Big Hole River, Montana
Watershed Restoration Plan

Part II: Middle & Lower Big Hole Watershed

Produced by:
Big Hole Watershed Committee

Final
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Acronyms

BDNF	Beaverhead-Deerlodge National Forest
BHWC	Big Hole Watershed Committee
BHRF	Big Hole River Foundation
BLM	Bureau of Land Management
CCAA	Candidate Conservation Agreement with Assurances
DEQ	Montana Department of Environmental Quality
EPA	Environmental Protection Agency
ESA	Endangered Species Act
MFWP	Montana Fish, Wildlife and Parks
NRDP	Natural Resources Damages Program
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	US Fish & Wildlife Service

A Note on Spelling:

It is common for creeks or locations to have several spellings for the same location. A single spelling is used in this document when applicable:

Case 1: Pintlar versus Pintler: Pintlar Creek is the spelling used in the TMDL document from which this plan is based, and therefore used in this document. Pintler Creek is the spelling used on maps and other resources. Since the Anaconda-Pintler Wilderness is a title, “Pintler” is retained. Where “Pintler” is used in text from the USFS plan, Pintler is retained since this is a direct quote from the Forest Plan.

Case 2: Pattengail versus Pettengill: Pattengail Creek is the spelling used in the TMDL; therefore, “Pattengail” is used widely in this document. MFWP and USFS used Pettengill; therefore , “Pettengill” is retained where their information is a direct quote.

Project Area

The Big Hole River watershed is located in southwest Montana (Figure 1). The colored areas within the watershed represent public lands and the white areas represent private lands. The Big Hole River headwaters begin in the south-west corner of the watershed and flow north, then east, to its confluence with the Beaverhead River near Twin Bridges. There are two watershed restoration plans at work in the Big Hole River watershed. The black line shows the division between two watershed restoration plans:

Part I: Upper & North Fork Big Hole River Watershed Restoration Plan (separate document)

Part II: Middle & Lower Big Hole River Watershed Restoration Plan (this document)

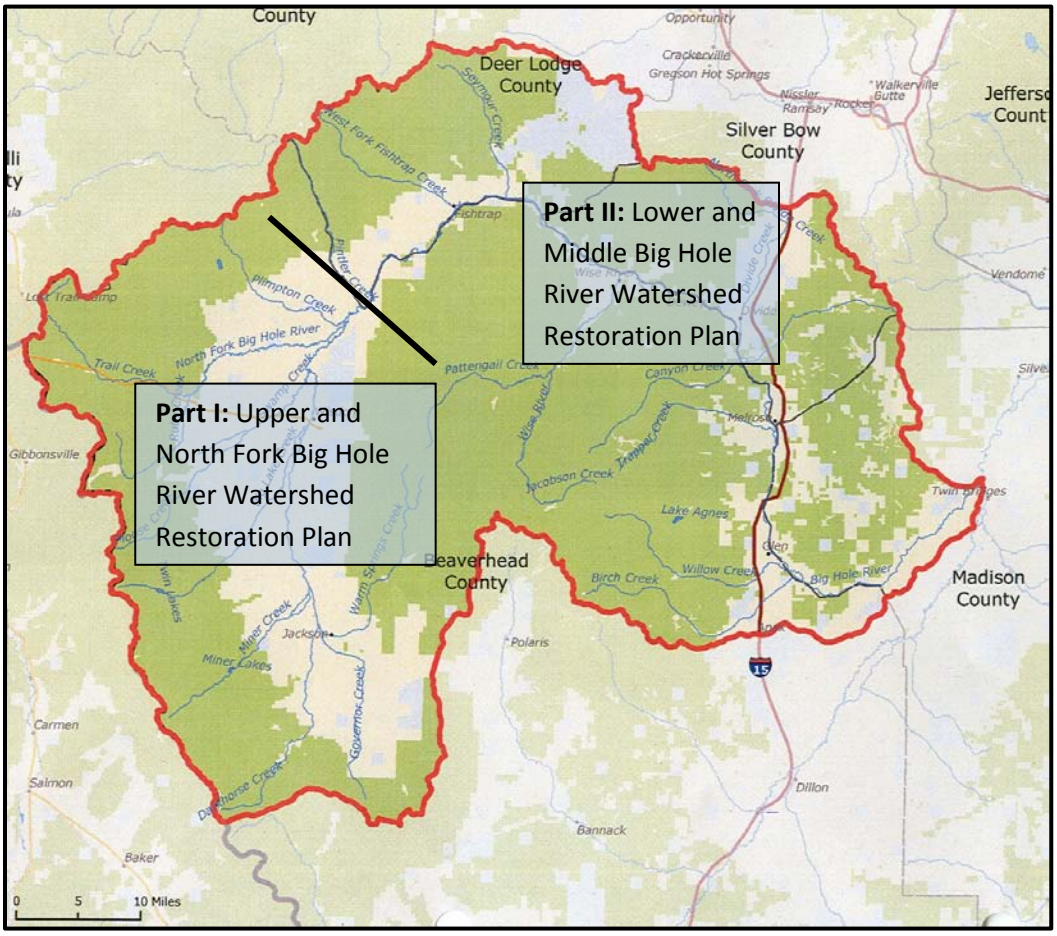


Figure 1: Big Hole River Watershed, Montana

Executive Summary

The Watershed Restoration Plan is a coordinated document that outlines restoration in terms of impacts, goals, objectives, and measures of improvement. The plan serves to coordinate restoration efforts among stakeholders.

There are four active watershed restoration plans in place in the Middle-Lower Big Hole watershed beyond this watershed restoration plan. The four plans are the US Forest Service (USFS) Beaverhead Deerlodge Forest Plan, Bureau of Land Management's (BLM) Watershed Assessments and Land Health Evaluations, Upper Big Hole Candidate Conservation Agreement with Assurances (CCAA) program, and the Montana Fish, Wildlife and Parks Statewide Fisheries Management Plan (see Figure 2).

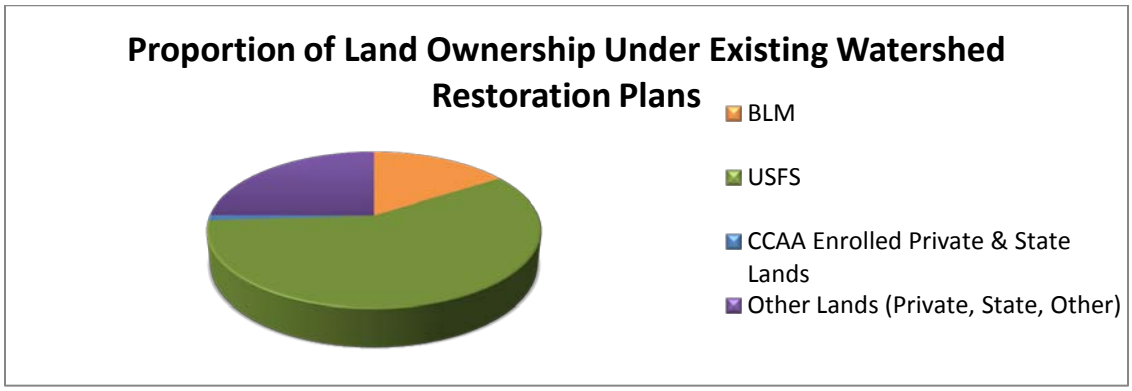
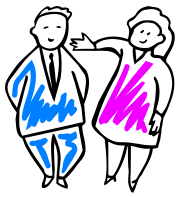


Figure 2: Proportion of land ownership in the Middle-Lower Big Hole watershed managed under existing watershed restoration plans.

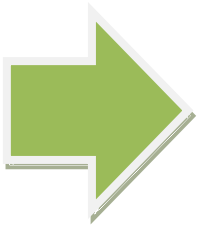
The primary water quality issues of concern in the Middle-Lower Big Hole watershed are high water temperature, often attributed to low flows due to drought and irrigation withdrawals and the lack of riparian vegetation, and high sediment loads resulting from channel and bank erosion changes that occur as a result of riparian vegetation loss. Improvement in water temperature and sediment issues are often difficult to track given that changes occur over years or decades and varies with natural changes in precipitation and air temperature. In some cases high nutrients and high metals may also be a water quality issue, but typically on a local scale.

The Middle & Lower Big Hole Planning Area TMDL was completed in 2009 (Montana DEQ, September 2009). Significant effort towards watershed restoration has occurred since the information for the TMDL was collected in 2005.



It is important to focus on land managers interested in making water quality improvements and to continue to implement projects that will decrease water temperature and increase stream flows. This occurs through riparian vegetation, grazing management, irrigation infrastructure upgrades, and wetlands restoration.

Purpose



This Watershed Restoration Plan was compiled by the Big Hole Watershed Committee (BHWC). The BHWC serves as a coordination hub and communication group between interests in the Big Hole Valley, including private land owners, residents, agencies, conservation groups, sportsman, and guides/outfitters.

The goal of this plan is to provide a coordinated approach to restoration in the Big Hole. The Middle-Lower Big Hole Valley is unique in that there are several active restoration plans already in place. These existing plans have varied goals, such as to improve the fishery, forest health, or range production. However, many of the activities used to achieve these goals also have a positive effect on water quality. Identifying plan goals and activities that include water quality benefits can be a cost effective way to improve water quality in the Middle-Lower Big Hole. The BHWC determined the best approach to accomplish watershed restoration in the Middle-Lower Big Hole was to

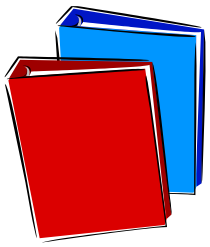
1. Compile the existing efforts into one concise resource (this plan)

2. Coordinate efforts among interests and encourage communication.

3. Support planned activity, either with in-kind, implementation, financial, or other support

4. Advocate including water quality benefits in planned projects.

Watershed Restoration Planning



A Watershed Restoration Plan is a guiding document that outlines watershed restoration goals and needs to address non-point source pollution. The plan describes actions to occur over a 3-5 year period. It is designed to be a working document that is reviewed and updated as needed. The goals and needs outlined will help watershed groups and stakeholders clearly meet objectives and coordinate efforts between stakeholders.

The Big Hole River watershed is divided into two sections - the Upper & North Fork Big Hole River and Middle & Lower Big Hole River. There is a watershed restoration plan for each section. The plans were developed with support from Montana Department of Environmental Quality 319 program.

The Environmental Protection Agency (EPA) developed a protocol for Watershed Restoration Plan development. Each Watershed Restoration Plan should contain the following 9 minimum elements:

1. Identification of causes of impairment (Section I)

2. An estimate of the load reductions expected from management measures (Section III)

3. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions (Section III)

4. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan (Section IV)

5. An information and education component to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented (Section IV)

6. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious (Section IV)

7. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented (Section V)

8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards (Section V)

9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established (Section VI)

The Big Hole Watershed Committee

The Big Hole Watershed Committee (BHWC), established 1995, seeks common ground among diverse viewpoints for watershed restoration and preservation in the Big Hole River watershed.

Mission: *"To seek understanding of the Big Hole River and agreement among individuals and groups with diverse viewpoints on water use and management in the Big Hole watershed."*

The BHWC operates within four focus areas, each with a priority initiative:

1. Land Use Planning: Climate resiliency, specifically riparian protection standards and incentives for landowners to preserve riparian systems.

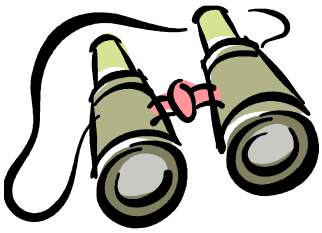
2. Wildlife: Reduce predator-human conflict with non-lethal deterrence

3. Water Quality & Quantity: Gain climate resiliency, specifically in water scarcity & high water temperature. Actions are through management plans, monitoring, research, and restoration activities. This includes the use of wetlands as a tool to improve or maintain water quality.

4. Invasive Species: Reduce and prevent invasive species infestation, particularly noxious weeds.

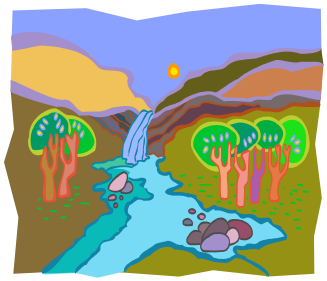
More information is available on our website: **bhwc.org**

Vision



The Big Hole watershed hosts fully functioning aquatic ecosystems and supports and sustains a viable ranching economy. Biological populations and water quality are monitored closely. The watershed is resilient to drought and other climate pattern changes. Plans are in place to adjust human activities during drought to sustain aquatic systems. Its residents are invested in watershed health. Provisions are in place to protect sensitive areas of the watershed in perpetuity. Efforts to improve or protect the watershed are coordinated among interest groups.

Watershed Characterization



The Middle-Lower Big Hole River watershed is a high elevation valley. The landscape is rural. The valley bottom is primarily private lands used for cattle ranching and hay production sustained by flood irrigation. The uplands are primarily public lands managed by USFS, BLM, or State of Montana. Public lands are often leased by ranches for cattle grazing. The Anaconda-Pintler Wilderness is located at the most upstream portion of the Middle-Lower Big Hole watershed. Population is sparse. Several small towns dot the river bottom, including Wise River, Dewey, Divide, Melrose, and Glen. The confluence of the Big Hole River with the Jefferson River is near the town of Twin Bridges. The Big Hole River is a headwater tributary to the Missouri River. It begins near the town of Jackson at the Continental Divide. The Middle-Lower Watershed begins at the confluence of Pintlar Creek with the Big Hole River and ends at the rivers confluence with the Jefferson River. See **Table 1** for watershed details. Attention has been directed towards this watershed as it is home to the Arctic grayling, a fish that faced significant decline in the 1970-1980's and a candidate for endangered species listing. Significant focus has been placed on actions and plans to recover the species over the last two decades.

Table 1: Watershed Characterization ***(note: The spellings of "Pintler Creek" and "Pintlar Creek" are synonymous and refer to the same creek.)***

Description	**Pintlar Creek to Confluence with Beaverhead River**
Miles of river in Middle-Lower Big Hole River • Middle Big Hole River (Pintlar Creek to Divide Creek) • Lower Big Hole River (Divide Creek to Beaverhead River)	95.2 miles • 43.8 miles • 51.4 miles
Watershed Area	1,021,021 acres; 1596 square miles
Counties	Beaverhead, Anaconda-Deer Lodge, Madison, Butte-Silver Bow
Land Ownership	USFS: 58% Private: 20% BLM: 16% State: 6%
Fish Species of Special Concern	Westslope Cutthroat Trout Yellowstone Cutthroat Trout Arctic Grayling
High Priority Abandoned Hard Rock Mine Sites (14 mines) (See Table Page 33 of TMDL (Montana DEQ, September 2009))	4 located in Silver Bow County, located in Moose Creek, Camp Creek, Soap Gulch and Maiden Rock. 3 located in Madison County, located in Rochester Creek and Nez Perce Creek. 7 located in Beaverhead County, located in Trapper Creek, Lost Creek, Birch Creek and Wise River.

Sensitive Species

There are 32 Montana Fish, Wildlife and Parks Animal Species of Concern in the Middle-Lower Big Hole watershed. The most prominent aquatic species sensitive to water quality are described below. A full Animal Species of Concern list is provided in **Table 2**.

The Fluvial Arctic Grayling and the CCAA Program

Montana FWP: Species of Special Concern
USFWS: Candidate for Endangered Species Listing
USFS: Sensitive Species
BLM: Sensitive Species

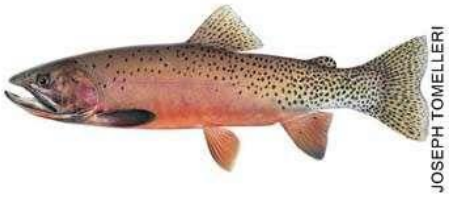
The Fluvial Arctic grayling (*Thymallus arcticus*) is a member of the trout family. The Big Hole River is the last remaining native population in the lower 48 states. They spawn in the spring and their diet is largely made up of aquatic insects. While the grayling can be found throughout the Big Hole River drainage, the majority of the population resides in the Upper Big Hole and the upper portion of the Middle Big Hole. Therefore, much of the restoration effort and future needs are driven by the habitat needs of the Arctic grayling. The grayling require cold and clear waters. They are typically a small fish with an identifiable large, iridescent dorsal fin. (Montana Field Guide)

Candidate Conservation Agreement with Assurances (CCAA) Program: In the Upper and Middle-Lower Big Hole, the BHWC is a partner in an ambitious conservation and restoration initiative known as the Candidate Conservation Agreement with Assurances or CCAA. The Big Hole CCAA is the largest of its kind in the United States. Bringing together local, state, and federal agencies, private landowners, non-profit organizations and many other parties, the CCAA develops restoration projects targeted to the last remaining population of fluvial Arctic grayling in the lower 48 states. Montana Fish, Wildlife & Parks (MFWP) and US Fish & Wildlife Service (USFWS) determined that the most immediate human-influenced threats to fluvial Arctic grayling in the Big Hole River are habitat loss, degradation, and fragmentation. *The CCAA proposes to remediate those threats by addressing the following four issues: reduced streamflows; degraded and non-functioning riparian habitats; barriers to fish migration; and entrainment in ditches.* The agencies "have developed a phased implementation schedule to provide immediate and long-term benefits to grayling, facilitate maximum landowner participation, and enable development of meaningful site-specific plans that are tailored to (each) property," including a monitoring plan. (Montana Fish, Wildlife and Parks and the U.S. Fish and Wildlife Service, 2006)

Legal Status of Fluvial Arctic Grayling: On April 24, 2007 the USFWS determined that the grayling population in the upper Missouri River basin was no longer warranted for listing under the ESA. This determination removed grayling from the Candidate Species List. Grayling remain a "Species of Special Concern" in Montana. On November 15, 2007 a lawsuit was filed by the Center for Biological Diversity, the Grayling Restoration Alliance, the Federation of Flyfishers and the Western Watersheds Project to overturn the USFWS decision not to list the grayling population in the upper Missouri River basin as

either Threatened or Endangered. In the settlement agreement, the Service agreed to publish a new status review finding on or before August 30, 2010. As part of the settlement, the Service agreed to consider the appropriateness of a Distinct Population Segment (DPS) designation for Arctic grayling populations in the upper Missouri River basin. Since the 2007 finding, additional research has been conducted and new information on the genetics of Arctic grayling has become available. As a result, on September 8, 2010, the Service determined that listing the upper Missouri River basin as a DPS of Arctic grayling, as threatened or endangered under the Endangered Species Act is warranted, but that listing the fish is precluded at this time by the need to complete other listing actions of a higher priority. In 2011, the Center for Biological Diversity reached an agreement with the USFWS to move forward on listing decisions on 757 species, including the Arctic grayling. Under the settlement, a final listing proposal is due in 2014. (Montana Fish, Wildlife and Parks, 2012)

Westslope Cutthroat Trout



Montana Fish, Wildlife and Parks: Species of Special Concern
USFWS: NA
USFS: Sensitive
BLM: Sensitive

The Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi)* is one of two cutthroat trout species in Montana. The cutthroat is the Montana state fish. The fish is identified by red throat slashes and black spots on the body. The cutthroat population is significantly reduced, now occupying less than 3% of its original range. The decline is attributed to hybridization and competition from non-native trout and from habitat degradation. The cutthroat trout requires cool waters with little sediment. They spawn in the spring leaving their eggs in redds made in the gravels. Westslope cutthroat trout restoration is active in the Big Hole watershed. (Montana Field Guide)

Western Toad

Montana Fish, Wildlife and Parks: Species of Concern
USFWS: N/A
USFS: Sensitive
BLM: Sensitive

The Western Toad (*Bufo boreas*) is, with one rare exception, the only toad species in western Montana. The Western Toad may occupy a wide range of habitat types including wetlands, dry conifer forest and aspen stands, streams, and wet meadows. The toad reproduces in the spring. Their eggs and larvae require shallow, still water for survival through the summer. The toad eats live insects. Specialists recommend the following actions to benefit toads in their known breeding sites: Reduce grazing and avoid pesticide use in and near, avoid stocking predatory game fish if not already present, and remove toads prior to use lethal stream treatments on the fishery. (Montana Field Guide)

Western Pearlshell Mussel

Montana Fish, Wildlife and Parks: Species of Concern
USFWS: N/A
USFS: Sensitive
BLM: N/A

The Western Pearlshell (*Margaritifera falcata*) is the only mussel to live in Montana's coldwater streams in habitats that typically also house westslope cutthroat trout. Their typical size range is between 50-80mm long. Threats to this species include impoundments, siltation and eutrophication (resulting from high nutrients). (Montana Field Guide)

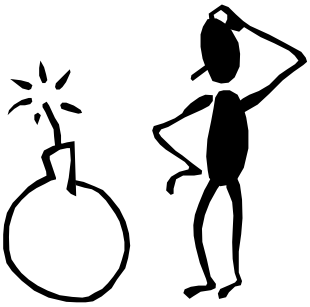
Table 2: Montana animal Species of Concern located in the Middle –Middle Lower Big Hole watershed (Montana Natural Heritage)

Species *Latin Name* Common Name	**Habitat**
Mammals	Sagebrush
Gulo gulo Wolverine	Boreal Forest and Alpine Habitats
Martes pennanti Fisher	Mixed conifer forests
Lasiurus cinereus Hoary Bat	Riparian and forest
Myotis thysanodes Fringed Myotis (Bat)	Riparian and dry mixed conifer forests
Brachylagus idahoensis Pygmy Rabbit	Sagebrush
Corynorhinus townsendii Townsend's Big-eared Bat	Caves in forested habitats
Birds	
Ardea herodias Great Blue Heron	Riparian forest
Strix nebulosa Great Gray Owl	Conifer forest
Accipiter gentilis Northern Goshawk	Mixed conifer forests
Catharus fuscescens Veery	Riparian forest
Haemorhous cassinii Cassin's Finch	Drier conifer forest
Leucosticte atrata Black Rosy-Finch	Alpine
Nucifraga columbiana Clark's Nutcracker	Conifer forest
Numenius americanus	Grasslands

Long-billed Curlew	
Spizella breweri Brewer's Sparrow	Sagebrush
Falco peregrinus Peregrine Falcon	Cliffs / canyons
Certhia americana Brown Creeper	Moist conifer forests
Otus flammeolus Flammulated Owl	Dry conifer forest
Dryocopus pileatus Pileated Woodpecker	Moist conifer forests
Centrocercus urophasianus Greater Sage-Grouse	Sagebrush
Buteo regalis Ferruginous Hawk	Sagebrush grassland
Artemisiospiza belli Sage Sparrow	Sagebrush
Oreoscoptes montanus Sage Thrasher	Sagebrush
Athene cunicularia Burrowing Owl	Grasslands
Rhynchophanes mccownii McCown's Longspur	Grasslands
Dolichonyx oryzivorus Bobolink	Moist grasslands
Fish	
Oncorhynchus clarkii lewisi Westslope Cutthroat Trout	Mountain streams, rivers, lakes
Thymallus arcticus Arctic Grayling	Mountain rivers, lakes
Oncorhynchus clarkii bouvieri Yellowstone Cutthroat Trout	Mountain streams, rivers, lakes
Amphibians	
Anaxyrus boreas Western Toad	Wetlands, floodplain pools
Invertebrates	
Euphydryas gillettii Gillette's Checkerspot (Butterfly)	Wet meadows
Margaritifera falcata Western Pearlshell (Mussel)	Mountain streams, rivers
Leucorrhinia borealis Boreal Whiteface (Dragonfly)	Forested Wetlands

- *For More Information:* **Montana Natural Heritage - Animals of Concern**

Section I: What is the Problem? Causes of Impairment in the Middle-Lower Big Hole Watershed



Non-point source impairments to water quality in the Middle-Lower Big Hole watershed include high water temperature, sediment, nutrients and metals (Table 3). Factors that contribute to water quality impairments are largely human caused due to agriculture (grazing and hay production), historic mining, development, and forest land practices (roads and timber harvest); however weather patterns and natural causes also are contributing factors. Impairments in the Middle-Lower Big Hole River can largely be attributed to a loss of riparian vegetation resulting in channel changes. Other water quality issues include dewatering, nutrient influx, abandoned mines and unpaved roads. As a result, streams may be listed on Montana DEQ's list of impaired waters. Listed streams in the Middle-Lower Big Hole are presented in Table 4 and Figure 3.

