CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES FOR FLUVIAL ARCTIC GRAYLING IN THE UPPER BIG HOLE RIVER

Montana Fish, Wildlife & Parks

Annual Report

2007

CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES FOR FLUVIAL ARCTIC GRAYLING IN THE UPPER BIG HOLE RIVER

ANNUAL REPORT 2007

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The Candidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in The Upper Big Hole River State and Federal Agency Partnership Includes:

Montana Fish, Wildlife & Parks
USDA Natural Resources Conservation Service
U.S. Fish and Wildlife Service
USFWS Partners for Fish and Wildlife Program
Montana Department of Natural Resources and Conservation

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I. INTRODUCTION

A Candidate Conservation Agreement with Assurances (CCAA) is an agreement between the U.S. Fish and Wildlife Service (USFWS) and any non-Federal entity whereby non-Federal property owners who voluntarily agree to manage their lands or waters to remove threats to species at risk of becoming threatened or endangered receive assurances against additional regulatory requirements should that species be subsequently listed under the Endangered Species Act (ESA).

The conservation goal of the CCAA for the Fluvial Arctic Grayling in the Upper Big Hole River (Big Hole Grayling CCAA) is to secure and enhance a population of fluvial (river-dwelling) Arctic grayling (*Thymallus arcticus*); (grayling) within the upper reaches of their historic range in the Big Hole River drainage. Under the Big Hole Grayling CCAA, Montana Fish, Wildlife and Parks (FWP) holds an ESA section 10(a)(1)(A) Enhancement of Survival Permit issued to it by USFWS and will issue Certificates of Inclusion to non-Federal property owners within the Project Area who agree to comply with all of the stipulations of the Program and develop an approved site-specific conservation plan (Figure 1). Site-specific conservation plans will be developed with each landowner by an interdisciplinary technical team made up of individuals representing FWP, USFWS, USDA Natural Resources Conservation Service (NRCS), and Montana Department of Natural Resources and Conservation (DNRC) (the Agencies). The conservation guidelines of the Big Hole Grayling CCAA will be met by implementing conservation measures that:

1. Improve streamflows

2. Improve and protect the function of riparian habitats

3. Identify and reduce or eliminate entrainment threats for grayling

4. Remove barriers to grayling migration

This planning effort will help alleviate private property concerns, as well as generate support from private landowners which will improve habitat conditions for grayling throughout the Project Area (Figure 1). The goal for the population of grayling inhabiting the Project Area is to increase the abundance and distribution of grayling within the Project Area (FWP and USFWS 2006).

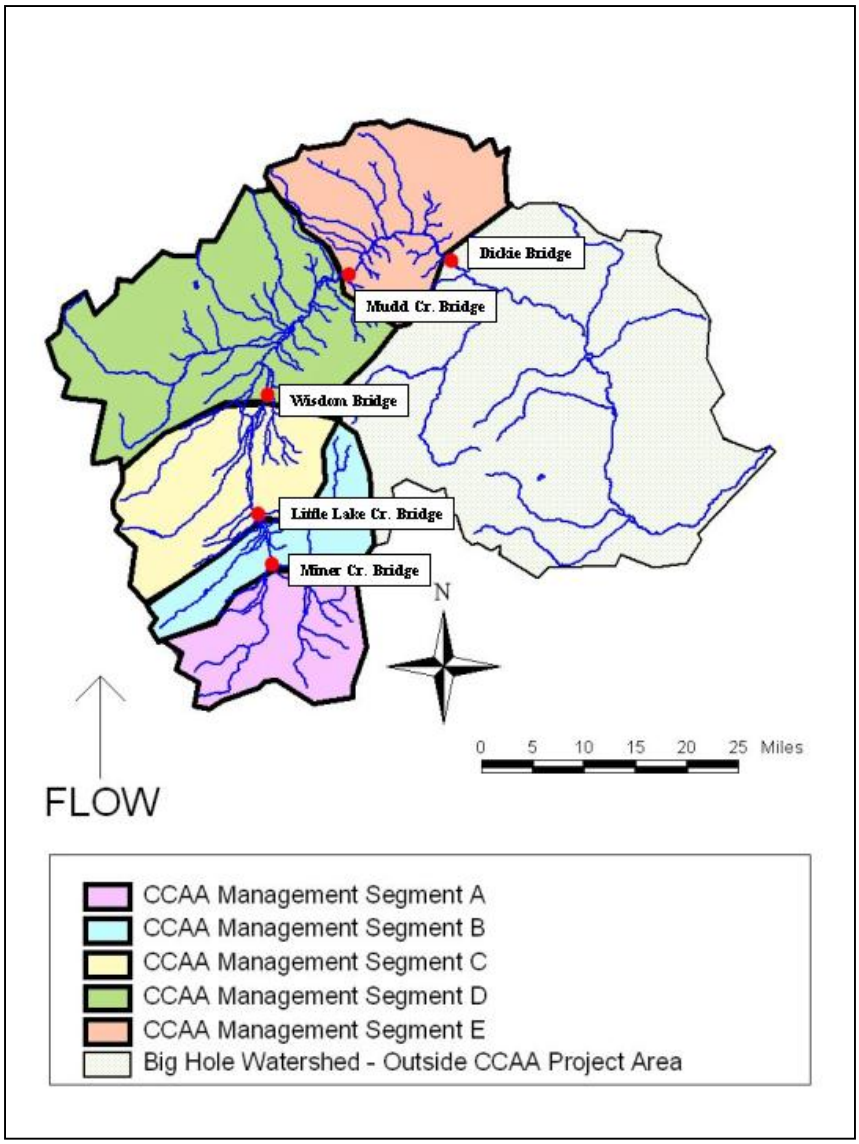

Figure 1. The Big Hole Grayling CCAA Project Area and Management Segments.

A majority of the habitat occupied by grayling in the Big Hole River and its tributaries is on or adjacent to private property. The recovery of grayling in the system is linked to the active involvement of private landowners and is viewed as critical to the conservation of the species in the Project Area. However, the occurrence or expansion of grayling in waters on their properties is a concern to private landowners because of potential regulatory restrictions on ranch operations should grayling be listed as threatened or endangered under the ESA in the future. These restrictions may affect landowner willingness to participate in efforts to conserve the species.

The Big Hole Grayling CCAA is a collaborative effort among private landowners, state and federal agencies, and non-government organizations. These stakeholders have agreed to work together for the common goals of preserving grayling, improving the local fishery, addressing private property concerns, maintaining the current land ownership dynamics, and enhancing the overall health of the upper Big Hole watershed.

II. LEGAL STATUS OF FLUVIAL ARCTIC GRAYLING

On April 24, 2007 the USFWS determined that the grayling population in the upper Missouri River basin was no longer warranted for listing under the ESA. This determination removed grayling from the Candidate Species List. Grayling remain a "Species of Special Concern" in Montana. On November 15, 2007 a lawsuit was filed by the Center for Biological Diversity, the Grayling Restoration Alliance, the Federation of Flyfishers and the Western Watersheds Project to overturn the USFWS decision not to list the grayling population in the upper Missouri River basin as either Threatened or Endangered. The current legal status of grayling does not remove the need for the Big Hole Grayling CCAA since it is still possible that grayling may become listed as either Threatened or Endangered under the ESA in the future.

III. LANDOWNER ENROLLMENT

On August 1, 2006 the USFWS issued FWP ESA section 10(a)(1)(A) Enhancement of Survival Permit # TE-104415 authorizing the Big Hole Grayling CCAA. The issuance of this permit allowed for the official enrollment of any non-federal landowner within the Big Hole Grayling CCAA Project Area. Enrolled non-federal landowners are provided incidental take coverage and regulatory assurances once the non-federal landowner, FWP, and the USFWS counter-sign the Certificate of Inclusion and the approved site-specific conservation plan for the enrolled property. In 2007, 12 private landowners enrolled 66,842 acres of private and 3,600 acres of state land into the program. Since August 1, 2006, 32 landowners (Participating Landowners) have enrolled 152,139 acres of private and 6,030 acres of state land into the Big Hole Grayling CCAA (Table 1, Figure 2). Enrollment for the Big Hole Grayling CCAA will remain open until 90 days prior to a proposed ESA listing date for grayling being published by the USFWS in the Federal Register. As of December 31, 2007, the USFWS had counter-signed 15 of the 32 Certificates of Inclusion signed and submitted by FWP.

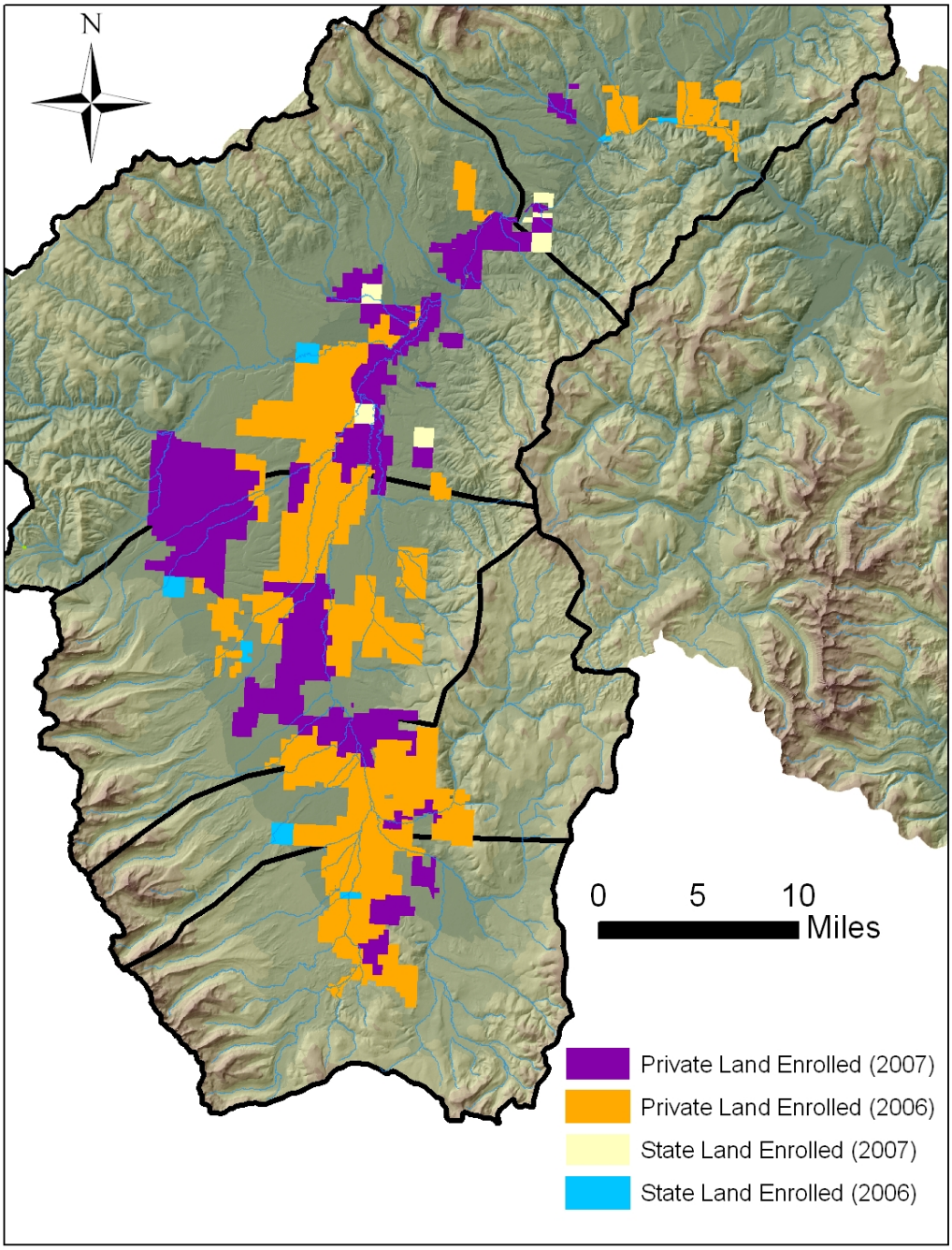

Figure 2. Area of state and private land enrolled into the Big Hole Grayling CCAA Program in 2006 and 2007.

Table 1. Landowners, location of enrolled property, acreage enrolled, and year of enrollment in the Big Hole Grayling CCAA.

