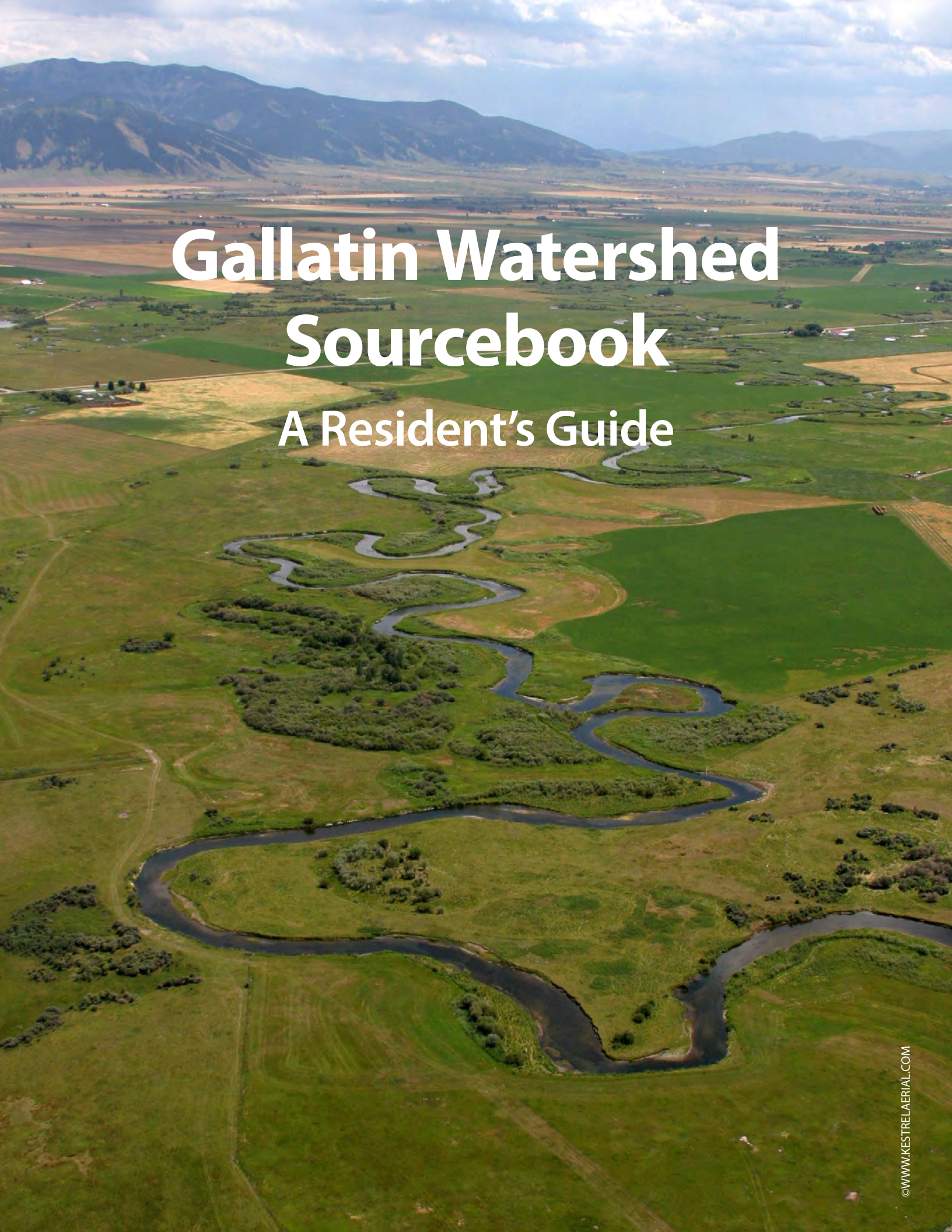
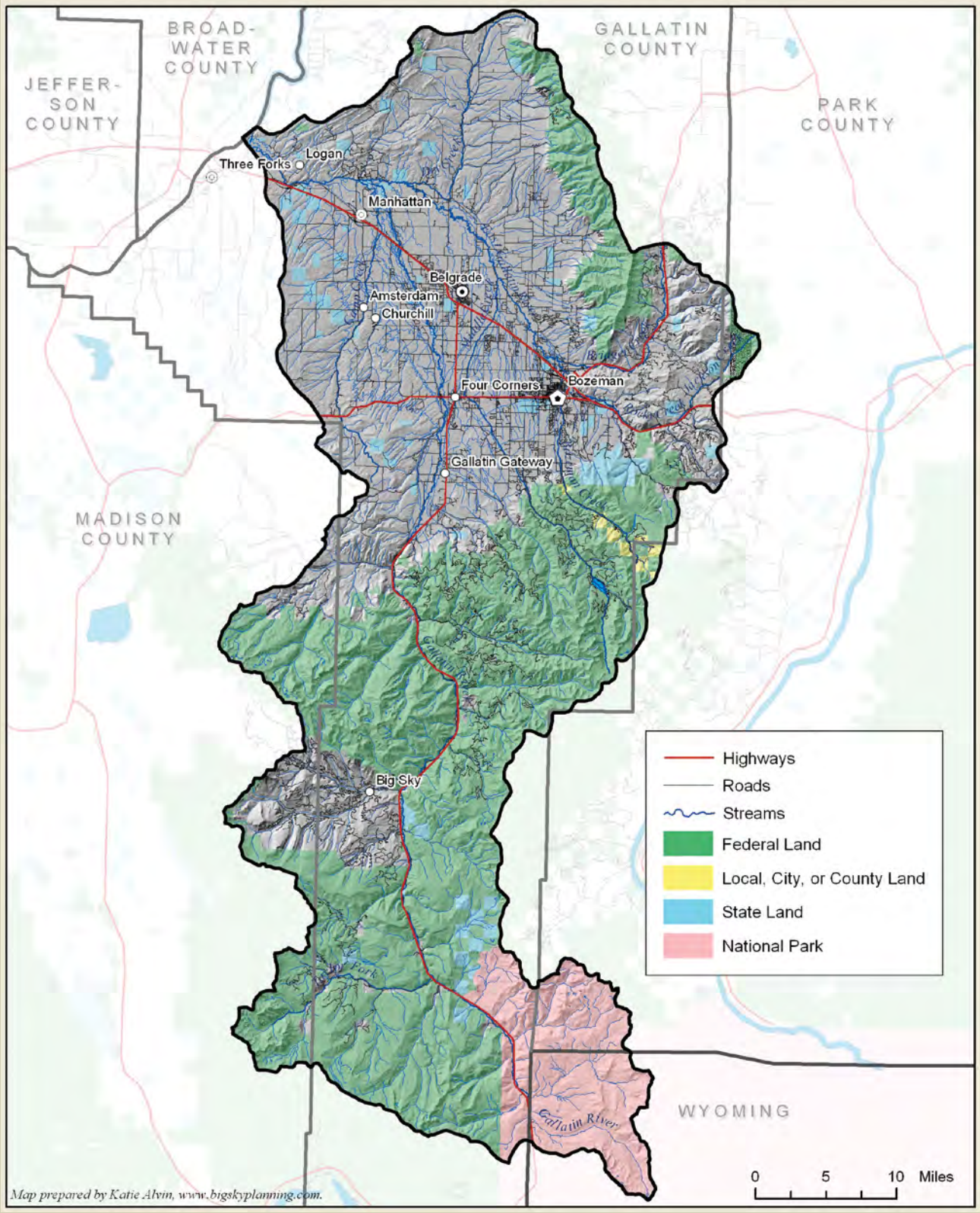
Gallatin Watershed Sourcebook

A Resident's Guide



The Gallatin River Watershed

Welcome to the Gallatin Watershed. A watershed is the land area from which rainfall and snow melt drains into a single water body. Ridges of higher ground generally form the watershed boundary. The Gallatin Watershed encompasses some 1,800 square miles.



Graphic: Katie Alvin, Big Sky Planning, Inc.

Gallatin Watershed Sourcebook: A Resident's Guide

A Reference Guide to Water Resources in the Gallatin Valley

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Acronyms Used in this Guide

AGAI - Association of Gallatin Agricultural Irrigators
CMZ - Channel Migration Zone
DEQ - Montana Department of Environmental Quality
DNRC - Montana Department of Natural Resources and Conservation
EDC - Endocrine Disrupting Chemicals
EPA - U.S. Environmental Protection Agency
FEMA - Federal Emergency Management Agency
GCD - Gallatin Conservation District
GGWC - Greater Gallatin Watershed Council
GLWQD - Gallatin Local Water Quality District
GRTF - Gallatin River Task Force
HHW - Household Hazardous Waste
MBMG - Montana Bureau of Mines & Geology
MCA - Montana Code Annotated
FWP - Montana Fish, Wildlife and Parks
MSU - Montana State University
NFIP - National Flood Insurance Program
NPS - Nonpoint Source
NRCS - U.S. Department of Agriculture, Natural Resources Conservation Service
PPCP - Pharmaceuticals and Personal Care Products
TMDL - Total Maximum Daily Load
USDA - U.S. Department of Agriculture
USGS - U.S. Geological Survey
USFWS - U.S. Fish and Wildlife Service
WRP - Watershed Restoration Plan

1 You Live in a Very Special Place

Contributed by Steve Forest. Updates: Torie Haraldson, Gallatin Local Water Quality District

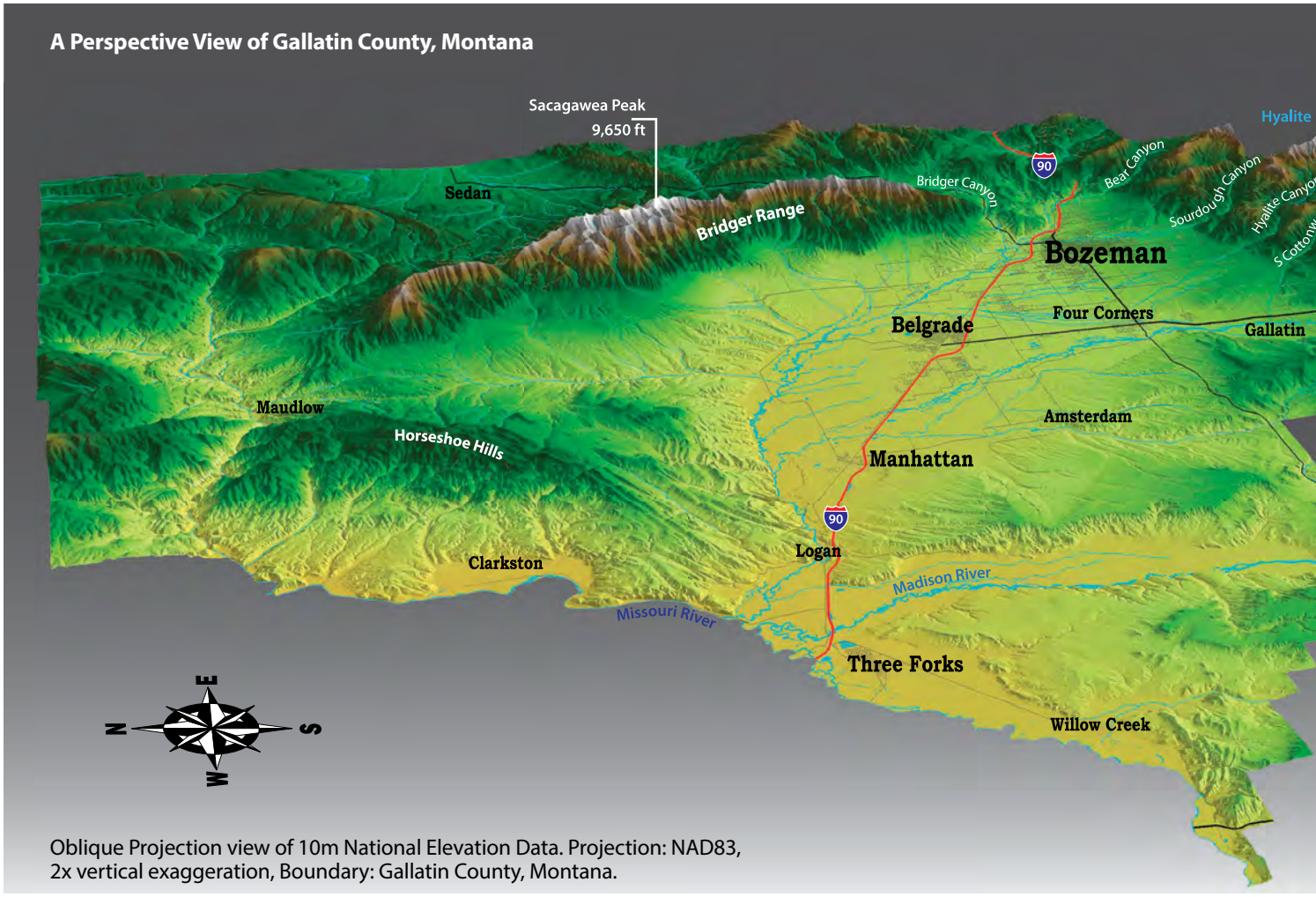
Water on the Landscape

Shaped by water, the Gallatin Valley spans more than one million acres of southwest Montana and is home to more than 400 miles of stream channel. From its origins on the Yellowstone Plateau, the roof of the North American continent, the Gallatin River cascades between the Madison Mountain Range to the west and the Gallatin Range to the east. Descending in a torrent that the Shoshone called "Cut-tuh-o'-gwa" (swift water), the river slices through a canyon rimmed by the fossil remains of a lush tropical valley that existed some fifty million years ago.

At the canyon's mouth, where rushing water still cuts at the canyon floor, the river bursts into a broad valley before joining the Jefferson and Madison Rivers to form the headwaters of the mighty Missouri River and flowing out of northwestern Gallatin County. In an average year, the Gallatin's rivers and streams carry enough water to cover 1,200 square miles, an area the size of Rhode Island, in a foot of water.

Throughout the valley, numerous springs nurture lush vegetation, which in turn sustains vigorous fish and wildlife populations. Abundant wildlife in and along the Gallatin first attracted prehistoric North American people to the region. Later, Blackfeet, Crow, Bannock, Nez Perce, and Shoshone Indians hunted in the valley. In 1806, William Clark and Meriwether Lewis led their Corps of Discovery into the area, and named it for US Secretary of the Treasury Albert Gallatin. In his journal, Clark described:

"a b[ea]utiful navigable stream. Saw a large Gangue of Elk in the plains and Deer in the river bottoms...I saw



Oblique Projection view of 10m National Elevation Data. Projection: NAD83, 2x vertical exaggeration, Boundary: Gallatin County, Montana.

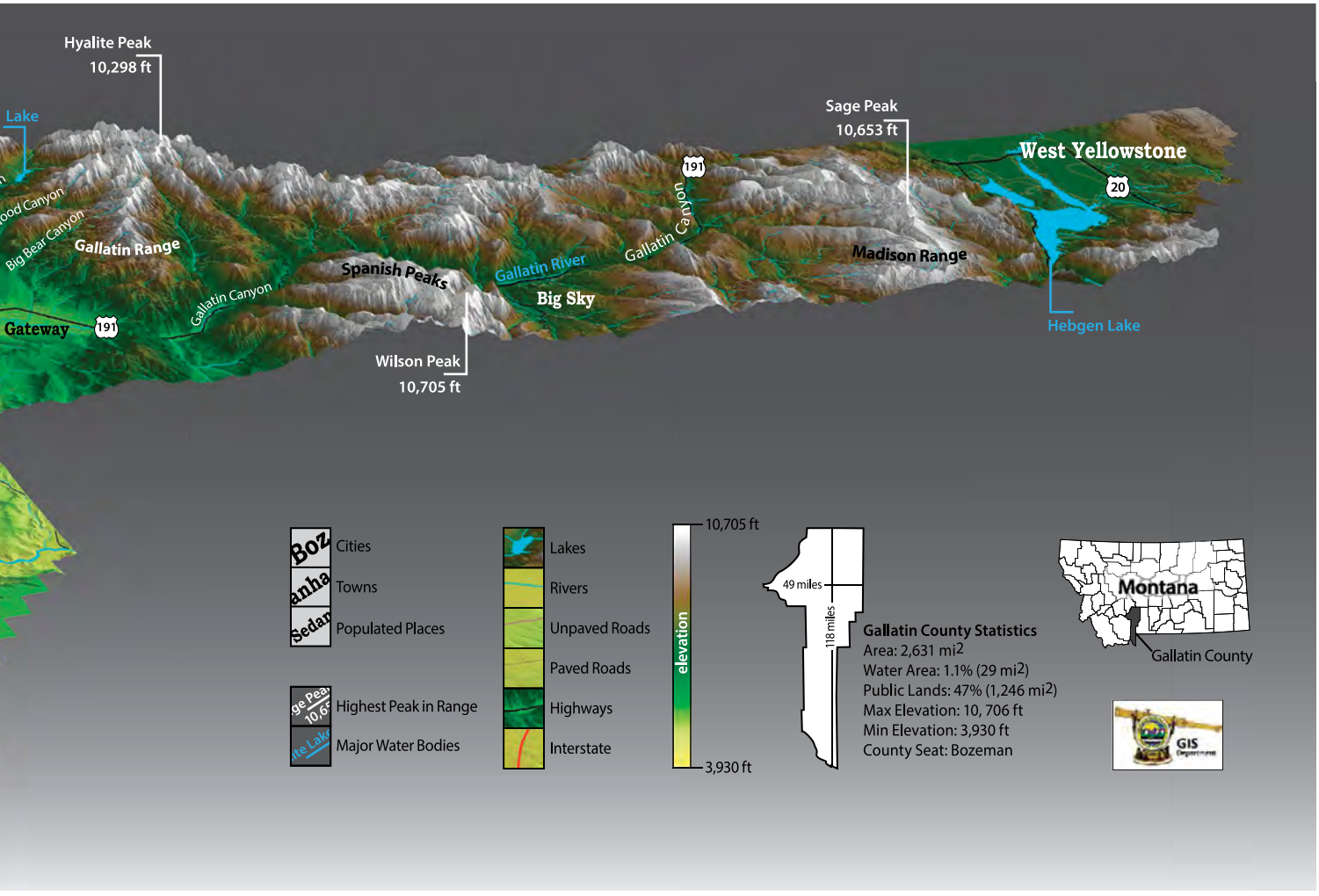
several Antelope, common Deer, wolves, beaver, otter, Eagles, hawks, crows, wild gees, does, etc... emence quantities of beaver... I proceeded on about two miles crossing those different channels all of which were dammed with beaver in such a manner as to render the passage impracticable... being swamped as I may say in this bottom of beaver."

A Resource to Use

Later settlers to the Gallatin Valley had to cope with the challenges of removing the abundance of water described by Clark, and then bring that water to higher fertile ground. The first diversion of water in the valley is credited to the Penwell brothers northeast of Belgrade in 1864. In 1871, in one of the first mutual ditch-building efforts in Montana, settlers of the Middle Creek area formed the Upper Middle Creek Ditch Company. Other for-profit companies entered the water supply arena in the 1880s and 90s, building the Farmers and High Line Canals, which served ranches on both sides of the main stem of the West Gallatin. The last large-scale

Photo: Gallatin County Historical Society

Digging out a portion of the White Canal ditch, June 1920.



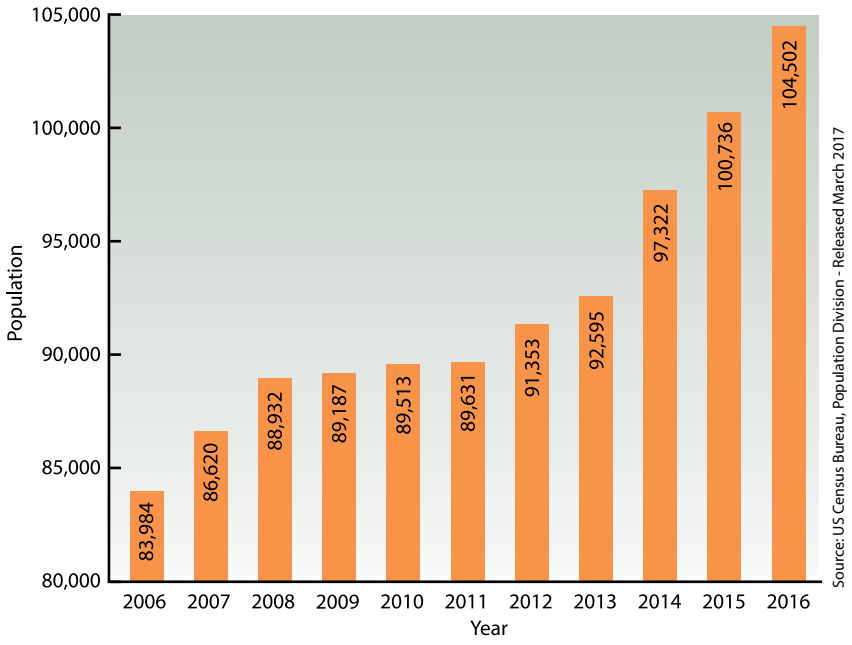
effort to supply agricultural water to the valley was the construction of Hyalite Reservoir, completed in 1950. Today, the West Gallatin River is the source of water for three fourths of the irrigated land in the valley.

