Thompson River Watershed Restoration Plan

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Upper Thompson River near Bend. Photo Credit: Brian Sugden

LOWER CLARK FORK WATERSHED GROUP

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Authors:
Sarah Bowman – Lower Clark Fork Watershed Group
Brita Olson – Lower Clark Fork Watershed Group

Secondary Authors:
Ryan Kreiner – Montana Fish, Wildlife & Parks
Samantha Tappenbeck – Soil and Water Conservation Districts of Montana
Brian Sugden – Weyerhaeuser Company

Contributing Stakeholders:
Clark Fork Coalition: *John DeArment*
Eastern Sanders County Conservation District: *Steve Dagger*
Flathead Conservation District: *Valerie Kurth*
Green Mountain Conservation District: *Leona Gollen*
Lincoln Conservation District: *Becky Lihme*
Lower Clark Fork Watershed Group: *Brita Olson, Jay Stuckey, Jean Dunn, Ruth Watkins, Sarah Bowman, Sean Moran*
Montana Department of Environmental Quality: *Eric Trum*
Montana Department of Natural Resources and Conservation: *Dave Mousel, Dave Olsen, Mike Anderson, Tony Nelson*
Montana Fish, Wildlife & Parks: *Ryan Kreiner*
Natural Resources Conservation Service (Kalispell Field Office): *Angel Rosario*
Natural Resources Conservation Service (Plains Field Office): *Travis Lemke, Troy Hidy*
NorthWestern Energy: *Brent Mabbott, Jordan Tollefson*
Sanders County: *Carol Brooker, Katherine Maudrone*
Soil and Water Conservation Districts of Montana: *Jessica Makus, Samantha Tappenbeck*
Thompson River Drainage Association: *Jerry McGuire*
Trout Unlimited: *Christine Brissette, Paul Parson, Rob Roberts*
United States Forest Service – Lolo National Forest: *Chris Partyka, Dave Hattis, Heather Berman, Jon Hanson, Kristin Duckworth Richardson, Traci Sylte*
Weyerhaeuser Company: *Brian Sugden*

Funders:
Lolo National Forest
Montana Department of Natural Resources and Conservation
NorthWestern Energy
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List of Acronyms

ACM: Anaconda Copper Mining Company
BEHI: Bank Erosion Hazard Index
BMP: Best Management Practice
CR: County Route
CWA: Clean Water Act
DEQ: [Montana] Department of Environmental Quality
DNRC: [Montana] Department of Natural Resources and Conservation
EIS: Environmental Impact Statement
EPA: Environmental Protection Agency
ESCCD: Eastern Sanders County Conservation District
FCD: Flathead Conservation District
FR: Forest Route
FWP: [Montana] Fish, Wildlife, and Parks
GMCD: Green Mountain Conservation District
HCP: Habitat Conservation Plan
LCD: Lincoln Conservation District
LCFWG: Lower Clark Fork Watershed Group
LWD: Large Woody Debris
MCA: Montana Climate Assessment
MDT: Montana Department of Transportation
MFISH: Montana Fish Information System
MOU: Memorandum of Understanding
MWCC: Montana Watershed Coordination Council
MTNHP: Montana Natural Heritage Program
NFS: National Forest System
NPS: Nonpoint Source [Pollution]
NRCS: Natural Resources Conservation Service
RKM: River Kilometer
RM: River Mile
SMZ: Streamside Management Zone
SWCDM: Soil and Water Conservation Districts of Montana
TAC: Technical Advisory Committee
TMDL: Total Maximum Daily Load
TN: Total Nitrogen
TP: Total Phosphorus
USFS-KNF: United States Forest Service - Kootenai National Forest
USFS-LNF: United States Forest Service - Lolo National Forest
USFWS: United States Fish and Wildlife Service
WRP: Watershed Restoration Plan
WY: Weyerhaeuser Company

Section 1: Introduction

1.1: Watershed Restoration Plans

A watershed restoration plan (WRP) is a locally developed document that provides a framework for managing, protecting, and restoring local water resources. Creating a plan is one of the requirements to receive grant funding under Section 319 of the federal Clean Water Act (CWA). The CWA, passed by congress in 1972 to be implemented by the Environmental Protection Agency (EPA), establishes the basic structure for addressing discharges of pollutants into waters of the United States and its major goal is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (DEQ 2014).

Point sources, defined as pollution that comes from a single source, are regulated through discharge permits acquired from the Montana Department of Environmental Quality (DEQ). These permitted points of pollutant discharge are typically associated with factories, wastewater treatment plants, or other industries. The CWA has been successful in reducing the impacts of point source pollution through this permitting process.

Nonpoint source (NPS) pollution comes from a variety of diffuse sources and is transported by runoff (i.e., rainfall or snowmelt moving over and through the ground). Runoff picks up and transports natural and human-caused pollutants, and ultimately deposits them into lakes, rivers, wetlands, and groundwater (EPA 2017). Nonpoint source pollution is addressed by natural resource managers, landowners, and community members through a combination of both regulatory and voluntary actions. Watershed Restoration Plans help guide voluntary actions to holistically address NPS pollution by providing an assessment of the contributing causes and sources of NPS pollution for a specific watershed and setting priorities for implementing step-wise management actions to prevent or reduce NPS pollution.

In Montana, DEQ administers and distributes CWA Section 319 project funding to government or nonprofit organizations (such as watershed groups) to address NPS pollution in accordance with accepted WRPs. Approval of individual WRPs is contingent on the presence of nine key elements developed by the EPA. Information pertaining to each of these elements can be found in the sections of this document identified parenthetically after each element as listed below.

1. Identify NPS pollutant causes and sources **(Section 1 & 2)**
2. Estimate NPS pollutant loading into the watershed and expected load reductions **(Section 3)**
3. Describe NPS management measures to achieve load reductions **(Section 3)**
4. Estimate technical and financial assistance needed to implement the plan **(Section 4)**
5. Develop an information/education component **(Section 5)**
6. Develop a NPS management implementation schedule **(Section 5)**
7. Describe measurable milestones **(Section 6)**
8. Identify indicators to measure progress and effectiveness **(Section 6)**
9. Develop a monitoring component to evaluate implementation effectiveness **(Section 6)**

1.2: Impaired Streams and Total Maximum Daily Loads

The CWA requires that each state designate beneficial uses of their waters and develop water quality standards to protect those uses. In Montana, the water quality beneficial use classification system includes: agriculture, drinking water, fish and aquatic life, industry, recreation, and wildlife (DEQ 2012; DEQ 2014).

Once a water body fails to meet one or more water quality standard, it is identified as impaired and no longer fully supporting its designated beneficial use. Montana DEQ updates a Water Quality Integrated Report every two years which identifies impaired streams and associated pollutants (DEQ 2016). After a stream has been identified as impaired, both Montana state (75-5-701 of the Montana Water Quality Act) and federal law (Section 303(d) of the CWA) require development of total maximum daily loads (TMDLs), defined as the maximum amount of pollutants that a waterbody can receive and still meet water quality standards. TMDLs are published in a document which identifies impaired streams, the pollutants impairing those streams, current water quality standards, and general strategies for reducing NPS pollutant loads (DEQ 2014). WRPs are then developed to guide step-wise, locally driven action that addresses impairments identified in a TMDL document. Figure 1.1A illustrates DEQ's Adaptive Water Quality Management Process (DEQ 2012).

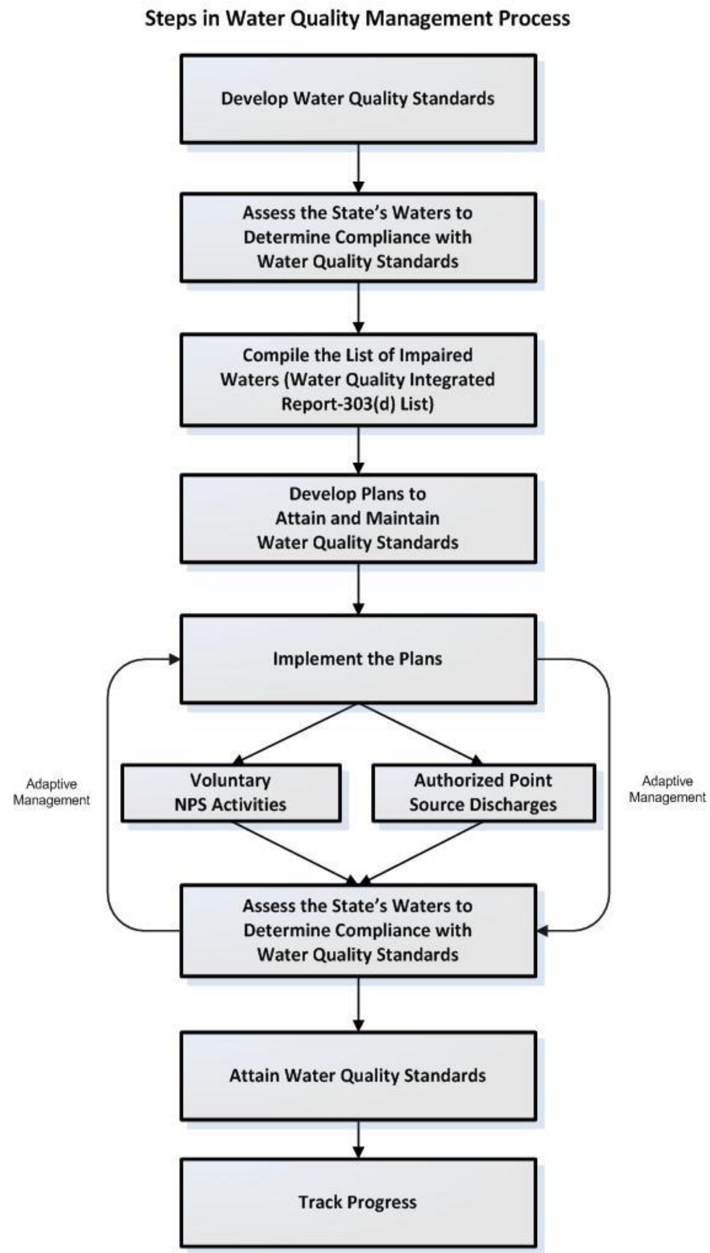


Figure 1.1A. Montana DEQ's Adaptive Water Quality Management Process (DEQ 2012).

1.3: Causes and Sources of Impairments

A "cause of impairment" refers to the pollutant that prevents the waterbody from meeting water quality standards. Sediment, temperature, and nutrients are the primary pollutant causes of impairment within the Thompson River Watershed. A "source of impairment" refers to the activity or entity from which a pollutant is derived, such as fertilizer application or loss of riparian habitat. In addition to the primary pollutant causes of impairments, there are non-pollutant causes, such as alteration in streamside vegetation, that affect stream structure and function, and are therefore important management concerns. Unlike primary pollutant causes, these non-pollutant causes primarily relate to habitat and have no calculated loads (DEQ 2014). Additional information about specific causes and sources of pollutants and non-pollutants for impaired waterbodies in Montana can be found on the CWA Information Center website.

Sediment Causes and Sources

Erosion, sedimentation, and sediment transport are natural processes important to building and maintaining streambanks, floodplains, and quality aquatic habitat. However, excessive amounts or accelerated rates of sedimentation and erosion due to human activities creates unnaturally high levels of sediment, streambed aggradation, channel incision, and bank erosion that impairs stream health and beneficial uses in the following ways:

- Causes unnatural acceleration of erosion and land loss.
- Increases turbidity, reduces light penetration, and creates murky and discolored water, which limits aquatic plant growth, and also can decrease recreational experiences and aesthetic appreciation of the stream.
- Obscures sources of food, habitat, hiding places, and nesting sites, which impairs reproduction and survival of aquatic organisms.
- Clogs fish gills and causes abrasive physiological damage, reduces availability of suitable spawning sites, smothers eggs or hatchlings, hinders emergence of newly hatched fish, depletes oxygen supplies, and causes accumulation of metabolic waste around developing embryos.
- Reduces the quality of fishery available for recreational use and guiding commodity.
- Increases filtration costs for water treatment facilities that provide safe drinking water.
- Increases flooding frequency in areas of aggradation.
- Increases maintenance and replacement costs to roads and other infrastructure within flood-prone areas.

Major sources of sediment include:

Streambank Erosion: Streambank erosion is a natural process, but human disturbances to riparian vegetation, road encroachment, or altered stream hydrology can accelerate natural rates. Accelerated erosion often results from instability caused by partial or complete removal of riparian and streamside vegetation, loss of channel capacity, channel incision, or impairment of natural meandering pattern and processes. Reductions in streamside vegetation is commonly associated with the roadway footprint occupying space that otherwise would be inhabited with large trees, prominent shrubs, forbs, and grasses (DEQ 2014). Other activities such as historic road construction and maintenance practices, timber harvest prior to the Montana Streamside Management Zone Law (SMZ), livestock over-grazing, and illegal firewood harvest and gathering near streams can also damage or eliminate streamside vegetation and accelerate streambank erosion.

Upland Erosion: Upland sediment originates beyond the stream channel and is caused when ground cover is disturbed and unprotected. Detached soil particles are transported to streams by concentrated and non-concentrated runoff processes. Erosion and sedimentation rates are influenced by land use and type and extent of vegetative cover. While natural sources contribute a considerable portion of the sediment load, activities that disturb the soil surface, such as grazing, agriculture, unmitigated timber harvest, roads, or wildfire can influence sediment loading to streams (DEQ 2014). Increases in upland erosion arising from the above land use changes can be mitigated through the implementation of Best

Management Practices (BMPs); for example, timber harvest impacts to upland erosion are largely controlled through adherence to forestry BMPs as well as the Montana SMZ law (Ziesak 2016; Cristan et al. 2016

Road Surfaces: Roads located near stream channels degrade and replace riparian vegetation, preclude trees and recruitment of trees that would otherwise provide shade and stream habitat, encroach on the channel, limit natural stream meandering processes, and contribute sediment directly to the stream. Factors influencing sediment contributions from roads include proximity to the stream, road type, construction specifications, maintenance, drainage, soil type, topography, and precipitation frequency and intensity. Culverts that are undersized, improperly installed, or insufficiently maintained can increase erosion, sediment loading, and preclude movement and propagation of fish and other aquatic species such as freshwater mussels. Most sediment loading comes from short, limited sections of roads that encroach on riparian areas immediately adjacent to streams, and a number of road crossings with inadequate size or improper maintenance (DEQ 2014).

Nutrient Causes and Sources

Nitrogen and phosphorus are naturally occurring chemical elements that are taken up, retained, and released (i.e., “cycled”) by healthy and properly-functioning aquatic ecosystems. Human influences can alter nutrient cycle pathways by creating excess nutrients in the watershed, causing damage to biological and physical stream function. Excess nutrient loading to aquatic ecosystems can lead to:

- Elevated nitrates in drinking water, which can inhibit normal hemoglobin function in infants.
- Blooms of blue-green algae, which can produce toxins lethal to aquatic life, wildlife, livestock, and humans.
- Excess algal biomass leading to substrate embedment and changes to food web structure (macroinvertebrates and the fish that feed on them).
- Changes to overall water quality and aesthetics of surface water due to excess algal biomass, which harms recreational uses such as fishing, swimming, and boating.
- Increased costs to treat drinking water or health risks if algae are ingested in untreated drinking water.

Major sources of nutrients include:

Grazing: Location, intensity and frequency of grazing can affect the composition and growth of vegetation in upland and riparian areas as well as cause direct channel widening, sediment delivery, and bank trampling. In addition, livestock with uncontrolled access to streams contribute pollutants to the water via excrement and damaged vegetation and riparian buffers. While managed livestock grazing can promote growth and diversity of vegetation, over-grazing can deteriorate or destroy vegetation and inhibit its ability to take up nutrients, provide shade, minimize erosion, and provide proper channel dimensions through stream channel stability. Additionally, decomposition of livestock excrement mobilizes nutrients that then enter surface water via overland flow (DEQ 2014).

Agriculture: Agricultural practices can contribute substantial nutrient loads to watersheds if proper BMPs are not utilized. Nutrient loading from agriculture is often a result of excessive or incorrect fertilizer application, lack of cover crops, plowing fields at improper angles, and lack of riparian buffers (DEQ 2014).

Development: Residential and municipal development contributes nutrients to the watershed through collective influences. Increased impervious surfaces and lawn fertilization/irrigation concentrate the amount of nutrients in the soil, which is then picked up by increased runoff to accelerate nutrient loading into streams (DEQ 2014).

Septic Systems: Septic systems contribute nutrients to surface water through subsurface pathways. The amount of nutrients a given septic system contributes to a waterbody depends on discharge, soils, and proximity to the waterbody. Overall age, condition, and efficiency of the septic system itself, also contributes to nutrient loading if regular maintenance is not performed (DEQ 2014).

Timber Harvest: While intensity, and therefore impact, of timber harvest varies widely, harvest activities result in changes to biomass uptake of nutrients and soil conditions that affect the nutrient cycle. Nutrient uptake by biomass is greatly reduced after timber harvest, leaving more nutrients available for runoff. This increase of nutrients in a harvested area generally only lasts up to two or three years before returning to pre-harvest levels (DEQ 2014).

Sediment: Excess sediment delivery from streambank erosion, road runoff, and saturation of agricultural soils can also lead to increased nutrient levels, specifically increased phosphorus levels, in surface water bodies with additional availability of phosphorus attached to soil particles (DEQ 2014).

Temperature Causes and Sources

High stream temperatures result in reduced dissolved oxygen levels and also have direct metabolic impacts to cold-water fish species. Stream temperatures are highest during the summer months due to greater solar insolation, increased water use for irrigation, and natural summer decrease of flow volume. However, human activities such as livestock grazing, timber harvest, and irrigation can cause stream temperatures to rise because they:

- Reduce stream shade (reduce amounts of riparian vegetation).
- Increase stream channel width (change the width/depth ratio).
- Add heated water or take water out of the stream (alteration of instream flow).

Loss of Riparian Shade: Riparian vegetation provides shade to stream channels, which reduces the amount of sunlight hitting the stream, and ultimately reduces the thermal load to the stream. Riparian vegetation also reduces near-stream wind speed and traps air against the water surface, which reduces the rate of heat exchange with the atmosphere (DEQ 2014).

Width to Depth Ratio: When channel width increases relative to depth as a result of human activities and erosion, the channel loses its ability to stay cool due to an increase in surface area exposed to the sun and warm air. A channel with a lower Width to Depth ratio (deep water relative to channel width) has less surface area in contact with the air and is slower to absorb heat during periods of warm temperatures. Additionally, the riparian canopy shades a larger percentage of the water surface area of narrow channels (DEQ 2014).

Instream Flow and Water Use: Due to the physical properties of water, more time and energy (solar radiation) is required to heat larger volumes. As a result, when instream flows are reduced, whether by irrigation draw-downs or restricted flow from headgates, the ability of the stream to buffer incoming solar radiation is reduced. A stream channel with less water will heat up much faster than a channel with identical morphology and shading conditions (DEQ 2014).

Non-Pollutant Causes and Sources

Non-pollutant causes of sediment, nutrient, or temperature impairments may impact beneficial uses without a quantifiable measurement or direct link to a pollutant. Non-pollutants are often listed as a probable cause of impairment when available data at the time of a water quality assessment do not provide a direct, quantifiable link to a specific pollutant and can be listed together with NPS pollutants (DEQ 2014).

Alteration of stream-side vegetative covers: Alteration of stream-side vegetative cover refers to any circumstance where stream-side practices have altered or removed riparian vegetation. This can occur when riparian vegetation is removed due to activities such as road construction or overgrazing by livestock along the stream. The loss of vegetative root mass leads to greater bank instability, over-widening of the stream channel, and elevated sediment, nutrient and/or temperature loads (DEQ 2014).

Alteration of fish habitat: Activities or practices that alter the natural habitat can negatively affect native fish populations. Fish habitat can be altered by many features and mechanisms, such as stream straightening and channel simplification resulting in loss of meander bends, reductions in stream length, compromised pool depths and complexity, excessive sedimentation, loss of in-channel wood and habitat complexity, removal of riparian vegetation which provides shelter and shade to the stream, addition of excess plant or algal growth from excess nutrients which inhibits movement and oxygen intake, or by a change in stream bed composition that impairs reproductive survival and obscures food sources, among others (DEQ 2014).

Other alterations to flow regime: Other alterations to flow regime include any change to water yield of a watershed relative to natural conditions. This can be associated with changes in yield and stream flow due to activities such as urban development, road construction, irrigation diversions, or timber harvest. Changes in runoff are often linked to elevated stream flows, which can cause streambank erosion and lead to excess sedimentation (DEQ 2014).

Fish-Passage Barrier: Fish-passage barriers refer to any alteration to a waterbody that prevents the upstream and/or downstream passage of fish species. These barriers fragment habitat and can prevent fish from reaching upstream spawning areas as well as propagation of fresh water mussel life stages (Stagliano 2015). Fish-passage barriers that result from human activities include improperly designed and undersized road culverts, dams, and irrigation diversion structures (DEQ 2014).

1.4: Additional Streams and Water Quality Management Considerations

Additional streams may also be included in a WRP alongside DEQ-listed impaired streams. Although not included on the 303(d) list of impaired streams, opportunities may exist to protect, maintain, enhance, or restore water resources, fisheries populations and fish habitat, or to reduce potential threats to a stream’s ability to continue to support beneficial uses into the future. Including additional streams, where there are opportunities and local impetus (beyond 303(d) listing) for watershed improvement work, helps make a WRP a more comprehensive plan for restoration throughout an entire watershed and a more meaningful reflection of all stakeholder priorities. Therefore, additional water quality restoration strategies are considered in conjunction with NPS pollution reduction guidelines.

Additional management considerations in the Thompson River Watershed that have informed this plan have focused primarily on native salmonid management and conservation (specifically Bull Trout and Westslope Cutthroat Trout). In addition, some organizations within the watershed are also concerned about other wildlife populations. For example, beaver populations within the Thompson River Watershed are a concern for the Lolo National Forest (USFS-LNF). Due to habitat loss and removal through trapping or other means, local beaver populations in North America are believed to be only 10% or less of pre-European levels (Baker & Hill 2003). Beaver are considered a keystone species with benefits (impounding and raising water tables, increasing water storage, reductions in stream velocity and sediment detention, improving stream temperatures, and improving habitat and water availability) beyond their immediate requirements for food and space. Beaver management practices can preserve existing land uses while maintaining benefits such as enhanced water quality, wildlife habitat, livestock grazing, recreation, and aesthetic values (Pollock et al 2017).

Management techniques intended to improve fish habitat focus on supporting resilient populations into the future. Restoration efforts that reduce NPS pollution and improve fish habitat will also contribute to overall watershed health. In addition to direct water quality impacts from sediment and nutrient loading and high stream temperatures, there are a number of factors that limit native fish population growth in northwestern Montana. In the Thompson River Watershed, contributing factors include habitat degradation and non-native species interactions.

Habitat Degradation: Historic activities such as road construction, logging, grazing, mining, energy production, and development of transportation/energy corridors have degraded and fragmented habitats and has reduced connectivity of streams and rivers with resident native fish populations. Both Westslope Cutthroat Trout and Bull Trout are cold-water species and require cool, clear, fast-running streams for adequate spawning and rearing habitat (USFWS 2015). Streams that have become wider and shallower or simplified from lack of wood or meander bends, contain fewer large deep pools, and therefore have lost habitat complexity under which native fish populations evolved and adapted. Large woody debris (LWD) is an important factor in healthy streams because it reroutes sediment and water, creating a complexity of niches, drives the natural formation and placement of pools, riffles, and cover, and acts as a substrate for biological activity. Loss of LWD inhibits the stream's ability to reduce stream velocities, and in addition, reduces habitat complexity and shade, which are critical to the life cycle of native fish populations (USFS 2013).

Non-Native Species Interactions: Native fish populations can be negatively affected by interactions with introduced fish through hybridization, competition, and predation. Non-native and hybridized species are often better adapted to habitat conditions and compete with native populations when they occur together, even in un-degraded habitats (USFWS 2015, McMahon et al. 2007). For example, in the Thompson River drainage, warmer water temperatures promote non-native Brown Trout, and impair Bull Trout populations. While the presence of non-native species is an important factor affecting the continued success of native species in the Thompson River Watershed, this WRP does not focus on nonnative species management but rather on improving habitat quality throughout the entire drainage (Blakney 2016).

1.5: Thompson River Watershed Restoration Plan Goals and Objectives

The Thompson River WRP is intended to identify opportunities for, plan, and prioritize watershed restoration and enhancement efforts throughout the Thompson River Watershed. While the Lower Clark

Fork Watershed Group (LCFWG) is the sponsor and author of the Thompson River WRP, the overall goal for this document is to incorporate the diverse perspectives and priorities of stakeholders throughout the watershed into a comprehensive watershed-wide plan, and to develop partnerships that will lead to successful restoration efforts in the future. The primary goal of the collaborative group of stakeholders involved in the development of the Thompson River WRP is to improve and maintain the health of the watershed, such that it will provide clean, abundant water to support all beneficial uses into the future.

The main objectives for the Thompson River WRP are:

1. To facilitate TMDL implementation and address NPS pollution of DEQ-listed impaired streams in the Thompson River Watershed.
2. To identify and prioritize opportunities for the protection and enhancement of additional streams that, while not listed as impaired by DEQ, are also a focus for local restoration needs and multi-faceted conservation efforts.
3. To establish a DEQ-accepted WRP that can be used to receive CWA Section 319 funding, as well as to identify and to qualify for other sources of funding offered at local, state, and national levels.
4. To serve as a comprehensive strategic plan for restoration in the Thompson River Watershed to promote water quality, native fish populations, and overall ecological health.

The Thompson River WRP is a living document that will be revised collaboratively every 10 years and revisited annually to provide updates on project implementation progress. It serves as a user-friendly reflection of the priorities of current stakeholders and currently available information and expertise, with the understanding that there may be unforeseen events (wildfires, flooding, etc.) that change priorities and create new impetus for restoration. This plan is meant to serve as a guide for voluntary stream restoration and conservation within the Thompson River Watershed and the suggestions made within this document are not mandated by law. This type of planning in no way overrides or undermines private property rights or landowner preferences. By creating this plan, we will have a guide to identify and pursue stream restoration and conservation opportunities that maximize benefits to the watershed, contribute to the local restoration economy, and reflect local priorities.

The Thompson River WRP uses a comprehensive approach to restoration in the watershed by addressing drainage systems rather than isolated stream reaches. Tributaries to impaired streams are potential contributors of NPS pollution, so restoration plans for tributary reaches will benefit the NPS reduction efforts across the watershed. Although this plan addresses drainage systems as a whole, versus isolated stream reaches, restoration planning will focus only on lotic (flowing) systems, such as streams and rivers. Lentic (non-flowing) systems, such as lakes and ponds are important components of the Thompson River Watershed, but at this time restoration planning for these habitats will not be the focus of this document.

Data sources for this WRP originate from a variety of sources, including the perspectives of the stakeholders engaged throughout the development of this plan. The majority of information related to DEQ-listed streams is derived from the Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (DEQ 2014), which establishes TMDLs for the Thompson River Watershed and other nearby TMDL planning areas, and numerous other data sources that are periodically referenced herein. Additional references will be utilized to further refine, plan, and prioritize restoration efforts through future revisions and collaboration.

Section 2: Thompson River Watershed

2.1: Thompson River Watershed Characterization and Streams Identified

Figure 2.1A. Mainstem Thompson River. Photo credit: Ryan Kreiner

The Thompson River Watershed, located in the Clark Fork Basin in northwestern Montana, drains an area of roughly 639 square miles (408,841 acres) and consists of a stream network of 1,326 linear miles (PPL 2013). The Thompson River (pictured above in Figure 2.1A and below in Figure 2.1B) is approximately 45 miles long and a tributary to the Lower Clark Fork River, which flows into Lake Pend Oreille in Idaho, and ultimately into the Pacific Ocean as part of the Columbia River Basin (see below, Figure 2.1C; PPL 2013).

