Water Body Assessment Guidance

Second Edition – Final

January 2002

Idaho Department of Environmental Quality

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Department of Environmental Quality

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Acronyms

Acronym	Explanation
ALUS	Aquatic Life Use Support
BURP	Beneficial Use Reconnaissance Program
Cfs	Cubic feet per second
CWA	Clean Water Act
CW ALUS	Cold Water Aquatic Life Use Support
CWE	Cumulative Watershed Effects
DE	Discrimination efficiency
DEQ	Department of Environmental Quality
DO	Dissolved oxygen
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
fs	Feet per second
GIS	Geographic Information System
GPS	Global Positioning System
HUC	Hydrologic unit codes
IDFG	Idaho Department of Fish and Game
ISU	Idaho State University
m	Meter
MDAT	Daily Average Temperatures
MDMT	Daily Maximum Temperatures
mg/l	Milligrams per liter
mm	Millimeter
MWMT	Maximum Weekly Maximum Temperatures

Acronym	Explanation
NA	Not assessed
NAWQA	National Water Quality Assessment
NCDC	National Climatic Data Center
NFS	Not fully supporting
ORW	Outstanding Resource Water
PFC	Proper Functioning Condition
QA	Quality assessment
QC	Quality control
RBP	Rapid Bioassessment Protocol
RDI	River Diatom Index
RFI	River Fish Index
RMI	River Macroinvertebrate Index
RPI	River Physicochemical Index
SCR	Secondary Contact Recreation
SFI	Stream Fish Index
SHI	Stream Habitat Index
SMI	Stream Macroinvertebrate Index
SRW	Special Resource Waters
TDG	Total dissolved gas
TMDL	Total maximum daily load
USGS	United States Geological Survey
WBAG	Water Body Assessment Guidance
WBID	Water Body Identification System
WQS	Water Quality Standard

Executive Summary

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

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

- Determine the beneficial use support of a water body.
- Determine the degree of biological integrity.
- Compile descriptive information about the water body.

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

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

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

In Section 4, the DEQ policy concerning when and how data from sources other than BURP may be used in water body assessments is discussed. All data are evaluated based on scientific rigor and relevance criteria. Tier I data, that is BURP compatible, is incorporated directly into the appropriate aquatic life assessment index. Non-BURP compatible Tier I data may also be used for 303(d) listing or delisting purposes, if it meets DEQ data policy requirements set forth in this section.

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

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

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

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

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

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

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

Section 1. Water Body Assessment Guidance Overview

1.1. Intent

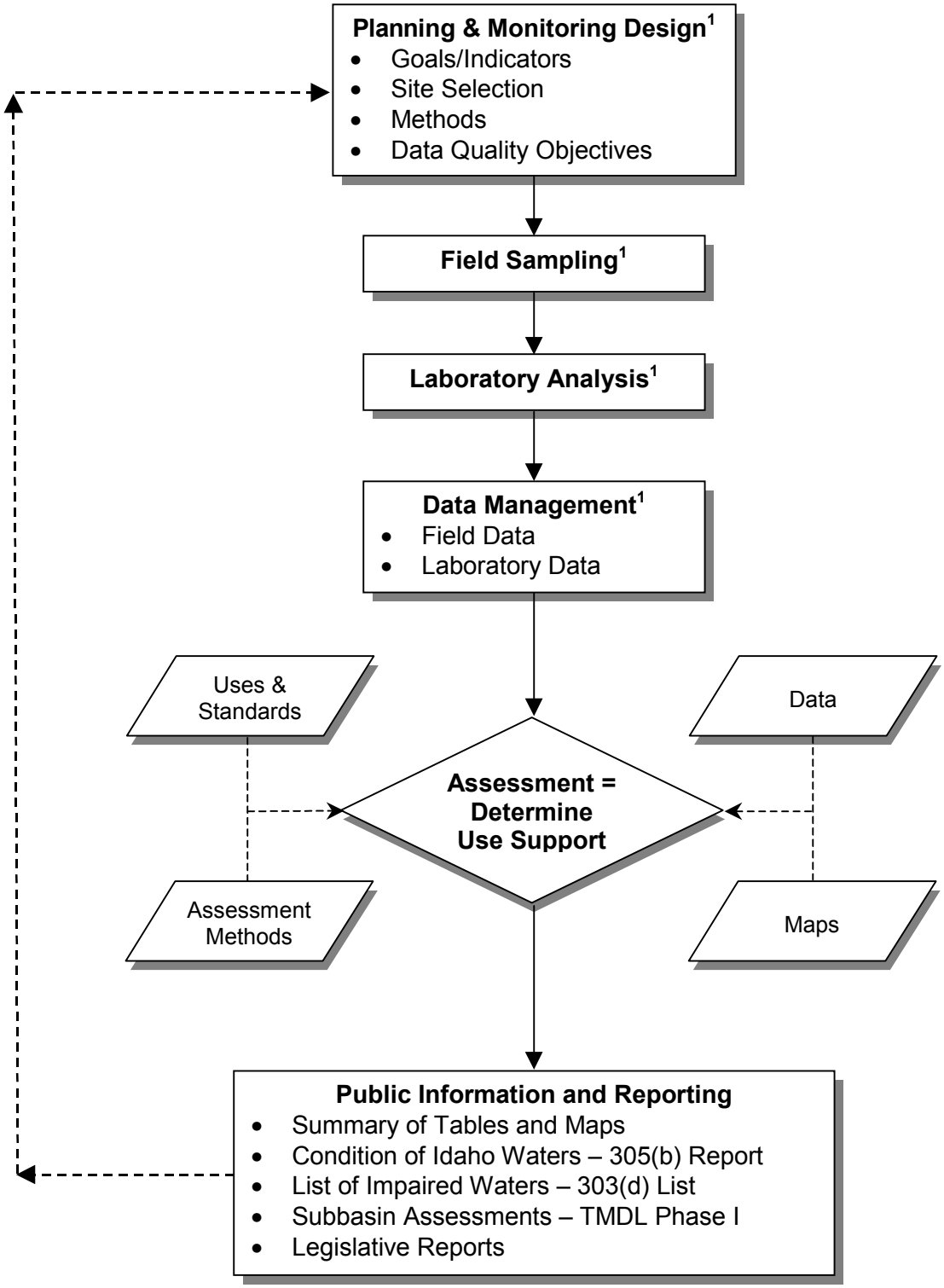
This Water Body Assessment Guidance (WBAG) describes Idaho Department of Environmental Quality (DEQ) methods used to consistently evaluate data and determine beneficial use support of Idaho water bodies. The methodology addresses many reporting requirements of state and federal rules, regulations, and policies. This document is a revision of the first assessment guidance (DEQ 1996) and is intended solely as an analytical tool to guide the assessor through a standardized assessment of beneficial use status.

1.2. Overview of the Assessment Process

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

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

Figure 1-1 illustrates the assessment process. The process encompasses several steps before DEQ determines use support. DEQ starts by planning and designing the monitoring program. Next, relevant data are collected, analyzed, and aggregated to allow sound and consistent assessments. These assessments determine use support and are then summarized to meet state and federal reporting requirements.



[1] Information regarding the BURP monitoring protocols, laboratory analysis, and data management may be found in annual work plans and quality assurance procedures.

Figure 1-1. Assessment Process Overview

The WBAG is a dynamic document. It will be adapted to meet new needs as assessment methods develop and changes occur to Idaho's Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02.100)[1].

1.3. How to Use This Document

This document provides the assessor with guidance throughout the water body assessment process. Such guidance includes information on DEQ policies, assumptions, and analytical methods. However, the document does not present a rigid structure limiting flexibility for unique situations or preclude the use of sound scientific judgment. In these situations, it is the DEQ assessor's responsibility to provide justification for variations from the guidance. DEQ may use third-party data sources in the assessment process; however, these sources must undergo data review to determine how the data will be used. Section 3 takes the assessor through this process

The WBAG is limited to perennial, wadeable, and nonwadeable lotic water bodies and applies to both reconnaissance and more intensive monitoring. Although the fundamental approach should also be applicable to lakes, reservoirs, springs, and wetlands, DEQ must further investigate these types of water bodies to develop scientifically sound assessment processes.

This document is organized according to the steps taken in the assessment process. Figure 1-2 illustrates the sequence of these steps. Section 1 addresses the overall process and regulatory setting for the assessment. Section 2 discusses the DEQ monitoring design and data representation methods for collected data. Next, Section 3 explains methods for identifying beneficial uses for assessment purposes. Section 4 describes DEQ criteria for evaluating different types of data and the policies regarding their use. Section 5 concerns policies to interpret numeric criteria exceedances for different physicochemical parameters. The discussion of assessment methods of beneficial uses begins in Section 6 where aquatic life assessment methods and policies are described. Contact recreation (Section 7) follows the aquatic life section, and water supply (Section 8) and wildlife and aesthetics (Section 9) assessment policies complete the methodology sections. Section 10 illustrates assessment procedures through an example, and Section 11 addresses the public appeals process.

[1] Henceforth, subsections of Idaho Administrative Code within IDAPA 58.01.02 are abbreviated as "WQS.XXX" where XXX is the subsection. For example, "IDAPA 58.01.02.100" is abbreviated as "WQS § 100." Idaho statutes are referred to as "Idaho Code" and abbreviated "IC § 39-3601," for example.

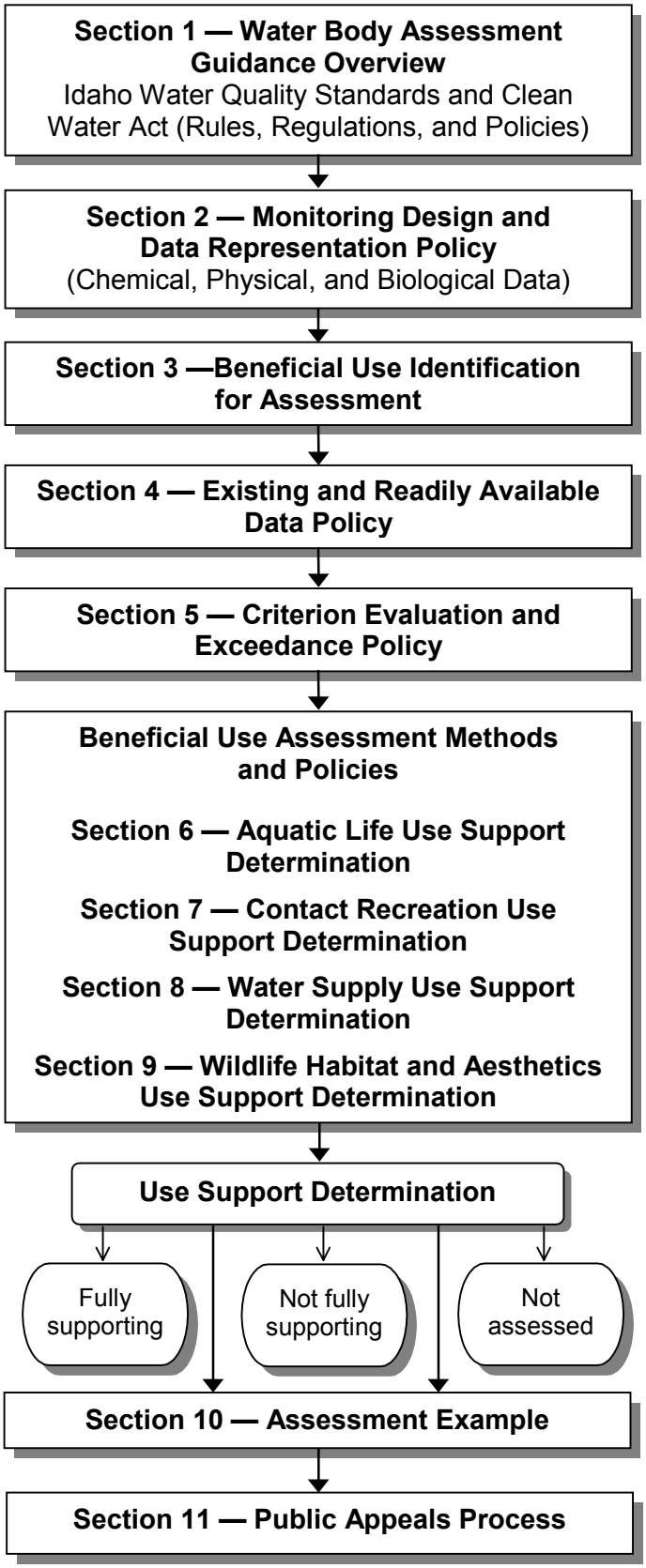


Figure 1-2. Water Body Assessment Guidance Structure

1.4. Regulatory Background

1.4.1. Clean Water Act

In 1972, Congress passed Public Law 92-500, Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA). The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it generated have changed over the years as experience and perceptions of water quality have changed. It has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. This goal, along with the 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

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

For the most part, the WBAG addresses federal requirements found in Sections 303 and 305 of the CWA. The statutory and regulatory requirements differ significantly for 303 and 305 documents (EPA 1977). Figure 1-3 illustrates the conceptual relationship among different elements of the water quality program. These sections focus on the following elements.

- Section 303 requires DEQ to adopt, with EPA approval, water quality standards and review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish total maximum daily loads (TMDLs) for each pollutant impairing the waters. Further, the agency must set appropriate controls to improve water quality and permit the water bodies to meet their designated uses. These requirements result in two reports:

  1) *List of Impaired Waters [303(d) List]*
     This list describes water bodies that do not meet water quality standards. Waters identified on this list require further analysis performed under a TMDL.

  2) *Subbasin Assessment and TMDL*
     The subbasin assessment includes an evaluation and summary of current water quality status, pollutant sources, and control actions to date. DEQ may use the WBAG as one of many tools to interpret data used in a subbasin assessment.

The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. 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.

- Section 305 requires a report describing and analyzing the water quality condition of Idaho water bodies. "Condition" is defined as the extent state waters are meeting water quality standards. This document is often referred to as the 305(b) Report. The 305(b) Report includes assessment results from the 303(d) list and subbasin assessments.

1.4.2. Idaho Water Quality Standards

The Idaho water quality standards program, as envisioned in Section 303 of the CWA, is a joint effort between Idaho and EPA. Idaho has primary responsibility for setting, reviewing, revising, and enforcing water quality standards. EPA develops regulations, policies, and guidance to help Idaho implement the program and ensure that our adopted standards are consistent with the requirements of the CWA and relevant regulations. EPA has authority to review and approve or disapprove state standards and, where necessary, to promulgate federal water quality standards (Barbour et al.1999).

Idaho adopts water quality standards (IDAPA 58.01.02 or see http://www2.state.id.us/deq/rules/waterrul.htm) to protect public health or welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

1.4.2.1. Designated Uses

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards (WQS § 3.35 and § 100.01 - .05). These uses include:

- aquatic life support — cold water aquatic life, seasonal cold water aquatic life, warm water biota, and salmonid spawning;
- contact recreation — primary (swimming) and secondary (boating);
- water supply — domestic, agricultural, and industrial; and
- wildlife habitat and aesthetics.

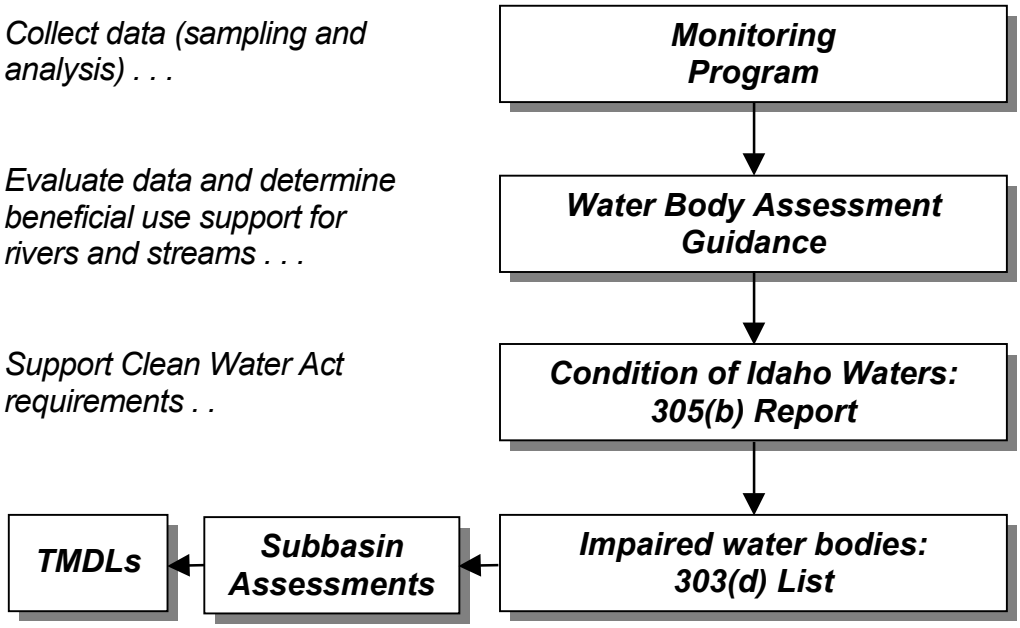


Figure 1-3. Conceptual Relationship Between the 305(b) Report, 303(d) List, Subbasin Assessments, and TMDLs

1.4.2.2. Criteria

Criteria are the conditions presumed to support or protect the designated uses (Karr 1991). These conditions may be expressed as numeric values or narrative statements.

1.4.2.2.1. Numeric Criteria

Numeric criteria generally consist of three components: magnitude, duration, and frequency of a pollutant.

- Magnitude — how much of a pollutant, expressed as a concentration, is allowable.
- Duration — the period of time (averaging period) over which the in-stream concentration is averaged for comparison with criteria concentrations. This specification limits the duration of concentrations above the criteria.
- Frequency — the number of times an event occurs over a fixed time interval.

A typical numeric statement for aquatic life criteria usually contains a concentration and averaging period (WQS § 250 – 253). For example, the water temperature numeric criteria for protection of salmonid spawning (does not address bull trout criteria) is 13 degrees C or less with a maximum daily average no greater than 9 degrees C (WQS § 250.02.e.ii).

1.4.2.2.2. Narrative Criteria

Narrative criteria (WQS § 200) are statements that protect against impairment of beneficial uses by pollutants that have no numeric criteria. The following is an example of a narrative criterion:

"Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses (WQS § 200.06)."

1.4.2.3. Antidegradation

Antidegradation (WQS § 51) describes policies set by the state to maintain water quality even if it exceeds levels necessary to support beneficial uses. Related policies also address waters identified as Outstanding Resource Waters (ORWs) and Special Resource Waters (SRWs). Designation or nomination procedures for such waters are addressed in WQS § 55-56.

Section 2. Monitoring Design and Data Representation Policy

2.1. Monitoring Design

DEQ annually monitors water bodies statewide based on assessment and data quality priorities. Although DEQ may use data collected from other sources, the WBAG is primarily designed to assess data collected under the DEQ Beneficial Use Reconnaissance Program (BURP) and USGS/DEQ Trend Monitoring Network.

2.1.1. Beneficial Use Reconnaissance Program (BURP)

BURP uses a targeted monitoring design to collect physicochemical, physical habitat, and biological data on water bodies. Targeted site selection is used to answer specific questions regarding the condition of particular areas. DEQ specifically selects representative sites with the intent of assessing a broader geographic area.

In 1993, DEQ implemented a rapid bioassessment program (RBP) aimed at integrating biological and chemical monitoring with physical habitat assessment as a way of characterizing water quality and stream integrity (McIntyre 1993). This program, known as BURP, closely follows concepts and methods described in the *Rapid Bioassessment Protocols for Use in Streams and Rivers* developed by EPA (Barbour et al. 1999). The main purpose of BURP is to provide consistency in monitoring, collecting data, and reporting. To the extent possible, the program documents existing beneficial uses of water bodies and provides data for beneficial use support assessments.

DEQ publishes an annual work plan for statewide use by DEQ field crews as well as other entities. There are six regional BURP coordinators who train and direct crews, while the state office BURP coordinator and other staff audit crews to ensure consistent monitoring practices. The monitoring is conducted during the index period of July through September for streams and August through mid-October for rivers. Collected data are transmitted to the state office for quality assurance review and entry into a statewide BURP database. The quality assurance process follows the DEQ *Beneficial Use Reconnaissance Program Quality Assurance Plan for Field Data Sheets on Wadeable (Small) Streams* (DEQ 2001). Biological samples are identified by qualified professional taxonomists and historically, have been sent to the Orma J. Smith Museum at Albertson College of Idaho for curation and storage.

Using this monitoring design, DEQ has extensively monitored Idaho water bodies (see Section 2.2.1. for water body scale). A large percentage of the water bodies

that have not been monitored are inaccessible (e.g., wilderness areas or canyons), larger water bodies, reservoirs, or lakes. In 1997, DEQ developed a monitoring protocol for larger water bodies (Grafe 1997) and is working on monitoring protocols for lakes and reservoirs. Further, DEQ is participating in a five-year study that started in 2000 to evaluate randomized sampling methods (e.g., Environmental Monitoring and Assessment Program — EMAP) in the western United States. DEQ will continue to evaluate the strengths and weaknesses of incorporating such a monitoring design into BURP.

2.1.2. USGS/DEQ Trend Monitoring Network

In 1990 the U.S. Geological Survey (USGS), in cooperation with DEQ, implemented a statewide water quality monitoring program. The objective was to provide water-quality managers with a coordinated statewide program to detect trends in surface water quality. The USGS monitors 56 stations (see Figure 2-1) of which 40 are designated as biological sampling sites. To accommodate budget limitations, biological sites are divided among three regions (i.e., southeastern, southwestern, and northern) and sampled once over a three-year rotation (O'Dell et al 1998).

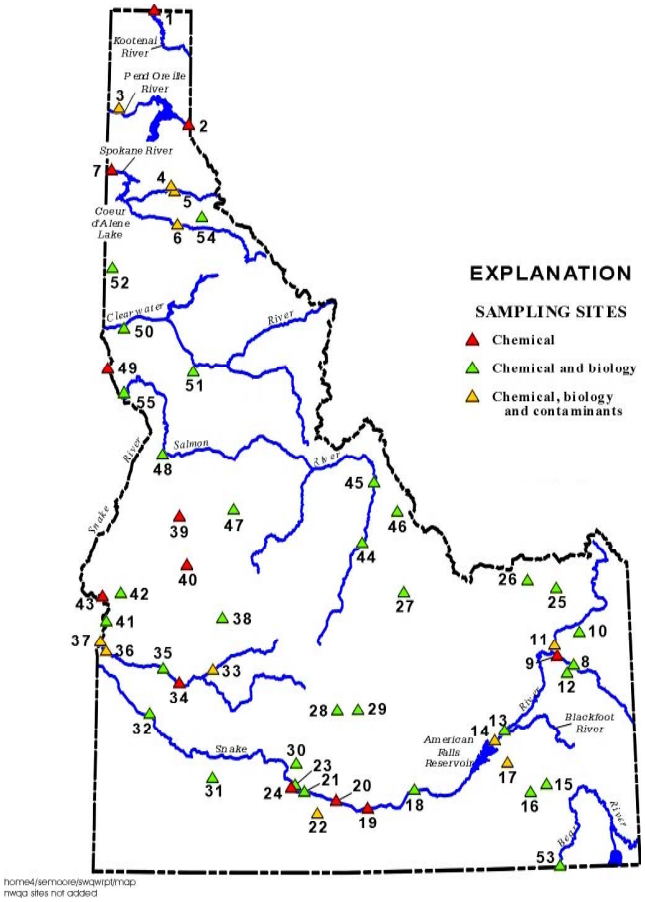


Figure 2-1. USGS/DEQ Trend Monitoring Sites

Water chemistry sample collection occurs monthly during April through September and consists of discharge, specific conductance, pH, temperature, turbidity, dissolved oxygen, bacteria, nutrients, and suspended sediment. Temperature is recorded continuously during summer months (June to September) at sites where samples are collected for biological analyses. Major ions and alkalinity are sampled during base flow conditions in September. Biological sampling occurs during summer/fall low flow conditions and consists of macroinvertebrates, fish, and associated stream habitat parameters (O'Dell et al. 1998). Biological data are collected following protocols designed for the National Water Quality Assessment (NAWQA) Program (Crawford and Luoma, 1993; Cuffney et al. 1993a, 1993b).

2.1.3. Data Management

All data collected under BURP are stored in a centralized database at the state office. Data for each sample site are recorded on standard field sheets. Regional offices house original field forms and send copies directly to the state office for quality assessment (QA) review prior to data entry. During the QA process, the field forms are checked for completeness, legibility, and accuracy. Presently, DEQ does not manage data collected outside the Department. Figure 2-2 illustrates the monitoring and data management processes.

2.2. Data Representation

The extent or size of a water body represented by a given sample site is important because it affects the quality of assessment results. The basis for extrapolating data ultimately depends on the monitoring design and water body scale. DEQ uses a geo-referenced system, known as the Water Body Identification System (WBID), as the foundation for extrapolating data results.

2.2.1. Water Body Identification System (WBID)

The Idaho WBID is a geo-referenced network of Idaho water bodies based on a combination of two hydrography scales: 1:100,000 and 1:250,000. Water bodies are coded according to a 1:250,000 hydrography and named based on a 1:100,000 hydrography. Some water bodies were combined or split based on land use considerations. Canals (unless they follow a natural channel), stock ponds, and tailing ponds are not coded in the system.

The numbering or coding system of the WBID is based on the USGS cataloging units in Idaho. USGS developed hydrologic unit codes (HUCs) as a national standard for water resources planning and data management. In the WBID, each cataloging unit (4th field HUC or 8-digit code) is numbered starting at the pour point. Figure 2-3 provides an example of the WBID system for HUCs.

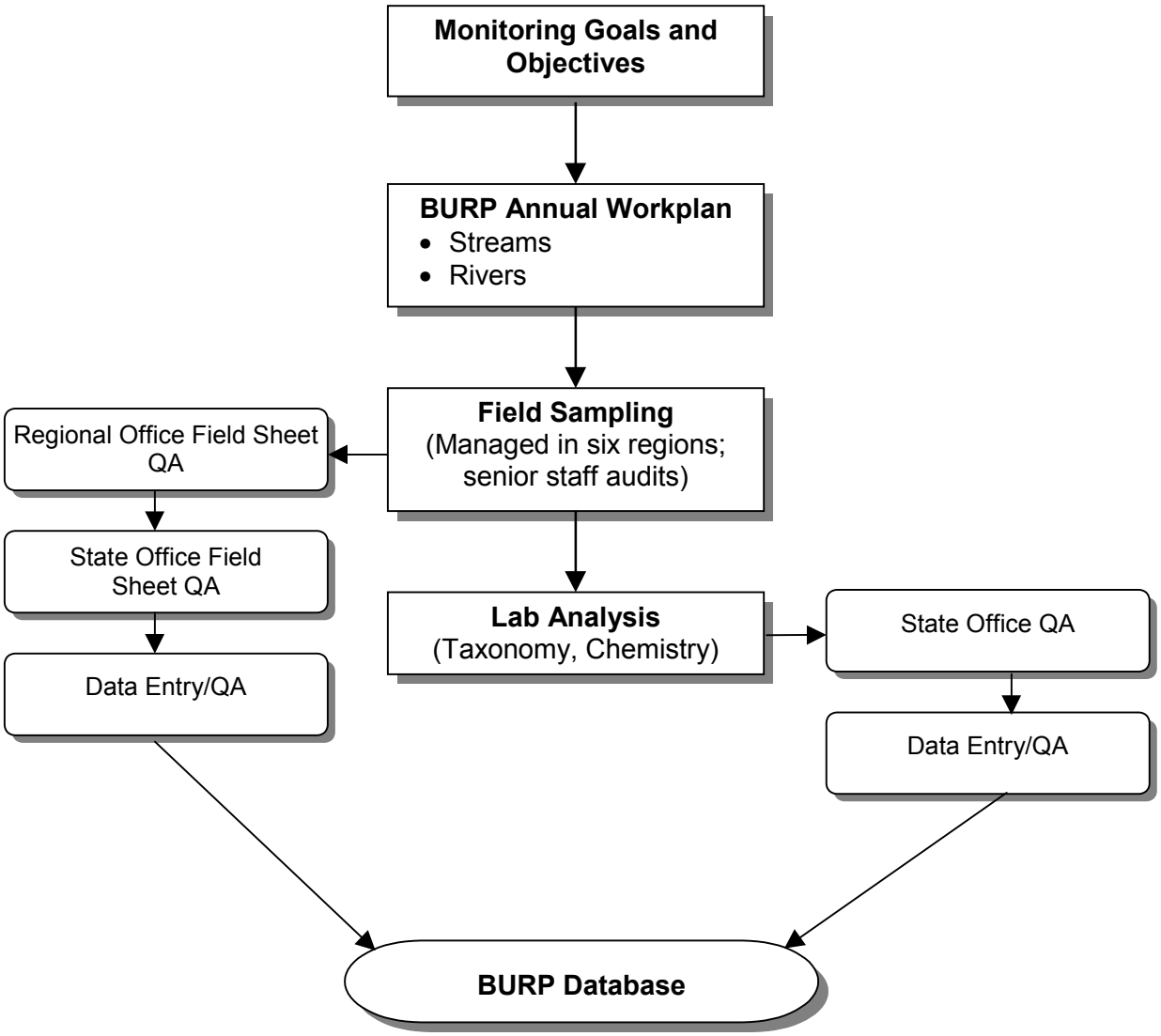


Figure 2-2. Monitoring and Data Management Overview

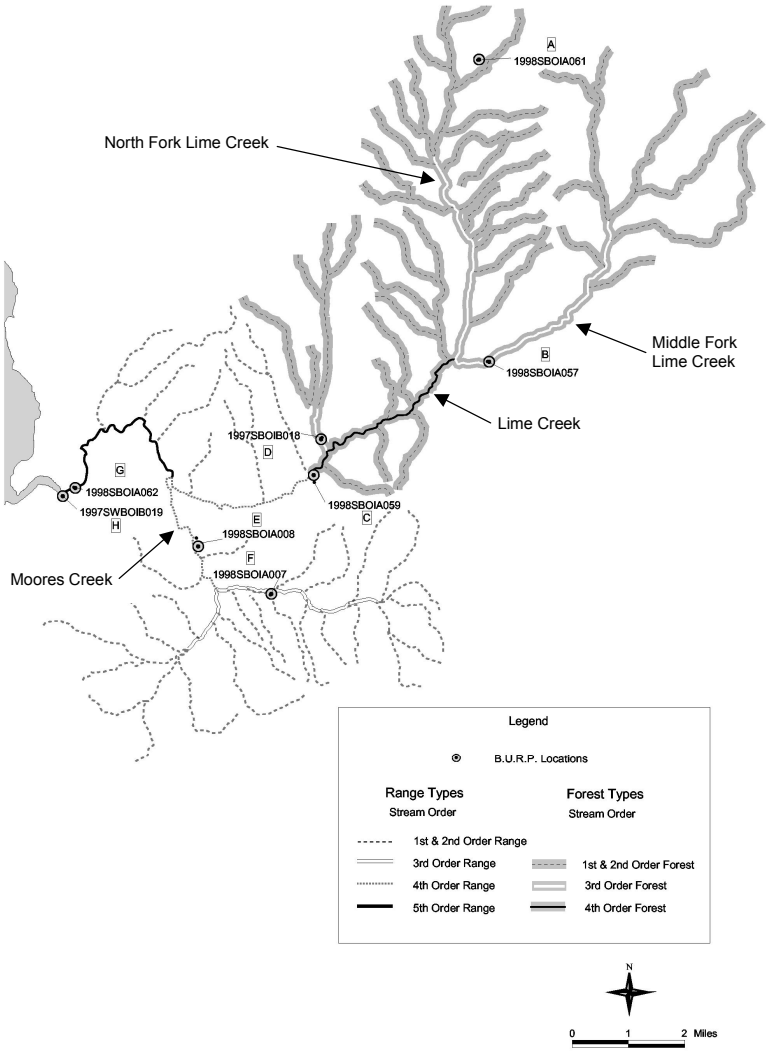


Figure 2-3. Lime Creek 17050113-10 Data Representation Example

The WBID is the basis of identifying water bodies in the water quality standards and implementing the watershed management approach in Idaho. The system is also the basic unit of record for water quality assessment information. The WBID eliminates conflicts and discrepancies between current Idaho water quality standards, and the EPA River Reach, Pacific Northwest River Study, and Bonneville Power numbering systems. Approximately 2,500 water bodies comprise the WBID, which is within the EPA-recommended range for manageable assessments (EPA 1997).

A geo-referenced water body system, such as WBID, is important in integrating location information using Geographic Information System (GIS) technology. GIS technology allows individuals to analyze water bodies and stream reach data spatially. Such spatial analysis improves the reliability of DEQ analysis and assessment methods.

2.2.2. Water Body Stratification

The data representation policy guides the assessor in interpreting and extrapolating data for assessment purposes. The policy is based on a stratification approach using the WBID system. Stratification is a classification method used to characterize comparable segments within each water body identified in the WBID system. In essence, stratification allows DEQ to compare apples to apples and extrapolate site data. The stratification approach must be refined enough to identify suitable groupings of water bodies for assessment purposes, but not so detailed the number of water bodies to be assessed becomes unmanageable.

DEQ reviewed several types of stratifiers and found land use and stream order provide enough assessment resolution without making the process unwieldy. The scale of stratification is based on the WBID. The procedure is to stratify each WBID water body using land use and stream order criteria. DEQ uses the Strahler (Strahler 1957) method at the 1:100,000 scale to determine stream order. DEQ combines first and second order streams with similar land uses. For land use, DEQ uses GIS capabilities and local knowledge to determine locations of land use and sources relative to stream segments. Presently, the most detailed and available information is the National Land Cover Data, which includes information regarding developed land, forested areas, and different agricultural uses. DEQ combines the first and second stream orders to improve the manageability of the stratification procedure since there are over 100,000 miles of streams in Idaho.

In some cases, there may be more than one monitoring site located within a stratified water body, that will be used to evaluate use support. To interpret the aquatic life use support of three or more sites, DEQ averages the results of the multimetric index scores. In cases where there are only two sites, DEQ uses the lower index score to interpret aquatic life use support (see Section 6.5). In evaluating the support status of the other beneficial uses, such as contact recreation, DEQ uses the lowest support status determination. DEQ still applies other data quality policies such as preferring to use data that is five years old or newer.

2.2.3. Water Body Size Determination

The WBAG uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. This distinction is important since DEQ uses different bioassessment tools to assess the aquatic life support use of these two classes (see Section 6). Through literature review and data analysis, DEQ found that no one criterion entirely characterized water body size in Idaho. Consequently, DEQ defines water body size according to three criteria: stream order; average wetted width at base flow; and average depth at base flow. “Chapter 2: Water Body Size Determination” (Grafe 2002a) discusses this determination and supporting analysis in more detail.

Stream order, average wetted width at base flow, and average depth at base flow are rated according to size distinctions originally developed by Idaho State

University (ISU) (Royer and Minshall 1999). For bioassessment purposes, DEQ has condensed the ISU size distinctions into two categories: small and large. The criteria and corresponding size categories are located in Table 2-1.

Table 2-1. Water Body Size Categories Used to Rate Each Criterion

Water Body Size Category	Stream Order	Ave. Width at Base Flow (m)	Ave. Depth at Base Flow (m)	Rating
Large	≥5	≥15	≥0.4	3
Small	<5	<15	<0.4	1

DEQ rates each criterion and then averages the rating or score. Through additional analysis, DEQ found that only two size categories, streams and rivers, were necessary to represent small to large water body characteristics for bioassessment purposes. Consequently, DEQ designates water bodies with average scores of greater than or equal to 1.7 as “rivers” while those water bodies scoring less than 1.7 would be classified as “streams” (see Table 2-2).

DEQ chose 1.7 based on the different combinations of rating results. Specifically, if a water body rated twice (1+1) in the small water body size category and only once (3) in the large category, then the total of five would result in an average score rating of 1.67, just below 1.7. Water bodies that have inconsistent scores in the three categories should be further evaluated using additional measures of stream size. The ultimate goal of determining water body size should be to ensure that the proper aquatic life use assessment process (see Section 6) is used. If the water has physical and biological characteristics indicative of a river rather than a stream the assessor needs to use the river assessment process. Section 10 provides a examples of determining water body size.

Table 2-2. Water Body Size Average Score Rating Categories.

Water Body Class	Average Score Rating
River	≥1.7
Stream	<1.7

Section 3. Beneficial Use Identification for Assessment

Idaho water quality standards state that in determining whether a water body fully supports designated and existing beneficial uses, DEQ shall determine whether all of the applicable water quality standards are being achieved and whether a healthy, balanced biological community is present (WQS § 053). Therefore, in order to determine whether beneficial uses are supported, the assessor needs to first determine which uses are designated or existing. These are determined separately as follows.

3.1. Designated Uses

Surface water use designations are defined and listed in the Idaho water quality standards (WQS § 100-160). These include uses that are applied on a water body-specific basis (aquatic life, recreation, domestic water supply), and uses that are applied to all waters of the state (agricultural and industrial water supply, wildlife habitat, and aesthetics). Waters may also be designated as outstanding or special resource waters (WQS § 055, 056); however, these two designations are not covered in this guidance.

Water bodies with specific use designations are listed in tables in WQS § 110-160 following the Idaho WBID (see Section 2 for an explanation of the WBID system). Unless broken out separately in the tables, use designations listed in the tables as the standards for a WBID unit apply to all perennial segments of waters included within that particular WBID unit. Usually these are tributaries, but in a few cases include nearby disconnected waters, since the WBID system has to encompass all waters in the state. For example, Cottonwood Creek, WBID 17040212-14, is designated for cold water and secondary contact recreation uses. This designation also includes subordinate streams within that WBID unit as shown in Table 3-1.

Table 3-1. Subordinate Streams within WBID 17040212-14

WBID #	WBID Name	Included Waters	Perennial portions also become designated as:
14	Cottonwood Creek	Burnt Creek	COLD SCR[1]
		Cottonwood Creek	COLD SCR
		Dry Cottonwood Creek	COLD SCR
		North Cottonwood Creek	COLD SCR
		Williams Reservoir	COLD SCR

[1] COLD = cold water;
SCR = secondary contact recreation

If, for example, North Cottonwood Creek also had unnamed tributaries, then the cold water and secondary contact recreation designations would apply to those perennial portions of the unnamed tributaries as well.

The distinction that, unless otherwise designated, the use designations of a WBID unit only apply to perennial portions of waters in the WBID is necessary because of the inclusive manner in which WBIDs are defined. Somewhere in the continuum of stream channels from rivers to rills, there is a point above which a rivulet is so small that it cannot provide an aquatic habitat that can support a biological community with composition and function similar to reference conditions. All of the aquatic life uses presume fully established biological communities, which in turn presume a persistent aquatic environment. Temporary waters (e.g., intermittent streams, vernal pools) may have important ecological functions but cannot attain the same biological communities as perennial waters.

3.2. Undesignated Surface Waters

Waters listed in WQS § 110-160 for which uses have not yet been designated or which have incomplete use designations are considered undesignated waters for those uses. Two concepts that are important for determining which beneficial uses are to be protected, and thus assessed on undesignated waters, are addressed in the Idaho WQS: presumed uses and existing uses.

3.2.1. Presumed Uses

DEQ presumes that most waters in Idaho will support cold water aquatic life and, depending on the characteristics of the water body (Section 7), primary or secondary contact recreation (WQS § 101.01a). Cold water aquatic life use support determination procedures, including numeric criteria and recreation criteria, apply to undesignated, perennial waters to protect these presumptive uses. If an undesignated surface water body is intermittent (i.e., has zero flow at some time during most years), then aquatic community indexes cannot be applied; however, numeric criteria do apply to intermittent waters during periods of “optimal” flow (see WQS § 003.51, 070.07).

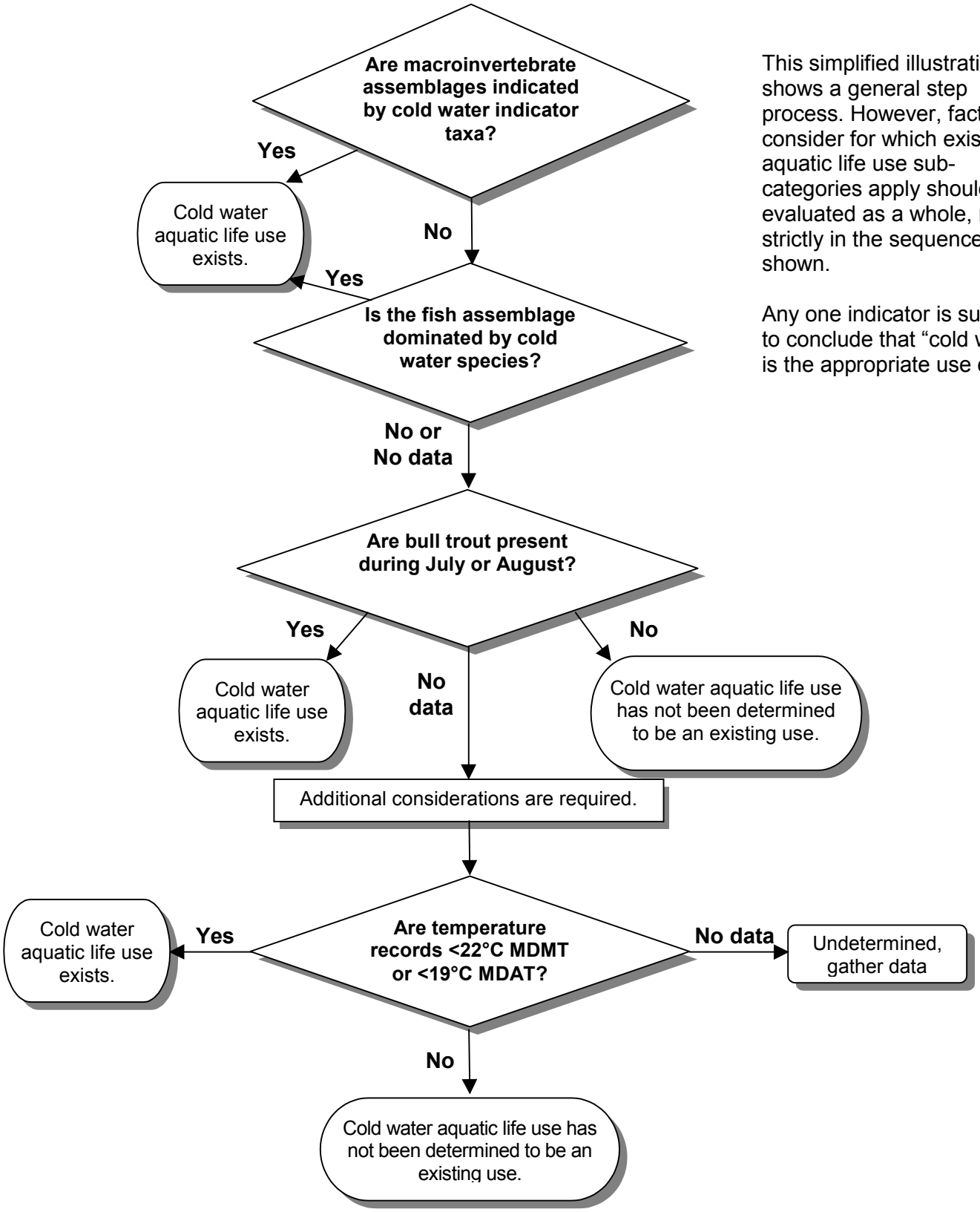
3.2.2. Existing Uses

Existing beneficial uses of the waters of the state are to be protected, even if not designated (WQS § 050.02b). “Existing” is defined as more recent than 1975, if the use no longer can be documented to occur. Section 7 describes how to determine which recreational use is “existing.” For the purpose of determining whether a water body fully supports designated and existing beneficial uses per the WQS § 053, aquatic life beneficial uses may be assumed to exist as described in Section 3.2.2.1. These initial determinations of existing aquatic life uses are needed to complete water body assessments and to assemble a 303(d) list. Actual subsequent use designations may be different, depending upon

additional information that may be received following the procedures described in Idaho Code 39-3604 and the WQS § 101.01.

3.2.2.1. Cold Water, Seasonal Cold Water, or Warm Water Aquatic Life Use (ALUS) Determination

In an effort to reflect that the temperature patterns of natural waters are expected to occur across a gradient of very cold to warmer waters as they progress from the mountains toward the oceans, the aquatic life use designations include three sub-categories of aquatic life uses according to temperature. However, the WBAG is focused on evaluating cold water aquatic life uses, so existing use determinations of seasonal cold or warm water aquatic life uses are not included here. The following sections describe several lines of evidence to determine whether the cold water aquatic life use should be assessed. These involve evaluating either literature-derived or empirically-derived macroinvertebrate cold water indicator taxa lists, fish cold water indicator taxa, the fishery classification, and temperature data logger records. If these lines of evidence are *inconclusive*, the assessor may presume a cold water aquatic life use and proceed with the assessment. If the lines of evidence *conflict* with the presumption of cold water aquatic life use, use support should not be assessed using cold water aquatic life indexes (see Figure 3-1).



This simplified illustration shows a general step process. However, factors to consider for which existing aquatic life use sub-categories apply should be evaluated as a whole, not strictly in the sequence shown.

Any one indicator is sufficient to conclude that "cold water" is the appropriate use class.

Figure 3-1. Cold Water Existing Use Determination for Undesignated Waters

The cold water indicators set forth in Figure 3-1 and described below are not exclusive of one another, nor is there a basis for applying them in a strict hierarchical manner. If these aquatic life use indicators provide conflicting information for an undesignated water body, generally it would be prudent to not determine an existing use nor designate the water body until more information can be obtained to resolve the question. However, if data are abundant, but ambiguous to which aquatic life use is "existing," obtaining more, similar data is unlikely to be helpful. In this situation, a decision concerning what is an existing use simply needs to be made and documented. Such decisions should err toward cooler use classifications.

Macroinvertebrate cold water indicator taxa

Benthic macroinvertebrates are the preferred indicator fauna because of their typical life history patterns. Many benthic macroinvertebrates have either limited migration patterns or a sessile form of life. This makes them well suited for evaluating site-specific environmental conditions. Some macroinvertebrate species are only present in streams with cold temperatures. If these species are present, then one can conclude that the stream likely has consistently cold temperatures. Lists of macroinvertebrate cold water indicator species have been developed from two sources: 1) empirical relationships between species occurrence and temperatures that were found in an analysis of the Idaho Beneficial Use Reconnaissance Program data (Appendix A) and 2) review of published literature reports (Appendix B).

