Montana Final
2016 Water Quality Integrated Report

Document number WQPBIMTSTR-011f

DEQ
Montana Department of Environmental Quality

Fellow Montanans –

I'm proud to present you Montana's 2016 Integrated Report on water quality. As a headwaters state on top of three continental watershed divides, Montana realizes both the benefits and responsibilities of high quality water. It's vital to aquatic life, public drinking water systems, recreation, agriculture and other industries. One of our jobs here at the Department of Environmental Quality is to ensure human activities are conducted in a manner that protects these beneficial uses. Monitoring and assessing the condition of waterbodies under state jurisdiction is a key component of assessing our effectiveness in this endeavor.

This protection is the result of lots of work by lots of different people – landowners, local watershed groups, regulated industries and municipalities, advocacy groups, and other stakeholders and interested parties. By working together and using solid, peer-reviewed data such as that contained in this report, we can continue to work together successfully for the protection of this vital resource.

Thank you for your interest in Montana's water quality.

Tom Livers
Director
Montana Department of Environmental Quality

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Executive Summary

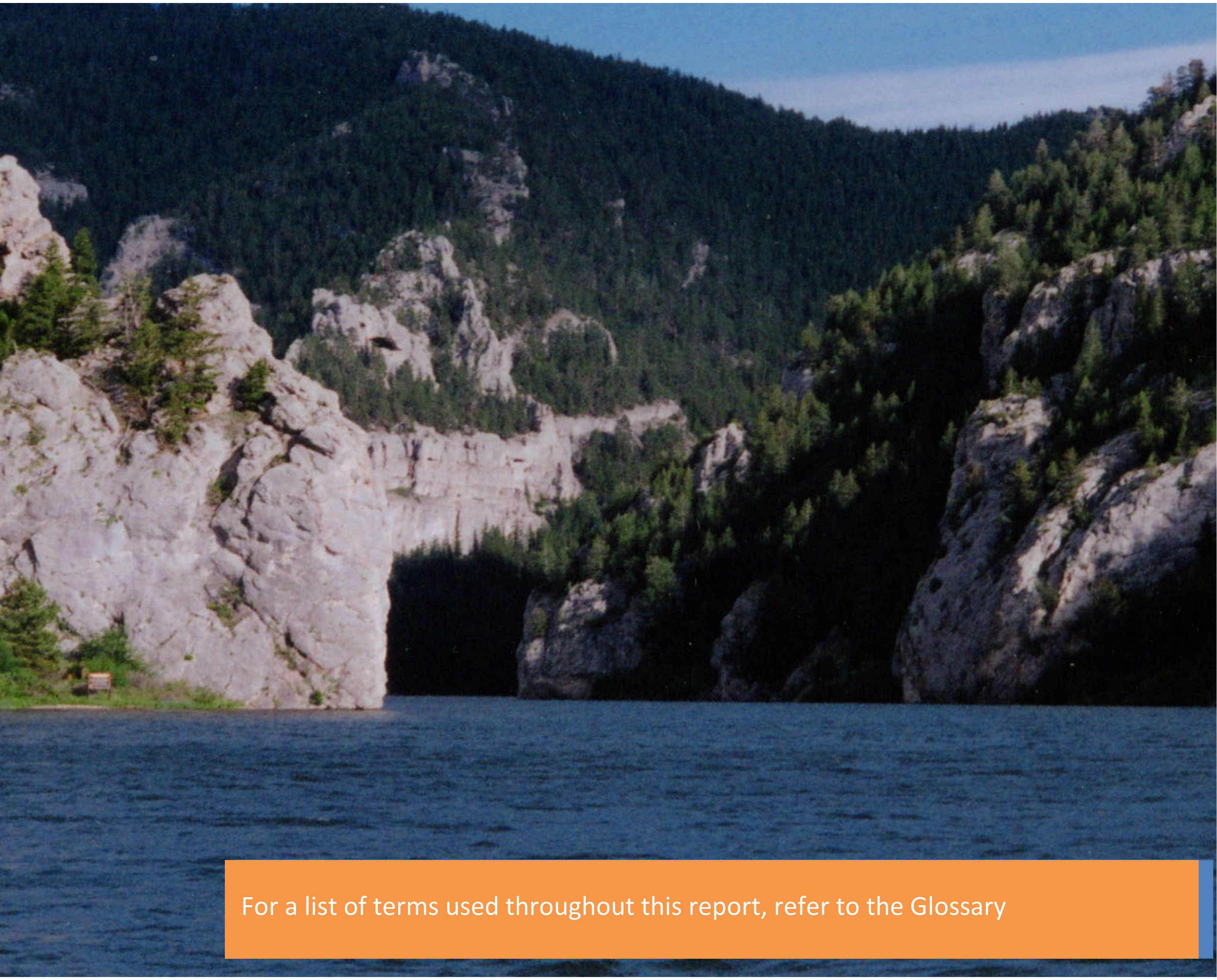
The Montana Department of Environmental Quality (DEQ) prepares this biennial Integrated Report (IR) to list the status of water quality for waterbodies under state jurisdiction. Specifically, this IR describes the condition and trends of Montana's streams and lakes, contaminates found in groundwater, and the safety of drinking water during the previous 2-year period; thus, the 2016 IR reports on the state's condition of water quality for the years 2014–2015.

DEQ oversees assessing the quality of waterbodies under state jurisdiction, specifically, those waters that are not within federally-recognized Indian Reservations. We do not actively assess waters in national parks or wilderness areas. As of this reporting, we have assessed the water quality of 20,300 stream miles and 493,236 acres of lakes/reservoirs, roughly 35% and 70%, respectively, of the total number of waterbodies under the state's jurisdiction, i.e., management authority.

During the 2016 cycle we:

- Created 12 new Assessment Units (AUs)
- Received approval on 237 TMDLs
- Delisted 264 AU/pollutant combinations
- Added 9 AUs to the 303(d) list
- Changed the category of 124 AUs based on new information
- Assessed 61 AUs
- Updated databases to match the National Watershed Boundary Dataset edits
- Amended the use support of 530 AUs

Water Quality Reporting



For a list of terms used throughout this report, refer to the Glossary

Gates of the Mountains

WHY DO WE REPORT ON WATER QUALITY?

The Federal Water Pollution Control Act, commonly referred to as the Clean Water Act, is the primary federal law governing water pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing or strictly regulating pollution sources.

As the state agency responsible for implementing certain components of the federal Clean Water Act (CWA), and as directed under Montana's Water Quality Act (MCA 75-5-702), the Montana Department of Environmental Quality (DEQ) is required to prepare this biennial Integrated Report (IR) to list the status of water quality for waterbodies under state jurisdiction.

The 2016 IR reports on the state's condition of water quality for the years 2014–2015 fulfilling requirements under the federal Clean Water Act by reporting on elements found in two sections of the act:

When interpreting the results of water quality assessments presented in this IR, you must use all figures and data in context. Please address questions to DEQ's Water Quality Planning Bureau at 406-444-6763.

1. Section 303(d), a list of threatened, or "impaired," waterbodies in the state that need a TMDL (Total Maximum Daily Load)
2. Section 305(b), a report on the condition of waterbodies under state jurisdiction and the status of the state's delegated water quality programs

DEQ oversees efforts to measure the quality of all waterbodies under state jurisdiction only, which includes lakes, reservoirs, and rivers/streams. The state does not manage waterbodies on tribal lands nor actively assess waters in national parks or wilderness areas.

Limited financial and personnel resources prevent us from monitoring all of the waters under state jurisdiction every reporting cycle; we therefore develop our monitoring priorities to align with priority goals identified via an integrated planning process that includes the needs of point and non-point source water quality management needs.

For more information about water quality reporting, visit cwaic.mt.gov.

THE CORNERSTONES OF WATER QUALITY REPORTING

Two important concepts form the cornerstones for reporting on water quality and, therefore, this IR: **beneficial use** and **Total Maximum Daily Load**.

BENEFICIAL USE

Beneficial uses are the various ways a particular waterbody can be used by people, wildlife, and livestock, such as for drinking water, habitat for fish and waterfowl, recreation, or agricultural or industrial purposes. Once beneficial uses are officially designated, we can establish appropriate water quality criteria and non-degradation rules that will maintain water quality to protect those uses. Thus, beneficial uses are really goals for achieving water quality. Each goal has a standard that establishes the maximum amount of any particular pollutant while still allowing a waterbody to maintain a given beneficial use. Together, water quality criteria, beneficial uses, and non-degradation form water quality standards, that is, benchmarks to aim for in protecting and maintaining water quality.

If a waterbody is deemed "impaired," it means one or more of its beneficial uses are limited or harmed to some extent. Federal law requires states to assess waterbodies to determine whether they are supporting their beneficial uses—and to what extent—based on the presence or absence of pollutants. From the results, DEQ classifies each assessed waterbody into one of three main categories:

- **Fully supporting:** the waterbody meets all of its water quality standards to support all designated beneficial uses, or all uses that have been assessed
- **Not fully supporting:** the waterbody meets some of its water quality standards to support some of its designated beneficial uses; some beneficial uses are limited
- **Threatened:** the waterbody currently meets water quality standards but will likely exceed a pollutant limit if current conditions do not change

In addition, the status of some waterbodies cannot be determined because we have insufficient data to assess whether they meet water quality standards. Further, not all waterbodies under state jurisdiction have been sampled yet; therefore, we do not know whether their beneficial uses are being fully supported.

In Montana, the most common threats to beneficial uses are too much sediment, nutrients, or metals, all of which alter physical and chemical properties of a waterbody. These threats can come from one or a combination of three source types:

- **Point sources:** known human activities from a specific location that are regulated, such as discharges from wastewater treatment plants
- **Nonpoint sources:** human activities that accumulate pollutants from widespread areas and are non-regulated, such as runoff from agricultural lands or roadways
- **Naturally-occurring sources:** not as a result of human activities, such as naturally-occurring arsenic from Yellowstone National Park's geothermal basin

Keep in mind that land uses and other human activities that affect beneficial uses can change over time; therefore, managing and improving water quality throughout our vast state can be challenging and requires careful monitoring, development of effective quality standards, and a plan to restore water quality, called a Total Maximum Daily Load.

TOTAL MAXIMUM DAILY LOAD

A Total Maximum Daily Load (TMDL) is a regulatory term under the Clean Water Act. TMDL is a calculation of the maximum amount of a contaminant (pollutant) that a waterbody can receive and still meet water quality standards. That is, support its beneficial uses. The formula for calculating a TMDL allocates pollutants among both point and nonpoint sources, while also accounting for naturally-occurring conditions that can degrade water quality. In addition, TMDLs must consider the uncertainty in predicting how well reducing a pollutant will result in meeting water quality standards. The TMDL calculation also considers seasonal variations, such as temperature and water flow, which can affect how waterbodies respond to certain pollutants.

DEQ uses TMDLs to set water quality targets for watersheds; thus, TMDLs provide both a way to measure water quality and to plan for improving it. TMDLs evaluate how much of any given pollutant is present (its "loading"), where it comes from (its source), and by how much it needs to be reduced so the waterbody can meet its *most sensitive* criteria or standard. TMDLs may also address threatened waterbodies by setting loading limits on pollutants known to be contributing to declining trends in water quality.

A TMDL defines explicitly what is needed for a waterbody to meet its water quality criteria for each pollutant identified during the study. Therefore, until all TMDLs are established and implemented for each pollutant affecting a particular waterbody, that waterbody will likely be limited in supporting one or more of its beneficial uses.

We use a watershed approach to develop TMDLs and water quality restoration plans. In this way, many rivers, streams, and lakes within a watershed can be efficiently addressed in a single TMDL document. We work with watershed stakeholders during TMDL development so that local watershed groups and/or other interested parties can use completed TMDLs as tools to help guide local activities for improving water quality.

Benefits of a Watershed Approach for TMDLs

- targets priority water-quality problems
- promotes stakeholder involvement
- integrates knowledge and authority of multiple agencies and experts
- uses monitoring and data analysis to evaluate load reductions

WHAT'S NEW SINCE THE LAST IR: 2016 IR AT A GLANCE

As of this reporting, we have assessed the water quality of 20,300 stream miles and 493,236 lake/reservoir acres, roughly 35% and 70%, respectively, of the total number of waterbodies under the state's jurisdiction, i.e., management authority.

This cycle we:

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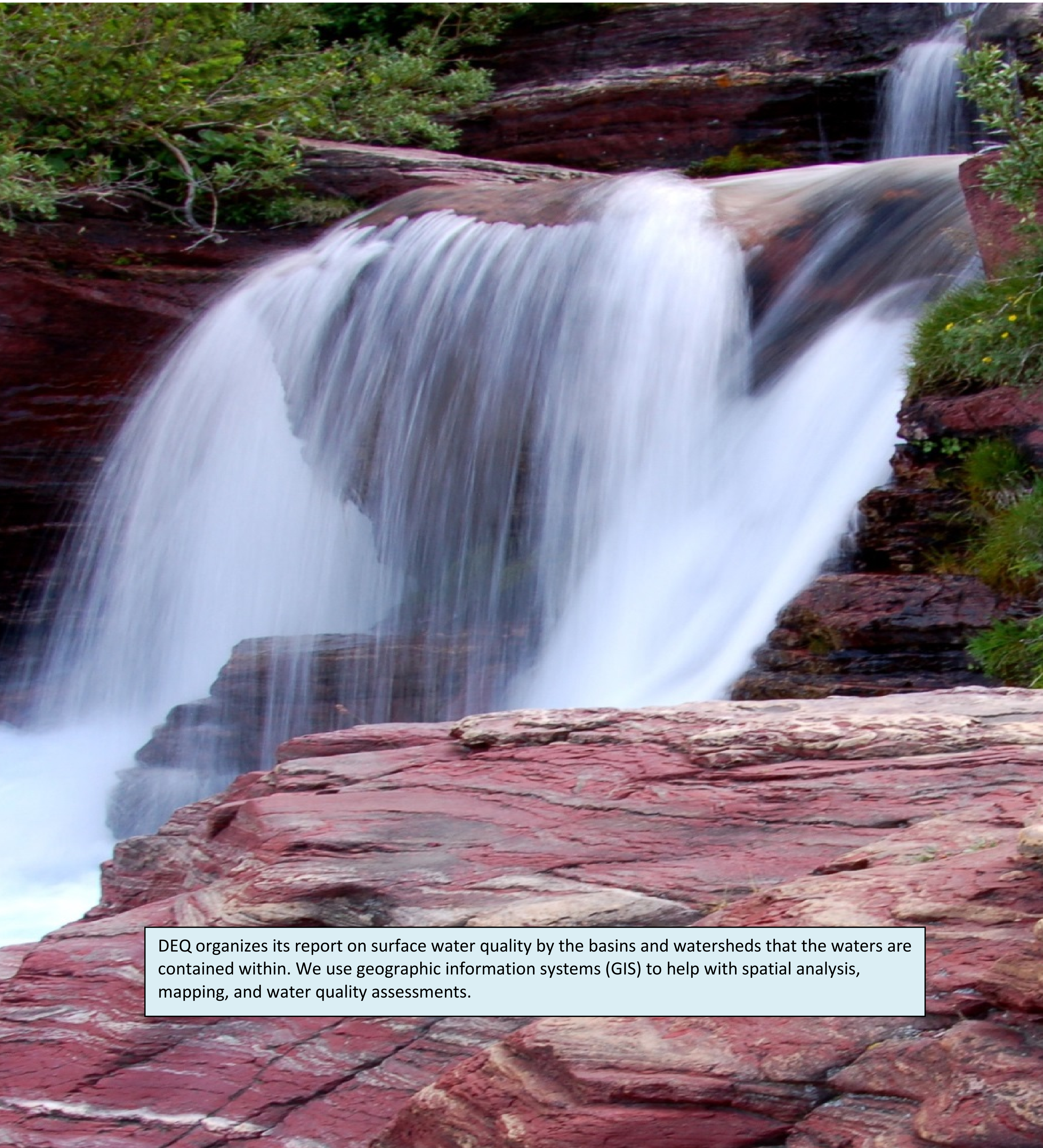
2014 Cycle					
Category	River		Lake / Reservoir		Count
	Miles	Count	Acres	Count	Total
1	2,318	123	60,360	15	138
2	802	42	9,407	11	53
3	2,142	109	24,994	16	125
4A	3,440	275	5,799	3	278
4B					0
4C	1,940	95	11,446	3	98
5	11,025	435	406,224	24	459
5, 5N	754	21			21
Total	**22,420**	**1,100**	**518,231**	**72**	**1,172**

2016 Cycle					
Category	River		Lake / Reservoir		Total
	Miles	Count	Acres	Count	Count
1	2,235	120	60,360	15	135
2	843	45	9,407	11	56
3	2,337	119	24,994	16	135
4A	4,858	376	6,150	4	380
4B					0
4C	1,923	93	11,446	3	96
5	9,542	331	402,115	22	353
5, 5N	911	28	3,758	1	29
Total	**22,649**	**1,112**	**518,230**	**72**	**1,184**

Figure 1. Size and Count of Assessment Units Assigned to Reporting Categories[1]

[1] Refer to table 3, page 23 for category definitions

MONTANA'S WATER RESOURCES



DEQ organizes its report on surface water quality by the basins and watersheds that the waters are contained within. We use geographic information systems (GIS) to help with spatial analysis, mapping, and water quality assessments.

