Watershed Restoration Plan for the Upper Clark Fork River Tributaries

Prepared By The Watershed Restoration Coalition For The Upper Clark Fork River

In Cooperation With Our Watershed Partners

December 13, 2012

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NOTE: The Watershed Restoration Coalition Watershed Restoration Plan was created by first securing the views and objectives of key agencies, local organizations and individual landowner participation. In this process, the area Conservation Districts, the Clark Fork Coalition, Trout Unlimited and the Natural Resources Conservation Service were key contributors.

1. Executive Summary

The Upper Clark Fork River Watershed Restoration Plan represents the combined efforts of the Watershed Restoration Coalition of the Upper Clark Fork River (WRC) and its partners; particularly the Mile High (MHCD) and Deer Lodge Valley Conservation Districts (DLVCD), the Clark Fork Coalition (CFC), and Trout Unlimited (TU) as well as other agencies and organizations which participate in the WRC's Watershed Council.

The Watershed Restoration Plan is intended to implement the findings of the Upper Clark Fork Tributaries TMDLs and Framework Watershed Water Quality Improvements Plan completed in 2010 by the Montana Department of Environmental Quality. That document forms the basis of much of the information contained herein and is referenced for those who wish to have a more in-depth look at the issues and solutions proposed in the basin. However, the Watershed Restoration Plan also recognizes other resource issues and solutions which are concerns of the WRC' partners and landowners. Therefore, these additional resource concerns and proposed solutions are therefore also addressed in the plan.

The planning area included in this plan includes all Upper Clark Fork tributaries from the headwaters of Silver Bow Creek above Butte to the Flint Creek confluence near Drummond. The Little Blackfoot River landowners have just joined the WRC. This plan provides some preliminary focus to the Little Blackfoot drainage; however, that tributary will be addressed in more depth through an addendum to this plan beginning in 2012. This planning area is bounded by the Boulder Mountains to the east, the Highland and Anaconda Pintler Ranges to the south, the Flint Creek Range to the west, and the Garnet Range to the north. The total area is approximately 1,490 square miles, minus the Little Blackfoot drainage, with land ownership consisting of federal, state, county, city, and private agricultural and timber lands.

In 1999 under the leadership of the Deer Lodge Valley and Mile High Conservation Districts, the WRC began its mission to restore impacted watersheds and to protect open space in the Upper Clark Fork Basin. The WRC expanded its mission in 2001 to implement a much broader watershed restoration program leveraging multiple funding resources. Since that time, the Clark Fork Coalition (CFC) and Trout Unlimited (TU) have begun to participate directly with the WRC in project planning and implementation.

While the Upper Clark Fork Tributaries Total Maximum Daily Load (TMDL) and Framework Watershed Water Quality Improvement Plan focuses on thirty tributaries, the WRC Watershed Plan focuses on only eleven drainages considered key by the WRC, the CFC, and TU.

2. Introduction

Watershed Location & Overview

The Watershed Restoration Coalition of the Upper Clark Fork River (WRC) works in Granite, Silver Bow, Powell, and Deer Lodge counties. The *Upper Clark Fork Tributaries Total Maximum Daily Load (TMDL) and Framework Watershed Water Quality Improvement Plan,* completed in 2010 (DEQ, 2010) sets TMDL targets and sketches a "framework" for future water quality improvement work in the TMDL Tributary Planning Area (TPA). This planning area includes all Upper Clark Fork tributaries in a planning area from the headwaters of Silver Bow Creek above Butte to the Flint Creek confluence near Drummond (except for the Little Blackfoot River). This planning area is bounded by the Boulder Mountains to the east, the Highland and Anaconda Pintler Ranges to the south, the Flint Creek Range to the west, and the Garnet Range to the north. The total area is approximately 1,490 square miles, minus the Little Blackfoot drainage, with land ownership consisting of federal, state, county, city, and private agricultural and timber lands. Thirty-three tributary streams feed the Clark Fork River in this planning area. This document summarizes the WRC's plan for restoring water quality in these tributaries, fulfilling the DEQ and Clean Water Act requirements for a Watershed Restoration Plan.

Figure 1.

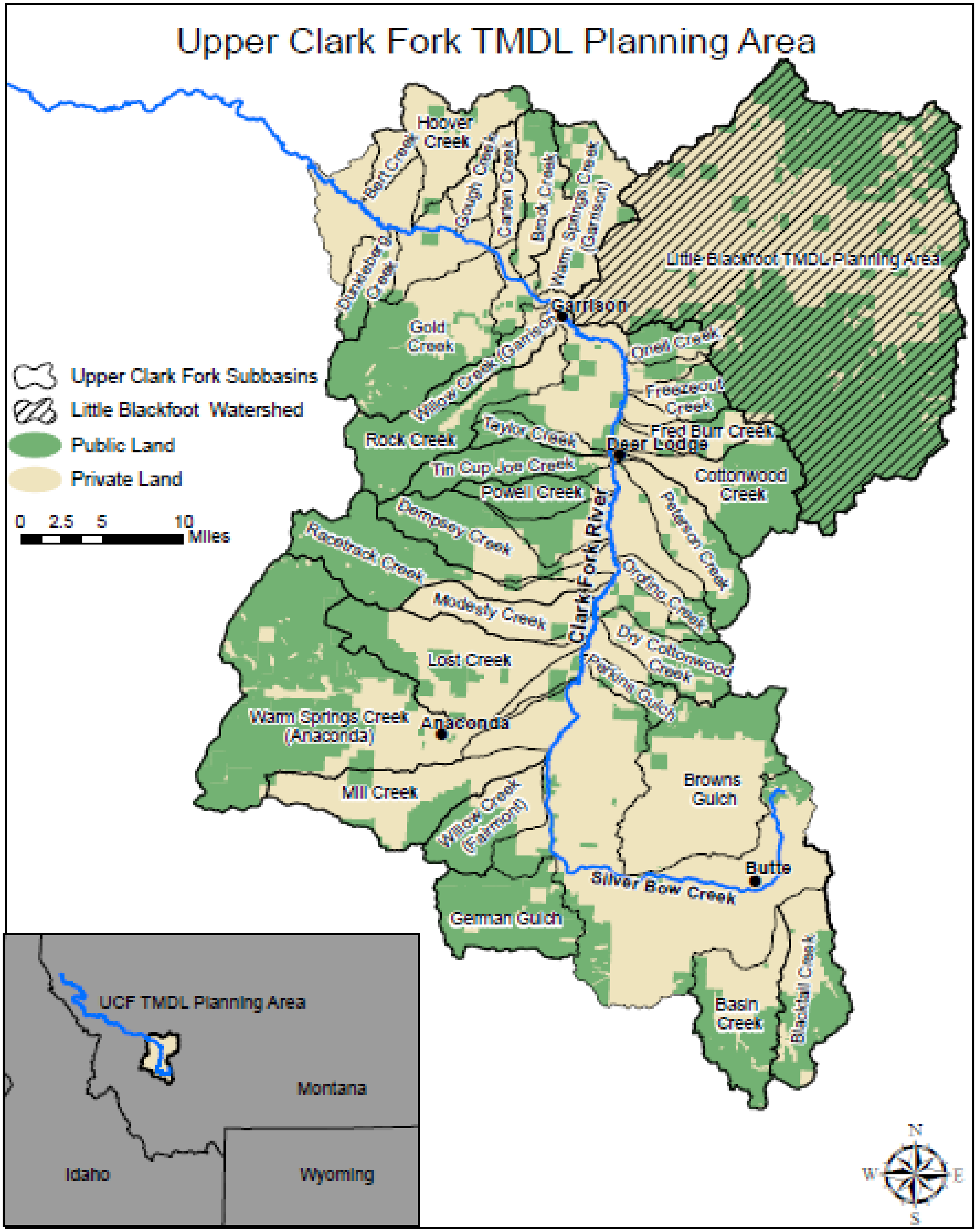
Upper Clark Fork TMDL Planning Area
Upper Clark Fork Subbasins
Little Blackfoot Watershed
Public Land
Private Land
0 2.5 5 10 Miles
Hoover Creek
Bert Creek
Gough Creek
Carten Creek
Brock Creek
Warm Springs Creek (Garrison)
Little Blackfoot TMDL Planning Area
Dunkleberg Creek
Garrison
Gold Creek
Willow Creek (Garrison)
Oneil Creek
Freezeout Creek
Fred Burr Creek
Rock Creek
Taylor Creek
Deer Lodge
Tin Cup Joe Creek
Cottonwood Creek
Powell Creek
Dempsey Creek
Peterson Creek
Racetrack Creek
Clark Fork River
Orofino Creek
Modesty Creek
Dry Cottonwood Creek
Lost Creek
Perkins Gulch
Warm Springs Creek (Anaconda)
Anaconda
Mill Creek
Willow Creek (Fairmont)
Browns Gulch
Butte
Silver Bow Creek
German Gulch
Basin Creek
Blacktail Creek
UCF TMDL Planning Area
Montana
Idaho
Wyoming
N
W
E
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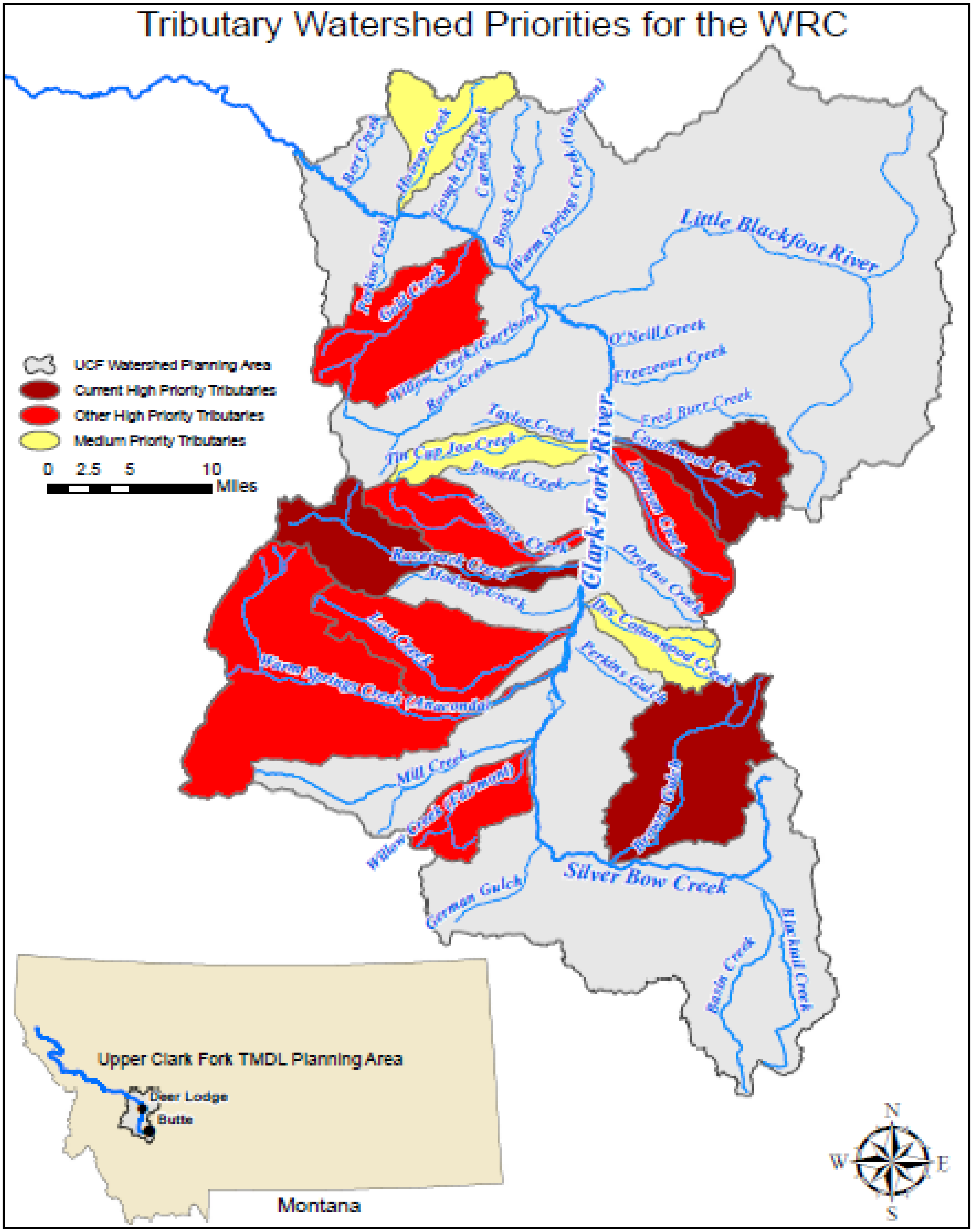
Figure 2.


Tributary Watershed Priorities for the WRC
Little Blackfoot River
Clark Fork River
Silver Bow Creek
UCF Watershed Planning Area
Current High Priority Tributaries
Other High Priority Tributaries
Medium Priority Tributaries
0 2.5 5 10
Miles
Upper Clark Fork TMDL Planning Area
Deer Lodge
Butte
Montana
N
S
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W

Watershed Restoration Coalition History

The Watershed Restoration Coalition of the Upper Clark Fork (WRC) began its mission in 1999 to restore impacted watersheds and to protect open space in the Upper Clark Fork River Basin. The WRC expanded its mission in 2001 to implement a much broader watershed restoration program leveraging multiple funding resources.

Since its inception, the WRC established a project planning and monitoring system which clearly outlines the goals, objectives, tasks, and deliverables on each of its projects. Since April of 2011, the WRC has a project coordinator in place, a bookkeeper, and an Executive Director who oversees all of the WRC's activities. These staffing changes have allowed for closer project oversight while the organization expands its projects and programs.

Over the course of its history, the WRC has led and completed large restoration projects and numerous small projects, often in close partnership with NRCS, conservation districts, and other non-profits. Some examples are:

The East Valley South Half Watershed project (2003-2006) where fifteen off-stream stockwater pipelines were installed to improve grazing management on seven large ranches (with NRCS); several corrals were moved off stream and monitoring was established for uplands and riparian sites.

The WRC was the lead local entity for completion of the Upper Clark Fork River Tributaries TMDL (2007-2010) and is leading the collaborative group working with the US Forest Service on the East Deer Lodge Forest Stewardship Project affecting 40,000 acres of federal lands (2008-2011).

The WRC is leading an integrated watershed restoration project with multiple landowners on Cottonwood Creek, including winterized stockwater pipelines and stock tanks, new fish-friendly irrigation diversions, a fish screen/ irrigation pipeline/ pivot irrigation system, and riparian enhancement projects. The Natural Resource Damage Program, NRCS, and NFWF are key funding partners. In 2011 funding was secured from the National Fish and Wildlife Foundation for a fish passage project to connect Cottonwood Creek to the Clark Fork River.

These projects are an example of the WRC's vision of integrated tributary stream restoration; improving instream flows, fish passage, riparian health and uplands, while strengthening agriculture and forestry. For the last two years, the WRC has contracted with Trout Unlimited to complete an irrigation infrastructure mapping project throughout the upper Clark Fork to address fish passage issues on a valley-wide basis. The WRC has cooperated with the Clark Fork Coalition for the last two years by helping supervise two summer field technicians conducting riparian and stream assessments on eleven priority tributaries. These two inventory and assessment projects built a foundation for planning integrated restoration projects on these key eleven streams in the coming years. The WRC's strategy includes recruiting key landowner Board members from these priority streams to facilitate landowner relationship-building in those drainages.

Watershed Restoration Coalition Goals & Objectives

Mission Statement The WRC is dedicated to restoring the natural resources while protecting the heritage and open spaces of the Upper Clark Fork River Basin.

Values To support and preserve the way of life in the Upper Clark Fork River Basin, especially ranching and /or farming, in concert with balancing the needs of natural resource conservation.

WRC Goals

- The overall goal of the WRC is to maintain the resources of the Upper Clark Fork River Basin (UCFRB) for both present and future generation:
- More specifically:
- Assess local and regional natural resources, as practical to implement reasonable means of preserving and improving the resources of the basin.
- Restore water quality, water quantity, grazing lands, riparian habitat, soil health, and fish and wildlife habitat.
- Promote sound and efficient use of surface and ground water.
- Promote timber and other natural resources management for sustainable production and aesthetic values.
- Increase the capacity of the organization to better ensure the success of the WRC's goals.
- Promote and protect the maintenance of open space and regional heritage.

WRC Objectives

- Inform landowners and the public about natural resource issues and prioritize basin-scale restoration needs for on-the-ground implementation.
- To inventory and document resource conditions for planning restoration activities and monitoring.
- To seek and use all methods available to control the spread of noxious weeds in a manner that is consistent with improving the land and range ecology.
- To promote sound game and fish management that will ensure the existence of sustainable numbers of game birds, game animals, game fish, and other native species and try to maintain them in balance with the competing land uses and habitat that support these species.
- To develop solutions to problems which will protect agriculture, roads, timber harvest and other existing land uses. Solutions that will not damage, but improve and protect natural resources.
- To work with federal, state, city, and county representatives to coordinate watershed improvement activities in a feasible and economic manner.
- To work with agencies and other organizations to help secure funding to improve natural resources in the watershed area.
- To work with neighboring associations on common problems in bordering and overlapping areas.

WRC Management Strategies

Twelve strategic cornerstones are used by the WRC to restore watersheds:

1. Fiscal responsibility
2. Leadership: partnering, collaboration & outreach
3. Aggressively seek and retain funding
4. Access to private lands
5. Operate with clear priorities and project targeting
6. Social and scientific objectivity
7. Communicate in rural Montana dialects
8. Sound scientific assessment, planning & design
9. Monitoring restoration projects
10. Adaptive management
11. Patience & perseverance
12. Honor the people that live in the watershed

WRC Priority Resource Issues

The WRC's resource concerns are built upon the philosophy that watershed processes and partnerships should be designed to protect and enhance the ecosystem while protecting local economic interests. Both healthy natural resources and economic prosperity can be unified in the UCFRB.

The focus of the WRP is on the tributaries to the Clark Fork River, as the main stem of the Clark Fork is being addressed by the Environmental Protection Agency and the Montana Department Of Environmental Quality as well as the Montana Natural Resource Damage Program.

Riparian Health/Conservation: The WRC is concerned with protecting and preserving riparian corridor health throughout the UCFRB. Although 99 percent of Montana's acreage is dry land, riparian lands support 90 percent of the state's 235 bird species. About 45 percent of the state's birds can't exist except in lush stream bank habitats according to the USFWS. Many other wildlife species also depend heavily on riparian areas for food and shelter. Healthy riparian corridors protect water quality, protect stream banks from soil loss, and provide shading and habitat for aquatic resources.

Range Health/Conservation: The WRC is concerned with protecting rangeland throughout the UCFRB. Rangeland provides herbaceous cover and food for birds, wildlife, and livestock. Conserving rangeland through prescribed grazing and sustainable agricultural operations protects local economic needs and native species.

Water Quality Restoration: Water is the life blood of the UCFRB's residents, agricultural operations, and aquatic resources. The WRC is concerned with the amount of water in streams and rivers in the UCFRB. During periods of drought, over allocated water supplies are impacted. Through proper assessment and planning, water conservation and voluntary sharing of water is needed to maintain minimum flows and protect agricultural interests in the future.

Fishery Conservation: The WRC is concerned with enhancing native fish species, such as westslope cutthroat trout in headwaters, and improving recreational fisheries on lower reaches of tributary streams.

Wildlife and Avian Species Conservation: The WRC is concerned with wildlife and avian species conservation as well as management in terms of balancing agricultural interests and watershed-scale ecosystems in the UCFRB. Healthy and sustainable wildlife and bird populations benefit everyone and help maintain a high quality of life.

Open Space & Agricultural Heritage Protection: Protecting and enhancing family agricultural operations in the UCFRB is the primary concern for the WRC. The WRC is committed to keeping lands in the UCFRB in active agriculture and implementing Best Management Practices (BMP's) and restoration projects in target watersheds as well as on the scale of the entire UCFRB. The WRC is committed to working in partnership with landowners, stakeholders, and agency personnel to find common ground that will protect the agricultural heritage and land use in the UCFRB.

Forest Health/ Conservation: The WRC is concerned with protecting forests from invading insects and encouraging BMP's for harvesting of timber on all lands. In addition, the WRC is concerned with hazardous fuels reduction in the UCFRB and pre-commercial thinning projects that protect against catastrophic fire losses.

Invasive Species Management: Loss of native range and riparian vegetation communities is a major concern for the WRC. Livestock and wildlife competition are exacerbated when noxious weeds take over native habitat. The WRC is committed to integrating weed management for all of its projects and educating project partners on the importance of mitigating noxious weeds.

Soil Health: "The capacity of a soil to function within ecosystem and land use boundaries, to sustain productivity, maintain environmental quality, and promote plant and animal health." In general, soil health and soil quality are considered synonymous and can be used interchangeably**.** The WRC maintains that protecting and maintaining soil health is a key concern in the watershed.

Connected Ecosystems and Conservation: The WRC maintains that natural resource conservation should integrate ridge to ridge watershed planning with emphasis on natural restoration techniques. Also, the WRC maintains watershed projects work best when efforts link ecosystem restoration and sustainable agricultural practices.

3. Existing Watershed Assessments

Upper Clark Fork Tributaries TMDLs and Framework Watershed Water Quality Improvement Plan

The following summary is intended to only present an overview of the key findings of the Upper Clark Fork Tributaries TMDLs and Framework Watershed Water Quality Improvement Plan. For more information, please refer to the Montana Department of Environmental Quality web site at where the document can be accessed electronically.

The Upper Clark Fork Tributaries TMDLs and Framework Watershed Water Quality Improvement Plan documents present a Total Maximum Daily Load (TMDL) and framework water quality restoration for 78 pollutant-water body combinations on nineteen impaired tributaries in the Upper Clark Fork River TMDL Planning Area (TPA). The Upper Clark Fork TPA extends from Butte to Drummond, Montana, and includes Antelope, Beefstraight, Brock, Cable, Dempsey, Dunkelberg, Gold, Hoover, Lost, Mill, Modesty, Peterson, Tin Cup Joe, Warm Springs (near Anaconda), Warm Springs (near Phosphate), Willow, and Storm Lake creeks, and German Gulch and Mill-Willow Bypass.

The Upper Clark Fork TMDL Planning Area is located in Granite, Silver-Bow, Powell, and Deer Lodge counties and includes the Clark Fork River and its tributaries from Butte to the Flint Creek confluence near Drummond. The TPA is bounded by the Boulder Mountains to the east, the Highland and Anaconda Pintlar Ranges to the south, the Flint Creek Range to the west, and the Garnet Range to the north. The total area is 955,622 acres, or approximately 1,493 square miles, with land ownership consisting of federal, state, and private lands.

Water Quality Base Issues

Sediment

Sediment was identified as a cause of impairment of aquatic life, coldwater fisheries, and/or public contact recreation in Antelope, Brock, Cable, Dempsey, Hoover, Peterson, Tin Cup Joe, Warm Springs (near Phosphate), Willow and Storm Lake creeks. Sediment is impacting beneficial water uses in these streams by altering aquatic insect communities, reducing fish spawning success, and increasing levels of turbidity. Water quality restoration goals for sediment in these stream segments were established on the basis of stream morphology, fine sediment levels in trout spawning areas, pool quality and riparian condition. The DEQ believes that once these water quality goals are met, beneficial uses currently impacted by sediment will be restored.

Metals

Metals related impacts were identified as a cause of impairment to the beneficial uses of agriculture, aquatic life, coldwater fisheries, and drinking water in Beefstraight, Dunkelberg, Gold, Lost, Mill, Modesty, Peterson, Warm Springs (near Anaconda), and Willow creeks, and in German Gulch and Mill-Willow Bypass. Identified metals affecting some or all of these streams are Arsenic, Cadmium, Copper, Cyanide, Iron, Lead, Selenium, and Zinc. Water quality goals for metals are based on Montana's numeric water quality standards for these metals. Metals loads were determined by the collection and review of water chemistry data throughout each of the listed watersheds. Sampling locations were chosen to observe the temporal metals loading fluctuations (high flow, low flow, and storm events) and to identify source areas or distinct sources and include tributary drainages, abandoned mines, and historic atmospheric deposition. Metal load reductions necessary to meet TMDL based on the known data range from 8% to 96% depending on the stream and pollutant combination.

Temperature

Temperature related impacts were identified as a cause of impairment to the beneficial uses of aquatic life and coldwater fisheries in Peterson Creek. Water quality restoration goals to meet the temperature standard for Peterson Creek include improving riparian shade, maintaining current stream dimensions, improving irrigation infrastructure, and reducing human caused surface water inflow. The DEQ believes that once these water quality goals are met, all water uses currently impacted by temperature will be restored.

Temperature loads were quantified using a QUAL2K water quality model which investigated various scenarios to identify the current condition of Peterson Creek, and the potential improvement in temperature under certain circumstances. The model showed temperature reductions capable of as much as 13 degrees in some sections of the stream under certain situations.

Proposed Best Management Practices

Recommended strategies for achieving the pollutant reduction goals of the Upper Clark Fork Tributaries TMDLs are also presented in this plan.

They include Best Management Practices (BMP) for agriculture, timber harvests, roads, and mining lands as well as expanding riparian buffer areas and using other land, soil, and water conservation practices that improve the condition of stream channels and associated riparian vegetation.

Specific Best Management Practices identified for implementation in the plan include:

- Re-naturalize /stabilization of stream channels (riparian habitat improvements)
- Instream flow augmentation /enhancement through irrigation efficiency/irrigation management projects
- Modification or replacement of existing diversions
- Grazing management
- Noxious weed control
- Forest health improvements
- Road/ transportation corridor management (ditch relief culverts, stream crossing improvements, road maintenance)

Implementation of most water quality improvement measures described in this plan is based on voluntary actions of watershed stakeholders. Ideally, the TMDL and associated information is designed to be used by the WRC and its partners as a tool to help guide and prioritize local water quality improvement activities. These improvement activities can be documented within a watershed restoration plan consistent with DEQ and EPA recommendations.

It is recognized that a flexible and adaptive approach to most TMDL implementation activities may become necessary as more knowledge is gained through implementation and future monitoring. The plan includes an effectiveness monitoring strategy that is designed to track future progress towards meeting TMDL objectives and goals and to help refine the plan during its implementation.

Landowner Surveys

In the late summer of 2011, the WRC developed a landowner survey which was mailed to all landowners in the Upper Clark Fork. The survey was designed to solicit landowner comments on various land management practices and land management issues from their perspective. Over 400 surveys were mailed out, with a return rate of 22%, which is high for mailed surveys. This data was incorporated into the strategic planning process. The WRC is using the survey results to plan for the types of management activities to be advocated in the priority tributaries. The survey results are available for review as attachment one (1) of this document.

WRC Priority Tributary Summaries

Database Development: The WRC has been working with various partners, the DEQ, the CFC, and TU, to assess the condition of streams on priority tributaries in the Upper Clark Fork. During summers of 2010-2011, two field technicians work under the supervision of the Project Coordinator to collect data on flows, water temperatures, riparian condition, geomorphology, fish habitat, and woody vegetation in ten priority tributaries. This large quantity of data required a well-structured data base for proper data management. The WRC worked with the Clark Fork Coalition to hire a consultant and develop the data base in the fall of 2011. The Microsoft ACCESS 2010 database is now up and functioning, with all 2010-2011 data entered, and includes standard queries and PDF maps of the water sheds. In the future, the WRC may integrate this database with a geographic information system. In addition to being able to access the data at the WRC web site, hard copies of the tributaries' summaries are attached to this document. (Attachment 2)

The WRC is utilizing the Montana DEQ's TMDL report that has identified 19 impaired water bodies within the Upper Clark Fork River Watershed Basin. However, by using the data compiled through the work of the interns, the WRC has selected eleven tributaries as high priority over the next five years. Attachment 3 outlines the priority setting process.

4. Additional Technical and Financial Resource Needs

Flow Targets

The WRC recognizes that competition for scarce water resources can lead to conflicts and poor water management. Flow targets are a tool used in some areas to balance agricultural needs and aquatic health concerns (primarily fisheries). The target is a flow level which partners strive to achieve by modifying withdrawals during low-water periods. Usually flow targets are set by hydrologic and biological analysis, and then negotiated with water users to arrive at a feasible target. In the Upper Clark Fork, Montana Fish Wildlife and Parks set some flow targets in 1986 using a hydrologic and habitat analysis called "wetted perimeter method" (Montana FWP, 1986 "*Upper Clark Fork Flood Targets for Instream Flow,"* Helena), but many streams lack targets, and existing targets are not used in management. Clearly established targets set using a transparent and participatory process with water users, could lead to better water management and better aquatic health. Estimated cost for establishment of flow targets is $150,000.00.