The watershed is primarily forested - almost 90% of the land area in the drainage is made up of conifer-dominated forests (MTNHP 2017, see below Figure 2.1D). Grassland systems make up roughly 5%, while lakes, rivers, streams and wetlands make up 2% of the drainage. It is a rural area with approximately 1% of the land area comprised of agriculture (primarily hay production) or developed human land uses. Developments are concentrated in valley bottoms and along rivers and streams. Other landcover types include shrubland, steppe, and savannah systems and sparse and barren systems which collectively make up 2% of the watershed area.

The primary disturbances in the drainage include wildfire, timber harvest practices, and livestock grazing. The largest fires in recent years have been the Chippy Creek and the Copper King. The Chippy Creek fire burned a large area midway up the eastern side of the drainage in 2007, and the Copper King fire burned in the southern end of the watershed near the mouth of the Thompson River in 2016. Additional fires burned in the northcentral/northwestern headwaters of the watershed in 2017. The 2016 and 2017 fires have not yet been incorporated into the Montana Land Cover Framework (MTNHP 2017), which forms the base of Figure 2.1D, but their perimeters have been identified in red. Timber harvest occurs on private, state, and federal lands throughout the drainage.

The majority of the Thompson River Watershed is located within Sanders County, with northern portions in Flathead and Lincoln Counties (Figure 2.1E). The watershed area overlaps the boundaries of four conservation districts: Eastern Sanders, Green Mountain, Flathead, and Lincoln. The area can be accessed from both the south (from Highway 200) and north (from Highway 2) via two roads (Thompson River Road and ACM Road) that run between the two highways along the Thompson River. At the time of the US Census in 2010, the population of Sanders County was just over 11,000 (US Census Bureau 2011). The closest towns are Thompson Falls and Plains; other small communities are located along Highway 200 (which follows the Clark Fork River) and Highway 2 (on the north end of the drainage).

The majority of the Thompson River drainage is publicly owned: 47% of the drainage is national forest, primarily managed by the USFS-LNF (a small area in the northern part of the drainage is managed by the Kootenai National Forest (USFS-KNF) and another 7% of the drainage are state timberlands, managed by the Montana Department of Natural Resources (DNRC). In addition, Weyerhaeuser Company (WY), the largest owner of private timber lands in the United States, merged with Plum Creek Timber Company in 2016 and owns approximately 42% of lands in the Thompson River drainage. Montana Fish, Wildlife & Parks (FWP) holds a conservation easement on approximately half of WY land, along the center of the drainage and the mainstem Thompson River. In addition to the federal, state, and private timberlands described above, there are other small private holdings dispersed throughout the drainage (mostly concentrated on the northern end), which total only around 4% of the land area in the drainage (Figure 2.1E).

While agricultural activities such as hay production occur on <1% of the drainage, livestock grazing is treated as a separate practice in this plan and is common in a number of areas in the watershed. The Thompson River Grazing Cooperative is a cooperative agreement between major landowners in the drainage including USFS-LNF, WY, DNRC, and FWP. Through this agreement, these major landowners lease grazing licenses to private ranchers through a single license administered and managed by the DNRC. Additional grazing also occurs within the watershed outside of this cooperative, including two grazing allotments held by the USFS-LNF located in the southeastern part of the watershed and grazing on private lands. Grazing leases (through the cooperative and USFS-LNF) occur primarily in the northcentral and southeast portions of the watershed (Figure 2.1E). In addition to wildfire and timber harvest, grazing provides a significant amount of disturbance for a number of streams within the Thompson River Watershed.

The Thompson River is a highly valued recreational fishery, and one of the best trout fishing destinations in the area (Figure 2.1B), receiving angler pressure from both residents and non-residents. Montana Fish, Wildlife & Parks has conducted statewide angling use surveys for the mainstem annually from 1982-1985, and then biannually from 1989 to present, to estimate angling use in number of "angler days", defined as one fisherman fishing one body of water for any amount of time on a given day. Angler pressure estimates have increased over the past 10 years and has transformed the mainstem Thompson River from a locally used fishing stream to a regional trout fishing destination. Local anglers, as well as anglers from Missoula, Kalispell, Sandpoint, ID, and Spokane, WA (and beyond), are commonly observed fishing the Thompson River (Kreiner and Terrazas *In Prep.)*. The Thompson River and its tributaries support multiple native fish species including Bull Trout (*Salvelinus confluentus*), Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*), Mountain Whitefish (*Prosopium williamsoni*), and sculpin species (*Cottus spp.*) (Kreiner and Terrazas *In Prep.*). In the Lower Clark Fork area one of the strongest populations of Bull Trout, which is listed as threatened under the federal Endangered Species Act, is in the Thompson River Watershed (Kreiner and Terrazas *In Prep.)*. Preserving and enhancing a quality sport fishery (in addition to the conservation of native fish populations) will continue to be a priority in the Thompson River and its tributaries into the future.

Figure 2.1B. Fishing is a popular activity along the Thompson River. Photo credit: Danielle Tholl.

Subwatersheds: DEQ-Listed Impaired Streams and Additional Streams Included in the Thompson River Watershed Restoration Plan

The Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (DEQ 2014) lists four streams within the Thompson River Watershed as impaired: Lazier Creek, Little Thompson River, McGinnis Creek, and McGregor Creek (Table 2.1A below). Additional streams were identified as priorities for further conservation, restoration, and/or enhancement by local stakeholders because they provide habitat for native Westslope Cutthroat Trout and Bull Trout: Big Rock Creek, Fishtrap Creek, mainstem Thompson River, and West Fork Thompson River. These DEQ-listed streams and additional streams identified by stakeholders (Figure 2.1F) are the focus of the Thompson River WRP.

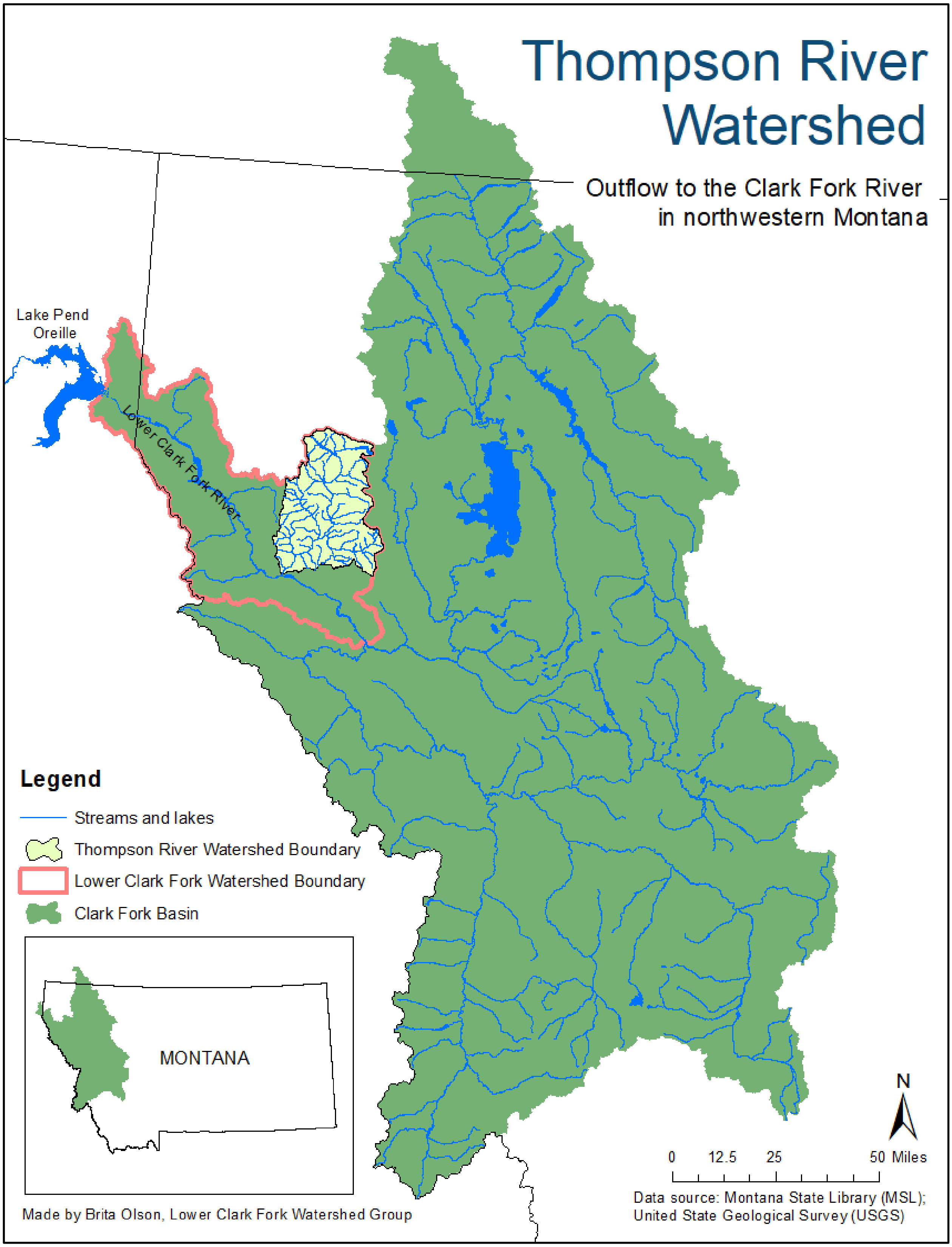


Figure 2.1C. The Thompson River Watershed located in the Clark Fork Basin in northwestern Montana.

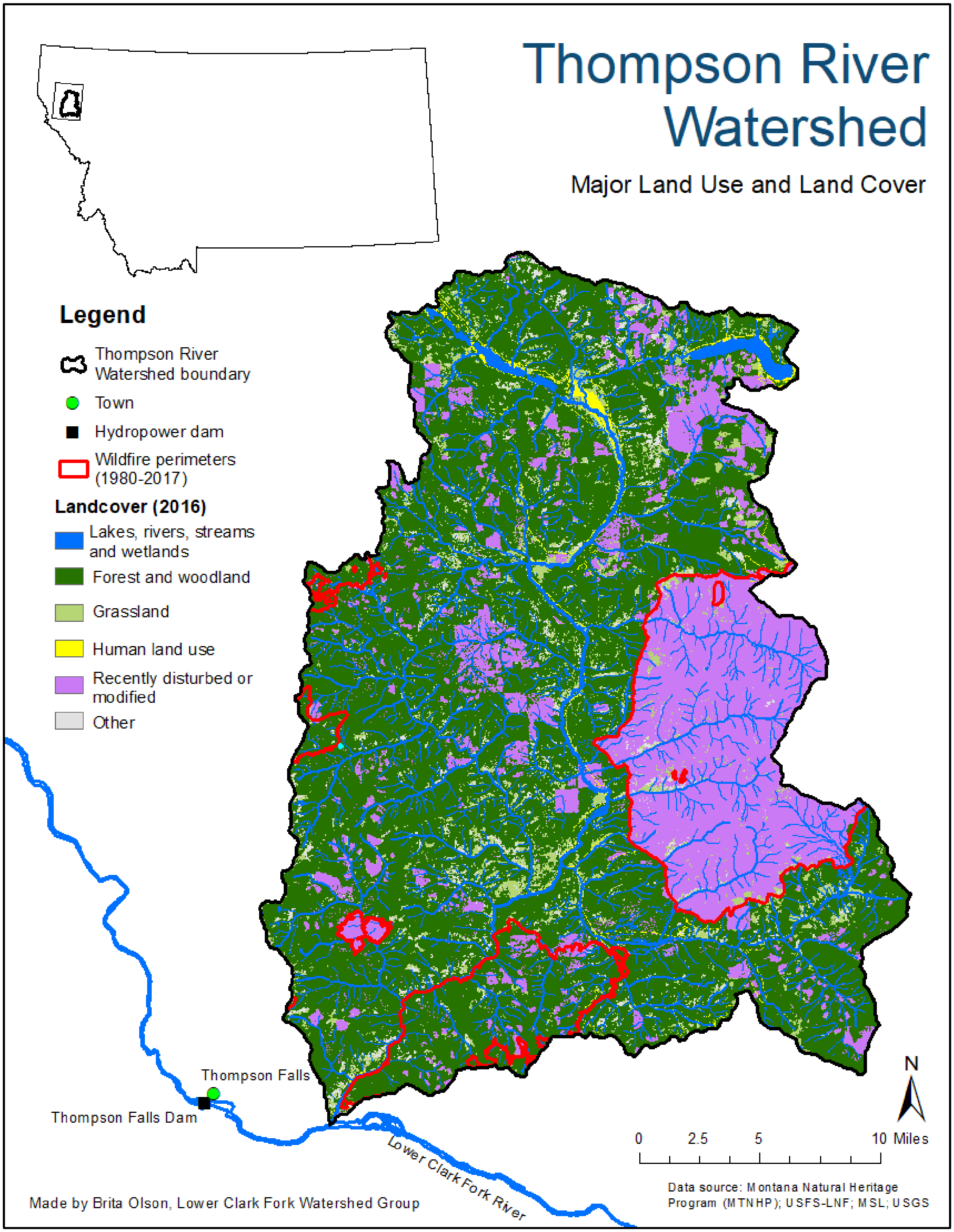


Figure 2.1D. Major land use and land cover in the Thompson River Watershed in northwest Montana. Land cover types are identified by color and extent of wildfire burns are identified by red boundary lines.

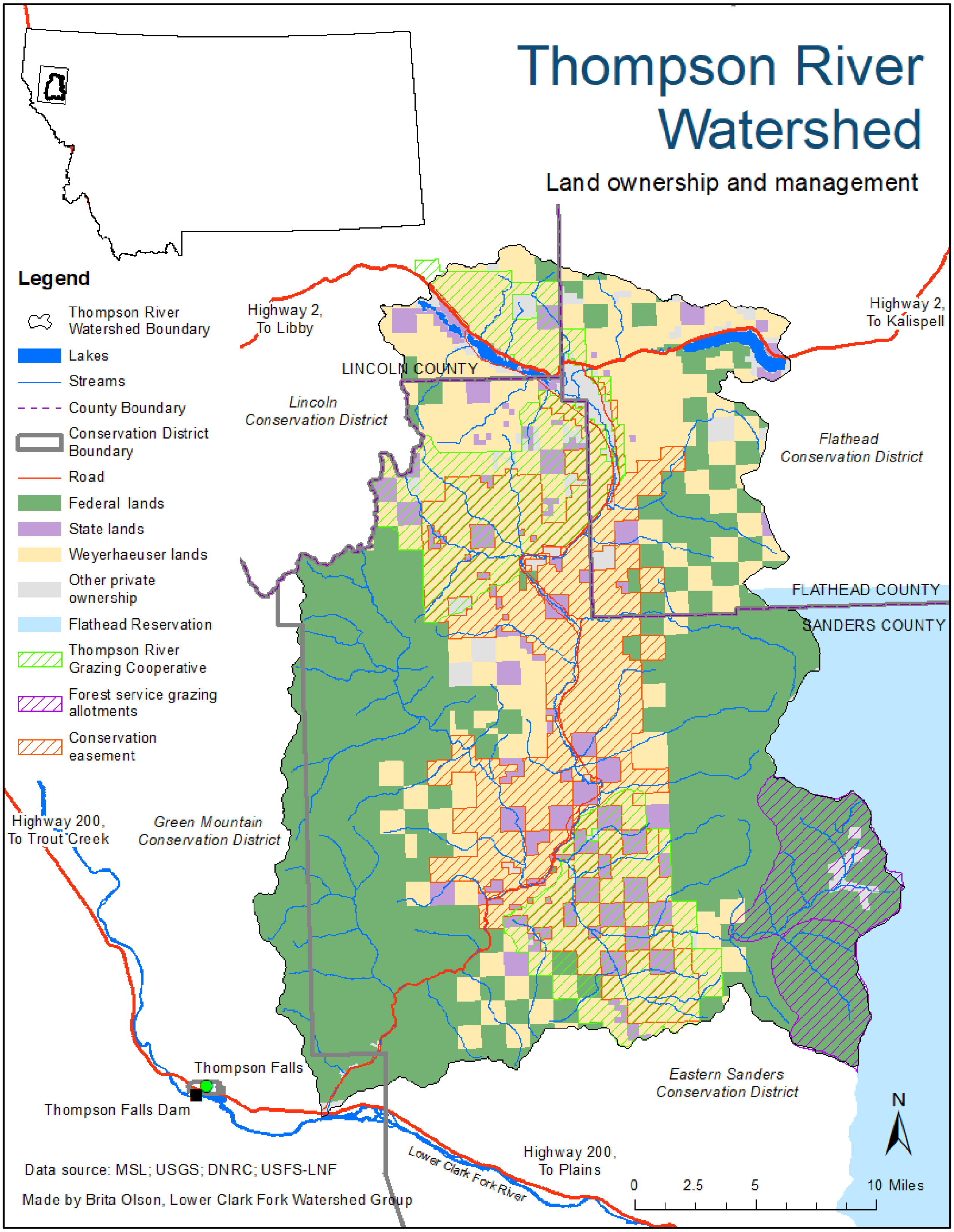


Figure 2.1E. Primary land ownership and land management in the Thompson River drainage in northwestern Montana.

Table 2.1A. DEQ-listed impaired streams, causes of impairment, and impaired uses (DEQ 2014).

Waterbody	**Causes of Impairment**								**Impaired Use**	
	Total Nitrogen	Total Phosphorus	Sediment	Temperature	Alteration in Stream-Side Vegetation	Alteration in Fish Habitat	Other Flow Regime Alterations	Fish Passage Barrier	Aquatic Life	Primary Contact Recreation
Lazier Creek, headwaters to mouth (Thompson River)	**X**	**X**	**X**		**X**				**X**	**X**
Little Thompson River, headwaters to mouth (Thompson River)	**X**	**X**	**X**		**X**				**X**	**X**
McGinnis Creek, headwaters to mouth (Little Thompson River)			**X**					**X**	**X**	
McGregor Creek, headwaters to mouth (Thompson River)			**X**	**X**			**X**		**X**	

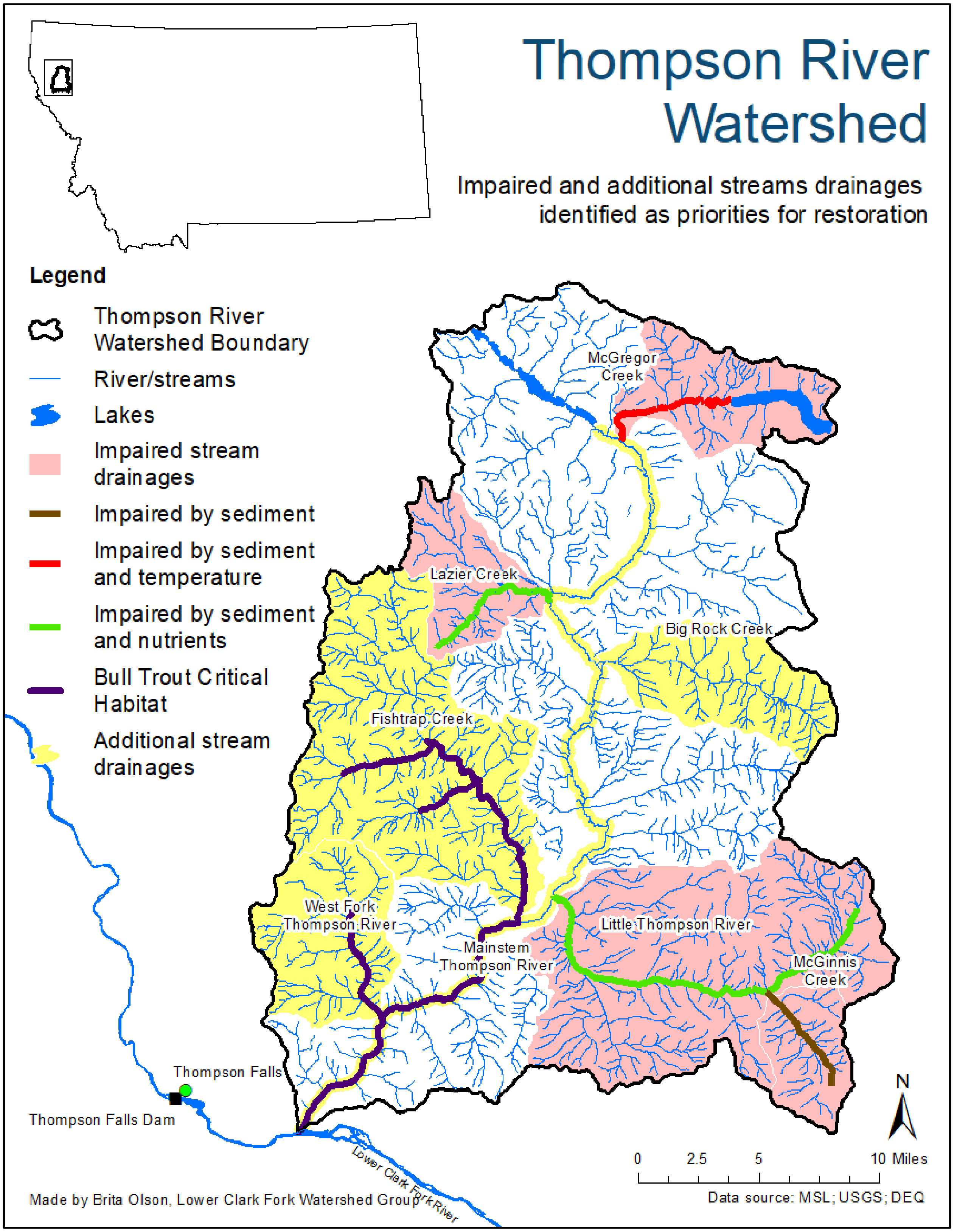
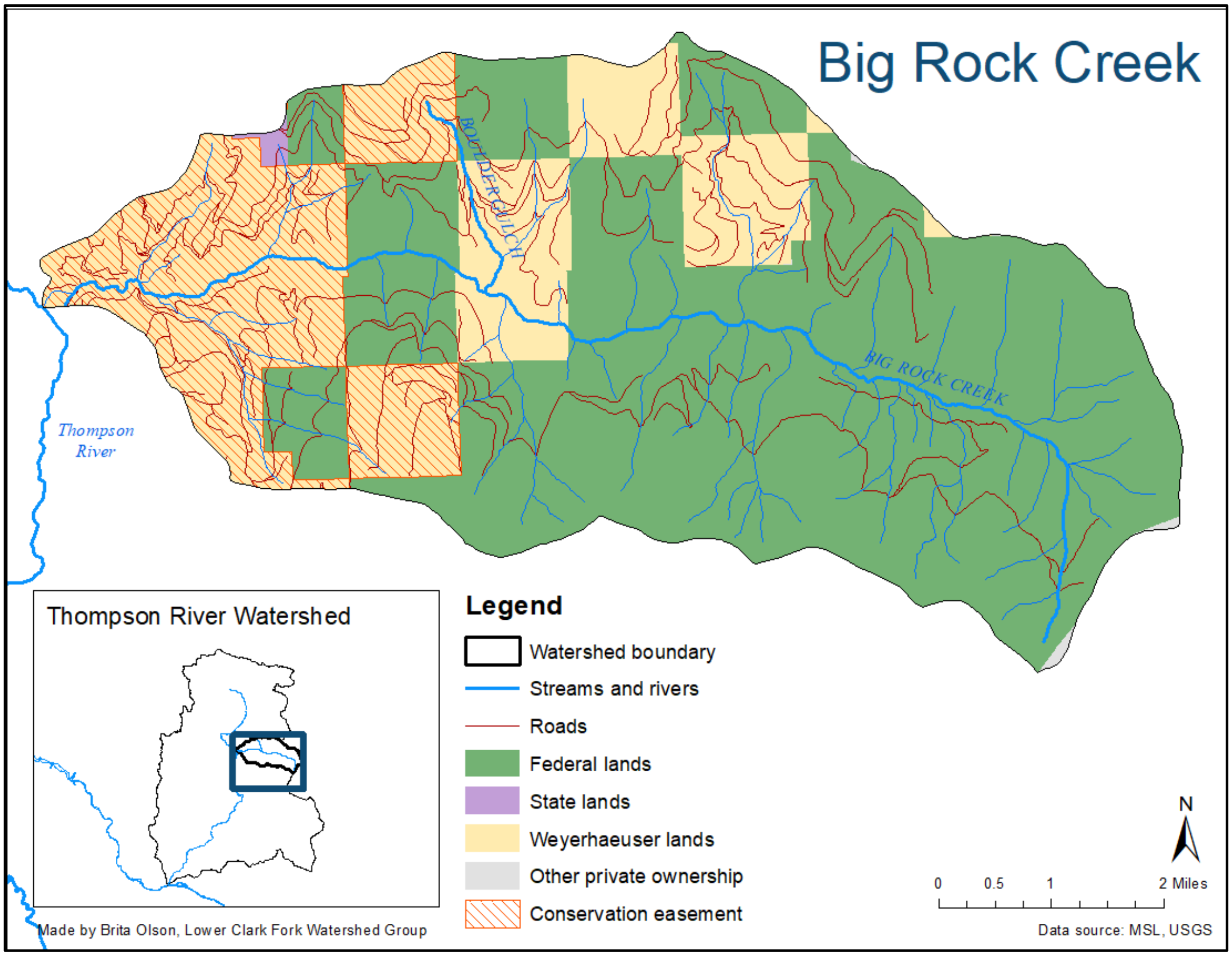


Figure 2.1F. Impaired streams and additional streams identified as priorities for restoration and enhancement within the Thompson River Watershed in northwestern Montana.

2.2: Big Rock Creek Subwatershed

Drainage Characterization

Big Rock Creek is a tributary stream to the Thompson River located in the east-central part of the Thompson River Watershed (Figure 2.2A) and, draining an area of 33.4 sq mi (21,385 acres), enters the Thompson River approximately 32.6 river miles (rm) (52.4 river kilometers (rkm)) upstream from its confluence with the Clark Fork River. Land ownership/land management within the drainage is comprised of USFS – LNF (68%) in the upper watershed and WY lands (31%) in the lower watershed, with state and other private lands composing less than 1% of total land area. The stream is home to both Bull Trout and Westslope Cutthroat Trout, although Rainbow Trout hybridization is present in Westslope Cutthroat Trout and the presence of Brown Trout have recently been discovered in lower reaches (R. Kreiner, FWP, personal communication). The topography in the upper drainage is gentle, and the stream winds through the gentle valley for several miles. The stream gains velocity and volume with the additions of Mandy Gulch (rm 7.2 / rkm 11.6), Broken Nose Gulch (rm 4.7 / rkm 7.6), and Boulder Gulch (rm 5.0 / rkm 7.4). In this reach, the stream flows over falls (Figure 2.2B), through several canyons (Figure 2.2C), deep pools are common, and water temperatures are coldest. Land management in this watershed is primarily focused on timber management on both USFS-LNF and WY lands. A portion of USFS-LNF lands in this watershed are Inventoried Roadless Areas. The road system, developed for timber management in the 1980-90s, was planned and constructed using an interdisciplinary approach considering soil and landform stability, watershed health, wildlife security, and economics. Due to this approach, most roads are located at mid- and upper-slope locations where they have less direct adverse effect to watershed health (e.g. no roads parallel to stream courses; Figure 2.2A) (C. Partyka, USFS-LNF, personal communication).



2.2A. Big Rock Creek drainage.

Figure 2.2B. Cascade falls on lower Big Rock Creek.

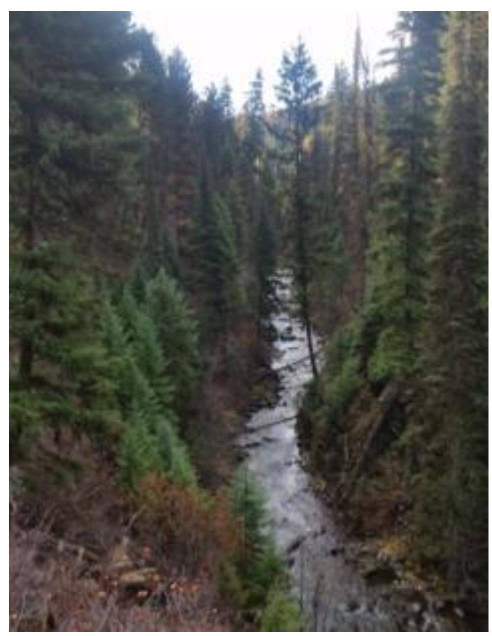


Figure 2.2C. Big Rock Creek flowing through a canyon as it flows down to its confluence with the Thompson River.

