Fort Boise Road	Old Fort Boise Road
Indian below Sugar	002_04	Nampa WWTP, Simplot, Mouth	Simplot Boulevard
Dixie Slough	001_02	River Road	River Road
Indian headwaters	003d_02	Slater Creek at Indian Creek Road	Slater Creek at Indian Creek Road
Indian above Reservoir	003d_03	Reservoir inlet	Reservoir inlet
Indian above	003b_03	none	Upstream of Sand Creek

Mora			
Sand Creek	012_02	Catalpa Park	Catalpa Park
Mason	006_02	Polk Road	Polk Road
Willow	015_03	Highway 44	Highway 44

5.2. Load Capacity

The load capacities for E. coli and sediment are based upon meeting target concentrations. For E. coli, the load capacity is the load that would be present when a **concentration of 126 CFU/100ml** is achieved. For sediment, the load capacity is the load that would be present when **the target concentration** is achieved. Table X8X provides some example load capacities. The targets apply at any time during which the beneficial use can occur.

The load capacities can also be expressed as equations, with flow (and in the case of sediment, concentration) as the variable:

The equation for **sediment** is:

$$\text{LC (in kg/day)} = \text{Q (in cfs)} \times \text{C (in mg/L)} \times 2.45$$

The equation for **E. coli** is:

$$\text{LC (in } 10^9 \text{ CFU/day)} = \text{Q (in cfs)} \times 3.08$$

Where Q is the flow of the creek measured in cfs and C is the sediment target concentration measured in mg/L.

The coefficients are simply a collection of conversion constants:

Sediment: $\frac{86400\ s/day \times 28.3\ L/cf}{10^6\ mg/kg} = \mathbf{2.45}\ \frac{kg.L}{day.cfs.mg}$

E. coli: $126\ CFU/100mL \times \frac{86400\ s/day \times 28.3\ L/cf}{0.1\ L/100mL \times 10^9} = \mathbf{3.08} \times 10^9\ CFU/day/cfs$

Table X8X Example load capacities

Example Discharge (cfs)	**Target Concentration**		**Load Capacity**	
	Sediment (mg/L)	**E. coli** (CFU/100ml)	**Sediment** (kg/day)	**E. coli** (10^9 CFU/day)
25	20	126	1,225	77
	23	126	1,409	
	33	126	2,021	
50	20	126	2,450	154
	23	126	2,818	

	33	126	4,043	
75	20	126	3,675	231
	23	126	4,226	
	33	126	6,064	
100	20	126	4,900	308
	23	126	5,635	
	33	126	8,085	
150	20	126	7,350	462
	23	126	8,453	
	33	126	12,128	
200	20	126	9,800	616
	23	126	11,270	
	33	126	16,170	
300	20	126	14,700	924
	23	126	16,905	
	33	126	24,255	

5.3. Natural Background

Even unimpaired streams have natural levels of sediment. To quantify this, sample results from EMAP (Environmental Monitoring and Assessment Program) were examined. EMAP was a research program run by EPA to develop the tools necessary to monitor and assess the status and trends of national ecological resource.

153 sample sites in the xeric west were examined, and 25 of these were judged to be in 'least impacted' condition, as evidenced by a ranking of 'good' in both their macroinvertebrate and fish populations. The average suspended sediment concentration in these least-impacted sites was **2.5mg/L.** This is a reasonable estimate for the natural background concentration of sediment in a stream in the xeric west during the summer months.

The natural background level of sediment must be subtracted from all anthropogenic sources, and therefore represents a reduction in the available load capacity. Said another way, even perfectly pure water would naturally be expected to gain up to 2.5mg/L of sediment as it travelled down the stream, through processes such as bank erosion.

The water quality standards do not make a distinction between anthropogenic and background sources of E. coli. 'Natural' E. coli (from sources such as birds and deer), is also now more likely to enter the streams because of irrigation and storm conveyances. For this reason, the background levels of e. coli will be incorporated in the load allocation.

5.4. Load and Wasteload Allocations

Aside from contributions from point sources, the existing in-stream loads are generated by the land uses occurring in each watershed. Load allocations will be established for compliance points near the bottom of each assessment unit, and all land uses upstream of the compliance point that contribute pollutants should make combined reductions to meet the load allocation.

To improve beneficial uses, water quality managers should focus on the target *concentrations*, rather than absolute loads. However, to meet the requirements of the Clean Water Act, flow-variable loads are assigned to each tributary. Loads apply year-round, and are calculated as averages: 30 days for E. coli and 4 months for sediment.

POINT SOURCES - WASTE LOADS

The E. coli wasteloads are based on 126 CFU/100ml, collected as a 5-sample geometric mean over 30 days. The sediment wasteloads are based upon 20mg/L, less 2.5 mg/L for natural background (section 5.3.1). The sediment wasteloads are expressed as 4 month averages, as stated in section 5.1.1.

The same target concentrations apply to every NPDES facility. This provides a clear regulatory system for permitting. In every case, the current discharge concentration is substantially below the target concentration.

This TMDL is concentration-based, so the wasteload allocations are based upon the design flow. The equation for **sediment** is:

$$\text{WLA (in kg/day)} = \text{Q (in mgd)} \times 66.2$$

The equation for **E. coli** is:

$$\text{WLA (in } 10^9 \text{ CFU/day)} = \text{Q (in mgd)} \times 4.76$$

Where Q is the design flow of the facility.

If the design flow were to increase, then the wasteload allocation would correspondingly increase, according to the equations above. The present design flows, and wasteload allocations, are shown in table 7.

Again, the coefficients are simply a collection of conversion constants:

Sediment: $\frac{(20-2.5)mg}{L} \times \frac{3.785\ L/gal \times 10^6\ gal/million\ gal}{10^6\ mg/kg} = \mathbf{66.2}\ kg/day/mgd$

E. coli: $126\ CFU/100mL \times \frac{3.785\ L/gal \times 10^6\ gal/million\ gal}{0.1L/100mL \times 10^9} = \mathbf{4.76} \times 10^9 CFU/\ day/mgd$

Table 4. Point source wasteload allocations for tributaries in the lower Boise River subbasin. The wasteloads are given

Facility	**NPDES[a] Number**	**Affected AU**	**Present Design Flow** (mgd)	**Wasteload Allocation at Present Flow**	
				Sediment (kg/day) [b]	**E. coli** (10^9 CFU/day) [c]
City of Meridian	ID-002019-2	010_03 Five Mile	10.20	675.6	49

City of Parma	ID-002177-6	017_06 Sand Hollow	0.68	45.0	3
City of Nampa	ID-002206-3	002_04 Indian Creek	18.00	1192.3	86
Sorrento-Lactalis	ID-002803-7	006_02 Mason Creek	1.52	100.7	7
City of Greenleaf	ID-0028304	001_02 Dixie Slough	0.24	n/a [d]	1

[a] National Pollutant Discharge Elimination System (NPDES)
[b] 4 month average
[c] 30 day geometric mean
[d] Dixie Slough is not 303(d) listed for sediment

All point sources in the table above presently meet these wasteload allocations.

NONPOINT SOURCES – LOADS

The E. coli loads are based on 126 CFU/100ml, collected as a 5-sample geometric mean over 30 days. The sediment loads are based on the targets stated in 5.1.1, less 2.5 mg/L for natural background (section 5.3.1). The sediment wasteloads are expressed as 3 or 4 month averages, as stated in section 5.1.1.