Landowner	Management Segment(s)	Private Land Enrolled (acres)	State Land Enrolled (acres)
1. Dooling Livestock Co. (2006)	A	6,300	0
2. Upper Big Hole LLC. (2006)	A	3,100	0
3. Lapham Ranch Co. (2006)	A&B	7,000	0
4. Jackson Ranches, Inc. (2006)	A&B	4,230	200
5. H Lazy J Ranch (2006)	A&B	3,370	640
6. Strodtman Trust (2006)	A&B	1,231	0
7. Peterson Brothers Cattle Company (2007)	A&B	2,400	400
8. Dick Hirschy Cattle Inc. / Heidi Hirschy (2007)	A, B, C&D	24,153	0
9. Rocky Mountain Ranches (2006)	B	3,445	0
10. Finch Ranches, LLC (2007)	B	1,052	0
11. Husted Ranches, Inc. (2006)	B&C	3,744	0
12. Johnson Brothers, Inc. (2006)	B&C	2,490	0
13. Ralph Huntley and Son, Inc. (2006)	C	9,200	560
14. Wisdom River Cattle Co. (2006)	C	3,721	0
15. Foster Company (2006)	C	2,017	400
16. Fred and Lynn Hirschy (2007)	C	1,550	0
17. John and Phyllis Erb / Erb Livestock Co. (2006)	C&D	23,174	560
18. Big Hole Grazing Association (2006)	C&D	5,192	0
19. John Nelson (2007)	C&D	3,340	640
20. Jack Hirschy Livestock, Inc. (2007)	C&D	14,787	0
21. Harrington, Co. (2007)	C&D	8,334	640
22. Big Hole River LLC. (2006)	D	1,473	0
23. Stanley Rasmussen (2006)	D	160	0
24. Joe and Barbara Clemans (2006)	D	30	0
25. Quarter Circle 3T Ranch (2007)	D	2,530	640
26. Weaver Ranch (2007)	D	680	0
27. Ralston Ranch, Inc. (2006)	E	2,850	0
28. LaMarche Creek Ranch (2006)	E	1,670	0
29. Reinhardt Ranch Co. (2006)	E	900	70
30. Christiansen's East Bench Ranch (2007)	E	6,336	1,280
31. K.L. Spear (2007)	E	700	0
32. Ernest Bacon (2007)	E	980	0
Totals		**152,139**	**6,030**

IV. BIG HOLE GRAYLING CCAA RAPID ASSESSMENTS

The Participating Landowners in the Big Hole Grayling CCAA must allow the Agencies to conduct a "rapid assessment" of the enrolled lands within 90 days. The rapid assessment focuses on the identification of immediate threats of mortality to grayling on the property and the validation of water rights compliance. Immediate threats to grayling may include structures, mechanical devices, or pollutants that pose a threat of immediate mortality to grayling. Examples include: unscreened pumping from a creek or river or toxic effluent entering into a creek or river. Additional information may be gathered through the assessments that assist with the development of the site-specific conservation plan with the Participating Landowner (Petersen and Lamothe 2006).

A. Surveys for Immediate Threats to Grayling

There were no surveys for immediate threats to grayling conducted in 2007. Surveys of property enrolled in 2007 were completed in 2006. Additional surveys are scheduled for 2008. Monitoring of enrolled property for immediate threats continues as the site-specific conservation plan is being developed by the Agencies.

B. Water Rights Compliance Evaluation

The DNRC provides expertise on the all facets of water rights, water use, and water monitoring. In addition to assisting the Agencies with water right information requests, DNRC continued with the initial compliance of Participating Landowners water rights as part of the Big Hole Grayling CCAA rapid assessment requirements. At each diversion, flow was recorded as well as presence and condition of diversion dams, headgates, and measuring devices. The DNRC met with newly enrolled or potentially enrolled landowners in 2007 to specifically discuss their water rights and water use in the context of the Big Hole Grayling CCAA. These meetings typically involved discussions resulting in the gathering of information on operational and historic use of water and education of landowners on their legal rights to use water. The meetings were followed up by the water rights compliance assessment. In addition, several points of diversion were assessed or re-assessed for water rights compliance associated with landowners enrolled in 2006. Approximately 50 points of diversion were assessed during this effort, bringing the total number of assessed points of diversion between 2005 and 2007 to over 550. During the fall of 2007, reports detailing the findings of the water rights compliance assessments were submitted to FWP.

V. SITE-SPECIFIC CONSERVATION PLANS COMPLETED AND APPROVED

There were no site-specific conservation plans completed in 2007. Components of the site-specific plans including: rapid assessment results, location of potential migration barriers, riparian assessments, grazing plans, results from entrainment surveys, stream channel morphology parameters, historic fish population data, and stream temperature and flow data were compiled in anticipation of completing several of the site-specific conservation plans in 2008.

The timeline for completing site-specific conservation plans is 30 months from the date the USFWS co-signs the Participating Landowner's Certificate of Inclusion.

VI. BIG HOLE GRAYLING CCAA CONSERVATION MEASURES

The purpose of the Big Hole Grayling CCAA conservation measures is to take a holistic approach to addressing limiting factors to grayling within the Big Hole Grayling CCAA Project Area that are within the control of the Participating Landowners. The expectation is that through the implementation of these measures the grayling population in the Project Area will respond by increasing in abundance and distribution.

A. Improving Streamflows

The goals associated with improving streamflows within the Project Area are to promote stream ecosystem function, provide adequate seasonal high-flow events and baseflow conditions, and eliminate human-caused dewatering events (FWP and USFWS 2006). The ability of the Agencies and the Participating Landowners to meet these goals are dependent on: the availability of water (i.e. snowpack and precipitation conditions, and water-use dynamics of non-participating landowners), compliance of Participating Landowners with existing water use laws, the ability of Participating Landowners to measure and control withdrawals from the Big Hole River and its tributaries, and Participating Landowner involvement in water conservation measures.

Conservation Actions to Improve Streamflows in the Big Hole River and its Tributaries

In 2007, the Agencies worked with Participating Landowners and Jim Boetticher, the Upper Big Hole Water Commissioner, to maintain suitable streamflows in the Big Hole River and its tributaries for grayling through the increased management of irrigation withdrawals during drought conditions. Montana Trout Unlimited (TU) provided funding for the water commissioner and the Big Hole Watershed Committee (BHWC) managed the funds. Contributions from six landowners at 11 points of diversion were documented over the period June 1, 2007 to October 15, 2007 resulting in a net contribution of 134.7 cfs to streamflows in the Big Hole River and Rock Creek that could have legally been used for irrigation or stock watering. Contributions are defined as a reduction in irrigation withdrawals or allowing water to pass a point of diversion that may have been used legally by the landowner for irrigation or watering of livestock. The net contribution from Participating Landowners for 2007 was greater than the amount documented in 2006 (134.7 vs. 103.4 in 2006) with the burden of these contributions falling on a smaller number of Participating Landowners in 2007 (6 vs.12 in 2006). A series of public meetings, led by DNRC, were held during winter 2008 to address this dynamic.

Projects to Improve the Ability to Control and Measure Irrigation Withdrawals

Spokane Irrigation Ditch Repair

Project Overview

Ice jams during run-off in spring 2007 caused a breach in a side-wall of the Spokane Irrigation Ditch (Figure 3). The breach made it impossible to effectively manage irrigation water at this point of diversion. The Arctic Grayling Recovery Program (AGRP) worked with the landowner (John and Phyllis Erb) and Rowe Excavation to quickly repair the ditch. The repair required the addition of large rock to stabilize and close the side-wall (Figure 3). Since 2004 the Participating Landowner has contributed the largest amount of water, that could have been otherwise used legally to irrigate hay and grazing pastures, to enhance streamflows in the upper Big Hole watershed. The repairs allowed for the continued management of water, in a way that benefited streamflows in the Big Hole River.

Project Funding Partners

The project was funded in cooperation by AGRP and the Participating Landowner (Table 2). The repairs were made quickly to insure the proper management of water at this key point of diversion.

Figure 3. The breach in the Spokane Irrigation Ditch caused by ice jams and the repair made to insure water could be properly managed at this point of diversion (project photos).

Funding Summary

Table 2. Funding associated with the Spokane Irrigation Ditch Repair project.

Funding Partner	Financial Contribution
AGRP	$3,887.50
John and Phyllis Erb	Cost of on-site materials and in-kind

Huntley Irrigation Improvement Project

Project Overview

The NRCS, FWP, and DNRC are collaborating with Ralph Huntley and Son, Inc. to improve the ability to control and measure irrigation withdrawals from the Big Hole River at three points of diversion (Figure 4). The project will replace three existing diversions and four headgates in need of repair (Figure 5). The project will also install two irrigation water measuring devices in the associated irrigation systems. The project design and permitting were completed in 2007. Project construction is scheduled for spring 2008. The total cost for the project including design, construction, and oversight is $75,123.00 (Table 3).

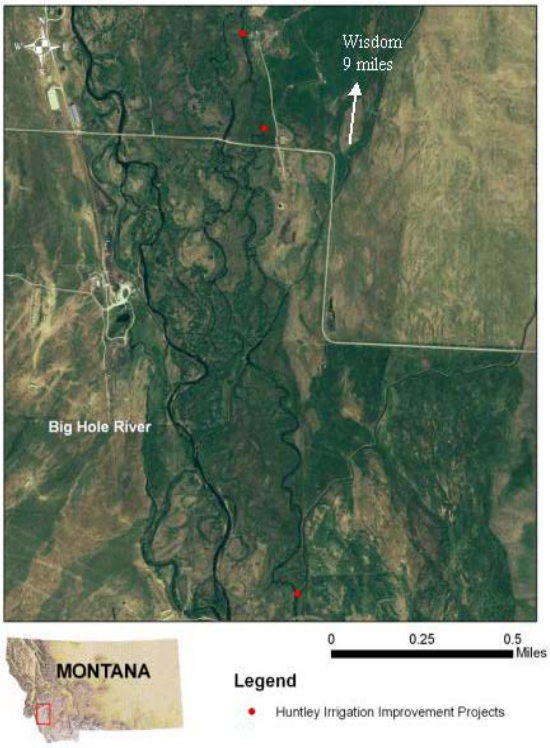

Figure 4. The location of the points of diversion involved in the Huntley Irrigation Improvement Project.

Figure 5. One of the headgates to be replaced as part of the Huntley Irrigation Improvement Project (pre-project photo).

Project Funding Partners

The project is funded largely by the Participating Landowner ($59,136.00) primarily through funding provided by the NRCS EQIP program (Table 3). The FWP and DNRC are also contributors to this important project to improve the management of irrigation water in the upper Big Hole watershed. The FWP State Wildlife Grant funds (SWG) are made up of one-third federal funds, one-third match from the state's general fund and one-third match from sportsmen's license dollars.

Funding Summary

Table 3. Funding partners and contributions for the Huntley Irrigation Improvement Project.

Funding Partner	Financial Contribution
Ralph Huntley & Son, Inc. (EQIP)	$54,136.00
FWP - SWG	$11,987.00
Ralph Huntley & Son, Inc. (cash)	$5,000.00
DNRC	$4,000.00

SWG = State Wildlife Grant

B. Improve and Protect the Function of Riparian Habitats

A healthy, functioning riparian corridor provides shade to the stream, water storage during flooding, and food sources for stream microbes and insects (Hunter 1991). Rivers and creeks with healthy riparian vegetation have a high degree of bank stability, pool quality and habitat diversity.

In the upper Big Hole River, Lamothe and Magee (2004) found a direct correlation between the abundance of overhanging vegetation and the quality of instream habitat and Arctic grayling abundance. High quality pools are important to the life history of grayling as they provide critical feeding, wintering, and refuge habitats (Hughes 1992, 1998; Lamothe and Magee 2003). The abundance of relatively high quality pools in the upper Big Hole River is correlated to the presence of overhanging vegetation, with the river reaches with high quality pools and a

diversity of pool types supporting a relatively high abundance of grayling (Lamothe and Magee 2004). The current condition of much of the riparian vegetation and streambanks along the upper Big Hole River is considered to be in need of improvement in order to attain long-term sustainability (Upper Big Hole TMDL 2003, Lamothe and Magee 2004).

Riparian Assessments and Prescribed Grazing Plans

As part of the development of site-specific conservation plans for Participating Landowners, riparian areas are assessed on the entire enrolled property using the NRCS Riparian Assessment Method. A team of biologists from NRCS and FWP conduct the assessments. The assessment results form the basis for the prescribed grazing plan developed for riparian areas on the enrolled property. The goal and purpose of the riparian assessments and prescribed grazing plans is that all riparian areas with the Project Area will reach a level of sustainability within 15 years (2021).

Riparian Assessments

The NRCS and FWP completed riparian assessments on 14 Participating Landowners riparian habitat from June 1 to September 1, 2007. Over 62 miles of riparian areas along the Big Hole River and its tributaries were assessed in 2007 (Figure 6). Noxious weed species were documented and mapped while riparian assessments were performed by the Agencies. The results of the assessments conducted in 2007 show that most of the riparian areas on enrolled properties are considered “At Risk” when assessed using the NRCS Riparian Assessment Method (Figure 6) (NRCS 2004) (See Figure 6).

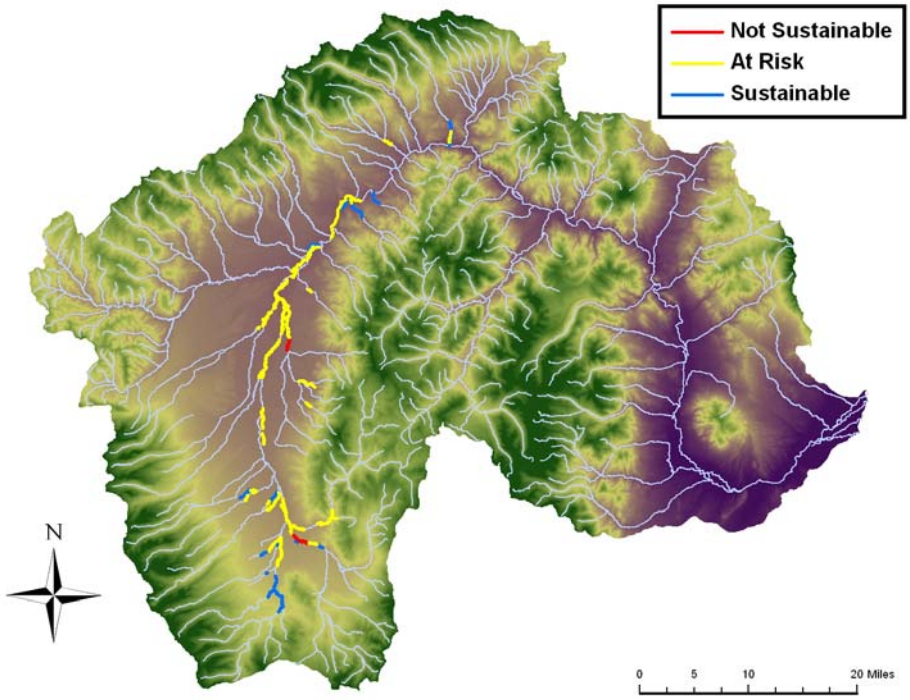

Figure 6. Spatial summary of riparian assessments conducted in 2007 on CCAA enrolled property.