Current Stream Conditions

Big Rock Creek is not listed as impaired by DEQ, but was identified by local stakeholders as a priority stream for restoration and fish habitat conservation within the Thompson River Watershed.

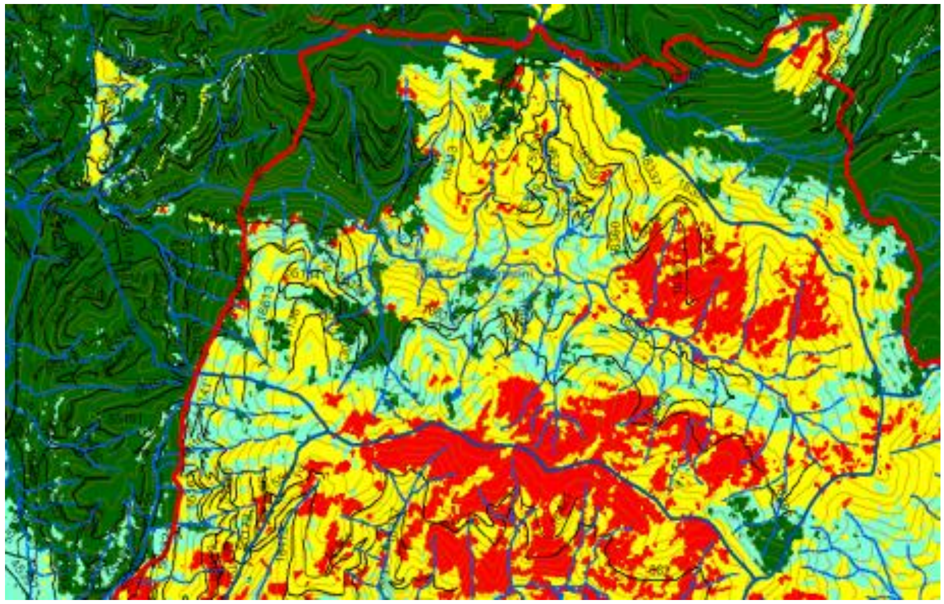


Figure 2.2D. USFS-LNF map of vegetative burn severity in the northern portion of Chippy Creek Fire (High-Red, Mod-Yellow, Low-Aqua, None-Green) with the outline of the Big Rock Creek drainage in red.

In 2007 the Chippy Creek fire (the largest wildfire in Montana that year) burned a majority of the Big Rock Creek drainage. As a result, the upper portions of the drainage lack large conifers in many locations, although alders have begun to reestablish and are thick in some areas. Riparian areas along Big Rock Creek were impacted by the fire (Figure 2.2D). Monitoring of post-fire stream temperatures indicate that mean annual maximum stream temperatures have warmed by 1-2 degrees C (Figure 2.2E; B. Sugden, WY, personal communication). The moderate increase may be attributed to the topography and shading by the canyon section along the lower reaches of the creek; surveys conducted by FWP indicate that water temperatures are coldest in the canyon reach. In 2016, water temperatures were monitored near the mouth of Big Rock Creek and upstream below Boulder Gulch. Mean daily temperatures exceeded 53.6 °F (12°C), the upper limit of ideal temperatures for Bull Trout, on only three occasions during July and August at the upper site, while at the lower site temperatures exceeded 53.6°F (12°C) on 49 days during that same time period with some mean daily values exceeding 59°F (15°C), which is the temperature believed to limit Bull Trout distribution (USFWS 2015; Al-Chokhacy et al. 2016). Temperatures remain within the acceptable range for native trout species, including Bull Trout (Al-Chokhachy et al. 2016).

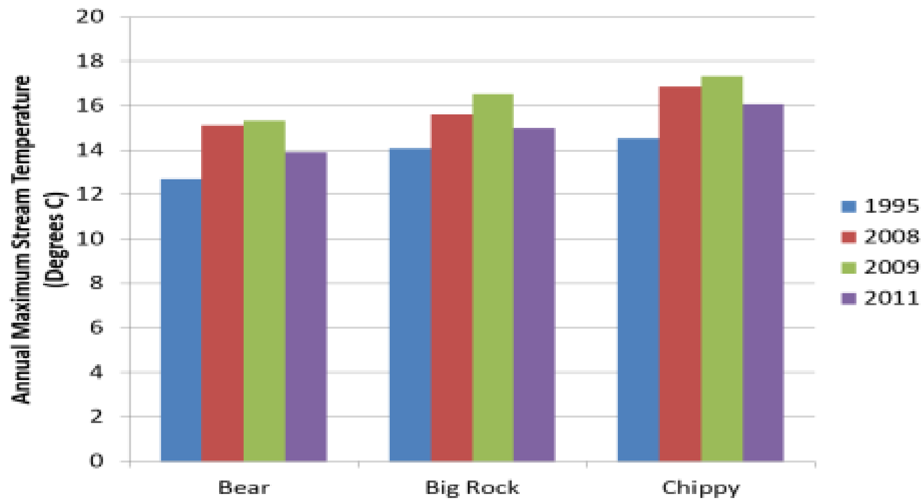


Figure 2.2E. Annual maximum temperature in three tributaries draining the Chippy Creek fire area in 1995 (pre-fire), and 2008, 2009, and 2011 (post-fire). Source: WY

In the past, flooding events have also negatively impacted Big Rock Creek by contributing sediment loads. Flooding in spring 2009 washed out a portion of the county road below a newly installed bridge (Figure 2.2F) at the mouth of the drainage where the stream gradient flattens. Efforts have been made in recent years to replace washed out roads and also revegetate the washed out reaches (Figure 2.2G).

Figure 2.2F. Washed out portion of the county road below a newly installed bridge, following flood events in spring of 2009.

Figure 2.2G. Washed out reach of the county road (opposite direction as Figure 6.1E) that has been revegetated.

Fisheries surveys conducted in 2010 and 2013 documented Bull Trout presence between rm 1.3 (rkm 2.1) and rm 6.0 (rkm 9.7) (R. Kreiner, FWP, personal communication). Their abundance (based on catch per unit effort) was highest in the middle (rm 3.9/rkm 6.3) and tapered off on the upper and lower reaches. Westslope Cutthroat Trout were present at all locations from rm 1.3 (rkm 2.1) to rm 9.6 (rkm 15.4), but based on phenotypic characteristics, hybridization with Rainbow Trout was detected through at least rm 3.0 (rkm 4.9). Brown Trout were present in high densities at rm 1.3 (rkm 2.1), and a single individual was captured at rm 2.4 (rkm 3.9) in 2013.

Education and Outreach Opportunities

Future outreach opportunities include increased communication among stakeholders within the drainage, but no additional educational opportunities have been identified at this time.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.2A. Recently completed projects within the Big Rock Creek Drainage.

Project description	Lead entity	Cost	Date completed
Fish barrier culvert replaced on tributary to Big Rock Creek in Section 6 (T24N, R26W) (Figure 2.2H)	WY	$10,000	2003
Culvert cleaning and replacement, drain dip construction, ditch enlargement and roadside weed treatments following Chippy Creek fire on all USFS roads in the watershed	USFS-LNF	$145,000	2008
Replacement of undersized culvert on County Road crossing of Big Rock Creek following 2007 Chippy Creek wildfire	USFS-LNF, Sanders County	$80,000	2008
Relocation of washed out section of County Road (County Route 56) along lower Big Rock Creek following spring 2009 flooding. FWP coordinated revegetation of streambank (Figure 2.2I)	Sanders County, WY, FWP	$20,000	2009
Decommissioning and storage of approximately 2.5 miles of USFS roads near Tepee Mountain	USFS-LNF	$12,500	2010
Road BMP upgrades in Big Rock Creek watershed on WY land	WY	$60,000	1998-2015

Figure 2.2H. Baffled fish passage culvert being lowered into place in a tributary to Big Rock Creek in 2003. Photo credit: WY.

Figure 2.2I. Bridge over Big Rock Creek on the county road installed in 2009 (or 2010).

2.3: Fishtrap Creek Subwatershed

Drainage Characterization

Fishtrap Creek is a major tributary to the Thompson River, draining an area of 93.5 square miles (59,842 acres) (Figure 2.3A). It flows into the Thompson River from the west, at rm 15.5 (rkm 24.9). Land ownership/land management in the drainage is distributed among USFS-LNF (74%), WY (23%), DNRC (2%), and other private (<1%). It is primarily forested, and generally managed for timber, wildlife protection, roadless, and recreation. Some land owned by DNRC along Fishtrap Creek is leased for cabins. The USFS-LNF manages two seasonal campgrounds at Fishtrap Creek and at Fishtrap Lake. Grazing on USFS-LNF lands was discontinued in 2007 with closure of the Fishtrap grazing allotment.

Bull Trout and Westslope Cutthroat Trout are found within the Fishtrap Creek drainage, including the mainstem and many of its tributaries. The WY Native Fish Habitat Conservation Plan (HCP) classifies Fishtrap Creek and its tributaries as a Tier 1 Bull Trout spawning and rearing watershed. It is further classified as a “Native Fish Assemblage,” which indicates its exceptional value as a native fish stronghold. The drainage is classified as critical Bull Trout habitat by the USFWS (specifically the mainstem, Jungle Creek, Beatrice Creek, and West Fork Fishtrap Creek) and falls within the Lake Pend Oreille Recovery Unit (USFWS 2015).

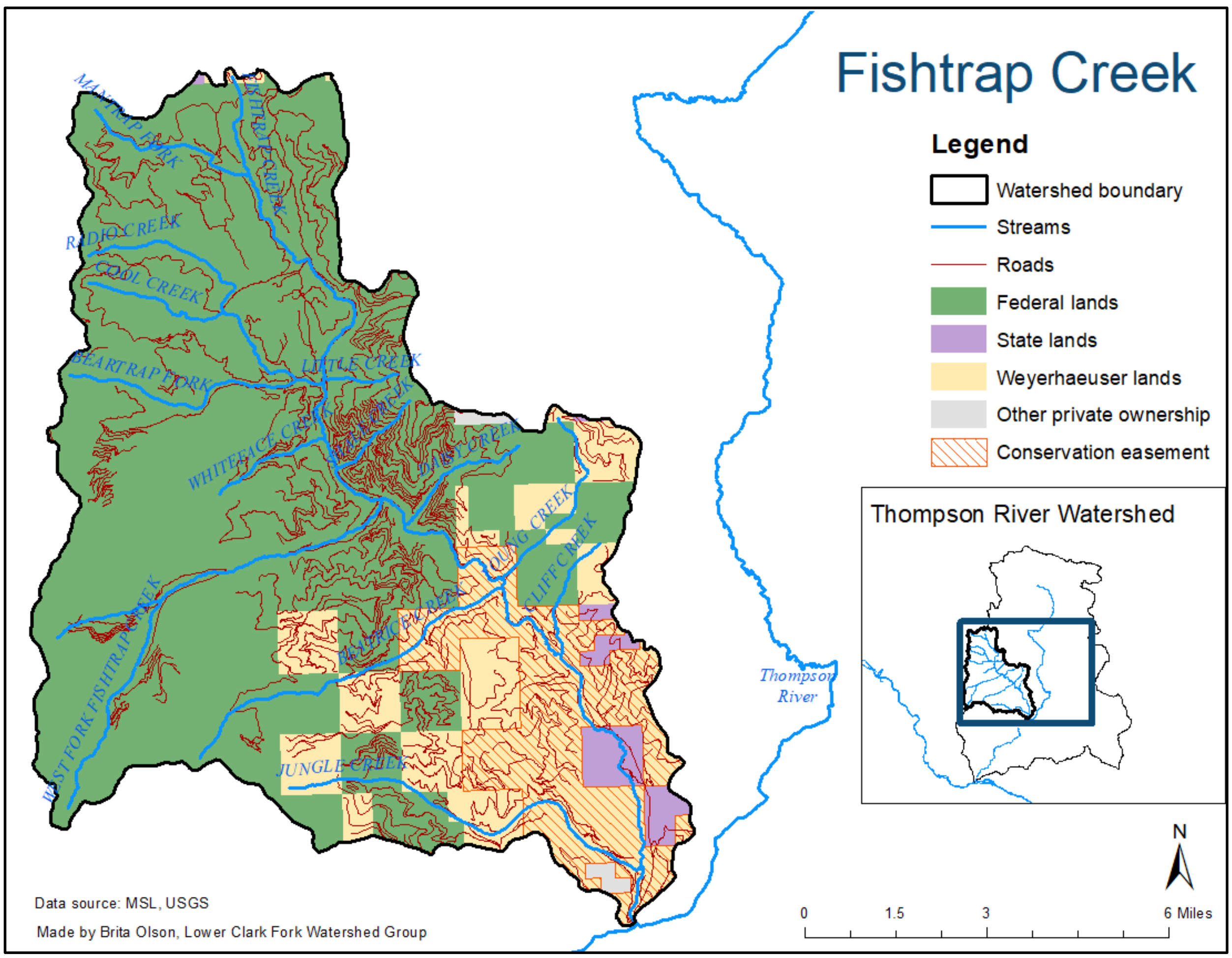


Figure 2.3A. Fishtrap Creek drainage.

Current Stream Conditions

Fishtrap Creek is not currently listed as impaired by DEQ, but it has been identified by local stakeholders as a priority for restoration and fish habitat conservation. Historically, Fishtrap Creek was listed by Montana DEQ as water quality limited, but this was based on insufficient information and the stream was re-evaluated and found to fully support beneficial uses in 2006. Though not listed by DEQ, the Fishtrap Creek drainage is important Bull Trout and Westslope Cutthroat Trout habitat and also has the highest density of roads of any drainage in the Thompson River Watershed that supports a Bull Trout fishery in the Thompson River Watershed. Substantial improvements were made to the primary streamside road accessing this watershed in 1990 and later in 2010. In addition, a science-based transportation analysis was conducted by the USFS-LNF in 2009 to assess the upper portion of the watershed, and various projects have been completed to improve fish passage, reconstruct, relocate, store, and decommission both upland and riparian roads in the upper tributaries of the watershed between 2008 and 2017 (C. Partyka, USFS-LNF, personal communication). However, additional efforts to reduce, maintain, and implement road BMPs would benefit the fisheries and overall water quality of the drainage.

Bull Trout occupy more than 25 miles of habitat in Fishtrap Creek and its tributaries. The primary spawning and rearing habitat for migratory Bull Trout occurs from just above the confluence with the West Fork Fishtrap Creek to an area downstream of Beatrice Creek, and also includes lower portions of Beatrice and West Fork Fishtrap Creeks. Bull Trout are believed to be primarily resident (non-migrating) in Jungle Creek, Beatrice Creek, upper West Fork Fishtrap Creek, certain areas of the upper mainstem, lower Radio Creek, and Beartrap Fork, although overlap between non-migratory and migratory life histories is likely (Huston 1994).

Westslope Cutthroat Trout also inhabit the Fishtrap Creek drainage including all major tributaries and upper and lower Fishtrap Lakes. Fishtrap Lakes were historically stocked with non-native Rainbow Trout and Yellowstone Cutthroat Trout. Hybridization with Rainbow Trout is a threat to Westslope Cutthroat Trout in lower Fishtrap Creek and hybrids have been documented up to and including Beatrice Creek and West Fork Fishtrap Creek. A survey conducted in 2016 found that hybridization with Yellowstone Cutthroat Trout in the lakes was less than 1% (Kreiner and Terrazas *In Prep*).

Education and Outreach Opportunities

Future outreach opportunities include communication with DNRC cabin leaseholders, campers, and recreational users of the drainage. One important aspect of education efforts for Fishtrap Creek should be the negative impact of rock dams on native fish. Multiple handmade rock dams have been observed in streams near popular campsites and stream access sites in the drainage. During low flows, these structures can restrict fish passage.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.3A. Recently completed projects within Fishtrap Creek drainage.

Project description	Lead entity and partners	Cost	Date completed
Decommissioning of Radio Mantrap Road	USFS-LNF	$75,000	1996
Beatrice Creek Watershed Analysis	WY	$25,000	1997
Road BMP upgrades (130 miles) of Fishtrap Creek watershed– average cost $800/mile	WY	$104,000	1998-2010
Annual Bull Trout redd monitoring in Fishtrap Creek tributaries (Jungle, Beatrice)	WY	$12,000	1999-2016
Replace undersized culvert in lower Jungle Creek with fish friendly culvert (Figure 2.3B)	WY (Cost-shared with Avista through Green Mountain CD)	$14,000	2002
Abandonment of 1 mile of road along Fishtrap Creek below Basin draw	WY	$2,500	2003
Fishtrap Creek Limiting Factors Analysis	WY	$15,000	2003-2005
WY pilot large wood project and follow-up effectiveness monitoring (Figure 2.3C)	WY	$37,000	2006, monitoring 2007-2013)
Closure of Fishtrap Grazing Allotment under the Lolo Consolidated Livestock Grazing Allotment Closure Decision Memo	USFS-LNF	NC	2007
Road BMP upgrades in Fishtrap Creek watershed	USFS-LNF	$350,000	2008
Large Wood Debris placement under Fishtrap EIS	USFS-LNF	$30,000	2005-2009
Surface reconditioning and gravel surfacing of Fishtrap Road	USFS-LNF	$625,000	2010
Reconstruction of Stone Terrace Roads	USFS-LNF	$120,000	2010
Culvert replacement of AOPs in Radio and Mantrap Creeks	USFS-LNF	$50,000	2010
Removal of undersized AOP culvert and replacement of West Fork Fishtrap Bridge.	USFS-LNF	$120,000	2010
Benson Peak Road decommissioning	USFS-LNF	$10,000	2011
Fishtrap Stewardship road storage and decommissioning (149 miles)	USFS-LNF	$280,000	2012
Benson Draw AOP culvert replacement	USFS-LNF	$60,000	2013
Reconstruction and surfacing of Fishtrap Lake Road 7593	USFS-LNF	$65,000	2016
Stony Lake Bridge replacement	USFS-LNF	$130,000	2017

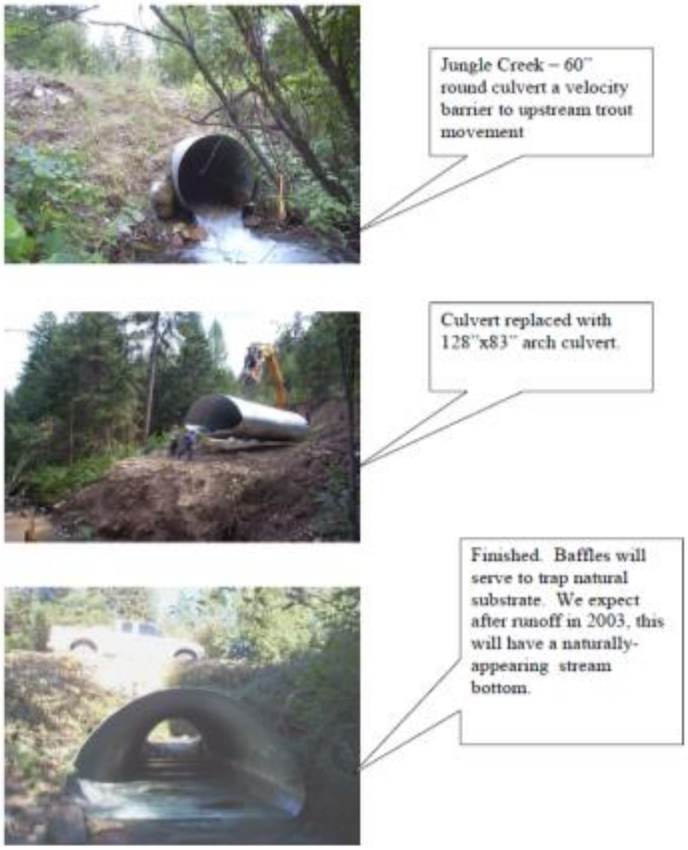


Figure 2.3B. Jungle Creek fish barrier corrected in 2002 through cooperative project between WY and Avista.

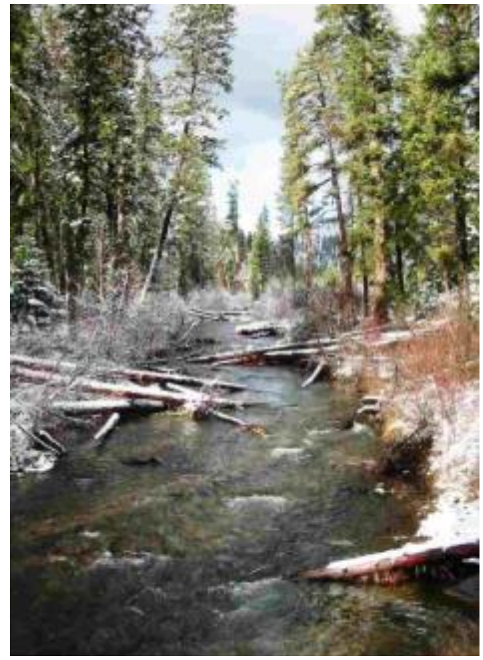


Figure 2.3C. Pilot large wood placement project in Fishtrap Creek by WY in 2006.

2.4: Lazier Creek Subwatershed

Drainage Characterization

Lazier Creek is a small, perennial stream located in the northeastern section of the Thompson River Watershed and, draining an area of 23.8 sq mi (15,248 acres), flows approximately 8 miles (12.9 km) from its headwaters to its confluence with the Thompson River.

The watershed is primarily forested and managed for timber harvest. WY owns the majority (64%) of the Lazier Creek drainage and has undertaken most of the stream restoration work within the drainage. Other land ownership/land management within the Lazier Creek drainage includes DNRC (16%), USFS-LNF (16%), and other private (4%). Most roads on the USFS-LNF lands were previously stored or decommissioned (C. Partyka, USFS-LNF, personal communication). The Thompson River Ranch holds a grazing lease through the Thompson River Grazing Cooperative which spans almost the entire drainage and is administered by the DNRC (Figure 2.4A).

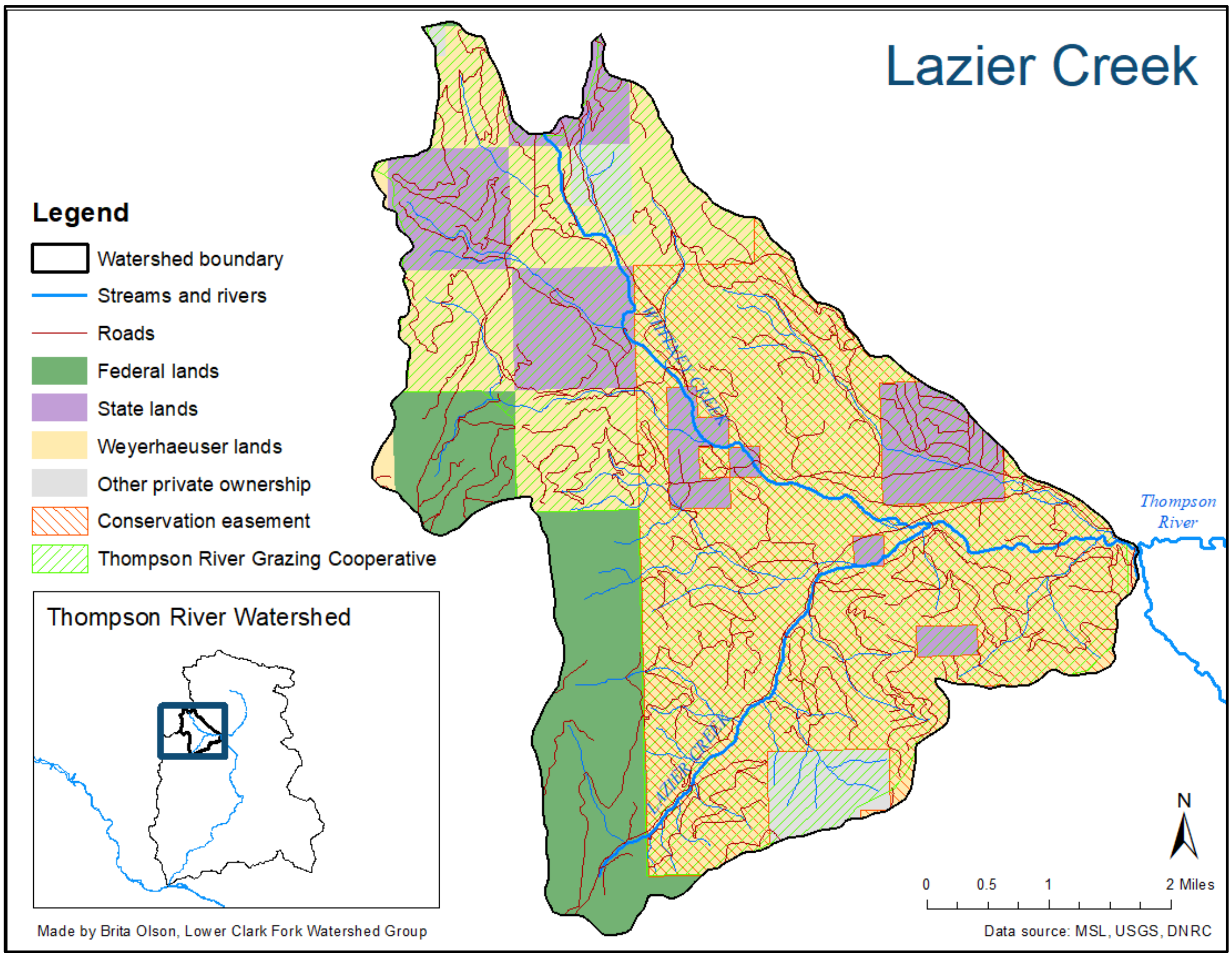


Figure 2.4A. Lazier Creek drainage.

Current Stream Conditions

Lazier Creek was listed as impaired by sediment in 1996 and nutrients (TP and TN) in 2006 (DEQ 2014). In addition, Lazier Creek is listed for alteration in stream-side vegetation. These impairments negatively affect aquatic life and primary contact recreation beneficial uses.

Lazier Creek is impacted by three land uses – grazing, forestry, and agriculture associated with a historic homestead at the Lazier Creek - Whitney Creek confluence. High sediment levels in the drainage are primarily attributed to anthropogenic streambank erosion (Figure 2.4B; DEQ 2014). Lazier Creek did not exceed state target values for nutrients, but failure to meet multiple biological targets warranted DEQ to keep Lazier Creek as impaired by nutrients. Grazing activities likely have the greatest impact on nutrient inputs to streams within the drainage. The drainage has been in a recovery phase for the past 25 years as BMPs and SMZs have been implemented for forestry activities, and grazing BMPs have been required of the grazing leaseholder. All roads have also been substantially upgraded to meet modern BMPs under the WY Native Fish Habitat Conservation Plan (Plum Creek Timber Company 2000). Stream conditions have improved dramatically over the past 25 years due to completion of these projects (Figure 2.4C), but there are still additional opportunities to reduce NPS pollution (B. Sugden, WY, personal communication).