Water quality managers should focus on the concentration targets.

The load allocations are calculated here, and are based on the flow of water from nonpoint sources. These flows are highly variable, so flow-variable equations are used.

The equation for **sediment** is:

$$\text{LA (in kg/day)} = Q \times (C - 2.5) \times 2.45$$

The equation for **E. coli** is:

$$\text{LA (in } 10^9 \text{ CFU/day)} = Q \text{ (in cfs)} \times 3.08$$

Where Q is the flow of the creek measured in cfs and C is the sediment target concentration measured in mg/L. Again, the coefficients are simply a collection of conversion constants.

If the flows were to increase, then the load allocations would correspondingly increase, according to the equations above. The present nonpoint source flows, and corresponding load allocations, are shown in table 8. These values are merely examples.

Table 5. Example nonpoint source load allocations for tributaries in the Lower Boise River subbasin.

Stream	Assessment Unit	Sediment Target (mg/L)	Present Flow (cfs)	Load Allocation at this Flow	
				Sediment kg/day	E. coli 10^9 CFU/day
Five Mile	010_03	33	63.8	4,767	197

Nine Mile	010_02	n/a	10.0 b	n/a	31
Ten Mile	008_03	33	70.4	5,261	217
Fifteen Mile	007_04	23	120.6	6,057	371
Sand Hollow	016_03	20	0.6	26	n/a
Sand Hollow	017_03	20	26.4	1,132	81
Sand Hollow	017_06	20	142.2	6,097	438
Willow	015_03	23	39.5	1,984	n/a
Dixie	001_02	n/a	200.0	n/a	616
Indian below Sugar	002_04	20	126.0 a	5,402	388
Indian headwaters	003d_02	20	1.1	45	3
Indian above Mora	003b_03	20	15.5 b	665	n/a
Indian above Reservoir	003d_03	20	16.5 b	707	n/a
Sand	012_02	n/a	0.9 b	n/a	3
Mason	006_02	20	162.7	6,976	501

[a] This flow was measured at Caldwell, where it has significantly increased from the flow listed in table x3x

[b] There were no flow data available for Nine Mile, Sand or upper Indian Creek, so USGS StreamStats values were used as a approximations.

The time frame for meeting these allocations is as soon as funding permits.

5.4.1. Margin of Safety

An implicit margin of safety is built into the TMDL for four reasons:

1. Each of the impaired creeks is heavily influenced by groundwater infiltration. This ground water most likely contains very little sediment or *E. coli.* As such, if all surface water sources discharged at the target, dilution would become available as a result of groundwater infiltration into the stream.
2. The point sources are discharging at extremely low concentrations (<20 CFU/100ml E. coli and <7 mg/L sediment), thereby providing further dilution.
3. The water quality target was based upon not causing lethal or paralethal effects on juvenile salmonids: a severity rating of ‘8’. In their paper, Newcombe and Jensen (1996) define the threshold as *between* levels 8 and 9 (equivalent to perhaps level 8.5). Therefore, a level ‘8’ is a slightly more conservative level of protection that would still support the beneficial use.
4. The natural background concentration assumes all the water in the creek is exposed to the streambanks (the source of background sediment) for the creek’s entire length. In fact, these streams have no headwater inflow, and their water comes mainly from agricultural return flows. This means that their water enters the creek throughout its length. Water entering at the bottom end of the creek has no streambanks to erode and therefore is potentially cleaner than water entering at the top of the creek, which has far more opportunity to collect sediment from the banks. This functions as a margin of safety.

5.4.2. Seasonal Variation

Water quality standards apply year-round, and so the *E. coli* target of 126 CFU/100ml must be met all year.

The sediment targets are based upon supporting cold water aquatic life. The targets apply during any period when the appropriate stage of cold water aquatic biota could be expected to exist. The data from each creek indicate that the highest sediment levels are typically seen between April and mid-September.

5.4.3. Reasonable Assurance

Although the impaired watersheds have several point sources of E. coli and sediment pollution, all of these sources discharge at a concentration lower than the water quality criterion. In other words, the point sources are reducing the E. coli and sediment concentrations with their discharge. This means that the only way to reduce E. coli levels to the water quality target is to reduce the pollution from non-point sources. There must be reasonable assurance that these reductions will be implemented and effective in achieving the water quality target

The following discussion is excerpted from the 2001 subbasin assessment.
Under Section 319 of the Clean Water Act, each state is required to develop and submit a nonpoint source management plan. Idaho's most recent Nonpoint Source Management Program was finalized in September 1999. The plan was submitted to and approved by the EPA. Among other things, the plan identifies programs to achieve implementation of nonpoint source BMPs, includes a schedule for program milestones, outlines key agencies and agency roles and is certified by the state attorney general to ensure that adequate authorities exist to implement the plan and identifies available funding sources. Idaho's nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, such as the formation of Basin Advisory Groups (BAGs) and Watershed Advisory Groups (WAGs) (IDAPA 58.01.02.052). The WAGs are to be established in high priority watersheds to assist DEQ and other state agencies in formulating specific actions needed to decrease pollutant loading from point and nonpoint sources that affect water quality limited waterbodies. The Lower Boise Watershed Council is the designated WAG for the lower Boise River watershed.

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

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

Authority	**IDAPA Citation**	**Responsible Agency**
Rules Governing Solid Waste Management	58.01.02.350.03(b)	Idaho Department of Health and Welfare
Rules Governing Subsurface and Individual Sewage Disposal Systems	58.01.02.350.03(c)	Idaho Department of Health and Welfare
Rules and Standards for	58.01.02.350.03(d)	Idaho Department of Water

Stream-channel Alteration		Resources
Rules Governing Exploration and Surface Mining Operations in Idaho	58.01.02.350.03(e)	Idaho Department of Lands
Rules Governing Placer and Dredge Mining in Idaho	58.01.02.350.03(f)	Idaho Department of Lands
Rules Governing Dairy Waste	58.01.02.350.03.(g)	Idaho Department of Agriculture

The state of Idaho uses a voluntary approach to address agricultural nonpoint sources. However, regulatory authority can be found in the water quality standards (IDAPA 58.01.02.350.01 through 58.01.02.350.03). IDAPA 58.01.02.054.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan) (IDHW and SCC, 2003) which provides direction to the agricultural community approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (SCDs) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, it assigns the local SCDs to assist the landowner/operator with developing and implementing BMPs to abate nonpoint pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations that may be determined to be an imminent and substantial danger to public health or environment (IDAPA 58.01.02.350.02(a)). The Idaho Water Quality Standards and Wastewater Treatment Requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the Director of the Department of Health and Welfare's authority provided in Section 39-108, Idaho Code (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs; the Soil Conservation Commission for grazing and agricultural activities; the Department of Transportation for public road construction; the Department of Agriculture for aquaculture; and DEQ for all other activities (IDAPA 58.01.02.003).

5.4.4. Stormwater Runoff Load and Wasteload Allocations

5.4.4.1 Nature of Runoff

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).

5.4.4.2 Point-source vs Nonpoint-source

'True' stormwater is that produced by runoff from storms. When it is discharged by an MS4, this discharge is regulated as a point-source.

In addition to true stormwater, stormwater systems in the Treasure Valley accept other inputs of water. In some cases, this is voluntary, and regulated by the NPDES permit, for example, an MS4 permittee might agree to accept water pumped from a construction site.