An empirically-derived list of cold water indicator taxa was derived by analyzing temperature and species co-occurrence (Brandt, Appendix A). In an attempt to determine the obligate cold water taxa found in Idaho streams, the temperature data and macroinvertebrate communities of more than 1000 sampling locations were analyzed. From this information the probability of an individual taxa being present in any given temperature was determined. Specifically, 137 of 289 commonly occurring taxa exhibited a distinct temperature preference. Cold water obligates were determined by selecting the taxa that had less than a 10 percent probability of occurring in streams where the water temperature exceeded 19°C. 19°C is the maximum average daily temperature considered suitable for cold water aquatic life (WQS § 250.02). This resulted in a list of 64 cold water obligate taxa that commonly occur in Idaho stream samples (Brandt 2001 and see Appendix A). At sites at which stream temperatures were less than 19°C at the time macroinvertebrate samples were taken, greater than or equal to two taxa from the empirically-derived cold water taxa list were usually collected. Thus for assessment purposes, DEQ will also assume that cold water aquatic life is an existing beneficial use for undesignated streams when greater than or equal to two taxa from the empirically-derived list of cold water macroinvertebrate indicator taxa are present.

A list of cold water indicator taxa was derived from published accounts of thermal requirements for some Idaho benthic macroinvertebrates by Lester and Robinson (2000). This list is summarized in Appendix B.

Similarly to the evaluation of occurrences of the empirically-derived cold water taxa list and stream temperatures, the literature-derived list of cold water invertebrate was compared with stream temperatures to provide a basis for assuming a cold water existing use and the use of aquatic life use indexes for undesignated streams. The statewide surface water monitoring program was selected for this evaluation because its 56 stations were selected to be representative of the major drainages of Idaho. The statewide surface water quality monitoring network is a comprehensive program that has collected both continuous temperature records and macroinvertebrates from the same locations (O'Dell et al. 1998). Monitoring results (Maret et al. 2001) were reviewed to estimate the number and percentages of literature-derived list of cold water indicator taxa likely at sites where summer stream temperatures met cold water aquatic life criteria. At sites where summer temperatures never exceeded the maximum cold water aquatic life temperature criterion, 0 to 6 cold water indicator taxa were collected with an average of 1.4 taxa, and 0 to 9 percent of macroinvertebrates were listed as cold water taxa with an average of 1.0 percent. From this comparison, DEQ thinks if, using the literature derived cold water taxa list, it likely that if greater than or equal to 3 cold water taxa are present in a sample, or if greater than or equal to 3 percent of the entire sample consisted of cold water indicator taxa, stream temperatures at the site would usually be less than cold water criteria, and cold water aquatic life could be assumed as an existing use.

Thus for assessment purposes, DEQ will assume that cold water aquatic life is an existing beneficial use for undesignated streams when using the *empirically-derived* cold water taxa list (Appendix A), greater than or equal to 2 macroinvertebrate cold water indicator taxa are present, or when using the *literature-derived* cold water taxa list (Appendix B), greater than or equal to 3 macroinvertebrate cold water indicator taxa are present, or when greater than or equal to 3 percent of the assemblage consists of cold water indicator taxa. An simplified example follows (Table 3-2).

Table 3-2. Example of cold water existing use indications using macroinvertebrate taxa lists

Taxa	Order (common name)	Classification	Count
Baetis bicaudatus	Mayfly	Cold (E,L)	26
Baetis tricaudatus	Mayfly		12
Rhyacophila verrula	Caddisfly	Cold (E,L)	26
Tricorythodes minutus	Mayfly		12
Epeorus longimanus	Mayfly		24
Totals 5 taxa			100 individuals
Table Notes Classification: E – Empirically derived cold water taxa list (Appendix A); L – Literature derived cold water taxa list (Appendix B)			

In this example, both the empirically derived and literature derived taxa lists considered 2 taxa to be cold water indicator taxa. This is sufficient to assume a cold water aquatic life existing use. Further, 52/100 individuals, or 52% were cold water macroinvertebrates using the literature derived lists, which would add further support to the assumption of cold water aquatic life as an existing use.

Fish cold water indicator taxa

Fish species observed at a site may indicate if cold water aquatic life use may be considered an existing use for a water body. Fish are less desirable for this purpose than macroinvertebrates because of their motility. However, since there are many fewer species of fish than aquatic macroinvertebrates, and they have been comparatively well studied, the literature on thermal requirements of fish is much more complete than that for invertebrates. Cold water aquatic life should be considered an existing use if the fish assemblage at a site is dominated by cold water adapted species. "Dominated by" means that either greater than or equal to 50 percent of the species present, or greater than or equal to 50 percent or more of individual fish in a sample, are classified as cold water species. A listing of fish species temperature classifications is in Appendix C.

The dominance test is needed because the mere presence of cold water adapted species is usually insufficient to determine a cold water existing use. This is because waters for which both cold and cool water species occur could be considered to have a seasonal cold-water existing use. The use of greater than or equal to 50 percent of cold water individuals for this purpose is supported by analyses in the stream and river fish index technical reports. Among reference sites, the median percentage of cold water individuals in forest streams was 100 percent, and for rangeland streams and for rivers, the median percentage of cold water individuals was greater than 50 percent. Further, one fish species, bull trout, is highly stenothermal, i.e. found only in cold waters. Three independent analyses of large data sets showed that bull trout are

unlikely to be found in the wild at temperatures greater than 19°C (Rieman and Chandler 1999, Mebane 2000a, and Dunham and Chandler 2001). Thus for assessment purposes, DEQ will also assume that cold water aquatic life is an existing beneficial use for undesignated streams if the presence of an individual bull trout during July or August is documented.

Temperature data logger records

If representative temperature data logger records are available for a water body, they may be used to evaluate which aquatic life sub-category is the appropriate use. If the maximum daily maximum temperatures (MDMT) do not exceed 22°C, or if the maximum daily average temperatures (MDAT) do not exceed 19°C, then a cold water aquatic life temperature regime is likely present. These temperatures are the current numeric temperature standards for cold water aquatic life. Measured MDATs and MDMTs should be rounded off to the nearest 1°C for this purpose.

Fishery management objectives

A further source of information for determining if cold water aquatic life is the appropriate existing use to assess on undesignated waters is the *Idaho Fisheries Management Plan* (IDFG 2000). This plan provides information on management goals, species present, and desired management direction (e.g., habitat maintenance and protection needs) for many waters of the state. Where available, the *Idaho Fisheries Management Plan* and other reports of the IDFG may be used to document an existing use, or used as supporting information for determinations. IDFG considers native sport fish (native salmonids and sturgeon) to be the primary fish species to be protected through their management. However, where habitat conditions are unsuitable for native sport fish (e.g., due to river to reservoir conversions or other factors), and to provide diverse fishing opportunities, some waters are managed for warm water fisheries. The aquatic life use classifications and fisheries management type classifications should generally correspond, as shown in Table 3-3. These water quality and fisheries management categories may not exactly match for adjacent categories in the table. For example, some waters managed for mixed fisheries may still be designated for cold water aquatic life use, or a seasonal cold use determination may be made for a water body managed for mixed use. However, by their definitions, waters managed for a cold water fishery should not be designated for warm water aquatic life or vice versa. While conflicting use designations should be reviewed in consultation with IDFG, and resolved, revisions to use designations are beyond the scope of water body assessment.

Table 3-3. Comparison of DEQ and IDFG management terms

Aquatic life use classifications	Fisheries Type[1]
Cold water	Cold water or anadromous fishery
Season cold water	Mixed Fishery
Warm water	Warm water fishery

[1]IDFG fisheries type definitions:

- Cold water - fisheries supported by resident populations of salmonid game fish including trout, char, nonanadromous salmon (kokanee, coho, and chinook), and whitefish (family Salmonidae).
- Warm water - fisheries supported by warm water or cool water game fish including bass, crappie, sunfish, catfish, northern pike, tiger muskie, walleye, and yellow perch (families Centrarchidae, Ictaluridae, Percidae, and Esocidae).
- Mixed - fisheries supported by a combination of cold water and warm water fish species.
- Anadromous - fisheries supported by anadromous salmonids (steelhead trout, chinook salmon, and sockeye salmon).

If, for a perennial water body, data are insufficient to determine whether cold water or seasonal cold water uses are existing uses, then a cold water aquatic life use is presumed, and its applicable numeric water quality standards apply. To determine the spatial extent of an existing use by extrapolating data from a sample site to a water body, refer to Section 2.

3.2.2.2. Salmonid Spawning

Waters that provide or could provide a habitat for self-propagating populations of salmonid species are to be protected for salmonid spawning (WQS § 100.01b). Evidence of reproduction is considered evidence that the waters provide or could provide habitat for salmonid spawning. Summertime presence of juvenile salmonids (i.e., individuals less than 100 mm overall length) in first through fourth order streams may be considered sufficient evidence that salmonid spawning has occurred in the near vicinity. In that case, salmonid spawning may be considered an existing use for assessment purposes in the portions of the stream for which the site is representative.

The presence of juvenile salmonids in streams is considered indicative of nearby spawning because most resident or anadromous trout and salmon species migrate to their natal streams to spawn. Further, juvenile salmonids may move downstream from natal streams into larger waters after hatching (Bjornn and Reiser 1991). Thus, the presence of juvenile salmonids in a river may not necessarily indicate that the fish hatched there. Before considering salmonid spawning to be an existing use for a larger stream (greater than fourth order), in addition to the presence of juvenile fish, additional evidence would be needed such as presence of suitable habitat characteristics (e.g., substrate, depth, velocity, and temperature; see Bjornn and Reiser,1991) or actual observations of spawning.

3.2.2.3. Contact Recreation Uses

For primary and secondary contact recreation, DEQ evaluates evidence of recreational uses in the water body. There are three main categories of evidence to identify primary contact as the recreation use:

- designated recreational facilities (swimming areas or bathing beaches);
- water body size (generally, greater water body depth and width would allow a moderate to high probability of primary contact); or
- accessibility (generally, an accessible water body combined with a large size would allow a moderate to high probability of primary contact).

If there are no indications of primary contact use, then the assessor evaluates the water body according to secondary contact recreation criteria. For assessment purposes, the only difference this will make is in the application of the *E. coli* instantaneous standard to determine requirements for additional sampling.

3.2.2.4. Water Supply Uses

Water supply uses requiring assessment include domestic, agricultural, and industrial. Agricultural and industrial beneficial uses are presumed for all Idaho water bodies. Most Idaho drinking water is supplied by ground water; however, there are some public water systems supplied by surface water. To determine if domestic water supply is a beneficial use, the assessor should refer to the Idaho drinking water standards. The standards define a public water system as one that serves 25 or more persons on a regular basis or a system with 15 or more service connections (42 U.S.C.A. § 7401 et seq.). DEQ also presumes a domestic water supply as a beneficial use if the agency receives notification by interested parties that this use exists.

Section 4. Existing and Readily Available Data Policy

Data are the foundation of DEQ's assessment process. Although the WBAG was designed primarily to assess BURP data obtained by DEQ, DEQ also considers existing and readily available data from other sources. The data used in the assessment process may be from other agencies, institutions, commercial interests, interest groups, or individuals and may relate to the existence, support status, or associated criteria for the beneficial uses in a water body. This section explains how DEQ classifies data as Tier I, II, or III and how that data is used in water quality decisions.

Tier II or III data are not used in 303(d) listing determinations but are used in other water quality decisions requiring assessment information. DEQ will use outside Tier I BURP-compatible data in the multimetric index process. If Tier I data are not BURP compatible or are not in an electronic format they will not be run through the multimetric indexes, but may be used to determine numeric criteria exceedances (Section 5) or beneficial use support determinations (Section 6) depending upon their form as explained further in this section. Figure 4-1 represents the process of determining how non-DEQ data can be used in DEQ's water body assessment process.

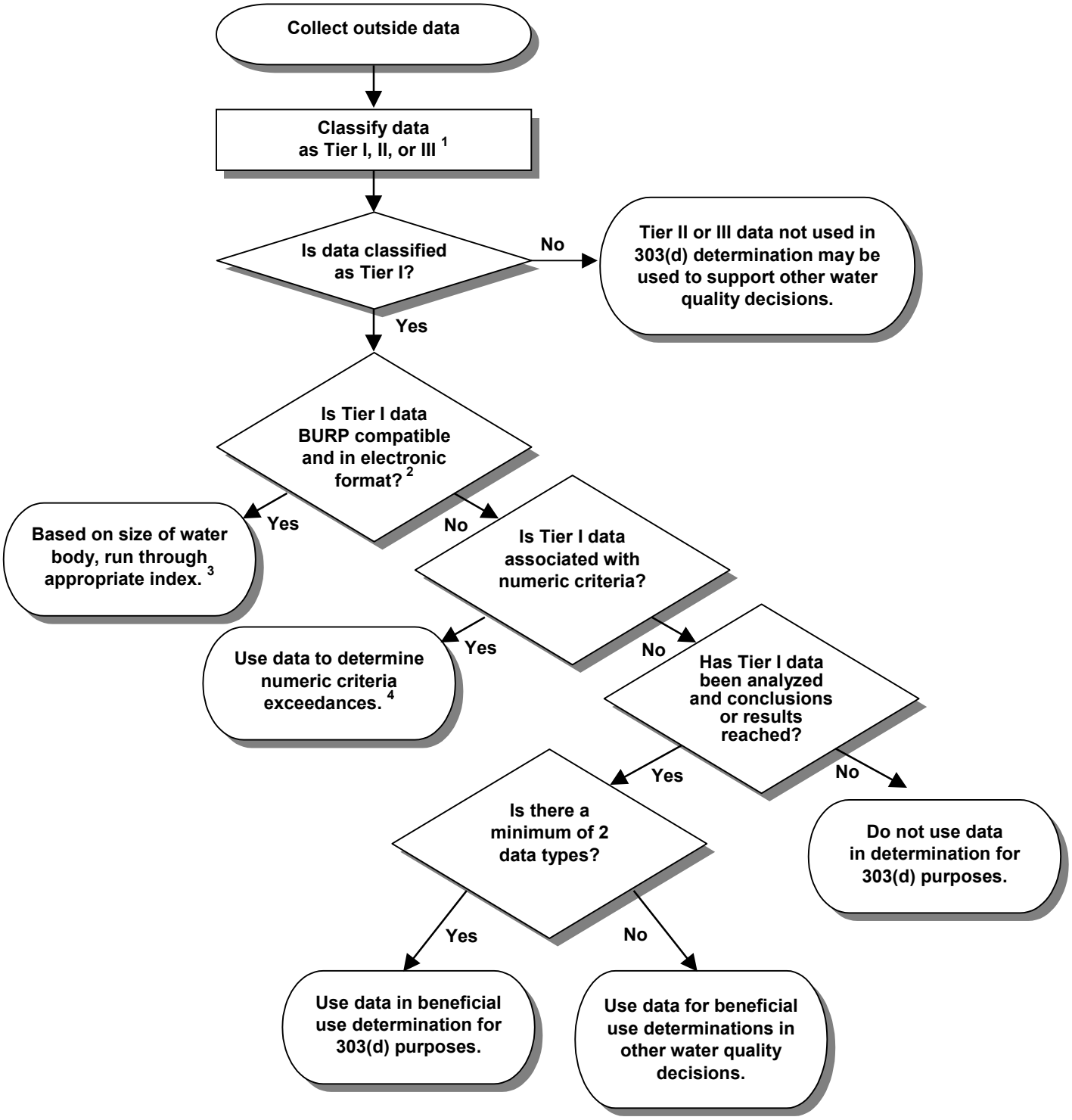
To obtain outside data, DEQ will publicize a request for data and solicit data from appropriate sources for water bodies targeted for assessment. An example of a DEQ data request letter is shown in Figure 4-1.

4.1. BURP-Compatible Data

If DEQ receives BURP-compatible data in an electronic format for a water body, the data will be incorporated directly into the appropriate assessment index and the results used to determine water body status. BURP-compatible data are collected in the same manner as DEQ data. All the multimetric indexes DEQ uses were developed using BURP-compatible data. Consequently, BURP-compatible data are necessary to correctly calculate and apply the various biological and habitat indexes used in assessing aquatic life (see Section 6). In this way, index outputs can be directly compared to one another. Not doing so introduces variability and bias brought on by different sampling equipment, locations, or times that may invalidate the comparison (EPA 1997). This is analogous to comparing apples to oranges. DEQ characterizes compatible data as having similar protocols to those used in BURP (see Table 4-1). DEQ treats BURP-compatible data equally with regards to the data integration methods described in Section 6.

Table 4-1. BURP Compatible Requirements

Parameter or assemblage	Requirements to be considered compatible to BURP
Macroinvertebrates	Quantitative sampler, sampled in riffles, 500 micrometer mesh, collected during July 1 through October 15, insects identified to lowest possible taxonomic level
Fish	Fish assemblage sampled with a battery or gas powered electrofisher, over 100m of stream sampled, effort recorded, fish identified, species counted, and lengths of salmonids and cottids recorded
Algae	Quantitative sampler, collected from natural substrate in riffle, minimum of 800 valves enumerated to lowest possible taxonomic level for diatoms
Habitat	Minimum of 10 habitat parameters sampled some are rated (r) while others are measured (m): instream cover (r), large organic debris (m), % fines <2mm (m), embeddedness (r), number of wolman size categories (m), channel shape (r), bank vegetation (m), canopy cover (m), disruptive pressures (r), zone of influence (r)



[1] See Table 4-2
[2] See Table 4-1
[3] See Section 6 either river or stream
[4] See Section 5

Figure 4-1. How Data Is Used in the Water Body Assessment Process

July 1, 2000

John Smith
U.S. Forest Service
123 State Street
Anywhere, Idaho 12345

Dear Mr. Smith:

The Boise Regional Office of the Idaho Department of Environmental Quality (DEQ) will be assessing the water quality beneficial uses of Deep Creek within your management area. Beneficial uses include aquatic life, salmonid spawning, contact recreation, agricultural water supply, domestic water supply, industrial water supply, wildlife, and aesthetics. DEQ will evaluate the beneficial uses for monitored water bodies using the DEQ Water Body Assessment Guidance. We are requesting data from you to help with this effort.

Specifically, the following types of data and information would be helpful:

- water column chemistry data (e.g., dissolved oxygen, ammonia, phosphorous, metals, etc.);
- physical data (e.g., temperature, riparian proper functioning condition, cumulative watershed effects, etc.);
- biological or bioassessment data (e.g., macroinvertebrate, fisheries, periphyton, etc.); and
- land use data including location, size, and types of specific land uses.

When providing us with collected data, please also furnish information about the quality assurance and quality control procedures used. We will review the data and information. Data less than five years old and in computer readable format is particularly helpful. The furnished data may be used for a variety of purposes including comprehensive state water quality assessments [305(b) reports], water quality impairment lists [303(d) lists], and total maximum daily loads (TMDLs). Thank you in advance for your help with this effort. If you have already supplied us with the requested data, then please disregard this inquiry.

Sincerely,

Jane Doe
Regional Water Quality Assessor

Figure 4-2. Example of Data Request Letter

4.2. How Data Is Evaluated — Tiered Approach

Although the WBAG was designed primarily to assess BURP data, DEQ also evaluates existing and readily available data from other sources. “Evaluate” means to consider submitted data for use in beneficial use determinations including aquatic life use support determinations. Specifically, DEQ evaluates the scientific rigor and relevance of non-BURP compatible data to determine where and how it will be incorporated into the assessment process and other water quality decisions (EPA 1997). Numeric data that relate to specific water quality criteria are evaluated according to the criterion evaluation and exceedance policy described in Section 5.

Other types of data may be used to affirm or change a use support determination based on the scientific rigor and relevance used to collect and analyze the data, as well as its significance to the assessment process. DEQ uses a tiered approach to provide consistent weighting and consideration of various types of data. Initial aquatic life support status calls may be confirmed or modified based on other available information (see Section 6). Table 4-2 summarizes the three tiers and provides examples of different data types in each tier. The table also describes how DEQ uses different tiered-data for planning and reporting purposes.

Table 4-2. Description, Examples, and Incorporation of Data Tiers

Tier	Scientific Rigor	Relevance	Example	How Used
I	• Quantitative. • Parameters measured. • Established monitoring plan with QA and defined protocols. • >30 hours of supervised training. • Samples processed in EPA-certified lab following standard methods or by professional taxonomist. • Organisms identified by a professional taxonomist.	• Data relates to either water quality standard(s), especially numeric, or a beneficial use. • ≤5 years old. • Data relates to a named water body (GIS, latitude and longitude or map location provided).	• Ph.D. or masters thesis. • Published or printed studies or reports. • Published predictive models. • EPA EMAP. • BURP data. • Use attainability analyses. • Rapid Bioassessment Protocols (RBP).	• 303(d) listing or de-listing. • 305(b) reports • subbasin assessments. • TMDLs. • Planning for future monitoring.
II	• Qualitative or semi-quantitative in nature. • May have a monitoring plan. • No QA/QC provided for within plan. • Protocols may or may not be defined. • Parameters rated. • Field staff may not be trained: Lab may not be certified. • Taxonomist may not be a professional.	• Data may relate to a watershed. • Not water body specific. • Data >5 years old. • Data may relate to other agency guidelines or objectives.	• Environmental assessments. • Proper Functioning Condition. • Cumulative Watershed Effects. • Most citizen monitoring. • Models with documentation. • Agency planning documents.	• 305(b) reports. • Subbasin assessments or TMDLs when data adds to overall assessment quality. • Planning for future monitoring.
III	• May be qualitative in nature. • Parameters evaluated. • Field staff have little to no training. • No documented monitoring plan. • No QA/QC. • Anecdotal in nature.	• Not specific to water quality standards or beneficial uses. • Location not specific. • Data ≥10 years old.	• Non-specific reports or studies. • Newspaper articles. • Simple models without any documentation.	• Planning for future monitoring. • Hold for further investigations.

4.2.1. Scientific Rigor

Scientific rigor concerns the extent that scientific methods are used to collect and analyze data. It encompasses quality assurance, quality control, training, level of expertise, and protocols. DEQ categorizes data into three tiers of scientific rigor with more weight given to data with a higher level of scientific rigor.

4.2.2. Data Relevance

Data must be relevant as well as scientifically rigorous to be incorporated into the assessment process. To determine relevance, DEQ applies a two-part test:

1. Data must relate to a water quality standard, beneficial use, or cause of impairment and;

2. Data must be tied geographically to a particular site on a particular water body. Location information such as latitude and longitude (GPS), a specific map, or public land survey system (i.e., township and range) description must accompany the data.

4.2.3. Tier Descriptions

4.2.3.1. Tier I

The scientific rigor of Tier I data is characterized as high and typically includes monitored data collected by professional scientists or professionally trained technicians with more than 30 hours of supervised training. The data are collected and analyzed under a monitoring plan with quality assurance and parameters measured. Samples are processed in an EPA-certified lab following standard methods or by a professional taxonomist. Biological data may come from one of several different assemblages, such as macroinvertebrates, fish, or algae, and are identified by a professional taxonomist. Physical habitat data may have quantitative measurements and standardized qualitative assessment procedures.

To be considered relevant, Tier I data usually include direct measurements or observations of beneficial uses, criteria, or causes of impairment. In addition, the sampling needs to be representative, that is, 1) to have been conducted at multiple times and locations or 2) at a representative location with specific locations identified on a map or with GIS. The information must be less than five years old and must be able to be differentiated along a gradient of environmental conditions (EPA 1998). Predictive models must include calibration factors and, as noted below, are not used exclusively to make beneficial use determinations.

Examples of the types of monitoring data typically meeting Tier I criteria include BURP, EPA Environmental Management and Assessment Program (EMAP), RBP, Use Attainability Analyses, graduate theses, and

professionally prepared and peer-reviewed studies, reports, or predictive models. These data can come from a number of possible sources such as state and federal agencies, academic institutions, local governments, or private parties. Tier I data are of sufficient quality and relevance to be used for 303(d) listing and de-listing decisions, 305(b) reports, subbasin assessments, and TMDL development. Data must meet both scientific rigor and relevance of Tier I criteria to be classified at the Tier I level.

4.2.3.2. Tier II

DEQ characterizes the scientific rigor of Tier II data as qualitative or semi-quantitative data. The data collectors will have followed documented field, laboratory, and data-handling protocols, have rated parameters, and may have a monitoring plan. The monitoring plan may not provide quality assurance (QA) or quality control (QC) information. Tier II data include professionally conducted evaluations and habitat data consisting primarily of standardized visual assessments or evaluations. However, some field staff may not be trained, the evaluating laboratory may not be certified, or a professional taxonomist may not identify the samples. Relevant Tier II data may include evaluations based on monitored or evaluated data more than five years old, watershed land use information, modeling results with estimated inputs, or measurement of an atypical event (EPA 1998). Data may relate to a watershed rather than be water body specific. They may also relate to guidelines or objectives of other government entities.

Data collected for Environmental Assessments, Proper Functioning Condition (PFC) assessments, Cumulative Watershed Effects (CWE) Process, and agency planning documents, as well as Citizen Volunteer Monitoring data, are examples of types of data that would be considered Tier II. Tier II data are not used in 303(d) listing decisions due to higher data requirements for impairment decisions under Section 303 (see Section 1.4.1). However, Tier II data may be used in subbasin assessments and TMDLs when the assessor has the time to consider these data in context with other collected information. These data can also be used to establish beneifical uses for assessments and in 305(b) reports (see Table 4-2).

4.2.3.3. Tier III

The scientific rigor of Tier III data often includes information collected by unknown or untrained individuals. The data may not have been collected or analyzed following standard or reported protocols. Data without any originating documentation also appears in this category. Relevance of data is limited due to information having no intrinsic judgment or known reference for comparison. The data may have been extrapolated based on other sites, or a reflection of a specific localized condition not representative of the water body. This type of information may be considered as general background information, but it is not of sufficient rigor and relevance for listing decisions or regulatory actions.

Tier III data are not used in 303(d) decisions, subbasin assessments, TMDLs, or 305(b) reports due to the uncertainty in the scientific rigor in their collection and relevance to beneficial uses or water quality standards. This data may be used in helping DEQ target future planning and monitoring.

4.3. How Tier I Data Are Used In Beneficial Use Determinations

In summary, data are used for different water quality decisions depending on how it is classified. As noted above, only Tier I data are used in making a 303(d) listing or de-listing decision. As shown in Figure 4-1, the format of the Tier I data will determine its use. The sections below describe how DEQ uses different forms of Tier I data.

4.3.1. Tier I and BURP Compatible Data

As explained in Section 4.1, if the Tier I data are BURP compatible (see Table 4-1.) and in electronic form, they are run through the appropriate multimetric index and the results are used to determine the status of the water body. A minimum of two different indexes are required for data integration and the determination of aquatic life use support (see Section 6). The requirement of two or more different indexes does not supersede the minimum threshold policy for macroinvertebrates or fish as discussed in Section 6.

4.3.2. Tier I Data Associated with Numeric Criteria

If Tier I data are associated with numeric criteria, then DEQ will assess this data according to the criteria exceedance policies described in Section 5. A single data type can be used to determine numeric criteria exceedances. Data type is defined as one set of particular data. For instance, one set of temperature results from continuous data loggers (i.e., thermagraphs) is considered one data type. DEQ prefers Tier I data submitted in electronic form and the accompaniment of analysis and conclusions. However, DEQ will accept raw data and perform analysis for numeric criteria exceedances.

4.3.3. Tier I and Non-BURP Compatible Data

4.3.3.1. Number of Data Types

If the Tier I data are not BURP compatible, then DEQ evaluates the number of data types. DEQ policy is to use a minimum of two data types to make listing or delisting decisions. These data types can be physical (e.g., sediment) or biological (e.g., macroinvertebrates). Also, the weight of evidence from these data types should convincingly refute or support the beneficial use determination. See Section 4.4 for guidance on documenting use support determinations using non-BURP compatible data.

A single data type not associated with numeric criteria may be incorporated into other water quality decisions, but is not used solely for 303(d) listing or delisting decisions.

4.3.3.2. Data Analysis and Conclusions

After determining the number of data types, DEQ then ascertains if the data have been analyzed and if conclusions or results were reached. If this information does not accompany the data, then DEQ policy is to not use this data for 303(d) listing determinations. Please note that this policy only pertains to data not associated with numeric criteria. This DEQ policy is based on two important considerations. First, DEQ is concerned about the error rate associated with analyzing someone else's data for listing or delisting decisions. Second, DEQ does not believe it has the time and resources necessary to adequately analyze someone else's data during the 303(d) assessment process. For beneficial use determinations in other water quality decisions, DEQ evaluates the decision to use unanalyzed data based on the available time and resources required in analyzing that data.

4.4. Reconciliation of Conflicting Data Results

Although the assessment process is designed to be comprehensive and accurate in determining impairment status of beneficial uses, there may be times where other data show a different result. Throughout this guidance, DEQ repeatedly states that the assessor has the latitude to change an assessment determination with sound justification. Another situation where the assessor may need to provide justification occurs when using only non-BURP compatible data types.

Sound justification or documentation entails providing convincing evidence for an initial support determination or reconciliation of conflicting data results. The DEQ guidance for this evidence is slightly different depending on the support determination.

If the assessor believes that the determination should be not full support, then the justification should demonstrate the following:

1. Data show measurable and adverse change to the beneficial use;

2. The adverse change is linked to a causative pollutant; and

3. The pollutant is linked to a human-caused action.

If the support determination is believed to be full support, then the assessor should demonstrate the following:

1. Weight of evidence convincingly shows no measurable adverse change to the beneficial use; or

2. Data convincingly show that an adverse change is not due to a causative pollutant; or

3. Data convincingly show that the pollutant is not linked to a human-caused action.

Section 5. Criterion Evaluation and Exceedance Policy

Setting of water quality standards under the Clean Water Act is a state responsibility, subject to EPA oversight. Federal policy allows latitude to the states in interpretation of the standards they develop. This section provides interpretive guidance on certain aspects of both narrative and numeric criteria found in Idaho's water quality rules.

Narrative criteria are often called "free from" criteria as they often contain statements like "waters shall be free from toxics in toxic amounts," and have no quantitative thresholds set in rule. This requires an assessor to make a case-by-case evaluation of whether the narrative is met. Guidance for this evaluation is provided below. Numeric criteria, on the other hand, set quantitative thresholds that apply broadly. While these are much easier to evaluate, the simple "one-size-fits-all" approach does not always fit well with the natural variability of water bodies. As the goal is protection of beneficial uses, Idaho's water quality rules and policy described in this section provide for limited flexibility in determining when exceedance of numeric thresholds is a violation of water quality standards.

This section describes narrative criteria interpretation and numeric criteria implementation, including a 10 percent criteria exceedance policy applicable to conventional pollutants only, Idaho's temperature exemption, allowance for natural background conditions for all pollutants, guidance on determining when and where salmonid spawning occurs for the purpose of applying salmonid spawning criteria, and evaluation of toxics criteria.

5.1. Narrative Criteria Evaluation Policy

Narrative criteria are statements that protect against impairment of beneficial uses by pollutants that have no numeric criteria. The Idaho water quality standards generally state that surface water shall be free from the following materials in concentrations that would result in the impairment of the designated beneficial uses (see WQS 200):

- hazardous materials;
- toxic substances;
- deleterious materials;
- radioactive materials;
- floating, suspended, or submerged matter;

- excess nutrients;
- oxygen-demanding materials; and
- sediment.

DEQ largely relies on its biological metrics for evaluation of narrative criteria (see Section 6). However, it is recognized that there can be clear evidence of narrative criteria being violated in absence of BURP data. For example, a water body may have reports of fish kills or cattle killed from drinking water containing toxic algae. Even though no numeric criterion exists for general toxic substances or nutrients, there is clearly an impairment of beneficial uses.

In the absence of specific criteria, the assessor must use substantiated best professional judgment to determine a violation. Should the assessor determine an impairment has occurred they must provide a documented rationale for their judgement. **This documentation must consider that there is a source of pollution (i.e., anthtropogenic cause), a pathway, and a measurable adverse effect on a beneficial use** (see Section 4)**.** It is recommended that to the extent possible appropriate data be collected to substantiate such determinations.

Most often the assessor will be faced with evaluating Idaho's narrative criteria for nutrients or sediment. These are particularly difficult because they are natural constituents of water and only become controllable problems when elevated above natural amounts. Taking sediment, for example, and applying the guidance of the previous paragraph, there first must be an anthropogenic source of sediment, a road or mass failure attributable to a road or land management activity. Secondly, that source must have delivered sediment as evidenced by current delivery (i.e., mass failure runout ending in a stream channel), recent delivery (i.e., delta or sediment deposits in stream directly traceable to a source), or probable future delivery (i.e., deposition in a draw, dry channel, or ditch leading to a live stream). Thirdly, that sediment delivery must be of sufficient quantity and duration to have resulted in an adverse response in the stream. This is most defensible when the response is directly measurable as an undesirable change in the aquatic life of the stream. It may, however, be possible to use physical changes in the stream which have been previously associated with adverse biological changes to infer a likely adverse effect on a beneficial use. This is a difficult association and must be done on a watershed specific basis; for example see Bauer and Ralph (1999). Such inferences should be followed up with bioassessment.

5.2. Numeric Criteria Evaluation Policy

It is important to understand that water quality conditions vary from place to place (spatial) and from time to time (temporal). This happens because factors such as geology, vegetation, elevation, climate control, and natural or ambient water quality change (EPA 1998). In response to these changes, macroinvertebrates, fish, and algae have evolved with different life histories, physiologies, and mobilities (Pan et al. 2000).

Most surface waters and aquatic organisms have an ability to tolerate or adapt to small exceedances over short time periods for conventional water quality parameters (DO, pH, turbidity, TDG, temperature) without deleterious affects (Carins Jr. 1977, Connel 1978). This concept is embedded in the theories of resistance and resiliency, chronic vs. acute, and the buffering capacity of running waters (Wetzel 1983, Allan 1995). The DEQ exceedance policies attempt to better clarify the occurrence and interpretation of these situations.

Due to natural variability in water quality, variability in translation to a biological response, and possible measurement errors, DEQ does not interpret the numeric criteria for conventional pollutants as a sharp line between impairment and non-impairment. Rather, there is a gray-zone where there may or may not be an impairment.

Because criteria are developed conservatively, DEQ believes this gray-zone falls above the set criteria levels. By policy DEQ thus establishes a zone up to 10 percent criteria exceedance in which the assessor has flexibility to consider other evidence to determine a violation. This numeric criteria evaluation policy of DEQ is consistent with guidance from EPA (EPA 1997) and other states in EPA Region 10 (WDOE 1997). Figure 5-1 provides an overview of the policy.

While this policy deals solely with frequency, DEQ does recognize that magnitude and duration of any criteria exceedance is also important to the biological response and ideally should be considered as well. Magnitude, duration, and frequency are typically not independent of one another. Thus, evaluating frequency alone, while it can have its limitations, is a practical gage of criteria exceedance and one that is supported by national EPA policy.

Our knowledge and understanding of the relationship between pollutant levels and support of beneficial uses can change. Consequently, water quality standards and policies often change from year to year, making it imperative that the most recent standards and policies for specific numeric criteria be used. DEQ has specific policies to interpret different numeric criteria exceedances as discussed below.

5.2.1. Exceedance Policy for Dissolved Oxygen (DO), pH, Turbidity, Total Dissolved Gas (TDG), and Temperature

The intent of this section is to publicly establish the guidelines for determining if a particular set of criteria exceedances has resulted in a water quality impairment and thus, violation of standards. Results above 10 percent exceedance are always considered a violation. Up to and including 10 percent exceedance DEQ may determine a numeric criteria violation for dissolved oxygen, pH, turbidity, total dissolved gas, or temperature if other evidence indicates measurable impairment. A minimum of at least two measurements must be evaluated in any of these parameters before a determination of violation can be made. Figure 5-1 illustrates this process.

In using this policy it is important the assessor consider the period of measurement. To determine meaningful frequencies, the data record should be representative of the entire period when the criteria apply. Because of the seasonal cycle of temperature special consideration is in order.

To evaluate salmonid spawning criteria, temperature data should be collected for at least 45 consecutive days during the spawning and incubation period for the particular salmonid species inhabiting those waters. For cold water aquatic life, temperature data collected over the entire summer (June 22 through Sept. 21) should be used. In addition, the frequencies must be calculated on the metric of interest (e.g., the frequency of daily maximum stream temperature exceeding daily maximum criteria). DEQ has prepared a memo specifically on procedures for calculating frequency of exceedance for temperature (DEQ, 10-23-01, Appendix D). This memo should be consulted by anyone evaluating temperature exceedances.

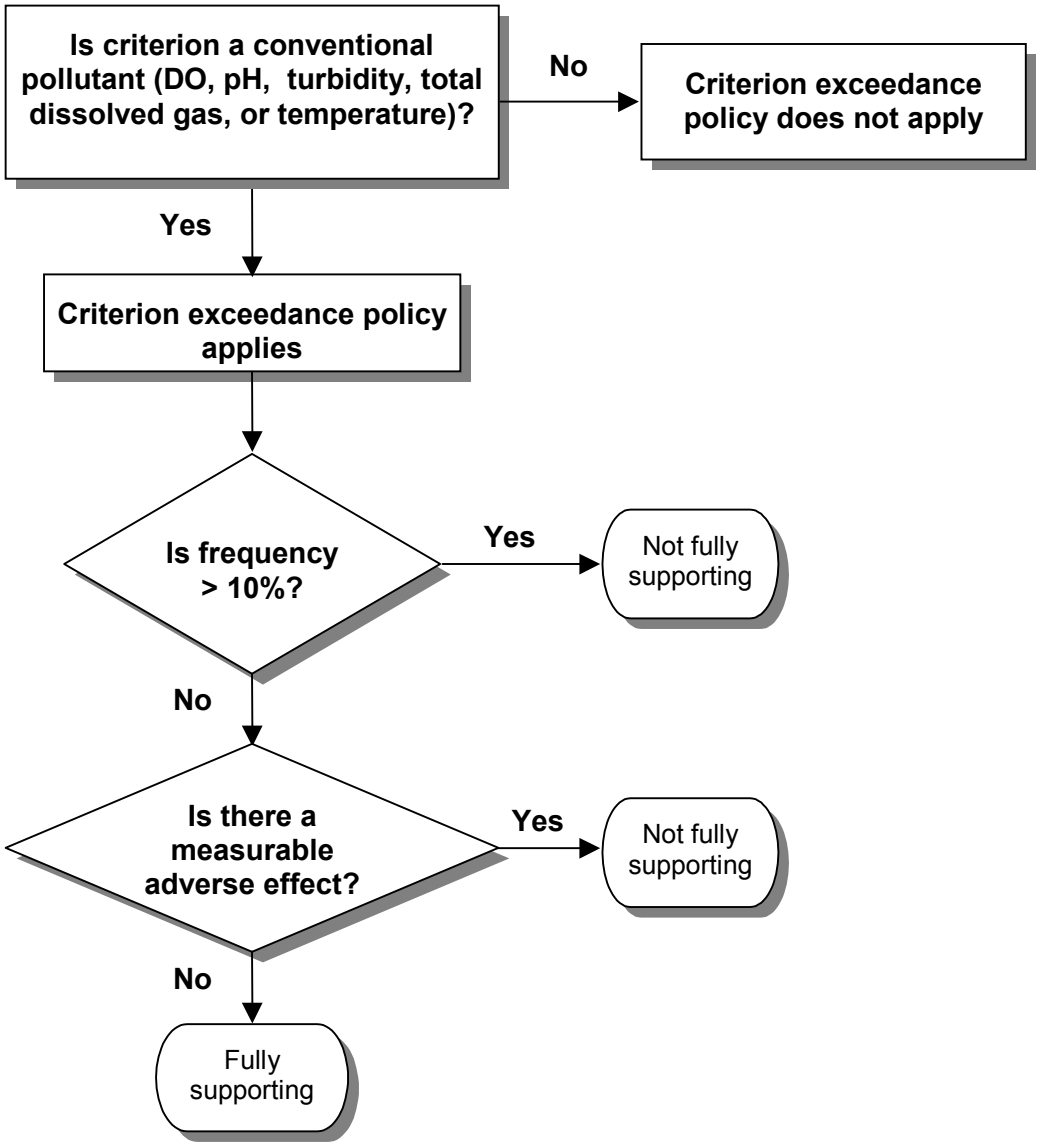


Figure 5-1. Numeric Criterion Exceedance Evaluation for 303(d) Listing

5.2.2. Temperature Exemption

During exceedingly hot weather it is expected stream temperatures will rise also. In some waters this alone can cause temperature to exceed criteria. Thus, Idaho and other agencies acknowledge that when the ambient air temperature is extremely high, exceeding water temperature criteria may not be a standards violation (WQS § 080.04; ODEQ 1995; Coutant 1999; EPA ANPRM).

The Idaho water quality standards define air temperature extremes as any time "... the air temperature exceeds the ninetieth percentile of the seven (7) day average daily maximum air temperature..." (WQS § 080.04). In practice, DEQ will

require a minimum of a 10-year period of record to calculate a 90th percentile for applying this rule.

To simplify application of this exemption Strong and Essig (2001) (Appendix E) compiled 30-year air temperature records for weather stations representative of the 10 climate divisions in Idaho set by the National Climatic Data Center. From these records they determined annual seven-day average maximum air temperatures for each station, and then calculated the 90th percentile of these annual maxima over the 30-year period of record. When these 90th percentile values are exceeded at the representative weather station within these climate zones, temperature criteria in the water quality standards do not apply in any water bodies within that climatic zone.

5.2.3. Natural Background

It is possible that exceedances of numeric criteria can occur under natural conditions. For instance, many streams and rivers draining wilderness or minimally disturbed watersheds cannot meet Idaho's current temperature criteria (Bugosh 1999). The Idaho water quality standards state that natural background must be considered in criteria evaluations. Specifically:

> Where natural background conditions exceed any applicable water quality criteria set forth in sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions (WQS § 200.09).

DEQ defines natural background conditions to be "no measurable change in the physical, chemical, biological, or radiological conditions existing in a water body without human sources of pollution within the watershed." In evaluating waters for impairment it is desirable to consider whether natural conditions or human sources are the cause. This is often difficult to sort out and typically there is not enough time nor data to fully consider causes when conducting statewide assessments for reporting required by Clean Water Act sections 303(d) or 305(b).

Therefore, the assessor should assume wilderness and other roadless watersheds to be without human sources of pollution and thus *a priori* at natural background condition. Other watersheds with some human disturbance could be determined to exhibit natural conditions for specific pollutants. A watershed assessment, such as prepared in prelude to a TMDL, will be needed for less obvious cases of natural conditions. DEQ will be developing more complete and separate guidance on determination of natural background conditions.

5.2.4. Salmonid Spawning

A subcategory of the criteria for cold water aquatic life use (CW ALUS) is to protect spawning for salmonid fishes (trout, salmon, and whitefish, WQS § 250, 250.02.e). In addition to all other numeric criteria, waters for which salmonid

spawning is a designated or existing use additionally have colder temperature criteria, intergravel dissolved oxygen criteria, and water column dissolved oxygen saturation requirements (Table 5-1). These criteria apply in addition to criteria that apply to all waters for which CW ALUS criteria apply (Section 6.4). This discussion focuses on temperature criteria, although much of it is relevant to applying dissolved oxygen criteria as well.

Table 5-1. Cold water aquatic life criteria that change depending whether salmonid spawning is considered a designated or existing use

Characteristic	Cold Water: without salmonid spawning	Cold water: with salmonid spawning
Temperature	19°C daily average, 22°C daily maximum	9°C daily average, 13°C daily maximum
WCDO	6 mg/l minimum	Greater of 6 mg/l and 90% of saturation
IGDO	None	5 mg/l minimum, 7-day average >6 mg/l

WCDO – water column dissolved oxygen; IGDO – intergravel dissolved oxygen

However, application of water quality standards to salmonid spawning waters takes special consideration, because the time frame of their application is species and spawning/incubation period specific. The WQS § 250.02.e reads as follows:

> Salmonid spawning: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters…

Listing all the possible spawning and incubation periods for different species for different areas is beyond the scope of the WQS at § 250.02 or of the WBAG. However, in order to apply criteria, the assessor needs to estimate the applicable time periods. Table 5-2 lists core-time periods when salmonid spawning and egg incubation commonly occur. These time periods may be used as a guide for when to apply salmonid spawning criteria. If more specific information is desired about time periods for when spawning and egg incubation likely occurs for a specific water body or region, assessors are encouraged to use more specific information instead. The information sources used need to be documented in the assessment process. Sources of information might include articles from fisheries journals, reports, or written records of field observations made by fisheries biologists for the locale.

Table 5-2. Common core-periods for spawning and egg incubation for several native and introduced salmonid species that occur in Idaho

Fish Species	(Annually) Time Period	Fish Species	(Annually) Time Period
Chinook salmon (spring/summer)	Aug 15 - June 1	Bull trout	Sept 1 - Apr 1
Chinook salmon (fall)	Oct 1 - Apr 15	Kokanee salmon	Sep 1 - May 1
Sockeye salmon	Oct 1 - June 1	Mountain whitefish	Oct 15 - Mar 15
Steelhead trout	Apr 1 - July 15	Brown trout	Oct 1 - Apr 1
Redband/rainbow trout	Mar 15 - July 15	Brook trout	Oct 1 - June 1
Cutthroat trout	Apr 1 – Jul 1		

Appendix F includes some further considerations for applying criteria and an annotated bibliography of some spawning periods that have been reported for cutthroat trout, *Oncorhynchus mykiss* (i.e., rainbow, redband, or steelhead trout), and Chinook salmon. This bibliography is appended with the hope that it may be useful for those interested in more refined estimates of spawning and incubation periods for the particular species inhabiting the waters of interest.

Assessors are encouraged to estimate spawning and incubation periods with a level of detail appropriate for the assessment purpose. For example, if an assessor is screening over a hundred temperature records for exceedances, Table 5-2 may be sufficiently detailed. If an assessor is examining temperature records from a single watershed or subbasin, and the precision of the estimates are biologically or economically important, a careful literature and records review, convening an expert panel or field surveys might be justified. Assessors may use any reasonable and knowledgeable approach for estimating these time periods, as long as the approach is sufficiently documented so that it could be reconstructed.

Bull trout are directed by regulation to spawn during September and October, so unlike other species, spawning criteria for bull trout waters need to be applied to bull trout waters in September and October regardless of local information (WQS § 250.02.f; 40 CFR 131.33).

