Beneficial Use Assessment Method for Montana's Surface Waters

Stillwater River

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REVISION HISTORY

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2.0	August 2006	Mark Bostrom	All	Described processes for sufficient credible data (SCD) assessment and beneficial use determination (BUD).
3.0	June 2011	Mindy McCarthy	All	Major revision to provide a structured and consistent approach for assessing Montana's waters. The most significant changes to the process are the incorporation of pollutant-specific methods to assess water quality and a specific process for evaluating data used for assessments.
3.1	Nov 2011	Mindy McCarthy	All	Minor revision in response to public comments. Temperature was removed as one of the pollutant groups. Tables were removed from Section 6.
4.0	January 2020	Katie Makarowski	All	Major revisions to incorporate background information, clarify terminology, provide guidance and process for beneficial use support decision-making as well as impairment listing, and summarized newly-developed parameter-specific assessment methods.

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ACRONYMS

AFDW	Ash-free Dry Weight
ARM	Administrative Rules of Montana
ATTAINS	Assessment, Total Maximum Daily Load Tracking and Implementation System
AU	Assessment unit
AUID	Assessment unit ID
BOD	Biochemical Oxygen Demand
BU	Beneficial Use
CFL	Cycle First Listed
CFR	Code of Federal Regulations
CFU	Colony-Forming Unit
Chla	Chlorophyll-a
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DO	Dissolved Oxygen
DQA	Data Quality Assessment
EC	Electrical Conductivity
EPA	U. S. Environmental Protection Agency
eWQX	EQuIS Water Quality Exchange database
GM	Geometric Mean
HAB	Harmful Algal Bloom
HBI	Hilsenhoff Biotic Index
HUC	Hydrologic Unit Code
ISI	Instability Index
MCA	Montana Code Annotated
MDL	Method Detection Limit
MPDES	Montana Pollutant Discharge Elimination System
MPN	Most Probable Number
NHD	National Hydrography Dataset
ORW	Outstanding Resource Water
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Residual Pool Depth
RRL	Required Reporting Limit
RSI	Riffle Stability Index
SAP	Sampling and Analysis Plan
SAR	Sodium Adsorption Ratio
SC	Specific Conductivity
SCD	Sufficient Credible Data
SOP	Standard Operating Procedure
STAG	Statewide TMDL Advisory Group
STV	Statistical Threshold Value
TMDL	Total Maximum Daily Load
TN	Total Nitrogen

	Water Quality Assessment Method
TP	Total Phosphorus
USGS	U.S. Geological Survey
V*	Residual Pool Volume
WARD	Water Quality Assessment, Reporting and Documentation
WET	Whole Effluent Toxicity
WQIR	Water Quality Integrated Report
WQPB	Water Quality Planning Bureau
WQS	Water Quality Standards
WQA	Water Quality Act
WRA	Watershed Risk Assessment

GLOSSARY

Assessment units (AUs): delineations of waterbodies, or segments of waterbodies, used to track water quality assessment information; the smallest spatial unit for which a determination of water quality impairment can be made.

Assessment unit ID (AUID): Assessment units (AUs) are assigned a unique identifier - known as an **assessment unit ID (AUID)** – which follows a standardized convention in which each part of the AUID represents a location attribute of the assessment unit

Beneficial uses: goals and expectations specified in water quality standards for how state surface waters should be able to be used; also referred to as designated uses or designated beneficial uses.

Data quality assessment (DQA): a process of reviewing physical, chemical, and biological data based on technical, spatial, temporal, quality, and age components of the data to determine if available data is of sufficient quality for making parameter-specific impairment determinations.

Impaired waterbody: a waterbody or segment for which sufficient credible data shows that it is failing to achieve compliance with applicable water quality standards (75-5-103(14), MCA).

Indicators: measures of water quality used to characterize whether a water quality standard and its components is attained (EPA, 2002).

Nonpoint source pollution: any source of water pollution that does not meet the legal definition of point source and comes from many diffuse sources (e.g., land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification).

Non-pollutants: causes of impairment that do not meet the pollutant definition.

Parameters: physical, biological, or chemical properties of water that affects the quality of water (75-5-103, MCA).

Point source pollution: any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged; the term does not include agricultural storm water discharges and return flows from irrigated agriculture (40 CFR § 122.2).

Pollutants: dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those

regulated under the Atomic Energy Act of 1954), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water (40 CFR § 122.2).

Pollution: contamination or other alteration of the physical, chemical, or biological properties of state waters that exceeds that permitted by Montana water quality standards or the discharge, seepage, drainage, infiltration, or flow of liquid, gaseous, solid, radioactive, or other substance into state water that will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, or welfare, to livestock, or to wild animals, birds, fish, or other wildlife; the term does not include activities that are authorized by DEQ, including pollution discharge permit rules or other exceptions (75-5-103, MCA).

Probable causes of impairment: pollutants and non-pollutants that prevent waterbodies or segments from meeting water quality standards or supporting beneficial uses; also knows as impairment causes or impairment listings.

Probable sources of impairment: the activities, facilities, or conditions that generate the pollutants that prevent waters from meeting water quality standards.

Reference condition: the condition of a waterbody capable of supporting its present and future beneficial uses when all reasonable land, soil, and water conservation practices have been applied (DEQ, 2006).

Stressors: any chemical, physical, or biological entity that can cause an adverse effect in the environment (EPA, 2008); for assessment purposes, stressors are analogous to causes of impairment.

Threatened waterbody: a waterbody or stream segment for which sufficient credible data and calculated increases in loads show that it is fully supporting its designated uses but threatened for a particular designated use because of (a) proposed sources that are not subject to pollution prevention or control actions required by a discharge permit, the nondegradation provisions, or reasonable land, soil, and water conservation practices; or (b) documented adverse pollution trends (75-5-103(36), MCA).

Thresholds: the numeric value or narrative description that distinguishes attainment from impairment (EPA, 2002).

Total maximum daily load (TMDL): the maximum amount of a pollutant a river, stream or lake can receive and still support all designated uses.

Water quality protection practices: activities, prohibitions, maintenance procedures, or other management practices applied to point and nonpoint sources to protect, maintain, and improve water quality. They include but are not limited to treatment requirements, standards of performance, effluent standards, and operating procedures and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from material storage (75-5-103, MCA).

Water quality standards: beneficial uses, criteria, and nondegradation requirements that describe the desired condition of a waterbody adopted to protect public health or welfare, enhance the quality of water, and provide water quality to protect beneficial uses (40 CFR § 131.2); serve as the regulatory basis for the establishment of water-quality based treatment controls and strategies (40 CFR § 131.2).

Watershed approach: a widely-applied coordinating framework for environmental management that focuses efforts to address the highest priority problems within hydrologically-defined geographic areas (EPA, 1996).

Watershed risk assessment: a process for collecting, organizing, and analyzing scientific information to evaluate the likelihood that adverse ecological effects occur due to exposure to one or more stressors and their probable sources in the watershed (EPA, 2008).

1.0 INTRODUCTION

Montana DEQ's water quality programs aim to protect and improve water quality of state waters. An important step in achieving these goals is to assess current water quality conditions. DEQ assesses surface water quality as directed by the Montana Water Quality Act (75-5-702, MCA) and Section 303(d) of the federal Clean Water Act (33 U. S. Code § 1251). The primary objective of water quality assessment is to determine whether waters are supporting each of their designated beneficial uses. Each use may be affected by multiple types of pollution, therefore, evaluating use support entails evaluating whether multiple water quality parameters associated with each use are meeting applicable water quality standards.

If a waterbody is not meeting water quality standards for a parameter, it is considered impaired for that parameter. Similarly, a waterbody may be considered threatened if standards are currently being met but adverse pollution trends suggest it is likely to become impaired soon. When any single parameter associated with a beneficial use is impaired, the use is not fully supported. To make impairment decisions for waterbody-parameter combinations, DEQ collects and compiles data and applies parameter-specific assessment methods. Every two years, DEQ submits a revised list of impaired and threatened waters to EPA via Montana's Water Quality Integrated Report, and DEQ and other stakeholders use this list to inform pollution control and restoration strategies. While DEQ's parameter-specific assessment methods guide impairment decisions for specific waterbody-parameter combinations, they individually do not allow an assessor to affirm that a use is fully supported. To affirm a use is fully supported, assessments for all core parameters associated with the use must be assessed and indicate non-impairment. In the case of aquatic life, direct measures of the use may be used to determine if the use is fully supported.

The intent of this document is to describe the overall process that Montana DEQ uses to assess state waters, and to lay out a framework for making consistent use support decisions. This document also describes aspects of assessment that are applied universally among parameter-specific assessment methods to limit redundancy and inconsistency among assessment methods, such as requirements for data quality assessment and delineating assessment reaches). This document contains the following sections:

Section 2.0 - Background and Definitions: An overview of Montana's water quality standards and DEQ's water quality planning process which assessment is a component of.

Section 3.0 - Programmatic Approach to Assessment: DEQ's approach for prioritizing and scoping water quality assessment projects and for delineating waterbodies for assessment.

Section 4.0 - Assessment Method Applicability: A summary of the waters for which this assessment method applies.

Section 5.0 - Project Initiation and Information Gathering: DEQ's process for soliciting and acquiring water quality data.

Section 6.0 - Data Quality Assessment (DQA): DEQ's process for evaluating the suitability of data for assessment purposes.

Section 7.0 - Assessment Method: DEQ's method for making beneficial use support determinations and impairment listing decisions for individual waterbody-parameter combinations.

Section 8.0 - Data Management and Reporting: DEQ's approach to managing and sharing outcomes of water quality assessments.

Section 9.0 - Review and Approval: The review and approval process for finalizing assessment decisions.

2.0 Background and Definitions

This section summarizes the state and federal laws which mandate water quality assessment, the water quality standards that form the foundation of assessment, and DEQ's water quality planning process which includes assessment as an integral component.

2.1 Montana Water Quality Act and Federal Clean Water Act

Montana DEQ implements Montana's Water Quality Act (WQA), a series of statutes which provide guidelines to prevent, abate, and control the pollution of Montana state waters in a manner consistent with national standards (75-5-102, MCA). The WQA integrates clauses of Montana's Constitution, which affirms all peoples' right to a clean and healthful environment, and the federal Clean Water Act (CWA) objective to restore and maintain the chemical, physical, and biological integrity of the Nation's waters by achieving water quality that supports fish, shellfish, wildlife, and recreation and eliminating the discharge of toxic pollutants in toxic amounts (33 U.S.C §1251(a)).

2.2 Water Quality Standards

Water quality standards describe the desired condition of a waterbody. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and provide water quality to protect beneficial uses (40 CFR § 131.2). Water quality standards define water quality goals and are used as benchmarks when protecting and maintaining water quality, and they serve as the regulatory basis for the establishment of water-quality based treatment controls and strategies (40 CFR § 131.2). Water quality standards consists of three elements (75-5-301, MCA):

1. Beneficial uses a waterbody is expected to support,
2. Criteria that defines the water quality necessary to protect beneficial uses, and
3. Nondegradation requirements to protect existing uses and prevent degradation of high-quality waters.

DEQ revises standards as needed during a triennial review period.

2.2.1 Beneficial Uses and Use Classification System for Surface Waters

Beneficial uses (sometimes called designated uses or designated beneficial uses) are goals and expectations specified in water quality standards for how state surface waters should be able to be used. Beneficial uses provide context for assessing the suitability of water quality. Montana's beneficial uses for surface waters as stated in the Administrative Rules of Montana (ARM) are:

- Drinking, culinary, and food processing (after treatment),
- Bathing, swimming, and recreation,
- Growth and propagation of fishes (either salmonid or non-salmonid) and associated aquatic life, waterfowl and furbearers

- Agricultural water supply, and
- Industrial water supply.

Each surface water in Montana is classified according to the present and future beneficial uses it is expected to support (75-5-301, MCA). Use classifications were assigned to waters based on their actual or anticipated uses in the early 1970s. Designated beneficial uses apply to waterbodies whether they are currently being attained or not (40 CFR § 131.3(f)). Montana's surface water use classification system includes seventeen classifications which are notated with letters A through F and further subdivided using numbers 1 through 5 (**Appendix A**). Waters within the same drainage typically receive the same use classification with some exceptions (ARM 17.30.607 through 17.30.613). A waterbody can be reclassified from one use classification to another following a use attainability analysis (UAA) (i.e., an investigation of facts indicating that a body of water is not properly classified in accordance with its existing, present, and future beneficial uses) as well as rulemaking and approval from the Board of Environmental Review (75-5-302, MCA).

Most surface waters in Montana are classified A, B or C (**Table 1**) and there are several I waters. Waters in national parks, wilderness and primitive areas are classified A-1 (ARM 17.30.614). The D, E and F classifications define certain constructed ditches, seasonal and semi-permanent lakes, and ephemeral streams (ARM 17.30.615). A UAA is required before a waterbody can be reclassified as D, E or F and Montana currently has no waters classified as D, E, or F.