However, in many cases the stormwater system is intertwined with the valley's agricultural drainage system. This follows patterns of development in the valley, when for example, traditional drainage ditches were incorporated into a storm drain. The ditches still function to drain agricultural lands, and yet are now part of a permitted MS4. The combined nature of the plumbing gives the MS4 entity no choice but to accept the drainage water. Separating the systems would be expensive, and would likely offer no benefit to water quality, because the agricultural drainage water would still be routed to the nearest stream or river. In effect, the MS4 shares a pipe with non-point source discharges.

These non-point-source inputs may originate from groundwater infiltration, water-line flushing, or irrigation and drainage activities.

To the extent that their discharge originates from nonpoint-sources, it is DEQ's intent to assign *load* allocations to the MS4 outfalls. The remainder of the discharge will be regulated as a point source, and will therefore be assigned a *wasteload* allocation.

The plumbing of the combined stormwater/drainage system is intricate, and the exact quantity of the non-stormwater inputs is presently unknown. However, some of the MS4 permittees have recommended initial estimates for the percentage of their non-stormwater discharge that originates from nonpoint-sources. These estimates are very approximate, and are based on professional judgement, rather than hard date. They should be refined by monitoring and mapping in future permit cycles.

TABLE 8P

Facility[1]	**NPDES[2] Number**	**Dry-weather discharge attributable to nonpoint-sources**
ACHD (and co-permittees) Phase 2	ID-028185	*
ACHD (and co-permittees) Phase 1	IDS-027561	*
City of Caldwell	IDS-028118	98%
Canyon HD #4	IDS-028134	100%
ITD #3	IDS-028177	*
Nampa HD #1	IDS-028142	0%
City of Nampa	IDS-028126	99%
City of Middleton	IDS-028100	*
Industrial Facilities	Multi-Sector General Permit	0%

Construction Activities	Construction General Permit	0%
Confined Animal Feeding Operations	IDG010000	0%

* Estimates not received by 1/14/15.

5.4.4.3 Stormwater targets

True stormwater discharge typically lasts a few hours or days and so is a short-duration pollutant. This TMDL is concerned mainly with pollutants of long-duration, and has found no evidence that the short-duration sediment targets in Newcombe and Jensen are exceeded.

The E. coli wasteloads are based on attaining 126 CFU/100ml. The sediment wasteloads are based upon 20mg/L, less 2.5 mg/L for natural background (section 5.3.1). It is crucial to note that *these targets are averages* (4 months for sediment and 30 days for E. coli), and only apply to outfalls that discharge for the entire averaging period. They must not be construed as instantaneous, end-of-pipe limits.

The same target concentrations apply to every stormwater facility. This provides a clear regulatory system for permitting. In many cases, permitted entities may discharge into multiple streams.

5.4.4.4 Stormwater Allocations

The volume of stormwater discharge is presently unknown, and so flow-based equations are used for the load and wasteload allocations (table 8). A table of examples is also provided (table 8x).

For short-term discharges ('true' stormwater), a narrative wasteload allocation is assigned:

1. **Stormwater entities must continue management practices that reduce sediment and E. coli**
2. **Stormwater entities must continue to identify and characterize inputs to their systems**

NPDES permit writers may also consider using the short-duration sediment targets (appendix F), although DEQ has no data that suggest these targets are exceeded.

For long-term discharges (i.e. at least 30 days for E. coli, and 4 months for sediment), the following loads and wasteloads are allocated:

Table 8. Load and wasteload allocations for *long-term stormwater* discharges:

Facility	**NPDES[1] Number**	**Load or Wasteload Allocation[3]**	
		Sediment kg/day [2]	**E. coli** 10^9 CFU/day [3]
ACHD (and co-permittees) Phase 2	ID-028185	Q (in cfs) × 42.9	Q (in cfs) x 3.08
ACHD (and co-permittees) Phase 1	IDS-027561		

City of Caldwell	IDS-028118		
Canyon HD #4	IDS-028134		
ITD #3	IDS-028177		
Nampa HD #1	IDS-028142		
City of Nampa	IDS-028126		
City of Middleton	IDS-028100		
Industrial Facilities	Multi-Sector General Permit		
Construction Activities	Construction General Permit		
Confined Animal Feeding Operations	IDG010000		

[1] National Pollutant Discharge Elimination System (NPDES)
[2] 4 month average.
[3] 30 day geometric mean

Notes

1. The wasteload allocation is 'per assessment unit'. For example, ITD#3 might have separate wasteload allocations for Sand Hollow and Indian Creeks.
2. 'Q', the variable for discharge in the above equations, represents the entire flow from each stormwater entity into a given assessment unit, rather than any specific outfall.
3. The division of the allocation between load and wasteload is found by multiplying the allocation by the percentage in table 8P. For example, Caldwell's sediment *load* allocation is 98% × Q × 42.9. Its sediment *wasteload* allocation is 2% × Q × 42.9.
4. It is DEQ's intent to include in the MS4 wasteload allocation only that non-storm water that is categorized as allowable under the MS4 NPDES permit, and to treat other non-storm water flow as a nonpoint source. This TMDL does not obviate the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.

Table 8X

Example Discharge	**Target Concentration**		**Load or Wasteload Allocation**	
	Sediment	E. coli	Sediment	E. coli
cfs	mg/L	CFU/100ml	kg/day	10^9 CFU/day
0.5	17.5	126	21	2
1	17.5	126	43	3
2	17.5	126	86	6
5	17.5	126	215	15
10	17.5	126	429	31
20	17.5	126	858	62
50	17.5	126	2,145	154
100	17.5	126	4,290	308

Again, the wasteload allocations in the table above only apply to long-term discharges: at least 30 days for E. coli, and 4 months for sediment.

5.4.4.1. Municipal Separate Storm Sewer Systems ("MS4")

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

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

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

5.4.4.2. Industrial Stormwater Requirements

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

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.

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.

5.4.4.3. Construction Stormwater

The CWA 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 Construction General Permit (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.

5.4.5. Reserve for Growth

The TMDLs are each based upon a target *concentration*. Therefore, growth can occur provided that:

1. the receiving stream channel can transport the extra effluent
2. the effluent contains concentrations of:
   i. E. coli less than 126 CFU/100ml (30 day geometric mean)
   ii. Suspended sediment less than 17.5mg/L (4 month average)

If these conditions were met, the effluent would actually dilute the impaired streams and reduce the pollutant concentrations. This recognizes that point sources almost always discharge their pollutants *in solution*, and whether the water were ‘new’ (from wells or ratepayers) or ‘old’ (taken from the creek itself), as long as it met the above criteria, it would contribute to improving the beneficial uses.

This is in no way a statement about water rights or availability.

This TMDL is concentration-based, so the reserve allocations are based upon the design flow of the future source (Q), less 2.5 mg/L for natural background. The equations are the same as for the wasteload allocations. See section 5.4 for an explanation of the constants in the equations below.

For **sediment**, the equation is:

$$\text{Reserve (in kg/day)} = Q \text{ (in mgd)} \times 66.2$$

The equation for **E. coli** is:

$$\text{Reserve (in } 10^9 \text{ CFU/day)} = Q \text{ (in mgd)} \times 4.76$$

Where Q is the design flow of the future facility.

Examples of reserves for growth are shown in table XXZ.