Criteria are intended to protect indigenous species; however, the state may, in addition, elect to protect non-indigenous species if the state considers them a desired species. If for a water body, a non-indigenous salmonid species is present and the Idaho Department of Fish and Game (IDFG) considers that species socially desirable for that drainage, then salmonid spawning criteria would be applied for that species. The management objectives of IDFG's Fisheries Management Plans specifies by drainage which species are considered desirable and are managed for propagation and sustainable populations.[2] Species such as rainbow trout have ambiguous origins and occur both as an indigenous species and have been widely stocked within and beyond their historical range. In these cases, fish are considered indigenous if they are

[2] e.g. http://www.state.id.us/fishgame/fishplan.htm

located within the historical range for that species and if they naturally reproduce in the water body.

5.2.5. Bacteria *(E. coli)*

The Idaho water quality standards address frequency for bacteria criteria exceedances in the primary and secondary contact recreation criteria by using triggers or instanteneous criteria for additional sampling. If additional sampling is required, then a geometric means is calculated and interpreted to determine a violation (see Section 6).

5.2.6. Evaluating "Toxics" — Ambient Chemical Water Quality Criteria

Reserved.

Section 6. Aquatic Life Use Support (ALUS) Determination

The strength of the ALUS determination is the use of ecological indicators in water quality assessments. Water quality is evaluated and compared to levels needed for the protection and maintenance of viable communities of aquatic species. Measurements of aquatic assemblages reflect long-term stream conditions more than instantaneous chemical measurements and provide a direct measure of the aquatic life beneficial use.

The aquatic life beneficial use comprises four general subcategories of beneficial uses: cold water, salmonid spawning, seasonal cold water, and warm water. Bioassessment procedures are described in the following sub-sections for cold water and salmonid spawning beneficial uses. Since the multimetric indexes for cold water aquatic life communities were developed from statewide data sets that include sites with both cool and cold water species present, it may be feasible to evaluate waters designated for seasonal cold water aquatic life uses using the cold water assessment procedures. However, reference conditions for seasonal cold waters would likely need to be established. Such an application will require further evaluation and consequently there are no assessment tools for seasonal cold water aquatic life uses. No assessment tools for evaluating warm water biological communities are presently available. DEQ uses both biological indicators and numeric water quality criteria to assess aquatic life use.

6.1. Multimetric Indexes

6.1.1. Multimetric Index Description

To evaluate aquatic life use, DEQ applies multimetric indexes based on rapid bioassessment concepts developed by EPA (Barbour et al. 1999). Measurements of biological, physical habitat, or physicochemical conditions known as metrics comprise the indexes. The indexes include several characteristics to gage overall ecosystem health. The multimetric index value for a sample site is the sum of individual metric scores. Multimetric index scores are unitless, and therefore easily comparable.

The strength of such an approach is the integration of biological, physical, and chemical characteristics of the water body at different scales — individual, population, community, and ecosystem (Karr et al. 1986). This integration allows DEQ to detect water quality impairment cost-effectively and furnishes this information in an understandable format.

Data used to calculate certain indexes, such as the Stream Fish Index, may be limited due to sampling resource requirements, endangered or threatened

species sampling restrictions, and sampling protocols incompatible with BURP methods. Therefore, DEQ has developed several bioassessment tools to limit reliance on just one tool and still ensure direct measurements of aquatic life.

6.1.2. Establishing Reference Condition

As part of the multimetric approach, reference sites are used to develop a range of conditions that can be divided into any number of categories indicating different levels of impairment (Barbour et al. 1999). Reference sites are grouped to establish a reference condition, the benchmark used in the assessment process. DEQ compares multimetric index scores of sites to this reference condition to determine use support.

6.1.3. Reference Condition and Water Quality Standards

Idaho Code states that reference streams or conditions shall be selected to represent the land types, land uses, and geophysical features found within the majority of the basins. Reference conditions are to be representative of either 1) natural conditions with few impacts from human activities, or 2) minimum conditions needed to fully support the designated uses (IC § 39-3606, WQS 003.085).

This direction is reflected in the DEQ assessment process. DEQ estimates reference condition by screening stream and river sampling sites and identifying those with few impacts from human activities. In terms of water quality standards, these sites are similar to the “highest level of support attainable in the basin” (WQS § 003.85). Also, DEQ organizes sampling locations into reasonably comparable groups based on factors like land type, land uses, geophysical features, climate, and size of the water body (see IC § 39-3606). If the water body in question has similar physical, chemical, or biological measures to those found at the reference condition, then the water body is considered to be “fully supporting” its beneficial use (IC § 39-3606).

6.1.4. Reference Condition and Hydrologically Modified Waters

Based on the body of research leading to this assessment process, DEQ believes that most streams and rivers have the capacity for their biological and habitat parameters to measure within the ranges of comparable reference conditions. For most waters, if point or nonpoint pollution sources were managed, then biological and habitat parameters could be expected to be within the range of natural variability for reference conditions.

However, hydrologic modifications such as dams or diversions have fundamentally altered some streams and rivers from their original conditions, and their biological and physical conditions likewise have been fundamentally altered from their historical conditions. An obvious example is the conversion of a river to a reservoir. As aquatic conditions are changed from river to reservoir, conditions that favor trout and other fish adapted to cold-swift waters are shifted

to pond-like conditions that favor warm water fishes, largely introduced from the Midwest, such as large and smallmouth bass, carp, crappy, and catfish (Li et al. 1987). These species may be considered desirable and represent “fishable” aquatic life and recreational beneficial uses. In another example, historically anadromous salmon inhabitated the Snake River basin upstream to natural barrier waterfalls (e.g. Shoshone Falls, Malad Falls). Impassible dams and reservoirs (e.g., Dworshak Dam blocking the North Fork Clearwater River or the Hells Canyon dam complex blocking the Payette, Boise, and mid-Snake systems) make it unrealistic to expect the presence of steelhead trout or salmon in the rivers upstream of these hydrological modifications.

With this in mind, DEQ believes that pervasively hydromodified systems should not be compared to unregulated rivers. Certain conditions may be presently unattainable if the dams, diversions, or other hydrological modifications are operated for the purpose for which they were constructed. DEQ will base the beneficial use assessment on those minimum conditions needed to fully support the designated uses of these fundamentally modified systems. These minimum conditions will be determined on a case-by-case basis to protect their “fishable” beneficial uses.

6.2. Technical Support Documents

The development of multimetric indexes relevant to Idaho beneficial uses is a substantial research effort. Several years of data collection and extensive technical analyses provide the basis for use of these bioassessment tools in the assessment process. The specifics of these analyses are beyond the scope of this guidance; however, DEQ does provide this information in the *Idaho Stream Ecological Assessment Framework* (Grafe 2002b) and *Idaho River Ecological Assessment Framework* (Grafe 2002c) if the reader seeks more details regarding the development of the cold water aquatic life bioassessment tools. For convenience, brief summaries of the principle components of these assessment tools are found in Appendixes H and I of this document.

6.3. Water Body Size Determination

The WBAG uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. This distinction is important since DEQ uses different bioassessment indexes to assess the aquatic life support use of these two classes. Section 2 of this document describes the method used to determine water body size. For more details regarding the development of this method, please refer to Grafe 2002a.

6.4. Aquatic Life Use Support Determination — Cold Water Aquatic Life

6.4.1. Stream Index Scoring

DEQ uses BURP-compatible data to calculate the Stream Macroinvertebrate Index (SMI), Stream Fish Index (SFI), and Stream Habitat Index (SHI). The results of these indexes are used to evaluate support of cold water aquatic life. DEQ may also use physicochemical data to identify numeric criteria exceedances of water quality standards (see Section 5.2.) and/or other available data to support or modify assessment interpretations (see Section 4.3.).

6.4.1.1. Stream Macroinvertebrate Index

The SMI is a direct biological measure of cold water aquatic life. The details of the SMI development and supporting analysis may be found in Jessup and Gerritsen (2000). Additionally, Appendix H of this document provides a brief summary of the classifications and metrics for this index.

DEQ uses a scoring approach similar to methods recommended in the *Rapid Bioassessment Protocols* (Barbour et al. 1999). The scoring criteria are derived from percentile categories of the reference condition. Figure 6-1 provides an example of the scoring approach for the SMI in the Central and Southern Mountains bioregion (see Table 6-1 for scoring criteria of this bioregion).

DEQ based the breakpoints for the SMI condition ratings on two tests: discrimination efficiencies and Type I/II errors. First, DEQ analyzed the reference and impaired SMI data set to determine where there was a balance of Type I (i.e., unimpaired stream, but WBAGII determines it impaired) and Type II (i.e., impaired stream, but WBAGII determines it unimpaired) errors. DEQ found this balance of error generally occurred for all the bioregions at the 10th percentile.

Next, DEQ evaluated the discrimination efficiencies of the SMI data set. The discrimination efficiency (DE) is the percent of disturbed sites with SMI scores less than a particular reference percentile score. Because an objective was to have a balance of Type I and II errors, DEQ first evaluated the DE at the 10th percentile and found results ranging from 85 to 88 percent for all the bioregions. This means that approximately 85 percent of the impaired sites were correctly identified at the 10th percentile of reference condition. DEQ believes that about 80 percent is an acceptable DE to distinguish impairment and consequently, assigned the condition rating of 2 at the 10th percentile.

To assign the condition rating of 3, DEQ evaluated the DE at the 25th percentile and observed results ranging from 90 to 97 percent. DEQ believes about 90 percent is an appropriate level to assign the higher condition rating of 3.

At first glance, the use of the 10th and 25th percentiles may appear to be a low standard. However, it is important to remember that the comparison is to *reference condition*. The reference condition is based on a group of sites that are considered minimally disturbed for that bioregion.

Below the minimum of reference condition is identified as a minimum threshold. The purpose of a minimum threshold is to identify significant impairment that may not be apparent after data index integration. DEQ uses this as a signal from individual indexes to ensure protection of cold water aquatic life. DEQ concludes not fully supporting if a water body has even one index result below a minimum threshold.

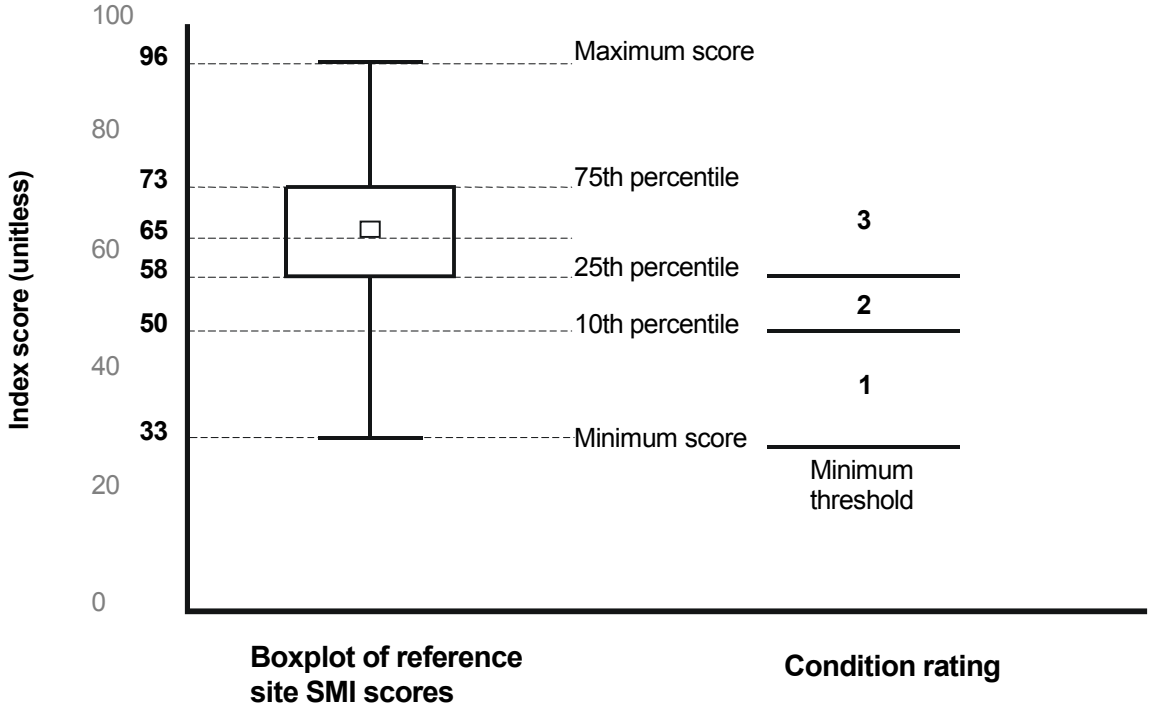


Figure 6-1. Example of Multimetric Scoring Method for the SMI in the Central and Southern Mountains Bioregion

This scoring approach uses percentile categories of only the identified reference sites that comprise the reference condition. The box plot above depicts the distribution of reference site scores.

Each condition category is assigned a rating of 1, 2, or 3 (see Figure 6-1). This rating assignment allows DEQ to effectively integrate multiple index results into one score. The final score derived from these multiple data sets is then used to determine use support. Table 6-1 summarizes the scoring criteria for the SMI. The scoring criteria are assigned according to each bioregion reference condition. Bioregions are divided into Northern Mountains, Central and Southern Mountains, and basins.

Table 6-1. SMI Bioregion Scoring Criteria*

	Bioregion Classification			
Condition Category	**Northern Mountains**	**Central and Southern Mountains**	**Basins**	**Condition Rating**
Above the 25th percentile of reference condition	≥65	≥59	≥51	3
10th to 25th percentile of reference condition	57 – 64	51 – 58	43 – 50	2
Minimum to 10th percentile of reference condition	39 – 56	33 – 50	33 – 42	1
Below minimum of reference condition	<39	<33	<33	Minimum Threshold

*Scoring for all the indexes is rounded to the nearest whole number.

6.4.1.2. Stream Fish Index

The SFI is also a direct biological measure of cold water aquatic life. The details of the SFI development and supporting analysis may be found in Mebane (2002a). For a brief summary of the classifications and metrics for this index, please refer to Appendix H of this document.

DEQ uses a similar scoring approach to that used for the SMI. However, the breakpoints for condition ratings are different based on analyses of DEs and Type I/II errors. DEQ found the balance of error occurred for both the rangeland and forest streams at the 25th percentile. The DEs at this percentile were 78 and 74 percent for forest and rangeland, respectively. Consequently, DEQ assigned the condition rating of 2 at the 25th percentile. The DEs at the median of reference condition were 88 and 92 percent for forest and rangeland, respectively, so DEQ assigned the condition rating of 3 at this level. Below the 5th percentile of reference condition was identified as a minimum threshold. Table 6-2 summarizes the scoring criteria for the SFI for each bioregion.

Table 6-2. SFI Bioregion Scoring Criteria

	Bioregion		
Condition Category	**Rangeland**	**Forest**	**Condition Rating**
Above the median of reference condition	≥82	≥81	3
25th percentile to median of reference condition	62 – 81	67 – 80	2
5th to 25th percentile of reference condition	39 – 61	34 – 66	1
Below 5th percentile of reference condition	<39	<34	Minimum Threshold

6.4.1.3. Stream Habitat Index

The details of the SHI development and supporting analysis may be found in Fore and Bollman (2000). A summary of the SHI metrics is provided in Appendix H of this document.

Although fundamentally the SHI scoring system is based on similar concepts used for the other indexes, DEQ does not use a minimum threshold for this index. This is different from the SMI and SFI for two reasons. First, and most importantly, Fore and Bollman (2000) and Bauer and Ralph (1999 and 2000) reported significant variability among physical habitat measures. Although DEQ believes physical habitat is a useful interpretive tool, the agency is cautious about using the SHI solely to determine aquatic life use support. Second, the SHI comprises non-biological components and consequently, is not a direct measure of the aquatic life use.

DEQ did use the SMI reference and impaired data set to generate a scoring system for each SHI ecoregion. Using DEs and Type I/II error analyses for the SHI, DEQ found the balance of error generally occurred for all the ecoregions at the 10th percentile. The DEs were extremely high at this percentile ranging from 92 to 100 percent. Consequently, DEQ assigned the condition ratings of 2 at the 10th percentile and 3 at the 25th percentile. Table 6-3 summarizes the scoring criteria for the SHI.

Table 6-3. SHI Scoring Criteria.

Condition Category	Northern Rockies	Northern Basin and Range	Snake River Basin/ High Desert	Condition Rating
Above 25th percentile of reference condition	≥66	≥63	≥58	3
10th to 25th percentile of reference condition	58 – 65	50 – 62	55 – 57	2
Below 10th percentile of reference condition	<58	<50	<55	1

6.4.2. River Index Scoring

6.4.2.1. Biological and Physicochemical Indexes

DEQ uses BURP-compatible data to calculate the River Macroinvertebrate Index (RMI), River Fish Index (RFI), and River Diatom Index (RDI). The results from these indexes are used to evaluate support use of cold water aquatic life in rivers. DEQ may also use physicochemical data to identify numeric criteria violations of water quality standards (see Section 5) and/or other available data to support or modify assessment interpretations (see Section 4).

The RMI, RFI, and RDI are direct biological measures of cold water aquatic life. The details of index development and supporting analyses may be found in Royer and Mebane (2000), Mebane (2002b), Fore and Grafe (2000), and Brandt (2002). Appendix I of this document provides brief summaries of the metrics used in these indexes.

Scoring methods used for the river biological indexes differ according to the techniques used to develop the indexes. The RMI and RFI used reference condition approaches similar to those methods used in the development of the SMI and SFI. The developers of the RMI and RDI did not adjust index scores to a 100-point scale. Therefore, the maximum score of these indexes are the highest scores of the individual metrics comprising the indexes. However, the RFI is based on a 100-point scale.

Both the RMI and RFI base condition categories on the 25th percentile of reference condition, which is considered adequately conservative in identifying sites in good condition (Jessup and Gerritsen 2000). DEQ applies the authors' recommendations when identifying additional condition categories. For the RFI, DEQ uses the median and 5th percentiles; below the 5th percentile is distinguished as a minimum (Mebane 2002b). For the RMI, Royer and Minshall (1996) recommended the minimum score of the reference condition to distinguish additional condition categories. DEQ evaluated the range in each condition category of the RMI and then linearly extended the range to identify a minimum threshold.

The development of the RDI scores were based upon the distribution of the entire data set rather than just reference sites, due to the limited number of reference sites. Fore and Grafe (2000) recommend scores assigned to the different index categories based on the 75th, 50th, and 25th percentiles. Fore and Grafe (2000) did not have supporting analysis to recommend a minimum threshold.

Although the RPI is not used in the river data integration process, the index results may still be used in water quality interpretations and decisions other than 303(d). The RPI uses a scoring classification approach based on the development methods of the Oregon Water Quality Index (Cude, in press), the index on which the RPI is based. Standard deviation was used to identify the different index categories of expected condition.

In addition to different indexes, the stream and river bioassessment approaches use different classification methods. The stream approach uses an ecoregion or a grouping of ecoregions into bioregions to classify similar water bodies before applying a scoring system. The developers of the river bioassessment tools did not apply this classification step into the scoring system for several reasons. First, Fore and Grafe (2000) initially grouped test data sets by ecoregional groupings; however, they found no differences in scoring results. Second, large rivers often transcend geological and ecoregional changes making application of distinct classifications difficult. Finally, there are significantly fewer large rivers in Idaho resulting in much smaller test data sets than streams. If the small test sets were further reduced for classification purposes, the analysis would lose considerable scientific rigor.

Similar to the stream cold water aquatic life approach, each condition category is assigned a rating of 1, 2, or 3. This rating assignment allows DEQ to effectively integrate multiple index results into one score. The final score derived from these multiple data sets is then used to determine use support. Table 6-4 summarizes the scoring and rating categories for the RMI, RDI, RFI, and RPI. It should be noted that the RPI scoring criteria is provided for information only. This index is not directly used in the river data integration process. However, the RPI results may be used for supplement water quality interpretations.

Table 6-4. RMI, RDI, RFI, and RPI Scoring and Rating Categories

Index	Minimum Threshold	1	2	3
RMI	<11	11 – 13	14 – 16	>16
RDI	NA[1]	<22	22 – 33	>34
RFI	<54	54-69	70-75	>75
RPI	<40	40 – 70	70 – 80	>80

[1] Fore and Grafe (2000) did not identify a minimum threshold category.

6.4.3. Index Data Integration Approach and Use Support Determination for Rivers and Streams

DEQ applies the index integration approach to determine aquatic life use support. However, as mentioned previously, DEQ may use physicochemical data to identify numeric criteria violations of water quality standards (see Section 5) and/or other available data to support or modify assessment interpretations (see Section 4). To use the multiple index integration approach, all data must be BURP-compatible and meet Tier I criteria (see Section 4).

DEQ believes that water bodies require an integration of multiple data types to assess ecosystem health. With this in mind, DEQ does not use any one piece of evidence to solely assess aquatic life use support. The multiple data integration approach is applied according to available data during the assessment process. If there are not enough data types to calculate two different indexes, then the water body is not assessed until more data are gathered or other Tier I data can be used according to policies described in Section 4. Figure 6-2 illustrates the process of applying this approach.

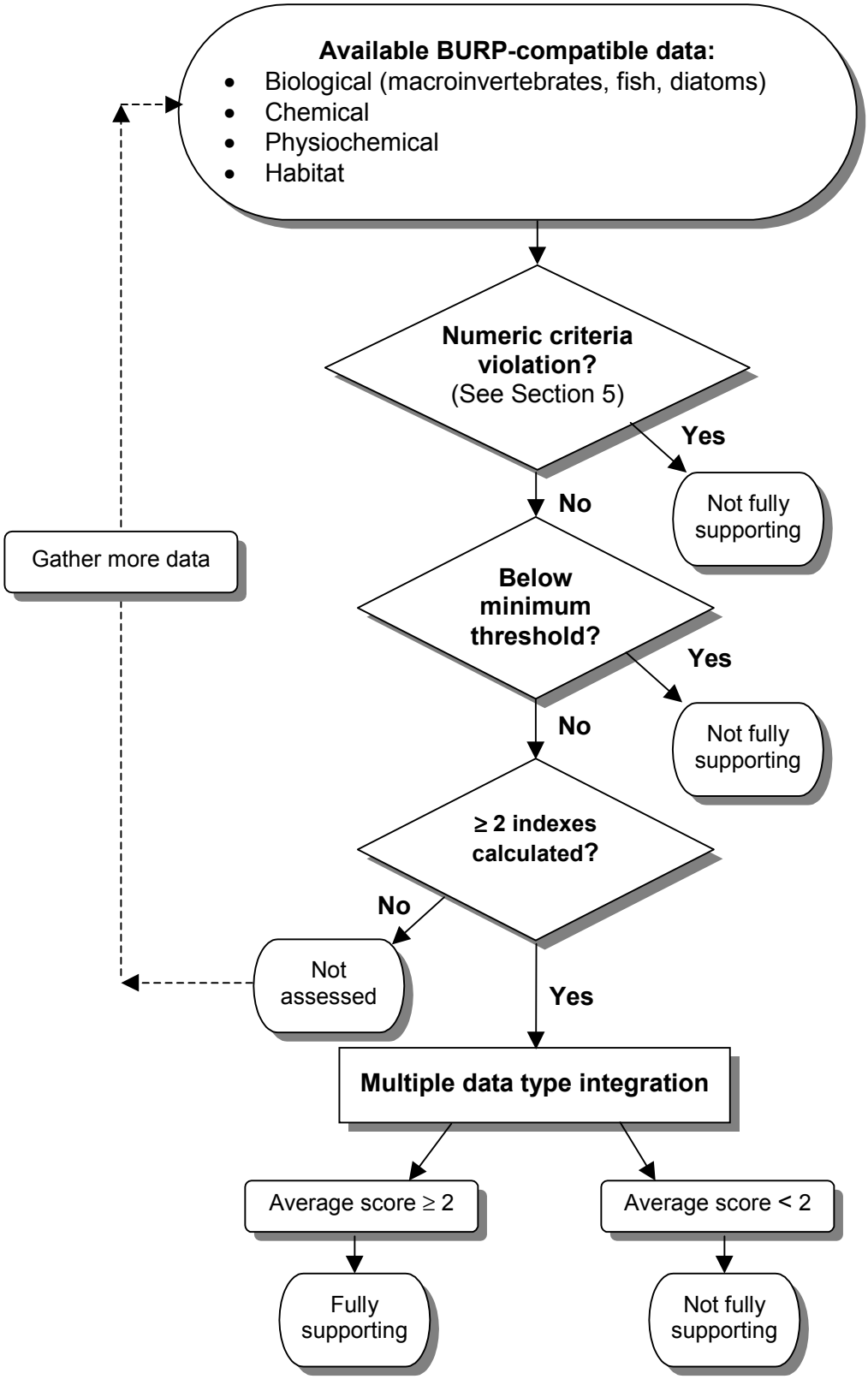


Figure 6-2. ALUS Preliminary Cold Water Aquatic Life Use Support Determination

The data integration approach uses the following steps to determine use support of cold water aquatic life for streams and rivers.

Step 1
Identify any numerical water quality standard violation as determined by using the criterion evaluation and exceedance policy (see Section 5).

If there is a numeric criteria violation, then DEQ automatically determines the water body is not fully supporting.

Step 2
Calculate the index scores and determine if there are at least two indexes.

If there are less than two indexes, then the water body is not assessed unless other Tier I data is available (see Section 4.3.). Additional data should be gathered.

Step 3
Identify any index scores below the minimum threshold levels.

If there are any scores below minimum threshold levels, then DEQ automatically determines the water body is not fully supporting.

Step 4
Identify corresponding 1, 2, or 3 condition ratings for each index.

Step 5
Average the index ratings to determine the use support. To average the individual index ratings, sum the ratings and divide by the number of indexes used.

An average score of greater than or equal to 2 is considered fully supporting.
An average score of less than 2 is considered not fully supporting.

Step 6
Review these preliminary, quantitative results to ensure that they meet logical expectations and data requirements. If not, re-evaluate the data and provide sound justification for support status ratings/assignments different from the indication of the quantitative results (see Section 4.3.).

6.5. Aquatic Life Use Support Determination – Salmonid Spawning

The Idaho water quality standards require that waters designated for salmonid spawning be protected if they "provide or could provide a habitat for active, self-propagating populations of salmonid fishes" (WQS § 100.01b). To evaluate salmonid spawning within the context of the ALUS determination, DEQ must first interpret the regulatory intent of the water quality standards and EPA guidance. DEQ then applies an assessment approach that meets this intent and is workable based on current science and available resources. This approach is applied similarly to small streams and rivers.

6.5.1. Regulatory Interpretation of Salmonid Spawning Use Support

In interpreting regulatory requirements, DEQ considered regulatory definitions, guidance, and numeric criteria. The water quality standards define salmonid spawning as a sub-category of the aquatic life beneficial use (WQS § 100). EPA guidance directly addresses aquatic life use bioassessment, but does not separate bioassessment of salmonid spawning or other sub-categories of aquatic life use (EPA 1994; EPA 1997). This regulatory structure and guidance implies that salmonid spawning is a part of the overall aquatic life use support determination.

Additionally, the definition of salmonid spawning states "habitat" should be protected for salmonid fish. Salmonid spawning generally requires habitat that contains well-oxygenated gravel substrate and cold water for egg incubation. The Idaho water quality standards address these requirements through numeric criteria specific to salmonid spawning (WQS § 250.02.e). Intergravel dissolved oxygen, water temperature, and ammonia salmonid spawning criteria are different from cold water aquatic life criteria. Consequently, DEQ considers numeric criteria for salmonid spawning separately from cold water aquatic life.

6.5.2. Assessment Approach

Since 1996, DEQ has developed and improved the bioassessment tools used in the ALUS determination. For instance, DEQ has developed quantitative fish indexes (SFI and RFI) that incorporate direct measurements of healthy fish communities. These indexes are a significant improvement over the former qualitative approach—the Reconnaissance Index of Biotic Integrity (DEQ 1996). Also, DEQ has revised the habitat index (SHI) to better reflect conditions affecting aquatic condition. DEQ applies a scientifically defensible approach, which, depending on water body size (see Section 2), uses a combination of different biological indexes (fish, macroinvertebrates, and diatoms) as well as physical habitat and physicochemical information. This approach is more robust than that used in the previous WBAG (DEQ 1996).

In light of these bioassessment developments and interpretations of regulatory intent, DEQ believes it is reasonable to evaluate salmonid spawning within the context of the ALUS determination and applicable numeric criteria. Such a

process considers the ecological health of fish communities and addresses numeric criteria specific to salmonid spawning. This approach applies similarly to streams and rivers (Figure 6-3). Nationally, this approach seems consistent to methods used by many other states (EPA 1997; EPA 2000). The following steps summarize this approach.

Step 1.
Determine ALUS using appropriate aquatic life numeric criteria and applicable multimetric indexes for streams or rivers (see Section 6.5).

> If ALUS = not fully supporting, then salmonid spawning is not fully supporting.
>
> If ALUS = fully supporting, then continue to Step 2.

Step 2.
Determine if readily available data exist to apply appropriate numeric criteria (intergravel dissolved oxygen, water temperature, and ammonia criteria) specific to salmonid spawning (WQS § 250.02.e).

> If appropriate data do not exist, then salmonid spawning is assumed to be fully supporting based on ALUS = fully supporting.
>
> If appropriate data do exist, then continue to Step 3.

Step 3.
Do data indicate violations (see Section 5) of numeric criteria (intergravel dissolved oxygen, water temperature, and ammonia criteria) specific to salmonid spawning (WQS § 250.02.e)?

> If numeric criteria is violated (see Section 5), then salmonid spawning is not fully supporting.
>
> If numeric criteria is not violated or does not indicate measurable impairment (see Section 5), then salmonid spawning is fully supporting.

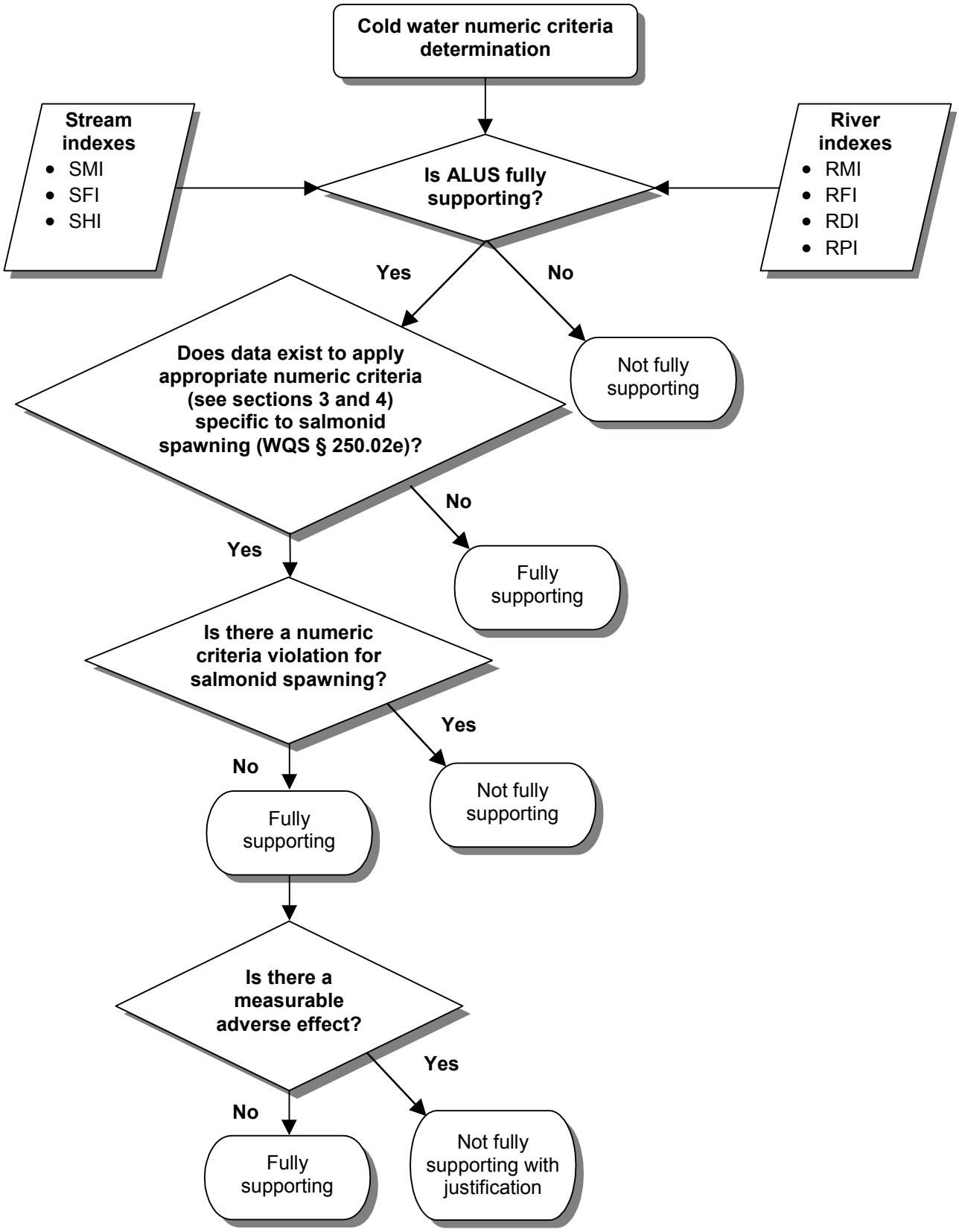


Figure 6-3. Salmonid Spawning Use Support Determination

6.5.3. Use of Outside Data

Although DEQ collects electrofishing data for streams, the agency depends heavily on fisheries data collected from other entities. This is particularly true for large rivers, since DEQ does not routinely collect fisheries data. Additionally, DEQ collection of fisheries data continues to be limited due to endangered or threatened species. With this in mind, it is particularly important for the assessor to locate BURP-compatible fisheries data collected outside DEQ for the SFI and RFI calculations and subsequent ALUS determinations. It is also important for the assessor to coordinate with fish management agencies, such as IDFG, when evaluating salmonid spawning.

6.5.4. Approach Rationale

Alternate approaches that DEQ considered using included assessing salmonid population status, habitat suitability, and various combinations (Grafe and Mebane 2000; Mebane 2000). We considered alternatives for determining whether salmonid populations in a water body were self-sustaining. These alternatives would assess whether a population was self-sustaining using combinations of minimum population size to avoid the risk of extinction in 100 years (Hoelscher 2000), minimum inter-connected patch size or stream miles, and number of age classes. Habitat suitability alternatives included assessing substrate quality, assessing salmonid spawning-specific habitat measures, and using the SHI (Grafe and Mebane 2000; Hoelscher 2000).

DEQ decided not to further develop these alternatives based on concerns of "mission creep" and the belief that the overall ALUS process provides a holistic estimate of the water body's ecological condition. The "mission creep" concern involves the complex undertaking by DEQ, depending upon the carrying capacity of the specific water body, of defining whether a salmonid population is self-sustaining. Such an undertaking seems more appropriate in the realm of fish and wildlife management agencies, such as the IDFG, U.S. Fish and Wildlife Service, or researchers such as the U.S. Forest Service Rocky Mountain Research Station.

With regards to habitat suitability alternatives, the SHI is a broad index of aquatic and riparian physical habitat measures which were correlated with macroinvertebrate and fish assemblage metrics (Fore and Bollman 2000). However, the index was not specifically developed to assess salmonid spawning and incubation, nor has it been validated for that purpose (Fore 2000). As found by Maret et al. (1993), field measures to assess habitat suitability for salmonid spawning and incubation can be far too labor-intensive to apply at a statewide scale.

The current ALUS process is a fairly complex process by itself. The labor, contractual, and other costs to attempt to resolve and measure the habitat and population sustainability issues have been significant. DEQ chose the current method because it best meets the intent of the Idaho water quality standards, is consistent with other state approaches, and is workable given present scientific tools and available resources.

6.6. ALUS Approach and Legal Requirements

The Idaho Code and administrative water quality standards provide direction for aquatic life use determination and monitoring waters to conduct beneficial use attainability and status surveys. Idaho water quality standards state that aquatic life communities are "beneficial uses" of waters and that where attainable, desirable aquatic species of aquatic life communities be maintained or restored (WQS § 050.02). DEQ approaches to determine whether aquatic life beneficial uses are attained include, but are not limited to, comparing biological and habitat parameters in the stream or water body of interest with those found in reference streams or conditions. DEQ considers whether all water quality standards are met and whether a healthy, balanced, biological community is present (WQS §§ 003.040, 003.85, 053).

The cold water aquatic life assessment process follows guidance from Idaho water quality standards and Idaho Code (Table 6-5). The Idaho water quality standards state that DEQ shall use biological and aquatic habitat parameters listed below and in the current version of the WBAG. These parameters may include, but are not limited to those listed in Table 6-5.

Table 6-5. Comparison of aquatic habitat and biological parameters listed in Idaho Water Quality Standards or Idaho Code, and corresponding indexes used in the cold water aquatic life use support determination.

Indicator	**Water Quality Standards** (WQS § 053, IC 39-3607)	**ALUS Tools**
Aquatic Habitat	Stream width and depth, shade, sediment impacts, bank stability, and water flows	SHI
Biological – Aquatic Macroinvertebrates	Evaluation of Ephemeroptera, Plecoptera, and Trichoptera, Hilsenhoff Biotic Index, and functional feeding groups	SMI, RMI
Biological – Fish	Number and variety of fish to determine community functionality and diversity	SFI, RFI
Biological – Algae	… or other aquatic life	RDI

The actual parameters selected for use in the aquatic life use support determination depended upon their supporting scientific analyses. For example, the SMI includes all the parameters listed in the water quality standards (Table 6-5), plus parameters of richness and pollution tolerance. The SFI includes number of coldwater fish, diversity of ages of fish, and variety of native species among other parameters that distinguished between reference and disturbed sites. Appendixes H and I provide summaries of the stream and river indexes.

Section 7. Contact Recreation Use Support Determination

The Idaho water quality standards provide for water bodies to be designated for either primary or secondary contact recreation use. Primary contact recreation is often considered the “swimmable” goal of the CWA where there is a moderate to high probability of prolonged and intimate contact by humans. Primary contact recreation activities include swimming, water skiing, or skin diving where ingestion of small quantities of water is likely to occur. Secondary contact recreation is often considered recreation “on” or “about” the water. These recreation activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.

7.1. Recreation Criteria Evaluation Policy

DEQ evaluates recreation criteria using data that are less than five years old. For narrative criteria, DEQ investigates beach or swimming closures occurring in the last five years to identify potential exceedances. If two or more closures indicate bacteria or toxic substance causes, then DEQ concludes the water body is not fully supporting. Figure 7-1 illustrates the use determination process for contact recreation. DEQ also evaluates other evidence that indicates an exceedance of numeric criteria. For toxic substances criteria, DEQ concludes not fully supporting if there are any exceedances of toxic substance criteria as specified in WQS § 210.01-02 (See Figure 7-1).

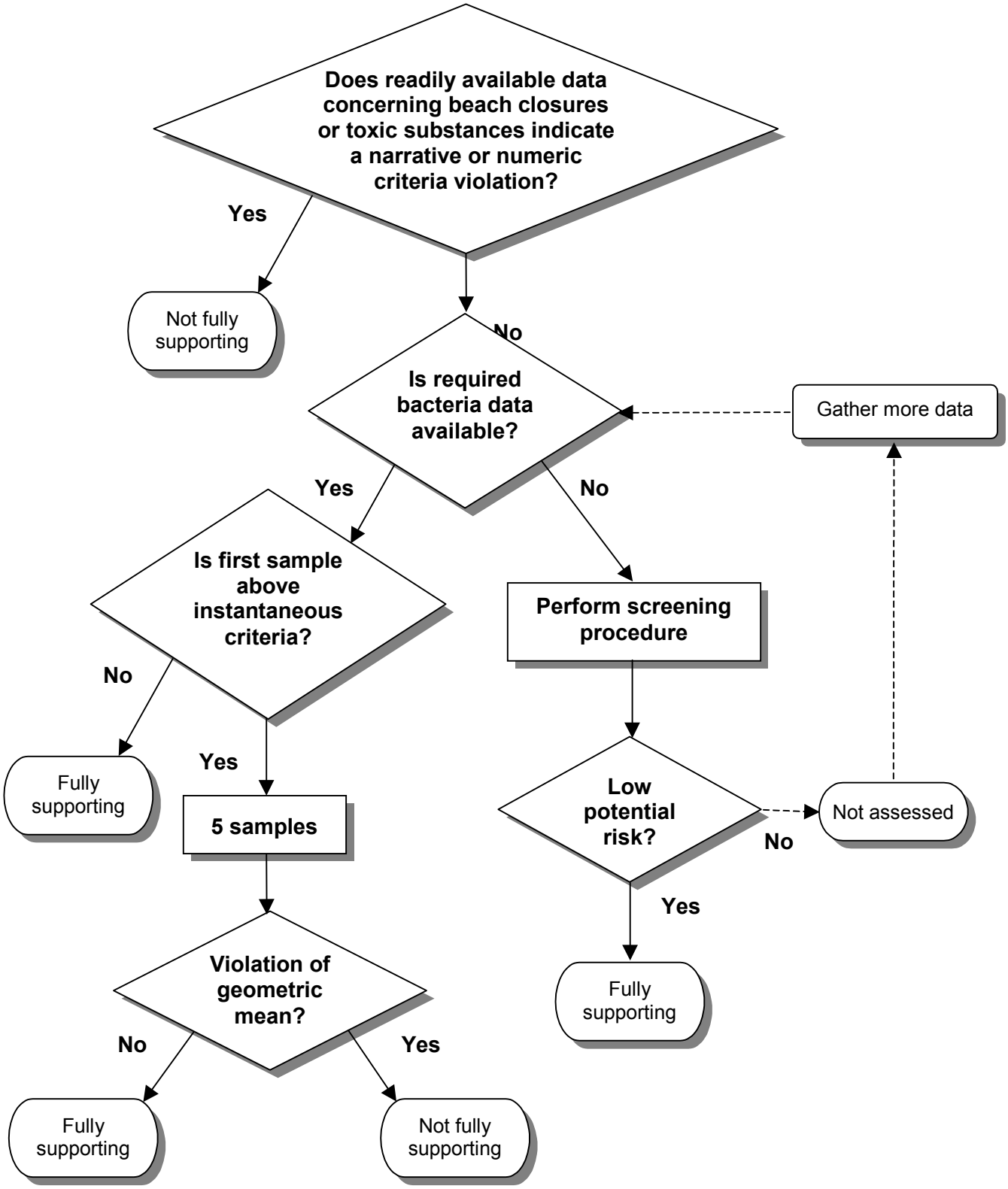


Figure 7-1. Contact Recreation Use Support Determination

7.2. Bacteria Data

The numeric bacteria criterion for an exceedance is the same for primary and secondary contact recreation. The *E. coli* bacteria count must exceed 125 organisms per 100 ml geometric mean (five samples within 30 days). However, the instantaneous criterion to trigger additional sampling is different for primary and secondary contact recreation. The *E. coli* bacteria count must exceed 406 organisms per 100 ml for primary contact and 576 organisms per 100 ml for secondary contact (WQS § 251.01).

The assessor first evaluates if instantaneous criteria indicate requirements for additional sampling. If not, then the water body is fully supporting. If so, then DEQ assesses the geometric mean results from five samples to determine support status. If the required additional sampling results are not available, then the water body is determined not assessed (NA) until sampling results permit an assessment. If bacteria data are not available for the water body, then DEQ will use a bacteria-screening procedure.

If instantaneous bacteria criteria do not indicate requirements for additional sampling, then DEQ determines the use support is fully supporting.

If the geometric mean of the bacteria samples does not indicate a numeric criteria exceedance, then DEQ determines the use support is fully supporting.

If the geometric mean of the bacteria samples indicates a numeric criteria exceedance, then DEQ determines the use support is not fully supporting.

If data are not available, then DEQ uses the bacteria screening procedure.

7.3. Bacteria Screening Procedure Policy

This procedure is used when current bacteria, toxic substances and/or narrative data do not exist for the water body. BURP also incorporates this procedure to guide monitoring procedures for bacteria.

DEQ uses GIS capabilities and local knowledge to determine if upstream land uses have the potential for increasing bacteria concentrations in the water body. Activities that could affect the reach include agriculture, grazing, urban or housing development, wastewater treatment facilities, or septic tanks. If there is a low potential risk, then the water body is considered fully supporting for recreation. If there is a moderate to high potential risk, then the water body is determined not assessed and additional data is gathered. The level of potential risk is based on the best professional judgment of the assessor. Bacteria data are collected during the required index period to permit a later assessment.

If there is a low potential risk for a numeric criteria exceedance, then DEQ presumes the use support is fully supporting.

If there is a moderate to high potential risk for a numeric criteria exceedance, then DEQ identifies the water body as not assessed and gathers necessary data.

Section 8. Water Supply Use Support Determination

8.1. Domestic Water Supply (Drinking Water)

There are presently over 2,100 public water supply systems in Idaho, 80 percent of which serve 500 or fewer people (Idaho Wellhead Protection Plan 1997). In Idaho, 90 percent of drinking water comes from ground water, and only 10 percent is supplied by surface water. Public water systems supplied by surface water are generally located in northern Idaho; however, there are some systems in southern Idaho. The water quality standards (WQS 252.01.b.i.) list the present small drinking water systems supplied by surface water. The assessor will coordinate with the DEQ regional office drinking water program to determine if a particular water body supplies a public water system and identify any numeric criteria exceedances of the ambient surface water quality standards for water supply (WQS § 252). These standards principally address turbidity criteria.

The assessor will also coordinate with the DEQ source water assessment program to identify potential contaminant threats to public drinking water systems due to impaired surface water quality. The source water assessments include delineating the source water assessment area, inventorying potential contaminants within the delineated area, and conducting a susceptibility analysis of the potential contaminants (DEQ 1999).

The source water assessment results are compiled in a report that includes any violations of drinking water standards. The DEQ assessor will coordinate with the source water assessment program and review these reports to identify any numeric criteria exceedances of the surface water quality standards for water supplies. DEQ also will review any additional data supplied by third parties for numeric criteria exceedances.

DEQ will take the following steps to make a use support determination for domestic water supply:

> If there are numeric criteria exceedances of the ambient surface water quality standards for water supply (IDAPA 210), then the water body is not fully supporting.
>
> Unless there is evidence to the contrary, DEQ will presume use support of domestic water supply is fully supporting.

8.2. Agricultural and Industrial Water Supply

Generally, DEQ considers agricultural and industrial water supplies fully supporting although violations of narrative criteria might occur. However, excessive nutrients or toxic contaminants might result in a not fully supporting determination. The assessor should refer to WQS § 252.02-03 and provide a documented rationale for a not fully supporting determination. Collection of additional data to support such a determination is recommended.

> Unless there is evidence to the contrary, DEQ will presume use support of agricultural and industrial water supply is fully supporting.