BASINS IN MONTANA

For program management purposes, we group the state's waters into 4 state administrative basins, which contain 16 sub-major basins delineated by the U.S. Geological Survey's hydrologic unit code system (**Figure 2**). The four state administrative basins are:

- **Columbia** – all waters west of the Continental Divide, including the Clark Fork, Flathead, and Kootenai rivers
- **Lower Missouri** – Missouri River basin from the Marias River confluence to the North Dakota border, including Montana headwaters of the St. Mary River in the Upper South Saskatchewan River basin
- **Upper Missouri** – Missouri River basin from the headwaters downstream to the confluence with the Marias River
- **Yellowstone** – all waters of the Yellowstone River within Montana and the Little Missouri/Belle Fourche watershed in southeast Montana

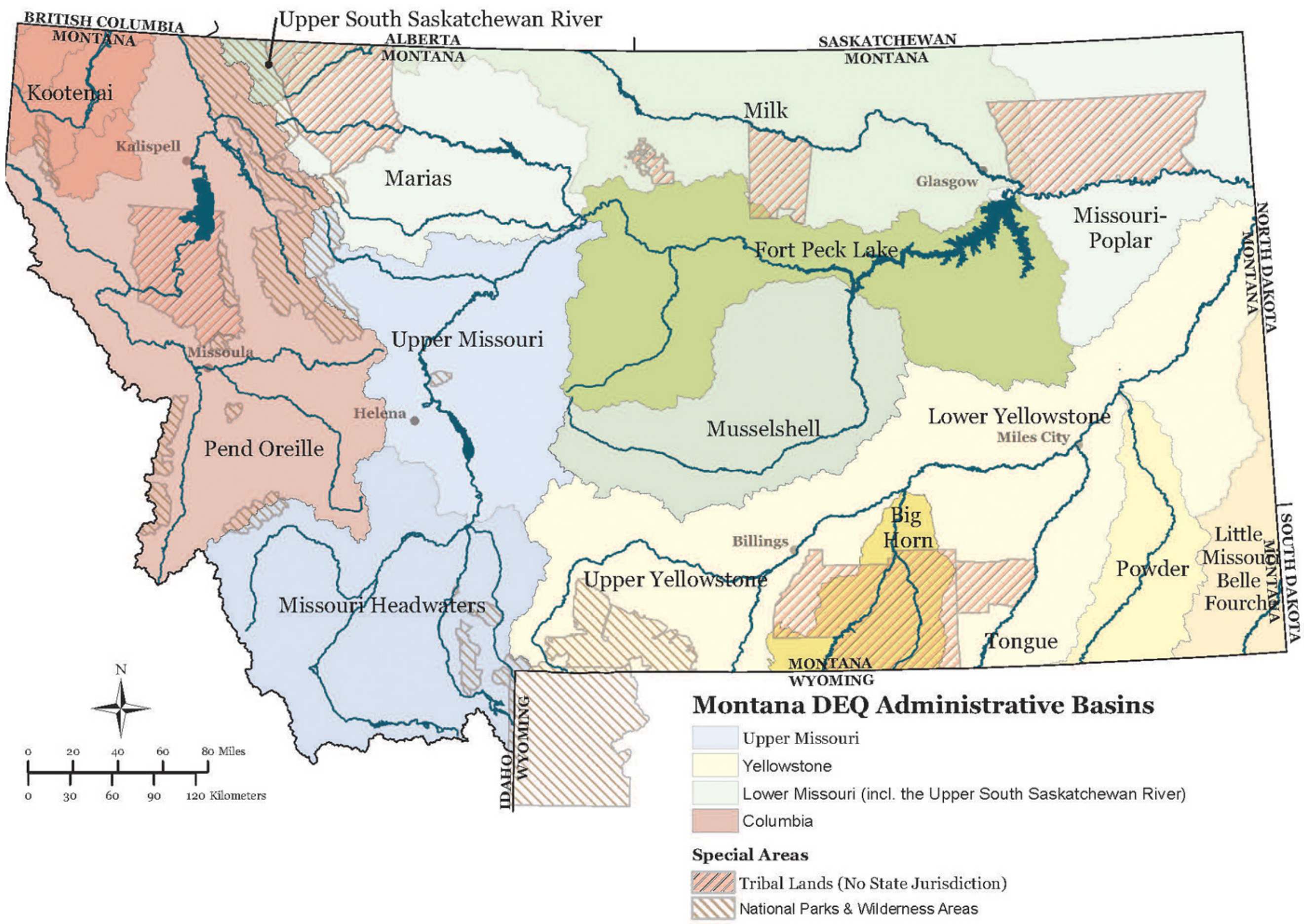


Figure 2. Basins of Montana

PERENNIAL SURFACE WATER LOCATION

DEQ does not have delegated authority over all of the waters in the state. The tribal governments and/or the U.S. Environmental Protection Agency (EPA) are responsible for managing the quality of waters located within the reservations of federally-recognized tribes. In addition, the state has established a few assessment areas within national parks and wilderness areas but, because these areas are managed under federal laws restricting activities, does not actively monitor or assess their conditions for this report. Waters within national parks and wilderness areas are designated outstanding resource waters (ORW).[1]

Figure 3 presents a picture of the waters in the state by their location in DEQ's administrative basins (**Figure 2**) and the tribal and ORW waters.

Stream miles and lake size estimates used in this report come from the high resolution National Hydrography Dataset.[2] We calculate the total length of streams, ditches, and canals from all linear waters in the dataset. Because of potential sources of error, and in order to report these numbers as accurately as possible with the available data, the summary of state waters are given in the nearest 100 miles for streams, while the total lake area is based on named waters of at least 5 acres.

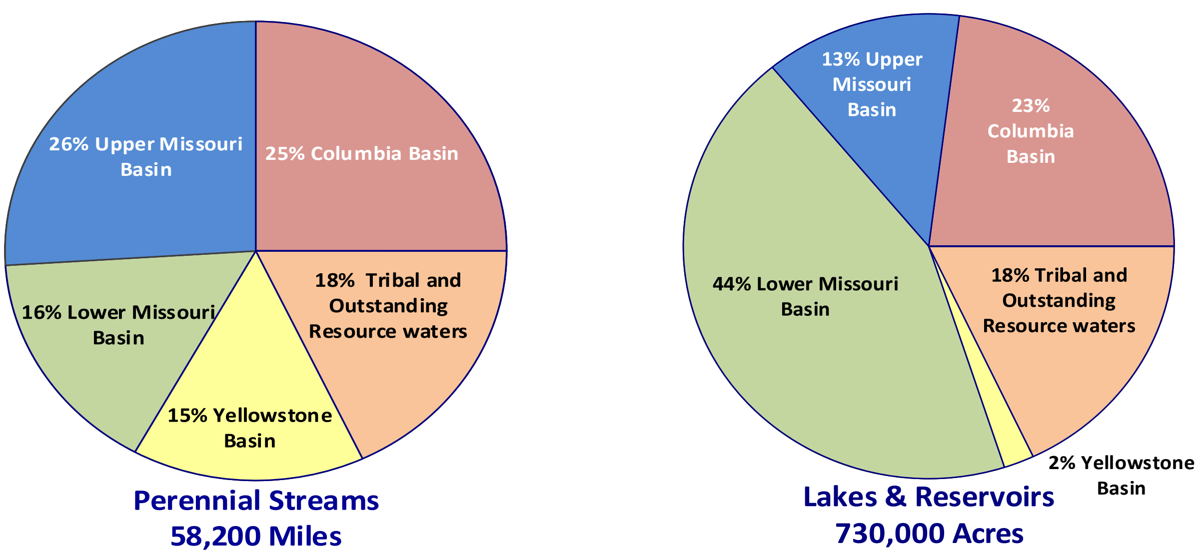


Figure 3. Surface Water in Montana

Surface Waters

Surface waters include streams, rivers, lakes, reservoirs, and wetlands.

- Montana is the fourth largest state in the Union and also ranks fourth in total stream miles, with more than 170,000 miles of perennial and intermittent streams and rivers.

- Wetlands and riparian areas (streamside vegetation zones) cover 1–4% of Montana and support half of the state's plant species and 38% of amphibians, reptiles, birds, and mammals of special concern.

- The Yellowstone River is undammed, making it the longest free-flowing river in the Lower 48.

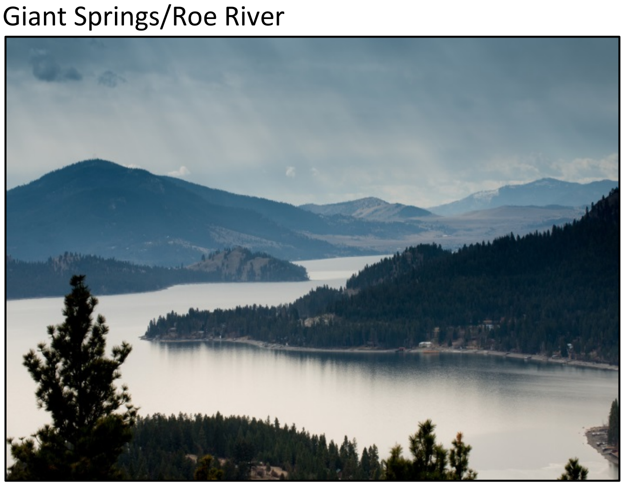
- Montana contains the headwaters for three continental watersheds: (1) Upper South Saskatchewan River – drains into the Hudson Bay, (2) Columbia River – drains into the Pacific Ocean, and the (3) Missouri River – drains into the Gulf of Mexico.

- Flathead Lake is the largest natural freshwater lake west of the Mississippi River.

- The Roe River at 200 feet long is the shortest river in the United States. It flows out of Giant Springs, one of the largest freshwater springs in the world.


Giant Springs/Roe River


Roe River


Flathead Lake


Yellowstone River

Streams

Streams belong to one of three general categories based on their flow characteristics and relative position of their streambed to the local shallow groundwater table. Perennial streams total 58,200 stream miles, but the 307,000 miles of small, intermittent or ephemeral streams account for most of Montana's stream miles.

- **Perennial Streams:** Below the local shallow groundwater table and typically flow on the surface throughout the year.

Perennial Stream

- **Intermittent Streams:** Below the local shallow groundwater table during part of the year and flow in response to groundwater recharge and precipitation.

Intermittent Stream

- **Ephemeral Streams:** Above the local shallow groundwater and flow only in response to snowmelt or rainfall. Dry most of the year and typically exist in the semi-arid and mountain headwater regions.

Ephemeral Stream

Lakes

Montana has 1,417 named lakes, reservoirs, and ponds that are 5 acres or greater covering about 577,000 acres within the state's jurisdiction.

These waterbodies include various natural lakes – alpine lakes and closed basin lakes (i.e., lakes with no surface outlet), as well as large reclamation and/or hydropower reservoirs, and a lake formed from an earthquake that damned the Madison River – Quake Lake.

Lake types

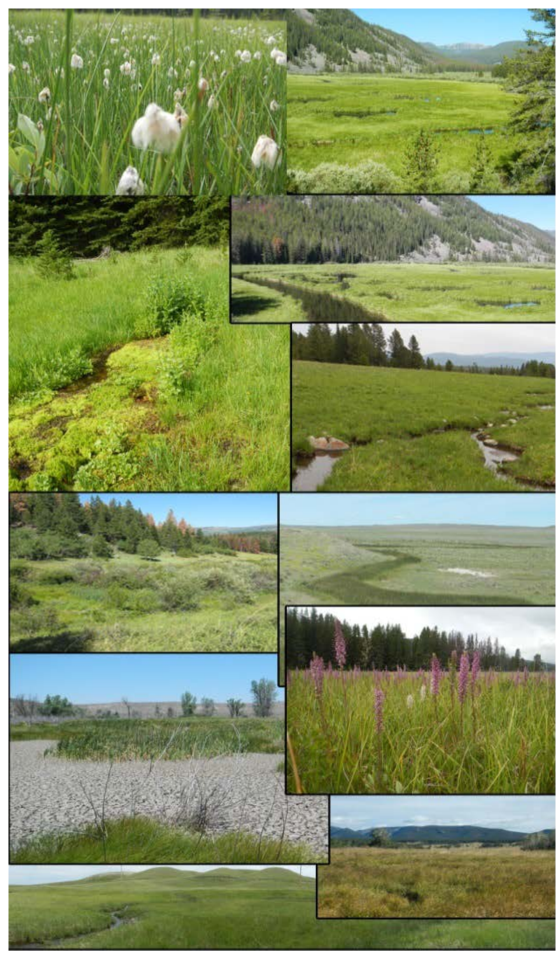
Wetlands

Wetlands are areas where water covers the soil or is present either at or near the surface of the soil year-round or for varying periods during the year, including during the growing season. The presence of water determines the nature of soil development and the types of plant and animal communities living in the soil and on its surface.

- Approximately two-thirds of Montana's wetlands (>2 million acres) and riparian areas (>600,000 acres) are mapped.

- Montana's wetland habitat types include

  - prairie and glacial potholes
  - saline basins and alkali flats
  - riparian scrub/shrub wetlands
  - sloughs and cut-offs along rivers
  - spring seeps and hot springs
  - emergent fringe wetlands around lakes, ponds, and reservoirs
  - fens and wet meadows
  - man-made wetlands



Wetlands Types

GROUNDWATER

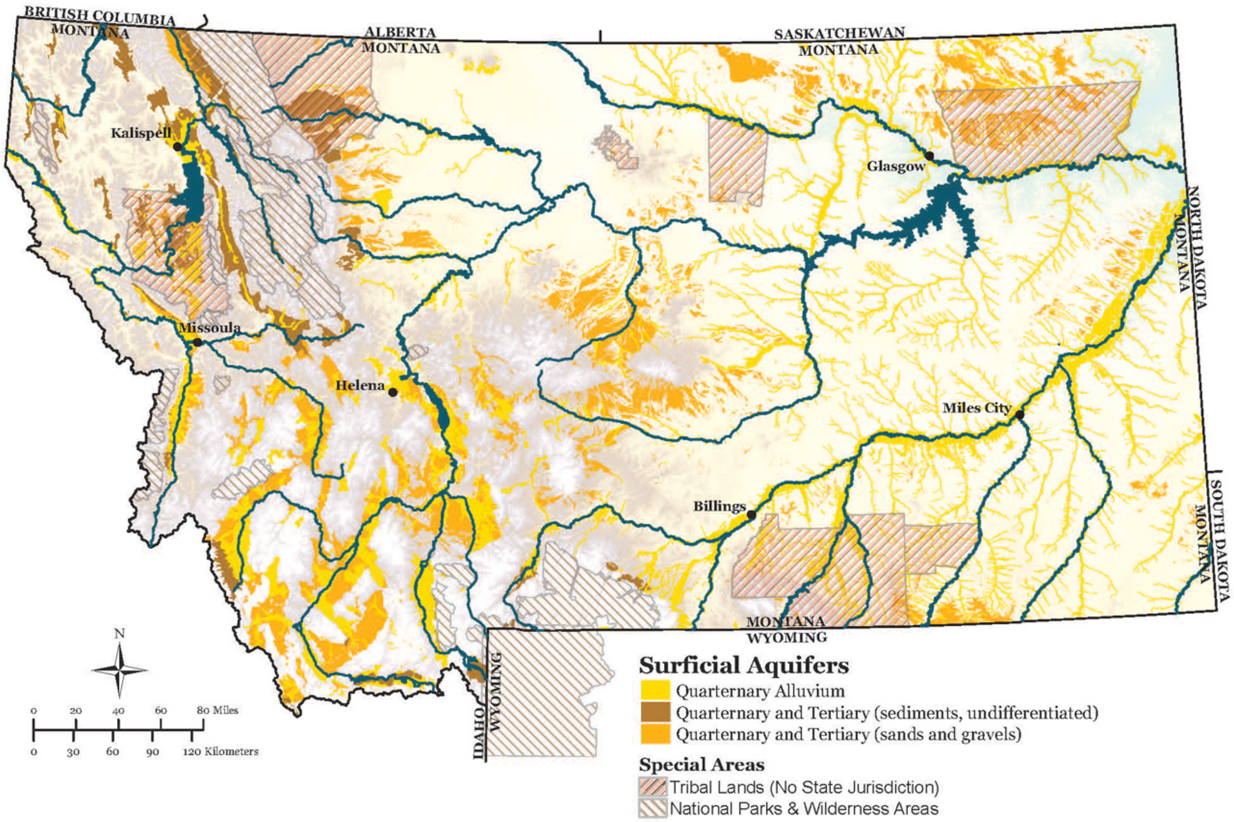
Groundwater is any water that flows or seeps downward or is stored below the ground in rock crevices or other pores of geologic materials. Groundwater feeds springs and wells, and the upper surface of the saturated zone is the water table. The quality and availability of groundwater varies greatly across the state.

Western Montana

Aquifers are typically found within unconsolidated valley-fill materials that coincide with stream valleys between mountain ranges. These aquifers often yield relatively large quantities of high-quality water to relatively shallow wells. Fractured bedrock aquifers surrounding these valleys have also become important sources of domestic water to accommodate growth and development in these areas.

Eastern Montana

Aquifers are found in unconsolidated alluvial valley-fill materials, glacial outwash, or consolidated sedimentary rock formations. In some areas of eastern Montana, thick shale formations near the surface make access to water difficult or produce poor-quality water. Also, aquifers in the east typically yield less water than those in western Montana. To reach higher-quality water, wells have to be drilled deeper, which is more costly.



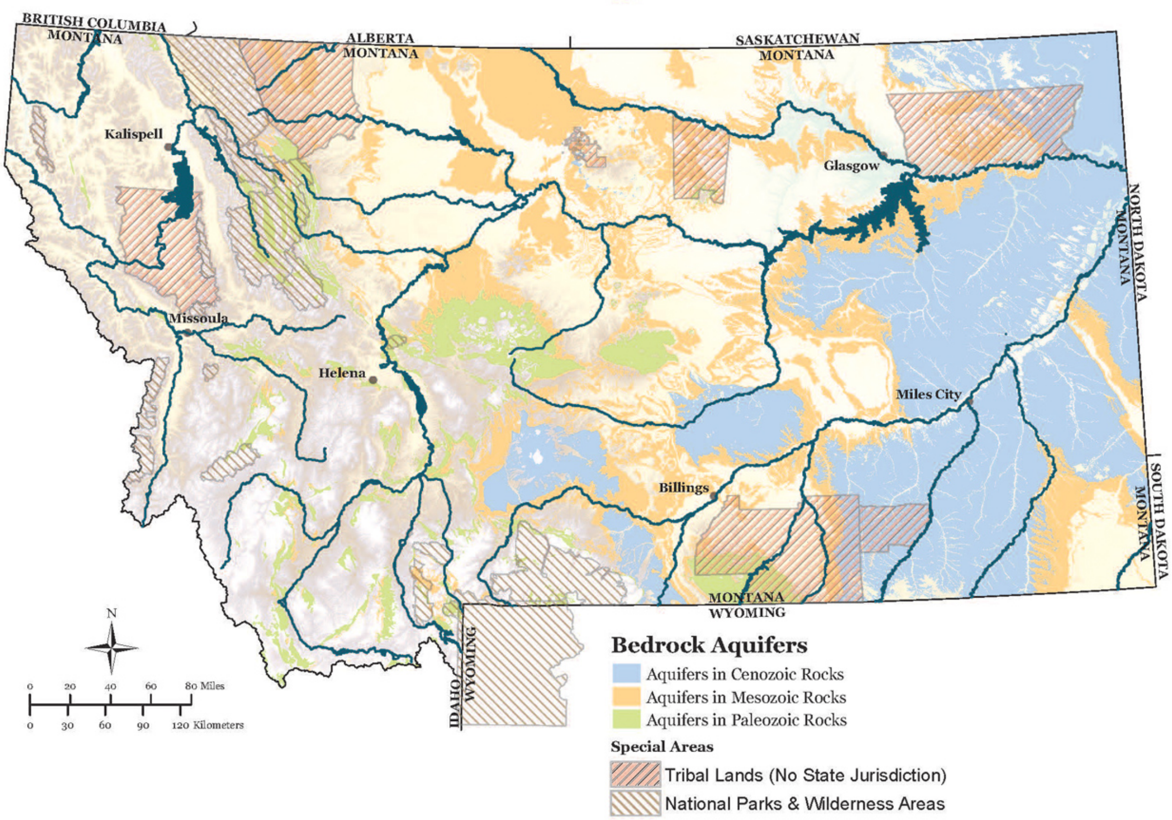


Figure 4. Montana Aquifers[3]

Beneficial Uses & Water-Use Classification

In the 1950s, Montana classified its waterbodies according to the present and future beneficial uses they *should* be capable of supporting.[4] Montana's water-use classification system identifies the following five main beneficial use categories.[5]

- drinking, culinary, food processing
- aquatic life support for fishes and associated aquatic life, waterfowl, furbearers
- bathing, swimming, recreation
- agricultural and industrial water supply

Each use is defined below.

Beneficial Uses

Aquatic Life

Water used to support aquatic life is broadly defined as those waters that support the populations of macro- and micro-invertebrates, aquatic plants, fish, waterfowl, furbearers, and other animals normally associated with a healthy ecosystem. Healthy aquatic life depends on an environment free from harmful levels of chemical pollutants, sediment, and/or total dissolved solids (e.g., minerals, salts). Aquatic life is also sensitive to water temperature changes and other actions that disrupt the naturally-occurring hydrologic regime.[6]

Recreation

Recreation includes primary and secondary contact recreation, such as swimming or boating, respectively. Both excess algae growth and *E. coli* bacteria can harm the recreational use of waterbodies.