Biological Goals

The WRC believes that an important tool for developing landowner support for fish and wildlife management is clear biological goals. Substantial resources are being invested by NRDP and other programs in fisheries restoration in the Upper Clark Fork. Clear goals for restoring the depleted fisheries, tributary by tributary, would be helpful to organizations like the WRC which need to prioritize among various water resource conservation projects. The WRC recognizes that landowners have little information about fisheries, fish habitat requirements, and threats to native fish. Setting clear biological goals for fisheries restoration could help improve communications between landowners, conservation groups, and agencies. This issue is now being addressed by Trout Unlimited at an estimated cost of $25,000.00.

Additional Staffing

Recognizing the need to coordinate and enhance watershed restoration activities in the Upper Clark Fork River Watershed, the Watershed Restoration Coalition (WRC), Deer Lodge Valley CD (DLVCD), Mile High CD (MHCD), the Clark Fork Coalition (CFC), Trout Unlimited (TU), and the Natural Resources Conservation Service (NRCS) have joined together to develop and implement a "Joint Watershed Restoration Initiative'' in the Upper Clark Fork River Watershed. The initiative's focus is to increase financial and technical assistance to Upper Clark Fork River Watershed landowners, while coordinating project development and implementation activities to increase project benefits.

The partnering organizations currently work together on a cooperative basis to individually deliver program and project assistance to landowners. The Joint Watershed Restoration Initiative marks the first time the partnering organizations will cooperate to create a shared staff position dedicated to developing and implementing a plan of work designed to increase technical and financial assistance to area landowners.

The WRC and its partners are now in discussions with the NRCS to begin establishing the position. Estimated cost for the cooperative position is $50,000.00 annually.

Community Involvement Strategy

The WRC recognizes the fact that awareness of the organization's existence and purpose is based in a relatively small number of invested landowners, agencies, and organizations. This fact creates the need to engage a broader base in order to be successful in wide spread dissemination of best management practice information and on the ground project development. Beginning in 2012, the WRC will begin an outreach and education effort aimed at engaging a larger audience by using the assistance of an AmeriCorps volunteer. Estimated annual cost for outreach is $15,000.00.

5. Five-Year Plan

The objective of the five-year plan is to restore water quality and healthy aquatic ecosystems in the key tributaries while promoting continued livestock grazing, irrigated crop production, and forest management activities in the basin. Such an approach will improve water quality and quantity while also leading to improved fisheries, wildlife, and recreation opportunities. For the next five years, the WRC will focus its restoration efforts in the eleven (11) key tributaries identified in the Watershed Assessment section of this document. The remaining tributaries will be addressed after prioritization by the partners or if issues or requests for assistance arise prior to commencing coordinated planning actives in the remaining tributaries.

Focus areas and priority resource concerns:

<u>Tributary Riparian Issues</u>

A) Water quality (sediment, nutrients, temperature, metals)
B) Channel alterations/eroding banks/sedimentation
C) Riparian vegetation health
D) Historic metals mining
E) Dewatering/in-stream flow
F) On farm irrigation/efficiency
G) Drought management
H) Invasive noxious weed control
I) Fisheries enhancement
J) Monitoring

<u>Upland Resource Concerns</u>

A) Conifer encroachment
B) Rangeland health
C) Forest health
D) Soil health
E) Unpaved road erosion control near streams
F) Road maintenance and runoff BMP's
G) Invasive noxious weed control

<u>Cross Cutting Issues</u>

A) WRC operations
B) Board operations
C) Partnerships
D) Funding & Fundraising
E) Outreach & Education

Interim Progress Indicators for WRP implementation

Each year the WRC will hold a WRP implementation review at the November Board of Directors meeting in order to complete an annual summary report. Measurable accomplishments will be reviewed and activities related to the accomplishments documented. The measurable milestone used for each measurable accomplishment will be those actions proposed in the WRP. If the proposed strategies and timelines are not being met, the WRC will make an in-depth review of the existing situation and take the necessary corrective action.

Milestones

The following annual milestones have been set for the WRP.

- Work with a minimum of 7 new landowners/year for each of the first 5 years on a total of:
- 4,000 linear feet of Re-naturalized stream channels & accompanying riparian fencing
- Replace 10 irrigation diversions
- Install 4 fish screens
- Replace 5 culverts
- Complete upland sediment management plans for 5 new landowners for a total of 5,000 acres with accompanying noxious weed control, grazing management, and irrigation management plans and other key land use issues to be dependent on the individual agricultural unit.

6. Measurable Accomplishments on Priority Tributaries

The following section outlines specific measurable project accomplishments identified in each of the key tributaries by the WRC, landowners and partners. The identified projects will be the primary focus of the WRC for the five-year planning period covered by this document. Potential projects will be reviewed for other tributaries in the watershed if an important project or concern arises, however, due to the limitation of staff and resources, the key tributaries will be the primary focus for the WRC and its partners. The WRC and its partners will work together to decide the lead organization on a given drainage and specific objectives. This has been done for the first three (3) tributaries. The partners will meet to determine responsibilities for the remaining tributaries prior to commencing joint restoration efforts in that tributary. The time period all actions are intended to be accomplished in extends from 2012 to 2017.

The top three tributaries while not identified as impaired do have significant temperature and sediment issues. They are also the top Natural Resource Damage Program tributaries due to key fisheries and flow issues. The secondary tributaries for the WRC include seven tributaries identified as impaired.

The Little Blackfoot River group of landowners were recently added to the WRC. Projects identified in the Little Blackfoot are therefore considered to be preliminary. The Little Blackfoot River TMDL is nearing completion by the DEQ (late 2011). The WRC will engage in separate watershed restoration planning activity in 2012 in that drainage upon the completion of the TMDL. The completed Little Blackfoot WRP will then be added as an addendum to this document.

PRIORITY TRIBUTARIES:

Browns Gulch

Background: Browns Gulch, a tributary to Silver Bow Creek (which is a headwater tributary to the Clark Fork) originates in the Boulder Mountains near the Continental Divide and flows for about 18 miles to Silver Bow Creek. Browns Gulch drains an area of over 80 square miles and contains the major tributaries Alaska Gulch, American Gulch, Flume Gulch, Telegraph Gulch, Meadow Gulch, Hail Columbia Gulch and several others. Grazing and irrigated hay productions, as well as past and present timber harvest, are common land uses within the basin. Few mines exist, and those are near the lower reaches of Browns Gulch and its tributaries. See Attachment 4.

Objectives:

a) Sediment and nutrient reduction-stream banks, agricultural land and roads
b) Increase fish passage
c) Instream flow enhancement
d) Noxious weed control
e) Forest health
f) Irrigation water management improvements
g) Grazing management

Strategies and Outcomes:

1. Re-naturalize the stream channel with four (4) or more landowners for a total over 8,000 linear feet; reduce sediment inputs from eroding stream banks.
2. Modify or replace fourteen (14) existing diversions for fish passage
3. Replace three or more culverts and install new road drainage culverts to reduce sediment discharge to streams.
4. Develop a list of potential fish screening projects; install at least one pilot fish screen.
5. Work with two or more landowners to develop viable strategies to enhance in-stream flow
6. Work with Butte Silver Bow Public Works to improve road drainage/BMPs
7. Include noxious weed control as a part of all project planning & implementation while developing a joint approach with the Butte Silver bow Weed Board
8. Seek funding from federal and state sources for project implementation.
9. Develop new conservation plans on a minimum of five (5) landowners which address the above issues as well as forest health, irrigation water management and grazing management.

Responsibility:

- WRC: coordinate project implementation and fund initiatives as well as stream channel re-naturalization projects
- Trout Unlimited: lead fish passage initiatives
- Clark Fork Coalition: lead instream flow enhancement initiatives
- Butte Silver Bow Public Works, execute county road improvement projects
- Butte Silver Bow Weed Board, execute noxious weed control connected with all projects
- The partnership's Project Conservationist will be responsible for the development of ranch conservation plans, in coordination with NRCS.

Timelines: 2012-2014

Cottonwood Creek

Background: Cottonwood Creek descends from the Boulder Mountains and flows westward through the East Deer Lodge Valley, draining about 42 square miles. The creek enters the Clark Fork on the Grant-Kohrs Ranch, near the city of Deer Lodge, after flowing over six miles through predominantly private agricultural lands. Cattle grazing and pasturing, hay production, urbanization, timber harvest, and historic mining are the dominant land uses in the watershed. Private ownership comprises 30% of the watershed while 69% of the watershed is under federal ownership. State government manages the remaining 1%. The Beaverhead Deer Lodge National Forest manages the upper watershed containing the creek's four headwater tributaries: North, Middle and South Cottonwood, and Baggs Creek. See Attachment 4.

Objectives:

a) Increase fish passage/reconnect to Clark Fork
b) Instream flow enhancement: summer and winter/spring
c) Reduce nutrient/sediment inputs
d) Re-naturalize/protect channel
e) Noxious weed control
f) Forest health
g) Irrigation water management improvements
h) Grazing management/ off-stream water development

Strategies:

1. Re-naturalize the stream channel with one (1) landowner for a total of 2,200 linear feet.
2. Modify or replace eleven (11) existing diversions for improved fish passage with a minimum of seven (7) landowners/water users.
3. Develop a minimum of three (3) fish screening projects.
4. Work with the Montana Department of Transportation to address I- 90 culvert fish passage.
5. Work with City of Deer Lodge and Powell County to improve aquatic/riparian habitat in town
6. Work with three landowners to develop feasible strategies to enhance stream flow
7. Include noxious weed control as a part of all project planning & implementation while developing a joint approach with the Powell County Weed Board
8. Seek funding from federal and state sources for project implementation.
9. Develop new conservation plans with a minimum of three landowners which address the above issues as well as forest health, irrigation water management and grazing management

Responsibility:

- WRC: coordinate project implementation and fund development initiatives as well as stream channel re-naturalization projects
- Trout Unlimited: lead irrigation fish passage initiatives
- Clark Fork Coalition: lead instream flow enhancement initiatives
- WRC/Montana Department of Transportation, I-90 culvert improvements
- Powell County Weed Board, noxious weed control connected with all projects
- The partnership's Project Conservationist will be responsible for the development of conservation plans in coordination with NRCS.

Timelines: 2012-2014

Racetrack Creek

Background: Racetrack Creek has its headwaters in the Flint Creek Range. It drains an area of about 51 square miles and flows for approximately 23 miles until joining with the Clark Fork River. The lower portion of the watershed is used mainly for agricultural purposes while the upper section is owned by the Forest Service and used for recreation. Racetrack Creek and several of the high lakes within the basin are used extensively for agricultural irrigation. See Attachment 4.

Objectives:

a) Irrigation water management improvements
b) Increase fish passage
c) In-stream flow enhancement
d) Riparian habitat improvement
e) Channel re-naturalization/stabilization
f) Noxious weed control
g) Grazing management improvements

Strategies:

1. Assist landowners to upgrade irrigation water conveyance, improving efficiency and saving energy by developing multi-landowner canal/pipeline projects (Cement/Morrison ditches)
2. Re-naturalize the stream channel and improve riparian habitat on a minimum of three (3) landowners for a total of 20,000 linear feet.
3. Modify or replace a minimum of nine (9) existing diversions, some in conjunction with fish screening projects ,with a minimum of five (5) landowners
4. Improve riparian habitat/grazing management/off-stream stockwater with a minimum of three (3) landowners
5. Buy/lease storage rights on Racetrack Lake and other available water rights to enhance flows.
6. Install one (1) crossing/siphon at Whalen Ditch
7. Include noxious weed control as a part of all project planning & implementation while developing a joint approach with the Powell County Weed Board
8. Seek funding from federal and state sources for project implementation.
9. Develop new conservation plans on a minimum of four landowners which address the above issues as well as irrigation water management and grazing management.

Responsibility:

- WRC: coordinate project implementation and fund development initiatives as well as stream channel re-naturalization and riparian habitat/grazing projects
- Trout Unlimited: lead fish passage initiatives
- Clark Fork Coalition: lead instream flow enhancement initiatives, including surface water rights & storage water right purchases, and energy saving projects
- Powell County Weed Board, noxious weed control connected with all projects
- The partnership's Project Conservationist will be responsible for the development of conservation plans in coordination with NRCS.

Timelines: 2012-2014

Note: Although the WRC will address issue and projects in the following drainages focused work will begin on the following tributaries beginning 2014-2017

Dempsey Creek

Background: Dempsey Creek originates in the Flint Creek mountain range and drains an area encompassing about 36 square miles southwest of the town of Deer Lodge. The creek flows for 16.5 miles until it reaches the Clark Fork River, two and a half miles north of the community of Dempsey. The land in Dempsey Creek is mainly shared by U.S. Forest Service, the Montana State Prison, and private landowners, and is used for National Forest recreation, grazing and irrigated agriculture. The State Prison uses large quantities of irrigation water from Dempsey Creek. The large amount of private land has impeded comprehensive environmental assessments of the watershed in the past.

Objectives:

a) Sediment reduction
b) Increase fish passage
c) Irrigation water management to prevent dewatering
d) Sediment reduction
e) Flood prevention
f) Noxious weed control
g) Forest health
h) Grazing management

Preliminary Strategies:

1. Re-naturalize the stream channel with a minimum of three (3) landowners for a total of over 4,000 linear feet.
2. Modify or replace a minimum of six (6) existing diversions in conjunction with screening projects to improve fish passage, with at least two (2) landowners.
3. Powell County Weed Board, noxious weed control connected with all projects
4. Develop new conservation plans on a minimum of one landowner which address the above issues as well as forest health, irrigation water management and grazing management.

Responsibility: To be determined

Timelines: 2014-2017

Gold Creek

Background: Gold Creek originates in the Flint Creek mountain range and flows for about 15 miles until it reaches its confluence with the Clark Fork. The Gold Creek watershed contains the tributaries of Blum Creek, Pikes Peak Creek, Crevice Creek, and North and South Fork Gold Creek, as well as several smaller streams. Gold Creek is the site of the first gold discovery in Montana, and thus has a long mining history. The watershed also supports agriculture, grazing and timber harvest. The basin is comprised mainly of private and Forest Service land, with a small percentage of state-owned property.

Objectives:

a) Nutrient and sediment reduction
b) Increase fish passage
c) Irrigation water management to prevent dewatering
d) Noxious weed control
e) Forest health
f) Improve grazing management, especially in riparian corridor

Preliminary Strategies:

1. Modify or replace a minimum of five (5) existing diversions in conjunction with screening projects with five landowners; explore consolidation of diversions.
2. Powell County Weed Board, noxious weed control connected with all projects
3. Move corral off stream for at least one landowner.
4. Explore in-stream flow enhancement initiatives, including irrigation efficiency improvements.
5. Finalize an inventory of existing irrigation structures to evaluate passage & entrainment issues
6. Develop new conservation plans on a minimum of three landowners which address the above issues as well as forest health, irrigation water management and grazing management

Responsibility: To be determined

Timelines: 2014 to 2017

Little Blackfoot River

Background: The Little Blackfoot River is located in western Montana and flows west from the continental divide near Helena to Garrison, where it joins the Clark Fork River. The watershed is approximately 265,000 acres in size, with 48 miles of main stem river originating in the Boulder Mountains. The continental divide runs along the southern, eastern and northern borders of this watershed. Elevations in the watershed range form approximately 4,300 to 5,500 feet above mean sea level in the valley to mountain peaks over 8,500 feet.

A more in-depth planning initiative will be launched in 2012 in the Little Blackfoot drainage after acceptance of the Little Blackfoot TMDL and Water Quality Framework Improvement plan by the Montana Department of Environmental Quality. The following objectives are therefore preliminary.

Objectives:

a) Reduce sediment inputs from unstable banks
b) Increase fish passage
c) Irrigation water management to prevent dewatering
d) Sediment reduction
e) Noxious weed control
f) Forest health
g) Grazing management

Preliminary Strategies:

1. Do more in-depth riparian and water quality assessments recommended in the TMDL-WQIP
2. Stabilize banks using natural or “soft” techniques along main stem Little Blackfoot and tributaries (e.g. lower Spotted Dog Creek).
3. Do a pilot modification of a diversion in conjunction with a fish screen.
4. Have Powell County Weed Board do noxious weed control connected with all projects
5. Conduct a more detailed inventory of existing irrigation structures to evaluate passage & entrainment issues
6. Develop new conservation plans on a minimum of three landowners which address the above issues as well as forest health, irrigation water management and grazing management

Responsibility: To be determined

Timelines: 2014 to 2017

Lost Creek

Background: Lost Creek flows from the Flint Range for approximately 23 miles before joining the Clark Fork River. The drainage is shared between U.S. Forest Service, state, and private lands, with most of the private land located within the lower 16 miles of the creek's basin. Land use in the upper part of the basin consists mostly of National Forest recreation, while activities in the lower portion include agriculture (irrigated hay and cattle operations) and rural home site development.

In the past, Lost Creek was part of the Mt. Haggin Ranch, and for more than 100 years, experienced heavy use from both cattle and sheep. Additionally, soils in the basin have been contaminated by aerial deposition of metals/arsenic from the Anaconda copper smelter.

Objectives:

a) Instream flow enhancement
b) Riparian restoration
c) Noxious weed control
d) Irrigation water management improvements
e) Grazing management

Strategies:

1. Riparian fencing repair with one (1) landowner near mouth of stream
2. Modify or replace a minimum of three (3) existing diversions for fish passage in conjunction with screening projects on three landowners.
3. Conduct more detailed assessment on dewatering issue in lower Lost Creek.
4. Develop new conservation plans with landowners which address the above issues as well as forest health, irrigation water management and grazing management

Responsibility: To be determined

Timelines: 2014 to 2017

Peterson Creek

Peterson Creek originates in the foothills of the Boulder Mountains and flows for more than twelve miles before joining the Clark Fork River. The Peterson Creek watershed comprises about thirty square miles and includes the tributaries of Jack Creek, Spring Creek and Burnt Hollow Creek. The watershed contains mostly private land and is used for irrigated hay production, livestock grazing and timber harvest (MFWP, 2009).

Objectives:

a) Sediment and nutrient reduction related to agricultural cropping/riparian grazing
b) Reduce dewatering, improve irrigation efficiency
c) Increase fish passage
d) Noxious weed control
e) Forest health
f) Grazing management

Preliminary Strategies:

1. Explore flow transactions with two landowners
2. Riparian fencing/off-stream water improvements with three (3) landowners
3. Installation of pipeline to pivots with one landowner
4. Install fish screening project with one (1) landowner.
5. Complete bank stabilization project on one (1) landowner
6. Develop new conservation plans on a minimum of three landowners which address the above issues as well as forest health, irrigation water management and grazing management

Responsibility: To be determined

Timelines: 2014 to 2017

Tin Cup Joe Creek

Background: Tin Cup Joe Creek flows from the Flint Creek Range and travels for almost 15 miles before joining the Clark Fork River. The basin encompasses close to 25 square miles, originates on Forest Service lands, and passes through the Montana State Prison for much of its middle reaches. Timber harvest, grazing and irrigated hay are the main land uses within the watershed, and a few abandoned mines are present.

Objectives:

a) Reduce riparian habitat damage and sediment production from grazing
b) Address dewatering
c) Improve irrigation water management
d) Noxious weed control
e) Restore urbanized area of lower Creek.

Preliminary Strategy:

1. Work with State Prison to develop conservation opportunities.
2. Develop new conservation plans with one or more landowners.

Responsibility: Not determined at this time

Timelines: 2014 to 2017

Warm Springs Creek-Anaconda

Background: Warm Springs Creek-Anaconda is a headwater tributary to the upper Clark Fork river, which drains 144 square miles of the Anaconda-Pintler and Flint Creek mountains. Warm Springs Creek is formed by the tributaries Cable Creek, Storm Lake Creek, Twin Lakes Creek, Foster Creek, Barker Creek, and discharge from Silver Lake, all on U.S. Forest Service lands. Warm Springs Creek flows eastward for approximately 24 miles from its headwaters, passing through the town of Anaconda, and forms the upper Clark Fork river at its confluence with Silver Bow Creek, at Warm Springs, Montana. Approximately 63% of the drainage is owned by the U.S. Forest Service, 10% is state-owned, and 27% is private lands. Timber production, agriculture, and recreation are currently the principal land uses, while minerals processing was the principal economic activity for the majority of the 20th century. Impairments to Warm Springs Creek include contamination from heavy metals, low-flow, physical substrate alterations, and alteration in streamside vegetation cover. Fisheries in lower Warm Springs Creek are highly productive, and key native fish strongholds exist in the upper drainage.

Objectives:

a) Instream flow enhancement: summer and fall.
b) Reduce metals contamination
c) Increase fish passage, reduce barriers.
d) Improve channel stability, riparian vegetation (especially in urban area)
e) Improve forest health, reduce impacts from forest roads.

Strategies:

a) Work with Butte-SB local government to secure water rights and improve delivery of instream water from Silver Lake.
b) Remove concentrated sources of metals from floodplain in lower drainage.
c) Work with Butte-SB government to modify 2-3 major fish passage barriers to improve movements, reduce entrainment. Work with irrigators in lower drainage to improve 1-2 diversions.
d) Improve channel stability and riparian vegetation for 2 miles in the Anaconda area.

Responsibility:

- WRC will support Montana Fish Wildlife and Parks, the NRDP, Butte-Silver Bow government in pursuing instream flow options.
- WRC will support NRDP-DEQ in metals clean-up work.
- WRC will support Trout Unlimited and Butte-SB government on fish passage opportunities.
- WRC will work with Anaconda local government and NGOs on improving Warm Springs Creek channel and riparian corridor. WRC will work with CF Coalition, TU and U.S. Forest Service to promote watershed-level improvements to riparian corridors in forested uplands.

Timelines: 2012-2016

Willow Creek

Background: Willow Creek lies within the Silver Bow Creek Watershed, but no longer connects with Silver Bow Creek. The creek originates in the Continental Divide and flows for almost 13 miles before entering the Mill-Willow bypass and joining the Clark Fork River near the town of Opportunity (MFWP, 2009). The creek drains an area of almost 30 square miles, with the Mount Haggin Wildlife Management Area dominating land ownership in the upper watershed, and private agricultural land dominating the lower watershed. The Willow Creek watershed supports livestock grazing, irrigated agriculture and some timber harvest, and has suffered historical contamination from Butte mine tailings and aerial deposition from the Anaconda smelter (MFWP, 2009).

Objectives:

a) Sediment reduction from channel bank erosion
b) Improve irrigation water management; seek in-stream flow enhancement opportunities
c) Additional in-depth assessment related to dewatering
d) Noxious weed control
e) Improve riparian grazing management/ riparian habitat in lower watershed

Preliminary Strategies:

1. Assess the streamflow/ irrigation water management issues in depth.
2. Refine the new inventory of existing irrigation structures and irrigated lands
3. Work with Deer Lodge/Powell County Weed Boards on noxious weed control connected with all projects
4. Develop new conservation plans on a minimum of three landowners which address the above issues, especially sediment control, irrigation water management and riparian grazing management

Responsibility: To be determined

Timelines: 2014 to 2017

Cross Cutting Issues

1. Board Operations

Background: The organization structure includes the WRC Board of Directors, an overall Watershed Council made up of local organizations and agencies and individuals committed to supporting local efforts in the watershed.

Objectives: Insure local input into all planning and implementation projects carried out by the board.

Strategies:
1. Conduct a minimum of 11 monthly board/ council meetings yearly
2. Update the WRC Watershed Restoration Plan (WRP) through a series of local planning meetings and postings on the WRC web site.
3. Begin the publishing of the WRC newsletter.
4. Develop an annual Plan of Work for the WRC based on the WRP
5. Develop an annual operations budget

Responsibility: WRC Board of Directors, WRC Executive Director

Timelines: Ongoing

2. Funding, and Fund Raising

Background: In order to accomplish its mission, the WRC needs funds to pay for operating costs as well as specific projects. Operating funds go to pay for the WRC staff contractors, overhead costs including: communication through a variety of means, meetings, insurance, office supplies and fees. Project funds pay for specific projects that are consistent with the WRC's mission and identified in the WRC's work plan.

The WRC will strive to attain stable and sustainable funding by achieving an appropriate balance among the following funding sources:

- Grants;
- Membership contributions;
- Major donors; and
- Fundraising events.

The WRC recognizes that education and outreach activities are essential to its mission. Education and outreach will be integrated into fundraising activities whenever possible and appropriate.

Objective: Secure ongoing funding for implementation the WRC Watershed Restoration Plan and Annual Plan of work.

Strategies*:*

a) Annual Budget- Develop an annual budget for the JRWC to guide fundraising activities as well as day-to-day spending decisions.

b) Fundraising Targets**--** Set targets for each fundraising category to raise sufficient funds to cover the WRC's annual budget.

Responsibility: WRC Board of directors in consultation with Council, WRC Executive Director

Timelines: All developed at first board of directors meeting annually.

3. Outreach and Education

Background: WRC achieves all of its successful efforts through voluntary support for its activities. A proactive outreach and education program is necessary to maintain support for the WRC and to insure that WRC's projects and associated program activities are know and supported by watershed residents, and potential funders.

Objective: Have a proactive outreach and education plan for all WRC programs and projects which promotes and educates stakeholders on the WRC's activities

Strategies:

1. Identify Target audiences
   Compile and provide resource information to realtors, residents and local groups in the watershed area.
   Priority groups:
   New residents
   Realtors
   Land managers
   Local organizations
   Local governments
   Canal Managers
   Legislators & congressional delegation

2. Implementation Tools
   a) WRC Web site
   Strategy: Continue to update as needed
   Responsibility: WRC Executive Director
   Timelines: Ongoing

   b) Workshops
   Strategy: Organize stand alone & cooperative workshops
   Responsibility: WRC Board, Council, Executive Director
   Timelines: Scheduled on an ongoing basis

   c) Multi Media marketing

   d) TMDL outreach

4. Cooperative Staff Position

Background: The partnering organizations believe that a cooperative staff position jointly funded by the partners will increase the impact of all of their individual efforts as well as create a platform from which federal (NRCS) technical and financial assistance, and complementary programs, can be delivered to landowners. The partnering organizations believe the coordination and sharing of expertise to develop a plan of work for the initiative will lead to increased impact of projects through the targeting of priority tributary watersheds, and project needs in each watershed.

Objective: Coordinated watershed restoration activities in the Upper Clark Fork River Watershed leading to: increased on ground restoration activities, leveraging the expertise of the partnering organizations to design and implement the initiative, increasing access to public and private funds for watershed restoration in the Upper Clark Fork River Watershed, and increased on ground restoration activities through a shared staff position.

5. Cooperative Staff Position

Background: The partnering organizations believe that a cooperative staff position jointly funded by the partners will increase the impact of all of their individual efforts as well as create a platform from which federal (NRCS) technical and financial assistance, and complementary programs, can be delivered to landowners. The partnering organizations believe the coordination and sharing of expertise to develop a plan of work for the initiative will lead to increased impact of projects through the targeting of priority tributary watersheds, and project needs in each watershed.

Objective: Coordinated watershed restoration activities in the Upper Clark Fork River Watershed leading to: increased on ground restoration activities, leveraging the expertise of the partnering organizations to design and implement the initiative, increasing access to public and private funds for watershed restoration in the Upper Clark Fork River Watershed, and increased on ground restoration activities through a shared staff position.

Strategies:

- Establish a shared staff position through a contribution agreement between the United States Department of Agriculture Natural Resources Conservation Service and the Deer Lodge Valley Conservation District and the Mile High Conservation District
- Design and implement state and federal NRCS watershed initiatives through sharing of existing plans and data. Targeted initiatives include state NRCS approved special watershed initiatives & a federal NRCS Cooperative Conservation Partnership Initiative (CCPI)
- Gain support from state programs for increased project funding in conjunction with federal NRCS Environmental Incentives (EQIP) funds.

Responsibility: WRC Board of Directors in consultation with Council, Trout Unlimited, Clark Fork Coalition, Mile High & Deer Lodge Valley Conservation Districts, WRC Executive Director.