Table 3: Water quality impairments, causes, and remedies in the Big Hole River watershed. See for detailed impairments by sub watershed and stream. Source: (Montana DEQ, September 2009)

Water Quality Impairment	**Cause of Impairment**	**Remedy**
Temperature	Lack of riparian vegetation for shade Low summer time stream flows Widened channels	Restore Riparian Vegetation to: 1 Provide shade 2. Reduce width-to-depth ratios 3. Absorb nutrients 4. Reduce bank erosion 5. Prevent additional sediment inputs 6. To catch sediment before reaching the stream Improve Irrigation Efficiency Prevent sediment from washing into streams from roads. Use wetlands as a means to attain water quality
Nutrients	Natural sources Upland grazing runoff Streambank erosion Fertilizer use Animal feeding operations	
Sediment	Streambank erosion Upland erosion Erosion off unpaved roads Historic mining	
Metals	Abandoned mines Natural sources	
Other Watershed Issues	**Cause of Issue**	**Remedy**
Arctic grayling	High water temperature Low stream flows Entrainment in ditches	Riparian vegetation restoration to decrease water temperature Improve irrigation efficiency Provide fish passage or exclusion

Table 4: Sub-watersheds, 2012 listed streams, and their impairment sources (4 pages). See Table 16 and Table 17 for details. See Figure 3 for map. See page 84 for sub-watershed summaries.

	Water body & Stream Description	Probable Cause of Impairment
Big Hole River Mainstem	**Big Hole River –Middle Segment** Pintlar Creek to Divide Creek	**Copper** **Lead** **Temperature** Alteration in stream-side or littoral vegetative cover Low flow alterations Physical substrate habitat alterations **Sedimentation/ Siltation**
	Big Hole River –Lower Segment Divide Creek to the mouth at Jefferson River	Cadmium Copper Lead Zinc **Temperature** Low flow alterations Physical substrate habitat alterations
Big Hole River - Fishtrap Creek	**Fishtrap Creek** Confluence of West & Middle Forks to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Low flow alterations Phosphorus (Total) **Sedimentation/ Siltation**
	Sawlog Creek Tributary to Big Hole River	Alteration in stream-side or littoral vegetative cover Arsenic Phosphorus (Total) **Sedimentation/ Siltation**

	Water body & Stream Description	Probable Cause of Impairment
Deep Creek	**Corral Creek** Headwaters to mouth (Deep Creek)	Alteration in stream-side or littoral vegetative cover Physical substrate habitat alterations **Sedimentation/ Siltation**
	Deep Creek Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Low flow alterations **Sedimentation/ Siltation**
	California Creek Headwaters to mouth (French Cr-Deep Creek)	**Arsenic** Iron **Copper** Dewatering Bank erosion **Sedimentation/ Siltation** Riparian degradation **Turbidity** Fish habitat degradation
	French Creek Headwaters to mouth (Deep Creek)	**Arsenic** **Copper** **Sedimentation/ Siltation**
	Oregon Creek Headwaters to mouth (California Creek - French Creek - Deep Creek)	Alteration in stream-side or littoral vegetative cover **Arsenic** **Copper** Lead Other anthropogenic substrate alterations Physical substrate habitat alterations **Sedimentation/ Siltation**
	Twelvemile Creek Headwaters to mouth (Deep Creek)	Sedimentation/ Siltation
	Sevenmile Creek Headwaters to mouth (Deep Creek)	Alteration in stream-side or littoral vegetative cover **Sedimentation/ Siltation**
	Sixmile Creek Headwaters to mouth (California Creek)	Physical substrate habitat alterations **Sedimentation/ Siltation**
Wise River	**Elkhorn Creek** Headwaters to mouth (Jacobson Creek-Wise River)	**Arsenic** **Cadmium** **Copper** **Lead** **Zinc** **Sedimentation/ Siltation**
	Gold Creek Headwaters to mouth (Wise River)	Alteration in stream-side or littoral vegetative cover Phosphorus (Total) **Sedimentation/ Siltation**
	Grose Creek Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Other flow regime alterations **Phosphorus (Total)** **Sedimentation/ Siltation**
	Pattengail Creek Headwaters to mouth (Wise River)	Alteration in stream-side or littoral vegetative cover Physical substrate habitat alterations **Sedimentation/ Siltation**
	Wise River Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Low flow alterations Physical substrate habitat alterations **Sedimentation/ Siltation** **Copper, Lead, Cadmium**

	Water body & Stream Description	Probable Cause of Impairment
Big Hole River - Divide	**Charcoal Creek** Tributary of the Big Hole River	Nitrogen (Total) Phosphorus (Total) Sedimentation/ Siltation
	Jerry Creek Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover **Copper** Excess algal growth Lead Low flow alterations Physical substrate habitat alterations **Sedimentation/ Siltation**
	Delano Creek Headwaters to mouth	Alteration in stream-side or littoral vegetative cover **Sedimentation/ Siltation**
Divide Creek	**Divide Creek** Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Low flow alterations **Phosphorus (Total)** **Sedimentation/ Siltation** **Temperature** **Total Kjeldahl Nitrogen (TKN)**
Big Hole River - Melrose	**Moose Creek** headwaters to mouth (Big Hole River)	Low flow alterations **Sedimentation/ Siltation**
	Camp Creek headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover Arsenic Low flow alterations **Phosphorus (Total)** **Sedimentation/ Siltation** **Solids (suspended/bedload)**
	Trapper Creek Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover **Copper** **Lead** **Zinc** **Arsenic** **Cadmium** Low flow alterations Physical substrate habitat alterations **Sedimentation/ Siltation**
	Lost Creek	Alteration in stream-side or littoral vegetative cover **Arsenic** **Nitrogen (Total)** **Phosphorus (Total)** **Sedimentation/ Siltation**
	Wickiup Creek Tributary to Camp Creek (Big Hole River)	Alteration in stream-side or littoral vegetative cover Bottom deposits **Copper** Lead Mercury Phosphorus (Total)
	Canyon Creek Headwaters to mouth (Big Hole River)	Low flow alterations **Sedimentation/ Siltation**
	Soap Creek Headwaters to mouth (Big Hole River)	Alteration in stream-side or littoral vegetative cover **Nitrogen (Total)** **Phosphorus (Total)** **Sedimentation/ Siltation**
	Sassman Gulch Headwaters to mouth (Big Hole River)	Arsenic

	Water body & Stream Description	Probable Cause of Impairment
Lower Big Hole River	**Birch Creek** Headwaters to the USFS Boundary	**Sedimentation/ Siltation** Alteration in stream-side or littoral vegetative cover Low flow alterations Physical substrate habitat alterations
	Birch Creek USFS Boundary to mouth (Big Hole River)	Physical substrate habitat alterations Low flow alterations Other anthropogenic substrate alterations Alteration in stream-side or littoral vegetative cover **Sedimentation/ Siltation**
	Rochester Creek Headwaters to mouth (Big Hole River)	**Arsenic** **Copper** **Lead** **Mercury** Physical substrate habitat alterations **Sedimentation/ Siltation**
	Willow Creek Headwaters to mouth (Big Hole River)	Low flow alterations Sedimentation/ Siltation

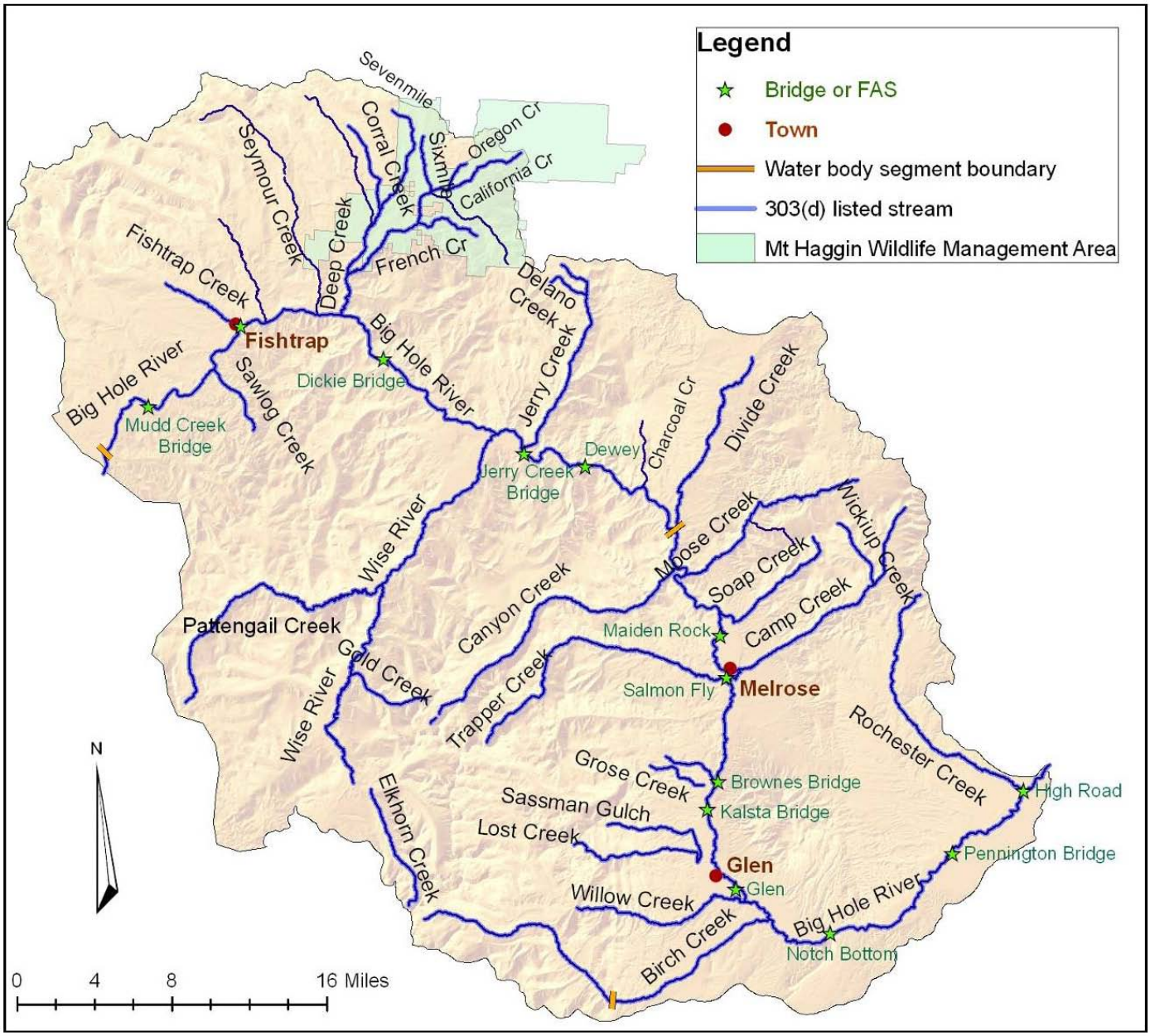


Figure 3: Middle-Lower Big Hole watershed impaired water bodies. From Middle-Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan Appendix A-2 (Montana DEQ, September 2009).

Section II. Who Addresses Water Quality Issues?

This section identifies key players in the Big Hole River watershed that work under plans that ultimately improve water quality:

- Montana Department of Environmental Quality (DEQ)
- US Forest Service: Beaverhead Deerlodge National Forest (USFS)
- Bureau of Land Management (BLM)
- CCAA/US Fish and Wildlife Service (CCAA)
- Montana Fish, Wildlife and Parks (MFWP)
- Big Hole Watershed Committee (BHWC)

Each plan has unique goals, work areas, and action plans. This section provides a summary of each plan and reference to each plan. This watershed restoration plan incorporated the goals and actions identified in the other plans in order to create a coordinated approach to watershed restoration.

Water Quality: Montana Department of Environmental Quality

The TMDL & Impaired Waters List:

The Middle & Lower Big Hole River Planning Area TMDLs (Total Maximum Daily Loads) and Framework was finalized in 2009 (Montana DEQ, September 2009). The TMDL summarized non-point source water quality impairments, targets for restoration, and guidelines for restoration for the mainstem Big Hole River and several tributaries. A non-point source pollutant cannot be tied to a single source as the source is widespread. In contrast, a point source pollutant can be tied to single location or source. A summary of the impairments listed in the TMDL are provided in **Table 4**.

Every two years, DEQ publishes a Water Quality Integrated Report that includes a list of impaired waters (Appendix A) (Montana DEQ, March 2012). Streams found on this list are not meeting one or more beneficial uses for water quality. There are four beneficial uses: 1. Drinking Water, 2. Aquatic Life, 3. Agriculture, 4. Recreation. The intention of this list is to provide a list of impaired waters in which TMDLs have been developed or need to be developed (303(d) list). A list of impaired waters and 303(d) listed streams in the Middle-Lower Big Hole watershed is provided in **Table 4**, **Table 16** and **Table 17.** Links to these resources are also provided:

- **Montana 2012 Water Quality Integrated Report**
- **Montana Impaired Waters List Summary (Appendix A of Integrated Report)**
- **303d lists on CWAIC**
- **Middle-Lower Big Hole River Planning area TMDL and Framework**

The TMDL produced for the Middle-Lower Big Hole developed targets that can be used to assess progress towards meeting water quality goals. The targets are described in detail in the TMDL document in Tables 5-2, 6-2, 7-4 and 8-1 (Montana DEQ, September 2009). Four impairments and the measures used in the targets are described in **Table 5.**

Table 5: TMDL Target Summary

Impairment	Target Measures
Temperature	Maximum Allowable Temperature Over Naturally Occurring Temperatures, or Riparian Shade Channel Width-Depth Ratio Irrigation Water Management Inflows to Stream
Sediment	Percent Fine Sediment Channel Width-Depth Ratio Pool Frequency Fish Population BEHI (Bank Erosion Hazard Index)Rating Eroding Banks Riparian Shrub Cover Along Green Line Macroinvertebrate Assessment Periphyton Human Caused Sources
Nutrients	Total Nitrogen NO_3+NO_2 as N Total Phosphorous Chlorophyll a Human Caused Sources Riparian Shrub Cover Along Green Line Percent Bare Ground Along Green Line
Metals: Cadmium, Copper, Mercury, Zinc and Lead	Montana's Numeric Water Quality Standards Supplemental Indicators Periphyton Sediment Metal Concentrations Human Caused Sources

USFS Beaverhead - Deerlodge Forest Plan

The US Forest Service Beaverhead-Deerlodge National Forest (BDNF) adopted a Forest Plan in 2009 (US Forest Service, 2009). The plan covers the entire forest of 3.38 million acres, of which the Middle-Lower Big Hole watershed is a part. The BDNF manages for four forest services and commodities: recreation, timber, grazing, and leasable minerals. Within the plan, BDNF addresses several natural resource and forest condition goals, objectives and standards (listed in Table 6). A link to the plan is provided:

- **Beaverhead Deerlodge National Forest Plan**

Table 6: USFS Beaverhead Deerlodge National Forest Plan - Resource Categories. Each category lists goals, objectives and standards. (US Forest Service, 2009)

Resource Categories - Chapter 3 of Forest Plan
Forest Wide
Air Quality
American Indian Rights & Interests
Aquatic Resources
Economic & Social Values
Fire Management
Heritage Resources
Infrastructure
Lands
Livestock Grazing
Minerals, Oil, Gas
Recreation & Travel Management
Scenic Resources
Soils
Special Designations
Timber Management
Vegetation
Wildlife Habitat

The plan outlines a move by the USFS to manage lands with an aquatics focus. New additions include the installation of a 300 foot buffer on each side of the stream to protect riparian zones, project work must not have a negative impact on aquatic resource without mitigation in key watersheds, and the creation of key watersheds for either 1) Fish, representing the highest quality watersheds, and 2) Restoration, representing the most impacted watersheds that are in need of restoration. As part of the plan, grazing plans are being reviewed to update grazing management and travel management is under review to address roads and road maintenance (US Forest Service, 2009). Appendix H of the Forest Plan outlines the key watersheds. The Middle-Lower Big Hole key watersheds are provided in Table 7 and Figure 4.

Table 7: USFS Beaverhead Deerlodge National Forest Key watersheds in the Middle-Lower Big Hole watershed. (US Forest Service, 2009)

Key Watershed	Resource Emphasis
Seymour Creek	Restoration
Sullivan Creek	Restoration
Deep Creek	Fish
Upper Jerry Creek	Fish
Cherry Creek	Fish
Lost Creek	Restoration
Willow Creek (Upper and Lower)	Restoration
Birch Creek	Restoration

USFS Watershed Assessments in Middle-Lower Big Hole Watershed

See Also:

- Fleecer Mountains Watershed Assessment
- Birch Willow Lost Watershed Assessment

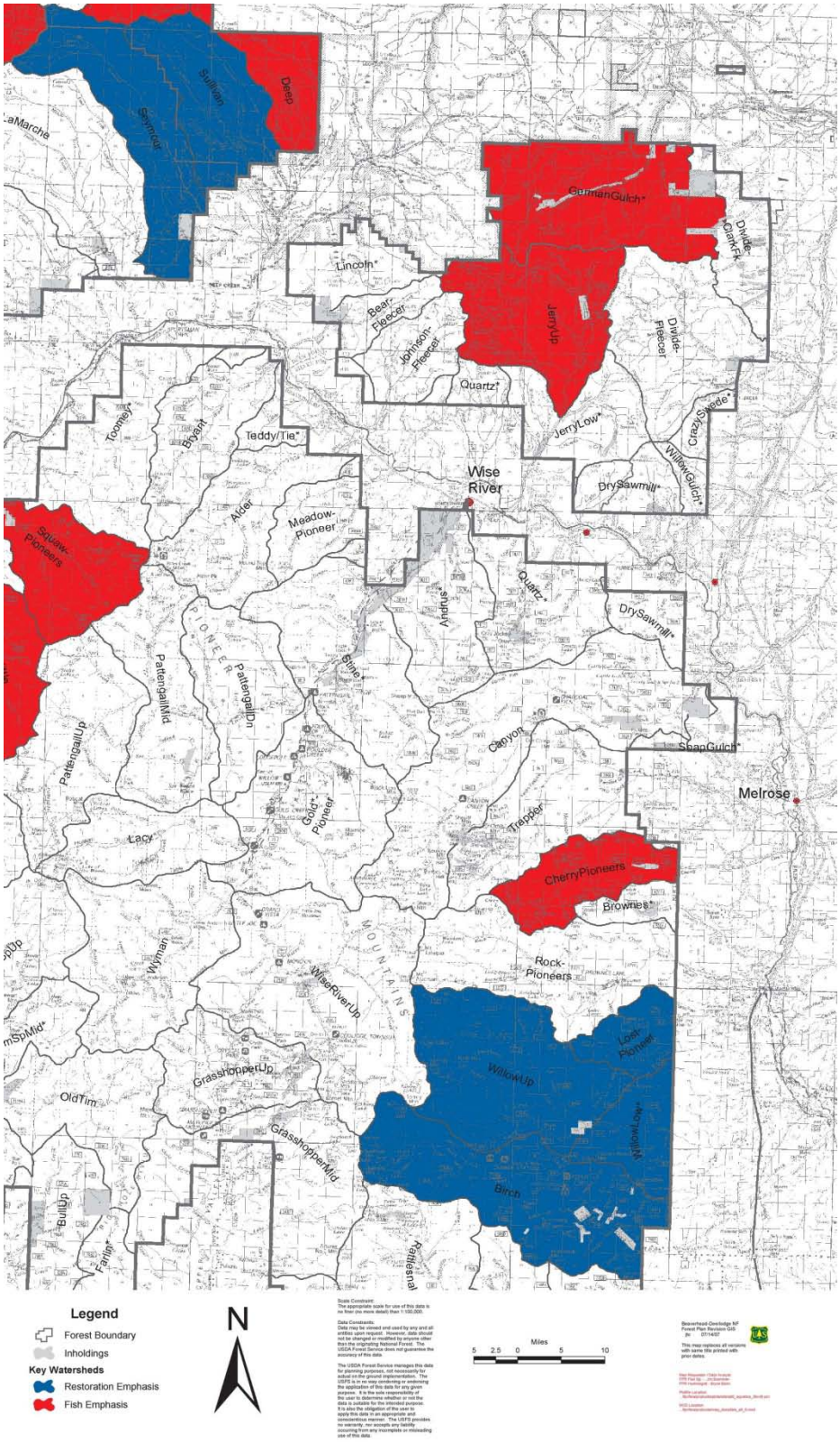


Figure 4: USFS Beaverhead Deerlodge National Forest Plan - Key watersheds. Note: This map is cropped from its original size to show only the Middle-Lower Big Hole watershed. (US Forest Service, 2009)

The Forest Plan defines the area for the Middle-Lower Big Hole watershed in the "Management Area Direction: Big Hole Landscape."