The Gallatin River has seen other use in the service of industry. At the turn of the century, tie cutters working out of the Taylor's Fork gathered their logs behind retaining dams. The dams were broken in the spring, floating the logs on a flood of water to mills at Central Park, near Manhattan. This practice was discontinued by 1907. A scheme to dredge mine the West Gallatin from West Fork to the Yellowstone Park boundary failed through lack of investment in 1917. Proposals to dam the Gallatin surfaced periodically beginning in the 1930s. The most serious of these proposals was to dam the river at the mouth of Spanish Creek, but strong opposition from recreational interests in the 1950s finally laid the issue to rest.

Photo: Gallatin County Historical Society

Log drive on the Gallatin River, ca. 1910.

Population Growth in Gallatin County, 2006-2016



Source: US Census Bureau, Population Division - Released March 2017

A Resource to Protect

In 1864, W.W. Alderson described the Gallatin Valley as "one of the most beautiful and picturesque valleys the eye ever beheld, abounding in springs of clear water." Others in the late 1800s echoed these sentiments, calling it "The Egypt," or "The Garden Spot of Montana." These descriptions are still largely fitting. The valley is still fertile, and the water supplying this Eden with its life force is no less appreciated today. Abundant, renewable water from the Gallatin and its tributaries shapes every aspect of our daily lives, whether for farming, ranching, recreation, or household use.

Flowing, dynamic water is a challenging resource to manage. Changes in land use alter the nature and timing of our demands on water resources, and Gallatin County is the 26th fastest growing county in the nation (Source: 2016 U.S. Census). As large tracts of farmland become small residential lots, the watershed faces new challenges. Protection of water resources is critical if we are to maintain the water quality necessary to sustain our growing communities.

Ultimately, the well-being of the Watershed and our ability to rely on it depend on people who live here. As stewards of this resource, we have a responsibility to be informed, become involved, and make the investment of time and energy needed to ensure that our water resources are protected. This Sourcebook will help residents determine where they can make their contributions to sustaining water resources in the Gallatin Watershed.

Enjoying the Special Place We Live In: Recreating in the Gallatin

Outdoor recreation is an essential component of our economy within the Gallatin Watershed. The area provides countless opportunities for people to fish, swim, boat, and otherwise enjoy water resources. Tourism brings more than eleven million visitors to Montana each year, supporting over 50,000 jobs and adding an estimated $3.5 billion to the state's economy. Fly fishing guides, rafting outfitters, innkeepers and sporting goods dealers are just a few of those directly employed in providing recreational services.

Year-round recreational opportunities are plentiful in the Gallatin Watershed. Kayaking, rafting, fishing, climbing, and backpacking are just a few activities enjoyed throughout the calendar year. Winter simply shifts recreational activities uphill to snowshoeing, skiing, and ice climbing. The watershed is a terrific place to encounter wildlife. Photographers, hikers and hunters flock here in search of deer, elk, moose, bears, mountain lions and migratory birds.

Recreating Responsibly

Responsible recreation in and around our waterways requires planning and care. The riparian corridor is a unique environment that can be rejuvenated by yearly flooding, erasing evidence of casual human use. However, Montana's riparian corridors are often confined spaces with high densities of human traffic, particularly in the Gallatin where everyone seems to love being outdoors. Please consider the following when you head out to enjoy the river:

- **Garbage** – If you pack it in, pack it out. See someone else's garbage? Pick it up. Clean up fishing line that can ensnare birds and other animals. In addition to being a fire hazard, cigarette butts contain toxic chemicals that can be consumed by animals or dissolve in water.
- **Dogs** – It's great to share the outdoors with your best friend, but dog ownership means accepting responsibility for ALL of your buddy's actions. Pick up and pack out waste, don't allow your dog to harass wildlife or dig destructively, and hang his food with yours whenever you're in bear country.
- **Human waste** – In the event nature calls and no facilities are available, pack it all out in a sealed plastic bag or make sure you move at least 100 feet away from any water source and bury your waste 6+ inches below the soil. If you choose to bury it, please pack out your TP.
- **Camping and outdoor dining** – Use only designated camping/picnic areas. Leave unspoiled areas looking unspoiled. When it comes to fires, use an existing fire pan or fire ring, and leave a clean pit.
- **Soap and other chemicals** – Don't use soap or chemicals like shampoo in the river or lake. Wash and rinse dishes away from the water's edge, preferably in an established campground. Choose products labeled for use in the wilderness.
- **Aquatic invasive species** – Make sure you know the proper way to inspect any recreation gear you use in multiple water bodies. Zebra and Quagga mussels were detected in Montana in 2016 and extreme care needs to be taken to prevent their spread.
- **Trails** – Stay on existing trails to avoid erosion and damage to streambanks.

Montana's Stream Access Law

In general, the public is allowed recreational access to all river systems in Montana without regard to the ownership of the underlying land (MCA 23-2-300 et seq.). This does not allow travel out of the water onto private land above the high water mark. While everyone is entitled to use waters that cross private lands in Montana, users should first obtain permission from the landowner before accessing private land.

Photo: Leah Bellus

2 The Gallatin Watershed

Contributed by Steve Forest. Updates: Christine Miller, Gallatin Local Water Quality District

What is the Gallatin Watershed?

Chances are that wherever you live in the Gallatin Valley, a stream, river, or irrigation ditch is less than a few hundred feet from your door. This abundance of free-flowing water gives the Gallatin Valley its unique character. A "watershed" includes the land that water flows over or under from its highest points on hilltops and mountains to its lowest points along streams, rivers or lakes. The Gallatin Watershed is composed of the streams, rivers and groundwater (water stored in rock and soil below ground) that flow to the Gallatin River. Nested within the Gallatin Watershed are the smaller watersheds of its tributaries, such as the Taylor Fork Watershed and the Bozeman Creek Watershed. How we take care of the environment and manage our land affects what happens not only in our watershed but also in larger watersheds downstream. We are all part of the watershed community and we each play a role in keeping it free from contamination.

The Gallatin Watershed

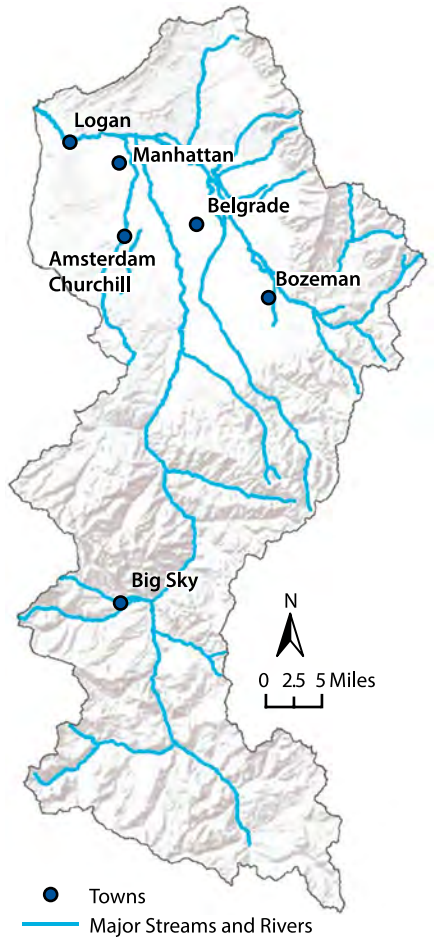


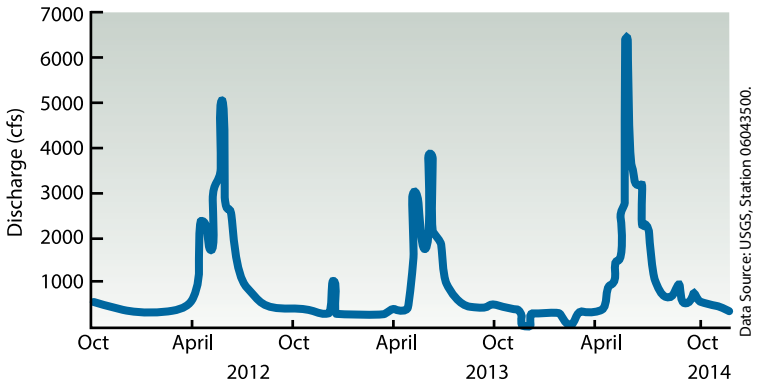
Photo: GLWQD

The East Gallatin River is one of two rivers in the Gallatin Watershed.

Sources of Water

The primary source of water for streams, springs, groundwater and wetlands in the Gallatin Watershed comes in the form of mountain snowpack. The headwaters of the watershed, in the Gallatin and Madison Ranges, receive nearly 400 inches per year of snow on average. This equals approximately 67 inches of rain. In contrast, the lower watershed at Logan may receive fewer than 12 inches of rain per year–a near desert by comparison.

Hydrograph of the Gallatin River near Gallatin Gateway



A "hydrograph" shows changes in annual flows, here for the Gallatin River near Gallatin Gateway. Spring snowmelt drives large peak flows.

A Cross-Section of the Gallatin Watershed Vegetation Types

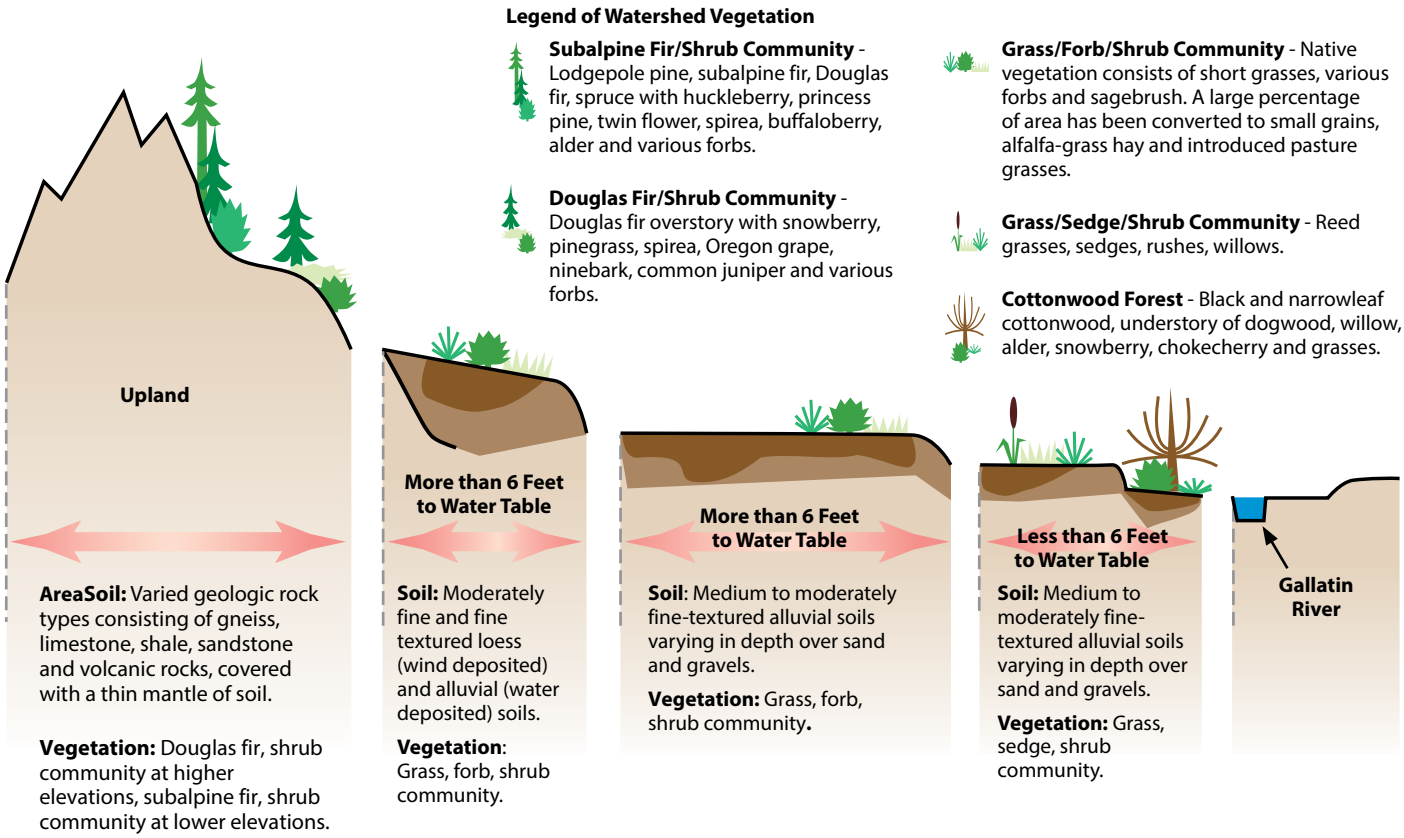


Diagram: Tony Rolfes, NRCS.

Geology and Soils

The main stem of the Gallatin River originates in the Madison and Gallatin Ranges. These mountains are composed primarily of "basement rocks" of gneiss and schist, covered in places by a thin layer of rocks formed from the sediments that sank to the bottom of an ancient shallow sea that covered Montana from 570 to 65 million years ago. The East Gallatin River originates in the Bridger Range, which is also composed of basement rocks overlain by younger sedimentary formations. Where the streams leave the mountains, the valley widens into a large basin filled with sediments, in places more than 6,000 feet deep, such as east of Bozeman Hot Springs. These sediments, laid down during the Tertiary period (from 65 to 2.6 million years ago), vary in type, but are mostly rocks made from sand and silt. On top of these sediments are up to 150 feet of gravel, sand, silt, and clay washed from streams and rivers, called alluvium. More recent alluvial deposits compose the next and last layer of fill, which covers half of the valley. These deposits extend in large fans from the source streams where they break out of the mountains. The largest fan is at the base of the Gallatin Range south of Bozeman. Other prominent fans extend down from the foothills of the mountains on the west side of the Bridger Range. This recently deposited Quaternary alluvium is mostly composed of pebbles and gravel. Its thickness ranges from 70 feet at Bozeman Hot Springs to 800 feet near Belgrade. The Quaternary alluvium that covers most of the central valley is important, because it is some of the most permeable material in the valley and the most reliable source of groundwater.

Coarse-textured rocks like gneiss, schist, and sandstone typically form gravelly and sandy soils, while sedimentary rocks like shale and limestone form clayey fine-textured soils. Many landslides and earthflows in the watershed are associated with these fine-textured soils, and contribute high amounts of sediment to waterways. In contrast, soils formed from coarse-textured rocks usually allow passage of water at a high rate. Valley soils are usually formed from either fine-textured sediments, wind-blown silt deposits (called loess), or stream alluvial deposits.

Real-time hydrographs for the Gallatin River and the East Gallatin River are available from the USGS National Water Information System at waterdata.usgs.gov/nwis

Hydrology of the Watershed

Peak flows in local streams and rivers usually occur in May and June, as snow melts in the high elevation areas and precipitation falls in the form of rain. Irrigation return flows, or water returning to the river as irrigation water not consumed by evapotranspiration, can cause an increase in fall stream and river flows in the downstream end of the valley, such as in the Gallatin and East Gallatin Rivers near Manhattan and Logan. It is thought that all water exiting the Gallatin Valley does so as surface water near the community of Logan. This is caused by a natural bedrock dam near Logan that crosses the river valley, constricting the aquifer system so that the groundwater is pushed to the surface. More recent research conducted by the Montana Bureau of Mines and Geology indicates that more complicated groundwater flow paths through karst limestone features near Logan may also exist in the area.

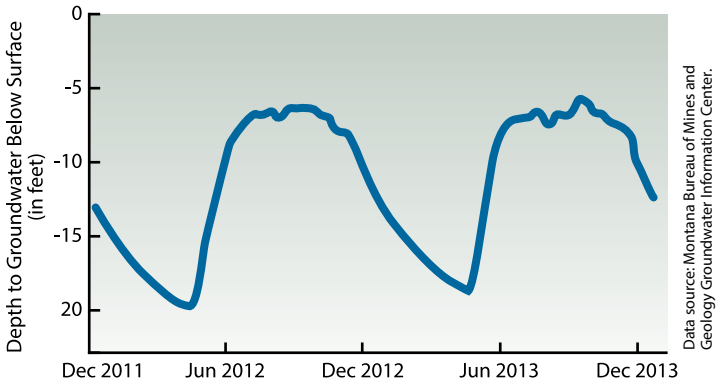
Surface Water

Water held as snowpack in the Bridger, Gallatin and Madison Ranges typically contributes to peak flows in lower watershed streams and rivers in May and June. A higher percentage of runoff from the Gallatin and Madison Ranges occurs later in the summer compared to runoff from the Bridger Mountains. Because of the combination of deeper snowpack and higher elevations (resulting in slower snowmelt), these streams are more reliable sources for late-summer irrigation.

Groundwater

Groundwater is an important source of water for drinking and irrigation in the Gallatin Watershed. Valley fill deposits from the Quaternary and Tertiary aged geologic deposits described above are the primary aquifers from which most drinking and irrigation water is drawn. Groundwater flow in the valley is generally from the east and southeast to the northwest, where the Gallatin River exits the valley at Logan. Depth to groundwater varies greatly, from a few feet below the ground surface in the central valley to nearly 500 feet in the Camp Creek Hills. Groundwater depth fluctuates seasonally, with the lowest depths usually occurring in late winter. Periods when groundwater recharge occurs coincide with peak flows from surface water and when irrigation water is applied.

Groundwater Depth Variability



Depth to groundwater can vary throughout the season, as well as among different locations. This graph shows groundwater depth variability in a well near Manhattan, MT. In this well (GWIC ID# 226764), groundwater is influenced by seasonal runoff and irrigation recharge.

Irrigation Water

Water used for irrigation is an important part of the hydrologic system in Gallatin County, where nearly 2,000 miles of ditches and canals exist. These ditches and canals convey water across the landscape to places where streams and rivers do not, and are used to irrigate agricultural land. Groundwater depth is greatly influenced by irrigation practices. Flood irrigation and leaky ditches can contribute to higher water tables during the growing season, after spring runoff has occurred. In years when less irrigation water is used, depth to groundwater drops in areas traditionally irrigated.

Photo: Christine Miller

Irrigation water is a major component of the hydrologic system in the Gallatin Watershed.

Groundwater - Surface Water Connection: One Resource

Concept of Baseflow

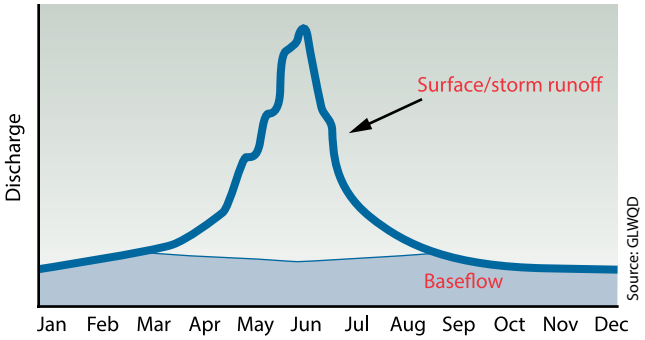
Rainfall and snow melt contribute to surface water flow in streams and rivers within the watershed. Perennial streams (flow year-round), and at times intermittent streams (only flows during certain seasons), also receive flow from discharging groundwater. The groundwater contribution to the surface water flows in streams and rivers is referred to as baseflow.

A hydrograph showing the discharge of surface water in a river or stream can be analyzed to determine the relative contribution of precipitation and snowmelt runoff and groundwater baseflow to the total flow in the river or stream. For a typical river in the western United States, on average, about half of the annual flow is attributed to groundwater baseflow. During dry periods groundwater contributes almost all of the flow to the river.

Locally, sections of the Gallatin River and smaller tributaries generally behave as a "losing river" meaning that water is leaking out of the river bed and recharging groundwater, or as a "gaining river" meaning that groundwater is discharging to the river.

Groundwater pumping near a river can "capture" groundwater that would otherwise discharge to the river as groundwater baseflow. This groundwater capture can result in decreased surface water flows.

Discharge as a Function of Time



The Hyporheic Zone

Near stream channels, there are complex groundwater/surface water interactions and flow patterns. This is due to meanders (bends or turns) in the stream, abrupt changes in stream gradient (slope or angle), and changes in streambed sediments. This transition zone between groundwater and surface water is an ecologically important component of streams and rivers, and is called the hyporheic zone. The width of the hyporheic zone can vary from just a few feet wider than the stream or river channel to more than a mile away! A zone of mixed groundwater and surface water creates a unique environment for microorganisms and macroinvertebrates (aquatic insects). The hyporheic zone provides these organisms with a dry-season refuge if the stream channel dries up, or a wet season refuge if stream flows are extremely fast.