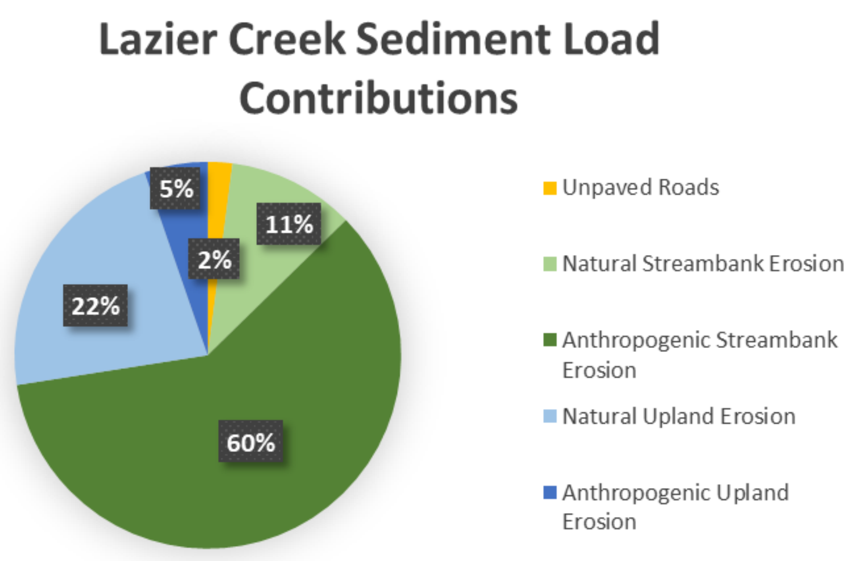


Figure 2.4B. DEQ identified sources of sediment in the Lazier Creek drainage (DEQ 2014; Atkins 2013A, 2013B and 2013C).

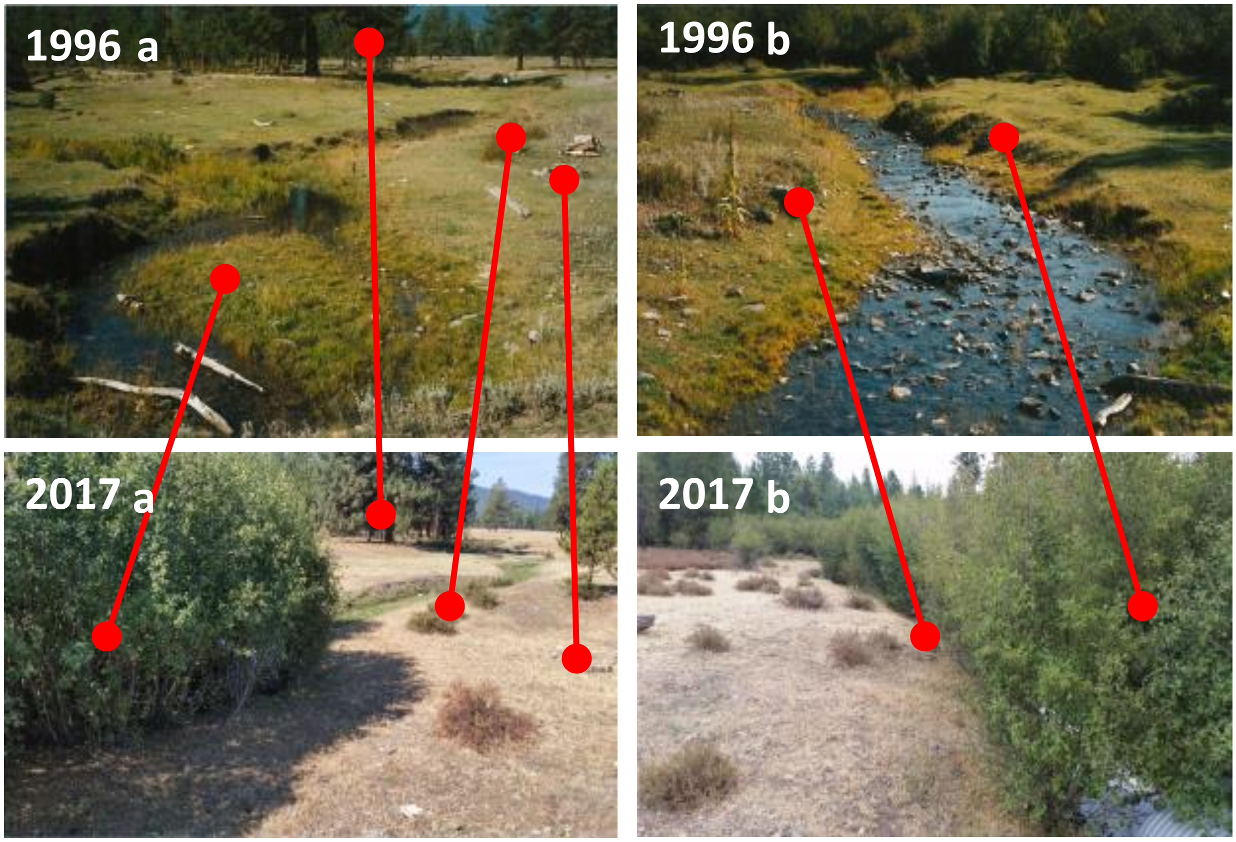


Figure 2.4C. Lazier Creek conditions between 1996 and 2017 looking (a) upstream and (b) downstream from road crossing just below the Lazier-Whitney confluence. Red points connected by a line across images identify features that occur in both photos. Photo credit: Brian Sugden (WY).

Education and Outreach Opportunities

Future outreach opportunities include increased communication among stakeholders within the drainage, but no additional education opportunities have been identified at this time.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.4A. Recently completed projects within the Lazier Creek drainage**.**

Project description	**Lead entity and partners**	**Cost**	**Date completed**
Fencing Lazier-Whitney Confluence	WY, Thompson River Ranch	$5,000	Installation completed in 1998. Maintenance needed prior to 2020 grazing season.
Road BMP upgrades	WY	$30,000	Completed 2011

2.5: Little Thompson River Subwatershed

Drainage Characterization

The Little Thompson River is located in the southeast corner of the Thompson River Watershed and flows west from its headwaters approximately 20 miles (32.2 km) to its confluence with the mainstem Thompson River (Figure 2.5A). The Little Thompson River is the largest tributary to the mainstem Thompson River, draining 123.1 sq mi (78,793 acres) and nearly 20% of the basin. The primary fish species present within this drainage include Westslope Cutthroat Trout, and non-native species such as Brook Trout, Rainbow Trout, and Brown Trout. Westslope Cutthroat Trout and Brook Trout exist in most of the tributaries of Little Thompson River. Brown Trout, Rainbow Trout and hybrids are common in the lower mainstem. Bull Trout are not currently known to inhabit the drainage, although there have been occasional reports of historic presence and angler catch (PPL 2013; R. Kreiner, FWP, personal communication). The Weyerhaeuser Native Fish HCP classifies the Little Thompson River as "Tier 2" (non-Bull Trout) habitat (Plum Creek Timber Company 2000). Western Pearlshell Mussels, a species of special concern in Montana, also inhabit the drainage (Stagliano 2015).

Land ownership/land management in the drainage is distributed among the USFS-LNF (57%, primarily in the headwaters), Weyerhaeuser (31%), DNRC (10%), and other private (2%) (Figure 2.4B). The entire drainage is forested and generally managed for multiple forest uses, roadless, and recreation, though grazing is the predominant land use (DEQ 2014). The Thompson River Grazing Cooperative has a common grazing lease in the lower portion of the Little Thompson which includes USFS-LNF, WY, and DNRC lands. Two additional grazing allotments (managed by the USFS-LNF) are in the headwaters of the drainage. Some of the land owned by DNRC is leased for cabins. Recreation is dispersed, with no designated/managed sites. Various projects have been completed in the past to reduce the effects of roads and grazing on water quality, including gravel surfacing of roads, culvert replacement, road decommissioning, culvert armoring of cattle watering areas, and riparian grazing exclosures. However, various opportunities still exist to improve watershed condition (C. Partyka, USFS-LNF, personal communication).

Four irrigation diversions exist in the drainage including two trans-basin diversions. The Flathead Agency Irrigation Division has water rights to divert 64.60 cubic feet per second (cfs) from Alder Creek (Figure 2.5B), and 58.70 cfs from McGinnis Creek (both tributaries to the Little Thompson River) to reservoirs near Hot Springs, MT. The period of diversion is from April 1 to October 31, although during summer months the volume diverted is often less than the full water rights. Upper Little Rock Creek is also diverted year-round to Marten Creek for unknown purposes, and lower Little Rock Creek is only recharged by seepage from the ditch.

Figure 2.5B. Alder Creek ditch directing water from Little Thompson River to the Flathead Reservation.

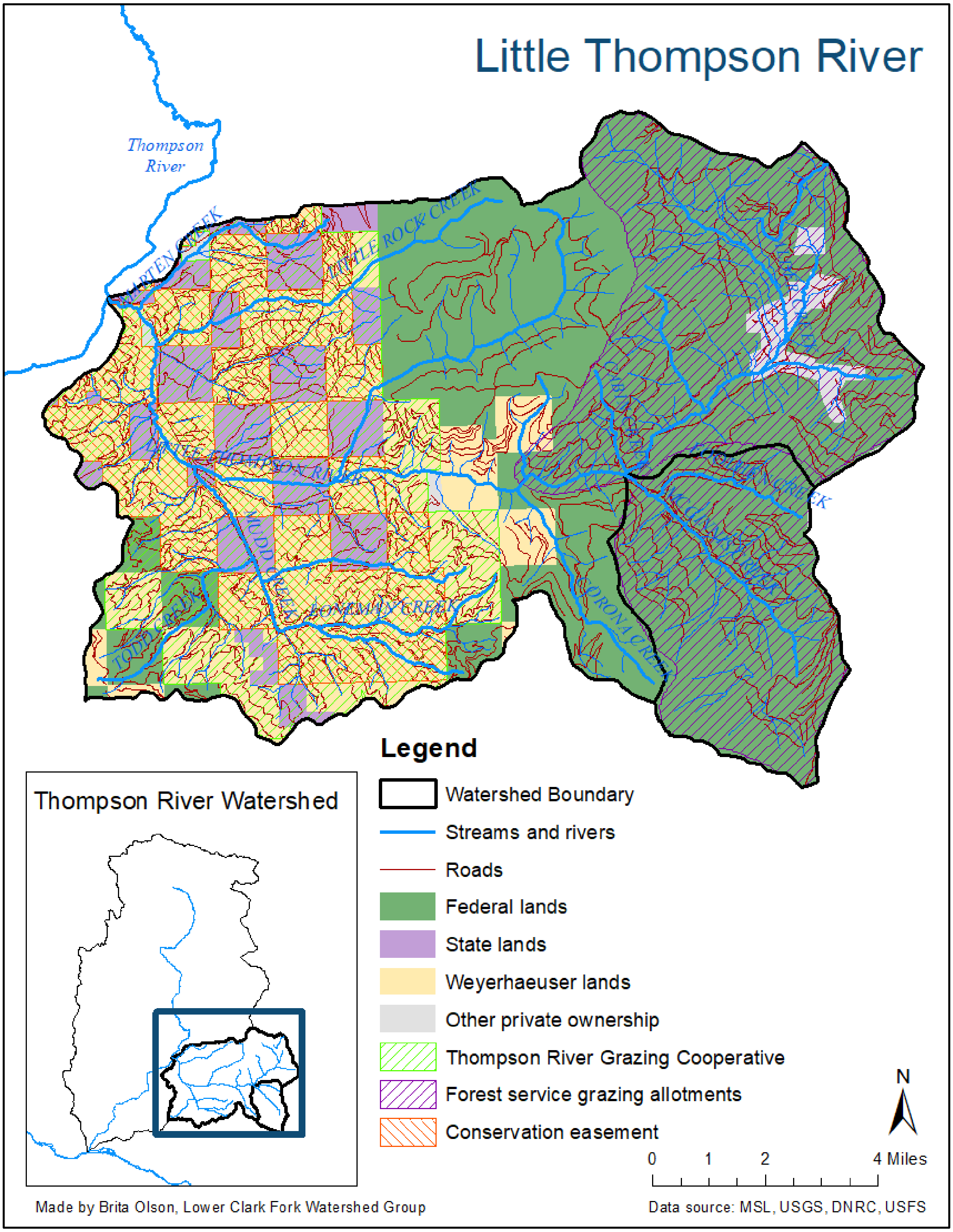


Figure 2.5A. Little Thompson River drainage.

Current Stream Conditions

The Little Thompson River was listed for sediment in 1996 and nutrients (TP and TN) in 2006 (DEQ 2014), and is also listed for alteration in stream-side vegetation. These impairments impact aquatic life and primary contact recreation beneficial uses. While not listed by DEQ for temperature impairments, local stakeholders have also identified rising stream temperatures as negatively impacting aquatic life (Kreiner and Terrazas *In Prep.*).

Natural and anthropogenic sources contribute sediment to the Little Thompson River drainage (Figure 2.5C). The primary sources of elevated sediment levels within the Little Thompson River drainage are grazing and logging activities (DEQ 2014). Grazing livestock that are provided unrestricted access to streams have reduced riparian vegetation and bank stability. BMPs associated with logging activities have been implemented throughout the drainage to reduce sediment contributions and benefit native fish populations. In addition to grazing and logging activities, irrigation may contribute to sediment loads by reducing stream volume via diversions and thereby eliminating sediment-flushing spring flows. This drainage has been affected by large wildfires (2007 Chippy Fire) but measures have since been taken to reduce erosion effects from the burned areas. McGinnis Creek is a tributary to the Little Thompson River and is also listed for sediment.

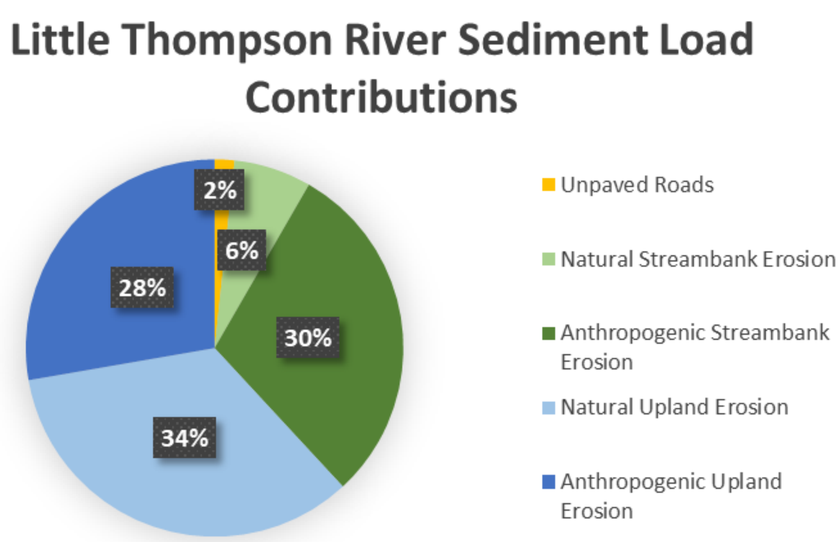


Figure 2.5C. DEQ identified sources of sediment in the Little Thompson River drainage. Sediment contributions from McGinnis Creek are not included (DEQ 2014; Atkins 2013A, 2013B and 2013C).

Water temperature in the Little Thompson River becomes elevated during dry summers, with maximum temperatures occasionally exceeding 73.4°F (23°C) (Kreiner and Terrazas *In Prep*). The Little Thompson River is often warmer than the mainstem Thompson River at its confluence. The gentle topography and south-facing aspect of the drainage likely naturally influence stream temperatures. However, land-use practices including livestock grazing (reduced riparian vegetation, shade, and LWD), water diversion (reduced water volume), and historic timber harvest cause unnatural increases in stream temperatures.

At time of assessment, nutrient (TN and TP) concentrations within the Little Thompson River drainage did not exceed state target values for nutrients, but failure to meet multiple biological targets warranted DEQ to keep Little Thompson River listed as impaired by nutrients (DEQ 2014). Grazing is common throughout the drainage and the primary source of nutrient inputs to the Little Thompson River (Figure 2.5D). Additional nutrient sources may be coming from historic and current timber harvesting activities.

Figure 2.5D. Cow manure and trampled banks contribute excess nutrients to Little Rock Creek, tributary to Little Thompson River.

Temperature, sediment, and nutrient impairments have the potential to negatively impact fisheries of the Little Thompson River drainage. Further impacts to fisheries result from reductions in riparian vegetation, bank stability and instream LWD caused by grazing, and entrainment of fish species, reductions in water volume (and corresponding increases in temperature), and elimination of sediment flushing spring flows caused by irrigations diversions. In 2016, large Westslope Cutthroat Trout were observed in the Alder ditch, while nearly the entire volume of Alder Creek was being diverted. Maximum summer temperatures are consistently 5.4-7.2°F (3-4°C) higher in lower Little Rock Creek (below the diversion) than in the upper creek (Kreiner and Terrazas *In Prep*). Westslope Cutthroat Trout are the dominant fish species above the Marten Creek diversion, while nonnative Brook Trout dominate below. Still, despite impacts to streams and degraded habitat throughout the drainage, there is still potential for streams in the Little Thompson River drainage to support native fisheries. In Loneman and Partridge Creeks (despite grazing impacts the riparian areas), Westslope Cutthroat Trout are the dominant fish species (R. Kreiner, FWP, personal communication).

Education and Outreach Opportunities

Future outreach to private landowners within the drainage is needed to implement grazing BMPs. Further outreach to DNRC cabin leaseholders is an opportunity to engage frequent users of the basin.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.5A. Recently completed projects within the Little Thompson River drainage.

Project description	**Lead entity and partners**	**Cost**	**Date completed**
Decommissioned 4 miles of ACM Haul Road paralleling the County Road – included removing crossings over Marten, Little Rock, Sears Gulch, and the Little Thompson River	WY	$8,000	1995
Past fencing of priority areas in Partridge Creek	WY	$1,500	1996
Past fencing to keep cattle out of Thompson and Little Thompson Rivers	WY, Leaseholder	$8,000	1999-2003
Removed crossing over lower Todd Creek	DNRC, WY	$1,500	~2005
Removed crossing over Little Rock Creek following Chippy Creek wildfire (Figure 2.5E)	WY	$1,500	2007
Culvert cleaning, drain dip construction, ditch enlargement, and roadside weed treatments following Chippy Creek fire on all USFS roads in watershed	USFS-LNF	$145,000	2007-2009
Replaced TeePee Creek, Alder Creek Culverts, aggregate surfacing 7520	USFS-LNF	$130,000	2007-2009
Little Thompson River bridge replacement	WY, USFS-LNF	$80,000	2008
Road storage and decommissioning (4 miles) in Alder Creek	USFS-LNF	$20,000	2009
Upgrading of culverts on Mudd Creek in Sections 12 and 29	WY, DNRC	?	2010, 2014
Upgraded culvert on Loneman Creek (Section 21)	WY	$5,000	2014
Removed two crossings over Mudd Creek	WY	$5,000	2015
Road BMP upgrades under Native Fish HCP 1998-2015	WY	Unknown	1998-2015
Decommissioned 1 mile of ACM haul road paralleling Mudd Creek in S. 19 (Figure 2.5F)	WY	$2,000	2016
3 culverts upgraded for fish passage and two culverts removed on unnamed tributary to Mudd Creek in Section 29 (T22N, R26W) (Figure 2.5G)	WY	$15,000	2016
Little Thompson River Copper King post fire road improvements	USFS-LNF	$75,000	2017

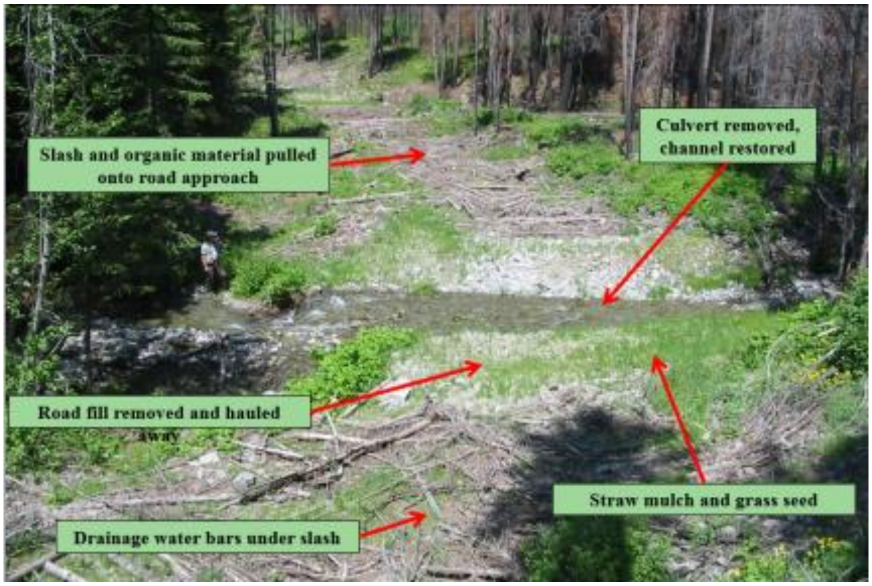


Figure 2.5E. Removal of crossing in upper Little Rock Creek (and applied BMPs) to address post fire runoff risk following 2007 Chippy Creek fire.

Figure 2.5F. ACM haul road decommissioned along 1 mile of Mudd Creek by WY in 2016.

Figure 2.5G. Stream crossing culvert upgraded by WY for fish passage on tributary to Mudd Creek in 2016.

2.6: McGinnis Creek Subwatershed

Drainage Characterization

McGinnis Creek is located in the southeastern corner of the Thompson River Watershed and flows approximately 5 miles (8.1 km) from its headwaters northwest to its confluence with the Little Thompson River (Figure 2.6A). McGinnis Creek drains and area of 17.5 sq mi (11,202 acres), which is entirely forested and managed by USFS-LNF. Forest Route 7517 parallels McGinnis Creek for the majority of its length, and work is currently in progress on this road to reduce sediment delivery. Grazing occurs throughout the drainage through the McGinnis Grazing Allotment managed by the USFS-LNF.

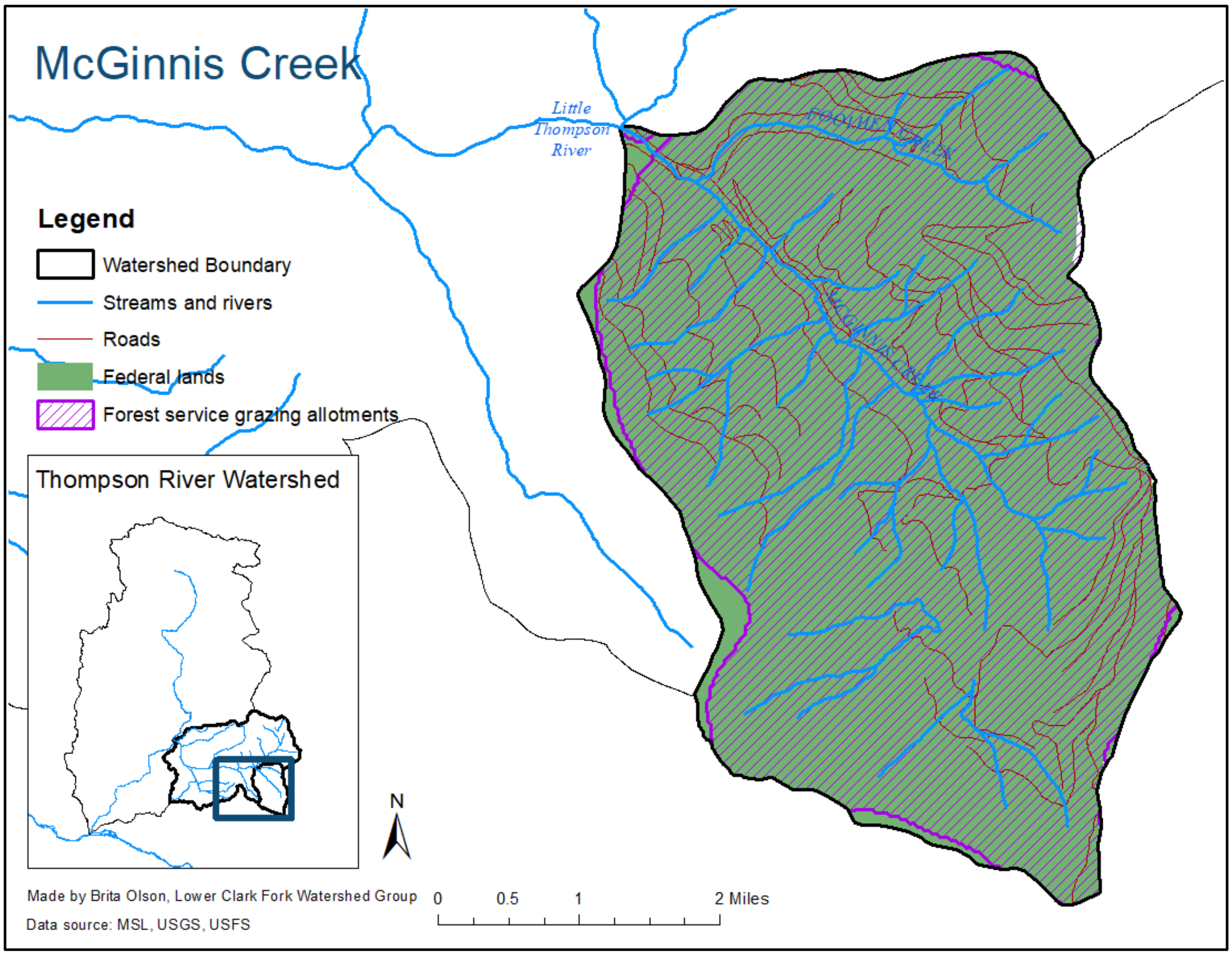


Figure 2.6A. McGinnis Creek drainage.

At the time of DEQ assessment in 2004, 15% of the McGinnis Creek drainage had been harvested over a 30-year period, but direct impacts to the stream channel were not observed. Signs of more intensive historic logging activity were found closer to the channel in lower reaches of the drainage compared to upper reaches. A grazing allotment was located near the stream in lower reaches of the drainage, but it appeared to be managed well with little to no eroding streambanks or hoof shear. Riparian exclosures and armoring of cattle watering locations may have helped with this conclusion.

During EPA sediment and habitat assessments in 2011, upper reaches of the drainage showed vegetation re-growth in historically logged areas. Signs of livestock grazing were observed along the creek, but streambank erosion was limited and primarily occurred in areas where LWD directed flow towards the streambank. Riparian vegetation included a dense coniferous overstory with alders occurring along the channel margin (DEQ 2014). The lower reaches of the drainage also showed vegetation growth in historically logged areas, with alders along the channel margin and conifers in the overstory. Streambank erosion was also limited due to large angular cobble material armoring the streambanks.

Current Stream Conditions

McGinnis Creek was listed as impaired by sediment in 1996 (DEQ 2014). Through TMDL assessments, half of the sediment load contributions to McGinnis Creek were determined to occur through natural upland erosion processes. The second highest contributor of sediment within the McGinnis Creek drainage is anthropogenic streambank erosion, primarily due to grazing activities and potentially from historic logging activities (Figure 2.6B; DEQ 2014).

Recent observations confirm that grazing still occurs near the mouth of McGinnis Creek, but that fencing is in place to protect the riparian area around lower McGinnis Creek. There was evidence of livestock accessing the stream and in riparian areas in at least one location along the creek, but riparian vegetation and streambanks seem to be recovering well (S. Dagger, Eastern Sanders County Conservation District, personal communication).

Forest Route 7517 closely parallels McGinnis Creek from the confluence with Little Thompson River over approximately ¾ of its length and diverts from the channel near the headwaters. While unpaved roads only comprise 4% of the total sediment load contributions (Figure 2.6B), 42% of the stream falls within 300 feet of the road, and 15% falls within 150 feet of the road (DEQ 2014). Opportunities may exist to implement road BMPs to reduce sediment contributions, however, work is currently in progress on this road to reduce sediment delivery.