Several distinctions among use classes may have assessment implications:

- Waters classified with a 1 or 2 (i.e., A-1, B-1, B-2, C-1) are expected to support salmonid fishes, whereas waters classified with a 3 (i.e., B-3, C-3) are expected to support non-salmonid fishes.
- Whereas most use classifications indicate "growth and propagation" of fishes and associated aquatic life, waters classified with a 2 (i.e., B-2, C-2) indicate "growth and marginal propagation" of salmonid fishes.
- Distinctions are made among the level of treatment before use for drinking water, culinary, and food processing; waters classified A-closed indicate simple disinfection, whereas other A and B classifications require conventional treatment.
- Recreational use is either primary contact or secondary contact.
- C-3 streams are naturally marginal for drinking, culinary, and food processing purposes, agriculture, and industrial water supply.

Table 1. Summary of Beneficial Uses Applicable to each Common Use Classifications

Beneficial Uses	Additional distinctions	Use Classifications							
		A-closed	A-1	B-1	B-2	B-3	C-1	C-2	C-3
Drinking, culinary, and food processing	simple disinfection	X							
	conventional treatment of naturally present impurities		X						
	conventional treatment			X	X	X			M
	Salmonid growth	X*	X	X	X		X	X	
	Salmonid propagation	X*	X	X	M		X	M	

Beneficial Uses	Additional distinctions	Use Classifications							
		A-closed	A-1	B-1	B-2	B-3	C-1	C-2	C-3
Fishes and associated aquatic life, waterfowl, and furbearers	Non-salmonid growth and propagation	X*				X			X
Bathing, swimming, recreation	Primary and secondary contact	X	X	X	X	X	X	X	X
Agriculture	-		X	X	X	X	X	X	M
Industrial	-		X	X	X	X	X	X	M

X = Beneficial use applies; M = Marginal use applies
*A-closed does not distinguish between salmonid and non-salmonid fishes

2.2.2 Numeric Criteria

Criteria expressed as a concentration are commonly referred to as numeric criteria. Numeric criteria specify the allowable *magnitude* (i.e., concentration) of a pollutant and take into consideration the *duration* (how long) and the *frequency* (how often) of exposure to the pollutant at the concentration of concern (DEQ, 2011). Numeric criteria are grouped in three categories:

- Acute aquatic life criteria (based on a one-hour exposure event and can only be exceeded once, on average, in a three-year period),
- Chronic aquatic life criteria (based on a 96-hour exposure and can only be exceeded, on average, once in a three-year period), and
- Human health criteria (incorporates routes of exposure via water consumption and fish consumption, and concentrations may not exceed these values).

Montana adopted numeric criteria for:

- Toxic, carcinogenic, radioactive, and harmful pollutants (DEQ, 2017),
- *Escherichia coli* (ARM 17.30.620-629),
- Total nitrogen and total phosphorus for streams and rivers (DEQ, 2014),
- Aesthetic qualities from excess algal biomass and nutrient levels in the Clark Fork River (ARM 17.30.631), and
- Electrical conductivity and sodium absorption ratio in select waters within the Tongue, Powder, and Rosebud watersheds (ARM 17.30.670).

Site-specific numeric criteria may be adopted for a waterbody or segment and, if so, must be applied during assessment of that waterbody or segment.

2.2.3 Narrative Criteria

Narrative criteria are statements that describe the desired conditions of a waterbody rather than providing magnitude, frequency and duration (ARM 17.30.620 through 17.30.670). Narrative criteria are adopted for parameters that are difficult to determine at a broad scale, where numeric criteria don't apply well (e.g., taste, odor, color), or if there is insufficient information to develop numeric criteria. Some narrative criteria specify that waters must be "free from substances" that will create toxic, objectionable or nuisance conditions (e.g., sludge deposits, floating debris, scum, grease globules) (ARM

17.30.637). Other narrative criteria restrict allowable change from natural conditions (e.g., sediment, settleable solids, oils), or specify acceptable ranges or degrees of change (e.g., pH, turbidity, color).

2.2.4 Nondegradation

Montana's nondegradation policy specifies that existing uses of state waters and the level of water quality necessary to protect those uses must be maintained and protected and, unless authorized, the quality of high-quality waters must be maintained (75-5-303, MCA). The requirements for what constitute non-significant degradation and the conditions under which authorizations to degrade (i.e., discharge permits) are allowed are described in ARM 17.30.701–718.

Nondegradation is relevant to assessment because water quality impairment status is considered during the MPDES permitting process. If a waterbody is not listed as impaired for a parameter it is considered a high quality water for that parameter when permit limits are being developed and nondegradation evaluation would apply to newly permitted sources. Also, during assessment, DEQ identifies and reports on instances where water quality standards are being met. When standards are met, DEQ promotes efforts to maintain and protect these favorable conditions. DEQ also uses the threatened designation to track adverse pollution trends that are likely to trigger an exceedance of standards. A threatened listing triggers planning to prevent further degradation of these waters.

2.3 Pollution

During assessment, pollution causes of impairment are categorized and tracked as either pollutants or non-pollutants. Pollutants means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water (with some exceptions) (40 CFR § 122.2). Non-pollutants are other pollution causes of impairment that do not meet the pollutant definition.

Pollution is further categorized as either coming from a point source or nonpoint source. Point source pollution is any discernible, confined and discrete conveyance (e.g., pipe, ditch, concentrated animal feeding operation, vessel, etc.) from which pollutants are or may be discharged, except from agricultural sources. Nonpoint source pollution is any source of pollution that does not meet the legal definition of point source and comes from diffuse sources (e.g., land runoff, atmospheric deposition, drainage, seepage).

2.4 DEQ's Water Quality Planning Process

To understand how water quality assessment helps DEQ achieve water quality goals, one must know that assessment is an integral component of DEQ's water quality planning process (**Figure 1**). This process is applied in watersheds across Montana to investigate water quality conditions and guide water quality protection and improvement activities. The process is cyclic as waterbodies are revisited and reassessed through time.

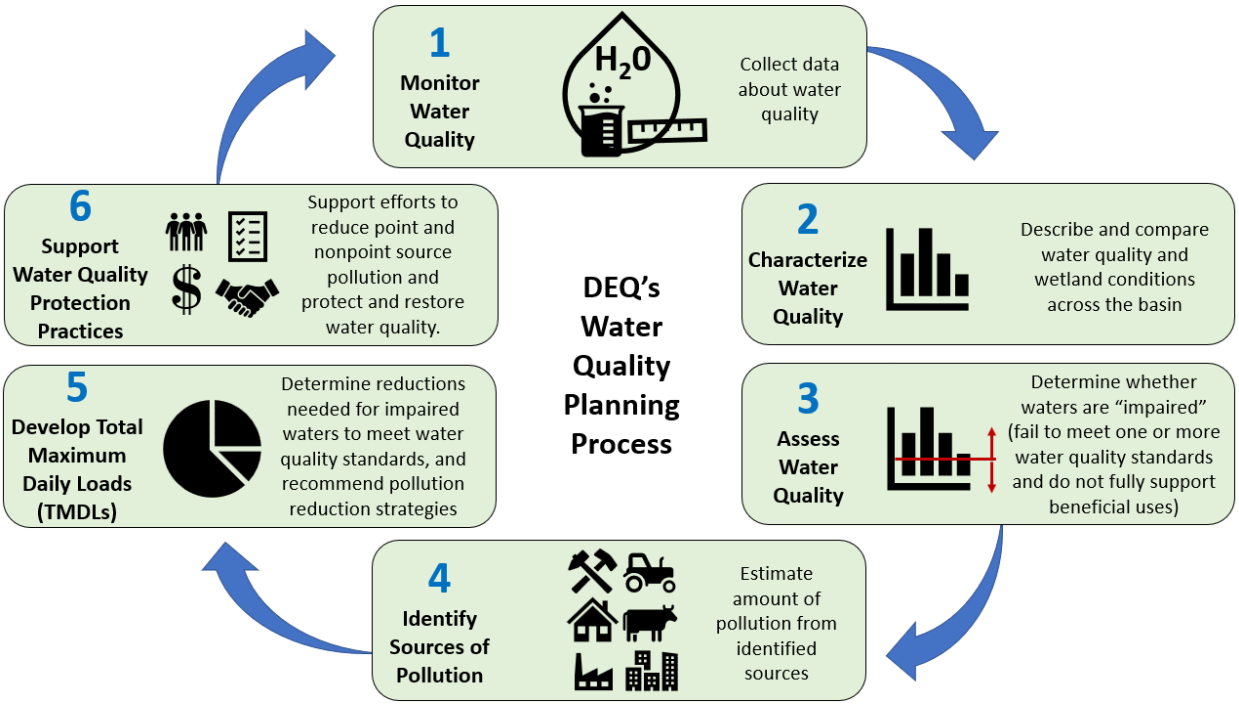

Figure 1. DEQ's Water Quality Planning Process

Monitoring: DEQ monitors parameters in state waters to produce credible data that can be used to assess water quality. Parameters are physical, biological, or chemical properties of water that affect the quality of water (75-5-103, MCA). Monitoring for assessment purposes is guided by data quality requirements set forth in **Section 5.4** and in DEQ's parameter-specific assessment methods (**Section 6.1**). DEQ also compiles data from external sources and incorporates it during assessment if it meets data quality requirements. Data applied during assessment must meet stringent data quality requirements and, as such, monitoring adheres to established protocols and procedures for data collection, documentation and management.

Assessment: DEQ determines whether waterbodies are supporting designated beneficial uses by evaluating whether they are meeting water quality standards. For waters that are not meeting standards, DEQ reports the probable causes of impairment (also called impairment causes or impairment listings). These are the pollutants and non-pollutants that prevent waterbodies from fully supporting beneficial uses and include chemical contaminants (such as metals, nutrients, PCBs, etc.), physical conditions (such as elevated temperature, excess sediment, or habitat alterations), and biological parameters (such as *E. coli* or nuisance algal growth). For each identified probable cause of impairment, DEQ also reports probable sources of impairment. These are the activities, facilities, or conditions that generate point and nonpoint source pollution (e.g., municipal wastewater treatment plants, abandoned mines, livestock grazing, septic systems, agricultural runoff, roads, silviculture activities, and many others) (**Section 6.4**). Natural sources also exist for many pollution causes, though DEQ focuses primarily on human sources during assessment (**Section 6.3.7**).

Total Maximum Daily Load (TMDL) Development: For each pollutant cause of impairment identified during assessment, DEQ is required to develop a total maximum daily load (TMDL) (75-5-703, MCA; 33 U. S. Code § 1251). TMDL development involves: 1) calculating the total maximum daily load, that is, the maximum amount of a pollutant a waterbody can receive from all sources and still meet water quality

standards for that pollutant, 2) comparing the TMDL to the existing load that the waterbody is currently receiving from all sources (for impaired waters, the existing load exceeds the TMDL), 3) allocating the TMDL among all significant contributing sources (i.e., wasteload allocations for point sources and load allocations for nonpoint sources), and 4) determining for each source the amount of pollution reduction needed to achieve water quality standards. TMDL documents then provide recommendations for water quality improvement activities that, if implemented, should help the impaired waterbodies achieve water quality standards.

Water Quality Protection: Water quality protection practices are applied to point and nonpoint sources to control or reduce pollution sources so water quality improves and standards are met. For nonpoint sources, DEQ supports voluntary implementation of reasonable land, soil, and water conservation practices in consultation with conservation districts, watershed advisory groups, and landowners (75-5-703, MCA). For example, DEQ supports the development of watershed restoration plans, provides funding to implement water quality protection practices, and performs TMDL Implementation Evaluations (TIEs) to evaluate progress toward meeting water quality standards. For point sources, DEQ issues Montana Pollutant Discharge Elimination System (MPDES) discharge permits to regulate and limit the amount of pollutants that can be discharged to state surface waters. The impaired waters list and TMDL wasteload allocations are used to inform permit limits.

3.0 Programmatic Approach to Assessment

This section overviews DEQ's process for prioritizing and scoping water quality assessment projects.

3.1 Prioritizing Watersheds for Assessment

Watersheds or project areas are prioritized for assessment and subsequent water quality planning activities in accordance with the Montana Water Quality Act (75-5-702 and 703, MCA) and in coordination with DEQ water programs, the Statewide TMDL Advisory Group (STAG), EPA, and other stakeholders. Criteria that may be considered when prioritizing assessment projects include:

- **Stakeholder and community interest**: DEQ receives input from local, state and federal stakeholders about water quality interests and concerns, such as restoration and remediation efforts and new water quality threats. Many watershed improvement activities are implemented voluntarily and are most successful when locally led with community support.
- **DEQ water program integration**: DEQ water programs coordinate to leverage resources to advance water quality improvements in watersheds where program objectives align (e.g., jointly select focus watersheds to concentrate point and non-point source technical and financial support and track water quality improvements). Projects may also be spurred by the need for a TMDL prior to a new NPDES permit being issued.
- **State TMDL Advisory Group (STAG) input**: Assessment and TMDL development projects are solicited and vetted by STAG as authorized under 75-5-702(9), MCA; STAG serves in an advisory capacity to the Department and represents a diverse group of water related interests.
- **Inter-agency coordination**: Assessment projects may be coordinated with other agencies where common objectives align.