Drinking Water

Water used for human consumption includes drinking, culinary, and food processing uses. Safe drinking water depends on non-harmful levels of toxins and carcinogens. For carcinogens such as arsenic, levels in the water need to be below that which could result in an increased cancer risk from lifelong exposure via drinking or consuming fish from the same waters.

Agriculture & Industry

Generally, if a waterbody supports the other use classes, it will—in most cases—also support agricultural and industrial uses. However, additional salinity and toxicity information may be required to determine suitability for use in agriculture or industry.

USE CLASSES FOR SURFACE WATERS

Classes for Montana's surface waters group the designated uses of waters with similar quality conditions. These conditions identified existing and anticipated beneficial uses of a waterbody or waterbodies mostly by geographical area. Classes are notated with letters A, B, and C and are further subdivided using numbers 1, 2, and 3 (**Table 1**). For a detailed description of each use class, go to our CWAIC FAQ site at http://deq.mt.gov/Water/WQPB/cwaic/faqs and click "What are the surface water use classes?"

A unique use classification (Class I) was applied to a few waters and identifies the water quality goal of fully supporting the following beneficial uses:

- drinking, culinary, and food processing after conventional treatment
- bathing, swimming, and recreation
- growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers
- agricultural/industrial water supply

Table 1. Designated Beneficial Uses by Waterbody Class

Beneficial Uses	**Water Use Classification**							
	A-Closed	A-1	B-1	B-2	B-3	C-1	C-2	C-3
Aquatic Life/Fishes (salmonid)	X	X	X	X		X	X	
Aquatic Life/Fishes (non-salmonid)					X			X
Drinking Water (human health)	X	X	X	X	X			M
Recreation	X	X	X	X	X	X	X	X
Agriculture	X	X	X	X	X	X	X	M
Industry	X	X	X	X	X	X	X	M
X = Beneficial Use; M= Marginal Use (i.e., might exist)								

Use Classes for Groundwater

The state established groundwater classifications for use based on quality and *actual* uses as of October 1982, as opposed to anticipated or potential uses for surface waters. Groundwater has four use classes, denoted by Roman numerals I, II, III, and IV, and which indicate specific conductance levels (**Table 2**). Specific conductance is a measure of water's ability to conduct an electrical current. Waters high in salts and dissolved minerals have a high specific conductivity, while waters with fewer dissolved salts and minerals have lower conductance. Specific conductance, therefore, is an important measure of water quality because it indicates how much dissolved salts and minerals are in that water.

Table 2. Groundwater Classifications

Classification	I	II	III	IV
Specific Conductance @ 25°C **Beneficial Uses**	< 1,000 µS/cm	1,000 to 2,500 µS/cm	2,500 to 15,000 µS/cm	>15,000 µS/
Public & Private Water Supply	X	M		
Food Processing	X	M		
Irrigation	X	X	M	
Stock Water	X	X	X	
Commercial & Industrial Use	X	X	X	X

X = Beneficial Use; M= Marginal Use (i.e., may exist)

CONTROLLING WATER POLLUTION IN MONTANA

Montana's water pollution control programs help state waters achieve the federal Clean Water Act's broad goal of being fishable and swimmable, i.e., meeting water quality standards.

Section 305(b) of the federal Clean Water Act requires each state to submit a report to EPA every even-numbered year describing the status and trends of its waters. The document, commonly referred to as the 305(b) Report, includes an assessment of existing water quality in Montana and an overview of the state's water pollution control efforts.

Algae and Aquatic Plants in Big Spring Creek

POLLUTION: POLLUTANTS VS NON-POLLUTANTS

What is the difference between a pollutant and a non-pollutant?

- **Pollutant:** A form of pollution that is any substance introduced into a waterbody–naturally or by human activity–that harms water quality for a specific use, such as aquatic life. Common pollutants include nutrients, metals, or many substances discharged from industrial sites or municipal or agricultural waste treatment facilities. Some pollutants occur naturally but can still harm water for a specific use, such as arsenic that seeps into water from the Yellowstone geothermal basin.

- **Non-Pollutant (Pollution):** A change in the environment caused by humans that affects the waterbody or its biological community. For example, a manmade physical change would be building a diversion dam or removing riparian vegetation, which can block fish passage or cause streambanks to collapse, respectively. Both of these changes can harm water quality in different ways and can also result in adding one or more pollutants; e.g., erosion causes sediments to build up in streams.

Pollutant – Contaminated discharge from Golden Anchor Mine dam failure, Powell County

Non-pollutant – Alteration of streamside habitat

Terminology Note: In the CWA and state law, the term "pollution" applies to both pollutants and non-pollutants. Temperature is its own category within the CWA and specifically requires TMDL development; thus for simplicity, we also classify temperature as a pollutant. A TMDL is required for specific pollutants and temperature, but not for other types of pollution. For this reason, we will use the *pollutant* and *non-pollutant* terminology throughout this document. *Therefore, the term pollution, if used, would include both pollutants and non-pollutants*.

WATERBODY USE SUPPORT STATUS

We evaluate waterbodies by what is called an assessment unit (AU), each of which represents a homogenous segment of a waterbody. Creating AUs is a useful way to analyze waterbodies in order to assess water quality status (i.e., use support). For integrated reporting purposes, all assessed waterbodies are assigned to categories, which define the status of the waterbody (**Table 3**). Category 5 waterbodies have one or more pollutants that need a TMDL, and comprise Montana's 303(d) list. Category 4C waterbodies have only non-pollutant-caused listings (e.g., human alteration of the landscape) and will not receive a TMDL. Category 4A and 4B waters have a TMDL or equivalent, but the impaired use or uses have not been fully restored yet. Category 1 and 2 waters have fully supported uses and Category 3 waters have not been assessed.

Table 3 Water Quality Reporting Categories

Reporting Category	EPA Category Definition
Category 1:	All beneficial uses have been assessed for the waterbody and all uses are fully supported.
Category 2	Some, but not all, beneficial uses have been assessed and all assessed uses are fully supported for the waterbody.
Category 3	Insufficient data prevents assessing the use support of any beneficial use for the waterbody.
Category 4A	All required TMDLs are in place to correct identified impairments or threats.
Category 4B	The waterbody has a pollutant control program in place to correct issues, which stands in lieu of a TMDL.[7]
Category 4C	The waterbody is impaired or threatened by causes that cannot be resolved with a TMDL (e.g., low flow, habitat changes, dams, etc.).
Category 5	The waterbody has at least one impaired or threatened use, but a required TMDL or other control program is not yet in place.
Category 5N*	The waterbody has at least one standard that is not being met, and available data/information indicates that the cause could be a natural condition (i.e., no human-caused sources have been identified.)
Category 5-Alt	The waterbody has an impaired or threatened use, and an alternative restoration approach is currently being pursued in lieu of a TMDL.

* Category 5N is not an EPA category but a Montana defined category

WATER QUALITY STANDARDS

Water quality standards are a set of pre-established goals for a particular waterbody, or portion thereof, which define:

- designated uses for a waterbody
- necessary criteria to protect those uses
- provisions to prevent degrading the quality

These three components form the foundation of Montana's water pollution control programs.

RULEMAKING PROCESS

The Board of Environmental Review (BER) adopts water quality standards into the Administrative Rules of Montana (ARM). This rule-making process involves the Water Pollution Control Advisory Council, the governor's office, EPA, and the public. We review Montana's water quality standards every three years and update or modify existing standards as needed.

WATER QUALITY CRITERIA

States develop or implement federal criteria for evaluating water quality. These criteria must accurately reflect the latest scientific knowledge. They are based solely on data and scientific judgments about pollutant concentrations and their effects on the environment, aquatic life, and human health. Montana water quality criteria include both numeric and narrative criteria. Water quality criteria for each use class are detailed in the Administrative Rules of Montana.[8]

Numeric Criteria

Most of Montana's water quality criteria are numeric; that is, the criteria define precise, measurable concentrations of pollutants that if exceeded would harm the use. Montana's numeric water quality criteria are published in *Circular DEQ-7 and Circular DEQ-12A*; however, the state also has numeric criteria for the New World Mining District (temporary standards),[9] algal biomass and nutrients on the Clark Fork River,[10] and electrical conductivity and sodium adsorption ratio for waters in the basins of the Rosebud, Tongue, Powder, and Little Powder rivers.[11]

Montana's numeric water quality criteria are published in Circular DEQ-7 *and* Circular DEQ-12A

Narrative Criteria

Some pollutants have narrative water quality criteria, which are statements (instead of specific quantities) that describe the desired water quality condition in terms of allowable ranges and maximums (e.g., water pH and temperature) or in terms of specific variation from natural conditions (e.g., water turbidity and color).

Each use class defined in the rule has narrative criteria, and some narratives define an allowable change from naturally-occurring conditions. For example: True color must not be increased more than five color units above naturally-occurring color.[12] Naturally-occurring conditions are determined by reviewing historical data for a waterbody, if available, or by comparing conditions with a reference waterbody. Reference waterbodies are unaltered or otherwise in their most natural condition and provide a baseline for what a relatively pristine, undisturbed similar waterbody might be like if fully supporting its uses.

On February 27, 2015–after 12 years of research, including 7 years of collaboration with stakeholders–EPA approved Montana's new numeric nutrient (nitrogen and phosphorus) standards rule package. The rule provides science-based criteria that ensure protection of water quality and aquatic life, along with a practical implementation process. These standards are found in DEQ Circular 12A.

Nondegradation Policy

Montana's nondegradation policy,[13] applicable to new or increased sources of pollutants, requires water quality be maintained so that all existing and anticipated designated uses are protected for all state waters (Tier 1).

Waters considered high-quality (Tier 2), where water quality is better than required by standards, degradation is only allowed if changes from the proposed activity are determined to be nonsignificant.[14] DEQ may authorize degradation of Tier 2 waters only when we find doing so is necessary for promoting important economic or social development. However, all existing and anticipated uses must still be protected.

For waters classified as Outstanding Resource Waters (Tier 3), no degradation or permanent change in water quality from a new or increased point source discharge is allowed. All state surface waters located wholly within the boundaries of designated national parks or wilderness areas as of October 1, 1995, are Outstanding Resource Waters.[15] To date these are the only waters in the state so designated.

Glacier National Park Has 250 Lakes Within Its Boundaries

TOTAL MAXIMUM DAILY LOAD PROGRAM

A Total Maximum Daily Load (TMDL) is the maximum amount of a pollutant a waterbody can receive from all sources combined and still meet its water quality standards (i.e., support its beneficial uses).

DEQ develops TMDLs for impaired and threatened waterbodies – essentially a plan for restoring and protecting a waterbodies' beneficial uses. Because water quality is best addressed through integrated efforts within a defined geographic area (i.e., a watershed), we normally combine multiple TMDLs into one project.

A single waterbody can be impaired or threatened from multiple pollutants, which means it may require multiple TMDLs. For example, if one stream segment is impaired by sediment, copper, and iron, that segment has three waterbody–pollutant combinations that must be addressed by three separate TMDLs.

Developing a TMDL generally takes 2 to 3 years for each project area, depending on the complexity of the system and available data and resources. After stakeholder and the public review a TMDL, we submit it to EPA for approval.

As part of TMDL public outreach, we have created an interactive TMDL project website that identifies current TMDL priority areas and provides a rationale on how these priorities were determined. The website also includes our method for setting TMDL priorities. Because of the large number of existing TMDL documents, in addition to working on new TMDL development in priority areas, it is anticipated that a significant amount of future work will address updates and improvements to these documents with regard to local stakeholder implementation.

TMDL development is water quality planning that focuses on protecting and fully restoring uses throughout a watershed

PRIORITIZING TMDLS

To determine a watershed's TMDL development priority, DEQ applies factors defined in state law[16] and consults with the statewide TMDL advisory group. Factors that most influence priority include

- TMDLs needed to support new individual discharge permit applications
- TMDLs that have the greatest potential to be readily implemented
- TMDLs that offer the greatest ability to improve coordination among water quality programs
- waters with high resource value
- pollutants with high potential to harm a beneficial use or uses

<u>High Priority:</u> Watersheds with TMDL completion anticipated within the next 2 years.
<u>Medium Priority:</u> Watersheds where TMDL completion is anticipated by 2022.
<u>Low Priority:</u> All other watersheds that require TMDLs or waters that have TMDL alternative restoration approach(s) in place.

During the 2016 reporting cycle, EPA approved 237 TMDLs on 106 waterbodies. Of these, 233 TMDLs addressed pollutants included on the 2014 303(d) List.

Development and Implementation

Developing a TMDL for an impaired waterbody is a problem-solving exercise. The problem is excess pollutants entering a waterbody and impairing or threatening designated uses. The solution is to identify three factors:

1. the total acceptable pollutant loading (amounts)—the TMDL
2. all the significant pollutant-contributing sources
3. where pollutant-loadings can be reduced to achieve an acceptable load—the TMDL

TMDLs must be implemented by people and often function as information tools. Individual pollutant allocations for point sources (referred to as wasteload allocations) are managed using discharge permits, which DEQ issues through the Montana Pollutant Discharge Elimination System (MPDES). Pollutant allocations for nonpoint sources (referred to as load allocations) are predominately managed voluntarily by land management agencies, watershed groups, conservation districts, landowners, and interested citizens.

Point Source Control Program

Pollutants can arise from different source types, one of which is called a point source; that is, pollutants arising as a result of human activities from a specific location, such as discharges from an industrial facility, and via an identifiable conveyance, such as a pipe. Point sources are regulated, meaning that facilities must have a permit to discharge pollutants from point sources into waterbodies.

In Montana, the Board of Environmental Review adopts rules governing all issues related to the state's permitting process, while EPA governs the pretreatment and municipal biosolids control programs in Montana.

Montana Pollutant Discharge Elimination System Program

State and federal regulations require industries or works (e.g., construction sites, wastewater treatment plants, etc.) to have a permit before they can discharge wastes or pollutants from any point source into state waters. Montana's Pollutant Discharge Elimination System (MPDES) is the permitting program that controls point-source discharges of wastewater.

Discharge permits provide a regulatory process for defining limitations of pollutant amounts, which may be developed for each point source as part of the TMDL process. If a waterbody doesn't have an approved TMDL for existing pollutant discharges, DEQ imposes effluent limitations that will protect water quality.

In addition to permits issued to individual dischargers, general permits are issued for categories of discharges that affect waters statewide or within a limited geographic range (**Figure 5**). General permits must conform to all of the criteria applicable to individual discharges. Further, general permits may contain additional provisions that DEQ deems necessary to protect water quality.

Figure 5. MPDES General Permits

MONTANA GROUND WATER POLLUTION CONTROL SYSTEM PROGRAM

In addition to controlling the discharge of pollutants from point sources into surface waters, we control pollutant discharges into groundwater through the Montana Ground Water Pollution Control System (MGWPCS) permitting process. The Montana Board of Environmental Review has adopted rules governing such discharges, which define a "source" as any point source or disposal system, including a waste-holding pond that under normal operating conditions may reasonably be expected to discharge pollutants into groundwater.

Pollution control standards for groundwater in *Circular DEQ-7* are set to protect human health and include an insignificance number based on DEQ's nondegradation policy. [17, 18] The rules include a water-use classification system for groundwater based on natural specific conductance and groundwater standards to protect those uses.

Groundwater rules do not require minimum treatment standards for discharge from mechanical treatment. The level of treatment or pollutant control is based on compliance with the applicable water quality standards after dilution within a DEQ-approved mixing zone (i.e., an area of groundwater allowed to mix with effluent before compliance is measured).

In Montana, the majority of water quality problems are the result of nonpoint source pollution.

Nonpoint Source Control Program

Like point sources of pollutants, nonpoint sources (NPS) arise from human activities. Unlike point sources, however, NPS pollutants are generally not regulated because they accumulate from diffuse sources over widespread areas, such as runoff from agricultural or urban areas. When rainfall and snowmelt moves over and through the ground, it collects and carries naturally occurring and manmade pollutants into lakes, rivers, wetlands, and groundwater. Activities that contribute to NPS pollution include grazing, logging, farming, mining, and developing land, among others. **Table 4** contains a list of activities by source category and the typical pollutants and pollution from those activities.

DEQ promotes using best management practices (BMPs) to reduce NPS pollution. In addition, when NPS pollutants limit the beneficial uses of a waterbody, our watershed approach to developing TMDLs provides an effective way to allocate pollutant load reductions to achieve full beneficial use support.

Primary Categories of Nonpoint Source Pollution

Agriculture

Ranches and farms cover two-thirds of the state—about 60 million acres. Approximately 65% is rangeland-pasture and 30% is cropland.[19]

Pollution from agriculture operations can include nutrients, sediment, and temperature (pollutants), or streamside (riparian) habitat and/or flow alterations (non-pollutants).

Forestry

Forests cover nearly a quarter of the state – 22.5 million acres and are the headwaters for many rivers and streams. Approximately 64% is under federal management (USFS or BLM), 20% private, 8% commercial, and 4% each Indian Trust and State.[20] These waters provide drinking source waters for communities, habitat for Montana's diverse wildlife, and some of the West's best fishing.

Pollution from forestry and silviculture operations can also include nutrients, sediment, and temperature (pollutants), or streamside (riparian) habitat alterations and flow alterations (non-pollutants).

Transportation

The network of roads and highways in Montana is extensive with approximately 73,775 miles of roadways and ramps. Of these, 11,275 are maintained by the Montana Department of Transportation[21] and remaining miles are maintained by other entities, e.g., counties or cities.

Pollution from the transportation system can also include sediment and oil and grease (pollutants), or channel degradation (non-pollutant).

Best Management Practices: In water pollution control, BMPs can include operational and management techniques and/or structural controls to reduce or eliminate pollutants entering waterbodies and to improve the quality of water runoff. The goal is to reduce or eliminate NPS pollutants entering streams and rivers. A BMP technique may include reducing the use of chemical fertilizers and pesticides. A structural control may include building retention ponds to capture pollutants, or water treatment measures, like using filters.

Hydrologic Modification

Manmade changes to the natural flow of a waterbody can affect an entire watershed. Examples of changes include dams, weirs, water diversions, bank stabilization structures (e.g., riprap), shallow groundwater pumping, and other modifications that remove water from its natural flow course.

Urban / Suburban

The vast majority of Montana is rural; however, those areas that are now urban or suburban significantly increase the types and amount of pollutants that enter waterbodies. This is a result of the reduced natural ground cover and increased paved areas and structures. Paved areas prevent rain and snowmelt from soaking into the ground and routes concentrated polluted water into storm drains and eventually into wetlands, streams, rivers, and lakes.

Pollution in urban areas comes in a variety of sub-categories, listed below.

❖ *Stormwater Runoff*

Stormwater runoff from urban and industrial areas is a significant source of pollutants, including nutrients, sediment, herbicides, and pesticides.

To reduce the harmful effects of urban stormwater runoff, discharge permits for storm sewer systems are required for Montana's 7 largest urban areas:[d]

Billings *Bozeman* *Butte*
Great Falls *Helena* *Kalispell*
Missoula

❖ *Construction*

Home and commercial construction disturbs soil and increases erosion, which in turn increases the potential for sediment and nutrients to flow into surface waters. Streamside habitat alteration (i.e., changing or removing riparian vegetation) can also significantly alter water quality. General discharge permits for construction activities require builders and contractors to protect water quality from their activities that disturb more than 1 acre.