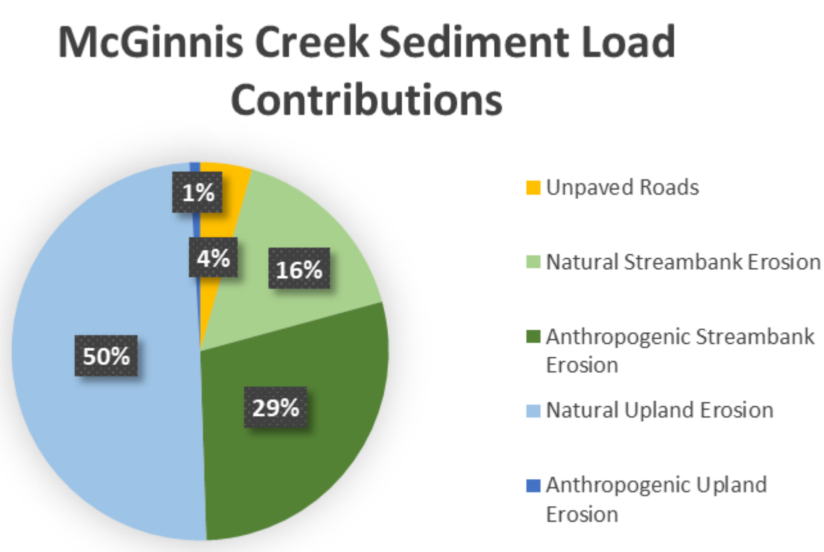


Figure 2.6B. DEQ identified sources of sediment in the McGinnis Creek drainage (DEQ 2014; Atkins 2013A, 2013B and 2013C).

Education and Outreach Opportunities

Future outreach to private landowners within the drainage will include working with private landowners to update implement grazing management BMPs.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.6A. Recently completed projects within the McGinnis Creek drainage.

Project description	**Lead entity and partners**	**Cost**	**Date completed**
McGinnis Stewardship Road BMPs	USFS-LNF	$50,000	2014
McGinnis Creek Road reshaping	USFS-LNF	$40,000	2016

2.7: McGregor Creek Subwatershed

Drainage Characterization

McGregor Creek is a perennial stream that originates at the outlet of McGregor Lake, drains 31.1 sq mi (19,900 acres), and flows approximately 7 miles (11.3 km) west to its confluence with the Thompson River (Figure 2.7A below). It is located in the northwest corner of the Thompson River Watershed, entirely within Flathead County.

Landowners/land managers in the drainage are WY (65%), USFS-Kootenai National Forest (USFS-KNF; 16%), state (7%), and other private entities (12%). The lower 1.5 miles (2.4 km) of McGregor Creek above the confluence with the Thompson River is privately owned, and additional grazing lands managed through the Thompson River Grazing Cooperative are immediately upstream. USFS-KNF manages the land and an irrigation control headgate at the outlet of McGregor Lake (Figure 2.7B). WY conducts timber harvest and forest management on their lands in the McGregor Creek drainage. There is also a decorative rock quarry in the Twin Creek drainage that is owned and permitted by WY, and currently operated by Montana Rockworks.

Figure 2.7B. Irrigation control dam/ headgate at outlet of McGregor Lake.

US Highway 2 follows the McGregor Creek stream corridor and is maintained by the Montana Department of Transportation (MDT). Flathead Electric Cooperative owns and maintains utility lines within an easement that follows US Highway 2 and often falls within close proximity to the McGregor Creek channel. Vegetation growth in utility corridors is restricted according to maintenance specifications.

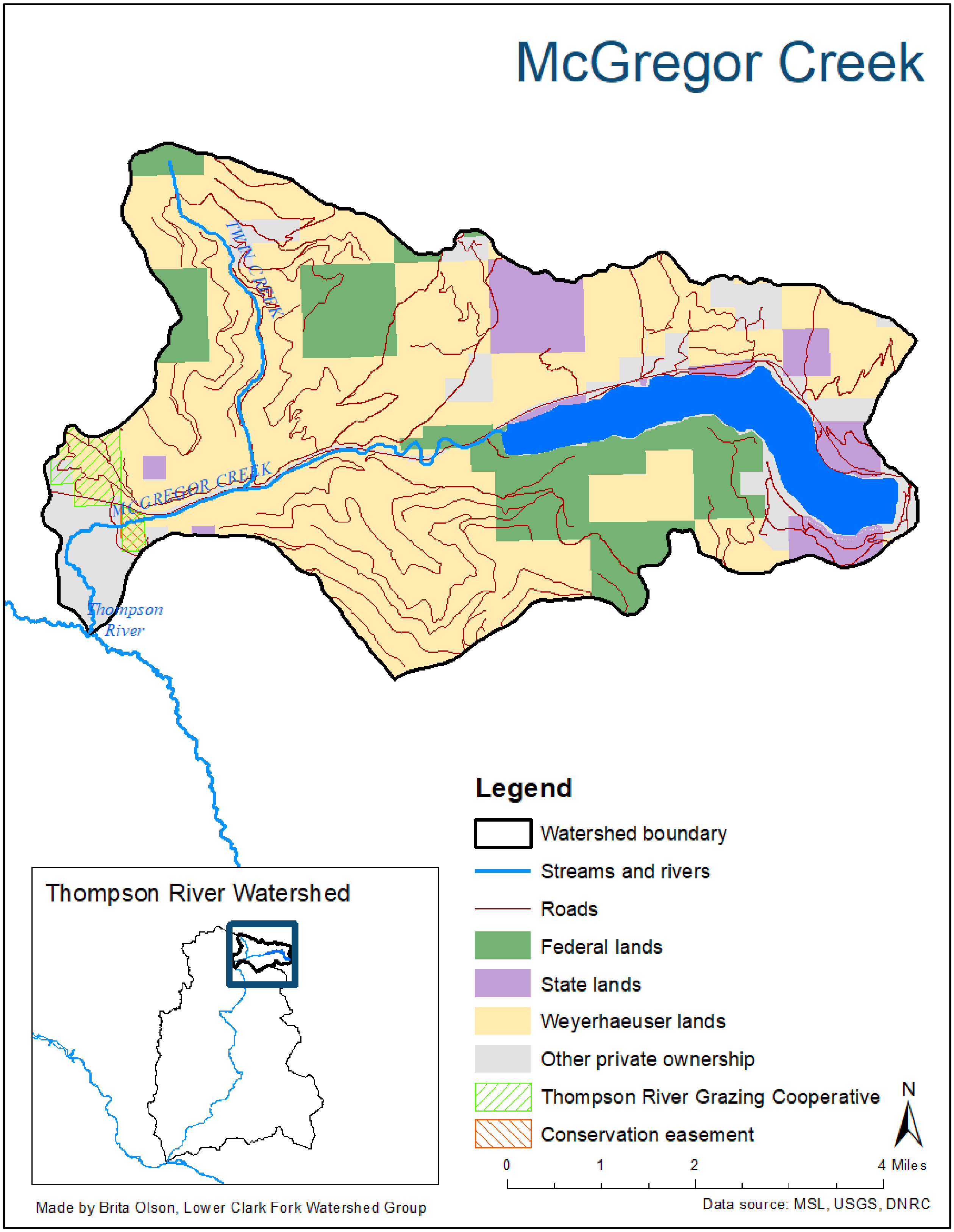


Figure 2.7A. McGregor Creek drainage.

Current Stream Conditions

McGregor Creek was listed by DEQ as impaired by both sediment (1996) and temperature (2006), and is also listed as impaired by the non-pollutant "other flow regime alteration" (DEQ 2014).

At the outflow of McGregor Lake, a headgate regulates stream flow and creates approximately three vertical feet (~3737 acre-feet) of storage in McGregor Lake. A special use permit is in place for operation of the headgate, which is used as an irrigation control dam. 310 permits were issued in 1994 to reface the dam, and in 2000 to alleviate/reduce dam leakage resulting from inadequate fill at the base of the structure. Temperatures reported in McGregor Creek just below the headgate have been warmer than the optimal growth range for Westslope Cutthroat Trout. Elevated temperatures are expected below the outlet of a lake (regardless of the presence of a headgate) and did not lead to listing of McGregor Creek for temperature impairment. High temperatures in McGregor Creek occur further downstream where lack of shade from riparian vegetation has led to impairment conditions because the stream has not cooled to the extent it should have (DEQ 2014).

The majority of the McGregor Creek drainage is forested land owned by WY and USFS-KNF. Timber harvest and forest management occur in the drainage, and over the past 25 years BMPs and SMZs have been implemented. As a result, riparian buffers remain largely intact along the upper 5 river miles of the channel. There are some isolated opportunities for plantings and rehabilitation of riparian buffers in wet meadow areas that were historically logged (and in some cases, broadcast burned). It appears that competition with grasses (or other undetermined factors) has to some extent prevented full recovery of riparian buffers, but alders and other native shrubs have reestablished on the stream banks (Figures 2.7C and 2.7D). Patches of noxious weeds exist in locations where riparian buffers are near the highway, but weed encroachment is not extensive (Figure 2.7E).

Figure 2.7C. Wet meadow and riparian buffer (historically logged area) below McGregor Lake.

Figure 2.7D. McGregor Creek channel and riparian zone.

After McGregor Creek crosses under Thompson River Road (Figure 2.7F), it flows through privately-owned land towards its confluence with the Thompson River. The land adjacent to the stream along the lower 1.5 miles (2.4 km) is grazed by livestock and used for hay production. This reach of McGregor Creek appears to be unfenced and fully accessible to grazing livestock with little to no riparian buffer besides reed canary grass, a highly competitive non-native species.

Figure 2.7E. Patch of noxious weeds (primarily Canada thistle) near McGregor Creek channel.

Figure 2.7F. Looking downstream on McGregor Creek after it passes under bridge on Thompson River Road.

Sediment levels in McGregor Creek exceed water quality standards and impact aquatic life. The two highest sediment sources identified include anthropogenic streambank erosion and anthropogenic upland sources (Fig. 2.7G; DEQ 2014). Recent (2017) observations of a lack of riparian vegetation and cattle grazing in the lower 1.5 miles (2.4 km), erosion along Highway 2, and timber harvest activities within the McGregor Creek drainage suggest that these processes are ongoing (S. Bowman, LCFWG, B. Sugden, WY, and S. Tappenbeck, SWCDM, personal communication).

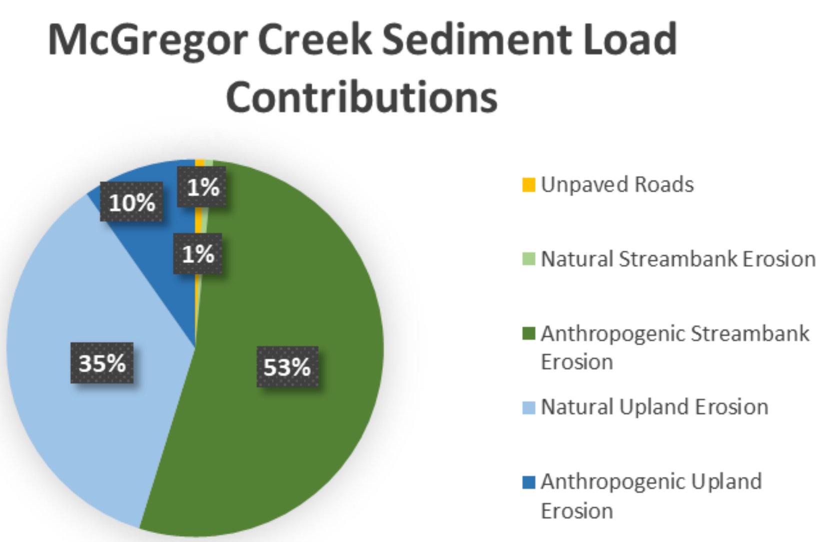


Figure 2.7G. DEQ identified sources of sediment in the McGregor Creek drainage (DEQ 2014; Atkins 2013A, 2013B, and 2013C).

US Highway 2 follows along the north side of McGregor Creek for five miles (mile markers 81-86) prior to the stream turning south towards its confluence with the Thompson River. Highway 2 was rebuilt in the 1960s, and 1969 aerial photographs (Figure 2.7H) show numerous erodible lacustrine silt and glacial till cutslopes that have revegetated over time. However, there are several cutslopes on the north side of the highway that are steep, bare, and show visible signs of active erosion (Figure 2.7I). Culverts direct runoff under the highway towards McGregor Creek (Figure 2.7J). MDT leases land from WY on the north side of US Highway 2 for highway sand storage at the intersection with Thompson River Road. Erosion and runoff control measures have been installed on this property.

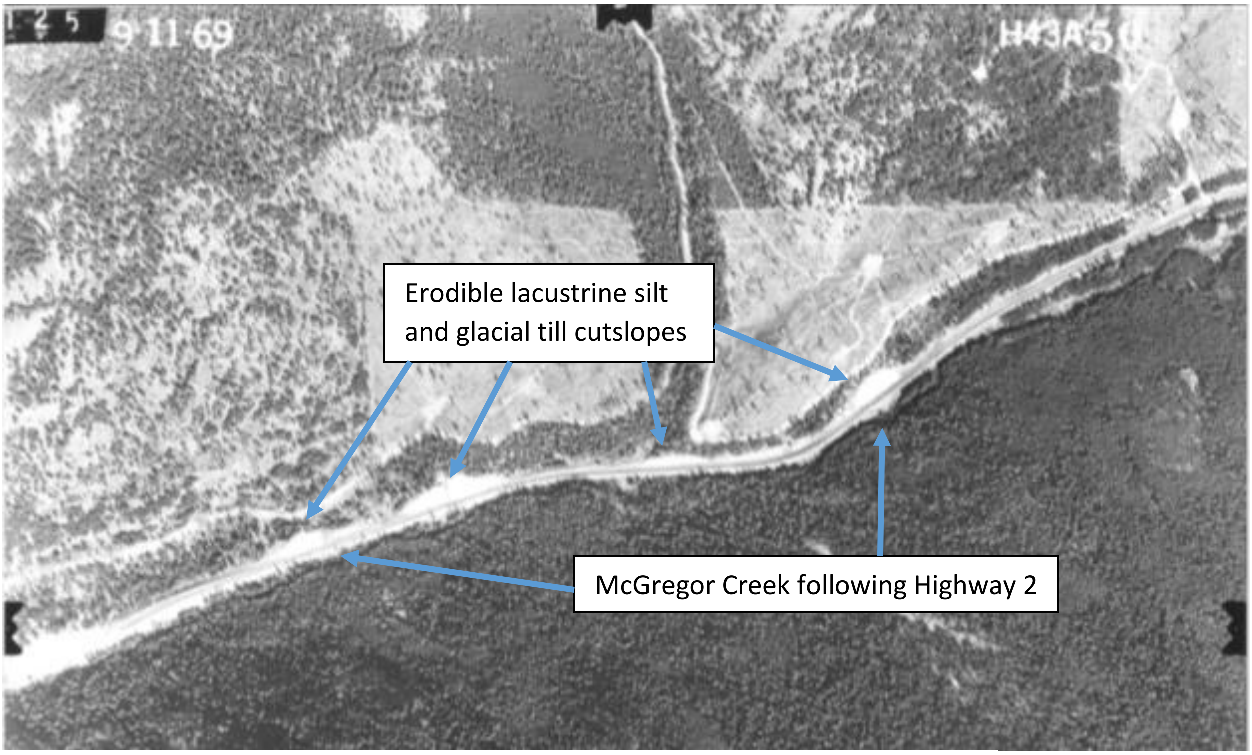


Figure 2.7H. 1969 aerial image of McGregor Creek and Highway 2.

Figure 2.7I. Current cutslopes along US Highway 2 that is eroding and a potential source of sediment to McGregor Creek.

Figure 2.7J. Culvert that directs highway runoff and sediment load towards McGregor Creek.

Twin Creek is the only perennial tributary to McGregor Creek, and drains mostly WY timber land and USFS-KNF land. There is a WY/USFS-LNF cost-shared road (Forest Route 6725) that runs close to the Twin Creek channel along much of its length. In the past, relocation of the road was discussed, but the decision was made to make use of strategically-placed drain dips and insloping to control sediment delivery to Twin Creek. This work was completed around 2006. Timber harvest and forest management take place in the drainage, and over the past 25 years BMPs and SMZs have been implemented. A lower bridge crossing on Twin Creek was removed around 2008. A second bridge crossing on Twin Creek was removed in late 2017 (Figure 2.7K). Just upstream of the confluence with McGregor Creek, Twin Creek flows through a box culvert that is likely acting as a migration barrier to native fishes.

Figure 2.7K. Bridge on Twin Creek removed in 2017.

Education and Outreach Opportunities

Future outreach endeavors will include targeted outreach to landowners on lower McGregor Creek with information about grazing BMPs and programs offering financial assistance (see table 5B). Additional outreach will need to be conducted to MDT and Flathead Electric Cooperative to identify the feasibility and potential timeline for sediment erosion mitigation along US Highway 2 and possibility of burying utility lines to allow further vegetation growth along upper McGregor Creek.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.7A. Recently completed projects within the McGregor Creek drainage.

Project description	Lead entity and partners	Cost	Date complete
2000 feet of riparian road decommissioned and abandoned	WY	$5,000	2007, 2008
Removal of lower Twin Creek bridge and crossing reclamation/abandonment	WY	$1,000	2008
Upgrading road BMPs on Twin Creek Road to reduce sediment delivery	WY, USFS-LNF	$20,000	2010
BMP upgrades to WY roads across McGregor Creek watershed	WY	$50,000	2015
Relocation and burial of utility lines in canyon reach along Hwy 2	Flathead Electric Coop	Unknown	~2015
Stormwater runoff BMP installation at maintenance/sand storage area at junction of Hwy 2 and Thompson River Road	MDT	$2,000	2015
Removal of old collapsing bridge crossing of Twin Creek	WY	$3,000	2017

2.8: Thompson River (Mainstem)

Drainage Characterization

The Thompson River is the mainstem and outlet of the Thompson River Watershed and flows south from its headwaters in the Thompson Chain of Lakes to its confluence with the Clark Fork River. The Thompson River can be split into two sections with different character. The upper river, which originates from the Thompson Chain of Lakes, is relatively low gradient in a wide valley. The lower river, starting about 17 miles upstream from the mouth, is higher gradient in a narrower valley (PPL 2013). While the warmest stream temperatures in most rivers and streams are found near the mouth, in the Thompson River, the warmest temperatures are found just downstream of the confluence of the Little Thompson River, above the confluence of Fishtrap Creek. The coolest temperatures are found at the mouth of the river, after the river is cooled by cold waters from Fishtrap Creek, West Fork Thompson River, and other smaller order tributaries to the lower river (PPL 2013).

WY is the largest landowner along the mainstem Thompson River, though ownership varies with the LNF-KNF lands along the lower river, state lands dotted throughout, and other private lands mostly concentrated along the upper river. Much of the WY land along mainstem Thompson River is under conservation easement owned by FWP (Figure 2E). This easement precludes development, but allows forestry, grazing, hunting, and fishing. Public access is secured through this easement (DEQ 2014). With the exception of the private agricultural lands in the headwaters, the mainstem Thompson River is excluded from grazing.

The Thompson River and its tributaries provide prime opportunities for angling. The mainstem and its tributaries contain abundant native fish species including Westslope Cutthroat Trout, Bull Trout, Mountain Whitefish, suckers, and sculpins. Common, non-native recreational fish species in the Thompson River include Rainbow Trout, Brown Trout, and Brook Trout. Western Pearlshell Mussels, a species of special concern in Montana, also inhabit the drainage, primarily in the upper mainstem and the Little Thompson River (Stagliano 2015). A recent study of juvenile Bull Trout outmigration in the Thompson River found that Bull Trout use the mainstem Thompson River for extended periods of time (Glaid 2017).

Figure 2.8A. The Thompson River is closely paralleled by CR 56 and FR 9991. Photo Credit: Paul Parson (TU).

County Route (CR) 56 and Forest Route (FR) 9991 (commonly known as Thompson River Road and ACM Road, respectively) parallel the entire length of the river channel from Montana Highway 200 to US Highway 2 (Figure 2.8A), and are in closest proximity along the lower 17 mi where the valley is narrower (29 km; PPL 2013). As the valley widens in the upper basin, there is less encroachment on the river, but redundant road systems and crossings are common. CR56 follows the west side of the river and was initially constructed during the Great Depression (1930s) by the Civilian Conservation Corps (Hagerman-Benton 2003). It was eventually extended to run all the way to Highway 2 near the Thompson Chain of Lakes. In the mid-1950s, the Anaconda Copper Mining (ACM) Company constructed a timber truck haul road the length of the valley from north to south (FR 9991). The road connected the company's lands as far north as Pleasant Valley to a rail reload facility at the mouth of the Thompson River, and allowed ACM to haul loads which exceeded limits on many county road crossings. Wide log bunks and heavy two-way traffic made use of county roads a public safety hazard. The dual-road transportation system was therefore constructed in drainage. ACM sold their lands to Champion International in the 1960s, and logs continued to be transported from the rail reload in Thompson Falls until the early 1980s.

Current Stream Conditions

The greatest impacts to the mainstem Thompson River are from CR56 and FR 9991 and include: increased sediment load contributions from road surfaces, increased stream temperatures due to alteration and reduction of riparian buffer vegetation and shade, reduced floodplain connectivity, and decreased optimal native fish habitat. Since the 1960s, there have been various efforts to evaluate consolidation of roads and upgrades to deteriorating roads and road crossings within the drainage (Figures 2.8B and 2.8C). Several alternatives have been put forth for reducing the redundant road system while maintaining adequate land access. However, various political, environmental, operational, and fiscal issues have precluded action. The exception is in the Little Thompson River drainage, where in 1995, Plum Creek Timber Company decommissioned the parallel road system and elected to use only the county road. Other portions of the parallel road system that extend up along Mudd Creek were decommissioned as recently as 2016. An updated feasibility assessment of road consolidation by key stakeholders (USFS-LNF, WY, DNRC, Sanders County, Flathead County, FWP, and the USFWS) is recommended. This would require a thorough account of the history of work and barriers to implementation.

Figure 6.8B. Big Hole Creek culverts (Big Hole Creek confluence with Thompson River) prior to upgrade (2016 photo). Photo credit: Ryan Kreiner.

Figure 6.8C. New crossing on ACM road of Big Hole Creek. Installed by USFS-LNF in 2017.

In 2008, the USFS-LNF conducted a series of assessments by various authors and field inventories on the entire mainstem in conjunction with and funded by a forest highway proposal that did not progress. The assessment efforts produced 14 assessment reports providing detailed information on stream channel morphology, fluvial geomorphic trend, bank condition, riparian vegetation, large wood recruitment, wetland delineation, road sediment delivery, riparian shade, road contaminants, McNeil Cores, stream crossings, aquatic habitat, fish populations, fish angling, summary of proposed road alignments, and restoration needs (Beussink et al 2008). Although appropriate updates should always be considered with passing of time, much of the information in these reports remains very applicable and could provide a starting point for additional road assessments.

In addition to impacts from roads, the mainstem Thompson River receives high pressure from anglers. Total angling pressure on the Thompson River has fluctuated since 1982, but recently exceeded 13,000 angler days in 2015 (FWP 2011). Fishing pressure can exacerbate the impacts from the road system as a result of increased traffic and numbers of unofficial "spur" access roads to various points along the river and campgrounds (Figure 2.8D).

Figure 2.8D. A segment of the Thompson River wedged in between the parallel road system and unofficial spur-road/access point that lacks riparian vegetation.

Grazing and hay meadows along the upper mainstem have impacts to the river that include: increased nutrient and sediment loads, reduced riparian vegetation, and increased temperature due to reduced stream shading. The mainstem river downstream of the agricultural area is no longer directly grazed. However, grazing on tributary streams, including the Lazier Creek and the Little Thompson River, likely route added nutrients to the mainstem (B. Sugden, WY, personal communication).

Clearing of lands on private lands in the upper mainstem to create hay meadows was conducted in the early-to-mid 1900s. Beginning in the mid-1990s, WY recognized that active shrub restoration could accelerate recovery beyond simple grazing exclosure on some reaches of mainstem. A pilot project with Bitterroot Restoration was initiated in 1998. The lessons learned from that were then levered into a large-scale riparian restoration project along the upper mainstem (north of Bend). A number of revegetation polygons were created and two site-preparation techniques employed to control competing Reed Canary Grass. Nearly 2000 containerized shrubs were planted in revegetation plots. Beginning in 2005, natural shrubs in the upper river were protected from big game browse, and have responded well. These revegetation efforts have been maintained to present by WY (B. Sugden, WY, personal communication).

Education and Outreach Opportunities

Outreach to landowners along the upper Thompson River and grazing leaseholders throughout the drainage is needed in order to implement grazing BMPs and offer information about programs and available financial assistance (see table 4B). Additional outreach and cooperation between local stakeholders within the watershed is needed to collaborate on large projects such as the road consolidation project. Opportunities may exist to inform and educate anglers and other recreationalists to use proper spur roads for access to the stream and campgrounds to reduce impacts to beneficial uses.

Completed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.8A. Recently completed projects within the mainstem Thompson river drainage.

Project description	Lead entity and partners	Cost	Date complete
Thompson Road Improvement Project assessments	USFS-LNF	Unknown	1980s-mid 2000s
Riparian fencing along upper Thompson River	WY	$10,000	1994-1995
Canyon Face Timber Sale – Thompson River Road reshaping, gravel surfacing, and delineators	USFS-LNF	Unknown	1995
Discontinued grazing leases affecting 15 miles of mainstem	WY	Unknown	~1996
Thompson River Riparian Restoration Pilot Project – experimental control of reed canarygrass, coir log placement with shrub revegetation	WY	$20,000	1998
Riparian condition assessments of mainstem river (Scott Miles, Riparian Resources Inc.)	WY	$15,000	2002
Thompson River Riparian Restoration Project – shrub restoration along upper river	WY (FWP)	$140,000	2003-2016
ARRA replacement of Deerhorn bridge	USFS-LNF	$115,000	2010
Lower ACM road decommissioning and asphalt approaches on lower bridge	USFS-LNF	$80,000	2012
Copper King Drainage Improvements – replacement of Big Hole and Bay State culverts, and replacement and removal of Buckeye culverts	USFS-LNF	$165,000	2017

2.9: West Fork Thompson River Subwatershed

Drainage Characterization

The West Fork Thompson River flows southeast from the headwaters to its confluence with the Thompson River, draining 35.6 sq mi (22,792 acres). The entire drainage is managed by the USFS-LNF (Figure 2.9A). Native fish species residing within West Fork Thompson River include both Bull Trout and Westslope Cutthroat Trout.

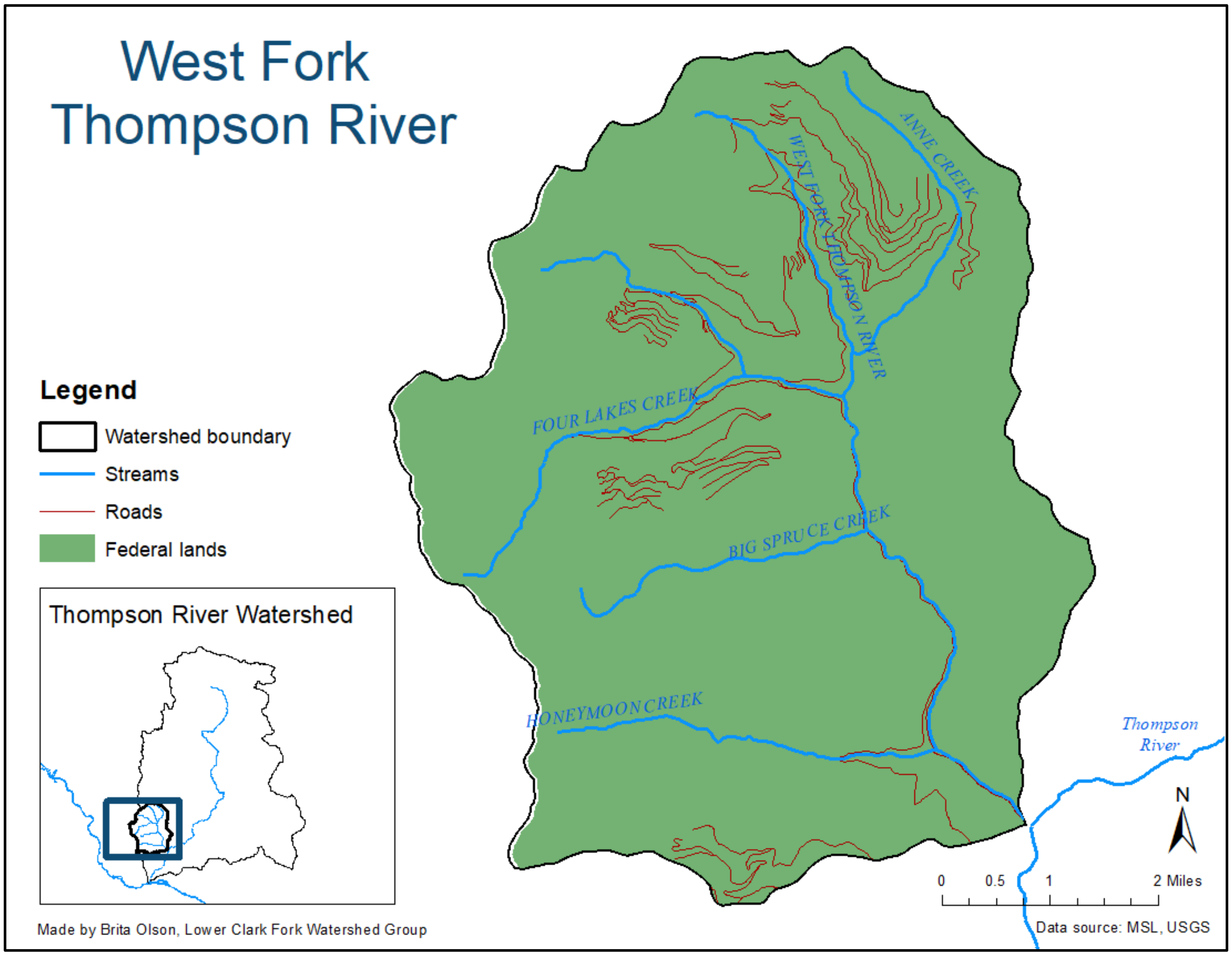


Figure 2.9A. West Fork Thompson River drainage.