- **Watershed value**: Areas that provide extraordinary ecological or aesthetic value are more likely to be prioritized, especially if communities rely heavily on good water quality for economic or social wellbeing and widespread water quality threats or improvements are occurring.
- **Time lapse since previous assessments**: Water quality, habitat, and flow conditions change over time due to natural variability and human influences. Water quality conditions are periodically reassessed with current information, particularly if substantial time has lapsed since previous assessments or if changes are suspected.
- **Extent of existing or emerging human sources of degradation:** DEQ prioritizes areas where there is especially high risk to water quality due to human sources or where there are emerging sources likely to degrade water quality (e.g., resource extraction, concentrated residential or urban development).
- **Availability of agency resources**: Resources must be available for all phases of an assessment project, including monitoring, analysis and decision-making, reporting, and outreach. Assessment projects often span multiple years and involve several staff.
- **External resources:** When there are additional resources available from stakeholders or partners (e.g., for monitoring support), these resources may supplement DEQ's available resources and allow DEQ's assessment program to broaden the scope of the project.
- **Availability of assessment tools:** Assessment tools such as water quality standards, monitoring protocols and assessment methods are necessary for DEQ to effectively make accurate and credible assessment decisions.
- **Other factors:** While prioritizing agency resources, managers may need to consider unforeseen factors that arise.

3.2 Schedule/Timing

Assessment projects include various stages of project planning, monitoring to collect data, data analysis, and reporting. Generally, DEQ strives to incorporate data collected over at least two years to capture variability that may occur due to varying wet or dry water years, seasonal flow conditions, etc. Accordingly, assessment projects often take two to four years to complete. A project plan will outline each project's schedule. At the outset of an assessment project, DEQ identifies the integrated reporting cycle that assessments will likely be posted to for that project, although unforeseen events or delays sometimes prompt the assessment outcomes to post on subsequent biennial cycles. DEQ managers plan and coordinate with partners over time to prioritize future projects and maintain flexibility to accommodate changes in resource availability and department priorities through time.

3.3 Assessment Scope and Scale

Assessment scope describes which waters within a watershed will be assessed and which parameters will be assessed for each. Because a one-size-fits-all monitoring and assessment program which applies a broad suite of parameters to every waterbody is resource intensive, DEQ instead often uses a targeted, risk-based watershed approach to systematically prioritize monitoring and assessment projects (**Section 3.1**). DEQ plans the assessment scope in advance then conducts targeted monitoring to achieve assessment objectives. DEQ may also receive available data from external entities which is then incorporated into the assessment scope whenever possible (**Section 5.1**).

Although DEQ strives to adhere to holistic watershed approach and risk assessment principles while planning assessment projects, monitoring and assessment resources are limited and project managers must be flexible in response to resource availability and management priorities. For example, some assessment projects may have very narrowly-focused project objectives and target one or few specific waterbody-parameter combinations in small-scale watersheds. Others may more holistically identify parameters that pose the highest risk to water quality based on the most pervasive pollution sources and entail assessing multiple waterbodies within a larger watershed.

3.3.1 Watershed Approach

The watershed approach is a widely-applied coordinating framework for environmental management that focuses efforts to address the highest priority problems within hydrologically-defined geographic areas (EPA, 1996). The watershed approach encourages integrated, holistic management organized at the basin scale (Serveiss, *et al.,* 2005) and has three guiding principles (EPA, 1996) which DEQ applies during assessment:

1. Partnerships: DEQ coordinates with watershed stakeholders to collect information, identify priorities, and develop management strategies to address priority water quality issues in a watershed. DEQ prioritizes assessment in watersheds where stakeholders are engaged in local watershed improvement efforts, integrates Clean Water Act programs toward common goals via the water quality planning process (**Section 2.4**), coordinates with agency partners to leverage resources and share information, and provides opportunities for public comment and stakeholder involvement throughout the water quality planning process.
2. Geographic Focus: DEQ orients assessments and other water quality activities around watersheds as they are effective units for water resource planning because they link water resources with the surrounding land use activities that influence water quality. DEQ conducts assessment projects at a watershed scale, strives to protect multiple beneficial uses of water, and promotes water quality as one of many important and interrelated water resource issues (e.g., management of weeds, drought, flood, habitat, and aquatic invasive species).
3. Sound Management Techniques based on Strong Science and Data: DEQ applies watershed risk assessment principles (**Section 3.2.2**) to better understand sources and pathways of pollution and to focus efforts toward addressing priority issues in a watershed, applies standard operating procedures and data quality assessment to ensure data used during assessment is robust, develops science-based assessment methods to ensure assessment decisions are consistent and accurate, and periodically reassesses waters to incorporate new data and reflect current conditions.

3.3.2 Watershed Risk Assessment

DEQ applies watershed risk assessment principles to varying degrees when scoping assessment projects depending on resource availability and project flexibility. Watershed risk assessment is a process of collecting, organizing, and analyzing scientific information to evaluate the likelihood that adverse ecological effects occur due to exposure to one or more stressors and their probable sources in the watershed (EPA, 2008). Stressors are any chemical, physical, or biological entity that can cause an adverse effect in the environment (EPA, 2008) and are essentially analogous to causes of impairment.

Assessors document the presence, extent, and proximity of probable human sources of pollution and use this information to rank risk of water quality impairment (e.g., low to severe). When ranking risk, consideration is given to factors that influence water quality and vulnerability such as geology, climate,

geographic setting, and aquatic species life cycle requirements, as well as the degree to which reasonable land, soil and water conservation practices are currently in place. Risk rankings are then coupled with considerations of water resource value, stakeholder interests, and resource availability to determine the assessment scope. This process can help identify waters at risk of impairment as well as waters that are likely not impaired but need protection.

Applying watershed risk assessment helps ensure that assessment projects focus on the most prevalent human sources of pollution and the causes of impairment most closely linked to those sources. Human activities and land uses are often associated with multiple types of pollution and therefore addressing a single prevalent source may simultaneously reduce multiple pollutants. Watershed risk assessment also helps managers prioritize activities that are most likely to achieve environmental goals and to focus limited resources where they are needed most. Other less-prevalent parameters may also be included if a likely source has been identified.

3.3.3 Assessment Units

Assessment units (AUs) are delineations of waterbodies, or segments of waterbodies, used to track water quality assessment information. AUs are the smallest unit for which a water quality impairment determination can be made. AUs may consist of an entire waterbody (e.g., a lake, or a stream from headwaters to mouth), or a segment of a waterbody (e.g., a stream may be split into two or more segments such as headwaters to a tributary confluence and tributary confluence to mouth or a long river may have many segments). AUs are intended to represent relatively homogeneous segments and are delineated primarily by hydrologic or watershed boundaries, minimum and maximum length or area, ecoregions, use classification, geomorphology, and surrounding land use. An AU's geographic location is based on the U.S. Geological Survey's (USGS) high resolution 1:24,000 National Hydrography Dataset (NHD) which provides the best representation of state surface waters and is generally equivalent to USGS 1:24,000 topographic maps (DEQ, 2011).

AUs are assigned a unique identifier - known as an assessment unit ID (AUID) – which follows a standardized convention in which each part of the AUID represents a location attribute of the assessment unit:

A: "MT" – Signifies the State of Montana.

B: "41A" – Signifies the minor basins of Montana (86 total) which correspond generally with the HUC4 sub-major basins in the Waterbody Boundary Dataset (USGS and NRCS, 2013).

C: "001_" – Signifies the predominance sequence of waterbodies within the minor basin (HUC4); "001" is applied to the primary stream or river within the minor basin; subsequent numbers "002," "003," etc., are applied to significant tributary streams or lakes/reservoirs (generally HUC5 watersheds).

D: "_010" – Signifies individual stream segment numbers assigned to smaller tributaries (generally HUC6 watersheds) of the primary and secondary streams and rivers.

3.3.4 Assessment Reaches

Segmenting an AU into two or more homogenous reaches when developing monitoring designs and performing data analysis may allow assessors to better represent water quality conditions that vary between reaches due to significant geomorphological differences, concentrated human sources, or other factors that lead to heterogeneity within AUs. Reach breaks may be made for any waterbody type (e.g., a stream or river may be divided longitudinally into upstream and downstream reaches whereas a lake or reservoir may be split into separate regions or zones). Even if reach breaks are used and data is analyzed separately for each reach, assessment decisions regarding impairment and beneficial use support are still always made for the AU as a whole (i.e., even if only one reach signifies impairment, the entire AU is considered impaired).

Reach breaks are based on watershed-scale evaluations of patterns in human activity, land use, or changes in geophysical features most likely to influence the overall character of a waterbody such as ecoregion, slope, or confinement, not on measured differences in water quality. Thus, the decision to split an AU into reaches should preferably be made before data collection activities begin. Furthermore, minimum data requirements apply to each reach. To control the amount of resources expended to generate adequate data sets, it is recommended to avoid excessive sub-segmentation and only apply reach breaks when essential.

Some of DEQ's parameter-specific assessment methods contain explicit guidance for reach breaks. For example, the sediment assessment method (Kusnierz, *et al*., 2013) uses a stratification procedure to target certain low-gradient, depositional reach types. Different reach breaks may be applied for different parameters depending on parameter-specific considerations (e.g., an assessor may decide to split an AU into reaches for nutrient assessment purposes but not for metals assessment purposes). The following considerations for establishing reach breaks may apply if explicit reach break criteria is not already specified in an applicable assessment method:

- Transitions from one ecoregion to another
- Shifts in slope
- Significant differences in land cover or land use (e.g., forest/valley boundary)
- Areas of concentrated human sources of pollution or suspected pollution hot-spots.

4.0 Assessment Method Applicability

The assessment method described in this document applies to all state surface waters under state jurisdiction. A state water is defined as a body of water, irrigation system, or drainage system, either surface or underground (75-5-103, MCA). DEQ does not have delegated authority over all the waters in the state. The term 'state water' does not apply to ponds or lagoons used solely for treating, transporting, or impounding pollutants, or irrigation waters or land application disposal waters when the waters are used up within the irrigation or land application disposal system and the waters are not returned to state waters (75-5-103, MCA). Tribal governments and/or the EPA are responsible for managing the quality of waters located within the reservations of federally-recognized tribes. Also, waters wholly within national parks and wilderness areas are designated Outstanding Resource Waters (ORW) (75-5-316, MCA; ARM 17.30.617) and, because these areas are managed under federal laws, DEQ generally does not assess their conditions.

This assessment method is primarily applicable to perennial and intermittent streams, rivers, and lakes and reservoirs within state jurisdiction in Montana. The methods for assessing impairment status and making beneficial use determinations described in this document focuses on waters with use classifications A, B, C and I. Currently, no waters are assigned D through F use classifications in Montana and an appropriate assessment methodology will be developed for these waters if needed in the future. The parameter-specific assessment methods associated with this assessment method specify which waters or use classes those parameter-specific methods apply to.

Wetlands are generally not assessed with the same process as other surface waters and are usually not a focus for assessment projects, although DEQ may apply Circular DEQ-7 (DEQ, 2017) standards to larger contaminated wetlands as needed. However, DEQ recognizes the value of properly functioning wetlands and evaluates and reports on wetland conditions relative to the expected ecological functions they provide (e.g., water storage, nutrient attenuation).

5.0 Project Initiation and Information Gathering

When initiating assessment projects, management coordinates with partners to solicit project ideas, selects a targeted watershed based on prioritization criteria (**Section 3.4**), then allocates staff and financial resources. Resource availability sets boundaries on the level of detail, assessment scope, and the degree of coordination possible with partners. The project team:

- Develops a project plan,
- While scoping assessment projects and before performing assessments, DEQ compiles and synthesizes relevant information including maps, previous assessments, technical reports, permits, and existing and readily available data (**Section 3.5**).
- If resources allow, conducts reconnaissance to collect qualitative information, acquaint the project team with the landscape and water resources, ground-truth assumptions, and identify potential monitoring locations. This includes discussions with stakeholders to gather input about local interests and concerns.
- If resources allow, performs watershed characterization monitoring, a short-term investigation that captures water quality during key hydrologic periods (e.g., pre-runoff, peak flow and mid-summer baseflow) at fixed-stations on major waterbodies (e.g., mainstem and near mouths of major tributaries) to detect broad-scale temporal and spatial patterns between sites and across watersheds (DEQ, 2015).

5.1 Existing and Readily Available Data and Montana's Call for Data

In revising the list of impaired and threatened waters, Montana's Water Quality Act requires that DEQ use all currently available data, including information or data obtained from federal, state, and local agencies, private entities, or individuals with an interest in water quality protection (75-5-702, MCA). Similarly, the federal Clean Water Act states that "each State shall assemble and evaluate all existing and readily available water quality-related data and information" to develop their impaired waters lists (40 CFR Part 130.7(5)).

To fulfill these laws, DEQ solicits water quality data and information during a biennial call for data in preparation for each biennial Water Quality Integrated Report cycle. During the call for data, DEQ

notifies interested parties via an automatic mailing list service comprised of individuals, agencies, and other entities involved in water quality monitoring and management (DEQ, 2010). During this call for data, DEQ receives data accompanied by requests for assessment in areas that are not currently in existing work plans. DEQ makes reasonable effort to incorporate this data and these requests during the current integrated reporting cycle, but may consider larger workload requests during subsequent Integrated Reporting cycles due to workforce and time limitations.