❖ *Waste Disposal*

There are an estimated 230,000 on-site septic systems in Montana. Septic systems range in design from low-level conventional systems or simple "tanks" buried in the ground to more technical engineered systems designed for increased pollutant removal.

Pollutants from waste disposal system include nutrients, pathogens, chemicals and personal care products.

Riparian and Wetland Alteration

When complex riparian systems are simplified or reduced by changing their vegetation, soils, and/or water-flow patterns, their ability to filter pollutants diminishes. Many riparian and wetland areas have been converted to manicured lawns or small-acreage pastures for domestic livestock, increasing the amount of nutrients, sediment, and bacteria in waterbodies and leading to nuisance or toxic algae blooms, elevated water temperatures, greater channel erosion, and greater property damage from flooding.

Abandoned Mines

Montana has addressed many long-abandoned mine and mill sites.

To date 407 projects have been completed. As of 2015, DEQ's Abandoned Mine Program has 8 active reclamation projects located in various parts of the state.

Increased concentrations of heavy metals and sediments in waterbodies are the most common causes of NPS pollution associated with mining. State and federal permits regulate active mines; however, abandoned and inactive mines are significant sources of pollutants in many of Montana's watersheds. Programs throughout DEQ work together to mitigate damage from historical mine sites and to protect water quality from new mine developments.

Recreation

Boating, fishing, hiking, and other recreational activities can harm waters in different ways. The major NPS pollution concerns include increased sediments (from roads and trails, shoreline and streambank trampling); loss of habitat (disturbed stream banks and stream bottoms); inappropriate waste disposal; and spills or discharges of gasoline, oil, and other petroleum products. A growing concern is the proliferation of aquatic nuisance species, which can be unknowingly and widely distributed by boaters, fishers, and hikers.

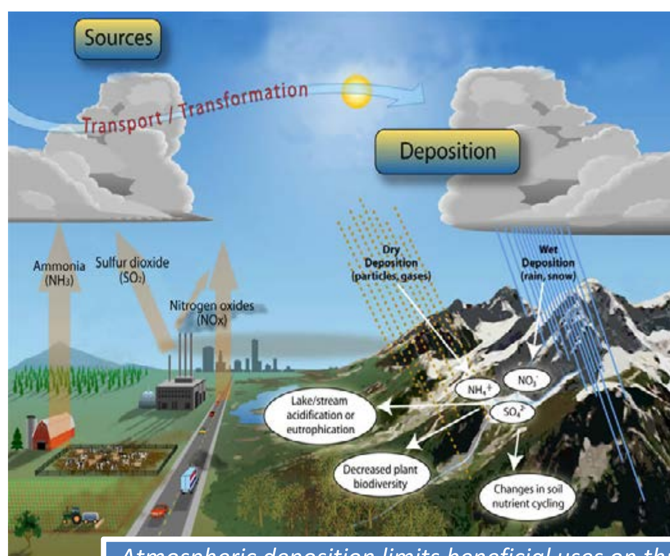
88% of Montanans engage in outdoor recreation, 60% of which is water-based.[a] In addition, tourists, many of whom came for water-based activities, spent an estimated $3.9 billion in 2014[b]

Atmospheric Deposition & Climate Change

Atmospheric deposition happens when pollutants in the air fall to the ground. Usually the pollutants come from outside the region, yet they affect waterbodies and whole watersheds. Because these pollutants are not generated locally, they are hard to control.

In addition, global climate changes have far-reaching and uncontrollable harmful effects on waterbodies.

Limiting the effects of atmospheric deposition and climate change requires significant agreement and coordination among state, regional, national, and international governments. The goal of the nonpoint source program is to develop a more complete understanding of the effects of atmospheric deposition and climate change on water quality and recommend appropriate public policies.



Atmospheric deposition limits beneficial uses on three of Montana's large lakes and reservoirs: Flathead Lake, Fort Peck Reservoir, and Holter Lake

Table 4. Nonpoint Source Activities and Related Pollution

Nonpoint Source	Activity	Pollutant	Non-Pollutant
Agriculture	Pesticide Application Irrigation Livestock Watering Riparian Habitat Disturbance (trampling) Removal of Native Riparian Vegetation	Sediment Nutrients Salinity Temperature Bacteria Pesticides	Habitat Loss Flow Alteration Channelization
Forestry	Logging Road Construction	Sediment Nutrients Temperature	Habitat Loss
Transportation	Road Construction Road Maintenance Accidental Spills Atmospheric Deposition	Sediment Oil & Grease Metals	Habitat Loss Channel Degradation
Urban & Suburban	Stormwater Runoff Construction Residential Waste Disposal	Oil & Grease Pesticides Fertilizers Bacteria Metals Sediment Contaminants Nutrients Temperature	Habitat Loss Flow Alteration Channel Degradation Nuisance Algae Blooms Toxic Algae Blooms Channel Erosion
Contaminated Sediments	Abandoned Mines	Metals Sediment	Habitat Loss Erosion
Hydrologic Modification	Channel Straightening Channel Widening Channel Relocating Water Diversion Dam Construction	Temperature Sediment Transport Dissolved Oxygen	Bank Stability Instream Flows
Recreation	Boating Fishing Hiking/Mountain Biking Off-Highway Vehicles	Oil & Grease Sediment Invasive Species Bacteria	Habitat Loss
Atmospheric Deposition	Farming Industry Other Human Activity	Nitrogen Mercury Chemicals (PCBs)	

COMMUNITY SUPPORT PROGRAMS

SOURCE WATER PROTECTION PROGRAM

Under the 1996 federal Safe Drinking Water Act, the state is required to implement a source water assessment program. The aim is to delineate areas that provide a source for public drinking water, which applies to both existing and new supply sources. During delineation, geologic and hydrologic conditions are evaluated and, when identified, are protected as sources of drinking water. The assessment process identifies businesses, activities, or land uses that generate, use, store, transport, or dispose of certain contaminants in source water protection areas. The susceptibility to contamination from these sources is then estimated. Delineation and assessment identify significant threats to drinking water supplies and provide suppliers of public water with the information they need to protect their water sources.

WATER POLLUTION CONTROL STATE REVOLVING FUND

Established in the 1987 amendments to federal Clean Water Act, the Water Pollution Control State Revolving Fund (WPCSRF) gave EPA the authority to make capitalization grants to the states. Along with state matching funds, the grants provide financial assistance for constructing water pollution control projects.

The long-term goal of WPCSRF is to maintain, restore, and enhance the chemical, physical, and biological integrity of Montana's waters for the benefit of the overall environment and to protect public health, while maintaining a long-term, self-sustaining program.

Each year, Montana's WPCSRF prepares an Intended Use Plan and Project Priorities List, which ranks projects using the following criteria:

- By the effects on water quality resulting from the current project situation
- By the likelihood of improving water quality (restoring designated uses) after implementing the proposed project
- By the project sponsor's pollution prevention efforts
- By the sponsor's readiness to proceed

The WPCSRF also provides technical assistance to municipal wastewater treatment facilities, including inspecting their operations and maintenance as well as comprehensively evaluating their performance to optimize water treatment efforts. WPCSRF also funds training in wastewater treatment for wastewater operators and funds technical assistance for engineers and the public.

DRINKING WATER STATE REVOLVING FUND

In 1995 the Montana Legislature created the Drinking Water State Revolving Fund (DWSRF), a program that offers loans with at- or below-market interest rates to eligible Montana entities wishing to improve the infrastructure of public drinking water facilities. DWSRF also funds other activities related to public health and compliance under the federal Safe Drinking Water Act.

DEQ oversees the program by providing technical expertise and preparing an annual plan for intended use for each capitalization grant application, while DNRC administers the financial aspect, including overseeing loans and the sale of state general obligation bonds.

Cost–Benefit Assessment of Pollution Control

The federal Clean Water Act requires states to report on the economic and social benefits of actions necessary to achieve the clean water objective.[22] Because several state, federal, and private entities implement water quality improvements in Montana, expense details are complex and not readily available for preparing a comprehensive cost-benefit assessment. Furthermore, most benefits are non-monetary and thus hard to calculate.

Below is a summary of the program costs and benefits associated primarily with our point-source and nonpoint source efforts. Costs are estimated for state fiscal years 2013 (July 1, 2012 – June 30, 2013) and 2014 (July 1, 2013 – June 30, 2014). Because of how we collect data, benefits are estimated for calendar years 2013 and 2014.

Summary of Montana's Clean Water Costs

The average annual cost for Montana's point- and nonpoint source pollution programs from all funding sources, plus wetland and drinking water protection, was approximately $64.3 million in FY 2013 and FY 2014 (**Figure 6**); however, this figure does not include enforcement, permitting, or public drinking water programs, which are quite small expenses compared with $64 million.

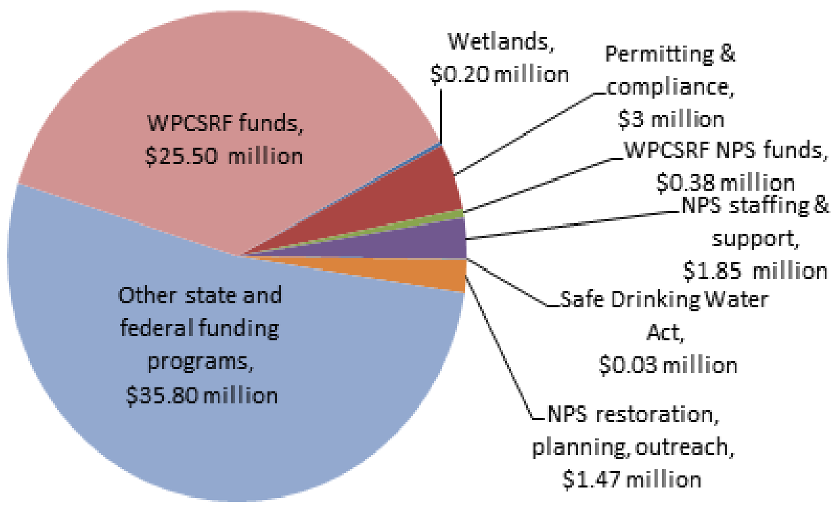


Figure 6. Average Annual Costs for Clean Water Act Programs[23]

Benefits of Complying With the Clean Water Act

While the benefits of clean water and a healthy environment may be challenging to quantify in pure economic numbers, their derived benefits and importance to all plants and animals (including humans) cannot be understated. Indeed, several aspects of water quality management programs are simply designed to prevent the deterioration of current conditions (e.g., by preserving water quality standards and controlling point sources of pollutants). Without water quality management, however, the benefits of aesthetics, recreational activities and drinking water supplies, to name a few, would be diminished or lost.

Point Source Program Achievements

In calendar years 2013 and 2014, Montana's Water Pollution Control State Revolving Fund (WPCSRF) program benefited water quality and public health in the following ways:

- Improved quality of various state waters by upgrading, expanding, or replacing ten inadequate secondary treatment systems that empty into state waters.
- Improved water quality and reduced operating expenses of eight municipal wastewater projects by reducing infiltration and inflow in the collection systems and replacing leaky pipes to prevent stormwater runoff or groundwater from entering the system.
- Reduced nutrient and other pollutant loading to state waters by funding 17 projects involving advanced treatment processes, such as nutrient removal and disinfection.
- Protected water quality by funding approximately 11 NPS projects, helping state waters maintain or improve their capacity for designated uses.

Nonpoint Source Program Achievements

In calendar years 2013 and 2014, DEQ helped improve water quality through numerous projects:

- Completed water quality improvement plans (including 375 TMDLs addressing 401 pollutants) for 23 TMDL Project Areas.
- Supported development of 27 watershed-based plans (Watershed Restoration Plans, or WRPs). To date, we have accepted 21 WRPs. Benefits from restoration projects include:
  - estimated reduction of 403 tons of sediment from new projects in streams impaired by sediment
  - estimated reduction of 937 pounds of nitrogen from new projects in streams impaired by high nutrient concentrations
  - estimated reduction of 384 pounds of phosphorus from new projects in streams impaired by high nutrient concentrations
- Demonstrated and documented improvements in water quality in Meadow Creek, a tributary of the East Fork of the Bitterroot River, through forestry and road BMP implementation.
- Obtained approval of numeric nutrient standards and implementation strategies.
- Continued development of Montana's Water Quality Assessment, Reporting & Documentation system.
- Reported on the status of water quality in Montana and provided an updated list of impaired waters in the 2014 Water Quality Integrated Report.

Source Water Protection Benefits

DEQ's source water protection program can help communities avoid costs related to contamination, including:

- finding and developing new water supplies and/or providing emergency replacement water
- treating and/or improving source waters
- informing the public when incidents arouse public and media interest in source water pollution
- abandoning a drinking water supply because of contamination
- litigating against parties responsible for contaminating source waters
- meeting Safe Drinking Water Act regulations
- addressing health concerns

DEQ started a program to offer low-interest loans to facility owners who need to make improvements in their water system. Many facility owners have taken advantage of this funding, and we anticipate that these loans will help address many noncompliance issues. Interested parties may direct questions to our Technical and Financial Assistance Bureau

PROGRAM PRIORITIES

MONITORING AND ASSESSING WATER QUALITY & DEVELOPING TMDLS

DEQ's water quality planning priorities for 2016 through 2022 include monitoring and assessment activities to support the development of TMDLs in 10 basins and the Yellowstone river system (**Figure 7**). These areas include all high and medium TMDL priorities on the 303(d) list.

We use a team approach to better coordinate our TMDL projects, which provides a smoother transition from monitoring and assessment to TMDL development. In addition, this approach helps us coordinate with external stakeholders.

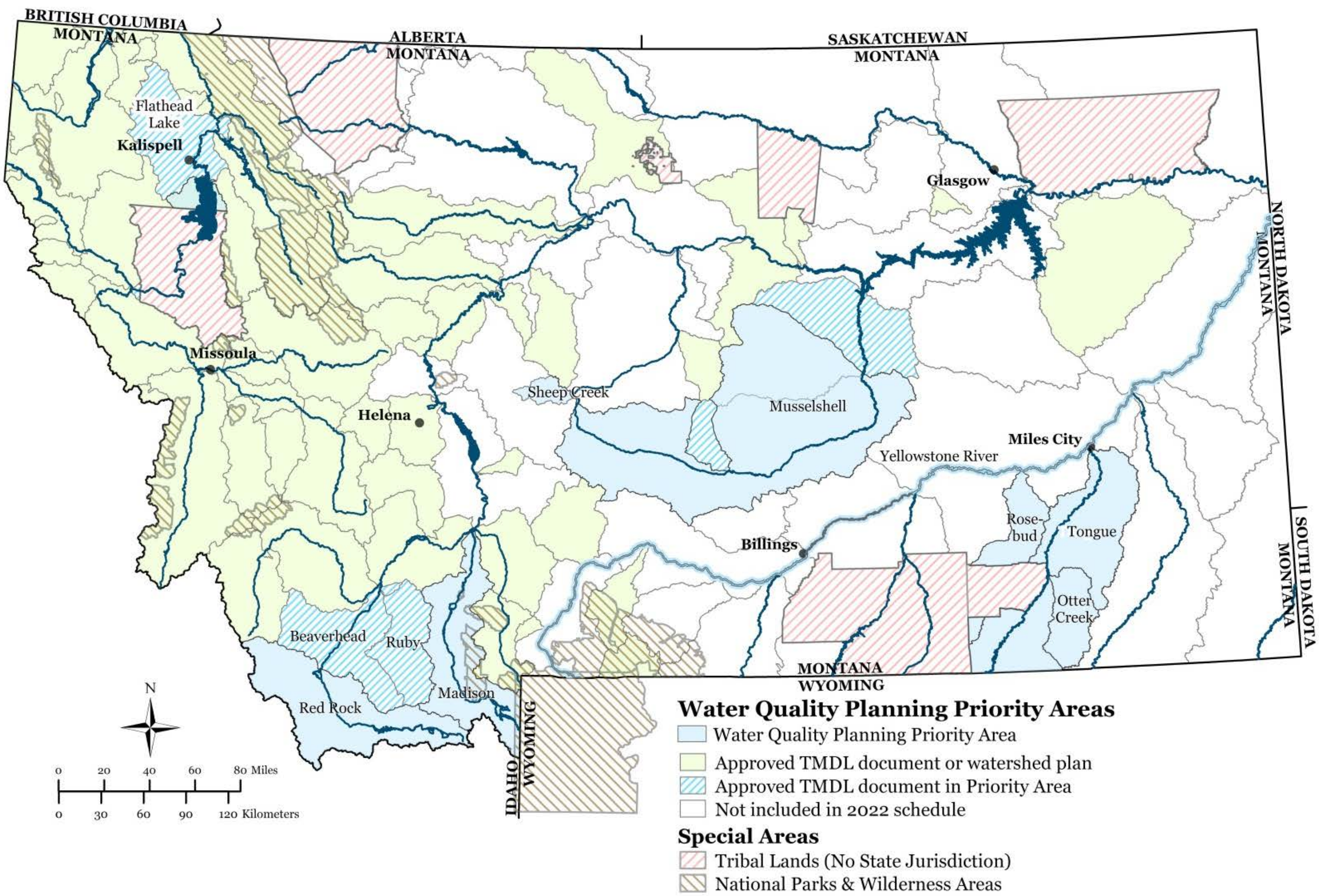


Figure 7. Water Quality Planning Priority Areas

REDUCING NONPOINT SOURCES OF POLLUTION

Our priorities are to support implementation of TMDLs, and are based on the following items:

- Where watershed restoration plans are completed and approved–21 plans have been approved and 5 more are being developed (**Figure 8**).
- Where there is potential for local watershed groups to implement watershed restoration plans where TMDLs are being developed.
- Where CWA Section 319 funding has been or will be awarded through a competitive bid process.[24]
- Where the Natural Resources Conservation Service and DEQ have jointly selected watersheds for National Water Quality Initiative funding.
- Where substantial restoration activities have taken place based on the recommendations contained in a TMDL and may warrant a new beneficial use support assessment.