Current Stream Conditions

The West Fork Thompson River is not currently listed by DEQ as impaired by any pollutants, but it was identified as a priority stream within the watershed due to its importance to native Bull Trout populations (PPL 2013). The West Fork Thompson River supports a large segment of the fluvial Bull Trout population within the Thompson River Watershed (USFS 2013). While conditions in the West Fork Thompson River are generally better than the rest of the Thompson River Watershed, a number of factors negatively impact native Bull Trout populations.

The network of roads and stream crossings is a potential source of excess sediment within the West Fork Thompson River drainage. The West Fork Thompson River Road (Forest Route 603) parallels the West Fork Thompson River for approximately 6 miles from confluence with the Thompson River up into the headwaters. Additionally, there is an extensive network of USFS-LNF roads in the headwaters of the West Fork Thompson River that is, for the most part, revegetated and inaccessible for motor vehicles. Reduced riparian canopy cover along the West Fork Thompson River Road may reduce canopy cover and increase stream temperatures due to loss of shade. The USFS-LNF road system may increase sediment loads due to proximity to the stream channel. Further investigation is needed to determine impacts (USFS 2013). Culverts on tributaries to West Fork Thompson River (Honeymoon Creek, Big Spruce Creek, and Four Lakes Creek) are potential barriers to fish passage (USFS 2013). This road system should be assessed for potential to condense or relocate roads in order to reduce runoff and improve riparian conditions (USFS 2013). Implementation of road BMPs and removal of barriers to fish passage may improve fish habitat, but further assessment is needed.

Education and Outreach Opportunities

There are no identified education or outreach opportunities at this time.

Completed and Proposed Projects for NPS Pollution Reduction and Native Fish Conservation

Table 2.9A. Recently completed projects within the West Fork Thompson River drainage.

Project description	**Lead entity and partners**	**Cost**	**Date completed**
Canyon Face TS – bin wall replacement and slide stabilization	USFS - LNF	$150,000	1995
Honeyman Creek Bridge replacement	USFS - LNF	$100,000	2009
West Fork Thompson River Road reconstruction and gravel surfacing	USFS - LNF	$75,000	2012
Canyon Face Road decommissioning	USFS - LNF	$40,000	2013
Thompson Complex BAER road BMPs	USFS - LNF	$40,000	2015

Section 3: Recommended Best Management Practices, Restoration, and Expected Pollutant Reductions

3.1: Best Management Practices and Restoration

Best Management Practices (BMPs) are practices designed to protect or improve the physical, chemical, or biological characteristics of water resources (DEQ 2012). The Administrative Rules of Montana defines BMPs as “methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after pollution-producing activities.” (DEQ 2012). The Montana Forest Best Management Practices guide defines BMPs as practices that cause minimal to zero negative impacts and ideally improve the condition of natural resources if the practice is properly planned and applied (DNRC 2015). Most BMPs are voluntary actions, while some, such as those implemented through the Montana Streamside Vegetation Zone Law, are regulated activities.

Many BMPs are described in existing publications concerning the Thompson River Watershed, including the 2012 Montana Nonpoint Source Management Plan (DEQ 2012), the Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (DEQ 2014, the Montana Forest Best Management Practices guide (DNRC 2015), the Montana Streamside Management Zone Law (DNRC 2006), the Prescribed Grazing NRCS guides (USDA 2017), and Habitat Conservation Plans which contain mitigation measures to protect cold-water fisheries and/or terrestrial species, such as the Weyerhaeuser Native Fish Habitat Conservation Plan (Plum Creek Timber Company 2000) and the DNRC Habitat Conservation Plan (DNRC 2010). Many of the BMPs identified in these plans are summarized in Table 3.1A.

BMPs are typically designed and implemented for a specific purpose and include management methods as well as actual physical structures. BMPs must be chosen and applied on a site-specific basis (DEQ 2012). There are a number of other factors necessary to identify proper BMPs for a site. Some questions to ask before moving forward with a particular BMP are:

- Is the BMP feasible for this site?
- Will this BMP be effective at reducing NPS loading targets or achieving additional management goals?
- Is this the most cost-effective BMP?
- Do all stakeholders agree on the proposed BMP?
- How will the BMP be maintained, if needed?

To answer these questions, consult local stakeholders and existing resources containing BMPs that have proven to be successful in addressing water quality issues. Additional resources available from local stakeholders within the Thompson River Watershed can be found in Section 4.

While BMP’s are already being widely applied in most, if not all, forestry and grazing practices in the Thompson River Watershed, implementing BMPs may not always be enough to properly reduce NPS pollution or meet other management goals in the watershed. In this case, additional restoration activities should be implemented. Restoration activities can be separated into two general categories: passive and active (DEQ 2014).

Active restoration: involves intervention using an approach that accelerates natural processes or changes the direction of succession to have a more immediate impact on water quality. Examples of active restoration include the use of heavy machinery to change the course of water flow, or mass plantings to accelerate vegetative growth in riparian areas (DEQ 2014).

Passive restoration: involves removing a source of disturbance and allowing natural succession of an ecosystem to occur over a long period of time. An example of passive restoration is installation of riparian fencing to prevent access by grazing livestock to a stream and its banks in order to prevent bank erosion and allow riparian vegetation to naturally regenerate (DEQ 2014). Passive restoration is often preferable to active because it is more cost effective, less labor intensive, and reduces the amount of short term pollutant loading that active restoration may cause. In some cases, the implementation of standard BMPs results in passive restoration. For example, during ongoing timber and grazing activities can allow for passive restoration to occur naturally across the landscape (B. Sugden, Weyerhaeuser Timber Company, personal communication).

Table 3.1A. Summary of BMPs for stream restoration in the Thompson River Watershed. For specific suggestions for implementation of BMPs via restoration projects in the Thompson River WRP, refer to Section 5.

Restoration Category	NPS Pollutants Addressed	Other Benefits Addressed	Target Areas/Locations	BMP Examples / Restoration Techniques
Aquatic organisms passage	• Sediment • Temperature	• Support life histories of aquatic organisms and promote habitat diversity • Prevent population isolation	• Stream segments with man-made barriers to aquatic organism passage	• Fish screen installation • Culvert replacement/resizing or removal • Dam removal or modification • Irrigation diversion maintenance
Riparian restoration	• Sediment • Temperature • Nitrogen • Phosphorus	• Prevent/minimize loss of land • Maintain flow capacity in stream • Improve fish and wildlife habitat • Improve recreation • Enhance aesthetics	• Anywhere banks are eroding excessively • Anywhere adjacent to streams where natural vegetation has been altered	• Channel reconstruction • Revegetation / riparian buffers • Streambank stabilization • Wetland restoration or creation • Floodplain reestablishment
Education, information, outreach	• Sediment • Temperature • Nitrogen • Phosphorus	• Promote community water quality awareness and support • Promote community water quality restoration and BMP participation • Promote community fish and aquatic life conservation awareness	• All communities within designated watershed • Stakeholders and users of the target resource	• Educational tours, field days, trainings, conferences, workshops • Brochures, newsletters, fliers, mailings, webpages, social networking • Service learning
Filtration	• Sediment • Temperature • Nitrogen • Phosphorus	• Slow runoff	• Agriculture: Down gradient from crop field or pasture • In conjunction with grazing management practices • Down gradient from urban/transportation impervious surfaces	• Revegetation • Riparian buffers • Clean water diversions • Filter strips • Cover crops • Alley cropping • Contour farming • Stripcropping • Grassed waterways • Settling basins or sediment traps
Forest management	• Sediment • Temperature • Nitrogen • Phosphorus	• Slow runoff	• Any timber management areas	• Adherence to the Montana SMZ law • Montana forestry BMPs for road construction and maintenance, transportation, timber harvesting design and implementation, and site preparation.

Grazing management	• Sediment • Temperature • Nitrogen • Phosphorus	• Prevent or minimize flow reduction • Protect riparian vegetation and habitat • Protect in-stream aquatic habitat • Promote plant species diversity • Prevent or minimize bank erosion • Prevent siltation of stream	• Livestock watering and management	• Off-stream watering facility • Pasture rotation and rest • Riparian fencing • Water gap • Corral/pen relocation • Placing salt blocks away from streams
In-stream habitat restoration	• Sediment • Temperature • Nitrogen • Phosphorus	• Maintain streambed complexity and increase pool densities • Enhance floodplain connectivity • Reduce stream velocity and maintain stream geomorphology • Protect in-stream aquatic habitat and fish reproductive zones	• Any stream segments experiencing high velocity flows and over-widening stream banks • Can be used in conjunction with riparian vegetation improvements.	• Large woody debris • Riparian revegetation • Non-native species management • Fish surveys
In-stream flow maintenance	• Sediment • Temperature • Nitrogen • Phosphorus	• Maintain stream wetted perimeter • Maintain aquatic life and fish passage • Promotes riparian vegetation • Dilutes pollutant concentrations	• Any stream segment that is over allocated for water use: primarily dewatered sections	• Irrigation diversion maintenance or replacement • Irrigation canal conversion • Irrigation system conversion • Irrigation tailwater control
Sustainable recreational activities and infrastructure	• Sediment • Temperature • Nitrogen • Phosphorus	• Protect riparian vegetation • Improve fish and wildlife habitat • Improve recreation • Enhance aesthetics	• Any stream segments frequented by recreationalists	• Public boat ramps and fishing access sites • Maintain public trails and remove “unofficial” trails • Waste handling and management
Road management	• Sediment • Temperature • Nitrogen • Phosphorus	• Limit roadway footprint to extent needed to accommodate transportation needs • Reduce or eliminate road surface erosion and consequent sedimentation • Improve access for travelers	• Anywhere roads are built and are adjacent to or cross streams	• Road sand management • Road repair, maintenance, surface drainage, grading • Improve crossings/replace undersized culverts • Transportation planning and analysis • Road relocation or decommission • Dust abatement, gravel, paving • Excessive width narrowing • Road consolidation and realignment

Urban/ Stormwater management	• Sediment • Temperature • Nitrogen • Phosphorus	• Retain water and limit runoff • Enhance natural water filtration • Reduce flood severity • Maintain proper operation • Avoid costly repairs or replacement • Minimize unpleasant odors • Reduce algal growth in surface water • Maintain safe drinking water supply	• Residential • Commercial • Installation and maintenance of roads and other infrastructure	• Clean water diversions • Septic system maintenance • Storm drain inlet protection • Stormwater reuse systems • Settling basins or sediment traps • Lawn fertilizer and irrigation management • Construction site stormwater runoff control • Conservation easements
Water Storage and Beaver Influence	• Sediment • Temperature • Nitrogen • Phosphorus	• Increase water storage and stream base flows • Detain sediment and nutrients • Elevate water table, increase forage potential reduce weeds • Slow water velocities • Deepen pools, increase channel complexity, lower stream temperatures	• Low gradient stream segments and basins • Simplified, small stream reaches	• Installation of beaver dam analogs • Beaver translocation • Beaver deceiver devices at road crossings and head gates.

3.2: Expected Pollutant Reductions

The Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (DEQ 2014*),* estimates the expected reduction of NPS pollutants if appropriate BMPs are implemented.

All significant pollutant sources were quantified by DEQ so that current pollutant loads of each NPS pollutant could be determined (DEQ 2014; Tables 3.2A, 3.2B, and 3.2C). In order to identify TMDLs, a determination of the total allowable load over the appropriate time period is necessary to comply with applicable water quality standards (DEQ 2014). Therefore, the TMDL is defined as the total allowable loading during a time period that is appropriate for applying the water quality standards and is consistent with established approaches to properly characterize, quantify, and manage pollutant sources in the Thompson River Watershed. As such, pollutant loads for this watershed are expressed as an allowable annual load. The TMDL, or allowable load, is calculated as a function of stream flow and the numeric water quality criteria for that pollutant (DEQ 2014), this means that these numbers are examples, as stream flow can change, making the allowable load of the stream change as well depending on when samples are being taken or which BMPs are being implemented. The estimated pollutant reduction is the difference between the current pollutant loads and allowable pollutant loads (TMDL) and is the amount of pollutant reduction needed in order to achieve allowable pollutant loads (Tables 3.2A, 3.2B, and 3.2C). This number can also be thought of as the expected pollutant reductions if all appropriate BMP's are applied to the impaired watershed.

Exact pollutant load reductions will ultimately be the result of the number of effective projects put in place. Reductions will vary according to location in the watershed due to changes in sediment composition, riparian buffer and shade composition, and land uses. Monitoring will be an important activity as projects are implemented in order to verify load reductions in the watershed. Section 6 has more information on monitoring and criteria.

Table 3.2A. Estimate of sediment load reductions from nonpoint sources (tons/year) expected by implementing BMPs by source category and total for streams with sediment TMDLs (DEQ 2014). Percent reduction from current estimated load is shown in parentheses.

Waterbody	Sediment Contributor	Current Sediment Load (tons/year)	Allowable Sediment Load (tons/year)	Estimated Sediment Reduction (tons/year)
Lazier Creek	Unpaved Roads**	8.45	4.17	4.28 (51%)
	Streambank Erosion	340	229	111 (33%)
	Upland Erosion	113	73	40 (36%)
	Total	**461.45**	**306.17**	**155.28 (34%)**
Little Thompson River*	Unpaved Roads**	31.2	14.6	16.6 (53%)
	Streambank Erosion	845	579	261.9 (31%)

	Upland Erosion	1,071	647	428.4 (40%)
	Total	**1,947.2**	**1,240.6**	**706.9 (36%)**
McGinnis Creek	Unpaved Roads**	6.88	1.85	5.03 (73%)
	Streambank Erosion	71	60	11 (16%)
	Upland Erosion	78	51	27 (35%)
	Total	**155.88**	**112.85**	**43.03 (28%)**
McGregor Creek	Unpaved Roads**	3.54	1.63	1.91 (54%)
	Streambank Erosion	279	187	92 (33%)
	Upland Erosion	196	114	82 (42%)
	Total	**478.54**	**302.63**	**175.91 (37%)**

*Loads from McGinnis Creek not included as they are listed separately in the table.
**Sediment loads from both parallel unpaved road segments and road crossings.

Table 3.2B. Estimate of nutrient load reductions from nonpoint sources (lbs/day) expected by implementing nutrient-reducing BMPs for streams with nutrient TMDLs (DEQ 2014). Because streamflow varies seasonally, the TMDLs are not expressed as a static value, but as an equation of the appropriate target by flow. As flow increases, the allowable load increases. Representative median flows from 2011-2012 sampling period were used to calculate the below TMDLs (DEQ 2014).

Waterbody	Nutrient	Allowable Nutrient Load (lbs/day)	Current Nutrient Loads (lbs/day)	Estimated Nutrient Reduction* (lbs/day)
Lazier Creek	TN	0.3119	0.0794	N/A
	TP	0.0432	0.0156	N/A
Little Thompson River	TN	12.1	1.1	N/A
	TP	1.06	0.4675	N/A

*The methods and models used to calculate allowable loads and expected reductions are estimates and use average observed stream flows and temperatures. Because of this, there is a possibility that certain streams may not show the need for pollutant load reductions, even though they are still impaired. Lazier Creek and Little Thompson River are both listed as impaired by nutrients, but neither the Total Nitrogen (TN) nor Total Phosphorus (TP) TMDLs show a need for reductions. Nutrient uptake by algae and other primary producers may decrease nutrient loads, which can make it appear as though nutrients are not impairing the stream. The TMDL document shows that there are target exceedances of other indicators of nutrient loading, including excessive algal growth, periphyton, and macroinvertebrate test scores. Therefore, a reduction of nutrient inputs and implementation of BMPs is still desirable to address target exceedances (DEQ 2014).

Table 3.2C. Estimate of temperature load reductions from nonpoint sources (°F) expected by implementing temperature-reducing BMPs for streams with temperature TMDLs (DEQ 2014). This estimate is an example TMDL for McGregor Creek based on the modeled naturally occurring maximum daily temperature at the mouth with a simulated stream flow (DEQ 2014). Percent reduction from current estimated load is shown in parentheses.

Waterbody	Allowable Temperature Load	Current Temperature Load	Estimated Temperature Reduction
McGregor Creek	55.09°F (12.83°C)	60.64°F (15.91°C)	5.55 °F (3.08°C or 19%)

Section 4: Available Resources

4.1: Technical Resources

Most organizations working within the Thompson River Watershed have planning documents in place that prioritize and identify projects or provide guidance on how to implement BMPs. One of the primary objectives of the Thompson River WRP is to consolidate information from those separate organization-specific documents into a comprehensive document for the watershed. Table 4.1A identifies the major prioritization and BMP guiding documents for these organizations that are useful resources for anyone planning on implementing restoration projects or educating about stream restoration within the Thompson River Watershed.

Table 4.1A. Organization-specific planning and guidance documents. This table is intended to identify major prioritization and BMP guidance documents for the Thompson River Watershed and is not all-inclusive.

Organization	Document	Description
DEQ	Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (2014)	Identifies streams in the Thompson River Watershed that are impaired by pollutants and no longer support beneficial uses, quantifies TMDLs for each pollutant, and provides guidance on BMPs to reduce NPS pollution.
DNRC	State Forest Land Management Plan (1996)	Provides consistent policy, direction, and guidance for the management of state forested lands.
	Montana Stream Permitting: A Guide for Conservation District Supervisors and Others (2001)	Developed to assist conservation districts and agencies in reviewing stream projects. It provides information on stream form, function, and management; and also provides examples of a variety of stream projects along with design considerations.
	Habitat Conservation Plan (2012)	A 50-year collaborative document between the USFWS and DNRC that includes conservation actions focused on Bull Trout and Westslope Cutthroat Trout.
	Montana Forestry Best Management Practices (Revised 2015)	Provides explanation of and guidelines for implementation of Montana Forestry BMPs. DNRC also coordinates biennial audits of statewide implementation of forestry BMPs and the SMZ Law.
	Montana State Water Plan (2015)	This plan synthesizes the visions and efforts of regional Basin Advisory Councils established in Montana's four main river basins: the Clark Fork/Kootenai, Upper Missouri, Lower Missouri, and Yellowstone. Identifies key water-related issues facing Montana and identifies ways to address them on a state-wide scale.

FWP	Montana Statewide Fisheries Management Plan (2013-2018)	Montana's first Statewide Fisheries Management Plan which describes management strategies for Montana's diverse and abundant fisheries resources. Includes management direction for most major water-bodies in the state.
Montana Institute on Ecosystems	Montana Climate Assessment (2017)	This assessment describes past and future climate trends that affect different sectors of the state's economy and will focus on climate issues that affect agriculture, forests, and water resources.
NRCS	Field Office Technical Guide	Contains technical information about the conservation of soil, water, air and related plant and animal resources. Technical guides used in each field office are localized so that they apply specifically to the geographic area for which they are prepared.
NorthWestern Energy	Memorandum of Understanding: Thompson Falls Hydroelectric Project (Renewed 2013)	Provides instruction for the continuing operation of the TAC and allocation of annual TAC funds, and provides assurances to stakeholders that measures to reduce impacts to Bull Trout at the Thompson Falls Project will be implemented in a timely fashion.
	Thompson River Bull Trout Enhancement and Recovery Plan (2013)	Addresses the Thompson Falls Dam as a fish barrier and identifies priorities for the recovery and enhancement of migratory Bull Trout in the Thompson River drainage.
USFS LNF	Watershed Climate Change Vulnerability Assessment: Lolo National Forest (2016)	Addresses how climate change could impact three forest resources: aquatics (Bull Trout and Pearlshell Mussel), water supply, and infrastructure (recreational areas, trails, and roads). Offers a framework to help guide future land management decisions with regards to maintaining resilient watersheds.
	Guidance for Stream Restoration and Rehabilitation (2015)	Serves as a guidance document with information available to assist professionals with the process of planning, analyzing, and designing a stream restoration or rehabilitation project.
	Conservation Strategy for Bull Trout on USFS lands in Western Montana (2013)	Used to guide conservation activities for Bull Trout on National Forest lands; standardizes the process for updating Bull Trout habitat and population baselines, provides a structured assessment of fish populations and habitat conditions, stressors, and needs, and identifies opportunities that will further guide the location, type, and extent of projects
	The Lolo National Forest Plan (1986)	Provides forest-wide management goals, objectives, standards, and other direction for the Lolo National Forest, including water, soil, and fish resources. Identifies research needs and desired future conditions of the forest.

WY	Native Fish Habitat Conservation Plan (2000)	A 30-year plan written in collaboration between WY (formerly Plum Creek Timber Company), Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS). This plan is a Habitat Conservation Plan and an Environmental Impact Statement (EIS) that includes 713,000 acres of Plum Creek (WY) land in Montana, Idaho, and Washington as well as the access roads leading to those lands upon which WY has some management responsibility. This plan focuses on conservation efforts towards native fish species, including Bull Trout, Westslope Cutthroat Trout, and Columbia River Redband Rainbow Trout.

4.2: Financial Resources

The success of watershed restoration projects relies on funding available through private, state, local, and federal organizations. It is often necessary to diversify and leverage funding sources to ensure implementation and continuation of watershed restoration. Numerous funding programs are available for restoration and NPS pollution reduction projects within the Thompson River Watershed (Table 4.2A). Organizations, such as the LCFWG or a conservation district, can collaborate with watershed stakeholders to fund projects in the watershed. Some resources are directly available to the public, while others require grant applications and/or management plans to be in place in order to access resources.

Table 4.2A. Major funding sources available to organizations and private landowners within the Thompson River Watershed.

Funding Source	Purpose	Who can apply?	Funding Type	Application Due Dates	Funding Limits
Conservation Districts – FCD, LCD, ESCCD, GMCD	Primarily fund conservation projects on the properties of private landowners.	Private landowners	Local-Government	Vary – check respective CD websites	Vary – typically cost-sharing programs
DEQ – 319 Program	Address NPS pollution in waterbodies identified as “impaired”, watersheds must have a DEQ-accepted WRP	Governmental entities and 501c(3) nonprofits	Federal	Annually in the fall	$300,000 per project
DEQ/ SWCDM – Mini Grants	Fund local education and outreach efforts addressing NPS pollution and water quality issues. Administered by SWCDM.	Governmental entities and 501c(3) nonprofits	Federal	Biannually	$3,000
DNRC – “HB223” Grant	Provide funding for conservation district projects.	Conservation districts	State	Quarterly	$20,000 for on-the-ground projects/ $10,000 for education projects
DNRC – Renewable Resources Grants (Planning and Project Implementation)	To fund planning efforts, for public entities, for projects that conserve, manage, develop, or preserve renewable resources in Montana. A separate grant funds the implementation of projects.	State agencies and universities, counties, incorporated cities and towns, conservation districts, irrigation districts, water/sewer/solid waste districts and tribes.	State	May 15th in even-numbered years	$10,000 for preliminary engineering/ technical investigation & feasibility; $5,000 for administrative; $50,000 for watershed planning; $125,000 for project implementation
DNRC – Watershed Management Grant	Watershed planning and management activities which	Local, state, and Tribal government entities.	State	April	$20,000

	conserve, develop, manage or preserve Montana's renewable resources and/or support the implementation and development of the state water plan.	Private entities that provide a cost share of 75% in in-kind services and/or cash.			
FWP – Future Fisheries Grant	Can fund costs of design/build, construction, and maintenance of projects that restore, enhance, or protect habitat for wild fishes.	Any group or individual. FWP recommends applicants consult with local FWP biologists prior to application submittal.	State	Prior to December 1 and June 1 of each year	Limited by funding availability. Typically $150,000 - $350,000 available for each cycle.
National Fish & Wildlife Foundation Grant	Funds projects that sustain, restore, and enhance nation's fish, wildlife, and plants and their habitats.	Federal, state, and local governments, educational institutions, nonprofit groups	Federal and/or private	Varies, but typically annually	Varies greatly by individual grant program
NorthWestern Energy	Mitigation fund can go towards restoration or research for Bull Trout populations above the Thompson Falls Dam, including the Thompson River.	Any group or individual. Projects approved by the Thompson Falls Technical Advisory Committee.	Private Foundation	Late fall	Varies. NorthWestern makes an annual contribution of $100,000, and is capped at $250,000.
NRCS – EQIP / ACEP	Funding available primarily for agricultural producers to maintain or enhance their land in a way beneficial to agriculture and/or the environment.	Approved applicants include private landowners with cropland, rangeland, grassland, pastureland and forestlands. Check website for specific application requirements.	Federal	Annually	Varies by program
SWCDM – Ranching for Rivers	Funding available to promote management of riparian pastures	Private landowners	Federal (provided	Spring	Cost-share covers up to 50%. Can be

	as an alternative to complete exclusion of the riparian area to livestock, for improvement of fisheries habitat, instream flows, and establishment of woody riparian species.		from CWA and passes through DEQ 319 program)		paired with other funding sources to further reduce cost to landowners.
WY – Weyerhaeuser Giving Fund	Funding available to local communities in the areas where WY has land or manufacturing. One of the four focus areas of the giving fund is Environmental Stewardship.	Tax-exempt, nonprofit public charities classified under Section 501(c)(3) of the U.S. Internal Revenue Code, or a public education institution or government entity qualified under Section 170(c)(1) of the U.S. Internal Revenue Code	Private Foundation	October 30, but may be submitted at any time during our cycle year, and are processed throughout the year.	No limit, but typically less than $10,000.
U.S. Forest Service – Lolo National Forest	Funding available for road management, fish and stream habitat management, watershed protection and improvement, recreation uses, grazing management, and monitoring.	Federal land management activities including cooperators/partners providing matching funds.	Federal	Annual budget appropriations as determined by Congress. Project specific revenue from sale of forest products and services.	Varies

Section 5: WRP Development and Priorities for Restoration

5.1: WRP Development Process

Stakeholder engagement and outreach

Stream restoration and conservation is the focus of many entities and organizations with broad representation in the Thompson River Watershed. These organizations, in addition to anyone who lives, works, recreates, or uses the resources within the Thompson River Watershed, are collectively referred to as “stakeholders”. Stakeholder-based watershed restoration planning engages stakeholders throughout the watershed to determine the highest priorities for action to reduce pollutants, protect native fish populations, and restore the land to more fully support a healthy watershed. Stakeholder involvement and collaboration has been emphasized throughout the development of this document, as the overall goal has been to incorporate the diverse perspectives and priorities of all local stakeholders into a comprehensive watershed-wide plan, and to develop partnerships that will lead to successful restoration efforts in the future.