In addition to data collected by DEQ and data received via the call for data, DEQ also routinely compiles pertinent data available via the National Water Quality Portal (NWQMC, 2019). DEQ's Water Quality Planning Bureau manages a water quality library and archives pertinent reports as they are provided to the program from other sources. We make reasonable effort to acquire data from other agencies or available sources that DEQ is aware of for use to support the objectives of our assessment projects.

5.2 Data Sources

When making impairment and beneficial use support decisions, DEQ may use:

Data and information collected by DEQ through internal monitoring activities. DEQ's internal data is stored in DEQ's EQuIS Water Quality Exchange database (MT-eWQX) and submitted weekly to the national Water Quality Portal (NWQMC, 2019).

Secondary data submitted to DEQ by other governmental agencies and other interested parties, including non-governmental organizations, volunteer monitoring programs, academic institutions, private entities and individuals. Secondary data must be submitted to DEQ's MT-eWQX database in a specific format using the data submittal process (DEQ, 2010) and is screened to determine if it is suitable for use in making water quality assessment decisions based on the objectives, spatial and temporal representation, and rigor of quality assurance and quality controls applied during collection. If large amounts of raw data have been collected but not yet processed or analyzed by an external entity, DEQ may not assume the costs and responsibility of processing the data and such raw data are usually considered "not readily available" for assessment until the entity responsible for collecting it has processed it into a useable dataset or report (DEQ, 2006).

Other readily-accessible data in public databases that meets data quality objectives.

5.3 Data Types

EPA recommends that states incorporate a suite of parameters during assessment because different types of data provide unique insights into water quality standards attainment status; data can be collected directly from a waterbody or can be modeled or calculated (EPA, 2002). Data types that may be applied during assessment are (EPA, 2016):

Chemical and physical data address key chemical constituents in water, sediments, and fish tissue, and physical characteristics in water and sediments. It provides direct information about whether specific pollutants are present in amounts that are causing or likely to cause adverse impacts to aquatic organisms (EPA, 2002). Physical attributes are useful screening indicators of potential problems often because they can have an impact on the effects of chemicals (EPA, 2016). EPA recommends the use of chemical and physical indicators as core and supplemental indicators of aquatic life–based water quality standards (EPA, 2002).

Biological data measure actual effects of pollutants on an aquatic community. Measurements often include population estimates, biomass, number and relative abundance of sensitive or pollution-tolerant species, diversity, and distribution (DEQ, 2006). Biological assessments directly measure effects of pollutants on aquatic communities and can contribute valuable information toward making aquatic life beneficial use support decisions. Biological assessments typically quantify the difference between reference or expected conditions of aquatic communities and those found at a specific site being evaluated (EPA, 2002). Chemical-specific assessments evaluate impacts from single pollutants whereas biological assessments are typically unable to distinguish a specific cause of impairment although, unlike chemical-specific assessments, biological assessments can represent the response to cumulative effects of past or current impacts from multiple physical and chemical stressors (EPA, 2002).

Habitat assessments incorporate physical attributes such as substrate, velocity, depth, width, sinuosity, flow, volume, vegetation and land use summarized into an index or summary of overall habitat conditions. Typically, habitat assessments are integrated with biological assessments when assessing applicable whether aquatic life uses are being attained (EPA, 2002).

Toxicity tests from ambient water column and sediment examine the effects of unknown mixtures of chemicals in surface waters and may also be used to confirm that an observed impairment is not due to chemical or toxicity-related sources. Toxicity levels are determined by exposing aquatic organisms to water samples. Whole effluent toxicity (WET) testing is commonly performed at point-source discharges and can trigger monitoring for toxicity (EPA, 2002).

Water quality modeling results may be used to inform assessment decisions. For example, modeling result may be used to show that water quality standards may be exceeded soon (i.e., within one or two listing cycles) due to uncontrolled sources; in this case the pollutant would be listed as threatened. Also, if ambient data is not available for a waterbody but data exists for upstream waters or sources, mixing calculations may be used to determine exceedances of water quality standards and trigger an impairment listing.

6.0 DATA QUALITY ASSESSMENT (DQA)

DEQ may modify the list of waterbodies that are identified as threatened or impaired only if there is sufficient credible data to support the modification (75-5-702, MCA). Sufficient credible data (SCD) means “chemical, physical, or biological monitoring data, alone or in combination with narrative information, that supports a finding as to whether a waterbody is achieving compliance with applicable water quality standards” (75-5-103(35), MCA). DEQ evaluates all data and information to ensure data quality is adequate for making assessment decisions. Data that does not meet DEQ’s data quality objectives will not be included formally in the assessment but may be used to supplement the assessment determination (DEQ, 2011).

Since 2011, DEQ has used a data quality assessment (DQA) process to determine if available data is of sufficient quality for making parameter-specific impairment determinations (DEQ, 2011). The DQA process is centered on four components that contribute to data validity: technical soundness of methodology, spatial and temporal coverage, data quality, and data currency. DQAs are performed separately for each parameter group being assessed according to that parameter’s assessment method specifications. For example, if nutrients, metals and sediment are all being assessed while evaluating aquatic life beneficial use support, each of these three parameter groups would undergo separate DQAs.

Assessors use the WARD system (**Section 8.1**) to document the DQA outcome (pass or fail) for each parameter group being assessed per beneficial use. All data quality indicators must be met to pass the DQA; if a single indicator is not met, the DQA fails for that parameter group. An assessor may override pass or override fail a DQA but they must accompany this override with adequate justification.

The data quality indicators specified in the DQA for each parameter-group are in **Appendix B**. Additional data quality requirements specific for a parameter group may be set forth in parameter-specific assessment methods (**Section 6.1**). For inclusion in assessment decision-making, data must represent ambient conditions of the waterbody being assessed and therefore must be collected directly from the assessment unit itself and cannot be collected within the mixing zone of permitted point source discharges. Data quality requirements that apply universally include:

- Data must be representative of current conditions; generally, this means data must be less than 10 years old, although data greater than 10 years old may be considered if conditions are known not to have changed or, alternately, data may be excluded even if it is less than 10 years old if conditions are known to have changed.
- Data must be linked to a documented location (i.e., latitude and longitude).
- Data must be submitted to DEQ in the specific MT-eWQX format using the data submittal process described in "MT-eWQX Guidance Manual - Call for Data" (DEQ, 2010).
- Data must include written documentation (such as a Quality Assurance Project Plan (QAPP) and/or Sampling and Analysis Plan (SAP)) which describes monitoring objectives, data quality objectives, quality assurance (QA) and quality control (QC) measures, study design, field sample collection and laboratory analytical methods.
- Data must include field notes, laboratory notations, or summaries that indicate deviations from the QAPP or SAP and their potential impact on the data quality and objective outcome.

7.0 Assessment Method

This section describes DEQ's procedures for making beneficial use support decisions for waterbodies and making impairment assessment decisions for specific waterbody-parameter combinations.

7.1 Beneficial Use Assessment

Each beneficial use may be affected by a variety of water quality parameters. Parameters used during assessment may represent chemical, physical or biological measures of a waterbody. When assessing use support, parameters associated with a use can be tiered as either core or supplemental depending, for example, on how closely they are linked to use support or how prevalent their sources are in a watershed (**Section 7.1.3**). Beneficial use support assessments result in one of the following outcomes: not fully supporting, fully supporting, threatened, insufficient information, or not assessed.

Because each beneficial use may be affected by various types of pollution, determining whether a waterbody is fully supporting its beneficial uses is reliant upon the outcomes of multiple parameter-specific impairment assessments (**Section 7.2**). Impairment assessments are performed for individual waterbody-parameter combinations and these decisions are guided by parameter-specific assessment methods. When a waterbody is found to be impaired by a parameter, that parameter is listed as a cause of impairment and an assessor can affirm that the associated use (or uses) is not fully supported.

However, an assessor can only affirm a use is fully supported if a cumulative evaluation of impairment assessment outcomes for multiple parameters associated with the use, especially the core parameters most likely to affect use support, are assessed and found to be not impaired.

7.1.1 Core and Supplemental Parameters for Beneficial Use Assessment

Core parameters are those that are especially closely linked to beneficial use support. Whenever possible, assessment of core parameters should be required when performing a comprehensive beneficial use assessment, especially if attempting to affirm that a use is fully supported. Core parameters tend to represent Montana's most prolific causes and sources of water quality impairment. They often have numeric water quality standards and DEQ typically prioritizes developing parameter-specific assessment methods to guide assessment decisions for them (**Section 6.1**).

Core parameters may be supplemented with additional parameters as resources allow or when data is readily available. Supplemental parameters also have the potential to impact a use, but may be less directly tied to use support or their sources or occurrence may be less prevalent. A full support determination may be still be made if supplemental parameters are not included. Alternately, when credible data exists that provides compelling evidence that these supplemental parameters are limiting beneficial use support, they may be identified as causes of impairment and the waterbody determination for that use is similarly deemed not fully supported.

Table 2 presents a guide for identifying candidate core and supplemental parameters for each beneficial use. This table is a useful reference but identifying which parameters will be considered core and which will be considered supplemental for a given assessment unit depends on a variety of factors and should be decided on a case-by-case basis. The outcome of watershed risk assessment (**Section 3.3.2**) can play an important role in determining which parameters should be considered core given their potential for impairment based on prevalence of sources in a watershed. Core parameters may also vary depending on the use classification of an assessment unit and other key considerations per beneficial use (**Section 7.1.3**). DEQ continues to work on pollution specific assessment documentation.

Although ecological significance considerations are key in identifying core parameters, other limiting factors may also inform the decision to consider a parameter core or supplemental. For example, a parameter may be considered supplemental if the risk of impairment is very low in the watershed or if a parameter-specific assessment method has not been developed (especially if narrative criteria applies).

Table 2. Core and secondary assessment parameters for beneficial use assessment.

Beneficial Use	Suggested Assessment Parameters		Limitations/Considerations/Guidance
Aquatic Life and Fish	Core Parameters	Nutrients	Assessment method for wadeable streams (Suplee and Sada, 2016).
		Parameters with numeric aquatic life standards (e.g., metals)	Assessment method for metals (Drygas, 2012)
		Sediment	Assessment method for wadeble streams in mountain/transitional areas (Kusnierz, et al., 2013)

		Temperature	No assessment method
		Dissolved oxygen (DO)	No assessment method
		Biological communities	Biological metrics apply for some pollutant specific assessment methods
	Supplemental Parameters	Habitat	No assessment method
		Electrical conductivity (EC)	No assessment method
		Sulfate	No assessment method
		Turbidity/TSS	No assessment method
		pH	No assessment method
		Flow alterations	No assessment method
Recreation	Core Parameters	*Escherichia coli* (*E. coli*)	E. coli assessment method (Makarowski, 2020)
		Nutrients (mountain/transitional streams only)	Assessment method for wadeable streams (Suplee and Sada, 2016)
	Supplemental Parameters	Harmful algal blooms (HABs)	No assessment method; no numeric standards
		Oil & Grease	No assessment method
		Aesthetics/Odor	No assessment method
Drinking Water (Human Health)	Core Parameters	Parameters with numeric human health standards (e.g., metals)	Assessment method for metals only (Drygas, 2012)
		Escherichia coli (*E. coli*) (A-1 and A-closed only)	E. coli assessment method (Makarowski, 2020). Applies to A-1 and A-closed use classes only
Agriculture	Core Parameters	Electrical conductivity (EC) and Sodium Adsorption Ratio (SAR) for Rosebud Creek, Tongue River, Powder River, Little Powder River, and Tongue River Reservoir	Assessment method applies to select waterbodies with numeric standards (Bell, *et al.*, 2020)
		Electrical conductivity (EC) and Sodium adsorption ratio (SAR)	No assessment method in areas without numeric standards.
	Supplemental Parameters	Harmful algal blooms (HABs)	No assessment method; no numeric standards

7.1.2 Beneficial Use Support Decisions

Beneficial use support decisions are made for each use independently from other uses and a waterbody may support some uses while not supporting others. Drinking water, aquatic life, and contact recreation uses are typically more sensitive to pollution impacts than agriculture and industrial uses. Beneficial use

support determinations fall into one of the following: Not Fully Supporting, Fully Supporting, Threatened, Insufficient Information, or Not Assessed.

Not Fully Supporting

A waterbody is not fully supporting a beneficial use if any one or more parameter (pollutant and/or non-pollutant) associated with that use is not attaining water quality standards and is therefore listed as a cause of impairment.

Fully Supporting

A waterbody is fully supporting a beneficial use if all core parameters associated with the use are attaining applicable water quality standards, and if there are no supplemental parameters associated with the use that indicate non-support.

Threatened

Threatened waters are AUs for which sufficient data and information exists to determine that designated uses are being attained but that non-attainment is predicted within the next two Integrated Report cycles (approximately 4 years). These AUs are included in Category 5. This type of listing should include some type of trend analysis and would likely include modeling of sources over time. Waterbody-pollutant combinations that are threatened are reported as causes of impairment, they appear on the 303(d) list of pollutant-impaired waters in need of a TMDL and the associated use is not fully supported.