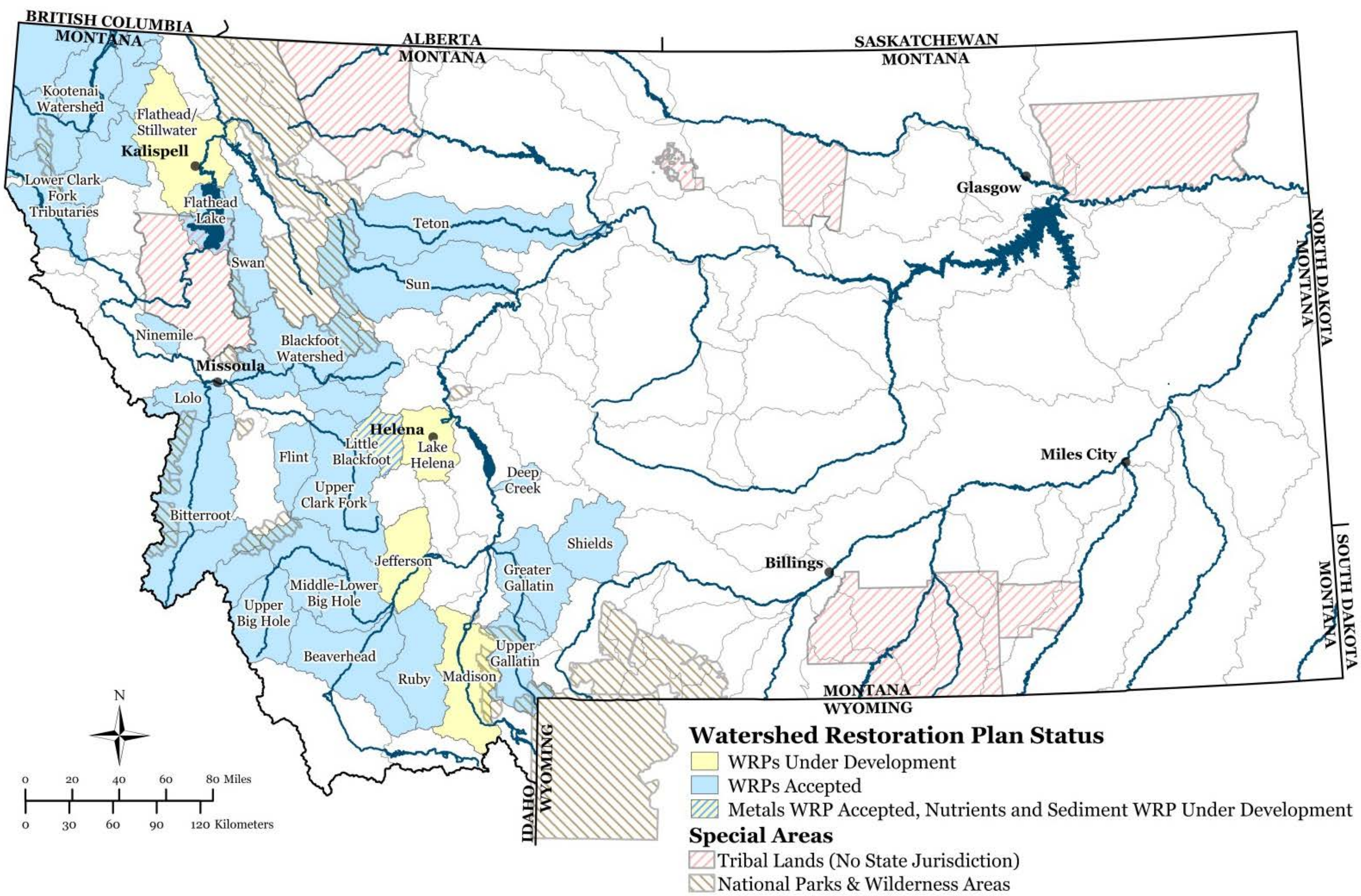


Figure 8. Watershed Restoration Plan Status

Developing Water Quality Standards

Our priorities for the development or refinement of water quality standards include the following for the next two years:

- Evaluation of the current dissolved oxygen threshold and the periphyton nutrient increaser taxa in southern Montana. If necessary, we will modify the current dissolved oxygen standard in prairie streams.
- Completing our technical analysis for the upper Yellowstone River to determine numeric nutrient criteria for the Yellowstone River from the Bighorn River to upstream of Livingston.
- Develop water quality standard rules to address new state regulation for natural conditions and variances.[25]
- Research actions that will assist communities with wastewater lagoons to meet ammonia water quality criteria.
- Sampling the Yellowstone and Madison/Missouri basins in order to define the level of arsenic concentrations for determining appropriate water quality standards.
- Evaluating established reference streams around the state to determine whether they can still be used as reference sites. We will collect additional data to enhance our datasets and refine water quality standards, and systematically sample the network to analyze long-term trends.
- Completing our technical analysis to develop numeric nutrient criteria in Flathead Lake, including stakeholder outreach.

SURFACE WATER MONITORING & ASSESSMENT

DEQ works with other federal and state agencies and organizations to collect water quality data, monitor surface waters and determine whether waterbodies are supporting their beneficial uses and meeting water quality standards.

MONITORING & ASSESSMENT

DEQ's water quality program monitors and assesses the status of water quality by collecting data to characterize the physical, chemical, and biological integrity of surface waters. We also develop and test water quality assessment methods to interpret water quality standards.

We collect data to

- assess and document whether state waters are supporting their beneficial uses and meeting water quality standards
- identify threatened or impaired waterbodies and the potential causes of harm
- assess the effectiveness of pollution control and restoration activities
- document statewide water quality status and trends
- develop numeric criteria for water quality standards
- calibrate water quality and watershed models

Our monitoring and assessment efforts are focused on the roughly 58,000 miles of perennial streams and on significant (i.e., > 5 acres) publicly-owned lakes that have public access. We also focus efforts on waterbodies where specific concerns have been identified and on waters that are more likely to have water quality issues, regardless of flow characteristics.

Our program uses a rotating watershed approach to gather data from both fixed and targeted stations. In other words, we monitor different watersheds over time. This method is more efficient and takes advantage of limited financial and personnel resources. In addition, we collect data from sites in watersheds we have identified as potentially at risk and in need of protecting or restoring.

Also, we support large-scale projects to track water quality trends or new threats independent of our rotating watershed monitoring.

Coordinating and collaborating with other entities is essential for implementing Montana's statewide monitoring and assessment strategy. We have partnerships and cooperative agreements with the US Bureau of Land Management, the US Forest Service, the University of Montana, US Geological Survey, and several state conservation districts, as well as local nonprofit watershed groups and other organizations. In addition, we coordinate with local volunteer monitoring groups when we have mutual objectives. By collaborating on data collection, assessment, and other projects, we can better meet our water quality improvement goals.

MONITORING PROJECTS

DEQ undertook several monitoring projects during 2013–2014:

- fixed-station water quality networks
  - lower Missouri
  - upper Missouri
  - Clark Fork watershed
- rotating watersheds using risk-based approach
  - Madison basin
  - upper and middle Musselshell basin
  - Red Rock basin
  - Flathead PCBs
  - Sheep Creek
  - lower Flathead River
  - Deep Creek
- targeted water quality monitoring
  - eastern Montana (oil & gas development)
  - Lake Koocanusa (coal mining)

- reference sites
- watershed modeling
    - Otter Creek
    - Tongue River basin
    - Powder River basin
- water quality standards development
    - Canyon Ferry Lake
    - middle Missouri River
    - upper Missouri River
    - upper Yellowstone River

Fixed-Station Network

In 2013–2014, we collected data from our fixed-station monitoring networks in the following areas:

- Lower Missouri basin
    - Musselshell Fixed Station Characterization Monitoring
- Upper Missouri
    - Red Rock Fixed Station Characterization Monitoring
- Clark Fork watershed
    - Clark Fork Watershed Nutrients
    - Lake Koocanusa Trend Monitoring

Rotating Watersheds Monitoring

In 2013–2014, we collected data in priority watershed planning areas, which included sampling in the Madison, Musselshell, Red Rock, Flathead, Sheep Creek, and Deep Creek watersheds. This included data collection on more than 241 waters and updates to 153 waterbody assessment units.

Targeted Water Quality Monitoring

These projects collected samples in areas that have potential threats to water quality. This monitoring collected baseline data in eastern Montana to investigate potential water quality contamination from past and current oil and gas extraction. We also work with the US Army Corps of Engineers and Montana Fish, Wildlife & Parks to collect data for assessing the effects of coal mining in Canada on Lake Koocanusa.

Reference Sites

Montana's narrative water quality standards are based on reference condition; that is, comparing current conditions with a relatively pristine waterbody—its reference condition—of a similar nature. In the early 1990s, we initiated a project to define the water quality and biological characteristics of minimally disturbed streams.[26] The project established a network of reference sites and defined reference conditions to guide water quality assessment decisions. At present, we have 185 reference sites across the state.

In 2013 and 2014, the standards section revisited established reference stream sites around the state to determine whether they were still useful as reference sites. We collected additional data from these sites to enhance existing datasets and to refine water quality standards, and we carried out systematic sampling to allow for long-term trend analysis.

Water Quality Standards Development

In 2013, DEQ deployed nutrient-diffusing substrates in the upper Missouri River to investigate whether pesticides, herbicides, and arsenic were inhibiting algal growth in the absence of nutrient limitation. This sampling will determine whether the QUAL2K model–which will be used to develop nutrient standards in the near future–needed additional calibration to address the additional factor inhibiting algal growth.

Also in 2013 and 2014, we measured dissolved oxygen in southeastern Montana to evaluate its current threshold. If necessary, we will modify the current dissolved oxygen standard in prairie streams.

In 2014, we sampled the middle Missouri River to develop nutrient criteria using the QUAL2K model. We also sampled Canyon Ferry Lake to develop nutrient criteria using a CE-QUAL model.

Watershed Modeling

Our monitoring projects supporting the development of watershed models in the Powder and Tongue basins and Otter Creek (tributary to the Tongue River) focused primarily on salinity levels; however we also collected nutrient, sediment, and metals data. The DEQ collaborated with the USGS and BLM on these projects. We sampled the Powder River basin in 2013 only but sampled in the Tongue River basin and Otter Creek in both 2013 and 2014.The models we have developed or will develop will be used to inform water quality standards and/or TMDL allocations.

Otter Creek

Quality Assessment Methodology

DEQ has developed methods to assess water quality for nutrients, sediment, and heavy metals–the most common pollutants harming Montana's surface waters. The methods allow us to rigorously and consistently assess water quality, which in turn allows us to make reproducible and defensible decisions about whether a waterbody is supporting its beneficial uses.

Identifying Available Data

DEQ solicits outside data and information from

- local, state, and federal agencies
- volunteer monitoring groups, private entities, and nonprofit organizations
- others involved in water quality monitoring and management

Outside data and information are combined with the results of DEQ's monitoring to provide a basis for assessing water quality. We use data from outside sources only if that data meets our rigorous quality standards.

Evaluating Data Quality

Our pollutant-based assessment methods have specific objectives for making decisions and assessing the validity and reliability of the data we collect. Our data quality assessment process considers the technical, representativeness, currency, quality, and spatial and temporal components of readily available data and information for each of the data types (biological, chemical, and physical/habitat) and is conducted individually per beneficial use and pollutant group (e.g., aquatic life & fishes – sediment).

Supporting Beneficial Use

All waters are assigned a use class and designated beneficial uses. During our assessment of water quality for any given waterbody, we evaluate each beneficial use to determine whether water quality standards are attained and the beneficial use is supported for that waterbody.

Accessing Assessment Records

Our documentation for assessment methods can be can be found online at http://deq.mt.gov/Water/WQPB/qaprogram. This site includes the most current applied assessment methods as well as older methods applied to assessments conducted between 2000 and 2008 that have yet to be updated.

Access to all electronic assessment reports, information, and maps is available on the CWAIC website at http://cwaic.mt.gov. Here, you can run queries of the state's water quality assessment records for the current and two previous reporting cycles. CWAIC also provides access to Montana's Water Quality Integrated Report documents and online mapping tools.

SUMMARY OF CURRENT WATER QUALITY ASSESSMENTS

DEQ evaluates waterbodies by defining assessment units (AUs), each of which represents a homogenous segment of a waterbody. Creating AUs is a useful way to assess beneficial use support and identify impairments for a given waterbody segment. For the current reporting period, we have defined 1,184 AUs, which includes 1,112 rivers and streams and 72 lakes and reservoirs.

Assessed waterbodies are put into categories that define their water quality condition. Those that do not meet water quality standards are listed as one of the following:

- impaired by pollutants (Category 5 or 5,5N)
- impaired by pollution only (Category 4C)
- those with all necessary TMDLs completed and approved (Category 4A)

*During the current reporting period, 9 waterbodies were added to the 2016 303(d) List. For the full list, see **Appendix B***

The current reporting period

- In total 3,409 AU–cause combinations are identified as impairing Montana's surface waters (**Appendix A**). An AU–cause combination is a specific waterbody segment and its associated cause listing. A waterbody may have multiple causes harming its uses.
- Montana's 2016 303(d) List (**Appendix B**) includes 941 specific pollutant listings on 382 AUs that need a TMDL.
- 1,049 AUs have had their water quality status assessed, of these 382 are listed in Category 5 or 5,5N and need a TMDL (**Figure 9**).
- Of the 72 specific impairment causes listed in 2016, the two most common were sediment-related (pollutant) and alterations of streamside vegetative cover (pollution).
- Grazing in riparian or shoreline zones is the most common *confirmed* source associated with impairments. Of the 2,773 identified AU–source combinations listed, only 666 (24%) have been confirmed at the time of the assessment decision.

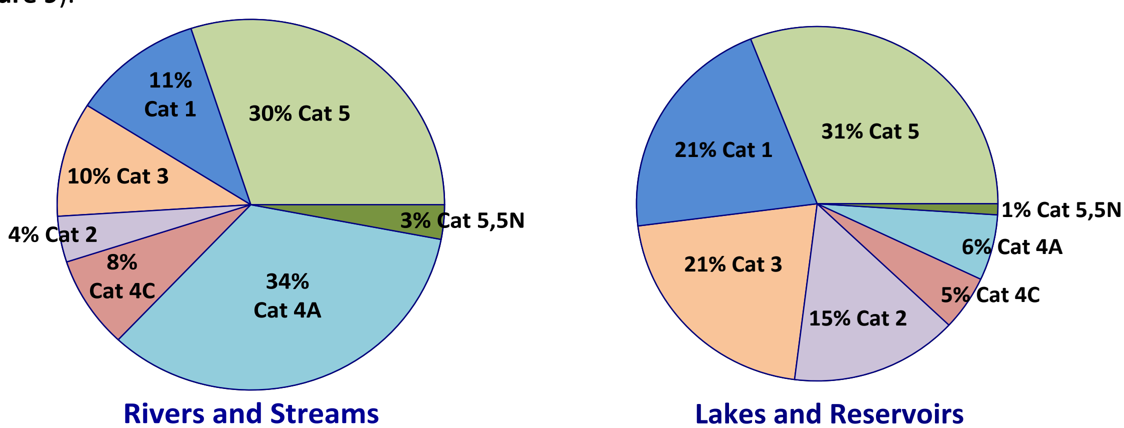


Figure 9. Assessed waterbodies under state jurisdiction, by listing category

Rivers and Streams

To date, of the more than 58,000 miles of perennial rivers and streams under the state's jurisdiction, we have defined approximately 22,650 miles as assessment units. The majority of the assessed rivers and streams are not fully supporting the aquatic life use, which reflects the prominence of listings for sediment- and flow-related impairment. Conversely, most of the assessed waters do fully support their drinking water, recreation, agriculture, and industrial uses (**Figure 10**).

The current reporting period:

- Montana's rivers and streams have 67 identified causes of impairment; the most common are sediment-related (pollutant) and alterations of streamside vegetative cover (pollution).
- Montana Rivers and streams have 56 confirmed sources of impairment; the most common confirmed source was riparian, or shoreline, grazing by livestock.

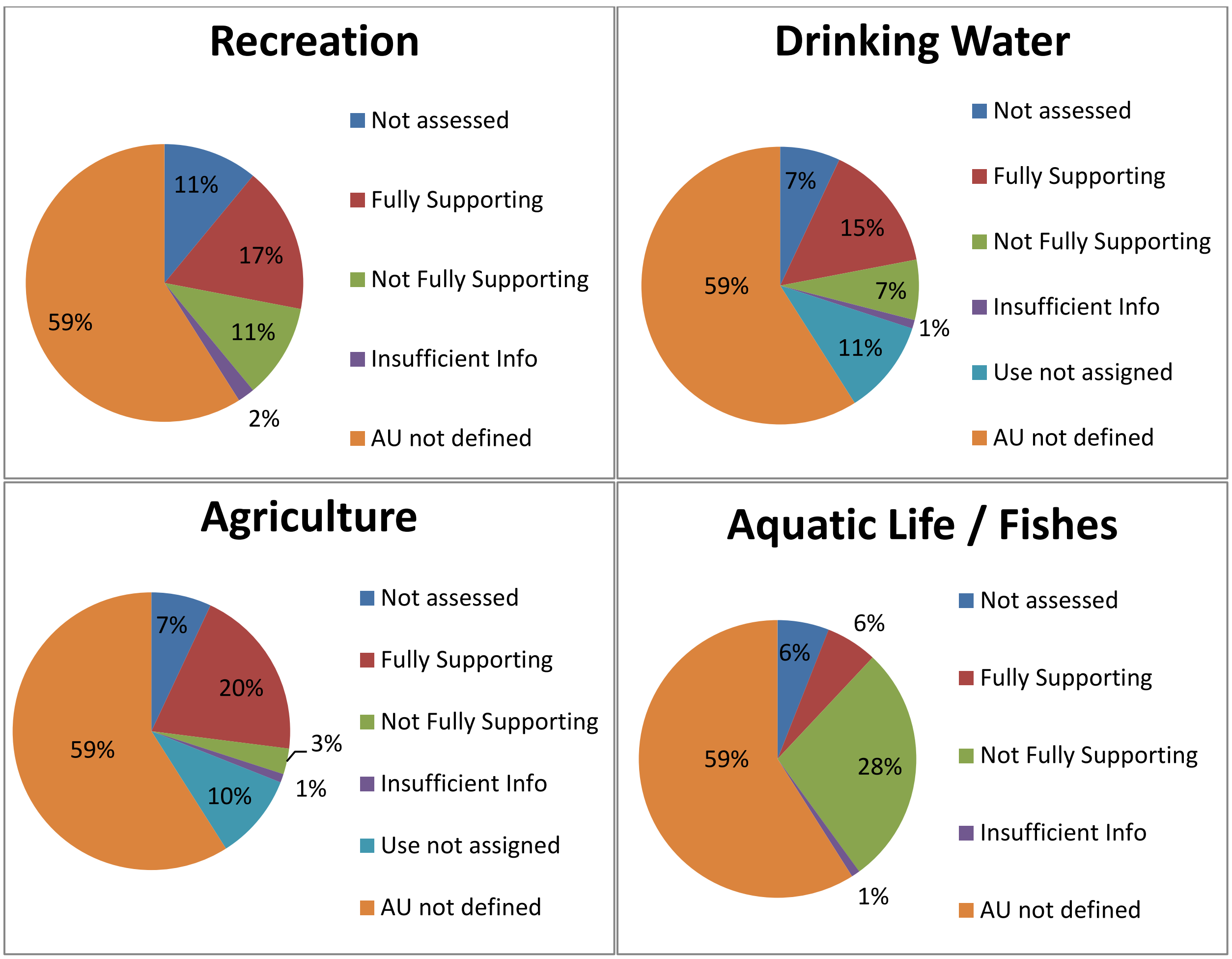


Figure 10. Beneficial use status of rivers and streams under state jurisdiction

Note: The assessment figures represent only those waterbodies outside of federal-recognized tribal reservations and, thus, do not include all the waterbodies in the state. To date, we have assessed 34% of the waterbodies within our jurisdiction and outside national parks and wilderness areas.

Lakes and Reservoirs

To date, of the 602,000 acres of lakes and reservoirs under state jurisdiction, DEQ has defined over 500,000 acres as unique assessment units. The majority of the assessed lakes and reservoirs do not fully support the aquatic life or drinking water uses but do fully support recreational uses (**Figure 11**).