Throughout development of the Thompson River WRP, voluntary input and participation from private landowners was considered a valuable resource for information on historical and current uses, and for identification of conservation and restoration priorities. To facilitate community participation, the LCFWG carried out the following activities:

- Published an article on the Thompson River WRP in the local newspaper (Sanders County Ledger)
- Mailed informational materials (letter and postcard) to all Thompson River Watershed landowners
- Created a webpage on the Thompson River WRP as an extension of the LCFWG website
- Created an online survey that is located on the LCFWG website and open to the public

In addition to landowners, LCFWG attempted to contact and gain input from local community groups and users within the Thompson River Watershed, including:

- Thompson River Drainage Association
- Sanders County Flycasters

Input received through the online survey (Figure 5.1A) was used to identify concerns of local landowners and other community members and assist with ideas for priority areas within the watershed. Community members and landowners who filled out the survey also had the option to sign up to receive updates on the WRP and projects implemented within the Thompson River Watershed after the WRP has been accepted. A total of 12 responses were received from the online survey from local landowners, community members, and visitors. 11 of the 12 responders were Montanans coming from Noxon, Thompson Falls, Kalispell, Columbia Falls, Libby and Hungry Horse. One response came from Rathdrum, Idaho.

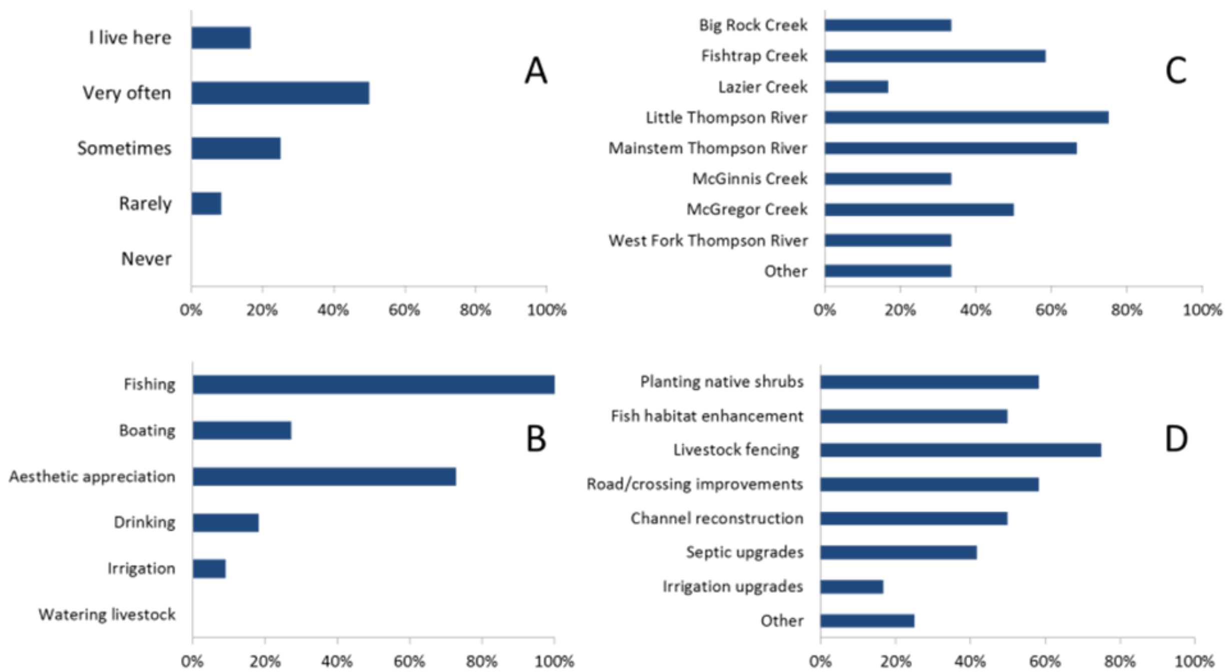


Figure 5.1A. Results from online survey from 12 total respondents. (A) Question: *How often do you visit the Thompson River Watershed?* (B) Question: *How do you use the water in the Thompson River Watershed?* (C) Question: *What are the most important tributaries/streams/areas in the Thompson River Watershed to you?* (D) Question: *Do you feel any of the below actions would help to restore or conserve streams you identified in the previous question?*

LCFWG will continue to engage with land owners, public land managers, the community, and other users of the Thompson River Watershed. Through education and outreach efforts, LCFWG will keep the community informed of water quality issues and restoration progress, provide examples of successful restoration efforts, and facilitate opportunities for landowners to provide input and participate in volunteer activities. All restoration projects and management plans proposed in this WRP are voluntary actions, so the continued engagement of the community, landowners, and watershed stakeholders is important for the successful implementation of restoration projects and watershed management practices. Education and outreach goals will be met in the following ways:

- **LCFWG website updates**: to inform the public of watershed activities and provide educational material on BMPs.
- **Biannual Newsletter:** distributed via email to LCFWG members and interested community members, with information on current activities in the Lower Clark Fork watershed, which will include updates on Thompson River Watershed activities, as well as activities from other drainages within the LCFWG coverage area. Spring/Summer newsletters will summarize plans for summer and Fall/Winter newsletters will summarize field season accomplishments and plans for winter restoration goals and activities.
- **LCFWG Quarterly Meetings:** will provide updates on current issues and activities in the Lower Clark Fork watershed. These meetings are open to the public.
- **Project specific outreach:** in conjunction with specific restoration projects, effort will be made to engage and inform landowners and stakeholders impacted by or involved in individual projects.

Project Identification and Ranking Process

The LCFWG held an initial stakeholder meeting in February 2017, at the beginning of the WRP development process. Working groups were formed for each of the eight sub-drainages identified in the WRP and comprised of major stakeholders in each sub-drainage and a designated leader. Throughout the summer and fall of 2017 working groups identified needs and potential projects in their respective sub-drainages. For more on the people and organizations involved, see the Acknowledgements page at the beginning of this document.

A second stakeholder meeting was held in September 2017 to discuss WRP development progress and watershed-wide project prioritization based on projects identified by stakeholders over the summer. However, due to a very busy summer field and wildfire season, it was decided that an additional two months were needed in order to flesh out ideas and identify more projects. A final stakeholder meeting was held in November 2017 and stakeholders were able to collectively discuss and rank projects.

Ranking criteria were developed by LCFWG staff and refined and agreed upon by stakeholders at the November meeting. Projects were ranked using the following criteria:

- Addresses water quality impairment
- Benefits native fish
- Project sponsor and partners identified
- Landowner consent and involvement
- Cost
- Availability of resources
- Permitting and environmental compliance
- Overall potential to benefit ecological integrity of the stream/watershed

A weighted points system was paired with the above criteria and used to rank projects per each ranking criterion (Appendix A1). A higher number of total points corresponded to higher priority projects that will be implemented sooner than projects that received a lower number of points.

After ranking was completed, all projects were compiled into two master watershed-wide project lists sorted by overall rank (Appendices A2 and A3). From these ranking lists, two implementation schedules were created: (1) identifying specific projects to be implemented on-the-ground to improve stream condition, and (2) identifying necessary investigations where the deliverable will be a report and inform the development of on-the-ground projects. Final implementation schedules are presented in Section 5.2 (Tables 5.2A and 5.2B).

Prioritization and ranking allow local stakeholders to select projects for implementation that will have the greatest impact on watershed health. Prioritizing projects provides direction for future watershed-wide restoration, but it does not preclude the pursuit of other projects that address water quality in the Thompson River Watershed. Some projects were ranked lower in the prioritization process due to scale and feasibility, despite a potentially substantial benefit to the watershed. An example of this is consolidation of the dual road system along the mainstem Thompson River, which is considered a high priority for a number of stakeholders and could provide substantial benefits to the ecological health of the mainstem Thompson River. This project would be complex, huge in scale, and involve many different stakeholders that would need to be engaged as a part of the process.

The LCFWG plans to update project rankings and the investigation and implementation schedules on an annual basis, checking in with all stakeholders to receive updates on project progress and new priorities. This will help fuel momentum for watershed restoration and keep stakeholders engaged. An update to this WRP is planned to take place in 10 years following approval of this plan, but an update can occur sooner or later if deemed necessary. This includes any projects identified after the November 2017 prioritization meeting (Appendix A4). Since these projects were not ranked with the larger stakeholder group, they will be saved for future annual updates where they will be ranked and incorporated into current project schedules.

5.2: Priorities for Restoration

The following tables (Tables 5.2A and 5.2B) show the current priority projects for restoration identified and ranked by Thompson River Watershed stakeholders during the final stakeholder meeting in November 2017. Projects were broken into two priority project schedules to reflect separate priority investigation projects and priority implementation projects. For both schedules, projects that were given a higher-ranking score will be implemented sooner than projects given a lower ranking score. Short-term priority projects have the highest-ranking scores and should be completed by the year 2020, mid-term priority projects have lower scores than short-term priority projects and should be completed by the year 2025, and long-term projects have the lowest ranking scores and should be completed by the year 2030 or even considered for future WRP updates. These timelines are not set in stone and may be adjusted annually based on stakeholder priorities, funding availability, and other priority project ranking factors

Table 5.2A: Investigation project schedule. These projects should result in assessments that will lead to additional projects to implement in the future. Refer to Appendix A2 to see specific ranking criteria identified.

Stream Name	Project Description	Lead Entity and partners	Location	Ranking Score
By 2020				
Beatrice Creek (tributary to Fishtrap Creek)	Investigate any possible sediment sources in Beatrice Creek, and recommend follow-up actions for WRP.	WY (in conjunction with FWP and USFS)	Beatrice Creek	29
Fishtrap Creek	Convene Fishtrap stakeholders to evaluate past Large Wood (LW) placement efforts to evaluate success and develop a detailed action plan for any next steps. Output will be a summary memo.	FWP (in conjunction with WY, USFS, DNRC)	Fishtrap Creek drainage	27
Fishtrap Creek	Continue to monitor natural mass wasting erosion of high terrace bordering Fishtrap Creek. Consider a future project as warranted.	FWP	Lower Fishtrap Creek (mainstem)	27
Nancy Creek (tributary to Little Thompson River)	Evaluate replacement old squash culvert (slightly perched).	USFS	USFS road easement; *Contact USFS*	25
By 2025				
Lazier Creek	Road BMP inventory and upgrading where needed to reduce sediment delivery	DNRC, USFS, Stimson Lumber Co.	Lazier Creek drainage	24

Little Thompson River	Monitoring/survey of grazing management in USFS Little Thompson River grazing allotment	USFS	USFS Thompson River grazing allotment	24
Little Thompson River	Transbasin diversion from Alder Creek (Alder Ditch) - monitor diversion volume and timing, investigate potential fish screens, and work to increase spring flushing flows.	FWP	*Contact Ryan Kreiner, FWP*	24
McGinnis Creek	Monitoring/survey of grazing management on grazing lease lands.	USFS	McGinnis Creek drainage	24
Thompson River	Investigate BMP mitigation and consolidation to mainstem road system.	USFS/WY	Entire length of Thompson River	23
Lazier Creek	Evaluate utility of additional range fencing to create more pastures for better control over grazing timing, duration, and intensity; and implement.	Thompson River Ranch, DNRC, WY	Thompson River Grazing Cooperative allotment in Lazier Creek	21
Lazier Creek	Evaluate potential for off-site water development to reduce riparian impacts outside fenced exclosure areas.	Thompson River Ranch, DNRC, WY	Thompson River Grazing Cooperative allotment in Lazier Creek	21
Little Thompson River	Evaluate potential improvements to improve riparian and channel conditions in cooperation with the grazing leaseholder. Potential actions include: • Development of additional pastures to increase control over distribution and timing of grazing, as well as allow for rest-years. • Identify possibility of creating off-channel water sources that would reduce riparian impacts. • Loneman Creek: Fence the lower ½ mile of channel enable riparian recover. Plant conifers in the excluded reach. • Partridge Creek: Evaluate potential fencing (or installation of brush barriers) on grazing impact areas to protect native cutthroat trout. • Little Thompson River: Evaluate the possibility of exclosing a four mile stretch immediately above the Mudd Creek confluence. • Evaluate possibility of riparian fencing the Little Thompson River on private lands in the lower and watershed.	DNRC (WY, USFS)	Thompson River Grazing Cooperative allotment in Little Thompson River	21
McGinnis Creek	Transbasin diversion from McGinnis Creek: monitor diversion volume and timing, investigate potential fish screens, work to increase spring flushing flows.	FWP, USFS	*Contact Ryan Kreiner, FWP*	21
By 2030				

West Fork Thompson River	Investigate impacts of old road system in upper drainage.	USFS	West Fork Thompson River drainage	20
West Fork Thompson River	Investigate feasibility for relocating riparian road.	USFS	West Fork Thompson River drainage	20
Little Rock Creek (tributary to Little Thompson River)	Evaluate head gate installation and stream re-naturalization. • Evaluate channel below diversion to determine current condition, and potential actions to prepare channel for flood flows that it has presumably not seen in many decades. This could include excavation/ removal of channel organics, wood placement, etc. • Evaluate possible control/removal of Brook Trout associated with this projector need to create a beneficial barrier to upstream colonization of exotic fish. • Evaluate current water right diversion volume and investigate beneficial use. • Evaluate current culverts below diversion to evaluate their capacity to receive flood flows. As needed install larger culverts. This includes a culvert on WY land (cost-share road with DNRC) as well as the county road (Figure 6.4H). • Evaluate implications for grazing lease, including water sources, potential need to develop off-channel water, potential new riparian impacts, etc.	FWP	*Contact Ryan Kreiner, FWP*	19
Little Thompson River	Investigate/evaluate potential for riparian grazing BMPs on agricultural land in headwaters.	SWCDM, ESCCD, Private landowners	Private land; *contact Steve Dagger, ESCCD*	19
Little Thompson River	Evaluate channel reconstruction: consideration/removal of check dams.	USFS	~1.5 miles upstream of McGinnis Confluence	18
Thompson River	Investigate potential to consolidate redundant road system on the mainstem Thompson River.	USFS/FWP	Entire length of Thompson River	18
Mudd Creek (tributary to Little Thompson River)	Investigate road/sediment delivery along Mudd Creek.		Lower 6 miles of Mudd Creek	17
McGregor Creek	Evaluate erosion and sediment delivery associated with unvegetated cutslopes along US Highway 2, and implement any necessary actions.	MDT	Highway 2, various locations	17
Thompson River	Investigate areas in need of riparian revegetation efforts and opportunities to implement riparian and grazing BMPs.	FWP/USFS/SWCDM	Entire length of Thompson River	17
Thompson River	Investigate potential to reduce riparian spur roads or excessive riparian campground roads in the Thompson River (e.g. Clark Memorial Campground).	USFS	Entire length of Thompson River	17
Fishtrap Creek	Investigate road/stream interactions and look for opportunity to improve. Consider future projects as warranted.	FWP/USFS	Fishtrap Creek drainage	16

Big Rock Creek	Investigate impacts of old road system in Big Rock Creek drainage on sediment delivery to streams and riparian encroachment. Pursue projects as warranted.	USFS/FWP	Big Rock Creek drainage	11

Table 5.2B: Implementation project schedule. These are on-the-ground projects ready to be implemented that will result in NPS pollutant reduction or improvement of overall water quality and/or fish habitat. Refer to Appendix A3 to see specific ranking criteria identified.

Stream Name	Project Description	Lead Entity and Partners	Location	Ranking Score
By 2020				
Beartrap Creek (tributary to Fishtrap Creek)	Remove the culvert on Beartrap Creek.	USFS	*Contact Jon Hanson, USFS*	38
Alder Creek (tributary to Little Thompson River)	Addition of beaver analogue structures	USFS	RM 1.3	37
Partridge Creek (tributary to Little Thompson River)	Upgrade undersized 18" culvert to better accommodate flood flows.	WY	SW 1/4 of Section 17	37
Twin Creek (tributary to McGregor Creek)	Silt fencing or straw waddles (for additional filtration) on outlet of erosion control dips on Twin Creek Road (Forest Route 6725)	WY, USFS	Twin Creek Road (Forest Route 6725)	35
Lazier Creek and Indian Spring Creek (tributary to Lazier Creek)	Fence out the Lazier-Indian Spring Complex at mouth of watershed to grazing.	WY, DNRC, Thompson River Ranch	Mouth of watershed	25
Lazier Creek and Whitney Creek (tributary to Lazier Creek)	Fencing along Lazier-Whitney Creek confluence maintenance	WY, DNRC, Thompson River Ranch	Lazier-Whitney Creek confluence	25
By 2025				
Big Rock Creek	Pursue potential fisheries projects intended at maintaining native fishery in Big Rock Creek.	FWP	Big Rock Creek drainage	24
Fishtrap Creek	As determined from convening stakeholders, implement additional LWD placement.	FWP (in conjunction with WY, USFS, DNRC)	TBD	24
Fishtrap Creek	LWD addition - with pre- and post-monitoring	USFS	RM 9.8 to confluence with West Fork FT Creek (~1.4 miles; 66 logjams)	24
Fishtrap Creek	LWD addition - with pre- and post-monitoring	USFS	RM 12.5-10.0 (Shale Creek Section; ~0.5 miles; 10 logjams)	24
McGinnis Creek	Forest Route 7517 culvert replacements and gravel surfacing (2018-2019)	USFS	Forest Route7517	24
Whitney Creek (tributary to Lazier Creek)	Fencing of Whitney Creek up to Whitney Springs	DNRC, WY, Thompson River Ranch	Whitney Creek up to Whitney Springs	22

Whitney Creek (tributary to Lazier Creek)	Channel naturalization and removing diversion	FWP, WY	Whitney Creek; *Contact Brian Sugden, WY*	22
McGregor Creek	Fencing and riparian buffer improvement on agricultural land	SWCDM, Private Landowners	Lower McGregor Creek	22
McGregor Creek	Grazing BMPs	SWCDM, Private Landowners	Lower McGregor Creek	22
By 2030				
Indian Spring Creek (tributary to Lazier Creek)	Lazier-Indian Spring Creek Culvert replacement	WY	*Contact Brian Sugden, WY*	20
Lazier Creek	Lazier Creek Culverts - replace existing twin 36 inch culverts under ACM road.	WY	*Contact Brian Sugden, WY*	20
Lazier Creek	Lazier Creek Culvert - increase size of culvert crossing of Lazier Creek to reduce failure risk and improve fish passage.	WY	Section 20 (T25N, R27W)	20
Little Thompson River	Look for opportunities to adjust the transportation network throughout the drainage to allow stream-adjacent road segments to be decommissioned.	WY, DNRC, USFS	Little Thompson River drainage	20
Nancy Creek (tributary to Little Thompson River)	Grazing management	SWCDM, ESCCD, private landowners	Private land; c*ontact Steve Dagger, ESCCD*	19
West Fork Thompson River	Riparian road improvement	USFS	RM 0.0 - RM 5.0 of mainstem West Fork Thompson river	19
Little Thompson River	Armor unarmored ford in headwaters which is over-widenened and eroding.	ESCCD, Private landowners	Private land; c*ontact Steve Dagger, ESCCD*	17
McGregor Creek	Riparian plantings and buffer improvement	USFS, LCFWG	TBD	16
McGregor Creek	Relocation and burial of utility lines impacting riparian function	Flathead Electric Cooperative	Upper McGregor Creek	12
Thompson River	Acquire or purchase of any private land or conservation easements for sale on the Thompson River for the purpose of conservation or walk-in fish access.	FWP	Entire length of Thompson river	9
Twin Creek (tributary to McGregor Creek)	Box culvert-fish barrier replacement/removal	MDT, FWP	*Contact Brian Sugden, WY*	8

5.3: Adaptive Management – Shifting Priorities in the Face of Future Climate Change

There are many factors that go into identifying restoration priorities within a watershed. While this document identifies current water quality and fish conservation priorities for the Thompson River Watershed, it is important to consider how climate change will affect water quality and fish habitat. Consequently, climate change has the potential to influence priorities for many stakeholders within the Thompson River Watershed in the future.

The Montana Institute on Ecosystems released the Montana Climate Assessment (MCA) in September 2017. This publication was created to synthesize, evaluate, and share scientific information about climate change in Montana (Whitlock, et. al., 2017). It describes historical and projected climate change for the entire state, as well as specific climate divisions (Figure 5.3A) to address localized variability. The Thompson River Watershed is located within the western climate division.

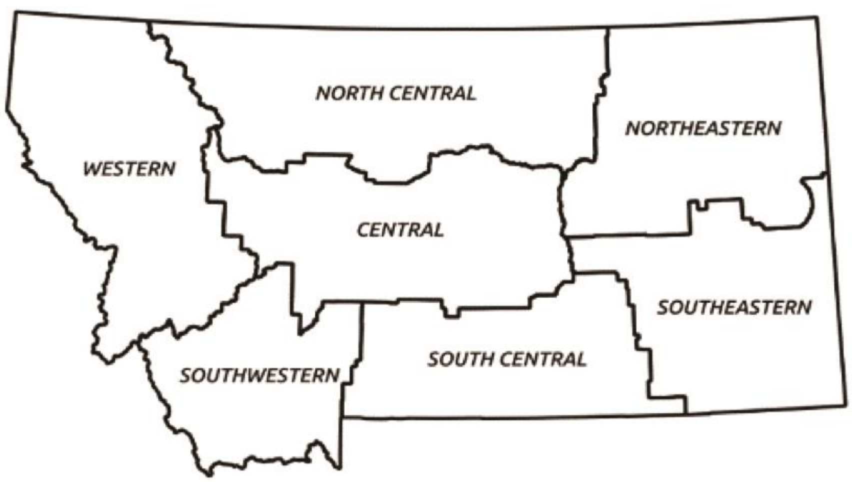


Figure 5.3A. Seven climate divisions in the State of Montana from the MCA. The Thompson River Watershed is located within the Western division.

In the western climate division, temperatures have increased by 0.39°F and precipitation has decreased by 0.58 inches per decade on average since 1950 (Table 5.3A). Statewide, temperatures are expected to increase by 4.5-6°F by mid-century and 5.6-9.8°F by end-of-century, depending on model conditions (Table 5.3B). In the western climate division, precipitation is projected to increase by 1.3-1.6 inches/year by mid-century and 2.0-2.2 inches/year by end-of-century, depending on model conditions (Table 5.3C)

Table 5.3A. Decadal rate of change for average annual temperatures (°F) and annual precipitation (inches/decade) for the Western division, Statewide, and United States from 1950-2015. A value of 0 indicates no significant change. Data and table adapted from the *Montana Climate Assessment* (Whitlock et al. 2017)

Montana Climate Division	Climate Change Variable	Annual	Winter	Spring	Summer	Fall
Western	Temperature (°F)	+0.39	+0.38	+0.49	+0.38	+0.29
	Precipitation (inches/decade)	-0.58	-0.57	0	0	0

Statewide	Temperature (°F)	+0.42	+0.56	+0.40	+0.30	+0.25
	Precipitation (inches/decade)	0	-0.14	0	0	0
United States	Temperature (°F)	+0.26	+0.30	+0.40	+0.18	+0.18
	Precipitation (inches/decade)	+0.33	0	+0.08	+0.08	+0.16

Table 5.3B. Statewide projections of average annual temperature changes (°F) for mid-century and end-of-century. Small differences exist between climate divisions, but the general magnitude of these changes is consistent across the state. The Stabilization model assumes that technological advancements will lead to a peak in greenhouse gas emissions at about 2040 followed by a decline. The business-as-usual model assumes that greenhouse emissions will increase throughout the 21st century due to society being unsuccessful in curbing emissions. Data and table adapted from the Montana Climate Assessment (Whitlock et al. 2017).

Projection Time Period	Model Type	Projected Change in Temperature (°F)
Mid-Century (2040-2069)	Stabilization	+4.5
	Business-as-usual	+6.0
End-of-Century (2070-2099)	Stabilization	+5.6
	Business-as-usual	+9.8

Table 5.3C. Projections of average annual precipitation changes (inches/year) of the northwestern climate division for mid-century and end-of-century. The Stabilization model assumes that technological advancements will lead to a peak in greenhouse gas emissions at about 2040 followed by a decline. The business-as-usual model assumes that greenhouse emissions will increase throughout the 21st century due to society being unsuccessful in curbing emissions. Data and table adapted from the Montana Climate Assessment (Whitlock et al. 2017).

Projection Time Period	Model Type	Projected Change (inches/year)
Mid-Century (2040-2069)	Stabilization	+1.3
	Business-as-usual	+1.6
End-of-Century (2070-2099)	Stabilization	+2.2
	Business-as-usual	+2.0

Changes in climate have the potential to directly and indirectly affect water and forest resources throughout the state of Montana and Thompson River Watershed. Declines in snowpack have occurred since the 1930s in the mountains both east and west of the continental divide and this trend is predicted to continue over the next century due to temperature increases (Whitlock et al. 2017). Peaks in the hydrograph resulting from snowmelt runoff have begun to shift earlier in spring as temperatures rise, a trend that is expected to continue. Earlier onset of snowmelt and spring runoff, as well as less snowpack overall, will reduce late-summer water availability in watersheds where the hydrograph is dominated by snowmelt runoff, such as the Thompson River Watershed. This increases potential for more severe droughts, low-flow conditions, and a more severe fire season during the summer and fall.

Increased temperatures will have a number of impacts on forest structure and processes, depending on local site and stand conditions. Increased temperatures may drive forest mortality to outpace gains in forest growth and productivity, leading to a net loss of forested area in Montana (Whitlock et al. 2017). Increased temperatures and associated drier conditions will increase fire risk as a result of prolonged fire seasons and increased fuel loads resulting from past fire suppression. Rising temperatures are also likely to increase bark beetle survival, which will create increased fire risk from increased numbers of dead trees in Montana forests (Whitlock et al. 2017).

Managing for climate change will be inherently uncertain and require a shift in thinking because managers cannot assume persistence of existing conditions, but must plan for inevitable ecological change (Wade et al. 2016). With increases in fire severity and frequency associated with climate change, more funding and time may be allocated towards wildland firefighting, restoration efforts, and other wildfire-related activities. Accordingly, priorities among stakeholders in the Thompson River Watershed may shift towards wildland fire management activities, particularly the USFS – LNF.

In addition to the MCA, the USFS – LNF, in collaboration with the Clark Fork Coalition, created the Watershed Climate Change Vulnerability Assessment – Lolo National Forest (Wade et al. 2016). This assessment identifies vulnerable watersheds and predicts potential future impacts from climate change, in order to provide a solid foundation for adaptive management and planning (Wade et al. 2016). In this report, vulnerability is a function of *exposure* (the magnitude or probability of physical changes in climate conditions), *sensitivity* (the likelihood of adverse effects to an organism or system given climate changes and potential interaction of non-climate stressors), and *adaptive capacity* (the intrinsic ability for an organism or system to reduce its sensitivity by successful response to changing climate; Wade et al. 2016). The information provided by this assessment may serve as guidance towards meeting USFS-LNF management and conservation goals in the face of uncertainties and complexities associated with climate change.

The vulnerability assessment specifically determines the relative vulnerability of three forest resources that are likely to be strongly affected by climate change: Bull Trout, water supply, and infrastructure (recreation areas, trails, and roads). The Thompson River Watershed was identified as one of the most vulnerable watersheds within all three of these forest resources within the Lolo National Forest study area (Wade et al. 2016). Before assessing vulnerability of forest resources, the projected changes in stream temperature, winter stream high flow days, and summer stream flows were modeled for current baseline conditions, mid-century conditions (2040), and end-of-century conditions (2080; Wade et al. 2016). The overall trend between these models is that summer stream temperatures and winter high stream flow days will rise and summer stream flows will decline over the next century.

Vulnerability of Bull Trout was assessed separately for temperature and flow because of the different nature of the two exposure effects, and because of the higher uncertainty in flow indices as compared to temperature. The Thompson River Watershed stood out as one of the most vulnerable areas to both flow and temperature stressors (having both high exposure and sensitivity). Bull Trout populations were projected to be more exposed to changes in flow than to increased temperatures as most Bull Trout populations generally occupy higher elevation streams which represent thermal refuges (Wade et al. 2016).