Insufficient Information

Insufficient information is typically used when some core parameters have been assessed and found to be not impaired, but there is not sufficient credible data to assess all core parameters associated with the use. Even if one or more core parameters was assessed and found to be not impaired, the assessor cannot confidently say the use is fully supported if there are core parameters that have not been assessed. For example, a nutrient assessment may indicate that nutrients are not impairing an AU, but an assessor cannot assert that the aquatic life use is fully supported until assessment indicates that the waterbody is not impaired due to the other core parameters associated with the aquatic life use. Also, for example, if biological data suggests that there may be a stressor present that is affecting aquatic life use but core parameters have been assessed and do not confirm which stressor(s) may be present, assessors should describe the situation in the assessment record and indicate “insufficient information” as the beneficial use support determination for the use.

Not Assessed

If there are no causes of impairment already linked to a use and if none of the core parameters associated with the use have been assessed, the use is not assessed.

7.1.3 Key Considerations per Beneficial Use

Each beneficial use has nuanced distinctions that should be considered during assessment, including when selecting parameters to evaluate and metrics and thresholds to use during analysis.

Aquatic Life and Fishes

- Per Administrative Rules of Montana, the aquatic life beneficial use includes “fishes and associated aquatic life, waterfowl, and furbearers.”

- Use classifications distinguish between salmonid and non-salmonid fish species because water quality conditions necessary to sustain these communities varies.
- The inclusion of the terms "growth and propagation" highlight the need for water quality conditions that support all life cycle stages of organisms so they can not only live and grow but also reproduce and spread. The term "marginal" further stratifies areas where full reproductive capacity does not exist for salmonid fish.
- Protection of waterfowl and furbearers promotes consideration of riparian habitat evaluations in water quality assessments.
- EPA recommends that monitoring for aquatic life use support include measurement of chemical parameters in water and sediment and the collection of habitat and community level biological data (DEQ, 2006).
- EPA recommends that states include biological indicators among the core indicators used to assess attainment with aquatic life–based water quality standards (EPA, 2002). DEQ will review biological data when considering the full support of aquatic life use. Some pollutant specific assessment methods contain guidance for evaluating biological data. However, assessors cannot use biological data alone (i.e., direct measures of aquatic life support) to override pollution specific assessment outcomes. DEQ will not list or delist waterbody-pollutant impairments or consider the use fully supported based solely on biological data. If biological data exists, to affirm that the aquatic life use is fully supported, the assessor must ensure that biological data does not indicate non-support.
- DEQ may consider data and information related to fish consumption (e.g., fish tissue data or fish consumption advisories) when making aquatic life use support determinations.

Contact Recreation

- Per Administrative Rules of Montana, the recreation beneficial use includes "bathing, swimming, and recreation."
- For parameters that are harmful or toxic to human health (e.g., *E. coli*, harmful algal blooms), the recreation use criteria generally protect "contact recreation" and criteria may distinguish between primary contact recreation (e.g., swimming) and secondary contact recreation (e.g., boating).
- Other parameters that affect aesthetic or odor qualities may also affect the suitability of waters for recreation use.
- DEQ may consider data and information related to fish consumption (e.g., fish tissue data or fish consumption advisories) when making recreation use support determinations.

Drinking Water

- Per Administrative Rules of Montana, the drinking water beneficial use includes "drinking, culinary, and food processing."
- Surface waters are not intended for consumption without adequate treatment and use classifications distinguish between the level of treatment necessary for drinking water use (i.e., after convention treatment or after simple disinfection).

- Circular DEQ-7 provides a basis for assessing human health beneficial use. Many numeric standards in DEQ-7 take into consideration the human exposure pathway of fish consumption, especially for chemicals that bioaccumulate.

Agricultural

- The agriculture beneficial use encompasses agricultural water supply for various uses (e.g., livestock watering, irrigation).
- Criteria and thresholds for parameters may vary depending on the agricultural use being protected (e.g., a threshold for consumption of water by livestock may be more or less stringent than the threshold used to evaluate toxicity to plants via irrigation).

Industrial

- The industrial use encompasses water supply for any industrial uses (e.g., fabricating, processing, cooling).
- DEQ does not report the use support status for industrial use because, as the least sensitive beneficial use, it is assumed that if a waterbody supports other more sensitive beneficial uses it will also support industrial uses.

7.1 Impairment Assessment

Impairment assessment involves identifying parameters that are not meeting water quality standards and are therefore causes of impairment limiting a water's ability to fully support beneficial uses. Impairment listing decisions are made for waterbody-parameter combinations and are guided by parameter-specific assessment methods (**Section 7.1.1, Appendix C**). Impairment listing decisions are used to update Montana's list of impaired waters and are reported in Montana's Water Quality Integrated Report (**Section 8.4**).

7.1.1 Parameter-Specific Assessment Methods

DEQ develops parameter-specific assessment methods to provide frameworks for making consistent and scientifically-sound impairment listing decisions. Existing parameter-specific assessment methods are summarized in **Appendix C**, and DEQ develops new methods or revises existing methods over time. In each parameter-specific assessment method, DEQ identifies indicators (or measures of water quality) which are used to characterize whether a water quality standard and its components is attained (EPA, 2002). Indicators may be tiered as core or secondary depending on how directly they can be used to evaluate standards attainment (especially numeric criteria) and how heavily they are weighted in decision-making.

Although core and secondary indicators are often interpreted together using a weight of evidence approach when making assessment decisions, the policy of independent applicability applies. For assessment purposes, independent applicability says that when evaluating multiple types of data and any one type of data indicates an element of a water quality standard is not attained (e.g. chemical concentrations exceed a numeric criterion), the waterbody should most likely be identified as impaired. The intent of independent applicability is to protect against dismissing exceedances of a water quality standards through a weight of evidence approach, though EPA recognizes that there are circumstances when conflicting results should be investigated further before an attainment or nonattainment decision is made (EPA, 2002).

For each indicator, parameter-specific assessment methods identify the thresholds used to demonstrate harm to a beneficial use and distinguish attainment from impairment (EPA, 2002). Thresholds used in assessment are often numeric criteria or other numeric values. In some cases, DEQ may also apply a reference condition approach for determining water quality standards attainment for parameters with narrative standards. For example, the narrative sediment standard states that there "can be no increase above naturally occurring concentrations of sediment and settable solids… sufficient to create a nuisance or render the water harmful, detrimental or injurious to…fish, or other wildlife" (ARM 17.30.622 through 629). Because the amount of sediment that would cause problems to wildlife varies depending on stream and site characteristics, sediment-related indicators measured at study streams are compared to conditions at reference sites with comparable stream and site characteristics where human influence is minimal or where all reasonable land, soil, and water conservation practices have been applied.

Parameter-specific assessment methods also describe the data collection and analysis requirements for each indicator (e.g., spatial and temporal requirements, defined index periods, and a minimum sample size), data quality objectives used for determining the validity and reliability of data, and decision frameworks for each applicable cause of impairment. Parameter-specific assessment methods promote consistency in selecting appropriate cause names and sources, and Montana's WARD system and the national ATTAINS systems align in tracking these.

Most parameter-specific assessment methods also describe conditions which constitute overwhelming evidence of impairment, that is, when a single data set irrefutably proves that impairment exists. For example, very high exceedances of a toxic criterion or visual evidence of widespread impact such as fish kills may be sufficient to determine impairment even if minimum data requirements have not been met. Overwhelming evidence provisions may also be used to establish that a use is fully supported, such as when direct rigorous measurement of the biological community indicates the aquatic life use is fully supported (DEQ, 2006).

7.1.2 Impairment Listing Decisions

Impairment listings may be added to or delisted from a waterbody when sufficient credible data becomes available to support the modification (75-5-702, MCA). Impairment listings carry over from reporting cycle to reporting cycle until they are delisted. Assessments for each waterbody-parameter combination results in one of three outcomes: non-attainment, attainment, or insufficient information.

Non-attainment (list or keep listed)

When assessment confirms that a waterbody is not attaining water quality standards for a pollutant or non-pollutant cause of impairment, the assessment decision is either to "list" the waterbody-cause combination if it is a newly discovered impairment, or to "keep listed" if the waterbody-cause combination is already listed. In WARD, the parameter is indicated as impaired, the assessment method used to make the assessment decision is cited, at least one probable source of impairment is associated with each cause, and each source is indicated as confirmed or not confirmed. The integrated reporting cycle when a cause is first associated with an assessment unit is tracked as the cycle first listed (CFL).

Attainment (do not list or delist)

When assessment confirms that a waterbody is attaining water quality standards for a parameter, the assessment decision is either "do not list" if the waterbody-parameter combination is not already listed, or "delist" if the waterbody-cause combination was listed previously. The parameter is marked in WARD

as meets criteria, the assessment method used to make the decision is cited and, if applicable, the delisting reason, date and comments are also documented.

Pollutants may be removed from the impaired waters list only if an allowable delisting reason is specified (**Table 3**). For consistency and to ensure that integrated reports meet both state and federal needs, Montana's allowable delisting reasons align with the "good cause" delisting provisions provided in 40 CFR Part 130.7(b)(6)(iv) (DEQ, 2011). Causes of impairment cannot be delisted due to lack of credible data or because of insufficient information. There are several actions for which the term "delisting" is used; these delisting reasons help to clarify each. For example, when TMDLs are approved for all pollutant causes, an AU is "delisted" from Category 5 to Category 4A because all pollutants were removed from the 303(d) list of impaired waters in need of TMDLs (a subset of the total impaired waters list); however, the AU remains on the list of impaired waters. Once all causes of impairment (including pollutants and non-pollutants) are "delisted" because water quality standards are met and all uses are fully supported, the AU moves to Category 1, 2 or 3 and is removed from the list of impaired waters.

Table 3. Montana's Delisting Process

Delist Reason	Delist Result
New data or information indicates full support of beneficial uses because water quality has been restored and water quality standards are being met.	The waterbody-pollutant combination is moved from Category 5 to Category 1.
Flaws in the original analysis of data and information led to the cause being incorrectly listed.	The waterbody-pollutant combination is removed from Category 5, and the AU moves to the listing category as defined by the status of those remaining listings.
Other point source or nonpoint source controls are expected to meet water quality standards.	The waterbody-pollutant combination is moved from Category 5 to Category 4B.
The impairment is due to a non-pollutant.	The waterbody-pollutant combination is moved from Category 5 to Category 4C if no other pollutant cause remains listed.
A TMDL was completed and approved by EPA.	The waterbody-pollutant combination is moved from Category 5 to Category 4A if all pollutant causes have approved TMDLs.
The waterbody is not in the state's jurisdiction.	The waterbody-pollutant combination is removed from Category 5, and the waterbody AU is removed (retired) from the state's data system.
Other	The waterbody-pollutant combination is removed from Category 5, and the AU moves to the listing category as defined by the status of those remaining listings.

Insufficient Information

If minimum data quality requirements are not met to pass the DQA for a parameter, and if there is no acceptable rationale for overriding the DQA failure, there is insufficient information to make an impairment listing decision.

Decision Error

Throughout the assessment process, attempts are made to control Type I and Type II decision error. Type I (false rejection, α) error is incorrectly rejecting a true null hypothesis (EPA, 2000). For example, Type I error would be mistakenly identifying an assessment unit as not impaired when, in fact, the waterbody is impaired. A potential consequence of a false rejection error is that human health and environmental problems will not be addressed. Ways to reduce this error include lowering the level of significance for statistical tests and applying multiple approaches to grouping and analyzing data.

Type II (false acceptance, β) error is incorrectly retaining a false null hypothesis (EPA, 2000). Type II error would be identifying an assessment unit as impaired when, in fact, the waterbody is not impaired. A potential consequence of false acceptance decision error is unnecessary resource expenditure to address a problem that does not exist. Examples of ways assessment methods may minimize the likelihood of Type II error include setting minimum data requirements and ensuring that scenarios only result in an impairment listing when there are numerous exceedances of criteria.

7.1.3 Probable Sources

For each cause of impairment, assessors identify at least one probable source of impairment. Probable sources of impairment are the activities, facilities, or conditions that generate the pollutants that prevent waters from meeting water quality standards. Source information helps people to focus efforts to protect and improve water quality but are geared to help guide the TMDL program. In WARD, the assessor checks the Source Confirmed box if water quality data is available that proves a probable source is contributing loads or increasing concentrations, whereas the assessor checks the Source Not Confirmed box if probable sources are present in the watershed but are not confirmed using data. The assessor may also include a brief description of sources in the overall condition summary. As the next step in the water quality planning process, TMDLs identify all significant sources, quantify them, and provide allocations to reduce pollutant levels. A full and quantified source assessment will be completed during TMDL development.

Many of Montana's standards are prefaced with "no person may," and DEQ's Clean Water Act programs are generally oriented around managing human sources of water quality impairment. Because people can implement water quality protection and improvement activities to abate human impacts, DEQ prioritizes water quality assessment where human sources of impairment are most likely and does not consider it a priority to identify new impairment conditions when human sources are absent. Alternatively, EPA requires impairment determinations when numeric standards are not met. Although usually not targeted for assessment work, the program occasionally encounters fully natural (non-anthropogenic) sources of a pollutant at levels that do not meet a numeric standard. In these cases, Montana uses the 5N listing category when a pollutant is above a numeric standard and the assessor cannot find any indication that significant human sources are present. This category is used to track waterbodies with pollutant levels above water quality standards because of natural or non-anthropogenic conditions.