Changing Hydrology

When land historically irrigated by flood or sprinkler irrigation is replaced by urban and suburban development, the potential exists to change the hydrologic landscape. This is because there is a decrease or loss of groundwater recharge from the removal of irrigation on the land, and in most cases the urban and suburban development is accompanied by new groundwater pumping, and an increase in impervious area where precipitation can no longer percolate through the surface to groundwater. The net result of the changes can lead to: 1) declining groundwater levels in previously irrigated areas and 2) potential decreases in surface water flows due to the combined effect of the decrease in irrigation return flows, and the new groundwater pumping.

Surface-water exchange with groundwater in the hyporheic zone is associated with abrupt changes in streambed slope (A) and with stream meanders (B).

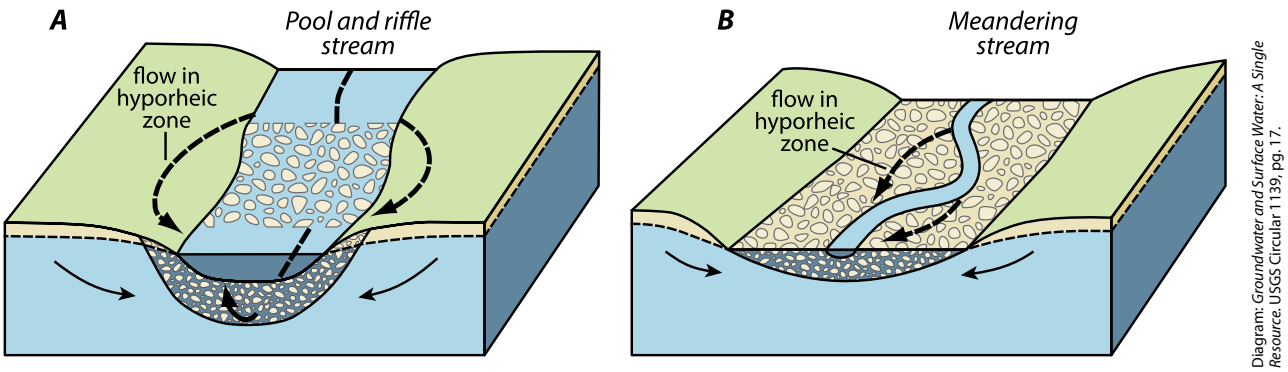


Diagram: *Groundwater and Surface Water: A Single Resource*. USGS Circular 1139, pg. 17.

3 Sensitive Areas in this Special Place

Contributed by Steve Forest. Updates: Peter Brown & Lucas Cain, Gallatin Valley Land Trust

Photo: USDA-NRCS

Healthy riparian areas have a lush growth of vegetation.

Riparian Areas

The surface waters of Montana provide 98 percent of the water used to grow food and feed livestock. Although areas adjacent to rivers and streams make up less than 5 percent of the landscape, they contain 75 percent of our state's plant and animal biodiversity.

A riparian area is the vegetated interface between land and a river or stream.

Healthy riparian areas usually contain a swath of lush growing water-adapted plants. Fully functioning riparian areas are critical in maintaining healthy hydrologic systems. Residents near these areas have the most immediate stewardship responsibility to protect this resource as activities closest to streams are more likely to have immediate effects on water quality. As stewards of the headwaters of the Missouri River system, we have an obligation to pass these waters on "unimpaired" to users downstream.

Activities that might disturb the streambed or the adjacent riparian area require planning as it is likely you will need permits from one or more regulatory agencies to protect these sensitive and important areas. Chapter 13 contains a guide to permitting. If you live in a riparian area, this means that you also live in a floodplain. Gallatin County requires a 300-foot setback from the Gallatin and East Gallatin Rivers, and a 150-foot setback from all other surface waters for residential or commercial construction. Setbacks protect the riparian system from residential, commercial and agricultural activities. It also helps protect the landowner from flooding during spring snowmelt runoff and summer storms.

Benefits of Healthy Streamside Vegetation

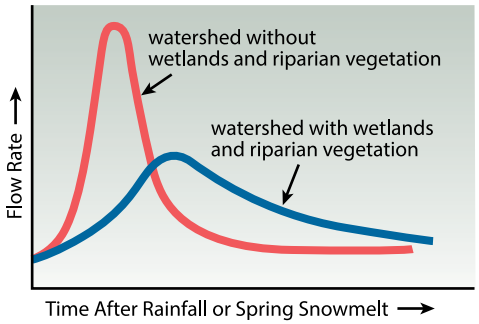
- Nutrient Uptake and Sediment Reduction
- Streambank Stabilization and Erosion Prevention
- Floodwater Velocity Reduction
- Critical Wildlife Habitat
- Recreational and Scenic Values

Any activity that occurs in or near a riparian area (cropping, concentrated livestock grazing, forestry, residential and commercial uses) can have significant negative impacts on water quality. Local agencies distribute informational resources that are designed to help landowners mitigate the effects these activities may have on important streamside resources (see Resources section at the back of this publication).

Wetlands

Wetlands are important components of any watershed and are characterized as land areas that are either seasonally or permanently inundated with water. Wetlands typically act as a sponge–absorbing excess spring runoff and releasing it over time, thereby reducing peak flood flows. They serve an important role in groundwater recharge. Wetlands provide passive water quality treatment benefits to our watershed

Effect of Wetlands on Stream Flow



Source: Dunne and Leopold, Water in Environmental Planning.

Destruction of wetland and riparian vegetation results in poor retention of water, resulting in higher peak flood flows and shorter duration of productive flows.

Photo: Tim Crawford; GVLT conserved property

Why are Wetlands important?

- Flood Attenuation – slow and disperse floodwaters.
- Water Storage – act as a natural reservoir storing water from high flows that are then released during drier times.
- Water Quality Benefits – wetlands filter and clean the water before returning it to nearby streams.
- Wildlife – Numerous Montana animal species utilize wetland habitats throughout their lives.

community, such as trapping sediments, removing nutrients from agricultural and urban runoff, and decomposing solids. Wetlands provide recreation and economic benefits, and opportunities for education as informal laboratories. Wetlands also provide habitat for wildlife and plants, many of which are unique to wetlands. Nearly 60 percent of Montana's threatened and endangered species rely on wetlands to meet all or part of their seasonal needs.

Wetlands have historically been seen as wastelands that offer few tangible benefits and as a result, many acres of wetlands have been filled or drained in the course of human activities. Trends in this thought have been changing; we now realize the immense benefits and ecological services that wetlands provide. Recent research has helped us determine the economic benefit of wetlands. Compared to the cost of man-made systems built to do the same work, the benefits provided by wetlands at no cost can be substantial.

Patterns of human activities in the Gallatin Valley and in Montana as a whole have greatly impacted wetlands and riparian areas.

Functional Ecological Value of Wetlands and Other Ecosystems

Ecosystem Type	Unit Value ($/ha/year)
Estuaries	$22,832
Wetlands	$14,785
Lakes and Rivers	$8,498
Forests	$969
Grasslands	$232

Source: Mitsch & Gosselink (2000)

Since pioneer settlement, approximately one-third of Montana's naturally occurring wetlands have been lost to land use conversion.

Photo: GLWQD

Wetlands provide homes for many species and provide water purification and recreation benefits.

Photo: GLWQD

Filling of wetlands for residential and commercial land use is still occurring.

In 2001, the GLWQD undertook a study to inventory the extent of the remaining wetlands and riparian areas in the Gallatin Valley. The inventory revealed only about 38% of the valley's original wetland and riparian habitat remained in 2001. Additionally, a pattern of human activities that have impacted wetlands and riparian areas emerged:

Contributing factors that have diminished wetlands in the Gallatin Valley – late 1800s until present:

1. **Trapping of beaver and significant reductions in beaver populations.** The result was a decrease in wetlands, ponds and backwater areas.
2. **Agricultural development.** Wetland draining for grazing of wet meadows and clearing of riparian vegetation for increased grazing and hay production has had a negative impact. However, the construction of irrigation ditches and canals has created a significant number of linear riparian and wetland features.
3. **Construction of transportation corridors.** Roads and railroad beds have altered surface water flow patterns by damming surface water on the uphill side and reducing surface and subsurface flow patterns on the downhill side.
4. **Urban and suburban development.** This has generally resulted in a decrease in wetland and riparian habitat due to the intensive land use changes within urban and suburban areas. Urban development associated with the growth of Bozeman appears to have had the largest impact. Much of the land area now occupied by the City of Bozeman may have originally been covered by wetlands that buffered the East Gallatin River and other small streams that flow through town.

Regulation to protect valuable wetland resources has been implemented at the federal level. "Jurisdictional wetlands" (those wetlands that may receive some protection under federal law) have the following characteristics:

- **source of water at or near the surface that occurs with a frequency and duration that supports life in saturated soil conditions;**
- **the presence of distinctive (hydric) soils, which are poorly drained;**
- **the presence of distinctive vegetation (hydrophytes) adapted to wet soils.**

Certain activities affecting jurisdictional wetlands are regulated by federal, state and local governments. Section 404 of the federal Clean Water Act gives the Army Corps of Engineers authority to issue a permit for discharging dredge or fill material into wetlands or for draining wetlands. Most activities involving wetland disturbance require a permit, although some farming, ranching and logging activities less than three acres may be exempt under nationwide permits. Regardless of project size; if you are contemplating activities that may affect a wetland or are unsure whether a wetland is involved, first contact NRCS or another professional trained in wetland regulation for further information. Gallatin County regulations prohibit subdivision within wetlands without prior Corps approval. "Swampbuster" provisions of the 1985 Food Security Act may also involve penalties when wetlands are altered to produce a commodity crop.

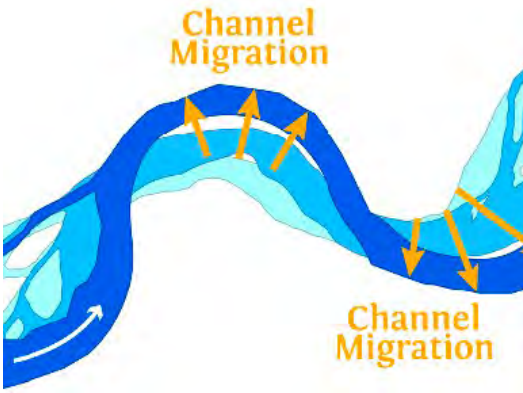
Floodplains

In the Gallatin, where few dams exist to alter natural flows, spring runoff typically results in flooding of valley streams and rivers. Flooding occurs regularly in the Bozeman area. Along the Gallatin and East Gallatin Rivers, floods occur nearly every year in some areas.

The floodplain is the low-lying area adjacent to a stream or river where water spreads out when it leaves its banks.

Floodplain soils are often poorly drained, due to the nearness of the groundwater table to the surface. Floodplains result from the continuous process of depositions of material and later cutting away of the surface material over time by the meandering action of rivers. The floodplain may not be much wider than the rivers channel where banks are steep. It may extend for many hundreds of feet from the channel in low-lying areas. Due to deposited sediments and a high water table, floodplains contain high diversity of plants and animals.

Flooding is a natural process. Floodplains dissipate the energy of spring torrents, reducing flood damage downstream and providing recharge areas for adjacent streams. However, runoff from a watershed can be greatly influenced by the kinds of plants and soils in the watershed. Vegetated stream banks reduce the likelihood of flooding.



What is a 100-Year Flood?

A 100-year flood is one that can be expected to occur once every 199 years (1% of the time), based on watershed records. However, just because a 100-year flood occurred last year does not mean that another 100-year flood couldn't occur next year. The likelihood is related to the magnitude of the flood, not the time that has passed between the 100-year flood events. The 100 year floodplain is the area that will be occupied by water when a 100 year flood occurs. Are you confident that your home site location has not flooded in the past 200 years?

Photos: Scott Gillilan

Where streamside activities remove vegetation, flood events occur more often and with greater severity. Healthy floodplains are those where the activities occurring within the floodplain are benefited by or can adapt to occasional flooding, such as agriculture, recreation, and wildlife uses.

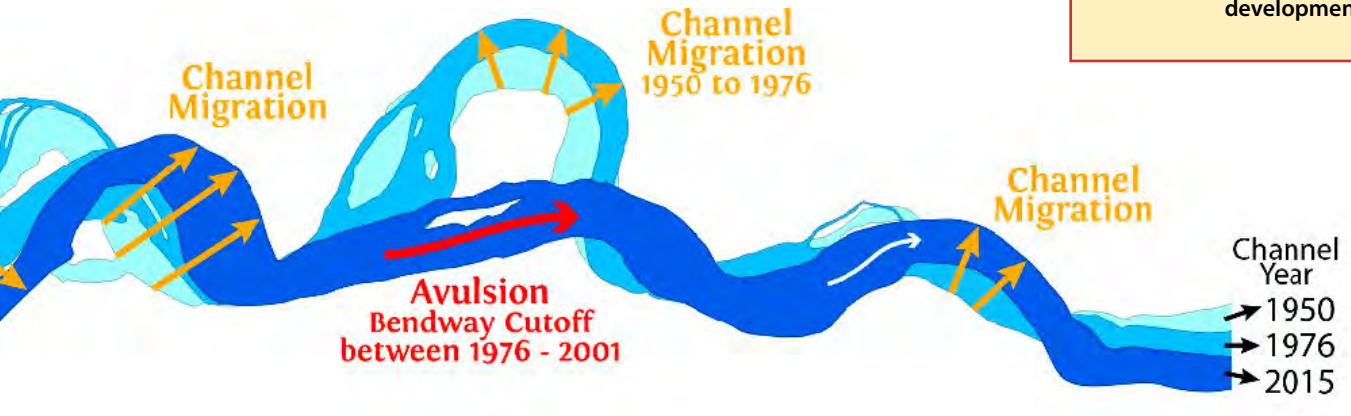
Floodplain management involves reducing the risk of damage to property from flooding, as well as maintaining the natural functions that floodplains provide. To this end, federal, state and local governments regulate certain activities that occur in floodplains. The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP). NFIP is the only source of flood insurance in the country.

Floodplain mapping software has improved greatly in recent years and is now available to the public from both the City of Bozeman, as well as from Gallatin County. The jurisdictional mapping software depicts floodplain boundaries based on the FEMA Floodplain Insurance Studies. Channel Migration Zone (CMZ) mapping is a science-based tool formulated on the understanding that rivers are dynamic, moving laterally across their floodplains through time. This tool can be used to help the public, landowners, and decision makers develop an understanding of river dynamics, along with the inherent risks and benefits associated with those processes. A set of maps from the CMZ study for the West Gallatin and East Gallatin Rivers have been given to the Gallatin Conservation District as a reference tool.

W A R N I N G :

Your home was not built to be a boat.

If you are considering purchasing property, building a structure, or altering the landscape in any way near a stream or river you should contact the Gallatin County or City of Bozeman Floodplain Administrators as there are restrictions on floodplain and floodway development.



Source: Boyd and Thatcher. East Gallatin River Channel Migration Mapping (2017).

4 Plumbing the Gallatin: Water Supply and Distribution

Contributed by Scott Compton, Kerri Strasheim. Updates: Nikki Sandve, Department of Natural Resources and Conservation

The Gallatin's landscape is a product not only of its great natural streams and springs, but also a result of the intricate network of water diverted, pumped and channeled around the valley. The "engineered watershed" helps to determine where people can live and which land is most productive and has affected the aquifer levels.

Water Supply Overview

Overall, water supplies in the Gallatin Watershed are good—providing enough water to meet the needs of the residents. Large quantities of groundwater exist in the central valley, although some foothills areas have experienced declines in groundwater levels at times. Land use changes and conversions from flood to sprinkler have changed the "engineered watershed" by lessening the aquifer recharge from flood irrigation and ditch seepage. Drought, increased demand, and climate changes will also affect the timing of seasonal water level changes. Late season surface water flows will be affected the most, with groundwater levels in sensitive areas in the valley also showing some effect. Depending on weather and climate changes in the coming years, this trend may be variable.

Water supply depends on the yearly snowpack and rainfall. Low water years may cause surface water rights to be cut off sooner than usual and affect some crop production. On the other hand, Hyalite Reservoir is one of DNRC's most consistent water supplies in the state.

While supplies of water are physically available in the Gallatin, new water rights for surface water or large groundwater uses are not legally available. The Gallatin is one of several rivers in the upper Missouri Basin closed to new withdrawals (see Chapter 5).

Public and Domestic Water Supply

Towns in the Gallatin Watershed receive their supply of water from different systems. The largest system supplying water for household and commercial use in the Gallatin Watershed is the City of Bozeman. Bozeman draws water from three sources: Sourdough Creek, Hyalite Creek (and Hyalite Reservoir), and Lyman Creek. This system supplies around 45,250 full-time residents (2016) and 10,000 to 15,000 transient residents (commuters, visitors, etc.) (2008).

Photo: GLWQD

Domestic wells are the drinking water source for many residents in the watershed.

Belgrade's water is supplied by groundwater from six wells. Manhattan, by comparison, receives its supply through both wells and a spring. Big Sky, which isn't incorporated, is run as a county water and sewer district. The water is supplied by multiple wells.

In addition to the towns within the watershed, there are over 160 "community" water systems (from a small trailer court to Rae Water and Sewer District) that supply domestic water. All of these systems are supplied by groundwater.

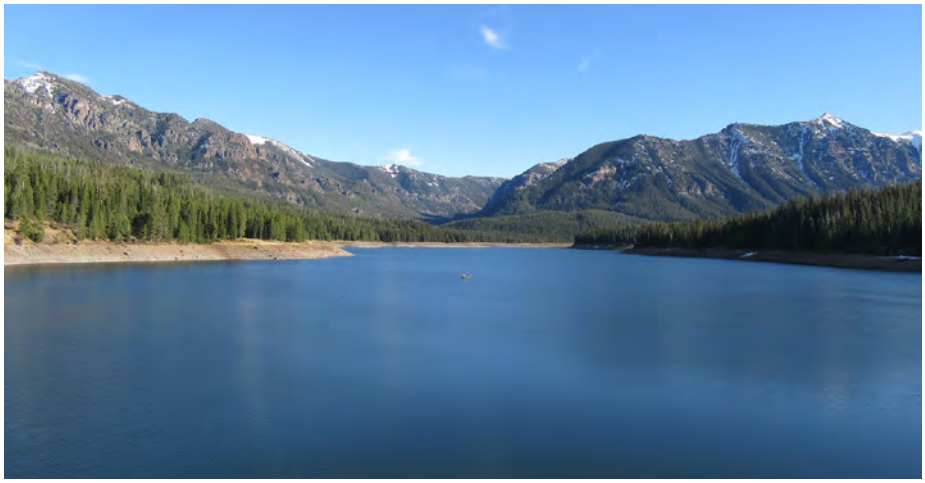


Photo: Leah Bellus

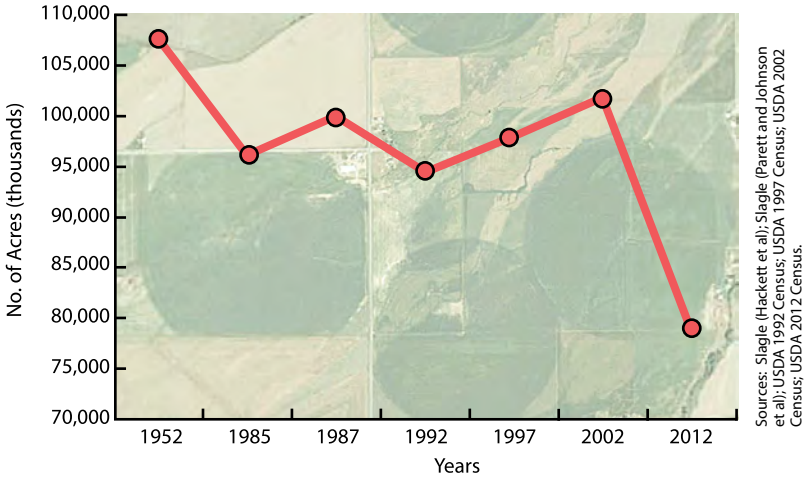
The water from Hyalite Creek flows into Hyalite Reservoir, where it is stored for current and future use. Hyalite Reservoir is one of the three sources serving City of Bozeman's drinking water supply.

Irrigation Water Supply

Many canals and ditches crisscross the valley, delivering water for irrigation. Most of the water taken from the main stem of the Gallatin is diverted between the mouth of the canyon and Four Corners. These diversions have water rights that essentially capture the entire flow of the river until return flows recharge the lower Gallatin below Four Corners. However, cooperation between the court-appointed Water Commissioner and irrigators (represented by Association of Gallatin Agricultural Irrigators (AGAI)) work in partnership to keep the river from being dewatered, as it was historically. Montana Bureau of Mines & Geology (MBMG) measured losses in ditches and canals in the valley, finding that an average of 1.1 cfs per mile conveyance loss.

In the Gallatin, most canals and ditches are privately owned (through ditch easements) and managed by local irrigators. One exception is the Middle Creek Water Users' Association, a non-profit corporation that manages some storage rights to Hyalite Reservoir, a state-owned project.