As made evident by the two reports described in this section (Wade et al. 2016; Whitlock et al. 2017), Montana's water resources have been, and will continue to be affected by climate change. This will force forest and water resource managers and stakeholders within the Thompson River Watershed to adapt to new climates and change restoration priorities as needed.

Section 6: Progress Evaluation

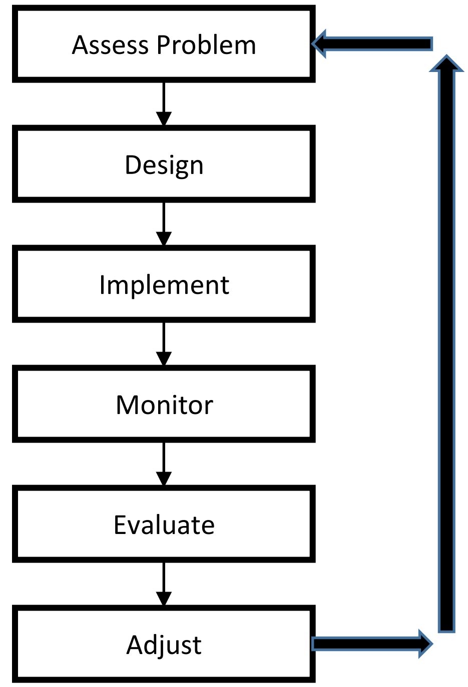


Figure 6A. Adaptive Management Process.

LCFWG and local stakeholders will work together to implement this WRP and track restoration progress in the Thompson River Watershed. Over time, changes to priorities may be necessary as projects are completed or new concerns arise. These changes may include addition of priority streams or adjustment of proposed BMPs to reflect new information. Setting tangible milestones, monitoring watershed conditions, and evaluating progress is an important part of any restoration effort. This allows natural resource managers to focus or redirect efforts to the most effective projects in the watershed, and to maximize improvement to water resources throughout the drainage. This systematic approach for improving resource management by learning from management outcomes is known as adaptive management and allows for flexible decision making (Figure 6A; DEQ 2014). To evaluate progress toward stream restoration goals, this WRP identifies: project milestones to steer efforts, progress indicators, current monitoring efforts and available data, and monitoring and data gaps. This will inform management in the Thompson River Watershed and allow for appropriate adjustments to techniques and priorities over time.

6.1: Milestones

Milestones are benchmarks that will be used by Thompson River Watershed stakeholders to ensure implementation goals are met. In this section, we identify general milestones for implementation of the entire Thompson River WRP:

Yearly milestones:

- LCFWG and partners are engaged in planning and implementing at least one project in the Thompson River drainage aimed at improving water quality and/or native fish habitat.
- Thompson River implementation schedules (Table 6.2A and 6.2B) are up-to-date and reflect implementation progress and revised priorities.
- Thompson River stakeholders are up-to-date on WRP implementation and receive (at least) semiannual updates from LCFWG.

Short-term milestones (By 2020):

- LCFWG and partners have planned at least one restoration project identified in the Thompson River WRP.
- LCFWG and partners are engaged in planning further WRP implementation identified in the Thompson River implementation schedules.

Mid-term milestones (By 2025):

- WRP implementation efforts have been made in all impaired and additional stream drainages.

- Thompson River stakeholders continue to be engaged in WRP implementation efforts.

Long-term milestones (By 2030)

- Measurable improvements to water quality have been made in drainages where restoration actions have occurred.
- Complete an update to the Thompson River WRP that reflects a decade of implementation efforts and improved watershed health.
- Thompson River stakeholders continue to be engaged in WRP implementation efforts.

The milestones outlined above reflect broad goals for implementation of the Thompson River WRP. It is also important to identify measurable objectives for specific projects to allow for directed effectiveness monitoring, which is a valuable adaptive management tool and a requirement of many funding sources. Depending on the project, measures of success may include improved stream connectivity; number of culverts removed; miles of roads decommissioned/removed/rerouted; length of streambank restored; increases in riparian shading; decreased water temperature; reduced sedimentation; reduced nutrients; improved fish passage, improved fish habitat; and increased abundance of native fishes (specifically Westslope Cutthroat Trout and Bull Trout).

6.2: Monitoring

Degradation of aquatic resources usually happens over many decades and “quick-fix” restoration projects often do not have the desired long-term effects. Restoration is a long-term process, and natural variability in water quality conditions necessitates a long-term monitoring effort in order to be accurate and effective. Trends in water quality can be difficult to define and even more difficult to directly relate to restoration or other changes in management. Determination of specific monitoring methods, priorities, and locations will depend on the type of restoration project implemented, surrounding landscape, specific land use practices, and budget and time constraints. As restoration activities are implemented throughout the Thompson River Watershed, pre- and post-monitoring to understand resulting changes will be necessary to track effectiveness of specific projects. Monitoring activities should be designed to directly measure parameters that indicate project effectiveness.

Water quality data and assessments that comprise the Thompson Project Area Metals, Nutrients, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (DEQ 2014) served as the foundation of this WRP. These data were obtained through tours of the watershed, assessments of aerial photographs, incorporation of GIS information, review and analysis of existing data, and review of published scientific studies (DEQ 2014). Additionally, there is a long history of monitoring activities within the Thompson River Watershed and many organizations continue to collect water quality and quantity data to describe long-term trends in watershed health. These are important activities that allow land and water managers to identify water quality issues and need for restoration, as well as track overall success of watershed restoration efforts. Table 6.2A identifies past and ongoing monitoring activities within the watershed.

Table 6.2A. Past and ongoing monitoring conducted within the Thompson River Watershed.

Organization	Monitoring Parameter	Streams (or Location)	Monitoring Techniques	Timeline
DEQ	Sediment	McGregor Creek, McGinnis Creek, Lazier Creek, Little Thompson River	Fine sediment (riffles and pebble counts), bankfull width/depth ratios, entrenchment ratio, residual pool depth, LWD, riparian health (shrub cover), macroinvertebrate and periphyton indices	2004-2011
	Nutrients	McGregor Creek, McGinnis Cree, Lazier Creek, Little Thompson River	Nitrate, TN, TP, macroinvertebrate and periphyton indices, Chlorophyll-a	2004-2012
	Temperature	McGregor Creek	Temperature and streamflow measurements, riparian shade, channel morphology, climate data assessment	2011
EPA	Sediment and Habitat	McGregor Creek, McGinnis Creek, Lazier Creek, Little Thompson River, Fishtrap Creek	Field assessments of channel morphology, riparian and instream habitat parameters, fine sediment	2011
USFS-LNF	Temperature	West Fork Thompson River, mainstem Fishtrap Creek, West Fork Fishtrap Creek, mainstem Thompson River	Temperature and streamflow measurements	Annual (continuous daily measurements since 2012)
	Project-specific	Varied	Photo points, bank erosion hazard index (BEHI), channel geometry surveys, environmental DNA, road surveys	Varied
	Stream health	Thompson River	Wetland delineation, stream morphology, road contamination, road sediment, LWD recruitment, riparian shade, McNeil Cores, stream crossings, aquatic habitat, fish population, angler surveys	2008

PIBO	Sediment and Habitat	McGinnis Creek, Little Thompson River	Channel morphology, temperature, fine sediment, biological indices, riparian health	2001-2015
FWP	Temperature	Thompson River, Fishtrap Creek, West Fork Thompson River, Little Thompson River, Big Rock Creek	Temperature and streamflow measurements	Some annually, others varied
	Fish	Thompson River, Fishtrap Creek, West Fork Thompson River, Little Thompson River, Big Rock Creek	Habitat measurements, fish surveys, electrofishing, Redd surveys	Some annually, others varied
NRCS	Water Supply Forecasts	Basso Peak	Snow surveys	Monthly during first half of each year
	Project-specific	Varied	Photo monitoring, grazing monitoring, vegetation transects	Varied
LCFWG	Project-specific (pre- and post-project typically)	Varied	Photo points, BEHI, site visits (usually used as supplemental to monitoring conducted by agency and resources professionals)	Varied
WY	Temperature	Beatrice Creek	Onset data loggers	Summer annually
	Riparian Condition	Throughout Thompson	As part of Native Fish HCP, WY tracks riparian trends with a network of fixed riparian plots.	Every 10 years
	Roads	Throughout Thompson	As part of Native Fish HCP, road BMP condition is periodically inspected.	Every 5-7 years
	Grazing riparian impacts	Little Thompson River and Upper Thompson River	As part of Native Fish HCP, grazing impacts are monitored twice annually by grazing leaseholders and reported to WY	Twice annually
	Grazing Impacts	Lazier Creek	As part of the Native Fish HCP, WY monitors a reach on Lazier Creek as part of an intensive study of grazing BMP effectiveness.	Every 5 years

	Riparian Restoration	Upper Thompson River	As part of a riparian restoration project on the Upper Thompson River, riparian conditions are monitored at several monumented cross sections.	Every decade

In addition to local monitoring efforts, there are many large-scale water quality and quantity databases available that are maintained by statewide and federal agencies and organizations.

- United States Geological Survey, National Water Information System database of surface water chemistry and discharge
- EPA STORET database of surface water chemistry and stream discharge
- Federal and state government agency geographical information system (GIS) data for geology, topography, land cover, and land-use layers
- Montana DEQ Clean Water Act Information Center - Water Quality
- DNRC Natural Resources Information System for water usage data
- MWCC Water Monitoring database of statewide monitoring programs
- FWP Montana Fisheries Information System (M-FISH)

Project-specific monitoring plans focused on measuring the success of individual projects are also an important addition to broad monitoring plans. Some projects will require more technical expertise for monitoring than others and the type of monitoring techniques used will depend on the anticipated outcome and type of impairment or water quality problem the restoration project or BMP is attempting to address. The monitoring protocol used for a particular project will also depend on the organization leading the project, and the resources available. Ongoing monitoring efforts will likely be a valuable contribution to project effectiveness monitoring; but additional efforts may be necessary. As projects are developed as a part of Thompson River WRP implementation, progress indicators (Table 6.2B) will be identified and measured to evaluate the achievement of project objectives and overall progress towards meeting Thompson River WRP implementation milestones and addressing water quality issues within the Thompson River Watershed. These indicators are measurable, quantifiable, and should indicate progress towards milestone achievement by either an increase or decrease in value of the specific indicator.

Table 6.2B. Possible indicators for the main water quality issues identified in the Thompson River Watershed.

Water Quality Issue	**Progress Indicator**
Sediment loading	Total suspended solids DEQ sediment assessment indicators: percent fine sediment in riffles and pool tails, width:depth ratios, entrenchment ratios, residual pool depth, pools/miles, and percent greenline shrub and bare cover (to be measured against targets for each stream) Length of roads improved or number of crossings stabilized or replaced Percent of vegetated and stable banks along a stream reach or segment
Nutrient loading	Populations of pollution-intolerant macroinvertebrates Periphyton biomass Number and extent of nuisance algae blooms

Temperature/low-flow alterations	Stream flow Temperature data loggers Percent shade cover Number of culverts maintained/repaired/replaced
Riparian habitat degradation	Percent of woody riparian vegetation along a reach or segment Number of feet of fencing installed Number of off-site or water gap structures installed Number of miles of road *decommissioned* within 100 ft Acreage of floodplain reconnected with stream Acreage placed into grazing management plans
Fisheries and fish habitat degradation	Percent of LWD in the stream Number of native and/or non-native fish

Monitoring and data gaps

Resources available for monitoring efforts on both broad and local scales are limited. It is therefore crucial that monitoring efforts (especially those that focus on progress evaluation) be targeted and effective, and emphasis be placed on monitoring efforts that will best inform water quality improvement efforts. In order to improve the effectiveness of monitoring and overall watershed restoration efforts in the Thompson River, the following monitoring and data management recommendations have been identified.

- Strengthen the spatial understanding of water quality issues to inform future restoration work. Focused monitoring that identifies specific sources of water quality impairments and habitat degradations will allow watershed restoration that maximizes resource improvement.
- Coordinate among stakeholders to standardize data collection protocols and quality control methods. The type and quality of information collected by different agencies and organizations varies. Future coordination among stakeholders will generate consistency, facilitate direct comparisons to TMDL targets, and standardize monitoring towards meeting TMDL load reductions and WRP goals (DEQ 2014).
- Increase available data. Furthermore, increased coordination among stakeholders will allow for a more comprehensive understanding of the Thompson River Watershed and the current conditions of native fish species and their habitat, by increasing access and availability of data to all parties.

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Appendices

A1: Ranking Criteria Matrix

Ranking Criteria	Description and point assignments			
	6	3	1	0
Addresses water quality impairment	Addresses NPS impairment identified in the TMDL	Addresses non-pollutant impairment identified in the TMDL	Addresses NPS or non-pollutant impact to water quality identified elsewhere but not in the TMDL	Does not address water quality
Benefits native fish	Benefits native fish; no nonnatives present	Benefits native fish; nonnatives present	Improves fish habitat; only nonnatives present	No fish present
Project sponsor and partners identified	Project sponsor and additional partners confirmed	Project sponsor confirmed and potential partners identified	Project sponsor identified; no other partners identified	No project sponsor or partners identified
Landowner consent and involvement	Landowner consents; landowner contributes in-kind AND financial resources	Landowner consents; landowner contributes in-kind OR financial resources	Landowner consents; landowner contributes NO additional resources	No confirmed landowner consent or resource contribution
Cost	LOW (<$10,000)	MEDIUM ($10,000-$100,000)	HIGH ($100,000 - $500,000)	VERY HIGH (>$500,000)
Availability of resources	All funding is obtained	Partial funding obtained	Potential funders identified but not confirmed	No funding plan or financial resources acquired
Permitting and environmental compliance	All necessary permits and environmental compliance are acquired	All necessary permits and environmental compliance are in process	Some but not all permits and environmental compliance are in process OR acquired; no permits required	NO permits or environmental compliance work has been completed
Overall potential to benefit ecological integrity of the stream/watershed	HIGH	MEDIUM	LOW	UNKNOWN

A2: Investigation Project Rankings (Highest to Lowest)

Stream Name	Project Description	Lead Entity and Partners	Location	Project Ranking Criteria								Rank
				Addresses water quality impairment	Benefits native fish	Project sponsor and partners identified	Landowner consent and involvement	Cost	Availability of resources	Permitting and environmental	Potential to benefit overall ecological integrity of the stream / watershed	
Beatrice Creek (tributary to Fishtrap Creek)	Investigate any possible sediment sources in Beatrice Creek, and recommend follow-up actions for WRP.	WY, FWP, USFS	Beatrice Creek	1	3	6	3	6	6	1	3	29
Fishtrap Creek	Convene Fishtrap stakeholders to evaluate past Large Wood (LW) placement efforts to evaluate success and develop a detailed action plan for any next steps. Output will be a summary memo.	FWP, WY, USFS, DNRC	Fishtrap Creek drainage	1	3	6	3	6	6	1	1	27
Fishtrap Creek	Continue to monitor natural mass wasting erosion of high terrace bordering Fishtrap Creek. Consider a future project as warranted.	FWP	Lower Fishtrap Creek	1	3	6	3	6	6	1	1	27
Nancy Creek (tributary to Little Thompson River)	Evaluate replacement old squash culvert (slightly perched)	USFS	USFS road easement; *Contact USFS*	6	3	1	6	1	6	1	1	25
Lazier Creek	Road BMP inventory and upgrading where needed to reduce sediment delivery	DNRC, USFS, Stimson	Lazier Creek drainage	6	3	3	3	6	1	1	1	24
Little Thompson River	Monitoring/survey of grazing management in USFS Little Thompson River grazing allotment	USFS	USFS Thompson River Grazing allotment	6	3	1	3	6	1	1	3	24
Little Thompson River	Transbasin diversion from Alder Creek (Alder Ditch) - Monitor diversion volume and timing, investigate potential fish screens, and work to increase spring flushing flows	FWP	*Contact Ryan Kreiner, FWP*	6	6	3	0	6	1	1	1	24
McGinnis Creek	Monitoring/survey of grazing management on grazing lease lands	USFS	McGinnis Creek drainage	6	3	1	3	6	1	1	3	24
Thompson River	Investigate BMP mitigation and consolidation to mainstem road system	USFS/WY	Entire length of Thompson River	1	3	3	3	6	3	1	3	23

Lazier Creek	Evaluate utility of additional range fencing to create more pastures for better control over grazing timing, duration, and intensity; and implement	Thompson River Ranch, DNRC, WY	Thompson River Grazing Cooperative allotment	6	3	3	3	3	1	1	1	21
Lazier Creek	Evaluate potential for off-site water development to reduce riparian impacts outside fenced exclosure areas	Thompson River Ranch, DNRC, WY	Thompson River Grazing Cooperative allotment	6	3	3	3	3	1	1	1	21
Little Thompson River	Evaluate potential improvements to improve riparian and channel conditions in cooperation with the grazing leaseholder. Potential actions include: • Development of additional pastures to increase control over distribution and timing of grazing, as well as allow for rest-years; • Identify possibility of creating off-channel water sources that would reduce riparian impacts; • Loneman Creek: Fence the lower ½ mile of channel enable riparian recover. Plant conifers in the excluded reach. • Partridge Creek: Evaluate potential fencing (or installation of brush barriers) on grazing impact areas to protect native cutthroat trout. • Little Thompson River: Evaluate the possibility of exclosing a four mile stretch immediately above the Mudd Creek confluence. • Evaluate possibility of riparian fencing the Little Thompson River on private lands in the lower and watershed.	DNRC, WY, USFS	Thompson River Grazing Cooperative allotment in Little Thompson River	6	3	3	3	3	1	1	1	21
McGinnis Creek	Transbasin diversion from McGinnis Creek: monitor diversion volume and timing, investigate potential fish screens, work to increase spring flushing flows	FWP, USFS	*Contact Ryan Kreiner, FWP*	6	3	3	0	6	1	1	1	21
West Fork Thompson River	Investigate impacts of old road system in upper drainage	USFS	West Fork Thompson River drainage	1	6	1	3	6	1	1	1	20
West Fork Thompson River	Investigate feasibility for relocating riparian road	USFS	West Fork Thompson River drainage	1	6	1	3	6	1	1	1	20
Little Rock Creek (tributary to Little Thompson River)	Evaluate head gate installation and stream re-naturalization • Evaluate channel below diversion to determine current condition, and potential actions to prepare channel for flood flows that it has presumably not seen in many decades. This could include excavation/ removal of channel organics, wood	FWP	*Contact Ryan Kreiner, FWP*	6	3	1	0	6	1	1	1	19

	placement, etc. • Evaluate possible control/removal of brook trout, or need to create a beneficial barrier to upstream colonization of exotic fish. • Evaluate current water right diversion volume and investigate beneficial use. • Evaluate current culverts below diversion to evaluate their capacity to receive flood flows. As needed install larger culverts. This includes a culvert on WY land (cost-share road with DNRC) as well as the county road. • Evaluate implications for grazing lease, including water sources, potential need to develop off-channel water, potential new riparian impacts, etc.											
Little Thompson River	Investigate/evaluate potential for riparian grazing BMPs on agricultural land in headwaters	SWCDM, ESCCD, Private landowners	Private land; *contact Steve Dagger, ESCCD*	6	3	3	0	3	1	0	3	19
Little Thompson River	Evaluate channel reconstruction: consideration/removal of check dams	USFS	~1.5 miles upstream of McGinnis Confluence	6	3	0	1	6	0	1	1	18
Thompson River	Investigate potential to consolidate redundant road system on the mainstem Thompson River	USFS/FWP	Entire length of Thompson River	1	3	3	0	3	1	1	6	18
Mudd Creek (tributary to Little Thompson River)	Investigate road/sediment delivery along Mudd Creek		Lower 6 miles of Mudd Creek	6	3	0	0	6	0	1	1	17
McGregor Creek	Evaluate erosion and sediment delivery associated with unvegetated cutslopes along US Highway 2, and implement any necessary actions	MDT	Highway 2 (Various locations)	6	3	1	0	3	0	1	3	17
Thompson River	Investigate areas in need of riparian revegetation efforts and opportunities to implement riparian and grazing BMPs	FWP/USFS/ SWCDM	Entire length of Thompson River	1	3	3	0	6	0	1	3	17
Thompson River	Investigate potential to reduce riparian spur roads or excessive riparian campground roads in the Thompson River (e.g. Clark Memorial Campground)	USFS	Entire length of Thompson River	1	3	3	0	6	0	1	3	17
Fishtrap Creek	Investigate road/stream interactions and look for opportunity to improve. Consider future projects as warranted	FWP/USFS	Fishtrap Creek drainage	1	3	3	3	3	1	1	1	16
Big Rock Creek	Investigate impacts of old road system in Big Rock Creek drainage on sediment delivery to streams and riparian encroachment. Pursue projects as warranted.	USFS/FWP	Big Rock Creek drainage	1	3	0	1	6	0	0	0	11

A3: Implementation Project Rankings (Highest to Lowest)

Stream Name	Project Description	Lead Entity and Partners	Location	Project Ranking Criteria: Addresses water quality impairment	Benefits native fish	Project sponsor and partners identified	Landowner consent and involvement	Cost	Availability of resources	Permitting and environmental compliance	Potential to benefit overall ecological integrity of the stream / watershed	Rank
Beartrap Creek (tributary to Fishtrap Creek)	Remove the culvert on Beartrap Creek	USFS	*Contact Jon Hanson, USFS*	1	6	6	6	6	6	6	1	38
Alder Creek (tributary to Little Thompson River)	Addition of beaver analogue structures	USFS	RM 1.3	6	6	6	6	6	3	1	3	37
Partridge Creek (tributary to Little Thompson River)	Upgrade undersized 18" culvert to better accommodate flood flows	WY	SW 1/4 of Section 17	6	6	6	6	6	6	0	1	37
Twin Creek (tributary to McGregor Creek)	Silt fencing or straw waddles (for additional filtration) on outlet of erosion control dips on Twin Creek Road (Forest Route 6725)	WY, USFS	Twin Creek Road (Forest Route 6725)	6	3	6	6	6	6	1	1	35
Lazier Creek and Indian Spring Creek (tributary to Lazier Creek)	Fence out the Lazier-Indian Spring Complex at mouth of watershed to grazing	Thompson River Ranch, DNRC, WY	Mouth of watershed	6	3	3	3	6	1	0	3	25
Lazier Creek and Whitney Creek (tributary to Lazier Creek)	Fencing along Lazier-Whitney Creek confluence maintenance	Thompson River Ranch, DNRC, WY	Lazier-Whitney Creek confluence	6	3	3	3	6	1	0	3	25
Big Rock Creek	Pursue potential fisheries projects intended at maintaining native fishery in Big Rock Creek.	FWP	Big Rock Creek drainage	0	6	3	6	1	1	1	6	24
Fishtrap Creek	As determined from convening stakeholders, implement additional LWD placement.	FWP, WY, USFS, DNRC	TBD	1	3	6	3	3	1	1	6	24

Fishtrap Creek	LWD addition - with pre- and post-monitoring	USFS	RM 9.8 to confluence with West Fork FT Creek (~1.4 miles; 66 logjams)	1	3	6	3	3	1	1	6	24
Fishtrap Creek	LWD addition - with pre- and post-monitoring	USFS	RM 12.5-10.0 (Shale Creek Section; ~0.5 miles; 10 logjams)	1	3	6	3	3	1	1	6	24
McGinnis Creek	Forest Route 7517 culvert replacements and gravel surfacing (2018-2019)	USFS	Forest Route 7517	6	3	1	6	3	3	1	1	24
Whitney Creek (tributary to Lazier Creek)	Fencing of Whitney Creek up to Whitney Springs	DNRC, WY, Thompson River Ranch	Whitney Creek up to Whitney Springs	6	3	3	3	3	1	0	3	22
Whitney Creek (tributary to Lazier Creek)	Channel naturalization and removing diversion	FWP, WY	Whitney Creek; *Contact Brian Sugden, WY*	6	3	3	3	3	1	0	3	22
McGregor Creek	Fencing and riparian buffer improvement on agricultural land	SWCDM, Private Landowners	Lower McGregor Creek	6	3	3	0	3	1	0	6	22
McGregor Creek	Grazing BMPs	SWCDM, Private Landowners	Lower McGregor Creek	6	3	3	0	3	1	0	6	22
Indian Spring Creek (tributary to Lazier Creek)	Lazier-Indian Spring Creek Culvert replacement	WY	*Contact Brian Sugden, WY*	6	3	3	3	3	1	0	1	20
Lazier Creek	Lazier Creek Culverts - replace exisitng twin 36 inch culverts under ACM road (Forest Route 9991)	WY	*Contact Brian Sugden, WY*	6	3	3	3	3	1	0	1	20
Lazier Creek	Lazier Creek Culvert - increase size of culvert crossing of Lazier Creek to reduce failure risk and improve fish passage	WY	Section 20 (T25N, R27W)	6	3	3	3	3	1	0	1	20
Little Thompson River	Look for opportunities to adjust the transportation network throughout the drainage to allow stream-adjacent road segments to be decommissioned	WY, DNRC, USFS	Little Thompson River drainage	6	3	3	1	3	0	1	3	20
Nancy Creek (tributary to Little Thompson River)	Grazing management	SWCDM, ESCCD, private landowners	Private land; *contact Steve Dagger, ESCCD*	6	3	3	0	3	1	0	3	19

West Fork Thompson River	Riparian road improvement	USFS	RM 0.0 - RM 5.0	1	6	1	3	3	1	1	3	19
Little Thompson River	Armor unarmored ford in headwaters which is over-widenened and eroding	ESCCD, Private landowners	Private land; *contact Steve Dagger, ESCCD*	6	3	1	0	6	0	0	1	17
McGregor Creek	Riparian plantings and buffer improvement	USFS, LCFWG	TBD	6	3	0	0	6	0	0	1	16
McGregor Creek	Relocation and burial of utility lines impacting riparian function	Flathead Electric Cooperative	Upper McGregor Creek	6	3	1	0	1	0	0	1	12
Thompson River	Acquire or purchase of any private land or conservation easements for sale on the Thompson River for the purpose of conservation or walk-in fish access	FWP	Entire length of Thompson River	1	3	1	0	0	0	1	3	9
Twin Creek (tributary to McGregor Creek)	Box culvert-fish barrier replacement/removal	MDT, FWP	*Contact Brian Sugden, WY*	1	3	0	0	3	0	0	1	8

A4: Proposed Projects Not Yet Ranked

These are proposed implementation projects that were identified post-November 2017 prioritization meeting. Therefore, they were not ranked with the larger stakeholder group and will be saved for future annual updates where they will be ranked and incorporated into current project schedules.

Drainage Name / Location	Lead Entity and Partners	Project Description
Big Rock Creek / Mouth of Big Rock Creek	USFS	Road armoring and gravel surfacing of approximately 3 miles of Forest Route 5574 in proximity to mouth of Big Rock Creek to reduce road surface erosion and overland flow.
Fishtrap Creek / Daisy Creek and Shale Creek tributary drainages	USFS	Daisy- Shale road decommissioning. Implement recommendations of Fishtrap science based roads analysis. (2025)
Fishtrap Creek / Cliff Creek, Daisy Creek, Shale Creek and unnamed tributary crossings on Forest Route 516.	USFS	Tributary culvert replacements on Forest Route 516 – cliff, daisy, shale, and unnamed tributaries. (2025)
Fishtrap Creek / Beatrice Creek	USFS	Beatrice Creek Grizzly Bear road closures. (2020)
Little Thompson River / Little Thompson River Road (mile-points 5-7)	USFS - LNF	Road surfacing and addition of drain dips and road fill armoring at drain dip outlets between mile-points 5 and 7 (steep gradients) on Little Thompson River road.
Thompson River (mainstem) / Lower 13 miles of County Route 56	USFS	Gravel surfacing of County Route 56, mile-point 4.2 to mile-point 17 (as per desired location for long-term preferred location of single road).
West Fork Thompson River / Forest Route 603	USFS	Gravel surfacing of West Fork Thompson River Road (Forest Route 603) and other roads from Honeymoon to trailhead.
West Fork Thompson River / Spruce Creek Crossing	USFS	Replace Spruce Creek Culvert with bridge.
West Fork Thompson River / Anne Creek Crossing	USFS	Anne Creek Bridge Removal and road storage.