Prescribed Grazing Plans

Prescribed grazing plans for five Participating Landowners were completed covering 16,410 acres of enrolled property (Figure 7). Grazing plans include livestock grazing alternatives for pastures containing riparian areas. They also address feedlot issues, alternative stock watering systems and weed management. Plans were completed for LaMarche Creek Ranch, Upper Big Hole LLC, Ralston Ranch Co., Johnson Brothers, Inc., and Dooling Livestock Co.

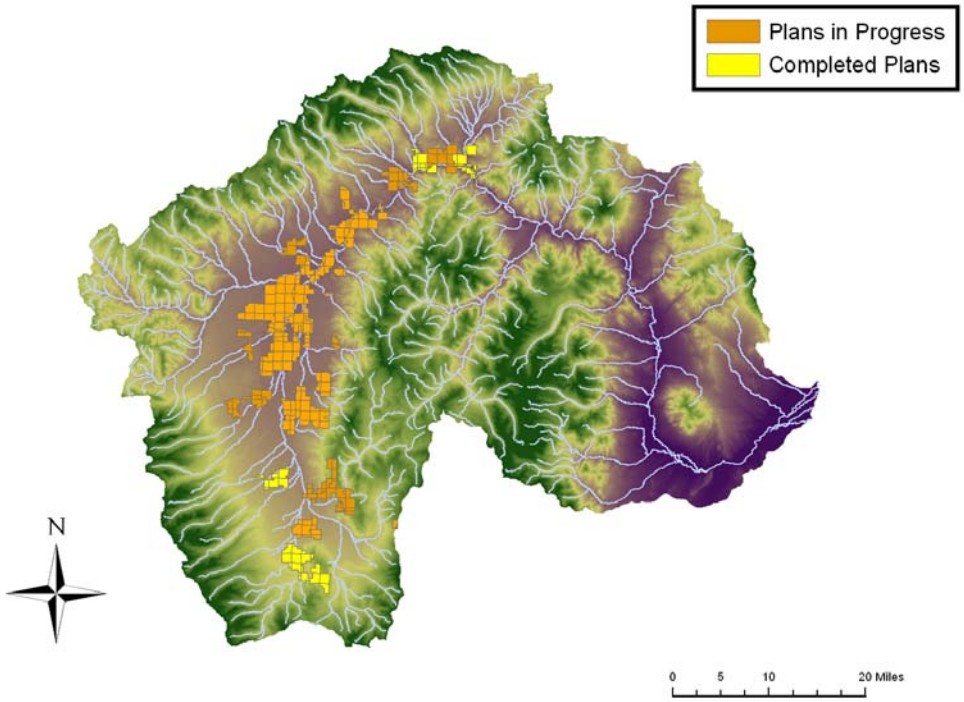

Figure 7. Spatial summary of acres with completed grazing plans in 2007.

Riparian and Stream Habitat Restoration Projects

In parts of the watershed where the Agencies determine the need is justified, the Participating Landowner is willing, and the funding is available, a more aggressive approach to stream and riparian habitat restoration will be applied. These actions are justified to: assist in meeting the timelines for conservation actions and trying to stabilize and improve conditions for grayling as quickly as is possible.

Big Hole River Restoration – Wisdom Reach

Project Overview

The Big Hole River Restoration – Wisdom Reach Project focused on riparian habitat restoration and streambank stabilization on 1.75 miles of the Big Hole River adjacent to the town of Wisdom, MT (Figure 8). Both the riparian habitat and streambank stability were in need of enhancement in parts of the project area (Figure 9). The project is a collaborative effort among two private landowners (John and Phyllis Erb/Erb Livestock Co. and Stanley Rasmussen), state and federal agencies (FWP, USFWS, and NRCS), and non-government organizations (BHWC and The Nature Conservancy). Project design, funding, and permitting were completed in 2006. Project implementation was completed in fall 2007. The project included 3.5 miles of riparian fence (4 and 5-strand barbwire), riparian revegetation (mature willow transplants and willow cuttings), and streambank stabilization (sodmats, revegetation and toe armoring). The project is protected by an agreement with both landowners to not graze livestock within the riparian areas of the project for five years. This reach of the Big Hole River is considered critical to grayling spawning and juvenile rearing.

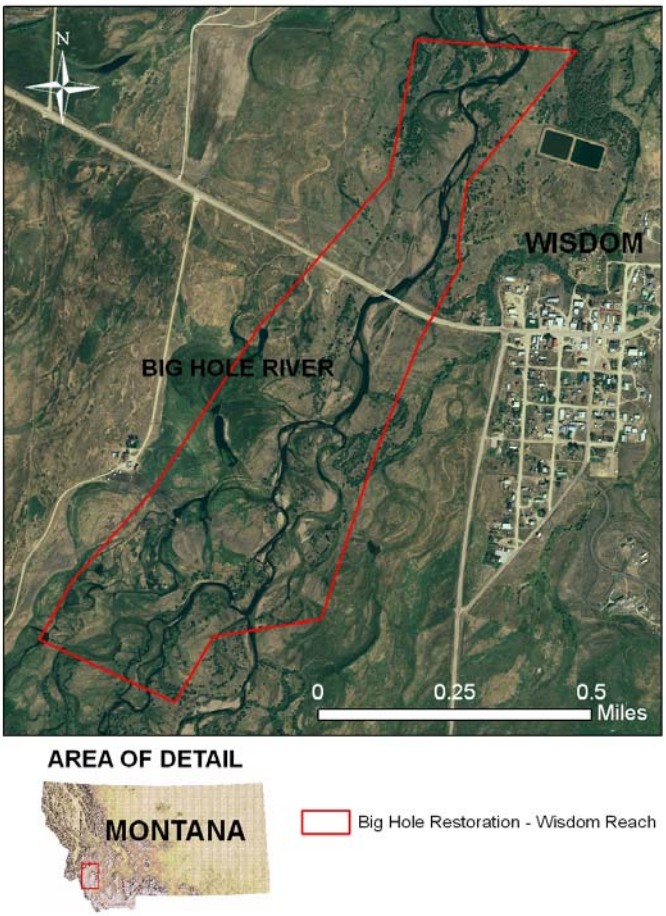

Figure 8. Project area location for the Big Hole River Restoration – Wisdom Reach Project.

Project Funding Partners

The Big Hole River Restoration – Wisdom Reach Project was a collaborative funding effort put together to implement an important restoration project. The funding partners for the project included: the landowners (the estimated value of on-site materials and NRCS EQIP funds), the AGRP, BHWC, the Nature Conservancy (TNC) and FWP (Table 4).

Funding Summary

Table 4. Funding partners and financial contributions for the Big Hole River Restoration - Wisdom Reach Project.

Funding Partner	Financial Contribution
BHWC	$87,453.50*
FWP - SWG	$59,203.86
AGRP	$22,000.00
TNC	$20,840.00
Stanley Rasmussen/NRCS	$4,259.00**
John and Phyllis Erb/Erb Livestock Co.	Value of on-site materials

* Includes the cost of the project design.
** Represents NRCS EQIP dollars for riparian fencing.

Figure 9. Streambank within the Big Hole River Restoration – Wisdom Reach project area being stabilized with native vegetation and streambank toe armoring techniques (project photos).

Big Hole River Restoration – Little Lake Creek Road Reach

Project Overview

The Big Hole River Restoration – Little Lake Creek Road Reach Project focused on riparian habitat restoration and streambank stabilization on one mile of the Big Hole River near the town of Jackson, MT (Figure 10). Both the riparian habitat and streambank stability are in need of enhancement in parts of the project area (Figure 11). The project is a collaborative effort among one private landowner (Dick Hirschy Cattle Company), a state and federal agency (FWP and USFWS), and a non-government organization (BHWC). Project design, funding, and permitting were completed in 2006. Riparian revegetation and streambank stabilization was completed along one mile of the Big Hole River in fall 2007. Riparian revegetation along an additional mile of the Big Hole River is scheduled for fall 2008. The project included 4.5 miles of riparian and pasture fence (5-strand barbwire), riparian revegetation (mature transplants, cuttings and nursery stock) and streambank stabilization (sodmats, revegetation and toe armoring). This reach of the Big Hole River is considered important for expanding the distribution of grayling in the upper Big Hole watershed.

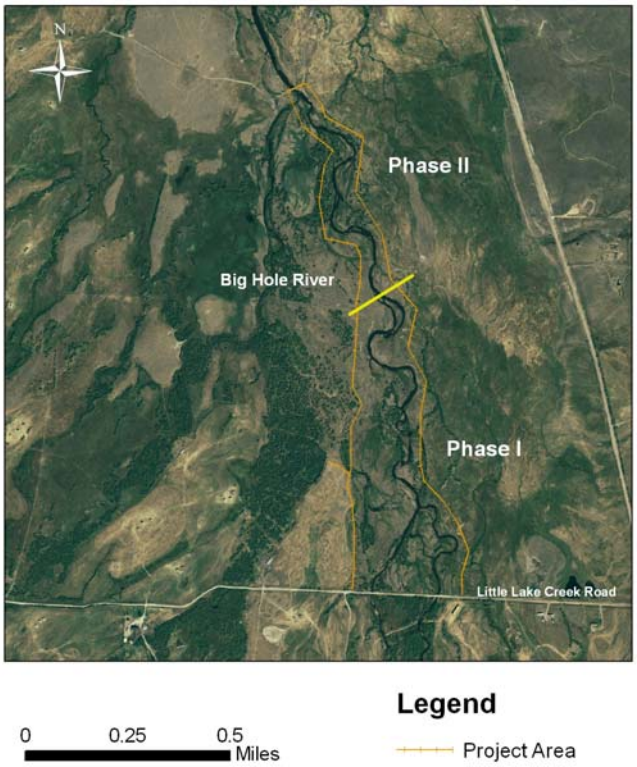

Figure 10. Project Area location for Big Hole River Restoration – Little Lake Creek Road Reach Project.

Figure 11. Pre and post project photos of the Big Hole River Restoration – Little Lake Creek Road Reach Project (project photos).

Project Funding Partners

The Big Hole River Restoration – Little Lake Creek Road Reach Project is another example of a collaborative funding effort put together to implement restoration of grayling habitat. The funding partners for the project included: the landowners (the estimated value of on-site materials), BHWC, and FWP. The contributions to project funding are summarized in Table 5.

Funding Summary

Table 5. Funding partners and financial contributions for the Big Hole River Restoration – Little Lake Creek Road Reach Project.

Funding Partner	Financial Contribution
BHWC	$94,558.50*
FWP - SWG	$70,514.12
Dick Hirschy Cattle Co.	Value of on-site materials and fence removal
* Includes the cost of the project design.	

Big Hole River Restoration – Jackson Reach

Project Overview

The Big Hole River Restoration – Jackson Reach Project focused on riparian habitat and stream channel restoration at two locations on approximately 0.75 mile of the Big Hole River near the town of Jackson, MT (Figure 12). The riparian habitat was in need of enhancement and the stream channel morphology needed to be returned to natural conditions (Figure 13). The project was a collaborative effort among one private landowner (Upper Big Hole LLC), a state and federal agencies (FWP, USFWS, and NRCS), and a non-government organization (BHWC). Project design, funding, and permitting were completed in 2006. Project construction was completed during fall 2007.

Project Funding Partners

The Big Hole River Restoration – Jackson Reach Project was another good example of a collaborative funding effort put together to implement an important restoration project that will enhance riparian and stream habitats in the upper Big Hole watershed. The funding partners for the project included: the landowners (the estimated value of on-site materials), BHWC, and FWP. The contributions to project funding are summarized in Table 6.

Funding Summary

Table 6. Funding partners and financial contributions for the Big Hole River Restoration – Jackson Reach Project.

Funding Partner	Financial Contribution
BHWC	$40,860.49*
FWP - SWG	$16,688.00
Upper Big Hole LLC	Value of on-site materials

* Includes the cost of the project design.

Figure 12. Project Area locations for the Big Hole River Restoration – Jackson Reach Project.

Figure 13. Pre and post-project photos looking upstream on the Big Hole River (project photos).