Timelines: Development of draft cooperative agreement underway. Proposing to establish the position in 2012.

7. Sediment Loads and Reduction Estimates

The primary TMDL issue addressed by this WRP is sediment. Three sediment sources were addressed by the WRP, bank erosion, road sediment, and upland sediment. The following information is presented only as a summary of the existing loads and reduction estimates. For detailed information on specific drainages please refer to Appendix I, Sediment load Reduction Determinations "Upper Clark Fork River Tributaries Sediment, Metals and Temperature TMDLs and Framework for Water Quality Restoration.

Bank Erosion: Eight major causes of bank erosion indentified in the TMDL were; natural, forest, transportation, grazing, irrigation, cropland, and other. Natural and transportation related cause were the major cause identified in the TMDL. Existing sediment loads ranged from 196 tons/year to 766 tons /year. Required reductions range from 109 tons/year to 318 tons /year totaling 2,687 tons /year in required reductions. As several of the priority watersheds identified by the WRC the for the first 5 years are not included in the drainages with bank erosion estimates, and the lack of detailed load reduction estimates for proposed projects, the WRC cannot provide a reliable estimate as to the potential reductions sought in the TMDL. Estimated load reductions will begin to be compiled upon completed projects on involved stream reaches. Please refer to Monitoring and Long-Term Evaluations section of this document.

Table 7.1: Sediment Load Reduction Estimates from BANK EROSION on TMDL Streams

Stream with developed TMDL for sediment:	WRP Priority Stream:	Feet of anthropogenically influenced stream:	Existing sediment load from bank erosion (tons/yr)	Allowable load from bank erosion (tons/yr)	Reduction required: (tons/yr)
Upper Peterson	Yes	26,794	352	177	175
Lower Peterson	Yes	39,859	454	200	259
Dempsey	Yes	48,821	766	448	318
Upper Willow	Yes	8,830	196	138	58
Lower Willow	Yes	40,813	470	205	265

The TMDL did not quantify feet of anthropogenically influenced stream, sediment loads or reductions from any other of the sediment-impaired streams (Brock, Cable, Hoover, Storm Lake, Warm Springs-Phosphate, Antelope or Tin Cup Joe). The WRC believes that the best approach for sediment reduction estimates on these streams, and on WRC priority streams where TMDLs were not developed is to use 11.4 minus 4.9 tons/year/1000 ft. or 6.5 tons/year/1000 ft. of affected stream. If a restoration project effectively addresses key bank erosion issues (transportation, grazing, agriculture) in the streamside land use, then WRC will estimate a reduction of 6.5 tons/year/1000 ft. unless better estimates can be developed. The WRC has some bank erosion data in its monitoring plots, and on specific projects it will also use this site-specific monitoring data to estimate bank erosion-related sediment reduction.

Short-term criteria for bank erosion: The numerical estimator (reduction of 6.5 tons/year/1000 ft) used above will be the short-term estimator for bank erosion sediment reduction. The number of thousands of feet of stream banks addressed by best management practices is the key criteria. The WRC will use the feet of project priority streams treated as an indicator of progress. The streams where the WRC has done NRCS riparian assessments include number of feet of stream rating "unsustainable" or "sustainable at risk," and if these ratings are combined with a low score (<4) on the stream segment Question #2 (pertains to NRCS method assessment of bank erosion), that segment can be estimated to be a "bank erosion problem reach." Progress by WRC projects will be tabulated for each WRP cycle (5 years) as estimated feet of problem reaches, and percent problem reaches treated with BMPs. The WRC will develop an estimated time to achieve 20% and 50% achievement of BMPs on problem reaches within a priority stream. It is estimated that achieving 20% implementation of BMPs will require 5-10 years on priority streams assessed thus far (Gold, Cottonwood, Peterson, Dempsey, Dry Cottonwood, Racetrack, Lost, Warm Springs-Opp, Willow, and Browns Gulch).

Road Sediment:

The TMDL estimate to sediment loads from roads was a coarse estimate applied to each identified road crossing in a given subwatershed. The method used does not identify true loads from any given road crossing nor did it identify which crossings are in need of restoration work. Existing sediment load estimates on the tributaries covered by the TMDL (Peterson, Dempsey, Willow) range from 17.9 tons/year to 67.7 tons / year. Required load reductions range from 10.6 tons/year to 37.2 tons/year. These data indicate that road sediment is a relatively minor component of the entire sediment budget. Estimated reduction estimates based on the TMDL's estimates for sediment generated per crossing will be compiled over time on any projects where WRC focuses on road sediments. Short-term criteria will focus on number of crossings improved and miles of streamside road upgraded with BMPs.

Upland Sediment:

In the TMDL, upland sediment loads were determined for each major land use category and each stream/ stream segment of interest using the SWAT model. Existing conditions were estimated, as well as the resultant loads assuming the implementation of BMPs. Additionally, riparian condition estimations were applied to the upland sediment loads that would occur given improvement of the riparian corridor.

The SWAT-modeled estimates of upland sediment varied widely from one drainage to the next with Dempsey Creek estimated at 7498 tons/year upland sediment with potential reduction of 1332 tons/year, and Lower Willow Creek-Opp generating only 224 tons of upland sediment/year with a potential reduction of 37 tons. The upland buffer area widths modeled to generate sediment, and the soil types are key factors in estimating upland sediment yields, and these variables are not explained in the TMDL document, and will need to be better defined in meetings with DEQ.

Range Brush and Range Grass land uses created the vast majority of upland sediment followed by urban and alfalfa. The majority of the surveyed tributaries rated good to fair as a percentage of riparian condition improvement potential. The WRC will use acres of uplands under BMP management as the key short-term criteria in estimating upland sediment yield. Unless DEQ recommends a different approach, the WRC will only estimate upland sediment improvements as occurring in a ¼ mile-wide buffer of uplands on either side of the perennial streams. The short-term criteria will be "acres of sediment BMPs within ¼ mile of perennial stream." This analysis will be done by GIS every 5 years. Reduction estimates on completed upland projects will be done per drainage in areas where WRC is conducting intensive projects (priority stream watersheds). Estimates of sediment eroded per acre in each drainage will be provided by the SWAT model results which DEQ developed.

Water Temperature:

A water temperature TMDL was only developed for Peterson Creek. The WRC believes a number of other streams, especially in their lower reaches, are water temperature impaired. Therefore, the WRC has monitored a number of streams for water temperature during summer months during 2010-2012, and plans to continue to do so in conjunction with its partners on a number of priority streams, including Peterson Creek.

The TMDL target for Peterson Creek is to achieve a maximum seasonal water temperature of 68.6 degrees F., which is substantially lower than the maximum temperatures of 75-78 degrees F. recorded by DEQ during 2007. The TMDL proposes to achieve this target by the application of "shade scenario 2" and a 15% increase in irrigation efficiency.

The WRC's short-term criteria for determining achievement of TMDL targets in Peterson Creek will be to monitor daily (half-hour time step) temperatures at three sites on Peterson Creek (mouth, I-90, and USFS bridge) each year. The short-term criteria for achievement of the TMDL target will be seven-day moving averages of the maximum daily temperatures for July-September. Other criteria which indicate progress toward the target which will be tracked include miles of riparian zone with improved BMPs from Jack Creek to the mouth of Peterson Creek, and number of acres of irrigated land converted from flood irrigation to sprinkler irrigation (unless actual cfs of water savings can be calculated for a particular project). Water temperature, stream corridor, and irrigation type data will be analyzed annually, but reported out only every five years to track progress on the TMDL (e.g. 2007, 2012, 2017).

8. Monitoring and Long-Term Evaluations

The objectives for monitoring in the UCF Tributaries TMDL planning area include: 1) baseline and impairment status monitoring to reveal whether streams should be included in future TMDL updates and whether water quality targets are being attained in listed tributaries, 2) refining the source assessments for pollutants and identifying opportunities for projects, and 3) monitoring the execution of restoration activities and evaluating the effectiveness of those activities, including the cumulative effects of restoration. The WRC is developing a Microsoft Access database to compile its monitoring data, and most of the 2010-2011 field season data is already entered in the database.

Monitoring to update impairment status is a responsibility of DEQ, but WRC can assist in this process. The Montana 303(d) list is updated every two years approximately to reflect up-to-date information on whether streams are impaired. Sometimes streams which have serious impairment issues are not listed, simply because no adequate data has been collected. Montana DEQ has raised the standards of “sufficient and credible data” considerably; therefore, monitoring done by WRC to document impairments needs to use protocols which meet DEQ’s criteria. There are several streams in the Upper Clark Fork which are not listed, but which have significant impairment issues, particularly temperature and/or sediment (e.g. Browns Gulch, Dry Cottonwood Creek, Cottonwood Creek).

Refining source assessments is an important task, because this is where the “causes” of problems are pinned down, and where projects to address water quality issues should be focused. Source assessments for sediment, nutrients, and temperature can often be accomplished by “stream walks,” such as the NRCS riparian assessment methodology or Hansen Lotic assessments. The WRC has used this method extensively in 2010 and 2011 to identify problem areas and develop project ideas. These “stream walks” also help identify fish passage and dewatering problems. The WRC will continue this type of assessment work on all priority tributaries as necessary to document improvements in riparian condition.

Monitoring the execution of project activities and evaluating the effectiveness of those activities is central to WRC’s program. Project activities will be documented in annual reports, and specifically located in on maps with coordinates for WRC’s database. Specific monitoring reaches are being set up on certain streams where project activity is ongoing or expected in the future. As of October, 2011, the WRC has established 17 monitoring reaches on eight tributaries which track geomorphic variables (channel slope, x-sections, pebble counts, bankfull-width depth ratios), fish habitat (habitat type, number of pools, residual pool depth, bank erosion, large woody debris) and woody vegetation regeneration (number and age of woody plant stems). Daily flow and temperature monitoring has also been conducted on five tributaries. These daily data sets are useful for monitoring the future impacts of in-stream flow or irrigation water management projects on streamflow and water temperature. These monitoring sites are labor-intensive to establish and maintain, but they create an excellent baseline for monitoring project impacts and long-term changes in impairment conditions.

Table 1: On-going monitoring sites established by WRC in 2010-2011

Streams:	Riparian Assessment	Flow sites	Flow &temp sites	Rosgen Fluvial Geomorphology	R1-R4 Fish Habitat & Vegetation Greenline
Type:	NRCS (miles)	periodic	Daily TruTrack	sites	sites
Dunkleberg Cr.	6.1	0	0	0	0
Gold Creek	5.3	3	3	3	3
Cottonwood Cr.	8.1	3	3	2	2
Peterson Cr.	9.0	2	0	2	2
Racetrack Cr.	11.5	4	3	2	2
Dempsey Cr.	6.8	2	2	2	2
Lost Cr.	7.1	1	0	0	0
Willow Cr-Opportunity	9.8	0	0	0	0
Dry Cottonwood Cr.	8.5	2	0	2	2
Perkins Gulch	4.0	0	0	2	2
Browns Gulch, tribs	0	5	3	2	2
TOTAL , Oct. 2011:	73.5	22	14	17	17

Attachments

Attachment 1: Cross –Walk of Watershed Restoration Plan Elements

EPA's 9 Minimum Elements for a WRP	Corresponding Section in WRP for the Upper Clark Fork Watershed
1. Identification of pollutant causes and sources	Section 3
2. Load Reduction estimate	Section 7
3. Identification of NPS management measures	Section 3
4. Technical and financial assistance needed	Section 4
5. Education and Outreach	Section 6
6. Implementation Schedule	Section 6
7. Milestones	Section 5
8. Short-Term Criteria	Section 7
9. Monitoring	Section 8

Attachment 2

Natural Resource Survey of Residents, Upper Clark Fork River Watershed*
Conducted by the Watershed Restoration Coalition
* (22% Response)

Resource Concern		Rangeland			Cropland		
			#	%	#		%
Number of Total Responses		**478**			**331**		
Noxious Weeds		144	24		86		26
Soil Health		55	12		34		10
Soil Erosion/Sedimentation	56	12		35		11	
Water Quality		74	15		47		14
Wildlife	44	9		23		7	
Grazing Practices	50	11					
Forage Production/Utilization		42	8				
Conifer Encroachment		28	6		2		1
Crop Production				30		9	
Irrigation Efficiency					49		15
Insects					9		3
Crop Rotation					16		5
Other		15	3				

Resource Concern		Pastureland			Hayland			
			#	%			#	%
Number of Total Responses		**411**			**349**			
Noxious Weeds		102		25			83	24
Soil Health		39		9			48	14
Soil Erosion/Sedimentation	47		12			40	12	
Water Quality		52		13			53	15
Wildlife	38		9			29	8	
Grazing Practices	44		11			17	5	
Forage Production/Utilization							37	9
Conifer Encroachment		17		4			1	0.1
Crop Production								
Irrigation Efficiency							54	16
Insects		5		0.1				
Crop Rotation							14	4
Other		1						

Resource Concern	Waterways & Riparian Areas				Mining			
			#	%			#	%
Number of Total Responses	**451**				**285**			
Noxious Weeds		94		21		76		27
Soil Health		45		10		37		13
Soil Erosion/Sedimentation	63		14		55		19	
Water Quality		62		14		66		23
Wildlife	13		5					
Fisheries	41		9					
Development of Flood Plain	19		4					
Water Quantity		55		12				
Public Health & Safety						36		13
Other		13		3		2		

Resource Concern	Residential Development			Other Land Use				
			#	%			#	%
Number of Total Responses	**327**				**284**			
Noxious Weeds		91		28		89	31	
Soil Health		23		7		32	11	
Soil Erosion/Sedimentation	31		10		49	17		
Water Quality		55		18		63	22	
Wildlife	37		11		35	12		
Development Concentration	58		18					
Other		32		10		16	6	

Resource Concern	Forest Land		
		#	%
Number of Total Responses	**392**		
Noxious Weeds		89	23
Soil Health		40	7
Soil Erosion/Sedimentation	28	10	
Water Quality		42	11
Wildlife	29	7	
Conifer Encroachment		6	
Insects		53	14
Fire		60	15
Other		29	7

Ranking Percentages of Resource Concerns

	%
Noxious Weeds	24
Water Quality	15
Soil Erosion	12
Forest Management	11
Soil Health	10
Crop & Range Management	9
Wildlife	8
Irrigation Efficiency/Energy Savings	4
Other (Development Issues)	3
Public Policy	3
Fisheries	1

ATTACHMENT 3: PRIORITIZATION PROCESS OF TRIBUTARY WATERSHEDS

The Watershed Restoration Coalition (WRC) developed a process in early 2011 for prioritizing which tributaries in the TMDL Planning area would be the focus for WRC's work in the coming years. This process was based on two over-arching factors: "need" and "opportunity." The WRC felt that its work should be focused on areas where need for water quality improvements and other conservation work were high, and where distinct opportunities to improve natural resources were known. The WRC was also clear that its effort would be best invested in areas where "social" support for conservation was likely to translate into successful projects and positive publicity for the WRC's conservation mission.

The prioritization system was broken into two parts: the "technical" criteria and the "social" criteria. The technical criteria and scoring logic were developed by WRC staff and consultants as well as Trout Unlimited, Clark Fork Coalition and Montana Fish Wildlife and Parks. The technical criteria primarily reflect the "need" for conservation work based on documented existing information about the status of natural resources in each drainage with a few criteria reflecting the "opportunity" to make a tangible difference in resource conservation. Technical criteria were sorted by the following categories: water quality, water quantity, fisheries, and other.

Water quality criteria included: TMDL impairments, other listed impairments, other known (but unlisted) impairments, priority mine sites, top 25 priority mines in MT, road density, MPDES permits, and CAFO/AFO permits. All these data could be tabulated from known databases and GIS data maintained by State agencies (primarily DEQ), with some additional data from WRC fieldwork and reports (e.g., other known, but unlisted impairments).

Water quantity criteria included: State dewatered stream list (FWP), other known dewatered streams, number of irrigation diversions, number of irrigation wells, percent of the watershed irrigated, existence of municipal or industrial water use, existence of storage reservoirs in the basin. All these data were extracted from State of Montana GIS layers or reports, or calculated by the WRC's consultant.

Fisheries criteria included: presence of bull trout, presence of westslope cutthroat trout, presence of other native fish, NRDP/FWP tributary priority for fisheries restoration, and perennial connectivity with the Clark Fork river. These data were derived from FWP sources. The NRDP/FWP tributary prioritization draft document for the Upper Clark Fork was available, and the WRC used that prioritization scheme as an input, with streams receiving high point scores in the "fisheries" category if they scored high on the NRDP/FWP scheme.

The WRC wished to include other data on status of natural vegetation in these drainages, and decided to include the level of weed infestations. Weed infestations are a very high priority issue for private landowners, and a good reflection of the overall condition of the natural vegetation in the watershed.

Technical criteria were assigned scores of low, medium and high depending on the distribution of data in the full data set for all 32 tributaries (e.g. top-middle-bottom third of scores). High scores were usually assigned three points, medium two points, and low one point. Some criteria were yes/no with one point for yes and zero for no. Summing the total points across all criteria gave the total technical score.

The social criteria were three subjective criteria designed to reflect the opportunity for conservation success: recognized conservation need, landowner interest, and educational/demonstration value of work in that drainage. In order to provide expert input for these subjective "social" criteria, the WRC passed out scoring sheets at a WRC meeting in July, 2011, to the following: all WRC board members (nearly all are large landowners in the basin), the Powell County weed coordinator, the DNRC Anaconda-district state lands forester, the FWP fisheries biologist, an experienced NRCS conservationist, and the Trout Unlimited local coordinator. Respondents were instructed to only provide scores for drainages where they were familiar with landowners and conditions on the landscape. The respondents provided scores of two (high), one (medium) or zero (low or none). Total scores for all respondents were summed to give an indication of social feasibility of WRC conservation work in that drainage.

The maximum “technical” score of any drainage was 21 for Lost Creek, and the minimum “technical” score was 4 for Bert Creek. Eight tributaries had technical scores above 18; these were regarded as “high priority” from a technical viewpoint. The maximum “social” score was 64 for Cottonwood Creek, and the minimum social score was 2 for Bert Creek. Eight tributaries had “social” scores of 27 or greater, including an overlap with six (6) streams which scored “high” on both technical and social criteria: Gold, Cottonwood, Peterson, Dempsey, Lost, and Warm Springs-Anaconda. These streams immediately rose to the top of WRC’s priority list.

To finalize the prioritization, the technical and social scores were combined, and a combined score of 30 or greater was used to distinguish high-priority from lower priority streams. This added the following streams to the potential priority list: Hoover, Tin Cup Joe, Racetrack, Dry Cottonwood, Willow-Opportunity, and Browns Gulch.

2) Sediment load reduction estimates. These estimates come directly from DEQ’s 2010 UCF TMDL, Appendix I: “Sediment Loads and Reduction Estimates.”

3) Priority Tributaries: The WRC used technical and social criteria to score the 33 tributaries in the Upper Clark Fork for their importance to water quality restoration. Of these tributaries, several stood out in the scoring as of highest importance:

*HIGH RANKING (>40 points): Gold Creek, Cottonwood Creek, Peterson Creek, Dempsey Creek, Racetrack Creek, Lost Creek and Warm Springs Creek. These seven tributaries were incorporated into WRC’s high priority list for the WRP.

*MEDIUM RANKING (>30 but <40 points): Hoover, Tin Cup Joe, Dry Cottonwood, Willow, and Browns Gulch scored in the medium range (technical plus social scores combined). Of these creeks, we decided against working on Hoover and Tin Cup Joe because the WRC has no history and no solid landowner contacts in those stream drainages. In Dry Cottonwood Cr. our partner organization, Clark Fork Coalition, has strong links and a number of ongoing projects. Those projects are being carried out by Clark Fork Coalition. In Willow Creek and Browns Gulch the WRC sees excellent opportunities, including future NRDP funding priority, and in Browns Gulch the WRC has a long history of diagnostic studies dating to 2005. Willow Creek is a new area for the WRC, but it is incorporated into the priority list because it is an NRDP priority stream (providing funding opportunities), some ongoing SuperFund clean-up is going to benefit the lower watershed, and the WRC has good contacts in the upper basin of Willow Creek. For these reasons Willow and Browns Gulch were added to the WRP priority streams list.

NOTE: The WRC staff decided to focus its efforts on a smaller number of drainages, and elevated Racetrack, Willow-Opportunity, and Browns Gulch to the high-priority list, because important work had already begun in those drainages with WRC and/or partners or the drainage was high priority for other programs or receiving streams such as Browns Gulch impact on Silver Bow Creek. The matrix used for technical scoring is attached, as is a summary scoring sheet for technical and social priority scores is shown on the following page.

TRIBUTARY PRIORITIES WRC WATERSHED RESTORATION PLAN, 2012-2017

Tributary Name	Tech SCORE	Tech Rank:	SOCIAL SCORE	TOTAL SCORE	Final Selection
Bert Creek	4	LOW	2	6	
Dunkleberg Creek	14	MED	9	23	
Hoover Creek	14	MED	19	33	NO
Gough Creek	5	LOW	15	20	
Carten Creek	5	LOW	4	9	
Gold Creek	20	HIGH	30	50	YES
Brock Creek	11	MED	10	21	
Warm Springs Creek (Garrison)	14	MED	14	28	
Willow Creek (Garrison)	9	MED	6	15	
Rock Creek (Garrison)	10	MED	17	27	
O'Neill Creek	5	LOW	14	19	
Freezeout Creek	5	LOW	3	8	
Fred Burr Creek	8	MED	11	19	
Cottonwood Creek	18	HIGH	46	64	YES
Taylor Creek	7	LOW	4	11	
Tin Cup Joe Creek	18	HIGH	17	35	NO
Peterson Creek	20	HIGH	25	45	YES
Powell Creek	6	LOW	4	10	
Dempsey Creek	19	HIGH	27	46	YES
Orofino Creek	7	LOW	8	15	
Racetrack Creek	16	MED	27	43	YES
Modesty Creek	12	MED	7	19	
Dry Cottonwood Creek	12	MED	27	39	NO
Lost Creek	21	HIGH	25	46	YES
Perkins Gulch	8	MED	8	16	
Warm Springs Creek (Anaconda)	19	HIGH	27	46	YES
Mill Creek	17	MED	9	26	
Willow Creek (Fairmont)	20	HIGH	13	33	YES
German Gulch	15	MED	5	20	
Browns Gulch	16	MED	16	32	YES
Basin Creek	16	MED	7	23	
Blacktail Creek	15	MED	8	23	

Attachment 4 - Watershed Summaries

Browns Gulch Watershed Summary

1. Description and Land Use:

Browns Gulch originates in the Boulder Mountains northwest of Butte, MT, and drains an area of 85 square miles, flowing south-southwest into Silver Bow Creek near Ramsay, MT. The Browns Gulch watershed includes a number of important tributaries, including Alaska Gulch, American Gulch, Flume Gulch, Telegraph Gulch, Meadow Gulch, Hail Columbia Gulch, and Bull Run. Land ownership is primarily in the Beaverhead Deer Lodge National Forest in the upper watershed, with private land dominating in the lower watershed. Land use is primarily forestry, recreation, and grazing, with some irrigated agriculture in the lower drainage. Mining is not a major land use.

Table 1: Browns Gulch Watershed Overview

Watershed Size	54,059 acres/85.0 sq miles/218.8 sq km
Elevation Range	2,556 feet [5,302-7,858]
Stream Miles	131.3
Land Ownership	Private: 22%/State: 1%/Federal: 46%/ Local Government (private): 31%
Road Miles	Local Road/City Street = 86.7 Highway = 1.5 Four-wheel drive trail = 1.3 Driveway/Service Road = 5.9 Alley/Access Ramp = 1.0 Total = 86.7

Source: Montana GIS Portal Data Layers

2. Impairments

Browns Gulch is not listed on the Montana DEQ 303d lists for 2008 or 2010, however, the WRC believes several significant impairments exist (WRC, 2012). The temperature regime in the lower watershed is affected by dewatering in late summer, early fall. Browns Gulch was assessed in 2005 by KirK Environmental Engineering and the findings are available in the *Browns Gulch Watershed Baseline Report* (2006). KirK cited data on sediment/siltation, nutrient levels, and elevated arsenic and copper levels as impairments to Browns Gulch. They suggested more research into impairment causes and pollutant levels (2006).

Table 2: Temperature Measurements for Browns Gulch (USFS PIBO)

	RM*	Start Date	End Date	Max T (°C)	Days>12°C	Days>18°C
PIBO 2008	14.0	7/15	8/31	14.0	23	0
PIBO 2003	14.0	7/15	8/31	19.2	42	4

*River Mile

Source: PIBO/USFS 2010

Table 3: WRC Temperature Data for Browns Gulch, 2011

SITE:	YEAR:	RIVER MILE:	START:	END:	MAX TEMP:	DAYS>20 C	7-DAY MEAN
Browns G/B1	2011	0.9	6/6	10/19	19.8	0	19.0
Browns G/B2	2011	3.2	6/23	10/19	25.5	13	22.0
Browns G/B3	2011	4.7	6/23	8/1	16.1	0	16.1

Native/Sport Fishery

Table 4: Fish Distribution in the Browns Gulch Watershed

Waterbody	Begin RM*	End RM*	Species	Updated
Browns Gulch	0.0	17.1	Westslope Cutthroat Trout	7/27/2009
Browns Gulch	0.0	7.6	Brook Trout	3/25/2009
Browns Gulch	7.6	18.1	Brook Trout	3/25/2009
Alaska Gulch	0.0	4.7	Westslope Cutthroat Trout	7/8/2009
Alaska Gulch	0.0	2.1	Brook Trout	2/20/2009
American Gulch	0.0	3.0	Westslope Cutthroat Trout	1/5/2005
American Gulch	0.0	2.0	Brook Trout	2/20/2009
Butcher Gulch	0.0	1.8	Westslope Cutthroat Trout	9/7/2006
Cooney Gulch	0.0	1.3	Surveyed; no fish captured	9/9/2008
Deep Canyon	0.0	1.3	Westslope Cutthroat Trout	1/5/2005
Flume Gulch	0.0	3.9	Westslope Cutthroat Trout	1/5/2005
Flume Gulch	0.0	2.4	Brook Trout	2/20/2009
Hail Columbia Gulch	0.0	7.4	Westslope Cutthroat Trout	1/5/2005
Hail Columbia Gulch	4.6	5.7	Slimy Sculpin	7/13/2009
Hail Columbia Gulch	0.0	7.0	Brook Trout	9/14/2009
Rocky Canyon	0.0	2.6	Westslope Cutthroat Trout	1/5/2005
Rocky Canyon	0.4	2.6	Brook Trout	7/13/2009
Sheep Gulch	0.0	4.5	Westslope Cutthroat Trout	1/5/2005
Telegraph Gulch	0.0	3.7	Westslope Cutthroat Trout	1/5/2005
Telegraph Gulch	0.0	2.5	Brook Trout	2/20/2009

Source: MFWP, 2010

Current Condition

Browns Gulch and its tributaries have been sampled for fish by the Montana FWP between 2005 and 2011 (Table 4). Several reaches provide habitat for native westslope cutthroat trout and also contain brook trout--which compete with westslope cutthroat trout for habitat, food and mates (KirK, 2006). However, the basin contains areas of high stream temperatures as well as degraded fish habitat and riparian areas.

Fishery Potential

Given the existence of trout in the majority of Brown Gulch's tributaries and in Brown Gulch itself, both a viable sport fishery and population of native trout appear possible. Montana FWP has recently detected colonization of Silver Bow Creek below and above Browns Gulch by westslope cutthroat trout originating in German Gulch. These larger fluvial fish are exploring lower Browns Gulch (fide J. Lindstrom, FWP, 2012). As mentioned in the previous section, degraded aquatic and riparian habitat is a problem throughout Browns Gulch and needs to be addressed for the fishery to reach its potential.

4. **Assessments**

Browns Gulch and some of its tributaries have been assessed several times in the last ten years but not as often as other impaired creeks in the same general area. Assessments have included noxious weeds, temperature, stream flow, geomorphology, riparian habitat and fish habitat. In 2011, the Mile Hi Conservation District and WRC hired Pioneer Technical Services to assess sources of sediment, current bank erosion and road erosion rates, and fish habitat conditions in Browns Gulch (Pioneer, 2011). This report highlighted the extremely high bank erosion rates in many parts of Browns Gulch affected by agricultural encroachment on the stream corridor, as well as specific sites where large pulses of sediment are contributed to the system by ephemeral stream channels (especially in Bull Run and Hail Columbia tributaries).