The USFS Forest Plan specifically addresses water quality and the TMDL as "Total Maximum Daily Loads (TMDLs): Management actions are consistent with TMDLs. Where waters are listed as impaired and TMDLs and Water Quality Restoration Plans are not yet established, management actions do not further degrade waters. Water quality restoration supports beneficial uses." (US Forest Service, 2009).

The USFS also manages the Anaconda-Pintler Wilderness. The wilderness area is 158,516 acres and contains the headwaters of streams originating in the upper portion of the Middle-Lower Big Hole watershed, including Mudd Creek, Fishtrap Creek, LaMarche Creek, and Seymour Creek. Motorized travel is not allowed in the wilderness.

USFS Strategy

The USFS Beaverhead Deerlodge National Forest Plan outlines specific goals, objectives and standards for forest management in each category, one of which is Aquatic Resources, as "Chapter 3: Forestwide Direction." This chapter, and specifically the Aquatic Resources portion, details specific plans for how the USFS intends to meet water quality and other aquatic resources needs. Additional criteria are applied to the key watersheds described in section 1 of this document, a minimum of which is no negative ecological response in fish key watersheds. The objectives of the Aquatic Resources section is provided here, beginning on page 13 of the Forest Plan

- **Chapter 3: Forestwide Direction**

The following is a direct excerpt from the Forest Plan. Use the link above to see the entire document.

Objectives

Vegetation Management: Manage vegetation to reduce the risk of adverse wildfire impacts to isolated native fish populations and water resources at the sub-watershed scale (6th Code HUC).

TMDLs: Cooperate with the state, tribal, and other agencies and organizations to develop and implement Total Maximum Daily Loads (TMDLs) and their implementation plans for 303(d) impaired water bodies influenced by National Forest System lands.

Watershed Analysis: Prepare and maintain a schedule for completing watershed analysis, with emphasis on key watersheds shown on page 58, or listed in Appendix H (IN).

Management Indicator Species: Maintain habitat conditions for native species as reflected by changes in abundance of *Drunella doddsi* (Mayfly) as a Management Indicator Species (MIS).

Restoration Key Watersheds: Complete watershed assessments for restoration key watersheds and associated restoration activities.

Spawning Areas: Reduce impacts from grazing practices in known or suspected threatened, endangered or sensitive fish spawning areas to avoid or reduce trampling of redds that may result in adverse impacts to threatened or endangered species, loss of viability, or a trend toward federal listing of sensitive species **(**GM 4**).**

Riparian Management Objectives: Establish stream specific Riparian Management Objectives (RMOs) using watershed or other analyses incorporating data from streams at or near desired function. RMOs

are a means to define properly functioning streams and measure habitat attributes against desired condition. The following RMOs apply by stream reach until new RMOs are developed through watershed or other site specific analysis,

(West of the Continental Divide) *(not included in this document)*

(East of the Continental Divide)

- Entrenchment Ratio (all systems) Rosgen Channel: A - <1.4, B – 1.6 – 1.8, C - >10.3, E ->7.5.
- Width/Depth Ratio (all systems) Rosgen Channel: A - <11.3, B – <15.8, C - <28.7, E -<6.9.
- Sediment Particle size, % < 6.25mm (all systems) Stream Type: B3 - <12, B4 - <28, C3 - <14, C4 - <22, E3 - <26, E4 - <28.
- Large Woody Debris: (forested systems) >20 pieces per mile, > 6 inch diameter, >12 foot length.
- Bank Stability: (nonforested systems) >80% stable.

Wildland Fire Management: Suppression activities are designed and implemented so as not to prevent attainment of desired stream function, and to minimize disturbance of riparian ground cover and vegetation. Strategies recognize the role of fire in ecosystem function and identify those instances where fire suppression actions could perpetuate or damage long-term ecosystem function or native fish and sensitive aquatic species (FM 1**).**

Temporary Fire Facilities: Incident bases, camps, helibases, staging areas, helispots and other centers for incident activities are located outside of RCAs. An interdisciplinary team, including a fishery biologist, is used to predetermine incident base and helibase location during pre-suppression planning (FM 2**).**

Fire Suppression: Chemical retardant, foam, or additives are not delivered to surface waters. Guidelines (fire management plan) are developed to identify exceptions in situations where overriding safety or social imperatives exist (FM 3**).**

Mineral Inspection: Mineral activities are inspected and monitored. The results of inspections and monitoring are evaluated and applied to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of desired stream function and avoid adverse effects on threatened and endangered aquatic species and adverse impacts to sensitive aquatic species (MM 6**).**

Road Drainage: Reconstruct road and drainage features that do not meet design criteria or operation and maintenance standards, or are proven less effective than designed for controlling sediment delivery, or retard attainment of desired stream function, or increase sedimentation in Fish or Restoration Key Watersheds (RF 3a**).**

Roads: Close and stabilize or obliterate and stabilize roads not needed for future management activities (RF 3c**).**

Recreation Sites: Existing, new, dispersed, or developed recreation sites and trails in RCAs are adjusted if they retard or prevent attainment of desired stream function, or adversely affect threatened or endangered species or adversely impact sensitive species. Adjustments may include education, use limitations, traffic control devices, increased maintenance, and relocation of facilities (RM 1)**.**

Bull Trout Restoration: Prioritize bull trout restoration activities with consideration given to bull trout core areas population status and health. Coordination will occur with USFWS, other federal, state, and local agencies.

End excerpt from USFS Forest Plan, Chapter 3

Bureau of Land Management

The Bureau of Land Management (BLM) holds land in several locations in the Middle-Lower Big Hole watershed. The lands are managed by two field office: Butte Field Office and Dillon Field Office. Most BLM lands in the watershed are used primarily as leased grazing allotments. In the middle segment, the BLM also holds lands that are used often by recreationists.

The Dillon field office has completed several watershed assessments throughout the Big Hole. The Butte field office uses more site specific assessments called Land Health Evaluation Reports. Each evaluation reviews land health and water quality and provides recommendations based on reports. **Table 8** summarizes the evaluation results pertaining to water quality.

Dillon Office: East Pioneer Watershed Assessments

- East Pioneer Watershed Assessment
- Beaverhead West Watershed Assessment (Small , most north-east portion)

Butte Office: Land Health Evaluation Reports (to link to report, Ctrl + Click on allotment name)

- **Copp-Jackson Allotment**
- **Deep Creek Allotment**
- **Indian Creek Allotment**
- **Jerry Creek Allotment**
- **Moose Creek AMP Allotment**
- **Moose Creek Non-AMP Allotment**
- **Alder Creek Allotment**
- **Charcoal Mountain Allotment**
- **Dickie Allotment**
- **Foothills Allotment**
- **Harriet Lou Allotment**
- **Leffler Allotment**
- **Quartz Hill Allotment**

Table 8: BLM Allotments and Watershed Assessments pertaining to water quality (Source: See links to allotments and watershed assessments above)

Allotment	Sub-Watershed	Impaired Stream?	Meeting Riparian Standard? Cause?
Copp-Jackson	Big Hole River-Divide	No	Yes
Deep Creek	Deep Creek	Yes	Yes
Indian Creek	Big Hole River - Divide	No	No - Sedimentation
Jerry Creek	Big Hole River - Divide	Yes	No – Vegetation Loss
Moose Creek AMP	Big Hole River - Melrose	Yes	No – Channel degradation
Moose Creek Non-AMP	Big Hole River Melrose	Yes	Not Applicable
Alder Creek	Big Hole River - Fishtrap	No	Yes
Charcoal Mountain	Big Hole River - Divide	Yes	Yes
Dickie	Big Hole River - Fishtrap	No	Not Applicable
Foothills	Wise River	No	Yes
Harriet Lou	Wise River	No	Yes
Leffler	Big Hole River - Divide	No	Yes
Quartz Hill	Big Hole River - Divide	No	Yes
East Pioneer	Big Hole River Melrose Lower Big Hole River	Yes: Birch Creek Willow Creek Lost Creek	Varied

CCAA Program

The Candidate Conservation Agreement with Assurances (CCAA) program assesses and identifies impairments for restoration on lands enrolled in the CCAA program (Figure 5). Each land is assessed individually and the results of the assessment are largely confidential. Each land is required to follow guidelines for restoration and for meeting milestones in order to be part of the program. Program staff reviews lands for riparian condition, irrigation infrastructure condition, noxious weed infestation, and so on. More information is available in the CCAA plan and can be accessed using the following link:

- **Candidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in the Upper Big Hole River**

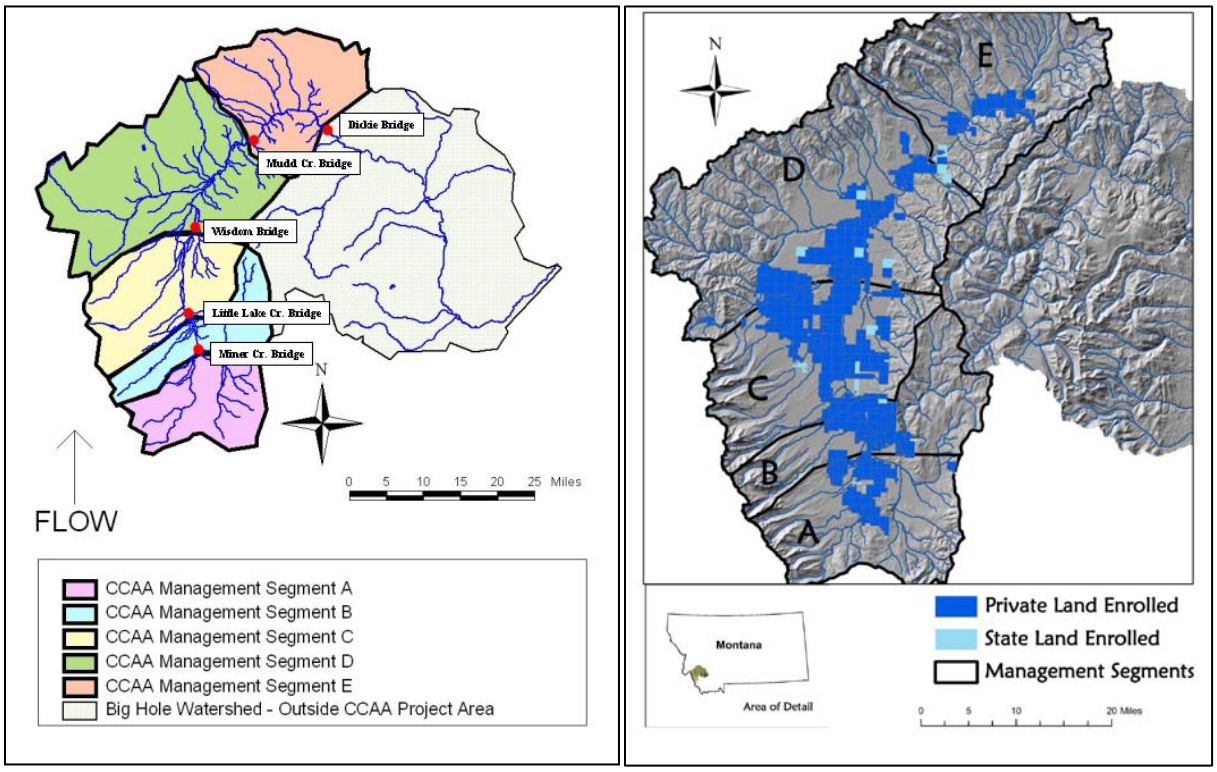


Figure 5: Left: CCAA Management Sections. Right: Area of state and private land enrolled into the Big Hole Grayling CCAA Program since August 1, 2006.

The CCAA program implements strategies and reviews progress to improve the Arctic grayling fishery through six mechanisms:

I. Fisheries Population Monitoring
II. Entrainment Surveys
III. Instream Flow Monitoring
IV. Instream Temperature Monitoring
V. Channel Morphology Measurements
VI. Riparian Health Monitoring

The strategies are in place to achieve three goals:

1. Improve riparian and channel function - Includes channel restoration, riparian fencing, willow planting, stockwater systems, grazing management plans, weed control.

2. Improve instream flows - Include communication, education, hydrological monitoring network, flow/drought management plans, improved infrastructure, programmatic effort.

3. Provide connectivity to important life-history habitats - includes improving stream flows, improve channel function, remove barriers - i.e. fish ladders, culvert replacements, minimize/eliminate entrainment.

The overarching goals of the program are two positive indicators:

1. Numbers of Arctic grayling show a positive population trend.

2. Arctic grayling occupy historic habitat.

CCAA Strategy

The CCAA program works towards five positive indicators. Progress towards these goals are measured and reviewed annually and every 5 years (Montana Fish, Wildlife and Parks and the U.S. Fish and Wildlife Service, 2006):

- Improve riparian and channel function - Measure: Sustainable Riparian Areas in 15 Years
- Improve instream flows - Measure: Meet established flow targets
- Provide connectivity to important life-history habitats - Measure: Increased fish distribution/use
- There will be and continue to be a positive trend in Arctic grayling numbers
- Arctic grayling will occupy historic habitats within 10 years of CCAA start (2006)

Middle-Lower Big Hole watershed CCAA Segments

The CCAA is divided into five management sections labeled sections A-E. A portion of section D and all of section E are located within the Middle-Lower Big Hole watershed.

Montana Fish, Wildlife and Parks

Montana Fish, Wildlife and Parks (MFWP) prioritize fisheries management work statewide under a Statewide Fisheries Management Plan, approved in 2012 and in action 2013-2018. Follow the link below to view the entire plan:

Montana Fish, Wildlife and Parks Statewide Fisheries Management Plan (Big Hole River, page 219)

The plan contains priorities by species and location for the entire Big Hole watershed. While MFWP works to improve fisheries is species driven, the environment for which these species rely is dependent on good water quality. Therefore, the BHWC can work with MFWP on restoring fish populations by addressing the water quality portion of their habitat needs. Portions of the plan that apply to the Middle-Lower Big Hole portions of the watershed are provided in **Table 9**.

Table 9: MFWP Statewide Fisheries Management Plan priorities for the Big Hole Watershed. This table includes priorities that apply to the Middle-Lower Big Hole River Watershed. The contents of this table for a direct copy from the statewide plan (Montana Fish, Wildlife and Parks, 2012)**. * denotes priority that applies to entire Big Hole River watershed.**

Water	Miles/Acres	Species	Origin	Management Type	Management Direction
Big Hole River and Tributaries - Headwaters to Dickey Bridge	93 miles	Arctic grayling, Lake trout, Mountain whitefish, Burbot, Westslope cutthroat trout Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout	Wild Wild	Conservation General/ Special Regulations	Continue native species conservation to maintain a viable, self-sustaining population Continue to manage to minimize potential impact on viability of Arctic grayling and secondarily for recreational angling
Habitat needs and activities: Continue to improve stream flows, improve riparian habitats, improve stream channel form and function, continue to prevent fish entrainment into irrigation ditches.					
Big Hole River and Tributaries - Dickey Bridge to Mouth	72 miles	Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout, Mountain whitefish(N) Westslope cutthroat trout (N)	Wild Wild	General Conservation	Maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth and, in some instances, to ensure they are not limiting the viability of westslope cutthroat trout or Arctic grayling populations. Continue native species conservation to maintain a viable, self-sustaining population
Habitat needs and activities: Implement and refine drought management plans to minimize impacts on fish populations. Continue to look for opportunities to increase river flows and develop spawning habitat in the Big Hole River downstream from Notch Bottom FAS. Pursue Fishing Access acquisition near High Road Bridge at Twin Bridges and between East Bank FAS and Jerry Creek FAS.					

Wise River and Tributaries	25 miles	Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout, Mountain whitefish (N) Westslope cutthroat trout (N)	Wild Wild	General Conservation	Maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth and, in some instances, to ensure they are not limiting the viability of westslope cutthroat trout. Continue native species conservation to maintain a viable, self-sustaining population
Habitat needs and activities: Develop drought management plan for Wise River. Pursue opportunities for habitat improvements in river section from Pettengill Creek to confluence with Big Hole which was affected by the Pettingill Dam breach in 1920's. Determine if Wise River could serve as possible Arctic graying reintroduction area.					
*Mountain Lakes		Westslope cutthroat trout, Hybridized cutthroat trout, Yellowstone cutthroat trout, Rainbow trout, Brook trout, Golden trout	Wild	Put- Take/ General	Monitor mountain lakes. Continue to manage stocking and harvest to maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth. Where appropriate pursue opportunities to expand golden trout into mountain lakes where such management would not conflict with cutthroat conservation.
*Cutthroat Conservation Streams	350 miles	Westslope cutthroat trout and other native fish species	Wild/ Transport	Conservation	Secure populations in tributary streams by removing non-native fish upstream of fish barriers and restoring westslope cutthroat trout.
Habitat needs and activities: Work with Forest Service, BLM and DRNC and private landowners on grazing regimes to minimize livestock impacts to streams. Work on water conservation projects to improve stream flows. Construct or utilize natural fish barriers to preclude non-native fish movement upstream. Remove non-native fish and restore WCT upstream.					

Water	**Miles/Acres**	**Species**	**Origin**	**Management Type**	**Management Direction**
Big Hole River and Tributaries - Headwaters to Dickey Bridge	93 miles	Arctic grayling, Lake trout, Mountain whitefish, Burbot, Westslope cutthroat trout Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout	Wild Wild	Conservation General/ Special Regulations	Continue native species conservation to maintain a viable, self-sustaining population Continue to manage to minimize potential impact on viability of Arctic grayling and secondarily for recreational angling
Habitat needs and activities: Continue to improve stream flows, improve riparian habitats, improve stream channel form and function, continue to prevent fish entrainment into irrigation ditches.					

Big Hole River and Tributaries - Dickey Bridge to Mouth	72 miles	Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout, Mountain whitefish(N) Westslope cutthroat trout (N)	Wild Wild	General Conservation	Maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth and, in some instances, to ensure they are not limiting the viability of westslope cutthroat trout or Arctic grayling populations. Continue native species conservation to maintain a viable, self-sustaining population
Habitat needs and activities: Implement and refine drought management plans to minimize impacts on fish populations. Continue to look for opportunities to increase river flows and develop spawning habitat in the Big Hole River downstream from Notch Bottom FAS. Pursue Fishing Access acquisition near High Road Bridge at Twin Bridges and between East Bank FAS and Jerry Creek FAS.					
Wise River and Tributaries	25 miles	Brook trout, Rainbow trout, Brown trout, Hybridized cutthroat trout, Mountain whitefish (N) Westslope cutthroat trout (N)	Wild Wild	General Conservation	Maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth and, in some instances, to ensure they are not limiting the viability of westslope cutthroat trout. Continue native species conservation to maintain a viable, self-sustaining population
Habitat needs and activities: Develop drought management plan for Wise River. Pursue opportunities for habitat improvements in river section from Pettengill Creek to confluence with Big Hole which was affected by the Pettingill Dam breach in 1920's. Determine if Wise River could serve as possible Arctic graying reintroduction area.					
*Mountain Lakes		Westslope cutthroat trout, Hybridized cutthroat trout, Yellowstone cutthroat trout, Rainbow trout, Brook trout, Golden trout	Wild	Put- Take/ General	Monitor mountain lakes. Continue to manage stocking and harvest to maintain present numbers and sizes. Consider increasing angler harvest to reduce numbers if necessary to maintain fish growth. Where appropriate pursue opportunities to expand golden trout into mountain lakes where such management would not conflict with cutthroat conservation.
*Cutthroat Conservation Streams	350 miles	Westslope cutthroat trout and other native fish species	Wild/ Transport	Conservation	Secure populations in tributary streams by removing non-native fish upstream of fish barriers and restoring westslope cutthroat trout.
Habitat needs and activities: Work with Forest Service, BLM and DRNC and private landowners on grazing regimes to minimize livestock impacts to streams. Work on water conservation projects to improve stream flows. Construct or utilize natural fish barriers to preclude non-native fish movement upstream. Remove non-native fish and restore WCT upstream.					

Big Hole Watershed Committee

The BHWC met with its board members, residents, landowners, agencies, counties and conservation groups to determine the top priorities and methods for watershed restoration planning. The results are consolidated and provided in Figure 6.

Figure 6: BHWC Watershed Restoration Planning Goals and Methods

The BHWC implements the goals and methods through four categories:

- Land use planning
- Wildlife
- Weeds/invasive Species
- Water quality/quantity

BHWC Strategy

The BHWC is a strong supporter of the restoration in the entire Big Hole watershed. The BHWC will measure success by:

1. Support and participation or partnership with Middle-Lower Big Hole restoration efforts. This includes continued close contact with agency employees, private landowners, and other stakeholders and continued fiscal support of restoration efforts.

2. Work with private landowners outside of the CCAA program on restoration goals when applicable.

3. Restore natural function ecosystems. Primarily, this means restoring adequate riparian vegetation and appropriate channel shape to meet water quality and fish and wildlife needs. Advocate the use the wetlands in wetland restoration as an important watershed restoration tool to improve water quality.

3. Support installation of functioning headgates, water measurement, and fish passage of every irrigation withdrawal point in the Big Hole watershed. In addition, BHWC supports the use of stockwater tanks to reduce late season irrigation withdrawals and supports the reconfiguration of irrigation systems for overall water savings to maintain instream flows. The BHWC recognizes that increased stream flows are critical to the health of the entire watershed.