Big Hole River Restoration - McDowell Reach

Project Overview

The Big Hole River Restoration – McDowell Reach Project is focused on riparian habitat restoration and streambank stabilization on six river miles of the Big Hole River near the town of

Wisdom, MT (Figure 14). The project is a collaborative effort among one private landowner (John and Phyllis Erb/Erb Livestock Co.), and one state and federal agency (FWP and USFWS), and non-government organizations (BHWC and TNC). Project design, funding, permitting, installation of the riparian fence and an Environmental Assessment were completed in 2007. Project implementation is scheduled for spring and fall 2008. The project includes approximately 12 miles of riparian fence (3-strand electric), riparian revegetation (mature transplants, cuttings and nursery stock) and streambank stabilization (sodmats, revegetation, bank pinning and willow wattles). This reach of the Big Hole River is considered critical to grayling spawning and juvenile rearing and has the potential to provide year round habitat for adults.

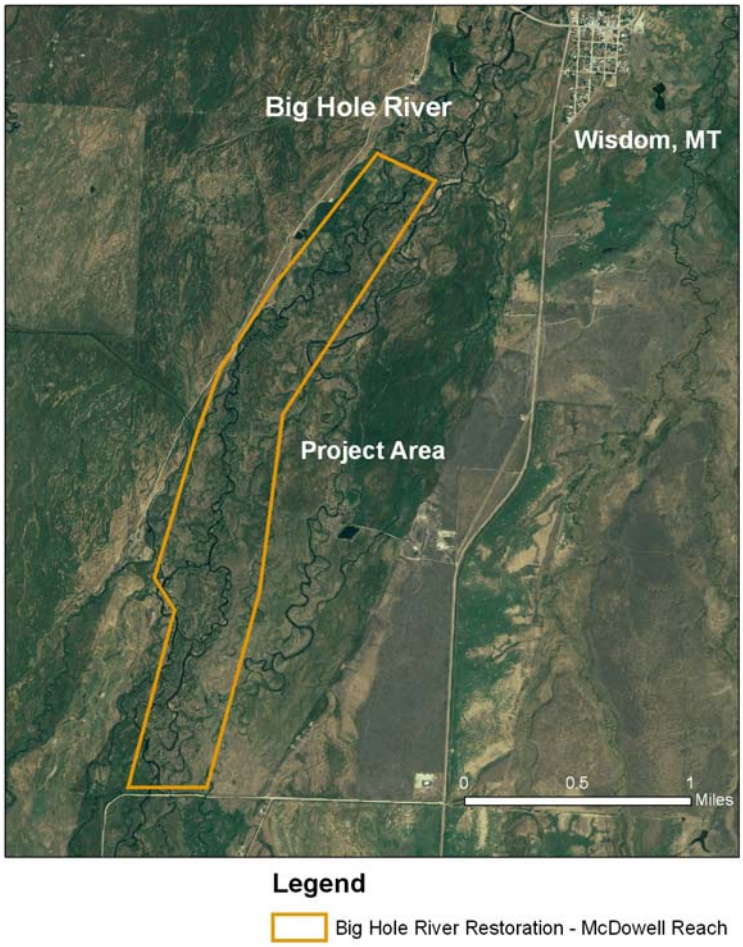

Figure 14. The location of the Big Hole River Restoration – McDowell Reach project area.

Project Funding Partners

The project is funded collaboratively by the Participating Landowner, BHWC, FWP and TNC. The BHWC funded the project design, project oversight and construction. TNC funded the installation of the riparian fence and FWP is funding project construction and project labor (Montana Conservation Corps work crews). The contributions to project funding are summarized in Table 7.

Funding Summary

Table 7. Funding secured to date for the Big Hole River Restoration – McDowell Reach Project.

Funding Partner	Financial Contribution
BHWC	$166,236.22
FWP - SWG	$150,000.00
TNC	$35,000.00
John and Phyllis Erb	Value of on-site materials

Big Hole River Restoration – Schindler Reach

Project Overview

The Big Hole River Restoration – Schindler Reach Project is focused on riparian and stream habitat restoration on one river mile of the Big Hole River near the town of Jackson, MT (Figure 15). The project also has fish passage and fish pond removal components. The project is a collaborative effort among one private landowner (Upper Big Hole LLC), one state and two federal agencies (FWP, NRCS and USFWS). The installation of the riparian fence was completed in 2007. Project design work is scheduled for spring and fall 2008. Project construction is scheduled for 2009. The project includes approximately 1 mile of riparian fence, riparian revegetation (mature transplants and nursery stock) and streambank stabilization, and restoring channel morphology (Figure 16). This reach of the Big Hole River represents an opportunity for the grayling population of the upper watershed to expand its range within the Project Area.

Project Funding Partners

The project is funded collaboratively among the Participating Landowner (with NRCS EQIP funds), FWP and the BHWC. FWP and the BHWC have covered the cost of generating a project design. The NRCS EQIP funds were used for the installation of the riparian fence and will be used for a majority of the riparian and stream habitat restoration costs. The contributions to project funding are summarized in Table 8.

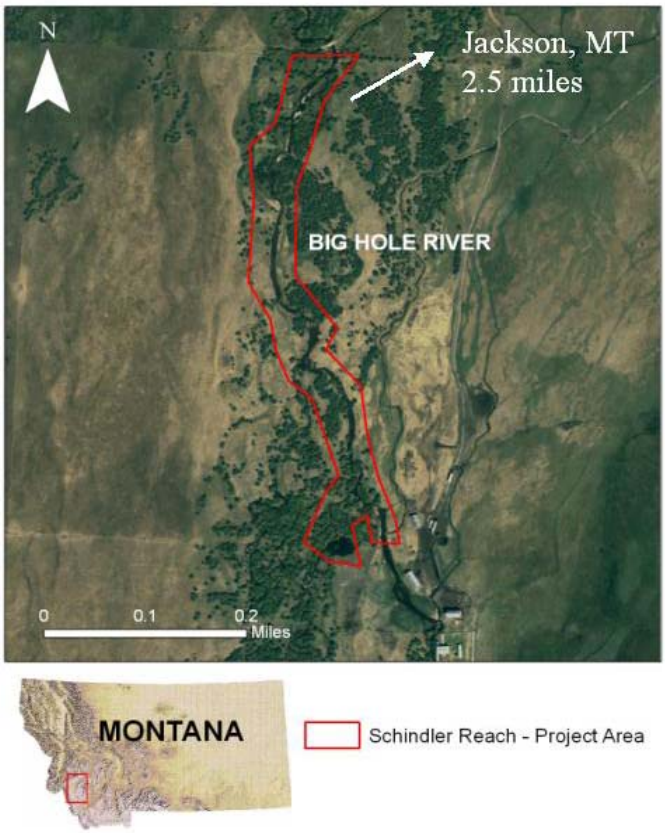

Figure 15. Project area location for Big Hole River Restoration – Schindler Reach Project.

Funding Summary

Table 8. Funding secured to date for the Big Hole River Restoration – Schindler Reach Project.

Funding Partner	Financial Contribution
Upper Big Hole LLC (NRCS EQIP)	$149,000.00
FWP - SWG	$15,000.00
BHWC	$10,000.00

Big Hole River Riparian Fence Project– Harrington Reach

Project Overview

The Big Hole River Riparian Fence Project – Harrington Reach will focus on the development of a short duration, high intensity grazing plan along approximately 2.5 miles of the Big Hole River, north of the town of Wisdom, MT. To facilitate the plan approximately 5 miles of riparian and cross fencing will be installed within the project area (Figure 17). The biological goal of the project is to develop a grazing strategy that will lead to the recovery of riparian areas along this reach of river. Once a grazing plan is established that meets the biological goals of the project, active revegetation of the project area may be initiated by the Agencies.

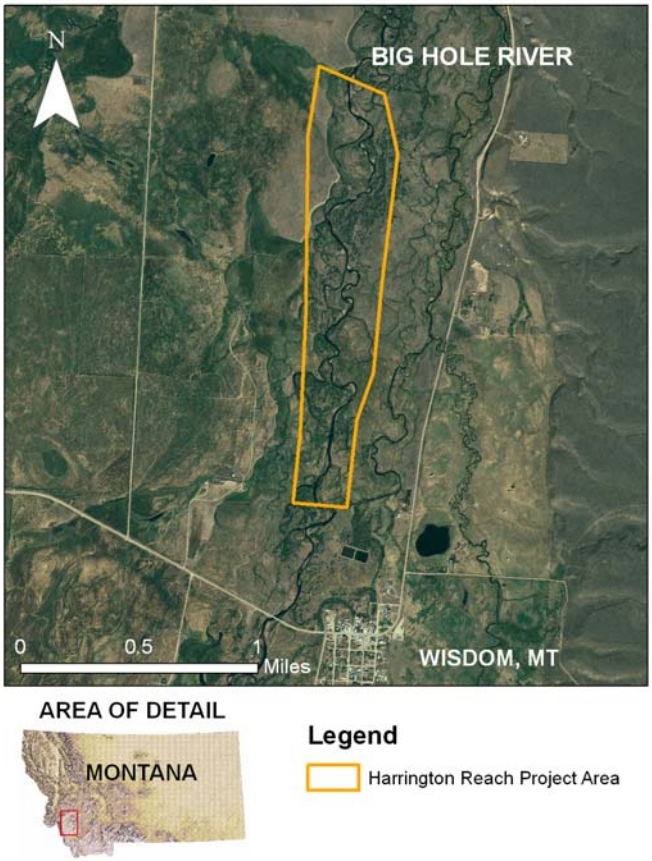

Figure 17. Project area location for the Big Hole River Riparian Fence Project – Harrington Reach.

Project Funding Partners

The project is funded through the FWP Future Fisheries Improvement Program (FFIP) and SWG program. The Participating Landowner is contributing to the project by removing existing non-functional pasture fence from the project site. The contributions to project funding are summarized in Table 9.

Funding Summary

Table 9. Funding secured to date for the Big Hole River Riparian Fence Project – Harrington Reach.

Funding Partner	Financial Contribution
FWP - SWG	$47,000.00
FWP - FFIP	$34,160.00
Harrington Co.	In-Kind and removal of existing fence

Figure 18. Typical riparian conditions within the Harrington Reach project area (pre-project photo)

Swamp Creek Riparian and Stream Habitat Restoration

Project Overview

Swamp Creek currently is considered a priority for protection and habitat enhancement due to its importance to grayling spawning and juvenile rearing. This project will protect approximately six miles of Swamp Creek (Figure 19) and involves both state and private land. The project will lead to the installation of approximately 10-12 miles of riparian and pasture fence, riparian revegetation, and streambank stabilization. The habitat quality within the project area is currently in need of enhancement (Figure 20). The contracting and funding for the riparian and pasture fence were completed in 2007. The construction of the riparian and pasture fence, the contracting and development of a restoration plan and construction of the restoration work is scheduled for 2008.

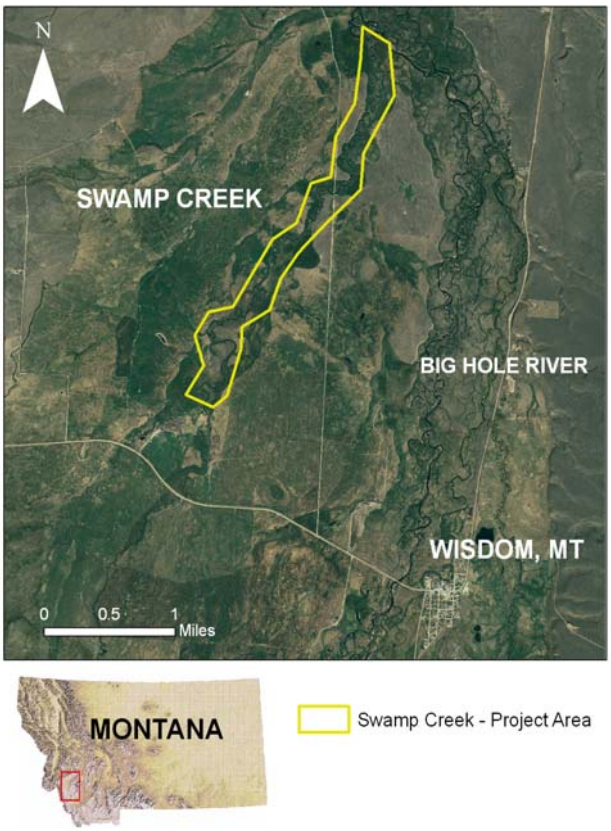

Figure 19. Project area location for the Swamp Creek Restoration Project.

Figure 20. Existing stream and habitat conditions within the project area (pre-project photo).

Project Funding Partners

To date, the funding for the project has been provided by the FWP FFIP and SWG programs. The funds have been used to install approximately 12 miles of riparian fence and to generate a project design. The project is protected by an agreement with the Participating Landowners to not graze the project area for five years.

Funding Summary

Table 10. Funding secured to date for the Big Hole Restoration – Swamp Creek project.

Funding Partner	Financial Contribution
FWP - SWG	$108,027.00
FWP - FFIP	$66,126.00
Erb Livestock, Harrington Co. and Nelson	In-Kind

Warm Springs Riparian Fence - Finch Ranches, LLC

Project Overview

Approximately 1.5 miles of riparian fence will be installed in 2008 along Warm Springs Creek near the town of Jackson, MT (Figure 21). The riparian fence on this property will allow for grazing plan to be developed that will allow to the landowner to meet their production goals and enhance the condition of existing riparian areas. The current health of riparian areas on the property is in need of improvement (Figure 22).