Table 5: Browns Gulch Assessments

Type	Agency	Year	Area
Sediment and Fish Habitat	Mile Hi CD	2011	Throughout
Riparian/Geomorphology/Flow Assessments	WRC	2010/2011	Throughout Browns Gulch
Tributary Prioritization/Rating Summary	MFWP	2010	Not listed
Browns Gulch Watershed Baseline Report	KirK	2006	Browns Gulch and Tributaries
PIBO Temperature	USFS	2010	River Mile 14, 16.3

5. Restoration

The WRC is working with Mile Hi Conservation District on developing restoration ideas for Browns Gulch. Sediment production, water temperature and aquatic and riparian habitat could be improved on agricultural lands with best management practices.

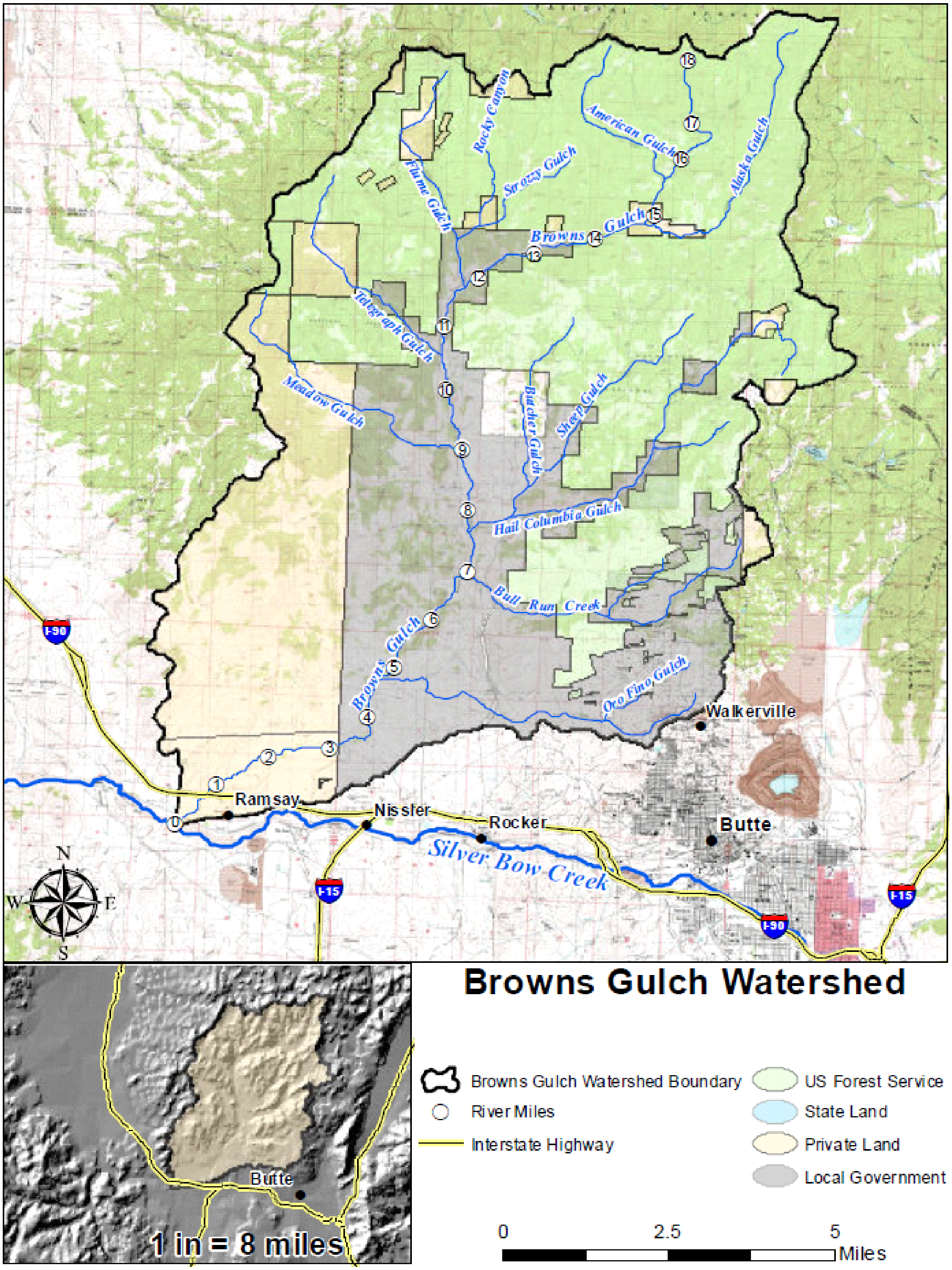
Needs

Working with landowners to improve grazing/agricultural management in the stream corridor.
Monitoring for temperature, TMDL impairments and fishery conditions
Encourage woody vegetation growth in stream corridors
Address road erosion to prevent sedimentation/siltation issues
Work with landowners to address dewatering/flow issues

6. Activities: Projects being undertaken by the WRC

7.Bibliography

Fischer, Jessie. Browns Gulch Watershed map. 1:100,000. [Printed/Computer Maps]. Fischer Geospatial Enterprises, LLC. Missoula, Montana. 2011.


Browns Gulch Watershed
American Gulch
Alaska Gulch
Rocky Canyon
Strozzy Gulch
Flume Gulch
Browns Gulch
Telegraph Gulch
Meadow Gulch
Butcher Gulch
Sheep Gulch
Hail Columbia Gulch
Bull Run Creek
Oro Fino Gulch
Walkerville
Ramsay
Nissler
Rocker
Butte
Silver Bow Creek
I-90
I-15
N
S
E
W
1 in = 8 miles
Browns Gulch Watershed Boundary
River Miles
Interstate Highway
US Forest Service
State Land
Private Land
Local Government
0
2.5
5
Miles

Cottonwood Creek Watershed Summary

1. Description and Land Use:

Cottonwood Creek descends from the Boulder Mountains and flows westward through the East Deer Lodge Valley, draining about 42 square miles. The creek flows through forest and agricultural land before entering the City of Deer Lodge near Interstate 90, and then flowing into the Clark Fork on the Grant-Kohrs Ranch.

Cattle grazing and pasturing, hay production, urbanization, timber harvest, and historic mining are the dominant land uses in the watershed (MFWP, 2008). Private ownership comprises 30% of the watershed, mostly in the lower reaches, while 69% of the watershed is part of Beaverhead Deer Lodge National Forest, including four headwater tributaries: North, Middle and South Cottonwood, and Baggs Creek (Kirk 2008).

Table 1: Cottonwood Creek Overview

Watershed Size	26,442 acres/42 sq miles/108.78 sq km
Elevation Range	3900 Feet [4500-8400 ft. above sea level]
Stream Miles	57.86
Land Ownership	30% Private /1% State,Local / 69% Federal
Road Miles	Local Road/City Street = 23.3 Four Wheel Drive Trail = 22.5 Service Road/Driveway = 5.1 Total = 50.9

Source: NRIS GIS Layers

2. Impairments

Although no sections of Cottonwood Creek are on the Montana DEQ's 303(d) list, impairments are reported throughout the watershed (Kirk 2008):

Mining/Metals

Priority abandoned mines within the Emery Mining District have been targeted as potential sources of acid mine drainage in the middle reach of Cottonwood Creek (KirK, 2008). A GIS data layer from the Montana Bureau of Mines and Geology shows 37 abandoned mines within the watershed area, five of which (Ding Bat [Blue-Eyed Maggie] Mine, Lower Hidden Hand Mine, Rocker Gulch Mine, St. Mary Mine and Sterrit Mine) exceed Montana water quality standards for arsenic and metals contamination. (KirK, 2008). Due to soil composition and ph levels, metals contaminants disseminate mainly through wind and water erosion (KirK, 2008).

Irrigation and Dewatering

Chronic dewatering results from the variety of land uses within the basin and has many implications for both water quantity and quality. In particular, irrigation water rights are over-allocated on Cottonwood Creek, which often causes complete dewatering in parts of the lower reaches (KirK, 2008). Peak flows for the creek (measured in 1964 and the annually during 1975-1991) were often in the 100-500 cfs range, with bankfull flow estimated at 250 cfs (Reiland, pers. comm.. 2011). But for much of the late summer, fall, winter and early spring flows range from one to ten cfs (KirK, 2008).

In addition to reduced stream flow, irrigation creates physical barriers to fish passage. Of the 15 irrigation ditch diversions within the drainage, nine were found to be partial barriers to fish movement (Kirk, 2010, and WRC-Trout Unlimited, 2010). Perched culverts exist on the downstream side of Interstate 90, which can substantially reduce fish migration (MFWP, 2008).

Temperature

Thermal impairments have also been attributed to dewatering, and are documented in the lower portion of the basin, especially in and downstream of the town of Deer Lodge. Temperatures below 16°C are optimum for westslope cutthroat trout growth, while temperatures below 20 °C are critical for their survival (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health. Temperature has been regularly monitored on reaches of Cottonwood Creek in the last five years (2007-2011), but its tributaries have not been monitored in recent years (MFWP, 2008).

Table 2: Temperature Measurements for Cottonwood Creek by MT FWP

Year	RM	Period	Days >15°C	Days >20°C	Max Temp (°C)
2007					
	7.0	7/17-10/17	25	0	17.8
2008	0.3	7/11-10/13	62	26	22.2
	7.0	7/16-10/23	19	0	16.6

Source: MFWP 2008

Table 3: Temperature Measurements for Cottonwood Cr. by WRC, 2010

Stream/ Site code	Year	River Mile:	Start Date	End Date	Max T (°C)	Days > 20° C	7-day mean max temps
Cottonwood/ C1	2010	0.2	5/7	11/19	22.6	18	21.0
Cottonwood/ C2	2010	1.5	7/1	11/19	18.6	0	17.3
Cottonwood/ C3	2010	5.2	5/18	11/19	16.1	0	15.5

Nutrients

Nutrient levels of nitrogen and phosphorous in Cottonwood Creek were compared to documented streams unaffected by human-caused eutrophication, and are considered elevated by those standards (KirK, 2008). Quantities of these two nutrients increase downstream and have their highest concentrations near the city of Deer Lodge (KirK, 2008). The most likely sources are livestock and urban drainage (KirK, 2008).

Riparian Habitat/Stream Channel

When Montana FWP performed a stream assessment on Cottonwood Creek in 2007, the creek received reduced scores in all assessed categories (MFWP, 2008). The channel has been manipulated in several places, beneficial riparian vegetation is often sparse due to human activities and livestock grazing, and noxious weeds are present throughout the area. The lack of woody vegetation has led to bank erosion and increased sedimentation, as well as reduced debris for fish habitat (MFWP, 2008). The four tributaries included in the assessment (Baggs Creek and the North, Middle and South Forks of Cottonwood Creek) suffer from many of the same issues, although the riparian conditions are better for the North and Middle Forks (MFWP, 2008).

The WRC performed a riparian health assessment in 2010, and found that several stream reaches were classified as “at-risk” or “not sustainable” due to many of the same impairments noted by Montana FWP. Grazing, lack of woody vegetation and historic mining effects have depleted riparian habitat and resulted in accelerated bank erosion (WRC, 2010).

3. Native/Sport Fishery Status

Current Condition

Cottonwood Creek is one of the more significant tributaries in the upper Clark Fork and provides some habitat for genetically pure westslope cutthroat trout--mainly in the upper reaches of the drainage. A 2007 survey found no westslope cutthroat trout in the lower reaches, but brook and brown trout are present throughout (MFWP, 2010). The drainage suffers from barriers to fish passage in the form of culverts, irrigation diversions, high temperatures and low flows. Riparian habitat quality along Cottonwood Creek is considered “fair at best” (MFWP, 2010), and impacts from mining, logging, riparian grazing and development continue to affect the fishery (MFWP, 2010; BDNF, 2007).

Fishery Conditions in Cottonwood Creek Tributaries

Baggs Creek: contains higher levels of westslope cutthroat trout, but still is rated only “fair” overall fish habitat (MFWP, 2008). Riparian vegetation (especially woody varieties) is sparse, and impacts from livestock are apparent.

North Fork: contains several private mining claims and is also impacted by agriculture, logging and recreation. The creek contains a substantial population of westslope cutthroat trout and some brook trout. Fish habitat in the assessed reach was scored as “excellent” (MFWP, 2008).

Middle Fork: supports the same land uses as the North Fork and also contains primarily westslope cutthroat trout. Fish habitat in the assessed reach was rated “good” (MFWP, 2008)

South Fork: supports agriculture, timber harvest and recreation, but mining is not listed as a major land use. The 2007 survey sample was comprised solely of westslope cutthroat trout. Fish habitat in the reach was rated “fair (MFWP, 2008).

Table 4: Fish Distribution in the Cottonwood Creek Basin

Stream	Begin*	End*	Species	Abundance	Origin
Cottonwood Creek	0.0	10.0	Brook Trout	Common	Introduced
	0.0	10.0	Brown Trout	Common	Introduced
	0.0	1.0	Common Carp	Unknown	Introduced
	0.0	1.0	Largescale Sucker	Unknown	Native
	0.0	1.0	Longnose Sucker	Unknown	Native
	0.0	1.0	Mottled Sculpin	Unknown	Native
	0.0	1.0	Redside Shiner	Unknown	Native
	0.0	10.0	Slimy Sculpin	Common	Native
	0.0	4.0	Westslope Cutthroat Trout	Rare	Native
	4.0	10.0	Westslope Cutthroat Trout	Common	Native
Rocker Gulch	0.0	2.0	Westslope Cutthroat Trout	Common	Native
South Fork Dry Cottonwood Creek	0.0	5.0	Westslope Cutthroat Trout	Rare	Native
Middle Fork Cottonwood Creek	0.0	3.0	Brook Trout	Rare	Introduced
	0.0	3.0	Westslope Cutthroat Trout	Common	Native
North Fork Cottonwood Creek	0.0	3.0	Brook Trout	Unknown	Introduced
	0.0	3.0	Westslope Cutthroat Trout	Common	Native

*River Mile   Source: KirK, 2008

Fishery Potential

While Cottonwood Creek experiences the above impairments, protection and enhancement possibilities for a viable trout fishery exist on several levels (Table 5). The USFS has classified Cottonwood Creek as a "fish priority" watershed in the BVDL Forest Plan.

FWP has shown an interest in managing (in collaboration with state agencies and other organizations) Cottonwood Creek as a recreational fishery, declaring lower Cottonwood Creek a "Priority 2" stream reach in the Final Tributary Rating Summary (2010). There is evidence of a fluvial westslope cutthroat trout population, with at least one radio-tagged fish ascending from the Clark Fork river to Baggs Creek in 2010 (J. Lindstrom, FWP, 2012). Improved management practices can increase the fishery viability by addressing documented impairments with appropriate restoration projects.

vegetation regeneration (number and age of woody plant stems). Daily flow and temperature monitoring has also been conducted on five tributaries. These daily data sets are useful for monitoring the future impacts of in-stream flow or irrigation water management projects on streamflow and water temperature. These monitoring sites are labor-intensive to establish and maintain, but they create an excellent baseline for monitoring project impacts and long-term changes in impairment conditions.

Table 1: On-going monitoring sites established by WRC in 2010-2011

Streams:	**Riparian Assess-ment**	**Flow sites**	**Flow &temp sites**	**Rosgen Fluvial Geomor-phology**	**R1-R4 Fish Habitat & Vegetation Greenline**
Type:	**NRCS (miles)**	**periodic**	**Daily TruTrack**	**sites**	**sites**
Dunkleberg Cr.	6.1	0	0	0	0
Gold Creek	5.3	3	3	3	3
Cottonwood Cr.	8.1	3	3	2	2
Peterson Cr.	9.0	2	0	2	2
Racetrack Cr.	11.5	4	3	2	2
Dempsey Cr.	6.8	2	2	2	2
Lost Cr.	7.1	1	0	0	0
Willow Cr-Opportunity	9.8	0	0	0	0
Dry Cottonwood Cr.	8.5	2	0	2	2
Perkins Gulch	4.0	0	0	2	2
Browns Gulch, tribs	0	5	3	2	2
TOTAL , Oct. 2011:	73.5	22	14	17	17

Table 5: Tributary Rating Summary for Cottonwood Creek (Priority 2)

Stream	Reach(RM)	Trout Species	Impairments
Cottonwood Creek	Lower: 0.0-5.8	Brook and Brown	Low summer flows due to irrigation, diversions, culverts; mining; livestock grazing in riparian areas; high temperatures; development; competition to westslope cutthroat from brook/brown trout
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Low			**Medium**

Source: MFWP (2010) and KirK (2008)

4. Monitoring/Assessments

Cottonwood Creek and its riparian areas have been monitored by several different agencies in recent years (Table 5). Assessments have included fish habitat and fishery potential, stream flow, temperature, noxious weeds, and stream channel and riparian habitat status.

Cottonwood Creek and its riparian areas have been monitored by several different agencies in recent years. Assessments have included fish habitat and fishery potential, temperature, noxious weeds, and stream channel and riparian habitat status.

Table 5: Cottonwood Creek Assessments

Type	Agency	Year	Area
Riparian/Geomorphology/Flow Assessment	WRC	2011/2012	Lower Cottonwood Creek
Tributary Prioritization /Rating Summary	MFWP	2010	Lower Cottonwood Creek
Fish Population/Riparian Habitat	MFWP	2008	Cottonwood Creek/Tributaries
Flow Report	KirK	2010	Cottonwood/Baggs Creek
Riparian/Geomorphology/Flow Assessment	WRC	2010	Cottonwood Creek
EDLV Landscape Assessment	KirK	2008	Cottonwood/tributaries
Youth Forest Monitoring Program	BDNF	2007	Tributaries

5. Restoration

Needs

- Address high stream temperatures in Cottonwood Creek and monitor those of the tributaries
- Address dewatering issues caused by over-irrigation and over-allocation of water rights
- Facilitate fish passage in areas with barriers such as diversions and culverts
- Promote methods of keeping livestock out of creeks and away from sensitive riparian areas to help with nutrient loading, metals contamination, sedimentation, and destruction of fish and riparian habitat
- Continued monitoring of abandoned mines

Activities: Projects being undertaken by the WRC

- Cottonwood Creek Habitat Enhancement- 2011 (install Applegate pivots)
- Cottonwood Creek Habitat Enhancement-2011 (install Applegate pipeline)
- Cottonwood Creek -2011 (design and install new Applegate irrigation diversions)
- Cottonwood Creek Habitat Enhancement-2011-2012 (install stockwater wells and tanks- McQueary Ranches)
- Cottonwood Creek Fish Passage, NFWF, 2011-2013 (design, install new diversions, fish passage structures incl. Kohrs & Manning Ditch)
- Cottonwood Creek-D. Johnson Channel Design, 2011-2012

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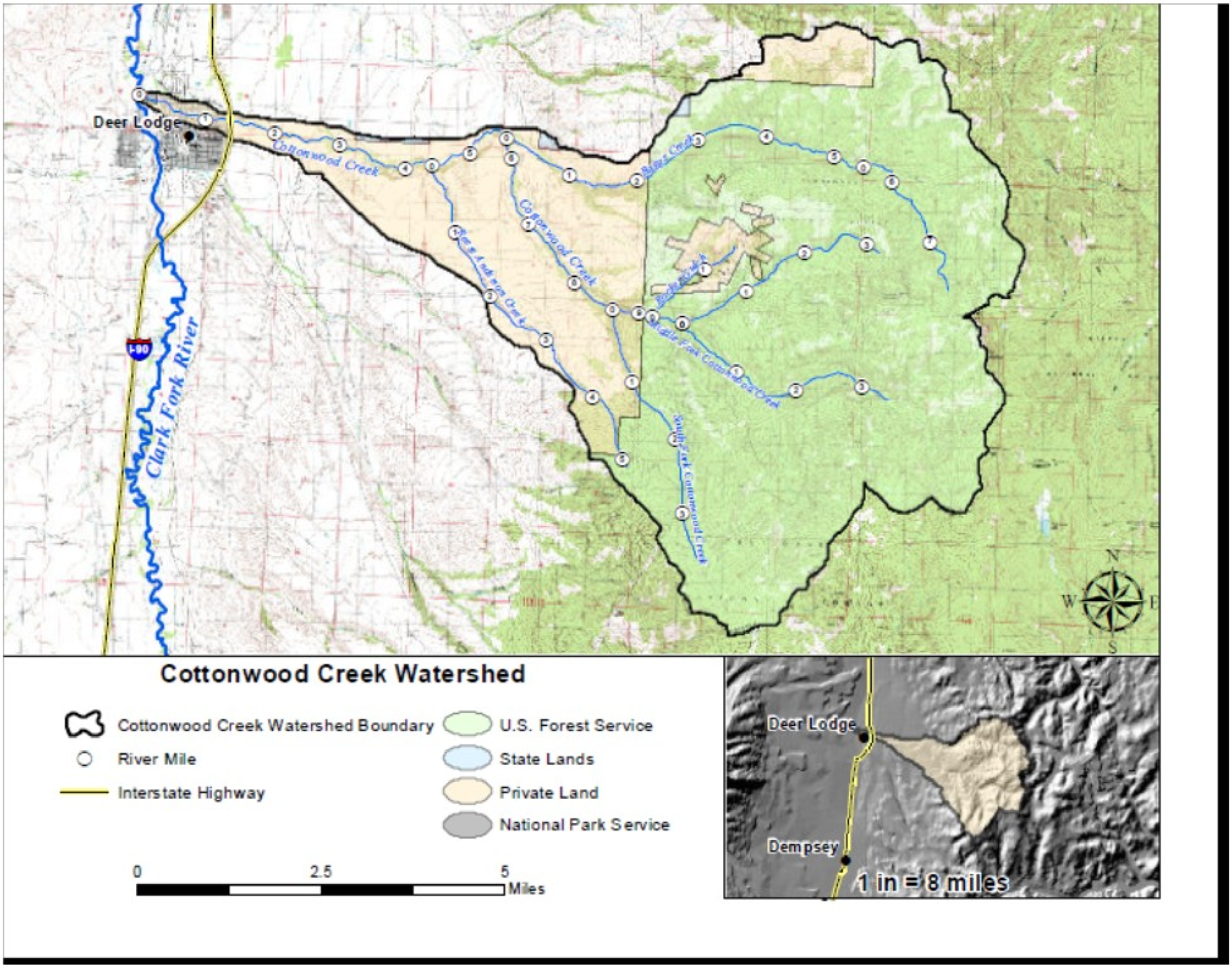

Cottonwood Creek Watershed
Deer Lodge
Cottonwood Creek
Clark Fork River
I-90
Baggs Creek
Middle Fork Cottonwood Creek
South Fork Cottonwood Creek
Cottonwood Creek Watershed Boundary
River Mile
Interstate Highway
U.S. Forest Service
State Lands
Private Land
National Park Service
0
2.5
5
Miles
N
S
E
W
Deer Lodge
Dempsey
1 in = 8 miles

Dempsey Creek Watershed Summary

1. Description and Land Use

Dempsey Creek originates in the Flint Creek mountain range and drains an area encompassing about 36 square miles southwest of the town of Deer Lodge. The creek flows for 16.5 miles until it reaches the Clark Fork River about five miles south of Deer Lodge near Sager Lane. The land ownership in Dempsey Creek is mainly shared U.S. Forest Service, Montana State Prison, and private landowners (Table 1), and is used for National Forest recreation, grazing and irrigated agriculture (MFWP, 2009).

Table 1: Dempsey Creek Watershed Overview

Watershed Size	18,158 acres/36.4 sq miles/94.2 sq km
Elevation Range	5,364 Feet [4,672-10,036]
Stream Miles	45.1
Land Ownership	Private: 38% /State: 7%/ Federal: 55%
Road Miles	Highway = 0.5 Local Road/City Street = 25.3 Four Wheel Drive Trail = 8.6 Service Road/Driveway = 2.1 Total = 36.5

Source: Montana GIS Portal Data Layers

2. Impairments

Montana DEQ has listed impairments on Dempsey Creek for nutrients, sediment, low-flow alterations and alteration in streamside vegetation. The FWP and WRC have unpublished data which indicates a thermal impairment in the lower five miles of Dempsey Creek.

Table 2: TMDL Impairments for Dempsey Creek

Impairment	Reach (River Mile)	Pollutant	Affected Beneficial Use
Nitrate/Nitrite (Nitrite + Nitrate as N)	RM 0.0.-10.2	Nutrients	Aquatic Life, Cold Water Fishery
Sedimentation/ Siltation	RM 0.0.-10.2	Sediment	Aquatic Life, Cold Water Fishery
Low flow alterations	RM 0.0.-10.2	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in streamside veg cover	RM 0.0.-10.2	*Not a Pollutant*	Aquatic Life, Cold Water Fishery

Source: MDEQ, 2010

Nutrients

Dempsey Creek exceeds Montana DEQ TMDL standards for nitrogen (nitrites/nitrates) throughout most of the drainage (Table 2). Nitrites and nitrates mainly come from agricultural runoff, and from in-stream livestock sources. According to KirK (2008), excessive nutrient levels can lead to undesirable algae growth which in turn can cause:

- Unpleasant tastes and odors in drinking water
- Corrosion and blockages of irrigation equipment
- Reduced dissolved oxygen
- Altered ecological communities, especially macroinvertebrates

Degradation of aesthetic value

Sediment/Siltation

Impairments from sediment and siltation often occur from over-grazing in the riparian areas near Dempsey Creek. Channel manipulation and historical grazing and clearing reduced woody vegetation in the riparian corridor in many reaches of lower Dempsey Creek, resulting in an unstable channel with high frequency of eroding banks. Intense livestock impact also, leads to accelerated bank erosion (MFWP, 2009). Sedimentation beyond that which is naturally occurring damages fish and macroinvertebrate habitat by filling in redds, reducing available habitat (such as riffles and pools), and by altering stream channels (MDEQ, 2011). Sediment levels in Dempsey Creek exceed those defined by Montana DEQ TMDL standards.

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. Many water rights exist on Dempsey Creek and North Fork Dempsey Creek (MDNRC, 2011), and several lakes near its headwaters are regulated for summer water use (MFWP, 2009). Low flows and complete dewatering are not uncommon below the State Prison reach, especially in late summer. Low flows result in unsuitable habitat for fish and macro-invertebrates due to increased temperatures and algal growth (Table 3). In addition, irrigation structures create barriers which impede fish passage and migration (MFWP, 2010).

Temperature

Thermal impairments do exist in lower Dempsey Creek, and are probably due to dewatering by flood irrigation, as well as return flow from flood irrigation, and poor shade cover over the stream (Table 3). Temperatures below 16°C are optimum for westslope cutthroat trout growth, while prolonged temperatures above 20 °C are lethal for westslope cutthroat trout.critical for their survival (Kirk, 2010). High temperatures encourage algae growth and reduce dissolved oxygen content, which can be detrimental to all aquatic life.

Interestingly, the water temperature data from FWP and WRC are very similar for the middle watershed (RM 5.2 is near the Prison Ranch headquarters) in 2008 and 2010. However, the data for the lower watershed is quite distinct, with FWP 2008 data showing cooler water temperature in lower Dempsey Creek than upstream, and 2010 WRC data showing warmer water in lower Dempsey Creek than the upstream site. This may be due to the fact that 2008 was a low-runoff year, and most flow at the lower site was probably cooler groundwater return flow (channel between RM 4 and RM 2 often dries up in late summer). In 2010, there was abundant runoff water, and probably a larger influence in the lower watershed from surface water, especially warm irrigation return flows from flood-irrigated fields.

Table 3: Temperature Measurements for Dempsey Creek

PIBO 2008	RM*	Start Date	End Date	Max T (°C)	Days>12°C	Days>18°C
	11.8	7/15	8/31	14.0	30	0
FWP 2008	RM*	Start Date	End Date	Max T (°C)	Days>15°C	Days>20°C
	0.6	7/12	10/13	17.1	4	0
	5.1	7/12	10/13	22.3	47	8
WRC 2010	RM*	Start Date	End Date	Max T (°C)	Days>15°C	Days>20°C
	0.6	7/1	11/2	22.0	63	15
	5.3	7/1	11/2	22.3	51	9

*River Mile

Source: PIBO/USFS 2010; MFWP 2009; WRC, 2011

3. Native/Sport Fishery Status

Current Condition

The Dempsey Creek fishery is severely affected by agricultural irrigation practices. Over-allocation of water has led to extreme low flows on the lower reaches of the creek, with complete dewatering in certain reaches. While upper reaches support populations of westslope cutthroat trout, the lower reaches (confluence with the North Fork to the mouth) contain none. Trout populations in this section are composed mainly of brook and brown trout (MFWP, 2010). As mentioned in earlier sections, low water flows also result in high temperatures and algal growth, which further compromise aquatic health.