4. Engagement and Education: The BHWC role in the restoration is to provide opportunities and encourage participation from stakeholders in activities, learning, listening and education on restoration activities. The BHWC will work to continue and increase support and engagement the restoration. Methods include monthly meetings with presentations, invitations to agencies to present progress and needs, information and announcements posted on website, social media, e-mail and newsletters, host public events called "tours" to view completed work, and more. This is measured by:

- Attendance at BHWC monthly meetings
- Number of social media members
- Number of members and/or annual donations
- Attendance at BHWC "tours" or other public events.
- Participation in BHWC Drought Management Plan

Wetlands for Water Quality

Montana Department of Environmental Quality and Montana Wetlands Legacy Partnership embarked on a project from 2011-2012 to incorporate wetlands into local watershed restoration plans as a means to meet water quality targets set forth by the TMDL. Historically, there has not been a large focus on using wetlands to help meet water quality goals in streams and rivers in the state. Two watershed groups were chosen to serve as a demonstration - the Big Hole and the Gallatin. These two groups were chosen because they were each beginning their watershed restoration plan, neither group had previously done wetland projects, and they represented a diverse area - the Big Hole as a rural and agricultural watershed and the Gallatin as an urban and developed watershed. For two field seasons, watershed representatives worked with Steve Carpenedo of Montana DEQ and Tom Hinz of Montana Wetlands Legacy Partnership to review the existing wetlands capacity, the water quality needs, and identified how wetlands could benefit water quality. Using reports generated by Montana DEQ, potential wetlands projects were sought based on TMDL targets and the potential for wetlands to aid in meeting TMDL targets. The scope and area were narrowed based on TMDL planning areas and the potential for sites to be impacted (See **Figure 7** and **Figure 8**). Sites were reviewed on the ground and a short list of potential projects was generated in Section IV under "Restore". An end goal of the project was to incorporate wetlands into this watershed restoration plan.

Resources

Montana DEQ's Exploring Your Aquatic Resources Mapping Program

Middle-Lower Big Hole River TMDL

Purpose

The BHWC is one of two demonstration watersheds hosted by the Montana Department of Environmental Quality Wetland Program and Montana Wetlands Legacy Partnership. The goal of the program was to incorporate wetlands into watershed restoration planning for watershed groups. Specifically, wetland priorities were established to meet water quality goals within the watershed restoration plan.

Partners

Currently several groups address wetland and water quality related issues. Our partners for this project include:

- Big Hole Watershed Committee
- Montana Department of Environmental Quality Wetland Program
- US Forest Service/Beaverhead-Deerlodge National Forest
- Montana Wetlands Legacy Partnership
- Montana Fish, Wildlife and Parks
- Montana Natural Heritage
- Private Landowners

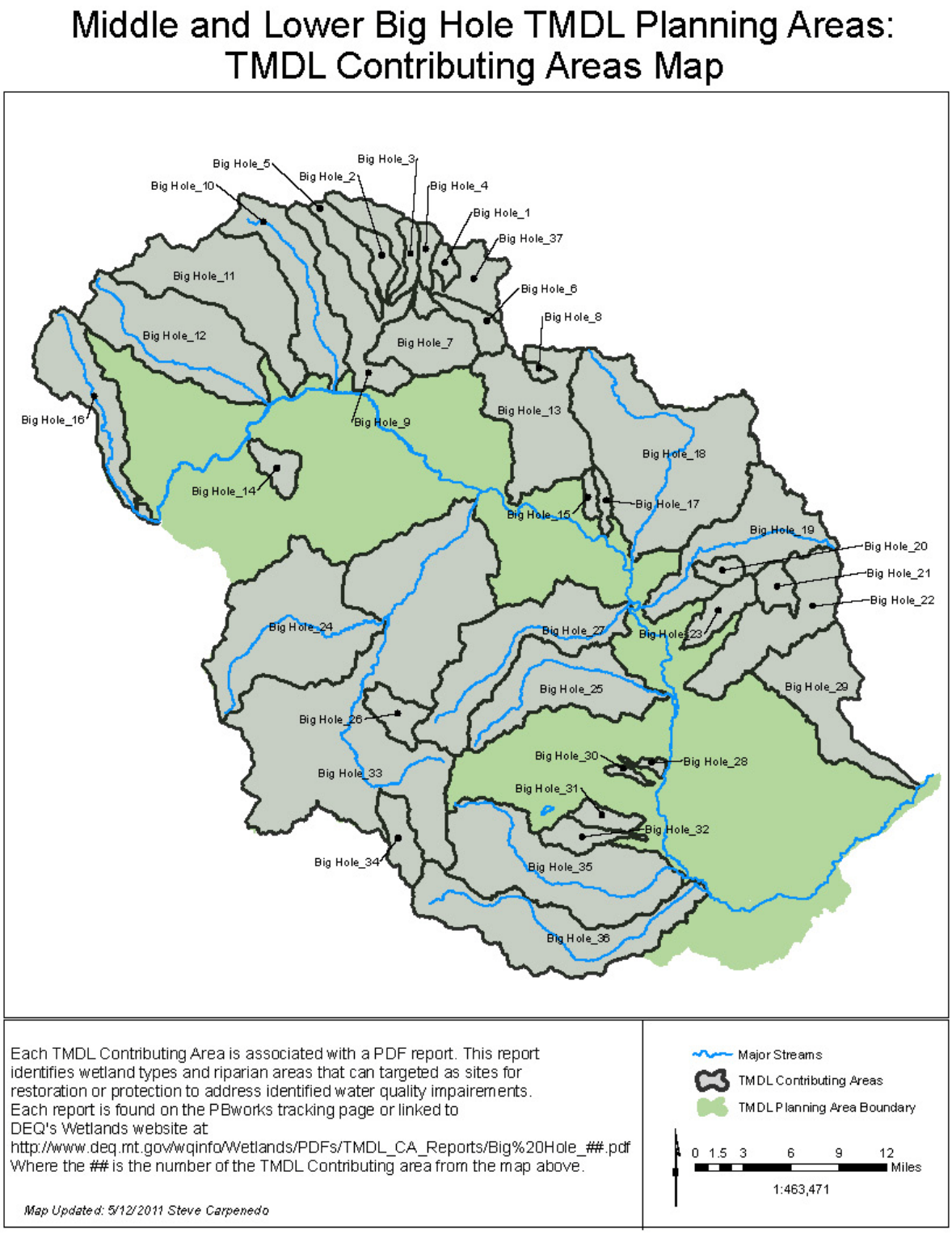


Figure 7: Middle-Lower Big Hole Planning Area TMDL Contributing Areas map. Watershed labels refer to a contributing area report (use the link provided above to see these reports). From Steve Carpenedo, Montana Department of Environmental Quality Wetlands.

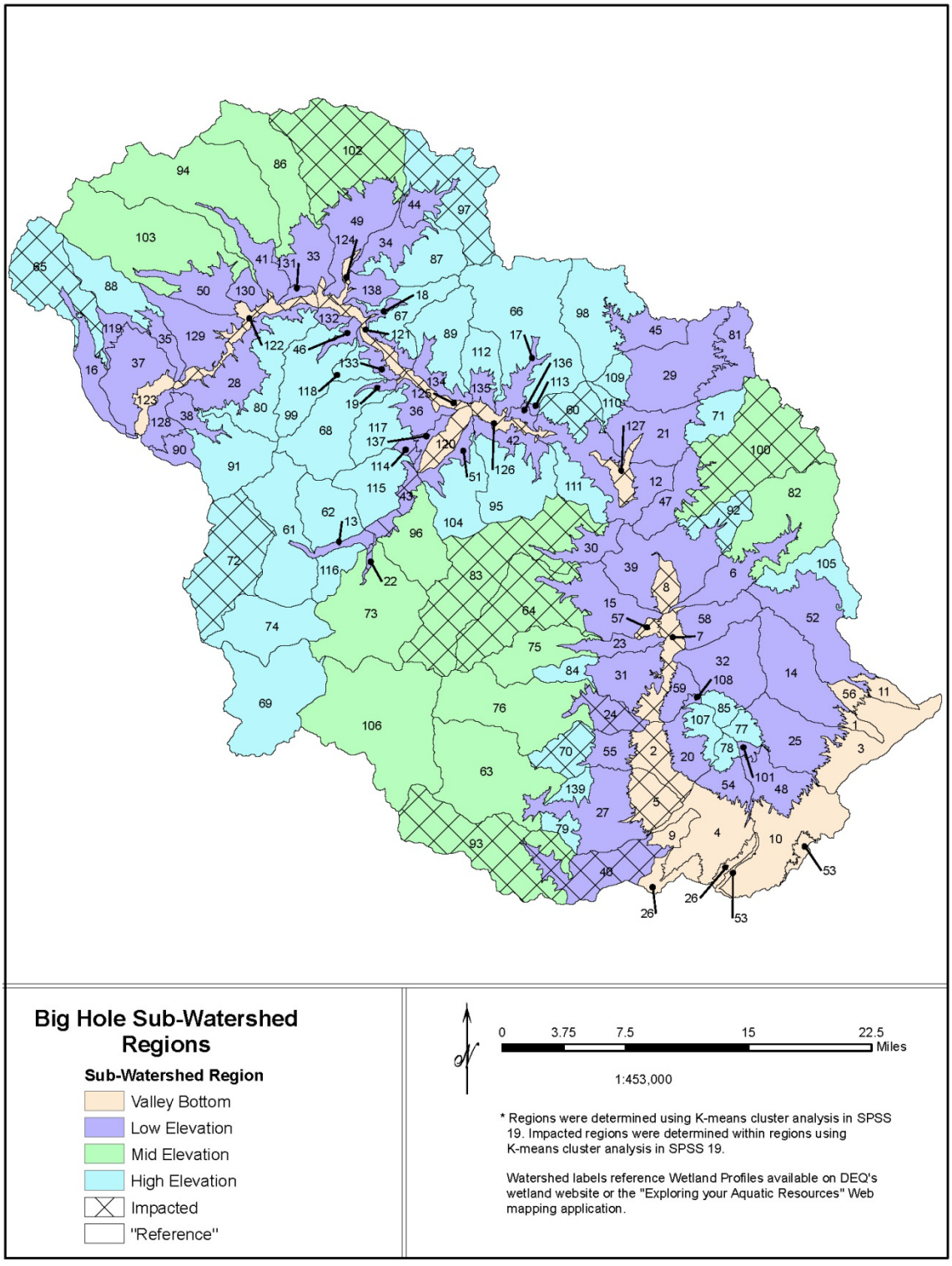
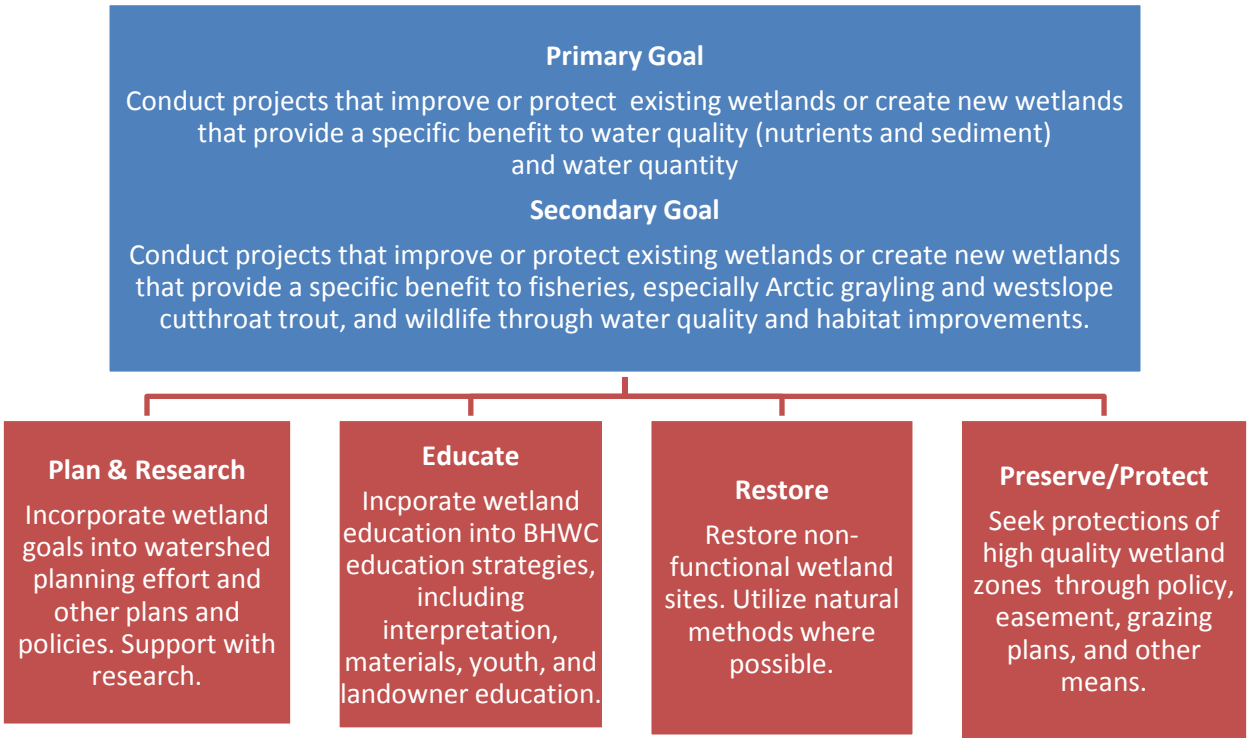


Figure 8: Middle-Lower Big Hole TMDL Planning Area Sub-Watersheds. Cross-hatched watersheds are considered more likely to be impacted based on many factors including roads, mining, irrigation, timber, water quality data, etc. Map created by Steve Carpenedo, Montana Department of Environmental Quality Wetlands. Sub-watershed labels refer to a short report.

Wetlands Goals and Priorities



Priority Wetland Reaches:

Priority reaches were selected based on impacted water quality and the availability of wetland resources. See **Figure 3** *for map.*

- **Top Priority: Big Hole River Mainstem - Pintlar Creek to Mouth**
  Mitigate for water temperature by seeking wetlands that will have a direct effect on water temperature, and wetlands that will have an indirect effect on water temperature by improving resiliency through stream flow maintenance, vegetation, and channel shape alteration.
- **Secondary Priority: Impaired Waters**
  Listed tributaries with listings other than metals
  Address tributaries on a case by case basis based on recommendations made by the TMDL, existing and available wetland zones, and sources for water quality improvement. Several tributaries are listed for metals. While metals are a significant negative impact, wetlands were not targeted towards metals reduction for this project. Tributaries with the greatest available wetland potential and identified as impacted watersheds are:
  Top Priority Tributaries:

Fishtrap Creek	*Deep Creek*
Wise River	*Jerry Creek*
Divide Creek	*Trapper Creek*
Willow Creek	*Birch Creek*

Wetlands for Water Quality Objectives

Plan and Research

- Incorporate wetlands prioritization into the Middle-Lower Watershed Restoration Plan.
- Support the wetland prioritization with research and studies.

Education

- Provide wetland interpretation where appropriate, such as within fishing access sites.
- Include wetland function in landowner education efforts.

Restore

- Identify and implement high quality wetland restoration projects that will have direct impact on goals.

Preserve & Protect

- Work with four counties to include wetland protection in county Growth Policies.
- Work with three Conservation Districts on wetland permitting, protection and education.
- Include language for wetland role and protection in the Big Hole Watershed Committees Land Use Planning effort - a committee working towards protection of channel migration zones from development.
- Seek support for landowners to protect lands through easement or other protections. Solicit landowners with identified high quality wetlands to participate in easement.

Section III: What Should the Watershed Look Like?
Water Quality Goals & Priorities

Blended Watershed Restoration Goals

There are several working watershed restoration plans in the Middle-Lower Big Hole watershed. Each varies by location, lead agency or group, and goals. However, many of the actions described in these plans ultimately benefit water quality. These plans work in unison in the Middle-Lower Big Hole watershed and are summarized in Section II of this document.

In order to fully reach watershed restoration and water quality goals in a timely and cost effective manner and to leverage expertise and resources most effectively, it is important to blend goals from the several current watershed restoration plans (see Section II) into one meaningful summary that focuses on watershed restoration. Table 10 combines the goals of each of these plans into seven watershed restoration categories.

Table 10: Blended watershed restoration goals from state, federal, and local groups.

Watershed Restoration Category	Category Goal
Water Temperature	• Improve water temperature, especially during July - September
Stream Flow	• Improve stream flows, especially during July - September
Sediment	• Reduce sediment inputs
Nutrients	• Reduce nutrient inputs
Fish & Wildlife	• Conduct activities that will improve fish and wildlife population, diversity, and native species. • Prevent the decline of species considered threatened or endangered. • Support coexistence with predator species and reduce human-predator conflict. • Reduce the spread of wildlife-cattle diseases.
Weeds/Invasive Species	• Prevent the spread of noxious weeds and invasive species already present. Prevent the introduction of new noxious weeds and invasive species.
Regulatory Protections	• Support existing regulatory protections. • Advocate and support the development and implementation of new regulatory protections. • Advocate for the insertion of watershed protections wherever possible into revision or development processes.

Restoration Priorities and Locations

The top restoration priorities are:

- Repair damaged riparian zones
- Improve irrigation infrastructure, add water measurement and fish passage devices.
- Take all measures possible to improve stream flows and water temperatures. This includes the use of wetlands, voluntary irrigation reductions and improvements, riparian corridors, etc.
- Protect completed restoration and lands in good condition. Incentivize good watershed stewardship.
- Protect the river corridor with land use planning and regulatory protections.
- Promote collaboration among stakeholders

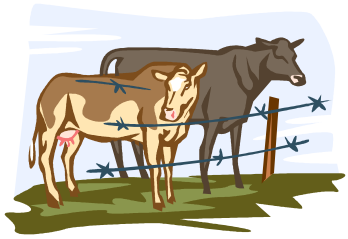
The top restoration priority regions are:

- Section D & E of the CCAA
- USFS Restoration Watersheds Seymour Creek, Sullivan Creek, Lost Creek, Willow Creek and Birch Creek.
- BLM lands allotments not meeting riparian standards or water quality standards
- Stream Restoration:

  French Creek *Middle Big Hole River*
  Lower Big Hole River *Big Hole River at Glen*
- Wetlands Top Priority Tributaries:

  Big Hole River Mainstem – Pintlar to the mouth
  Fishtrap Creek *Deep Creek*
  Wise River *Jerry Creek*
  Divide Creek *Trapper Creek*
  Willow Creek *Birch Creek*

Best Management Practices



The Big Hole watershed has a reputation for its progressive, grassroots efforts towards watershed restoration. This is largely due to the immense challenges the watershed has faced in the last two decades and the dedication of the people who live and work here. As a result, many of the restoration and management tactics used are bottom-up. That is, they are developed by the people who use them. Therefore, we know the practices are used since they are bought-into, they are reasonable, and they are effective. They are also voluntary, yet there is a high rate of participation and support. Many of the methods rely on conversations, understanding, long-term solutions that work for all (consensus), partnership/coordination, and education. Our Best Management Practices mirror this approach. See Table 11 for Best Management Practices.

Table 11: Best Management Practices

Management Strategy	Watershed Restoration Category	Schedule
Education *Private land ownership and public land manager buy-in to restoration goals is critical to ensure participation and support.* Request reporting of progress annually from CCAA program, USFS, BLM and BHWC (Watershed Restoration Plan review, report on progress). Presentations will be made to the BHWC meetings. Provide public opportunity for involvement to promote restoration goals. This occurs through student education, public tours, seminars, web and social media management, printed media, etc. Encourage involvement, partnership and collaboration from diverse viewpoints and open communication.	 All All All	 BHWC meetings occur monthly. Each group will be invited to present 1 time/year. Several times annually/ongoing
Drought Management Plan *The BHWC Drought Management Plan includes triggers and voluntary actions to increase stream flow, and subsequently decrease water temperature, during times of drought. This plan is reviewed annually and implemented when triggers are met. Enrolled landowners in the CCAA program follow additional drought management triggers.*	Temperature Stream Flow Fish& Wildlife	Reviewed annually, implemented as needed.
Irrigation Infrastructure *Just as it is important to restore the watershed, it is equally important to maintain the ranching operations located in the valley. While irrigation is critical to watering stock and pasture for feed production, infrastructure improvements can improve efficiency and water quality.* BMPs for irrigation improvements include:	 Stream Flow, Temperature Fish	 One per year

• Replace/improve headgates located on rivers and tributaries to allow water control, water measurement, and fish passage/deter fish entrainment. • Install offsite stockwater tanks when doing so would provide an instream water savings. • Conversion of one type of irrigation system to a more efficient system to improve instream flows (without compromising other water quality parameters)	In some cases, sediment Stream Flow, Temperature	until complete - led by CCAA program, supported by BHWC. As needed
Riparian Vegetation *The restoration of riparian vegetation was identified in the TMDL as the top rated activity to achieve multiple watershed restoration goals and can decrease sediment loading, increase stream flows, and decrease stream temperatures. Several projects to improve riparian restoration in the Big Hole River have been completed, both through active manipulations (i.e. plantings, machine manipulated channels) and passive (i.e. fencing to reduce grazing pressure) restoration. In a review of CCAA restoration, staff reported passive restoration to be the best means of riparian restoration for use of funds and results. Therefore, efforts in riparian restoration will focus on passive restoration. In select cases, active restoration may need to supplement passive restoration.* BMPs to improve riparian vegetation include: • Fencing to reduce grazing pressure • Off-stream watering facilities or water gaps • Livestock protection structures • Hardened stream crossings with fencing to protect riparian vegetation • Grazing management plans to improve upland and riparian vegetation conditions BLM and USFS: Review grazing leases to promote healthy riparian zones and wetlands and to sustain the fishery. CCAA: Continue implementation of grazing management plans including the use of riparian fencing to reduce riparian pressure and allowing riparian zones to return to functioning condition.	Nutrients Sediment Stream Flow Temperature Fish & Wildlife	On-going
Wetlands *The restoration of degraded wetlands can provide a positive impact to water quality and quantity. Wetlands can retain water for late season flows, cool waters, absorb nutrients, and trap sediment and other toxic substances.* BMPs for wetland restoration or creation can include: • Education on the value and function of wetlands • Proper identification of potential wetland areas that can improve water quality/quantity	Stream Flow Temperature Nutrients Fish & Wildlife Sediment	Identify opportunities - 2013

• Restore/repair dikes, ditches, and other irrigation control structures to improve hydrologic connectivity in potential wetland areas • Support efforts that can protect existing wetlands, such as easements, NRCS's conservation and wetland reserve programs, and grazing management plans • Beaver management where appropriate BLM: Notes degraded wetlands. Work with BLM staff on remedy. USFS: Identify degraded wetlands for possible restoration. Work with BLM staff on remedy. CCAA: Support incorporation of wetlands in landowner plans as a grazing management or irrigation management strategy. Support restoration as needed. Other: Support restoration of wetlands outside of the CCAA enrolled lands, USFS and BLM lands.		
Regulatory Environment *Regulations are an important tool for long-term watershed protections. An existing 150 foot development setback is in place and growth policies touch on the importance of resources in the Big Hole watershed. The following are guidelines for a positive regulatory environment:* 1. Land use development standards should be in place to adequately protect the most sensitive watershed resources, particularly those under restoration currently (this includes riparian zones and wetlands) from development. 2. Incentives should be used to encourage landowner driven conservation, such as the use of easements and payment for ecological services. 3. County Growth Policies should reflect the importance the protection of watershed resources in the Big Hole watershed for water quality, tourism, fish and wildlife, and rural landscape.	Regulatory protections	In-process

Restoration Objectives and Load Reductions

Riparian restoration goals can be further broken down into objectives. Each restoration objective can be tied to a reduction in load causing the water quality impairment or the resolution of a water quality or natural resource issue. These improvements are based on estimates and represent a best guess as to potential watershed improvement as a result of an activity. Table 12 lists watershed restoration objectives, potential load reductions and the source of the provided information. See Table 18 through Table 26 for detailed targets by watershed and stream reach.