The current reporting period:

- Montana's lakes and reservoirs have 33 identified causes of impairment; the most common causes are phosphorus (pollutant), other flow regime alterations (pollution), and salinity (pollutant).
- Of 37 identified impairment sources identified for Montana's lakes and reservoirs, 8 are confirmed; these include agricultural, point-source/urban, and climate-related sources.

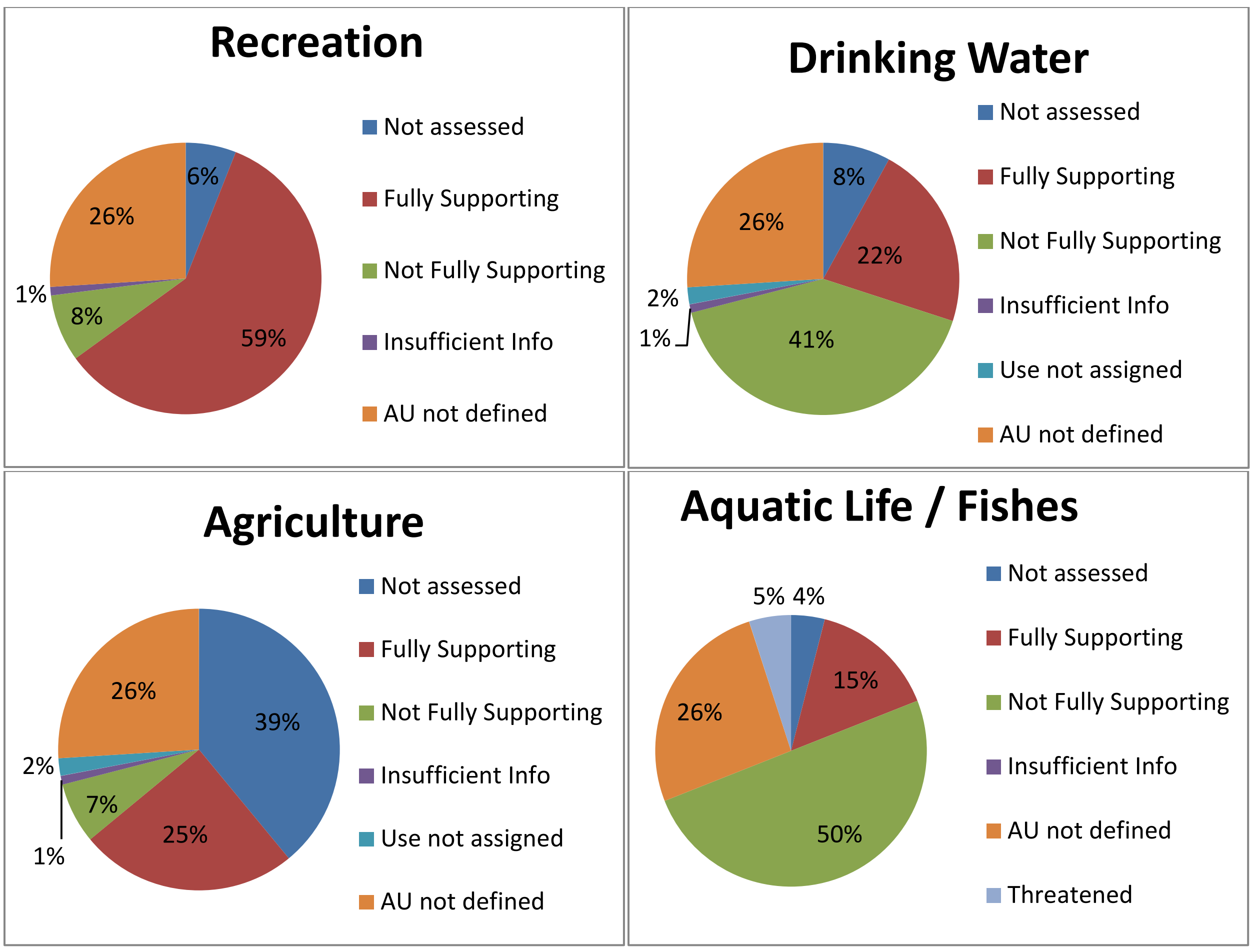


Figure 11. Beneficial use status of all lakes and reservoirs under state jurisdiction

Although we have limited data to evaluate lakes in the state, we have conducted some assessments of lake nutrient (trophic) status (i.e., biological productivity and water quality trends). Of the 72 lake assessment units (518,231 acres), 59 have been assessed for the status of nutrients (**Table 5**). Similarly, of these 59 lakes, 6 have been assessed for trends in nutrient levels (**Table 6**).

Defining Nutrient (Trophic) Status of Waterbodies

- **Oligotrophic:** Deep clear lakes with low nutrients levels, little organic matter, and a high dissolved-oxygen level.
- **Mesotrophic:** Moderate nutrients levels and moderately productive in aquatic animal and plant life.
- **Eutrophic:** High nutrient levels and highly productive in aquatic animal and plant life.
- **Hypereutrophic:** Extremely rich in nutrients and minerals.
- **Dystrophic:** Acidic and supporting many plants but few fish due to the abundance of organic matter.

Table 5. Nutrient Status of Lakes and Reservoirs

Nutrient Status	Number of Lakes	Total Size (Acres)
Oligotrophic	10	**137,285**
Mesotrophic	16	**303,507**
Hypereutrophic	0	**0**
Eutrophic	10	**31,473**
Dystrophic	0	**0**
Unknown	23	**39,461**
Total Assessed for Nutrient Status	**59**	**511,726**

Table 6. Water Quality Trends for Lakes and Reservoirs

Trend	Number of Lakes	Total Size (Acres)
Stable	4	**24,016**
Degrading	2	**30,392**
Unknown	53	**457,318**
Total Assessed for Trends	**59**	**511,726**

CATEGORY 5 POLLUTANT DELISTINGS

During the current reporting cycle, 264 pollutant causes were delisted (i.e., removed) from the 2014 303(d) List (**Table 7**). For the complete list, see **Appendix D**. Of these,

- 233 were delisted due to approved TMDLs (4A); however, the causes are still impairing at least one beneficial use.
- 30 were delisted for achieving water quality standards. This could be due to improvement of land management practices, restoration activities performed, changes in water quality standards or because the original basis for the listing was incorrect due to obsolete methods and/or technology.
- One AU was delisted because data and/or information was lacking to determine water quality status so the original basis for listing was incorrect (Category 3)

Table 7. Number of Pollutant Causes Delisted from 2014 303(d) List (Category 5)

2016 Category	Delisting reason		Total
1	Applicable WQS attained according to new assessment method	27	
	Applicable WQS attained but reason for recovery unspecified	2	
	Applicable WQS attained because original basis for listing was incorrect	1	
			30
3	Data and/or information lacking to determine water quality status; original basis for listing was incorrect (Category 3)	1	1
4A	TMDL approved or established by EPA	233	
			233
	Total Pollutant Causes Delisted		**264**

WQS: water quality standards

Wetlands Program

Montana's overarching wetland goal is no net loss of the state's remaining wetland resource (as of 1989) and an overall increase in the quality and quantity of wetlands. To assist in that goal, DEQ developed Montana's Wetland Program Plan in 2011, which provides state leadership to conserve wetlands for the benefits they provide, including improving water quality by filtering pollutants, maintaining water quantity, providing important habitat, and reducing the detrimental effects of flooding. The Wetlands Program is guided by a plan: "Priceless Resources – A Strategic Framework for Wetland and Riparian Area Conservation and Restoration in Montana, 2013-2017."

Monitoring and Assessing Wetlands

In 2011, DEQ received a grant to develop an initial wetland monitoring and assessment plan to assist in decision-making for aquatic programs. Monitoring and assessment priorities for the 2013–2017 Strategic Framework include:

- Developing a network of statewide reference standards for wetlands.
- Evaluating the ecologic effectiveness of restoration, management, and compensatory mitigation.
- Developing an approach to track wetland losses and gains in both quantity and quality.
- Expanding the Water Monitoring Work Group (under the Montana Watershed Coordination Council) to include wetlands and further the above priorities.

The Wetlands Strategic Framework contains seven directions to guide wetland protection:

1. Restoring, protecting, and managing wetlands
2. Mapping wetland locations
3. Monitoring and assessing wetland condition
4. Planning and developing protective policies
5. Focusing on vulnerable and affected wetlands
6. Communicating with and educating the public
7. Developing the Montana Wetland Council

Find more details at http://deq.mt.gov/Water/WPB/Wetlands/wetlandscouncil

Public Health Issues

Maintaining healthy water quality is an important public health consideration in Montana. DEQ aids in protecting public water supplies, ensuring safe drinking waters, and notifying the public of any health and safety issues related to water quality (e.g., fish kills).

Spill Reports

During 2013–2014, a total of 65 spills affecting surface water quality were reported to DEQ – the largest being 7,000 gallons of magnesium chloride spilled into the Clark Fork Yellowstone River. All incidents were investigated, and their reports are available from our Enforcement Division[27].

Fish Kills

During 2013–2014, five fish kills were reported to the Montana Department of Fish, Wildlife & Parks (FWP):

- January 3, 2013, Gallatin River Canyon at Deer Creek Bridge suffered an ice dam break, killing an unknown number of fish
- February 11, 2013, a tanker truck accident caused a magnesium chloride (road deicer) spill into the Clarks Fork Yellowstone River, killing approximately 25 fish
- July 15, 2013, over 30 fish were killed at Noxon Reservoir likely due to a bacterial infection
- July 15, 2013, hundreds of carp died in Holter Reservoir at Gates of the Mountains, possibly due to disease
- August 26, 2013, over 2,000 fish were killed in Lake Koocanusa due to temperature toxic shock

On January 17, 2015 the Poplar Pipeline ruptured spilling approximately 30,000 gallons of crude oil into a frozen Yellowstone River above Glendive (below). This is the second such spill in less than 5 years. The Silvertip Spill on July 1, 2011 leaked approximately 63,000 gallons of crude oil upstream of Laurel.

Fish Consumption Advisories

Every year, DEQ works with Montana Department of Public Health and Human Services and Montana FWP to issue fish consumption advisories for certain Montana waters where testing confirmed elevated levels of contaminants, specifically mercury and polychlorinated biphenyls (PCBs). More detailed information is available online at http://fwpiis.mt.gov/content/getItem.aspx?id=28187.

PUBLIC WATER SUPPLIES

DEQ regulates approximately 2,170 public water systems in Montana. Public water systems can be community (e.g., towns), non-transient non-community (e.g., schools, camps, or other businesses), or transient non-community systems (e.g., rest stops or parks). An annual compliance report lists and explains the number of Safe Drinking Water Act requirement violations according to drinking water standards, water treatment requirements, or a water quality monitoring/reporting requirement.[28]

DRINKING WATER QUALITY IN MONTANA

Most Montana residents have safe, potable drinking water. Many springs, wells, streams, and lakes that supply public drinking water originate from naturally protected mountain watersheds. Federal and state laws further protect surface water and groundwater sources against significant degradation. Some surface water sources serving the public are so pristine that disinfection is the only required treatment before consumption. Most groundwater sources are naturally protected against contamination and do not require treatment before use.

Montana has 232 public water systems that use surface water as a primary or secondary source (**Figure 12**); groundwater under direct Influence of surface water (GWUDISW) is the source for 6 of these systems. For regulatory purposes, GWUDISW systems are considered surface waters.[29] Of the 232 systems, 169 are purchased; that is, they rely on other water systems for their primary or supplemental supply of water. Although relatively few, the largest public water systems in Montana use surface water and collectively serve 447,098 people daily.

GROUNDWATER SYSTEMS

Most public water systems in Montana, a total of 1,938, use groundwater as a primary or secondary source (**Figure 13**). For this reason it is important that this critical groundwater resource be allocated and managed properly to conserve and protect it for current and future generations.

Most water systems comply with regulations, and, typically, violations are a result of facility owners being late to report required water sampling or failing to conduct required sampling. In 2013 and 2014, the aforementioned accounted for the most significant public water system violations, along with coliform bacteria contamination. The complexity of the new Ground Water Rule (GWR) was problematic for water system owners.

In 2000, DEQ adopted EPA's Safe Drinking Water Information System (SDWIS) for maintaining data on regulatory and compliance monitoring. Since then, SDWIS modernization has improved our ability to detect and respond to violations, a trend that has resulted in improved compliance. We recently received recognition from EPA for achievements in superior data quality maintained within SDWIS.

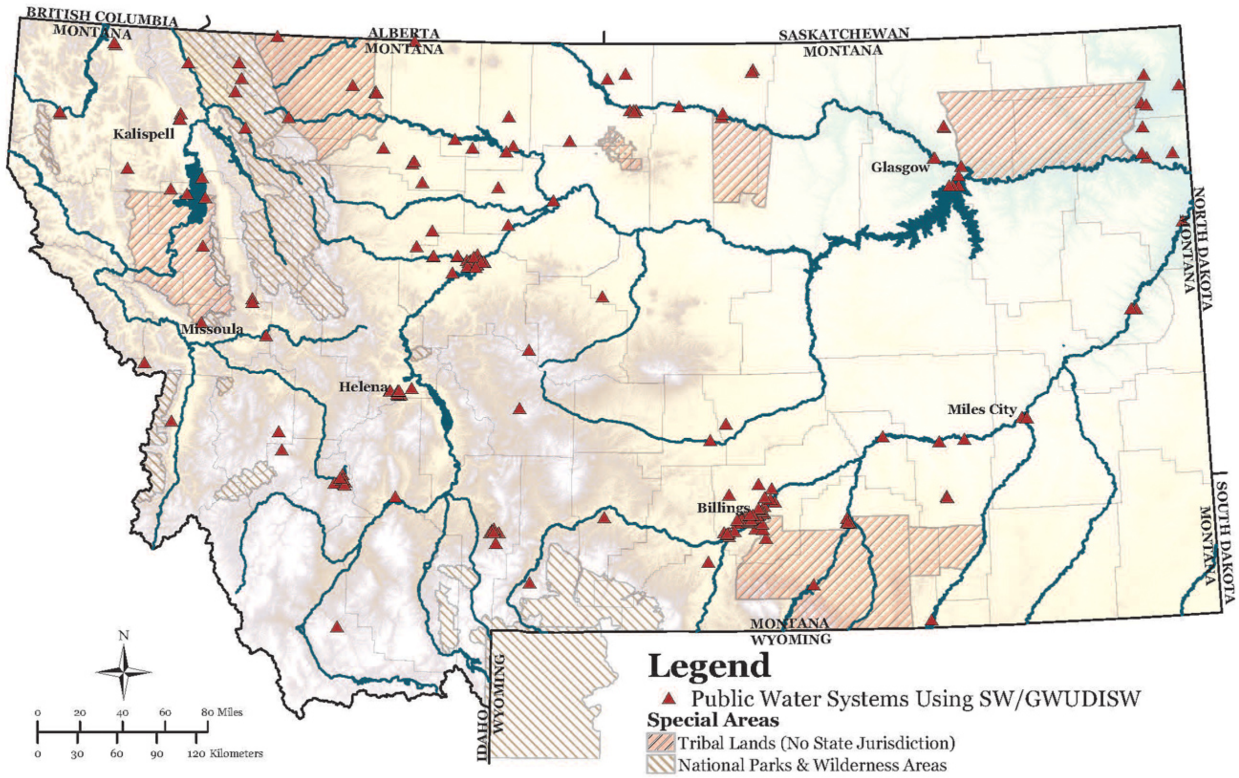


Figure 12. Distribution of Public Water Supply Using Surface Water Sources

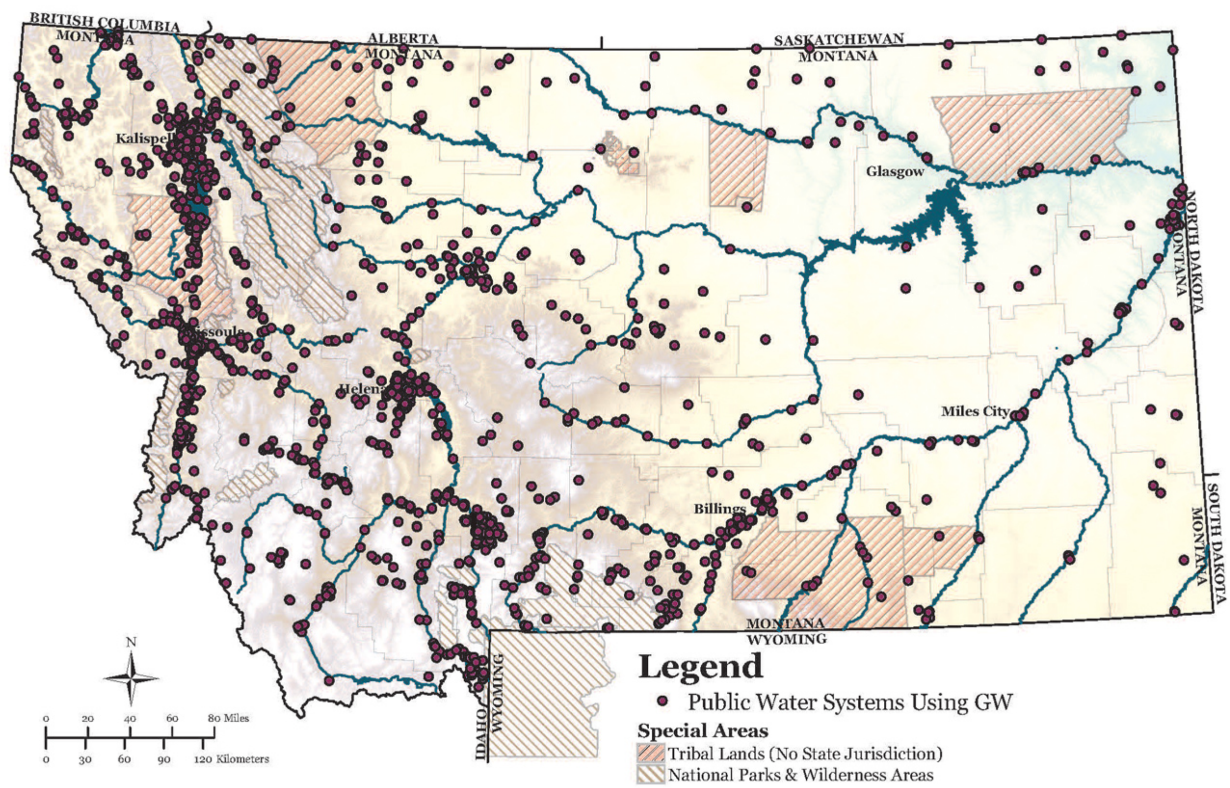


Figure 13. Distribution of Public Water Supply Using Groundwater Sources

Groundwater Monitoring & Assessment

Montana's population relies heavily on groundwater. About 61% of the state's population gets their drinking water from groundwater; about 32% get their drinking water from private wells. In addition to DEQ, other state and federal agencies monitor and assess Montana's groundwater:

- Montana Bureau of Mines and Geology
- Montana Department of Agriculture
- Montana Department of Natural Resources & Conservation
- United States Geological Survey

The Montana Ground Water Information Center (GWIC) database, maintained by the Montana Bureau of Mines and Geology, contains more than 213,000 water-well records.