Table XXZ. Examples of Reserves for Growth

Future Facility Design Flow	Maximum Concentration		Reserve For Growth	
	Sediment	E. coli	Sediment	E. coli
mgd	mg/L	CFU/100ml	kg/day	10^9 CFU/day
0.5	17.5	126	33	2
1	17.5	126	66	5
2	17.5	126	132	10
5	17.5	126	331	24

10	17.5	126	662	48
15	17.5	126	993	71
20	17.5	126	1,324	95
25	17.5	126	1,655	119
30	17.5	126	1,986	143

5.5. Estimates of Existing Pollutant Loads

Data have generally been collected from a single point at the lower end of each assessment unit, and by each point source. There are insufficient data to identify categories of nonpoint source pollution, and so a single load is presented.

Table 6. Current E. coli loads from all sources in the impaired assessment units.

Stream	**AU**	**Existing E. coli Concentration [8]** (CFU/100ml)	**Average Discharge [9]** (cfs)	**Existing E. coli Load** (10^9 CFU/day)	**Required Reduction to meet target**
Five Mile	010_03	768 [1]	56.3 [1]	1,058	81%
Nine Mile	010_02	709 [1]	10 [12]	173	82%
Ten Mile	008_03	700 [1]	70.3 [1]	1,204	82%
Fifteen Mile	007_04	748 [1]	92.7 [4]	1,696	78%
Sand Hollow	017_03	573 [1]	45 [5]	631	87%
Sand Hollow	017_06	669 [1]	157 [4]	2,570	83%
Dixie	001_02	482 [13]	200 [14]	2,362	74%
Indian below Sugar	002_04	490 [1]	156 [6]	1,870	79%
Indian headwaters	003d_02	1,338 [10]	1.06 [11]	35	91%
Sand	012_02	404[14]	0.87 [12]	9	69%
Mason	006_02	709 [3]	87.7 [7]	1,521	67%

1 – DEQ July 2011, 2 – DEQ July 2010, 3 – USGS and ISDA July 1999, 4 – ISDA July 2008, 5 – DEQ July 2008, 6 – USGS July 2010, 7 – ISDA July 1999, 8 – Maximum concentration, collected per IDAPA 58.01.02.251.02, 9 – During the same period as E. coli sample collection, 10 – DEQ May 2012, 11 – USGS Gauge at Mayfield May 2012, 12 – USGS Streamstats website 13 – DEQ and HyQual 2012 14 – City of Boise 1996-2011 14 – DEQ, 2014

In most cases, the highest E. coli values occurred in July. Sand Hollow Creek was highest in August, and upper Indian Creek was highest in May. Five, Nine, Ten and Fifteen Mile Creeks were also monitored in November 2011. Five, Ten and Fifteen Mile Creeks met the water quality criteria. Nine Mile Creek remained above the water quality criteria, albeit at a lower level – 365 CFU/100ml.

Table x3x. Current sediment loads from all sources in the impaired assessment units.

Stream	AU	Existing Sediment Concentration [5] mg/L	Average Discharge [6] cfs	Existing Sediment Load kg/day	Required Reduction to meet target
Five Mile	010_03	46.2 [1]	63.8 [1]	7222	34%
Ten Mile	008_03	75.1 [1]	70.4 [1]	12,953	59%
Fifteen Mile	007_04	67.9 [2]	120.6 [2]	20,062	70%
Sand Hollow	016_03	5.8 [3]	0.6 [3]	9	0%
Sand Hollow	017_03	126.0 [3]	26.4 [3]	8,150	86%
Sand Hollow	017_06	102.6 [2]	142.2 [2]	35,745	83%
Willow	015_03	25.2 [2]	39.5 [2]	2,439	19%
Indian below Sugar[7]	002_04	22.6 [4]	126.0 [8]	6,977	23%
Indian headwaters	003d_02	Unknown	1.1	Unknown	Unknown
Indian above Mora	003b_03	Unknown	15.5	Unknown	Unknown
Indian above Reservoir	003d_03	8 [9]	16.5	311	0%
Mason	006_02	80.4 [2]	162.7 [2]	32,049	78%

1 – DEQ 2011, 2 – ISDA 2008, 3 – DEQ 2008, 4 – City of Nampa 2003-2009, 5 – maximum recorded 4 month average concentration, 6 – during the same period as sediment data collection, 7 – Note that this site is midway through the assessment unit. There were no sufficiently large sediment datasets available for the preferred location, Simplot Boulevard. The data collected at the mouth is not representative. 8 – discharge data were collected at Caldwell at the preferred location, Simplot Boulevard. 9 – Bureau of Reclamation 2009

POINT SOURCES

Table 7. Current wasteloads from point sources in the impaired assessment units.

Facility	Per mit #	Affected AU	Existing Flow [1]	Existing Concentration[1]		Existing Wasteload	
				Sed.	E. coli	Sed.	E. coli
			mgd	mg/L	CFU/day	kg/day	10^9 CFU/day
City of Meridian	ID-0020 19-2	010_03 Five Mile	5.6	2.4	1	50	0.211

City of Parma	ID-002177-6	017_06 Sand Hollow	0.1	4.5	1	2	0.005
City of Nampa	ID-002206-3	002_04 Indian Creek	9.7	6.8	21.3	251	7.826
Sorrento-Lactalis	ID-002803-7	006_02 Mason Creek	0.7	4.3	2.3	10	0.057
City of Greenleaf	ID-0028304	001_02 Dixie Slough	0.7	n/a	1	n/a	0.013

1 Annual averages of reported values

Note that the City of Kuna and XL Four Star Beef discharge to an unimpaired section of Indian Creek that is not addressed in this TMDL. They already receive loading allocations from the Boise River TMDL, and will not be assigned further loads by this TMDL. The City of Greenleaf has only recently received its NPDES permit, and only has two months of data available.

5.6. Pollution 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).

5.6.1. 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.

5.6.2. Watershed-Specific Environmental Protection

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

5.6.3. IV.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. The elements of a trading document are described in DEQ's pollutant trading guidance (DEQ 2010).

5.7. Public Participation

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

- BAG members are appointed by DEQ's director for each of Idaho's basins.
- An "Integrated Report" is developed by DEQ every two years that highlights which water bodies in Idaho appear to be degraded.
- DEQ prepares to begin the SBA and TMDL process for individual degraded watersheds.
- A WAG is formed by DEQ (with help from the BAG) for a specific watershed/TMDL.

- With the assistance of the WAG, DEQ develops an SBA and any necessary TMDLs for the watershed.
- The WAG comments on the SBA/TMDL.
- WAG comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
- The public comments on the SBA/TMDL.
- Public comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
- DEQ sends the document to the U.S. Environmental Protection Agency (EPA) for approval.
- DEQ and the WAG develop, then implement, a plan to reach the goals of the TMDL.

DEQ will provide the WAG with all available information pertinent to the SBA/TMDL, when requested, such as monitoring data, water quality assessments, and relevant reports. The WAG will also have the opportunity to actively participate in preparing the SBA/TMDL documents.

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

5.8. Implementation Strategies

Implementation should focus on reducing nonpoint source pollution. Although small-scale projects may, collectively, produce water quality improvements, large-scale projects may be required to achieve the large reductions necessary.

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.

5.8.1. Time Frame

The point sources already meet their wasteload allocations. The nonpoint sources will attempt to meet their load allocations as soon as possible. This may be dependent upon the availability of funding.

5.8.2. Approach

Funding provided under section 319, and other funds, will be used to encourage voluntary projects to reduce nonpoint source pollution.