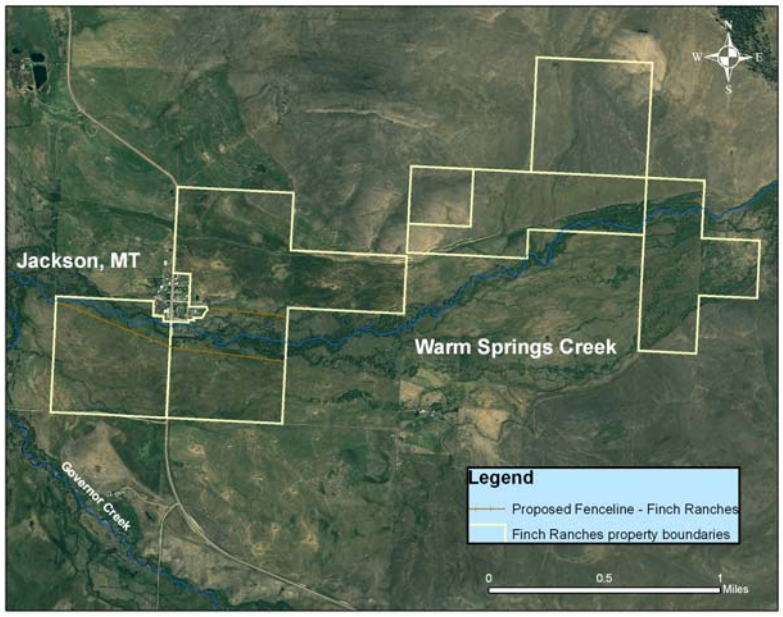

Figure 21. Proposed riparian fenceline on Finch Ranches, LLC enrolled property.

Figure 22. Existing riparian conditions on the enrolled property (2007).

Project Funding Partners

The project is funded by the FWP SWG program and the Participating Landowner. The project will be protected through the development of a prescribed grazing plan designed to enhance riparian areas. The contributions to project funding are summarized in Table 11.

Funding Summary

Table 11. Funding secured to date for the Warm Springs Riparian Fence Project – Finch Reach.

Funding Partner	Financial Contribution
FWP - SWG	$16,000.00
Finch Ranches, LLC	$1,000.00 & In-Kind

CCAA Big Hole – Ralston Riparian Fence and Stockwater Project

Project Overview

In 2007, the Agencies worked with Ralston Ranch, Inc to install approximately 3.5 miles of riparian fence along the Big Hole River and Bryant Creek. The fence is a 4-strand barbed wire design on treated wooden posts. The project also included the installation of one stockwater well (scheduled for 2008), two cutthroat flumes installed in the nearby irrigation system and exclusion fence to protect nearby haystacks from grazing by wildlife.

Project Funding Partners

The project was funded collaboratively by FWP's FFIP, SWG and wildlife division funding programs, the BHWC, DNRC and the Participating Landowner. The project will be protected through the development of a prescribed grazing plan designed to enhance riparian areas. The contributions to project funding are summarized in Table 12.

Funding Summary

Table 12. Funding secured to date for the CCAA Big Hole – Ralston Riparian Fence and Stockwater Project.

Funding Partner	Financial Contribution
FWP - FFIP	$31,353.00
BHWC	$10,000.00
FWP - SWG	$9,040.58
FWP - Wildlife	$1,500.00
DNRC	$500.00
Ralston Ranch, Inc.	In-kind

Stockwater Development Projects

Project Overview

In 2007, the Agencies began the development and installation of four new stock water wells in the CCAA project area. Each of these sites is unique and the stock water wells are associated with water conservation, riparian habitat improvement and the development and implementation of grazing management plans. The Bureau of Reclamation (BOR) provided funding for the drilling of the wells through their ground and surface water conservation program in Billings, MT. As a condition of these funds, BOR managed the bidding of the well drilling, contracted with a well driller for all the sites (Lindsay Drilling based in Clancy, MT), and completed the archaeological review of the project sites. The remaining funds from Future Fisheries, SWG, and USFWS were used to complete the installation of the stock tanks, pumps, and power to each site.

<u>LaMarche Creek</u>

This project involves two wells on the LaMarche Creek Ranch property, one east of LaMarche Creek and one on the west side. These two wells are not directly related to water savings but rather to riparian improvement and the development of a grazing management plan under the Big Hole Grayling CCAA. The first well, on the east side of the stream, is 340 feet deep and will feed two stock tanks via a buried pipeline. The second well is 125 feet deep and will serve one stock tank. This project will eliminate the need for an open crossing on LaMarche Creek as well as provide stock water to each of the pastures in the rest-rotation grazing system. Overhead power lines are within several feet of the well sites and new electrical service will be installed to run the system. This project is currently funded through SWG and will be completed as soon as ground conditions allow in the spring of 2008.

<u>Warm Springs Creek</u>

This site, on property owned by the Lapham Ranch Company, is part of a riparian improvement and grazing management plan that will help improve the instream and riparian habitat on Warm Springs Creek, a 3rd order tributary to the mainstem Big Hole River near the town of Jackson, MT. The remote site has no power and the well will be run off of a new solar system. The pastures in question are seasonal use only, and the solar pump (purchased from Solar Plexus in Hamilton, MT based on low bid) will supply enough water for more than 150 pair per day throughout the grazing season. Another component of this project is over 3,800 feet of new riparian fence, which is currently out for bid. The solar system and stock tanks will be installed along with the riparian fence as soon as ground conditions allow this spring, preferably before the grazing season begins.

Quarter Circle 3T Ranch

This site, located off of the Mussigbrod Road, is being developed as part of a grazing management plan and riparian improvement project for Plimpton Creek. The well is 130 feet deep and will supply stock water to over 800 acres of pasture. Power to the site is over a quarter mile away, and options for supplying power to the site (solar vs. new service) are being explored. The stock tanks will be recycled 13-foot heavy equipment tires, hauled to the site and set on concrete pads. This is the preferred method of stock tank installation in the upper Big Hole.

Building upon the success of the four stock water wells that were funded in 2007, the BOR awarded the BHWC funding for up to eight additional stock water well projects to be implemented in 2008. A summary of these wells and their locations will be detailed in the 2008 report.

Project Funding Partners

The projects were funded collaboratively by the BHWC through funds secured from BOR, FWP's SWG and FFIP programs, FWP through funds provided by the Bureau of Land Management (BLM) and the USFWS. The contributions to project funding are summarized in Table 13.

Funding Summary

Table 13. Funding partners for stockwater development projects.

Funding Partner	Financial Contribution
BHWC (BOR)	$25,115.00
FWP - SWG	$20,440.90
FWP - FFIP	$16,000.00
USFWS	$10,000.00
FWP - BLM	$7,323.27
Landowners	In –kind & costs to maintain and operate wells

Figure 23. Drilling a stockwater well in the upper Big Hole watershed (project photo).

Willow Bank Development Project

Project Overview

During 2007, work continued on the willow bank project. During the first two weeks of April, 21,000 willow clippings were collected primarily from the Dooling Livestock Co. and the Upper Big Hole LLC properties, with help from FWP, TNC, NRCS, and USFWS staff. These were transported to the state nursery in Missoula where they were rooted in 10-cubic inch containers and grown under controlled conditions. These rooted plants are placed in cold storage over the winter and will be available for transplant into several restoration projects in 2008. Projects which are currently scheduled to receive some of these plantings include the Peterson Feedlot Restoration, the McDowell Reach, Wisdom Reach, Jackson Reach, Little Lake Creek Road Reach, and several headgate replacement projects, as needed. In addition, 4,700 plants collected as part of the pilot project in 2007 were planted in the Rock Creek Restoration project in the second and third weeks of April (Lamothe and Petersen 2007). An internship for two Environmental Sciences students at the University of Montana Western (with support from the Big Hole River Foundation) was developed to monitor the survival of the willow stock, which looks at many different parameters.

C. Removal of Barriers to Grayling Migration

Adult grayling within the Project Area are highly mobile often moving greater than 40 miles to complete the life history (Lamothe and Magee 2003). Barriers to migration can often deny access to seasonally important habitats or lead to the entrainment of individuals within irrigation systems. Mitigating the effects of barriers to grayling migration should lead to expansion of the population in the upper Big Hole and improve the long-term viability of the population as access to a diversity of seasonally important habitats is secured.

Figure 24. A denil-style fish ladder installed in an irrigation diversion in Rock Creek to provide passage to migratory fish (project photo)

Rock Creek and Big Lake Creek Fish Ladder Projects

Project Overview

In 2007, FWP worked collaboratively with the NRCS and two private landowners (Erb Livestock Co. and John Nelson) to mitigate the potential impact of three irrigation diversions on the ability of grayling to access seasonally important habitats. The projects are located in Rock Creek (2 ladders) and Big Lake Creek, both creeks historically supported relatively high densities of grayling.

Project Funding Partners

The projects were funded collaboratively with funds secured from FWP's FFIP and SWG programs and the Participating Landowner through NRCS EQIP. The contributions to project funding are shown in Table 14.

Funding Summary

Table 14. Funding secured to date for the Rock and Big Lake Creeks Fish Passage Improvement Projects.

Funding Partner	Financial Contribution
FWP - FFIP	$5,230.00
John Nelson (NRCS EQIP)	$4,200.00
FWP - SWG	$4,200.00
FWP	$3,100.00

Governor Creek Culvert Removal Project

Project Overview

Governor Creek was historically inhabited by grayling, but these fish have not been found in this part of the watershed by FWP grayling monitoring efforts in over a decade (FWP unpublished data). This project will replace two deteriorated six-foot culverts at the Skinner Meadows road crossing on Governor Creek (Figure 25) with a 64-foot bridge built to county road standards. Currently, the Governor Creek culverts are a partial fish passage barrier and the placement of the culverts is causing significant erosion problems immediately downstream as well as aggradations of sediment upstream. By replacing the culverts with a bridge, we will eliminate the fish passage barrier problem and allow for the stream to function naturally, moving its sediment downstream

Figure 25. Culverts scheduled for removal in Governor Creek.

and eliminating a significant eroding bank. This project will effectively make the road crossing "transparent" to fish. Also, the crossing is a continual maintenance problem for the county and this project will make the stream crossing safer as well as allow for natural hydrologic function under the bridge. This project will compliment the site- specific plan on the Strodtman Trust property.

A secondary benefit to this project is that it will effectively remove the final fish passage barrier on private land in the Governor Creek drainage. Another fish passage barrier on a pin-and-plank diversion downstream was recently removed with the installation of a fish ladder.

In 2006, a collaborative effort among the BHWC, USFWS, Beaverhead County, and FWP was initiated to implement a project that would result in the culverts being removed and replaced with a bridge. The initial steps of creating a project design and acquiring project funding were completed in 2006. A preliminary design and funding were generated in 2007. Securing the remaining funding and construction of the project are scheduled for 2008.

Project Funding Partners
The project is funded by FWP's FFIP, Beaverhead County, the BHWC and the USFWS. The contributions to project funding are shown in Table 15.

Funding Summary
Table 15. Funding partners and potential funding to date for the project.

Funding Partner	Financial Contribution
FWP - FFIP	$150,000.00
Beaverhead County	$100,000.00
BHWC	$50,000.00*
USFWS	$50,000.00

*Pending approval of Advisory Committee and full watershed group.

D. Identify and Reduce or Eliminate Entrainment Threats to Grayling

The large number of points of diversion for irrigation water from the Big Hole River and its tributaries pose a potential threat to grayling by entraining individuals into the irrigation systems. The magnitude of this threat to grayling is largely unknown. The focus of this conservation measure is to: 1) identify the level of grayling entrainment within the Project Area; 2) rescue grayling captured in irrigation systems; and 3) work with Participating Landowners to exclude grayling from irrigation systems identified to entrain large numbers (20 or more) of individuals.

Surveys of Irrigation Ditches for Grayling Entrainment and Grayling Rescue Operations

In 2007, two and three person crews using a combination of backpack and mobile anode electrofishers surveyed 19.0 miles of irrigation ditch at 12 discrete points of diversion within the Big Hole Grayling CCAA Project Area for entrainment of grayling. Irrigation ditches were selected based on location within the watershed, the maximum flow rate associated with the claimed water right (Gale 2005), the timing of operation, and previous instances of documented grayling entrainment.

In 2007, eight grayling were captured in irrigation ditches that divert water from the North Fork of the Big Hole River (North Fork), transported, and returned to the North Fork. All grayling captured were anesthetized in a Tricaine Methanesulfonate (MS-222) bath and then measured for total length (± 0.1 in.) and weight (±0.01 lb.). All grayling were marked with a fin clip and a unique visible-implant (VI) tag. Upon recovery grayling were returned to nearest point of the Big Hole River or a tributary downstream of the irrigation structure that entrained the grayling (FWP and USFWS 2006). The level of entrainment recorded in 2007 at any survey site did not reach the threshold of requiring landowners to install fish exclusion devices (FWP and USFWS 2006).

Table 16. Length, weight, and tag information for grayling captured during 2006 and 2007 entrainment surveys.