Irrigated Acres in Gallatin County 1952-2012



Reservoirs - Water Storage

The largest reservoir in the watershed is Hyalite Reservoir, which stores some 10,100 acre-feet of water. This water storage facility, initially created for agricultural use, is also used for summer recreating as well as providing for the municipal water supply for the City of Bozeman. Most small reservoirs and ponds in the Gallatin have a recreation/fishing aspect to their use. Pond construction for recreation and aesthetic purposes by private landowners is increasing in the Gallatin Valley. Some areas may not be ideal for pond development. If you are considering creating a pond or small reservoir on your property, you can find an electronic copy of "A Guidebook for Montana Ponds: What you Need to Know about Ponds and Alternatives" at montanawatercenter.org/publications.

Water for the Next Century

As the valley's population increases, the question of how to quench its growing thirst looms larger. The continually growing city of Bozeman will reach several milestones in the next few decades, exceeding the existing capacity of its water treatment and distribution infrastructure and, ultimately, the maximum reliable yield of its current water supply.

While groundwater appears to be plentiful in most areas, changes in land use may affect aquifer recharge and water quality. The biggest threat growth may pose to groundwater is the contamination from increased density of individual septic systems and from localized chemical spills.

Major Diversions from the Gallatin River

	Irrigated Acres	Diversion (cfs)
Farmers' Canal	11,000	250
Lowline Canal	9,500	188
Highline Canal	12,000	170
West Gallatin Canal	8,000	150
Moreland Canal	1,600	125
Middle Creek Supply	5,300	122

Source: DNRC

Photo: MT DNRC

Diversion dam on Middle Creek.

5 Water Rights

Contributed by Scott Compton, Kerri Strasheim. Updates: Nikki Sandve, Department of Natural Resources and Conservation

The State of Montana owns all surface, underground, flood, and atmospheric waters within the state for the use of its people (Montana Constitution).

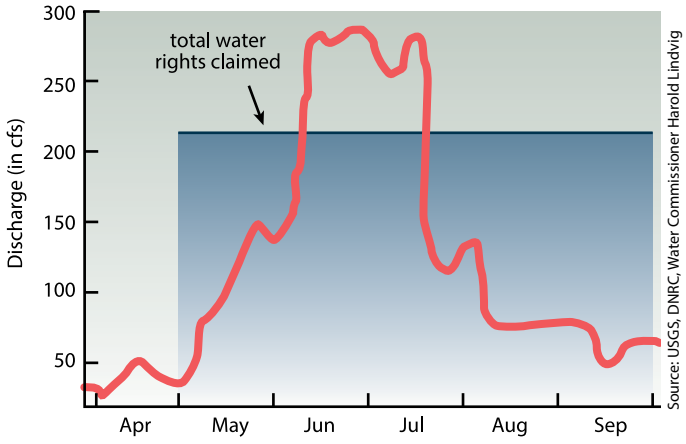
Because all water is state owned, water rights holders do not own the water itself, just the right to use that water within state guidelines.

Borrowing from rules worked out in mining camps, most western states, Montana included, adopted the Doctrine of Prior Appropriation to manage water rights. This doctrine, more commonly known as "first in time, first in right," determines how water in a stream is to be allocated among the water users. The doctrine gives the priority right (or "senior" right) to divert water from a stream or river for a "beneficial use" to the person ("appropriator") who first puts the water to use. This priority system is used to settle disputes that typically arise in low-flow years, when more than one appropriator wishes to use the same limited supply of water.

Water Rights History

In 1973 Montana passed the Water Use Act, which reformed the water rights process. This act grandfathered in all previous historic water appropriations (a Statement of Claim describing the use had to have been filed), created a permitting process for new water rights, adopted a central records system to be managed by the Montana Department of Natural Resources and Conservation (DNRC), and outlined a process to resolve water right disputes. In 1979, the law was amended to create a Water Court to "adjudicate" (finalize) claims for water use in the state. For administrative purposes, the state has been divided into 85 "basins," which reflect the boundaries of the watersheds involved. A temporary preliminary decree was issued for the Gallatin River Watershed (Basin 41H) in 1985. A second decree process is currently in progress and issuance is scheduled for early 2018. Approximately 5,750 claims were originally filed for historical water rights in the Gallatin Watershed.

How Water Rights Work



The total water rights claimed on the upper portion of Hyalite (Middle) Creek (blue box) total about 215 cfs, which exceeds the flow of Hyalite Creek (red line = average flow) most of the year. Junior claimants are typically cut off by early July, when storage water use is initiated. Remaining diversions essentially take the remaining flow for the rest of the irrigating season, resulting in some dewatering.

Acquiring and Transferring Water Rights

A permit from the DNRC is required before diverting, withdrawing, impounding, or distributing groundwater over a certain amount (presently 35 gallons per minute up to 10 acre-feet per year) or any surface water. Groundwater uses for less than these amounts also require filing a form, a simpler process done as a notice of completion filed within 60 days after the water is put to use. Many personal ponds using groundwater are small enough to fit under this limited-volume filing process. Currently, the upper Missouri Basin, including the Gallatin Watershed, is closed to any new withdrawals of surface water for consumptive use (some exceptions exist for high spring flow, storage, municipal, domestic, or livestock use and groundwater). This action was due to surface water being over appropriated.

Changes to some elements of an existing water right are possible following an application process with DNRC. The elements that can be changed are the point of diversion, the place of use, the purpose of use, or the place of storage. When land is sold or exchanged, title to appurtenant existing water rights is passed from the original appropriator to subsequent purchasers of the land benefited by the diverted water, unless severed or reserved in the deed. The DNRC uses

land ownership information from the Department of Revenue to assist with ownership updates for water rights linked to property parcels in the Gallatin.

What if a Ditch Crosses My Property?

Appropriators of water may have easements to convey water across the property of others. If an irrigation ditch crosses your property, the owner of the ditch not only has a right to all of the water flowing in the ditch, but a right to access your property to maintain the ditch. These rights may be formal easements recorded at the courthouse, or they may exist as prescriptive rights acquired by historic use.

Can Water Rights Be Lost?

Water rights can be lost through abandonment if there is: (1) nonuse, and (2) intent to abandon. Once the adjudication process is complete, abandonment can occur if the right is not used according to its terms and conditions for a period of 10 years. Water transfers and water rights not used because the land is in a federal or state set-aside program are not considered abandoned.

Maintaining Instream Flow

We generally think of the water in our streams as linked in one unbroken chain from a spring high in the mountains to the sea. Yet diversions from many of the Gallatin Watershed's streams may reduce flows to a trickle in years when water is scarce. Dewatering is of considerable public concern. We count on maintenance of adequate flows to dilute sediment and contaminated runoff, maintain cool temperatures for fish and other aquatic animals, and provide water for public enjoyment.

In 1969, the Montana legislature authorized the Game and Fish Commission to file for unappropriated rights for some blue-ribbon fishing streams, including the Gallatin River, to maintain stream flows. The legislation that established these so-called "Murphy rights" was repealed in 1973. The 1973 Montana Water Use Act included a new statutory process to create reserved water rights in the state. Claims for reserved rights on the Gallatin River were also made under this new law.

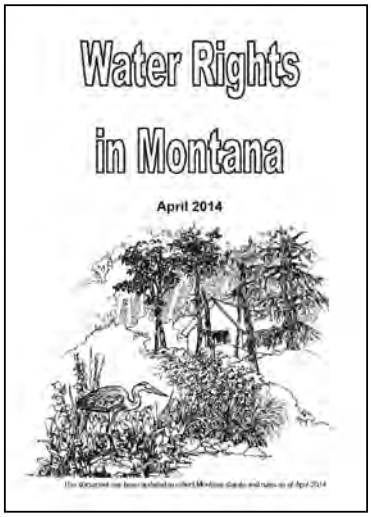
An appropriator may also lease (to Montana Fish, Wildlife & Parks or to another party) or convey an existing water right for an instream flow. Any conversion to an instream use requires a temporary change authorization from DNRC and must benefit fisheries. Also, local agricultural users have an agreement in place to maintain a minimum flow in the Gallatin River – this is voluntary, as they could legally dewater the Gallatin many times over with existing water rights.

Resolving Water Rights Disputes

1. **Talk** is encouraged among users to attempt to resolve the issue.
2. **If** a person is wasting water, using water unlawfully, or preventing water from moving to another person having a prior right to use the water, notify the DNRC (MCA 85-2-114).
3. **If** the water right has been through a decree process, a petition to appoint a water commissioner (MCA 85-5-101) may be filed.
4. **Fifteen** percent of owners of water rights on a stream or owners of fifteen percent of the flow rate of water rights affected may petition the court to appoint a water mediator (MCA 85-5-110).

Photo: USDA-NRCS

The owner of an irrigation ditch has a right to all of the water flowing in the ditch.



Information booklet available from the Montana Department of Natural Resources and Conservation (DNRC): dnrc.mt.gov/divisions/water/water-rights.

6 Water Quality

Contributed by Tammy Swinney. Updates: Torie Haraldson, Gallatin Local Water Quality District

Surface and Groundwater Quality in the Gallatin Watershed

Our common need for a sustainable supply of clean water binds the Gallatin Watershed's communities together.

Our surface water and groundwater are intimately connected – the water you see as you walk the length of any stream or river is constantly being exchanged with an important groundwater aquifer. Because of this close connection, impacts to one can affect the other. Virtually every type of land use in our watershed has some associated impact on the quality of our water resources. Residents of the Gallatin Watershed may rely on surface water or groundwater for drinking and other domestic uses, depending where their home is located.

Surface Water

As residents of a "headwaters" area, we reap the benefits of living upstream of many potential water quality impacts. Overall, surface water quality in the watershed is good. However, more than 300 miles of the Gallatin Watershed's rivers and streams are classified as "impaired" by Montana DEQ. In this legal sense, "impaired" means the stream or river does not fully support one or more "beneficial uses" defined by state water quality statutes (MCA 75-5-300 et seq.), such as agricultural, industrial, aquatic life support, cold water fishery, recreational contact, and drinking water. The beneficial uses of a given stream reach are often those associated with activities reasonably anticipated to be occurring if the reach were unimpaired.

Impairments may be due to single or multiple land uses within the watershed, and are related to surface water quality and/or availability.

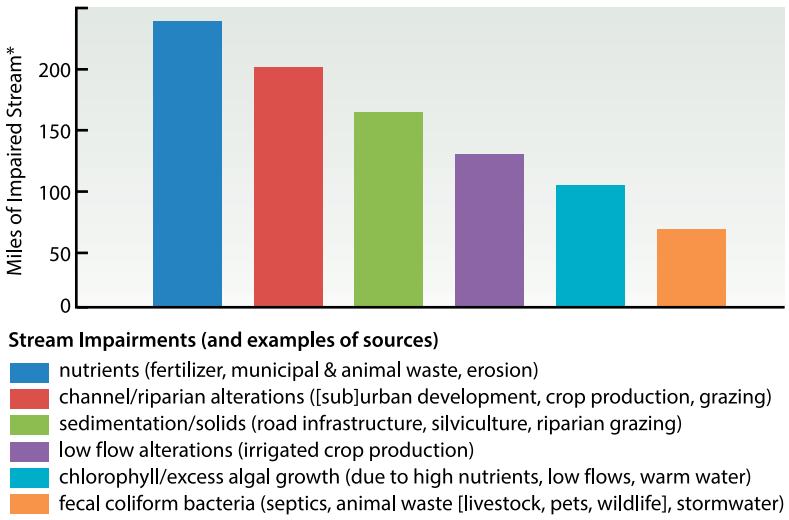
The State of Montana derives its surface water quality assessment framework from the federal Clean Water Act, which serves as the model for Montana's Water Quality Act. Scientists at local and state levels gather data on a variety of metrics of surface water quality, which are analyzed to determine if a stream is supporting any or all of its intended beneficial uses. Both physical contaminant data such as sediment and chemicals (nutrients, metals), and biological indicator data (aquatic insects, algae) are considered when determining the health of a stream.

In an effort to preserve surface water quality, several government entities provide oversight of all activities occurring in or near waterways. It is important for landowners to realize that most projects within these sensitive areas require permits in order to legally proceed, regardless of whether they will occur on private property. Please see the *Permitting and Regulations Guide* chapter for more information.

Groundwater

With the exception of those living within the City of Bozeman, residents of the Gallatin Watershed obtain their drinking water from groundwater. Groundwater quality is evaluated for its safety for domestic use by comparing it to federal and state drinking water standards. There are drinking water standards for microorganisms, disinfectants and disinfection byproducts, inorganic chemicals like arsenic and nitrate, organic chemicals like benzene and vinyl chloride, and radionuclides such as uranium. Municipal and smaller scale

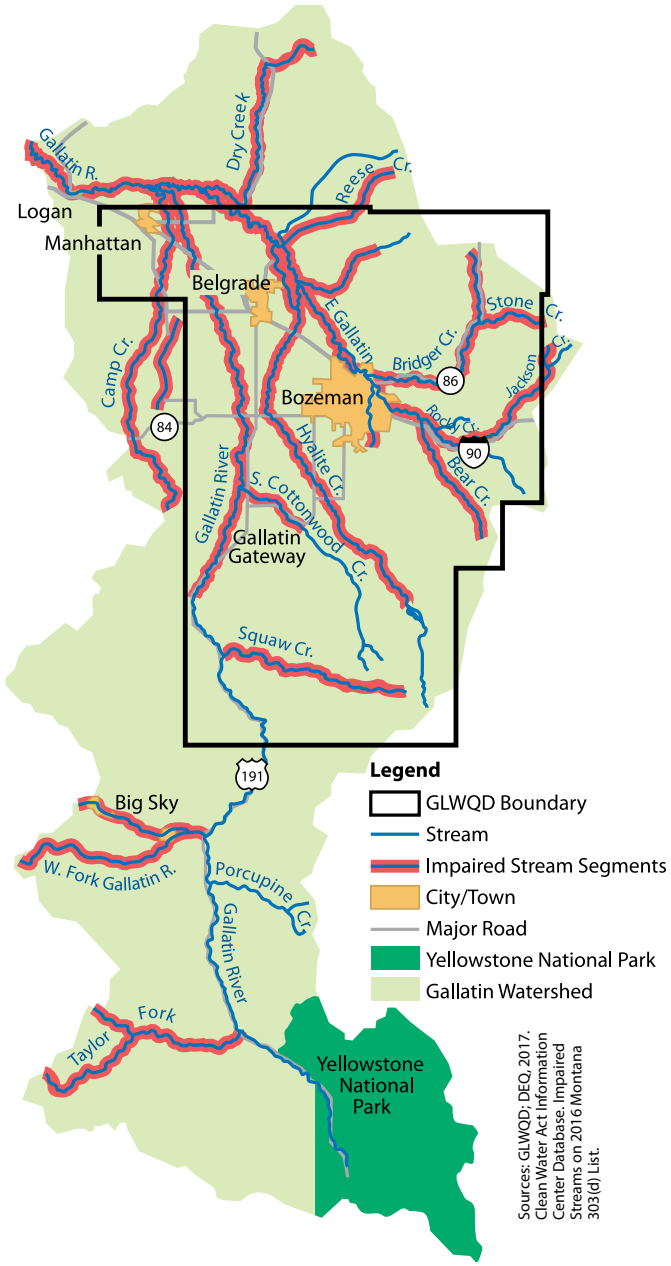
Most Common Stream Impairments in the Gallatin Watershed



*Streams may have more than one impairment.

Data Source: Adapted from DEQ Clean Water Act Information Center, 2016 Water Quality Information. deq.mt.gov/Portals/112/Water/wqpb/CWAIC/Reports/IRs/2016/App_A.pdf accessed 5/30/17. Montana Final 2016 Water Quality Integrated Report, Appendix A.

Impaired Stream Segments in the Gallatin Watershed



community water supply systems are regulated by the Montana Department of Environmental Quality, and undergo regular testing. Those who obtain their drinking water from an individual private well are encouraged to test it annually to ensure its continued safety.

Like surface water, groundwater in Montana is classified based on its beneficial uses. Groundwater beneficial uses include: domestic drinking, culinary and food processing, irrigation, drinking water for livestock and wildlife, commercial and industrial. These beneficial uses are classified into Class I, II, or III according to the Administrative Rules of Montana (ARM 17.30.1006), based upon the specific conductance of ground water. Specific conductance, commonly thought of as hardness, is an indirect measure of the presence of dissolved minerals in the water. Dissolved minerals can affect the taste and odor of water or cause staining of household fixtures and other aesthetic nuisances, but seldom, if ever, warrant treatment and will not adversely affect your health. Groundwater in the Gallatin Watershed typically ranges from low to moderate in hardness and is classified as Class I to Class II, making it "suitable" to "moderately suitable" for all of the beneficial uses.

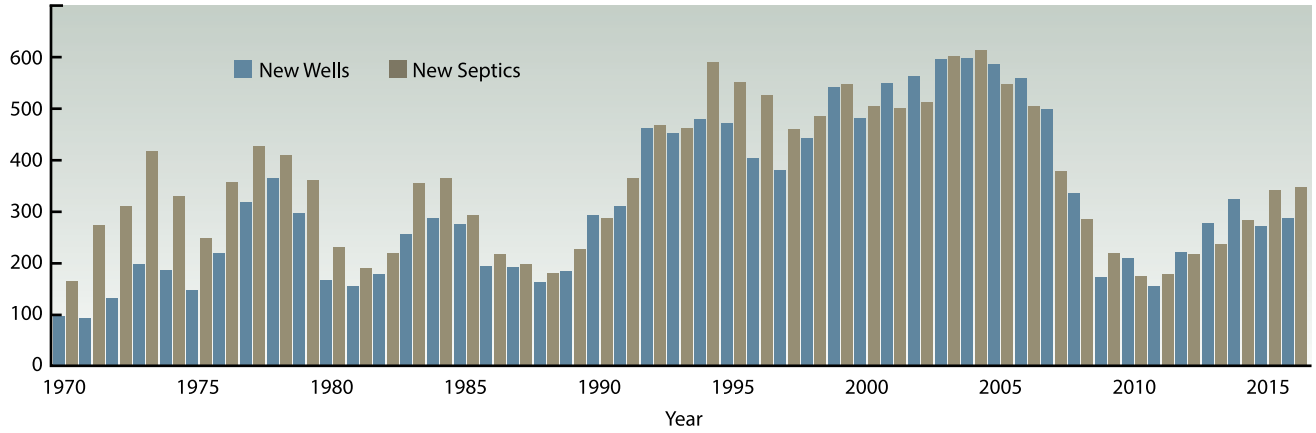
Overall, groundwater quality in the Gallatin Watershed is good and remains relatively free from regional impacts of harmful chemicals or contaminants.

However, like other developed areas, our watershed has its share of threats to groundwater quality. These include leaking underground fuel storage tanks, and state and federal Superfund groundwater contamination sites. Also of concern are the more than 17,000 residential on-site septic systems in use in rural and suburban areas of the watershed. If not maintained diligently, these systems are potential sources of contamination to our groundwater from bacteria, viruses, nitrate, pharmaceuticals, personal care products, and household cleaners, which can adversely affect human health.

Nonpoint Source Pollution: Connecting Land Use with Water Quality

Gallatin County's population continues to grow. With growth and development come numerous and complex challenges to protecting and maintaining good water quality for drinking water, aquatic life and other beneficial uses. One of the most dramatic changes is the rate at which traditional rural farm and ranchlands are being developed for residential, commercial and industrial use. This change in land use is evident in the number of new wells drilled and new septic permits issued in rural areas of the county, as large tracts of land are subdivided into smaller parcels.

New Wells and Approved Septic Permits in Gallatin County, MT



Sources: Montana Bureau of Mines & Geology, Ground-Water Information Center 2017, Gallatin City-County Health Department

Nonpoint source (NPS) pollution originates from many diffuse sources and is difficult to measure directly. It is typically the result of poorly managed land use practices, as rainfall and snowmelt move over and through the ground and pick up pollutants that are carried to surface and groundwater. Agricultural-related runoff was once considered the biggest contributor to NPS pollution within the watershed, but residential stormwater runoff and other urban contributions are quickly becoming major sources.

More Pavement

One of the biggest changes that urban land use has on water quality is the increase in impervious surfaces – various types of pavement that prevent water from infiltrating into the ground. These include parking lots, roads, sidewalks, driveways, rooftops, and even compacted soil. As water moves over these surfaces it picks up contaminants such as oil and grease from vehicles, sediment, and road salt, and transports them to storm drains and outfalls where it enters our waterways. Paved environments also reduce the time it takes for rain and snowmelt to find their way to our waterways, leading to brief periods of greatly increased stream velocities that contribute sediment to the stream through streambank erosion.

Photo: GLWQD

Sediment and other contaminants enter a storm drain during a rain event.