A survey of the hydrology of each stream should be attempted, with the goal of identifying the major inflows. These inflows could then be prioritized for projects to eliminate sediment and E. coli discharge to the tributary.

5.8.3. Responsible Parties

- Identify the federal, state, and local governments; individuals; or entities that will be involved in or responsible for implementing the TMDL. DMAs, specific point sources.

5.8.4. Monitoring Strategy

A repeat survey of sediment and E. coli concentrations should occur ten years after the approval of this TMDL. Measurements should be taken at the ideal locations identified in section 5.1.2. Sediment measurements should be collected every two weeks between April and November, and E. coli samples should be collected in July.

5.9. Conclusions

Concentration-based TMDLs are established for sediment and E. coli for the impaired streams in the lower Boise River watershed. Point sources all currently meet the pollutant targets. Implementation should focus on nonpoint sources, as funds allow.

Table 8. Summary of assessment outcomes.

Assessment Unit	Description	Pollutant	Recommended Changes to the 2014 Integrated Report	TMDL Load Capacities

Assessment Unit	Description	Pollutant	Recommended Changes to the 2014 Integrated Report	TMDL Load Capacities
ID17050114SW001_02	Dixie Slough	E. coli	Move to 4A – TMDL completed	126 CFU/100ml, averaged over 30 days. The load capacity is flow dependent, according to the following equation: LA (in 10^9 CFU/day) = Q (in cfs) x 3.08
ID17050114SW002_04	Indian Creek downstream of Sugar Ave			
ID17050114SW003d_02	Indian Creek and Tributaries upstream of Indian Creek			
ID17050114SW006_02	Mason Creek entire watershed			
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth			
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth			
ID17050114SW010_02	Nine Mile Creek 1st and 2nd order tributaries to Five Mile Creek			
ID17050114SW010_03	Five Mile Creek 3rd order section			
ID17050114SW012_02	Sand Creek			
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road			
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River			
ID17050114SW002_04	Indian Creek below Sugar	Sediment	Move to 4A – TMDL completed	20mg/L, averaged over 4 months. The load is flow dependent, according to the following equation: LA (in kg/day) = Q (in cfs) x 49.0
ID17050114SW003b_03	Indian Creek above Mora			
ID17050114SW003d_02	Indian Creek headwaters			
ID17050114SW003d_03	Indian Creek above Reservoir			
ID17050114SW006_02	Mason Creek entire watershed			
ID17050114SW016_03	Sand Hollow Creek C-line Canal to I-84			
ID17050114SW017_03	Sand Hollow Creek I-84 to Sharp Road			
ID17050114SW017_06	Sand Hollow Creek Sharp Road to Snake River			
ID17050114SW007_04	Fifteen Mile Creek from Five/Ten Mile confluence to mouth	Sediment	Move to 4A – TMDL completed	23mg/L, averaged over 84 days. The load capacity is flow dependent, according to the following equation: LA (in kg/day) = Q (in cfs) x 56.4
ID17050114SW015_03	Willow Creek 3rd order section (South Fork to mouth)			
ID17050114SW008_03	Ten Mile Creek Blacks Creek Reservoir to mouth	Sediment	Move to 4A – TMDL completed	33mg/L, averaged over 92 days.

Assessment Unit	Description	Pollutant	Recommended Changes to the 2014 Integrated Report	TMDL Load Capacities
ID17050114SW010_03	Five Mile Creek 3rd order section			The load capacity is flow dependent, according to the following equation: LA (in kg/day) = Q (in cfs) x 80.9

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Newcombe and Jensen

CH2M Hill: Final Summary Report: Lower Boise River Coliform Bacteria DNA Testing October 2003

Lower Boise River TMDL, approved Jan 28 2000

Lower Boise River Sediment and E. Coli TMDL approved June 3 2008

6.1.1.1. 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.

- Add list of GIS coverages to end of references (see guidance).

7. Glossary (Use glossary from new template, then streamline)

- Remove any terms not used and add any terms that are missing. To expedite searching, select a term and press Ctrl-F. If the term is found, select the *Go To* tab, of the *Find and Replace* window, choose *Bookmark* under *Go to what*, and select *glossary* under *Enter bookmark name*.
- If you add anything to this list (unless it is site-specific), please inform the TMDL Program Manager, so that we may provide everyone the most complete list possible.

305(b)

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

§303(d)

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

Acre-foot

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

Adsorption

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

Aeration

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

Aerobic

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

Adfluvial

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

Adjunct

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

Alevin

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

Algae

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

Alluvium

Unconsolidated recent stream deposition.

Ambient

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

Anadromous

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

Anaerobic

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

Anoxia

The condition of oxygen absence or deficiency.

Anthropogenic

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

Anti-Degradation

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

Aquatic

Occurring, growing, or living in water.

Aquifer

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

Assemblage (aquatic)

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

Assessment Database (ADB)

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

Assessment Unit (AU)

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

Assimilative Capacity

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

Autotrophic

An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.

Batholith

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

Bedload

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Benthic

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

Benthic Organic Matter.

The organic matter on the bottom of a water body.

Benthos

Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.

Best Management Practices (BMPs)

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

Best Professional Judgment

A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.

Biochemical Oxygen Demand (BOD)

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

Biological Integrity

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

Biomass

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

Biota

The animal and plant life of a given region.

Biotic

A term applied to the living components of an area.

Clean Water Act (CWA)

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

Coliform Bacteria

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

Colluvium

Material transported to a site by gravity.

Community

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

Conductivity

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

Cretaceous

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

Criteria

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

Cubic Feet per Second

A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Cultural Eutrophication

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

Culturally Induced Erosion

Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).

Debris Torrent

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

Decomposition

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

Depth Fines

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

Designated Uses

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

Discharge

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

Dissolved Oxygen (DO)

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

Disturbance

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

E. coli

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

Ecology

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

Ecological Indicator

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

Ecological Integrity

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

Ecosystem

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

Effluent

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

Endangered Species

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

Environment

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

Eocene

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

Eolian

Windblown, referring to the process of erosion, transport, and deposition of material by the wind.

Ephemeral Stream

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

Erosion

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

Eutrophic

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

Eutrophication

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

Exceedance

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

Existing Beneficial Use or Existing Use

A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Exotic Species

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

Extrapolation

Estimation of unknown values by extending or projecting from known values.

Fauna

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

Fecal Coliform Bacteria

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

Fecal Streptococci

A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.

Feedback Loop

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

Fixed-Location Monitoring

Sampling or measuring environmental conditions continuously or repeatedly at the same location.

Flow

See *Discharge*.

Fluvial

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

Focal

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

Fully Supporting

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

Fully Supporting Cold Water

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

Fully Supporting but Threatened

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

Geographical Information Systems (GIS)

A georeferenced database.

Geometric Mean

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

Grab Sample

A single sample collected at a particular time and place. It may represent the composition of the water in that water column.

Gradient

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

Ground Water

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

Growth Rate

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

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Basin

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

Hydrologic Cycle

The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit

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

Hydrologic Unit Code (HUC)

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

Hydrology

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

Impervious

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

Influent

A tributary stream.

Inorganic

Materials not derived from biological sources.

Instantaneous

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

Intergravel Dissolved Oxygen

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

Intermittent Stream

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

Interstate Waters

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

Irrigation Return Flow

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

Key Watershed

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

Land Application

A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.

Limiting Factor

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

Limnology

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

Load Allocation (LA)

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

Load(ing)

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

Load(ing) Capacity (LC)

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

Loam

Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.