Date	Location	Length (In.)	Weight (Lb.)	Vi Tag Info
9-11-06	North Fork #1	9.6	0.32	black/blue DT7
9-11-06	North Fork #1	9.3	0.27	black/blue DT6
9-11-06	North Fork #1	9.9	0.33	black/blue DT5
9-13-06	North Fork #2	9.1	0.21	black/blue DT4
9-13-06	North Fork #2	8.7	0.17	black/blue DT3
6-13-07	North Fork #2	6.8	0.13	black/blue JH3
9-10-07	North Fork #2	4.3	0.05	*
9-10-07	North Fork #2	5.4	0.07	*
9-10-07	North Fork #2	4.6	0.06	*
10-31-07	North Fork #2	5.1	0.05	*
10-31-07	North Fork #2	5.0	0.05	*
10-31-07	North Fork #2	4.8	0.05	*
10-31-07	North Fork #2	5.0	0.05	*

* Young of the year grayling are not marked with a VI Tag.

Fish Exclusion Projects

The Agencies are working with the water-users on the North Fork to address continued low levels of grayling entrainment in irrigation ditches in this part of the watershed (Figure 26). In 2007, PBS&J was awarded a contract to generate design work for fish exclusion devices at two North Fork irrigation systems. The project was funded by FWP. The cost of generating the design options was $23,105.00. A final design and structure type will be selected in spring 2008. The installation of two fish exclusion devices is scheduled for fall 2008.

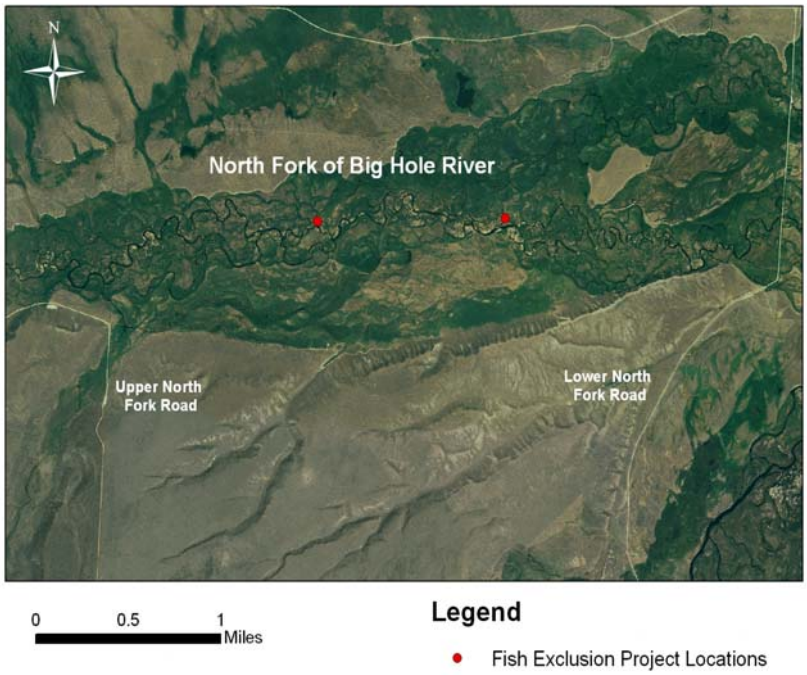

Figure 26. Location of proposed fish exclusion projects.

E. Projects Designed to Address Water Quality Issues

Peterson Brothers Feedlot Restoration Project

Project Overview

The Peterson Brothers Feedlot Restoration Project was completed in fall 2007. This project restored 1,100 feet of C4 stream channel and associated floodplain and riparian habitats. Prior to the project, the stream channel was straightened and run through a Confined Animal Feeding Operation (CAFO). This dynamic had existed for approximately 60 years. The stream channel suffered from a lack of instream habitat and a disconnection from its floodplain, along with elevated temperatures. Sediment and nutrient inputs to the stream system were measured prior to the project being implemented to serve as baseline data. The landowner signed a 20-year landowner agreement outlining management and maintenance of the project.

Restoration work began with the removal of accumulated animal wastes (hauled to irrigated hay pastures on the ranch and used as fertilizer), followed by the staking of the new stream channel using sub-centimeter grade GPS. Existing wetland sod mats, comprised of native sedges and rushes, were hauled in from a nearby wetland restoration project. These sod mats were transplanted to build the restored streambanks. Clean fill material was borrowed on-site to fill in and level the floodplain behind the newly-formed streambanks. Additional sod mats were placed on exposed fill and double-stacked on high-risk areas such as outside bends. Transplanting existing wetland sods has been used extensively in Montana and has been proven to be a highly-successful method of providing instant vegetation with deep-binding rootmass to hold streambanks together. A pattern for a stable C stream channel, with appropriate width/depth ratios, meander pattern and pool-to-pool spacing was built. Additionally, a low-level berm was constructed on the west side of the restored floodplain to prevent any high flow events from capturing the feedlot. A fence was constructed on top of the berm, completely removing livestock access to the stream channel. Several mature willow clumps and their associated root balls were harvested on site and transplanted onto the streambanks and strategic locations – both to stabilize the stream on high risk areas (outside banks) as well as to promote shading of the stream on southern and western streambanks. The newly restored floodplain will have additional containerized willow plantings with native Big Hole stock grown at the state nursery, and possibly additional mature willow transplants.

Figure 27 shows some of the construction work during the transplanting of sod mats for the new stream banks. Pre- and post project water quality and habitat assessments, fisheries population response and monitoring will be completed by the USFWS, FWP, and contracted water quality specialists. This project, in addition to restoring the stream channel and associated riparian habitats, brings the landowner into compliance with Montana water quality standards. The contributions to project funding are summarized in Table 17.

Funding Partners

Table 17. Funding partners and financial contributions for the Peterson Brother Feedlot Restoration Project.

Funding Partner	Financial Contribution
US-EPA	$27,237.73
FWP-FFIP	$24,842.50
Peterson Bros. Cattle Co.	$1,765.60 and the value of on-site material
USFWS	$600.00

Figure 27. The old stream channel (left) flows through the feedlots in the background, with the restored stream channel under construction to the right.

VII. SUMMARY OF ESTIMATED TAKE ASSOCIATED WITH THE BIG HOLE GRAYLING CCAA

In 2007, the grayling DPS in the upper Missouri River basin were determined to be unwarranted for listing under the ESA and were removed for the Candidate Species List. Due to its legal status there was no take of grayling associated with the implementation or monitoring of the Big Hole Grayling CCAA.

VIII. MONITORING

The Agencies are responsible for monitoring the effectiveness of the conservation measures in eliciting a positive response from the grayling population within the Project Area. The monitoring responsibilities fall into four categories: fish population monitoring, habitat monitoring, project performance monitoring, and landowner compliance monitoring.

Table 18. The locations of the ten monitoring reaches for the upper Big Hole CCAA in 2007.

Management Segment	Location
A	Big Hole River -Headwaters downstream to Miner Lakes Road Bridge
A	Governor Creek
B	Big Hole River – Miner Lakes Road Bridge downstream to Little Lake Creek Road Bridge
B	Miner Creek
C	Big Hole River – Little Lake Creek Road Bridge downstream to Wisdom Bridge
C	Rock Creek
D	Big Hole River – Wisdom Bridge downstream to Mudd Creek Bridge
D	Steel Creek
E	Big Hole River – Mudd Creek Bridge downstream to Dickie Bridge
E	Deep Creek

A. Fish Population Monitoring

Fish populations are monitored within 10 monitoring reaches on an annual basis during the fall (Figure 28). Populations are monitored using electrofishing techniques with a mobile-anode DC system powered by a generator coupled with a rectifying unit mounted on either a drift boat or crawdad. Each reach is surveyed in a single pass with a minimum of a three-person crew. Table 19 is a summary of the fish population monitoring results within the CCAA monitoring reaches in 2007.

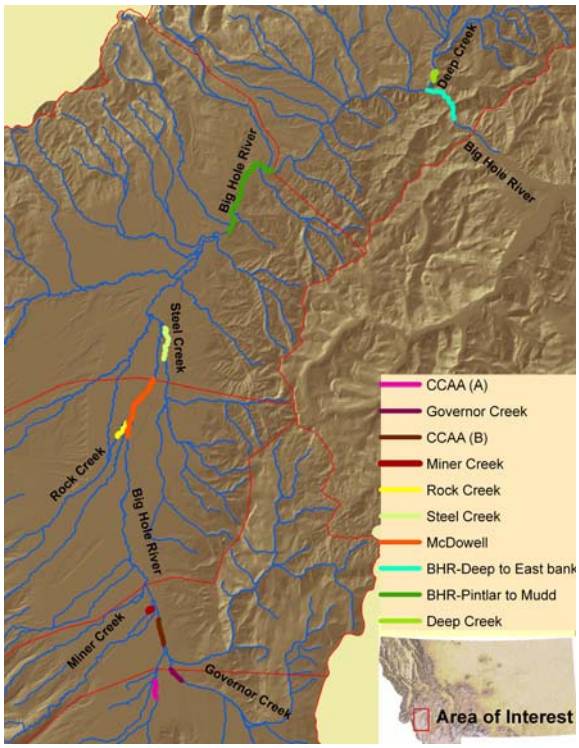

Figure 28. Location of the 10 fish population monitoring reaches.

Table 19. Summary of capture results for salmonids during 2007 electrofishing efforts.

Location	Segment	# Grayling Captured (yoy)	# Brook Trout Captured	# Brown Trout Captured	# Rainbow Trout Captured	Length Of Monitoring Reach (Miles)
Governor Creek	A	0	154	1	1	1.30
Big Hole River	A	0	774	2	36	1.76
Miner Creek	B	0	68	1	0	0.42
Big Hole River	B	0	447	34	31	2.34
Rock Creek	C	0	12	0	0	1.80
Big Hole River	C	5(3)	132	2	5	6.47
Steel Creek	D	73(63)	268	3	3	3.17
Big Hole River	D	11(11)	19	3	6	6.59
Deep Creek	E	5(2)	33	48	156	1.34
Big Hole River	E	0	5	56	142	3.81

yoy = young of the year

Spatial Summary of Species Distribution

The biological goal of the Big Hole Grayling CCAA is to increase the abundance and distribution of grayling in the project area. These increases should be a direct result of the conservation measures outlined in the Big Hole Grayling CCAA. While the Agencies feel that these benefits can be realized through improvement to streamflows, physical habitat parameters, improved fish passage and a reduction of entrainment, it is understood that issues like interactions with non-native salmonids (i.e. brown trout, rainbow trout, brook trout) will have to be taken into consideration when considering an overall recovery plan. The distribution and densities (fish/mile) of the non-native salmonid species within the project area are shown in Figure 29. Brook trout were the most abundant and were concentrated primarily in segments A and B. Brown and rainbow trout were more abundant in segment D with increases in densities in segments A and B.

The spatial distribution of grayling within the project area is shown in Figure 30. Based on the 10 monitoring reaches densities of young of the year (yoy) grayling were concentrated in segment D reflecting the importance of this part of the watershed to spawning and juvenile rearing. Juvenile and adult grayling densities in the ten monitoring reaches were relatively low with highest densities again being in segment D.

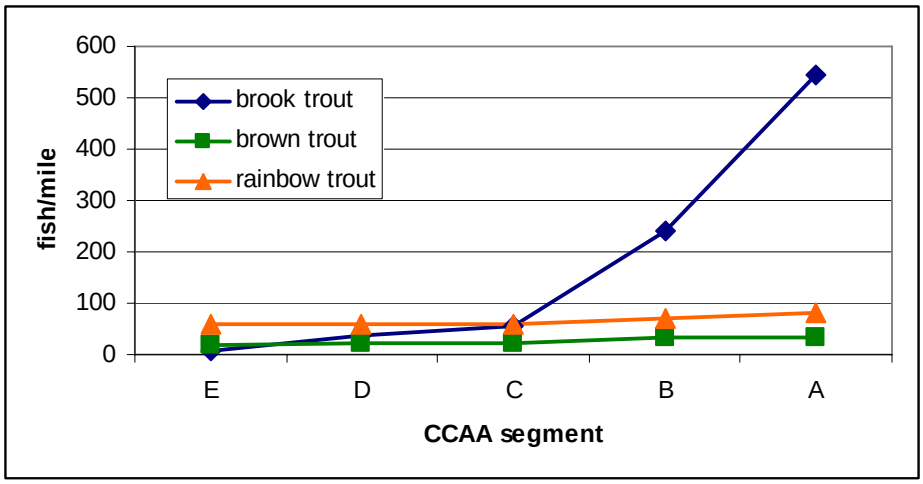

Figure 29. Cumulative frequency (densities) distribution of brook, rainbow and brown trout within the CCAA project area based on 2007 monitoring efforts.