The riparian habitat of lower Dempsey Creek is rated "fair to poor" by Montana FWP in 2010 due to its lack of woody vegetation and channel alteration from livestock access. In a riparian assessment completed in 2011, the WRC declared several of the creek's reaches "at-risk" and one as "not sustainable" due to lack of diverse and dense woody vegetation, bank erosion from livestock, low flows and noxious weeds.

Table 4: Fish Distribution in the Dempsey Creek Watershed

<u>Waterbody</u>	Reach (RiverMiles)		Species	Updated
Dempsey Creek	0.0	6.8	Slimy Sculpin	2/23/2009
Dempsey Creek	0.0	8.1	Brown Trout	1/5/2005
Dempsey Creek	5.2	13.1	Brook Trout	2/20/2009
Dempsey Creek	0.0	5.2	Brook Trout	2/20/2009
Dempsey Creek	8.1	16.8	WS Cutthroat Trout	1/5/2005
North Fork Dempsey	0.0	4.4	WS Cutthroat Trout	7/9/2009

Source: MFWP, 2010

Fishery Potential

While Dempsey Creek experiences several impairments, protection and enhancement possibilities for a viable trout fishery exist on several levels (Table 5). Montana FWP has shown an interest in managing Dempsey Creek as a recreational fishery, declaring lower Dempsey Creek a "Priority 2" stream reach in the agency's Final Tributary Rating Summary (2010). Improved management practices can increase the fishery's viability with appropriate restoration projects.

Table 5: Tributary Rating Summary for Dempsey Creek (Priority 2)

Stream	Reach(RM)	Trout Species	Impairments
Dempsey Creek	Lower: 0.0-8.1	Brook and Brown	Low summer flows due to irrigation with complete dewatering at certain reaches, livestock grazing in riparian areas; high temperatures; competition to westslope cutthroat from brook/brown trout; residential development
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Very Low			**Low**

Source: MFWP, 2010

4. Monitoring /Assessments

Dempsey Creek and its riparian areas have been monitored by several different agencies in recent years (Table xxx). Assessments have included fish habitat and fishery potential, temperature, stream flow, noxious weeds, and stream channel and riparian habitat status.

Table 6: Dempsey Creek Assessments

Type	Agency	Year	Area
Tributary Prioritization /Rating Summary	MFWP	2010	River Mile 0.0-8.1
Fish Population/Riparian Habitat	MFWP	2009	River Mile 4.4, 5.0, and 10.7
PIBO Streams and Riparian Areas	USFS	2010	River Mile 11.8
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0-10.2
Riparian/Geomorphology/Flow	WRC	2010/	River Mile 0.0-7.0
Irrigation Structure Inventory	WRC	2010	Dempsey Creek

The WRC assessed riparian condition on the lower seven (7) miles of Dempsey Creek in 2010 and 2011. Of a total of 18 assessed reaches, one reach scored “sustainable,” nine reaches were scored “at risk,” and eight reaches were scored “unsustainable.” The unsustainable reaches were concentrated in the reach from RM 1.8 to RM 3.7, which includes a high proportion of manipulated channel, much of which probably had the woody riparian vegetation mechanically cleared. These sites are almost entirely vegetated with disturbance-induced grasses along the stream channel, and have no deep binding root mass, little woody vegetative cover, noxious weeds, and poor recruitment of woody species. The reaches from RM 3.7 to RM 6.1 are mostly Montana State Prison, and have these same characteristics, but the riparian woody vegetation and channel characteristics improve somewhat as you move upstream.

Montana FWP assessed riparian conditions at three sites (RM 4.4, 5.0, 10.7) where they also sampled fish. The lowest site, RM 4.4, on the lower end of the Prison property was dominated by disturbance-induced grass, and partly dewatered by irrigation diversions. No fish were present. At RM 5.0, the riparian condition and fish habitat improved slightly as some riparian woody vegetation, and large debris (rootwads) appeared. This reach had some non-native trout. At RM 10.7 the stream was passing through a spruce-alder habitat on the USFS property, with very high riparian condition, and very good fish habitat, with westslope cutthroat and brook trout present.

5. Restoration

Needs

- Address irrigation and dewatering issues within the affected stream reaches
- Address issues of livestock access to Dempsey Creek and its riparian areas
- Continue to monitor temperature and stream flow
- Improve habitat for trout, especially native westslope cutthroat populations
- Stabilize riparian areas and provide stream cover by restoring riparian vegetation communities
- Monitor and control invasive weeds
- Improve community outreach methods in order to overcome limits to monitoring on private land within the watershed

Activities:

The WRC has contacted several landowners on lower Dempsey Creek about improving channel conditions, and in-stream flow, and is beginning a conceptual design for one landowner. No projects are yet developed. The CF Coalition and DL Valley CD are studying a large gravity pipeline project concept which would potentially affect flows in Racetrack and Dempsey Creek.

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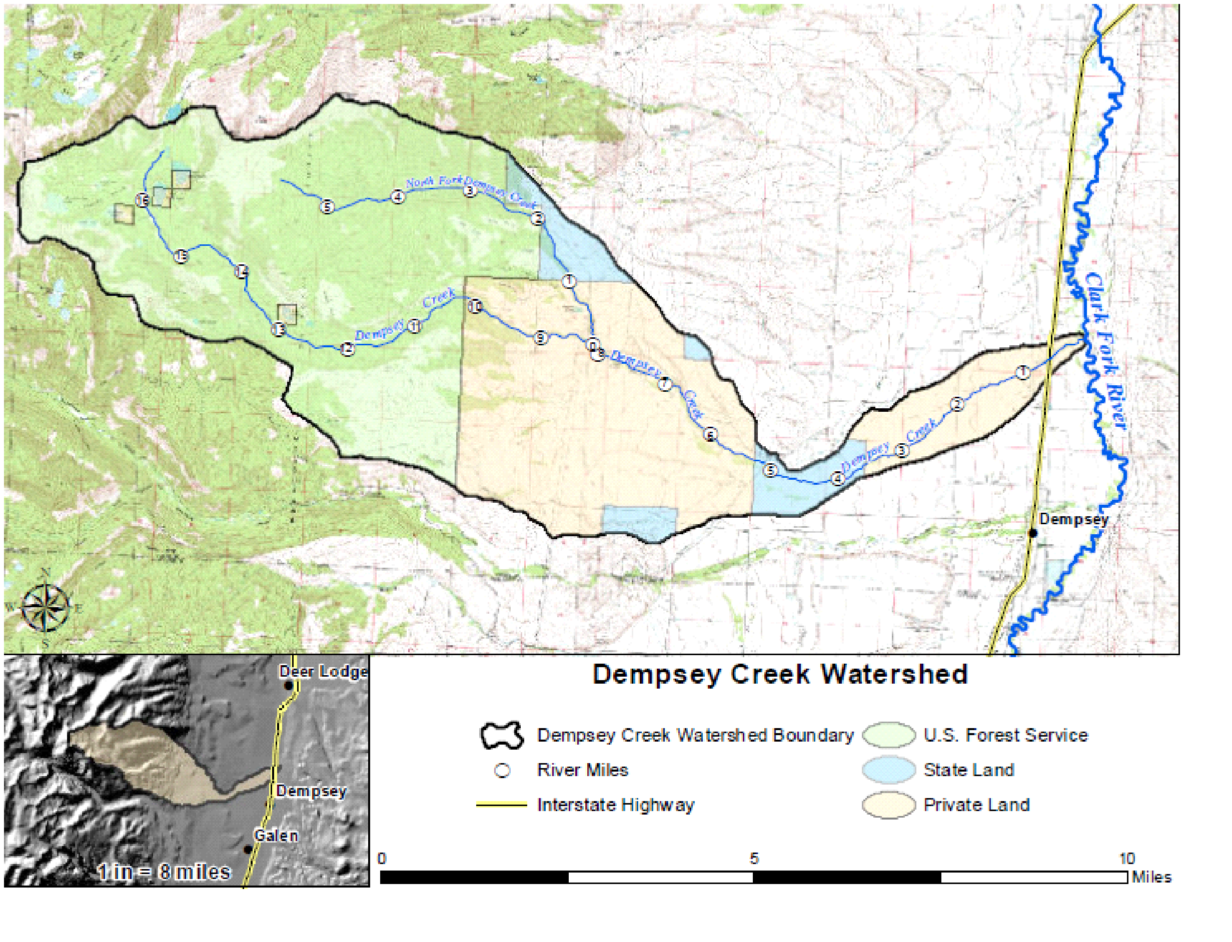

Clark Fork River
North Fork Dempsey Creek
Dempsey Creek
Dempsey
Deer Lodge
Galen
1 in = 8 miles
Dempsey Creek Watershed
Dempsey Creek Watershed Boundary
River Miles
Interstate Highway
U.S. Forest Service
State Land
Private Land
0
5
10
Miles

Gold Creek Watershed Summary

1. Description and Land Use

Gold Creek originates in the Flint Creek mountain range and flows for about 15 miles until it reaches its confluence with the Clark Fork. The Gold Creek watershed contains the tributaries of Blum Creek, Pikes Peak Creek, Crevice Creek, and North and South Fork Gold Creek, as well as several smaller streams. Gold Creek is the site of the first gold discovery in Montana, and thus has a long mining history (MDEQ, 2010). The watershed also supports agriculture, grazing and timber harvest (MFWP, 2009). The basin is comprised mainly of private and Forest Service land, with a small percentage of state-owned property (MFWP, 2010).

Table 1: Gold Creek Watershed Overview

Watershed Size	42,613acres/66.5 sq miles/172.4 sq km
Elevation Range	5,082 Feet [4,170-9,252]
Stream Miles	81.3
Land Ownership	Private: 40% /State: 2%/Federal: 58%
Road Miles	Local Road/City Street = 51.7 Four Wheel Drive Trail = 34.2 Service Road/Driveway = 3.1 Trail/Walkway = 2.2 Total = 91.2

Source: Montana GIS Portal Data Layers

2.Impairments

The DEQ has listed Gold Creek for nutrients, low-flow, and heavy metals.

Table 2: TMDL Impairments for Gold Creek

Impairment	Reach (River Mile)	Pollutant	Affected Beneficial Use
Iron & Lead	0-10.2	Metals	Aquatic Life, Cold Water Fishery
Nitrogen (Total)	0-10.2	Nutrients	Aquatic Life, Cold Water Fishery
Low Flow Alterations	0-10.2	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation

Source: MDEQ, 2010

Metals

The Gold Creek basin contains over 80 abandoned mines (MBMG, 2002), many of which have been associated with adit discharge and/or waste rock dumps (MDEQ, 2010). Sampling for metals were taken in 2007 and 2008 by DEQ on the upper segment of Gold Creek, and elevated levels of lead were identified during the process. While no samples exceeded water quality targets, soil samples taken near some of the tributaries were found to have higher lead levels (MDEQ, 2010). Lower Gold Creek (River Mile 10.2- 0.0) was also sampled, but that section of the creek did not contain sufficient metals concentrations to warrant placement on the 2008 303 (d) list (MDEQ, 2010). However, the sample values for lead and iron on some of Gold Creek's tributaries are documented in the 2010 document because they exceed water quality target levels (MDEQ, 2010).

Nutrients

Gold Creek exceeds Montana DEQ TMDL standards for total nitrogen throughout the lower part of the drainage (Table 2). High levels of dissolved phosphorus in the stream are believed to be from natural sources (DEQ, 2010). Excess nitrogen probably comes mainly from agricultural runoff, and from livestock sources. According to KirK (2008), excessive nutrient levels can lead to undesirable algae growth which in turn can cause:

- Unpleasant tastes and odors in drinking water
- Corrosion and blockages of irrigation equipment
- Reduced dissolved oxygen
- Altered ecological communities, especially macro invertebrates

Degradation of aesthetic value

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. Many diversions exist in the Gold Creek basin (MDNRC, 2011) and lower sections of Gold Creek have been completely dewatered in the past, especially near Wall City (MFWP, 2009). A series of irrigation diversions dewaters Gold Creek for a short reach upstream and downstream of the Wall City bridge, before irrigation return flows and Pikes Peak Creek rewater the channel. In 2011, for example, the channel was totally dewatered at this site twice, once for 20 days in late August, and again for 9 days in late September (WRC, 2011). Low flows result in unsuitable habitat for fish and macro invertebrates due to increased temperatures and algal growth (Table 3). In addition, irrigation structures can create barriers which impede fish passage and migration (MFWP, 2010).

Temperature

Thermal impairments are attributed to agricultural dewatering, and have been documented on Gold Creek and North Fork Gold Creek. While temperatures on some reaches of the creek have regularly climbed above 15 °C, the 2007 and 2008 monitoring seasons showed a marked drop in water temperature. This drop was possibly caused by increased stream flows in the reach due to some irrigation improvements (MFWP, 2009).

Concerning fishery health and fish survival, temperatures below 16°C are optimum for westslope cutthroat trout growth, while sustained temperatures above 20 °C are lethal (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

In 2010 and 2011, water temperatures near the mouth of Gold Creek maintained temperatures well below 20 degrees C., but the site just above Wall City had 13 days and 29 days with temperatures above 20 degrees C, respectively in 2010/2011 when dewatering left only stagnant water in pools (WRC, 2011).

Table 3: Temperature Measurements for North Fork Gold Creek and Gold Creek

PIBO 2007 North Fork	**RM***	**Start Date**	**End Date**	**Max T (°C)**	**Days>12°C**	**Days>18°C**
	1.0?	7/15	8/31	18.1	37	0
FWP 2007 Gold Creek	**RM***	**Start Date**	**End Date**	**Max T (°C)**	**Days>15°C**	**Days>20°C**
	0.1	7/1	10/16	21.2	65	8
	5.7	7/1	10/16	16.1	10	0
FWP 2008 Gold Creek	0.1	7/4	10/13	16.9	37	0
	5.7	7/4	10/13	14.1	0	0

Source: PIBO/USFS, 2010; MFWP, 2009

3. Native/Sport Fisheries

Current Condition

Gold Creek is one of the largest tributaries to the Clark Fork between Flint Creek and the Little Blackfoot River, and provides habitat for brown trout and native westslope cutthroat trout. Fish samples taken in 2007 (RM 0.3, 4.4, 11.1, 13.8) show large numbers of juvenile fish from both trout species, which suggests that the creek is important for spawning and fry development (MFWP, 2010). Despite supporting populations of westslope cutthroat trout, Gold Creek still loses substantial water to irrigated hay production which contributes to low flows during drier years. Additionally, cattle grazing and pasturing have diminished woody vegetation in the area as well as contributed sediment and nutrients to the stream (MFWP, 2010).

Table 4: Fish Distribution in Gold Creek

Water Body	Begin*	End*	Species	Updated
Gold Creek	0.0	12.1	Brown Trout	11/18/2009
Gold Creek	0.0	2.8	Mountain Whitefish	2/20/2009
Gold Creek	0.0	4.6	Slimy Sculpin	9/14/2009
Gold Creek	0.0	14.4	Westslope Cutthroat Trout	7/27/2009
North Gold Creek	0.0	1.1	Westslope Cutthroat Trout	7/24/2009
North Gold Creek	1.1	4.4	Westslope Cutthroat Trout	1/5/2005
South Gold Creek	0.0	3.0	Westslope Cutthroat Trout	1/5/2005
Pikes Peak Creek	0.0	12.8	Westslope Cutthroat Trout	1/5/2005
Crevice Creek	0.0	4.5	Westslope Cutthroat Trout	
Blum Creek	0.0	5.5	Westslope Cutthroat Trout	1/5/2005

*River Mile

Source: MFWP, 2010

Fishery and Habitat Conditions in Gold Creek Tributaries

Pikes Peak Creek: primarily supports populations of westslope cutthroat trout (MFWP, 2009). However, Montana FWP (2009) rates the creek's fish habitat only as "fair" due to heavy grazing in the riparian area which has depleted woody vegetation and damaged stream banks. In addition to grazing, the Pikes Peak Creek drainage is affected by timber harvest and has historically been mined (MFWP, 2009).

Crevice Creek: also contains westslope cutthroat trout, and sample taken in 2007 by Montana FWP returned no other trout species (MFWP, 2009). Montana FWP rated fish habitat at RM 1.8 as "good", but not at its potential. While there is a good amount of woody vegetation, much of it showed the results of heavy browsing. Stream bank erosion was also present due to hoofshear, and noxious weeds were evident near the sample site (MFWP, 2009). Habitat at RM 4.4 was rated only "fair" and not at its potential because of heavy grazing, hoofshear, lack of deep pools and fine sediment accumulation (MFWP, 2009).

North Fork Gold Creek: was found to support populations of westslope cutthroat trout at RM 1.6 and none at a sample site on RM 3.7., despite a riparian habitat score of 100%. Fish habitat at the first site was rated good, but could benefit from more woody vegetation and deeper pools. An irrigation diversion also exists near the site (MFWP, 2009).

South Fork Gold Creek: A 2007 Montana FWP sample at RM 0.8 was comprised entirely of westslope cutthroat trout. The creek received a score of 100%, was rated as "good" and thought to be near its potential as a fishery (MFWP, 2009). Woody vegetation was varied and abundant, although pools were not deep and fine sediment accumulation was noted (MFWP, 2009).

Fishery Potential

While Gold Creek experiences several impairments, protection and enhancement possibilities for a good trout fishery exist on several levels (Table 5). Montana FWP is interested in managing Gold Creek as a recreational fishery, declaring lower Gold Creek a "Priority 2" stream reach in the agency's Final Tributary Rating Summary (2010). Improved management practices can increase the fishery viability by addressing documented impairments (Table 5) with appropriate restoration projects. Several major tributary streams have westslope cutthroat trout populations.

Table 5: Tributary Rating Summary for Gold Creek (Priority 2)

Stream	Reach(RM)	Trout Species	Impairments
Gold Creek	Lower: 0.0-10.2	Brown and West-slope Cutthroat	Low summer flows due to irrigation with complete dewatering at certain reaches; livestock grazing in riparian areas; high temperatures; competition to westslope cutthroat from brown trout; residential development
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
High			**High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
High			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Medium			**Medium**

Source: MFWP, 2010

Table 6: Tributary Rating Summary for Pikes Peak Creek (Unrated)

Stream	Reach(RM)	Trout Species	Impairments
Pikes Peak Creek	0.0-12.7	Westslope Cut-throat	Low summer flows due to irrigation with complete dewatering at certain reaches, livestock grazing in riparian areas; high temperatures; historic mining and timber harvest impacts
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Low			**Low**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**Medium**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
High			**High**

Source: MFWP, 2010

4. Monitoring/Assessments

Gold Creek's habitat and water quality status have been assessed several times in the last 10 years (Table 7). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and habitat status.

Table 7: Gold Creek Assessments

Type	Agency	Year	Area
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0-10.2
PIBO Stream s and Riparian Areas	USFS	2009	River Mile 1.0
Tributary Prioritization	MFWP	2010	River Mile 0-10.2
Fish Population/Riparian Habitat	MFWP	2009	Gold Creek/tributaries
Riparian/ Geomorphology/ Flow/ Temp	MWRC	2010/2011	River Mile 0.0-5.7
Irrigation Structure Inventory	WRC/ TU/ MFWP	2010	Throughout Gold Creek

The WRC assessed riparian condition in 2010 on about 5 miles of the lower mainstem of Gold Creek from the mouth upstream to the bridge at RM 5.5. The assessment indicated that seven of fourteen reaches were in "sustainable" condition, with five reaches "at risk" and two reaches "unsustainable." The two unsustainable reaches were dominated by livestock corrals or paddocks in intensive use. The larger corral, near RM 0.6 is currently being relocated as part of a larger restoration effort. The "at risk" reaches were characterized by low levels of woody riparian cover, noxious weeds, and low recruitment of woody species. Some "at risk" reaches had moderate levels of lateral bank erosion (WRC, 2011).

Montana FWP assessed riparian condition along Gold Creek at their fish sampling sites (RM 0.3, 4.4, 11.1, and 13.8) in 2007. The lower site (Rosgen C channel) had simplified riparian vegetation and poor cover, with low flows and overall poor fish habitat. The sites from RM 4.4 on upstream (Rosgen B channels) had high riparian condition scores, and had markedly better fish habitat, scoring good to very good.

5. Restoration

Needs

- Address high stream temperatures in Gold Creek and monitor those of the tributaries
- Monitor abandoned mine areas for metals discharge and leaching
- Address dewatering issues caused by over-irrigation and over-allocation of water rights
- Facilitate fish passage in areas with barriers such as diversions and culverts
- Promote methods of keeping livestock out of creeks and away from sensitive riparian areas to help with nutrient loading, metals contamination, sedimentation, and destruction of fish and riparian habitat
- Riparian plantings for improved woody vegetation communities and stream cover

Monitor and address noxious weed issues

Activities:

The WRC has participated in a large project from 2008-2011 on a ranch in the lower two miles of Gold Creek which has included: installation of pivot sprinklers to replace flood irrigation, fish screen, off-stream water development, riparian fencing, moving a large corral system. This project, funded by NRCS and several others (DEQ, MFWP, USFWS) is in its final stages in 2012.

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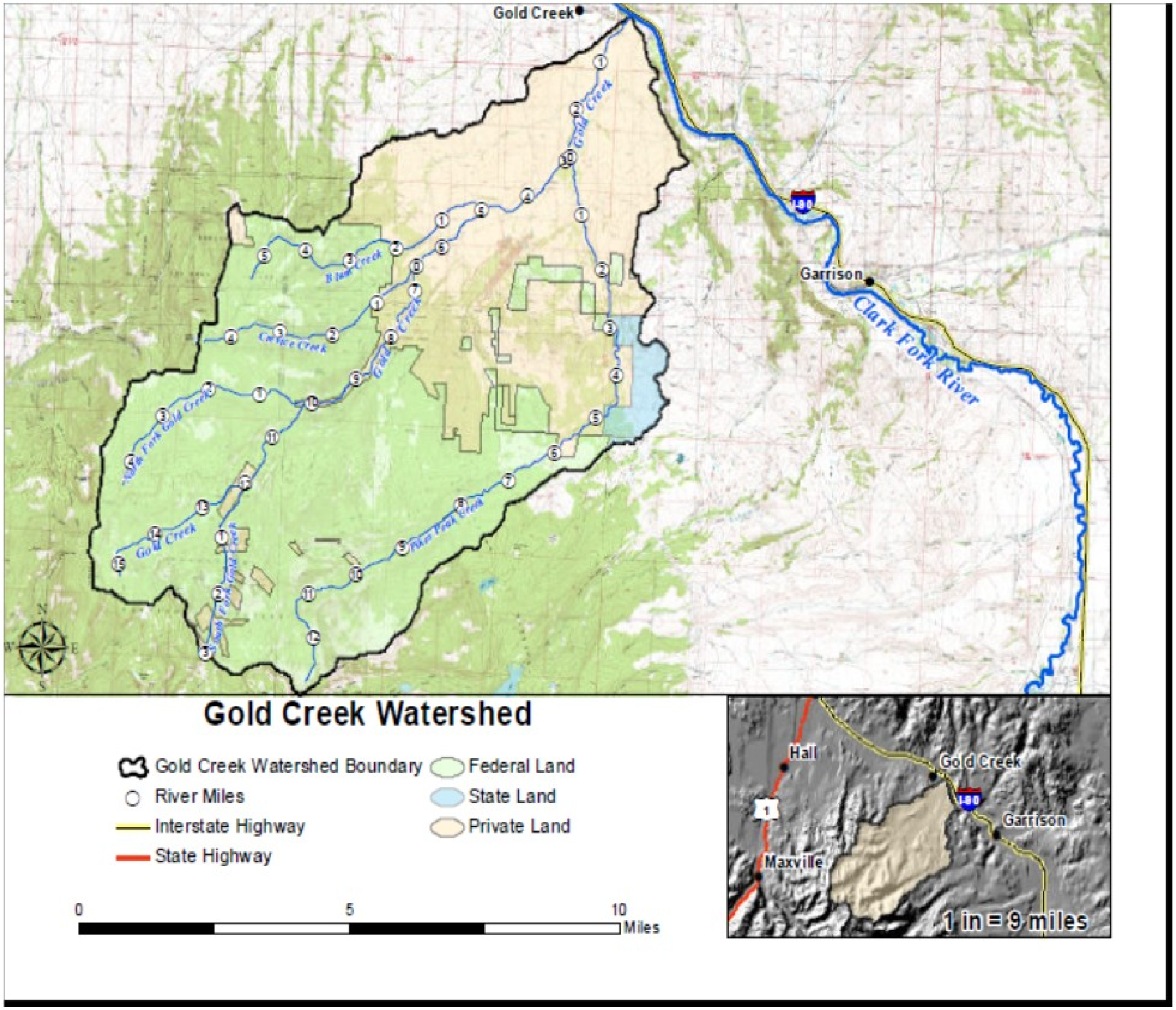
Gold Creek
Garrison
Clark Fork River
Blue Creek
Carpp Creek
Gold Creek
North Fork Gold Creek
South Fork Gold Creek
Pikes Peak Creek
Gold Creek Watershed
Gold Creek Watershed Boundary
River Miles
Interstate Highway
State Highway
Federal Land
State Land
Private Land
0
5
10
Miles
Hall
Maxville
Gold Creek
Garrison
1 in = 9 miles

Lost Creek Watershed Summary

1. Description and Land Use

Lost Creek flows from the Flint Range for approximately 23 miles before joining the Clark Fork River. The drainage is shared between U.S. Forest Service, state, and private lands, with most of the private land located within the lower 16 miles of the creek's basin (MFWP, 2009). Land use in the upper part of the basin consists mostly of National Forest recreation, while activities in the lower portion include agriculture (irrigated hay and cattle operations) and rural homesite development (MFWP, 2009). In the past, Lost Creek was part of the Mt. Haggin Ranch, and for more than 100 years, experienced heavy use from both cattle and sheep. Additionally, soils in the basin have been contaminated by arsenic and metals air fall-out from the Anaconda copper smelter (Harris and Watson, 2000).

Table 1: Lost Creek Watershed Overview

Watershed Size	38,451 acres/60.1 sq miles/ 155.6 sq km
Elevation Range	4, 203 feet (4,780-8,983)
Stream Miles	112.5
Land Ownership	Private: 65% /State: 7%/Federal: 29%
Road Miles	Local Road/City Street = 25.9 Four Wheel Drive Trail = 5.0 Service Road/Driveway = 6.8 Highway = 0.7 Total = 38.4

Source: Montana GIS Portal Data Layers

2. Impairments

Impairment	Reach (River Mile)	Pollutant	Impaired Beneficial Use
Arsenic	0.0-15.9	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
Iron	0.0-15.9	Metals	Aquatic Life, Cold Water Fishery
Manganese	0.0-15.9	Metals	Aquatic Life, Cold Water Fishery
Sulfates	0.0-15.9	Metals	Aquatic Life, Cold Water Fishery
Nitrate/Nitrite (Nitrite + Nitrate as N)	0.0-15.9	Nutrients	Aquatic Life, Cold Water Fishery
Low Flow Alterations	0.0-15.9	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in stream-side or littoral vegetative cover	0.0-15.9	*Not a Pollutant*	Aquatic Life, Cold Water Fishery
Physical substrate habitat alterations	0.0-15.9	*Not a Pollutant*	Aquatic Life, Cold Water Fishery

Source: MDEQ, 2010

Metals

Multiple mines exist within the boundary of the Lost Creek watershed. However, none of these mines are listed for having adit discharge or tailings located within the floodplain of the creek (MDEQ, 2010). Much of the metals contamination in the basin is from the Anaconda copper smelter and was deposited atmospherically, through contaminated water, and through mine wastes near water sources. Iron, manganese, arsenic and sulfate are now present in soils throughout the lower 16 miles of the basin (MDEQ, 2010).