Loess

A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.

Lotic

An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.

Luxury Consumption

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

Macroinvertebrate

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

Macrophytes

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

Margin of Safety (MOS)

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

Mass Wasting

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

Mean

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

Median

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

Metric

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

Milligrams per Liter (mg/L)

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

Million Gallons per Day (MGD)

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

Miocene

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

Monitoring

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

Mouth

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

National Pollution Discharge Elimination System (NPDES)

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

Natural Condition

The condition that exists with little or no anthropogenic influence.

Nitrogen

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

Nodal

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

Nonpoint Source

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

Not Assessed (NA)

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

Not Attainable

A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

Not Fully Supporting

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

Not Fully Supporting Cold Water

At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

Nuisance

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

Nutrient

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

Nutrient Cycling

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

Oligotrophic

The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.

Organic Matter

Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate

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

Oxygen-Demanding Materials

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

Parameter

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

Partitioning

The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.

Pathogens

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

Perennial Stream

A stream that flows year-around in most years.

Periphyton

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

Pesticide

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

pH

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

Phased TMDL

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

Phosphorus

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

Physiochemical

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

Plankton

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

Point Source

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

Pollutant

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

Pollution

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

Population

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

Pretreatment

The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary Productivity

The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.

Protocol

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

Qualitative

Descriptive of kind, type, or direction.

Quality Assurance (QA)

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

Quality Control (QC)

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

Quantitative

Descriptive of size, magnitude, or degree.

Reach

A stream section with fairly homogenous physical characteristics.

Reconnaissance

An exploratory or preliminary survey of an area.

Reference

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

Reference Condition

1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).

Reference Site

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

Representative Sample

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

Resident

A term that describes fish that do not migrate.

Respiration

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

Riffle

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

Riparian

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

Riparian Habitat Conservation Area (RHCA)

A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:

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

River

A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.

Runoff

The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediments

Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids

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

Species

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

Spring

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

Stagnation

The absence of mixing in a water body.

Stenothermal

Unable to tolerate a wide temperature range.

Stratification

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

Stream

A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Stream Order

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

Storm Water Runoff

Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Stressors

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

Subbasin

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

Subbasin Assessment (SBA)

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

Subwatershed

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

Surface Fines

Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 millimeters depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff

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

Surface Water

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

Suspended Sediments

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

Taxon

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

Tertiary

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

Thalweg

The center of a stream's current, where most of the water flows.

Threatened Species

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

Total Maximum Daily Load (TMDL)

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

Total Dissolved Solids

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

Total Suspended Solids (TSS)

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

Toxic Pollutants

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

Tributary

A stream feeding into a larger stream or lake.

Trophic State

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

Total Dissolved Solids

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

Total Suspended Solids (TSS)

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

Toxic Pollutants

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

Tributary

A stream feeding into a larger stream or lake.

Trophic State

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

Turbidity

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

Vadose Zone

The unsaturated region from the soil surface to the ground water table.

Wasteload Allocation (WLA)

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

Water Body

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

Water Column

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

Water Pollution

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

Water Quality

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

Water Quality Criteria

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

Water Quality Limited

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

Water Quality Limited Segment (WQLS)

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

Water Quality Management Plan

A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water Quality Modeling

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

Water Quality Standards

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

Water Table

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

Watershed

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

Water Body Identification Number (WBID)

A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

Wetland

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

Young of the Year

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

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Appendix C. Data Sources

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Appendix D. Distribution List

Lee Van De Bogart, City of Caldwell
Liz Paul, Idaho Rivers United
Robbin Finch, City of Boise
Steve Sweet, Quadrant Consulting
Dan Steenson, Sawtooth Law
Alan Newbill, Pioneer Irrigation District
Robert Braun, Amalgamated Sugar
Henry Hamanishi, JR Simplot Company
Erica Anderson-Maguire, Ada County Highway District
Jack Harrison, HyQual
Tom Dupuis, HDR
Marti Bridges, IDEQ
Bill Stewart, EPA
Hawk Stone, IDEQ
Doug Conde, IDEQ

Appendix E. Public Comments/Public Participation

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Appendix F. Sediment Targets in the Lower Boise River Tributaries

Rationale for Using Newcombe and Jensen (1996)

Idaho's narrative sediment criterion is expressed in IDAPA 58.01.02.200.08 and states that:

> "Sediment shall not exceed quantities … which impair designated beneficial uses."

In this case, every assessment unit has Cold Water Aquatic Life as its most stringent designated or existing beneficial use. TMDL sediment targets must be based upon attainment of this use. The Lower Boise River ("mainstem") TMDL used a 1996 paper by Charles Newcombe and Jorgen Jensen to make the link between sediment levels and beneficial uses.

Although there have been many studies that investigated how sediment affects fish, they were conducted over various timescales and species, and measured different response variables. Newcombe and Jensen performed a meta-analysis, and were able to unify and rationalize the results from 80 different studies. They found an empirical relationship between the concentration and duration of sediment, for a given effect on fish. According to DEQ and EPA scientists, and the WAG, this paper is still the best resource for establishing the effects of sediment on fish.

SEV Level

Newcombe and Jensen categorized the negative effects on fish on a scale of severity between 0 and 14. They further divided the scale into 3 categories: 'behavioral effects', 'sublethal effects', and 'lethal and paralethal effects'. We must choose a severity level (SEV) that is protective of cold water aquatic life. This makes the link to the narrative standard above.

SEV9 is the lowest score in the 'lethal and paralethal effects' category. In addition to high levels of physiological stress, the density of fish is reduced and their growth is retarded by as much as 84%. At SEV9, an angler is less likely to catch a fish because of its behavioral and feeding problems, and any fish he does catch will be a runt, with skin and gill damage. This clearly does not support the Clean Water Act's goal of 'fishable'.

SEV8 represents the highest level of impacts in the 'sub-lethal' category. In other words, fish experience stress, but it is not sufficient to cause death or growth defects. This stress can be severe, and includes skin and gill damage. DEQ believes this is the minimum level to avoid impairment of the fishable use as this is used in the sediment narrative criteria.

The 1998 mainstem Boise River TMDL set a chronic sediment target at 50mg/L for 60 days. This is most closely equivalent to a SEV8 on Newcombe and Jensen's juvenile salmonid chart:

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			

Based upon the above descriptions, and maintaining consistency with the mainstem TMDL, DEQ believes that **SEV8 is protective of the cold water aquatic life beneficial use**.

DURATION AND FISH ASSEMBLAGE

To derive a concentration target, it remains to choose an assemblage and a duration. These will vary from creek to creek.

If the duration matches one of the matrix durations used by Newcombe and Jensen, the sediment concentration can be simply read from the matrix. If an intermediate duration is desired, Newcombe and Jensen provide an equation:

$$\mathrm{SEV} = a + b \ln D + c \ln x$$

Where SEV is the severity index, D is duration in hours, x is concentration in mg/L, and a, b and c are constants for a given assemblage.

This can be rearranged to:

$$x = e^{\left(\frac{SEV-a}{c}\right)} D^{\left(\frac{-b}{c}\right)}$$

Aside from pollutant levels, the largest obstacle to trout in the Boise River tributaries is high water velocities. Raleigh (1984) showed that adult rainbow trout are able to persist in velocities up to about 2.4 ft/s before becoming exhausted. Juvenile trout require slower water, ideally between 0 and 2 ft/s. The velocity profiles of each creek will have an effect on the biological assemblage that can live there.