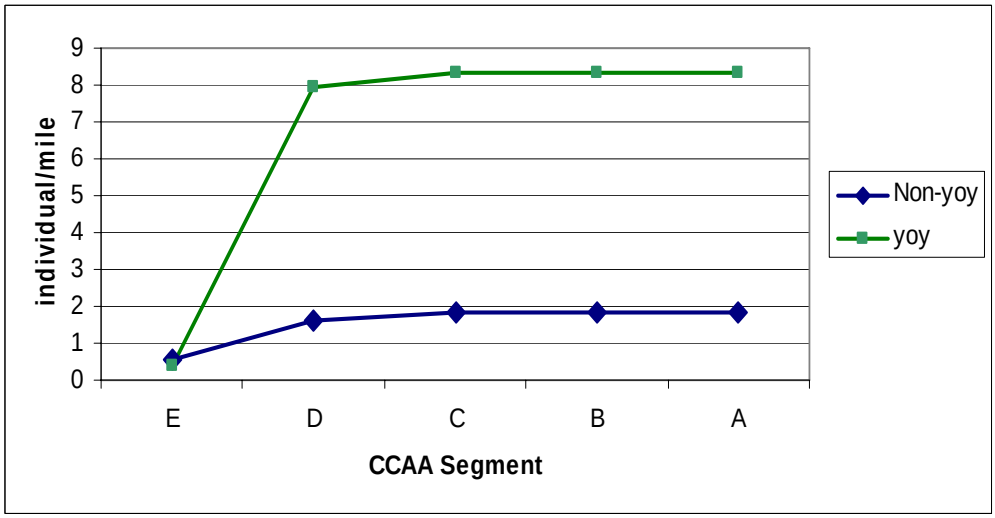

Figure 30. Cumulative frequency (densities) distribution of young of the year (yoy) and non-yoy (juveniles and adults) Arctic grayling within the CCAA project area based on 2007 monitoring efforts.

B. Habitat Monitoring

Bayley and Li (2008) state that very few restoration efforts are monitored for there benefits to the target fish species and that nationwide only 10% of restoration activities on aquatic systems have a monitoring plan. The commitment of resources made to the Big Hole Grayling CCAA for monitoring represents a unique opportunity to base a long term (20 years) recovery effort on empirical data, not just the "instincts' of the biologists. This opportunity can only be realized through the continued commitment of the staff and equipment necessary to accomplish the annual needs of this effort.

Streamflow Conditions

Availability of water

The 2007 snowpack conditions at the NRCS Darkhorse Lake SNOTEL Site were below average when compared to the 30-year period of record (1971-2000) (Figure 31). Warm temperatures in May caused the snowpack to melt earlier than normal. The combination of below average snowpack amounts and early melt-off resulted in a relatively short duration high streamflow event in excess of 1,900 cubic feet per second (cfs) at the Wisdom Bridge (Segment C) in early June (see Figure 32). The total precipitation that fell at this site was below normal for the water year (October 1 – September 30) when compared to the period of record (Figure 31).

Gaging Stations

Hydrologic monitoring in 2007 consisted of maintaining a network of established continuous flow gages, installing several new gages, and conducting synoptic flow measurement runs to quantify basin inflows and mainstem seepage.

The flow monitoring network provided daily flow data for sites located on the mainstem Big Hole River (7), tributaries (16), and irrigation diversions (10) for a total of 33 stations (Table 20). Included with the mainstem gages were sites established to monitor flows associated with CCAA

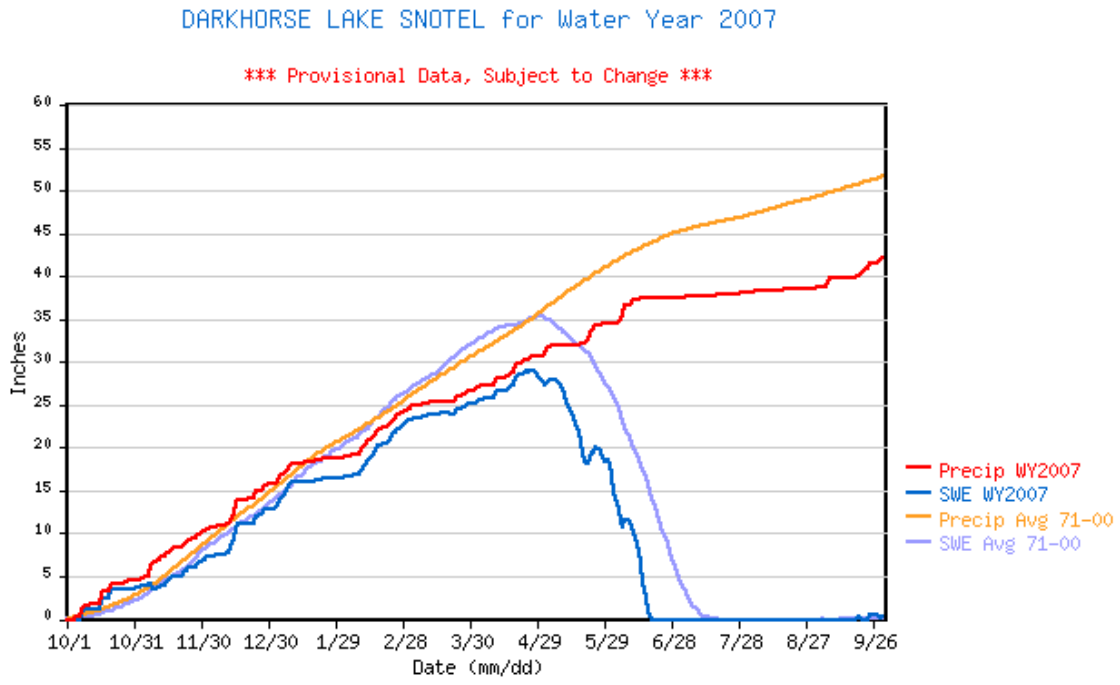

Figure 31. Snowpack and precipitation data for 2006 from the NRCS Darkhorse Lake Snotel Site.

Segments A, B, and E (Segments C and D are monitored with USGS real-time stations). Data collected at these 33 stations were used to:

- Track baseline flows (pre-CCAA implementation),
- Provide daily flow status for on-the-ground flow management,
- Monitor flow targets outlined in the CCAA, and
- Develop flow agreements within the CCAA site-specific plans.

Eighteen of the 33 continuous gages were new in 2007. With the cooperation of FWP, they were installed prior or near the beginning of the irrigation season. The gages consist of a perforated stilling pipe and continuous stage recording instruments developed by either AquaRod© or Trutrack©. To determine daily flows, stage-discharge ratings were developed at each site and applied to data collected by these instruments.

In addition to the continuous monitoring, DNRC conducted monthly basin inflow synoptic flow measurement runs above Wisdom. These data provide a spatial snapshot of basin wide flow conditions and water use throughout the irrigation season. They provide a good comparative tool to assess the progress of CCAA implementation. Synoptic flow measurement runs were also conducted on the mainstem Big Hole River between Little Lake Creek Bridge and Wisdom. These data are important to understanding the gaining or losing characteristics of the management reaches, and the availability and conservation of water inputs to the basin.

Table 20. Flow Monitoring Stations in 2007.

Site	AquaRod #	TruTrack #	Date gage Established
Big Hole R @ Saginaw	3218		2003
Big Hole R @ Miner Lakes Rd.	3343		2005
Big Hole R @ LLC (east)	3605		2005
Big Hole R @ Peterson Br.	3262		2002
Big Hole R @ Twin Lakes Rd.	3618		2005
Big Hole R @ Dickie Br.		0404053	2005
Big Lake Cr. @ Twin Lakes	3174		1999
Steel Cr. @ Forest	3165		2006
Steel Cr. @ Hwy 43	3345		2002
Steel Cr. Abv Mouth	3344		2006
North Fork Big Hole River	3342		2004
La Marche Cr. @ Hwy 43	3308		2005
Huntley Ditch on 40 Bar		0602302	2006
Spokane Ditch	3082		2002
Strowbridge Ditch		0501298	2006
Governor Cr. @ Miner Lakes Rd.		0705210	2007
Miner Cr. @ Mouth		0705208	2007
Fishtrap Cr. @ Hwy 43		0705209	2007
Seymour Cr. @ Hwy 43		0704319	2007
Deep Ck @ Hwy 43		0705210	2007
Rock Creek @ Project Boundary	3346		2007
Rock Creek @ Mouth		404022	2007
Rock Creek – Old Channel		510249	2007
Rock Creek - Ditch		502235	2007

Table 20. Flow Monitoring Stations in 2007.

Site	AquaRod #	TruTrack #	Date gage Established
Swamp Creek @ L. NF Rd.		705212	2007
Swamp Creek @ mouth		705207	2007
North Fork @ L. NF Rd.		705203	2007
North Fork Ditch #1		705201	2007
North Fork Ditch #2		705206	2007
Upper Big Hole LLC Ditch #1		705201	2007
Upper Big Hole LLC Ditch #2		705206	2007
Upper Big Hole LLC Ditch #3		603245	2007
Upper Big Hole LLC Ditch #4		603288	2007

2007 Streamflow Conditions

The combination of less than average basin snowpack and precipitation, early snowmelt, and record high summer temperatures (July) resulted in below average streamflows in the Project Area in 2007. These factors coupled with irrigation demands resulted in flow targets not being met in all CCAA Management Areas. Targets were met with greater infrequency during the summer/fall period (Table 21).

Table 21. CCAA Management Area target flow frequency in 2007.

Mgmt Area	Station	Min Flow Target Spring	Min Flow Target Sum/Fall	Flow Volume % average spr,sum/fall,season	% days above Min. Flow Target (spring,summer/fall)
A	Miner Cr. Road Bridge	60	20	*	52, 16
B	Little Lake Cr. Road Bridge	100	40	*	77, 28
C	Wisdom Bridge	160	60	61, 42, 57	66, 22
D	Mudd Cr. Bridge	350	100	88, 80, 86	92, 53
E	Dickie Bridge	450	170	*	99, 42**

*Period of gage record too short for assessment
**Summer/Fall-Dickie Bridge data gap due to instrument failure

Warm early season air temperatures resulted in a release of the snowpack throughout the upper basin approximately two to three weeks earlier than the 30-year average timing of snowmelt. This resulted in most snowmelt runoff occurring in early to mid-May. A second, higher magnitude, shorter duration event occurred in response to an intense precipitation event mixed with some snowmelt in early June. Streamflows at Wisdom topped 1700 cfs on June 11. Within 10 days streamflows receded to below flow target levels (160 cfs) and by June 26, streamflows fell below 20 cfs. Low flow conditions were exacerbated in July and August due to record high temperatures and low precipitation. Streamflows began to recover to near average or slightly above average levels in late-September due to precipitation, decreased temperatures, and a decrease in water demand by vegetation throughout the Big Hole Grayling CCAA Project Area watershed. The average daily streamflows for each management area are shown in Figure 33.

Many of the tributaries to the Big Hole River faired even worse due to of the same factors affecting streamflows in the river. Of the tributaries monitored as part of the CCAA efforts in 2007 Deep Creek and Steel Creek provided the best season-long, relatively suitable habitat conditions (Figure 34). In the past, a vast majority of the Agencies efforts to maintain suitable streamflows have been concentrated on the Big Hole River in management segment C because of this areas importance to grayling spawning and juvenile rearing. The monitoring and conservation efforts associated with the Big Hole Grayling CCAA should allow for the basin wide approach necessary to improve habitat conditions at a scale that will lead to significant improvements for grayling abundance and distribution.

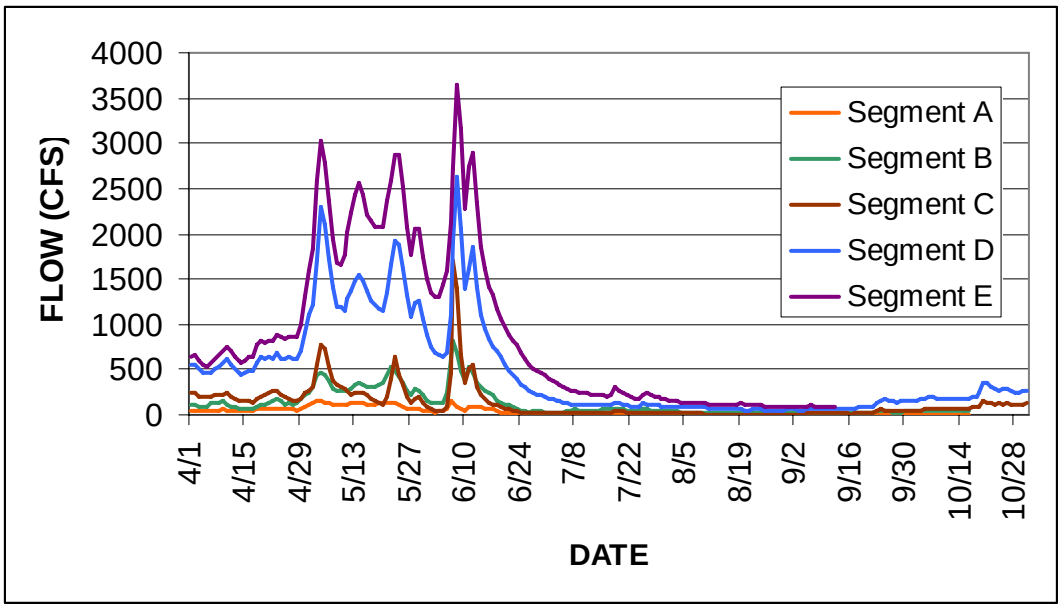

Figure 32. Average daily streamflows for 2007 (April-October) for the five Big Hole Grayling CCAA Management Segments (A-E).