Section 9. Wildlife Habitat and Aesthetics Use Support Determination

Wildlife habitat and aesthetics are designated uses for all surface waters of Idaho. Unless there is evidence to the contrary, DEQ policy is to determine these uses are fully supporting. Evidence to the contrary would likely occur through a public forum or from documentation submitted by wildlife experts (e.g., IDFG, U.S. Fish and Wildlife Service, universities, etc.).

Unless there is evidence to the contrary, DEQ presumes support use of wildlife habitat and aesthetics are fully supporting.

Section 10. Assessment Examples

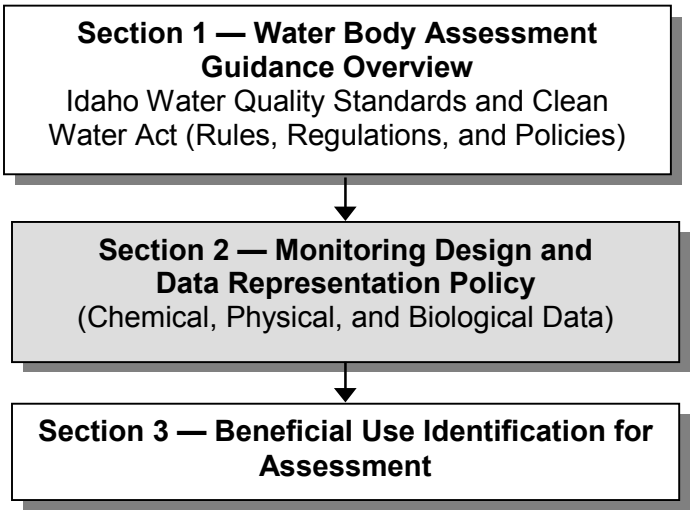
The following examples describe the application of the WBAG using actual data collected from Idaho streams. The steps shown here follow the sequence of WBAG sections. The results and conclusions explained in this section are for example purposes only. For this illustration, DEQ has informally attempted to obtain outside data in addition to BURP data. However, additional information could be supplied as a result of a formal 303(d)/305(b) request for data that might support or change the beneficial use results described here for these stream examples.

10.1. Example 1 - Big Cottonwood Creek

The Big Cottonwood Creek example illustrates using BURP data only in the assessment process. In the past, a majority of the assessments have fallen into this category.

10.1.1. Water Body Identification and Stratification

Please see Figure 1-2 to become familiar with the sequence of the WBAG sections that lead to a beneficial use support or non-support determination. The initial three sections of the WBAG sequence are as follows:



The first step in the assessment process is to identify the location of the water body and stratify it into groups for assessment purposes. Big Cottonwood Creek is approximately 21 miles long and a second order stream located in the Goose Creek HUC #17040211 (see Figures 10-1 and 10-2). The shrubland watershed

has a road crossing at the BURP site and is used for both recreation and grazing purposes. USFS and IDFG have retired the grazing allotments along the lower portion of Big Cottonwood Creek. After Big Cottonwood Creek leaves BLM public lands it is diverted for agricultural uses and flows only occasionally in its natural channel.

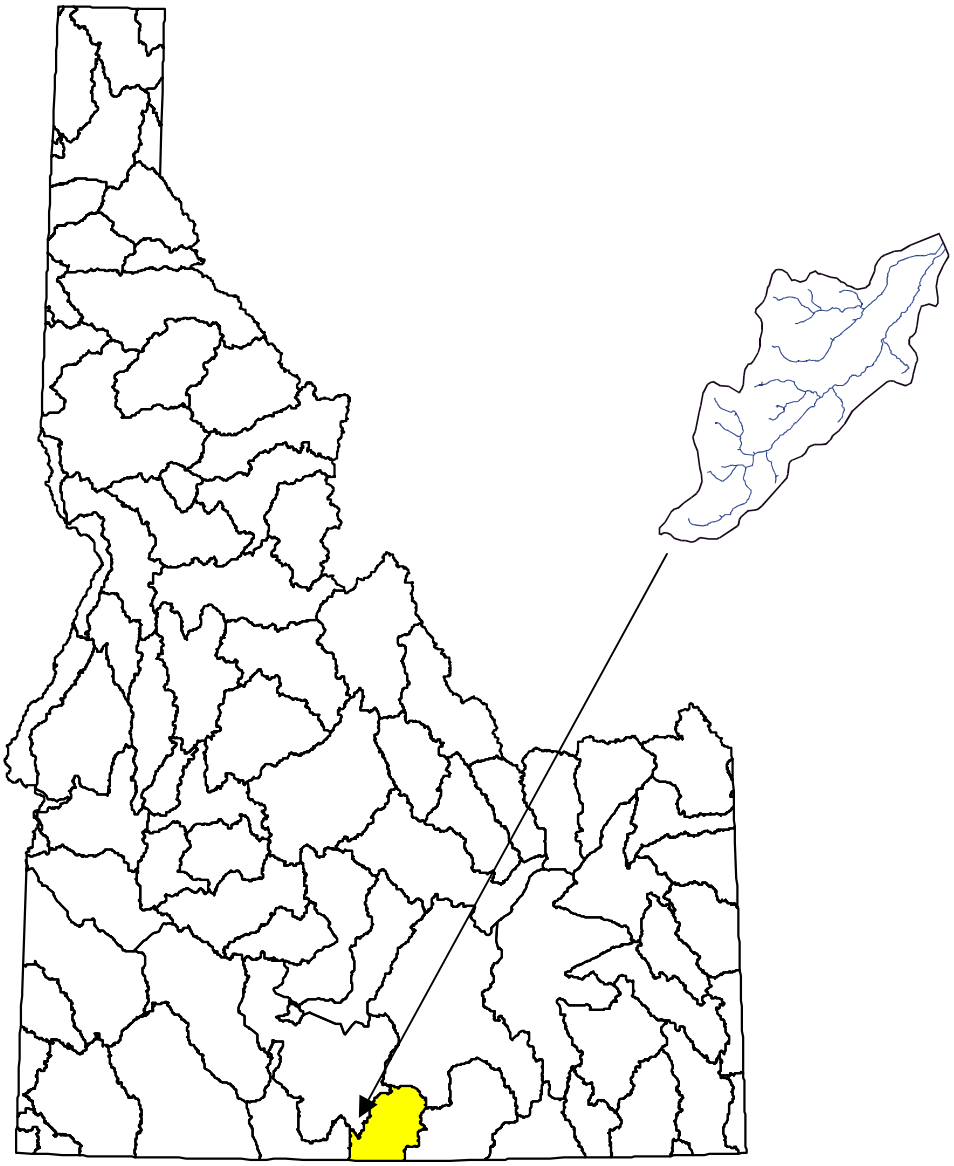


Figure 10-1. Big Cottonwood Creek located in Goose Creek HUC #17040211

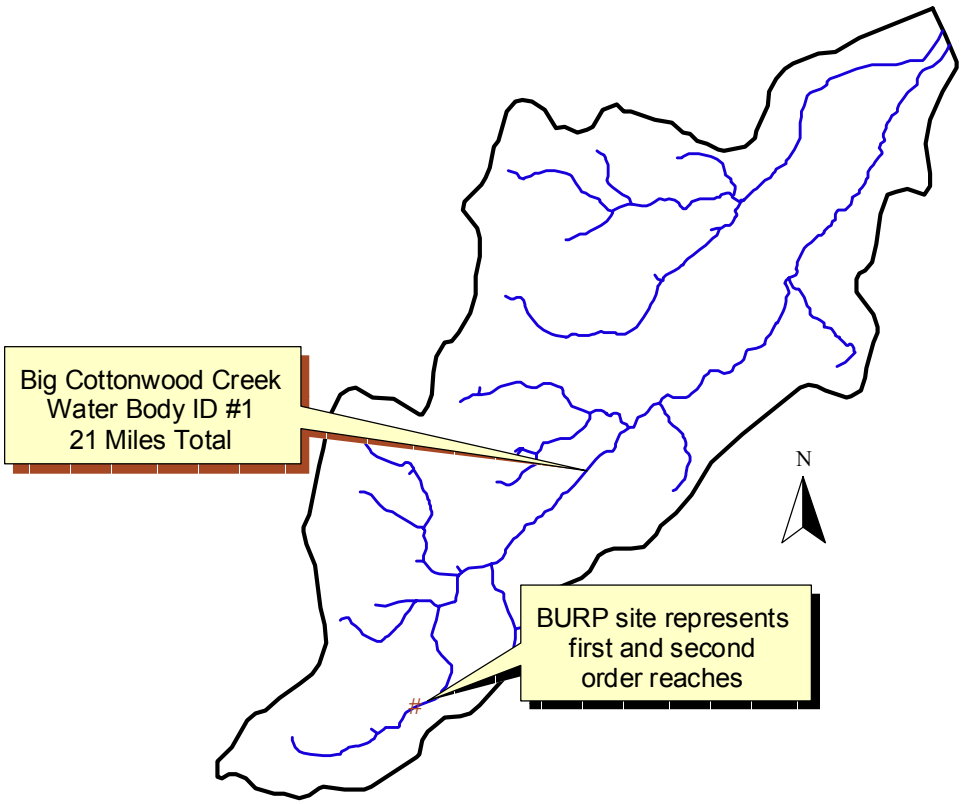


Figure 10-2. Big Cottonwood Creek in 6th Field HUC #170402111901. BURP site at upper portion of watershed

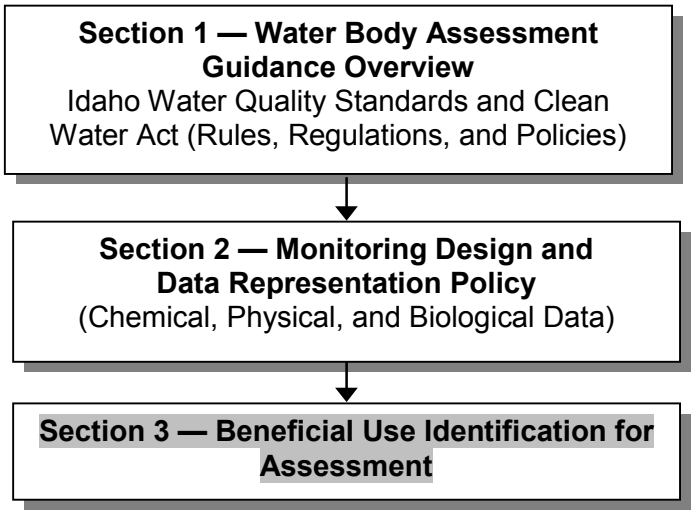
10.1.2. Water Body Size Determination

The second step in the WBAG process is to determine the water body size and whether it is a stream or river. DEQ uses different bioassessment indexes to make this determination (see Section 2). After identifying values and an average criteria rating for the water body size criteria, the assessor determines the average rating is less than 1.7 and consequently, classifies Big Cottonwood Creek as a stream. Table 10-1 summarizes the results of the water body size determination.

Table 10-1. Summary of water body size criteria results

Criteria	Value	Rating
Stream order	3.00	1
Average width at base flow (m)	1.85	1
Average depth at base flow (m)	0.16	1
	Average Rating	1

10.1.3. Identification of Beneficial Uses for Assessment

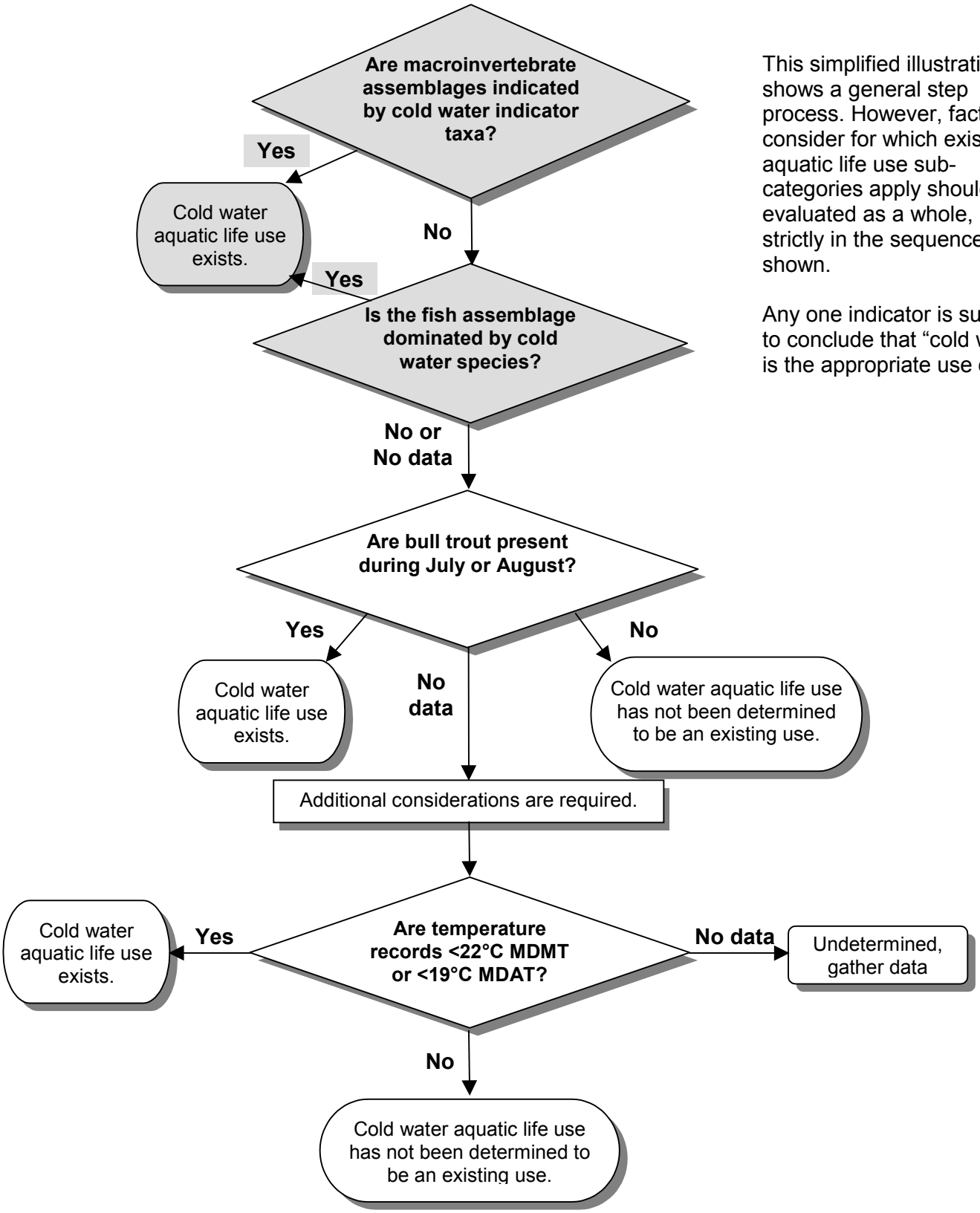


Before assessing the water body, the assessor must first determine which beneficial uses to assess. Surface water use designations are defined and listed in the Idaho water quality standards (WQS § 100-160). These include uses that are applied specifically to a water body (aquatic life, recreation, domestic water supply), and uses that are applied to all waters of the state (agricultural and industrial water supply, wildlife habitat, and aesthetics). Water bodies with specific use designations are identified in WQS § 110-160.

In this example, Big Cottonwood Creek has not been designated for aquatic life or contact recreation uses. Sampling of the creek identified the presence of cold water indicator taxa (see Table 10-2, Section 3.2.2.1, and Appendix A) and a dominance of cutthroat trout (cold water species). Using this information and the guidance from Section 3, the cold water aquatic life beneficial use was identified for assessment purposes (see Figure 10-3). Since the sample was comprised of many individuals measuring less than 100 mm, salmonid spawning was also identified as a beneficial use. Lastly, primary contact recreation was selected as an assessment use since this stream is accessible and used heavily for recreational purposes.

Table 10-2. Cold water indicator taxa found in Big Cottonwood Creek sample

ORDER	Genus/Species	Temperature Preference
Coleoptera		
	Narpus sp.	12.58
Ephemeroptera		
	Baetis bicaudatus	8.76
	Cinygmula sp.	10.31
	Drunella doddsi	10.47
Plecoptera		
	Cultus sp.	11.04
	Leuctridae	9.43
	Paraperla sp.	9.32
	Perlidae	11.26
	Sweltsa sp.	11.45
Trichoptera		
	Apatania sp.	11.04
	Parapsyche elsis	9.47
	Rhyacophila brunnea gr.	10.56



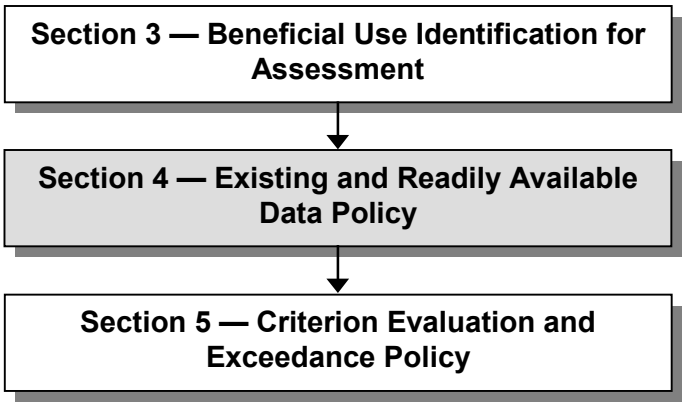
This simplified illustration shows a general step process. However, factors to consider for which existing aquatic life use sub-categories apply should be evaluated as a whole, not strictly in the sequence shown.

Any one indicator is sufficient to conclude that "cold water" is the appropriate use class.

Figure 10-3. Identification of Beneficial Uses for Big Cottonwood Creek

10.1.4. Evaluation of Existing and Readily Available Data

The next step is to evaluate existing and readily available data according to policies described in Section 4 and illustrated in Figure 4-2.



Macroinvertebrate, fish, and habitat data were collected at one BURP site for this assessment unit. Due to heavy recreational uses on this stream, DEQ also collected bacteria samples to assess the primary contact beneficial use.

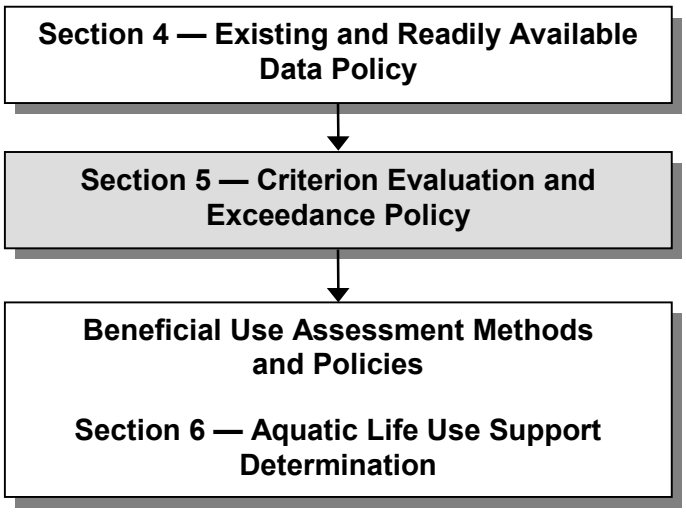
All the data was collected using BURP protocols and consequently are evaluated as Tier I and BURP compatible (see Table 10-3). The macroinvertebrate, fish and habitat data types are run through the appropriate DEQ multimetric indexes for data integration and ALUS preliminary determinations.

Table 10-3. Summary of data evaluation for Big Cottonwood Creek

Data Type (Source)	Tier	BURP compatible?	Associated with numeric criteria?	Analysis and conclusions reached?	Action
Macroinvertebrate (DEQ)	I	Yes	No	No	Calculate SMI score and assess according to Section 6.
Fish (DEQ)	I	Yes	No	No	Calculate SFI score and assess according to Section 6.
Habitat (DEQ)	I	Yes	No	No	Calculate SHI score and assess according to Section 6.
Bacteria (DEQ)	I	Yes	Yes	No	Assess according to Section 7.

10.1.5. Criterion Exceedance Evaluation

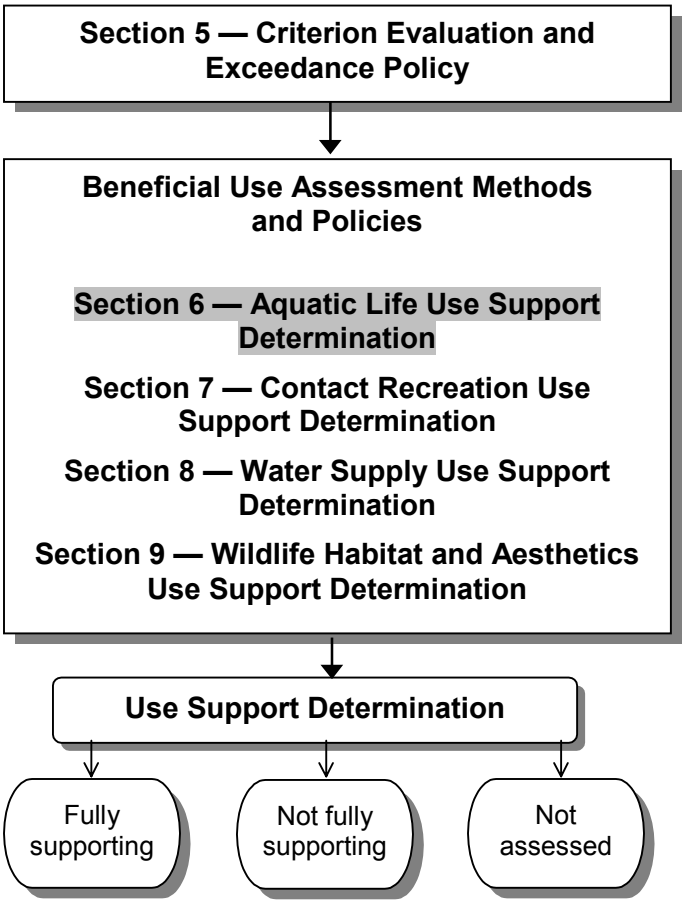
After evaluating the existing and readily available data, the next step is to ensure that the narrative and numeric criteria policies, as described in Section 5, are taken into consideration during beneficial use assessments.



DEQ assesses narrative and numeric criteria for each beneficial use, beginning with aquatic life use support determinations, and ascertains their effect on the support status determinations. For narrative criteria, DEQ depends largely on biological data to interpret impacts to the beneficial use. Sections 4.3 and 5.1 describe policies concerning use of other data types to interpret narrative criteria. For this example, DEQ will interpret narrative criteria using biological data as applied in Section 6. Other than bacteria data, DEQ is not aware of any other data collected that was associated with numeric criteria.

10.1.6. Aquatic Life Use Support Determination

The aquatic life use support determination involves making a support/non-support determination for cold water aquatic life uses as well as salmonid spawning uses. The processes for making these determinations follow.



10.1.6.1. ALUS Determination for Cold Water Aquatic Life

The assessor calculates the stream index for the macroinvertebrate, fish, and habitat BURP data. Table 10-4 summarizes the index calculations for the available BURP compatible data. The assessor then assigns condition ratings to each index score for data integration purposes. In assigning these ratings, the assessor uses the following classifications: basins (Table 6-1, SMI), range (Table 6-2 SFI), and Snake River Basin/High Desert (Table 6-3 SHI) classifications. These corresponding condition ratings are also shown in Table 10-4.

Table 10-4. Stream index scores and corresponding condition ratings for Big Cottonwood Creek

Monitoring Station	SMI Score	SMI Condition Rating	SFI Score	SFI Condition Rating	SHI Score	SHI Condition Rating	Condition Rating Average
Site	87	3	79	2	82	3	2.67

DEQ averages the condition ratings to integrate the different index scores. The result for Big Cottonwood Creek is 2.67. If there had been two BURP sites, DEQ uses the lower average of the condition ratings. If there had been more than two monitoring sites, then DEQ takes an average of all the condition ratings.

The assessor is now ready to make a preliminary ALUS determination. There are no numeric criteria exceedances (see Section 10.1.4) or index scores below the minimum threshold breakpoints (see Table 10-4 and the corresponding threshold tables in Section 6). The average condition rating for the stream index scores greater than 2.0 resulting in a fully supporting preliminary determination. Figure 10-4 depicts this decision process.

10.1.6.2. ALUS Determination for Salmonid Spawning

DEQ evaluates salmonid spawning within the context of the ALUS determination and applicable numeric criteria through a two-step process. First, the assessor uses the preliminary ALUS determination. This determination is considered to be the same for cold water aquatic life and salmonid spawning before applicable numeric criteria are applied. Consequently, the preliminary salmonid spawning determination is fully supporting.

Next, the assessor determines if a numeric criteria violation has occurred specific to salmonid spawning (see WQS § 250.02.3, Section 5.2.4., and Section 6.5.2). Since there was no data associated with salmonid spawning numeric criteria, salmonid spawning does not require further assessment and is determined fully supporting. Figure 10-5 depicts this decision process.

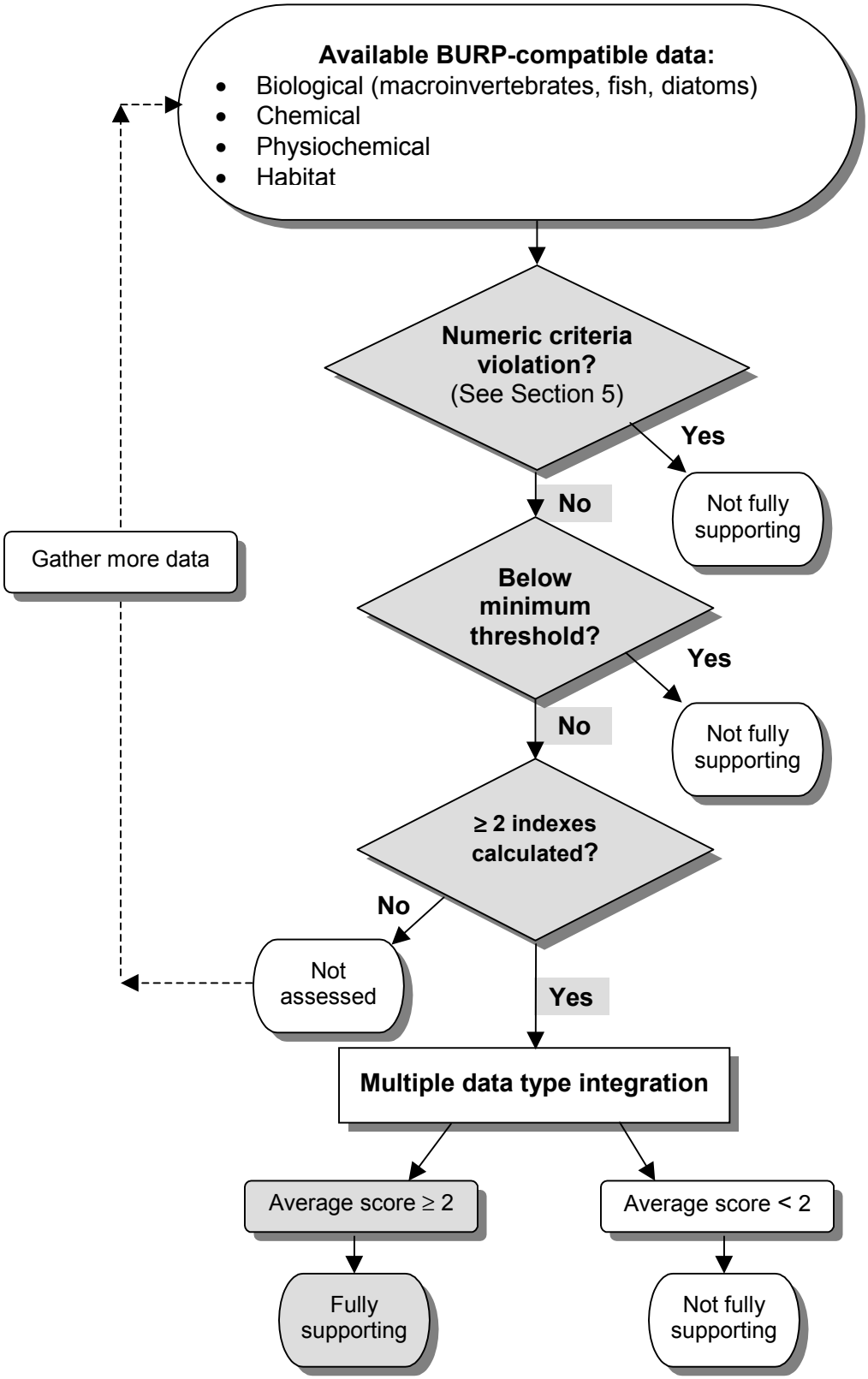


Figure 10-4. Stream cold water aquatic life use support determination for Big Cottonwood Creek

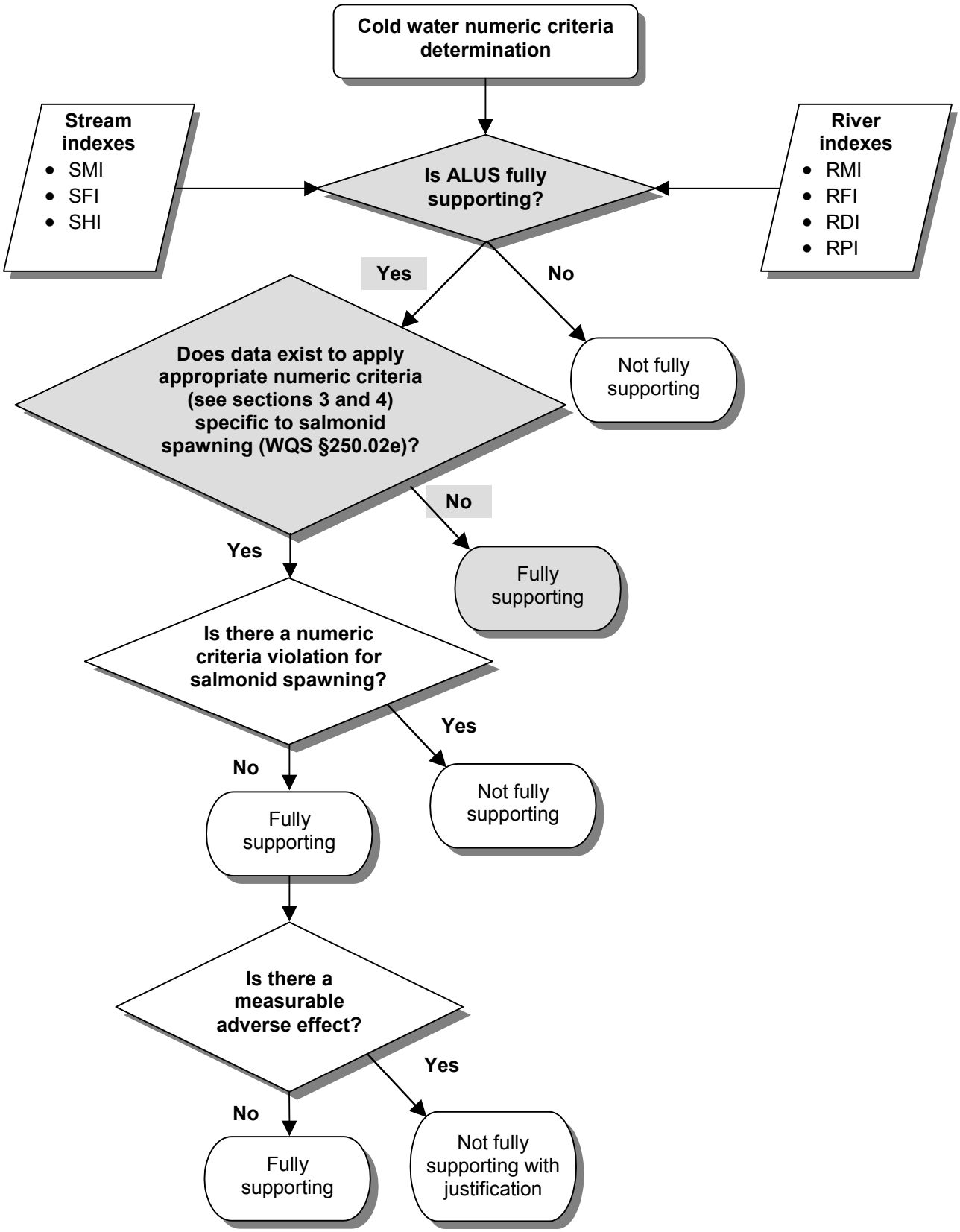
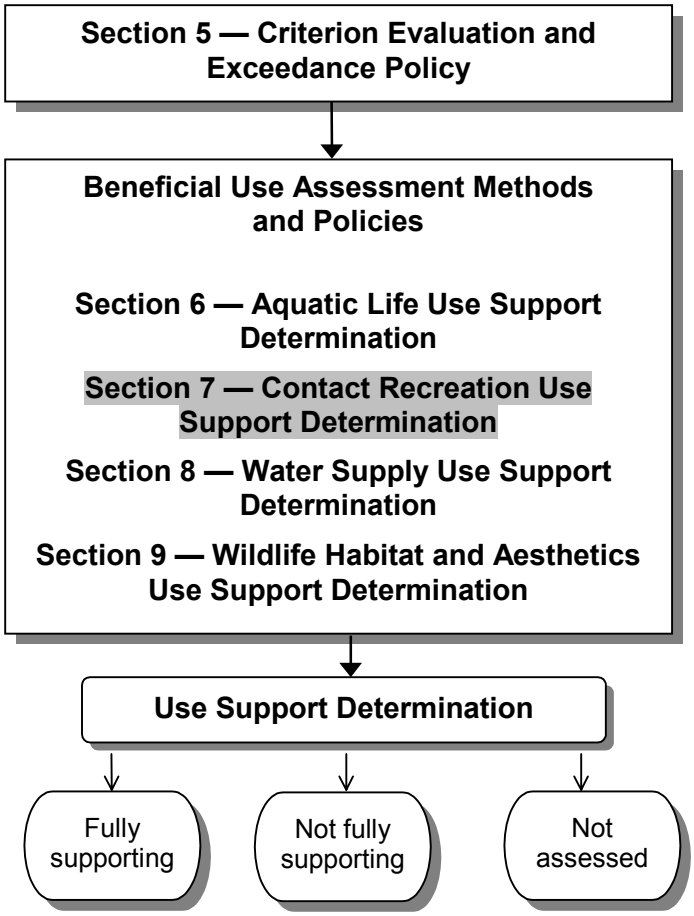


Figure 10-5. Stream salmonid spawning use support determination for Big Cottonwood Creek

10.1.7. Contact Recreation Use Support Determination



To determine the support status of contact recreation, DEQ normally assesses bacteria data. There may be cases where other data apply (see Section 7.2.). For this example, the bacteria data did not indicate any exceedance of the numeric criteria standard. Specifically, the grab sample was 40 *E. coli* colonies per 100 ml and considerably less than the primary contact instantaneous stream criteria of 406 *E. coli* per 100 ml. Therefore, primary contact recreation is fully supporting. Figure 10-6 depicts this decision process.

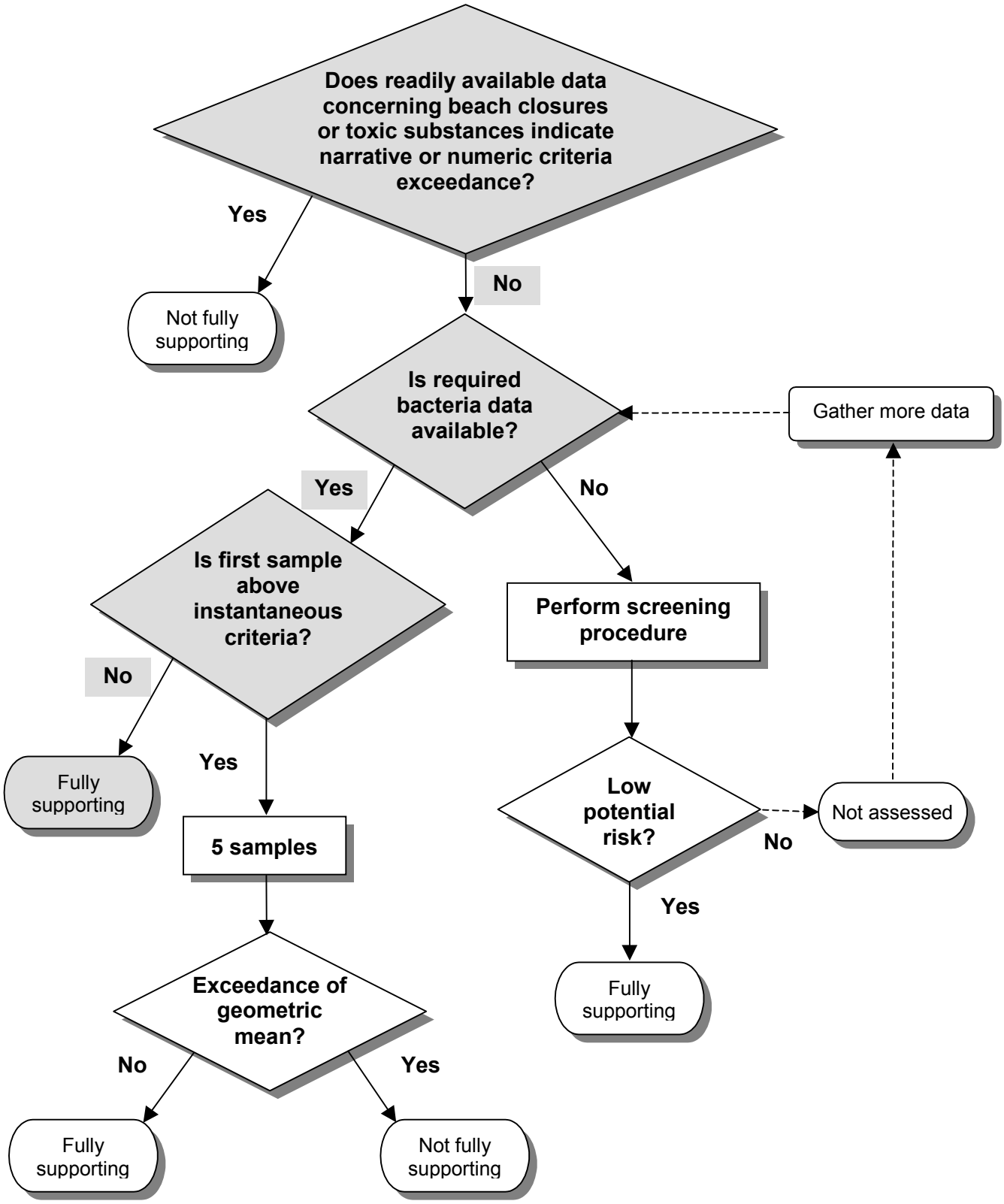


Figure 10-6. Contact recreation use support determination for Big Cottonwood Creek

10.1.8. Summary of Beneficial Use Support Determinations for Big Cottonwood Creek

Sections 8 and 9 address the other beneficial uses. At this time, DEQ policy is to assume these uses are fully supporting unless there is evidence to the contrary. For this example, there was no evidence to the contrary for these beneficial uses. Table 10-5 summarizes the assessment results of Big Cottonwood Creek which is determined to be fully supporting.

Table 10-5. Summary of beneficial use support determinations for Big Cottonwood Creek

Beneficial Use	Support Determination	Basis for Determination
Aquatic Life	Fully Supporting	Index data integration indicates fully supporting.
Contact Recreation	Fully Supporting	Bacteria results.
Water Supply, Wildlife Habitat, and Aesthetics	Fully Supporting	No evidence to the contrary and policy.

10.2. Example 2 - Deer Creek

10.2.1. Water Body Identification and Stratification

Deer Creek is a third order stream located in the Bruneau River HUC #17050102 (see Figure 10-7). This water body originates in Nevada and flows approximately 8.7 miles in Idaho (see Figure 10-8). The assessment unit for this example is located about one mile above Three Creek Road in a shallow canyon. The watershed is mainly shrubland and the major land use in this area is grazing with limited recreation. The creek is diverted below the BURP site and becomes intermittent especially during the summer months.

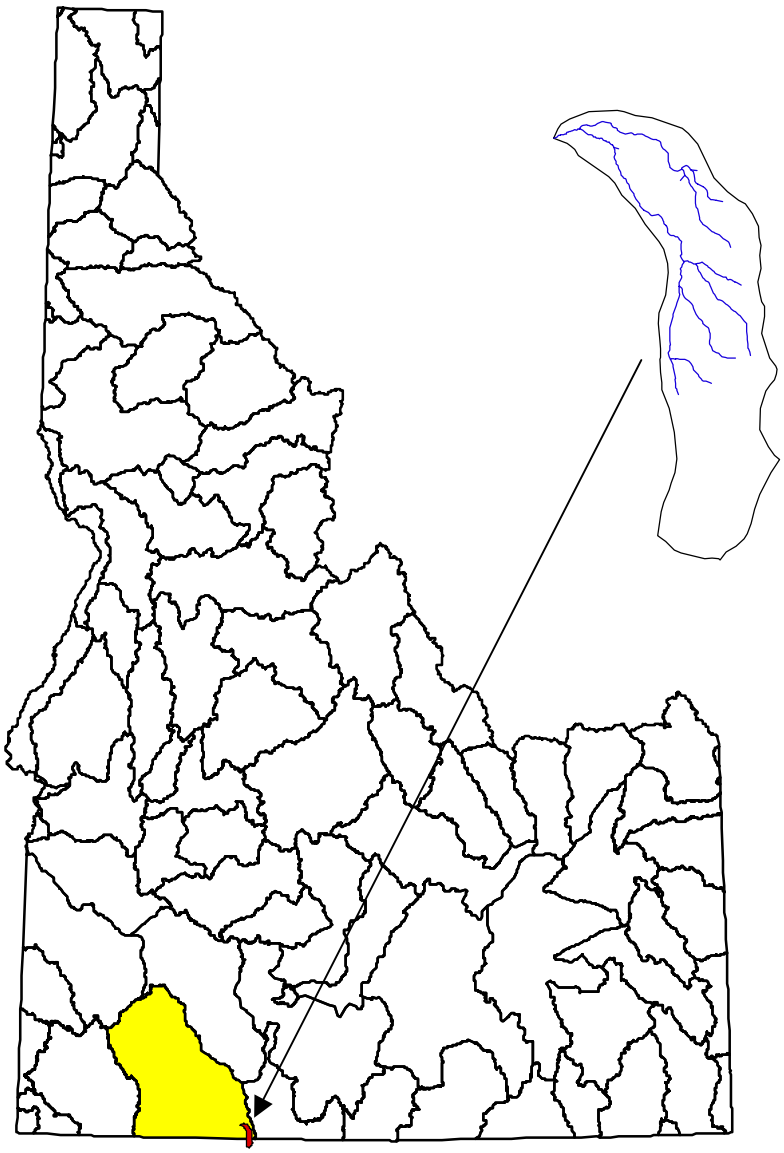


Figure 10-7. Deer Creek located in Bruneau HUC #17050102

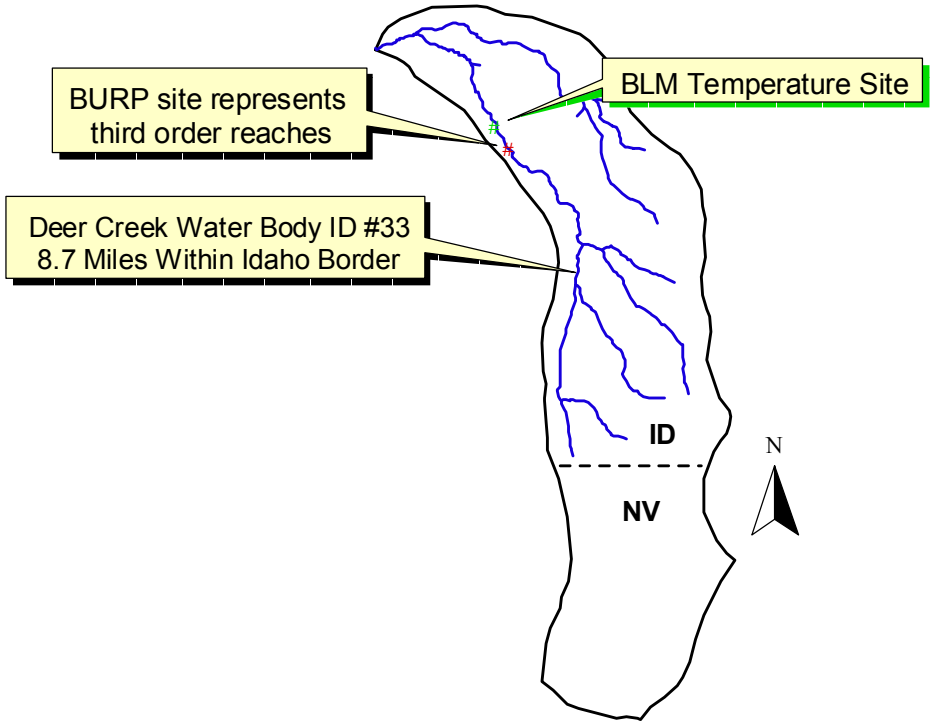


Figure 10-8. Deer Creek in 6th Field HUC #170501021003

10.2.2. Water Body Size Determination

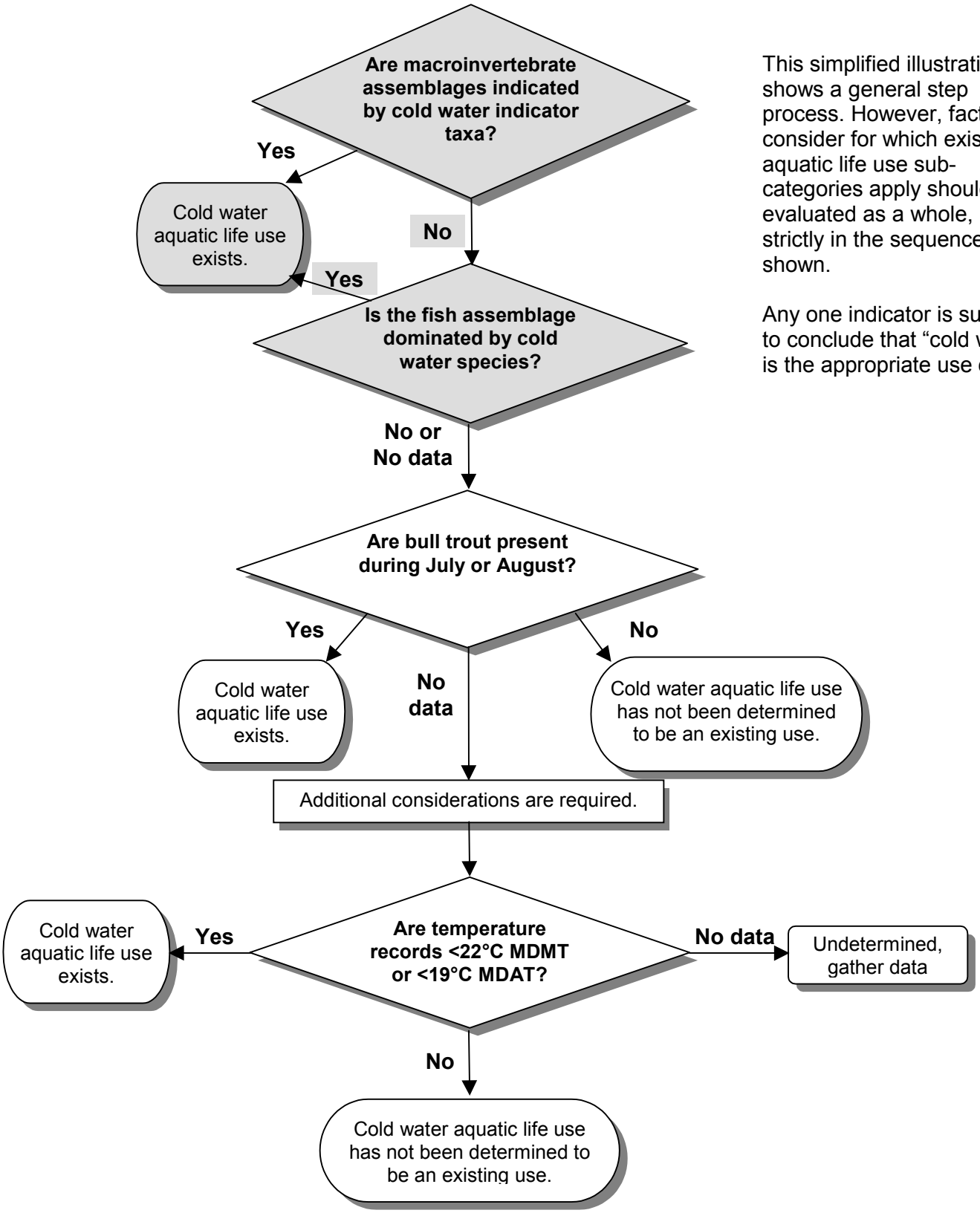
The average rating of water body size criteria is 1 and accordingly, Deer Creek is classified as a stream. Table 10-6 summarizes the results of the water body size determination.