Table 12: Restoration objectives and associated potential load reductions.

Remedy	Watershed Restoration Category	Restoration Objective	Load Allocation Associated with:	Source
Riparian Condition	Temperature	Riparian Shade: Middle Big Hole: Existing percent shade is between 1.4% and 7.9% Lower Big Hole: Existing percent shade is between 2.1% and 14.2%. Big Hole River between Pintlar Creek and Wise River should be 80% willows, 20% grass cover (3.5% shade) Big Hole River from Butte Diversion to mouth should be 30% cottonwood gallery, 70% grass cover (7.4% shade) Divide Creek should be 80% willows, 20% grass cover (27% shade).	Middle Big Hole: Increase percent shade between 5% and 15% Lower Big Hole: Increase percent shade between 3.5% and 42%	DEQ TMDL (Table 8-10, Table 8-11, Table 8-1)
		On USFS Lands: Large Woody Debris: (forested systems) >20 pieces per mile, > 6 inch diameter, >12 foot length. Bank Stability: (nonforested systems) >80% stable.		USFS Plan
	Sediment	Stream banks should have a stable or improving trend. Non-eroding banks for at least 85% of reach for A, B and C type streams.		DEQ TMDL (Table 5-2)
	Sediment	Percent of streambank with riparian shrubs >48%		DEQ TMDL (Table 5-2)
		Conservation and restoration of riparian habitats by fencing, off-channel livestock watering facilities,		CCAA (Table 5)

		prescribed grazing plans, more active livestock management, etc. • Frequency of livestock presence in riparian areas with decrease significantly during first 5 years leading to rapid improvement. • Steady riparian recovery thereafter with "sustainable" status achieved on 95% of enrolled lands by year 15. Current Riparian Assessment Rankings: • 9.5 miles "Not Sustainable" • 110 miles "At Risk" • 57 miles "Sustainable" • 176.5 total assessed miles	68% or 119.5 miles of enrolled lands need to achieve "Sustainable Rating" Priority Areas: Sections C & D of CCAA (near Wisdom)	
Width-Depth Ratio (w/d ratio)	Temperature, Sediment	On the Middle Big Hole River between Pintlar Creek and Wise River, decrease the median w/d ratio from 92 to <= 60	34% decrease in width-to-depth	DEQ TMDL (Table 8-10)
	Sediment	*On USFS Lands:* Entrenchment Ratio (all systems) Rosgen Channel: A - <1.4, B – 1.6 – 1.8, C - >10.3, E ->7.5. Width/Depth Ratio (all systems) Rosgen Channel: A - <11.3, B – <15.8, C - <28.7, E -<6.9.		USFS Plan
Irrigation	Temperature	Warm water irrigation return flows to the Big Hole River and its tributaries are unknown, but likely a minor source. Address in adaptive management.	If present, reduce warm water irrigation return flows by 50%.	DEQ TMDL (Table 8-10)

		Improve irrigation efficiency	15% improvement in irrigation efficiency during warmest months (mid-June through August)	DEQ TMDL (Table 8-1)
In-Stream Flow	Temperature	Big Hole River and its tributaries, stream flows are often below flows recommended for most sensitive uses.	All reasonable irrigation water management practices with water savings applied to in-stream flow via local, voluntary approach.	DEQ TMDL (Table 8-10)
		Increased flows through: water rights compliance, improved irrigation management, less water intensive crops, instream flow leases, stockwater wells, etc. (Table 5, CCAA Plan)	Water right compliance, installation of headgates/measuring devices within 5 years of enrollment As part of landowner site plans, ensure streamflows meet flow targets 75% of the time by 2015.	CCAA (Table 5)
In-Stream Sediment	Sediment	Percent fine surface sediment <6mm comparable to reference. Percent fine surface sediment <2mm average value not to exceed 15% for E channels and 13% for all other channels. Width/Depth ratio, see above. Entrenchment ratio >1.8 for E Channels, >5.1 for C Channels, >3.7 for E channels. Pool frequency 5.5 to median bankfull width per reach. Sediment load reductions achieved through riparian re-vegetation, riparian and upland grazing management, and road maintenance BMP's.	Sediment load varied by segment (*See **Table 18** through **Table 26**).* Sediment loads ranged from 129 tons per year to 191,651 tons per year. Sediment load reductions required to meet water quality targets ranged between 8% - 40%.	DEQ TMDL Table 5-2 Table 9-1
		On USFS Lands: Sediment Particle size, % < 6.25mm (all systems) Stream Type: B3 - <12, B4 - <28, C3 - <14, C4 - <22, E3 - <26, E4 - <28.		USFS

Fish: Wild (not Arctic Grayling)	Temperature	*Improve wild fisheries:* • Secure and restore native Westslope Cutthroat Trout Populations • Alter harvest to maintain growth • Improve stream channels • Reduce fish entrainment in ditches • Improve flows to benefit fish • Improve and expand drought management plans		MFWP
		On USFS Lands: **Spawning Areas:** Reduce impacts from grazing practices in known or suspected threatened, endangered or sensitive fish spawning areas to avoid or reduce trampling of redds that may result in adverse impacts to threatened or endangered species, loss of viability, or a trend toward federal listing of sensitive species **(**GM 4**).** **Management Indicator Species:** Maintain habitat conditions for native species as reflected by changes in abundance of *Drunella doddsi* (Mayfly) as a Management Indicator Species (MIS).		USFS
Fish: Arctic Grayling		Positive trend grayling population within 5 years (2010)	n/a	CCAA
		Grayling reoccupation of historic waters within 10 years (2015)	n/a	CCAA
Nutrients	Nutrients	Immediate reduction in threat at time of site specific plan implementation	varied	CCAA
		Total Nitrogen < 0.320 mg/l NO3 + NO2 as N < 0.100 mg/L Total Phosphorous < 0.048 mg/L Chlorophyll a < 150 mg/m2 for foothill/valley Percent shrubs along greenline, except where	15%-92% reduction in nitrogen 0%-90% reduction in phosphorus	DEQ TMDL (Table 6-2, Section 6-

		coniferous >= 49% Percent bare ground along greenline <= 5% Restoration to improve nutrients most often relates to improving riparian grazing and fertilizer use. Recommendations include improving streamside grazing management, off-stream livestock watering, irrigation and fertilizer improvement, and improving streamside vegetative buffer (TMDL Section 9.4.2 and Table 9-1)		0, Table 9-1)
Roads	Sediment	*On USFS Lands:* **Road Drainage:** Reconstruct road and drainage features that do not meet design criteria or operation and maintenance standards, or are proven less effective than designed for controlling sediment delivery, or retard attainment of desired stream function, or increase sedimentation in Fish or Restoration Key Watersheds (RF 3a**).** **Roads:** Close and stabilize or obliterate and stabilize roads not needed for future management activities (RF 3c**).**		USFS Plan
Wetlands	Temperature, Sediment, Nutrients	Improve and expand wetland resources to benefit water quality.	See DEQ water quality targets - wetlands are used to achieve these targets.	BHWC

Section IV: How Will We Get There?
Road Map to Watershed Restoration

Restoration activities that can support improvements in water quality as defined in the previous section are divided into four watershed restoration goals:

- Plan & Research
- Restoration
- Education
- Preservation

In order to achieve water quality goals and ultimately our vision for the Big Hole watershed, activities will need to occur in each of the four categories for a balanced approach to restoration that is calculated, timely, sustainable, and cost effective.

In addition, significant restoration activity has occurred since 2005 when the TMDL data was collected.

This section includes activities for watershed restoration in each of the four categories. Activities in each category that have occurred between 2005 and the present are listed and are followed by proposed future activities. *Note: Past projects are not a comprehensive list, but do serve to identify many important landmark projects or events.* Each activity's anticipated watershed restoration impact is listed. For future activities, anticipated costs and funding sources are indicated.

The watershed restoration categories are:

Watershed Restoration Goal Category
Water Temperature
Stream Flow
Sediment
Nutrients
Fish & Wildlife
Weeds/Invasive Species
Regulatory Protections

This section is divided into two parts:

1. Projects Completed or On-Going
2. Projects On-Going or Proposed

Projects Completed or On-Going:

Plan & Research

Plan & Research Projects Completed Since 2003:

Year	Project	Watershed Restoration Category	Lead	Reference or Contact
2003	Lower Wise River Stream Corridor Assessment	Water Temperature, Sediment, Nutrients	BHWC, NRCS, DNRC	(NRCS, DNRC, 2003)
2003	Southwest Highlands Watershed Assessment Report	Water Temperature, Sediments, Nutrients, Fish & Wildlife, Weeds/Invasive Species	BLM	(U.S. Bureau of Land Management, 2003)
2005	Flood Inundation Potential Mapping and Channel Migration Zone Delineation, Big Hole River, Montana	Water Temperature, Sediment, Nutrients, Regulatory Protections	BHWC	(Thatcher & Boyd, 2005)
2007	Montana Non-Point Source Management Plan	Water Temperature, Sediment, Nutrients	DEQ	(Montana Department of Environmental Quality, 2007)
2008	Using Historic Aerial Photography and Paleoflood Hydrology to Assess Long-term Ecological Response to Two Montana Dam Removals	Water Temperature, Sediment	MSU	(Schmitz, 2008)
2008	Modeling Stream Flow and Water Temperature in the Big Hole River, Montana	Water Temperature, Stream Flow	DEQ	(Flynn, 2008)
2008	Beaverhead West Watershed Assessment Report	Water Temperature, Sediments, Nutrients, Fish & Wildlife, Weeds/Invasive Species	BLM	(U.S. Bureau of Land Management, 2008)
2008	Lower Big Hole Irrigation Infrastructure Survey & Prioritization	Water Temperature, Stream Flow, Fish & Wildlife	BHWC	(PBS&J, March 2008)
2009	East Pioneer Watershed Environmental Assessment	Water Temperature, Sediments, Nutrients, Fish & Wildlife, Weeds/Invasive Species	BLM	(U.S. Bureau of Land Management, July 2, 2009)
2009	Middle-Lower Big Hole River TMDL	Water Temperature, Sediment, Nutrients	DEQ	(Montana DEQ, September 2009)
2010	Freshwater Mussels in Montana . . .	Fish & Wildlife	Montana	(Stagliano, 2010)

			Natural Heritage	
2010	Big Hole River Thermal Infrared (TIR) Temperature Analysis Interpretive Report	Water Temperature	USGS, BHWC	(Watershed Consulting, LLC, July 2010)
2010	Wise River Irrigation Infrastructure Survey & Prioritization	Water Temperature, Stream Flow, Fish & Wildlife	BHWC	(Oasis Environmental, 2010)
	Fluvial Arctic Grayling Pit-Tag Study	Fish & Wildlife	MSU, BHWC	
2011	Streb-Gallagher Ditches, Alternatives Assessment	Water Temperature, Stream Flow, Sediment	BHWC	(Mainstream Restoration and Allied Engineering, 2011)
2011	Beaver Habitat Suitability Model - Big Hole Watershed	Water Temperature, Sediment, Fish & Wildlife	DEQ	(Carpenedo, March 2011)
2012	Lower Big Hole River Corridor Assessment	Fish & Wildlife, Water Temperature, Stream Flow	BHWC	(Confluence Consulting, Inc., 2012)
2011-2012	Wetlands and Watershed Restoration	Water Temperature, Stream Flow	BHWC & DEQ	Included in this document.
2013	Middle-Lower Big Hole Watershed Restoration Plan	All	BHWC	(This document)
2013	Big Hole River Trend Analysis	Water Temperature, Stream Flow	BHWC, USFS	(Big Hole Watershed Committee and Beaverhead Deerlodge National Forest, 2013)

Educate

Educate - Projects Completed or On-Going since 2005:

Year	Project	Watershed Restoration Category	Lead
Big Hole Watershed Committee			
	Big Hole Watershed Committee Online Resources • Website • Social Media • E-Mails	All	BHWC
1995 -	Monthly Watershed Meetings (10 meetings/year)	All	BHWC
Annual	Weed Whackers Ball Fundraiser	Weeds	BHWC
3-4 times per year	Newsletters	All	BHWC
Annual	Watershed Tours	All	BHWC
Annual	Youth Field Days	All	BHWC
Occasional	Classroom visits to MSU, MSU-Western, University of Montana	All	CCAA
Annual	CCAA Annual/5 Year Report Presentations to local meetings of American Fisheries Society, Trout Unlimited, BHWC, etc.	All	CCAA
Other Education and Outreach			
May	Arctic Grayling Recovery Program (AGRP) Annual Meeting	All	AGRP
2008-	Kids Day on the Big Hole at Meriwether Ranch	All	BHRF
2012	"Landscape Conversations" Seminar with Montana Wildlife Society	All	CCAA
2012-2013	CCAA Landowner Appreciation Dinner & Progress Report	All	CCAA
	Newsletters	All	BHRF
2012 -	Arctic Grayling Genetics Project - Spokane High School	Fish & Wildlife	CCAA
2013 -	Wildlife Workshops “Living with Wildlife Series”	Fish & Wildlife	WCS, et. al.

Restore

Restoration - Projects Completed or On-Going Since 2004:

Year(s)	Project	Watershed Restoration Category	Lead, Partner
Irrigation Infrastructure Improvements			
2004	Company & Truman Ditch Flow Control Structure, Company Ditch Headgate (Wise River)	Fish & Wildlife	BHWC
2007	Hagenbarth Big Hole Ditch	Water Temperature, Stream Flow	BHWC
2007	Carpenter Ditch	Water Temperature, Stream Flow	BHWC
2010	Kalsta Spring Creek Slough	Water Temperature, Stream Flow, Fish & Wildlife, Nutrients, Sediment	BHWC
2010	Kamperschroer Stockwater Tanks	Stream Flow	USFWS - BHWC
2010	Big Hole Cooperative Ditch	Water Temperature, Stream Flow	BHWC, RVCD
2011-12	Corder Ditch	Sediment, Stream Flow	Future West Sonoran Institute
2012	Wise River Irrigation Infrastructure *5 points of diversion consolidated into one with new headgate, flow measurement. In addition, landowner replaced one remaining Wise River headgate.*	Stream Flow, Water Temperature, Sediment, Fish & Wildlife	BHWC - DEQ
Other Restoration			
2012	Carpenter Fence Project	Sediment, Water Temperature	BHRF, BHWC
2011-12	Cherry Creek Barrier and WCT	Fish & Wildlife	FWP, USFS, BLM, BHWC
2011-2012	Divide Diversion Dam and Pump House Replacement	Fish & Wildlife	BSB County
Invasive Species Management			
On-going	Weed Spray Days	Weeds/Invasive Species	BHWC, County, BLM, USFS
On-going	Oxeye Daisy Test Site	Weeds/Invasive Species	BHWC

Preserve & Protect

Preserve & Protect – Projects Completed Since 2000:

Year(s)	Project	Watershed Restoration Category	Lead
2000	Land Use Development Standards: Subdivision Setback: Building site must be >150ft from Big Hole River. Big Hole River Conservation Development: No structure with a roof within 500ft of Big Hole River Floodplains: Building in 100 year floodplain requires mitigation. Septic/Sewage: All buildings required to have water and sewer.	Water Temperature, Sediment, Nutrients, Regulatory Protections	BHWC, Future West, Counties
1997 - ongoing	Big Hole River Drought Management Plan	Stream Flow, Water Temperature, Fish & Wildlife	BHWC, DNRC, FWP (Big Hole Watershed Committee, 1997 - 2013)
2005	Beaverhead County Growth Policy	Regulatory Protections	Beaverhead County (Beaverhead County, 2005)
2008	Butte-Silver Bow Growth Policy	Regulatory Protections	Butte-Silver Bow County (Butte-Silver Bow County, 2008)
2011	Anaconda Deer Lodge County Growth Policy	Regulatory Protections	Anaconda-Deer Lodge County (Anconda-Deer Lodge County, 2010)
2012	Madison County Growth Policy	Regulatory Protections	Madison County (Madison County, 2012)

Projects On-Going or Proposed

Plan & Research:

Future and On-Going:

Year	Project	Watershed Restoration Category	Lead (Partner)	Cost & Potential Funding Source
Lower Wise River Water Resources Investigation				
2011-2013	*Monitoring included groundwater levels, surface water flow and temperature, and fisheries collected 2011-2012. The results will be available summer 2013.* Continuation: Portions of this project will continue including continuous stream flow and water temperature, continuous groundwater level monitoring, habitat changes, and fisheries. This information will provide baseline data for future work and will aid in developing future restoration projects.	Water Temperature, Stream Flow, Fish & Wildlife	BHWC, DNRC, MBMG, FWP	BHWC, DEQ, GWIP
Big Hole River Water Monitoring				
On-going	*There are several continuous USGS real-time gages in the Middle-Lower Big Hole. Maintaining the monitoring network is critical to the BHWC Drought Management Plan and monitoring water quality improvements. Funding for existing gages is required annually. In addition, there are several upgrades identified:* • Maintain existing USGS stream gages. • Upgrade USGS gages to include water temperature, weather. • Install a USGS real time flow & temperature gage near the mouth of Wise River. • Include air temperature with all water temperature gages. • Maintain two weather stations in the Big Hole that track air temperature, precipitation, solar radiation, etc.	Water Temperature Stream Flow Fish & Wildlife	BHWC, DNRC MFWP, USGS	BHWC, DNRC, MFWP
Other Planning Efforts				
	Watershed Assessment - Seymour Creek Deep Creek Watershed Assessment	Sediment, Fish & Wildlife	USFS	USFS
2008 -	Macroinvertebrates	Fish & Wildlife	BHRF	BHRF, BHWC

Educate:

Future or On-Going:

Year or Time Period	Project	Watershed Restoration Category	Lead	Cost - Source
Big Hole Watershed Committee				
Monthly - 3rd Wednesdays	**Monthly Watershed Meetings** *Includes seminars on watershed topics, updates from 4 BHWC subcommittees, updates from BHWC, and new watershed news. Serves as monthly opportunity to address watershed issues. Public welcome.*	All	BHWC	$10,000/year - Private funds, project specific sources
~1/year	**Watershed Tours** *1-2x/year depending on topics. Public opportunity to visit projects and hear watershed restoration progress.*	All	BHWC	$4,000/year - Project specific sources
~1-2/year	**Youth Programs** *Annual events for kids grades K-8 with watershed related activities. Opportunity to build watershed stewardship among students. Field days are science based on during a normal school day. Other school events may include presentations or activities in school.*	All	BHWC, Others	$2000/year - Project specific sources, private funds
Continuous	**BHWC Online Resources** *E-mails* *Website* *Social Media*	All	BHWC	Private Donations
1/year	**Weed Whackers Ball** *Fundraiser put on by the Big Hole Watershed Weed Sub-Committee each September to raise money to fights weeds.*	Weeds	BHWC	Fundraiser
~3/year	**BHWC Newsletters**	All	BHWC	BHWC

Pending	**Interpretation** *Notch Bottom Fishing Access Site* Due to the high traffic volume and the poor habitat condition, this site could be restored and used to provide interpretation on the importance of wetlands to the river landscape.	All	BHWC	DEQ Mini Grant, MFWP
	Conservation Easement Seminar *Provide seminar on methods, resources, and benefits of conservation easements. The goal of the seminar would be to encourage landowners to seek long-term land protections.*	All	BHWC and Partners	Partners
CCAA				
March/year	**AGRP - Arctic Grayling Restoration Annual Meeting**	Fish & Wildlife	CCAA/AGRP	CCAA
2012	**CCAA Tours** *Agencies involved in CCAA program visit CCAA to view progress.*	Fish & Wildlife	CCAA	CCAA
Annual	**CCAA Annual/5 Year Report Presentations** To local meetings of American Fisheries Society, Trout Unlimited, BHWC, etc.	All	CCAA	CCAA
Other Education & Outreach Efforts				
May/year	**Kids Day on the Big Hole at Meriwether Ranch** *Kids invited to spend day fishing and learning topics surrounding fishing. Program is recreation based.*	All	BHRF	Varied, but requires $2000-$5000/year
~3/year	**Newsletters**	All	BHRF	BHRF
Ongoing	**Local Museum and Historical Compilation**	All	Wise River Community Foundation	Wise River Community Foundation
Varied	**Community Exchange Days, Wildlife Series**	All	Wildlife Conservation Society	Wildlife Conservation Society
July Annually	**Big Hole River Day**	Fish & Wildlife	BHRF	BHRF