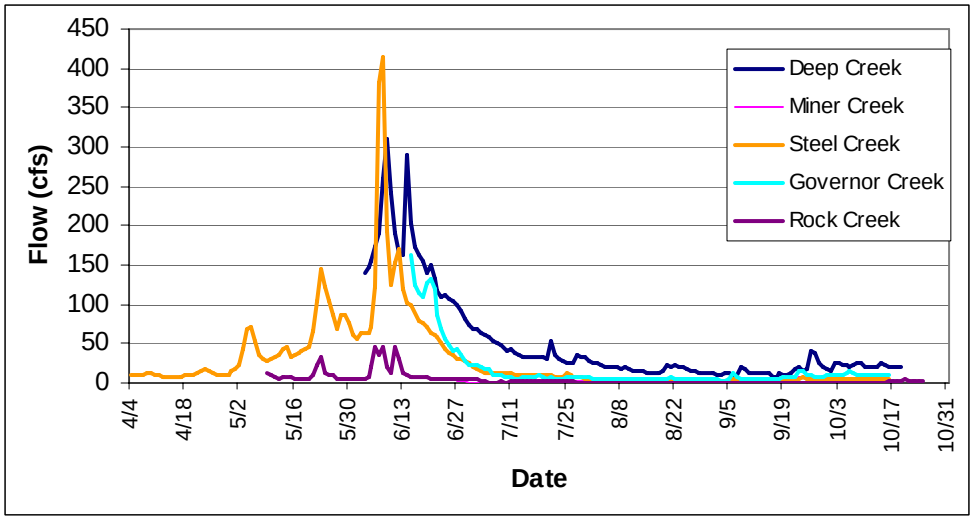

Figure 33. Average daily sreamflows for 2007 in the five tributaries monitored as part of Big Hole Grayling CCAA efforts.

Stream Temperature Conditions

In 2007, the Agencies monitored stream temperatures at ten locations within Project Area. Water temperatures were warmest in both mainstem and tributary sites in July with mainstem sites having a higher average temperature than tributary sites (Table 22). The small difference between lumped mainstem and lumped tributary sites is due to the relatively warm water temperatures in Rock Creek (Table 23). Demand for irrigation water and continued drought conditions in 2007 led to thermally stressful conditions in Rock Creek with temperatures reaching upper incipient lethal temperatures (77º F) for 85 hours (Table 23) (Lohr et al. 1996).

Table 22. Monthly mean temperature data from ten monitoring locations.

Month	Mean Temp. (F) – Mainstem Locations*	Mean Temp. (F) – Tributary Locations*
April	44.2 (0.10)	43.6 (0.12)
May	50.6 (0.10)	50.3 (0.12)
June	58.2 (0.11)	57.3 (0.12)
July	66.7 (0.10)	66.0 (0.10)
August	59.8 (0.09)	58.0 (0.10)
September	51.5 (0.11)	50.0 (0.10)
October	41.4 (0.06)	40.5 (0.06)
November	35.5 (0.06)	34.7 (0.06)

***** Standard Error shown in parentheses

Table 23. Mean and maximum temperatures from the 10 CCAA monitoring reaches (April-October).

Management Segment	Location	Mean Temperature	Maximum Temperature	Hours over 77º F
A	Big Hole River	50.3 (.13)	75.0	0
A	Governor Creek	51.7 (.15)	78.9	14
B	Big Hole River	51.5 (.14)	77.0	0
B	Miner Creek	49.8 (.14)	79.3	11
C	Big Hole River	53.5 (.15)	77.8	18
C	Rock Creek	51.5 (.15)	84.0	85
D	Big Hole River	54.0 (.15)	82.4	73
D	Steel Creek	53.8 (.15)	78.2	5
E	Big Hole River	53.4 (.15)	80.7	24
E	Deep Creek	50.9 (.15)	77.3	1

Stream Channel Morphology and Habitat Conditions

Stream cross-section parameters may be used to assess fish habitat quality in respect to grayling habitat preferences. Grayling prefer sections of the Big Hole River with abundant overhanging vegetation, high quality pools, and a diversity of pool types, and these reaches are closely associated with healthy riparian vegetation (Lamothe and Magee 2003). As such, cross section parameters such as max pool depth, width/depth ratios, and percent fines in the sample are likely indicators of riparian health, streambank stability, and overall grayling habitat quality. Deviation from expected values for a given parameter can also be used as a relative indicator of stream and riparian habitat quality (Rosgen 1996). Expected stream channel parameters for stream types found in the upper Big Hole watershed (Table 24) (Rosgen 1996).

Several stream cross-section sites monitored in 2007 display measurements indicative of some level of stream habitat degradation. Pools and riffles measured in Governor Creek and the Big Hole River upstream of Mudd Creek Bridge displayed width/depth ratios that were higher than expected, given their stream order and Rosgen stream classification. Higher width/depth ratios than expected can indicate an unstable system that is unable to transport incoming sediment loads (Rosgen 1996). The ability of a stream to transport sediment will be reduced when width/depth ratios are high because mean velocity is reduced when width is increased without a corresponding increase in depth.

Higher width/depth ratios than expected are also likely indicators of poor grayling habitat, as adults and juveniles of the species prefer cool, slow, deep water with abundant overhead cover (Lamothe and Magee 2003). Reaches with high width/depth ratios in the Big Hole are generally wide, shallow, do not offer depth as a cover type, and lack abundant riparian vegetation.

The composition of stream channel materials may also serve as an indicator of grayling habitat quality and the quality of surrounding riparian areas. High sediment loads negatively impact fish and macroinvertebrate communities (Bruton 1985; Newcombe and Jensen 1996), and may be indicators of streambank stability and associated riparian health (Waters 1985). Several sites displayed sediment counts that are higher than average or expected. Rock Creek and Miner Creek contained a relatively high percentage of fines in their pebble count samples. The elevated sediment count observed in Rock Creek is likely related to habitat restoration construction

activities that occurred in fall 2006 (Lamothe and Petersen 2007). Percent fines in Rock Creek are expected to drop as riparian vegetation and streambank stability increase in the restoration reach. Miner Creek also displayed higher than average levels of sediment in both pool and riffle substrate samples. These elevated levels may indicate recent streambank disturbance in nearby reaches.

In contrast to sites with potentially degraded habitat, Steel Creek displayed a low percentage of fines (0%) in both pool and riffle substrate samples, and this was an apparent decrease from past years when percent fines averaged approximately 12% in pools and riffles. Although this initial trend may indicate improving instream habitat and riparian conditions for grayling in Steel Creek, results should be interpreted cautiously, as the potential for bias may be high when conducting Wolman Pebble Counts (Marcus et al. 1995).

Table 24. Expected stream cross-section values for several stream types found in the Upper Big Hole (Rosgen, 1996).

	Rosgen Stream Type			
Attribute	**C3**	**C4**	**C5**	**F4**
Average Width/Depth Ratio	33.2	29.28	27.0	28.22
Range of Expected Width/ Depth Ratios	10.3 – 36.7	13.5 – 28.7	12.6 – 46.0	12.0 – 30.0
D 50 (inches)	4.20	0.63	0.03	0.08
D 85 (inches)	5.5	2.2	0.1	0.6
Average % Fines	< 10	< 10	20	35

Table 25. Pool habitat data for the 10 Big Hole Grayling CCAA habitat monitoring reaches.

River Reach	Bankfull Width (ft)	Max Pool Depth (ft)	Mean Bankfull Depth (ft)	Width to Depth Ratio	Wetted Perimeter (ft)	Fine Sediment (% of sample)	Dominant Particle Size (inches)	D85 (inches)
Big Hole River (A)	21.4	2.50	1.43	14.9	17.6	0.03	0.89 – 1.26 Coarse Gravel	1.92 Very Coarse Gravel
Governor Creek	39.8	2.20	0.88	39.2	24.4	0.04	0.89 – 1.26 Coarse Gravel	1.52 Very Coarse Gravel
Big Hole River (B)	32.9	3.10	1.94	17.0	31.0	0.03	1.77– 2.5 Very Coarse Gravel	2.43 Very Coarse Gravel
Miner Creek	17.8	2.16	1.29	13.8	13.4	0.40	Fine Sediment	0.31 Medium Gravel
Big Hole River (C)	40.4	3.84	2.06	19.6	23.0	0.10	0.63 – 0.89 Coarse Gravel	1.04 Coarse Gravel
Rock Creek	18.5	2.60	1.54	12.0	11.5	0.38	0.63 – 0.89 Coarse Gravel	1.03 Coarse Gravel
Big Hole River (D)	121.0	3.47	2.01	60.3	97.7	0.12	0.89 – 1.26 Coarse Gravel	0.84 Coarse Gravel
Steel Creek	42.7	3.36	1.66	25.7	33.3	0.02	0.63 – 0.89 Coarse Gravel	1.34 Very Coarse Gravel
Big Hole River (E)	199.0	4.83	3.40	58.6	181.5	0.00	5.0 – 7.1 Large Cobble	4.54 Small Cobble
Deep Creek	22.2	3.54	2.40	9.2	21.0	0.06	3.5 – 5.0 Small Cobble	3.29 Small Cobble

Table 26. Riffle habitat data for the 10 Big Hole Grayling CCAA habitat monitoring reaches.

River Reach	Bankfull Width (ft)	Max Depth (ft)	Mean Bankfull Depth (ft)	Width to Depth Ratio	Wetted Perimeter (ft)	Fine Sediment (% of sample)	Dominant Particle Size (in.)	D 85 (in.)
Big Hole River (A)	29.0	1.72	0.93	31.2	22.0	0.02	1.26 – 1.77 Very Coarse Gravel	1.87 Very Coarse Gravel
Governor Creek	45.3	1.53	0.66	45.6	25.9	0.09	0.89 – 1.26 Coarse Gravel	1.69 Very Coarse Gravel
Big Hole River (B)	50.7	2.59	1.51	33.5	40.1	0.00	1.77– 2.5 Very Coarse Gravel	3.09 Small Cobble
Miner Creek	12.5	1.29	0.86	14.6	9.7	0.18	Fine Sediment	1.09 Coarse Gravel
Big Hole River (C)	45.0	3.28	2.59	17.4	33.8	0.08	0.63 – 0.89 Coarse Gravel	1.25 Coarse Gravel
Rock Creek	16.0	2.03	1.37	11.7	0.0	0.06	0.02 – 0.04 Coarse Sand	0.82 Coarse Gravel
Big Hole River (D)	155.5	1.63	3.15	95.6	115.5	0.11	0.89 – 1.26 Coarse Gravel	0.86 Coarse Gravel
Steel Creek	49.4	1.85	1.34	36.7	36.6	0.00	0.89 – 1.26 Coarse Gravel	0.90 Coarse Gravel
Big Hole River (E)	208	4.30	3.22	64.6	173.0	0.00	3.5 – 5.0 Small Cobble	3.50 Small Cobble
Deep Creek	39.1	2.33	1.38	28.3	23.4	0.01	2.5 – 3.5 Small Cobble	2.85 Small Cobble

IX. PUBLIC OUTREACH, TECHNICAL COMMITTEES, AND SPECIAL FUNDING

The Big Hole Grayling CCAA represents a collaborative effort among the Participating Landowners, the Agencies, and several non-government organizations with a conservation interest in grayling and the Big Hole watershed. Working groups and technical committees have and will be formed to deal with a variety of issues associated with the Big Hole Grayling CCAA as they arise to meet our commitments and maximize the effectiveness of this Program.

A. Hub and Spoke Working Group

The Hub and Spoke Working Group is made up of both government and non-government organizations directly involved in preserving the health of the Big Hole River watershed and the local grayling population. Members of the Big Hole Watershed Steering Committee created the concept for this group. Existing funding from both the Big Hole Watershed Committee and the Big Hole River Foundation were used to hire a Grayling Recovery Support Coordinator. The position is employed by the Big Hole Watershed Committee. The group has met regularly since May to provide updates on issues associated with the upper Big Hole watershed, grayling recovery, to discuss restoration project ideas, and brainstorm on project funding opportunities. Members of the Group represent: the Big Hole Watershed Committee, the Big Hole River Foundation, Montana Trout Unlimited, the Western Water Project, The Nature Conservancy, FWP, the USFWS, DNRC, and NRCS.

B. Upper Big Hole Watershed Water Rights Technical Committee

The Upper Big Hole Watershed Water Rights Technical Committee was formed to assist and provide technical expertise to the Agencies and private landowners in dealing with the water right issues associated with implementing the conservation measures described in the Big Hole Grayling CCAA. The Committee is made up of staff from FWP, DNRC, the Western Water Project, and the Montana Water Trust. In 2007, the Committee assisted landowners with Applications to Change a Water Right, provided input into streamflow monitoring needs, and worked on legislation that would protect Big Hole Grayling CCAA Participating Landowners that give up irrigation water to improve streamflow conditions from challenges of water right abandonment.

C. Fish and Cow Documentary

Geoff Stephens and Rick Smith, working with The Nature Conservancy of Montana created an 18-minute documentary of the cooperative efforts taking place in the upper Big Hole watershed to save grayling. The short film was selected as a finalist in the "newcomer" category at the Jackson Hole Wildlife Film Festival in Jackson Hole, Wyoming. The film can be viewed at: http://www.nature.org/wherewework/northamerica/states/montana/news/news2427.html

D. NRCS Special Funding

In 2007, NRCS provided funding for a full-time technician with both FWP and DNRC. These positions are dedicated to collecting data that will assist in the completion of the site-specific plans. These positions are vital to collecting data that improves the decision making about approaches to conservation actions aimed at benefiting grayling.

E. The Arctic Grayling Recovery Website

A website providing updates on activities and reports related to grayling recovery is maintained by FWP and AGRP. The website can be accessed at: http://www.graylingrecovery.org/.

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