Table 10-6. Summary of water body size criteria results for Deer Creek

Criteria	Value	Rating
Stream order	3.00	1
Average width at base flow (m)	2.70	1
Average depth at base flow (m)	0.18	1
	Average Rating	1

10.2.3. Identification of Beneficial Uses for Assessment

Deer Creek is an undesignated water body. The electrofishing sample was comprised entirely of rainbow trout, a cold water species. Consequently, the cold water aquatic life beneficial use was identified because the fish assemblage was dominated by cold water species (see Section 3 and Appendix C). Figure 10-10 illustrates this identification. Since the sample had juvenile salmonids measuring less than 100 mm, salmonid spawning was also identified as a beneficial use. Lastly, secondary contact recreation was selected since this stream is fairly small and has limited recreation.



This simplified illustration shows a general step process. However, factors to consider for which existing aquatic life use sub-categories apply should be evaluated as a whole, not strictly in the sequence shown.

Any one indicator is sufficient to conclude that "cold water" is the appropriate use class.

Figure 10-9. Identification of Beneficial Uses for Deer Creek

10.2.4. Evaluation of Existing and Readily Available Data

DEQ collected macroinvertebrate, fish, and habitat data at one BURP site in the lower section of the stream. BLM collected temperature data from June 4 – September 23, 1997, approximately one-quarter mile downstream from the BURP site. The macroinvertebrate, fish, and habitat data were collected using BURP protocols and consequently, are evaluated as TIER I and BURP compatible. The temperature data was collected using thermagraphs and also met Tier I criteria. Table 10-7 summarizes the evaluation of existing and readily available data.

Table 10-7. Summary of data evaluation for Deer Creek

Data Type (Source)	Tier	BURP compatible?	Associated with numeric criteria?	Analysis and conclusions reached?	Action
Macroinvertebrate (DEQ)	I	Yes	No	No	Calculate SMI score and assess according to Section 6.
Fish (DEQ)	I	Yes	No	No	Calculate SFI score and assess according to Section 6.
Habitat (DEQ)	I	Yes	No	No	Calculate SHI score and assess according to Section 6.
Temperature (BLM)	I	NA	Yes	No	Assess according to Section 5.

10.2.5. Criterion Exceedance Evaluation

Section 5 describes the policies for evaluating narrative and numeric criteria. DEQ interprets narrative criteria using biological data as applied in the ALUS process.

Temperature was the only data type associated with numeric criteria. DEQ uses guidance found in Section 5.2.1-4 to interpret temperature data for the cold water aquatic life and salmonid spawning. The assessor first determines if there is a temperature exemption due to air temperature extremes during the time of data collection (see Section 5.2.2.and Appendix E). There is no temperature exemption, so the assessor next determines if the temperature was measured during the critical time period for cold water aquatic life and salmonid spawning.

The temperature data was collected from June through September and therefore meets the critical time period requirement for cold water aquatic life (i.e., June 22 through September 21; see Section 5.2.1.). Next, the assessor identifies fish species collected during the BURP monitoring and uses Table 5-2 or Appendix F to ensure data were collected during the critical salmonid spawning time period. The critical spawning period for redband/rainbow trout is March 15 through July 15. DEQ evaluates the BLM temperature data within this time period to evaluate exceedances specific to salmonid spawning criteria (see Appendix D).

The next step is to calculate the percent of temperature exceedances for cold water aquatic life and salmonid spawning. If the percent of temperature exceedances is greater than 10, then DEQ determines a numeric criterion violation has occurred. Table 10-8 provides a summary of these numeric criteria results that will be incorporated in ALUS determinations described in Section 6.

Table 10-8. Summary of criteria exceedances and violations for Deer Creek

Beneficial Use	Criterion	% Exceedance	Violation
Cold Water Aquatic Life	19°C daily average	1%	No
	22°C daily maximum	22%	Yes
Salmonid Spawning (Spring)	9°C daily average	95%	Yes
	13°C daily maximum	73%	Yes

10.2.6. Aquatic Life Use Support Determination

10.2.6.1. ALUS Determination for Cold Water Aquatic Life

Table 10-9 summarizes the macroinvertebrate, fish and habitat index calculations for the available BURP compatible data. These index results then receive condition ratings for data integration purposes. In assigning these ratings, the assessor uses the following classifications: basins (Table 6-1, SMI), rangeland (Table 6-2 SFI), and Snake River Basin/High Desert (Table 6-3 SHI) classifications.

Table 10-9. Stream index scores and corresponding condition ratings for Deer Creek

Monitoring Station	SMI Score	SMI Condition Rating	SFI Score	SFI Condition Rating	SHI Score	SHI Condition Rating	Condition Rating Average
Site	35	NA	79	2	68	3	2.5

The assessor observes the particularly low SMI score relative to the SFI and SHI scores. In reviewing the macroinvertebrate data sheet, the assessor notes only 121 individuals were collected. DEQ attempts to collect a minimum of 500 individuals and does not calculate the SMI index if there are less than 150 individuals in the sample. This example

illustrates the benefit of using more than one assemblage to make an ALUS determination.

After noting the low macroinvertebrate sample size, the assessor then incorporates numeric criteria results. Although the average condition rating is 2.5, there are violations of the cold water aquatic life temperature numeric criteria (see Table 10-8) resulting in a not fully supporting determination. Figure 10-10 depicts this decision process.

10.2.6.2. ALUS Determination for Salmonid Spawning

As mentioned previously, DEQ evaluates salmonid spawning within the context of the ALUS determination and applicable numeric criteria. The preliminary ALUS determination indicated not fully supporting due to cold water aquatic life numeric criteria violations. Consequently, the salmonid spawning determination is not fully supporting. Salmonid spawning also would have been determined not fully supporting due to violations of specific salmonid spawning criteria. Figure 10-11 illustrates this decision process.

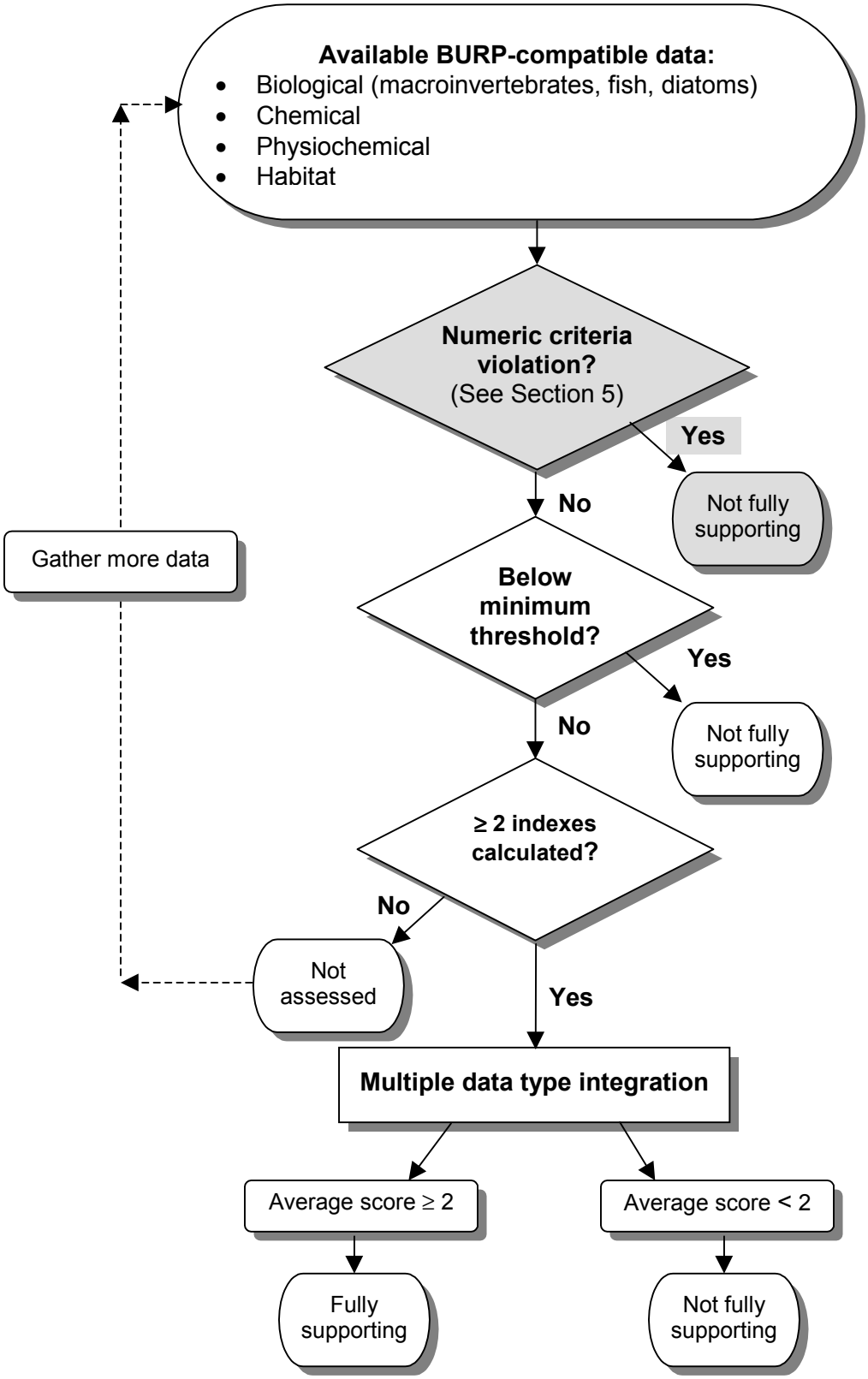


Figure 10-10. Stream cold water aquatic life use support determination for Deer Creek

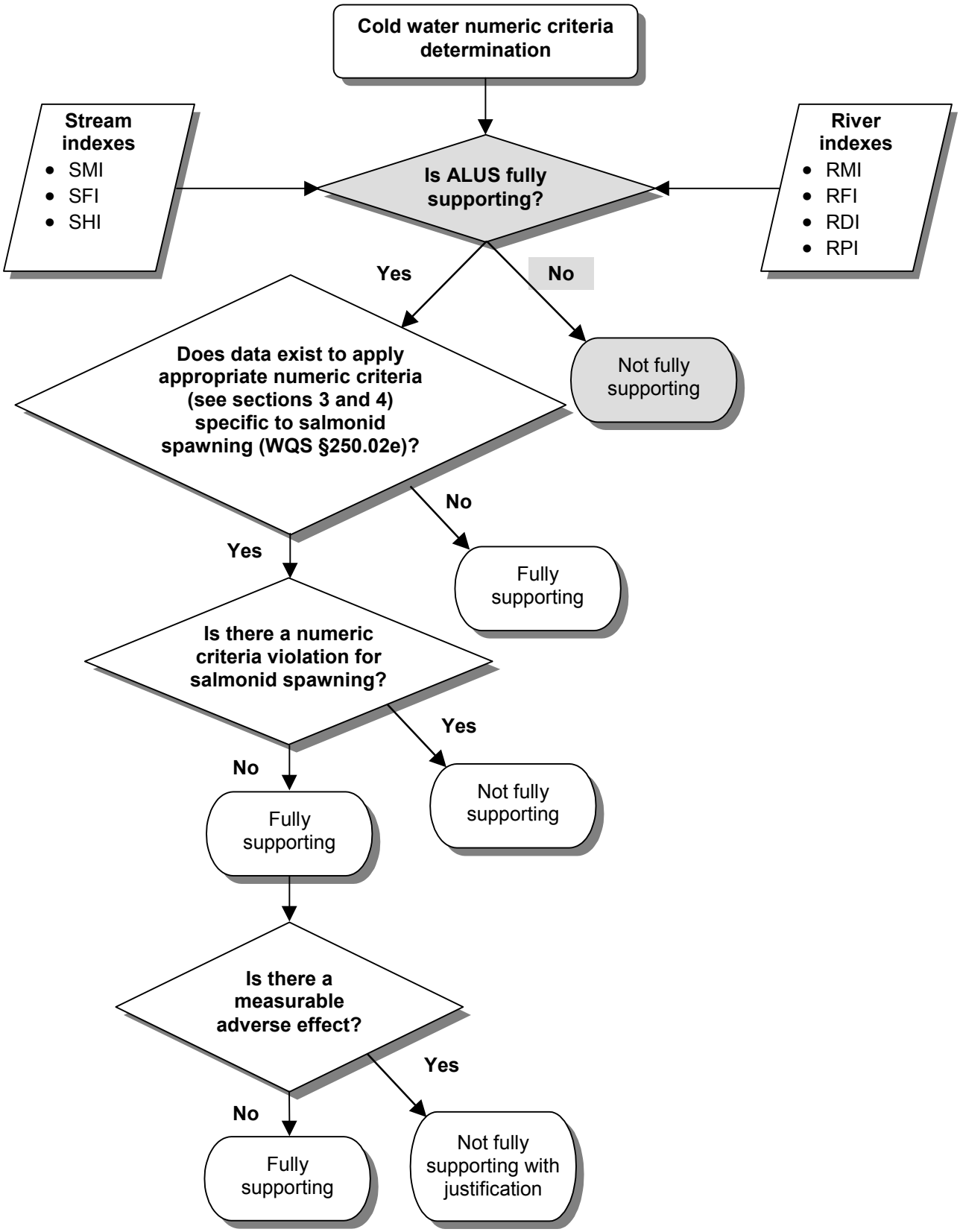


Figure 10-11. Stream salmonid spawning use support determination for Deer Creek

10.2.7. Contact Recreation Use Support Determination

For this example, there were no bacteria data available. As a result, the assessor applies the bacteria screening procedure (see Section 7.4.). This procedure entails using GIS procedures and local knowledge to determine if upstream land uses have the potential for increasing human pathogens. The assessor determined there was medium to high potential risk because moderate grazing occurs in the area. Therefore, contact recreation is unassessed until additional data are collected. Figure 10-12 depicts this decision process.

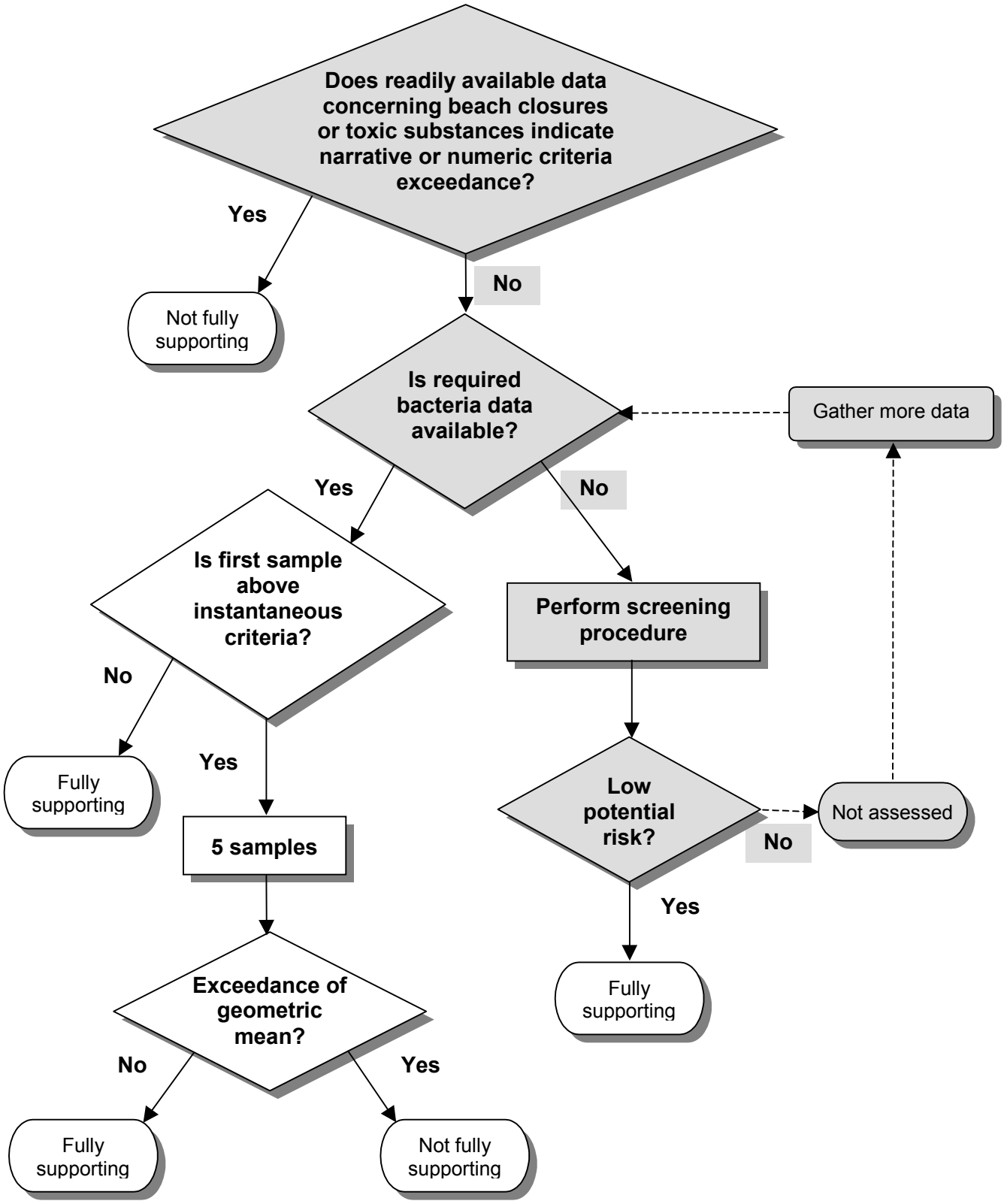


Figure 10-12. Contact recreation use support determination for Deer Creek

10.2.8. Summary of Beneficial Use Support Determinations for Deer Creek

DEQ had no evidence to the contrary of a fully supporting determination for water supply, wildlife habitat, and aesthetic beneficial uses (see Sections 8 through 9). Table 10-10 summarizes the entire Deer Creek assessment and indicates not fully supporting for aquatic life due to temperature criteria violations.

Table 10-10. Summary of beneficial use support determinations for Deer Creek

Beneficial Use	Support Determination	Basis for Determination
Aquatic Life	Not Fully Supporting	Index results indicate fully supporting; however, temperature violations of both cold water aquatic life and salmonid spawning criteria result in a not fully supporting determination.
Contact Recreation	Unassessed	No bacteria data and bacteria screening procedure.
Water Supply, Wildlife Habitat, and Aesthetics	Fully Supporting	No evidence to the contrary and policy.

Section 11. Public Appeals Process

There are several reasons why the public may wish to appeal a beneficial use support determination. First, DEQ may not have used all existing and readily available data in the assessment (see Section 4). Although DEQ attempts to request data from known sources, it is possible to miss data collected by all sources, particularly if those data were not submitted to DEQ for consideration. Also, the public may disagree with a DEQ interpretation of the data results and consequently, the use support determination. This might occur when the assessor diverges from the WBAG and provides a documented rationale for this difference. In this case, the public may not agree with the justification provided by the assessor.

The public may appeal or comment on a water body use support determination during the identified public comment period for that determination. DEQ holds public comment periods for scheduled 303(d) lists (required every two years according to the CWA) and individual subbasin assessments. The public may provide comment concerning use support determinations of specific water bodies at these times.

Individuals should contact the DEQ state office through a public record request (PRR), if they wish to review any appeals. In general, the DEQ state office manages all public appeals and comments associated with the 303(d) list. Appropriate regional offices handle public appeals and comments concerning particular subbasin assessments, and a copy of an appeal will be provided to the DEQ state office for reference only.

Appendix A. Empirically Derived Macroinvertebrate Cold Water Indicator List

Some factors are critical in determining species presence/absence and community structure (Sweeney 1984). One of the factors thought to be key in aquatic community structure is water temperature (Thieneman 1954). The relationship between macroinvertebrates and stream temperature is known for a limited number of taxa. Literature values are helpful but may not reflect the macroinvertebrate assemblages found in Idaho. In an attempt to determine the obligate cold water taxa found in Idaho streams DEQ analyzed the temperature data and macroinvertebrate communities of more than 1000 sampling locations. From this information DEQ was able to determine the probability of an individual taxa being present in any given temperature. Specifically, 137 of 289 common taxa exhibited a distinct temperature preference. Cold water obligates were determined by selecting the taxa that had less than a 10 percent probability of occurring in streams where the water temperature exceeded 19°C. This resulted in 64 cold water obligate taxa. As an additional check the weighted mean of stream temperature and probability of occurrence was calculated. This calculation gave DEQ the preferred temperature of the taxa. The empirically derived obligate cold water taxa as well as the temperature preference of the taxa can be found in Table A-1.

Table A-1. Idaho Cold Water Taxa and Temperature DEQ Preferences

ORDER	Genus/Species	Temperature Preference
Chironomidae (family)	Diamesa sp.	10.00
	Heleniella sp.	8.13
Coleoptera		
	Heterlimnius corpulentus	11.51
	Heterlimnius sp.	11.24
	Lara sp.	11.56
	Narpus sp.	12.58
Diptera		
	Glutops sp.	9.40
	Hesperoconopa sp.	10.76
	Oreogeton sp.	9.29
	Rhabdomastix sp.	10.12
Ephemeroptera		
	Ameletus similor	8.74

ORDER	Genus/Species	Temperature Preference
	Baetis bicaudatus	8.76
	Caudatella hystrix	8.25
	Cinygmula sp.	10.31
	Drunella coloradensis	9.86
	Drunella doddsi	10.47
	Drunella flavilinea/coloradensis	9.98
	Drunella spinifera	10.56
	Epeorus (Ironopsis) sp.	9.95
	Epeorus deceptivus	9.90
	Ephemerellidae	10.97
	Epeorus (Ironopsis) grandis	9.95
	Rhithrogena hageni	8.25
	Rhithrogena robusta	6.84
Plecoptera		
	Cultus sp.	11.04
	Despaxia augusta	7.09
	Kogotus sp.	8.12
	Leuctridae	9.43
	Megarcys sp.	10.15
	Neaviperla sp.	10.93
	Nemouridae	10.03
	Paraperla sp.	9.32
	Perlidae	11.26
	Setvena sp.	7.99
	Sweltsa sp.	11.45
	Taeniopterygidae	6.30
	Visoka cataractae	9.52
	Yoraperla brevis	10.36
	Yoraperla sp.	8.84
	Zapada columbiana	9.71
	Zapada oregonensis gr.	8.80
Trichoptera		
	Anagapetus sp.	8.26
	Apatania sp.	11.04
	Neophylax sp.	10.88
	Neothremma alicia	7.65
	Neothremma sp.	8.66
	Oligophlebodes sp.	7.87
	Parapsyche elsis	9.47
	Parapsyche sp.	9.38
	Rhyacophila alberta gr.	6.47

ORDER	Genus/Species	Temperature Preference
	Rhyacophila betteni gr.	10.61
	Rhyacophila brunnea gr.	10.56
	Rhyacophila hyalinata gr.	10.20
	Rhyacophila iranda gr.	8.02
	Rhyacophila narvae	9.53
	Rhyacophila pellisa	10.22
	Rhyacophila sibirica gr.	7.42
	Rhyacophila vaccua Milne	8.02
	Rhyacophila vagrita gr.	8.63
	Rhyacophila valuma	6.87
	Rhyacophila valuma/pellisa	9.16
	Rhyacophila verrula	7.58
	Rhyacophila vofixa gr.	8.57
Tricladida		
	Polycelis coronata	9.76

Appendix B. Macroinvertebrate Taxa List – Temperature Tolerance

Table B-1 describes the fields used in the macroinvertebrate taxa list with corresponding temperature tolerances (see Table B-2). The temperature tolerance assignments were derived from literature searches and are continually updated. The entire macrinvertebrate taxa list is quite voluminous. For information about other macroinvertebrate attributes or to obtain the most recent taxa list, please contact DEQ Surface Water Program or visit the DEQ web site http://www2.state.id.us/index.htm and follow web links to surface water.

Table B-1. Field descriptions of macroinvertebrate taxa list – temperature tolerance

Field	Description
TAXON	Taxon number assigned by Idaho
TAXONNAME	Taxonomic identification
ORDER	Taxonomic order
FAMILY	Taxonomic family
TEMPTOL	Temperature tolerance derived from literature search. Eurythermal describes a wide range of temperature as opposed to stenothermal which is a narrow range of temperature.

Table B-2. Macroinvertebrate taxa list with corresponding temperature tolerances (sorted by taxon name)

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
993	Ablabesmyia sp.	Chironomidae (family)	Chironomidae	Eurythermal
459	Acamptocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
453	Acari	Acari (subclass)		Eurythermal: warm summer
601	Acentrella insignificans	Ephemeroptera	Baetidae	Eurythermal: warm summer
640	Acentrella sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
781	Acentrella turbida	Ephemeroptera	Baetidae	Eurythermal: warm summer
702	Acentria sp.	Lepidoptera	Pyralidae	
1147	Acricotopus sp.	Chironomidae (family)	Chironomidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
793	Aelosoma sp.	Aphanoneura (class)	Aelosomatidae	Eurythermal: warm summer
4	Aeschnidae	Odonata	Aeschnidae	
932	Aeshna sp.	Odonata	Aeschnidae	Eurythermal: warm summer
992	Agabinus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
588	Agabus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
171	Agapetus sp.	Trichoptera	Glossosomatidae	Eurythermal: warm summer
643	Agathon sp.	Diptera	Blephariceridae	Stenothermal: cold
181	Agraylea sp.	Trichoptera	Hydroptilidae	Eurythermal: cool summer
201	Allocosmoecus partitus	Trichoptera	Limnephilidae	Stenothermal: cold
795	Allognosta sp.			
875	Allomyia sp.	Trichoptera	Apataniidae	Stenothermal: cold
131	Alloperla sp.	Plecoptera	Chloroperlidae	Eurythermal: warm summer
819	Ambiguelmis sp.			
597	Ambrysus sp.	Hemiptera	Naucoridae	Eurythermal: warm summer
962	Ameletus celer	Ephemeroptera	Ameletidae	Eurythermal: cool summer
634	Ameletus connectus	Ephemeroptera	Ameletidae	Eurythermal: cool summer
579	Ameletus cooki	Ephemeroptera	Ameletidae	Eurythermal: cool summer
693	Ameletus similor	Ephemeroptera	Ameletidae	Eurythermal: cool summer
13	Ameletus sp.	Ephemeroptera	Ameletidae	Eurythermal: cool summer
711	Ameletus sparsatus	Ephemeroptera	Ameletidae	Eurythermal: cool summer
587	Ameletus validus	Ephemeroptera	Ameletidae	Eurythermal: cool summer
14	Ameletus velox	Ephemeroptera	Ameletidae	Eurythermal: cool summer
961	Ametor sp.	Coleoptera	Hydrophilidae	Eurythermal: cool summer
718	Ametropus sp.	Ephemeroptera	Ametropodidae	Eurythermal: cool summer
501	Amiocentrus aspilus	Trichoptera	Brachycentridae	Eurythermal: warm summer
232	Amiocentrus sp.	Trichoptera	Brachycentridae	Eurythermal: warm summer
824	Amnicola sp.	Gastropoda (class)	Hydrobiidae	Eurythermal: warm summer
7	Amphiagrion sp.	Odonata	Protoneuridae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
1143	Amphicosmoecus canax	Trichoptera	Limnephilidae	Stenothermal: cold
586	Amphicosmoecus sp.	Trichoptera	Limnephilidae	Stenothermal: cold
82	Amphinemura sp.	Plecoptera	Nemouridae	Eurythermal: warm summer
443	Amphipoda	Amphipoda		Eurythermal: cool summer
249	Amphizoa sp.	Coleoptera	Amphizoidae	Eurythermal: cool summer
257	Ampumixis dispar	Coleoptera	Elmidae	Eurythermal: cool summer
985	Ampumixis sp.	Coleoptera	Elmidae	Eurythermal: cool summer
922	Anabolia sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
1148	Anacaena sp.	Coleoptera	Hydrophilidae	
172	Anagapetus sp.	Trichoptera	Glossosomatidae	Stenothermal: cold
5	Anax sp.	Odonata	Aeschnidae	
852	Anchytarsus sp.	Coleoptera	Ptilodacytilidae	Eurythermal: cool summer
428	Ancylidae	Gastropoda (class)	Ancylidae	Eurythermal: warm summer
444	Anisogammarus sp.	Amphipoda	Gammaridae	Eurythermal: cool summer
973	Anisoptera			
419	Annelida			
574	Anodonta nuttalliana idahoensis			
454	Anodonta sp.	Bivalvia (class)	Unionidae	Eurythermal: warm summer
680	Antocha monticola	Diptera	Tipulidae	Eurythermal: warm summer
284	Antocha sp.	Diptera	Tipulidae	Eurythermal: warm summer
212	Apatania sp.	Trichoptera	Apataniidae	Stenothermal: cold
211	Apataniinae	Trichoptera	Limnephilidae	Eurythermal: cool summer
999	Apedilum sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
861	Arachnidae (T)		Arachnidae	
968	Araneae			
920	Archanara sp.	Lepidoptera	Noctuidae	
919	Arctopora sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
845	Arctopsyche californica			
192	Arctopsyche grandis	Trichoptera	Hydropsychidae	Eurythermal: cool summer
191	Arctopsyche sp.	Trichoptera	Hydropsychidae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
190	Arctopsychinae	Trichoptera	Hydropsychidae	Eurythermal: cool summer
8	Argia sp.	Odonata	Coenagrionidae	Eurythermal: warm summer
476	Asellidae	Ephemeroptera	Asellidae	Eurythermal: warm summer
449	Asellus occidentalis			
448	Asellus sp.			
474	Astacidae	Decapoda	Astacidae	Eurythermal: warm summer
1162	Asynarchus sp.	Trichoptera	Limnephilidae	
311	Atherix sp.	Diptera	Athericidae	Eurythermal: warm summer
312	Atherix variegata	Diptera	Athericidae	Eurythermal: warm summer
258	Atractelmis sp.	Coleoptera	Elmidae	Eurythermal: cool summer
804	Atrichopogon sp.	Diptera	Ceratopogonidae	Eurythermal: warm summer
38	Attenella delantala	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
600	Attenella margarita	Ephemeroptera	Ephemerellidae	Eurythermal: warm summer
37	Attenella sp.	Ephemeroptera	Ephemerellidae	Eurythermal: warm summer
1061	Aulodrilus limnobius	Oligochaeta (class)	Tubificidae	
1098	Aulodrilus piqueti	Oligochaeta (class)	Tubificidae	
1062	Aulodrilus pluriseta	Oligochaeta (class)	Tubificidae	
1079	Aulodrilus sp.	Oligochaeta (class)	Tubificidae	
16	Baetidae	Ephemeroptera	Baetidae	Eurythermal: warm summer
942	Baetis A. Morihara			
978	Baetis alius	Ephemeroptera	Baetidae	Eurythermal: cool summer
1048	Baetis bi/tricaudatus	Ephemeroptera	Baetidae	
18	Baetis bicaudatus	Ephemeroptera	Baetidae	Stenothermal: cold
790	Baetis flavistriga	Ephemeroptera	Baetidae	Eurythermal: cool summer
481	Baetis insignificans McDunnough			
941	Baetis intercalaris	Ephemeroptera	Baetidae	Eurythermal: cool summer
19	Baetis intermedius Dodds	Ephemeroptera	Baetidae	
869	Baetis notos	Ephemeroptera	Baetidae	Eurythermal: warm summer
791	Baetis parvus (Plauditus armillatus)			
624	Baetis propinquus	Ephemeroptera	Baetidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
17	Baetis sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
20	Baetis tricaudatus	Ephemeroptera	Baetidae	Eurythermal: warm summer
938	Baetis virile (Plauditus virilis)			
855	Barbaetis sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
105	Beloneuria sp.	Plecoptera	Perlidae	
785	Berosus sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
542	Bezzia sp.	Diptera	Ceratopogonidae	Eurythermal: warm summer
841	Bibiocephala sp.	Diptera	Blephariceridae	Stenothermal: cold
1130	Bisancora sp.	Plecoptera	Chloroperlidae	
1137	Bivalvia	Bivalvia (class)		Eurythermal: warm summer
792	Bledius sp.	Coleoptera	Staphylinidae	
592	Blepharicera sp.	Diptera	Blephariceridae	Stenothermal: cold
292	Blephariceridae	Diptera	Blephariceridae	Stenothermal: cold
321	Boreoheptagyia sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
500	Brachycentridae	Trichoptera	Brachycentridae	
234	Brachycentrus americanus	Trichoptera	Brachycentridae	Eurythermal: warm summer
235	Brachycentrus occidentalis	Trichoptera	Brachycentridae	Eurythermal: warm summer
233	Brachycentrus sp.	Trichoptera	Brachycentridae	Eurythermal: warm summer
630	Brachycera sp.			
876	Brachycera sp. DUPLICATE			
923	Brachycera/Cyclorrhaphous			
828	Brachycercus prudens			
465	Branchiobdellida	Branchiobdellida (class)		
323	Brillia flavifrons	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
324	Brillia retifinis	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
322	Brillia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
325	Brundiniella sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
760	Brychius hornii	Coleoptera	Haliplidae	Eurythermal: warm summer
536	Brychius sp.	Coleoptera	Haliplidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
1134	Bryophaenocladius sp.	Chironomidae (family)	Chironomidae	
1144	C. Barr undescribed sp.	Coleoptera	Elmidae	Stenothermal: cold
477	Caecidotea communis			
835	Caecidotea sp.	Isopoda	Asellidae	Eurythermal: warm summer
59	Caenidae	Ephemeroptera	Caenidae	Eurythermal: warm summer
1052	Caenis amica	Ephemeroptera	Caenidae	Eurythermal: warm summer
878	Caenis latipennis	Ephemeroptera	Caenidae	Eurythermal: warm summer
1099	Caenis punctata	Ephemeroptera	Caenidae	
60	Caenis sp.	Ephemeroptera	Caenidae	Eurythermal: warm summer
1053	Caenis youngi	Ephemeroptera	Caenidae	Eurythermal: warm summer
1084	Calanioda			
109	Calineuria californica	Plecoptera	Perlidae	Eurythermal: warm summer
106	Calineuria sp.	Plecoptera	Perlidae	Eurythermal: warm summer
970	Calineuria/Doroneuria			
21	Callibaetis sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
137	Callicorixa sp.	Hemiptera	Corixidae	Eurythermal: warm summer
752	Calliperla sp.	Plecoptera	Perlodidae	
617	Caloparyphus sp.	Diptera	Stratiomyidae	Eurythermal: warm summer
1060	Calopterygidae	Odonata	Calopterygidae	Eurythermal: cool summer
11	Calopteryx sp.	Odonata	Calopterygidae	Eurythermal: cool summer
805	Camelobaetidius sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
1097	Camelobaetidius warreni	Ephemeroptera		Eurythermal: warm summer
1100	Camptocladius sp.	Chironomidae (family)	Chironomidae	
101	Capnia sp.	Plecoptera	Capniidae	Stenothermal: cold
100	Capniidae	Plecoptera	Capniidae	Stenothermal: cold
280	Carabidae	Coleoptera	Carabidae	
1000	Cardiocladius albiplumus	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
326	Cardiocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
120	Cascadoperla sp.	Plecoptera	Perlodidae	Stenothermal: cold

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
40	Caudatella edmundsi	Ephemeroptera	Ephemerellidae	Stenothermal: cold
41	Caudatella heterocaudata	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
42	Caudatella hystrix	Ephemeroptera	Ephemerellidae	Stenothermal: cold
39	Caudatella sp.	Ephemeroptera	Ephemerellidae	Stenothermal: cold
946	Caurinella idahoensis	Ephemeroptera	Ephemerellidae	Stenothermal: cold
933	Caurinella sp.	Ephemeroptera	Ephemerellidae	Senothermal: cold
773	Cenocorixa bifida bifida	Hemiptera	Corixidae	Eurythermal: warm summer
497	Cenocorixa bifida hungerfordi	Hemiptera	Corixidae	Eurythermal: warm summer
138	Cenocorixa sp.	Hemiptera	Corixidae	Eurythermal: warm summer
22	Centroptilum sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
611	Ceraclea sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
1101	Ceraclea tansversa	Trichoptera		Eurythermal: warm summer
291	Ceratopogonidae	Diptera	Ceratopogonidae	Eurythermal: warm summer
770	Ceratopogoninae	Diptera	Ceratopogonidae	Eurythermal: warm summer
327	Ceratopsyche sp.	Trichoptera	Hydropsychidae	
930	Chaetarthria sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
1102	Chaetogaster diastrophus	Oligochaeta (class)	Naididae	
1167	Chaetogaster sp.	Oligochaeta (class)	Naididae	
1163	Chaoboridae	Diptera	Chaoboridae	
994	Chaoborus sp.	Diptera	Chaoboridae	Eurythermal: warm summer
306	Chelifera sp.	Diptera	Empididae	Eurythermal: warm summer
508	Cheumatopsyche campyla			
509	Cheumatopsyche enonis			
510	Cheumatopsyche pettiti			
197	Cheumatopsyche sp.	Trichoptera	Hydropsychidae	Eurythermal: warm summer
593	Chimarra sp.	Trichoptera	Philopotamidae	Eurythermal: warm summer
319	Chironomidae	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
945	Chironominae	Chironomidae (family)	Chironomidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
543	Chironomini	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
328	Chironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
130	Chloroperlidae	Plecoptera	Chloroperlidae	Eurythermal: warm summer
977	Chloroperlinae	Plecoptera	Chloroperlidae	
638	Choroterpes sp.	Ephemeroptera	Leptophlebiidae	Eurythermal: warm summer
604	Chromagrion sp.	Odonata	Coenagrionidae	Eurythermal: hot summer
648	Chrysomelidae	Coleoptera	Chrysomelidae	
652	Chrysops sp.	Diptera	Tabanidae	Eurythermal: warm summer
1085	Chydoridae			
215	Chyranda centralis	Trichoptera	Limnephilidae	Stenothermal: cold
214	Chyranda sp.	Trichoptera	Limnephilidae	Stenothermal: cold
728	Cinygma integrum	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
25	Cinygma sp.	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
26	Cinygmula sp.	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
108	Claassenia sabulosa	Plecoptera	Perlidae	Eurythermal: cool summer
107	Claassenia sp.	Plecoptera	Perlidae	Eurythermal: cool summer
440	Cladocera			Eurythermal: warm summer
995	Cladopelma sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
329	Cladotanytarsus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
885	Cleptelmis addenda	Coleoptera	Elmidae	Eurythermal: cool summer
260	Cleptelmis ornata	Coleoptera	Elmidae	
259	Cleptelmis sp.	Coleoptera	Elmidae	Eurythermal: cool summer
307	Clinocera sp.	Diptera	Empididae	Eurythermal: warm summer
982	Clinocera/Oreogeton			
1093	Clostoeca disjucta	Trichoptera	Limnephilidae	
703	Clostoeca sp.	Trichoptera	Limnephilidae	
969	Coenagrion/Enallagma sp.	Odonata	Coenagrionidae	
6	Coenagrionidae	Odonata	Coenagrionidae	Eurythermal: hot summer
533	Coleoptera	Coleoptera		Eurythermal: warm summer
671	Collembola	Collembola		

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
888	Colymbetes sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
330	Conchapelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
331	Constempellina sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
441	Copepoda	Copepoda		Eurythermal: warm summer
636	Coptotomus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
990	Corbicula fluminea	Bivalvia (class)	Corbiculidae	Eurythermal: warm summer
670	Cordulegaster sp.	Odonata	Cordulegasteridae	
832	Cordulliidae	Odonata	Cordulidae	
139	Corisella sp.	Hemiptera	Corixidae	Eurythermal: warm summer
136	Corixidae	Hemiptera	Corixidae	Eurythermal: warm summer
551	Corticacarus delicatus			
150	Corydalidae	Megaloptera	Corydalidae	Eurythermal: warm summer
332	Corynoneura sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm
883	Cosmopterigida Pyroderceo			
989	Crangonyx sp.	Amphipoda	Crangonyctidae	Eurythermal: cool summer
277	Crenitis sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
336	Cricotopus (Isocladius) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1103	Cricotopus (Isocladius) Type I	Chironomidae (family)	Chironomidae	Eurythermal: cool
337	Cricotopus (Nostococladius) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
334	Cricotopus bicinctus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
335	Cricotopus festivellus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1001	Cricotopus ornatus	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
333	Cricotopus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
338	Cricotopus tremulus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
339	Cricotopus trifascia gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
472	Crustacea			Unknown
202	Cryptochia sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
340	Cryptochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
870	Cryptolabis sp.	Diptera	Tipulidae	Eurythermal: cool summer
1002	Cryptotendipes sp.	Chironomidae (family)	Chironomidae	Stenothermal: warm
724	Crysomelidae			
293	Culicidae	Diptera	Culicidae	Eurythermal: warm summer
503	Culoptila cantha	Trichoptera	Glossosomatidae	Eurythermal: warm summer
1091	Culoptila sp.	Trichoptera	Glossosomatidae	Eurythermal: warm summer
116	Cultus sp.	Plecoptera	Perlodidae	Eurythermal: cool summer
682	Curculionidae	Coleoptera	Curculionidae	Eurythermal: warm summer
762	Cyclopoida			
866	Cylloepus sp.	Coleoptera	Elmidae	Eurythermal: warm summer
842	Cymatia sp.	Hemiptera	Corixidae	Eurythermal: warm summer
1171	Dactylolabis sp.	Ephemeroptera	Baetidae	
749	Daphnia dp.			
450	Decapoda	Decapoda		Unknown
1003	Demicryptochirono mus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1063	Dero digitata	Oligochaeta (class)	Naididae	
1064	Dero nivea	Oligochaeta (class)	Naididae	
1065	Dero sp.	Oligochaeta (class)	Naididae	
662	Deronectes sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
684	Deronectes striatellus LeConte			
850	Desmona sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
949	Desmopachria sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
94	Despaxia augusta	Plecoptera	Leuctridae	Stenothermal: cold
578	Despaxia sp.	Plecoptera	Leuctridae	Stenothermal: cold
956	Deuterophlebia inyoensis			
583	Deuterophlebia nielsoni Kennedy			
1153	Deuterophlebia personata	Diptera	Deuterophlebiidae	
294	Deuterophlebia sp.	Diptera	Deuterophlebiidae	Stenothermal: cold
664	Deuterophlebiidae	Diptera	Deuterophlebiidae	Stenothermal: cold
341	Diamesa sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
575	Diamesinae	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
937	Diamesini	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
458	Diaptomus pribilofensis			
860	Dibusa sp.	Trichoptera	Hydroptilidae	
200	Dicosmoecinae	Trichoptera	Limnephilidae	
204	Dicosmoecus atripes	Trichoptera	Limnephilidae	Eurythermal: cool summer
205	Dicosmoecus gilvipes	Trichoptera	Limnephilidae	Eurythermal: warm summer
203	Dicosmoecus sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
285	Dicranota sp.	Diptera	Tipulidae	Eurythermal: warm summer
342	Dicrotendipes sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
468	Dina sp.			
839	Dineutus sp.	Coleoptera	Gyrinidae	Eurythermal: warm summer
679	Diphetor hageni	Ephemeroptera	Baetidae	Eurythermal: warm summer
901	Diphetor sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
736	Diplectrona sp.	Trichoptera	Hydropsychidae	Eurythermal: cool
1132	Diplocladius sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
281	Diptera	Diptera		Unknown
769	Disanycha sp.			
117	Diura knowltoni	Plecoptera	Perlodidae	Eurythermal: cool summer
917	Diura sp.	Plecoptera	Perlodidae	Eurythermal: cool summer
296	Dixa sp.	Diptera	Dixidae	Eurythermal: warm summer
675	Dixella sp.	Diptera	Dixidae	Eurythermal: warm summer
295	Dixidae	Diptera	Dixidae	Eurythermal: warm summer
1104	Djalmabatista sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
78	Doddsia occidentalis	Plecoptera	Taeniopterygidae	Stenothermal: cold
698	Dolichopodidae	Diptera	Dolichopodidae	Eurythermal: warm summer
188	Dolophilodes sp.	Trichoptera	Philopotamidae	Eurythermal: cool summer
837	Donacia sp.	Coleoptera	Chrysomelidae	
111	Doroneuria baumanni	Plecoptera	Perlidae	Stenothermal: cold
110	Doroneuria sp.	Plecoptera	Perlidae	Stenothermal: cold