8.0 Data Management and Reporting

Effective communication is important as assessors strive to translate often complex scientifically information about beneficial uses, stressors, sources, and ecological effects into concepts that are more directly relatable to the public. Clear communication about current water quality conditions and how

human activities affect water quality can promote water quality improvements. DEQ reports water quality assessment information using a variety of approaches.

8.1 Water Quality Assessment, Reporting and Documentation (WARD) System

In accordance with 75-5-702, MCA, DEQ developed and maintains a Water Quality Assessment, Reporting, and Documentation (WARD) data management system. This system links information with EPA's national Attains Database (EPA, 2019) and provides the basis for Montana's list of impaired waters and other water quality reporting. Upon request, DEQ makes data publicly available per 75-5-702, MCA.

8.2 Water Quality Assessment Records

The WARD system (**Section 8.1**) is used to maintain and update detailed water quality assessment records for each waterbody assessment unit. Assessment records include:

- Summary information (e.g., assessment unit name, ID, description, size, watershed, assessor)
- Citations for data and information sources referenced during the assessment
- Data quality assessment
- Data matrix that summarizes data and information used for assessment
- Listing history summarizing key impairment decisions made during each previous reporting cycle
- Overall condition summary for the waterbody
- Assessment outcomes, including impairment listings (impairment causes, probable sources, and parameters that meet criteria) and beneficial use support determinations
- Impairment delistings, delisting reason and date.

8.3 Integrated Reporting Categories

Montana uses a system of reporting categories to summarize the impairment status for each assessment unit (AU) (**Table 4**). Categories range from Category 1 (fully supporting all uses) to Category 5 (one or more uses is impaired by a pollutant and requires a TMDL). All of Montana's known impaired waters are in categories 4A, 4B, 4C, 5 and 5N. Categories describe impairment status for AUs but are also used to describe individual AU-cause combinations. The database assigns AUs to a category based on the "worst case" listing. For example, even if only one pollutant cause is impairing a waterbody's ability to support any one of the beneficial uses, the AU is Category 5.

Categories may change if the assessment is updated based on new data or information and causes are added (listed) or removed (delisted). For example, a previously unassessed waterbody that is listed for two pollutant causes changes from Category 3 to Category 5. If a TMDL is developed for only one of the two pollutant causes, the reporting category remains as 5. It is not until TMDLs are completed for both pollutant causes that the category changes to 4A.

Table 4. Water Quality Integrated Reporting Categories for Surface Waters

Category	Description
1	All designated uses are supported, and no use is threatened.
2	Available data and/or information indicate that some, but not all, of the designated uses are supported.
3	There is insufficient available data/information to make a use support determination.
4A	Available data and/or information indicate that at least one designated use is not being supported or is threatened, but all TMDLs have been completed for waterbody-pollutant combinations.
4B	Available data and/or information indicate that at least one designated use us not being supported or is threatened, but a TMDL is not needed because other required control measures are expected to result in the attainment of Water Quality Standards in a reasonable period of time. Montana does not often use this category.
4C	Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed because the impairment or threat is not caused by a pollutant.
5	One or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat.
5N	Natural conditions may be higher than the water quality standards but further source assessment is needed to fully determine this condition. The TMDL program completes more thorough source assessments for all pollutants identified as limiting a beneficial use. If natural sources are determined to be a sole cause of water quality standards exceedance during TMDL development, a natural conditions analysis may be pursued.

8.4 Water Quality Integrated Report (WQIR)

Montana reports water quality assessment information biennially in the Water Quality Integrated Report (WQIR). The WQIR includes the list of impaired and threatened waterbodies as well as the list of pollutant-impaired waters in need of a TMDL (referred to as the 303(d) list; EPA reviews and approves this list). It also includes a description of overall condition of aquatic resources in Montana, including the nature and extent of nonpoint sources of pollutants. Therefore, the WQIR satisfies requirements of both Section 305(b) and Section 303(d) of the federal Clean Water Act. In addition to surface water assessment information, the WQIR presents background information about the waters of Montana, shares goals and successes of state water pollution control programs, reviews ground water monitoring and assessment information, and other water quality-related information of public interest. Montana's WQIR reporting cycles span two years; the report is due by April 1st on each even-numbered year, is preceded by a call for data, and has a public comment period.

8.5 Clean Water Act Information Center (CWAIC)

DEQ makes assessment information accessible to the public via the Clean Water Act Information Center (CWAIC) available at www.cwaic.mt.gov. CWAIC includes links to current and past Water Quality Integrated Reports, a searchable feature to access assessment records and assessment summaries, and interactive mapping features to view and download data from DEQ's water quality database.

8.6 National Reporting

EPA's Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) is an online system for accessing information about the conditions in the Nation's surface waters. Montana submits water quality assessment outcomes to ATTAINS via WARD. ATTAINS defines the allowable domain values for assessment reporting, including parameter names, source names, delisting reasons, etc. EPA also developed an online resource called How's My Waterway for the public to access data and information about water quality conditions based on the assessment information submitted by states via ATTAINS.

9.0 Review and Approval

This section summarizes the review and approval process that DEQ's uses to finalize assessment decisions.

9.1 DEQ Technical Review and Approval

Prior to submittal in WARD, each assessment decision is typically reviewed and vetted by a group of DEQ water quality specialists and section supervisors, particularly representatives from the Monitoring and Assessment and Watershed Management (TMDL) sections. Also, at least ten percent of the assessment records submitted by assessors into WARD, especially those with delistings, are selected for technical review by a technically-qualified peer, section supervisor, or quality assurance officer in the Water Quality Planning Bureau. Technical review helps ensure that data, information, and decisions are adequately described, data quality assessment outcome is reasonable, assessments reflect previously agreed-upon decisions and rationale, and that the assessment record is generally accurate and complete.

9.2 EPA Technical Review and Approval

EPA does not formally approve assessment methods, but they do approve Montana's list of impaired waters in which decisions using assessment methods are completed. As such, DEQ and EPA have forged a cooperative relationship for reviewing the draft assessment methods and data analysis and decision-making process based upon them. Assessment listing decisions are typically reviewed in advance of the final IR between the Monitoring and Assessment Section Supervisor and EPA.

9.3 Public Review and Comment

Prior to publishing a final list of impaired waters, DEQ provides public notice and allows 60 days for public comment on the draft list, and makes available for public review, upon request, documentation used in the decision to list or delist a waterbody (75-5-702, MCA).

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APPENDIX A. SURFACE WATER USE CLASSIFICATIONS IN MONTANA

Use Classification	Description	Administrative Rule
A-Closed	Waters are to be maintained suitable for drinking, culinary, and food processing purposes after simple disinfection. Water quality is to be maintained suitable for swimming, recreation, growth, and propagation of fishes and associated aquatic life, although access restrictions to protect public health may limit actual use of A-Closed waters for these uses.	17.30.621
A-1	Waters are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.622
B-1	Waters are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.623
B-2	Waters are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.624
B-3	Waters are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.625
C-1	Waters are to be maintained suitable for bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.626
C-2	Waters are to be maintained suitable for bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.	17.30.627
C-3	Waters are to be maintained suitable for bathing, swimming, and recreation, and growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers. The quality of these waters is naturally marginal for drinking, culinary, and food processing purposes, agriculture, and industrial water supply.	17.30.629

Use Classification	Description	Administrative Rule
I	The goal of the state of Montana is to have these waters fully support the following uses: drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply. An analysis will be performed for each of these waters during each triennial standards review period to determine the factors preventing or limiting attainment of the designated uses listed herein. Based on these analyses, specific standards will be adjusted to reflect any improvements which have occurred in water quality as a result of water quality control of nonpoint-source pollution.	17.30.628
D-1	Waters are to be maintained suitable for agricultural purposes and secondary contact recreation.	17.30.650
D-2	Waters are to be maintained suitable for agricultural purposes and secondary contact recreation. Because of conditions resulting from flow regulation, maintenance of the ditch or geomorphological and riparian habitat conditions, the quality of these waters is marginally suitable for aquatic life.	17.30.651
E-1	Waters are to be maintained suitable for agricultural purposes, secondary contact recreation and wildlife.	17.30.652
E-2	Waters are to be maintained suitable for agricultural purposes, secondary contact recreation, and wildlife. Because of habitat, low flow, hydro-geomorphic and other physical conditions these waters are marginally suitable for aquatic life.	17.30.653
E-3	Waters are to be maintained suitable for agricultural purposes, secondary contact recreation, and wildlife.	17.30.654
E-4	Waters are to be maintained suitable for aquatic life, agricultural purposes, secondary contact recreation, and wildlife.	17.30.655
E-5	Waters are to be maintained suitable for agricultural purposes, secondary contact recreation, saline tolerant aquatic life, and wildlife.	17.30.656
F-1	Waters are to be maintained suitable for secondary contact recreation, wildlife and aquatic life not including fish.	17.30.657

APPENDIX B. DATA QUALITY ASSESSMENT (DQA) INDICATORS

Data Type	Data Quality Indicator	Applicable Data Quality Indicators in WARD per Pollutant Group and Beneficial Use							
		Nutrients (AQL, REC)	Metals (AQL, DW)	E. coli (REC)	Sediment (AQL)	Temperature (AQL)	Common (AGR)	Other (AQL, REC, DW)	Other (AGR)
Chemistry	Is the Data <= 10 years old?	X	X	X			X	X	
	Are conditions known not to have changed since the data was collected?	X	X	X	X	X	X	X	
	Is the quality managed at the project level and documentation available (QAPP/SAP)?	X	X	X	X	X	X	X	
	Is there written assurance or documentation demonstrating that the procedures and methods written in the QAPP or SAP were followed and data requirements were met?	X	X	X	X	X	X	X	
	Is the facility to be performing the chemical analysis (state-DPHHS or nationally-NELAC) certified with a documentation quality system (LQAP) or has it been verified by WQPB MDEQ?	X	X	X			X	X	
	Does the sample collection follow the DEQ SOP or cite procedures from other approved entities by WQPB MDEQ?	X	X	X	X	X	X	X	
	Does the collected data follow the requirements of the specific pollutant/non-pollutant assessment method for spatial representativeness, minimum sample size, index period, and data independence?	X	X	X	X	X	X	X	
	Does the data contain the minimum number of parameters and samples required for the specific pollutant/non-pollutant assessment method?	X	X	X	X	X	X	X	
	Does the data (MDEQ/other) include all the required fields (meta-data) & standard documentation that are required by WQPB protocols?	X	X	X	X	X	X	X	
	Was the data analyzed to meet the minimum required concentration (Required Reporting Limit)	X	X	X			X	X	

AQL = Aquatic Life & Fishes; REC = Recreation; DW = Drinking Water; AGR = Agriculture

Data Type	Data Quality Indicator	Applicable Data Quality Indicators in WARD per Pollutant Group and Beneficial Use							
		Nutrients (AQL, REC)	Metals (AQL, DW)	E. coli (REC)	Sediment (AQL)	Temperature (AQL)	Common (AGR)	Other (AQL, REC, DW)	Other (AGR)
	necessary to effectively evaluate the data to water quality criteria?								
	Select Yes or No and use override to describe what other assessment type used.								X
Biology	Is the Data <= 10 years old?	X						X	
	Are conditions known not to have changed since the data was collected?	X						X	
	Is the quality managed at the project level and documentation available (QAPP/SAP)?	X						X	
	Is there written assurance or documentation demonstrating that the procedures and methods written in the QAPP or SAP were followed and data requirements were met?	X						X	
	Is the facility to be performing the taxonomic analysis and ecological interpretations certified by a MT state contract or approved by WQPB MDEQ?	X						X	
	Does the sample collection follow the DEQ SOP or cite procedures from other approved entities by WQPB MDEQ?	X						X	
	Does the collected data follow the requirements of the specific pollutant/non-pollutant assessment method for spatial representativeness, minimum sample size, index period, and data independence?	X						X	
	Does the data contain the minimum number of assemblages required for the specific pollutant/non-pollutant assessment method?	X						X	
	Are the assemblages applicable to WQPB MDEQ assessment tools or metrics?	X						X	
	Is standard documentation and meta-data (MDEQ/other) available to allow results and sampling events to be traceable?	X						X	
	Select Yes or No and use override to describe what other assessment type used.								X

AQL = Aquatic Life & Fishes; REC = Recreation; DW = Drinking Water; AGR = Agriculture

APPENDIX C. PARAMETER-SPECIFIC ASSESSMENT METHOD SUMMARIES

At present, DEQ has developed assessment methods for several parameters or groups of parameters which represent the most common pollutants impairing Montana's surface waters; each is summarized here. Others are under development or will be developed as needed and as resources allow.