Artesian well on US Hwy 12, McDonald Pass

GROUNDWATER USES

Montanans withdraw an estimated 7,630 million gallons per day (mgpd) of fresh-water from surface and groundwater sources.[30] Groundwater provides 2–3% of this withdrawal amounting to about 268 mgpd. The largest groundwater withdrawals are for:

- irrigation – 127 mgpd
- drinking – 87 mgpd
- industrial – 37 mgpd
- livestock – 12 mgpd

Groundwater use is highest in western Montana, where the predominant uses are domestic and irrigation supported by high-yield aquifers. Use for livestock is common throughout Montana but is most prevalent in eastern counties, where ranching is an important industry.

Since 1975, Montanans have constructed more than 110,758 domestic wells, 13,235 livestock wells, and about 6,376 irrigation wells.[e]

MONITORING & ASSESSMENT

The 1991 Montana Legislature established the Montana Ground Water Assessment Program, directing the Montana Bureau of Mines and Geology (MBMG) to characterize Montana's hydrogeology and to monitor long-term water level conditions and water chemistry. In 2009, the Montana Legislature established the Ground Water Information Center (GWIC) within MBMG to conduct detailed groundwater investigations in areas with the most serious concerns. GWIC (http://mbmggwic.mtech.edu) maintains and distributes data generated by the assessment, investigations, and monitoring programs as well as data generated by many other groundwater projects.

CONTAMINANTS & SOURCES

The water chemistry data evaluated for this report were collected by the groundwater monitoring, assessment, and investigations programs (388 samples) and other MBMG programs (246 samples) within specific study areas. Of the 634 samples evaluated for this report, 49% came from unconsolidated aquifers (**Figure 14**).

To be included in the dataset for this report, the water quality sample must

- have been collected between July 1, 2013, and June 30, 2015
- have an identifiable geologic source and represent "ambient" water quality (i.e., not collected as part of an effort to determine the extent of contamination by the evaluated parameter)
- have come from a well or spring

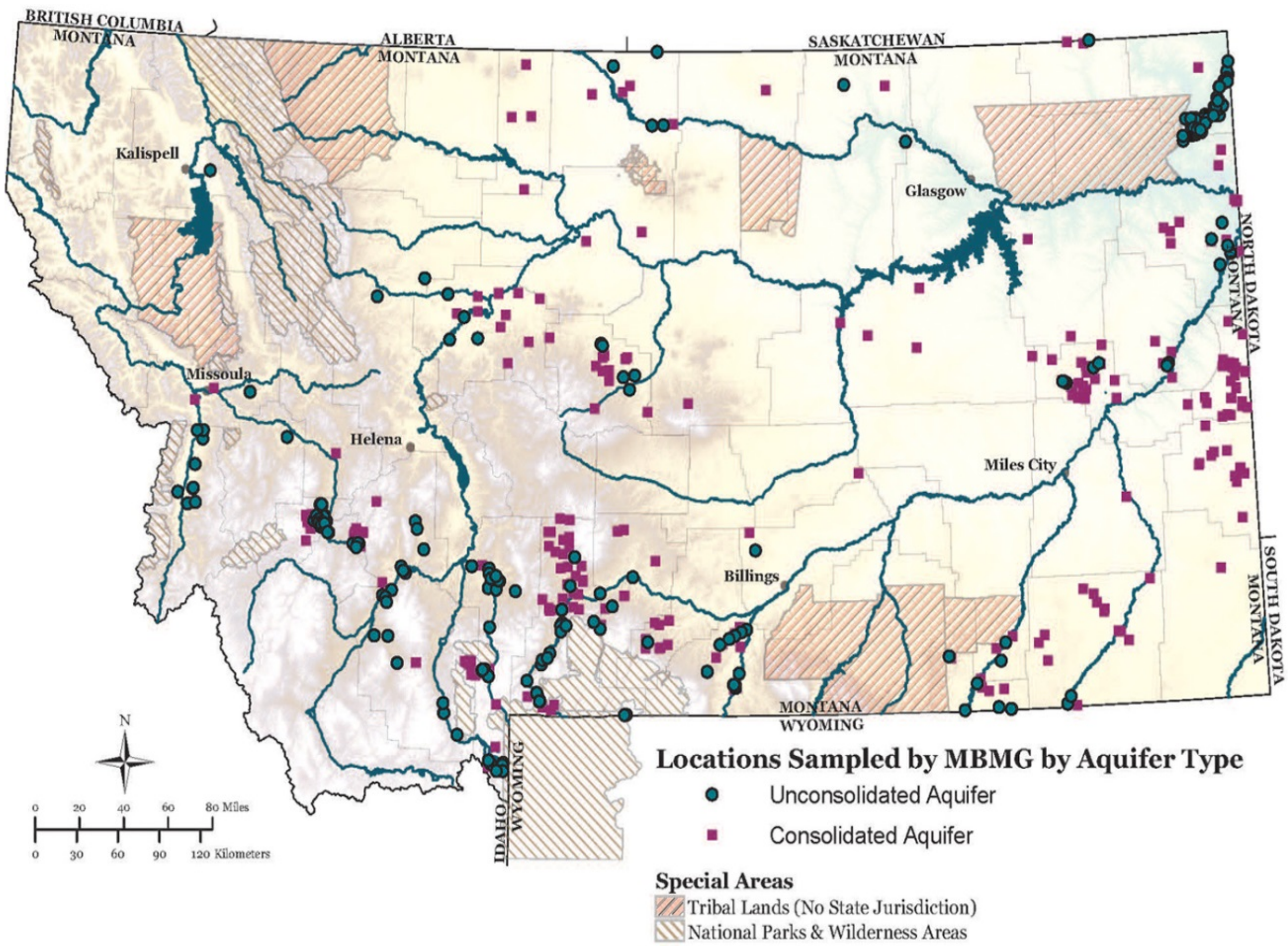


Figure 14. Distribution of samples from wells and springs completed in unconsolidated and consolidated aquifers

An unconsolidated aquifer is an underground layer of permeable rock that holds water, which can be extracted with a water well. "Unconsolidated" refers to the type of permeable rock (e.g., gravel, sand, silt, clay). In a consolidated aquifer, the rock materials have been metamorphosed or cemented together (e.g., limestone and sandstone), and water flows through fractures in the rock.

Based on various parameters, groundwater quality is evaluated for maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs), or DEQ adopted standards (*Circular DEQ-7*).

Groundwater is tested for the presence of eight general contaminants.

Pollutant	Number of samples	Standard		% of samples over standards	% Unconsolidated	% consolidated
TDS	634	500 mg/L	SMCL	48%	45%	51%
Nitrate	634	10 mg/L	MCL	2%	1%	2%
Fluorine	634	4 mg/L	MCL	3%	2%	5%
Sulfate	634	250 mg/L	SMCL	33%	31%	35%
Chloride	634	250 mg/L	SMCL	1%	0%	1%
Arsenic	634	10 µg/L	MCL	14%	22%	5%
Iron	634	0.3 mg/L	SMCL	19%	25%	12%
Manganese	634	0.05 mg/L	SMCL	27%	38%	16%
Aluminum	634	50 µg/L	SMCL	1%		
Antimony	634	6 µg/L	MCL	1%		
Barium	634	1000 µg/L	DEQ-7	0%		
Beryllium	634	4 µg/L	MCL	0%		
Cadmium	634	5 µg/L	MCL	0%		
Chromium	634	100 µg/L	MCL	0%		
Copper	634	1300 µg/L	MCL	0%		
Lead	634	15 µg/L	MCL	0%		
Nickel	634	100 µg/L	DEQ-7	0%		
Selenium	634	50 µg/L	MCL	0%		
Silver	634	100 µg/L	DEQ-7	0%		
Thallium	629	2 µg/L	MCL	0%		
Uranium	560	30 µg/L	MCL	3%		
Zinc	634	2000 µg/L	DEQ-7	0%		
Strontium	634	4000 µg/L	DEQ-7	5%		

MCLs: The maximum level of a contaminant allowed in public drinking water supplies, established by EPA (2012[c]). MCLs are set to ensure that the contaminant does not pose significant risk to public health and are legally enforceable standards that apply to public water systems.

SMCLs: Non-enforceable guidelines for contaminants that may cause unpleasant cosmetic effects (e.g., skin or tooth discoloration) or affect the aesthetics of drinking water (e.g., taste, odor, or color).

DEQ Adopted Standards: *Circular DEQ-7* standards mostly–but not always–match each parameter's MCL. If a numeric DEQ-7 value is available, but it differs from a parameter's MCL, the DEQ-7 value is compared with concentrations in the sample sets.

GROUNDWATER MANAGEMENT STRATEGY

DEQ makes an effort to educate the public and raise awareness about groundwater protection. This is needed because groundwater supplies the drinking water for most public and private users in Montana and because contaminated groundwater is difficult to clean up. The rate and scale of groundwater degradation is increasing because of the growth and development in areas that use septic systems and an increase in agricultural use of groundwater for irrigation and livestock watering. The latter is a result of basin closures for surface water rights. Use for irrigation and livestock can potentially reduce the amount of water that gets recharged into the groundwater system, while increasing the harmful effects of fertilizers, pesticides, and animal wastes leeching into groundwater.

PROTECTION

As part of their daily business, several DEQ bureaus and other state agencies address many of the protection strategies laid out in the Montana Ground Water Plan.[31] Multiple agencies are responsible for implementing various groundwater protection strategies.

The 1989 Montana Agricultural Chemical Ground Water Protection Act[32] identifies the Montana Department of Agriculture (MDA) as responsible for the preparation, implementation, and enforcement of agricultural chemical ground water management plans, providing public education, and conducting ground water monitoring.

GROUNDWATER MONITORING & EDUCATION

MDA conducts ambient groundwater monitoring for agricultural chemicals through a state-wide permanent monitoring network. If agricultural chemicals are found in groundwater, they will verify, investigate, and determine an appropriate response as necessary. Their education program offers initial and re-certification training for applicators of commercial and government pesticides. They also provide or assist in training and educating the public about pesticides.

STATEWIDE GROUNDWATER–PESTICIDE PROJECTS

MDA's Groundwater Protection Program conducts both statewide monitoring and regional-scaled special projects. Statewide monitoring is conducted at established permanent monitoring well locations while special projects sites are selected based on agricultural setting, soil type, groundwater table, and sampling access of the wells. These projects provide a snapshot of pesticide and nitrate levels in groundwater, and are used to correlate land use patterns with groundwater pesticide and nitrate concentrations.

GROUNDWATER ENFORCEMENT PROGRAM

MDA is responsible for primary enforcement of the Montana Agriculture Chemical Ground Water Protection Act while DEQ is responsible for adopting water quality standards for agricultural chemicals (pesticides and fertilizers). MDA ensures compliance by conducting statewide comprehensive inspections of agricultural chemical users, dealers, and manufacturers; by collecting groundwater and soil samples; and by investigating and monitoring incidents and spills that could harm groundwater. When necessary, MDA implements compliance actions and orders to prevent or remediate problems in groundwater associated with agricultural chemicals

REMEDIATION

In order to protect human health and the environment; prevent exposure to hazardous or harmful substances released into soil, sediment, surface water, or groundwater; and to ensure compliance with applicable state and federal regulations, DEQs Remediation Division oversees

- investigation and cleanup of groundwater at state and federal Superfund sites
- implementation of corrective actions for leaking underground storage tanks
- reclamation of abandoned mines
- remediation of groundwater contaminated by agricultural and industrial chemicals

Currently, the Groundwater Remediation Program is actively working on 88 sites, [33] coordinating remediation activities with the Montana Department of Agriculture when pesticides affect groundwater.

GROUNDWATER–SURFACE WATER INTERACTIONS

The 1986 provisions of the Safe Drinking Water Act introduced the Surface Water Treatment Rule, which requires using filtration and treatment techniques for public water systems that use surface water or groundwater under the direct influence of surface water. The rule requires each state to assess all public water suppliers that use groundwater to determine whether their sources come from groundwater under the direct influence of surface water. DEQ performs these assessments.

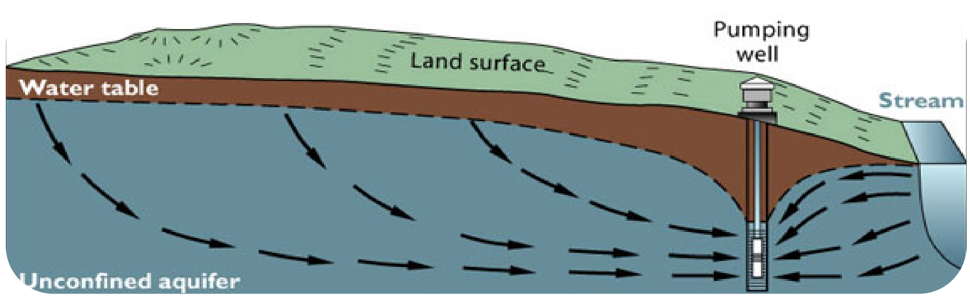
LOCAL WATER QUALITY DISTRICTS

Communities establish Local Water Quality Districts to protect, preserve, and improve the quality of surface water and groundwater within their districts.

We collaborate with the districts to support their water quality programs. The districts meet annually to review programs and activities and share ideas about how each approaches and manages local water quality issues. Each district prepares an annual report about its activities, which allows for assessment of these activities in meeting the districts' program objectives.

Currently, there are 4 WQ districts in Montana:

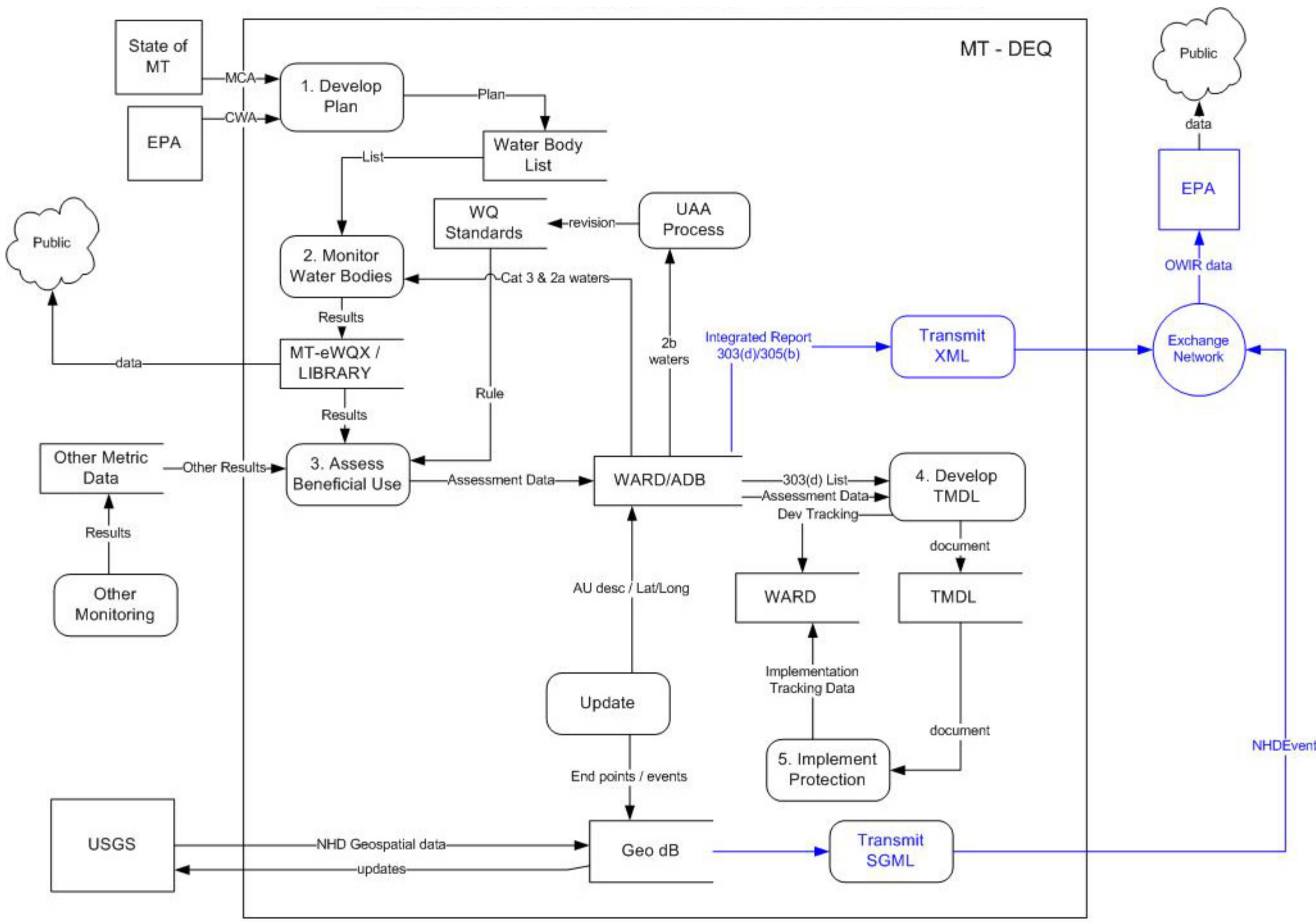
1. *Lewis and Clark County, covering the Helena valley watershed*
2. *Missoula Valley, covering the Missoula valley sole-source aquifer*
3. *Butte/Silver Bow, covering Silver Bow County*
4. *Gallatin, covering the Gallatin valley*



Groundwater Under Direct Influence of Surface Water

Managing Water Quality Data

DEQ constantly works to improve our assessment, data management, and reporting abilities and systems. We have made several program improvements, and we report cases where errant data is discovered and corrected. Details of the changes mentioned below can be found in **Appendix I**.



Data Changes & Corrections

As a result of our improved data management system for Montana Water Quality Act and federal Clean Water Act section 305(b) reporting, we are better able to visualize assessment data and their relationships. We identify inconsistencies or data entry errors that are resolved or corrected to better represent water quality assessment decisions. Our goal is to improve reporting abilities, clarify assessment data and related information, and make the assessment process transparent for stakeholders and interested parties.

Corrected Assessment Unit (AU) Metadata and Data Entry Errors

During data management activities and report development, we discovered and corrected some basic data entry and GIS indexing errors. In addition, we revised some Assessment Unit (AU) location descriptions, either to improve clarity or to ensure that all descriptions run upstream to downstream.

Changes in NHD

A recent update of the National Watershed Boundary Dataset, which defines hydrologic unit (basins, sub-basins, and watersheds) names and boundaries, has required some adjustment to be made in the naming of basins and rearrangement of some of the sub-basins contained therein.

Changes in AU Categories

The reporting category for some waterbodies has been changed.

Changes to AUs

During the reporting cycle, we designated 13 new AUs for assessment purposes.

Changes to AU Use-Support Designation

In an effort to more clearly define beneficial use support we have replaced the “partially supporting” designation to “not fully supporting” for 676 uses on 504 AUs. We also changed the use support designation nomenclature of “Not Supporting” to “Not Fully Supporting” to better reflect the typical condition of an “impaired use.”

Other changes to beneficial uses were made during this cycle due to assessment activities. These details are contained in **Appendix E**.

Changes to AU Use-Class Assignments

While managing the data and generating this Integrated Report, we discovered and corrected errors and made changes in use-class assignments.

Changes to Causes Associated with Assessment Units

This cycle there were no changes to causes related to assessment units (e.g., replacing Total Kjehldahl Nitrogen (TKN) with Nitrogen (Total).