FIVE MILE AND TEN MILE CREEKS

Instantaneous velocity measurements were taken from these streams during the normal summer time flow period. They varied between 2.0 and 4.6 ft/s. They are straight, steep-sided denuded channels, which has been their design since they were developed into perennial streams by the Bureau of Reclamation. As vital components in the irrigation system, they will continue to be maintained in this condition. The high velocities, flume-like characteristics and many diversion structures provide insurmountable barriers to juvenile trout during the summer period of elevated sediment. Although adult trout were found in Ten Mile Creek, juvenile trout have not been found in either stream. For these reasons, it is appropriate to use the adult rather than juvenile salmonid assemblage in the Newcombe and Jensen equations (i.e. model 2 rather than model 1.)

Five and Ten Mile Creeks experience extremely high flows in late-May as irrigation managers charge the system before the onset of heavy use. This has been confirmed by Greg Curtis, district superintendent for Nampa Meridian Irrigation Company. It is also shown in the 2008 hydrograph for Fifteen Mile Creek, as collected by ISDA. These flows are two or three times the normal summertime flows, which commence by June 19 (2008 ISDA). Given that the normal summertime flow is already at the limit of what adult rainbow trout can tolerate, it is unlikely that they will remain in the system during the pre-season charging flow. Therefore, while sediment levels are high earlier in the year, adult trout will not be present and exposed to the sediment levels until June 19.

Sediment levels return to their wintertime baseline by mid-September, specifically September 19 in the 2011 DEQ dataset. The ISDA 2008 data is the most complete summertime flow data (DEQ flow data does not start until mid-July), and the DEQ 2011 dataset is the most recent sediment data.

This leads to an assemblage-led start date of June 19, and a concentration-led end date of September 19. This represents a period of 92 days as the duration of exposure to elevated sediment levels.

Using the equation, with SEV = 8, D = 92 days (2208 hours), and the coefficients *a*, *b* and *c* from their ‘model 2’ (adult salmonids):

$$x = e^{\left(\frac{SEV - a}{c}\right)} D^{\left(\frac{-b}{c}\right)}$$

$$x = e^{\left(\frac{8 - 1.6814}{0.7565}\right)} \times 2208^{\left(\frac{-0.4769}{0.7565}\right)}$$

$$\boldsymbol{x = 33\ mg/L}$$

The TMDL target would only apply to the perennial segments of each creek. That means below McDermott Road for Ten Mile Creek, and below Locust Grove for Five Mile Creek.

The monitoring points are at the Franklin Road crossings, at the bottom of each assessment unit.

FIFTEEN MILE CREEK AND WILLOW CREEK

Instantaneous velocity measurements were taken from Fifteen Mile Creek during the normal summer time flow period. Across the stream, the velocity varied between 1.1 and 4.1 ft/s. This is notably less than Five and Ten Mile Creeks.

In both Fifteen Mile and Willow Creeks, the channel dimensions, especially near the mouths, are slightly more natural, and the banks have occasional riparian features that create small refugia for fish. They also both have unbroken connectivity to the Boise River, making them attractive thermal refuges for trout. The low water velocities make Fifteen Mile Creek suitable for juvenile trout during the normal summer flow period, and Willow Creek is assumed to behave in a similar manner. Therefore, it is appropriate to use the juvenile salmonid assemblage in the Newcombe and Jensen equation.

The 2008 ISDA data indicate that the target duration for Fifteen Mile Creek and Willow Creeks should begin on June 19, which is the end of the high-velocity system-charging flow that would prevent the presence of trout. The same dataset shows sediment levels return to their wintertime baseline by September 11.

This leads to an assemblage-led start date of June 19, and a concentration-led end date of September 11. This represents a period of 84 days.

Using the equation, with SEV = 8, D = 84 days (2016 hours), and the coefficients *a, b* and *c* from their 'model 1' (includes juvenile salmonids):

$$x = e^{\left(\frac{SEV-a}{c}\right)} D^{\left(\frac{-b}{c}\right)}$$

$$x = e^{\left(\frac{8-1.0642}{0.7384}\right)} \times 2016^{\left(\frac{-0.6068}{0.7384}\right)}$$

$$\boldsymbol{x = 23\ mg/L}$$

The TMDL target would be measured at the Lincoln Road crossing, which represents the furthest downstream crossing.

SAND HOLLOW CREEK, MASON CREEK and INDIAN CREEK

Juvenile trout have been found in Sand Hollow and Mason Creeks. Juvenile trout are found upstream and downstream of the sediment-impaired section of Indian Creek, and so it is reasonable to use Newcombe and Jensen's 'model 1' to calculate a sediment target for all three streams.

Sediment levels remain elevated in Sand Hollow and Mason Creeks until at least mid-October. The only long-term dataset for Indian Creek was collected at the Nampa WWTP. At this point, the creek has very few return flows, and experiences its highest sediment levels during the spring. The Nampa dataset shows that the creek experiences a four-month spike in sediment levels, typically lasting from January through May.

In all three of these cases, the closest matrix duration is 4 months. Using Newcombe and Jensen's 'model 1', and choosing the closest matrix duration of 4 months, yields a target of 20mg/L.

Juvenile and Adult 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	10	11	11	12	12	13	14	14	-	-	-	12
59874	9	10	10	11	12	12	13	13	14	-	-	11
22026	8	9	10	10	11	11	12	13	13	14	-	10
8103	8	8	9	10	10	11	11	12	13	13	14	9
2981	7	8	8	9	9	10	11	11	12	12	13	8
1097	6	7	7	8	9	9	10	10	11	12	12	7
403	5	6	7	7	8	9	9	10	10	11	12	6
148	5	5	6	7	7	8	8	9	10	10	11	5
55	4	5	5	6	6	7	8	8	9	9	10	4
20	3	4	4	5	6	6	7	8	8	9	9	3
7	3	3	4	4	5	6	6	7	7	8	9	2
3	2	2	3	4	4	5	5	6	7	7	8	1
1	1	2	2	3	3	4	5	5	6	7	7	0
	1	3	7	1	2	6	2	7	4	11	30	
	Hours			Days			Weeks		Months			

SHORT TERM TARGETS

DEQ is also concerned to address the effects of shorter-term spikes in sediment, which will typically be associated with storms and runoff events. The effects of a storm may last for hours or days, and it is unclear which timescale (and therefore concentration), should be used as an appropriate target. Rather than arbitrarily picking a duration, we can continue to **use Newcombe and Jensen's severity level of 8 as a flexible target** for storm timescales (6 days or less). This could eventually provide for a set of short-term numeric targets (such as for MS4 permits) that vary depending on the period of elevated sediment. See figure XXX below.

Juvenile and Adult 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	10	11	11	12	12	13	14	14	-	-	-	12
59874	9	10	10	11	12	12	13	13	14	-	-	11
22026	8	9	10	10	11	11	12	13	13	14	-	10
8103	8	8	9	10	10	11	11	12	13	13	14	9
2981	7	8	8	9	9	10	11	11	12	12	13	8
1097	6	7	7	8	9	9	10	10	11	12	12	7
403	5	6	7	7	8	9	9	10	10	11	12	6
148	5	5	6	7	7	8	8	9	10	10	11	5
55	4	5	5	6	6	7	8	8	9	9	10	4
20	3	4	4	5	6	6	7	8	8	9	9	3
7	3	3	4	4	5	6	6	7	7	8	9	2
3	2	2	3	4	4	5	5	6	7	7	8	1
1	1	2	2	3	3	4	5	5	6	7	7	0
	1	3	7	1	2	6	2	7	4	11	30	
	Hours			Days			Weeks		Months			

It is important to note that the target duration is a *maximum* exposure time before the fish exhibit the effects of SEV8. In other words, after being exposed for the relevant duration, the fish ‘need a break’. The targets should be expressed as:

> *An average of* <concentration> *mg/l for a maximum of* <duration>.