Stormwater Runoff Management

Low impact development (LID) techniques are aimed at reducing frequency and intensity of stormwater runoff. Many of these techniques can be implemented by individual homeowners and land developers. Some common practices include:

- Pervious pavement
- Rain gardens
- Native landscaping
- Soil quality restoration
- Bioswales

Types and Sources of NPS Pollutants

Type	Source
Excess fertilizers, herbicides and insecticides	Residential areas, agricultural lands
Oil, grease, toxic chemicals	Urban and suburban runoff (stormwater runoff)
Sediment	Construction sites, crop and forest lands, eroding stream banks
Bacteria and nutrients	Septic systems, pet and livestock waste
Salt	Winter road salting, irrigation practices
Pharmaceuticals & personal care products	Septic systems, onsite community wastewater facilities

Adapted from: U.S. EPA. epa.gov/nps/types-nonpoint-source. Accessed June 2017.

Pharmaceuticals and Personal Care Products

As the population of the Gallatin Watershed grows, so do the challenges of wastewater disposal. A 2016 report on a study conducted by the Gallatin Local Water Quality District and the Montana Bureau of Mines and Geology commonly found pharmaceuticals and personal care products (PPCPs) in Gallatin County wells. An emerging problem in the United States, PPCPs are entering aquatic environments from wastewater treatment plants and on-site wastewater treatment systems (septic systems). While these treatment systems break down some products, others may persist in the environment. The human health effects of these chemicals are not fully understood, but research has shown they can be detrimental to

aquatic life. For example, endocrine disrupting chemicals (EDCs) are hormones commonly found in a variety of PPCPs. Fish and amphibian populations living in aquatic systems contaminated with EDCs experience dramatic changes to their reproductive organs, even at low levels.

How Can You Help Protect Our Water Resources?

Most human-caused ground and surface water problems can be solved through prevention. Land use and waste disposal best management practices, effective cleanup, and elimination of existing pollution sources are our best strategies. If we all do our part, we can reduce NPS pollution and keep our water resources clean for our use as well as for future generations.

About the Gallatin Local Water Quality District

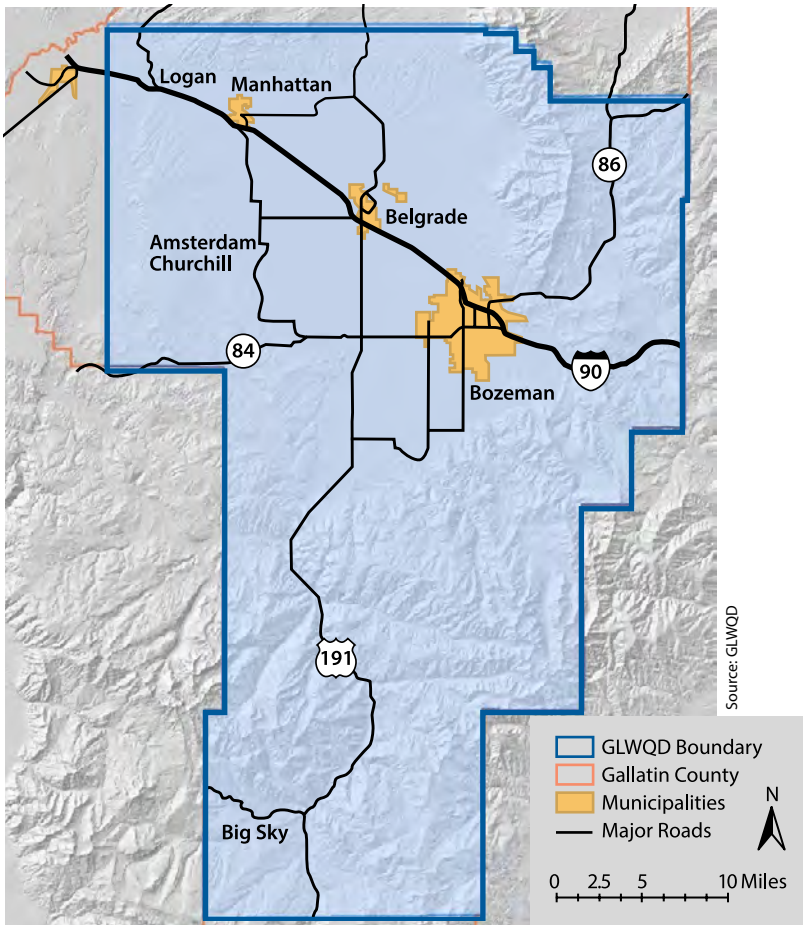
Created by the Gallatin County Commission in 1995 and approved by DEQ in 1997, the Gallatin Local Water Quality District (GLWQD) operates as a non-regulatory department of Gallatin County, located in the north central portion of the Gallatin Watershed. The GLWQD is governed by a nine member Board of Directors and liaisons, and includes representation by the municipalities located within the District.

Establishment and maintenance of a long-term water quality monitoring network is an ongoing project for the GLWQD. Work is conducted to establish baseline data and conduct long-term trend analyses on our water resources. The GLWQD collects, compiles, and disseminates water resource data and information for the benefit of all those interested in water resources within the District. Contact them at (406) 582-3168, or visit glwqd.org.

Land Management Options for Reducing Water Quality Impacts of Nonpoint Source Pollution on Our Water Resources

NPS Problem	Suggested Best Land-Use Practice
Bacteria & Nutrients (fertilizers, herbicides, pesticides, yard waste, animal & pet waste, septic systems)	Fertilizers, Pesticides, Herbicides: • Reduce the amount used. • Follow proper application instructions. • Don't use prior to a rain event. Yard, Animal & Pet Waste: • Clean up after your pet. • Manage animal waste by keeping it away from wellheads and surface water. • Leave grass clippings and leaf litter on your lawn to provide soil nutrients. • Don't rake excess yard waste into the street until shortly before your municipality is scheduled to pick it up. Septic Systems: • Have your system pumped on a regular basis. • Have your system inspected periodically. • Don't drive or plant trees on top of your drainfield.
Stormwater Runoff (oil, grease, salt, sediment, increased stream velocities)	• Properly maintain your vehicle. • Never pour anything down storm drains. • Plant native plants in bare soil and landscape areas. • Replace impervious surfaces with pavers or stepping stones where possible. • Limit use of salt or sand on streets and sidewalks.
Pharmaceuticals & Personal Care Products	• Dispose of unused medications at official drop-off sites, not in the toilet. • Use the smallest amount needed of products like shampoo, laundry soap, and mouthwash.

Gallatin Local Water Quality District Boundary



7 Your Septic System

Contributed by Lori Christenson, Gallatin County Environmental Health Services

Septic systems are wastewater treatment systems that collect, treat and disperse wastewater created by a home or business. Septic systems are designed to break down and neutralize wastewater contaminants before they enter groundwater or surface water. Contaminants in the wastewater include harmful bacteria that can cause illness, as well as nitrogen and phosphorus that can stimulate algae growth in water bodies.

A properly designed, installed and maintained septic system is an essential link in maintaining water quality and protecting public health in the Gallatin Watershed.

How Your System Works

The typical septic system consists of:

1. A septic tank, which separates, stores and begins to treat solid wastes
2. A distribution system, which is generally a series of perforated drainpipes
3. A drain field, or soil absorption system

The septic tank holds the wastewater long enough to allow solids to settle out and the fats, oils, and grease to float to the top. Effluent flows out to the drainfield for further treatment in the soil.

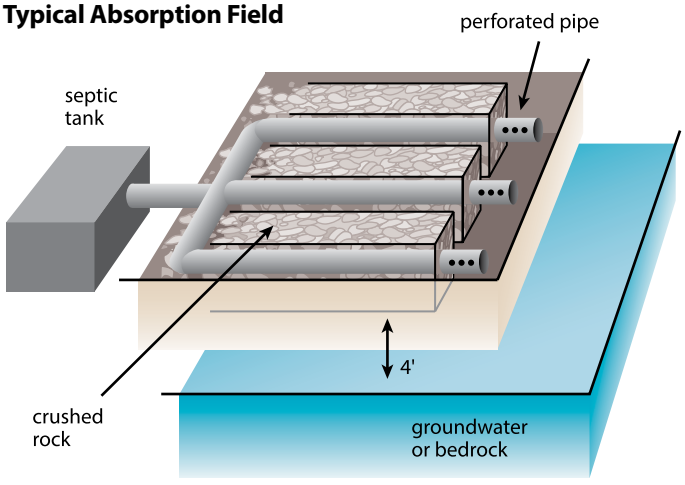
Siting Septic Systems/ Permitting

Because of its dependence on natural filtering and treatment, soil is the most important part of a septic system. Chemical processes and naturally occurring microbes in soil break down contaminants, while pathogens eventually perish in the inhospitable soil environment. If soils are too wet (hydric soils), oxygen is not available for organisms that break down waste. Gravelly soils allow water to pass through to surface or groundwater too quickly, before breakdown of contaminants is complete. Clay soils may delay the rate at which water is filtered. In combination with household chemicals like salts from water softeners, these soils can cause a system to fail.

The Gallatin Watershed has many areas of both hydric and gravelly soils, meaning that septic system design is not a "one size fits all' proposition. The design of a system is based on soil and site characteristics, including depth to groundwater and the size of the home. Depending on where you live, soil and site characteristics may determine that a more sophisticated septic system is required. The design and sizing of any septic system in Gallatin County requires approval of the County Sanitarian. Septic systems are inspected to insure that they are properly installed. State and county regulations require that all soil drainfields be located at least 100 feet from the 100-year flood plain and 100 feet from any surface water, as well as being located at least 100 feet from any existing well or spring.

Applications for state subdivision review and new local permits must also provide documentation to demonstrate that high quality state surface and groundwater will not be degraded by the proposed development. Nondegradation rules define limitations for the amount of pollutants from wastewater systems, specifically nitrate and phosphorous, that could potentially enter nearby surface and groundwater. The movement and pollutant load of wastewater after it enters the ground is evaluated by developing a predicted 'mixing zone' for the drainfield site. A mixing zone begins as the area under the drainfield receiving wastewater. Over time, depending on the groundwater gradient or slope of the site, the mixing zone plumes through the soil deeper and away from the drainfield land in the direction of groundwater flow. The purpose of these rules is

Typical Absorption Field



to determine if the site is suitable to receive the pollutant load from the wastewater without exceeding state limitations and negatively impacting water supplies. Mixing zones are also prohibited within 100 feet of any nearby wells. Once approved, the nondegradation analysis requires developers, building contractors, and registered septic installers to follow strict adherence to the approved location and size of the wastewater system.

Photo: Tammy Swinney

Installation of a septic system.

Common Causes of Septic System Failure

While many things can interfere with the operation of your septic system, by far the most important step you can take to prevent problems is to properly maintain your system. Your system requires two things to operate efficiently:

Proper bacterial action - the system is designed to accept normal household waste that contains the organisms necessary to promote digestion. Bacteria-killing products, like paint thinner, chemical drain cleaners, some water softening salts, paints, oils, acids and pesticides will destroy or impact the ability of your septic system to break down household waste.

Knowing When to Pump Your Tank

If you are unsure whether you need to pump, locate your access or inspection ports and determine the following:

- Scum is less than 3 inches from the bottom of the baffle or top of outlet tee.
- Sludge is less than 12 inches from the bottom of the outlet tee.
- If the sludge and scum together take up more than half of the tank.

Periodic pumping - sludge is the buildup of solid material that cannot be further broken down by bacterial action and must be pumped out every so often. Failure to pump the system allows solids to overflow and clog the drainfield. This not only can force a costly replacement of the system but may also result in sewage surfacing on the ground. While the frequency of pumping depends on the use of the system, the frequency of garbage disposal use, and the number of people using the system, generally a standard tank of 1,000 gallon capacity used by a family of four people should be pumped about every three years. Additives should not be added to your system to dissolve sludge. Several commercial septic pumping businesses operate in Gallatin County.

Septic system failure can also result from:

- Overloading. Avoid putting too much water into the system at one time; wash clothes at off-peak times, for example, rather than when the shower or sinks are being used.
- Adding decay-resistant materials into the system. Grease, sanitary napkins and other solids will fill the tank faster than expected.
- Tree roots. Roots can clog or destroy the absorption system.
- Compacting soil over the drainfield. Driving vehicles over the drainfield should be avoided.
- Age of the system. Septic systems are designed for an operational life of 20 to 30 years. If you have an aging system, it may be time to inspect and replace your system.

Periodic Cleaning of Filter

Your septic tank may also have a cylinder shaped filter that is placed in the septic tank outlet tee. As wastewater leaves the tank this filter collects small solids that have not settled to the bottom of the tank, protecting the drainfield trench and soil from receiving solids that may buildup and plug the soil over time. The filter requires cleaning, generally twice a year is recommended, and can be performed by the homeowner or a wastewater professional. Since July 2001, septic permits in Gallatin County have required filters and access ports over the outlet pipe for this maintenance.

Signs Your Septic System May Be Failing

- Sewerage backup in drains or toilets
- Sluggish drains
- Mushy ground or greener grass around septic system
- Outdoor odors
- Nitrates or bacteria in your drinking water
- Algae blooms in ponds adjacent to your home

8 Protecting Your Well from Contamination

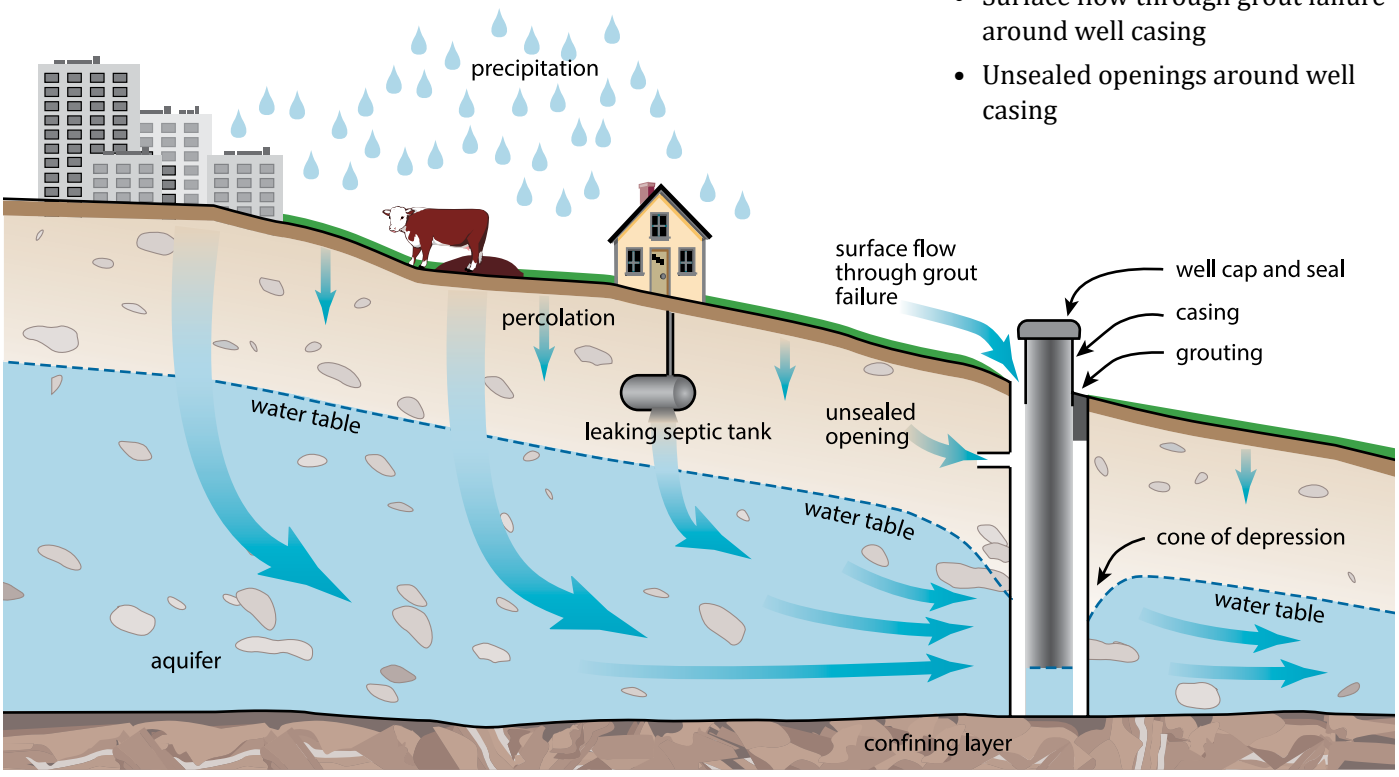
Contributed by Tammy Swinney. Updates: Christine Miller, Gallatin Local Water Quality District

Your drinking water resource is precious. In 1996, about 51 percent of Gallatin County's population relied on groundwater as a source of drinking water. The other 49 percent obtained drinking water from surface water sources. By 2006, that percentage had changed to 43% surface water and 57% groundwater. Based on 2015 population estimates, these proportions of surface water and groundwater users stayed the same, although the population of Gallatin County has increased. With more than half of the Gallatin Watershed's population relying on groundwater as their sole source of drinking water, it is important that we keep it clean. Groundwater, like surface water, can be contaminated by naturally occurring chemicals and metals; discharges of human-derived industrial, household or agricultural chemicals; nutrients such as nitrogen (nitrate) and microorganisms (bacteria, viruses) from animal waste or septic systems; and fertilizers, pesticides and other household hazardous chemicals.

Sources of Drinking Water

Well contamination can happen in two ways: (1) percolation (or infiltration) of contaminants through the soil from the land surface near the well casing, and (2) contaminants can enter groundwater directly through unsealed pipes, or poorly constructed or improperly abandoned wells. So, the key to protecting your drinking water well from contamination is prevention. Trying to clean up groundwater after it has become contaminated is costly and extremely difficult.

Well Contamination Sources



Well Contamination Sources Include:

- Fluid leaks from vehicles and equipment
- Improper disposal of waste oil and antifreeze through storm drains
- Surface spills of household hazardous chemicals (oil, antifreeze, etc.)
- Disposal of household hazardous wastes or chemicals down the drain and through the septic system
- Improper use and application of agricultural or household fertilizers, pesticides, or herbicides
- Manure piles or feed lots
- Leaking or failing septic tanks
- Human waste disposal through unpermitted or obsolete treatment systems
- Surface flow through grout failure around well casing
- Unsealed openings around well casing

Wellhead Protection: A Proactive Approach

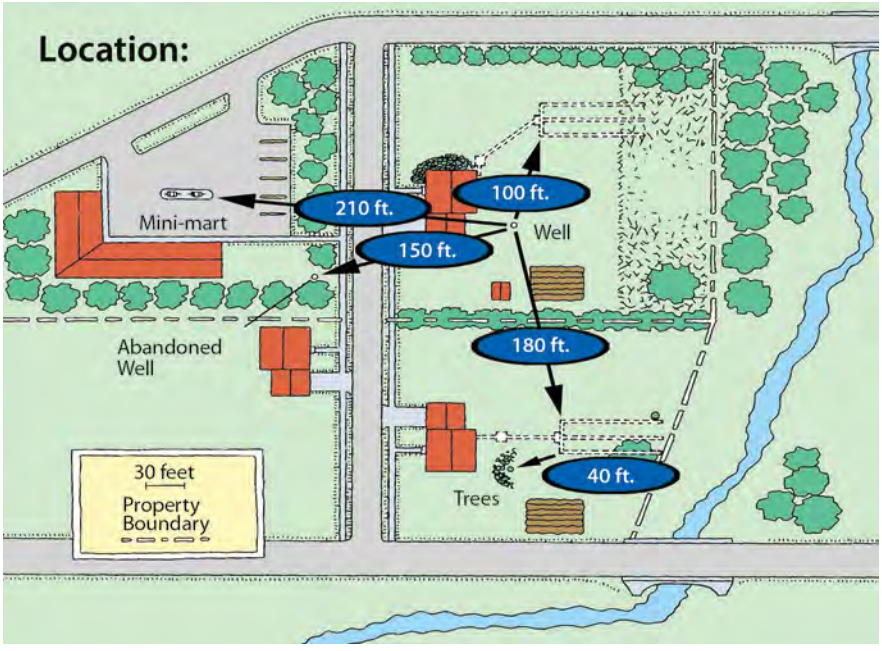
Wellhead protection (also known as source water protection) is a fundamental strategy for protecting your groundwater resource. Wellhead protection means keeping potential sources of pollution away from your drinking water supply. The rule of thumb is: any substance or material you don't want in your drinking water should be kept away from all wells. This is done by identifying the proper site for new well construction, using common sense when managing land uses near your well, properly maintaining your well and septic system, and eliminating the potential for hazardous chemical discharges in the vicinity of your well by minimizing chemical use and eliminating chemical storage near your well.