The four listed metals contaminants were last measured in the 1990s and only arsenic and iron levels exceeded human health allowances. Manganese exceeded the secondary maximum contaminant level (which addresses aesthetic values) and sulfate was listed because of the increase in concentration between the upper and lower reaches of the creek (MDEQ, 2010). Lost Creek is not listed for copper or lead, but both metals exceeded target concentrations, especially during storm events (MDEQ, 2010).

Nutrients

Lost Creek exceeds Montana DEQ TMDL standards for total nitrates/nitrites throughout the drainage (Table 2). The Lost Creek watershed traditionally has been heavily used for livestock operations and is a large contributor to nitrogen levels in the Clark Fork River (Harris and Watson, 2000). Excess nitrogen in rural areas typically comes mainly from agricultural runoff, in-stream livestock access, and residences without proper sewage management. (Harris and Watson, 2000). In Lost Creek, nitrates potentially originate from the Anaconda wastewater storage/infiltration ponds located near the headwaters of Dutchman Creek. Nitrogen encourages algae blooms which can decrease dissolved oxygen in the creek and harm fish populations (MFWP, 2009).

Riparian Habitat/Stream Channel

When Montana FWP performed a stream assessment on Lost Creek in 2008, the creek received “good” to “excellent” scores in all assessed reaches. However, Lost Creek is still listed for 303 (d) impairments relating to stream channel condition (Table 2).

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation diversions within the basin and has many implications for both water quantity and quality. Many irrigation diversions exist in the Lost Creek basin (MDNRC, 2011) and lower sections of Lost Creek suffer from extremely low flows (MFWP, 2009). The hydrology of Lost Creek is complicated by water from Warm Springs Creek which is conveyed into the Lost Creek basin, and spilled where these large canals cross Lost Creek. Low water levels result in unsuitable habitat for fish and macroinvertebrates due to increased temperatures and algal growth. In addition, irrigation structures in Lost Creek create barriers which impede fish passage and migration (MFWP, 2010).

Temperature

Thermal impairments are attributed to agricultural dewatering, and have been documented on lower reaches of Lost Creek. Temperatures on some reaches of the creek have often climbed above 15 °C, and sometimes exceed 20 °C (MFWP, 2009). Concerning fishery health and fish survival, temperatures below 16°C are optimum for westslope cutthroat trout growth, while temperatures below 20 °C are critical for their survival (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

Table 3: Temperature Measurements for Lost Creek

Year	RM*	Period	Days >12°C	Days >18°C	Max Temp (°C)
PIBO 2003	19.0	7/15-8/31	0	0	11.4
Year	**RM***	**Period**	**Days >15°C**	**Days >20°C**	**Max Temp (°C)**
FWP 2008	0.3	7/11-10/13	62	26	22.2
	7.0	7/16-10/23	19	0	16.6

*River Mile
Source: PIBO/USFS, 2010; MFWP, 2009

3. Native/Sport Fishery

Current Conditions

Lost Creek supports populations of resident and fluvial brown trout. Apparently the productivity of the fluvial population is affected by severe dewatering in late summer and early fall. The lower section, which was assessed by Montana FWP in 2010, also contains many irrigation diversions (the largest of these being the Gardiner Ditch) and structures that create obstacles for fish migration and recruitment (MFWP, 2009). Brook trout and native westslope cutthroat trout are only present in the middle and upper reaches of the creek and have not been detected in lower samples (MFWP, 2010). Other native fish in the lower creek include mountain whitefish, two species of suckers, a shiner and sculpin.

Table 4: Fish Distribution in Lost Creek

Water Body	Begin *	End*	Species	Updated
Lost Creek	10.3	20.2	Brook Trout	2/20/2009
Lost Creek	0.0	23.2	Brown Trout	1/5/2005
Lost Creek	0.0	9.4	Largescale Sucker	2/23/2009
Lost Creek	0.0	9.4	Longnose Sucker	2/23/2009
Lost Creek	0.0	10.2	Mountain Whitefish	2/20/2009
Lost Creek	0.0	9.8	Redside Shiner	2/23/2009
Lost Creek	7.4	10.3	Slimy Sculpin	9/14/2009
Lost Creek	0.0	7.4	Slimy Sculpin	2/23/2009
Lost Creek	18.5	19.5	Westslope Cutthroat Trout	7/14/2009
Lost Creek	15.0	17.0	Westslope Cutthroat Trout	1/5/2005
Lost Creek	5.6	15.0	Westslope Cutthroat Trout	1/5/2005

Source: MFWP, 2010

Fishery Potential

While Lost Creek experiences several impairments, including dewatering, seasonally high water temperatures in the lower creek, and some passage barriers, much of the habitat is in good to very good condition, and protection and enhancement possibilities for a viable trout fishery exist on several levels (Table 5). Montana FWP has shown an interest in managing Lost Creek as a recreational fishery, declaring lower Lost Creek a "Priority 2" stream reach in the agency's Final Tributary Rating Summary (2010). Improved management practices can increase the fishery viability by addressing documented impairments (Table 5) with appropriate restoration projects.

Table 5: Tributary Rating Summary for Lost Creek (Priority 2)

Stream	Reach(RM)	Trout Species	Impairments
Lost Creek	Lower: 0.0-10.3	Brown	Low summer flows due to irrigation, diversions, culverts; livestock grazing in riparian areas; high temperatures; no native trout species
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Very Low			**Low**

Source: MFWP, 2010

4. Assessments

Lost Creek's habitat and water quality status have been assessed several times in the last 10 years (Table 6). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

Table 6: Lost Creek Assessments

Type	Agency	Year	Area
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0-17.0
PIBO Stream and Riparian Areas (temperature)	USFS	2010	River Mile 19.1
Tributary Prioritization/Rating Summary	MFWP	2010	Lower: 0.0-10.3
Fish Population/ Riparian Habitat	MFWP	2009	RM 1.4, 10.2, 16.2, 18.5
Watershed Restoration Assessment	Harris &Watson	2000	Sites throughout the drainage
Riparian Assessment	WRC	2011	Lower, RM 0 to RM 7 (Galen Road)
Irrigation Structure Inventory	WRC/TU/ MFWP	2010	Throughout Lost Creek

The effects of historical grazing are present throughout the watershed and therefore, beneficial woody riparian vegetation is often sparse along the stream bank at many sites.

The riparian assessment by the WRC in 2011 along the lower seven (7) miles of Lost Creek found much of the riparian corridor "at-risk" but improving, with one reach at the confluence with the Clark Fork scored as "sustainable". Stream geomorphology is generally stable, with a B-channel near Galen Road transitioning to a Rosgen E channel form for much of the next six miles. Beaver and beaver dams are widespread. The riparian health scores reflect low densities of woody riparian plants due to historical grazing, and widespread issues with noxious weeds and undesirable plants (WRC, 2011). Indicators of current land use tend to indicate that grazing pressure is substantially reduced, and riparian woody plants are re-establishing in many reaches.
Montana FWP scores for riparian condition at three fish sampling sites in the lower and middle watershed ranged from "good" to "excellent."

5. Restoration

Needs

- Address low flows by finding methods to decrease irrigation dewatering.
- Address in-stream fish passage obstacles
- Maintain or improve grazing regimes to reduce nutrient and sediment loading.
- Monitor nutrient levels in the creek and work with landowners and municipalities to ensure proper sewage disposal.
- Continue to monitor 303 (d) listed and unlisted metals contaminants
- Monitor and treat invasive weeds

Activities:

Montana FWP invested considerable effort and funds in improvements to channel stability, fish habitat, and riparian habitat in Lost Creek from the Galen Hwy. downstream to the confluence with the Clark Fork in 1999-2004, with participation from NRCS, NRDP, and other agencies. Much of the stream corridor reflects this improved condition, although some issues, particularly flow issues, remain complex and unresolved.

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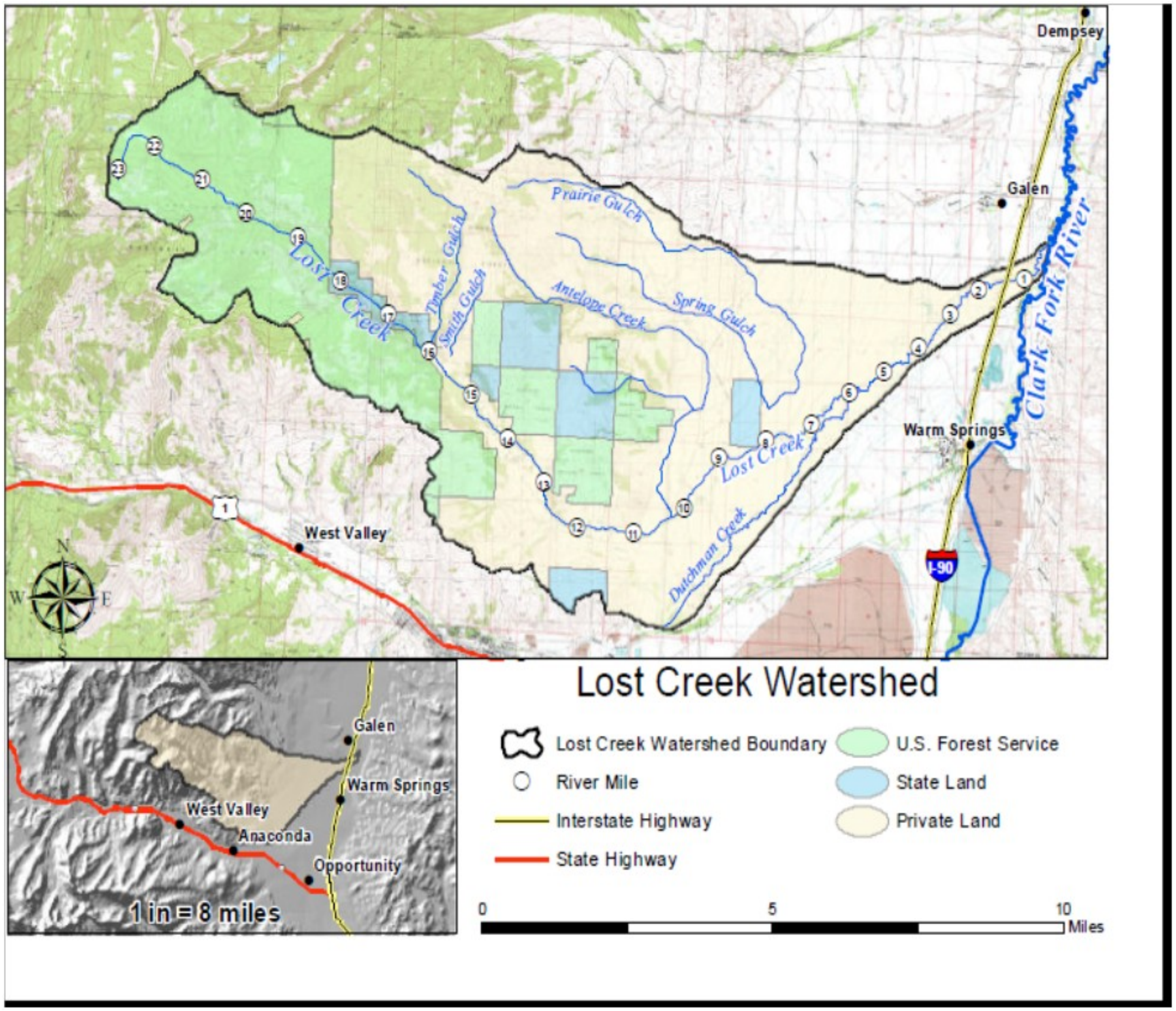
Lost Creek Watershed
Lost Creek Watershed Boundary
River Mile
Interstate Highway
State Highway
U.S. Forest Service
State Land
Private Land
0
5
10
Miles
1 in = 8 miles
Dempsey
Galen
Warm Springs
West Valley
Anaconda
Opportunity
Clark Fork River
Lost Creek
Prairie Gulch
Spring Gulch
Antelope Creek
Timber Gulch
Smith Gulch
Dutchman Creek
I-90

Peterson Creek Watershed Summary

1. Description and Land Use

Peterson Creek originates in the foothills of the Boulder Mountains southeast of Deer Lodge and flows for more than twelve miles before joining the Clark Fork River. The Peterson Creek watershed comprises about thirty-one square miles (Table 1) and includes the major tributaries of Jack Creek, Spring Creek and Burnt Hollow Creek. The watershed contains mostly private land and is used for irrigated hay production, livestock grazing and timber harvest (MFWP, 2009).

Table 1: Peterson Creek Watershed Overview

Watershed Size	19,914 acres/31.1 sq miles/80.6 sq km
Elevation Range	3,412 Feet [4,587-7,999]
Stream Miles	39.9
Land Ownership	Private: 63% /State: 7%/Federal: 30%
Road Miles	Local Road/City Street = 27.1 Four Wheel Drive Trail = 10.1 Highway= .5 Driveway/Service Road= 5.4 Total = 43.1

Source: Montana GIS Portal Data Layers

2. Impairments

The DEQ lists Peterson Creek for sediment, nutrients, heavy metals, and temperature pollutants, with low-flow, alteration of streamside vegetation, and alteration of physical substrate as other impairments.

Table 2: TMDL Impairments for Peterson Creek (2010 & 2008)

2010			
Impairment	**Reach (River Mile**	**Pollutant**	**Impaired Uses**
Copper	12.9-6.8	Metals	Aquatic Life, Cold Water Fishery
Iron	12.9-6.8	Metals	Aquatic Life, Cold Water Fishery
Lead	12.9-6.8	Metals	Aquatic Life, Cold Water Fishery
Sedimentation/ Siltation	12.9-6.8	Sediment	Aquatic Life, Cold Water Fishery
Temperature (water)	6.8-0.0	Temperature	Aquatic Life, Cold Water Fishery*
Sedimentation/ Siltation	6.8-0.0	Sediment	Aquatic Life, Cold Water Fishery
Iron		Metals	Aquatic Life, Cold Water Fishery
Lead	6.8-0.0		

2008			
Impairment	**Reach (River Mile)**	**Pollutant**	**Impaired Uses**
Copper	12.9-6.8	Metals	Aquatic Life, Cold Water Fishery
Nitrogen (Total)	12.9-6.8	Nutrients	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Phosphorus (Total	12.9-6.8	Nutrients	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Total Kjehldahl Nitrogen (TKN)	12.9-6.8	Nutrients	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Sedimentation/ Siltation	12.9-6.8	Sediment	Aquatic Life, Cold Water Fishery
Low Flow Alterations	12.9-6.8	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in stream-side or littoral vegetative	12.9-6.8	*Not a Pollutant*	Aquatic Life, Cold Water Fishery
Temperature (water)	6.8-0.0	Temperature	Aquatic Life, Cold Water Fishery*
Low Flow Alterations	6.8-0.0	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in stream-side or littoral vegetative	6.8-0.0	*Not a Pollutant*	Aquatic Life, Cold Water Fishery*
		Not a	Aquatic Life, Cold Water
Physical substrate habitat alterations	6.8-0.0	*Not a Pollutant*	Aquatic Life, Cold Water Fishery*

Temperature

Peterson Creek is used extensively for irrigation, and the lower ten miles contain many diversions (MFWP, 2009). Thermal impairments are attributed to agricultural dewatering, lack of riparian shade, and urban influences, and have been documented in the lower five miles of the basin (Table 3). Temperature modeling in the TMDL showed that thermal gains are extensive in the agricultural areas in the lower five miles of the stream due to lack of shade (MDEQ, 2010). Temperatures below 16°C are optimum for westslope cutthroat trout growth, while temperatures below 20 °C are critical for their survival (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

Table 3: Temperature Measurements for Peterson Creek

FWP 2008	RM*	S tart Date	End Date	Max T (°C)	Day s>15°C	Days>20°C
	0.2	7/11	10/13	22.6	54	30
	7.5	7/11	10/13	19.9	46	0
DEQ 2007	RM*	Start Date	End Date	Max T (°C)	7-day average maximum	
site: PTR 14	0.2	7/17	9/29	25.6	24.0	
PTR 12	3.0	7/17	9/29	24.3	22.8	

River Mile

Sources: MFWP 2009, MDEQ, 2010

Major findings and restoration recommendations from the TMDL relative to water temperature in Peterson Creek include:
*Temperature data collected in 2007 and the results of this QUAL2K modeling effort suggest that Peterson Creek fails to meet Montana's standard for temperature during low flow periods in the middle of summer.

*Modeling indicated that increased shading in reaches upstream of the Burnt Hollow Creek confluence, and the reach through the town of Deer Lodge would have maximum benefits to stream temperature. In 2007, maximum temperatures were observed at site PTR-12, which is located downstream of the Burnt Hollow Creek confluence. This further supports the need for improved riparian shading upstream of this site.

*Streamflows decreased by 80% between Burnt Hollow confluence and the Peterson confluence with the Clark Fork River. Thus, irrigation efficiency improvements should focus on Peterson Creek downstream of the confluence with Burnt Hollow Creek.

Metals

The area around the upper section of Peterson Creek contains several abandoned mines which have contributed to soil and surface water contamination (MDEQ, 2010). The main pollutants are copper, iron and lead, and have been found at levels high enough to warrant TMDL development (Table xxx,). These pollutants pose health issues for humans, wildlife and fish in the area. Levels on the lower reaches are also elevated, but metals in this section are most likely diluted contaminants from upper Peterson Creek (MDEQ, 2010).

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. Many irrigation water diversions exist on Peterson Creek and its tributaries (MDNRC, 2011). Low flows result in unsuitable habitat for fish and macro-invertebrates in the lower five miles of Peterson Creek (Table 5). In addition, irrigation structures can create barriers which impede fish passage and migration (MFWP, 2010).

Sediment/Siltation

Impairments from sediment and siltation often occur from over-grazing and channel manipulation (historical straightening) in the riparian corridor of the Peterson Creek drainage. Because livestock historically had unrestricted access to the riparian corridor, woody vegetation can be sparse. This, combined with livestock traffic, leads to accelerated bank erosion (MFWP, 2009). Placer mining was also widespread in the upper Peterson Creek drainage, although those areas have mostly revegetated. Sedimentation beyond that which is naturally occurring damages fish and macroinvertebrate habitat by filling in redds, reducing available habitat (such as riffles and pools), and by altering stream channels (MDEQ, 2011). Sediment levels in Peterson Creek exceed those defined by Montana DEQ TMDL standards.

3. Native/Sport Fishery

Current Condition

Montana FWP sampled Peterson Creek in five different sites in 2008 (River Mile 0.2, 1.1, 4.9, 7.9, 11.5). Trout populations in the lower reaches were sparse and mainly composed of brown trout. Brook and westslope cutthroat trout were present in the middle reaches, and westslope cutthroat trout became the main species in the upper reaches. The riparian assessment at each site rated the fish habitat as "poor" to "fair" in the lower reaches and as "fair" to "good" in the upper. Riparian vegetation was often sparse and disturbance-induced vegetation was common. Bank erosion was evident in several areas. Irrigation-related obstacles to fish passage exist throughout the drainage (MFWP, 2009).

Table 4: Fish Distribution in the Peterson Creek Watershed

Waterbody	Begin RM*	End RM*	Species	Updated
Peterson Creek	0.8	3.2	Brown Trout	11/18/2009
Peterson Creek	0.0	0.8	Brown Trout	11/18/2009
Peterson Creek	0.2	12.9	Westslope Cutthroat Trout	1/5/2005
Peterson Creek	5.9	10.9	Brook Trout	1/5/2005
Peterson Creek	0.0	5.9	Brook Trout	1/5/2005
Peterson Creek	0.0	5.9	Slimy Sculpin	1/5/2005
Peterson Creek	0.0	8.0	Longnose Sucker	8/28/2009
Jack Creek	0.0	3.3	Westslope Cutthroat Trout	7/9/2009
Spring Creek	1.4	1.5	Brook Trout	9/14/2009
Spring Creek	0.0	1.5	Westslope Cutthroat Trout	7/9/2009

Source: MFWP, 2010

Fishery Potential

While Peterson Creek experiences several impairments, protection and enhancement possibilities for a viable trout fishery exist on several levels (Table 5). Montana FWP has shown an interest in managing (in collaboration with state agencies and other organizations) Peterson Creek as recreational fishery in the agency's Final Tributary Rating Summary (2010). Improved management practices can increase the fishery viability by addressing documented impairments (Table xxx) with appropriate restoration projects.

Table 5: Tributary Rating Summary for Peterson Creek (Unranked)

Stream	Reach(RM)	Trout Species	Impairments
Peterson Creek	All: 0.0-12.8	Brook, Brown and Westslope Cutthroat	Low summer flows due to irrigation with complete dewatering at certain reaches, livestock grazing in riparian areas; high temperatures; competition to westslope cutthroat from brook/brown trout; bank erosion/ siltation
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Low			**Medium**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Low			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Medium			**High**

Source: MFWP, 2010

4. Assessments

Peterson Creek's habitat and water quality status have been assessed several times in the last 10 years (Table 6). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

Table 6: Peterson Creek Assessments

Type	Agency	Year	Area
Riparian, Geomorphology/Flow Assessment	WRC	2010-2011	Throughout Peterson Creek
Tributary Prioritization	MFWP	2010	All of Peterson Creek
Fish Population/	MFWP	2009	River Mile 0.2, 1.1,
Upper Clark Fork Tributaries TMDL	MDEQ	2010	All of Peterson Creek

The WRC assessed 5.7 miles of riparian corridor upstream of Jack Creek in 2010. The assessment indicated that the majority of reaches were Rosgen B channels in steep canyon environment with substantial shade from conifers, aspen, willow. In three reaches riparian conditions were "sustainable," and six reaches were "sustainable at risk." The "at risk" reaches include private and state land with issues related to noxious weeds, and heavy utilization of riparian woody vegetation by livestock, and heavy livestock impact on stream banks. Below Burnt Hollow confluence (RM 3.4), the assessment indicated a variety of channel types, some manipulated, with nine reaches "at risk" due to poor riparian woody plant cover, abundant noxious weeds, undesirable plants, heavy browse on woody plants, bank erosion, incisement, and other factors. One reach very incised reach near the lower end was "unsustainable" due to these factors, as well as poor fish habitat due to dewatering. A large reach between RM 3 and RM 6.2 was not assessed due to no access permission from the owner.

Montana FWP assessed riparian condition at five reaches in 2008 (RM 0.2, 1.1, 4.9, 7.9, 11.5) where they did fish sampling. The sites assessed by FWP included at least two with a historically manipulated (straightened) channel (RM 0.2 and RM 4.9). High levels of filamentous algae existed at RM 0.2, and fish habitat continued to be poor to fair upstream through the next 11 miles, due to incised channels with eroding banks and spotty riparian woody vegetation in the lower 5 miles, and lack of pools, and fair to good riparian woody plant cover in the upper watershed. Montana FWP noted a number of beaver dam complexes in the upper 4 miles (MFWP, 2009).

5. Restoration

Needs

- Continued temperature monitoring
- Work with landowners to address stream flow and dewatering issues
- Address fish passage barriers
- Limit livestock access to stream and riparian areas
- Continue to monitor metals loading
- Prevent further contamination through bank stabilization and riparian planting

Activities:

The WRC is involved in several projects on middle Peterson Creek. In 2010-2011, the WRC funded the installation of electric fence along three miles of Peterson Creek (State DNRC and Kramer Ranch reach). In 2011-2012 the WRC is engaged in improving off-stream water with a stock water pipeline and four tanks.

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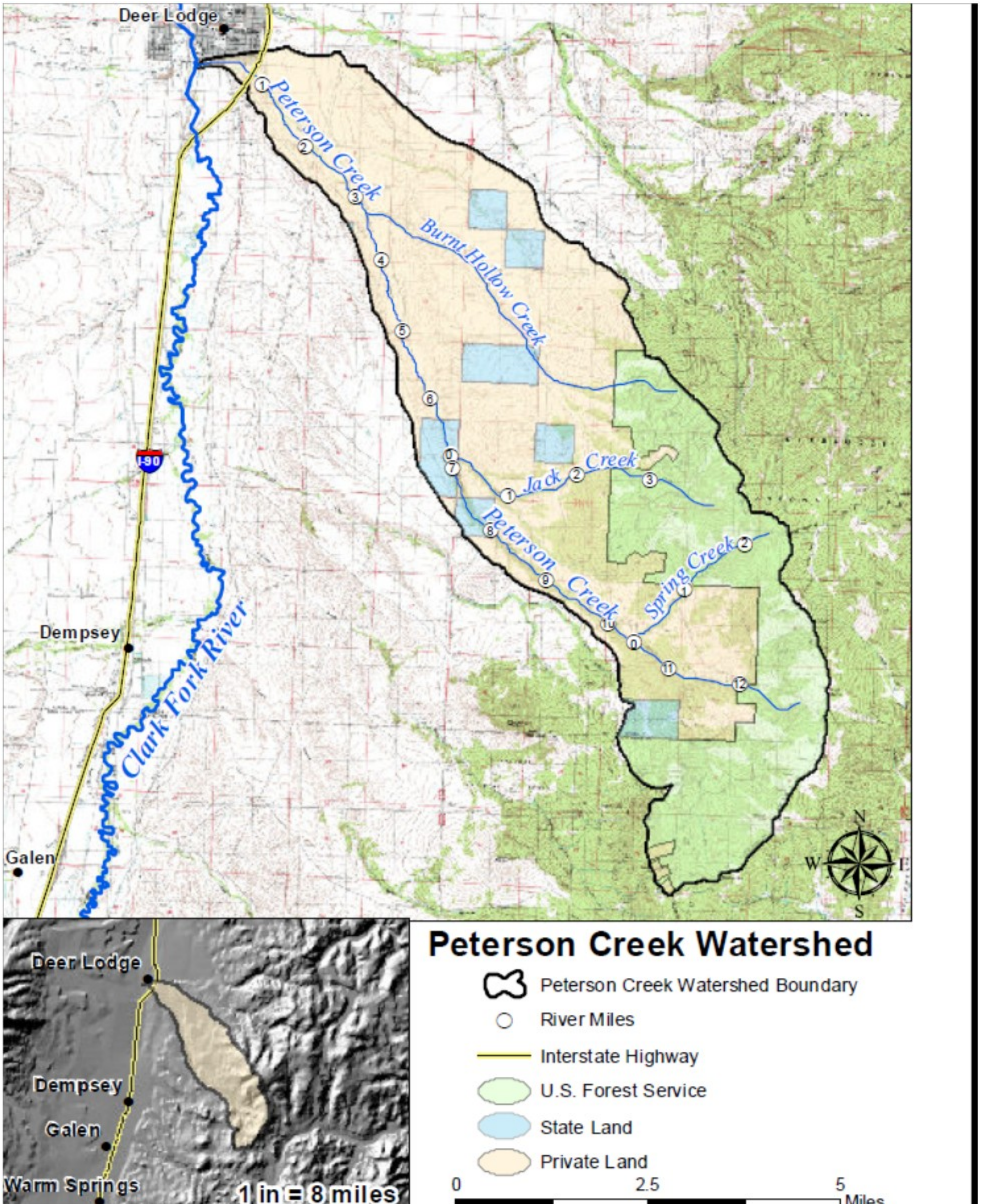

Peterson Creek Watershed

Racetrack Creek Watershed Summary

1. Description and Land Use

Racetrack Creek has its headwaters in a glaciated part of the Flint Creek Range. It drains an area of about 51 square miles and flows for approximately 23 miles until joining with the Clark Fork River about seven miles south of Deer Lodge. The lower portion of the watershed is used mainly for agricultural purposes while the upper section is owned by the Forest Service and used for recreation (MFWP, 2008). Racetrack Creek and several of the high lakes within the basin are used extensively for irrigation water supply (MFWP 2008).

Table 1: Racetrack Creek Watershed Overview

Watershed Size	32,937 acres/51.2 sq miles/132.7 sq km
Elevation Range	4, 852 feet [4,744-9,596]
Stream Miles	59.6
Land Ownership	Private: 21% /State: 1%/Federal: 78%
Road Miles	Local Road/City Street = 30.2 Four Wheel Drive Trail = 10.7 Highway= 1.0 Driveway/Service Road= 1.5 Total = 43.4

Source: Montana GIS Portal Data Layers

2. Impairments

Montana DEQ lists Racetrack Creek as impaired for low-flow and alteration in streamside vegetation. Data from FWP and WRC suggests that water temperature is also an issue, at least from RM 0.0 to RM 6.4.