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
112	Doroneuria theodora	Plecoptera	Perlidae	Stenothermal: cold
44	Drunella coloradensis	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
43	Drunella doddsi	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
46	Drunella flavilinea	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
622	Drunella flavilinea/coloradensis	Ephemeroptera	Ephemerellidae	
51	Drunella grandis	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
47	Drunella pelosa	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
45	Drunella sp.	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
48	Drunella spinifera	Ephemeroptera	Ephemerellidae	Stenothermal: cold
591	Drunella spinifera/grandis			
534	Dryopidae	Coleoptera	Dryopidae	Eurythermal: warm summer
780	Dubiraphia giullianii	Coleoptera	Elmidae	Eurythermal: warm summer
261	Dubiraphia sp.	Coleoptera	Elmidae	Eurythermal: warm summer
607	Dugesia sp.			
608	Dugesia tigrina	Tricladida	Planariidae	Eurythermal: warm summer
251	Dytiscidae	Coleoptera	Dytiscidae	Eurythermal: warm summer
879	Dytiscus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
206	Ecclisocosmoecus scylla	Trichoptera	Limnephilidae	
207	Ecclisomyia sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
1066	Eclipidrilus sp.	Oligochaeta (class)	Tubificidae	
895	Ectopria sp.	Coleoptera	Psephenidae	Eurythermal: cool summer
343	Einfeldia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
621	Elephantomyia			
253	Elmidae	Coleoptera	Elmidae	Eurythermal: warm summer
305	Empididae	Diptera	Empididae	Eurythermal: warm summer
972	Empidoidea			
9	Enallagma sp.	Odonata	Coenagrionidae	Eurythermal: hot summer
889	Enallagma/Ischnura			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
935	Enchytraeidae	Oligochaeta (class)	Enchytraeidae	
344	Endochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1004	Endochironomus subtendens	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1158	Enochrus sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
478	Entocytheridae			
687	Entomobryidae (T)		Entomobryidae	
686	Eocosmoecus schmidi	Trichoptera	Limnephilidae	Stenothermal: cold
666	Eocosmoecus sp.	Trichoptera	Limnephilidae	Stenothermal: cold
27	Epeorus (Ironopsis) sp.	Ephemeroptera	Heptageniidae	
844	Epeorus (Ironopsis) sp. DUPLICATE	Ephemeroptera	Heptageniidae	
28	Epeorus albertae	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
29	Epeorus deceptivus	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
30	Epeorus iron			
31	Epeorus longimanus	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
729	Ephemera sp.	Ephemeroptera	Ephemeridae	Eurythermal: cool summer
656	Ephemerella alleni	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
50	Ephemerella aurivillii	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
940	Ephemerella edmundsi (Caudatella edmundsi)			
963	Ephemerella grandis (Drunnella grandis)			
52	Ephemerella inermis Eaton			
616	Ephemerella inermis/infrequens	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
657	Ephemerella infrequens	Ephemeroptera	Ephemerellidae	Stenothermal: cold
817	Ephemerella lacustris			
49	Ephemerella sp.	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
36	Ephemerellidae	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
731	Ephemeridae	Ephemeroptera	Ephemeridae	Eurythermal: cool summer
480	Ephemeroptera	Ephemeroptera		

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
488	Ephoron sp.	Ephemeroptera	Polymitarcyidae	Eurythermal: warm summer
314	Ephydridae	Diptera	Ephydridae	Eurythermal: warm summer
767	Erioptera sp.	Diptera	Tipulidae	UNKNOWN
894	Erpetogomphus sp.	Odonata	Gomphidae	
952	Erpobdella punctata			
467	Erpobdellidae	Hirudinea (class)	Erpobdellidae	Stenothermal: cold
871	Erythropdiplax sp.	Odonata	Libellulidae	Eurythermal: hot summer
423	Eubranchiopoda			
820	Eubrianax edwardsi	Coleoptera	Psephenidae	
279	Eubrianax sp.	Coleoptera	Psephenidae	Eurythermal: warm summer
103	Eucapnopsis brevicauda			
775	Eucorethra sp.	Diptera	Chaoboridae	
346	Eukiefferiella brehmi gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
347	Eukiefferiella brevicalcar gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1105	Eukiefferiella brevicalcar Type I	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1106	Eukiefferiella brevicalcar Type II	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
348	Eukiefferiella claripennis gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1005	Eukiefferiella coerulescens gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
349	Eukiefferiella devonica gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
350	Eukiefferiella gracei gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
351	Eukiefferiella pseudomontana gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1128	Eukiefferiella similis gr.	Chironomidae (family)	Chironomidae	
345	Eukiefferiella sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1140	Eukifferiella rectangularis gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
548	Euparyphus sp.	Diptera	Stratiomyidae	
618	Euparyphus sp. (Duplicate Code 548)	Diptera	Stratiomyidae	Eurythermal: warm summer
1006	Euryhapsis sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
929	Fallceon quilleri	Ephemeroptera	Baetidae	Eurythermal: warm summer
1049	Fallceon sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
667	Farula sp.	Trichoptera	Uenoidae	Stenothermal: cold
598	Ferrissia rivularis	Gastropoda (class)	Ancylidae	Eurythermal: warm summer
429	Ferrissia sp.	Gastropoda (class)	Ancylidae	Eurythermal: warm summer
1056	Fisherola nuttali	Gastropoda (class)	Lymnaeidae	Eurythermal: cool summer
884	Fluminicola hindsi	Gastropoda (class)	Hydrobiidae	Eurythermal: cool summer
437	Fluminicola sp.	Gastropoda (class)	Hydrobiidae	Eurythermal: cool summer
562	Fontelicella sp.	Gastropoda (class)	Hydrobiidae	Eurythermal: cool summer
886	Forcipomyia sp.	Diptera	Ceratopogonidae	Eurythermal: warm summer
747	Forcipomyiinae	Diptera	Ceratopogonidae	Eurythermal: warm summer
821	Forcipomyiinae DUPLICATE			
563	Fossaria sp.	Gastropoda (class)	Lymnaeidae	Eurythermal: warm summer
118	Frisonia picticeps	Plecoptera	Perlodidae	Stenothermal: cold
677	Gammarus lacustris Sars			
445	Gammarus sp.	Amphipoda	Gammaridae	Eurythermal: cool summer
427	Gastropoda	Gastropoda (class)		
495	Gelastocoridae	Hemiptera	Gelastocoridae	Eurythermal: warm summer
496	Gelastocoris sp.	Hemiptera	Gelastocoridae	Eurythermal: warm summer
965	Georyssus sp.			
143	Gerridae	Hemiptera	Gerridae	Eurythermal: warm summer
145	Gerris buenoi	Hemiptera	Gerridae	Eurythermal: warm summer
146	Gerris remigis	Hemiptera	Gerridae	Eurythermal: warm summer
144	Gerris sp.	Hemiptera	Gerridae	Eurythermal: warm summer
470	Glossiphonia complanata	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
691	Glossiphonia sp.	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
469	Glossiphoniidae	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
174	Glossosoma alascense Banks	Trichoptera	Glossosomatidae	
175	Glossosoma intermedium	Trichoptera	Glossosomatidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
504	Glossosoma montana Ross			
176	Glossosoma oregonense Ling	Trichoptera	Glossosomatidae	
177	Glossosoma penitum Banks	Trichoptera	Glossosomatidae	
609	Glossosoma sp 1			
610	Glossosoma sp 2			
173	Glossosoma sp.	Trichoptera	Glossosomatidae	Eurythermal: cool summer
178	Glossosoma wenatchee Ross and Spencer	Trichoptera	Glossosomatidae	
170	Glossosomatidae	Trichoptera	Glossosomatidae	
316	Glutops sp.	Diptera	Pelecorhynchidae	Eurythermal: cool summer
761	Glyphopsyche sp.	Trichoptera	Limnephilidae	
1007	Glyptotendipes sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
224	Goera archaeon	Trichoptera	Limnephilidae	
848	Goeracea sp.	Trichoptera	Limnephilidae	Stenothermal: cold
957	Goereilla sp.	Trichoptera	Limnephilidae	
223	Goerinae	Trichoptera	Limnephilidae	
1	Gomphidae	Odonata	Gomphidae	Eurythermal: hot summer
425	Gonidea			
499	Gonidea angulata			
1159	Gonidea angulata (Duplicate Code 499)	Bivalvia (class)	Unionidae	Eurythermal: warm summer
254	Gonielmis sp.	Coleoptera	Elmidae	Eurythermal: warm summer
751	Gonomyia sp.	Diptera	Tipulidae	Eurythermal: cool summer
813	Grammotaulius sp.	Trichoptera	Limnephilidae	Eurythermal: warm summer
140	Graptocorixa sp.	Hemiptera	Corixidae	Eurythermal: warm summer
246	Grensia sp.	Trichoptera	Limnephilidae	
240	Gumaga sp.	Trichoptera	Sericostomatidae	
658	Gymnopais sp.	Diptera	Simuliidae	
431	Gyraulus sp.	Gastropoda (class)	Planorbidae	Eurythermal: warm summer
806	Gyrinidae	Coleoptera	Gyrinidae	Eurythermal: warm summer
274	Gyrinus sp.	Coleoptera	Gyrinidae	Eurythermal: warm summer
748	Haemopsis marmorata (Say)			
843	Haemopsis sp.			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
1123	Halesochila sp.	Trichoptera	Limnephilidae	
275	Haliplidae	Coleoptera	Haliplidae	Eurythermal: warm summer
641	Haliplus sp.	Coleoptera	Haliplidae	Eurythermal: warm summer
1008	Harnischia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1086	Harpacticoida			
1009	Hayesomyia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
352	Heleniella sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
250	Helichus sp.	Coleoptera	Dryopidae	Eurythermal: warm summer
764	Helichus striatus	Coleoptera	Dryopidae	Eurythermal: warm summer
535	Helichus striatus foveatus			
239	Helicopsyche borealis	Trichoptera	Helicopsychidae	Eurythermal: warm summer
238	Helicopsyche sp.	Trichoptera	Helicopsychidae	Eurythermal: warm summer
507	Helicopsychidae	Trichoptera	Helicopsychidae	
1107	Helisoma sp.	Gastropoda (class)	Planorbidae	Eurythermal: warm summer
984	Helobdella sp.	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
422	Helobdella stagnalis	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
1010	Helopelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
654	Helophorus sp.	Coleoptera	Hydrophilidae	
308	Hemerodromia sp.	Diptera	Empididae	
635	Hemerodromia sp. DUPLICATE	Diptera	Empididae	Eurythermal: warm summer
494	Hemiptera	Hemiptera		Eurythermal: warm summer
676	Heptagenia criddlei McDunnough (Nixe criddlei)			
482	Heptagenia elegantula	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
741	Heptagenia simpliciodes McDunnough (Nixe simpliciodes)			
34	Heptagenia sp.	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
815	Heptagenia/Nixe			
24	Heptageniidae	Ephemeroptera	Heptageniidae	
287	Hesperoconopa sp.	Diptera	Tipulidae	Stenothermal: cold

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
141	Hesperocorixa sp.	Hemiptera	Corixidae	Eurythermal: warm summer
113	Hesperoperla pacifica	Plecoptera	Perlidae	Eurythermal: cool summer
660	Hesperoperla sp.	Plecoptera	Perlidae	Eurythermal: cool summer
216	Hesperophylax sp.	Trichoptera	Limnephilidae	Eurythermal: warm summer
981	Heterelmis sp.	Coleoptera	Elmidae	Eurythermal: warm summer
263	Heterlimnius corpulentus	Coleoptera	Elmidae	Eurythermal: cool summer
950	Heterlimnius koebelei			
262	Heterlimnius sp.	Coleoptera	Elmidae	Eurythermal: cool summer
241	Heteroplectron californicum	Trichoptera	Calamoceratidae	
907	Heterotrissocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
353	Heterotrissocladius subpilosa gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
931	Hexagenia sp.	Ephemeroptera	Ephemeridae	Eurythermal: cool summer
286	Hexatoma sp.	Diptera	Tipulidae	Eurythermal: warm summer
668	Himalopsyche sp.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
421	Hirudinea	Hirudinea (class)		
420	Hirudinidae	Ephemeroptera	Hirudinidae	
1087	Holopedium sp.			
217	Homophylax sp.	Trichoptera	Limnephilidae	Stenothermal: cold
455	Homoptera			
446	Hyalella azteca	Amphipoda	Talitridae	Eurythermal: cool summer
818	Hyalella sp.	Amphipoda	Talitridae	
816	Hydaticus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
218	Hydatophylax sp.	Trichoptera	Limnephilidae	
881	Hydra DUPLICATE			
689	Hydra sp.	Hydroida	Hydridae	Eurythermal: warm summer
456	Hydracarina	Acari (subclass)		
774	Hydraena sp.	Coleoptera	Hydraenidae	Eurythermal: cool summer
723	Hydraenidae	Coleoptera	Hydraenidae	Eurythermal: warm summer
354	Hydrobaenus sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
560	Hydrobiidae	Gastropoda (class)	Hydrobiidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
705	Hydrobius sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
650	Hydrochus sp.	Coleoptera	Hydrochidae	
276	Hydrophilidae	Coleoptera	Hydrophilidae	Eurythermal: warm summer
899	Hydrophiloidea sp.			
807	Hydroporus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
511	Hydropsyche californica	Trichoptera	Hydropsychidae	Eurythermal: warm summer
512	Hydropsyche occidentalis	Trichoptera	Hydropsychidae	Eurythermal: warm summer
513	Hydropsyche oslari	Trichoptera	Hydropsychidae	
198	Hydropsyche sp.	Trichoptera	Hydropsychidae	
196	Hydropsychidae	Trichoptera	Hydropsychidae	
955	Hydropsychinae	Trichoptera	Hydropsychidae	
514	Hydroptila ajax			
515	Hydroptila arctia			
516	Hydroptila argosa			
182	Hydroptila sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
180	Hydroptilidae	Trichoptera	Hydroptilidae	
898	Hydroscapha sp.	Coleoptera	Hydroscaphidae	Eurythermal: warm summer
688	Hydrovatus sp.	Coleoptera	Dytiscidae	
552	Hygrobates occidentalis			
550	Hygrobatidae			
595	Hygrotus sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
457	Hymenoptera	Hymenoptera		
1080	Ilyodrilus templetoni	Oligochaeta (class)	Tubificidae	
669	Imania sp.	Trichoptera	Limnephilidae	
721	Incertus			
479	Insecta			
1054	Ironodes nitidus	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
33	Ironodes sp.	Ephemeroptera	Heptageniidae	
32	Ironopsis grandis	Ephemeroptera	Heptageniidae	Stenothermal: cold
715	Ironopsis sp	Ephemeroptera	Heptageniidae	
491	Ischnura sp.	Odonata	Coenagrionidae	Eurythermal: hot summer
927	Isogenoides sp.	Plecoptera	Perlodidae	Eurythermal: cool summer
493	Isogenus sp.	Plecoptera	Perlodidae	
128	Isoperla fulva	Plecoptera	Perlodidae	Eurythermal: cool summer
129	Isoperla fusca	Plecoptera	Perlodidae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
897	Isoperla mormona			
857	Isoperla pinta	Plecoptera	Perlodidae	Eurythermal: cool summer
127	Isoperla sp.	Plecoptera	Perlodidae	
447	Isopoda	Isopoda		Eurythermal: warm summer
438	Juga sp.	Gastropoda (class)	Pleuroceridae	Eurythermal: warm summer
132	Kathroperla perdita	Plecoptera	Chloroperlidae	
944	Kathroperla sp.	Plecoptera	Chloroperlidae	
1047	Kincadiana hexatheca	Oligochaeta (class)	Lumbriculidae	
119	Kogotus sp.	Plecoptera	Perlodidae	Eurythermal: cool summer
814	Kogotus/Rickera sp.	Plecoptera	Perlodidae	
1127	Krenopelopia sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
903	Krenosmittia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
960	Labiobaetis propinquus	Ephemeroptera	Baetidae	Eurythermal: warm summer
925	Labiobaetis sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
1108	Labrundinia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
659	Laccobius sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
796	Laccophilus sp.	Coleoptera	Dytiscidae	
754	Lanx sp.			
264	Lara avara	Coleoptera	Elmidae	Eurythermal: cool summer
596	Lara sp.	Coleoptera	Elmidae	Eurythermal: cool summer
355	Larsia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1169	Lauterborniella sp.	Chironomidae (family)	Chironomidae	
554	Lebertia			
553	Lebertiidae			
1124	Lenarchus sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
532	Lepidoptera	Lepidoptera	Coleophoridae sp.	Eurythermal: warm summer
522	Lepidostoma cinereum			Eurythermal: warm summer
722	Lepidostoma quercina			
237	Lepidostoma sp.	Trichoptera	Lepidostomatidae	Eurythermal: cool summer
521	Lepidostomatidae	Trichoptera	Lepidostomatidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
242	Leptoceridae	Trichoptera	Leptoceridae	Eurythermal: warm summer
1088	Leptodora kindti			
62	Leptophlebia sp.	Ephemeroptera	Leptophlebiidae	Stenothermal: warm
61	Leptophlebiidae	Ephemeroptera	Leptophlebiidae	Eurythermal: warm summer
840	Lestes sp.	Odonata	Lestidae	Eurythermal: hot summer
135	Lethocerus sp.	Hemiptera	Belostomatidae	Eurythermal: warm summer
517	Leucotrichia sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
872	Leucrocuta sp.	Ephemeroptera	Heptageniidae	
93	Leuctridae	Plecoptera	Leuctridae	Stenothermal: cold
649	Libellula sp.	Odonata	Libellulidae	Eurythermal: hot summer
811	Libellulidae	Odonata	Libellulidae	Eurythermal: hot summer
1154	Limnebius sp.	Coleoptera	Hydraenidae	
199	Limnephilidae	Trichoptera	Limnephilidae	
976	Limnephiloidea			
219	Limnephilus sp.	Trichoptera	Limnephilidae	Eurythermal: warm summer
213	Limniphilinae	Trichoptera	Limnephilidae	
1166	Limnodrilus cervix	Oligochaeta (class)	Tubificidae	
1109	Limnodrilus claparedeianus	Oligochaeta (class)	Tubificidae	
1067	Limnodrilus hoffmeisteri	Oligochaeta (class)	Tubificidae	
1068	Limnodrilus sp.	Oligochaeta (class)	Tubificidae	
1069	Limnodrilus udekemianus	Oligochaeta (class)	Tubificidae	
283	Limnophila sp.	Diptera	Tipulidae	Eurythermal: warm summer
646	Limnophora sp.	Diptera	Muscidae	Eurythermal: warm summer
356	Limnophyes sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
745	Limnoporus sp.	Hemiptera	Gerridae	Eurythermal: warm summer
288	Limonia sp.	Diptera	Tipulidae	Eurythermal: warm summer
1011	Lipiniella sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
357	Lopescladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
786	Lumbricina	Lumbricina		
710	Lumbriculidae	Oligochaeta (class)	Lumbriculidae	
1070	Lumbriculus sp.	Oligochaeta (class)	Lumbriculidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
882	Lutrochus sp.	Coleoptera	Lutrochidae	Eurythermal: warm summer
564	Lymnaea sp.	Gastropoda (class)	Lymnaeidae	Eurythermal: warm summer
430	Lymnaeidae	Gastropoda (class)	Lymnaeidae	Eurythermal: warm summer
460	Macronema			
358	Macropelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
948	Macropelopini	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
83	Malenka sp.	Plecoptera	Nemouridae	Eurythermal: warm summer
720	Manophylax sp.	Trichoptera	Limnephilidae	
576	Margaritifera margaritifera fal			
426	Margaritifera sp.	Bivalvia (class)	Margaritiferidae	Eurythermal: warm summer
298	Maruina sp.	Diptera	Psychodidae	Eurythermal: cool summer
854	Mayatrichia sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
95	Megaleuctra sp.	Plecoptera	Leuctridae	Stenothermal: cold
121	Megarcys sp.	Plecoptera	Perlodidae	Stenothermal: cold
1145	Megistocera sp.	Diptera	Tipulidae	
836	Melyridae	Coleoptera	Melyridae	
800	Meringodixa sp.	Diptera	Dixidae	Eurythermal: cool summer
1129	Meropelopia sp.	Chironomidae (family)	Chironomidae	
864	Mesovelia sp.	Hemiptera	Mesoveliidae	Eurythermal: warm summer
924	Mesoveliidae	Hemiptera	Mesoveliidae	Eurythermal: warm summer
766	Metacnephia sp.	Diptera	Simuliidae	Eurythermal: cool summer
921	Metretopus sp.	Ephemeroptera	Metreopodidae	Eurythermal: warm summer
1150	Metrichia sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
1146	Metriocnemus hygropetrica gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1012	Metriocnemus sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
709	Micrasema bactro			
236	Micrasema sp.	Trichoptera	Brachycentridae	Eurythermal: warm summer
1110	Microchironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
538	Microcylloepus pusillus	Coleoptera	Elmidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
778	Microcylloepus pusillus DUPLICATE	Coleoptera	Elmidae	Eurythermal: warm summer
537	Microcylloepus similis	Coleoptera	Elmidae	Eurythermal: warm summer
846	Microcylloepus sp.	Coleoptera	Elmidae	Eurythermal: warm summer
360	Micropsectra sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1013	Microtendipes pedellus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1014	Microtendipes rydalensis gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
361	Microtendipes sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
147	Microvelia sp.	Hemiptera	Gerridae	Eurythermal: warm summer
559	Molluska			
867	Molophilus sp.	Diptera	Tipulidae	Eurythermal: cool summer
362	Monodiamesa sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
359	Monopelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
644	Mooreobdella sp.	Ephemeroptera	Erpobdellidae	
96	Moselia infuscata	Plecoptera	Leuctridae	Stenothermal: cold
208	Moselyana sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
983	Muscidae	Diptera	Muscidae	Eurythermal: warm summer
313	Muscidae DUPLICATE			
991	Musculium sp.	Bivalvia (class)	Sphaeriidae	Eurythermal: warm summer
1089	Mysis relicta			
1111	Mystacides alafimbriata	Trichoptera		Eurythermal: warm summer
243	Mystacides sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
463	Naididae	Oligochaeta (class)	Naididae	
1112	Nais barbata	Oligochaeta (class)	Naididae	
1076	Nais behningi	Oligochaeta (class)	Naididae	
1071	Nais bretscheri	Oligochaeta (class)	Naididae	
1113	Nais communis	Oligochaeta (class)	Naididae	
1114	Nais pardalis	Oligochaeta (class)	Naididae	
1157	Nais simplex	Oligochaeta (class)	Naididae	
1164	Nais sp.	Oligochaeta (class)	Naididae	
1115	Nais variabilis	Oligochaeta (class)	Naididae	
784	Namamyia sp.	Trichoptera	Odontoceridae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
363	Nanocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
266	Narpus concolor	Coleoptera	Elmidae	Eurythermal: cool summer
265	Narpus sp.	Coleoptera	Elmidae	Eurythermal: cool summer
1015	Natarsia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
148	Naucoridae	Hemiptera	Naucoridae	Eurythermal: warm summer
853	Neaviperla forcipata	Plecoptera	Chloroperlidae	Eurythermal: cool summer
590	Neaviperla sp.	Plecoptera	Chloroperlidae	Eurythermal: cool summer
849	Neaviperla/Suwallia			
523	Nectopsyche gracilis			
524	Nectopsyche halia			
525	Nectopsyche lahontanensis			
639	Nectopsyche sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
526	Nectopsyche stigmatica			
417	Nematoda	Nematoda (phylum)		Eurythermal: warm summer
727	Nematomorpha	Nematomorpha (phylum)		Eurythermal: warm summer
975	Nemertea	Nemertea (phylum)		
1046	Nemotelus sp.	Diptera	Stratiomyidae	Eurythermal: warm summer
81	Nemouridae	Plecoptera	Nemouridae	Eurythermal: warm summer
629	Neoclypeodytes sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
226	Neophylax occidentalis	Trichoptera	Uenoidae	Eurythermal: cool summer
227	Neophylax rickeri	Trichoptera	Uenoidae	Eurythermal: warm summer
225	Neophylax sp.	Trichoptera	Uenoidae	Eurythermal: cool summer
228	Neophylax splendens	Trichoptera	Uenoidae	Eurythermal: cool summer
230	Neothremma alicia	Trichoptera	Uenoidae	
229	Neothremma sp.	Trichoptera	Uenoidae	Stenothermal: cold
520	Neotrichia halia			
594	Neotrichia sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
627	Nephelopsis obscura			
719	Nerophilus californicus			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
725	Nerophilus sp.	Trichoptera	Odontoceridae	Eurythermal: cool summer
1095	Neureclipsis sp.	Trichoptera	Polycentropidae	Eurythermal: warm summer
1016	Nilotanypus fimbriatus	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
364	Nilotanypus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
365	Nimbocera sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
483	Nixe criddlei	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
484	Nixe simplicoides	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
783	Nixe sp.	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
934	Nixe/Leucrocuta			
873	Noctuidae	Lepidoptera	Noctuidae	
655	Noteridae	Coleoptera	Noteridae	Eurythermal: warm summer
794	Notonecta sp.		Notonectidae	Eurythermal: warm summer
862	Notonectidae	Hemiptera	Notonectidae	Eurythermal: warm summer
851	Nyctiophylax moestus	Trichoptera	Polycentropidae	
717	Nyctiophylax sp.	Trichoptera	Polycentropidae	
183	Ochrotrichia sp.	Trichoptera	Hydroptilidae	
518	Ochrotrichia sp. (Duplicate Code 183)	Trichoptera	Hydroptilidae	Eurythermal: warm summer
742	Ochthebius sculptus			
2	Octogomphus sp.	Odonata	Gomphidae	Eurythermal: cool summer
490	Odonata	Odonata		
366	Odontomesa sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
695	Odontomyia sp	Diptera	Stratiomyidae	Eurythermal: warm summer
1141	Odontomyia/Hedrio discus sp.	Diptera	Stratiomyidae	Eurythermal: warm summer
1092	Oecetis avara	Trichoptera	Leptoceridae	Eurythermal: warm summer
244	Oecetis sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
418	Oligochaeta	Oligochaeta (class)		
231	Oligophlebodes sp.	Trichoptera	Uenoidae	Stenothermal: cold
502	Oligoplectrum sp.	Trichoptera	Brachycentridae	
367	Oliveridia sp.	Chironomidae (family)	Chironomidae	Stenothermal: hyper cold

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
209	Onocosmoecus sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
527	Onocosmoecus unicolor	Trichoptera	Limnephilidae	Eurythermal: cool summer
1072	Ophidonais serpentina	Oligochaeta (class)	Naididae	
3	Ophiogomphus sp.	Odonata	Gomphidae	Eurythermal: warm summer
539	Optioservus castanipennis			
540	Optioservus divergens	Coleoptera	Elmidae	Eurythermal: warm summer
268	Optioservus quadrimaculatus	Coleoptera	Elmidae	
967	Optioservus quadrimaculatus DUPLICATE	Coleoptera	Elmidae	Eurythermal: warm summer
269	Optioservus seriatus	Coleoptera	Elmidae	Eurythermal: warm summer
267	Optioservus sp.	Coleoptera	Elmidae	Eurythermal: warm summer
270	Ordobrevia nubifera	Coleoptera	Elmidae	Eurythermal: warm summer
628	Ordobrevia sp.	Coleoptera	Elmidae	Eurythermal: warm summer
712	Oreodytes congruus	Coleoptera	Dytiscidae	Eurythermal: warm summer
252	Oreodytes sp.	Coleoptera	Dytiscidae	Eurythermal: warm summer
580	Oreogeton sp.	Diptera	Empididae	Stenothermal: cold
309	Oreothalia sp.	Diptera	Empididae	
708	Ormosia sp.	Diptera	Tipulidae	Eurythermal: warm summer
151	Orohermes sp.	Megaloptera	Corydalidae	Eurythermal: cool summer
122	Oroperla sp.	Plecoptera	Perlodidae	Eurythermal: cool summer
905	Orthocladiinae	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
544	Orthocladiinae DUPLICATE			
370	Orthocladius (Eudactylo.) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1170	Orthocladius (Euortho.) nr. saxosus	Chironomidae (family)	Chironomidae	
1017	Orthocladius (Euortho.) rivicola	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1018	Orthocladius (Euortho.) rivicola grp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
1019	Orthocladius (Euortho.) rivulorum grp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
371	Orthocladius (Euorthocladius) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
372	Orthocladius (Pogonocladius) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1020	Orthocladius (Symp.) lignicola	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1021	Orthocladius annectens	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
368	Orthocladius Complex	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1116	Orthocladius Genus 1	Chironomidae (family)	Chironomidae	
1122	Orthocladius Genus 5	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
369	Orthocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
519	Orthotrichia sp.	Trichoptera	Hydroptilidae	
912	Osobenus sp.	Plecoptera	Perlodidae	
442	Ostracoda	Ostracoda		Eurythermal: warm summer
915	Oulimnius sp.	Coleoptera	Elmidae	Eurythermal: cool summer
602	Oxyethira sp.	Trichoptera	Hydroptilidae	
765	Oxyethira sp. (Duplicate Code 602)	Trichoptera	Hydroptilidae	Eurythermal: warm summer
475	Pacifastacus cambilii			
451	Pacifasticus connectens	Decapoda	Astacidae	Eurythermal: warm summer
452	Pacifasticus leniusculus		Astacidae	Eurythermal: warm summer
561	Pacifasticus sp.	Decapoda	Astacidae	Eurythermal: warm summer
373	Pagastia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1022	Pagastiella sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
779	Palpomyia sp.	Diptera	Ceratopogonidae	Eurythermal: warm summer
776	Palpomyia sp. DUPLICATE			
1023	Paraboreochlus sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
102	Paracapnia sp.	Plecoptera	Capniidae	Stenothermal: cold
374	Parachaetocladius sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
1024	Parachironomus frequens gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
996	Parachironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1025	Paracladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1117	Paracladopelma sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
971	Paracloeodes sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
1161	Paracricotopus sp.	Chironomidae (family)	Chironomidae	
798	Paracymus sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
759	Paradixa			
375	Parakiefferiella sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1026	Paralauterborniella sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
987	Paralepto. debilis/bicornuta			
64	Paraleptophlebia bicornuta	Ephemeroptera	Leptophlebiidae	Eurythermal: cool summer
633	Paraleptophlebia debilis	Ephemeroptera	Leptophlebiidae	Eurythermal: cool summer
868	Paraleptophlebia gregalis			
740	Paraleptophlebia memorialis (Eaton)			
63	Paraleptophlebia sp.	Ephemeroptera	Leptophlebiidae	
887	Paraleptophlebia vaciva	Ephemeroptera	Leptophlebiidae	Eurythermal: cool summer
98	Paraleuctra occidentalis	Plecoptera	Leuctridae	
97	Paraleuctra sp.	Plecoptera	Leuctridae	Stenothermal: cold
891	Parameletus sp.	Ephemeroptera	Siphloneuridae	Stenothermal: cold
376	Paramerina sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
377	Parametriocnemus sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1118	Parametriocnemus sp. Type II	Chironomidae (family)	Chironomidae	
714	Paraperla frontalis	Plecoptera	Chloroperlidae	
133	Paraperla sp.	Plecoptera	Chloroperlidae	
378	Paraphaenocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
194	Parapsyche almota	Trichoptera	Hydropsychidae	Eurythermal: cool summer
195	Parapsyche elsis	Trichoptera	Hydropsychidae	Stenothermal: cold
193	Parapsyche sp.	Trichoptera	Hydropsychidae	Eurythermal: cool summer
918	Parasimulium sp.	Diptera	Simuliidae	Stenothermal: cold
549	Parasitengona			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
379	Paratanytarsus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
380	Paratendipes sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
381	Paratrichocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1139	Parochlus sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
382	Parorthocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
530	Paychomyiidae			
289	Pedicia sp.	Diptera	Tipulidae	Eurythermal: cool summer
210	Pedomoecus sierra	Trichoptera	Limnephilidae	Eurythermal: cool summer
315	Pelecorhynchidae	Diptera	Pelecorhynchidae	Eurythermal: cool summer
566	Pelecypoda			
647	Peltodytes sp.	Coleoptera	Haliplidae	Eurythermal: warm summer
72	Peltoperlidae	Plecoptera	Peltoperlidae	Stenothermal: cold
589	Pentacora sp.	Hemiptera	Saldidae	
384	Pentaneura sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
383	Pentaneurini	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
777	Percymoorensis			
299	Pericoma sp.	Diptera	Psychodidae	Eurythermal: warm summer
822	Perlesta sp.	Plecoptera	Perlidae	
104	Perlidae	Plecoptera	Perlidae	Eurythermal: warm summer
123	Perlinodes aurea	Plecoptera	Perlodidae	Stenothermal: cold
673	Perlinodes sp.	Plecoptera	Perlodidae	
114	Perlodidae	Plecoptera	Perlodidae	Eurythermal: cool summer
99	Perlomyia sp.	Plecoptera	Leuctridae	Stenothermal: cold
248	Petrophila sp.	Lepidoptera	Pyralidae	Eurythermal: warm summer
385	Phaenopsectra sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
954	Philocasca sp.	Trichoptera	Limnephilidae	Stenothermal: cold
187	Philopotamidae	Trichoptera	Philopotamidae	
847	Philorus sp.	Diptera	Blephariceridae	Stenothermal: cold
926	Phryganea sp.	Trichoptera	Phyrganeidae	Eurythermal: warm summer
704	Phychodidae			
433	Physa sp.	Gastropoda (class)	Physidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
434	Physella sp.	Gastropoda (class)	Physidae	Eurythermal: warm summer
432	Physidae	Gastropoda (class)	Physidae	Eurythermal: warm summer
661	Phytobius sp.	Coleoptera	Chrysomelidae	
124	Pictetiella expansa	Plecoptera	Perlodidae	Stenothermal: cold
863	Pictetiella sp.	Plecoptera	Perlodidae	
555	Piersigiidae			
831	Pilaria sp.	Diptera	Tipulidae	Eurythermal: warm summer
471	Piscicola salmositica	Ephemeroptera	Piscicolidae	
623	Piscicola sp.	Ephemeroptera	Piscicolidae	
424	Pisidiidae			
568	Pisidium casertanum	Bivalvia (class)	Sphaeriidae	Stenothermal: cold
570	Pisidium compressum			
569	Pisidium idahoense			
435	Pisidium sp.	Bivalvia (class)	Sphaeriidae	Eurythermal: hot summer
768	Placobdella sp.	Hirudinea (class)	Glossiphoniidae	Eurythermal: warm summer
462	Planariidae	Tricladida	Planariidae	Eurythermal: warm summer
900	Planorbella sp.	Gastropoda (class)	Planorbidae	
436	Planorbidae	Gastropoda (class)	Planorbidae	
1050	Plauditus armillatus	Ephemeroptera	Baetidae	Eurythermal: warm summer
1160	Plauditus cestus	Ephemeroptera	Baetidae	
1051	Plauditus punctiventrus	Ephemeroptera	Baetidae	Eurythermal: warm summer
1125	Plauditus sp.	Ephemeroptera	Baetidae	Eurythermal: warm summer
492	Plecoptera	Plecoptera		
1057	Pleuroceridae	Gastropoda (class)	Pleuroceridae	
584	Plumiperla sp.	Plecoptera	Chloroperlidae	
84	Podmosta sp.	Plecoptera	Nemouridae	Eurythermal: cool summer
1027	Podonominae	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
797	Podura sp.			
619	Polycelis coronata	Tricladida	Planariidae	
757	Polycelis sp.			
529	Polycentropidae	Trichoptera	Polycentropidae	
185	Polycentropus sp.	Trichoptera	Polycentropidae	Eurythermal: warm summer
487	Polymitarcyidae	Ephemeroptera	Polymitarcyidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
387	Polypedilum (Pentadilum) sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1028	Polypedilum fallax gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
386	Polypedilum sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
685	Porifera			
890	Porifera DUPLICATE			
810	Potamopyrgus antipodarum	Gastropoda (class)	Hydrobiidae	Eurythermal: hot summer
701	Potamopyrgus sp.	Gastropoda (class)	Hydrobiidae	
388	Potthastia gaedii gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
389	Potthastia longimanus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
911	Potthastia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
803	Prionocera sp.	Diptera	Tipulidae	Eurythermal: cool summer
808	Prionoxystus	Gastropoda (class)	Hydrobiidae	
1168	Pristina leidyi	Oligochaeta (class)	Naididae	
1131	Pristinella jenkinae	Oligochaeta (class)	Naididae	
390	Procladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
928	Procloeon sp.	Ephemeroptera	Baetidae	Eurythermal: cool summer
391	Prodiamesa sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
939	Prodiamesinae	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
439	Promenetus sp.	Gastropoda (class)	Planorbidae	Eurythermal: cool summer
302	Prosimulium sp.	Diptera	Simuliidae	Stenothermal: cold
85	Prostoia besametsa	Plecoptera	Nemouridae	Stenothermal: cold
788	Prostoia sp.	Plecoptera	Nemouridae	Stenothermal: cold
988	Protanyderus sp.	Diptera	Tanyderidae	Eurythermal: cool summer
997	Protanypus sp.	Chironomidae (family)	Chironomidae	
653	Protoplasa fitchii Osten Sacken			
726	Protoplasa sp.	Diptera	Tanyderidae	Eurythermal: cool summer
505	Protoptila coloma			
179	Protoptila sp.	Trichoptera	Glossosomatidae	Eurythermal: warm summer
506	Protoptila tenebrosa			
556	Protzia californensis			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
393	Psectrocladius allopsectrocladius	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
394	Psectrocladius limbatellus	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
395	Psectrocladius sordidellus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
392	Psectrocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
396	Psectrotanypus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
278	Psephenidae	Coleoptera	Psephenidae	Eurythermal: warm summer
541	Psephenus falli	Coleoptera	Psephenidae	Eurythermal: warm summer
674	Psephenus sp.	Coleoptera	Psephenidae	Eurythermal: warm summer
397	Pseudochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
23	Pseudocloeon (Plauditus sp.)			
398	Pseudodiamesa sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
827	Pseudogoera sp.	Trichoptera	Odontoceridae	Eurythermal: cool summer
399	Pseudorthocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1149	Pseudosmittia sp.	Chironomidae (family)	Chironomidae	
958	Pseudostenophylar sp.			
1029	Psilometriocnemus sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
959	Psychoda sp.	Diptera	Psychodidae	Eurythermal: warm summer
297	Psychodidae	Diptera	Psychodidae	Eurythermal: warm summer
221	Psychoglypha bella	Trichoptera	Limnephilidae	
220	Psychoglypha sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
222	Psychoglypha subborealis	Trichoptera	Limnephilidae	
186	Psychomyia lumina	Trichoptera	Psychomyiidae	Eurythermal: warm summer
606	Psychomyia sp.	Trichoptera	Psychomyiidae	Eurythermal: warm summer
67	Pteronarcella badia	Plecoptera	Pteronarcyidae	Eurythermal: warm summer
68	Pteronarcella regularis	Plecoptera	Pteronarcyidae	Eurythermal: warm summer
66	Pteronarcella sp.	Plecoptera	Pteronarcyidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
65	Pteronarcyidae	Plecoptera	Pteronarcyidae	Eurythermal: cool summer
70	Pteronarcys californica	Plecoptera	Pteronarcyidae	Eurythermal: warm summer
739	Pteronarcys dorsata	Plecoptera	Pteronarcyidae	Eurythermal: cool summer
71	Pteronarcys princeps	Plecoptera	Pteronarcyidae	Eurythermal: cool summer
69	Pteronarcys sp.	Plecoptera	Pteronarcyidae	Eurythermal: cool summer
823	Ptiliidae	Coleoptera	Ptiliidae	Eurythermal: warm summer
651	Ptychoptera sp.	Diptera	Ptychopteridae	Eurythermal: warm summer
300	Ptychopteridae	Diptera	Ptychopteridae	Eurythermal: warm summer
1094	Pycnopsyche sp.	Trichoptera	Limnephilidae	Eurythermal: cool summer
247	Pyralidae	Lepidoptera	Pyralidae	Eurythermal: warm summer
809	Pyrgulopsis idahoensis	Gastropoda (class)	Hydrobiidae	Eurythermal: cool summer
859	Pyroderces sp.			
1073	Quistradrilus multisetosus	Oligochaeta (class)	Tubificidae	
1030	Radotanypus sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1031	Reomyia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
877	Rhabdomastix fascigera gr.	Diptera	Tipulidae	Stenothermal: cold
892	Rhabdomastix setigera gr.	Diptera	Tipulidae	Stenothermal: cold
615	Rhabdomastix sp.	Diptera	Tipulidae	Stenothermal: cold
743	Rhagorelia distincta			
858	Rhamphomyla sp.			
400	Rheocricotopus robacki	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1032	Rheopelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1133	Rheosmittia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1033	Rheotanytarsus exiguus gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
401	Rheotanytarsus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
485	Rhithrogena hageni	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
694	Rhithrogena morrisoni/hageni			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
625	Rhithrogena robusta	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
35	Rhithrogena sp.	Ephemeroptera	Heptageniidae	Eurythermal: cool summer
255	Rhizelmis sp.	Coleoptera	Elmidae	Eurythermal: cool summer
1077	Rhyacodrilus coccineus	Oligochaeta (class)	Naididae	
1165	Rhyacodrilus montana	Oligochaeta (class)	Tubificidae	
464	Rhyacodrilus sodalis			
1135	Rhyacodrilus sp.	Oligochaeta (class)	Tubificidae	
154	Rhyacophila acropedes Banks	Trichoptera	Rhyacophilidae	
631	Rhyacophila acropedes/vao			
155	Rhyacophila alberta gr.	Trichoptera	Rhyacophilidae	Stenothermal: cold
156	Rhyacophila angelita gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
162	Rhyacophila arnaudi	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
157	Rhyacophila betteni gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
581	Rhyacophila bifila gr.	Trichoptera	Rhyacophilidae	
165	Rhyacophila blarina	Trichoptera	Rhyacophilidae	
158	Rhyacophila brunnea gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
159	Rhyacophila coloradensis gr.	Trichoptera	Rhyacophilidae	Eurythermal: warm summer
1096	Rhyacophila ecosa gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
603	Rhyacophila grandis gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
160	Rhyacophila hyalinata gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
161	Rhyacophila iranda gr.	Trichoptera	Rhyacophilidae	
166	Rhyacophila narvae	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
772	Rhyacophila nervadensis gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
642	Rhyacophila oreia group			
167	Rhyacophila pellisa	Trichoptera	Rhyacophilidae	
771	Rhyacophila rayneri	Trichoptera	Rhyacophilidae	
913	Rhyacophila robusta			
163	Rhyacophila rotunda gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
164	Rhyacophila sibirica gr.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
153	Rhyacophila sp.	Trichoptera	Rhyacophilidae	Eurythermal: cool summer
838	Rhyacophila trissemani			
678	Rhyacophila tucula	Trichoptera	Rhyacophilidae	Stenothermal: cold
613	Rhyacophila vaccua Milne			
758	Rhyacophila vaefes gr.	Trichoptera	Rhyacophilidae	
753	Rhyacophila vaeter group			
168	Rhyacophila vagrita gr.	Trichoptera	Rhyacophilidae	Stenothermal: cold
713	Rhyacophila valuma			
801	Rhyacophila valuma/pellisa	Trichoptera	Rhyacophilidae	
856	Rhyacophila velora			
612	Rhyacophila vepulsa Milne			
169	Rhyacophila verrula	Trichoptera	Rhyacophilidae	Stenothermal: cold
830	Rhyacophila visor Milne			
812	Rhyacophila vofixa gr.	Trichoptera	Rhyacophilidae	Stenothermal: cold
152	Rhyacophilidae	Trichoptera	Rhyacophilidae	
936	Rhynchelmis sp.			
665	Rickera sorpta	Plecoptera	Perlodidae	Stenothermal: cold
696	Rickera sp.	Plecoptera	Perlodidae	Stenothermal: cold
986	Robackia demeijerei	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1034	Saetheria sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
706	Saldidae	Hemiptera	Saldidae	Eurythermal: warm summer
699	Saldula sp.	Hemiptera	Saldidae	Eurythermal: warm summer
789	Salpingidae	Coleoptera	Salpingidae	
782	Sciaridae	Diptera	Sciaridae	
833	Sciomyzidae	Diptera	Sciomyzidae	Eurythermal: warm summer
690	Sepedon sp.	Diptera	Sciomyzidae	Eurythermal: warm summer
1119	Sergentia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
582	Sericostomatidae	Trichoptera	Sericostomatidae	
874	Sericostriata sp.	Trichoptera	Uenoidae	Stenothermal: cold
902	Sericostriata surdikae	Trichoptera	Uenoidae	Stenothermal: cold

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
880	Serratella mitchneri	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
53	Serratella sp.	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
645	Serratella teresa	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
54	Serratella tibialis	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer
125	Setvena bradleyi	Plecoptera	Perlodidae	Stenothermal: cold
787	Setvena sp.	Plecoptera	Perlodidae	Stenothermal: cold
1059	Sialidae	Megaloptera	Sialidae	Eurythermal: warm summer
149	Sialis sp.	Megaloptera	Sialidae	Eurythermal: warm summer
498	Sigara alternata	Hemiptera	Corixidae	Eurythermal: warm summer
142	Sigara sp.	Hemiptera	Corixidae	Eurythermal: warm summer
763	Sigara washingtonensis			
599	Silvious sp.	Diptera	Tabanidae	Eurythermal: warm summer
301	Simuliidae	Diptera	Simuliidae	Eurythermal: warm summer
546	Simulium bivittatum	Diptera	Simuliidae	Eurythermal: warm summer
896	Simulium meridionale			
303	Simulium sp.	Diptera	Simuliidae	Eurythermal: warm summer
547	Simulium vittatum	Diptera	Simuliidae	Eurythermal: warm summer
12	Siphloneuridae	Ephemeroptera	Siphloneuridae	
15	Siphlonurus sp.	Ephemeroptera	Siphloneuridae	
979	Siphlonurus sp. (Duplicate Code 15)	Ephemeroptera	Siphloneuridae	
126	Skwala sp.	Plecoptera	Perlodidae	Eurythermal: warm summer
1136	Slavina appendiculata	Oligochaeta (class)	Naididae	
1035	Smittia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
73	Soliperla sp.	Plecoptera	Peltoperlidae	Stenothermal: cold
750	Somatochlora			
86	Soyedina sp.	Plecoptera	Nemouridae	Eurythermal: warm summer
1120	Specaria josinae	Oligochaeta (class)	Naididae	
558	Sperchon pseudoplumifer			
557	Sperchonidae			
730	Sperchopsis sp.	Coleoptera	Hydrophilidae	

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
567	Sphaeriidae	Bivalvia (class)	Sphaeriidae	
571	Sphaerium patella			
826	Sphaerium sp.	Bivalvia (class)	Sphaeriidae	Eurythermal: warm summer
572	Sphaerium striatum			
1074	Spirosperma ferox	Oligochaeta (class)	Tubificidae	
1078	Spirosperma sp.	Oligochaeta (class)	Naididae	
184	Stactobiella sp.	Trichoptera	Hydroptilidae	Eurythermal: warm summer
605	Stagnicola sp.	Gastropoda (class)	Lymnaeidae	Eurythermal: warm summer
681	Stagnicola/Fossaria			
614	Staphylinidae (T)		Staphylinidae	
402	Stempellina sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
403	Stempellinella sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
256	Stenelmis sp.	Coleoptera	Elmidae	Eurythermal: warm summer
1036	Stenochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
700	Stenonema sp.	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
1055	Stenonema terminatum	Ephemeroptera	Heptageniidae	Eurythermal: warm summer
964	Stenopelmus sp.	Coleoptera	Chrysomelidae	
1037	Stictochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1039	Stilocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
317	Stratiomyiidae	Diptera	Stratiomyiidae	Eurythermal: warm summer
1156	Stratiomys sp.	Diptera	Stratiomyidae	
1075	Stylaria lacustris	Oligochaeta (class)	Naididae	
405	Sublettea sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
577	Suwallia sp.	Plecoptera	Chloroperlidae	Eurythermal: warm summer
707	Suwallia/Neaviperla			
134	Sweltsa sp.	Plecoptera	Chloroperlidae	Eurythermal: warm summer
404	Symbiocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
910	Symposiocladius sp.			
406	Sympotthastia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
1155	Syndiamesa sp.	Chironomidae (family)	Chironomidae	
407	Synorthocladius sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
799	Syrphidae	Diptera	Syrphidae	
916	Syrphidae DUPLICATE	Diptera	Syrphidae	Eurythermal: warm summer
318	Tabanidae	Diptera	Tabanidae	Eurythermal: warm summer
697	Tabanus sp.	Diptera	Tabanidae	Eurythermal: warm summer
692	Tachopteryx sp.	Odonata	Petaluridae	
80	Taenionema pallidum	Plecoptera	Taeniopterygidae	Stenothermal: cold
79	Taenionema sp.	Plecoptera	Taeniopterygidae	Stenothermal: cold
77	Taeniopterygidae	Plecoptera	Taeniopterygidae	Stenothermal: cold
1090	Taeniopteryx burksi	Plecoptera	Taeniopterygidae	
1126	Taeniopteryx sp.	Plecoptera	Taeniopterygidae	Eurythermal: warm summer
473	Talitridae	Amphipoda	Talitridae	
802	Tangeridae			
716	Tanyderidae	Diptera	Tanyderidae	Eurythermal: cool summer
947	Tanypodinae	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
998	Tanypus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
545	Tanytarsini	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
408	Tanytarsus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1040	Tanytarus limneticus	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
829	Tenagobia sp.	Hemiptera	Corixidae	Eurythermal: warm summer
734	Thaumalea elnora			
735	Thaumalea fusca			
732	Thaumalea sp.	Diptera	Thaumaleidae	Eurythermal: cool summer
733	Thaumaleidae	Diptera	Thaumaleidae	Eurythermal: cool summer
626	Theromyzon sp.	Hirudinea (class)	Glossiphoniidae	Eurythermal: cool summer
908	Thienemanniella sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1041	Thienemannimyia gr. sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
410	Thienemannimyia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
409	Thienemanniola sp.			
55	Timpanoga hecuba	Ephemeroptera	Ephemerellidae	Eurythermal: warm summer
906	Timpanoga sp.	Ephemeroptera	Ephemerellidae	Eurythermal: cool summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
755	Tinodes sp.	Trichoptera	Psychomyiidae	
825	Tinodes sp. (Duplicate Code 755)	Trichoptera	Psychomyiidae	Eurythermal: warm summer
290	Tipula sp.	Diptera	Tipulidae	Eurythermal: warm summer
282	Tipulidae	Diptera	Tipulidae	Unknown
756	Tipulidae ormosia			
1151	Tokunagaia sp.	Chironomidae (family)	Chironomidae	
632	Trepobates sp.	Hemiptera	Gerridae	Eurythermal: warm summer
672	Trepobates sp. DUPLICATE			
245	Triaenodes sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
1042	Tribelos jucundum	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1043	Tribelos sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
744	Trichoptera	Trichoptera		
461	Tricladida			
56	Tricorythidae	Ephemeroptera	Tricorythidae	Eurythermal: warm summer
1142	Tricorythodes edmundsi	Ephemeroptera	Tricorythidae	Eurythermal: warm summer
58	Tricorythodes minutus	Ephemeroptera	Tricorythidae	Eurythermal: cool summer
57	Tricorythodes sp.	Ephemeroptera	Tricorythidae	
953	Triogma sp.	Diptera	Tipulidae	
531	Trissopelopia sp.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
865	Triznaka sp.	Plecoptera	Chloroperlidae	
746	Tropisternus sp.	Coleoptera	Hydrophilidae	Eurythermal: warm summer
466	Tubifex sp.	Oligochaeta (class)	Tubificidae	
1081	Tubifex tubifex	Oligochaeta (class)	Tubificidae	
486	Tubificidae	Ephemeroptera	Leptophlebiidae	
489	Tubificidae (Duplicate Code 486)	Oligochaeta (class)	Tubificidae	
1082	Tubificidae w/ cap setae	Oligochaeta (class)	Tubificidae	
1083	Tubificidae w/o cap setae	Oligochaeta (class)	Tubificidae	
416	Turbellaria			Eurythermal: warm summer
412	Tvetenia bavarica gr.	Chironomidae (family)	Chironomidae	Eurythermal: cool summer
413	Tvetenia discoloripes gr.			