References

Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact (Newcombe and Jensen 1996)

Guide to Selection of Sediment Targets for Use in Idaho TMDLs (Idaho DEQ, June 2003)

Selection of a Total Suspended Sediment (TSS) Target Concentration for the Lower Boise River TMDL (CH2M Hill 1998)

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish and Wildlife Service FWS/OBS-82/10.60.

G. List of Notices of Intent filed under the Multi-Sector General Permit

For waters in the Boise River Valley.

PERMIT_NUMBER	ORGANIZATION_NAME	RECEIVING_WATER	Notes
IDR05CI33	C A PAVING CO	BOISE RIVER	Boise River impaired, TMDL complete
IDR05C278	Masco dba Knife River	Boise River	Boise River impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05C279	Masco dba Knife River	Boise River	Boise River impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05CN94	Masco dba Knife River	Boise River	Boise River impaired, TMDL complete
IDR05C218	STAKER PARSON COMPANIES	Boise River	Boise River impaired, TMDL complete
IDR05C225	STAKER PARSON COMPANIES	Boise River	Boise River impaired, TMDL complete
IDR05C232	STAKER PARSON COMPANIES	Boise River	Boise River impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05C243	STAKER PARSON COMPANIES	Boise River	Boise River impaired, TMDL complete

IDR05C417	SIMPLOT TRANSPORTATION	BOISE RIVER (VIA DIXIE DRAIN AND MS4)	Boise River impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05CD07	Rambo Sand and Gravel, Inc.	Boise River- Indian Creek to Mouth	Boise River impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05CO01	Highway District #1	Famers Cooperative Canal	Farmers Cooperative Creek impaired, TMDL complete for one segment, TMDL not complete for another segment/parameter
IDR05C574	Basalite Concrete Products	Five Mile Creek	Five Mile Creek impaired, no data on TMDL
IDR05C321	CENTRAL PAVING CO., INC	LOWER BOISE RIVER	Lower Boise River impaired, TMDL complete

Streamstats Ungaged Site Report

For Indian Creek at Reservoir Inlet

Date: Thu Nov 6 2014 15:31:43 Mountain Standard Time
Site Location: Idaho
NAD27 Latitude: 43.3910 (43 23 28)
NAD27 Longitude: -116.0028 (-116 00 10)
NAD83 Latitude: 43.3909 (43 23 27)
NAD83 Longitude: -116.0037 (-116 00 13)
Drainage Area: 46.27 mi2
Percent Urban: 0.74 %
Percent Impervious: 0.0683 %

Peak-Flow Basin Characteristics

100% Peak Flow Region 7A (46.3 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	46.3	0.2	535.3
Mean Basin Elevation (feet)	4020	3605.5	8260.7

Low-Flow Basin Characteristics

100% Low Flow Region 7 (46.3 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	46.3	7.4	535.3
Stream Slope 10 and 85 Method (feet per mi)	78.1	18.4	372.8
Percent Forest (percent)	0	0	38.9
Mean Basin Elevation (feet)	4020	2984.4	7603
Slopes gt 30pct from 30m DEM (percent)	26	0	55.2
Mean Basin Slope from 30m DEM (percent)	19.2	1.7	35.3
Mean Annual Precipitation (inches)	15.1	8.2	29.1
Slopes Greater Than 50 Percent (percent)	2.41	0.189	28.5

Zero-Flow Probability Basin Characteristics

100% Low Flow Region 7 Prob Zero Flow (46.3 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	46.3	7.4	535.5
Mean Basin Slope from 30m DEM (percent)	19.2	10.1	35.3

Monthly and Annual Basin Characteristics

100% Low Flow Region 7 (46.3 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	46.3	7.4	535.3
Stream Slope 10 and 85 Method (feet per mi)	78.1	18.4	372.8
Percent Forest (percent)	0	0	38.9
Mean Basin Elevation (feet)	4020	2984.4	7603
Slopes gt 30pct from 30m DEM (percent)	26	0	55.2
Mean Basin Slope from 30m DEM (percent)	19.2	1.7	35.3
Mean Annual Precipitation (inches)	15.1	8.2	29.1
Slopes Greater Than 50 Percent (percent)	2.41	0.189	28.5

Peak-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK1_5	69.1	75		20.1	237
PK2	122	66		40.7	366
PK2_33	157	63		54.3	453
PK5	378	55		146	979
PK10	657	51		263	1640
PK25	1160	50		464	2890
PK50	1620	51		637	4120
PK100	2230	52		850	5840
PK200	2920	54		1070	7950
PK500	4030	58		1390	11700

Low-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
M1D10Y	0.5	160			
M7D10Y	0.61	140			
M7D2Y	1.18	140			
M30D5Y	0.93	140			

If the Zero-Flow Probability Basin Characteristics given above are within the valid range and one of the probabilities below is greater than 1/n where n is the recurrence interval in years (i.e. 0.1 for M1D10Y or M7D10Y, 0.2 for M30D5Y, or 0.5 for M7D2Y), then the flow estimate for the corresponding flow statistic is zero (0), and 0 should be used instead of the above low-flow estimate derived using regression equations. Also note that Wood and others (2009) presented alternative regression equations for 7-day 2-year low flow (M7D2Y) better suited to extrapolation to small streams, and used those equations to model perennial streams. The perennial streams model results may be viewed in the interactive map by turning on the Perennial Streams Model layer in the Map Contents listing.

Zero-Flow Probability Statistics

Statistic	Value	Standard Error (percent)
PROB_1DAY	0.33	
PROB_7DAY	0.23	
PROB_30DAY	0.16	

Monthly and Annual Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	5.23	80			
JAND20	26.2	68			
JAND50	6.75	68			
JAND80	3.38	69			
FEBD20	64.6	91			
FEBD50	20.6	75			
FEBD80	5.98	68			
MARD20	34.6	95			
MARD50	11.2	99			
MARD80	3.96	94			
APRD20	39.2	110			
APRD50	16.5	99			
APRD80	8.18	82			
MAYD20	17.3	110			
MAYD50	6.78	120			
MAYD80	3.52	110			
JUND20	8.73	120			
JUND50	4.02	110			
JUND80	2.52	100			
JULD20	3.58	99			
JULD50	2.28	110			
JULD80	1.61	130			
AUGD20	2.31	110			
AUGD50	1.81	130			

AUGD80	1.51	140			
SEPD20	2.53	120			
SEPD50	1.87	130			
SEPD80	1.46	140			
OCTD20	3.07	77			
OCTD50	2.28	98			
OCTD80	1.96	110			
NOVD20	3.51	69			
NOVD50	2.64	75			
NOVD80	2.18	85			
DECD20	4.12	79			
DECD50	2.84	70			
DECD80	2.46	70			

Appendix I Nampa Meridian Historical report
Appendix J Hydrologic report
Appendix K Indian Creek gauge report
Appendix L Pioneer Historical report