New Well Site Selection Criteria

If you are planning to drill a new well, proper site selection is very important in protecting your drinking water source. The following factors should be considered:

- Montana law requires that wells be located at least 100 feet upgradient from any septic drainfield, including your neighbors'.
- If your lot is less than 20 acres there is likely a Certificate of Subdivision Approval (COSA) that has a pre-approved, designated location for the well and septic system. In this case, the well must be drilled in the proper location in order to meet state and local regulations. The COSA for the lot can be found at the Gallatin County Clerk and Recorder's office or Environmental Health Department.
- If your lot does not have this document and it is not required, you should obtain local septic permit approval prior to drilling your well to make sure that the well meets all the regulations and you don't have to redrill.
- Avoid placing your well downhill (downgradient) or within 100 feet from a livestock pen or barnyard, fuel tank or storage area for hazardous chemicals or within 500 feet of any liquid or solid waste structures associated with animal feeding operations. If you plan to board livestock (horses, cattle, sheep, etc.), locate the barn and corral at least 100 feet downgradient from your well.
- Shallow wells (60 feet or less) are more likely to be affected by contaminants than deeper wells. Generally, the deeper the well is, the less susceptible it will be to contamination if properly constructed and maintained.
- Wells must also be located a minimum of 100 feet from surface waters. It is also recommended that this 100 foot setback be applied near irrigation canals.

Remember, the greater the distance you can put between your well and potential contamination, the better. The GLWQD, DNRC, local well drillers or groundwater professionals can assist you with identifying an appropriate well site.



Graphic: DNRC

Do a site survey to identify any potential contaminant sources to your well.

Constructing Your Well

Employ a Montana licensed well driller. Consult with DNRC on current well construction standards and ensure that proper compliance with those standards is maintained during well drilling. The following factors should be considered:

- Well casing should extend at least 18 inches above the natural ground surface or at least 2 feet above the maximum 100-year flood level, whichever is greater.
- Wells should be fitted with a sanitary well cap upon completion (see photo at right).
- Wells should be properly grouted to provide a layer of protection from land surface contamination.
- Wells designed to withdraw more than 35 gallons/minute, or greater than 10 acre-feet of water per year, require a water right permit from DNRC before construction. Consult with the DNRC regarding any potential water right permits you may need before you drill.
- File a Notice of Completion with the DNRC once your well has been completed and put to use. It is required by law.

Sanitary Well Cap

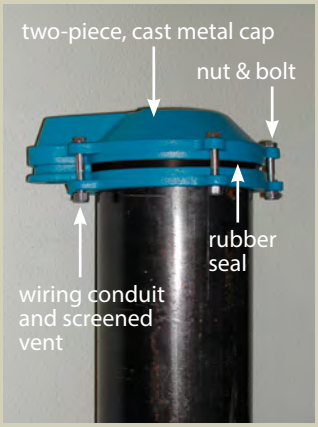


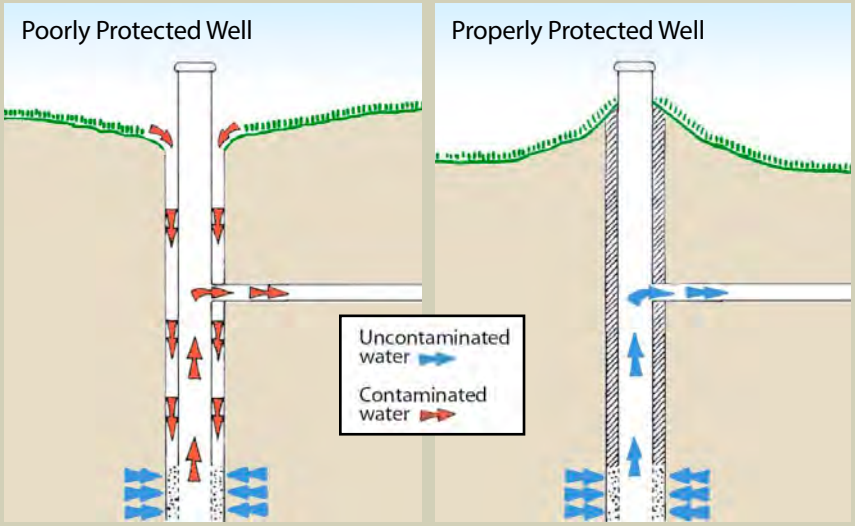
Photo: GLWQD

Non-Sanitary Well Cap

Photo: GLWQD

The land use and waste disposal practices near your well can have a profound effect on your water quality. If you have an existing well, options for protecting your water may be limited to controlling potential contamination sources nearby.

Well Casing



Graphic: DNRC

Photo: GLWQD

Drilling a domestic well.

Maintaining Your Well

- Test your water annually for bacteria, nitrate and other constituents of concern. If you live west of the West Gallatin River or in Big Sky, West Yellowstone, or Three Forks, you should also test for arsenic once every 3-5 years. Also test if there is a change in your water's taste, odor, or appearance; the well system is serviced; or after a flooding event.
- Annually, visually inspect the well casing, well cap and the ground surface around the well casing. Any holes or cracks found should be repaired immediately to prevent entry of dirt, surface water, insects or other sources of contamination.
- Replace a non-sanitary well cap with a sanitary one.
- Some older wells are connected to household plumbing systems or livestock watering areas without backflow regulators. Backflow prevention devices should be

installed. Backflow can also occur through hoses connected to well hydrants. Whenever filling an outside water container or chemical mixing tank, always maintain an air gap between the container and the fill hose. Failure to do so can result in back-siphoning to the well and direct contamination of your drinking water.

- Have your septic system pumped on a regular basis and operate it properly as recommended in Chapter 7.
- Hazardous materials (paint, oil, pesticides, household chemicals, etc.) should not be stored, mixed, or spilled near the well. Never dispose of these down the drain.
- Limit your use of lawn and garden chemicals (fertilizers, pesticides). Excess fertilizer product moves easily through the soil to groundwater and contributes to high nitrate levels. Excess pesticide use can result in pesticides in groundwater. Always apply these chemicals sparingly and follow the manufacturer's application instructions.
- When landscaping, slope the ground away from your well casing for proper drainage. Avoid planting flowers, trees, and shrubs near your well since they will require watering and fertilizing.
- Hire a Montana licensed well driller for any well modification or unused well abandonment and closure.
- Don't pile snow, leaves, dirt or other materials next to or on top of your well.
- Keep your well records in a safe place (this includes your well log, maintenance records, and water test results).

Photo: GLWQD

Well maintenance or repairs should only be performed by a licensed well driller or pump installer.

Water Testing: How Do I Know if My Well Water is Safe to Drink?

Periodic testing of your well water is important. It is the only way to determine if a water quality problem exists that may affect your health. It is also the only way to determine if the quality of your water has changed over time due to changes in land use either nearby or on-site. At a minimum, an annual test for nitrate and bacteria is recommended. Every five years, a full domestic drinking water analysis is recommended. A full domestic analysis includes the test for bacteria and nitrate as well as additional basic water quality characteristics. Also test your water for arsenic every 3-5 years if you live west of the West Gallatin River or in Big Sky, West Yellowstone, or Three Forks.

Public Water Supplies

If you live in Belgrade, Bozeman or Manhattan, your water is provided by that city and is called a public water supply. Outside of these city limits, some subdivisions are provided water through a groundwater source that is distributed to each residence and business. Other areas are serviced by a water and sewer district (River Rock, parts of Big Sky). These are also considered public water supplies. A public water supply is responsible for testing the water it provides on a regular basis. If problems are discovered, the residents are to be notified. Each year a public water supply is required to prepare and distribute a Consumer Confidence Report to those it serves. This report contains information on the source of your drinking water and the quality of it.

Individual Private Well

If you have a wellhead on your property, chances are you are the owner of a private well. This makes you a "private well water supply operator". There are no rules or regulations that obligate you to test your water or to maintain your distribution system. This also means that no one else is responsible for the quality of your drinking water. So, it is very important that you test your water on an annual basis to ensure a clean and safe drinking water supply for you and your family. You will want to use a private or public laboratory that is certified for drinking water analysis. Contact the GLWQD, the Gallatin County Environmental Health Department, or MSU Extension Water Quality for a listing of labs and to obtain the proper bottles and paperwork. The GLWQD can also help you assess potential water quality problems, provide help and information on collecting water samples, and assist you in determining your wellhead protection needs.

When Should I Test My Water?

- Annually.
- Change in water's taste, odor or appearance.
- Pipes show signs of corrosion.
- Well system (pump, pressure tank, etc.) is serviced.
- After a flooding event.

9 Handling Household Hazardous Waste and Electronic Waste

Contributed by Tammy Swinney, Gallatin Local Water Quality District.
Updates: Rob Pudner, Gallatin Solid Waste Management District

Household Hazardous Waste

Many homes in the Gallatin Watershed have cupboards and garages that contain some type of household chemical product. These products provide us with a convenience. Unfortunately, when they are not used up or disposed of properly, they pose a serious threat to the health of our families and our environment and are known as household hazardous waste (HHW). While each individual home in the watershed may have only small quantities of these household products, collectively, the amount of waste adds up quickly.

Disposal Problems

Improper disposal of HHW can contaminate our drinking water by seeping into groundwater. It is best if you can actually use up the product. Even then, some containers of hazardous material require special disposal.

It is never appropriate to dump or burn hazardous materials on your property, or dispose of products in the trash, on the ground, or down storm drains.

People forget that storm drain systems eventually flow straight into local streams or rivers.

All wastewater treatment systems use biological processes to break down sewage. Household chemicals disposed of down the drain can disrupt this process. When this happens, some of these chemicals and untreated sewage may pass through the system and enter our surface waters, or seep into the soil and contaminate drinking water supplies.

Photo: Gallatin Solid Waste Management District

Proper disposal of automotive oils and solvents.

Reducing the Risk

Sometimes, less toxic alternatives are not available, but you can improve the chances that these products will not harm our water resources by:

- **Purchasing only the right amount for the job.** If you buy more than you need, products will tend to accumulate, adding storage problems around the home to your list of concerns.
- **Looking for alternatives.** Often, non-toxic alternatives are available. For example, a metal snake can replace drain cleaner. Some products contain less toxic components than others. There are even businesses in the area that sell non-toxic paints. Several Gallatin businesses specialize in "biological control" agents that take the place of some pesticides.
- **Following label instructions.** Most manufacturers are explicit about when, where and how to use their product and how to store it and dispose of the empty container. If these instructions are followed to the letter, the product should pose little threat to our environment.
- **Recycling products.** Several area businesses take products for recycling such as batteries, antifreeze, toner cartridges, and used motor oil. Keeping HHW out of landfills extends landfill life and reduces groundwater contamination potential.

HHW Disposal Options

HHW should be disposed of through specialized disposal facilities. Once collected, HHW is packaged for transport and taken to a regulated facility where it may either be incinerated or buried in a landfill specially designed for hazardous chemicals. So remember, HHW doesn't just go away.

HHW Disposal Options

HHW Product	Contamination Concern	Disposal Option
Motor oil, antifreeze	Improper disposal can contaminate water resources. Antifreeze contains ethylene glycol; poisonous to fish, wildlife, pets, and people.	• City Shop Complex (5 gallon limit). Bozeman residents only. 582-2273 • Bozeman Convenience Site • Logan Landfill
Herbicides and pesticides	Over-application; improper disposal can lead to contamination of water resources.	• HHW events at the Bozeman Convenience Site • Large Quantities? MT Dept. of Agriculture Pesticide Collection Program (406) 465-0531 agr.mt.gov/Pesticide-Waste-Disposal
Latex paint	Liquid cannot be disposed of in landfill.	Dry and dispose with regular trash. Mix with kitty litter, sawdust, or dirt to thicken and dry, or pour into an empty container and dry in layers.
Oil-base paint	Improper disposal can contaminate water resources.	HHW events at the Bozeman Convenience Site
Pharmaceuticals	Harmful to aquatic life. Unknown health risks to humans.	• Belgrade Police Department lobby, 91 E. Central Ave. (2 blocks behind CHP, Belgrade) • Bozeman Police Department Downtown Station lobby, 34 N. Rouse Ave. (1/2 block east of CHP, Bozeman) • Gallatin County Law and Justice Center lobby, 615 S. 16th Ave. • Livingston Police Department lobby, 414 E. Callender Street • Manhattan Police Department lobby, 120 W. Main Street • West Yellowstone Police Department lobby, 124 Yellowstone Ave, (1 block E. of CHP, West Yellowstone)
Gas, mineral spirits, thinners	Improper disposal can contaminate water resources.	• HHW events at the Bozeman Convenience Site • Logan Landfill (gas only, no thinners)
Automotive batteries	Contain acids. Can contaminate water resources.	• Bozeman Convenience Site • Logan Landfill • Most auto parts stores. Call ahead.
Mercury (flourescent and compact flourescent bulbs, thermometers)	Never place in trash! Do not break! Poisonous and harmful to fish, wildlife, pets, and people. Can contaminate water resources.	• HHW events at the Bozeman Convenience Site • Logan Landfill • Lowe's Home Improvement
Chlorinated solvents (brake cleaners, spot removers, degreasers, paint strippers, aerosal lubricants)	Extremely toxic and persistent in the environment. Chlorine is added to make products more stable, making the substance slow to break down in the environment.	• Avoid buying or using products containing "chloro" in the name like trichloroethylene or perchloroethylene. • HHW events at the Bozeman Convenience Site

The Gallatin Solid Waste Management District hosts regular HHW collection events at the Bozeman Convenience Site on the second Saturday of each month from 9am to noon. Events are free to residents of Gallatin County. Small quantity commercial generators may be charged a fee. For more information on these monthly events, visit GallatinSolidWaste.org/HHW or call (406) 539-1161.

HHW Collection Trend for Gallatin County

Year	Customers	Volume Collected (items)
2013	275	3513
2014	363	5502
2015	392	5417
2016	327	4767
Total	**1605**	**23,118**

Source: Gallatin Solid Waste Management District

What to Do in Case of a Spill

Generally, never hose down a leak or spill. This will simply spread contamination. Use an absorbent material (like kitty litter) on the spill and dispose of the residue properly. If you have a spill that threatens to enter a storm drain or any surface water, or in case of an emergency, call 911. Both the Belgrade and Bozeman Fire Departments have hazardous materials teams able to respond.

Electronic Waste

Outdated, unwanted and broken electronic equipment is known as electronic waste (e-waste). E-waste is considered hazardous because it contains heavy metals and other materials that can harm humans and the environment. With the rapid advances in computer electronic technology and the relatively low price of purchasing replacement electronics, items that break or are outdated are usually discarded rather than repaired or upgraded.

Contaminants and Environmental Concerns

Heavy metals, such as cadmium, lead, mercury and hexavalent chromium are used in the production of consumer electronics. These chemicals are persistent in the environment and accumulate in living organisms as they travel up the food chain. Lead is a major contaminant in computers; one cathode ray tube (CRT) monitor can contain up to 8 pounds.

Manufacturers use many different types of plastic in computers and other electronic equipment, making it a challenge to recycle. Recycling electronics is not very profitable and a large volume of e-waste is shipped to Asia where labor costs are very low and health and environmental regulations are less stringent to non-existent. This impacts the environment – polluting water supplies in other parts of the world.

E-Waste Disposal Options

In the past, the public had to wait for an annual collection event to dispose of e-waste responsibly. In Gallatin County, free e-waste collection events hosted by Gallatin Solid Waste Management District take place annually around Earth Day, however, electronics are also accepted during normal operating hours at the Logan Landfill (Monday through Saturday) for a small fee.

Some retailers also accept certain electronics for recycling. For a list of places to bring e-waste, visit GallatinSolidWaste.org.

Photo: Gallatin Solid Waste Management District

Photo: Gallatin Solid Waste Management District

Old and unwanted electronics collected for proper disposal at an E-waste collection event.

E-Waste Recycling Trend for Gallatin County

Year	Volume Collected (tons)
2010	45.83
2011	110.95
2012	110.08
2013	113.4
2014	142.56
2015	116.22
2016	109
Total	**748.04**

Source: Gallatin Solid Waste Management District

What Can You Do About E-Waste?

- **Reduce.** Consider extending the life of your computer or other electronic devices by upgrading features and fixing or replacing parts. Several computer businesses in the area offer these services.
- **Reuse & Donate.** Donate your functioning computer or electronic device to a charitable organization. Contact them first to see if it is something they can use, otherwise, you are just passing on your disposal problem to someone else.
- **Recycle/Demanufacture.** Contact the computer manufacturer or local retail outlet. Many have recycling, take-back or lease programs. They may even give you a discount on the purchase of your next system in you return the old one to them.

10 Living in an Urban Environment

Contributed by Jessica Ahlstrom, Frank Greenhill, and Kyle Mehrens, City of Bozeman

Perched at the headwaters of the Missouri River Basin, the Gallatin Valley enjoys pristine water for drinking, recreating, and agriculture. As the Gallatin Valley expands, the growing population threatens this limited resource.

To counteract, the City of Bozeman's Water Conservation and Stormwater Divisions take proactive steps to ensure abundant and clean water is available for all users. The following article provides background information, a summary of current initiatives, and guidance on how residents can ensure a healthier future for Gallatin Valley's water resources.

Water Use and Conservation

Eighty percent of Bozeman's drinking water comes from snowmelt in the Gallatin Range which feeds Sourdough Creek and Hyalite Reservoir. The other twenty percent comes from Lyman Spring in the Bridger Mountains.

Bozeman relies entirely on snowpack for its water supply. Receiving only sixteen inches of average precipitation annually, Bozeman is considered semi-arid and drought prone. Shifting climate patterns are likely to cause our water supplies to become less reliable. In the future, more moisture is expected to arrive as rain instead of snow, and warmer temperatures will lead to earlier peak flows and drier summers. Plus, with Bozeman's growing population, more people will need more water, and eventually these supplies won't be enough.

In 2013, the City of Bozeman adopted an Integrated Water Resources Plan to guide Bozeman's water supply and use practices for the next 50 years. The Plan estimates that if current water uses are not reduced, Bozeman's demand for water will exceed available supply around 2036, or when the City's population exceeds 62,000. The Plan recognizes the finite nature of Bozeman's water supplies and identifies water conservation as the single largest source of water for Bozeman's future. Water conservation creates additional supplies by reducing water used in and around homes and businesses. It is the most cost-effective, most expedient and environmentally friendly way to assure a reliable water supply for the future.

Water Conservation depends on each and every one of us deciding to use less water in and around our homes and businesses. Roughly fifty percent of total household water use in Bozeman goes to outdoor watering of lawns and landscapes. These landscapes are important to our quality of life, but their value can be maintained while using less water. Outdoor water use can be reduced by installing drought tolerant plants in your landscape, adding mulch to your landscape beds, watering only when your plants need it, checking your sprinkler system for leaks and proper function, and installing high-efficiency sprinkler system products such as weather-based irrigation controllers, drip irrigation, rain sensors, and high efficiency nozzles.

Images: City of Bozeman

Indoor rebate and outdoor water use efficiency outreach examples.

Eighty percent of water used inside the home is consumed by toilets, faucets, showerheads, and clothes washers. Household leaks account for an additional 13%. Average household leaks can account for more than 10,000 gallons of water wasted every year. Indoor water use can be reduced simply by fixing leaks, turning the faucet off when brushing your teeth, installing faucet aerators, and swapping out old inefficient fixtures for high-efficiency replacements. Installing high efficiency fixtures not only conserves water but can result in energy and cost savings for homeowners as well. Simply swapping out one toilet in your home for a high efficiency model can save 13,000 gallons of water per year.

The City of Bozeman offers rebate incentives to Bozeman water customers for installing high-efficiency irrigation system products and indoor fixtures (such as toilets, showerheads, and clothes washers). The City also has water conservation tips and resources available on its website to help everyone do their part to conserve our limited water supplies. By using less water in and around homes and businesses, you are helping to ensure a reliable water supply for the future and leaving more water in our rivers and streams for downstream neighbors and the overall benefit to the environment.

Urban Stormwater Runoff

Historically, cities across the country had one thought in mind regarding urban stormwater runoff management: reduce flood risk by sending stormwater to rivers, lakes, and oceans as fast possible. As a result, cities designed and constructed extensive infrastructure systems capable of moving large quantities of urban stormwater runoff, successfully reducing flood risk. However, unbeknown to cities at the time, the connection established between urban landscapes and water bodies resulted in unforeseen water quality impacts to our nation's surface waters.

Today, cities' priorities are much different. Flood control, the quantity side of urban stormwater runoff, is still important, especially considering the aged and degraded condition of the nation's infrastructure. However, City officials across the country are increasingly paying more attention to the quality side of urban stormwater runoff, developing ratepayer funded stormwater programs that work to mitigate harmful environmental impacts within their boundaries.

The cities and towns found throughout the Gallatin Valley are no exception. Local communities are growing rapidly, replacing historically rural and natural landscapes with roads, buildings, and parking lots. This growth is increasing the quantity and decreasing the quality of urban stormwater runoff, requiring local leaders to take action.

One such example is the City of Bozeman, whose elected officials took proactive steps in 2015 by supporting the development of a 15-year $18 million effort to improve the management of its stormwater system. Work to date includes degraded pipe repair and replacement, infrastructure maintenance, treatment project installation, development standard implementation, and targeted community outreach.