Table 2 : Listed Impairments for Racetrack Creek

Impairment	Reach (River Mile)	Pollutant	Impaired Beneficial Use
Low Flow Alterations	0.0-10.4	*Not a Pollutant*	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in stream-side or littoral vegetative cover	0.0-10.4	*Not a Pollutant*	Aquatic Life, Cold Water Fishery

*River Mile

Source: MDEQ, 2010; MFWP 2008

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. The WRC has flow data which indicates late season flows, even in good water years like 2010 and 2011, can decline to less than 1 cfs in the lower three miles of Racetrack Creek (WRC, 2011). Complete dewatering (dry stream bed) occurs often near Yellowstone Trail crossing in late summer. Many irrigation diversions exist on Racetrack Creek and its tributaries (MDNRC, 2011), although the majority of the irrigation water use is based on the Cement and Morrison Ditches, with diversions approximately at RM 8. Low flows result in unsuitable habitat for fish and macroinvertebrates due to increased water temperatures and desiccation. In addition, various irrigation structures in Racetrack create seasonal barriers which impede fish passage and migration (MFWP, 2010).

Sediment/Siltation

Impairments from sediment and siltation often occur from over-grazing in the riparian areas throughout the Racetrack Creek drainage. Because livestock frequently have access to natural water sources in this area, riparian vegetation can be sparse. This, combined with livestock traffic, leads to accelerated bank erosion (MFWP, 2008). Sedimentation beyond that which is naturally occurring, damages fish and macroinvertebrate habitat by filling in redds, reducing available habitat (such as riffles and pools), and by altering stream channels (Kusnierz, P. and Welch, A., 2011). Sediment levels in Racetrack Creek exceed those defined by Montana DEQ TMDL standards.

Temperature

Racetrack Creek is used extensively for irrigation, and the basin contains many diversions (MFWP, 2008). Most of the PIBO and MFWP temperature data is from sites above the principal irrigation diversions near RM 8, except for one MFWP site at RM 6.4, which had two days above 20 degrees C in 2007. On the other hand, the WRC data from lower Racetrack Creek (RM 3.1) in 2010-2011 show extended periods with water temperatures above 20 degrees C, with maximum temperatures as high as 26 degrees C. These temperatures correspond to periods of low-flow during peak irrigation season. During these same periods water temperatures recorded by WRC at RM 10 showed no maximum temperatures above 14 and 13 degrees, respectively, for 2010 and 2011.

Thermal impairments are attributed to agricultural dewatering, and have been documented in the creek (Table 3). Temperatures below 15°C are optimum for trout growth, while prolonged temperatures above 20 °C are lethal for westslope cutthroat trout (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

Table 3: Racetrack Creek Water Temperature Data

Temperature Measurements (Probable Impairment)						
PIBO 2008	RM*	Start Date	End Date	Max T (°C)	Days>12°C	Days>18°C
	10.4	7/15	8/31	15.4	42	0
MFWP 2007	RM*	Start Date	End Date	Max T (°C)	Days>15°C	Days>20°C
	6.4	7/6	10/17	20.3	40	2
	10.8	7/10	10/17	18.7	32	0
	17.5	7/10	10/17	16.2	11	0
	RM*	Start Date	End Date	Max T (°C)	Days>15°C	Days>20°C
WRC	3.1	7/1	11/2	22.4	60	14
WRC	3.1	5/25	10/19	26.1	87	31

Sources: USFS, 2010; MFWP, 2009; WRC, 2011

3. Native/Sport Fishery

Racetrack Creek is a large stream system with high potential as a trout fishery, according to Montana Fish Wildlife and Parks. The lower one mile of Racetrack is a key spawning area for Clark Fork river brown trout. Brook and brown trout are found throughout the lower drainage, while rainbow trout are common in the middle watershed (USFS lands), and westslope cutthroat trout are found in the middle and upper watershed. Lakes in the upper drainage are stocked with rainbow trout. Bull trout were formerly known in this drainage, but not recently documented.

Table 4: Fish Distribution in the Racetrack Creek Watershed

Waterbody	Begin RM*	End RM*	Species	Updated
Racetrack Creek	0.0	12.8	Brook Trout	9/14/2009
Racetrack Creek	0.0	12.8	Brown Trout	9/14/2009
Racetrack Creek	0.0	6.6	Longnose Sucker	2/23/2009
Racetrack Creek	0.0	4.5	Mountain Whitefish	2/20/2009
Racetrack Creek	12.7	18.6	Rainbow Trout	9/14/2009
Racetrack Creek	0.0	14.9	Slimy Sculpin	7/27/2009
Racetrack Creek	6.4	23.2	Westslope Cutthroat Trout	1/5/2005
Racetrack Creek	12.6	19.0	Westslope X Rainbow	2/23/2009
North Fork Racetrack	0.0	3.0	Westslope Cutthroat Trout	1/5/2005
Granite Creek	0.0	2.3	Westslope Cutthroat Trout	1/5/2005
Thornton Creek	0.0	3.1	Westslope Cutthroat Trout	1/5/2005

*River Miles Source: MFWP, 2010

Current Condition

Montana FWP sampled fish populations in Racetrack Creek during August 2007 (River Mile 10.8, 12.7, 15.0, and 18.5). According to the report, no sections were sampled below River Mile 6.8 due to complete dewatering in that portion of the creek. Brown and brook trout were the only trout species sampled at River Mile 10.8, while all four species and their hybrids were present at RM 12.7. The upper two sites contained rainbow, westslope cutthroat and hybrid trout (MFWP, 2008).

Fish habitat was rated as "good" by Montana FWP (2008). However, flows in Racetrack are affected by several diversions below about RM 8, and, as mentioned previously, the stream below RM 6.8 was completely dry during the 2007 sampling. Irrigation barriers to fish passage exist in the first 8 miles of stream, and a natural barrier exists on the USFS land, at approximately RM 12 (MFWP, 2008).

Table 5: Tributary Rating Summary for Lower Racetrack Creek (Priority 1)

Stream	Reach(RM)	Trout Species	Impairments
Racetrack Creek	Upper: 0.0-13.0	Brook, Brown, Rainbow and Westslope Cutthroat	Low summer flows due to irrigation dewatering in lower reaches, livestock grazing in riparian areas; high temperatures; competition to westslope cutthroat from brook, brown and rainbow trout; residential devel-
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
High			**Very High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**Very High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Low			**Very Low**

Source: MFWP, 2010

Table 6: Tributary Rating Summary for Upper Racetrack Creek (Unranked)

Stream	Reach(RM)	Trout Species	Impairments
Racetrack Creek	Upper: 13.0-23.2	Rainbow and Westslope Cutthroat	Livestock grazing in riparian areas; competition to westslope cutthroat from rainbow trout; bank erosion/
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Low			**Medium**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			**Medium**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Low			**Low**

Fishery Potential

While Racetrack Creek experiences several impairments, good protection and enhancement possibilities for a viable trout fishery exist (Tables 5 and 6). Montana FWP is interested in collaboration with state agencies and other organizations to manage lower Racetrack Creek as a “Priority 1” recreational fishery according to the agency’s Final Tributary Rating Summary (2010). The upper section (River Mile 13 to the headwaters) was also assessed but is currently unranked. Native fishery values there are depressed by the high rate of hybridization of cutthroat trout with rainbow trout. Flow and habitat restoration projects could dramatically improve the Racetrack fishery.

4. Assessments

Racetrack Creek’s habitat and water quality status have been assessed several times in the last 10 years (Table 7). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

Table 7: Racetrack Creek Assessments

Type	Agency	Year	Area
Riparian, Geomorphology/Flow Assessment	WRC	2010/2011	Lower Racetrack Creek, RM 0.0 to 10.7
Temperature Monitoring	PIBO/USFS	2010	River Mile 10.4
Tributary Prioritization /Rating Summary	MFWP	2010	All of Racetrack Creek
Fish Population/Riparian Habitat	MFWP	2008	River Mile 10.8, 12.7,15.0, and 18.5
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0-10.4
Irrigation Structure Inventory	TU/WRC/MFWP	2010	Throughout Racetrack Creek

WRC and FWP Riparian Assessments

The WRC (2011) conducted NRCS riparian assessments on over 10 miles of lower Racetrack Creek in 2010 and 2011. Of the 19 assessed reaches, the WRC classified nine as “at-risk” and ten as “sustainable”. The WRC described risks to riparian health in the lower watershed as locally heavy grazing in combination with dewatering (WRC, 2011). Montana FWP (2008) conducted riparian assessment at fish sampling sites in the middle/upper watershed and rated the riparian condition in those sites as “good”. Woody vegetation was varied and dense, although invasive weeds were present. Grazing pressure appeared minimal in the upper watershed.

Needs

- Work with irrigation users to address dewatering issues
- Address fish passage barriers
- Continue to monitor temperature
- Address bank erosion and cover issues with riparian plantings and limited livestock access to stream and riparian areas
- Monitor and treat noxious weed populations

Activities:

The WRC funded a riparian fencing project from approximately RM 8 to RM 10 on the Five Rockin MS Angus Ranch in 2010-2011. The CF Coalition and DLV CD are working on flow restoration, with one deal complete (433 ac-ft of storage water secured for in-stream flow in Racetrack Lake), and several other opportunities under study. The CFC is beginning to raise funds for fish passage and habitat work in lower Racetrack Creek.

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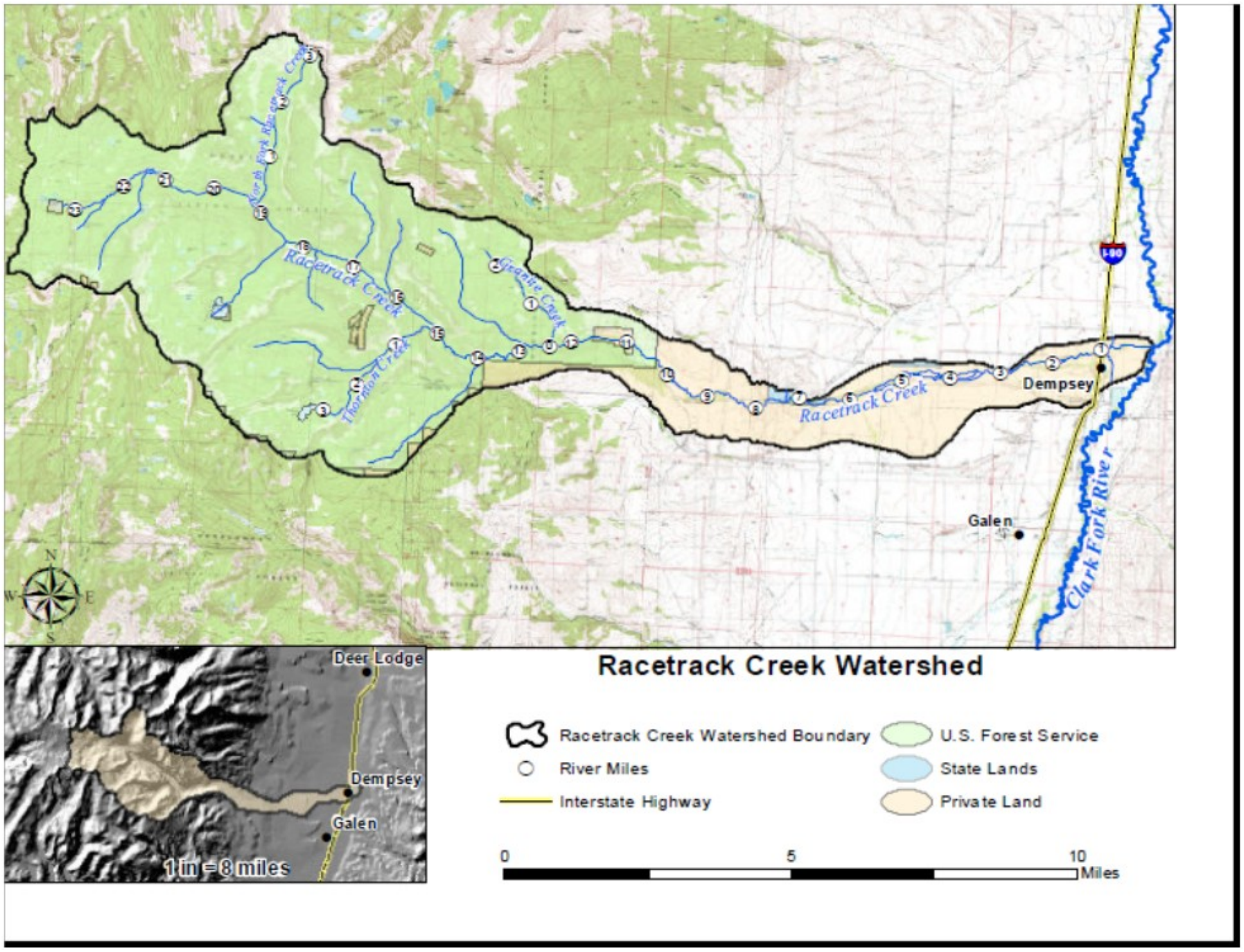
Racetrack Creek
Thornton Creek
Racetrack Creek
Dempsey
Galen
Clark Fork River
I-90
Deer Lodge
Dempsey
Galen
1 in = 8 miles
Racetrack Creek Watershed
Racetrack Creek Watershed Boundary
River Miles
Interstate Highway
U.S. Forest Service
State Lands
Private Land
0
5
10
Miles

Tin Cup Joe

1. Watershed Summary

Description and Land Use

Tin Cup Joe Creek flows from the Flint Creek Range and travels for almost 15 miles before joining the Clark Fork River. The basin encompasses close to 25 square miles and is divided mainly between state and federal entities (Table xxx). Timber harvest, grazing and irrigated hay are the main land uses within the watershed, and a few abandoned mines are present.

Table 1: Tin Cup Joe Creek Watershed Overview

Watershed Size	14,695 acres/24.6 sq miles/63.8 sq km
Elevation Range	5,328 Feet [4,560-9888]
Stream Miles	36.2
Land Ownership	Private: 5%/State: 55%/Federal: 40%
Road Miles	Local Road/City Street = 24.9 Four Wheel Drive Trail = 12.6 Driveway/Service Road/Alley= .5 Total = 38.0

Source: Montana GIS Portal Data Layers

2. Impairments

Montana DEQ lists Tin Cup Joe Creek for low-flow and sedimentation impairments. The WRC has not collected data on Tin Cup Joe Creek, although reports from partners indicated that water temperature is also likely impaired in the lower reaches.

Table 2: TMDL Impairments for Tin Cup Joe Creek

2010			
Impairment	**Reach (River Mile)**	**Pollutant**	**Impaired Beneficial Use**
Sedimentation/ Siltation	0.0-14.7	Sediment	Aquatic Life, Cold Water Fishery
2008			
Impairment	**Reach (River Mile)**	**Pollutant**	**Impaired Beneficial Use**
Low Flow Alterations	0.0-14.7	*Not a Pollutant*	Agriculture

Temperature

Thermal impairments are often attributed to agricultural dewatering, and have been documented on Tin Cup Joe Creek. Temperatures on lower reaches of the creek have often climbed above 15 °C, and sometimes exceed 20 °C (MFWP, 2008). Concerning fishery health and fish survival, temperatures below 16°C are optimum for westslope cutthroat trout growth, while temperatures below 20 °C are critical for their survival (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

Table 3: Temperature Measurements for upper Tin Cup Joe Creek

PIBO 2008	RM*	Start Date	End Date	Max T (°C)	Days>12°C	Days>18°C
	8.7	7/15	8/31	12.2	1	0
PIBO 2003	8.7	7/15	8/31	14.4	37	0

*River Mile

Source: PIBO/USFS 2010

Sediment/Siltation

Impairments from sediment and siltation often occur from road, bank and upland erosion throughout the Tin Cup Joe Creek drainage (MDEQ, 2010). Because livestock frequently have access to natural water sources in this area, riparian vegetation can be sparse. This, combined with livestock traffic, also leads to accelerated bank erosion (MDEQ, 2010). Sedimentation beyond that which is naturally occurring, damages fish and macroinvertebrate habitat by filling in redds, reducing available habitat (such as riffles and pools), and by altering stream channels (MDEQ, 2010). Sediment levels in Tin Cup Joe Creek exceed those defined by Montana DEQ TMDL standards. The creek's sediment TMDL is also the only evaluated stream TMDL to contain a Waste Load Allocation (WLA) due to two large point sources in the basin: the Montana State Prison Ranch and the Sun Mountain Lumber Company (MDEQ, 2010).

Irrigation and Dewatering

Dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. Over 200 irrigation diversions exist in the Tin Cup Joe basin (MDNRC, 2011) and lower sections of Tin Cup Joe Creek suffer from chronic low flows (MFWP, 2003). Low water levels result in unsuitable habitat for fish and macroinvertebrates due to increased temperatures and algal growth (Table xxx). In addition, irrigation structures can create barriers which impede fish passage and migration (MFWP, 2010).

4.Assessments

Tin Cup Joe Creek's habitat and water quality status have been assessed several times in the last several years (Table 4. Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

Table 4: Tin Cup Joe Creek Assessments

Type	Agency	Year	Area
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0- 14.7
PIBO Stream s and Riparian Areas	USFS	2010	River Mile 8.7
Tributary Prioritization			
FWP Dewatering Concern Areas	MFWP	2003	River Mile 0.0-5.2

5. Restoration

Needs

- Work with landowners to address dewatering issues
- Continue to monitor stream temperatures in the basin, preferably in more than one area
- Address sediment loading by restricting livestock access to streams and riparian areas, conducting riparian plantings, and monitoring road and bank erosion
- Continue to monitor sediment loading from the Sun Mountain Lumber Company and the Montana State Prison Ranch

Activities: None.

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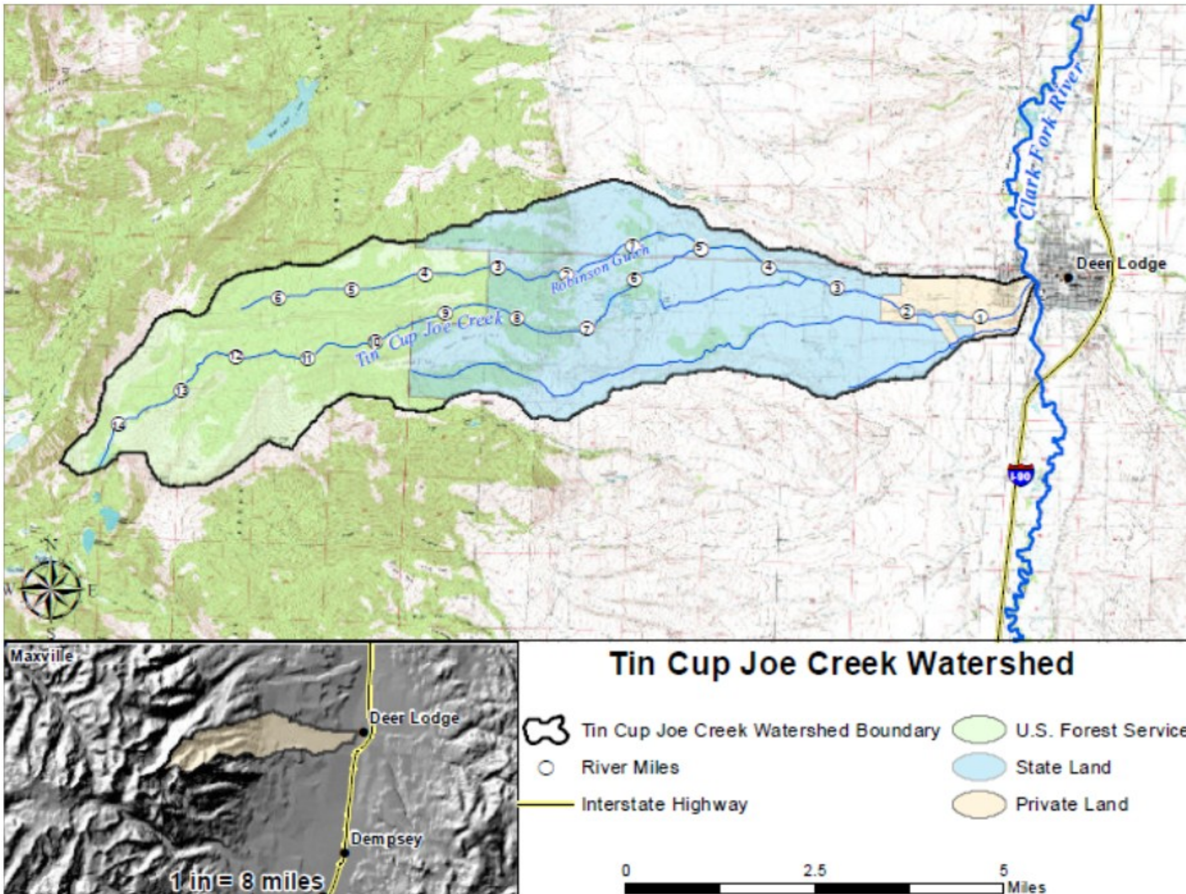
Clark Fork River
Deer Lodge
Robinson Gulch
Tin Cup Joe Creek
Maxville
Deer Lodge
Dempsey
1 in = 8 miles
Tin Cup Joe Creek Watershed
Tin Cup Joe Creek Watershed Boundary
River Miles
Interstate Highway
U.S. Forest Service
State Land
Private Land
0
2.5
5
Miles

Warm Springs Creek (Anaconda) Watershed Summary

1. **Description and Land Use**

Warm Springs Creek is a major tributary to the Clark Fork River and drains an area of about 144 square miles (Table 1), including 24 named tributaries. Land ownership in the basin is split between Forest Service, state and private land. The drainage includes various headwater streams and lakes and is mostly forested. It supports timber harvest, diverse recreation, grazing, urban residential areas, and has historically been the site of significant industrial mining/metals processing (MFWP, 2008). Its water is used for agriculture, but most of the irrigated areas are outside the basin itself.

Table 1: Warm Springs Creek Watershed Overview

Watershed Size	92,288 acres/144.2 sq miles/373.6 sq km
Elevation Range	5,781 feet [4,800- 10,581]
Stream Miles	215.2
Land Ownership	Private: 27% /State: 10%/Federal: 63%
Road Miles	Local Road/City Street = 128.7 Four Wheel Drive Trail = 16.3 Service Road/Driveway = 4.7 Frontage Road = 0.1 Highway = 19.1 Total = 168.9

Source: Montana GIS Portal Data Layers

2. Impairments

Montana DEQ has documented metals and low-flow impairments on Warm Springs Creek, and also alteration of streamside vegetation and physical substrate habitat alterations, as noted on the 303(d) list. Water temperature impairment may occur on the lowest reach of the Creek, according to data provided by Montana Fish Wildlife and Parks, while the upper tributaries to Warm Springs are very cold.

Table 2: Listed and Suspected Impairments for Warm Springs Creek

2010			
Impairment	**Reach (River Mile)**	**Pollutant**	**Impaired Beneficial Use**
Arsenic	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
Cadmium	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
Copper	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
Lead	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
Iron	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
Zinc	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
2008			
Impairment	**Reach (River Mile**	**Pollutant**	**Impaired Beneficial Use**
Physical substrate habitat alterations	16.6-32.5	Not a pollutant	Aquatic Life, Cold Water Fishery*
Arsenic	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
Copper	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery
Lead	0.0-16.6	Metals	Aquatic Life, Cold Water Fishery,
Low Flow Altera-tions	0.0-16.6	Not a pollutant	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
Alteration in streamside or littoral vegetative cover	0.0-16.6	Not a pollutant	Aquatic Life, Cold Water Fishery
Physical substrate habitat alterations	0.0-16.6	Not a pollutant	Aquatic Life, Cold Water Fishery

*River Mile

Source: MDEQ, 2010

Metals

The Warm Springs Creek basin lies within the Anaconda Smelter Superfund Site and, in addition to the effects of mine wastes and placer mining, exhibits impairments from atmospheric pollutant deposition from the smelter (MDEQ, 2010). Warm Springs Creek is listed for arsenic, copper, lead, cadmium, and zinc (Table 2). High concentrations of metals can have harmful effects on vegetation, macroinvertebrates, fish and human health. Lack of riparian vegetation leads to bank erosion, which contributes to further contamination (MDEQ, 2010). Remediation efforts to address the extensive metals contamination and to prevent further pollution from erosion and leaching have been ongoing since the 1990s (MDEQ, 2010).

Irrigation and Dewatering

Multiple diversions exist within the Warm Springs Creek watershed. Chronic dewatering has been an issue within the basin and has many implications for both water quantity and quality. Low flows increase water temperatures and result in unsuitable habitat for fish and macro-invertebrates as well as in excess algal growth. In addition to reduced stream flow, irrigation structures create physical barriers and impediments to fish passage. Meyers Dam, and industrial water supply diversion structure, presents a major obstacle at River Mile 16.6, and several unscreened irrigation diversions have been noted at sites throughout the creek (MFWP, 2008).

Sediment/Siltation

Impairments from sediment and siltation often occur from lack of woody vegetation in the riparian areas near Warm Springs Creek and its tributaries. Sulfur dioxide, a byproduct of the Anaconda Smelter, has damaged bank-stabilizing riparian vegetative communities (MDEQ, 2010). Timber harvest and roads also disturb plant communities and add sediment to streams. Additionally, livestock often have access to natural water sources in this area, which further harms vegetation and causes bank erosion (MFWP, 2008).

Sedimentation beyond that which is naturally occurring degrades fish and macroinvertebrate habitat by filling in redds, reducing available habitat (such as riffles and pools), and by altering stream channels (Kusnierz and Welch, 2011). In the case of contaminated creeks such as Warm Springs, metals and other pollutants are attached to soil particles and spread with eroding soil. Sediment levels in Warm Springs Creek exceed those defined by Montana DEQ TMDL standards (MDEQ, 2010).

Temperature

Thermal impairments are often attributed to agricultural dewatering, and were documented in 2007 on lower Warm Springs Creek (Table 3). Temperatures below 15°C are optimum for native fish, while prolonged temperatures above 20 °C are lethal to westslope cutthroat trout (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to fish health.