Public Participation

Because state and federal laws recognize the challenge of determining the extent of water quality impairments from nonpoint sources, DEQ is directed to assemble and evaluate all existing and readily available water quality data and information to compliment the data collected under our monitoring program for ambient water quality. To comply with this requirement, we request information about water quality from other groups who might have information that could be useful for updating water quality assessments. These collaborators include: known local watershed groups; federal, state, and local agencies; state university programs; private groups; and individuals who have an interest in water quality issues.

PUBLIC PARTICIPATION

In December 2014, we reached out with a “call for data” via e-mail and letters to local watershed groups; federal, state, and local agencies; state university programs; private groups; and individuals with interest in Montana’s water quality requesting data and/or information they might have that could be useful for updating our water quality assessments noted in this report. Further, the call for data was posted on DEQ’s website. DEQ received one direct response to this call for data consisting of 2010-2012 monitoring data from the Silver Bow Streamside Tailings Operable Unit.

State and federal laws also require us to consult with the public when developing methods for assessing water quality and setting priorities for TMDL planning. Additionally, state law requires a 60-day public comment period for our draft 303(d) list.

To initiate the 60-day comment period, which ran from March 14 through May 13, 2016, we placed public notices in major Montana newspapers, giving formal notice of the comment period. The comment period is also made public via press releases issued to Montana’s media outlets; posts on our website; and emails to members of the Integrated Report listserv.

The public was able to submit comments on the draft IR via a Public Comment Submittal Application on our CWAIC website at http://www.cwaic.mt.gov or send comments to the standard mailing address:

Department of Environmental Quality
2016 Integrated Report Comments
WQPB, IMTS
PO Box 200901
Helena, MT 59620-0901

COMMENTS AND RESPONSES

We received three comments on our 2016 report.

> **Comment 1.** Request for rewording of a portion of the groundwater section from one of our partner agencies.

DEQ Response: We acknowledged the request and amended some of the wording. Some requested text was not used as we have changed the format of the report in an attempt to be more accessible for a broader audience. To this end we eliminated much of the technical jargon and legal text included in previous reports, opting instead to reference these items in the endnotes. Finally, given the focus of our report on water quality we did not include references to the Montana Pesticide Act as that act is not specifically focused on water quality.

> **Comment 2 - Part A.** Request for explanation of relationship between impairment decisions and fish consumption advisories

DEQ Response: When considering toxic chemicals, DEQ primarily uses numeric water quality criteria to assess water column concentrations as a basis for determining a waterbody’s use support (or impairment) status. Water quality with concentrations below the state’s water column criteria (for mercury) does not always mean that fish tissue mercury concentrations will be at levels advisable for consumption. Waterbody-specific factors sometimes cause pollutants, including mercury, to accumulate in fish tissue at levels higher than predicted by the methodology used to determine the numeric human health criteria in the water column. Examples of such factors include water temperature, nutrient levels, food web structure, concentration of dissolved organic carbon, oxygen levels within sediments, and the type of bacteria present and accumulations of pollutants in the sediment.

Elemental mercury that becomes methylated (carbon and hydrogen added to elemental mercury via bacterial process) readily moves up the food chain and bioaccumulates easily even though water column concentrations may be very low. Mercury methylation rates in reservoirs are usually high due to sediments with low oxygen levels where methylating bacteria thrive. Methylated mercury adheres to anything that is carbon based, especially living tissue. The mercury moves up the food chain to top predators and is predominately not in the water. Hence, a waterbody can be meeting numeric water quality criteria, but still accumulating in fish tissue. This usually is not toxic to the fish, but can harm humans. At the same time, mercury at these levels does not pose a threat to drinking water use because water-column concentrations are very low.

This is the case in Tiber Reservoir where DEQ's mercury sampling results from water analysis are below laboratory detection limits. It is difficult to set water quality standards or write TMDLs for water conditions that are lower than laboratory detection limits. Therefore, Montana depends on the fish consumption advisory webpage that is discussed and referenced on page 49 of this Water Quality Integrated Report to advise citizens about fish consumption issues if they exist when ambient water-column concentrations of pollutants do not indicate an exceedance of water standards for chemicals that easily bioaccumulate. Montana DEQ coordinates with MT FWP and MT DPHHS to provide updates to Montana's fish consumption advisory tables.

Comment 2 - Part B. Question as to why the Marias River below Tiber Dam no longer has mercury listed as a cause of use impairment, especially given this water will be used as a large municipal water source.

DEQ Response: The main pathway that humans are affected by mercury pertains to bioaccumulation problem in fish that people eat. Mercury bioaccumulation problems of fish that live in streams do not occur as readily as they do in lakes and reservoirs because water is constantly mixing and exposed to air as the water flows downstream. Therefore methylating bacteria that live on the stream bottom are exposed to more oxygen and thus use oxygen for metabolic processes and do not produce methylation byproducts such as methylmercury. Elemental mercury does not bioaccumulate very easily but methylmercury does.

Montana DEQ assessed water column metals conditions on two segments of the Marias River during 2006 and determined mercury in the water column and sediments was not limiting a use. The data collected during 2005 were below human health and aquatic life standards. Additional water monitoring was conducted near Loma during 2012 and 2013 and all mercury results continued to stay below standards. No fish tissue data are available for the Marias River because the risk of bioaccumulation is low and reservoirs and large lakes are prioritized for fish tissue sampling by MT FWP where mercury methylation is more likely to occur. The original mercury listing during 2002 for the lowest segment of the Marias River was an error that could not be traced back to standards exceedances. Therefore, it was removed as a cause of impairment.

Comment 3 - Part A. The attainment record for the East Fork Armells Creek assessment unit, headwaters to Colstrip (MT42K002_170), is inaccurate. Specifically that the "Alteration in stream-side or littoral vegetative covers" cause listing attributed to Surface Mining is incorrect.

DEQ Response: DEQ agrees that several of the justifications for mining as being a potential source of habitat alteration in the assessment record were not substantiated and therefore they have been removed from the assessment record. Therefore, DEQ modified the list of potential sources for this waterbody. DEQ plans to collect more habitat data during 2017 to further update the assessment record for the 2018 IR.

Comment 3 - Part B. Data used in support of a statement in the assessment record [for East Fork Armells Creek - MT42K002_170] pertaining to salts (TDS) in groundwater is old and inaccurate.

DEQ Response: This segment is not currently listed as impaired by salinity conditions. The DEQ WQ assessment program does not assess groundwater conditions directly, although we may use the information for identifying potential sources if salinity listings occur. DEQ agrees that the information cited in the current assessment record is older and needs to be taken in context with newer information. The summary of the groundwater salinity data review for this waterbody was edited for the final 2016 IR. The WQ assessment program will reassess the segment during the 2018 IR. The 2018 IR assessment will review existing data, and if needed, subsequent data collection may occur during 2017. The information provided by the commenter will be considered during future assessment activities of this segment along with other readily available data sources.

Comment 3 - Part C. The reach upstream of Highway 39 and adjacent to the mine is ephemeral. The DEQ-IEMB concludes in its Written Findings – Attachment 1 pp 9-31 and 9-32 the following: "As discussed above, the potential changes to water quality in EFAC alluvium are small in comparison to the observed variability and are unlikely to impact livestock or wildlife drinking water use, or the listed uses for Class II or Class III groundwater, . . ." [DEQ-IEMB WF, Attachment 1, pp 9-31 and 9-32]

DEQ Response: Comment noted.

Comment 3 - Part D. Attributing the Total Nitrogen cause listing to Coal Mining on the lower segment of East Fork Armells Creek [MT42K002_110] is unlikely based on my review of the data used in the 2006 assessment of this stream.

DEQ Response: The last time this segment was evaluated was during the 2006 IR cycle. The nutrient assessment methods have been updated since that time. The new methods call for higher data quality and quantity, and specifically include total nitrogen, total phosphorus, and the response parameters of dissolved oxygen and periphyton metrics. The State must demonstrate a good cause to delist (40 CFR 130.7(b)(6)(iv)). Currently, Montana does not have good cause to change the nutrient listing because our data quality objectives are not met. DEQ plans to collect nutrient-related data along with other toxic parameters to reassess beneficial uses of this waterbody for the 2018 IR. DEQ will update potential sources of any pollutants that appear on the 2018 IR using current water quality assessment methods.

Comment 3 - Part E. The reaches of East Fork Armells Creek near the Rosebud Mine are ephemeral, meaning there is little to no groundwater contribution to streamflow. The mines surface water management retains most stormwater runoff in detention ponds, which are permitted and managed under a MPDES permit. Recent in-pond measurements of Total Nitrogen are 1.06 mg/L, which is similar to values reported in the stream below Colstrip. As such, nitrogen contributions to the stream from surface water detention ponds in the mine area are unlikely. Alternatively, one possible source of nitrogen from a coal mine is from residual blasting agent (ANFO) that fails to react during blasting. Due to chemical characteristics, nitrate would be the most likely nitrogen form to be found at elevate levels in the surface water from this source, however do to the lack of a nitrate signature in mine waters at the Rosebud Mine, the mine is not a significant source of Total Nitrogen to East Fork Armells Creek. A detonating chemistry reaction is provided to DEQ indicating that blasting activities are not a likely source of nitrates.

DEQ Response: The assessment record for MT42K002_110 indicates that mining is a *potential* (emphasis added) source for nutrients. If, after a current assessment is completed for the 2018 IR, the stream is determined to exceed nutrient criteria, a TMDL will need to be developed. It will be during the source assessment stage of the TMDL that the department estimates quantitative nutrient source contributions. The information provided, regarding water management and detonating chemistry reaction may be considered during the assessment update along with other readily available data. If a TMDL is developed, the potential sources identified in the IR are updated.

Comment 3 - Part F. The data summary provided in MDEQ Record is incomplete, and does not contain sufficient data with which to draw conclusions regarding aquatic life impairment.

DEQ Response: The last time this segment was evaluated was during the 2006 IR cycle. DEQ's assessment methods have been updated since that time. New methods call for higher data quality and quantity. The State must demonstrate a good cause to delist pollutants (40 CFR 130.7(b)(6)(iv)). Under the current scenario Montana does not have good cause to change any listings at this time because our data quality objectives are not met. The Department appreciates the additional citations and data. Our initial review indicates that even with the inclusion of this information we will still have gaps that are required to complete our current assessment methods. During the 2017 field season we will fill data gaps (i.e. sediment metals, water column metals, common ions, electrical conductance, discharge, e. Coli, habitat assessments, dissolved oxygen, periphyton metrics, etc.). After this effort, all available data will be considered during the assessment process for the 2018 IR.

Comment 3 - Part G. The aquatic community composition of EFAC is expected to be variable, consistent with the natural habitat conditions in EFAC, which is a naturally ephemeral, low-gradient stream. For this reason, any type of monitoring program which relies on a benthic macroinvertebrate community index to determine level of impairment will have an increased likelihood of concluding there are anthropogenic sources of impacts to the community when in fact the community composition and shifts reflect natural processes.

DEQ Response: DEQ WQ assessment program agrees that macroinvertebrate communities are highly adapted to naturally adverse environmental conditions in the Northwestern Great Plains, especially in ephemeral and intermittent streams. Given the high natural variability of stressors to the macroinvertebrate communities in the ecoregion and lack of response in macroinvertebrate community metrics to human induced change, there is little value utilizing macroinvertebrate communities to measure stream health in this region. This is why water quality assessment methods currently do not use macroinvertebrate metrics in the Northwestern Great Plains ecoregion. Other indicators of health and stress are used to assess aquatic life.

Glossary

303(d) list	A compilation of impaired and threatened waterbodies in need of water quality restoration. Specifically, TMDLs are prepared by DEQ and submitted to EPA for approval per the requirements of section 303(d) of the federal Clean Water Act of 1972.
305(b) report	A general overview report of state water quality conditions, which DEQ prepares and submits to EPA per the requirements of section 305(b) of the federal Clean Water Act of 1972.
assessment	A complete review of waterbody conditions relative to designated beneficial uses (see *beneficial uses*)
beneficial uses	The uses that a waterbody is capable of supporting (e.g., drinking water, aquatic life support, livestock watering, etc.).
bedrock aquifer	An aquifer composed of geologically older consolidated bedrock.
best management practices (BMPs)	Activities, prohibitions, maintenance procedures, or other management practices used to protect and improve water quality.
degradation	A change that reduces the quality of high-quality waters for a beneficial use.
hydrologic unit code (HUC)	A standardized mapping system devised by the US Geological Survey for the hydrology of the United States.
load allocation	The portion of the loading capacity attributed to (1) the existing or future nonpoint sources of pollution and (2) natural background sources.
macroinvertebrates	Animals that do not have backbones and are visible to the human eye (e.g., insects, worms, clams, and snails).
Montana Water-Use Classification System	Montana state regulations[34] assigning state surface waters to one of nine use classes. The class to which a waterbody is assigned defines the beneficial uses that it should support.
naturally-occurring	The present condition of water or material and substances in the water that occur outside of human influence or resulting from developed land where all reasonable land, soil, and water conservation practices have been applied.[35]
nonpoint source (NPS)	A source of pollution that originates from diffuse runoff, seepage, drainage, or infiltration.[36]
non-pollutant	A change in the environment caused by humans that affects the waterbody or its biological community (e.g., a dam or habitat alterations)
not fully supporting waterbody	A waterbody or stream segment for which sufficient credible data shows it does not comply with applicable WQS.[37]
parameter	A physical, biological, or chemical property of a waterbody that can be measured to determine the quality of that waterbody.[38]
pathogens	Bacteria or other disease-causing agents that may be present in water.
point source	A discernible, confined, and discrete conveyance, such as a pipe, ditch, or channel from which pollutants are or may be discharged.[39]

pollutant	A form of pollution that is any substance introduced into a waterbody, naturally or by human activities, that harms water quality relative to water quality standards for a specific use, such as for drinking for which a TMDL may be defined.
pollution	A change in the environment caused by humans that affects the waterbody or its biological community (includes both pollutants and non-pollutants).
prioritization	DEQ's ranking of impaired waterbodies, determined in consultation with the statewide advisory group, for preparing Water Quality Improvement Plans (specifically TMDL plans).
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.
riparian area	Plant communities alongside waterbodies that are affected by the waterbodies' hydrologic features. Riparian areas are usually transitional between streams and upland areas.
segment	A defined portion of a waterbody.
state water	A body of water under the jurisdiction of the state of Montana.
sub-major basin	The aggregation of several watersheds or HUCs into a larger drainage system.
sufficient credible data	Monitoring data, alone or in combination with narrative information, which supports a finding as to whether a waterbody complies with applicable WQS.[40]
surficial aquifer	Aquifer composed largely of geologically younger unconsolidated sedimentary deposits that are found near the land surface. These accumulations of sediment can be deposited by streams (alluvium), glacial ice (till), or glacial meltwater (outwash). Surficial aquifers are often unconfined or partially confined and therefore more susceptible to potential contamination sources located at or near the land surface. The terms sedimentary deposits, unconsolidated deposits, and surficial aquifers are often used interchangeably.
suspended solids	Materials such as silt that may be contained in water and do not dissolve.
threatened waterbody	A waterbody for which sufficient credible data show is fully supporting its designated uses but is 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.[41]
total maximum daily load (TMDL)	The maximum amount of a pollutant that a waterbody can receive while still meeting water quality standards. TMDLs include the sum of the individual wasteload allocations for point sources and load allocations for both nonpoint sources and natural background.[42]
true color	The color of water from which the turbidity (presence of suspended matter) has been removed

wasteload allocation	The portion of the receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution (e.g., permitted waste treatment facilities).
waterbody	A lake, reservoir, river, stream, creek, pond, marsh, wetland, or other body of water above the ground surface.
Water Quality Integrated Report (or Integrated Report or IR)	A document that EPA requires each state to prepare and that provides an overview of the status of state water quality monitoring and planning programs. It combines in one document the information previously submitted to EPA in separate 303(d) list and 305(b) report documents.
water quality restoration plan (WRP)	A written plan for improving water quality so specific waterbodies can achieve full support of their beneficial uses.
water quality standards (WQS)	The standards adopted in ARM 17.30.601 *et seq*. and *Circular DEQ-7* to protect, maintain, and improve suitability and usability of water for public water supplies, wildlife, fish and aquatic life, agriculture, industry, recreation, and other beneficial uses.

[1] ARM 17.30.617(1)
[2] http://nhd.usgs.gov/index.html
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[5] ARM 17.30.621-629
[6] ARM 17.30.602 (17)
[7] 40 CFR 130.7(b)(1)(iii)
[8] ARM 17.30.6 *et seq*.
[9] ARM 17.30.630
[10] ARM 17.30.631
[11] ARM 17.30.670
[12] ARM 17.30.623 (g)
[13] ARM 17.30.701 *et seq*.
[14] ARM 17.30.715
[15] ARM 17.30.617(1)
[16] 75-5-702(7), MCA
[17] 75-5-303, MCA
[18] ARM 17.30.701 *et seq*.
[19] U.S. Department of Agriculture, National Agricultural Statistics Service. 2014. 2012 Census of Agriculture: Montana State and County Data, Volume 1, Geographic Area Series, Part 26. Washington, DC: U.S. Department of Agriculture. AC-12-A-26. http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Montana/
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[21] Brian Anderson, MDT, personal communication, 2016.
[22] U.S. Environmental Protection Agency. 1997. Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Report Contents. Washington, D.C.: Assessment and Watershed Protection Division, Office of Wetlands, Oceans, and Watersheds, Office of Water, U.S. Environmental Protection Agency. EPA-841-B-97-002A
[23] Denise Kelley, DEQ, personal communication, 2015. Annually, funding sources for Permitting and Compliance include approximately $2.8 million from the regulated community in fees, $120,000 from the EPA Performance Partnership Grant (106), $35,000 from Montana's general fund grant match money.
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[25] 75-5-222, MCA
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[27] http://deq.mt.gov/DEQAdmin/ENF/statusreports
[28] Montana Department of Environmental Quality. 2014. Montana's 2014 Annual Public Water System Compliance Report. Helena, MT: Montana Department of Environmental Quality. http://deq.mt.gov/wqinfo/pws/default.mcpx
[29] 40 CFR 141.2, ARM 17.38.209, ARM 17.38.219, and Public Water Supply Circular PWS-5
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[32] 80-15-104(3), MCA
[33] Montana Department of Environmental Quality. 2015. Site Response Section WQA Priority Sites Sorted by County: Data as of October 08, 2014, Total Number of Sites=88. Helena, MT: Montana Department of Environmental Quality, Remediation Division. http://www.deq.mt.gov/StateSuperfund/gwrem.mcpx
[34] ARM 17.30.606 - 658
[35] 75-5-306(2), MCA
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[e] John LaFave, MBMG, Personal Communication 8/3/2015

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The production of this document has been a team effort, drawing from resources throughout DEQ and other state agencies. We would like to acknowledge the following individuals for their contributions Pamela Arroues, Jeff Blend, Greg Butts, Stephen Carpenedo, Nat Carter, Jon Dillard, Denise Kelley, Myla Kelly, Jon Kenning, Darrin Kron, John LaFave, Paul LaVigne, Melissa Levins, Jane Madison, Michael Pipp, Eugene Pizzini, Bill Puknat, Robert Ray, Trevor Selch, Mark Smith, Bill Snoddy, Kari Smith, Sarah Snyder, Amy Steinmetz, Andrea Vickory, and all of the wonderful photographers at DEQ whose photographs are use throughout this document.