Although beneficial, Bozeman's work is not enough. The local rivers we all cherish need your help. The Gallatin Valley's waterways require individual citizen assistance to stay healthy whether you live in an urban environment or not. What you do or, in some cases, do not do in your yard, driveway, field, or garden can have a meaningful impact. Simple behaviors that can make a difference include:

- Never dump anything into a storm drain
- Never over fertilize, especially right before rain events
- Pick up dog waste and litter
- Fix vehicle drips and leaks
- Clean up spills
- Sweep, collect, and dispose grass clippings blown into the street
- Dispose old paints, chemicals, and cleaners at designated sites
- Maintain clean construction sites
- Maintain vegetated buffer strips between your property and waterways
- Report pollution events to local officials

The biggest thing you can do to help is to be conscious of the direct connection between your property and local rivers. We all live upstream and downstream from someone.

Definition of Urban Stormwater Runoff

What is it?
Urban stormwater runoff results from rain that falls on and flows over impervious surfaces, such as roads, rooftops, driveways, and parking lots, commonly found in urban environments.

Where does it go?
Urban stormwater runoff dumps into local rivers after traveling through a network of inlets, manholes, and underground pipes. Wastewater treatment plants do not receive or treat urban stormwater runoff in Montana.

Why does it matter?
Urban stormwater runoff picks up pollutants as it flows, such as trash, dog waste, lawn fertilizers, metals, sediment, soaps, and oils that can negatively affect the health of local rivers once discharged.

Photo: City of Bozeman

Stormwater infrastructure maintenance.

Did you know?

A relationship exists between the amount of impervious area and the volume of urban stormwater runoff flowing from a given area.

Undeveloped areas with extensive vegetation and little impervious area generate small quantities of urban stormwater runoff, because falling rain is able to soak into the ground.

Developed areas with little vegetation and extensive impervious area generate large quantities of urban stormwater runoff, because falling rain does not soak into the ground.

11 Big Sky Country Living: Backyards, Barnyards, and Beyond

Contributed by Jennifer Mohler, Gallatin-Big Sky Weed Committee

Montanans are rightfully proud of their agricultural heritage. While the land base in the county is still primarily agricultural, the number of large farms and ranches has decreased as the population in the unincorporated parts of Gallatin County continues to grow. This means that many people living in rural parts of the county are relative newcomers. If you live near a farm or ranch, be aware that your proximity to farm and ranch operations requires special tolerance and additional obligations as a neighbor. Odors, dust, noise and slow-moving machinery are all facets of maintaining a robust agricultural economy. Being a good neighbor means respecting the land and the people who share the land.

For more information on what it means to live in Big Sky Country, check out the Code of the West at gallatin.mt.gov

Irrigation Canals

Irrigation canals (sometimes referred to as ditches) are an important part of our rural and urban landscape. Irrigation practices have important seasonal effects on groundwater levels. Here are some aspects of features you should be aware of:

- High groundwater tables and flooding during peak irrigation season is entirely likely on adjacent properties.
- Some canals are used seasonally, so dumping leaves, grass clippings or yard waste into the ditch may obstruct water flow and cause unintended flooding – perhaps on your own property!
- No water use out of a canal or ditch is allowed without a valid water right. This includes diverting water with pumps or dams, constructing ponds, or taking water in any way.
- Canals require routine maintenance. If a canal does cross your property, be aware that there is a conveyance or maintenance easement for the canal, and access for maintenance equipment to easily pass through must be maintained. So, construct fences accordingly. Also, do not plant trees or shrubs alongside the canal, they will likely be removed when canals are cleaned.

Photo: USDA-NRCS

Is it a ditch or a stream?
Contact:
- Gallatin Conservation District (406) 282-4350 *or*
- Gallatin County Planning Office (406) 582-3130

Do I have a valid water right to the ditch that crosses my property?
Contact:
- MT Dept. of Natural Resources & Conservation (406) 586-3136 *or*
- Association of Gallatin Agricultural Irrigators at AGAIMT.com

Protecting Riparian Areas and Water Resources

The way in which today's landowners manage their property directly affects not only the health of their family and livestock, but also their neighbors, community, and our watershed. As stewards of the land, we can greatly influence the health and vitality of our land simply by the way we manage it. The need for a sustainable supply of clean water is universal, and every landowner whether urban, suburban, or rural, has an impact on water resources.

Managing Runoff

One of the most effective ways to maintaining water quality is putting space between human activities and streams and wetlands. Maintaining healthy riparian vegetation is the most effective way to trap sediment and pollution before it enters surface waters. Vegetative cover also provides erosion control and flood management benefits, as well as affording habitat for fish and wildlife. Depending on where you live and the size of the waterway, you should consider providing a buffer of one or more of the following types:

Riparian forest buffers – NRCS recommends forest buffers (trees and/or shrubs) adjacent to streams, lakes, ponds, and wetlands. Riparian buffers are tailored to the type stream channel and size of the active floodplain.

Filter strips – These grass strips or other permanent vegetation at the edge of a cropped field or animal confinement area are intended to catch sediment and runoff before it enters a stream.

Livestock Management

Livestock management or the lack of it can have a tremendous impact on the vitality of any riparian or wetland area on your property. It can have impacts on your neighbors downstream as well. When pastured in a stream corridor, animals can cause extensive damage to riparian areas (overgrazing, streambank erosion) if left unmanaged. Manure from livestock can be washed or even deposited directly into the stream, allowing bacteria and pathogens to enter waterways. To keep streambank vegetation healthy and restore degraded riparian areas:

- Develop off-stream water sources (troughs, etc.)
- Create water gaps and gravel pad crossings
- Consider excluding livestock from riparian areas with fencing
- Plant willows and other shrubs to control erosion and reestablish fish and wildlife habitat
- Contact the Gallatin Conservation District for more information.

Photo: USDA-NRCS

Water Gap

A water gap is a controlled access point to a stream that limits the impact on the resource. The path to the gap should be gently sloped and stabilized with gravel and construction fabric. You may need a 310 permit to create a water gap, so contact the Gallatin Conservation District if you are considering this.

Manure Makes Mud

Research is clear on the negative effect of muddy conditions on animal health. Mud harbors bacteria, fungi, pathogens, and provides a breeding ground for insects. It results in slick, unsafe footing for the animals and the runoff is damaging to fish and streams by introducing excess sediment, nutrients, and pathogens. Manage animal waste properly by collecting and composting. Composting reduces volume, kills parasites and weed seeds, reduces odor, and provides slow-release fertilizer and soil amendment. Remember to locate manure piles and drylot (sacrifice) areas away from wells and streams – at least 150 feet.

You have a direct impact on your own water sources!

1 average horse produces:

40-50 pounds of manure per day *or* 16,500 pounds per year.

12 gallons of urine per day *or* 4,400 gallons of urine per year.

It can add up!

4 horses produce:

30 tons of manure per year *and* 17,500 gallons of urine per year. That's enough urine to fill a 15 x 30 foot swimming pool!

What Is a Drylot?

A drylot is a part of your land that you sacrifice so the rest of your land can grow grass! Sacrifice areas or drylots allow landowners to keep animals off pastures to avoid overgrazing, soil compaction, and damage during wet weather.

Photos: Jennifer Mohler

Grass filter strips surrounding drylots help trap sediment and nutrients, resulting in cleaner water.

Photo: Jennifer Mohler

Pasture Management

For small acreage landowners with grazing animals, water determines what kind and how much forage is available for your animals. The number and kind of animals combined with land management practices determine your impact on water resources. A healthy stand of grass is your best defense against weeds and the best way to protect soil and water resources. Overgrazing can lead to unhealthy grass, weed infestations, soil compaction, and heavier parasite loads. Continuous overgrazing eventually kills your grass. To maintain healthy pastures:

- Identify what is growing on your land. Some grasses may not offer good forage, and many weeds are poisonous.
- Develop a rotational grazing system so that only a portion of the pasture is grazed at one time, allowing the remaining pasture areas to rest. This improves long-term production and reduces weed invasions.
- Follow the take half, leave half principle to ensure pastures are sustainable. In general, begin grazing when grasses are 6-8 inches tall, stop when they are 4 inches tall and rotate to another pasture. Don't regraze that pasture until the grasses have regrown to 6-8 inches tall. If your grasses haven't regrown, it's time to feed hay (the cheapest form of weed control).
- The biggest mistake landowners make is putting too many animals on too few acres. **If you have limited acreage, and/or dryland pastures, face the fact that your pastures will be used primarily for exercise and plan to feed hay year-round.**

Fertilizing

Over fertilizing does not improve plant growth and can damage grass roots, and harms water quality. Nitrogen and phosphorus are easily washed into surface waters, increasing nutrient loads that cause excess algae growth which depletes the oxygen needed by other aquatic organisms. To reduce impacts to water resources and maintain a healthy lawn:

- Test your soil and fertilize only in the amounts needed and at the right time.
- Apply manure and fertilizer when plants are actively growing (don't apply on wet soils or frozen ground).

For more information on sustainable grazing practices, visit:

- Montana State University Extension: animalrangeextension.montana.edu/range/grazing-management.html
- Horses for Clean Water: horsesforcleanwater.com/horse-keeping

Pasture Irrigation

Identify what types of grasses you have in the pasture. They are often planted with introduced species that require additional water and fertilizer to keep them productive.

Noxious Weeds

Invasive weeds are the greatest threat to Montana's environment. Currently, Montana has approximately 7.6 million precious acres infested with state-listed noxious weeds, and several new and potentially devastating invaders knocking on the door at our borders. Noxious weeds, or invasive plant species, have widespread impacts such as:

Reducing agricultural production

Reducing property values

Decreasing biodiversity and disrupt ecosystems

Displacing native species

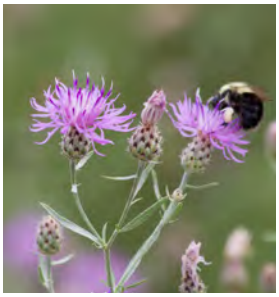
Increasing soil erosion and bank failure and clog waterways

Increasing the severity and frequency of wildfires

Further threatening endangered and rare species.

Do your part to control noxious weeds on your property and adopt "clean recreational habits" to ensure that what we love so much about Montana is not destroyed in our pursuit of experiencing it.

Noxious Weeds


Spotted knapweed.


Houndstounge - TOXIC to horses and cattle.


Canada thistle.


Musk thistle.


Hoary alyssum - TOXIC to horses.

Property owners are required by state law to control noxious weeds on their property (MCA 7-22-2116).

Some 32 different weeds in Gallatin County warrant control and management. Management methods include: biological control, mowing, hand pulling, and herbicide spraying. Landowners contemplating activities that will disturb the land (such as road building) are reminded that a Noxious Weed Management and Revegetation Plan may be required from the Gallatin County Weed Department.

Here are some simple actions to help prevent the introduction and spread of invasive species:

Learn to identify invasive species.

Remove plants & mud from boots, gear, pets, & vehicles.

Clean your gear before entering and leaving the trails.

Stay on designated roads and trails.

Use certified or local firewood and hay.

Plant only non-invasive plants in your garden (go native and help our pollinators!), and remove any known invasive plants.

Avoid dumping aquariums or live bait into waterways.

Pesticide Management

Surface and groundwater can easily be polluted by improperly applied and stored pesticides. Insecticides kill insects by damaging the central nervous system and can have the same effect on fish and wildlife. Herbicides interfere with photosynthesis or alter plant growth. If improperly applied, herbicides can easily be transported by runoff or groundwater, potentially harming non-target plants in other areas. Pesticide management tips include:

- Do not mix or dispose of lawn chemicals near wells or surface water.
- Don't spray in wetlands or riparian areas. Look into biological and mechanical control options for these areas.
- Avoid applying when wind speeds are >5 mph, during extreme temperatures, and when rain is in the forecast.
- Read and follow label guidelines. Need assistance? Contact the Gallatin County Weed Control District.

Aquatic Invasive Species

Invasive species are not limited to the land, there are also aquatic invasive species. Public waters and lands, and the limitless recreational opportunities they provide, drive our economy and serve as the foundation for our unparalleled quality of life, and active stewardship of these resources directly benefits everyone. If you fish or boat in Montana, get informed and follow these three steps:

Clean your boat and equipment every time you use it, especially if you plan to move it to a new location.

Drain all standing water, including any that may be left in the engine's cooling system, live wells, and bilge areas.

Dry everything that has come into contact with water.

For additional information on invasive species, check out these sites:

Terrestrial Invasive Species

- Gallatin County Weed Department: gallatincomt.virtualtownhall.net/Public_Documents/gallatincomt_weed/weeddept
- Gallatin-Big Sky Weed Committee: bigskyweeds.org
- Montana Weed Control Association: mtweed.org

Aquatic Invasive Species

- Montana Fish, Wildlife & Parks: fwp.mt.gov/fishandwildlife/species/ais
- Montana Mussel Response: musselresponse.mt.gov
- Clean, Drain, Dry protocols: fwp.mt.gov/cleandraindry

12 Watershed Restoration Success Begins with Partnerships and Planning

Contributed by Tammy Swinney, Gallatin Local Water Quality District

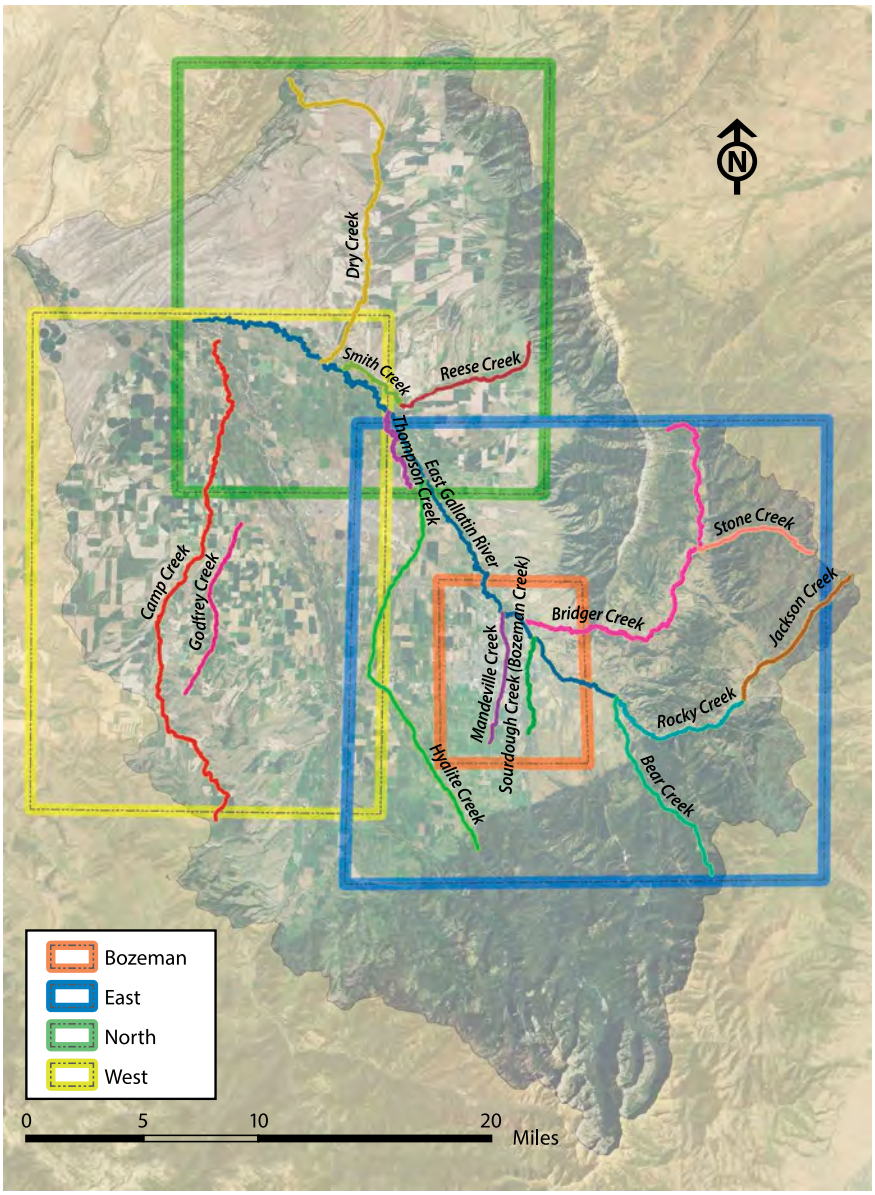
Water moves through every crevice of our daily lives.
While the importance of water to human life is paramount, we often assume that abundant supplies of clean water will always be available.

This assumption is challenged by the reality of rising demands for supply and diversifying threats of pollution. Locally, it is the responsibility of each of us to do our part to ensure that we pass on the legacy of abundant, clean water to future generations in our watershed and those downstream. But where do we start? How do we identify waters that may be impacted by pollution? What is the process necessary for community action? Who needs to be involved in the restoration of those waters? The answers are simple and, yet, complex at the same time: partnerships and planning are the key to restoration success and improving water quality.

There are standards for surface water quality in Montana to ensure our waters meet important beneficial, uses for aquatic life, drinking water, etc. Unfortunately, many streams and rivers in the Gallatin Watershed have water quality impairments that prevent them from fully supporting some, or all, of those important uses. Since many of the pollution problems affecting these waterways are a result of nonpoint source pollution (pollution from many different sources spread diffusely over the landscape), it can be overwhelming or even ineffective for one entity to attempt to restore and improve water quality in these streams. Besides, where do you begin?

Watershed Restoration Plans

Enter the watershed restoration plan (WRP). A WRP is a guidance tool for improving water quality and identifying restoration projects. Activities implemented from a WRP can essentially lead to improved water quality for a stream that was once impaired by one or more pollution sources. There are two WRPs for the Gallatin Watershed: The Upper Gallatin WRP, developed by the Gallatin River Task Force (GRTF), and the Lower Gallatin WRP, developed by the Greater Gallatin Watershed Council (GGWC).



Lower Gallatin Watershed divided into four watershed restoration planning areas – Bozeman, East, North and West.

Photo: Kristy Burt

Discussing watersheds and the importance of streamside vegetation with Camp Big Sky in the Big Sky Community Stormwater Conservation Garden.

Photo: Stephanie Lynn

West Fork Restoration Project: Restored streambank near the Big Sky Golf Course maintenance shed addressing Total Maximum Daily Loads (TMDLs) for nutrients and sediment.

Both GRTF and GGWC are locally-led, nonprofit watershed groups. Through support from the Montana Department of Environmental Quality (DEQ), funding was made available to evaluate local stream conditions and set priorities for water quality improvements. This critical information was then used by each watershed group, working with local citizens and other partners, to develop a WRP focused on the unique water quality concerns in their portion of the Gallatin Watershed. This included identifying and prioritizing possible water quality improvement projects along with education and outreach opportunities. Restoration strategies were identified for each stream along with restoration projects and prioritizations. Having a completed WRP for a watershed enables the local watershed group and other partners within the watershed to obtain funding from DEQ's 319 grant program for the implementation of water quality improvement projects on impaired stream segments.

Upper Gallatin Watershed Partnerships

Water quality problems identified in the Upper Gallatin/Big Sky WRP area include excess nutrients, sediment and *E. coli* bacteria in the West Fork of the Gallatin River (West Fork).

The GRTF, in partnership with the Big Sky Golf Course are working to improve management of the treated wastewater effluent irrigation and fertilizer application on the golf course to reduce nutrient inputs to the West Fork. Another project outlined in the Upper Gallatin WRP that addresses excess nutrients and sediment runoff into the West Fork is a large-scale restoration project at the Big Sky Golf Course that will enhance streamside (riparian) vegetation and stabilize streambanks at 10 sites on the West Fork. A demonstration stormwater garden with interpretive signage is at the entrance of the Big Sky School. This project was completed through a partnership between GRTF and the Big Sky School District. The largest partnership and planning effort in the Upper Gallatin is the Big Sky Sustainable Water Solutions Forum (Water Forum). The Water Forum is a collaborative stakeholder-driven planning effort to identify water resource issues in the Big Sky community and develop solutions to these issues. The outcome of this partnership effort is a water resources management plan and, as part of this, the Upper Gallatin WRP will be updated to reflect the future needs and growth of the Big Sky community.

Story Mill Community Park Project – Lower Gallatin Watershed

The Lower Gallatin WRP covers the entire Gallatin Valley with 15 streams identified with water quality impairments (excess nutrients, sediment, and *E. coli* bacteria). With this many streams, prioritizing potential water quality improvement projects was important. GGWC held community meetings in each of the four watershed planning areas to gather landowner input tailored to the unique needs of each area and projects were identified for future implementation in the WRP.

Partnerships Key to Story Mill Community Park Project

A large, comprehensive watershed restoration project needs partners and local stakeholder buy-in. The Story Mill Project partners include:

The Trust for Public Land,
City of Bozeman,
MT Dept. of Environmental Quality,
MT Dept. of Fish, Wildlife, and Parks,
Gallatin Local Water Quality District,
Gallatin Valley Land Trust,
Greater Gallatin Watershed Council,
Montana State University,
Trout Unlimited,
Sacajawea Audubon,
NorthWestern Energy,
and numerous local water resource professionals.