Restoration:

Future and On-Going:

Projected Year	Project	Watershed Restoration Category	Partners	Potential Funding Source
Riparian Restoration				
High Priorities:				
2013 - 2017	**French Creek Restoration (includes California Creek)** *Repair sediment issues associated with historic placer mining and smelter damage by reducing sediment loads reaching the stream via a gully wash, reconnecting the stream to its floodplain, and restoring upland, riparian and wetland areas.* *→ California Creek headwaters to French Creek/French Creek Headwaters to Deep Creek*	Sediment, Fish & Wildlife	MFWP, NRDP, BHWC	MFWP, Private Foundations, BHWC, NRDP, DEQ Cost: >$100,000
2014 - ongoing	**Middle Big Hole River Riparian Re-Vegetation and Channel Restoration.** *Encourage implementation of riparian and streambank BMPs to restore riparian vegetation growth, reduce bank erosion, and narrow the river channel over time.* *→ Big Hole River Pintlar Creek to Deep Creek*	Water Temperature, Sediment	BHWC, BLM, DNRC, MFWP, NRCS	Dependent on Method Cost: >$100,000
2013 - ongoing	**Lower Big Hole River** *Restoration activities to occur as recommended by the BHWC Lower Big*	All	BHWC, MFWP, Private Landowners	BHWC, Madison County, MFWP, Private, NRCS

	Hole River Sub-Committee, Lower Big Hole River Corridor report, etc. Improvements needed in riparian health and bank erosion, fish habitat, and irrigation infrastructure *→ Glen to the Big Hole River mouth*			Cost: >$100,000
2013 - ongoing	**Big Hole River Channel at Glen** *The Big Hole River in the Glen area has several in-stream alterations that may cause the river to form a new channel in time which could have detrimental effects on property, roads, etc. Potential solutions could include identifying appropriate channel migration areas, small natural structures to encourage the river to maintain the existing channel.* *→ Big Hole River at Glen*	Sediment	BHWC, Beaverhead County, Madison County, NRCS	Beaverhead County, Madison County, NRCS Cost: Dependent on method.
Lower Priorities:				
	Upper Jerry Creek Restoration *Fisheries and riparian restoration and protection to reduce nutrient inputs, sediment and habitat degradation. Restore native fish populations.* *→ Jerry Creek headwaters and headwater tributaries.*	Fish & Wildlife Sediment Nutrients	USFS	USFS
	Birch-Willow-Lost Creeks Restoration *Wide-spread vegetation management /watershed restoration that includes reducing conifer encroachment to*	Sediment, Fish & Wildlife, Weeds/Invasive Species	USFS	USFS

	revitalize aspen-dominated riparian areas to improve water quality. *→ Upper Birch, Willow and Lost Creeks (USFS Lands)*			
	Upper Wise River *Work with USFS to alter grazing management to allow riparian re-vegetation and channel restoration.* *→ Wise River headwaters to Pattengail Creek*	Stream Flow, Sediment, Fish & Wildlife	BHWC, USFS	USFS
	Lower Wise River Habitat Improvement *Repair historic channel disruption resulting from Pattengail Dam failure by increasing channel complexity.* *→ Wise River Pattengail Creek to mouth*	Fish & Wildlife	Private, BHWC, MFWP	DEQ, MFWP, NRCS, DNRC Cost: Dependent on method.
	Lower Moose Creek *Work with landowner to alter livestock management and encourage riparian re-vegetation.* *→ Moose Creek private lands*	Sediment, Water Temperature	Private, BHWC	BHWC, DEQ Cost: <$100,000
Wetlands to Improve Water Quality				
High Priorities:				
2013 - 2015	**French Creek (Includes California Creek)** *Restoration work planned with FWP to restore damaged riparian zones and wetlands in upper French Creek. Plans include implementing road and riparian BMPs to reduce sediment loading to the creek.*	Sediment	BHWC, MFWP, DEQ	BHWC, MFWP, DNRC, NRDP, DEQ Cost: >$100,000

	→ California Creek headwaters to French Creek, French Creek to Deep Creek			
2014 - ongoing	**Lower Big Hole River Corridor** *Alter existing irrigation system with upgrades to irrigation structures and rewetting of historic wetlands. See "Lower Big Hole River Corridor Phase I Report, 2012" for specific details.* (Confluence Consulting, Inc., 2012) → Big Hole River High Road Bridge and 3 miles upstream	Stream Flow, Water Temperature	BHWC, MFWP	MFWP, DNRC Cost: >$100,000
2014	**Big Hole River Pintlar to Deep Creek** *This reach of the Big Hole River suffers from a widespread lack of streamside vegetation and over widened channel causing high late summer water temperatures. Create long-term plan for targeted small area restoration to stabilize banks and retain flows/temperature.* *→ Big Hole River Pintlar Creek to Deep Creek*	Stream Flow, Water Temperature	BHWC, BLM, DNRC, MFWP, NRCS	BHWC, BLM, DNRC, MFWP, NRCS Cost: >$100,000
	Wise River Beaver Recolonization *Wise River is entrenched in several segments near Lacy Creek. Beaver recolonization could repair widespread bank destabilization* *→ Wise River headwaters to Pattengail Creek*	Sediment, Stream Flow	BHWC, USFS	BHWC, USFS, DEQ Cost: <$100,000

Lower Priorities:				
	Zuckers Big Hole Pasture Land *Work with landowner to alter pasture management and grazing plan to allow rewetting of historic wetland. Presently a ditch drains this pasture.* *→ Big Hole River near Wise River*	Stream Flow, Water Temperature	BHWC	BHWC, Private Cost: <$100,000
	North Fork Pasture Land & Toomey Lake *Work with landowner to alter pasture management and grazing plan to allow rewetting of historic wetland and improve pond on site.* *→ Big Hole River near North Fork Road*	Stream Flow, Water Temperature	BHWC	BHWC, Private Cost: <$100,000
	Jerry Creek *Work with landowners on grazing management plans to improve bank stabilization. Revegetation of willows.* *→ Jerry Creek near Delano Creek*	Nutrients, Sediment	BHWC	BHWC Cost: <$100,000
	Lower Big Hole River near Twin Bridges *Hydro-modified. Alter pasture management to allow rewetting of historic wetland* *→ Twin Bridges*	Stream Flow, Water Temperature	BHWC	DEQ Cost: <$100,000
	Burma Road Pinch Point *This region is also referred to as the turtle ponds due to many water potholes. However, chronic dewatering in the region causes late season water issues. Reduce dewatering impacts.*	Stream Flow, Water Temperature	BHWC, MFWP	BHWC, MFWP, Private Cost: <$100,000

	Follow with long term land protection. *→ Big Hole River Burma Road near Glen*			
	Bacon Modified Pasture *Need onsite view, but listed as large hydrologically modified wetland. May be good site for rewetted area with alteration in grazing and irrigation practice.* *→ Big Hole River near Seymour Creek*	Stream Flow, Water Temperature	BHWC	BHWC, DEQ, DNRC, NRCS Cost: Dependent on method.
	Mt. Haggin Wildlife Refuge *Alter range management to protect wetlands.* *→ Mt. Haggin Wildlife Refuge*	Sediment	BHWC, MFWP	MFWP Cost: <$100,000
	Moose Creek Headwaters *This high elevation pasture land suffers from extreme hummacing. Alter grazing management to allow willow growth* *→ Moose Creek headwaters*	Stream Flow	BHWC	DEQ Cost: <$100,000
	Pintlar Creek/Christensen Complex *The region of the Big Hole River on the east end of the North Fork Road and its intersection with Highway 43 holds many opportunities to alter current land use to allow for water storage and late season temperature buffers.* *→ Big Hole River near Pintlar Creek*	Water Temperature	BHWC	BHWC, Private Cost: Dependent on method.
	Pattengail Dam Site *Pattengail Dam site as storage wetland.* *→ Pattengail Creek*	Fish & Wildlife, Stream Flow	BHWC , USFS	BHWC, Private, USFS, MFWP Cost: Dependent on method.

Irrigation Infrastructure Improvements				
Big Hole River Irrigation High Priority				
2012-?	**Lower Big Hole River Corridor Restoration** Lott-Harvey & Logan-Smith Ditch Orphan Home Ditch → *Near Twin Bridges*	Water Temperature, Stream Flow, Fish & Wildlife	MFWP, BHWC	BHWC, DNRC Cost: >$100,000
	Streb-Gallagher Ditches → *Near Melrose*	Water Temperature, Stream Flow, Sediment	BHWC	DEQ, DNRC, NRCS Cost: >$100,000
	Garrison-Kilwien Ditch → *Near Glen*	Water Temperature, Stream Flow	BHWC	DEQ, DNRC, NRCS Cost: >$100,000
	Rafferty's Upper South Side → *Near Melrose*	Water Temperature, Stream Flow	BHWC	DEQ, DNRC, NRCS Cost: Dependent on method.
2013	**Lower McCauley** → *Near Melrose*	Water Temperature, Stream Flow	BHWC or Landowner	Private Cost: <$100,000
	Meriwether's & Meriwether's Buyan Slough → *Near Melrose*	Water Temperature, Stream Flow	BHWC or Landowner	DEQ, DNRC, NRCS Cost: Dependent on method.
	Melrose Canal → *Near Melrose*	Water Temperature, Stream Flow	BHWC or Landowner	DEQ, DNRC, NRCS Cost: Dependent on method.
	Hamilton Ranch Ditch → *Twin Bridges*	Water Temperature, Stream Flow	Landowner	Private Cost: Dependent on method.
	Sandy Ditch →	Water Temperature, Stream Flow	BHWC or Landowner	DEQ, DNRC, NRCS Cost: Dependent on method.

Wise River Irrigation High Priority				
	The following ditches need flow measurement devices installed, a need for participation in a proposed Wise River Drought Management section. Additional needs are noted when applicable. *Jolly Ditch – Review status and needs* *Town Ditch –Stabilize* *Truman Ditch – Stabilize* *Company Ditch - Stabilize* *Vineyard Ditch* *Connolly Ditch* *Split Diamond – Review POD change and flow control options* *→ Lower Wise River*	Water Temperature, Stream Flow	BHWC, DNRC	BHWC, DNRC Cost: Flow Measurement Devices are usually <$2500. Other upgrades dependent on method, but all expected to be <$100,000 each.

Preserve & Protect

Future and On-Going:

Year(s)	Project	Watershed Restoration Category	Lead	Cost - Potential Source
2012-2014	**Big Hole River Floodplain Maps** *Floodplain Approximate Zone A mapping was complete November 2012. The state of Montana will adopt the map in 2013. Anaconda-Deer Lodge, Beaverhead and Madison counties will seek county adoption of the maps followed by their own regulatory ordinances associated with the maps. This will provide a strong regulatory environment to protect the river corridor.*	Water Temperature, Sediment, Nutrients, Regulatory Protections	BHWC, Future West, Beaverhead, Butte-Silver Bow, Madison and Anaconda-Deer Lodge Counties, DNRC	Ongoing - FutureWest, DEQ, BHWC, Counties, DNRC
2010 -	**Land Use Planning Incentive Program** *Payment for Ecological Services.*	Water Temperature, Sediments, Nutrients, Fish & Wildlife, Stream Flow	BHWC, FutureWest, Counties	Ongoing - FutureWest, DEQ, BHWC, Counties
1997 -	**Big Hole River Drought Management Plan** *Review and update January annually.*	Water Temperature, Stream Flow	BHWC, DNRC, FWP	$3000 annually - DEQ, BHWC
2014	**Wise River Drought Management Plan** *Include Wise River irrigators in the Drought Management Plan.*	Stream Flow	BHWC	BHWC
Varied	**Easements** *Seek land easements for protection*	Water Temperature, Nutrients, Sediment, Fish & Wildlife	BHWC and Partners	Varied - many sources
2013	**Beaverhead County Growth Policy Revision** (Last Update, 2005)	Regulatory Protections	BHWC, Beaverhead County, Future West	Beaverhead County
2014	**Butte-Silver Bow County Growth Policy Revision** (Last Update, 2008)	Regulatory Protections	BHWC, Butte-Silver Bow County, Future West	Butte-Silver Bow County

2017	**Madison County Growth Policy Revisions** (Last Update, 2012)	Regulatory Protections	BHWC, Madison County, Future West	Madison County
2015	**Anaconda-Deer Lodge County Growth Policy Revision** (Last Update, 2010)	Regulatory Protections	BHWC, Anaconda-Deer Lodge County, Future West	Anaconda-Deer Lodge County
Wetlands Specific Protection				
	Easements Encourage landowner to enter land into easement to preserve high quality sections: • Divide Creek • Deep Creek • Big Hole River near Burma Road	Sediment, Stream Flow, Water Temperature, Fish & Wildlife		
	Wetland Protection Language *Work with greater land use planning efforts and agencies to incorporate wetland protection language where appropriate (i.e. Growth Policies, laws, plans, etc.)*	Regulatory Protections		

Partners

Partnership Collaboratives Existing & Ongoing:

Project, Status	Watershed Restoration Category
Big Hole Watershed Committee Sub-Committees *Sub-Committees provide an opportunity for partners to collaborate on a focused topic.*	
BHWC Wildlife Committee *Focus is on reducing predator conflict and the health of native wildlife populations.*	Fish & Wildlife
BHWC Weed Committee *Focus is on eliminating noxious weeds and preventing the introduction and spread of invasive and noxious terrestrial and aquatic plant species.*	Weeds
BHWC Land Use Planning Committee *Focus is to promote responsible land use development particularly in the Big Hole River floodplain. This includes maintaining and improving floodplain development standards and mapping, working with counties to strengthen regulatory protections, and developing an incentive program for appropriate floodplain conservation.*	Regulatory Protections
BHWC Lower Big Hole Committee *Focus is on the Big Hole River between Glen and the mouth and to be initiated in 2013. Partners will review issues at work in the Lower Big Hole including erosion, river migration, lack of fish habitat, low stream flows, high water temperatures, and more.*	Fish & Wildlife, Water Temperature, Stream Flow
Other Partnerships	
Missouri Headwaters Partnership - Annual meeting each fall.	All
Wildlife Conservation Society - Wolf deterrence, watershed restoration	All
Montana Watershed Coordination Council (MWCC) - Coordination between watershed groups	All
Montana Non-Profit Association (MNA) - Annual meeting each fall. BHWC's attendance brings watershed groups to the table with statewide non-profits and non-profit management.	All
Rural Voices for Conservation Coalition (RVCC)	All
High Divide/Crown of the Continent	All
Interagency Coordination Council of Beaverhead County	All

See next page (partners list) for a list of individual groups involved in the Middle-Lower Big Hole River watershed

Partners

The stakeholders of the Big Hole watershed and those who work, live and play here have a strong sense of partnership, from helping a neighbor or serving the community, to leveraging resources to accomplish big goals. There are many partners involved in the watershed and its restoration. Many have individual goals or methods, but in mass they have one common goal - to restore the watershed to fully functioning to sustain ranching, fish and wildlife, water quality, and communities. Each partner listed is also a link:

Conservation Groups & Related Non-Profit Organizations

- American Fisheries Society (AFS) Montana Chapter
- American Rivers
- Arctic Grayling Recovery Program (AGRP)
- Center for Biological Diversity
- Big Hole River Foundation (BHRF)
- Big Hole Watershed Committee (BHWC)
- Blackfoot Challenge
- Ducks Unlimited, Inc.
- Missouri Headwaters Partnership (MHP)
- Montana Association of Land Trusts
- Montana Audubon
- Montana Land Reliance
- Montana Natural Heritage Program
- Montana Non-Profit Association (MNA)
- Montana Trout Unlimited (TU)
- Montana Watershed Coordination Council (MWCC)
- Montana Wetlands Legacy Partnership
- National Fish Habitat Action Plan
- People and Carnivores
- Pheasants Forever - Beaverhead Chapter
- Rocky Mountain Elk Foundation (RMEF) Montana
- The Conservation Fund
- The Nature Conservancy (TNC)
- The Trust for Public Land
- Western Native Trout Initiative
- Wildlife Conservation Society (WCS)
- Wildlife Society - Montana Chapter

Agencies

- Montana Bureau of Mines & Geology (MBMG)
- Montana Department of Environmental Quality - Water Quality Bureau (MDEQ)
- Montana Department of Natural Resources & Conservation (DNRC)
- Montana Department of Transportation
- Montana Fish, Wildlife & Parks
- Natural Resources Conservation Service (NRCS)
- Natural Resources Damages Program (NRDP)
- US Forest Service Beaverhead Deerlodge National Forest - Wisdom Ranger District (USFS)
- US Bureau of Land Management - Dillon Field Office (BLM)
- US Bureau of Land Management - Butte Field Office (BLM)
- US Fish & Wildlife Service - Partners Program
- US Geological Survey (USGS)
    - USGS Climate Change Center

Local Government & Conservation Districts

- Beaverhead County
- Beaverhead Conservation District
- Anaconda-Deer Lodge County
- Butte-Silver Bow County
- Mile High Conservation District
- Madison County
- Ruby Valley Conservation District

Educational Institutions

- **Rural Schools (K-8):** Wise River School, Divide School, Melrose School , Reichle School
- **Elementary Schools:** Twin Bridges
- **High Schools:** Butte High School, Butte Central School, Beaverhead County High School, Twin Bridges High School, Spokane High School
- University of Montana Western Environmental Studies & Biology Programs
- Montana Tech
- University of Montana
    - Avian Science Center
- Montana State University
- Montana State Fisheries Cooperative Unit (MTCFRU)

Section V: How Will We Know When We Arrive?

Each plan discussed in this document describes its own goals, priorities and milestones. Yet, in mass many goals lead to improved water quality. The milestones, criteria and monitoring plans of each are summarized below. Success documented by these groups using their own criteria can show positive change in the watershed. This is followed by broader watershed milestone, criteria and monitoring. The professionals leading the plans for the CCAA, USFS, and BLM are dedicated and with a high skill level. The best use of resources is to refer to their work in assessing success. The monitoring components are provided in **Table 13**. Progress in watershed restoration can be tracked by achieving interim milestones, provided in **Table 14**. Finally, success targets can be viewed in **Table 15**.

Table 13: Monitoring components, responsible party, and occurrence.

Monitoring Component	Primary Responsibility	Source	When
Stream Flows • *USGS Gaging Stations* • *Individual Measurements* • *TruTracks (Flow & Temp)*	DNRC	CCAA	CCAA reports annually and every 5 years.
Water Temperature • *USGS Gaging Stations* • *Individual Measurements* • *TruTracks/Thermographs* • *Temperature Loggers*	DNRC, DEQ, MFWP	CCAA, DEQ (TMDL)	CCAA reports annually and every 5 years TMDL Implementation Evaluation (approx. 2014 or later)
Fish & Wildlife Arctic grayling Other Fish & Wildlife	 MFWP MFWP	 CCAA, MFWP projects	 CCAA reports annually and every 5 years FWP reports are project specific.
Education and Outreach	BHWC, others	Attendance and involvement tracking	BHWC reports annually.
Weeds	BHWC, Counties, MFWP	CCAA, varied	CCAA reports annually and every 5 years Other weed support provided as needed.
Riparian conditions and/or streambank condition		Aerial Photographs, CCAA, varied	Associated with specific restoration projects, CCAA.

Table 14: Watershed restoration interim milestones.

Milestone	End Point
Irrigation Infrastructure: Minimum one improvement per year (headgate, diversion, flow measurement or stockwater tank)	All irrigation infrastructures are updated to allow for water control, water efficiency, water measurement and adequate diversion that do not cause stream degradation.
Minimum one riparian improvement project per year in a stream reach as identified as having sparse or moderate riparian density.	95% of CCAA enrolled lands have a riparian condition rating of sustainable.
10 public opportunities each year to participate in watershed restoration, i.e. tours, seminars, meetings, etc.	No end point
Meet with each of the following one time annually to identify needs for watershed restoration and to report progress on watershed restoration: • DEQ • USFS • BLM • CCAA • MFWP	No end point

Table 15: Overarching watershed restoration success indicators.

Restoration Success Indicator	Goal
Positive restoration results in the CCAA restoration plan upon 5 year reviews	Results reported to BWHC every 5 years. Positive trends are based on CCAA approved monitoring plans and results.
Positive restoration results in BLM watershed assessments or land health evaluations every five years.	BLM Watershed Assessments reviewed every 5 years. Positive trends are based on BLM approved monitoring plans and results.
Positive restoration results in USFS efforts every three years.	Request updates from USFS every three years. Positive restoration includes expanded westslope cutthroat trout habitat, road improvements or closures that reduce sediment input, riparian restoration, etc.
Declining trend in water temperature over 10 year period.	Negative trend in water temperature is calculated as average water temperature from stream gages over a 10 year period July - September. Declining trend = average water temperature July - September is declining.
Positive trend in stream flow over 10 year period.	Positive trend in stream flow is calculated as average stream flow stream gages over a 10 year period July - September. Positive trend = average stream flow July - September is increasing.
Positive riparian vegetation growth throughout the Big Hole watershed.	Photo monitoring using both on site before and after photos and aerial photos or software.
Improve all river sources of irrigation withdrawals.	All irrigation structures are improved with flow measurement and fish passage.
100% participation in Drought Management	All irrigators and river users participate in the BWHC Drought Management Plan and/or the CCAA Drought Management Plan.
High education & engagement numbers in watershed activities.	A wide range of stakeholders and high number of stakeholders continue to regularly attend and engage in the restoration work of the Big Hole watershed. Measured by BHWC meeting attendance, online activity, and annual donations.
Regulatory environment provides increasing protections of sensitive watershed areas.	The number of easements or other land conservation protection measures are increasing. The development standards in the watershed protect sensitive riparian zones and wetlands from development and continue to strengthen.

Section VI: Discussion, Recommendations & Review

In the 1980's and 1990's the Big Hole watershed faced challenges that at the time seemed insurmountable. Ranchers, agencies, and other stakeholders were at odds. The drought, the dry river bed, the rapidly declining Arctic grayling population, and ranch livelihoods on the line resulted in an ugly finger pointing battle.

Fast-forward 20 years: While drought has reoccurred, the river has not run dry and Arctic grayling numbers are increasing. Landowners have embraced the notion of coexistence -- what's good for the watershed is good for ranching and good for neighbors. Agencies have embraced the notion of coexistence as well, with partnerships with landowners, listening to needs, and adapting restoration to meet those needs.

Coexistence has become the culture in the Big Hole, from predator deterrence to reduced wolf-human conflicts, to enrolled state and private lands in the CCAA program, to continued consensus based efforts of the BHWC, and the shared sacrifice of the Drought Management Plan.

Coexistence, or the collaboration and education of stakeholders, is why restoration is working in the Big Hole. It is trust and relationship building, teamwork, and patience. It is critical that this culture continues into the future for continued success. Without this continued culture, much of the work done to this point will unravel and be lost effort.

Much of this plan points to the coexistence culture as a high priority for restoration. Coexistence is not measured in, for example, miles of river restored or sediment load reduced. Therefore, indicators are developed to take into account a broader scope of restoration success, one that occurs over a long period and over a broad area. In reality, this broad scope for long-term success both fits the vision for the Big Hole watershed and is representative of a cumulative watershed effect.

Review the Watershed Restoration Plan

The Watershed Restoration Plan was compiled by the BHWC. The plan reviewed and takes into account existing plans and known upcoming projects. The next review of this plan should occur in 2018.

The 2018 review should include the revised BLM Watershed Assessment and the results of several monitoring and research studies that are currently in process. The results of those works will prove beneficial in future decision making. The 2018 version should also include updates in the Land Use Planning process and the updated Beaverhead County Growth Policy.

Note that 2015 is the 10th anniversary of the TMDL data collection for the Middle-Lower Big Hole watershed. It may be appropriate at this time to review Montana DEQ's targets and criteria for impairment and revise recommendations based on restoration efforts. This may be accomplished through Montana DEQ's own process of evaluating TMDL implementation activities. The Watershed Restoration Plan should be updated whenever a major landmark in the restoration plans occurs, such as a CCAA 5-year review, updated Forest Plan, updated BLM Watershed Assessment or other milestone.

Sub-Watershed Summaries

The Middle - Lower Big Hole watershed can be subdivided into smaller watershed basins (HUC 5). The sub-basins are ordered in the following pages upstream to downstream. Within each sub-basin, tributaries are ordered from upstream to downstream for easy reference.

Table 16: TMDL and 303d Listing Summary (2012) by HUC 5 watershed and grouped by impairment. Beneficial uses abbreviations: N=Not Supporting, P = Partially Supporting, F=Fully Supporting. Blue regions are potential water quality impairment sources with persistence in that stream marked with an x. Red regions are possible causes with persistence marked with an x. Source: (Montana DEQ, June 2009)

Major Watersheds	Area, Square Miles	Stream Length, Miles	2012 303d Impairments (Year Listed)	Aquatic Life	Agriculture	Drinking Water	Recreation	Arsenic	Cadmium	Copper	Lead	Mercury	Zinc	Iron	Excess Algal Growth	Phosphorus (Total)	Total Kjeldahl Nitrogen (TKN)	Nitrogen (Total)	Alteration in Streamside Cover	Low Flow Alterations	Other Anthropogenic Substrate Alterations	Physical Substrate/Habitat Alterations	Bottom Deposits	Sediment/Siltation	Turbidity	Other Flow Regime Alterations	Temperature, Water	Acid Mind Drainage	Atmospheric Deposition - Toxics	Contaminated Sediments	Abandoned Mines	Mine & Mill Tailings	Placer Mining	Dredge Mining	Erosion from Derilict Land (Barren Land)	Flow Alterations from Water Diversions	Subsurface Hardrock Mining	Irrigated Crops	Agriculture	Channelization	Hydrostructure Flow Regulation	Grazing in Riparian	Rangeland Grazing	Crop Production	Unspecified Unpaved Road or Trail	Forest Roads (Road Construction & Use)	Silviculture	Highway Runoff	Higway Infrastructure	Onsite Treatment Systems (Septic, etc)	Site Clearance (Land Development or Redevelopment)	Loss of Riparian Habitat	Natural Sources	Habitat Modification	Dam Construction	Streambank Modification/destabilization
Subwatershed Names and Tributaries								Mining							Nutrients				Physical Habitat Alterations - Sediment							Water		Mining Related Damages										Agriculture Related Damages							Road and Siliviculture Related Damages					Development Related		Unspecified Damages				
Middle Big Hole River																																																								
Middle Big Hole River: Pintlar Creek to Divide Creek	44.39			N	F	N	P			X	X								X	X		X		x			x	X			X							X	X			X	X						X							
Deep Creek	106.3																																																							
California Creek	28.6	8.28	Iron (1992)	N	N	N	P	X		X				X					X	X	X	X		X	X				X	X	X		X					X	X		X	X	X		X		X						X			
Sixmile Creek		4.4		P	F	F	F															X		X																			X		X		X									X
Oregon Creek		3.09	Lead (2000)	N	N	N	F	X		X	X								X		X	X		X				X	X			X		X	X				X	X	X				X	X	X		X				X			X
French Creek	20.3	10.08		N	X	N	X	X		X														X				X	X	X	X																									
Deep Creek	57.4	9.21		P	F	F	F												X	X				X														X					X														X
Corral Creek		5.2		P	F	F	F												X			X		X																			X				X						X			
Seven Mile Creek		6.43		P	F	F	F												X					X																			X										X			X
Twelvemile Creek		9.09	Sedimentation/Siltation (1992)																					X																		X					X									
Big Hole River - Fishtrap	291.7																																																						
Sawlog Creek		4.79	Phosphorus (Total)	N	F	F	F									X			X					X																		X			X											
Fishtrap Creek (confluence to mouth)	50.7	5.85	Confluence of West & Middle Forks to mouth: Phosphorus (Total) (2006)	P	F	F	P									X			X	X				X												X						X														
Wise River	261.9																																																						
Wise River - Headwaters to Mouth		26.67		P	F	F	P		X	X	X								X	X		X		X														X	X	X	X	X	X						X			X				
Pattengail Creek - Headwaters to Mouth		20.04		P	F	F	F												X			X		X																									X						X	
Elkhorn Creek		7.52		N	F	F	F	X	X	X	X		X											X							X	X																	X						X	
Gold Creek		4.92	Phosphorus (Total) (2006)	P	F	F	F									X			X					X																		X														
Big Hole River - Divide	170.7																																																						
Jerry Creek	45.9	12.69	Lead (2000)	N	F	N	P			X	X				X				X	X		X		X				X			X							X	X		X	X	X				X			X	X					
Delano Creek		2.32		P	F	F	F												X					X																		X														
Canyon Creek	50.2	18.41		x	x	x	P													X																		X	X																	
Charcoal Creek		4.06	Phosphorus (Total), Sedimentation/Siltation, Nitrogen (Total) (2006)	P	F	F	F									X		X						X																		X			X											
Divide Creek	92.8																																																						
Divide Creek		*13.99*		P	F	F	P									X	X	X	X	X				X			X									X			X																	

Table 17: TMDL and 303d Listing Summary (2012) by HUC 5 watershed and grouped by impairment. Beneficial uses abbreviations: N=Not Supporting, P = Partially Supporting, F=Fully Supporting. Blue regions are potential water quality impairment sources with persistence in that stream marked with an x. Red regions are possible causes with persistence marked with an x. Source: (Montana DEQ, June 2009)

Major Watersheds	Area, Square Miles	Stream Length, Miles	2012 303d Impairments (Year Listed)	Aquatic Life	Agriculture	Drinking Water	Recreation	Arsenic	Cadmium	Copper	Lead	Mercury	Zinc	Iron	Excess Algal Growth	Phosphorus (Total)	Total Kjeldahl Nitrogen (TKN)	Nitrogen (Total)	Alteration in Streamside Cover	Low Flow Alterations	Other Anthropogenic Substrate Alterations	Physical Substrate/Habitat Alterations	Bottom Deposits	Sediment/Siltation	Turbidity	Other Flow Regime Alterations	Temperature, Water	Acid Mind Drainage	Atmospheric Deposition - Toxics	Contaminated Sediments	Abandoned Mines	Mine & Mill Tailings	Placer Mining	Dredge Mining	Erosion From Derilict Land (Barren Land)	Flow Alterations From Water Diversions	Subsurface Hardrock Mining	Irrigated Crops	Agriculture	Channelization	Hydrostructure Flow Regulation	Grazing in Riparian	Rangeland Grazing	Crop Production	Unspecified Unpaved Road or Trail	Forest Roads (Road Construction & Use)	Silviculture	Highway Runoff	Highway Infrastructure	Onsite Treatment Systems (Septic, etc)	Site Clearance (Land Development or Redevelopment)	Loss of Riparian Habitat	Natural Sources	Habitat Modification	Dam Construction	Streambank
Subwatershed Names and Tributaries								**Mining**							**Nutrients**				**Physical Habitat Alterations - Sediment**							**Water**		**Mining Related Damages**									**Agriculture Related Damages**							**Road and Silviculture Related Damages**					**Development Related Damages**		**Unspecified Damages**					
Lower Big Hole River																																																								
Big Hole River - Divide Creek to Mouth		49.27	Lead, Copper, Cadmium, Zinc (2000)	N	F	N	P		X	X	X		X						X		X					X		X								X				X					X	X						X	X	X
Big Hole River - Melrose	306.9																																																						
Moose Creek	45	16.99		N	X	X	P									X		X		X				X												X																				
Soap Creek		8.24		P	F	F	F									X		X	X					X												X				X				X											
Grose Creek		4.93		P	F	F	P									X		X	X					X		X											X					X	X											
Big Hole River-Melrose	33.8																																																							
Camp Creek	38	15.6	Arsenic (2006)	P	P	N	P	X								x		X	X	X				x												X				X				X											
Wikiup Creek		4.09	Bottom Deposits, Lead, Mercury (1994), Phosphorus (Total) (2006)	N	F	N	F			X	X	X				X		X					X					X											X				X											
Trapper Creek	41.2	18.98		N	F	N	P	X	X	X	X		X			X			X	X			X			X		X	X							X			X	X				X		X								
Sassman Gulch (headwaters to the end of the stream reach in T4S R9W S9)		3.89	Arsenic (1988)	N	F	F	F	X												X									X													X														
Big Hole River-Lost Creek	33.9																																																							
Lost Creek		7.84		P	P	N	F	X								X		X	X					X								X									X				X										
Lower Big Hole River	285																																																							
Willow Creek		23.39		X	X	X	X												X																		X	X																
Birch Creek	53.5	24.58																																																						
Birch Creek HW to USFS Border		13.91		P	F	F	F												X	X		X		X												X	X		X	X														X
USFS Border to Mouth		10.67		N	F	F	N												X	X	X	X		X												X		X	X		X												X	
Rochester Creek	34.6	14.92		P	F	N	F	X			X	X	X									X		X								X									X														

Middle-Lower Big Hole Watershed - Whole

Water Quality Issues:

2012 303d Listed Streams: 13 streams listed - see **Table 16** and **Table 17** for streams

HUC 5 Watersheds within the Middle-Lower Big Hole Watershed

- Deep Creek
- Big Hole River - Fishtrap
- Wise River
- Big Hole River - Divide
- Divide Creek
- Big Hole River - Melrose
- Lower Big Hole River

Major Tributaries:

Fishtrap Creek
LaMarche Creek
Deep Creek
Bryant Creek
Johnson Creek
Wise River
Jerry Creek
Divide Creek
Canyon Creek
Moose Creek
Camp Creek
Trapper Creek
Cherry Creek
Rock Creek
Lost Creek
Willow Creek
Birch Creek

Major Issues: Fluvial Arctic Grayling, Wolves, Drought, High Water Temperatures, Lack of Riparian Vegetation and Appropriate Channel Shape.

Plans in place:

- USFS Beaverhead Deerlodge National Forest - Forest Plan
- Montana Fish, Wildlife & Parks - Conservation Strategy
- Big Hole Watershed Committee Drought Management Plan
- Bureau of Land Management Dillon & Butte Field Office Watershed Assessments
- Partners for Fish and Wildlife CCAA

Ownership: USFS Beaverhead Deerlodge National Forest & Anaconda-Pintler Wilderness, DNRC, BLM, Private Lands.

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Middle Big Hole River Mainstem	Middle Big Hole River (Pintlar Creek to Divide Creek)	191,651	28%			Copper Lead	Hi Flow: 61.884 Lo Flow .743 Hi Flow: 12.377 Lo Flow .371	Hi Flow: 5% Lo Flow: 0% Hi Flow: 10% Lo Flow: 0%	Reduce warm irrigation return flows by 50% Maintain instream flows	
	Pintlar Creek to Mudd Creek								%shade = 1.4% to 1.7% Median Channel W/D = 92	%shade = 15% increase W/D <= 60 35% decrease
	Mudd Creek Bridge to Deep Creek								%shade = 4.8% to 5.1% Median Channel W/D = 92	% shade = 5% increase W/D <= 60 35% decrease
	Deep Creek to Wise River								%shade = 3.5% to 3.8%	% shade = 9% increase
	Wise River to Diversion								% shade = 7.9%	n/a

Table 18: Middle Big Hole River mainstem TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Lower Big Hole River mainstem	Lower Big Hole River								Reduce warm irrigation return flows Maintain instream flow	
	Butte Diversion to end of Lower End Maiden Rock Canyon								% shade = 14.2% to 14.7%	% shade = 3.5% increase
	Maiden Rock Canyon to Brownes Bridge FAS								% shade = 7.5% to 9.6%	% shade = 28% increase
	Browns Bridge FAS to Glen FAS								% shade = 6.3% to 7.5%	% shade = 19% increase
	Glen to Notch Bottom FAS								% shade = 2.1% to 3.2%	% shade = 52% increase
	Notch Bottom FAS to Pennington FAS								% shade = 3.1% to 4.1%	% shade = 32% increase
	Pennington FAS to Jefferson River								% shade = 3.8% to 5.4%	% shade = 42% increase

Table 19: Lower Big Hole River mainstem TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Deep Creek

Water Quality Issues Summary: Metals and Physical Habitat Alterations. Damages due to mining and atmospheric deposition, agriculture, roads, and natural causes.

2012 303d Streams: California Creek - Iron, Oregon Creek - Lead, Twelvemile Creek - Sediment

Area: 106.3 square miles *Hydrologic Unit Code:* 1002000407

HUC 6 Watersheds within the Deep Creek watershed:

- California Creek
- French Creek
- Deep Creek

Major Infrastructure: Mill Creek Road (569), Past Anaconda Smelter Operation, Mount Haggin State Wildlife Management Area

High Priority Abandoned Hardrock Mines: None

Tributaries:

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Deep Creek	Deep Creek (headwaters to mouth)	9180	15%							
	California Creek	1328	32%			Arsenic Copper	Hi Flow: 6.347 Lo Flow: .544 Hi Flow: 3.035 Lo Flow: .052	Hi Flow: 57% Lo Flow: 52% Hi Flow: 62% Lo Flow: 0%		
	Sixmile Creek	528	24%			Arsenic	Hi Flow: 17.297 Lo Flow: .854	Hi Flow: 62% Lo Flow: 29%		
	Oregon Creek	n/a	19%			Arsenic Copper	Hi Flow: .983 Lo Flow: .076 Hi Flow: .541 Lo Flow: .006	Hi Flow: 50% Lo Flow: 71% Hi Flow: 74% Lo Flow: 0%		
	French Creek	3773	22%			Copper	Hi Flow: n/a Low Flow: .061	Hi Flow: 14% Lo Flow: 0%		
	Corral Creek	446	24%							
	Sevenmile Creek	468	18%							

Table 20: Deep Creek watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Big Hole River - Fishtrap

Water Quality Issues Summary: Nutrients and physical habitat alteration due to agriculture and roads.

303d Listed Streams: Sawlog Creek - Phosphorous, Fishtrap Creek (Confluence of forks to mouth) - Phosphorous

Area: 291.70 square miles *Hydrologic Unit Code:* 1002000408

HUC 6 Watersheds within the Big Hole-Fishtrap watershed:

- Fishtrap Creek
- LaMarche Creek
- Big Hole River-Fishtrap
- Seymour Creek
- Bryant Creek
- Alder Creek
- Big Hole River - Dickie Bridge
- Big Hole River - Meadow Creek

High Priority Abandoned Hardrock Mines: None

Tributaries:

Big Hole River (Pintler (Pintlar) Creek Confluence to Wise River Confluence)
- Salefsky (Squaw) Creek
- Goris Gulch
- Christiansen Creek
  - Papoose Creek
    - Shaw Creek
- Mudd Creek
  - Mudd Lake
  - Toomey Lake
- Toomey Creek
- Sawlog Creek
- Stewart Creek
- Tucker Creek
- Calvert Creek
- Walker Creek
- Fishtrap Creek
  - West Fork Fishtrap Creek
  - Middle Fork Fishtrap Creek
  - Swamp Creek
- Minnie Creek
- LaMarche Creek
  - West Fork LaMarche Creek
    - Warren Lake
  - Middle Fork LaMarche Creek
    - LaMarche Lake
    - Trout Creek
  - East Fork LaMarche Creek
    - Emerald Lake

Downstream

Pony Creek
Seymour Creek
- Chub Creek
- Lower Seymour Lake
- Upper Seymour Lake

Bear Creek
Bryant Creek
- Calvert Creek
- Dowell Creek

Teddy Creek
Johnson Creek
- Dodgeson Creek
- Cat Creek

Alder Creek
- Johanna Lake
- Osborne Creek
- Ferguson Lake
- Foolhen Creek
  - Foolhen Lake

Meadow Creek
- Harriet Lou Creek

Deep Creek confluence with Big Hole River - See Deep Creek HUC 5 Summary.

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Big Hole River - Fishtrap	Fishtrap Creek	3234	18%							
	Sawlog Creek	373	18%							

Table 21: Big Hole River Fishtrap watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Wise River

Water Quality Issues Summary: Metals, Phosphorous, Physical Habitat Alterations due to mine activity, agriculture, roads and past dam construction.

303d Listed Streams: Gold Creek – Phosphorous

Area: 261.90 square miles *Hydrologic Unit Code:* 1002000409

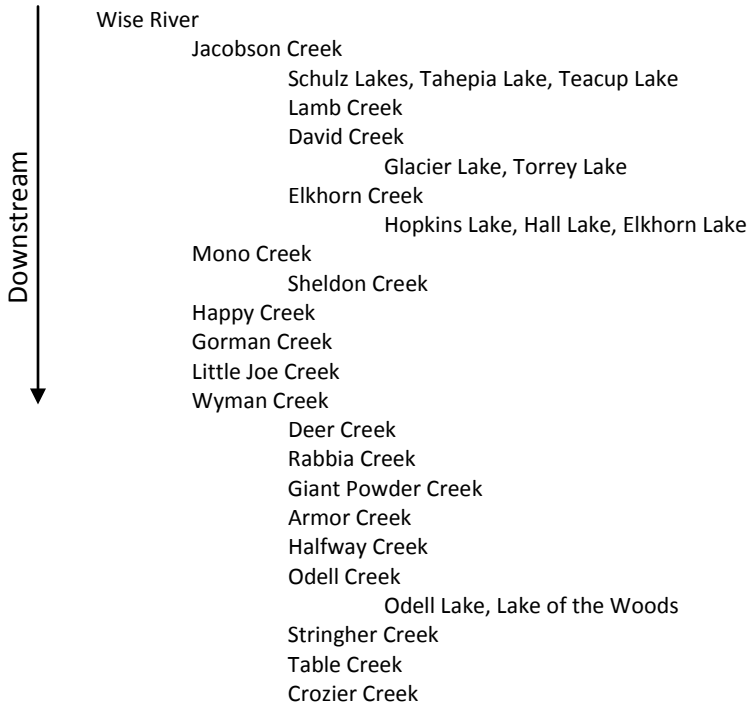
HUC 6 Watersheds within Wise River watershed:

- Headwaters Wise River
- Wyman Creek
- Lacy Creek
- Upper Wise River
- Upper Pattengail Creek
- Middle Pattengail Creek
- Lower Pattengail Creek
- Middle Wise River
- Lower Wise River

Major Infrastructure: Pattengail Dam and subsequent blowout, Pioneer Mountain Scenic By-Way, Elkhorn Mine (abandoned), Several USFS camping areas, Town of Wise River

High Priority Abandoned Hardrock Mines: Old Elkhorn (Elkhorn Creek)

Tributaries:



- Lacy Creek
  - Schwinger Lake
  - Skull Creek
  - Bobcat Creek
    - Bobcat Lakes
- Elk Creek
- Gold Creek
- Boulder Creek
  - Black Lion Creek
- Fourth of July Creek
- Pattengail Creek
  - Baldy Lake, Grassy Lake, Elbow Lake
  - Sand Creek
    - Sand Lake
  - Whiskey Creek
  - Demijohn Creek
  - Copper Creek
  - Stone Creek
    - Stone Lakes
  - Lost Horse Creek
    - Rocky Creek
    - Deboose Creek
    - Effie Creek
  - Cow Creek
  - Kelly Creek
  - Lambrecht Creek
    - Dicks Creek
    - Toland Creek
  - Reservoir Creek
  - Lews Creek
  - Evans Creek
  - Grouse Creek
    - Grouse Lakes
- Ross Gulch
- Sheep Creek
  - Clifford Creek
- Stine Creek
- Butler Creek
- Deno Creek
- Adson Creek
- Swamp Creek

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Wise River	Elkhorn Creek	491	22%			Copper	Hi Flow: 23.970 Lo Flow: .656	Hi Flow: 95% Lo Flow: 81%		
						Cadmium	Hi Flow: .306 Lo Flow: .013	Hi Flow: 99% Lo Flow: 97%		
						Zinc	Hi Flow: 44.344 Lo Flow: 4.024	Hi Flow: 63% Lo Flow: 60%		
	Pattengail Creek	2626	8%							
	Wise River	12037	34%			Copper	Hi Flow: 16.200 Lo Flow: .408	Hi Flow: 43% Lo Flow: 5%		
						Cadmium	Hi Flow: .389 Lo Flow: .005	Hi Flow: 92% Lo Flow: 0%		
						Lead	Hi Flow: 15.228 Lo Flow: .034	Hi Flow: 89% Lo Flow: 0%		
	Gold Creek	729	19%							

Table 22: Wise River watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Big Hole River - Divide

Water Quality Issues Summary: Metals, Nutrients, Physical Habitat Alteration due to past mining activity, agriculture, roads, and development.