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
411	Tvetenia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1044	Tvetenia vitracies gr.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
304	Twinnia sp.	Diptera	Simuliidae	Eurythermal: cool summer
683	Uenoidae	Trichoptera	Uenoidae	
974	Ulomorpha sp.	Diptera	Tipulidae	
1121	Unionacea	Bivalvia (class)		
573	Unionidae	Bivalvia (class)	Unionidae	
1152	Utaperla sp.	Plecoptera	Chloroperlidae	Eurythermal: warm summer
738	Valvata sp.	Gastropoda (class)	Valvatidae	Eurythermal: warm summer
1058	Valvata utahensis	Gastropoda (class)	Valvatidae	Eurythermal: cool summer
637	Valvatidae	Gastropoda (class)	Valvatidae	
980	Veliidae	Hemiptera	Veliidae	Eurythermal: warm summer
87	Visoka cataractae	Plecoptera	Nemouridae	Stenothermal: cold
320	Visoka sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
620	Visoka sp. (Duplicate Code 320)	Plecoptera	Nemouridae	Stenothermal: cold
737	Viviparidae	Gastropoda (class)	Viviparidae	Eurythermal: warm summer
834	Vorticifex effusa	Gastropoda (class)	Planorbidae	Eurythermal: cool summer
565	Vorticifex sp.	Gastropoda (class)	Planorbidae	Eurythermal: cool summer
663	Wandesia sp.			
310	Wiedemannia sp.	Diptera	Empididae	Eurythermal: cool summer
189	Wormaldia sp.	Trichoptera	Philopotamidae	Eurythermal: cool summer
528	Wormalidia gabriella			Eurythermal: warm summer
1045	Xenochironomus sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
1138	Ylodes sp.	Trichoptera	Leptoceridae	Eurythermal: warm summer
75	Yoraperla brevis	Plecoptera	Peltoperlidae	Stenothermal: cold
76	Yoraperla mariana	Plecoptera	Peltoperlidae	Stenothermal: cold
74	Yoraperla sp.	Plecoptera	Peltoperlidae	Stenothermal: cold
115	Yugus sp.	Plecoptera	Perlodidae	
272	Zaitzevia milleri	Coleoptera	Elmidae	Eurythermal: warm summer
273	Zaitzevia parvula	Coleoptera	Elmidae	Eurythermal: warm summer

TAXON	TAXONNAME	ORDER	FAMILY	TEMPTOL
271	Zaitzevia sp.	Coleoptera	Elmidae	Eurythermal: warm summer
89	Zapada cinctipes	Plecoptera	Nemouridae	Eurythermal: warm summer
90	Zapada columbiana	Plecoptera	Nemouridae	Stenothermal: cold
91	Zapada frigida	Plecoptera	Nemouridae	Eurythermal: cool summer
92	Zapada oregonensis gr.	Plecoptera	Nemouridae	Eurythermal: cool summer
88	Zapada sp.	Plecoptera	Nemouridae	Eurythermal: cool summer
414	Zavrelia sp.	Chironomidae (family)	Chironomidae	Eurythermal: warm summer
415	Zavrelimyia sp.	Chironomidae (family)	Chironomidae	Stenothermal: cold
10	Zoniagrion sp.	Odonata	Coenagrionidae	
951	Zygoptera			

Appendix C. Fish Taxa List

Table C-1 is a list of fish taxa and attributes used in the water body assessment guidance. The principal source was Zaroban et al. (1999). Some exceptions are mottled sculpin (see Stream Fish Index report), genus and family level classifications, and for some additional introduced species.

Table C-1. Fish taxa

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
2	WHITE STURGEON	Acipenser transmontanus	Acipenseridae	TRUE	I	CLD
76	STURGEON	*Acipenseridae sp.*	Acipenseridae	TRUE	I	CLD
42	UTAH SUCKER	*Catostomus ardens*	Catostomidae	TRUE	T	COL
43	LONGNOSE SUCKER	*Catostomus catostomus*	Catostomidae	TRUE	I	CLD
44	BRIDGELIP SUCKER	*Catostomus columbianus*	Catostomidae	TRUE	T	COL
45	BLUEHEAD SUCKER	*Catostomus discobolus*	Catostomidae	TRUE	I	COL
46	LARGESCALE SUCKER	*Catostomus macrocheilus*	Catostomidae	TRUE	T	COL
47	MOUNTAIN SUCKER	*Catostomus platyrhychus*	Catostomidae	TRUE	I	COL
89	SUCKER	*Catostomus sp.*	Catostomidae	TRUE		COL
102	SUNFISH	Centrarchidae	Centrarchidae	FALSE		
57	GREEN SUNFISH	Lepomis cyanellus	Centrarchidae	FALSE	T	WRM
58	PUMPKINSEED	*Lepomis gibbosus*	Centrarchidae	FALSE	T	COL
59	WARMOUTH	*Lepomis gulosus*	Centrarchidae	FALSE	T	WRM
60	BLUEGILL	*Lepomis macrochirus*	Centrarchidae	FALSE	T	WRM
92	SUNFISH	*Lepomis sp.*	Centrarchidae	FALSE	T	
61	SMALLMOUTH BASS	*Micropterus dolomieu*	Centrarchidae	FALSE	I	COL
62	LARGEMOUTH BASS	*Micropterus salmoides*	Centrarchidae	FALSE	T	WRM
93	BASS	*Micropterus sp.*	Centrarchidae	FALSE		WRM
63	WHITE CRAPPIE	*Pomoxis annularis*	Centrarchidae	FALSE	T	WRM
64	BLACK CRAPPIE	*Pomoxis nigromaculatus*	Centrarchidae	FALSE	T	WRM
94	CRAPPIE	*Pomoxis sp.*	Centrarchidae	FALSE	T	WRM
110	CONVICT CICHLID	*CICHLASOMA NIGROFASCIATUM*	Cichlidae	FALSE	T	WRM
111	BLUE TILAPIA	*TILAPIA AUREA*	Cichlidae	FALSE	T	WRM
112	MOZAMBIQUE TILAPIA	*TILAPIA MOSSAMBICA*	Cichlidae	FALSE	T	WRM

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
113	REDBELLY TILAPIA	*TILAPIA ZILLI*	Cichlidae	FALSE	T	WRM
3	AMERICAN SHAD	*Alosa sapidissima*	Clupeidae	FALSE	I	COL
123	American Shad	*Alosa sapidissima*	Clupeidae	FALSE	I	COL
97	HERRINGS	Clupeidae	Clupeidae	FALSE	I	COL
109	LOACH (COBITIDAE)	Cobitidae	Cobitidae	FALSE	T	WRM
107	ORIENTAL WEATHERFISH	MISGURNUS ANGUILLICAUDATUS	Cobitidae	FALSE	T	WRM
108	WEATHERFISH	*MISGURNUS SP.*	Cobitidae	FALSE	T	WRM
67	MOTTLED SCULPIN	*Cottus bairdi*	Cottidae	TRUE	I	CLD
68	PAIUTE SCULPIN	*Cottus beldingi*	Cottidae	TRUE	I	CLD
69	SLIMY SCULPIN	*Cottus cognatus*	Cottidae	TRUE	I	CLD
70	SHORTHEAD SCULPIN	*Cottus confusus*	Cottidae	TRUE	S	CLD
71	BEAR LAKE SCULPIN	*Cottus extensus*	Cottidae	TRUE	I	CLD
72	SHOSHONE SCULPIN	*Cottus greenei*	Cottidae	TRUE	S	CLD
73	WOOD RIVER SCULPIN	*Cottus leiopomus*	Cottidae	TRUE	S	CLD
74	TORRENT SCULPIN	*Cottus rhotheus*	Cottidae	TRUE	I	CLD
96	SCULPIN	*Cottus sp.*	Cottidae	TRUE		CLD
27	CHISELMOUTH	*Acrocheilus alutaceus*	Cyprinidae	TRUE	I	COL
28	GOLDFISH	*Carassius auratus*	Cyprinidae	FALSE	T	WRM
29	LAKE CHUB	*Couesius plumbeus*	Cyprinidae	TRUE	I	CLD
84	CHUB	*Couesius sp.*	Cyprinidae			CLD
118	GRASS CARP	*Ctenopharyngodon idella*	Cyprinidae	FALSE	T	WRM
99	MINNOWS	Cyprinidae	Cyprinidae	FALSE		
30	COMMON CARP	Cyprinus carpio	Cyprinidae	FALSE	T	WRM
31	UTAH CHUB	*Gila atraria*	Cyprinidae	TRUE	T	COL
32	TUI CHUB	*Gila bicolor*	Cyprinidae	FALSE	T	COL

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
33	LEATHERSIDE CHUB	*Gila copei*	Cyprinidae	TRUE	I	COL
85	CHUB	*Gila sp.*	Cyprinidae			COL
34	PEAMOUTH	*Mylocheilus caurinus*	Cyprinidae	TRUE	I	COL
119	SPOTTAIL SHINER	*Notropis hudsonius*	Cyprinidae	FALSE	T	COL
35	FATHEAD MINNOW	Pimephales promelas	Cyprinidae	FALSE	T	WRM
36	NORTHERN PIKEMINNOW (formerly N. squawfish)	*Ptychocheilus oregonensis*	Cyprinidae	TRUE	T	COL
86	PIKEMINNOW	*Ptychocheilus sp.*	Cyprinidae	FALSE	T	COL
37	LONGNOSE DACE	*Rhinichthys cataractae*	Cyprinidae	TRUE	I	COL
124	UMPQUA DACE	*Rhinichthys evermanni*	Cyprinidae	FALSE	I	COL
38	LEOPARD DACE	*Rhinichthys falcatus*	Cyprinidae	TRUE	I	COL
39	SPECKLED DACE	*Rhinichthys osculus*	Cyprinidae	TRUE	I	COL
87	DACE	*Rhinichthys sp.*	Cyprinidae		I	COL
40	REDSIDE SHINER	*Richardsonius balteatus*	Cyprinidae	TRUE	I	COL
88	SHINER	*Richardsonius sp.*	Cyprinidae	TRUE	I	COL
41	TENCH	*Tinca tinca*	Cyprinidae	FALSE	T	WRM
505	TIGER MUSKELLUNGE	*Esox luciuc E. MASQUINONGY*	Esocidae	FALSE	I	COL
26	NORTHERN PIKE	*Esox lucius*	Esocidae	FALSE	I	COL
83	PIKE	*Esox sp.*	Esocidae	FALSE	I	COL
54	BURBOT	*Lota lota*	Gadidae	TRUE	I	CLD
105	COD	*Lota sp.*	Gadidae	TRUE	I	CLD
48	BLACK BULLHEAD	*Ameiurus melas*	Ictaluridae	FALSE	T	WRM
116	YELLOW BULLHEAD	*AMEIURUS NATALIS*	Ictaluridae	FALSE	T	WRM
49	BROWN BULLHEAD	*Ameiurus nebulosus*	Ictaluridae	FALSE	T	WRM
104	BULLHEAD	*Ameiurus sp.*	Ictaluridae	FALSE	T	WRM
100	CATFISH	*Ictaluridae*	Ictaluridae	FALSE	T	WRM

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
120	BLUE CATFISH	*Ictalurus Furcatus*	Ictaluridae	FALSE	T	WRM
50	CHANNEL CATFISH	*Ictalurus punctatus*	Ictaluridae	FALSE	T	WRM
90	CATFISH	*Ictalurus sp.*	Ictaluridae	FALSE	T	WRM
51	TADPOLE MADTOM	*Noturus gyrinus*	Ictaluridae	FALSE	T	WRM
52	FLATHEAD CATFISH	*Pylodictis olivaris*	Ictaluridae	FALSE	T	WRM
25	RAINBOW SMELT	*Osmerus mordax*	Osmeridae	FALSE	I	CLD
106	SMELT	*Osmerus sp.*	Osmeridae	FALSE		
65	YELLOW PERCH	*Perca flavescens*	Percidae	FALSE	I	COL
95	PERCH	*Perca sp.*	Percidae	FALSE	I	COL
103	PERCH	*Percidae*	Percidae	FALSE	I	COL
122	Sauger	*Stizostedion canadense*	Percidae	FALSE	I	COL
66	WALLEYE	*Stizostedion vitreum*	Percidae	FALSE	I	COL
91	TROUT-PERCH	*Percopsis sp.*	Percopsidae	TRUE	I	COL
53	SAND ROLLER	*Percopsis transmontana*	Percopsidae	TRUE	I	COL
75	LAMPREY	*Lampetra sp.*	Petromyzontidae	TRUE	I	COL
1	PACIFIC LAMPREY	*Lampetra tridentata*	Petromyzontidae	TRUE	I	COL
55	WESTERN MOSQUITOFISH	*Gambusia affinis*	Poeciliidae	FALSE	T	WRM
114	SHORTFIN MOLLY	*POECILIA MEXICANA*	Poeciliidae	FALSE	T	WRM
56	GUPPY	*Poecilia reticulata*	Poeciliidae	FALSE	T	WRM
101	GUPPY	*Poeciliidae*	Poeciliidae	FALSE	T	WRM
115	GREEN SWORDTAIL	*XIPHOPHORUS HELLERI*	Poeciliidae	FALSE	T	WRM
121	PLATY	*Xiphophorus SP.*	Poeciliidae	FALSE	T	WRM
4	LAKE WHITEFISH	*Coregonus clupeaformis*	Salmonidae	FALSE	I	CLD
77	WHITEFISH	*Coregonus sp.*	Salmonidae	FALSE	I	CLD
17	GOLDEN TROUT	*Oncorhynchus aguabonita*	Salmonidae	FALSE	S	CLD
11	CUTTHROAT TROUT	*Oncorhynchus clarki*	Salmonidae	TRUE	S	CLD

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
501	CUTTHROAT TROUT (all stocks) X RAINBOW TROUT	*Oncorhynchus clarki X O. mykiss*	Salmonidae	TRUE	S	CLD
5	CHUM SALMON	*Oncorhynchus keta*	Salmonidae	FALSE	S	CLD
6	COHO SALMON	*Oncorhynchus kisutch*	Salmonidae	FALSE	S	CLD
10	RAINBOW TROUT	*Oncorhynchus mykiss*	Salmonidae	TRUE	S	CLD
117	STEELHEAD	*Oncorhynchus mykiss*	Salmonidae	TRUE	S	CLD
7	SOCKEYE SALMON	*Oncorhynchus nerka*	Salmonidae	TRUE	S	CLD
8	KOKANEE	*Oncorhynchus nerka*	Salmonidae	TRUE	S	CLD
78	PACIFIC TROUT OR SALMON	*Oncorhynchus sp.*	Salmonidae	TRUE	S	CLD
9	CHINOOK SALMON	*Oncorhynchus tshawytscha*	Salmonidae	TRUE	S	CLD
12	BEAR LAKE WHITEFISH	*Prosopium abyssicola*	Salmonidae	TRUE	I	CLD
13	PYGMY WHITEFISH	*Prosopium coulteri*	Salmonidae	TRUE	I	CLD
14	BONNEVILLE CISCO	*Prosopium gemmiferum*	Salmonidae	TRUE	S	CLD
79	WHITEFISH	*Prosopium sp.*	Salmonidae	TRUE	I	CLD
15	BONNEVILLE WHITEFISH	*Prosopium spilonotus*	Salmonidae	TRUE	I	CLD
16	MOUNTAIN WHITEFISH	*Prosopium williamsoni*	Salmonidae	TRUE	I	CLD
18	ATLANTIC SALMON	*Salmo salar*	Salmonidae	FALSE	S	CLD
80	ATLANTIC TROUT OR SALMON	*Salmo sp.*	Salmonidae	FALSE		CLD
19	BROWN TROUT	*Salmo trutta*	Salmonidae	FALSE	I	CLD
98	TROUT	Salmonidae	Salmonidae	FALSE		CLD
20	ARCTIC CHAR	Salvelinus alpinus	Salmonidae	FALSE	S	CLD
22	BULL TROUT	*Salvelinus confluentus*	Salmonidae	TRUE	S	CLD
21	BROOK TROUT	*Salvelinus fontinalis*	Salmonidae	FALSE	I	CLD
502	BROOK TROUT X BULL TROUT	*Salvelinus fontinalis X S. confluentus*	Salmonidae	FALSE	S	CLD
503	BROOK TROUT X LAKE TROUT (SPLAKE)	*Salvelinus fontinalis X S. namaycush*	Salmonidae	FALSE		CLD

TAXA CODE	Common Name	Taxonomic name	Family	Idaho Native	Sensitivity	Temperature preference
504	BROOK TROUT X BROWN TROUT (TIGER TROUT)	*Salvelinus fontinalis X Salmo trutta*	Salmonidae	FALSE		CLD
23	LAKE TROUT	*Salvelinus namaycush*	Salmonidae	FALSE	S	CLD
81	CHAR	*Salvelinus sp.*	Salmonidae	FALSE		CLD
24	ARCTIC GRAYLING	*Thymallus arcticus*	Salmonidae	FALSE	S	CLD
82	GRAYLING	*Thymallus sp.*	Salmonidae	FALSE	S	CLD
9999	Fish	Unidentified				

Table notes:
(1) Sensitivity: S – senstive; I – intermediate; T – tolerant. Sensitive species are those that are typically intolerant of siltation, turbidity, increased water temperature, and lowered dissolved oxygen and tend to be replaced by intermediate or tolerant species. Tolerant species are considered those that tend increase in abundance with human disturbances particularly in relation to increased siltation, turbidity, and water temperature and decreases in dissolved oxygen (Zaroban et al. 1999).
(2) Temperature classifications: CLD – Cold water; COL – cool water; WRM – warm water

Appendix D. Temperature Frequency of Exceedance Calculation Procedure

Memorandum

To: DEQ Water Quality Staff

From: Don Essig, Temperature Issues Coordinator, and
Chris Mebane, Water Quality Standards Program manager

Date: January 3, 2002

Re: Temperature Frequency of Exceedance Calculation Procedure, Revised

This memo builds on and strives to clarify application of the policy on allowable frequency of exceedance contained in WBAG II. It represents DEQ's further interpretation of Idaho's water quality criteria for temperature. This revision of the original Oct. 22nd, 2001 memo better addresses cases in which greater than 10% exceedance are apparent with less than a complete data record.

The 10% criteria exceedance policy is for 303(d) listing and de-listing decisions. It is still necessary to target the current water quality criteria in crafting a TMDL. However if your frequency of exceedance of the temperature criteria is less than 10%, and there is no other evidence of thermal impairment, then it is possible to move for de-listing rather than proceed with a temperature TMDL. If you proceed with a temperature TMDL, then during implementation of the TMDL the water will be reassessed. In that reassessment the goal for temperature would be considered met if criteria exceedances fall below 10% for a 90 percentile air T year (per our Air T exemption).

Frequencies of temperature exceedance must be calculated on the metric of interest (e.g., the frequency of daily maximum stream temperature exceeding daily maximum criteria). Except for single daily maximum criteria, this requires data processing of the raw temperature record before counting exceedances. What follows is more detail on calculation of a criteria exceedance frequency for water temperature.

Time periods of interest

For ***cold water aquatic life*** the summer period of June 21st through September 21st shall be considered the period of interest on which to gage frequency of exceedance. This 93 day period acknowledges the natural seasonal progression of water temperature in which peak water temperature typically occur between

July 15th and August 15th, with progressively cooler temperature generally to either side.

For ***salmonid spawning*** the time period of interest is the entire spawning and incubation period ***at a given site***, but not less than 45 days. Forty five days is set as a minimum spawning period as this allows 2 weeks for spawning and an additional month for egg incubation. The frequency of exceedance of salmonid spawning criteria should be based on the entire spawning and incubation period of the site in question. Note that the entire spawning period at a site, even when greater than 45 days, will usually be shorter than the broad periods that were formerly in Idaho's water quality standards. Those broad periods, often still used as rules of thumb, were intended to encompass spawning times statewide and from valley to mountain, not what would occur at any particular site.

Critical time period

In absence of data to the contrary, critical periods for water temperature are defined as follows. For ***cold water aquatic life*** the critical time period is from July 15th through August 15th, the time period when most streams reach there highest temperature of the year. Spawning often occurs when water temperatures are in a spring or fall transition. Therefore, for ***salmonid spawning*** the critical time period is the 22 days at the warmer end of the spawning period. For spring spawners this will be at the chronological end of the period, while for fall spawners this will be at the chronological beginning of the period.

Complete data records

In order to calculate and evaluate a percent exceedance for temperature an adequate data record is needed. The best situation is to have a complete data record for the entire period of interest as defined above and that should be the goal in any future monitoring effort. However it is acknowledged that this is not always the case, even when planned, and furthermore much historical data will not have been collected with this policy in place. Therefore the following allowances are made for evaluating partial data records.

Partial data records

For purposes of evaluating a frequency of exceedance partial data records that do not include the critical time periods are inadequate for estimating a frequency less than 10% and therefore can not be used to determine compliance with Idaho's temperature criteria.

On the other hand, partial data records that do not include the critical time periods may be sufficient to estimate a frequency of exceedance that is at least 10% and thus a violation of criteria. This occurs when the observed number of days over criteria in the partial record is greater than the number of days necessary to reach 10% exceedance for the entire period of interest. Take ***salmonid spawning*** for example, if a partial data record includes 41 days of a 90 day spawning period, and 15 of those days are over criteria then the frequency of exceedance is at least 15/90 = 17%, even if it were assumed the 49 days without data met criteria. For ***cold water aquatic life*** a frequency of

exceedance greater than 10% is documented with ten days of exceedance, even if those ten days are the only data available (10/93 = 11%). Data records less than 10 days for ***cold water aquatic life*** or less than 10% of the applicable spawning period are inadequate to show a frequency of exceedance that is at least 10% and are therefore inadequate to determine violation of Idaho's temperature criteria.

If the partial data record includes the critical time period it may be possible to infer the frequency of exceedance is not more than 10%. For ***cold water aquatic life***, if the partial data record includes the critical period from July 15 thru August 15th inclusive and the frequency of exceedance is less than 10%, then it can be assumed the frequency of exceedance for the entire summer period of interest is less than 10%. Similarly, if the data record during ***salmonid spawning*** includes the warmest 22 days of the spawning period (end or beginning of the time period depending on whether spawning extends into spring or fall) and the frequency of exceedance is less than 10%, then it can be assumed that the frequency of exceedance is less than 10% for the entire spawning period.

If calculated frequency of exceedance is greater than 10% for a partial data record it may still be possible to infer a frequency of exceedance as if data for the entire period of interest had been collected. To do so one must examine the data record and consider seasonal trends in temperature.

If the last (or first) seven consecutive days at the cool end of the record show no exceedances of criteria, then it may be assumed the entire following (preceding) unmonitored portion of the time period of interest is also without exceedances. In which case an inferred frequency of exceedance may be calculated using the entire period of interest as the denominator. For example, lets say the period of interest is a spawning period which begins May 1st and ends June 30th. The available data record however begins June 1st and shows 5 exceedances of a 13°C daily maximum criterion. The calculated frequency of exceedance is 5/30 = 17%. Further examination of the data record reveals that all 5 exceedances occurred after June 15th with no exceedances in the first 7 days of June, at the cooler beginning of the record. It can therefore be assumed that had data been obtained for May it would also show no exceedances of the criterion. The inferred frequency of exceedance for the entire spawning period would be 5/61 = 8%, no violation of standards.

CC: Michael McIntyre, Dave Mabe

Appendix E. Regional Application of the Idaho Water Quality Standards Temperature Exemption

E.1. Background

Ambient air temperature is one of the principal factors correlated with stream temperatures. It is also one factor that has been regularly monitored at a number of National Weather Service reporting stations for many years, allowing a statistical analysis of frequency of exceedance. When air temperatures are unusually hot, stream temperatures rise and may exceed fixed criteria for no other reason than the weather. For this reason the Idaho Water Quality Standards and Wastewater Treatment Requirements (Water Quality Standards) exempts the numeric temperature criteria when the air temperature exceeds the 90th percentile of the annual maximum weekly maximum temperatures (MWMT) as determined from the historical record of a nearby weather station (IDAPA 58.01.02.080.04). There is only one MWMT per year, and only 1 year in 10, on average, will see the MWMT greater than the 90th percentile value. The exemption is narrow by design and should take effect only rarely, on the hottest days of a warm summer and likely not at all in most years.

E.2. Explanation

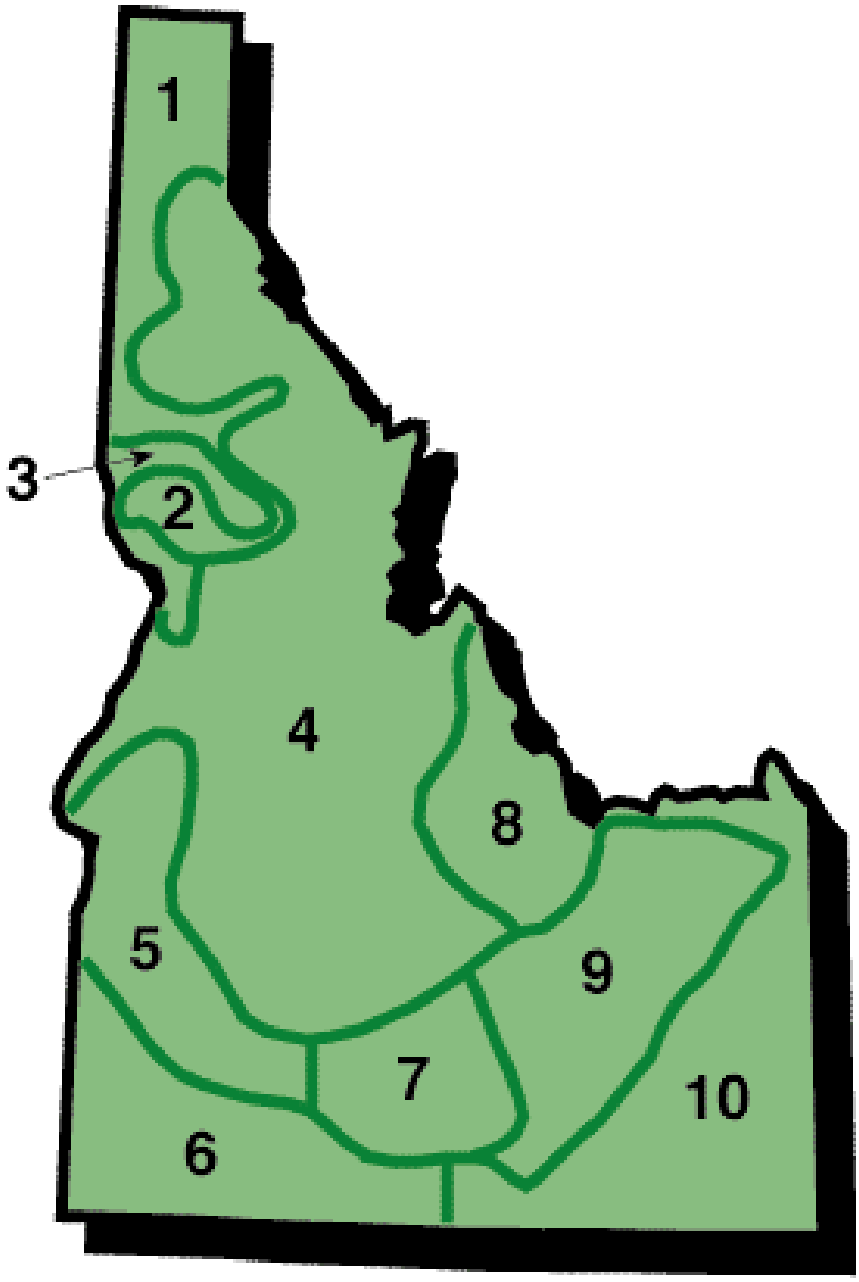
Although not the only factor affecting day to day changes in water temperature, we do expect water temperature to be unusually high when the weather is unusually hot. When the air temperature is unusually hot at one reporting locale, the air temperature is likely to be unusually high throughout the region. Since weather is a regional phenomenon, the temperature exemption is applied to regions of similar climate.

To that end, the maximum air temperature records for the past thirty years (1970-1999) were obtained for stations in the 10 climate divisions in Idaho set by the National Climatic Data Center (NCDC). The climate divisions established by NCDC are standardized regions within each state that designate areas of similar climate regimes (NCDC 2000a). The stations were chosen because they are both representative of their climate divisions and compared to other stations in their climate division, have a longer record of temperatures. Due to the size of climate division 4, records were obtained for three stations, one each in northern, southwestern, and central Idaho in order to provide a closer regional comparison. Table E-1 summarizes the locations of the stations used in this report and Figure E-1 identifies NCDC divisions.

Table E-1. Weather Stations Attributes

Climate Division	Coop ID	Station Name	County	Latitude/Longitude	Elevation (m)
1	101956	Sandpoint	Bonner	48°18' N, 116°33' W	640.1
2	106152	Moscow	Latah	46°44' N, 116°58' W	810.8
3	105241	Lewiston	Nez Perce	46°22' N, 117°01' W	437.7
4	104381	Kellogg	Shoshone	47°32' N, 116°07' W	707.1
4	105708	McCall	Valley	44°53' N, 116°06' W	1531.6
4	108676	Stanley	Custer	44°13' N, 114°56' W	1911.4
5	101022	Boise	Ada	43°34' N, 116°13' W	865.0
6	104295	Hollister	Twin Falls	42°21' N, 114°35' W	1379.2
7	109303	Twin Falls	Twin Falls	42°33' N, 114°21' W	1207.0
8	108080	Salmon	Lemhi	45°11' N, 113°54' W	1198.2
9	107211	Pocatello	Bannock	42°55' N, 112°34' W	1353.3
10	102676	Driggs	Teton	43°44' N, 111°07' W	1916.0

Source: Compiled from National Climatic Data Center, 2000a.



Source: National Climatic Data Center, 2000.

Figure E-1. National Climatic Data Center (NCDC) Climate Divisions

E.3. Process / Results

To identify the air temperature thresholds for the exemption, the 90 th percentile of the maximum weekly maximum temperature of the air for the above weather stations was calculated. First, a 7-day rolling average of the record was calculated for the 30-year period used to define climatic norms. Next, the highest value for the 7-day rolling averages, or the MWMT, was selected within each calendar year. For some stations (i.e., Kellogg, Stanley, Hollister, and Driggs), an accurate MWMT could not be determined in select years due to missing records in the summer months.

For each station, the 90th percentile of the annual series of MWMT was calculated. These are given in Table E-2 in both Fahrenheit and centigrade.

Table E-2 is provided for convenience and is not intended to preclude others from determining a 90th percentile air temperature threshold for a weather reporting station nearer their stream of interest, or for the most recent 30-year period.

Table E-2. 90th Percentile of Maximum Weekly Maximum Air Temperatures

Climate Division	Station Name	90th % MWMT (°F)	90th % MWMT (°C)
1	Sandpoint	92.60	33.67
2	Moscow	96.04	35.58
3	Lewiston	102.33	39.07
4	Kellogg	98.71	37.06
4	McCall	91.00	32.78
4	Stanley	87.80	31.00
5	Boise	101.30	38.50
6	Hollister	93.66	34.26
7	Twin Falls	94.44	34.69
8	Salmon	97.40	36.33
9	Pocatello	97.04	36.13
10	Driggs	88.60	31.44

Note: The Idaho Department of Environmental Quality has a spreadsheet used to calculate these values

E.4. Conclusion

The above calculations provide a guideline to determine the criteria for temperature exemptions within each climate division (see Figure D-1). The Water Quality Standards call for the nearest weather station to be used. The NCDC climate divisions, however, are representative of regional climate regimes and thus provide a general measure to show how the Water Quality Standards apply. For example, for a stream within climate division 8, the air temperature would need to exceed 97.4°F (36.3°C) in Salmon for the Water Quality

Standards' temperature exemption to take effect. For the three stations in climate division 4 used, the Water Quality Standards state that the nearest weather reporting station should be used.

E.5. References

National Climatic Data Center, 2000a. Weather Observation Station Attributes. See website: http://www.ncdc.noaa.gov

National Climatic Data Center, 2000b. Daily maximum temperature observations. Obtained by E-mail request from Idaho State Climate Services (climate@uidaho.edu). See website at: http://www.uidaho.edu/~climate

Appendix F. Time Periods for Salmonid Spawning

F.1. Time Periods for Salmonid Spawning

Section 5.2.4 summarizes general issues relating to the application of salmonid spawning and incubation for trout, salmon, and whitefish occurring in Idaho. This appendix describes some additional considerations and lists some reported spawning times for specific water bodies for Chinook salmon, *Oncorhynchus mykiss* (i.e., rainbow/ redband/ steelhead trout), and cutthroat trout. These species were selected for the bibliography because they are widespread native salmonids. Spawning times for bull trout were not considered since these are prescribed by regulation (September – October); therefore, when bull trout actually spawn is not relevant for the question of what time periods spawning criteria apply (WQS § 250.02.f). Spawning periods for mountain whitefish were not considered in detail because they spawn in late-fall and winter and maximum temperature criteria are not much of an issue at those times.

The salmonid spawning and incubation time periods listed in Table 5-2 and F-1 below were intended to reflect typical, core-time periods for spawning and incubation. The table was not intended to capture the extremes of variations in life histories reported for species.

Table F-1. Common core-periods for spawning and egg incubation for several native and introduced salmonid species in Idaho

Fish Species	(Annually) Time Period	Fish Species	(Annually) Time Period
Chinook salmon (spring/summer)	Aug 15 - June 1	Bull trout	Sept 1 - Apr 1
Chinook salmon (fall)	Oct 1 - Apr 15	Kokanee salmon	Sep 1 - May 1
Sockeye salmon	Oct 1 - June 1	Mountain whitefish	Oct 15 - Mar 15
Steelhead trout	Apr 1 - July 15	Brown trout	Oct 1 - Apr 1
Redband/rainbow trout	Mar 15 - July 15	Brook trout	Oct 1 - June 1
Cutthroat trout	Apr 1 – Jul 1		

Table notes: Principle sources consulted were Scott and Crossman (1998), Wydoski and Whitney (1979), Simpson and Wallace (1982), and for bull trout WQS 250.02.f. Days of the month (“1”, “15”) indicate early or mid-month; no higher precision is intended.

Unfortunately, selecting time periods to apply temperature criteria for salmonid spawning is somewhat circular. For example, temperature criteria suitable for salmonid spawning apply during time periods when salmonids are spawning (WQS § 250.02.e). Salmonids are cued to spawn during times when

temperatures become suitable. For example, for spring spawning species such as cutthroat trout and rainbow/redband/steelhead trout, spawning is initiated when temperatures rise to about 6 – 9°C (Benke 1992). Stream temperatures rise and spawning occurs as the weather warms in the spring. Thus, the time periods for applying temperature criteria suitable for spawning are determined by when temperatures are suitable for spawning. This tautology makes meaningful application of criteria difficult. The recommended approach for applying these criteria for assessment of many streams (e.g., 303(d) listing) is to compare observed temperatures over the available estimates of core time periods of spawning and incubation for the area of interest. If salmonid spawning numeric criteria are exceeded (9°C daily average or 13°C daily maximum) during these core-time periods, then violations of salmonid spawning temperature criteria should be determined in accordance with the criterion exceedance policy. For more focused evaluations (e.g., TMDL problem assessments or subbasin assessments), a more meaningful approach would additionally consider probable causes of the exceedance. Water quality standards are generally interpreted such that waters are not to vary from specified characteristics due to human activities. Thus, for focused evaluations, the assessor should consider if human activities within the watershed can be linked to increases in stream temperature. If so, criteria are violated; if not, temperature criteria are not violated. The level of analysis needed to distinguish natural from human-caused thermal sources is generally beyond the scope for broadscale evaluations (e.g., 303(d) water quality listing). Exceptions are likely limited to conditions when the assessor can readily determine that upstream of the measurement point, the watershed is completely free from roads or other mechanized disturbances in the riparian area of influence. Otherwise, more focused evaluations than are practical during the statewide 303(d) compilations are needed.

An additional consideration in applying salmonid spawning criteria is whether the time periods for applying spawning criteria would logically conflict with other life history requirements. For example, Harig and Fausch (in press) investigated minimum summer temperatures needed for translocated cutthroat trout to persist. Cutthroat trout spawn during the spring and are stimulated by rising temperatures, but cold water temperatures can delay spawning into late summer and prolong egg incubation, resulting in low embryo survival or increased time to fry emergence. Late-hatching fry may be unable to acclimate to a rapid decrease in water temperature or may starve during winter, so survival may depend on their ability to grow large enough to withstand metabolic deficits. Harig and Fausch (in press) found that in streams that support no or low numbers of cutthroat trout, cold temperatures (lesser than or equal to 7.8°C mean daily temperature for July) likely prevent successful reproduction and recruitment during most years. In streams ranked as supporting high numbers of cutthroat trout, summer water temperatures are probably warm enough (10.0°C mean July temperature) to allow successful reproduction and growth (Harig et al. 2000; Harig and Fausch, in press). Streams with daily maximum temperatures less than 9°C in July (spawning criteria) cannot have mean July temperatures of 10°C. In other words, temperatures that might be optimal for one life stage (less than 9°C for spawning and egg incubation), if maintained too long would reduce growth and juvenile survival. Therefore, overly broad application of spawning and egg incubation criteria could be counterproductive, rather than being necessarily “conservative” or “protective.”

Similarly, Thurow and King (1994) reported that cutthroat trout spawning *began* when mean daily temperatures rose above 10°C, and Magee et al. (1996) reported peak spawning of cutthroat trout occurred at mean daily temperatures of 8°C. These temperatures are near or above the less than 9°C spawning criteria, which indicates the criteria may be too low. Currently, these situations would be addressed by natural background provisions of the water quality standards. These provisions are that when natural background conditions exceed any numeric water quality criteria, criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions.

Hatching, the end of the incubation periods, can be estimated from reported fry emergence times. For criteria application, this may only be of practical interest for rainbow and cutthroat trout, the spring spawning species for which the egg incubation times extends into the summer heat. Rainbow trout eggs usually hatch 4-7 weeks after spawning, and alevins stay in the gravel for an additional 4-7 days. Cutthroat trout eggs usually hatch 6-7 weeks after spawning and alevins remain in the gravel another 1-2 weeks (Scott and Crossman 1998). These times, plus one to two weeks of spawning activity, result in minimum spawning and incubation periods on the order of 40-60 days.

Table F-2. Time of Spawning of Chinook salmon
Listed in order by run type, basin, and stream. "Basin" is used in generic sense; rather than a specific hydrologic or administrative definition.