Table 3: Water Temperature Data for Warm Springs Creek and Tributaries

Temperature Measurements (Suspected Impairment)							
PIBO	**Year**	**RM***	**Start Date**	**End Date**	**Max T (°C)**	**Days>12°C**	**Days>18°C**
Warm Springs Creek	2009	24.9	7/15	8/31	13.5	16	0
	2004	24.9	7/15	8/31	14.8	32	0
Foster Creek	2009	1.0	7/15	8/31	14.2	27	0
	2004	1.0	7/15	8/31	16.8	36	0
Twin Lakes Creek	2009	9.5	7/15	8/31	9.8	0	0
	2004	9.5	7/15	8/31	6.4	0	0
MFWP	**Year**	**RM***	**Start Date**	**End Date**	**Max T (°C)**	**Days>15°C**	**Days>20°C**
Warm Springs Creek	2007	1.0	7/6	10/17	21.2	58	8
		13.2	7/6	10/17	16.6	11	0
		27.4	7/6	10/17	7.7	0	0
Barker Creek	2007	0.1	7/6	10/17	14.7	0	0
Foster Creek	2007	1.5	7/6	10/17	16.1	11	0
Twin Lakes Creek	2007	0.2	7/6	7/12	15.3	Tampering caused only a week of results to be recorded. Results are insufficient.	
Storm Lake Creek	2007	1.4	7/6	10/17	15.1	1	0

Source: PIBO/USFS 2010

3. Native/Sport Fishery

Source: MFWP, 2010

Waterbody	Begin RM*	End RM*	Species	Updated
Warm Springs Creek	15.3	24.5	Westslope Cutthroat Trout	1/5/2005
Warm Springs Creek	9.4	10.7	Westslope Cutthroat Trout	1/5/2005
Warm Springs Creek	10.7	15.3	Westslope Cutthroat Trout	1/5/2005
Warm Springs Creek	24.5	32.5	Westslope Cutthroat Trout	1/5/2005
Warm Springs Creek	0.0	4.0	Westslope Cutthroat Trout	11/18/2009
Warm Springs Creek	13.1	24.1	Westslope X Rainbow	2/23/2009
Warm Springs Creek	0.0	26.1	Slimy Sculpin	2/23/2009
Warm Springs Creek	0.0	11.6	Rainbow Trout	3/25/2009
Warm Springs Creek	11.6	25.0	Rainbow Trout	8/28/2009
Warm Springs Creek	0.0	12.9	Mountain Whitefish	2/20/2009
Warm Springs Creek	0.0	22.3	Longnose Sucker	1/5/2005
Warm Springs Creek	12.3	24.4	Bull Trout	1/5/2005
Warm Springs Creek	24.4	32.6	Bull Trout	1/5/2005
Warm Springs Creek	18.2	24.4	Brown Trout	9/14/2009
Warm Springs Creek	0.0	18.2	Brown Trout	9/14/2009
Warm Springs Creek	14.0	28.4	Brook X Bull Trout hybrid	2/20/2009
Warm Springs Creek	13.1	29.4	Brook Trout	3/25/2009
East Fork Warm Springs Creek	0.0	1.9	Westslope Cutthroat Trout	1/5/2005
Middle Fork Warm Springs Creek	0.0	2.1	Westslope Cutthroat Trout	1/5/2005
West Fork Warm Springs Creek	0.0	2.1	Westslope Cutthroat Trout	1/5/2005
West Fork Warm SpringsCreek	0.0	2.0	Bull Trout	2/20/2009
Twin Lakes Creek	1.0	10.0	Westslope Cutthroat Trout	9/16/2009
Twin Lakes Creek	0.0	7.3	Slimy Sculpin	9/16/2009
Twin Lakes Creek	0.0	9.0	Bull Trout	1/5/2005
Twin Lakes Creek	0.0	9.0	Brook X Bull Trout hybrid	1/5/2005
Twin Lakes Creek	0.0	9.0	Brook Trout	1/5/2005
East Fork Twin Lakes Creek	0.0	2.0	Westslope Cutthroat Trout	8/7/2007
Storm Lake Creek	0.0	12.3	Westslope Cutthroat Trout	7/25/2008
Storm Lake Creek	1.5	3.5	Bull Trout	7/24/2009
Storm Lake Creek	0.0	1.5	Bull Trout	7/24/2009
Storm Lake Creek	0.0	3.5	Brook Trout	3/25/2009
Foster Creek	0.0	9.8	Westslope Cutthroat Trout	1/5/2005
Foster Creek	0.0	1.3	Slimy Sculpin	2/23/2009
Foster Creek	0.0	9.9	Bull Trout	1/5/2005
Foster Creek	0.0	2.4	Brook X Bull Trout hybrid	2/20/2009
Foster Creek	4.8	9.4	Brook Trout	2/20/2009
Foster Creek	0.0	4.8	Brook Trout	2/20/2009
Cable Creek	0.0	3.2	Westslope Cutthroat Trout	1/5/2005
Cable Creek	0.0	0.6	Rainbow Trout	7/13/2009
Cable Creek	0.0	3.2	Brook Trout	2/20/2009
Barker Creek	0.0	4.1	Westslope Cutthroat Trout	6/4/2009
Barker Creek	0.0	5.0	Bull Trout	7/24/2009
Barker Creek	0.0	0.7	Brook Trout	2/20/2009

Current Condition of Fishery

Montana FWP conducted fish sampling on Warm Springs Creek in 2007 at River Mile 1.8, 7.4, 8.4, 16.4, 18.6, 23.3, 27.4, and 29.1. Trout populations changed composition throughout the creek with brown trout comprising the majority in the lower reaches, brown trout, some brook trout and westslope cutthroat (including rainbows and hybrids) making up the lower to middle reaches, westslope cutthroat inhabiting the middle to upper reaches, and bull trout in the upper reaches (MFWP, 2008). Fish habitat ranged mainly from “good” to “excellent” with most sites being declared “near” or “at potential”. River Mile 18.6 and 23.3 scored only “fair” on the assessment and lacked deep pools and sufficient large woody debris (MFWP, 2008).

Tributary Fishery Conditions

West Fork Warm Springs Creek: The sample at RM 1.0 showed 58% bull trout and 48% westslope cutthroat trout. Fish habitat assessments received a perfect score. Montana FWP declared fish habitat “good” and at its potential (2008).

Middle Fork Warm Springs Creek: The sample at RM 0.4 found only westslope cutthroat trout. Fish habitat was scored as “good” but lacked sufficient large woody debris (MFWP, 2008).

East Fork Warm Springs Creek: The sample at RM 0.5 contained no fish and MFWP did not conduct a scored riparian assessment (MFWP, 2008).

Barker Creek: Montana FWP sampled the creek at RM 0.5, 1.6 and 2.9. Bull trout were the dominant species at each site, with westslope cutthroat and brook trout comprising the remainder. Some cutthroat -rainbow hybrids as well as bull-brook hybrids were present. Fish habitat at 0.5 was “excellent” but only “good” at the other two sites (MFWP, 2008).

Foster Creek: Sample sites included RM 1.1, 2.3 and 3.9 and mainly contained westslope cutthroat and brook trout. One bull-brook hybrid was noted. All three sites’ fish habitat received a score of “good” (MFWP, 2008).

Twin Lakes Creek: Sample sites at RM 1.4, 2.8, 4.7, and 7.2 showed populations of bull, westslope cutthroat and brook trout. Bull trout also occur in Upper and Lower Twin Lakes (which drain into Twin Lakes Creek). Fish habitat ranged from “fair” at RM 1.4 to “good” at the rest of the sites (MFWP, 2008).

Cable Creek: Fish samples were conducted at RM 0.8 and 2.2. Westslope cutthroat comprised the majority of the trout population at the lower site, while brook trout were the main species at the upper. Fish habitat scored better at RM 2.2 than 0.8 with 2.2 being rated “good” and 0.8 rated “fair” (MFWP, 2008).

Storm Lakes Creek: Fish samples and riparian assessment occurred at RM 0.6, 1.4, 3.0, 4.2, and 6.3. Westslope cutthroat and brook trout were most common at the sample sites, with bull trout and bull trout hybrids appearing in the upper reaches. Fish habitat ranged from “poor” at RM 0.6 to “good and even “excellent” at the other sites (MFWP, 2008).

Fishery Potential

Table 5: Tributary Rating Summary for Lower Warm Springs Creek (Priority 1)

Stream	Reach(RM)	Trout Species	Impairments
Warm Springs Creek	Lower: 0.0-16.6	Bull, Brook, Brown, Westslope Cutthroat and Rainbow	Low summer flows due to irrigation, industrial diversions, unscreened diversions; erosion; mining; livestock grazing in riparian areas; timber harvest; high temperatures; urban development; competition to bull and westslope cutthroat trout from brook/brown/rainbow trout
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Very High			**Very High**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
High			**High**
Current Native Fishery Value (westslope cutthroat)			Protection/Enhancement Value
Medium			**Medium**

Source: MFWP, 2010

Table 6: Tributary Rating Summary for Upper Warm Springs Creek (Priority 2)

Stream	Reach(RM)	Trout Species	Impairments
Warm Springs Creek	Upper:16.6-32.5	Bull, Brook, Brown, Westslope Cutthroat and Rainbow	Low summer flows due to industrial diversions, unscreened diversions; erosion; mining; livestock grazing in riparian areas; timber harvest; high temperatures; development; competition to bull and westslope cutthroat trout from brook/brown/rainbow trout
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Medium			High
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Medium			High
Current Native Fishery Value (bull; westslope cutthroat)			Protection/Enhancement Value
High			High

Source: MFWP, 2010

Table 7: Tributary Rating Summary for West Fork Warm Springs Creek (Priority 4)

Stream	Reach(RM)	Trout Species	Impairments
West Fork Warm Springs Creek	All: 0.0-2.0	Bull and Westslope Cutthroat	Low summer flows due to irrigation, diversions, unscreened diversions; erosion; mining; timber harvest; competition to bull and westslope cutthroat trout from brook/brown/rainbow trout
Current Recruitment/Restoration Fishery Value			Protection/Enhancement Value
Low			**Low**
Current Tributary/Replacement Fishery Value			Protection/Enhancement Value
Low			**Low**
Current Native Fishery Value (bull; westslope cutthroat)			Protection/Enhancement Value
Very High			**Very High**

Source: MFWP, 2010

While Warm Springs Creek and its tributaries experience several impairments, protection and enhancement possibilities for a viable trout fishery exist on several levels (Tables 5, 6, and 7). Montana FWP has shown an interest in managing (in collaboration with state agencies and other organizations) Warm Springs Creek and West Fork Warm Springs Creek as recreational fisheries, declaring lower Warm Springs Creek a “Priority 1” stream reach, upper Warm Springs Creek a “Priority 2” stream reach and West Fork Warm Springs Creek a “Priority 4” stream reach in the agency’s Final Tributary Rating Summary (2010). Improved management practices can increase the fishery viability by addressing documented impairments with appropriate restoration projects.

4. Assessments

Warm Spring Creek’s habitat and water quality status have been assessed several times in the last 10 years (Table 8). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

Table 8: Warm Springs Creek Assessments

Type	Agenc	Year	Area
Tributary Prioritization /Rating Summary	MFWP	2010	Warm Springs Creek and West Fork Warm Springs Creek
Fish Population/Riparian Habitat	MFWP	2008	Warm Springs Creek and tributaries
PIBO Temperature	USFS	2010	Warm Springs Creek and tributaries
Upper Clark Fork Tributaries TMDL	MDEQ	2010	River Mile 0.0-32.5
Irrigation Structure Inventory	WRC	2010	Lower/Middle Warm

FWP Riparian Assessment

Montana FWP conducted riparian assessments at all fish survey reaches on Warm Springs Creek and its tributaries during 2008 (Section 3 contains specific river mile references).

- **Warm Springs Creek:** The riparian condition at most sites scored well, with the presence of noxious weeds being the main detractor (MFWP, 2008). The site at RM 29.1 scored the lowest due to recent timber harvest near the stream and a lack of woody vegetation and stream cover (MFWP, 2008).
- **West Fork Warm Springs Creek**: Riparian assessment results at RM 1.0 received a perfect score.
- **Middle Fork Warm Springs Creek:** River Mile scored high on the riparian assessment, with fish habitat being the reducing factor (MFWP, 2008).
- **East Fork Warm Springs Creek:** The sample at RM 0.5 contained no fish and MFWP did not conduct a scored riparian assessment (MFWP, 2008).

- **Barker Creek:** Montana FWP assessed the creek at RM 0.5, 1.6 and 2.9. Riparian habitat at 0.5 was "excellent" but only "good" at the other two sites. Recent logging was apparent throughout the sampled reaches. Noxious weeds, decreased woody vegetation and some soil erosion appeared to be effects of the timber harvest (MFWP, 2008).

- **Foster Creek:** Assessment sites included RM 1.1, 2.3 and 3.9. The lower sites contained good levels of riparian woody vegetation but were limited by low flows. Flow at site 3.9 was good but riparian vegetation (and therefore large woody debris) was sparse.

- **Twin Lakes Creek:** Assessment sites at RM 1.4, 2.8, 4.7, and 7.2 showed the effects of timber harvest (past and recent) were present throughout the drainage. Woody vegetation and large woody debris were below optimum levels (MFWP, 2008).

- **Cable Creek:** Riparian assessments were conducted at RM 0.8 and 2.2. Habitat scored better at RM 2.2 than 0.8 with 2.2 being rated "good" and 0.8 rated "fair". Noxious weeds, sedimentation and lack of large woody debris reduced the scores (MFWP, 2008).

- **Storm Lakes Creek:** Riparian assessment occurred at RM 0.6, 1.4, 3.0, 4.2, and 6.3. Timber harvest effects were apparent throughout the drainage and sedimentation was noted at RM 4.2 and 1.4 (MFWP, 2008).

5. Restoration

Needs

- Continued monitoring and remediation for metals contamination
- Address bank erosion and sedimentation causes such as livestock access, timber harvest, roads
- Continued temperature monitoring
- Address fish passage issues by screening diversions and altering instream barriers
- Work with water users to address low streamflow

Activities: No activities led by WRC are currently underway. The NRDP intends to clean up some metals contamination hotspots in the lower reaches of Warm Springs Creek. The Anaconda-Deer Lodge County government and local non-profits are interested in stream corridor habitat enhancement in Washoe Park (urban).

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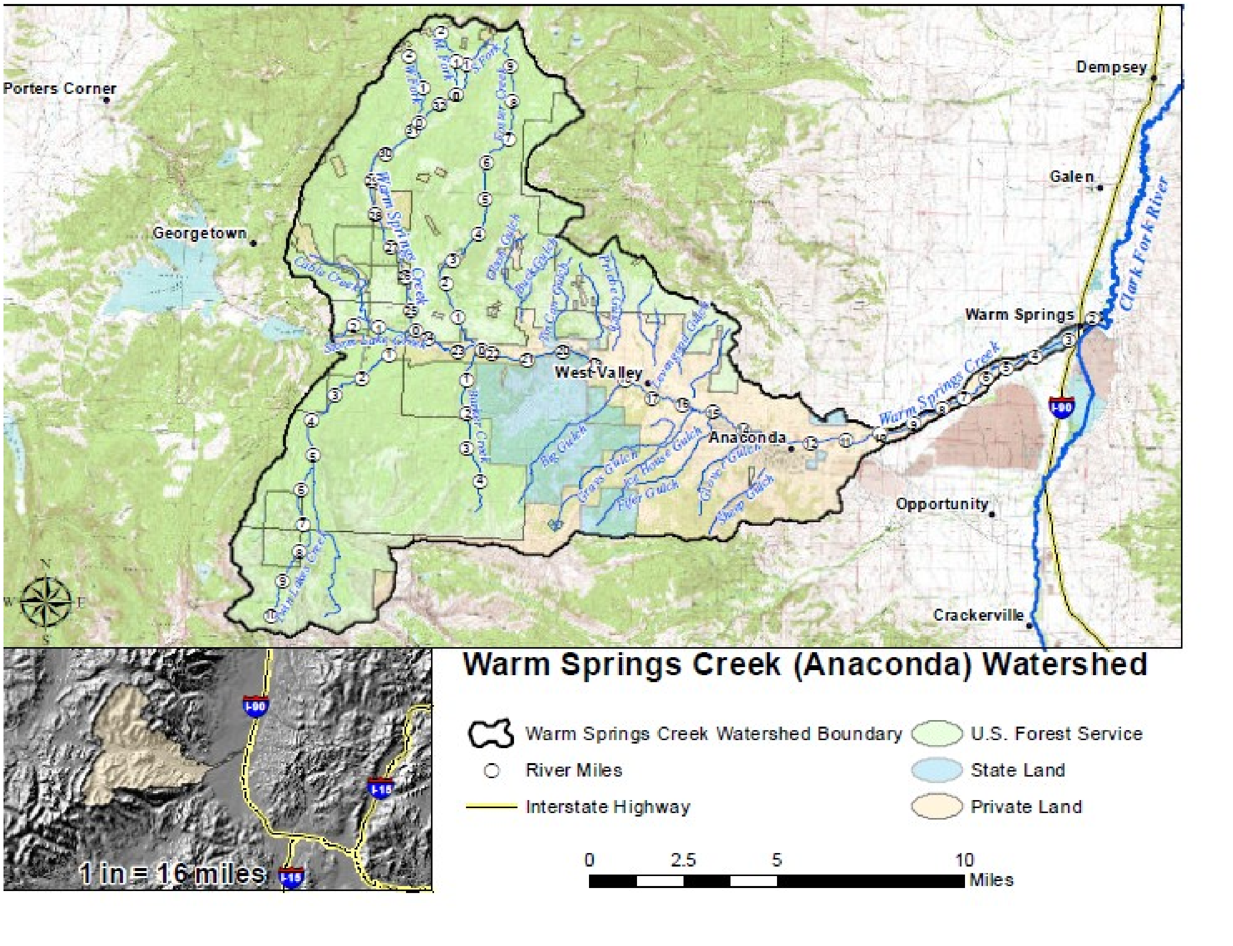
Porters Corner
Georgetown
Dempsey
Galen
Warm Springs
Clark Fork River
West Valley
Anaconda
Opportunity
Crackerville
Warm Springs Creek
Cable Creek
Storm Lake Creek
Barker Creek
Big Gulch
Grass Gulch
Ice House Gulch
Fifer Gulch
Glover Gulch
Sheep Gulch
Twin Lakes Creek
Lowland Gulch
Dutch Gulch
Mudd Gulch
Meyers Creek
N
E
S
W
1 in = 16 miles
I-90
I-15
Warm Springs Creek (Anaconda) Watershed
Warm Springs Creek Watershed Boundary
River Miles
Interstate Highway
U.S. Forest Service
State Land
Private Land
0
2.5
5
10
Miles

Willow Creek (Fairmont) Watershed Summary

1. Description and Land Use

Willow Creek lies within the Silver Bow Creek Watershed, but no longer connects with Silver Bow Creek. The creek originates in the Continental Divide and flows for almost 13 miles before entering the Mill-Willow bypass and joining the Clark Fork River below the Warm Springs Ponds near the town of Opportunity (MFWP, 2009).

Table 1: Willow Creek (Opportunity) Watershed Overview

Watershed Size	18,331 acres/28.7 sq miles/74.3 sq km
Elevation Range	2,615 feet [4,980-7,595]
Stream Miles	51.3
Land Ownership	Private: 39% /State: 61%
Road Miles	Driveway/Service Road= 0.1 Local Road/City Street = 12.5 Highway= 1.1 Total = 13.7

Source: Montana GIS Portal Data Layers

Willow Creek drains an area of almost 29 square miles. Much of the upper basin is public land, principally the state-managed Mount Haggin Wildlife Management Area, while private land predominates in the middle and lower watershed. The Willow Creek watershed supports livestock grazing, irrigated agriculture, and some timber harvest.

2. Impairments

Montana DEQ has documented impairments for metals, sediment, nutrients, and streamside vegetation on upper Willow Creek, and metals, sediment, low-flow, and alteration of streamside vegetation on lower Willow Creek. Recent data from Montana FWP suggests that lower Willow Creek also has temperature impairments, which is expected where low-flows and streamside vegetation are also issues.

Table 2: Listed Impairments for Willow Creek on DEQ 303(d) list

2010			
Reach	**Impairment**	**Pollutant**	**Impaired Uses**
Willow Creek River Mile 12.8 (Headwaters)-7.0	Arsenic	Metals	Drinking Water, Primary Contact Recreation
	Cadmium	Metals	Aquatic Life, Cold Water Fishery
	Copper	Metals	Aquatic Life, Cold Water Fishery
	Iron	Metals	Aquatic Life, Cold Water Fishery
	Lead	Metals	Aquatic Life, Cold Water Fishery
	Zinc	Metals	Aquatic Life, Cold Water Fishery
	Sedimentation/ Siltation	Sediment	Aquatic Life, Cold Water Fishery
Willow Creek River Mile 7.0-0.0 (Silverbow Creek)	Arsenic	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
	Cadmium	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
	Copper	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
	Iron	Metals	Aquatic Life, Cold Water Fishery, Drinking Water
	Lead	Metals	Aquatic Life, Cold Water Fishery
Willow Creek River Mile 7.0-0.0 (Silverbow Creek)	Zinc	Metals	Aquatic Life, Cold Water Fishery
	Sedimentation/ Siltation	Sediment	Aquatic Life, Cold Water Fishery
2008			
Reach	**Impairment**	**Pollutant**	**Impaired Uses**
Willow Creek River Mile 12.8 (Headwaters)-7.0 **Willow Creek** River Mile 12.8 (Headwaters)-7.0	Arsenic	Metals	Drinking Water, Primary Contact Recreation
	Cadmium	Metals	Aquatic Life, Cold Water Fishery
	Copper	Metals	Aquatic Life, Cold Water Fishery
	Lead	Metals	Aquatic Life, Cold Water Fishery
	Phosphorus (Total)	Nutrients	Aquatic Life, Cold Water Fishery, Primary Contact Recreation
	Sedimentation / Siltation	Sediment	Aquatic Life, Cold Water Fishery
	Alteration in stream-side or littoral vegetative cover	*Not a Pollutant*	Aquatic Life, Cold Water Fishery
Willow Creek River Mile 7.0-0.0 (Silverbow Creek)	Arsenic	Metals	Aquatic Life, Cold Water Fishery, Drinking Water

Metals

The Willow Creek basin contains no recorded abandoned mines (DNRC, 2011). However, the entire watershed lies within the Anaconda Smelter Superfund Site (MDEQ, 2010) and has historically received contaminants from several different sources, including air deposition from the smelter stack. The Yellow Ditch, which once brought water and tailings from Silver Bow Creek, multiple tile drains, railroad lines, polluted groundwater and atmospherically-contaminated eroding soil from the upper basin have all been cited as contributors to the metals problems in Willow Creek, especially in the lower reaches (MDEQ, 2010). While several of the listed metals exceed target allowances during peak flows, lead, arsenic and copper also exceed at low flows (MDEQ, 2010). Willow Creek is also listed for cadmium, zinc and iron (Table 2).

Irrigation and Dewatering

Chronic dewatering results from agricultural irrigation within the basin and has many implications for both water quantity and quality. Almost 90 water rights exist on Willow Creek (MDNRC, 2011) and contribute to low seasonal flows. Low flows result in unsuitable habitat for fish and macroinvertebrates due to increased temperatures and algal growth (Table xxx). In addition, multiple irrigation structures on Willow Creek create barriers which impede fish passage and migration (MFWP, 2010).

Sediment/Siltation

Impairments from eroded sediment and siltation occur widely in the middle and lower end of Willow Creek. Several reaches of Willow Creek have been straightened, resulting in large-scale bank erosion as the creek re-establishes a meander pattern. Woody riparian vegetation is sparse in several areas, especially in lower Willow Creek. This, combined with heavy livestock impact, leads to accelerated bank erosion (MFWP, 2009). A road associated with Superfund remediation was also cited by the Watershed Restoration Coalition as a source of erosion and fine sediment (WRC, 2011).

Sedimentation degrades fish spawning sites and macro-invertebrate habitat in the stream substrate, and reduces total available habitat (such as riffles and pools). Sediment levels in Willow Creek exceed those defined by Montana DEQ TMDL standards (MDEQ, 2010).

Temperature

Thermal impairments were documented by Montana FWP in 2008 in the lower watershed, with over 40 days of maximum water temperatures above 20 degrees C (Table 3). This temperature issues are most likely due to agricultural dewatering and lack of streamside woody vegetative cover. Temperatures below 16°C are optimum, while prolonged temperatures above 20 °C are lethal for westslope cutthroat trout (Kirk, 2010). High temperatures also encourage algae growth and reduce dissolved oxygen content, which can be detrimental to all fish.

Table 3: Water Temperatures in Willow Creek (Opportunity) in 2008

Source: FWP, 2008	RM*	Start Date	End Date	Max T (°C)	Days>15° C	Days>20°C
	2.1	7/8	10/13	24.1	72	42
	7.7	7/8	10/13	17.5	37	0

3. Native/Sport Fishery

Current Condition

Montana FWP conducted fish sampling at River Mile 1.0, 5.1, and 8.4 on Willow Creek in 2008. The samples showed predominantly brook and brown trout at RM 1.0, while westslope cutthroat trout appeared at RM 5.1. Westslope cutthroat trout were the dominant species at RM 8.4 and some brook trout were present as well (MFWP, 2009).

Fish habitat was scored as "fair" at RM 1.0 and 5.1 and "good" at RM 8.4. All sites lacked suitable amounts of large woody debris and contained elevated amounts of fine sediment. RM 1.0 and 5.1 lacked vegetative stream cover and suffered from low flows as well (MFWP, 2009).

Table 4: Fish Species Distribution in Willow Creek (Opportunity)

Waterbody	Begin RM*	End RM*	Species	Updated
Willow Creek	0.0	12.9	Brook Trout	8/10/2006
Willow Creek	0.0	3.6	Brown Trout	2/20/2009
Willow Creek	3.6	11.7	Brown Trout	2/20/2009
Willow Creek	0.0	7.0	Longnose Sucker	2/23/2009
Willow Creek	0.0	6.2	Redside Shiner	2/23/2009
Willow Creek	0.0	12.9	Slimy Sculpin	1/5/2005
Willow Creek	9.0	12.9	Westslope Cutthroat Trout	8/19/2009
Willow Creek	5.0	9.0	Westslope Cutthroat Trout	8/19/2009

Source: MFWP, 2010

Fishery Enhancement Potential

Table 5: FWP/NRDP Tributary Rating Summary for Willow Creek (Priority 2)

<table>
<tr><th>Stream</th><th>Reach(RM)</th><th>Trout Species</th><th>Impairments</th></tr>
<tr><td>Willow Creek</td><td>All: 0.0-12.8</td><td>Brook, Brown and Westslope Cut-throat</td><td>Low summer flows due to irrigation; erosion and channel incisement; lack of vegetative cover; livestock grazing in riparian areas; high temperatures; metals contamination; competition to westslope cutthroat trout from brook and brown trout</td></tr>
<tr><td colspan="3">Current Recruitment/Restoration Fishery Value</td><td>Protection/Enhancement Value</td></tr>
<tr><td colspan="3">Medium</td><td>High</td></tr>
<tr><td colspan="3">Current Tributary/Replacement Fishery Value</td><td>Protection/Enhancement Value</td></tr>
<tr><td colspan="3">Medium</td><td>High</td></tr>
<tr><td colspan="3">Current Native Fishery Value (westslope cutthroat)</td><td>Protection/Enhancement Value</td></tr>
<tr><td colspan="3">Medium</td><td>Medium</td></tr>
</table>

Source: MFWP, 2010

While Willow Creek experiences several impairments, protection and enhancement possibilities for a viable trout fishery exist on several levels (Table 5). Montana FWP has shown an interest in managing Willow Creek, in collaboration with state agencies and other organizations, as a recreational fishery, declaring it a "Priority 2" stream reach in the agency's Final Tributary Rating Summary (2010). Improved management practices can increase the fishery by addressing documented impairments (Table 2) with appropriate restoration projects.

4. Assessments

Willow Creek's habitat and water quality status have been assessed several times in the last 10 years (Table 6). Assessments have included fish habitat and fishery potential, temperature, noxious weeds, stream flow, and stream channel and riparian habitat status.

The Watershed Restoration Coalition conducted riparian assessments on the lower ten miles of Willow Creek in 2011. Assessed reaches within and immediately downstream of the Mount Haggin Wildlife Management Area were rated as "sustainable" for a total channel length of over three miles. Downstream of the railroad crossing to the Yellow Ditch scores were mostly "unsustainable" due to channelization, severe incisement and bank erosion, poor vegetative cover, and over-grazing of woody plants. Reaches below the Yellow Ditch were "at risk" or "unsustainable" due to active bank erosion, lack of riparian cover, weeds, poor regeneration of woody plants, and other issues. In total, five reaches totaling 3.3 miles were sustainable, four reaches totaling 2.8 miles were sustainable at risk, and four reaches were unsustainable (about 3.7 miles). Fish habitat scores were high in the area above the railroad and generally medium to very low in the lower reaches due to dewatering, poor habitat and poor cover (WRC, 2011).

Montana FWP conducted riparian assessments at each fish sampling site in 2008 (RM 1.0, 5.1, 8.4). Each site received fairly low scores for riparian condition owing to the prevalent noxious weeds, bank erosion/channel incisement and lack of woody vegetation. In some areas, livestock had access to the channel and evidence of hoofshear was present. Fish habitat was scored as "fair" at RM 1.0 and 5.1 and "good" at RM 8.4. All sites lacked suitable amounts of large woody debris and contained elevated amounts of fine sediment. RM 1.0 and 5.1 lacked vegetative stream cover and suffered from low flows as well (MFWP, 2009).

Table 6: Willow Creek Assessments

Type	Agency	Year	Area
Riparian/ Geomorphology/Flow	WRC	2011	RM 0.0 to 9.8 Willow Creek
Tributary Prioritization/ Rating Summary	MFWP	2010	All of Willow Creek
Fish Population/ Riparian Habitat	MFWP	2009	River Mile 1.0, 5.1, and 8.4
Upper Clark Fork Tributaries TMDL	MDEQ	2010	All of Willow Creek

5. Restoration

Needs

Continued monitoring of metals contamination throughout the basin and appropriate remediation
Address soil erosion issues with riparian plantings and limited livestock access in riparian areas
Work with water users to address dewatering and low flows
Continue to monitor temperature throughout the basin
Address barriers to fish passage

Activities: The WRC is not involved in any current restoration activities in Willow Creek. The Natural Resource Damage Program is proposing to do significant clean-up of metals-contaminated soils in the floodplain of the lower 1.5 miles of Willow Creek (near Opportunity), due to the historical contamination from Silver Bow Creek floodwaters.

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