303d Listed Streams: Jerry Creek - Lead, Charcoal Creek - Phosphorous, Nitrogen, Sedimentation/Siltation

Area: 170.70 square miles *Hydrologic Unit Code:* 1002000411

HUC 6 Watersheds within Big Hole River-Divide watershed:

- Jerry Creek
- Big Hole River - Quartz Hill Gulch
- Canyon Creek
- Big Hole River - Dewey

Major Infrastructure: Highway 43, Divide Diversion Dam and Pumphouse (replaced 2011-2012), Town of Dewey, Town of Divide.

High Priority Abandoned Hardrock Mines: None

Tributaries:

Big Hole River
- Jimmie New Creek
- Jerry Creek
  - Flume Creek
  - Delano Creek
  - Libby Creek
  - Long Tom Creek
    - Granulated Creek
    - Hansen Creek
    - Labree Creek
    - Fish Lake
  - Indian Creek
    - Parker Creek
  - Spruce Creek
  - Moores Creek
  - Laducet Creek
- Leffler Creek
- Charcoal Creek
- Sawmill Gulch

Downstream ↓

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Big Hole River - Divide	Jerry Creek	2640	19%			Copper	Hi Flow: n/a Lo Flow: 1.236	Hi Flow: 0% Lo Flow: 59%		
	Delano Creek	129	17%							

Table 23: Big Hole River Divide Creek watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Divide Creek

Water Quality Issues Summary: Nutrients, temperature & water, and physical habitat alterations as a result of agriculture

303d Listed Streams: none

Area: 92.8 square miles *Hydrologic Unit:* 1002000410

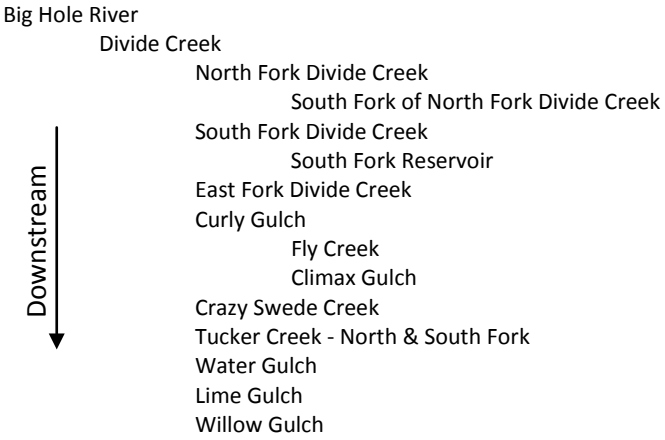
HUC 6 watersheds within Divide Creek watershed:

- North Fork Divide Creek
- Upper Divide Creek
- Lower Divide Creek

Major Infrastructure: Butte-Silver Bow Water Department Reservoir, railroad, Frontage Road, Interstate 15

High Priority Abandoned Hardrock Mines: None

Tributaries:



Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Divide Creek	Divide Creek	4783	12%	Downstream of North & East Forks	N: 82% to 89% P: 78% to 88%				% shade = 22%	% shade = 23% increase
				Near Mouth	N: 75% to 92% P: 50% to 65%					

Table 24: Divide Creek watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Big Hole River - Melrose

Water Quality Issues Summary: Metals, nutrients, physical habitat alterations as a result of past mine activity, agriculture, and roads.

303d Listed Streams: Camp Creek - Arsenic, Wikiup Creek - Bottom Deposits, Mercury, Phosphorous, Sassman Gulch - Arsenic

Area: 306.90 square miles *Hydrologic Unit Code:* 1002000412

HUC 6 watersheds within Big Hole River - Melrose watershed:

- Moose Creek
- Big Hole River - Melrose
- Camp Creek
- Trapper Creek
- Cherry Creek
- McCartney Creek
- Big Hole River - Browns Gulch
- Rock Creek
- Big Hole River - Lost Creek

Major Infrastructure: Railroad, Frontage Road, Interstate 15, County Barns, Town of Melrose, Glen and Twin Bridges.

High Priority Abandoned Hardrock Mines: Middle Fork Millsite (Moose Creek), Clipper (Camp Creek), Maiden Rock (Melrose), True Blue, Lower and Upper Cleve, Trapper, Silver King (Trapper Creek), Tungsten Mill Site (Lost Creek), Old Glory (Soap Gulch)

Tributaries:

Big Hole River
- Canyon Creek
  - Canyon Lake, Lake Abundance, Grayling Lake, Crescent Lake, Grace Lake
  - Lion Creek
    - Lion Lake, Vera Lake
  - Vipond Creek
    - Buffalo Head Gulch
  - Trusty Gulch
- Moose Creek
  - Middle Fork & North Fork Moose Creek
  - Maclean Creek
  - Chicken Gulch
- Camp Creek
  - Wickiup Creek
    - Blacktail Creek
  - Willow Creek
  - L Camp Creek
- Trapper Creek
  - Trapper Lake
  - Sucker Creek

Downstream

Sappington Creek
Cherry Creek
Cherry Lake, Granite Lake
McCartney Creek
Brownes Creek
Rock Creek
Storm Park Creek
Long Creek
Long Lake, Long Branch Lake
Brownes Lake, Lake Agnes, Rainbow Lake, Green Lake, Waukena Lake
Lost Creek

		Sediment		Nutrients		Metals			Temperature	
	Stream Reach	*Total Sediment Load (tons/ year)*	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Big Hole River - Melrose	Grose Creek	294	40%	Upper Site Lower Site	N: 31% to 45% P: 53% to 77% N: 33% to 53% P: 43% to 78%					
	Camp Creek	3450	29%	Between Reservoir & Irrigation Ditch Near Mouth	N: 27% to 60% P: 0 to 90% N: 64% to 76% P: 4% to 37%					
	Wikiup Creek					Copper	Hi Flow: .447 Lo Flow: .556	Hi Flow: 90% Lo Flow: 97%		
	Trapper Creek	3326	22%			Copper Cadmium Lead Zinc	Hi Flow: 2.552 Lo Flow: .436 Hi Flow: .076 Lo Flow: .019 Hi Flow: 12.906 Lo Flow: 2.485 Hi Flow: 21.981 Lo Flow: 6.297	Hi Flow: 66% Lo Flow: 7% Hi Flow: 66% Lo Flow: 38% Hi Flow: 98% Lo Flow: 95% Hi Flow: 50% Lo Flow: 17%		
	Lost Creek	742	21%	Upper Site Middle Site Lower Site	N: n/a to 23% P: 59% to 64% N: n/a P: 63% to 67% N: n/a P: 60%	Arsenic	Hi Flow: .027 Lo Flow: .302	Hi Flow: 0% Lo Flow: 64%		

Table 25: Big Hole River Melrose watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Lower Big Hole River

Water Quality Issues Summary: Metals and physical habitat alterations as a result of past mine activity, agriculture and dam construction.

303d Listed Streams: none

Area: 285.0 square miles *Hydrologic Unit Code:* 1002000413

HUC 6 watersheds within Lower Big Hole River watershed:

- Upper Willow Creek
- Lower Willow Creek
- Birch Creek
- Big Hole River - Stevens Slough
- Big Hole River - Biltmore Hot Springs
- Nez Perce Creek
- Rochester Creek
- Big Hole River - Twin Bridges

Major Infrastructure: Railroad, Frontage Road, Interstate 15, Town of Glen and Twin Bridges, Burma Road

High Priority Abandoned Hard Rock Mines: Indian Queen (Birch Creek), Emma (Nez Perce Creek), Thistle Mine/Tailings, Watseca (Rochester Creek)

Tributaries:

Big Hole Creek
- Willow Creek
  - Tendoy Lake
  - Gorge Creek
    - Gorge Lakes
  - Buckhorn Creek
  - Debois Creek
    - Barb Lake
  - Bond Creek
    - Bond Lake, Deerhead Lake
  - North Creek
- Birch Creek
  - Lily Lake, Boot Lake, May Lake, Pear Lake, Tub Lake, Chan Lake, Anchor Lake
  - Mule Creek
  - Thief Creek & South Fork Thief Creek
  - Armstrong Gulch
  - Sheep Creek
  - Farlin Gulch
  - Bridge Gulch
  - Canyon Gulch
- Garrison Ditch
- Stevens Slough
- Nez Perce Creek
- Rochester Creek

Downstream

Watershed	Stream Reach	Sediment		Nutrients		Metals			Temperature	
		Total Sediment Load (tons/ year)	*Target % Reduction*	*Location*	*Target Percent Reduction*	*Metal*	*Metals Load (pounds/day)*	*Target Percent Reduction*	*Existing Condition*	*Target Reduction*
Lower Big Hole River	Birch Creek (Upper Segment)	2015	13%							
	Birch Creek (Lower Segment)	3827	21%							
	Rochester Creek	2288	32%			Arsenic	Hi Flow: .020 Lo Flow: .020	Hi Flow: 89% Lo Flow: 95%		
						Mercury	Hi Flow: .00001 Lo Flow: .00021	Hi Flow: 0% Lo Flow: 660%		
						Copper	Hi Flow: .004 Lo Flow: .004	Hi Flow: 6% Lo Flow: 75%		
						Lead	Hi Flow: .001 Lo Flow: .0009	Hi Flow: 0% Lo Flow: 55%		

Table 26: Lower Big Hole River watershed TMDL targets for sediment, nutrients, metals and water temperature. Data from the Middle-Lower Big Hole River TMDL (Montana DEQ, September 2009).

Works Cited

Anconda-Deer Lodge County. (2010). *Anaconda-Deer Lodge County Growth Policy.* Anaconda, Montana: Anaconda-Deer Lodge County.

Beaverhead County. (2005). *Beaverhead County Growth Policy.* Dillon, Montana: Beaverhead County, Montana.

Big Hole Watershed Committee and Beaverhead Deerlodge National Forest. (2013). *Trend Analysis of Water Temperatures Relative to Air Temperatures and Flow in the Big Hole River.* Divide, MT.

Big Hole Watershed Committee. (1997 - 2013). *Big Hole River Drought Management Plan.* Big Hole Watershed Committee.

Butte-Silver Bow County. (2008). *Butte-Silver Bow County Growth Policy.* Butte, Montana: Butte-Silver Bow County.

Carpenedo, S. M. (March 2011). *Beaver Habitat Suitability Model: Big Hole Watershed, Montana.* Helena, MT: Montana Department of Environmental Quality Wetland Program.

Confluence Consulting, Inc. (2012). *Lower Big Hole River Corridor Assessment Phase 1.* Bozeman, Montana: Big Hole Watershed Committee.

DEQ, M. (2009). *Upper and North Fork Big Hole River Planning Area TMDLs and Framework Water Quality Restoration Approach. M03-TMDL-01A.* Helena, Montana: Montana Department of Environmental Quality.

Flynn, K. D. (2008). *Modeling Streamflow and Water Temperature in the Big Hole River, Montana - 2006. TMDL Technical Report DMS-2008-03.* Helena, Montana: Montana Department of Environmental Quality.

Madison County. (2012). *Madison County Growth Policy.* Virginia City, Montana: Madison County.

Mainstream Restoration and Allied Engineering. (2011). *Big Hole River Near Melrose, Montana - Alternatives Assessment to Improve the Pendergast-Spears-McCullough and Gallagher Diversions.* Bozeman, Montana: Big Hole Watershed Committee & MT Fish, Wildlife and Parks.

Marvin, R., & Abdo, G. (2000). *Divide Public School Wellhead Protection Plan, Divide, Montana MBMG Open-File Report 399-D.* Butte, Montana: Montana Bureau of Mines and Geology.

Montana American Fisheries Society. (2010, 30 9). *Status of Arctic Grayling in Montana*. Retrieved 3 27, 2011, from Montana American Fisheries Society: http://www.fisheries.org/units/AFSmontana/ArcticGrayling.html

Montana Department of Environmental Quality. (2007). *Montana Nonpoint Source Management Plan.* Helena, Montana: Montana Department of Environmental Quality.

Montana DEQ. (September 2009). *Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan. M03-TMDL-02A.* Helena: Montana Department of Environmental Quality.

Montana DEQ. (March 2012). *Montana 2012 Final Water Quality Integrated Report.* Helena, MT: Montana Department of Environmental Quality.

Montana DEQ. (June 2009). *Upper and North Fork Big Hole River Planning Area TMDLs and Framework Water Quality Restoration Approach. M03-TMDL-01A.* Helena, Montana: Montana Department of Environmental Quality.

Montana Field Guide. (n.d.). *Arctic Grayling — Thymallus arcticus.* Retrieved 4 3, 2012, from Montana Natural Heritage Program and Montana Fish, Wildlife and Parks: http://FieldGuide.mt.gov/detail_AFCHA07010.aspx

Montana Field Guide. (n.d.). *Lake Trout — Salvelinus namaycush.* Retrieved 4 2, 2012, from Montana Natural Heritage Program and Montana Fish, Wildlife and Parks: http://FieldGuide.mt.gov/detail_AFCHA05050.aspx

Montana Field Guide. (n.d.). *Westslope Cutthroat Trout — Oncorhynchus clarkii lewisi.* Retrieved 4 2, 2012, from Montana Natural Heritage Program and Montana Fish, Wildlife and Parks: http://fieldguide.mt.gov/detail_AFCHA02088.aspx

Montana Fish, Wildlife and Parks and the U.S. Fish and Wildlife Service. (2006). *Canidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in the Upper Big Hole River.*

Montana Fish, Wildlife and Parks. (2012). *Canidate Conservation Agreement with Assurances (CCAA) for Fluvial Arctic Grayling in the Upper Big Hole River Annual Report and 5-Year Report (2006-2011) [DRAFT REPORT].* Montana Fish, Wildlife and Parks.

Montana Fish, Wildlife and Parks. (2012). *Statewide Fisheries Management Plan.* Montana Fish, Wildlife and Parks.

Montana Natural Heritage. (n.d.). *Montana Natural Heritage - Animals of Concern Report*. Retrieved 3 13, 2013, from http://mtnhp.org/SpeciesOfConcern/?AorP=a

NRCS, DNRC. (2003). *Lower Wise River Stream Corridor Assessment Final Report.* USDA Natural Resources Conservation Service, Montana Department of Natural Resources and Conservation.

Oasis Environmental. (2010). *Lower Wise River Assessment Survey and Prioritization.* Livingston, Montana: Oasis Environmental for Big Hole Watershed Committee.

PBS&J. (March 2008). *Lower Big Hole Irrigation Infrastructure Survey and Prioritization.* Bozeman, Montana: Big Hole Watershed Committee.

Schmitz, D. M. (2008). Using historic aerial photography and paleohydrologic techniques to assess long-term ecological response of two Montana dam removals. *Journal of Environmental Management* (doi:10.1016/j.jenvman.2008.07.028), 12.

Stagliano, D. (2010). *Freshwater Mussels in Montana: Comprehensive Results from 3 years of SWG Funded Surveys.* Helena, Montana: Montana Natural Heritage Program for Montana Fish, Wildlife and Parks.

Thatcher, T., & Boyd, K. (2005). *Flood Inundation Potential Mapping and Channel Migration Zone Delineation Big Hole River, Montana.* Bozeman, Montana: DTM Consulting, Inc. and Applied Geomorphology, Inc. for Big Hole Watershed Committee and 6 others.

U.S. Bureau of Land Management. (2008). *Beaverhead West Watershed Environmental Assessment MT-050-07-EA-70.* Dillon, Montana: U.S Bureau of Land Management Dillon Field Office.

U.S. Bureau of Land Management. (July 2, 2009). *East Pioneer Watershed Environmental Assessment DOI-BLM-MT-050-2009-0001-EA.* Dillon, Montana: U.S. Bureau of Land Management Dillon Field Office.

U.S. Bureau of Land Management. (2003). *Southwest Highlands Watershed Assessment Report.* Dillon, Montana: U.S. Bureau of Land Management Dillon Field Office.

US Forest Service. (2009). *Beaverhead Deerlodge National Forest Plan.* US Forest Service.

Watershed Consulting, LLC. (July 2010). *Big Hole River Thermal Infrared (TIR) Temperature Analysis Interpretive Report (Revised Final Report).* Bozeman, Montana: USGS Northern Rocky Mountain Science Center.

Link Addresses

FWP

Montana Field Guide Online - Montana FWP	http://fieldguide.mt.gov/statusCodes.aspx
Montana Statewide Fisheries Management Plan	http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/managementPlan.html

USFS

Beaverhead Deerlodge National Forest Plan	http://www.fs.usda.gov/detailfull/bdnf/landmanagement/planning/?cid=stelprdb5052938&width=full
Chapter 3: Forestwide Direction	http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5052768.pdf

BLM

BLM: Butte Field Office	http://www.blm.gov/mt/st/en/fo/butte_field_office.html
BLM Dillon Field Office	http://www.blm.gov/mt/st/en/fo/dillon_field_office.html

USFWS

Candidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in the Upper Big Hole River	http://www.fws.gov/mountain-prairie/species/fish/grayling/CCAA_June2006.pdf

DEQ

303d lists on CWAIC	http://cwaic.mt.gov/query.aspx
Middle-Lower Big Hole River Planning area TMDL and Framework	http://www.deq.mt.gov/wqinfo/TMDL/finalReports.mcpx
Montana DEQ's Exploring Your Aquatic Resources Mapping Program	http://www.deq.mt.gov/wqinfo/wetlands/exploringaquaticresources.mcpx
2012 Water Quality Integrated Report	http://cwaic.mt.gov/wq_reps.aspx?yr=2012qryId=102298

Conservation Groups & Related Non-Profit Organizations

American Fisheries Society (AFS) Montana Chapter	http://www.fisheriessociety.org/AFSmontana/
American Rivers	http://www.americanrivers.org/
Arctic Grayling Recovery Program (AGRP)	http://www.fishhabitat.org/
Center for Biological Diversity	http://www.biologicaldiversity.org/species/fish/Montana_fluvial_Arctic_grayling/index.html
Big Hole River Foundation (BHRF)	http://www.bhrf.org/
Big Hole Watershed Committee (BHWC)	http://bhwc.org/
Blackfoot Challenge	http://blackfootchallenge.org/
Ducks Unlimited, Inc.	http://www.ducks.org/
Missouri Headwaters Partnership (MHP)	http://mtwatersheds.org/Watersheds/WatershedGroups/MissouriHeadwatersPartnership.html
Montana Association of Land Trusts	http://www.montanalandtrusts.org/
Montana Audubon	http://www.mtaudubon.org/
Montana Land Reliance	http://www.mtlandreliance.org/
Montana Natural Heritage Program	http://mtnhp.org/

Montana Non-Profit Association (MNA)	http://www.mtnonprofit.org/
Montana Trout Unlimited (TU)	http://montanatu.org/
Montana Watershed Coordination Council (MWCC)	http://www.mtwatersheds.org/
Montana Wetlands Legacy Partnership	http://www.wetlandslegacy.org/
National Fish Habitat Action Plan	http://www.fishhabitat.org/
People and Carnivores	http://peopleandcarnivores.org/
Pheasants Forever - Beaverhead Chapter	http://montanapf.org/MTPF/mt-chapters/dillon-beaverhead-862/
Rocky Mountain Elk Foundation (RMEF) Montana	http://www.rmef.org/Conservation/WhereWeWork/Montana/
The Conservation Fund	http://www.conservationfund.org/
The Nature Conservancy (TNC)	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/montana/placesweprotect/big-hole-valley.xml
The Trust for Public Land	http://www.tpl.org/
Western Native Trout Initiative	http://www.westernnativetrout.org/
Wildlife Conservation Society (WCS)	http://www.wcs.org/
Wildlife Society - Montana Chapter	http://joomla.wildlife.org/Montana/
Agencies	
Montana Bureau of Mines & Geology (MBMG)	http://www.mbmg.mtech.edu/
Montana Department of Environmental Quality - Water Quality Bureau (MDEQ)	http://www.deq.mt.gov/wqinfo/default.mcpx
Montana Department of Natural Resources & Conservation (DNRC)	http://dnrc.mt.gov/
Montana Department of Transportation	http://www.mdt.mt.gov/
Montana Fish, Wildlife & Parks	http://fwp.mt.gov/
Natural Resources Conservation Service (NRCS)	http://www.mt.nrcs.usda.gov/
Natural Resource Damages Program (NRDP)	https://doj.mt.gov/lands/
US Forest Service Beaverhead Deerlodge National Forest - Wise River Ranger District (USFS)	http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6IeDdGCqCPOBqwDLG-AAjgb6fh75uan6BdnZaY6OiooA1tkqlQ!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfMjAwMDAwMDBBODBPSEhWTjBNMDAwMDAwMDA!/?ss=110102&navtype=forestBean
US Bureau of Land Management - Dillon Field Office (BLM)	http://www.blm.gov/mt/st/en/fo/dillon_field_office.html
US Bureau of Land Management - Butte Field Office (BLM)	http://www.blm.gov/mt/st/en/fo/butte_field_office.html
US Fish & Wildlife Service - Partners Program	http://www.fws.gov/partners/
US Geological Survey (USGS)	http://www.usgs.gov/
USGS Climate Change Center	https://nccwsc.usgs.gov/
Local Government & Conservation Districts	
Beaverhead County	http://www.beaverheadcounty.org/
Anaconda-Deer Lodge County	http://www.anacondadeerlodge.mt.gov/index.aspx

Butte-Silver Bow County	http://co.silverbow.mt.us/
Madison County	http://madison.mt.gov/
Ruby Valley Conservation District	http://www.rvcd.org/
Educational Institutions	
University of Montana Western Environmental Studies & Biology Programs	http://www.umwestern.edu/
Montana Tech	http://www.mtech.edu/
University of Montana	http://www.umt.edu/future.aspx
Avian Science Center	http://avianscience.dbs.umt.edu/default.php
Montana State University	http://www.montana.edu/
Montana State Fisheries Cooperative Unit	http://www.montana.edu/mtcfru/