Stream	Basin	Time of Spawning		Run type	Reference
		Begin	End		
SF Clearwater	Clearwater	10/1	Dec 15	Fall Chin	CBAG-FTAG (2001)
Snake River	Columbia River	15 Oct	27 Nov	Fall Chin	Rondorf and Tiffan (1997)
Snake River Basin	Columbia River	Late-Oct	mid-Nov	Fall Chin	Lee et al. (1997)
Clearwater R.	Snake	16 Nov	12 Dec	Fall Chin	Arnsberg et al. 1992
Clearwater R.	Snake	20 Nov	3 Dec	Fall Chin	Arnsberg 1992
Salmon R.	Snake		3 Dec	Fall Chin	Arnsberg 1992
Snake River, Hells Canyon	Snake	Oct 21	Dec 13	Fall Chin	Groves and Chandler (1999)
Snake River	Snake River	late-Oct	mid-Nov	Fall Chin	Chapman et al. (1991)
Columbia Basin		Aug	Sept	Spr Chin	Healey (1991)
Bear Creek	Clearwater	mid-Aug	mid-Sept	Spr Chin	Murphy (1987)
Clearwater Drainage	Clearwater	Aug	Sept	Spr Chin	White and Cochnauer (1975)
Lolo Creek	Clearwater		9/9-9/16	Spr Chin	Espinosa (1976)
Selway River	Clearwater	mid-Aug	mid-Sept	Spr Chin	Murphy (1987)
SF Clearwater	Clearwater	8/15	9/30	Spr Chin	CBAG-FTAG (2001)
SF Clearwater tribs	Clearwater	8/15	9/30	Spr Chin	CBAG-FTAG (2001)
S. Fk. Clearwater	Clearwater River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Snake R. & Tribs	Columbia	20 Aug	1 Nov	Spr Chin	Murray 1964
Snake River Basin	Columbia River	mid-Aug	mid-Sept	Spr Chin	Lee et al. (1997)
Alturas	Salmon		8/29-9/4	Spr Chin	Chapman et al. (1991)
Bear Valley	Salmon		8/29-9/3	Spr Chin	Chapman et al. (1991)

Stream	Basin	Time of Spawning		Run type	Reference
		Begin	End		
Bear Valley Ck.	Salmon	11 Aug	4 Sept	Spr Chin	Bjornn et al. 1963
Beaver	Salmon		8/24-9/3	Spr Chin	Chapman et al. (1991)
Big	Salmon		8/28-9/8	Spr Chin	Chapman et al. (1991)
Big Ck.	Salmon	3 Aug	30 Aug	Spr Chin	Bjornn et al. 1963
Camas	Salmon		8/27-9/5	Spr Chin	Chapman et al. (1991)
Capehorn	Salmon		8/25-9/1	Spr Chin	Chapman et al. (1991)
Chamberlain	Salmon		9/1-9/14	Spr Chin	Chapman et al. (1991)
E. Fork Salmon	Salmon		9/12-9/28	Spr Chin	Chapman et al. (1991)
Elk	Salmon		8/29-9/3	Spr Chin	Chapman et al. (1991)
Elk Ck.	Salmon	15 Aug	4 Sept	Spr Chin	Bjornn et al. 1963
Johnson Ck.	Salmon	19 Aug	14 Sept	Spr Chin	Bjornn et al. 1963
Knapp	Salmon		8/25-9/1	Spr Chin	Chapman et al. (1991)
Knox Br. – S.F. Guard Sta.	Salmon		9/4-9/24	Spr Chin	Chapman et al. (1991)
Lemhi	Salmon		9/10-9/13	Spr Chin	Chapman et al. (1991)
Lemhi R.	Salmon	25 Aug	16 Sept	Spr Chin	Bjornn et al. 1963
Loon	Salmon		9/5-9/11	Spr Chin	Chapman et al. (1991)
Marsh	Salmon		8/26-9/1	Spr Chin	Chapman et al. (1991)
Marsh Ck.	Salmon	9 Aug	26 Aug	Spr Chin	Bjornn et al. 1963
Mid Fork Salmon	Salmon		8/11-9/5	Spr Chin	Chapman et al. (1991)
N. F. Salmon	Salmon		8/30-9/6	Spr Chin	Chapman et al. (1991)
Pahsimeroi	Salmon		9/19-9/29	Spr Chin	Chapman et al. (1991)
Panther	Salmon		9/6-9/7	Spr Chin	Chapman et al. (1991)
S. F. Salmon	Salmon		8/30-9/6	Spr Chin	Chapman et al. (1991)
S. Fk. Salmon R.	Salmon	17 Aug	21 Sept	Spr Chin	Bjornn et al. 1963
Secesh/Lake	Salmon		8/24-9/14	Spr Chin	Chapman et al. (1991)
Stanley	Salmon		8/30-9/14	Spr Chin	Chapman et al. (1991)
Stanley-Salmon	Salmon		9/19-9/24	Spr Chin	Chapman et al. (1991)
Sulpher	Salmon		8/24-9/3	Spr Chin	Chapman et al. (1991)
Valley	Salmon		9/6-9/18	Spr Chin	Chapman et al. (1991)
Warm Spring	Salmon		8/31-9/9	Spr Chin	Chapman et al. (1991)
Yankee Fork	Salmon		8/31-9/7	Spr Chin	Chapman et al. (1991)
Herd Creek	Salmon River	mid-Aug	mid-Sept	Spr Chin	Richards and Cernera (1986)
Lemhi River	Salmon River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Little Salmon River	Salmon River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
M. Fk. Salmon R.	Salmon River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Rapid River	Salmon River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Salmon River Drainage	Salmon River	Aug	Sept	Spr Chin	White and Cochnauer (1975)
Upper Salmon R.	Salmon River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Johnson	Salmon.		9/4-9/24	Spr Chin	Chapman et al. (1991)
Clearwater River	Snake River	mid-Aug	mid-Sept	Spr Chin	Keifer et al. (1992)
Upper Salmon R.	Salmon	16 Aug	30 Aug	Spr Chin Spr Chin	Bjornn et al. 1963

Stream	Basin	Time of Spawning		Run type	Reference
		Begin	End		
Little Salmon River	Salmon River	Sept	mid-Oct	Sum Chin	Keifer et al. (1992)
M. Fk. Salmon R.	Salmon River	Sept	mid-Oct	Sum Chin	Keifer et al. (1992)
Pahsimeroi River	Salmon River	Sept	mid-Oct	Sum Chin	Keifer et al. (1992)
S. Fk. Salmon R.	Salmon River	Sept	mid-Oct	Sum Chin	Keifer et al. (1992)
Salmon River Drainage	Salmon River	Sept	Oct	Sum Chin	White and Cochnauer (1975)
Upper Salmon R.	Salmon River	Sept	mid-Oct	Sum Chin	Keifer et al. (1992)
Columbia Basin		Sept	Late-Nov	Sum/Fall Chin	Healey (1991)

Table F-3. Time of Spawning of Steelhead and Redband Trout
Listed in order by basin and stream.

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
Kelly Ck.	Clearwater	Early April	15 June		Orcutt et. al (1968)
L. Moose Ck.	Clearwater	Early April	15 June		Orcutt et. al (1968)
Long Ck.	Clearwater	Early April	15 June		Orcutt et. al (1968)
Moose Ck. (Selway)	Clearwater	Early April	15 June		Orcutt et. al (1968)
N. Fk. Clearwater R.	Clearwater	Early April	15 June		Orcutt et. al (1968)
SF Clearwater	Clearwater	1 Feb	May 31		CBAG FTAG (2001)
SF Clearwater tribs	Clearwater	1 Feb	May 31		CBAG FTAG (2001)
Big Boulder Ck.	Salmon	March	May		Anderson et al. (2001)
Burntlog Ck.	Salmon	3 May	May		Thurow (1987)
Camp Ck.	Salmon	3 May	May		Thurow (1987)
Chamberlain Ck.	Salmon	7 April	18 May		Holubetz and Leth (1997)
E. Fk. South Fork	Salmon	3 May	May		Thurow (1987)
Fitsum Ck.	Salmon	3 May	May		Thurow (1987)
Fourmile Ck.	Salmon	3 May	May		Thurow (1987)
French Creek	Salmon	April	mid-July		Horton (1985)
Johnson Ck.	Salmon	Early April	15 June		Orcutt et. al (1968)
Johnson Ck.	Salmon	3 May	May		Thurow (1987)
Lemhi R.	Salmon	Early March	mid-May		Keifer et al. (1992)
Lick Ck.	Salmon	3 May	May		Thurow (1987)
Little Salmon R.	Salmon	March	mid-May		Keifer et al. (1992)
M. Fk. Salmon R.	Salmon	Early March	mid-May		Keifer et al. (1992)
Pahsimeroi R.	Salmon	Early March	mid-May		Keifer et al. (1992)
Rapid River	Salmon	5 April	27 May		Holubetz and Leth (1997)

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
Running Ck.	Salmon	1 April	10 May		Holubetz and Leth (1997)
S. Fk. Salmon R.	Salmon	16 April	16 May		Thurow (1987)
S. Fk. Salmon R.	Salmon	Early March	mid-May		Keifer et al. (1992)
Secesh R.	Salmon	3 May	May		Thurow (1987)
Tamarack Ck.	Salmon	3 May	May		Thurow (1987)
W. Fk. Chamberlain Ck.	Salmon	9 April	17 May		Holubetz and Leth (1997)
Asotin R.	Snake	May	March		Busby et al. (1996)
Clearwater	Snake	Late March	Early June		Mallet (1974)
Clearwater Drainage	Snake	May	June		White and Cochnauer (1975)
Clearwater R. (A-run)	Snake	mid-February	mid-May		Keifer et al. (1992)
Clearwater R. (B-run)	Snake	April	May		Keifer et al. (1992)
Grande Ronde R.	Snake	May	March		Busby et al. (1996)
Lower Snake River	Snake	April	June		White and Cochnauer (1975)
S. Fk. Clearwater R.	Snake	mid-March	June		Keifer et al. (1992)
Salmon	Snake	Late March	Early June		Mallet (1974)
Salmon Drainage	Snake	April	June		White and Cochnauer (1975)
Snake R.	Snake	mid-April	mid-June		Keifer et al. (1992)
SW and S. Central. Idaho high desert drainages	Snake	mid March	15 June	Peak in mid May	Grunder written communication
Tucannon R.	Snake	May	March		Busby et al. (1996)
Upper Salmon R.	Snake	Early March	mid-May		Keifer et al. (1992)
WA streams		February	June		Wydoski and Whitney (1979)
MT streams		April	July		Bronen (1971)
Canadian streams		mid-April	Late July		Scott and Crossman (1973)
Columbia Basin streams (redband)		March	June		Lee et al. (1997)
Columbia Basin streams (steelhead)		March	June		Lee et al. (1997)

Table F-4. Time of Spawning of Cutthroat Trout
Listed in order by basin and stream.

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
Columbia Basin		March	July	WCT	Lee et al. (1997)
General		May	June	YCT	Trotter (1987)
General		May	June		Trotter (1987)
General		March	July	WCT	USFWS (1999)

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
General Idaho		May	July	YCT	Thurow et al. (1988)
Panhandle Streams		April	May		White and Cochnauer (1975)
Pyramid Lake		December	March	LCT	Sigler and Sigler (1987)
Pyramid Lake		March	May or June	LCT	Sigler and Sigler (1987)
Bear River	Bear River	June	June	BCT	Trotter (1987)
Bear River	Bear River	April	July		White and Cochnauer (1975)
Stockton Creek	Bear River	1 April	30 June		Horton (1985)
Angus Creek	Blackfoot River	24 May	8 June	BCT	Thurow (1980)
Angus Creek	Blackfoot River		13 June	BCT	Thurow (1980)
Angus Creek	Blackfoot River	28 May	12 June	BCT	Thurow et al. (1982)
Angus Creek FK. 1	Blackfoot River		28 May	BCT	Thurow et al. (1982)
Bacon Creek	Blackfoot River		26 June	BCT	Thurow et al. (1982)
Bacon Creek	Blackfoot River		30 June	BCT	Thurow (1980)
Bacon Creek	Blackfoot River	4 June	15 June	BCT	Thurow (1980)
Bacon Creek	Blackfoot River		13 June		Heimer et al. (1987)
Blackfoot River	Blackfoot River	April	June		White and Cochnauer (1975)
Browns Canyon	Blackfoot River		13 June		Heimer et al. (1987)
Browns Canyon Creek	Blackfoot River	1 June	19 June	BCT	Thurow (1980)
Browns Canyon Creek	Blackfoot River	12 June	14 June	BCT	Thurow (1980)
Browns Canyon Creek	Blackfoot River	12 June	25 June	BCT	Thurow et al. (1982)
Daves Creek	Blackfoot River	7 June	7 June	BCT	Thurow (1980)
Diamond Creek	Blackfoot River	20 June	20 June	BCT	Thurow (1980)
Diamond Creek	Blackfoot River	8 June	14 June	BCT	Thurow (1980)
Diamond Creek	Blackfoot River	11 June	24 June	BCT	
Dry Creek	Blackfoot River	22 May	13 June	BCT	Thurow (1980)
Dry Creek	Blackfoot River	8 May	10 June	BCT	Thurow et al. (1982)
Kendall Creek	Blackfoot River	10 June	19 June	BCT	Thurow (1980)
Kendall Creek	Blackfoot River	11 June	11 June	BCT	Thurow (1980)
Kendall Creek	Blackfoot River	11 June	24 June	BCT	Thurow et al. (1982)
Kendall Creek	Blackfoot River		13 June		Heimer et al. (1987)
Lanes Creek	Blackfoot River	20 June	25 June	BCT	Thurow et al. (1982)
Little Blackfoot R.	Blackfoot River	19 May	21 May		Thurow (1980)
Olson Creek	Blackfoot River	18 June	18 June	BCT	Thurow et al. (1982)
Olson Creek	Blackfoot River	21 May	21 May	BCT	Thurow (1980)
Poison Creek	Blackfoot River	30 May	30 May	BCT	Thurow (1980)
Rasmussen Creek	Blackfoot River	28 June	28 June	BCT	Thurow et al. (1982)
Rasmussen Creek	Blackfoot River	7 June	7 June	BCT	Thurow (1980)
Rasmussen Creek	Blackfoot River	21 May	8 June	BCT	Thurow (1980)
Revelles Creek	Blackfoot River	7 June	7 June	BCT	Thurow (1980)
Revelles Creek	Blackfoot River	8 June	8 June	BCT	Thurow (1980)

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
Revelles Creek	Blackfoot River	29 May	18 June	BCT	Thurow et al. (1982)
Sheep Creek	Blackfoot River	13 May	29 June	BCT	Thurow (1980)
Sheep Creek	Blackfoot River	13 June	27 June	BCT	Thurow (1980)
Sheep Creek	Blackfoot River	29 May	25 June	BCT	Thurow et al. (1982)
Sheep Creek	Blackfoot River		13 June		Heimer et al. (1987)
Spring Creek	Blackfoot River	8 May	25 June	BCT	Thurow et al. (1982)
Spring Creek	Blackfoot River	19 May	29 June	BCT	Thurow (1980)
Spring Creek	Blackfoot River	31 May	27 June	BCT	Thurow (1980)
Stewart Creek	Blackfoot River	11 June	24 June	BCT	Thurow et al. (1982)
Timothy Creek	Blackfoot River	17 June	26 June	BCT	Thurow et al. (1982)
Timothy Creek	Blackfoot River	16 June	30 June	BCT	Thurow (1980)
Timothy Creek	Blackfoot River	4 June	15 June	BCT	Thurow (1980)
Timothy Creek	Blackfoot River		13 June		Heimer et al. (1987)
Upper Tributaries	Blackfoot River	20 May	20 June	BCT	Thurow et al. (1982)
Upper Tributaries	Blackfoot River	25 April	27 June	BCT	Thurow (1980)
Upper Tributaries	Blackfoot River	13 May	30 June	BCT	Thurow (1980)
Upper Tributaries	Blackfoot River	May	June	BCT	Thurow et al. (1982)
Wolf Lodge Creek	CDA Lake	April	June	LCT	Lukens (1978)
Wolf Lodge Creek	CDA Lake	May	June	WCT	Shepard et al. (1984)
Lighting Creek	Clark Fork	March	May		White and Cochnauer (1975)
Flathead Basin	Clark Fork River	May	June	WCT	Shepard et al. (1984)
Clearwater Drainage	Clearwater	April	July		White and Cochnauer (1975)
Crystal Creek	Clearwater River	May	June	WCT	Griffith (1972)
Hoodoo Creek	Clearwater River	May	June	WCT	Griffith (1972)
Pack Creek	Clearwater River	May	June	WCT	Griffith (1972)
SF Clearwater tribs	Clearwater River	Mar 15	June 30	WCT	CGAB FTAG (2001)
Upper Flathead	Flathead	May	June	WCT	Likens (1984)
Upper Flathead	Flathead	March	July	WCT	Likens (1984)
Flathead River	Flathead River	May	June	WCT	Shepard et al. (1984)
Hungry Horse Res.	Flathead River	May	June	WCT	Shepard et al. (1984)
Taylor Fork	Gallatin River	19 May	22 June	WCT	Magee et al. (1996)
Duck Creek	Henry's Fork	28 April	10 May	YCT	Rohrer (1982)
Henry's Lake	Henry's Fork	2 March	29 May	YCT	Rohrer (1982)
Henry's Lake	Henry's Fork	28 March	19 June	YCT	Irving (1954)
Henry's Lake	Henry's Fork	8 March	8 April	YCT	Gamblin et al. (1993)
Timber Creek	Henry's Fork	21 April	14 May	YCT	Rohrer (1982)
Young Creek	Lake Koocanusa	May	June	WCT	Shepard et al. (1984)
Big Timber Creek	Lemhi River	16 April	15 June	WCT	Horton (1985)
General	Mtn-Prairie Reg.	March	July	WCT	US Fish and Wildlife (2001) Internet
General	Mtn-Prairie Reg.	March	July	YCT	US Fish and Wildlife (2001) Internet
Deadwood River	Payette River	May	June		Cochnauer (1979)

Stream	Basin	Time of Spawning		Notes	Reference
		Begin	End		
SF Payette River	Payette River	April	July		Cochnauer (1979)
Howell Creek	Portneuf River	1 April	30 June		Horton (1985)
Portneuf River	Portneuf River	April	June		White and Cochnauer (1975)
Priest Lake	Priest Lake	April	June	WCT	Shepard et al. (1984)
Cassia Creek	Raft River	1 April	30 June		Horton (1985)
Pritchard Creek	S F Snake River	20 June	21 June		Elle et al. (1987)
Salmon River Drainage	Salmon River	May	June		White and Cochnauer (1975)
Burns Creek	SF Snake River	10 June	Late July		Moore and Schill (1984)
Palisades Creek	SF Snake River	15 April	17 April		Moore and Schill (1984)
Pine Creel	SF Snake River	20 June	7 July		Moore and Schill (1984)
Snake River	Snake River	October	November		Cochnauer (1976)
Upper Snake River	Snake River	March	June		White and Cochnauer (1975)
Upper Snake River	Snake River	April	June		White and Cochnauer (1975)
St. Joe River	St. Joe River	April	June	WCT	Averett and MacPhee (1971)
St. Joe River	St. Joe River	May	June	WCT	Shepard et al. (1984)
St. Joe Tributaries	St. Joe River	May	June	WCT	Rankel (1971)
Teton River	Teton River	April	June		White and Cochnauer (1975)
Dry Creek	Upper Snake River	1 April	30 June		Horton (1985)
Pine Creek	Upper Snake River	June	June	YCT	Thurow and King (1994)
General		March	July	WCT	Trotter (1987)
General		March	July	WCT	Behnke (1992)

Table F-5. Time of Incubation and Emergence of Chinook Salmon in Idaho Streams Data are from Keifer et al. (1992). The dash "-" means "to" not "through."

Run type	Stream	Basin	Incubation period	Emergence period
Spring	Snake River	Snake River	mid Aug – mid Dec	mid Dec – mid Mar
Spring	Clearwater River	Snake River	mid Aug – late Feb	late Feb – early Apr
Spring	S. Fk. Clearwater R.	Snake River	mid Aug – late Feb	late Feb – early Apr
Spring	Little Salmon River	Salmon River	mid Aug – mid Dec	mid Dec – mid Mar
Spring	Middle Fk Salmon R.	Salmon River	mid Aug – mid Dec	mid Dec – mid Mar
Spring	Upper Salmon River	Salmon River	mid Aug – mid Dec	mid Dec – mid Mar

Spring	Lemhi River	Salmon River	mid Aug – mid Dec	mid Dec – mid Mar
Summer	Little Salmon River	Salmon River	Sept – late May	Apr - June
Summer	S. Fk Salmon River	Salmon River	Sept – late May	Apr – June
Summer	Middle Fk Salmon R.	Salmon River	Sept – late May	Apr – June
Summer	Upper Salmon River	Salmon River	Sept – late May	Apr – June
Summer	Pahsimeroi River	Salmon River	Sept – late May	Apr – June

Table F-6. Time of Incubation and Emergence of Steelhead in Idaho Streams
Data are from Keifer et al. (1992). The dash "-" means "to" not "through."

Stream	Basin	Incubation period	Emergence period
Snake River	Columbia River	mid Apr – mid July	mid June – mid July
Clearwater River (A run)	Snake River	Mar – late Apr	mid Apr – late May
Clearwater River (B run)	Snake River	Apr – mid June	late May – Aug
S. Fk Clearwater River	Snake River	Mar – late June	mid May – Aug
Little Salmon River	Salmon River	early Mar – mid July	late June – late Oct
S. Fk Salmon River	Salmon River	early Mar – early July	late June – late Oct
Middle Fk Salmon River	Salmon River	early Mar – early July	late June – late Oct
Upper Salmon River	Salmon River	early Mar – early July	late June – late Oct
Lemhi River	Salmon River	early Mar – early July	late June – late Oct
Pahsimeroi River	Salmon River	early Mar – early July	late June – late Oct

Table F-7. Time of Emergence of Cutthroat Trout
The dash "-" means "to" not "through."

Stream	Basin	Notes	Emergence period	Reference
Snake River	Snake River		Oct – Mar	Cochnauer (1976)
SF Payette River	Payette River		Apr – Aug	Cochnauer (1979)
Deadwood River	SF Payette River		May – Aug	Cochnauer (1979)
Cassia Creek	Raft River		Apr – July	Horton (1985)
Dry Creek	U Snake		Apr – July	Horton (1985)
Howell Creek	Portneuf River		Apr – July	Horton (1985)
Big Timber Creek	Lemhi River		mid Apr – mid June	Horton (1985)
Angus Creek FK. 1	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
General		YCT	July – Aug	Trotter (1987)
Bacon Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Browns Canyon Creek	Blackfoot River	BCT	July – Nov	Thurow (1980)
Diamond Creek	Blackfoot River	BCT	late July – Sept	Thurow (1980)
Diamond Creek	Blackfoot River	BCT	July - Nov	Thurow et al. (1982)
Dry Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Rasmussen Creek	Blackfoot River	BCT	July – Nov	Thurow et al.

Stream	Basin	Notes	Emergence period	Reference
				(1982)
Kendall Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Lanes Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Olson Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Revelles Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Sheep Creek	Blackfoot River	BCT	late July – Sept	Thurow (1980)
Stewart Creek	Blackfoot River	BCT	July – Nov	Thurow et al. (1982)
Timothy Creek	Blackfoot River	BCT	July - Nov	Thurow et al. (1982)
Upper Tributaries	Blackfoot River	BCT	July - Nov	Thurow et al. (1982)
St. Joe River	St. Joe River		mid June – Sept	Averett and MacPhee (1971)
Flathead River	Flathead River	WCT	July – Sept	Shepard et al. (1984)
St. Joe River	St. Joe River	WCT	June – Aug	Shepard et al. (1984)
Upper Flathead	Flathead	WCT	July – Sept	Likens (1984)
Panhandle Streams			April – Aug	White and Cochnauer (1975)
Lighting Creek	Clark Fork		April – Aug	White and Cochnauer (1975)
Clearwater Drainage	Clearwater		April – Aug	White and Cochnauer (1975)
Salmon River Drainage	Salmon River		May – July	White and Cochnauer (1975)
Upper Snake River	Snake River		Apr – Aug	White and Cochnauer (1975)
Teton River	Teton River		Apr – Aug	White and Cochnauer (1975)
Blackfoot River	Blackfoot River		Apr – Aug	White and Cochnauer (1975)
Bear River	Bear River		Apr – Sept	White and Cochnauer (1975)
Portneuf River	Portneuf River		Apr – Aug	White and Cochnauer (1975)
General		WCT	About 75 days after spawning	Trotter (1987)

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Appendix G. Evaluating “Toxics” – Ambient Chemical Water Quality Criteria

Reserved.

Appendix H. Stream Aquatic Life Use Support Determination: Summaries of Metrics Used in Indexes

The stream ecological assessment framework integrates three multimetric indexes in the aquatic life use support determination. These indexes include the Stream Macroinvertebrate Index, Stream Fish Index, and Stream Habitat Index. Details describing the development of these indexes are found in *Idaho Stream Ecological Assessment Framework: An Integrated Approach* (Grafe 2002b). The following summaries describe the metrics and classification approaches used in the indexes.

H.1. Stream Macroinvertebrate Index

DEQ contracted Tetra Tech, Inc., to develop the Stream Macroinvertebrate Index (SMI). Benthic macroinvertebrates are aquatic insects found in bottom substrate. There are several reasons why macroinvertebrates are used as biological indicators of water quality. Macroinvertebrates:

- Indicate localized conditions because they are relatively sedentary.
- Integrate short-term environmental impacts due to their short life cycles.
- Allow experienced biologists to rapidly and easily examine water quality conditions.
- Comprise species possessing a wide range of trophic levels and pollution tolerances.
- Provide a primary food source for fish.
- Are relatively easy and economical to sample.
- Are abundant and diverse in most Idaho streams.

The details of the index development and supporting analysis may be found Jessup and Gerritsen (2000). In summary, Tetra Tech used sites identified as least impacted and as stressed to develop the SMI. Jessup and Gerritsen (2000) distinguished three classes, or bioregions, using two primary techniques: ordination and metric distribution comparisons. These bioregions, which are groupings of ecoregions, were Northern Mountains, Central and Southern Mountains, and Basins. Table H-1 identifies the ecoregions that are included in

these bioregions. The Northern Rockies ecoregion was divided into two bioregions: northern Northern Mountains and southern Northern Mountains. Preliminary analysis indicated that the Northern Rockies ecoregion contained biological characteristics that differed between the northern and southern portions. The ecoregion was therefore divided between the Clearwater River drainage to the north (northern Northern Rockies ecoregion) and the Salmon River drainage to the south (southern Northern Rockies ecoregion).

Table H-1. SMI Bioregion Classification

Northern Mountains	Central and Southern Mountains	Basins
Northern Northern Rockies	Southern Northern Rockies	Snake River Basin
	Blue Mountains	Northern Basin and Range
	Middle Rockies	Columbia Plateau
	Wasatch and Uinta Mountains	Wyoming Basin

Jessup and Gerritsen (2000) identified nine significant macroinvertebrate metrics to characterize water quality conditions. These SMI metrics include assemblage attributes such as richness, composition, pollution tolerance, diversity, feeding group, and habit. Table H-2 summarizes the metrics along with predicted responses to increasing perturbation. Jessup and Gerritsen (2000) provide descriptive formulas on how to calculate these metrics.

Table H-2. SMI Macroinvertebrate Metrics (Jessup and Gerritsen 2000)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Richness	Total taxa	Number of distinct taxa in the macroinvertebrate assemblage	Decrease
	Ephemeroptera taxa	Number of mayfly taxa	Decrease
	Plecoptera taxa	Number of stonefly taxa	Decrease
	Trichoptera taxa	Number of caddisfly taxa	Decrease
Composition	Percent Plecoptera	Percent of sample that is stonefly nymphs	Decrease
Pollution tolerance	Hilsenhoff Biotic Index	Abundance-weighted average tolerance of organisms to pollution (Hilsenhoff 1987)	Increase
Diversity	Percent five dominant taxa	Percent of sample in the most abundant five taxa	Increase

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Feeding group	Scraper taxa	Number of taxa that scrape periphyton from substrates	Decrease
Habit	Clinger taxa	Number of taxa that have fixed retreats or adaptations for attachment to surfaces in flowing water	Decrease

H.2. Stream Fish Index

The Stream Fish Index (SFI) is a bioassessment tool that directly measures the achievement of the Clean Water Act "fishable" goal. Details of the development of this index along with supporting analysis may be found in Mebane (2002a).

Mebane (2002a) used sites identified as least impacted and as stressed to develop the SFI. He developed two site classes (bioregions) - montane-forested and desert basin-rangeland - after extensive literature review. Table H-3 identifies the general ecoregions included in these bioregion classifications.

Table H-3. Site Classification Based on Grouping of Ecoregions

Montane – Forested	Desert Basin – Rangeland
Northern Rockies	Snake River Basin/ High Desert
Middle Rockies	Northern Basin and Range
Blue Mountains	Columbia Basin
Wasatch-Uinta Mountains	Wyoming Basin

Mebane (2002a) identified two different sets of metrics to characterize water quality conditions for forested and rangeland classes. For rangeland sites, six metrics were identified comprising assemblage attributes such as richness, composition, indicator, abundance, and condition (Table H-4). The forest metrics also included richness, composition, indicator, and abundance characteristics, as well as reproductive function attributes. It should be noted that number of sculpin age classes is not included if the sample is comprised entirely of salmonids. Both classifications also incorporate amphibian indicators as a secondary metric. Table H-5 summarizes the forest metrics along with predicted responses to increasing perturbation.

Table H-4. SFI Metrics Used in Rangeland Classification (modified from Mebane 2000a)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Richness and composition	% cold water individuals	Percent of individuals found in cold water streams. Includes introduced trout species.	Decrease
	Jaccard's community similarity coefficient	The degree of similarity in species composition between reference stations and the test site. Used eight most frequently occurring species at reference streams to define the assemblage.	Decrease
Indicator	% omnivores and herbivores	Percent of fish species that take significant quantities of plant and animal (including detritus) materials.	Increase
	% cyprinids as longnose dace	Percent of minnow species which are longnose dace. Of the native minnows, these may diminish with sedimentation, loss of riffle habitats, and diminished stream flows.	Decrease
Condition	% of fish with certain abnormalities	Percent of fish with external deformities, eroded fins, lesions, or tumors in response to exposure to contaminated sediments or other exposure routes.	Increase
Abundance	Catch per unit effort	Number of cold water individuals per minute of single-pass electrofishing.	Decrease

Table H-5. SFI Metrics Used in Forested Classification (modified from Mebane 2000a)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Richness and composition	Number of cold water native species	Number of native fish species typically found in cold water streams. Excludes introduced or tolerant native fish species.	Decrease
	% cold water individuals	Percent of individuals found in cold water streams. Includes introduced trout species.	Decrease
	% sensitive native individuals	Percent of native individuals sensitive to perturbations such as increased turbidity, sediment, and warmer temperatures.	Decrease
Reproductive function	Number of sculpin age classes[1]	Number of sculpin age classes (use measured size classes to infer) reflects the availability of unembedded cobble substrate required for cavity nesters and juvenile refuge.	Decrease
	Number of salmonid age classes	Number of salmonid age classes reflects suitability and stability of conditions for salmonid spawning, juvenile rearing, and adult salmonids.	Decrease
Abundance	Catch per unit effort, CPUE	Number of cold water individuals per minute of single-pass electrofishing.	Decrease

[1] Number of sculpin age classes is not included if the sample is comprised solely of salmonids.

H.3. Stream Habitat Index

DEQ contracted Statistical Design and Rhithron Biological Associates to develop the Stream Habitat Index (SHI). The details of the index development and supporting analysis may be found in Fore and Bollman (2000).

Fore and Bollman (2000) determined that ecoregion groupings provided the most useful classification approach for the SHI. These groupings are identified in Table H-6.

Table H-6. SHI Classification Based on Ecoregions

Ecoregions
Northern/Middle Rockies
Snake River Basin/High Desert
Northern Basin and Range

Fore and Bollman (2000) used land use data to evaluate human disturbance gradients in the Snake River Basin and Northern Basin and Range ecoregions. In the Northern/Middle Rockies ecoregion, it is more difficult to develop such a disturbance gradient using available land use data so DEQ professional biologists identified least impacted and stressed sites based on observations of human disturbance at the site and in the watershed. Fore and Bollman (2000) also tested habitat measures with biological data (fish and macroinvertebrates). Ultimately, they identified 10 habitat measures (metrics) that signaled water quality conditions. Five of these metrics are quantitatively measured while the other five are field rated using eye estimates (Table H-7).

Table H-7. SHI Metrics (Fore and Bollman 2000)

Metric Categories	Metric	Field rated or measured	Predicted response to increasing perturbation
Epifaunal substrate/ available cover	Instream cover	Rated	Decrease
	Large organic debris	Measured	Decrease
Embeddedness/ heterogeneity of substrate composition	Percent fines <2mm in wetted width	Measured	Increase
	Embeddedness	Measured	Increase
	Wolman size classes (number)	Measured	Decrease
Channel flow status	Channel shape (undercut)	Rated	Decrease
Bank vegetation protection	% Bank cover	Measured	Decrease
	% Canopy cover	Measured	Decrease
	Disruptive pressures	Rated	Increase
Riparian vegetation zone width	Zone of influence	Rated	Decrease

Appendix I. River Aquatic Life Use Support Determination: Summaries of Metrics Used in Indexes

Four multimetric indexes comprise the river ecological assessment framework and are integrated to determine aquatic life use support. These indexes are the River Physicochemical Index (RPI), River Macroinvertebrate Index (RMI), River Diatom Index (RDI), and River Fish Index (RFI). Details describing the development of these indexes are found in the Idaho River Ecological Assessment Framework: an Integrated Approach (Grafe 2002c). The following summaries describe the metrics used in the indexes. Unlike the stream indexes, classifications are not applied in the river indexes and therefore, not discussed in these summaries.

I.1. River Physicochemical Index (RPI)

DEQ uses a water quality index developed by Oregon DEQ to interpret certain physical and chemical parameters collected on larger water bodies. The Oregon Water Quality Index (Cude, in press) has been tested and used extensively in Oregon to assess water quality conditions. DEQ has slightly modified the OWQI and therefore refers to the Idaho version as the RPI. Brandt (2000) describes the rationale for incorporating physicochemical parameters into the river bioassessment process and the additional analyses DEQ performed to determine if this index was applicable to Idaho rivers.

Table I-1 lists the eight water quality parameters comprising the RPI. Subindex scores for each variable are calculated using complex regressions for data that falls within set range and threshold scores for data outside that range (Cude in press). The individual subindexes are then averaged, using the harmonic square mean method, to produce a single index value.

Table I-1. Water Quality Parameters Used in the RPI

Temperature	Total Solids or Total Suspended Solids
Dissolved Oxygen	Ammonia + Nitrate Nitrogen
Biochemical Oxygen Demand	Total Phosphorus
pH	Fecal Coliform

I.2. River Macroinvertebrate Index (RMI)

Royer et al. (in press) developed the RMI under a four-year contract with DEQ. They applied the multimetric method described in Barbour et al. (1999) to develop the RMI. The development of the index is based on the identification of least impacted and stressed sites. Royer and Mebane (2000) describe in more detail the RMI development along with the application of the index to medium- and large-size rivers in Idaho. Royer et al. (in press) identified five significant macroinvertebrate metrics to characterize water quality condition of Idaho rivers. Table I-2 lists these metrics.

Table I-2. RMI Macroinvertebrate Metrics (Royer et al., in press)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Richness	Number of taxa	Number of distinct taxa in the macroinvertebrate assemblage	Decrease
	Number of Ephemeroptera, Plecoptera, and Tricoptera	Number of distinct mayfly, stonefly, and caddisfly taxa in the macroinvertebrate assemblage	Decrease
Composition	Percent Elmidae	Percent of sample that is riffle beetles	Decrease
Feeding group	Percent predators	Percent of sample that is taxa which prey on other macroinvertebrates	Decrease
Diversity	Percent dominant taxon	Percent of sample in the most abundant taxa	Increase

I.3. River Diatom Index (RDI)

Periphyton, specifically diatom, indexes have been developed and applied in Montana, Oklahoma, and Kentucky. Additionally, periphyton indexes have been effectively used in Europe for river biomonitoring since the 1970s, particularly in the United Kingdom and France. Table I-3 lists the nine metrics of relative abundance and taxa richness that comprise the RDI. Fore and Grafe (2000) describe the RDI development in more detail along with supporting analysis.

Table I-3. RDI Diatom Metrics (Fore and Grafe 2000)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Tolerance and intolerance	Percent sensitive	Percent of sample that is taxa intolerant to disturbance	Decrease
	Percent very tolerant	Percent of sample that is taxa not sensitive to disturbance	Increase
Autecological guild	Eutrophic species richness	Number of distinct taxa tolerant to nutrients, typically derived from nonorganic sources.	Increase
	Percent nitrogen heterotrophs	Percent of sample that is taxa using amino acids created by other organisms as sources of carbon and nitrogen	Increase
	Percent polysaprobic	Percent of sample that is taxa tolerant to high nutrients and low oxygen often associated with organic waste	Increase
	Alkaliphilic species richness	Number of distinct taxa tolerant to alkaline conditions	Increase
	Percent high oxygen	Percent of sample that is taxa intolerant of low oxygen often associated with organic waste decomposition or stagnate water	Decrease
Morphometric guild	Percent very motile	Percent of sample that is taxa capable of moving across unstable substrate	Increase
Individual condition	Percent deformed cells	Percent of sample that is taxa with cell deformities often associated with contamination by heavy metals	Increase

I.4. River Fish Index (RFI)

Mebane (2002) developed the RFI using the basic index of biotic integrity framework initially established by Karr et al. (1986). Mebane (2002) describes in more detail the RFI development and supporting analysis. The RFI is a quantitative multimetric index comprised of assemblage richness and composition metrics, reproductive function, abundance, and condition metrics. Table I-4 summarizes the metrics along with their expected change due to disturbance or environmental degradation.

Table I-4. RFI Fish Metrics (Mebane 2002)

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Richness and composition	Percent cold water native species	Percent of sample that is native fish species typically found in cold water streams. Excludes introduced or tolerant native fish species	Decrease
	Percent cold water individuals	Percent of sample that is individuals found in cold water streams. Includes introduced trout species	Decrease
Indicator species	Percent sensitive native individuals	Percent of sample that is native individuals sensitive to perturbations such as increased turbidity, sediment, and warmer temperatures	Decrease
	Percent tolerant individuals	Percent of sample that is individuals tolerant to disturbance	Increase
	Number of non-indigenous species	Number of distinct species occurring due to invasion or introduction	Increase
	Percent Cyprinus carpio	Percent of sample that is carp in the fish assemblage	Increase
	Percent Cottids	Percent of sample that is sculpins in the fish assemblage	Decrease

Metric Categories	Metric	Definition	Predicted response to increasing perturbation
Reproductive function	Number of salmonid age classes	Number of estimated size classes inferred from length frequency data and typical length at age relationships. Metric reflects suitability and stability of conditions for salmonid spawning, juvenile rearing, and adult salmonids.	Decrease
	Number of sculpin age classes	Number of sculpin age classes (use measured size classes to infer) reflects the availability of unembedded cobble substrate required for cavity nesters and juvenile refuge.	Decrease
Abundance	Catch per unit effort, CPUE	Number of cold water individuals per minute of single-pass electrofishing.	Decrease
Condition	Percent of fish with DELT abnormalities	Percent of fish with external deformities, eroded fins, lesions, or tumors in response to exposure to contaminated sediments or other exposure routes.	Increase

Glossary

Note: This glossary is intended to define terms within the context of the WBAG. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
305(b)	Refers to section 305 subsection “b” of the Clean Water Act. 305(b) generally describes a report of each state’s water quality, and is the principle means by which EPA, congress, and the public evaluate whether US waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Section 303 subsection “d” of the Clean Water Act. 303(d) requires state to develop a list of water bodies that do not meet water quality standards. This section further requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to EPA approval.
A priori	Determination made before or without certain data examination; deductive. For example, macroinvertebrate data was not examined when selecting reference sites for the Stream Macroinvertebrate Index. However, other data such as habitat, chemistry, and land use were evaluated for this a priori site selection.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Aquatic	Pertaining to water. In this context, usually refers to plants or animal life living in, growing in, or adapted to water.

Note: This glossary is intended to define terms within the context of the WBAG. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
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).
Beneficial use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics.
Beneficial Use Reconnaissance Program (BURP)	Systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address wadeable streams, rivers, lakes, and reservoirs.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants, yet are compatible with the productive use of the resource to which they are applied.
Best professional judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
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).
Biota	The animal and plant life of a given region.
Biotic community	A naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

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Term	Definition
Clean Water Act	The Federal Pollution Control Act (PL92-500, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (PL100-4), establishes a process for states to develop information on and control the quality of the nation's water resources.
Coliform Bacteria	A group of bacteria found in the intestines of warm-blooded animals (including humans), plants, soil, air, and water. Fecal coliform are a specific class of bacteria, which only inhabit the intestines of warm-blooded animals. The presence of coliform is an indication that the water is polluted and may contain pathogenic organisms (also see Fecal Coliform Bacteria).
Community (aquatic)	An association of interacting assemblages in a given water body; the biotic component of an ecosystem (also see Assemblage) (EPA 1996).
Criteria	Numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.
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. DO is vital to fish and other aquatic life and helps prevent odors. DO levels are considered an important indicator of a water body's ability to support desirable aquatic life.
Disturbance	Any event or series of events that disrupt ecosystem, community, or population structure and alter the physical environment.

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Term	Definition
Duration	The period of time (averaging period) over which the in-stream concentration is averaged for comparison with criteria concentrations. This specification limits the duration of concentrations above the criteria.
E. coli	Escherichia Coli, is 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.
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	1) A living system exhibits integrity if, when subjected to disturbance, it sustains and organizes self-correcting ability to recover toward a biomass end-state that is normal for that system. 2) 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 environmental surroundings.
Endangered species	Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (human-caused) or other natural changes in their environment. Requirements for declaring a species endangered are contained in the Endangered Species Act.
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. (*Dictionary of Geologic Terms*, American Geologic Institute, 1962).

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Term	Definition
Eutrophication	(1) Natural process of maturing (aging) in a body of water. (2) Natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.
Exceedance	Above pollutant levels permitted by environmental protection standards. Violation of Idaho water quality standards may occur based on DEQ policy (see Section 5).
Existing beneficial use or existing use	A beneficial use present in waters on or after November 28, 1975, whether or not the use is designated for those waters in the *Water Quality Standards and Wastewater Treatment Requirements*.
Exotic species	A species that is not native indigenous to a region.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fecal coliform bacteria	Bacteria found in the intestinal tracts all warm-blooded animals of mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform).
Fixed-location monitoring	Sampling of an environmental or ambient medium for pollutant concentrations at one location continuously or repeatedly.
Frequency	The number of times air event occurs over a fixed time interval.
Fully supporting	In compliance with water quality standards and criteria, and meeting the reference conditions for all designated and existing beneficial uses as determined through the WBAG.
Fully supporting of cold water aquatic life	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1995).

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Term	Definition
GIS	Geographic Information System, a georeferenced database.
Grab sample	A single sample collected at a particular time and place. May represent the composition of the water only at that time and place.
Ground water	The supply of fresh water found beneath the earth's surface.
Habitat	The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.
Human made	Relating to or resulting from the influence of human beings on nature (anthropogenic)
Hydrologic Unit Code (HUC)	A watershed numbering system developed by the U.S. Geological Survey.
Hydrology	The science dealing with the properties, distribution, and circulation of water.
Instantaneous	A concentration of a substance measured at any moment (instant) in time.
Intergravel dissolved oxygen	The concentrations of dissolved oxygen in the spawning gravel. Considerations for determining spawning gravel include species, water depth, velocity, and substrate.

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Term	Definition
Intermittent stream	1) A stream (in contact with the ground water table) that flows only part of the year, such as when the ground water table is high or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It 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. A stream with a 7Q2 of less than 0.1 cfs is considered intermittent for steady-state waste load allocation modeling. Streams with perennial pools that create aquatic life uses are not intermittent (Idaho Water Quality Standards and Wastewater Treatment Requirements, IDAPA 58.01.02.51.).
Interstate waters	Waters that flow across or form part of state or international boundaries.
Lotic	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.
Macroinvertebrate	An invertebrate animal (without backbone) large enough to be seen without magnification and retained by a 0.595 mm (U.S.#30) screen.
Magnitude	How much of a pollutant, expressed as a concentration, is allowable.
Metric	One discrete measure of an ecological indicator (e.g., number of distinct taxon).
Monitoring	Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.
Natural condition	A condition without human-caused disruptions.

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Term	Definition
Non-point sources	Diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, and saltwater intrusion.
Not assessed	A concept and an assessment category describing water bodies that have been looked at, but are missing critical information needed to complete an assessment.
Not fully supporting	Not in compliance with water quality standards or criteria, or not meeting reference conditions for each beneficial use as determined through the WBAG.
Not fully supporting cold water aquatic life	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1995).
Nutrient	Any substance assimilated by living things that promote growth. In water, the term is generally applied to nitrogen and phosphorus, but is also applied to other essential and trace elements and organic carbon.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, pressure, and density are parameters of the atmosphere.
Pathogens	Microorganisms (e.g., bacteria, viruses, or parasites) that can cause disease in humans, animals and plants.
Periphyton	Attached microflora growing on the bottom, or on other submerged substrates, including higher plants. Epilithic periphyton is flora growing on the surface of rock or stones. Diatoms are a type of periphyton.

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Term	Definition
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	pH (pronounced as separate letters) is an expression of the intensity of the basic or acidic condition of a liquid. Mathematically, pH is the logarithm (base 10) of the reciprocal of the hydrogen ion concentration, [H+]. pH= Log (I/[H+]). The pH may range from 0 to 14, where 0 is most acidic, 14 most basic, and 7 neutral.
Phosphorus	An essential chemical food element that can contribute to the eutrophication of lakes and other water bodies. Increased phosphorus levels result from discharge of phosphorus-containing materials into surface waters.
Physicochemical	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 interchangeably with the term physical/chemical or physiochemical.
Point source	A discrete location or fixed facility from which pollutants are discharged; any single identifiable source of pollution.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

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Term	Definition
Pollution	A concept that encompasses the presence of a substance in the environment that because of its chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects as well as the human-made or human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction, as opposed to size, magnitude, or degree.
Quality assurance (QA)	A program organized and designed to provide accurate and precise results. Included are selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; selection of limits; evaluation of data; quality control; and qualifications and training of personnel. Its goal is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).
Quality control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicates. Quality control is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.

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Term	Definition
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 the expected ecological integrity of other localities on the same water body or nearby water bodies (EPA 1996).
Representative sample	A portion of material or water that is similar in content and consistency as possible to that in the larger body of material or water being sampled.
River	Large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels. See Section 2 for water body size criteria.
Salmonids	Members of the family *Salmonidae*, which includes trout, salmon, and whitefishes. Salmonids that have been reported to occur in Idaho include trout (bull, cutthroat, rainbow, redband, steelhead, brook, brown, golden, and lake), salmon (Chinook, coho, Kokanee, and sockeye) whitefishes, (Bear Lake, mountain, pygmy, lake, Bonneville whitefish and Bonneville cisco), and Arctic grayling. These include both native and introduced species.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that are suspended in, transported by, and eventually deposited by water or air.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

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Term	Definition
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	DEQ classification method used to characterize comparable segments within each water body identified in the WBID system. DEQ uses land use and stream order to stratify water bodies.
Stream	A natural water course containing flowing water, at least part of the year, together with dissolved and suspended materials, that normally supports communities of plants and animals within the channel and the riparian vegetation zone. See Section 2 for water body size criteria.
Stream order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc. (Strahler 1957)
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
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 non-point source pollutants in rivers, streams, and lakes.
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.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).

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Term	Definition
TMDL	An acronym that stands for total maximum daily load. A TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). 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.
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.
Turbidity	A measurement used to indicate the clarity of water. Technically, turbidity is an optical property of water based on the amount of light scattered by suspended particles. Turbidity cannot be directly equated to suspended solids because white particles scatter more light than dark-colored particles and many small particles will scatter more light than an equivalent weight large particle.
Water body	A homogeneous classification that can be assigned to rivers, lakes, estuaries, coastlines, or other water features.
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 use. 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 standards	State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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Term	Definition
Watershed	The land area that drains into a stream. An area of land that contributes runoff to one specific delivery point; large watersheds may be composed of several smaller "subwatersheds," each of which contributes runoff to different locations that ultimately combine at a common delivery point.
WBID	Water body identification number; a number that identifies a water body, and correlates to Idaho Water Quality Standards and GIS information.
Wetland	An area that is saturated by surface or ground water with vegetation adapted for life under those soil conditions, as swamps, bogs, fens, marshes, and estuaries.

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