Table C-1. Nutrients (Mountain and Transitional Streams)

Pollutant Group	Determining Assessment Reaches
NUTRIENTS	The assessor uses best professional judgment to determine when stratification of the assessment unit into assessment reaches is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment).
Beneficial Uses	
Aquatic Life and Fishes; Primary Contact Recreation	
Applicability	**Overwhelming Evidence of impairment**
Wadeable streams in mountainous and transitional ecoregions (perennial or intermittent; Strahler Order ≤ 6)	Rigorous data collection is unnecessary if the following are evident: (1) fish kills involving massive growths of senescent algae mats that are attached to the bottom or floating (with DO at dawn likely < 1 mg/L); **or** (2) filamentous algal growth covers the entire bottom from bank to bank and extends continuously for a substantial longitudinal distance (> 150m).
Computations Using Non-Detect Data	
Convert non-detects to 50% of reported detection limit; if >> 15% of dataset is non-detect, consult WQPB Standards Section.	

Assessment Method Overview: Using Core Indicators	Very Large Datasets
Method considers nutrient concentration data and biological indicator data to determine attainment of ecoregion-specific nutrient criteria using a two-level process. Level I assessment considers the results from two nutrient statistical tests and benthic algal chlorophyll *a* (Chl *a*) or ash-free dry weight (AFDW) and diatom metric results (if available) compared to thresholds. Level II assessment requires diatom metric results (except in the Middle Rockies ecoregion where validated diatom increaser metrics have not been developed) *and* macroinvertebrate metric results. Perform Level II assessment only when Level I assessment conclusions are "unclear." When Level II is "unclear," consult management to determine final outcome. Excel spreadsheet "NtrntAssessFramework.xlsx" contains the decision matrix for attainment determinations.	Assess using nutrient concentrations alone if a very large nutrient dataset exists n ≥ 90 (listed streams); n ≥ 50 (unlisted streams)

Statistical Analyses for Nutrient Concentration Data	
Methods	**Limits on Decision Errors**
Exact Binomial Test	α = 0.25 (25%); β = 0.14 - 0.35 (14% - 35%) critical exceedance rate (p) = 0.2 (20%); effect size (p2) = 0.15 (15%)
One-Sample Student's t-test for the Mean	α = 0.25 (25%); critical exceedance rate (p) = 0.2 (20%)

	Indicators	Analysis	Index Period	Minimum Sample Size	Data Independence
Level I	Nutrient Concentration (TN, TP)	Data (mg/L) are evaluated against nutrient criteria using two statistical tests. Either Excel spreadsheet "MT-NoncomplianceTool.xls" or "MT-ComplianceTool.xls" is used, depending on 303(d) listing status.	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 13 (listed); n ≥ 12 (unlisted); n = 7 (with ≥ 4 exceedances)	≥ 14 days; ≥ 1 stream mile
Level I	Benthic Algal Chlorophyll *a*/Ash-Free Dry Weight (AFDW)	Data are evaluated against recommended criteria (threshold values: 120 mg Chl *a*/m^2 or 35 g AFDW/m^2).		n ≥ 3	
Level I	Diatoms	Data are evaluated using an "increaser taxa probability of impairment" metric value (threshold value: 51%). Diatoms are optional during Level I but must be included if data exists.		n ≥ 2 (n = 0 in Middle Rockies ecoregion)	
Level II	Nutrient Concentration (TN, TP)	If additional data are collected, re-evaluate using analyses described in Level I prior to incorporating diatoms and macroinvertebrates.		n ≥ 13 (listed); n ≥ 12 (unlisted); n = 7 (with ≥ 4 exceedances)	
Level II	Benthic Algae Chlorophyll *a*/Ash-Free Dry Weight (AFDW)			n ≥ 3	
Level II	Diatoms	Data are evaluated using an "increaser taxa probability of impairment" metric value (threshold value: 51%). Diatoms are required for Level II assessment.		n ≥ 2 (n = 0 in Middle Rockies ecoregion)	
Level II	Macroinvertebrates	Data are evaluated using the Hilsenhoff Biotic Index (HBI) score (threshold value: 4).		n ≥ 2 (n ≥ 3 in Middle Rockies ecoregion)	

Table C-2. Nutrients (Prairie Streams)

Pollutant Group	Determining Assessment Reaches
NUTRIENTS	The assessor uses best professional judgment to determine when stratification of the assessment unit into assessment reaches is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment).
Beneficial Uses	
Aquatic Life and Fishes	
Applicability	**Overwhelming Evidence of impairment**
Wadeable streams in eastern prairie ecoregions (perennial or intermittent; Strahler Order ≤ 6)	Rigorous data collection is unnecessary if the following are evident: (1) fish kills involving massive growths of senescent algae mats that are attached to the bottom or floating (DO at dawn likely <1 mg/L); **or** (2) filamentous algal growth covers the entire bottom from bank to bank and extends continuously for a substantial longitudinal distance (>150m).
Computations Using Non-Detect Data	
Convert non-detects to 50% of reported detection limit; if >> 15% of dataset is non-detect, consult WQPB Standards Section.	

Assessment Method Overview: Using Core Indicators	Very Large Datasets	
Method considers nutrient concentration data, dissolved oxygen, and biological indicator data to determine attainment of ecoregion-specific nutrient criteria using a two-level process. Level I assessment considers the results from two nutrient statistical tests, diatom metric results compared to a threshold, and dissolved oxygen delta values (i.e., the daily DO maximum minus the daily DO minimum). Level II assessment incorporates biochemical oxygen demand (BOD) and visual assessments (Fish Cover/Other Form). Perform Level II assessment only when Level I assessment conclusions are "unclear." When Level II is "unclear," consult management to determine final outcome. Excel spreadsheet "NtrntAssessFramework.xls" contains the decision matrix for attainment determinations.	Assess using nutrient concentrations alone if a very large nutrient dataset exists n ≥ 90 (listed streams); n ≥ 50 (unlisted streams)	
	Statistical Analyses for Nutrient Concentration Data	
	Methods	**Limits on Decision Errors**
	Exact Binomial Test	α = 0.25 (25%); β = 0.14 - 0.35 (14% - 35%) critical exceedance rate (p) = 0.2 (20%); effect size (p2) = 0.15 (15%)
	One-Sample Student's t-test for the Mean	α = 0.25 (25%); critical exceedance rate (p) = 0.2 (20%)

	Indicators	Analysis	Index Period	Minimum Sample Size	Data Independence
Level I	Nutrient Concentration (TN, TP)	Data (mg/L) are evaluated against nutrient criteria using two statistical tests. Either Excel spreadsheet "MT-NoncomplianceTool.xls" or "MT-ComplianceTool.xls" is used, depending on 303(d) listing status.	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 13 (listed); n ≥ 12 (unlisted); n = 7 (with ≥ 4 exceed.)	≥ 30 days; ≥ 1 stream mile
Level I	Diatoms	Data are evaluated using an "increaser taxa probability of impairment" metric value (threshold value: 51%)	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 2	≥ 30 days; ≥ 1 stream mile
Level I	Dissolved Oxygen (DO) Deltas	Deltas (i.e., the daily DO maximum minus the daily DO minimum) are evaluated against a concentration threshold (threshold value: 5.3 mg/L)	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 3	Instantaneous: ≥ 1 day (daily min. pre-dawn to 8:00 am; daily max. usually 2:30 pm - 5:00 pm); Continuous: ≥ 1 day (15-min. time step)
Level II	Nutrient Concentration (TN, TP)	If additional data are collected, re-evaluate using analyses described in Level I prior to incorporating BOD and visual assessment	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 13 (listed); n ≥ 12 (unlisted); n = 7 (with ≥ 4 exceed.)	≥ 30 days; ≥ 1 stream mile
Level II	Diatoms	If additional data are collected, re-evaluate using analyses described in Level I prior to incorporating BOD and visual assessment	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 2	≥ 30 days; ≥ 1 stream mile
Level II	Dissolved Oxygen (DO) Deltas	If additional data are collected, re-evaluate using analyses described in Level I prior to incorporating BOD and visual assessment	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 3	Instantaneous: ≥ 1 day (daily min. pre-dawn to 8:00 am; daily max. usually 2:30 pm - 5:00 pm); Continuous: ≥ 1 day (15-min. time step)
Level II	Biochemical Oxygen Demand (BOD)	Data are evaluated against a concentration threshold (threshold value: 8 mg/L).	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 3	Standard 5-day BOD test
Level II	Visual Field Assessments	Observations of high levels of benthic algae or macrophytes may indicate nitrogen or phosphorus pollution (i.e., excess nutrients)	Ecoregion-Specific Growing Season (DEQ, 2014)	n ≥ 2 (during diatom sampling and at least once per site per reach)	

C-3. Metals (Aquatic Life)

Pollutant Group	Determining Assessment Reaches
METALS	The assessor uses best professional judgment to determine when stratification of the assessment unit into assessment reaches is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment).
Beneficial Uses	
Aquatic Life and Fishes	
Applicability	**Overwhelming Evidence of impairment**
Montana surface waters	Rigorous data collection is unnecessary if either of the following are evident: (1) ≥ 1 sample exceeds twice the acute aquatic life water quality standards (WQS), **or** (2) ≥ 3 exceedances of aquatic life WQS within an existing sample size of n = 3 to 7.

Computations Using Non-Detect Data	Very Large Datasets
Include non-detects in the dataset if the water quality standard (WQS) is higher than the laboratory detection limit for that metal parameter.	A method for how to select independent samples and deal with larger data sets is being developed and will be addressed at a future date.
Computations Using J-Flagged Data	
Data are flagged "J" when the empirical data result falls between the Reporting Limit (RL) and the Method Detection Limit (MDL). J flagged data must not be included in the dataset when the associated WQS lies *between* the RL and the MDL. Include J flagged data when the RL and the MDL are either both above or both below the WQS.	

Assessment Method Overview: Using Core Indicators	Statistical Analyses for Metals Concentration Data	
	Methods	**Limits on Decision Errors**
Method considers metals concentration data to determine attainment of numeric water quality standards in Circular DEQ-7 (DEQ, 2017 or current version) using a single-level process. Level I assessment evaluates metals concentration data against acute and chronic aquatic life WQS; the total recoverable fraction is considered for all metals except aluminum (which is analyzed for the dissolved fraction). If either of the following conditions are met within the dataset, the waterbody is not attaining WQS for a particular metal: (1) aquatic life WQS exceedance rate > 10%, or (2) ≥ 1 sample exceeds twice the acute aquatic life WQS. If aquatic life exceedance rate is > 10% but no human-caused metals sources are located in the drainage, the assessor should consult management for a case-by-case review.	Percent exceedance rate	α and β = approximately 0.35 (35%)

	Core Indicators	Analysis of Core Indicators	Index Period	Minimum Sample Size	Data Independence
Level I	Metals Concentration	Data (µg/L) are evaluated against both acute and chronic aquatic life WQS using an allowable exceedance rate of 10%	Year-round (at least 33% of sample set collected during high flow and the remaining collected during baseflow)	n ≥ 8; or n = 6 with ≥ 3 exceedances, where necessary	≥ 7 days during baseflow; temporal independence is evaluated on a case-by-case basis during high flow; ≥ 1 stream mile or > 1 acre

Table C-4. Metals (Drinking Water)

Pollutant Group	Determining Assessment Reaches
METALS	The assessor uses best professional judgment to determine when stratification of the assessment unit into assessment reaches is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment).
Beneficial Uses	
Drinking Water	
Applicability	**Overwhelming Evidence of impairment**
Montana surface waters	Rigorous data collection is unnecessary if the following is evident: ≥ 1 sample exceeds the human health standard.

Computations Using Non-Detect Data	Very Large Datasets
Include non-detects in the dataset if the water quality standard is higher than the laboratory detection limit for that metal parameter.	A method for how to select independent samples and deal with larger data sets is being developed and will be addressed at a future date.
Computations Using J-Flagged Data	
Data are flagged "J" when the empirical data result falls between the Reporting Limit (RL) and the Method Detection Limit (MDL). J flagged data must not be included in the dataset when the associated WQS lies *between* the RL and the MDL. Include J flagged data when the RL and the MDL are either both above or both below the WQS.	