The Story Mill Community Park project was identified as a high priority for early implementation in the Lower Gallatin WRP. In 2012, The Trust for Public Land in collaboration with numerous partners undertook a comprehensive effort to transform the 60-acres in the historical Story Mill area, located less than two miles from Bozeman's downtown core, into a unique city park. This included the ecological restoration of the Story Mill wetlands complex, doubling the existing wetland acreage to 14 acres; restoring fluvial processes along a half-mile of the East Gallatin River; creating green infrastructure for water quality improvements at Bozeman Creek; and reconnecting over 2.5 acres of floodplain to Bozeman Creek and the East Gallatin River. The result is the protection of on-site natural processes necessary for a functioning riparian and wetland system.

Gallatin Valley Conservation Partnership

This Natural Resources Conservation Service (NRCS) Regional Conservation Partnership Program promotes coordination by using partnerships between public and private entities, local communities, and non-governmental organizations to invest in conservation. In the Lower Gallatin Watershed, the Gallatin Valley Land Trust is the lead partner working with more than a dozen local and regional organizations to help agricultural producers and private landowners establish conservation easements and implement stream and watershed restoration projects to improve water quality, water quantity, and soil health on private land in the Gallatin Valley; many of which are identified in the Lower Gallatin WRP along Camp Creek and the East Gallatin River.

Why Watershed Restoration Plans are Key to Success

WRPs are successful for several reasons. They evolve from local input based on unique issues and concerns for an area. They provide guidance on project prioritization, short-, mid-, and long-term milestones to evaluate success. They include technical and community entities identified as potential partners for restoration projects, monitoring, and education activities. They require partnerships with landowners be formed in order to implement on-the-ground restoration projects with successful outcomes. They encourage regular review of the WRP to evaluate progress and revisit established goals to measure progress and adapt to changes in the watershed. When it comes to success in watershed restoration efforts, it really does take a village.

Watershed Restoration Project Implementation

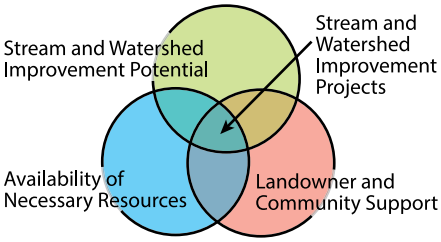


Photo: Maddy Pope

Stream bank restoration on the East Gallatin River at Story Mill Community Park.

Photo: Gallatin Valley Land Trust

Pivot irrigation efficiency upgrade completed simultaneously with a conservation easement through Gallatin Valley Conservation Partnership.

13 Permitting and Regulation Guide

Contributed by Debbie Earl. Updates: Leah Bellus, Gallatin Local Water Quality District

Regulations are necessary to protect one of Montana's most precious and limited resources, water. The rivers, streams, lakes and groundwater have shaped the stories of our rich history of mining, agriculture, recreation, and quality of life here in the Gallatin Valley. The impacts of water use in the state over time have created new stories. Tomorrow's stories will unfold as future demands on water from growing urban centers as well as climate change, impact water quality and quantity. It is obligatory on Montana residents to protect this resource, to fulfill current uses, and to meet the growing water demands.

It is important to understand the government's role in managing water. Montana's water is managed through an intricate system of federal, state and local authorities. Water management involves people who allocate water supplies, issue permits, regulate the resource according to state and federal laws, and enforce laws when violations occur. Management of water resources also includes legislative and administrative decision-making. Because every layer of government plays some part in water management, effective water management requires communication and collaboration among diverse individuals, interest groups, and government officials. Below is a list of common permits needed with activities that affect water resources. Although it is may take some time to obtain these permits, it is worth it in the long run. Additionally, fines for permit violations can be severe.

In an effort to facilitate the permitting process, one can use one joint application for the following permits: 310 Permit, Floodplain Permit, 404/Section 10, and 318 Authorization. Once the application is complete, photocopy it and put an ORIGINAL signature on each copy and send to the appropriate agency.

The joint application is titled, "Joint Application for Proposed Work in Streams, Lakes, and Wetlands in Montana" and can be accessed at dnrc.mt.gov/permits along with application instructions.

Montana Water Law

1. Montana's water belongs to the state for the use of its people. Therefore, water right holders do not own the water; they possess the right to use the water.
2. Doctrine of Prior Appropriation (first in time, first in right) guides Montana's water right system.
3. "Use it or lose it." A water right holder must use the water or risk losing the rights to it.
4. The water diverted must be for a beneficial use, and all beneficial uses are equal under the law).
5. A water right is a property right and can be separated from the land.
6. Any changes in the purpose, place of use, place of storage, or place of diversion of water right must first be approved by the MT Department of Natural Resources and Conservation (DNRC).

Table of Permits

Regulated Activity	Regulation	Length of Application Process & Fees (Approx.)	Governing Agency Information
Any activity that physically alters or modifies the bed or banks of a perennial stream, river or spring.	310 Permit	30-60 days.	Gallatin Conservation District (406) 282-4350
Any activity (such as construction) that will cause unavoidable short-term violations of water quality standards.	318 Permit	30-60 days. $150 fee.	MT Department of Environmental Quality (406) 444-2544
Any activity that might discharge into State or Tribal waters.	401 Water Quality Certification	60-90 days. Fee varies by project.	MT Department of Environmental Quality (406) 444-2544
Any activity that will result in the excavation, discharge, placement of dredged or fill material into lakes, ponds, rivers, streams, and wetlands.	404 Permit	45-120 days. $0- $100 fee.	U.S. Army Corps of Engineers (406) 441-1375
Installing an on-site wastewater treatment system	Septic Permit	30 days. Fee varies by project.	Gallatin City-County Health Dept., Environmental Health Services (406) 582-3120

Table of Permits

Regulated Activity	Regulation	Length of Application Process & Fees (Approx.)	Governing Agency Information
Ponds that charge a fee for fishing or ponds for rearing and selling live fish or fish processing.	Commercial Fish Pond License	$10, must renew yearly. Surety bond required.	MT Fish, Wildlife & Parks (406) 994-3285
Private fish pond that does not sell fish or fish eggs.	Non-Commercial Private Fish Pond License	$10, must renew every ten years.	MT Fish, Wildlife & Parks (406) 994-3285
Construction, repair, or removal of a dam that impounds 50 acre-feet or more at the normal operating pool.	Downstream Hazard Evaluation Permit	60 days. $125 fee.	DNRC Dam Safety Program (406) 444-6613
Any new construction within a designated 100-year floodplain.	County Floodplain Permit	Up to 60 working days. Fee varies.	Gallatin County Department of Planning (406) 582-3130 gallatin.mt.gov City of Bozeman Planning Department (406) 582-2260 bozeman.net
Land subject to being flooded by a flood of 100-year frequency A13, or land deemed to be subject to flooding by the City of Bozeman, shall not be subdivided or developed for building or residential purposes, or other uses that may increase or aggravate flood hazards to life, health or welfare, or that may be prohibited by state or local floodplain or floodway regulations.	City Floodplain Permit	60 days. $100 fee.	City of Bozeman Engineering Department (406) 582-2280 bozeman.net
Any person intending to acquire new or additional water rights, or change an existing water right.	Water Right Permit and Authorization to Change	Up to two years. $200-$800.	DNRC Water Rights Bureau (406) 444-6601
Groundwater appropriation of 35 gallons per minute or less, but not exceeding 10 acre-feet per year.	Certificate of Water Right	File within 60 days of water being put to use. $125 fee.	DNRC Water Rights Bureau (406) 444-6601
Any discharges into surface water or groundwater, including those related to construction, industry, mining, and gas activities.	Stormwater Montana Pollutant Discharge Elimination System Permit (MPDES)	Fees and processing time vary.	MT Department of Environmental Quality (406) 444-2544
Any regulated activity which may impact wetlands as indicated on the Bozeman Area Wetland Map or discovered through the development review process, and verified through a site-specific wetlands boundary determination.	Wetland Regulations		City of Bozeman Planning Department (406) 582-2263 bozeman.net
New Subdivision regulations require development be setback 300 feet from these major rivers: Gallatin, East Gallatin, West Gallatin, Jefferson, Missouri, Madison and 150 from all other watercourses. Watercourse mitigation plans required in order to reduce setbacks. For setbacks established through zoning ordinances contact planning department.	Setbacks	Fees are incorporated into subdivision application process. Processing time varies.	Gallatin County Planning Department (406) 582-3130 gallatin.mt.gov City of Bozeman Department of Planning and Community Development (406) 582-2260
Swampbuster provisions of the 1985 Food Security Act may involve penalties for USDA program participants when wetlands are altered to make it possible to produce a commodity crop.	Wetlands		NRCS (406) 587-6998
Land subject to being flooded by a flood of 100-year frequency A13, or land deemed to be subject to flooding by the City of Bozeman, shall not be subdivided or developed for building or residential purposes, or other uses that may increase or aggravate flood hazards to life, health or welfare, or that may be prohibited by state or local floodplain or floodway regulations.	Floodplain Permit		City of Bozeman Planning Department (406) 582-2263 bozeman.net
Any regulated activity which may impact wetlands as indicated on the Bozeman Area Wetland Map or discovered through the development review process, and verified through a site-specific wetlands boundary determination. Purpose is to encourage the avoidance of regulated activities within the regulated areas and to require best management practices in regulated areas.	Wetland Regulations		City of Bozeman Planning Department (406) 582-2263 bozeman.net

Resources

Bozeman Fish Technology Center holds an annual fishing derby for young anglers. (406) 587-9265
fws.gov/mountain-prairie/fisheries/ftc.php

City of Bozeman

Water Conservation. (406) 582-2280
bozeman.net/government/water-conservation

Stormwater Division. (406) 582-2270
bozeman.net/government/stormwater

Floodplain Administration

Flood insurance is available in Gallatin County through The National Flood Insurance Program (NFIP). Contact your insurance agent for more information.

City of Bozeman Engineering Division. (406) 582-2280

Gallatin County Planning Department. (406) 582-3130

Gallatin-Big Sky Weed Committee works to conserve native plants, wildlife habitat, and water resources through noxious weed education and management. (406) 209-0905
bigskyweeds.org

Gallatin County

City-County Environmental Health Department reviews and permits septic and sanitation proposals for solid waste and wastewater treatment under the Montana Sanitation in Subdivisions Act. (406) 582-3120
healthygallatin.org

Conservation District administers the Natural Streambed and Land Preservation Act, issuing "310" permits necessary for any alteration of a perennial waterways in Gallatin County. (406) 282-4350
gallatincd.org

Extension is a statewide educational outreach network that applies unbiased, research-based university resources to pratical needs identified by the people of Montana in their home communities. (406) 582-3280
msuextension.org/gallatin

Health Department is dedicated to protecting and promoting the health of county citizens and the environment through the efforts of dedicated and skilled employees and application of sound public health principle. (406) 582-3120
healthygallatin.org

Weed Department implements an effective noxious weed management program for the protection of the open space, natural and agricultural resources of Gallatin County. (406) 582-3265
gallatincomt.virtualtownhall.net/Public_Documents/gallatincomt_weed/weeddept

Gallatin Local Water Quality District (GLWQD) works to protect, preserve and improve groundwater and surface water quality within the Gallatin Watershed. (406) 582-3168
glwqd.org

Gallatin River Task Force (GRTF) focuses their efforts on the water resources of Big Sky, Montana. Program areas include Watershed Monitoring, Education & Outreach, and Conservation. (406) 993-2519
gallatinrivertaskforce.org

Gallatin Valley Land Trust (GVLT) connects people to the landscapes through the conservation of open spaces and creation of trail systems. (406) 587-8404
gvlt.org

Montana Aquatic Resources Services (MARS) works to identify and implement aquatic restoration projects that enhance stream and wetland functions, conserve clean water, and improve fish and wildlife habitat.
montanaaquaticresources.org

Montana Bureau of Mines and Geology (MBMG) maintains the Groundwater Information Center (GWIC) database. Data include well completion records, well performance and water level measurements, and water quality reports. (406) 496-4167 mbmg.mtech.edu

Montana Department of Environmental Quality (DEQ). (406) 444-2544 deq.mt.gov

Computer Recycling & E-Waste Disposal Options.
deq.mt.gov/Recycle/Electronics/index.asp

Design Standards for Septic Systems. (406) 444-4969

Enforcement Division. (406) 444-0379

Nonpoint Source Program 319 Grant Information.
deq.mt.gov/wqinfo/nonpoint/Grants/319Grants.asp

Public Water Supply is responsible for assuring that the public health is maintained through technical review, licensing, certifications, compliance monitoring, training and technical assistance related to public water supply systems. (406) 444-4400
deq.mt.gov/Water/PWSUB/pws

Resources

Safe Drinking Water Revolving Fund. (406) 444-5324

Water Protection Bureau issues permit authorizations for stormwater discharges associated with industrial or construction activities and municipal storm sewer systems. (406) 444-3080
deq.mt.gov/Water/WPB/mpdes/stormwater

Water Quality Planning Bureau. (406) 444-6697

Watershed Management Section TMDL Program identifies sources of nonpoint source pollution to Montana's streams and writes pollution reduction plans that can guide local communities in finding solutions to restore and maintain clean water. (406) 444-6697
deq.mt.gov/Water/WQPB/tmdl

Montana Department of Natural Resources and Conservation (DNRC)

Bozeman Water Resources Regional Office.
(406) 586-3136
dnrc.mt.gov/divisions/water/water-rights/water-resources-regional-offices

Water Rights Bureau.
dnrc.mt.gov/divisions/water/water-rights

Water Rights in Montana information booklet.
dnrc.mt.gov/divisions/water/water-rights/docs/2014-water_rights_in_mt_handbook.pdf

Montana Fish Wildlife & Parks (FWP) issues fishing and hunting licenses and co-leads the Montana Mussel Response Team. (406) 444-2535
fwp.mt.gov

Montana FWP Future Fisheries Improvement Program.
fwp.mt.gov/fishAndWildlife/habitat/fish/futureFisheries

Noxious Weeds.
fwp.mt.gov/fishAndWildlife/habitat/noxiousWeeds

Partners for Fish & Wildlife Program. (406) 727-7400
fws.gov/mountain-prairie/PFW/montana

Montana Land Reliance partners with private landowners to permanently protect agricultural lands, fish and wildlife habitat, and open space. (406) 443-7027
mtlandreliance.org

Montana Mussel Alert provides guidance on preventing the spread of aquatic mussels, helps locate inspection stations, and maintains a reporting hotline.
(406) 444-2440 musselresponse.mt.gov

Montana Natural Heritage Map Viewer: Wetland and Riparian Mapping.
mtnhp.org/mapviewer

Montana State University Extension Water Quality works to address the broad spectrum of water quality education and information needs of a diverse audience throughout Montana and its neighboring states through research, education, and outreach. (406) 994-7381
waterquality.montana.edu

Montana Water Court has exclusive jurisdiction over the adjudication of water rights claims. (406) 586-4364
courts.mt.gov/water

Montana Weed Control Association works towards strengthening and supporting noxious weed management efforts in Montana. (406) 684-5590
mtweed.org

Natural Resources Information System (NRIS), Water Information Systems is the starting point for finding water resources information in Montana, such as data on surface water, groundwater, water quality, riparian areas, wetlands, water rights, climate data and more.
geoinfo.msl.mt.gov/geography/water_information_system

Trout Unlimited, Montana Water Project.
(406) 522-7291
A Buyer's Guide to Montana Water Rights.
waterquality.montana.edu/resources/files_images/A_Buyers_Guide_MontanaWaterRights.pdf

Trust for Public Land (TPL) helps raise funds for conservation, protects and restores natural spaces, collaborates with communities to plan, design, and create parks, playgrounds, gardens, and trails; they work with communities to ensure that development happens for them, and not to them. (406) 522-7450
tpl.org

United States Department of Agriculture, Farm Service Agency, Conservation Reserve Program (CRP) - rental payments and cost-share assistance to establish long-term, resource-conserving cover on eligible land.
Gallatin Co. Farm Service Agency Service Center.
(406) 522-4000
fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program

Resources

United States Department of Agriculture, Natural Resources Conservation Service.
(406) 587-6811
mt.nrcs.usda.gov

Environmental Quality Incentive Program provides financial and technical assistance to agricultural producers in order to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation or improved or created wildlife habitat.
nrcs.usda.gov/wps/portal/nrcs/main/mt/programs/financial/eqip

Riparian & Floodplain Management.
nrcs.usda.gov/wps/portal/nrcs/detailfull/mt/water/resources/?cid=nrcs144p2_057479

Water Quality.
nrcs.usda.gov/wps/portal/nrcs/main/national/water/quality

Web Soil Survey.
nrcs.usda.gov/wps/portal/nrcs/main/soils/survey

Wetland Reserve Easements. NRCS provides technical and financial assistance directly to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement. (406) 587-6748
nrcs.usda.gov/wps/portal/nrcs/detail/mt/programs/easements/acep/?cid=nrcseprd400837

US Fish and Wildlife Service, Partners for Wildlife Program (Private Lands Program), National Wetland Inventory funds projects that create, enhance or restore wetlands and provides technical assistance to private landowners. (406) 761-5450
fws.gov/wetlands

US Geological Survey (USGS). (406) 441-1319
mt.water.usgs.gov

National Water Info System provides current Water Data for the Nation.
waterdata.usgs.gov/nwis/rt

Common Measures

1 cfs (cubic foot per second) = 7.48 gallons/second
= 448.8 gallons/minute
= 40 miner's inches
= 646,272 gallons/day
= 1.98 acre-feet/day

1 acre-foot = volume of water that covers an acre to a depth of 1 foot
= 43,560 cubic feet
= 325,851 gallons
supplies a family of 5 for 1 year

Water Glossary

Aquifer: a sand, gravel or rock formation capable of storing or conveying water below the surface of the land.

Avulsion: the action of pulling or tearing away.

Coliform bacteria: a group of bacteria predominantly inhabiting the intestines of man and animal but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms.

Cubic feet per second (cfs): a unit expressing rate of discharge, typically used in measuring stream flow. One cfs is equal to the discharge in a stream of a cross-section one foot wide and one foot deep, flowing with an average velocity of one foot per second.

Dewatered: natural flow of streams reduced due to withdrawals.

Erosivity: the capacity of a soil or land surface to be worn down or washed away by the action of water, ice or wind.

Floodplain: any normally dry land area that is susceptible to being inundated by water from any natural source.

Floodway: the channel of a river or stream and those parts of the adjacent floodplain adjoining the channel that are required to carry and discharge the base flood.

Groundwater: water in porous materials beneath the ground surface.

Hydric soil: a soil that, in its undrained condition, is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth of water-loving plants.

Hydrograph: a record showing the changes in flow of a river over time, or change in groundwater level over time.

Hyporheic Zone: transition zone between groundwater and surface water. An ecologically important component of streams and rivers.

Instream flow: the water left in a stream to maintain the existing aquatic resources and associated wildlife and riparian habitat.

Irrigation return flow: irrigation water not consumed and returned to a surface or groundwater supply.

Murphy Right: special instream flow water rights recognized in 1969 when an instream flow protection bill was passed by the Montana legislature to protect the unappropriated waters of 12 high-priority trout streams.

Nonpoint source: entry of a pollutant into a water body from widespread or diffuse sources with no definite point of entry. The source is not a readily discernible point like a discharge pipe.

Ordinary high-water mark: the line that water impresses on land by covering it for sufficient periods to cause physical characteristics that distinguish the area below the line from the area above it.

Permeable: the capacity of porous rock, sediment or soil to transmit water.

Riparian areas: land areas adjacent to water that are identified by the presence of vegetation requiring large amounts of water, normally available from a high water table. Common riparian vegetation includes sedges, willows, alders and/or cottonwoods.

Siltation: particles of soil smaller than sand but larger than clay particles that are washed into streams and may impair biological and physical processes.

Snowpack: the winter accumulation of snow.

Transmissivity: the rate at which water passes through an aquifer.

Tributary: a stream that contributes its water to another stream or body of water.

Water budget: the accounting of the inflows and outflows of water to and from a system.

Water table: the upper level of a saturated zone in an aquifer below the soil surface.

Watershed: The land area from which rainfall and snowmelt drains into a single waterbody. Ridges of higher ground generally form the watershed boundary.

Withdrawals: removing water from surface or groundwater sources in order to use it elsewhere.

Contributors and Acknowledgments

The first edition of the Gallatin Watershed Sourcebook was an outgrowth of a symposium held at the Museum of the Rockies in October 1996, entitled "Know Your Watershed: The Gallatin". The workshop was presented under a unique partnership of local groups interested in public education and natural resources conservation. Since then, our watershed landscape continues to change along with an ever-growing population. New and existing residents enjoy the way of life, recreational opportunities, and the natural and cultural amenities our watershed provides. The Gallatin Watershed Sourcebook continues to be updated so that residents have access to current water resource information. This third edition Sourcebook is the result of contributions made by numerous local partners.

Third Edition

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