Assessment Method Overview: Using Core Indicators	Statistical Analyses for Metals Concentration Data	
Method considers metals concentration data to determine attainment of numeric water quality standards in Circular DEQ-7 (DEQ, 2017 or current version) using a single-level process. Level I assessment evaluates metals concentration data against human health WQS; the total recoverable fraction is considered for all metals. If the following condition is met within the dataset, the waterbody is not attaining WQS for a particular metal: ≥ 1 sample exceeds the human health WQS. If human health exceedances exist but no human-caused metals sources are located in the drainage, the assessor should consult management for a case-by-case review.	**Methods**	**Limits on Decision Errors**
	Percent exceedance rate	n/a

	Indicators	Analysis	Index Period	Minimum Sample Size	Data Independence
Level I	Metals Concentration	Data (µg/L) are evaluated against human health WQS using an allowable exceedance rate of 0%	Year-round (at least 33% of sample set collected during high flow and the remaining collected during baseflow)	n ≥ 8; or n ≥ 1 with ≥ 1 exceedances, where necessary	≥ 7 days during baseflow; temporal independence is evaluated on a case-by-case basis during high flow; ≥ 1 stream mile or > 1 acre

Table C-5. Sediment

Pollutant Group	Determining Assessment Reaches
SEDIMENT	Physical data must be collected from a minimum of 1 representative site per stream segment. Segments are stratified using hard breaks based on valley confinement, valley gradient, ecoregion and stream order, and may be further stratified based on soft breaks based on tributaries, land use change, etc. Monitoring sites are selected to represent common depositional reach types. The length of monitoring sites approximates ≥ 20 times the bankfull width.
Beneficial Uses	
Aquatic Life and Fishes	
Applicability	
Wadeable streams that are: 1) in mountainous ecoregions (e.g., Northern, Middle, and Canadian Rockies or Idaho Batholith), 2) Strahler order ≤ 4 (order 1 only when appropriate), and 3) perennial or intermittent.	**Overwhelming Evidence of impairment**
Computations Using Non-Detect Data	n/a
n/a	

Assessment Method Overview: Using Core Indicators	Statistical Analyses for Sediment Data	
	Methods	**Limits on Decision Errors**
Fine sediment parameters (riffle and pool tail fines) and coarse sediment and habitat parameters (pool depth and frequency, width/depth ratio, and riffle stability index) are evaluated to determine whether streams experience sediment impairment. Data from the assessment unit is compared statistically to a reference dataset or literature/target values to determine attainment of narrative sediment water quality standards. If physical parameters do not differ significantly from reference data, the waterbody is considered "not impaired." If 2 or 3 fine sediment parameters differ significantly from reference, or if 2 or more coarse sediment and habitat parameters differ significantly from reference and there is evidence of the stream aggrading or degrading, the waterbody is considered impaired. To list sediment as a cause of impairment, human-caused sediment sources must be present. Additional parameters, including biological parameters, may be evaluated when the core indicators do not yield a straightforward impairment listing decision.	1-Sample Wilcoxon Signed Rank Test	α = 0.25 (25%) Tests compare potentially impaired stream data against reference condition data, literature values, or TMDL target values.
	Mann-Whitney U test	

	Indicators	Analysis	Index Period	Minimum Sample Size	Data Independence
Level I and **Level II**	Riffle Fines (< 6mm)	Data are evaluated against a reference dataset or literature/TMDL target values using one of two statistical tests. During Level II assessment, both years' data will be combined unless conditions have changed sufficiently since first year.	Baseflow	n ≥ 1 site (reference) or 3 sites (literature); ≤ 4 riffles; 400 particles	hydrologic water year; ≥ 1 site per 5 stream miles if segment is homogenous or ≥ 1 site per channel type transition if heterogenous
	Riffle Fines (< 2mm)				
	Pool Tail Grid Fines (< 6mm)			n ≥ 1 site (reference) or 3 sites (literature); ≤ 10 scour pool tails; 3 grid tosses per pool tail	
	Mean Residual Pool Depth (RPD)			n ≥ 1 site (reference) or 3 sites (literature); ≤ 20 scour pools	
	Pool Frequency			n ≥ 1 site (reference) or 3 sites (literature)	
	Diatoms	Data are evaluated using a sediment "increaser taxa probability of impairment" metric value	Ecoregion-Specific Growing Season	n ≥ 2 (for each metric)	≥ 30 days; ≥ 1 stream mile
	Macroinvertebrates	Data are evaluated using Macroinvertebrate Multimetric Indices (MMI) and Observed/Expected (O/E) metric values			
Level II	Riffle Stability Index (RSI)	These additional parameters may be (but are not required to be) collected only during Level II when core indicators do not yield a straightforward sediment impairment determination. When planning the second year of data collection, a local biologist and/or hydrologist should be contacted (if feasible), to determine which of these additional parameters should be collected to appropriately address particular issues.			
	Subsurface Fines				
	Intragravel Dissolved Oxygen and Flow				
	Residual Pool Volume (V*)				

Table C-6. *Escherichia coli* (*E. coli*)

Pollutant Group	Applicability
ESCHERICHIA COLI (*E. coli*)	All surface waters under state jurisdiction.
Beneficial Uses	**Determining Assessment Reaches**
Primary Contact Recreation (A, B, C and I waters); Secondary Contact Recreation (all waters); Drinking water (A-1 and A-closed waters only)	The assessor develops the Sampling and Analysis Plan using best professional judgment to define the assessment reach and determine when stratification is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment).
Computations Using Non-Detect Data	**Very Large Datasets**
E. coli result values reported as below detection are treated as 1 cfu/100ml and result values reported as above the maximum detection are treated as 2419.6 cfu/100ml.	Treated the same as smaller datasets.

Assessment Method Overview

Method considers *E. coli* concentration data (mpn/100ml or cfu/100ml) to determine attainment of *E. coli* criteria for contact recreation or drinking water. Several approaches are possible, depending on which beneficial use is being assessed and which minimum data requirements are met.

Use	Core Indicators	Analysis of Core Indicators	Index Period	Minimum Sample Size and Data Independence
Recreation	E. coli Concentration (cfu/100ml or mpn/100ml; geometric mean and individual result values)	<u>Preferred approach (30-day analysis)</u>: For each 30-day period that meets the minimum sample size requirements, the 30-day geometric mean is calculated and compared to the geometric mean criteria and individual result values are compared to the statistical threshold value criteria. If either the geometric mean exceeds the criteria, or if ten percent or more of samples exceeds the statistical threshold value criteria for any single consecutive 30-day period, the assessment unit is impaired by *E. coli*.	Primary contact recreation season = April 1 through October 31; Secondary contact recreation season = November 1 through March 31.	n ≥ 5 of separate 24-hour periods within 30 consecutive days
		<u>Alternate approach (recreation season analysis)</u>: For each contact recreation season that meets the minimum sample size requirements, the seasonal geometric mean is calculated and compared to the geometric mean criteria and individual result values are compared to the statistical threshold value criteria. If either the seasonal geometric mean exceeds the criteria, or if ten percent or more of samples exceeds the statistical threshold value criteria for any single recreation season, the assessment unit is impaired by *E. coli*.		n ≥ 11 samples from ≥ 5 separate 24-hour periods within an individual contact recreation season.
		<u>Overwhelming evidence</u>: If ≥ 4 values exceed the statistical threshold value criteria, the assessment unit is impaired by *E. coli*.		n ≥ 5 samples from separate 24-hour periods within an individual contact recreation season
		<u>Final risk screening</u>: If there are two or more exceedances and the assessment unit is routinely used for primary contact recreation and the, the state will consider additional monitoring (as resources allow) to meet the data requirements of the preferred or alternate assessment approaches.		n ≥ 2 samples (additional samples that have not already been used in the assessment)
Drinking Water	E. coli Concentration (cfu/100ml or mpn/100ml; geometric mean and individual result values)	Preferred approach (30-day analysis): For each 30-day period that meets the minimum sample size requirements, the 30-day geometric mean is calculated and compared to the geometric mean criteria and individual result values are compared to the statistical threshold value criteria. If either the geometric mean exceeds the criteria, or if ten percent or more of samples exceeds the statistical threshold value criteria for any single consecutive 30-day period, the assessment unit is impaired by *E. coli*.	Year-round	n ≥ 5 of separate 24-hour periods within 30 consecutive days (preferred)
		Overwhelming evidence: If ≥ 4 values exceed the statistical threshold value criteria, the assessment unit is impaired by *E. coli*.		n ≥ 5 samples from separate 24-hour periods within an individual contact recreation season

Table C-7. Electrical conductivity (EC) and Sodium Adsorption Ratio (SAR) for Rosebud Creek, Tongue River, Powder River, Little Powder River and Tongue River Reservoir

<table>
<tr><th colspan="2">Pollutant Group</th><th colspan="2">Applicability</th></tr>
<tr><td colspan="2">Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR)</td><td colspan="2">Rosebud Creek, Tongue River, Powder River, Little Powder River, and Tongue River Reservoir</td></tr>
<tr><th colspan="2">Beneficial Uses</th><th colspan="2">Determining Assessment Reaches</th></tr>
<tr><td colspan="2">Agriculture</td><td colspan="2" rowspan="3">The assessor uses best professional judgment to determine when stratification of the assessment unit into assessment reaches is warranted (e.g., stratify when one reach of the total segment can be isolated and its condition is substantially different from other parts of the segment). The assessor uses best professional judgement to determine when the Tongue Reservoir is stratified and what minimum data requirements need to be met.</td></tr>
<tr><th colspan="2">Very Large Datasets</th></tr>
<tr><td colspan="2">Treated the same as smaller datasets.</td></tr>
<tr><th colspan="4">Assessment Method Overview</th></tr>
<tr><td colspan="4">Continuous or discrete specific conductance (SC) data and discrete sodium adsorption ratio (SAR) data is compared against monthly average criteria and do not exceed criteria for EC and SAR to determine impairment.
EC and SAR criteria vary between irrigation season and non-irrigation season for Rosebud Creek, Tongue, Powder, and Little Powder Rivers. EC and SAR criteria is year-round for the Tongue River Reservoir.</td></tr>
<tr><th>Core Indicators</th><th>Analysis of Core Indicators</th><th>Index Period</th><th>Minimum Sample Size and Data Independence</th></tr>
<tr><td rowspan="3">Specific conductance (SC)</td><td rowspan="3">SC data is grouped by year and by season (irrigation and non-irrigation). A monthly average is calculated (calendar month with continuous data and discrete data) and compared against the monthly average criteria for EC. Also, individual SC values are compared against the EC 'do not exceed' criteria. If any month's average SC concentration exceeds the monthly average criteria or if any one SC concentration exceeds the do not exceed crtieria, the assessment unit is impaired for "Specific Conductance (SC)."</td><td rowspan="4">Year-round, but criteria differ for non-irrigation season (November 1 - March 1) and Irrigation season (March 2 - October 31)

Assesment targets irrigation season, especially three critical time periods: March - May, summer low flow conditions, and fall.</td><td>Preferred approach: At least three years (consecutive or not consecutive) within a ten-year period with at least three months per year with continuous SC data collected every 30 minutes for the entire calendar month; months sampled should represent critical time periods: March - May, summer low flow conditions, and fall.</td></tr>
<tr><td>Preferred approach: At least three years (consecutive or not consecutive) within a ten-year period with at least three months sampled per year with ≥ 4 discrete samples spaced approximately one week apart; each month sampled should represent critical time periods: March - May, summer low flow conditions, and fall.</td></tr>
<tr><td>Alternate approach: If there is both continuous data and discrete data collected during a month but neither meets minimum data requirements described above, a combination of continuous and discrete data can be used to represent the month as long as every week is represented by either continuous data collected every 30 minutes or discrete data (e.g., continuous data for the first three weeks of the month and discrete data for the fourth week of the month).</td></tr>
<tr><td>Sodium Adsorption Ratio (SAR)</td><td>SAR data is grouped by year and by season(irrigation and non-irrigation). A monthly average is calculated and compared against the monthly average criteria for SAR. Also, individual SAR values are compared against the SAR 'do not exceed' criteria. If any month's average SC concentration exceeds the monthly average criteria or if any one SAR concentration exceeds the do not exceed crtieria, the assessment unit is impaired for "Sodium Adsorption Ratio (SAR)."</td><td>At least three years (consecutive or not consecutive) within a ten-year period with at least three months sampled per year with ≥ 4 discrete samples spaced approximately one week apart; months sampled should represent critical time periods: March - May, summer low flow conditions, and fall.</td></tr>
</table>

APPENDIX D. QUICK LINKS

Administrative Rules of Montana (ARM)

http://www.mtrules.org/

Full text search for Administrative Rules adopted by Executive Branch agencies to guide them in administering programs and services. Includes Department 17 (Environmental Quality), Rule Chapter 30 (Water Quality).

DEQ Beneficial Use Assessment

http://deq.mt.gov/water/surfacewater/UseAssessment

Beneficial use assessment overview, definitions, and assessment methods.

DEQ Clean Water Act Information Center

http://deq.mt.gov/Water/Resources/cwaic

Access to waterbody assessment records, data mapping tools, Water Quality Integrated Reports, and other information about the quality of Montana's rivers, streams, lakes and wetlands in relation to Montana's water quality standards.

DEQ Surface Water Monitoring

http://deq.mt.gov/water/surfacewater/monitoring

Monitoring information and resources such as monitoring protocols, guidance documents and volunteer monitoring support.

DEQ Water Quality Division

http://deq.mt.gov/Water

Access information about DEQ's Clean Water Act programs, including Water Quality Monitoring and Assessment, Watershed Protection, Wetlands, and Surface Water Permitting.

DEQ Submit Water Quality Data

http://deq.mt.gov/Water/SurfaceWater/SubmitData

Guidance on how to submit ambient water quality data to DEQ using the system called Montana EQuIS Water Quality Exchange (MT-eWQX).

Montana Code Annotated (MCA)

https://leg.mt.gov/bills/mca/index.html

Compilation of the Montana State Constitution and all state laws (statutes). Includes Title 75 (Environmental Protection), Chapter 5 (Water Quality).

Water Quality Integrated Report

http://deq.mt.gov/Water/Resources/cwaic/reports

The biennial Integrated Report presents surface water monitoring and assessment summaries and other water quality-related information for Montana.

Water Quality Portal

https://www.waterqualitydata.us/

Water quality data collected by DEQ is uploaded into the Water Quality Portal, a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC).