FEDERAL ENERGY REGULATORY COMMISSION
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 1869-048 -- Montana
Thompson Falls Dam Project
PPL Montana

July 13, 2010



Mr. Jon Jourdonnais
PPL Montana LLC
45 Basin Creek Road
Butte, MT 59701

Reference: 2009 Annual activity report

Dear Mr. Jourdonnais:

We have reviewed your 2009 annual activity report for the Thompson Falls Dam Hydroelectric Project, filed on March 19, 2010. Pursuant to ordering paragraph (D) the Commission's Order Approving Construction and Operation of Fish Passage Facilities,[1] you are to file an annual report each April 1 to demonstrate compliance with the terms and conditions issued by U.S. Fish and Wildlife (FWS). This report is the first annual report, and describes the activities and results associated with baseline fisheries studies, northern pike studies, gas bubble trauma, water temperature, bull trout genetics, passage and incidental take, and proposed activities for 2010.

Your report indicates that baseline fisheries studies were conducted in the fall and spring of 2009 using a combination of techniques to establish information about species composition and relative abundance in the reservoir. Fall gillnetting efforts yielded a total of 55 fish representing 6 species, and electrofishing efforts in the spring and fall yielded 136 fish representing 14 species and 699 fish representing 11 species, respectively. Northern pike studies are performed to assess their impact on juvenile and sub-adult bull trout; population estimates, spawning, movement, and diet composition were examined for captured northern pike. During a meeting of the Thompson Falls Reservoir Technical Advisory Committee (TAC) in February 2010, the TAC determined it would continue baseline fisheries data in 2010, but would defer additional reservoir studies, including the northern pike study, until the 5-year Reservoir Plan was complete.

[1] 126 FERC ¶62,105 (February 12, 2009).

To determine the incidence of gas bubble trauma (GBT), 276 fish representing 14 species were captured in 2009 and examined visually for symptoms of GBT; no fish displayed symptoms of GBT. Water temperature gradients in Thompson Falls Reservoir was assessed in 2009 to determine if there are thermal gradients in the reservoir downstream of the Thompson River that could be used by bull trout as a migratory corridor; the data collected does not provide evidence that there are cool water zones that could serve as a migratory corridor for bull trout. Additionally, genetic testing was performed to determine the natal stream of bull trout captured downstream of Cabinet Gorge Dam and some fish were transported upstream of Thompson Falls. Your report also includes a summary of several projects funded by the TAC. The report was reviewed and approved by the FWS on March 18, 2010.

Thank you for filing the annual report for 2009. This report satisfies the reporting requirement of ordering paragraph (D) and demonstrates compliance with FWS terms and conditions. Your next filing is due April 1, 2011. Additionally, you are to file the 5-year (2010-2015) Reservoir Plan, operation and procedures manual for the completed upstream fish passage facility, and fish passage facility efficiency evaluation plan with the Commission by December 31, 2010. If you have any questions concerning this letter, please call Holly Frank at (202) 502-6833.

Sincerely,

Holly Frank
Biological Resources Branch
Division of Hydropower Administration
and Compliance

PPL Montana, 45 Basin Creek Road, Butte, Montana 59701

PPL MONTANA, LLC

PPLM-TFalls-2540

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

March 18, 2010

RE: Filing 2009 Annual Activity, Fish Passage and Bull Trout Take Report for the Thompson Falls Hydroelectric Project (1869)

Dear Secretary Bose:

Herein attached, per Item D of Commission Order February 12, 2009, is the 2009 Annual Activity, Fish Passage and Bull Trout Take Report for the Thompson Falls Project which PPL Montana has completed in consultation with agencies (USFWS, MFWP and MDEQ) and the Confederated Salish and Kootenai Tribes. USFWS signature of approval (under their Section 7 Terms and Conditions Authority) for this report and filing with the Commission is included on page 2.

Sincerely,

Jon Jourdonnais
Manager Hydro Licensing and Compliance

Cc: Mark Wilson, USFWS
Wade Fredenberg, USFWS
Tim Bodurtha, USFWS
Craig Barfoot, CSKT
Andy Welch, MDEQ
Jon Hanson, MFWP
Jim Darling, MFWP
Brent Mabbott, PPLM
Frank Pickett, PPLM
Gordon Criswell, PPLM
Dave Kinnard, PPLM
Carrie Harris, PPLM
Ginger Gillin, GEI
Kristi Webb, M-M
Erich Gaedeke, FERC Portland

The USFWS has reviewed, and by signature below, approves this Thompson Falls Project 2009 Annual Activity, Fish Passage and Bull Trout Take Report filing with the Commission.

R. Mark Wilson

Name

Field Supervisor

USFWS Position

March 18, 2010

Date

# 2009 Annual Report
# Fish Passage Project
## Thompson Falls Hydroelectric Project
## FERC Project Number 1869

Submitted to:
**Federal Energy Regulatory Commission**
Washington, D.C.

Submitted by:
**PPL Montana, LLC**
Butte, Montana

In Collaboration With:
**Montana Fish Wildlife and Parks**
Thompson Falls, Montana

**U.S. Fish and Wildlife Service**
Kalispell, Montana

**Confederated Salish and Kootenai Tribes**
Pablo, Montana

With Assistance From:
**GEI Consultants, Inc.**
Lake Oswego, Oregon

**Morrison Maierle, Inc.**, **Environmental Services Group**
Missoula, Montana

FINAL March 2010

# Table of Contents

## List of Appendices

# Executive Summary

PPL Montana, LCC is owner and operator of the Thompson Falls Dam (No. 1869), located on the Clark Fork River near Thompson Falls, Montana. The current Federal Energy Regulatory Commission (FERC or Commission) License was issued to Montana Power Company (now PPL Montana) in 1979 and is scheduled to expire on December 31, 2025.

In 1998, the bull trout (*Salvelinus confluentus*) was federally listed under the Endangered Species Act (ESA) as a threatened species; and critical habitat was designated in 2005. PPL Montana has conducted five years of studies and filed a Biological Evaluation with the Commission on April 7, 2008 discussing the effects of the Thompson Falls Project on bull trout and proposed conservation measures.

The 2008 Biological Evaluation was adopted as the Commission's final Biological Assessment and submitted to the U.S. Fish and Wildlife Service (FWS) on May 1, 2008. On November 4, 2008 the FWS filed with the Commission a Biological Opinion and an associated Incidental Take Statement, which includes reasonable and prudent measures, and Terms and Conditions to minimize incidental take of bull trout. On February 12, 2009 the Commission issued an Order Approving Construction and Operation of Fish Passage Facilities for the Thompson Falls Hydroelectric Project. This order included the reasonable and prudent measures, Terms and Conditions, and conservation recommendations from the Biological Opinion. FERC agreed with FWS's conclusion that the Thompson Falls Project is currently adversely affecting bull trout and PPL Montana's proposed conservation measures will reduce, but not totally eliminate, adverse impacts of the Project.

The FERC Order required PPL Montana to file with the Commission, for approval, study and operational plans referenced in the FWS's Terms and Conditions numbers 1 through 7, after development and approval by the FWS and the Thompson Falls Technical Advisory Committee. PPL Montana is required to file with the Commission, by April 1 of each year through the remainder of the License, the annual report referenced in Term 7a of the FWS's Terms and Conditions. In addition to the requirements stipulated in Term 7a the report should also address the Licensee's compliance with the FWS's Terms and Conditions.

This report is intended to fulfill the annual reporting requirement, as specified in Term 7a of the Biological Opinion and the requirements of the FERC Order. The following sections summarize PPL Montana's 2009 activities, including, baseline fisheries studies (Section 2.0), northern pike studies (Section 3.0), bull trout genetics (Section 4.0), gas bubble trauma (Section 5.0), water temperature (6.0), technical advisory committee funded projects (Section 7.0), bull trout passage and incidental take of bull trout (Section 8.0), and compliance with the Terms and Conditions outlined in the Biological Opinion (Section 9.0), as well as PPL Montana's proposed actions in 2010 (Section 10.0).

# 1.0 Introduction

## 1.1 Background

PPL Montana is owner and operator of the Thompson Falls Dam (No. 1869), located on the Clark Fork River near Thompson Falls, Montana. The current Federal Energy Regulatory Commission (FERC or Commission) License was issued to Montana Power Company (now PPL Montana) in 1979 and is scheduled to expire on December 31, 2025.

In 1998, the bull trout (*Salvelinus confluentus*) was federally listed under the Endangered Species Act (ESA) as a threatened species (Federal Register, 1998); and critical habitat was designated in 2005 (Federal Register, 2005). A revision to critical habitat was proposed in January 2010, but has not been finalized as of the time of this writing. Because bull trout are present within the Project area, a draft Biological Evaluation was prepared for the Thompson Falls Project and submitted to the U.S. Fish and Wildlife Service (FWS) and FERC in 2003.

After five years of studies, PPL Montana filed a new Biological Evaluation discussing the effects of the Thompson Falls Project on bull trout and proposed conservation measures with the Commission on April 7, 2008. PPL Montana's Biological Evaluation identified several factors directly related to project operation that negatively impact bull trout in the Clark Fork River. Inhibition of upstream migration and access to spawning habitat by the Thompson Falls Dam was identified as a major concern. Consequently, PPL Montana proposed to install a full height fishway at the Project and filed 90-percent drawings for the structure on April 7, 2008. The filing also contained a Memorandum of Understanding (MOU) signed by PPL Montana, the Confederated Salish and Kootenai Tribes of the Flathead Nation (CSKT), Montana Fish Wildlife and Parks (FWP), and FWS (MOU, 2008).[1]

The Commission concluded that the Thompson Falls Project is adversely affecting bull trout and the proposed conservation measures will reduce, but not totally eliminate, the Project's adverse effects on bull trout. The 2008 Biological Evaluation was adopted as the Commission's final Biological Assessment and submitted to the FWS on May 1, 2008.

On November 4, 2008 the FWS filed with the Commission a Biological Opinion and associated Incidental Take Statement which includes reasonable and prudent measures and Terms and Conditions to minimize incidental take of bull trout. The FWS concluded in its Biological Opinion that the Thompson Falls Project is currently adversely affecting bull trout and PPL

[1] The MOU provides Terms and Conditions regarding the collaboration between the Licensee and the FWS, FWP, and CSKT and the implementation of minimization measures for bull trout.

Montana's proposed conservation measures will reduce, but not totally eliminate, adverse impacts of the Project.

On February 12, 2009 the Commission issued an Order Approving Construction and Operation of Fish Passage Facilities for the Thompson Falls Hydroelectric Project. This order included the reasonable and prudent measures, Terms and Conditions, and conservation recommendations from the FWS Biological Opinion.

## 1.2 Compliance with the FERC Order

The FERC Order required PPL Montana to file with the Commission, for approval, study and operational plans referenced in the FWS's Terms and Conditions numbers 1 through 7, after development and approval by the FWS and the Thompson Falls Technical Advisory Committee. In order for the Commission to ensure compliance with the FWS's Terms and Conditions PPL Montana is required to file with the Commission, by April 1 of each year through the remainder of the License, the annual report referenced in Term 7a[2] of the FWS's Terms and Conditions. In addition to the requirements stipulated in Term 7a the report should also address the Licensee's compliance with the FWS's Terms and Conditions.

The report is intended to fulfill the annual reporting requirement, as specified in Term 7a of the Biological Opinion and the requirements of the FERC Order.

[2] Term 7a states, "Annually, by April 1 of each year for the remainder of the License (expires 2025), PPL Montana will prepare and submit to the Service for approval a report of the previous year's activities, fish passage totals, and next year's proposed activities and other fisheries monitoring that may result in intentional as well as incidental take of bull trout. The report will quantify the number of bull trout proposed to be incidentally taken by each activity and summarize the cumulative extent of incidental take from all previous year activities."

# 2.0 Baseline Fisheries Studies

Fisheries monitoring of the Thompson Falls Reservoir using gillnets and electrofishing has been conducted annually, within the same general time frame, for a number of years. The main objective of this monitoring is to establish baseline information on species composition and relative abundance within the reservoir. This information will help track changes to the fish community annually and over a long period of time. This is especially important due to the construction of the full height fish ladder to be operated at Thompson Falls Dam, beginning in late 2010. This is one monitoring tool that gives managers the ability to track potential system-wide changes with fish passing into the reservoir from downstream.

## 2.1 Fall Gill Netting

Gillnetting occurs during the second week of October with nets set in the early afternoon of one day and pulled the morning of the next day, approximately 18 hours later (Table 2-1). Experimental mesh nets are 125 feet in length with variable mesh sizes. Depths of set nets range from 1 foot, up to 25 feet. Nets are set perpendicular to the shore with smallest mesh closest to the bank and the largest mesh being set farthest from the bank.

**Table 2-1. Total number and dates of gillnetting activities on Thompson Falls Reservoir.**

| Year | Number of gillnets | Date set | Date pulled |
|---|---|---|---|
| 2004 | 6 | 10/13 | 10/14 |
| 2005 | 10 | 10/13 | 10/14 |
| 2006 | 10 | 10/12 | 10/13 |
| 2007 | 10 | 10/11 | 10/12 |
| 2008 | 10 | 10/8 | 10/9 |
| 2009 | 10 | 10/19 | 10/20 |

Gillnet locations were determined through reconnaissance of approximately 24 potential sites considering aquatic vegetation present, water current, depth, and proximity to tributaries. A subset of habitats was selected based on representative conditions and in all years, except 2004, 10 nets were set from approximately one-half mile above the Thompson Falls Dam upstream to approximately one-half mile above the mouth of Thompson River.

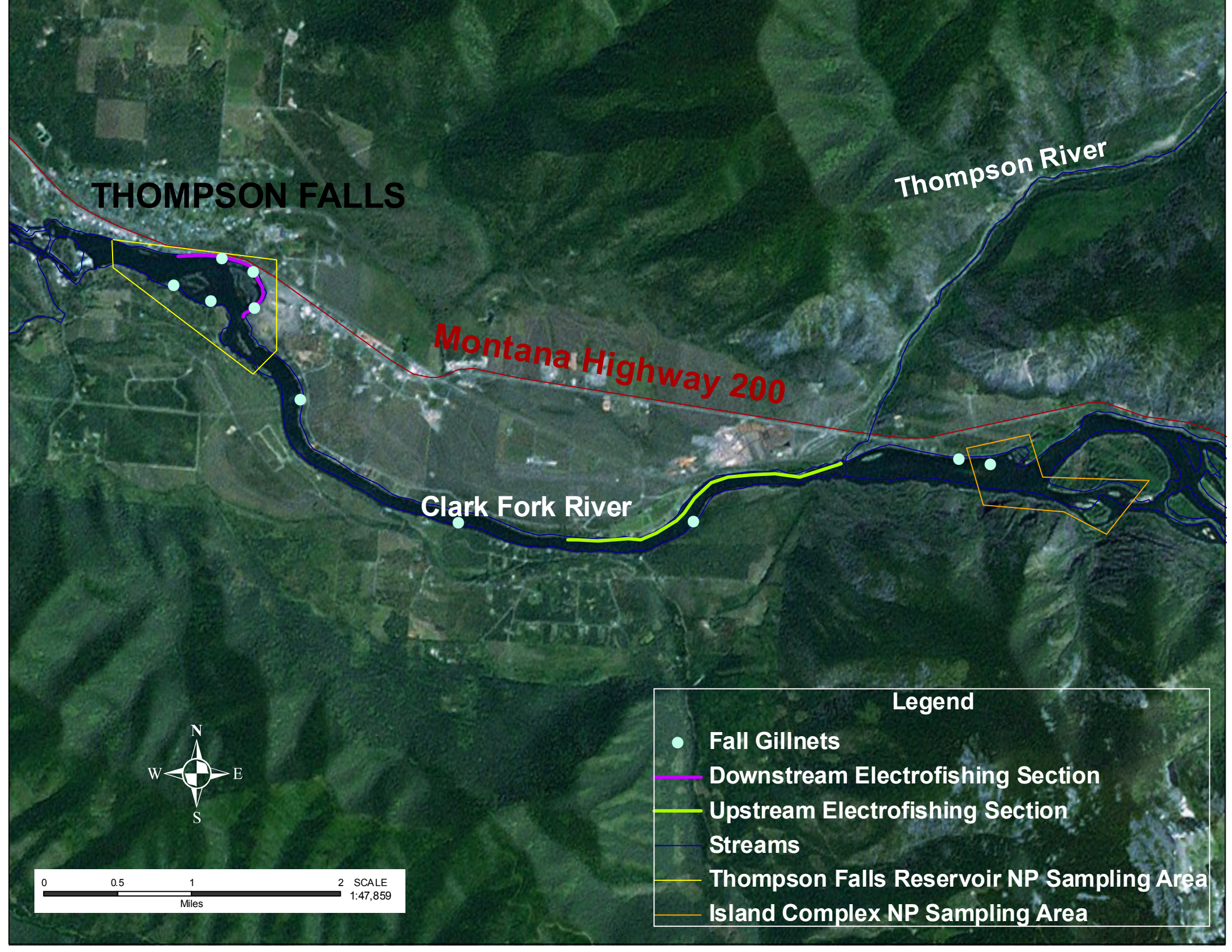
The following table identifies the abbreviations used in the tables and figures in this section. The table includes the abbreviation, common name, and scientific name.

**Table 2-2. Summary of abbreviations for fish identification, species common name, and scientific name.**

| Fish Abbreviation | Common Name | Scientific Name |
|---|---|---|
| LL | Brown trout | *Salmo trutta* |
| LMB | Largemouth bass | *Micropterus salmoides* |
| LSS | Largescale sucker | *Catostomus macrocheilus* |
| LT | Lake trout | *Salvelinus namaycush* |
| MWF | Mountain whitefish | *Prosopium williamsoni* |
| NP | Northern pike | *Esox lucius* |
| NPM | Northern pikeminnow | *Ptychocheilus oregonensis* |
| PEA | Peamouth | *Mylocheilus caurinus* |
| PUM | Pumpkinseed | *Lepomis gibbosus* |
| RBT | Rainbow trout | *Oncorhynchus mykiss* |
| RSS | Redside shiner | *Richardsonius balteatus* |
| SMB | Smallmouth bass | *Micropterus dolomieu* |
| WCT | Westslope cutthroat trout | *Oncorhynchus clarkii lewisi* |
| WCTxRBT | Westslope cutthroat x rainbow trout hybrid | *Oncorhynchus clarkii lewisi x Oncorhynchus mykiss* |
| YP | Yellow perch | *Perca flavescens* |

In 2004 six gillnets were deployed (Figure 2-1). In 2004 nets were set at the designated locations capturing 48 fish of eight species; 2005 efforts captured 79 fish and seven species; 2006 nets captured 116 fish and seven species; 2007 nets captured 122 fish and nine species; 2008 captured 59 fish of seven species; and recent 2009 efforts captured 55 fish of six species. Mean catch per net has varied widely by species and between years (Table 2-3, Figure 2-2). Lengths and weights were recorded for all fish and averages for both are presented by year in Appendix A.

**Figure 2-1. Location of fish sampling in Thompson Falls Reservoir (next page).**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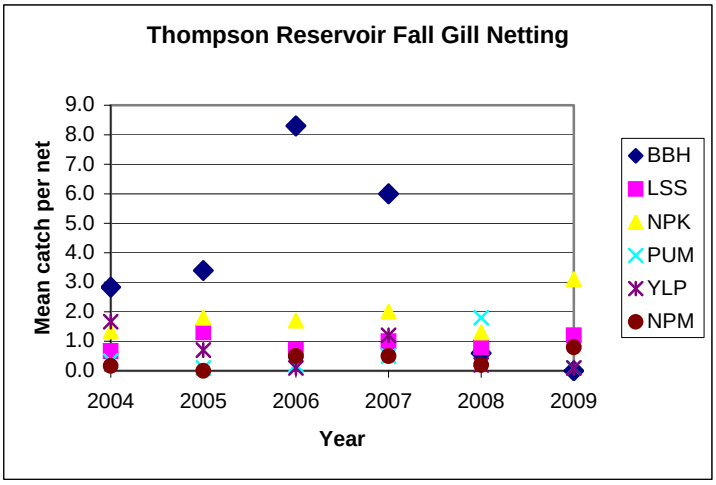
Fall Gillnets
Downstream Electrofishing Section
Upstream Electrofishing Section
Streams
Thompson Falls Reservoir NP Sampling Area
Island Complex NP Sampling Area

**Table 2-3. Mean catch per net, by species, during annual October gillnetting series on Thompson Falls Reservoir.**

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| BBH | 2.8 | 3.4 | 8.3 | 6 | 0.6 | 0 |
| LSS | 0.7 | 1.3 | 0.7 | 1 | 0.8 | 1.2 |
| NP | 1.3 | 1.8 | 1.7 | 2 | 1.3 | 3.1 |
| PEA | 0.0 | 0.1 | 0.1 | 0.1 | 0 | 0 |
| PUM | 0.3 | 0.1 | 0.2 | 0.5 | 1.8 | 0.1 |
| SMB | 0.3 | 0.1 | 0 | 0.5 | 0.1 | 0 |
| YP | 1.7 | 0.7 | 0.1 | 1.2 | 0.2 | 0.1 |
| LMB | 0.2 | 0 | 0 | 0.3 | 0 | 0 |
| NPM | 0.2 | 0 | 0.5 | 0.5 | 0.2 | 0.8 |
| RBT | 0 | 0 | 0 | 0 | 0 | 0.2 |

**Figure 2-2. Mean catch per net from 2004 to 2009, during Thompson Falls Reservoir fall gillnetting.**




## 2.2 Spring Electrofishing

In 2009 boom electrofishing was completed in Thompson Falls Reservoir on April 20 and 21, 2009. Two locations were sampled by slowly navigating a boat near the shore after daylight hours. The downstream section, sampled on April 20, is parallel with Highway 200 from Wild Goose Landing boat launch, upstream to a location approximately 750 feet above the pump house. The upstream section, sampled on April 21 is on the right bank from the confluence of Thompson River to the Cherry Creek boat launch (Figure 2-2). The upstream site is more characteristic of riverine conditions, with noticeable flowing water, average widths around 459 feet; little to no aquatic vegetation; and some recreational docks. The downstream site has substantially lower water velocity, mean widths near 1,673 feet, abundant aquatic vegetation, and is off the main river channel.

Fishing time was similar both nights with 2,118 seconds shocked for the downstream site and 2,130 seconds for the upstream site. Fish lengths and total weights were recorded for all species, and catch per unit effort is reported below in Figure 2-3 and Table 2-4.

**Figure 2-3. Catch per unit effort (CPUE) during 2009 spring electrofishing sections by species (spp.).**

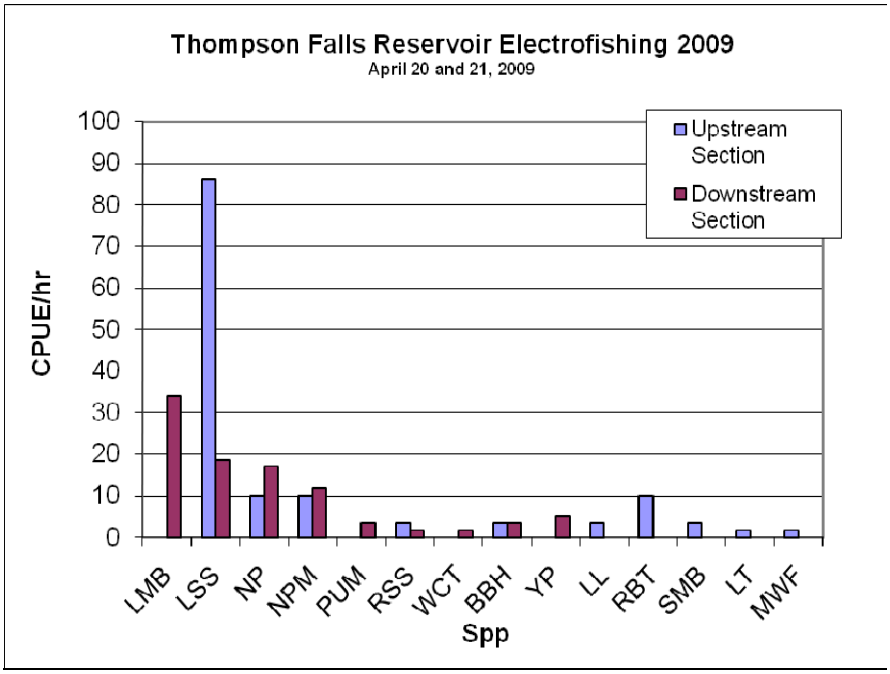



**Table 2-4. 2009 spring, catch per unit effort in two Thompson Falls Reservoir electrofishing sections.**

| Lower Section | | | Upper Section | | |
|---|---|---|---|---|---|
| **Species** | **Number** | **CPUE / hr** | **Species** | **Number** | **CPUE / hr** |
| **LMB** | 20 | 34.0 | **LMB** | 0 | 0 |
| **LSS** | 11 | 18.7 | **LSS** | 51 | 86.2 |
| **NP** | 10 | 17.0 | **NP** | 6 | 10.1 |
| **NPM** | 7 | 12.0 | **NPM** | 6 | 10.1 |
| **PUM** | 2 | 3.4 | **PUM** | 0 | 0 |
| **RSS** | 1 | 1.7 | **RSS** | 2 | 3.4 |
| **WCT** | 1 | 1.7 | **WCT** | 0 | 0 |
| **BBH** | 2 | 3.4 | **BBH** | 2 | 3.4 |
| **YP** | 3 | 5.1 | **YP** | 0 | 0 |
| | | | **LL** | 2 | 3.4 |
| | | | **RBT** | 6 | 10.1 |
| | | | **SMB** | 2 | 3.4 |
| | | | **LT** | 1 | 1.7 |
| | | | **MWF** | 1 | 1.7 |

## 2.3 Fall Electrofishing

Electrofishing the Clark Fork River above the Thompson River mouth took place the nights of October 20 and 21, 2009 starting at the mouth of Eddy Creek, working downstream approximately 5 miles (8 kilometers). The left bank was sampled on October 20 stopping approximately 0.5 mile (1 kilometer) above the mouth of Thompson River and the right bank was sampled October 21 stopping 1 mile (1.6 kilometers) above the mouth of Thompson River in the Island Complex.

Electroshocking efforts used an 18.5 foot, aluminum hull Wooldridge boat with a gasoline generator and a Smith-Root VVP 15A rectifier using 120-160 volts with 4-6 amps. The waveform setting varied and was dependent on conductivity in the river system, which varies seasonally. Two booms were attached to the hull extending 4 feet past the bow with four dangling electrodes per boom. Shocking crews consisted of the boat driver and two netters. Captured fish were put in a 100 gallon holding tank before being measured (total length).

A total of 699 fish consisting of 11 species were captured during this sampling with largescale sucker, mountain whitefish, and northern pikeminnow being the most abundant species. A total of 57 *Oncorhynchus* were also captured during this sampling. It is noteworthy that during spring gillnetting and electrofishing, downstream in the Thompson Falls Reservoir and the Island Complex above Thompson River resulted in 10 *Oncorhynchus* captured with considerably more effort. Figure 2-4 and Table 2-5 represent species totals as well as catch per unit effort for individual and total species captured.

**Figure 2-4. CPUE by species of Clark Fork River electrofishing during October 2009 sampling.**

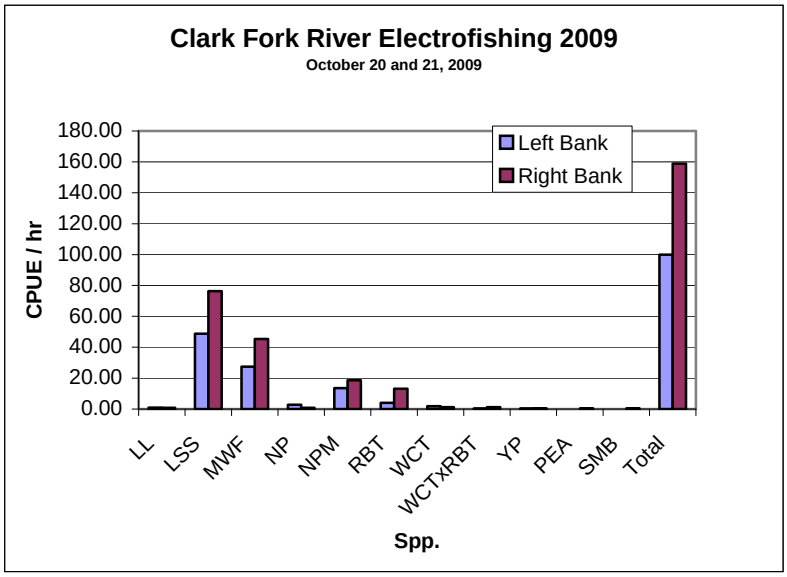


**Table 2-5. Total number of species captured and CPUE during October Clark Fork River sampling on the left bank and the right bank.**

| Left Bank (10/20/09) | | |
|---|---|---|
| **Species** | **Number** | **CPUE / hr** |
| **LL** | 3 | 0.9 |
| **LSS** | 158 | 48.8 |
| **MWF** | 89 | 27.5 |
| **NP** | 9 | 2.8 |
| **NPM** | 44 | 13.6 |
| **RBT** | 13 | 4.0 |
| **WCT** | 6 | 1.9 |
| **WCTxRBT** | 1 | 0.3 |
| **YP** | 1 | 0.3 |
| **Total** | 324 | 100.0 |

| Right Bank (10/21/09) | | |
|---|---|---|
| **Species** | **Number** | **CPUE / hr** |
| **LL** | 2 | 0.9 |
| **LSS** | 180 | 76.3 |
| **MWF** | 107 | 45.3 |
| **NP** | 2 | 0.9 |
| **NPM** | 44 | 18.6 |
| **PEA** | 1 | 0.4 |
| **RBT** | 31 | 13.1 |
| **SMB** | 1 | 0.4 |
| **WCT** | 3 | 1.3 |
| **WCTxRBT** | 3 | 1.3 |
| **YP** | 1 | 0.4 |
| **Total** | 375 | 158.9 |

# 3.0 Northern Pike Studies

## 3.1 Introduction

The FWS Biological Opinion for the Thompson Falls Hydroelectric Project requires an assessment of impacts of predatory nonnative fish species on juvenile and subadult bull trout residing in or passing through Thompson Falls Reservoir on the Clark Fork River. In 2009, PPL Montana and FWP joined in a collaborative effort to investigate northern pike populations in the Thompson Falls Reservoir and Island Complex (Figure 2-1). The following text summarizes the study objectives, sampling methodologies, results, and proposed actions for 2010.

## 3.2 Objectives

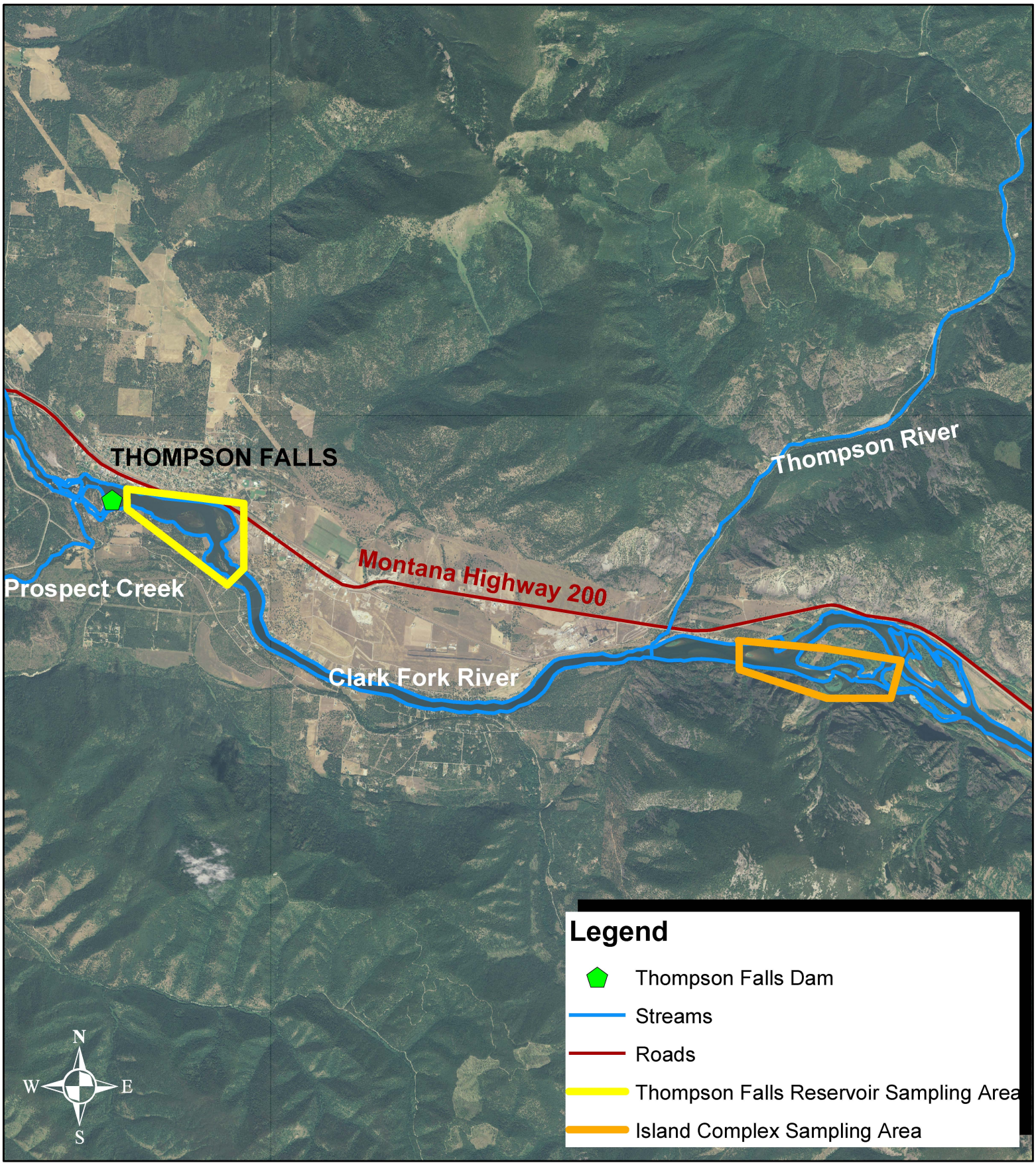
Northern pike are opportunistic feeders and prey upon the available food source, which can include bull trout. Although northern pike are known to be present in the Thompson Falls Reservoir and Island Complex areas, the impacts of northern pike predation on juvenile and subadult bull trout residing in or passing through Thompson Falls Reservoir and Island Complex areas are unknown. The 2009 study and future studies are focused on assessing impacts of predation of nonnative fish, such as northern pike, on bull trout.

The overall objective of the 2009 study was to learn more about northern pike present in the Thompson Falls Reservoir and Island Complex. Specific objectives of the 2009 study included the following: 1) describe population characteristics, 2) provide a population estimate, 3) determine diet composition, 4) determine time of spawning, and 5) monitor movement through multiple mark-recapture census and angler tag returns. Results from this study will help determine future studies and potential management activities, if any, aimed at protecting and enhancing bull trout populations.

## 3.3 Methods

### *3.3.1 Study Area*

The 2009 study focused on two locations in the lower Clark Fork River where northern pike habitat and species presence is known, the Thompson Falls Reservoir and the Island Complex located approximately 7 miles upstream of the Thompson Falls Dam (Figure 3-1).

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MORRISON MAIERLE, INC.
An Employee-Owned Company
Engineers
Surveyors
Scientists
Planners
3011 Palmer St.
Missoula, MT 59808
Phone: (406) 542-8880
Fax: (406) 542-4801


DATE: 1/8/10
PATH: M://4421.002.02
DRAWN BY: KMW
CHECKED BY: KMW

**Thompson Falls Northern Pike 2009 Sampling Area**

PROJECT NUMBER
**4421.002.02**

**AERIAL MAP**

FIGURE NUMBER
**3-1**

### *3.3.2 Sampling Efforts and Data Collection*

Two locations were sampled using three methods: electrofishing, gillnetting, and angling. Sampling efforts were routinely performed for 15 weeks, starting in late March and ending in July 2009. There were a total of 31 sampling days, of which fish were captured on 25 days. Table 3-1 identifies all sampling days for each sampling technique, including sampling days when no fish were captured.

**Table 3-1. A summary of northern pike sampling dates in 2009 that are organized by sampling method and location.**

| Sampling Method | Sampling Dates in 2009 | |
|---|---|---|
| | **Thompson Reservoir** | **Island Complex** |
| **Gillnetting** | March 26, 31*<br>April 3*, 8, 14*, 17, 22, 27<br>May 1, 7, 11, 21* | March 20*, 23*, 27<br>April 1, 6, 9, 15, 20, 24, 30<br>May 4, 8<br>July 7 |
| **Electrofishing** | April 20, 27<br>May 1, 7, 28 | April 24, 30<br>May 15, 20, 27, 29<br>June 18 |
| **Angling** | April 17 | April 1, 6, 9<br>May 8 |

The asterisk (*) indicates no fish were captured that day.

#### **3.3.2.1** Gillnetting

Gillnets were used for sampling northern pike between March and May 2009 in the Thompson Falls Reservoir and between March and July 2009 in the Island Complex. Each sampling effort included four to six gillnets of 1 inch mesh that were 150 feet long and 6 feet deep. The use of non-standardized gillnets was recommended by David Schmetterling, which provided the best capture results of northern pike during his 2000 study in Milltown Dam near Missoula, Montana (2001 Schmetterling). In this study, gillnets were set during daytime hours (morning and afternoon) for an approximately 1 hour interval. Nets were checked or pulled every hour to decrease net mortalities. No mortalities were recorded as a result of gillnetting efforts. Each sampling location (Thompson Falls Reservoir and Island Complex) was sampled between one to three times per week. Sampling times were varied in the effort to maximize the number of northern pike captured.

#### **3.3.2.2** Electrofishing

PPL Montana and FWP electrofished during the daytime hours by boat between April and May 2009 in the Thompson Falls Reservoir and between April and June 2009 in the Island Complex. Electroshocking efforts used an 18.5 foot, aluminum hull Wooldridge boat with a gasoline

generator and a Smith-Root VVP 15A rectifier using 120-160 volts with 4-6 amps. The waveform setting varied and was dependent on conductivity in the river system, which varies seasonally. Two booms were attached to the hull extending 4 feet past the bow with four electrodes per boom. Shocking crews consisted of the boat driver and two netters. Captured fish were put in a 100 gallon holding tank before being measured (total length), weighed, and sexed. Electrofishing efforts were generally completed once a week at each location for 1 to 2 hours per electrofishing event.

#### 3.3.2.3 Angling

A third sampling technique, angling, was attempted with hook and line and the use of smelt for bait. Angling efforts had minimal success and was not considered an effective method of sampling northern pike at either sampling location.

#### 3.3.2.4 Data Collection

For all sampling methods, northern pike characteristics including length, weight, scales for age analysis, and sex were recorded. Age was determined by observing scales under magnification and counting growth annulus. Sex was determined by applying pressure to the abdomen to induce passage of gametes from the urogenital pore. All fish captured were released back into the river.

Prior to release, an orange floy tag was implanted on the posterior end of the dorsal fin. Recaptured fish were recorded during subsequent sampling events.

Gastric lavage was performed on northern pike longer than 250 millimeters. Gastric lavage provides an efficient method of removing the stomach contents of live fish. No fish mortality resulted from gastric lavage. Stomach samples were either identified in the field or taken to the lab for identification using a microscope. Stomach content was identified and enumerated. Stomach content was not weighed.

#### 3.3.2.5 Population Estimate

For this study, the Schumacher-Eschmeyer (Ricker 1975, taken from Schneider 1998) formula for multiple sampling was applied to calculate population estimates (N) of northern pike in the Thompson Falls Reservoir and Island Complex. Over a 15 week period, northern pike were continually sampled and marked via gillnetting, electrofishing, and angling in these two locations.

The accuracy of the Schumacher-Eschmeyer method is based on the following assumptions

- The population is closed over the period of investigation (no recruitment through birth or immigration and no losses through death or emigration)
- All fish have the same chance of being caught in a sample (i.e., must be a random sample)
- Marking fish does not affect their catchability

- Fish do not lose marks between the two sampling periods
- All marks are reported on discovery in the second sample

Sources of variation in capture probabilities can be a result of the time (daily or seasonal variations) when sampling is conducted, changes in behavior of fish as a function of sampling effort ("trap-happy" or "trap-shy" responses), and variation in sampling method.

The following notation was used to estimate populations (N) in the Thompson Falls Reservoir and Island Complex using the Schumacher-Eschmeyer formula.

Where:

$N$ = population estimate in numbers of fish
$C_i$ = number of fish caught during day $i$
$M_i$ = number of marked fish available for recapture at start of day $i$
$R_i$ = number of recaptures during $i$
$i$ = sample number (usually days), ranging from first ($i_1$) to last ($i_n$)
$s^2$ = variance of samples
$m$ = number of days (or samples) in which fish were actually caught

From Ricker (1975, taken from Schneider 1998):

$$N = \frac{\sum_{i=1}^{n} C_i M^2_i}{\sum_{i=1}^{n} R_i M_i}$$

$$s^2 = \frac{\sum_{i=1}^{n} \frac{R_i^2}{C_i} - \left[\frac{(\sum_{i=1}^{n} R_i M_i)^2}{\sum_{i=1}^{n} R_i M_i}\right]}{m - 1}$$

$$\text{Variance of } N = N^2 \left[\frac{N\, s^2}{\sum_{i=1}^{n} R_i M_i}\right]$$

When a fraction of the population is caught in each sample ($C_i/N$) and the fraction of the total population is marked ($M_i/N$) are always less than 0.1 then it is best to calculate confidence limits based on reciprocals of N (i.e., 1/N). The confidence limits were based on a t-value with m-1 degrees of freedom and the standard error of 1/N. Variance, standard error, and 95 percent confidence limits were calculated using the following equations:

$$\text{Variance of } {}^{1}/_{N} = \left[\frac{s^2}{\sum_{i=1}^{n} C_i M^2_i}\right]$$

$$\text{Standard Error of } {}^{1}/_{N} = \sqrt{\text{Variance of } {}^{1}/_{N}}$$

$$95\%\text{ confidence limits of } {}^{1}/_{N} = {}^{1}/_{N} \pm t(\text{Standard Error of } {}^{1}/_{N})$$

The reciprocals of the fractional limits are then taken to obtain whole number confidence limits.

## 3.4 Results

As a result of 15 weeks of sampling the Thompson Falls Reservoir and Island Complex, a total of 170 northern pike were captured via gillnetting, electrofishing, and angling. Table 3-2 summarizes the total number of northern pike captured, including recaptures, by sampling method and sampling location.

**Table 3-2. Summary of northern pike sampled in the Thompson Falls Reservoir and Island Complex using three sampling methods between March and July 2009.**

| Sampling Method | Number of Northern Pike Sampled | | |
|---|---|---|---|
| | Total | Thompson Falls Reservoir (Recaptures) | Island Complex (Recaptures) |
| Gillnet | 59 | 17 (2) | 38 (2) |
| Electrofishing | 101 | 16 (2) | 65 (18) |
| Angling | 10 | 1 (0) | 9 (0) |
| **Total** | **170** | **34 (4)** | **112 (20)** |

Gillnetting efforts from March 26 through July 9, 2009 also resulted in the capture of nine species other than northern pike in the Thompson Falls Reservoir and Island Complex. These species included 14 yellow perch, six largescale suckers, seven pumpkinseed, five northern pikeminnow, two rainbow trout, one bull trout, one largemouth bass, one lake trout, one smallmouth bass, and one painted turtle (*Chrysemys picta).* The bull trout was captured via gillnetting in the Thompson Falls Reservoir on May 1, 2009. The bull trout was 271 millimeters long and 174 grams (g). PPL Montana and FWP implanted a passive integrated transponder (PIT) tag (ID# 985121009494278) and took a fin clip for genetic assignment testing prior to releasing the bull trout back to the reservoir. Genetic results indicate the fish was assigned to Fishtrap Creek, a tributary to Thompson River.

### *3.4.1 Population Characteristics*

#### 3.4.1.1 Length and Weight

Table 3-3 summarizes northern pike length (millimeters) and weight (grams) by sample location and method. The data below reflect sampling efforts between March and July 2009 and do not include recaptured northern pike.

**Table 3-3. Summary of population characteristics for northern pike sampled between March and July 2009 in the Thompson Falls Reservoir and Island Complex via gillnetting, electrofishing, and angling.**

| Location and Sampling Method | Length (mm) | | | Weight (g) | | |
|---|---|---|---|---|---|---|
| | N | Average | Range | N | Average | Range |
| **Thompson Falls Reservoir (TFR)** | | | | | | |
| Gillnet | 17 | 514 | 290-801 | 16 | 1,432 | 150-4,810 |
| Electrofishing | 16 | 563 | 292-775 | 16 | 1,529 | 152-3,440 |
| Angling | 1 | - | 538 | 1 | - | 1,450 |
| **TFR Total** | **34** | **538** | **290-801** | **33** | **1,479** | **150-4,810** |
| **Island Complex (IC)** | | | | | | |
| Gillnet | 37 | 602 | 327-1,088 | 37 | 2,346 | 220-12,000 |
| Electrofishing | 65 | 599 | 228-970 | 65 | 1,912 | 66-6,680 |
| Angling | 9 | 521 | 456-712 | 7 | 1,085 | 620-2,650 |
| **IC Total** | **111** | **594** | **228-1,088** | **109** | **2,006** | **66-12,000** |
| **TFR & IC TOTAL** | **145** | **581** | **228-1,008** | **142** | **1,884** | **66-12,000** |

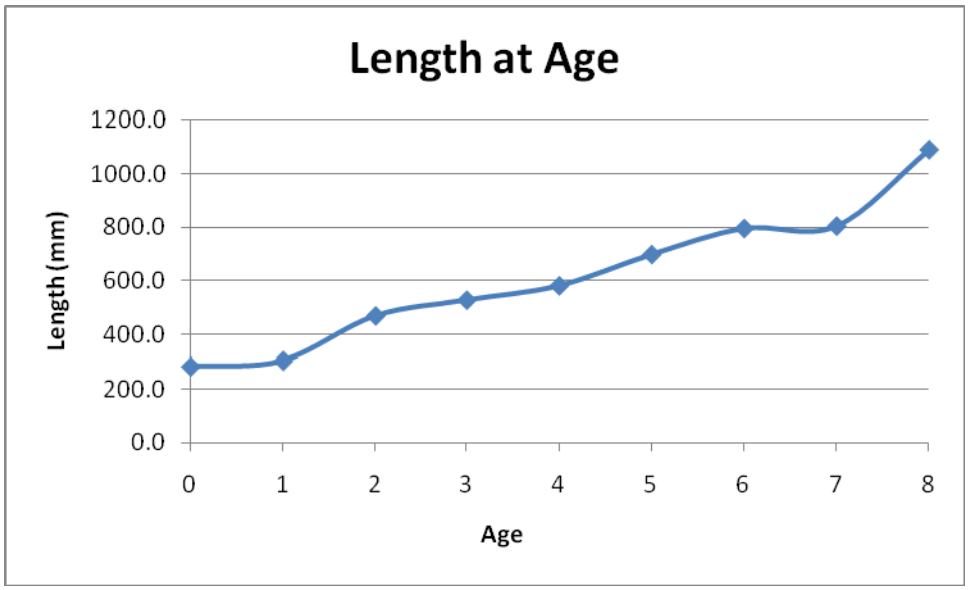
#### 3.4.1.2 Age

Of the 170 northern pike captured, a total of 116 were aged by scale analysis. Age data represents both sampling locations and ranges from 0 to 8 years. A summary of the age data is present in Table 3-4 and Figure 3-2.

**Table 3-4. Summary of age data for 116 northern pike sampled in the Thompson Falls Reservoir and Island Complex via gillnetting, electrofishing, and angling.**

| Estimate Age | Mean Length | Number of Northern Pike |
|---|---|---|
| 0 | 283 | 1 |
| 1 | 304 | 14 |
| 2 | 469 | 8 |
| 3 | 528 | 29 |
| 4 | 581 | 30 |
| 5 | 698 | 14 |
| 6 | 795 | 16 |
| 7 | 804 | 3 |
| 8 | 1,088 | 1 |

**Figure 3-2. Age estimate and length for 116 northern pike sampled via gillnetting, electrofishing, and angling in the Thompson Falls Reservoir and Island Complex.**




### *3.4.2 Population Estimate*

Population estimates were calculated for the Thompson Falls Reservoir and Island Complex locations using the Schumacher-Eschmeyer method. Out of the 25 sampling days, there were 16 sample days in the Thompson Falls Reservoir and 10 sample days in the Island Complex when fish were captured. All sampling techniques were included in the population estimate approximation. Population estimates and 95 percent confidence intervals are presented in Table 3-5 below.

**Table 3-5. Summary of the population estimates (N) and approximate 95 percent confidence limits for northern pike in the Thompson Falls Reservoir and Island Complex.**

| Location | N | 95% Lower Confidence Limit | 95% Upper Confidence Limit |
|---|---|---|---|
| Thompson Falls Reservoir | 177 | 98 | 918 |
| Island Complex | 562 | 309 | 636 |

### *3.4.3 Spawning*

Northern pike typically spawn in the spring after ice-out between March and May (Holton 2003). Typically, northern pike will spawn once water temperatures range between 46 and 53 degrees Fahrenheit (Casselman and Lewis 1996).

Because sampling for northern pike in this study corresponded to typical spawning season for northern pike, gametes were expressed from the urogenital pore to determine gender and as an indicator of spawning readiness. This study did not investigate spawning habitat or location.

During the sampling efforts between March and July 2009, the gender of 81 northern pike (63 males and 18 females) was recorded. The gender of the remaining 89 northern pike was either unknown or not recorded. Of the 63 males, 60 males were classified as ripe. Of the 18 females, 5 females were classified as gravid and 4 females were classified as spent. Ripe males were observed in the Thompson Falls Reservoir and Island Complex from April 6 through May 27. Gravid females were observed from April 20 through April 30. The four spent females were observed between April 30 and May 27. Gravid and spent females were only documented in the Island Complex. Female northern pike were observed in the Thompson Falls Reservoir; however, none were observed to be gravid or spent.

From March to June 2009, river temperatures ranged between 40 and 59 degrees Fahrenheit. When gravid females were observed in April, water temperatures were between 43 and 50 degrees Fahrenheit. Temperatures recorded in the field were within the range (46 to 53 degrees Fahrenheit) suitable for northern pike spawning (Casselman and Lewis 1996). River temperature and observed condition of female northern pike in 2009 indicate northern pike are spawning or preparing to spawn in April.

### *3.4.4 Diet Composition*

Gastric lavage was performed on 143 northern pike that were sampled between March and July 2009 in the Thompson Falls Reservoir and Island Complex. Of the 143 northern pike stomachs sampled, 84 were collected using electrofishing, 50 were collected using gillnetting, and nine were collected angling. A summary of the number of northern pike with stomach content versus empty stomachs is presented in Table 3-6 below.

**Table 3-6. Summary of gastric lavage performed on 143 northern pike. The data are summarized by sampling location and method, and whether the stomach was full or empty.**

| Sampling Location | Sampling Method | Stomach Content | Empty |
|---|---|---|---|
| Thompson Falls Reservoir (TFR) | Gillnetting | 3 | 11 |
| | Electrofishing | 6 | 10 |
| | Angling | 0 | 1 |
| Island Complex (IC) | Gillnetting | 13 | 23 |
| | Electrofishing | 35 | 33 |
| | Angling | 4 | 4 |
| **TFR & IC** | **TOTAL** | **61** | **82** |

Diet composition included fish, insects, leeches, worms, a frog, a pocket gopher, and grass. Of the 152 items identified in the stomachs, 118 (78 percent) were classified as fish (Figure 3-3). Fish species observed in the stomach content included mountain whitefish, peamouth, northern pikeminnow, rainbow/cutthroat trout, bull trout, largescale sucker, unknown sucker species, yellow perch, unknown *Oncorhynchus* spp., and unknown small fish. Unknown fish were 56 percent of stomach items, northern pikeminnow 22 percent, mountain whitefish 8 percent, and largescale sucker 8 percent. Unknown fish include small fish and fish parts that were not identified to the species level. One bull trout approximately 150 millimeters in length was recorded in a northern pike captured in the Island Complex via gillnetting on April 30. The northern pike that ate the bull trout was a ripe male that measured 480 millimeters in length and weighed 825 grams. Figure 3-4 shows the composition of fish species observed in the northern pike stomachs sampled in the Thompson Falls Reservoir and Island Complex.

**Figure 3-3. Summary of diet composition observed in the 61 northern pike stomachs sampled via gillnetting, electrofishing, and angling in the Thompson Falls Reservoir and Island Complex from March through July 2009.**

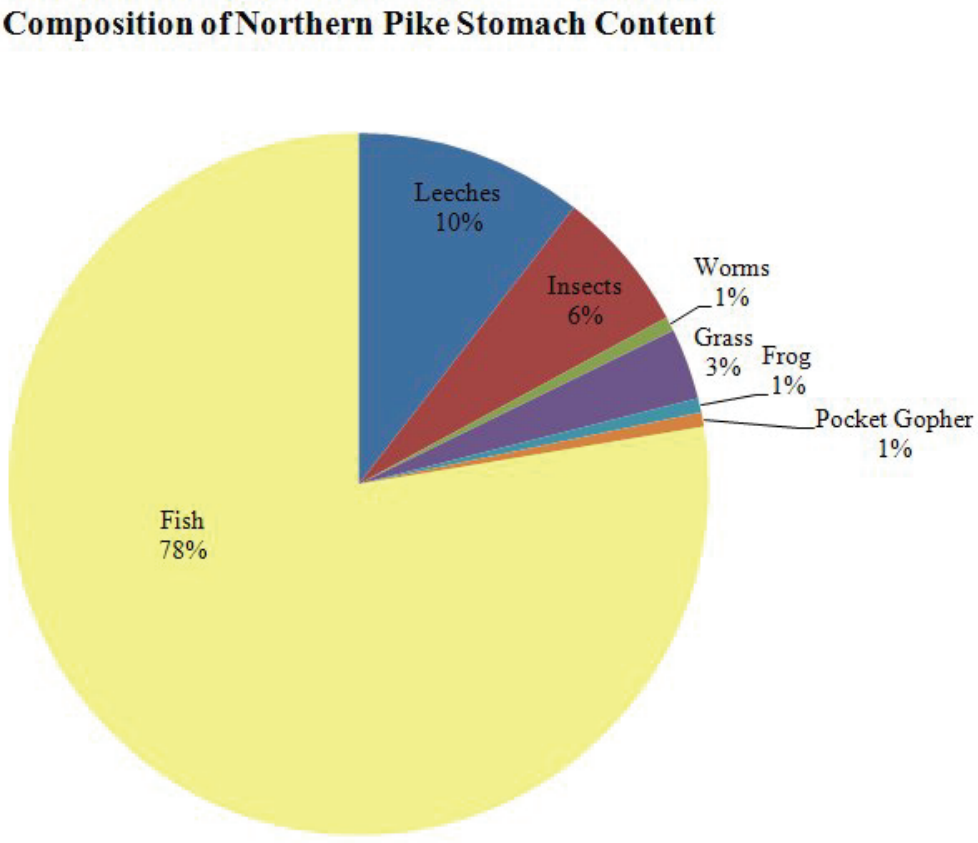
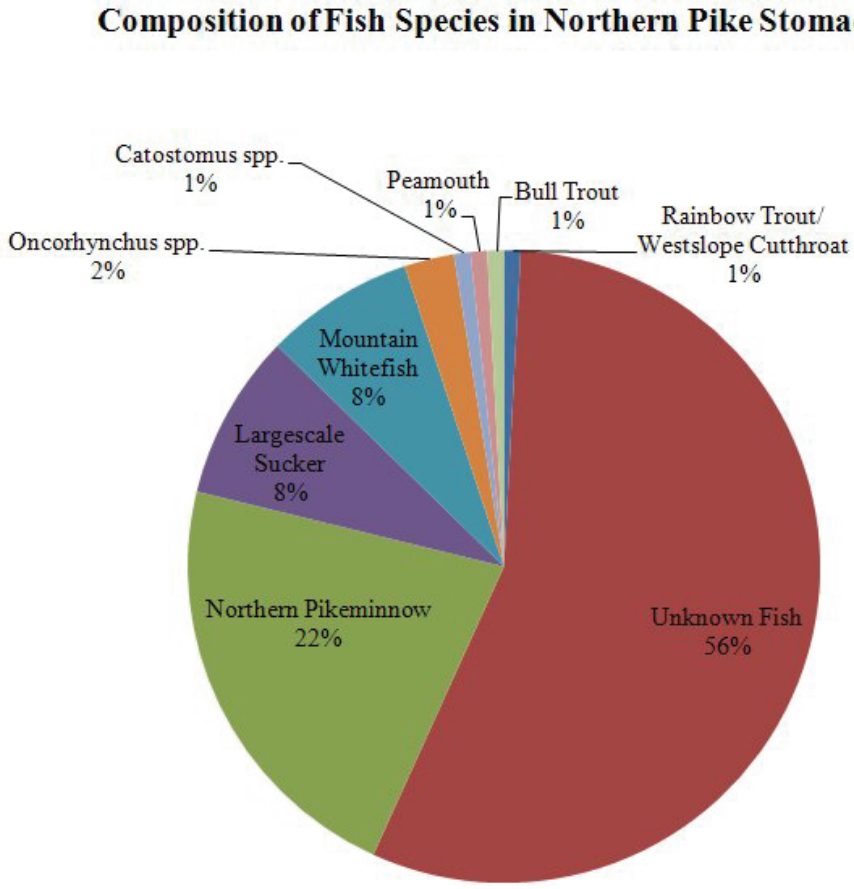


**Figure 3-4. Composition (by number) of fish species observed in the 61 northern pike stomachs sampled in the Thompson Falls Reservoir and Island Complex via electrofishing, gillnetting, and angling.**




### *3.4.5 Movement*

Northern pike movements between the Thompson Falls Reservoir and Island Complex were studied through the multiple mark-recapture census between March and July 2009. In 2009, all northern pike were marked with an orange floy tag upon their initial capture. Subsequent recaptures were then recorded and then released. Movement of northern pike was also documented through angler recovery of tagged northern pike. Anglers in the community contacted FWP and reported the floy tag number and location where they had caught a tagged northern pike. All northern pike caught and reported by anglers in 2009 had been initially tagged in 2009. All northern pike captured by anglers were removed from the system.

The mark-recapture efforts resulted in a total of 146 northern pike tagged with an orange floy tag between March and July 2009. Of the 146 northern pike, 112 fish were from the Island Complex and 34 were from the Thompson Falls Reservoir. During this study, a total of 24 northern pike were recaptured via gillnetting or electrofishing. All except one of the 24 recaptured northern pike had been initially tagged in 2009. One recapture had been marked with a yellow floy tag in April 2008.

Table 3-6 summarizes the northern pike recaptured during sampling efforts between March and July 2009. All 23 northern pike tagged and recaptured in 2009 were recaptured in the same sampling location. The northern pike that was tagged in April 2008 was initially captured in the Thompson Falls Reservoir and was recaptured in the Island Complex in 2009. Three tagged northern pike were captured multiple times during the 2009 study.

**Table 3-6. A summary of the recaptured northern pike, including the floy tag identification number, initial capture date, initial sampling location, initial sampling method, recapture date, recapture location, and recapture method.**

| Floy Tag ID | Initial Date | Initial Location | Initial Method | Recapture Date | Recapture Location | Recapture Method |
|---|---|---|---|---|---|---|
| 00002 | 3/27/2009 | IC | GN | 4/24/2009 | IC | EF |
| 00002 | 3/27/2009 | IC | GN | 5/27/2009 | IC | EF |
| 00002 | 3/27/2009 | IC | GN | 5/29/2009 | IC | EF |
| 00005 | 4/1/2009 | IC | Angling | 4/30/2009 | IC | EF |
| 00007 | 4/6/2009 | IC | Angling | 4/30/2009 | IC | EF |
| 00034 | 4/20/2009 | IC | GN | 4/24/2009 | IC | GN |
| 00034 | 4/20/2009 | IC | GN | 5/27/2009 | IC | EF |
| 00035 | 4/20/2009 | IC | GN | 5/15/2009 | IC | EF |
| 00057 | 4/24/2009 | IC | EF | 5/27/2009 | IC | EF |
| 00065 | 4/24/2009 | IC | EF | 5/15/2009 | IC | EF |
| 00070 | 4/24/2009 | IC | EF | 6/18/2009 | IC | EF |
| 00073 | 4/24/2009 | IC | EF | 5/15/2009 | IC | EF |
| 00075 | 4/24/2009 | IC | EF | 5/20/2009 | IC | EF |
| 00089 | 4/30/2009 | IC | EF | 5/15/2009 | IC | EF |
| 00091 | 4/30/2009 | IC | EF | 5/20/2009 | IC | EF |
| 00094 | 4/30/2009 | IC | GN | 5/4/2009 | IC | GN |
| 00094 | 4/30/2009 | IC | GN | 5/29/2009 | IC | EF |
| 00112 | 5/8/2009 | IC | GN | 6/18/2009 | IC | EF |
| 00131 | 5/20/2009 | IC | EF | 5/27/2009 | IC | EF |
| 00030 | 4/17/2009 | TFR | GN | 4/27/2009 | TFR | EF |
| 00048 | 4/20/2009 | TFR | EF | 5/7/2009 | TFR | GN |
| 00047 | 4/20/2009 | TFR | EF | 4/27/2009 | TFR | EF |
| 00103 | 5/1/2009 | TFR | EF | 5/7/2009 | TFR | GN |
| 16760 (yellow) | 4/28/2008 | TFR | EF | 5/29/09 | IC | EF |

IC = Island Complex, TFR = Thompson Falls Reservoir, GN = gillnetting, EF = electrofishing

FWP was contacted by several anglers between May 15 and December 11, 2009 with location information for 20 northern pike marked with floy tags. Angling reports indicate approximate 14 percent of tagged northern pike from this study were harvested. A summary of the initial sampling date and location and anglers' harvest date and location for each northern pike is provided in Table 3-7 below.

**Table 3-7. Summary of anglers reports for the northern pike recaptured in 2009.**

| Initial Sample Date | Initial Location | Recapture Date by Angler | Recapture Location |
|---|---|---|---|
| March 26, 2009 | TFR | August 12, 2009 | TFR |
| March 27, 2009 | IC | December 11, 2009 | TFR |
| April 6, 2009 | IC | September 6, 2009 | IC |
| April 9, 2009 | IC | May 17, 2009 | TFR |
| April 15, 2009 | IC | September 6, 2009 | IC |
| April 20, 2009 | TFR | May 2, 2009 | Unknown |
| April 20, 2009 | TFR | May 15, 2009 | Unknown |
| April 20, 2009 | TFR | December 9, 2009 | TFR |
| April 24, 2009 | IC | May 17, 2009 | TFR |
| April 30, 2009 | IC | September 6, 2009 | IC |
| May 1, 2009 | TFR | September 12, 2009 | Downstream of Thompson Falls Dam |
| May 7, 2009 | TFR | August 17, 2009 | TFR |
| May 7, 2009 | TFR | September 7, 2009 | Downstream of Thompson Falls Dam near Birdland Bay |
| May 8, 2009 | IC | September 6, 2009 | IC |
| May 11, 2009 | TFR | July 5, 2009 | Near Plains, Montana |
| May 15, 2009 | IC | June 24, 2009 | IC |
| May 15, 2009 | IC | August 20, 2009 | IC |
| May 20, 2009 | IC | August 12, 2009 | Unknown |
| May 27, 2009 | IC | July 11, 2009 | IC |
| May 28, 2009 | TFR | August 28, 2009 | TFR |

TFR = Thompson Falls Reservoir and IC = Island Complex

In three of the 20 angler reports, the location where the northern pike were captured was not provided. In 11 reports, the angler caught the northern pike in the same general location as it had been initially tagged. In the remaining six reports, the northern pike was caught in a new location. This information reported by the anglers illustrated various movement patterns by northern pike. These movements included three northern pike that were initially tagged in the Island Complex that were later caught in the Thompson Falls Reservoir; two northern pike tagged in the Thompson Falls Reservoir that were later caught downstream of the Thompson Falls Dam; and one northern pike tagged in the Thompson Falls Reservoir that was caught upstream, near Plains (approximately 22 miles southeast of Thompson Falls).

Data collected in 2009 indicate northern pike are not isolated to the Thompson Falls Reservoir or the Island Complex. Northern pike move between these two locations and migrate up and downstream of these two locations. This study did not cover all seasons; therefore seasonal movements were not extrapolated from these data.

### *3.4.6 Fall Sampling 2009*

Gillnetting efforts were also conducted in October 2009. On October 9 and 16, 2009 gillnetting efforts were completed in the Island Complex. On October 8 and 15, 2009 gillnetting efforts were completed in the Thompson Falls Reservoir. No fish were captured via gillnetting in the Thompson Falls Reservoir on October 15. Methods for fall gillnetting were the same as spring sampling efforts.

As a result of the October 2009 gillnetting efforts, a total of three fish species were captured, including one rainbow trout in the Island Complex, one yellow perch in the Thompson Falls Reservoir, two yellow perch in the Island Complex, and 15 northern pike in the Island Complex. No northern pike were captured during October gillnetting efforts in the Thompson Falls Reservoir.

Of the 15 northern pike captured in the Island Complex the length and weight averaged 347 mm (range 279 to 616 mm) and 247 g (130 to 1,700 g), respectively. Annual data collection, including electrofishing and gillnetting, as part of the long-term Thompson Falls monitoring study was conducted from October 19 through 21, 2009. Summary of these data are presented in Section 2.0 Baseline Fisheries Studies.

## 3.5 Discussion

The 2009 study has provided information on population characteristics, spawning, diet composition, and movement for northern pike present in the Thompson Falls Reservoir and Island Complex. This information has been presented to the Thompson Falls Technical Advisory Committee (TAC) and used to determine whether aspects of this study shall be continued or modified in 2010 and to identify new goals and objectives for 2010.

During the February 1, 2010 Thompson Falls TAC meeting, the TAC agreed to continue baseline fisheries data in 2010 but to defer additional reservoir studies, including studies on northern pike, until the 5-year Reservoir Plan was complete. In 2010, PPL Montana will collaborate with FWS and TAC members to develop the 5-year (2010-2015) Reservoir Plan in compliance with the FWS Biological Opinion Terms and Conditions #7. This plan will be developed and submitted to FERC by December 31, 2010.

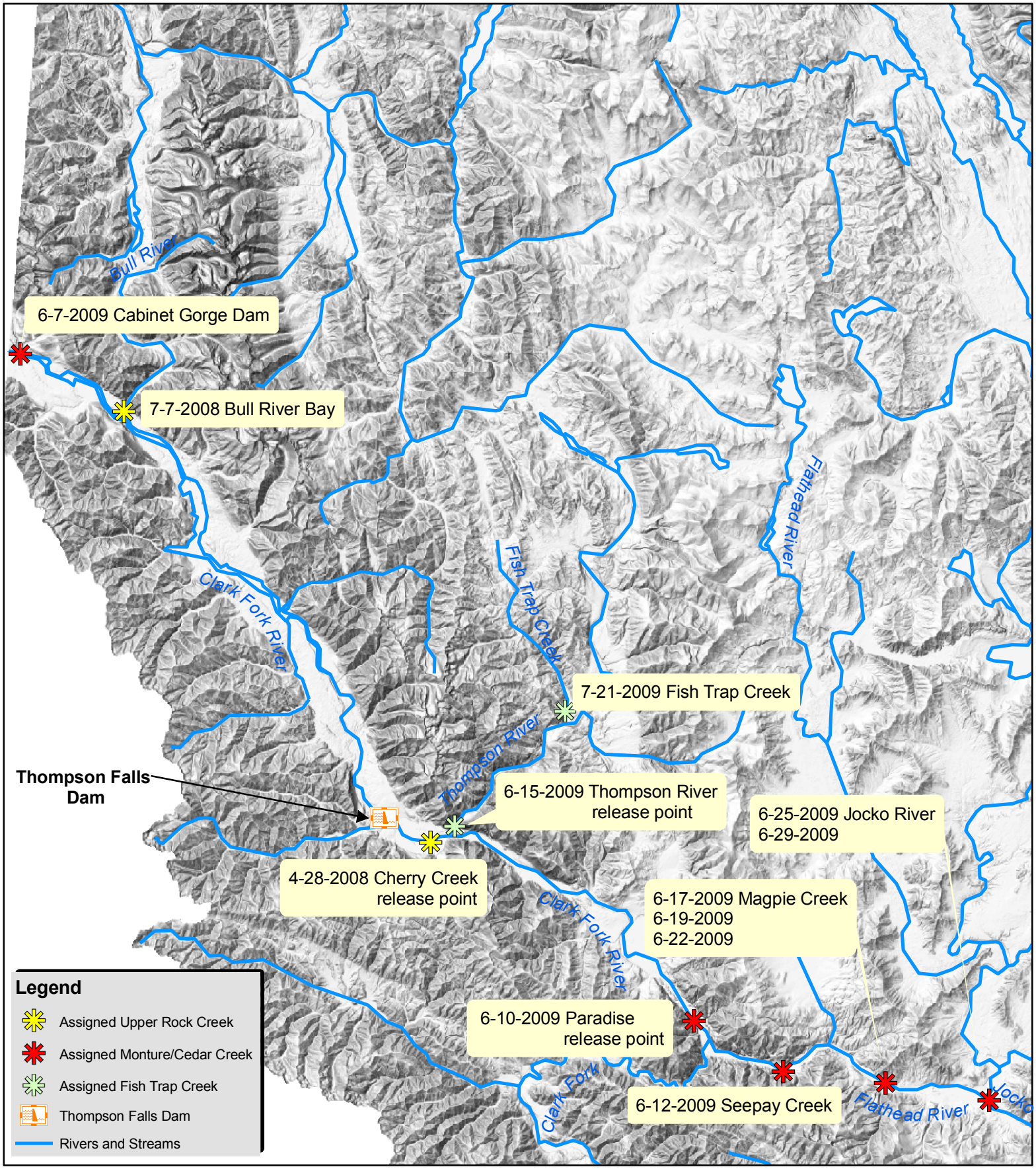
# 4.0 Bull Trout Genetics

Genetic testing was conducted at the U.S. Fish and Wildlife Service Abernathy Fish Technology Center using methods described by DeHaan and Arden (2008). Genetic assignment testing was used to determine the natal stream of bull trout captured downstream of Cabinet Gorge Dam. Bull trout assigned to natal streams upstream of Thompson Falls Dam (Region 4) were transported via truck to Region 4. Table A-1 displays all bull trout that were captured and transported to region 4 from below Cabinet Gorge Dam during 2008 and 2009.

In 2008 one bull trout genetically assigned to Upper Rock Creek near Missoula, Montana was transported to Region 4. Movements recorded by this bull trout are shown on Figure 4-1. This fish (radio tag # 149.740) was released April 28, 2008 at the mouth of Cherry Creek. Tracking was attempted both upstream and downstream of the release location. No detections from mobile tracking were recorded until July 7, 2008 when the fish was detected 2 miles downstream of Bull River Bay, downstream of both Thompson Falls Dam and Noxon Rapids Dam. It is not known whether the fish was alive or dead at the time of the detection.

In 2009 a 580 millimeter bull trout was implanted with radio tag # 148.500.55 and genetically assigned to Monture Creek. Movements recorded for this bull trout are shown on Figure 4-1. On June 10, 2009 this fish was transported to the Clark Fork River near Paradise, Montana at the Pair-a-Dice fishing access site. A stationary remote receiver was installed on the Clark Fork River 1 mile above the Flathead River confluence on June 23, 2009. Tracking was attempted two times a week by FWP personnel. Mobile telemetry located this fish approximately 0.5 miles up the Flathead River on June 11, 2009; 5 miles up the Flathead on June 12, 2009, and 18 miles up the Flathead (Magpie Creek mouth) on June 15, 2009. Confederated Salish Kootenai Tribes (CSKT) fishery personnel took over telemetry monitoring on June 16, 2009. This fish was last located on June 25, 2009, 0.5 miles above the Flathead and Jocko River confluence at the Town of Dixon. Numerous efforts using road, boat, and aerial telemetry were made to locate this fish in the Flathead and Jocko River systems to no avail and there were no detections on the remote receiver before it was taken out in October 2009. Due to the fish's last location in a popular fishing hole, and evidence of camping and bait fishing at this location, illegal capture is suspected to be the cause for the disappearance of the bull trout.

This fish proved a challenge to locate at times with low signal strengths received several times. It is worthy to note that this bull trout did not conform to the genetic assignment information, as it traveled up the Flathead River to the confluence of the Jocko River, as opposed to migrating up the Clark Fork River to either Monture Creek or the second most likely tributary of origin, Cedar Creek.




Montana shaded relief greyscale

N W E S

0 5 10 20
Miles

1 in = 10 miles

SCALE 1:635,000

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PATH: M:/4421.002.02
DRAWN BY: RJM
CHECKED BY: KMW

# Thompson Falls Project

Bull Trout Locations and Date

PROJECT NUMBER
**4421.002.02**

FIGURE NUMBER
**4-1**

One bull trout was unintentionally captured in Thompson Falls Reservoir during spring gillnetting as part of the northern pike population estimate. The fish was captured May 1, 2009 in a short set gillnet and released on site. It was 271 millimeters in length and weighed 174 grams. PIT tag # 985121009494278 was implanted and a fin clip sample was collected for genetic assignment testing. The bull trout genetically assigned to Fishtrap Creek.

A bull trout (PIT tag # 985120029215361) collected June 11, 2009 by hook and line sampling in the Clark Fork River below Cabinet Gorge Dam was released in the Thompson River June 15, 2009. It was 710 millimeters in length and weighed 3,686 grams. This fish was recaptured during electrofishing in Fishtrap Creek (a tributary of the Thompson River) on July 21, 2009. It appeared to be paired up with another bull trout, based on visual observation.

# 5.0 Gas Bubble Trauma

Dissolved gas super-saturation can cause a variety of physiological symptoms known as gas bubble trauma (GBT), which can be harmful or fatal to fish and other aquatic organisms. In 2008 and 2009, PPL Montana and FWP captured fish during high flow and visually examined fish for signs of GBT.

## 5.1 2008 GBT Data

Fish were sampled via electrofishing and evaluated for GBT six times between May 19 and June 23, 2008. Electrofishing was conducted via boat using the same methodologies as described in Section 2.0 for the baseline fisheries data collection. Fish were sampled downstream of Thompson Falls Dam and upstream of the Highway 200 Bridge. River flows during fish sampling varied from 55,197 cfs to 76,889 cfs. Fish were captured and visually inspected for signs of GBT before being released. The gills, lateral line, dorsal fin, and caudal fin were visually examined for blistering, bubbling, boils, or discoloration of the gills.

A total of 220 fish representing 16 species were collected between May and June 2008. Fish collected included one bull trout, four westslope cutthroat trout, 13 brown trout, 52 rainbow trout, one westslope cutthroat X rainbow trout, 29 mountain whitefish, nine northern pikeminnow, 35 peamouth, one kokanee (*Oncorhynchus nerka*), two largemouth bass, 16 smallmouth bass, two yellow perch, three northern pike, 13 lake whitefish (*Coregonus clupeaformis*), 36 largescale suckers, and three longnose suckers (*Catostomus catostomus*).

Of the 220 fish, one lake whitefish sampled on June 3, displayed visual signs of GBT. The signs documented included visual markings on the caudal fin, pelvic fins, dorsal fin, and anal fin, as well as signs of hemorrhaging and discoloration of the gills (darker than normal).

## 5.2 2009 GBT Data

In 2009 (May 28 and June 4), PPL Montana and FWP captured fish via electrofishing downstream of the Thompson Falls Dam and upstream of the Highway 200 Bridge. Electrofishing was conducted via boat using the same methodologies as described in Section 2.0 for baseline fisheries data collection. River flows during fish sampling varied from 54,880 cfs on May 28 to 57,154 cfs on June 4.

A total of 276 fish representing 14 species were examined for visual signs of GBT. The gills, lateral line, dorsal fin, and caudal fin were visually examined for blistering, bubbling, boils, or discoloration of the gills.

After visual examination of all 276 fish, there were no visual indications of any fish exhibiting GBT symptoms. Species totals were: 146 largescale sucker, 17 rainbow trout, four lake trout, six lake whitefish, three brown trout, 10 mountain whitefish, 49 smallmouth bass, six longnose sucker, 13 northern pikeminnow, 15 peamouth, four westslope cutthroat trout, one northern pike, one westslope cutthroat X rainbow trout hybrid, one sculpin (*Cottus* sp.).

PPL Montana is in the process of preparing a Totaled Dissolved Gas (TDG) Study Plan, which will be submitted to the TAC, including Montana Department of Evironmental Quality, for their review and comment. The Plan will include a summary of previous 2009 studies, with a discussion of results, and lessons learned. A plan for ongoing TDG studies will be described.

GBT monitoring will continue in 2010 and be reported in the 2010 Annual Report submitted to FERC on April 1, 2011. GBT monitoring will be initiated when river flows reach or exceed 50,000 cfs.

# 6.0 Water Temperature

The Biological Opinion for Thompson Falls Dam requires that PPL Montana, with TAC involvement and FWS approval, conduct a prioritized 5-year evaluation of factors contributing to the potential loss or enhancement of migratory bull trout passage through Thompson Falls Reservoir. This study is to focus, at a minimum, on better understanding temperature and water current gradients through the reservoir; travel time; residence time; pathways that juvenile and subadult bull trout select in moving through the reservoir; and an assessment of impacts of predatory nonnative fish species on juvenile and subadult bull trout residing in or passing through the reservoir.

This study began in 2009, with data collection on temperature gradients in Thompson Falls Reservoir. The Thompson River is a tributary to the Clark Fork River that enters Thompson Falls Reservoir at the upstream end of the Reservoir. The TAC has hypothesized that water temperature is colder in the Thompson River than in the Clark Fork River during the summer, and that there may be a cold water thermal plume in the reservoir in the summer months.

Bull trout are known to prefer cold water, and may seek out this cold water thermal plume, if it exists. The goal of the research in 2009 was to determine if there are thermal gradients in Thompson Falls Reservoir downstream of the Thompson River that could potentially be used as a migratory corridor by bull trout.

## 6.1 Methods

Water temperature data were collected on July 21, 2009 along three transects in Thompson Falls Reservoir. The locations of the three transects are shown on Figure 6-1. Each transects covered a horizontal section of water (right bank to left bank). Transect 1 was located 100 meters downstream of the Thompson River mouth, from right bank to left bank. Transect 2 was approximately 1 mile downstream of the Thompson River mouth, from right bank to left bank. Transect 3 was located approximately 2 miles downstream of the Thompson River mouth near the Cherry Creek boat launch, from right bank to left bank. Two to three temperature profiles were taken along each transect. Temperature data was collected from the surface to the bottom of reservoir. Maximum depth for the temperature profile data ranged between approximately 6 feet to 47 feet.

Water temperature data was also collected on July 30, 2009 in the Thompson Falls Reservoir. Water temperature data were collected in Thompson Falls Reservoir starting at the mouth of Thompson River and continuing downstream approximately 100 meters until there was no cold water influence from the Thompson River. Several temperature profiles were taken from the surface to the bottom depth. Specific locations for data collected on July 30, 2009 are not available.


Montana 2005 Color NAIP Orthophotos

N W E S

0 2,000 4,000 8,000
Feet

1 inch = 4,000 feet

SCALE
1:48,000

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**Thompson Falls Water Temperature Transects**

**AERIAL MAP**

PROJECT NUMBER
**4421.002.02**

FIGURE NUMBER
**6-1**

Water temperature was continuously recorded in the Clark Fork River just upstream of the Thompson River and in Thompson Falls Reservoir immediately downstream of Cherry Creek from March 16, 2009 to October 19, 2009.

Additionally in 2007, water temperature data was continuously recorded at several locations in the Project area over several months. These data are useful for comparing water temperature upstream and downstream of the Project.

## 6.2 Results

### *6.2.1 Transects with Temperature Profiles*

The temperature of Thompson Falls Reservoir was nearly uniform on July 21, 2009. Temperatures were approximately 68 degrees Fahrenheit at almost all locations and depths. Two profiles (Transect 1 Profiles A and B) showed slightly colder temperatures (58 to 59 degrees Fahrenheit), but no evidence of a significant thermal plume from the Thompson River (Figures 6-2, 6-3, 6-4). The areas where cooler water was measured were located approximately 100 meters downstream of the mouth of the Thompson River, within 50 meters of the right bank of the Thompson Falls Reservoir. This was the only area of the reservoir that was found to be cooler than the main body of the reservoir. There was no indication that a thermal plume extending from the Thompson River downstream to the Thompson Falls Dam exists. The data indicate no measurable variation in water temperature from the Thompson Falls Reservoir and Thompson River by Transect 2, approximately 1 mile downstream of the confluence with the Thompson River (Figure 6-3).

**Figure 6-2. Transect 1 - Temperature profiles, Thompson Falls Reservoir, July 21, 2009.**

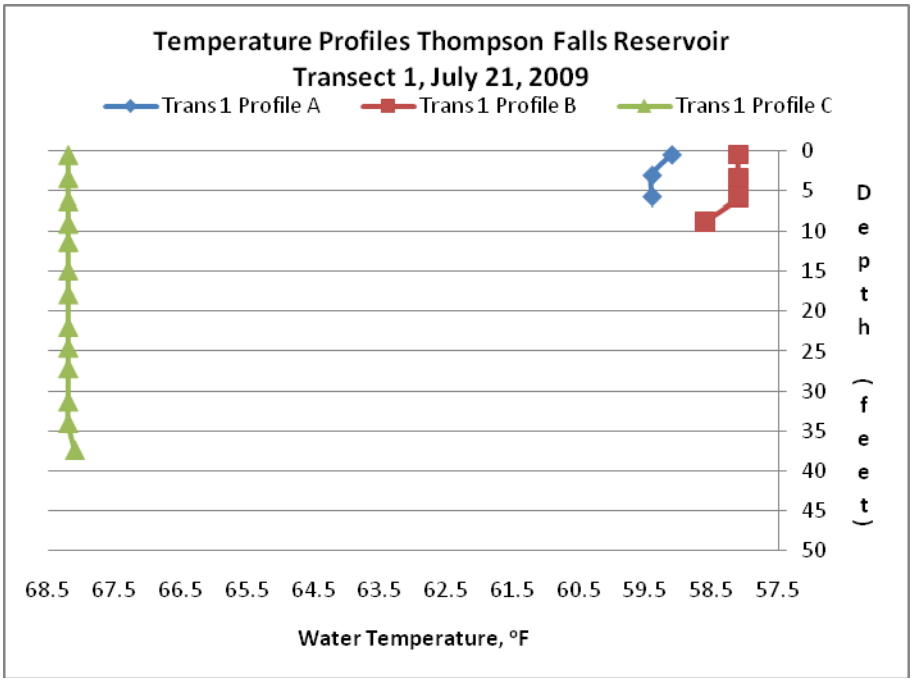


**Figure 6-3. Transect 2 - Temperature profiles, Thompson Falls Reservoir, July 21, 2009.**

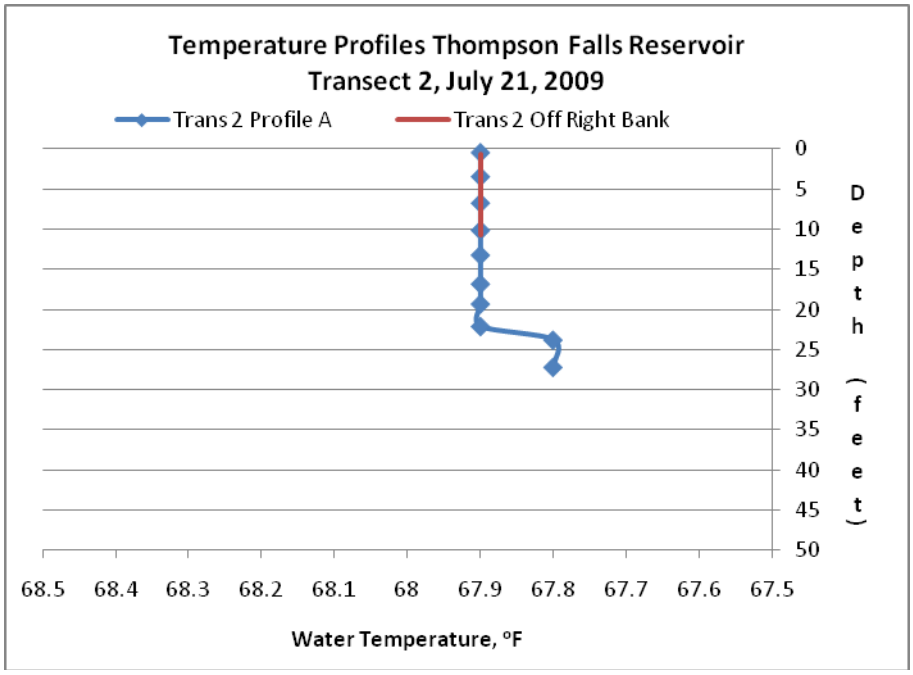
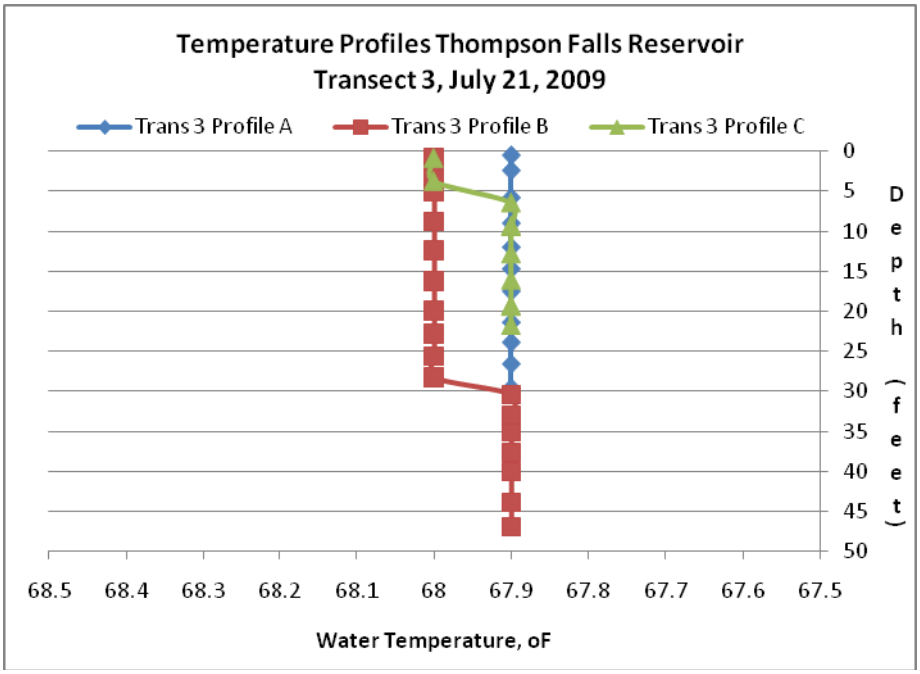


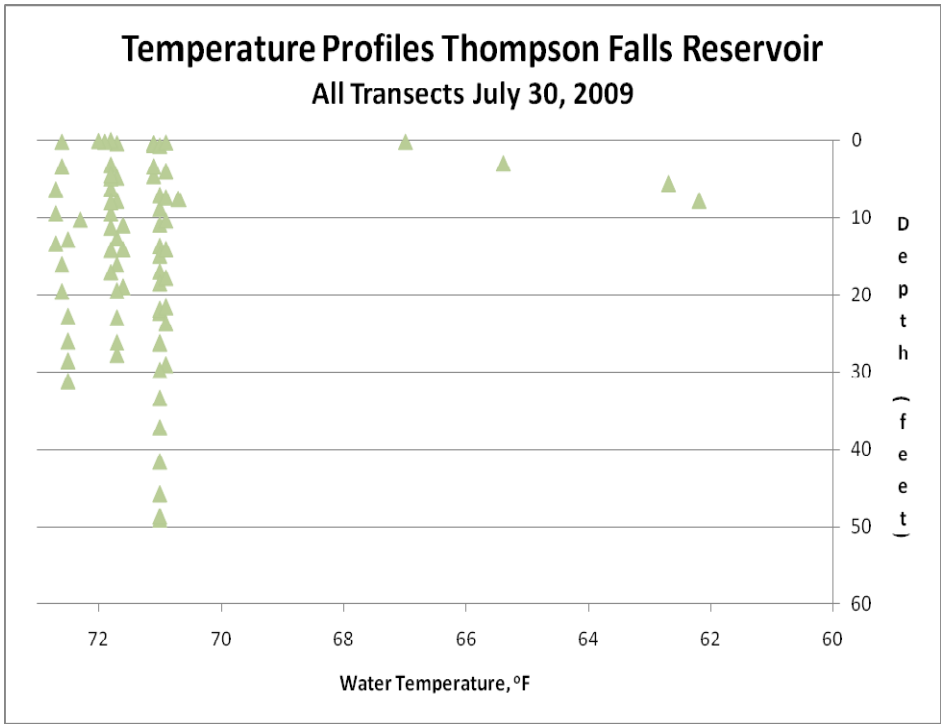

**Figure 6-4. Transect 3 - Temperature profiles, Thompson Falls Reservoir, July 21, 2009.**




On July 30, 2009, water temperatures had warmed between 71 to 73 degrees Fahrenheit in Thompson Falls Reservoir. There was still no evidence of thermal plume extending from the Thompson River to Thompson Falls Dam. A few cooler, shallow water locations were recorded

immediately downstream of the mouth of the Thompson River (Figure 6-5), but were not detected approximately 100 meters downstream of the confluence with the Thompson River.

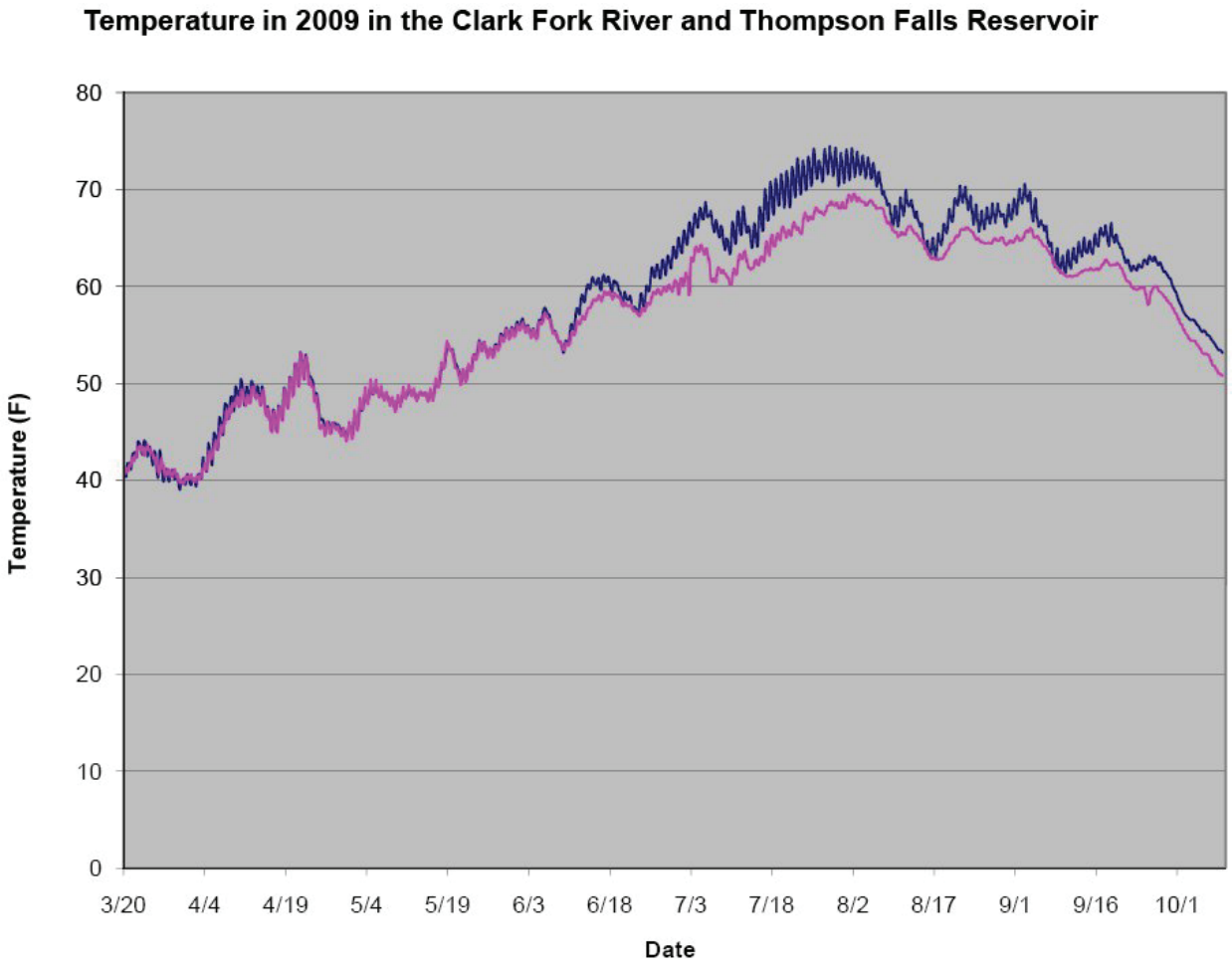
**Figure 6-5. Water temperature measured in Thompson Falls Reservoir July 30, 2009.**




### *6.2.2 Continuous Water Temperature Data*

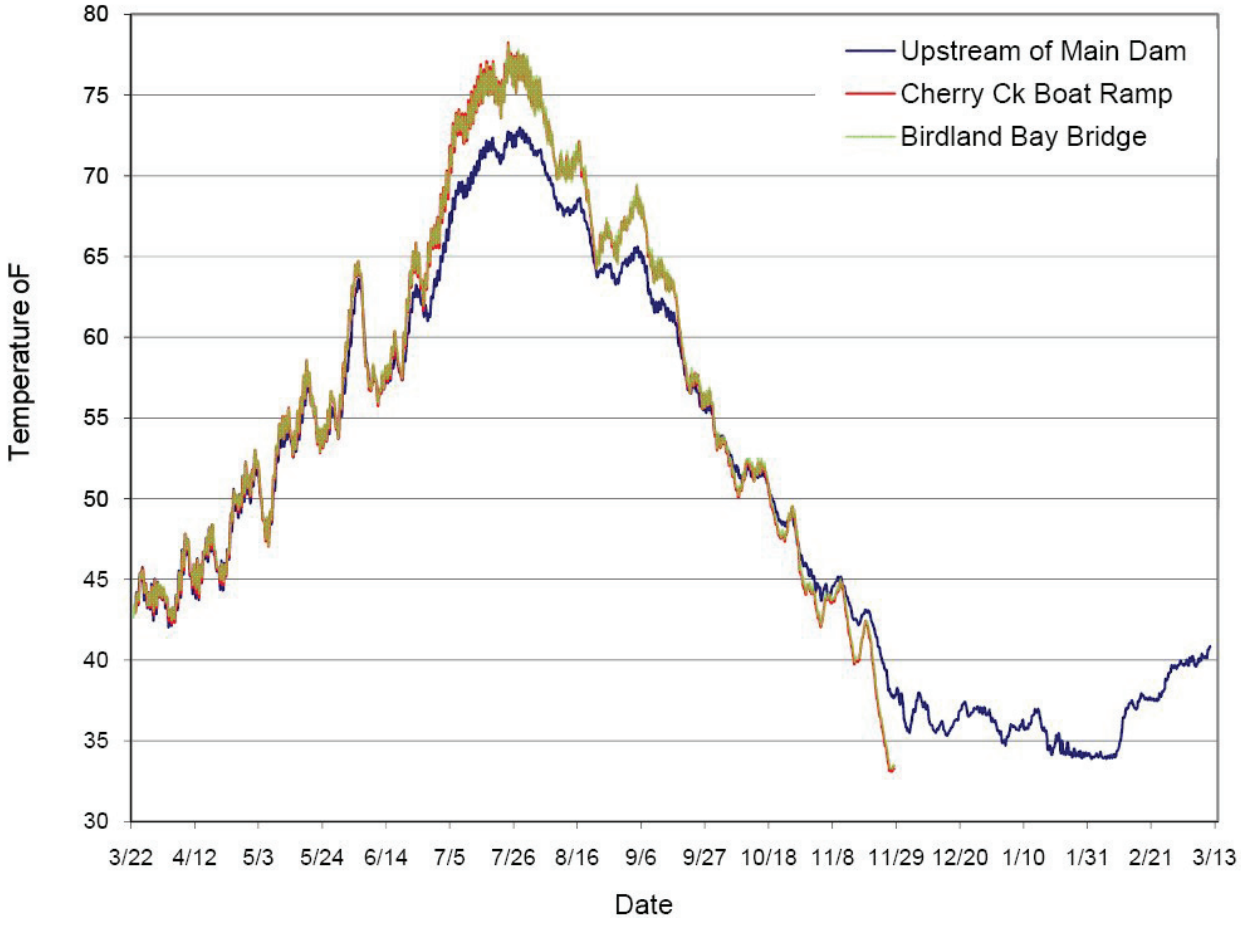
Water temperatures measured at two locations: the Clark Fork River upstream of the Thompson River and Thompson Falls Reservoir downstream of Cherry Creek were nearly identical during the spring of 2009. However, starting in early June, the Clark Fork River upstream of the Thompson River (upstream site) was slightly warmer than the site downstream of Cherry Creek (Figure 6-6). Maximum water temperature at the upper site on the Clark Fork River exceeded 70 degrees Fahrenheit from July 16 to August 6, 2009. Water temperature measured at the downstream site did not exceed 69 degrees Fahrenheit. The cooler water measured at Cherry Creek, approximately 2 miles downstream of the Thompson River, is not believed to be influenced by Thompson River. Water temperature profile data collected in July 2009 (Figure 6-2, 6-3, 6-4) detected the presence of a small thermal plume influenced by Thompson River extending 100 meters downstream of its confluence.

**Figure 6-6. Water temperature in the Clark Fork River upstream of the Thompson River (blue) and Thompson Falls Reservoir downstream of Cherry Creek (pink) in 2009. From continuous recorders.**




Temperature measures made in 2007 show that water temperature at Thompson Falls Dam (immediately upstream of the Main Dam) and at the Birdland Bay Bridge (downstream of the Project) are nearly identical (Figure 6-7). In the spring and fall, water temperatures in the Thompson Falls Reservoir (near the Cherry Creek Boat Ramp) were very similar to temperatures downstream. In the summer months, Thompson Falls Reservoir is several degrees cooler than water at Thompson Falls Dam and at the Birdland Bay Bridge (Figure 6-7). It is not unusual for water temperature to increase in a river system in a downstream direction.

**Figure 6-7. Water temperature measured at three sites in the Thompson Falls Hydroelectric Project area in 2007. Black line is water temperature measured at Birdland Bay Bridge (downstream of project), red line is water temperature measured upstream of the Main Dam, and the blue line is measured near the Cherry Creek boat ramp.**




## 6.3 Conclusions

Water temperature data collected in Thompson Falls Reservoir in summer 2009 indicate that there is no detectable thermal plume extending from the Thompson River downstream to Thompson Falls Dam. It appears there may be a thermal plume from the Thompson River extending approximately 100 meters downstream of its confluence and 50 feet from the right bank. Additional water temperature data indicate there may also be some cool water potentially from groundwater inflow, near Cherry Creek, approximately 2 miles downstream from the Thompson River. Based on the data available to date, it does not appear that there are cool water zones in Thompson Falls Reservoir that could be used by bull trout as a migratory corridor through the reservoir upstream to Thompson River.

# 7.0 Technical Advisory Committee Funded Projects

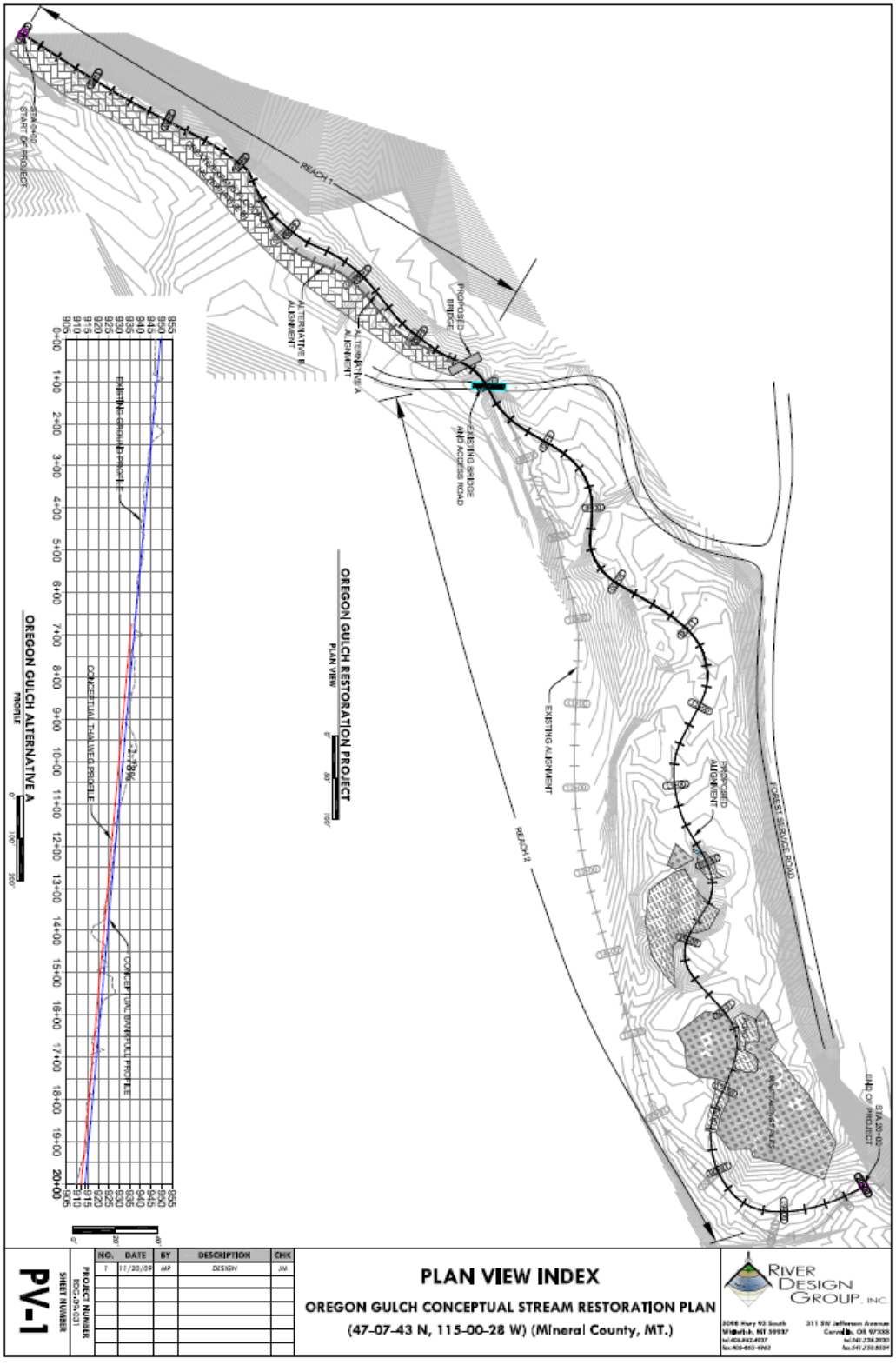
## 7.1 Oregon Gulch Mine Restoration

Trout Unlimited was awarded $15,000 in 2009 by the Thompson Falls Bull Trout protection, mitigation, and enhancement (PM&E) Fund for a design document for restoration and revegetation of 1,500 feet of stream channel and 10 acres of adjacent floodplain on Oregon Gulch. Oregon Gulch is a third order tributary of Cedar Creek, which flows into the Middle Clark Fork River near the town of Superior, Montana. Fluvial bull trout have been documented spawning in lower Oregon Gulch since 2002, and this area consistently produces the highest redd counts in the Cedar Creek watershed. The project location is a private land parcel that was heavily mined in the 1970s and prevents upstream fish migration during summer low flows.

TU staff and volunteers collected physical survey data at the Oregon Gulch mine site. Measurements included 1,750 feet of stream longitudinal profile and six cross sections that characterized the disturbances to the stream channel and floodplain. This information was collected as a baseline to estimate project limits, fill quantities, extent of riparian disturbance, etc., and to ground-truth consultant proposals and cost estimates.

TU distributed a Request for Proposals and selected River Design Group (RDG) to analyze the existing survey data, collect additional information, and develop a proposed design for channel realignment (planform and profile), habitat and bank stabilization features, dredge tailings management, and recommendations for reconstruction or realignment of the existing access bridge. RDG completed the conceptual design in October 2009 for 2,000 feet of channel restoration (Appendix B).

The recommendation is for full channel reconstruction to address the lack of surface water connectivity, impaired fish habitat, and channel modification. A moderately entrenched channel characterized by riffle-pool bedforms and cobble substrate will be constructed on the surface of the historical floodplain, as shown in Drawing PV-1. This planform will re-establish hydrologic connectivity between the channel and historical floodplain by providing a minimum meander belt width of 60 feet. Additional benefits would be increased channel length, geomorphic stability, improved late-season water storage in the floodplain, and improved spawning, rearing, and overwintering habitat conditions. The existing Oregon Gulch channel will be partially filled and/or plugged with existing dredge pile materials and material generated from new channel construction. Rather than disturb the existing vegetated levee that separates the historical floodplain surface and existing channel, RDG recommends maintaining this feature and utilizing the approximate 4,500 cubic yards of dredge material for construction of the plugs and fill.




**Drawing PV-1. Plan view Oregon Gulch Conceptual Stream Restoration Plan.**

TU plans to implement the project during the 2010 July-August bull trout construction window. TU will primarily be responsible for contracting, grant reporting and project implementation. MFWP will assist with project permitting and oversight, and conduct fisheries and aquatic monitoring.

## 7.2 Fish Creek Aquatic Habitat Passage Enhancement

Trout Unlimited (TU) was awarded $24,000 in 2009 by the Thompson Falls Bull Trout PM&E Fund for watershed rehabilitation work in the Fish Creek drainage to improve bull trout habitat and connectivity. TU, The Nature Conservancy, (TNC) and FWP proposed to restore aquatic passage at several prioritized sites within Fish Creek in conjunction with other work being performed in the drainage. Funds of $24,000 from PPL Montana were used on the Surveyor Creek and Bear Creek culvert removal projects; however, this report describes all of the projects completed in Fish Creek this year.

On North Fork Surveyor Creek two undersized culverts were removed. Decommissioned roads included a half mile of road along North Fork Surveyor Creek and 4.5 miles of upland roads on the south side of the creek and four smaller culverts. In decommissioning roads in the Fish Creek drainage, USFS “Road Storage” protocols were followed. Weeds were sprayed; the surface was ripped down to 18 inches; all culverts were removed, additional cross-drainage and waterbars were added, and reseeded with a native grass/forb mix.

In the lower Bear Creek drainage, two undersized culverts were removed and an administrative-use-only drivable fords were created. The initial intention was to replace the culverts, but during construction it was determined that drivable fords would be more appropriate and beneficial to the resource. All remaining upstream culverts were removed and hauled away and 25 miles of road were decommissioned. This represents virtually all roads in the Bear Creek drainage. In Wig Creek, two culverts were removed and one half mile of road was decommissioned. In Deer Creek 6 miles of road on the south side of the creek and 3 miles of road on the north side of the creek were decommissioned (culverts in this area had already been removed by Plum Creek Timber).

On main Thompson Creek, the two upper-most culverts were removed; as were six secondary culverts; and 7 miles of road were decommissioned. On Chicken Creek, the “last stop” in Fish Creek, two culverts were removed; 0.75 mile of closed road was decommissioned; and 200 yards of road was fully obliterated

FWP will continue monitoring Project reaches in Bear Creek, Surveyor Creek, Thompson Creek, and other tributaries as part of ongoing watershed acquisition, restoration, and native fish assessment efforts in Fish Creek. These include periodic evaluation of fish species composition, genetic composition, and native species abundance in tributaries, as well as monitoring of bull

trout spawning escapement through redd counts. The stability of stream project sites and success of revegetation will be evaluated over the next decade as FWP manages these parcels.

TNC, a partner in the Project, led a tour of construction sites with Mineral County's Fish Creek Advisory Council and FWP staff, and presented the results at a community meeting. Ongoing communication and education will be necessary to inform local community users of the biological and community benefits of these and future road improvement projects.

This stream restoration work is an example of collaboration at its best. With the help of partners, agencies, and volunteers we were able to complete much more than anticipated. Mineral County provided one full day of equipment work. FWP fisheries biologist Ladd Knotek worked on the projects, attended several site visits, provided design advice, and acquired all necessary permits. Steve Kloetzel from TNC provided numerous hours toward oversight on stream crossing remediation, weed treatment, and road removal. Volunteer assistance provided by Adam Liljeblad of the National Forest Foundation. In addition, TNC staff Jim Berkey and Chris Bryant worked on the Project for a day. Finally, U.S. Forest Service fisheries biologists Scott Spaulding and Aubree Benson worked one day in the field and provided project design assistance, and the Lolo National Forest staff permitted the restoration of cost-share roads in Bear, Surveyor, and Thompson creeks.

Photos of the Project are provided in Figure 7-1.

Surveyor Creek's lower culvert being prepped for removal.

Rebuilding the stream channel with an excavator (and with hand labor).

The freshly-finished product, complete with pools and transplanted native vegetation. The water cleared within an hour and cutthroat trout have now moved upstream.

Over 40 miles of roads in Fish Creek have been decommissioned under this grant: weeds sprayed, surface ripped to 18 inches, culverts removed, cross-drainage added, and reseeded.

**Figure 7-1. Photos of the Fish Creek Habitat Passage Enhancement Project.**

## 7.3 Clark Fork River Bull Trout DNA Sampling

Genetic sampling was funded by the Thompson Falls TAC for 2009 in the middle Clark Fork drainage. FWP did not conduct any sampling in 2009 and therefore, no fish was collected for genetic testing. Funding granted in 2009 was not used and was reallocated to TAC Funding for 2010 proposals.

During the northern pike study summarized in Section 3.0 of this report, genetic data was collected on the one bull trout that was captured during spring gillnetting efforts. The bull trout was PIT tagged and a genetic analysis indicates fish was assigned to Fish Trap Creek.

# 8.0 Bull Trout Passage and Incidental "Take" of Bull Trout

## 8.1 Bull Trout Passage Totals

The only fish passed over Thompson Falls Dam in 2009 were bull trout collected by the Avista Corp fish passage program below Cabinet Gorge Dam, and transported upstream of Thompson Falls Dam. This program collected a total of 47 different bull trout in 2009. Bull trout were tested using DeHaan and Hawkins' (2009) rapid response genetic identification methodology. The rapid response genetic testing provides population assignment within 6 to 24 hours after receipt of fish tissue samples. The analysis determines the natal stream of each bull trout before being released. Bull trout with a natal stream upstream of Thompson Falls Dam are referred to as "Region 4" fish. 12 Region 4 fish were transported and released above Thompson Falls Dam in 2009 (Table 8-1).

**Table 8-1. Summary of the 2009 Avista Corporation upstream adult migrating bull trout trap and haul program. (Source: Avista Corp. 2010)**

| Region of Origin | Capture Method | | | Totals | Comments |
|---|---|---|---|---|---|
| | Night E-fishing | Hook and Line | Cabinet Gorge Hatchery Fish Ladder | | |
| Region 1 Released | 2 | 4 | 9 | 14 | 3 out of the 13 released were too small to transport and one mortality from H&L |
| Region 2 Transports | 5 | 1 | 4 | 10 | |
| Region 3 Transports | 7 | 2 | 3 | 12 | |
| Region 4 Transports | 3 | 3 | 6 | 12 | |
| **Total Captures** | **17** | **10** | **22** | **49** | 2 fish out of the 49 were captured twice throughout the year so actual capture # was 47 different bull trout |

One of the bull trout transported upstream of Thompson Falls Dam was radio tagged. This fish was captured June 7, 2009 by night electrofishing in the lower Clark Fork River below Cabinet Gorge Dam. It was released June 10, 2009 in the Clark Fork River near Paradise, Montana, upstream of Thompson Falls Reservoir. After release, the fish moved upstream; up the Clark Fork River to the Flathead River, then upstream to the Jocko River. It was last detected on July 2, 2009 in the Jocko River, about one-half mile upstream of the Flathead River.

A bull trout collected June 11, 2009 by hook and line sampling in the Clark Fork River below Cabinet Gorge Dam was released in the Thompson River June 15, 2009. This fish was recaptured during electrofishing in Fishtrap Creek (a tributary of the Thompson River) on July 21, 2009. It appeared to be paired up with another bull trout.

None of the other bull trout transported above Thompson Falls Dam were recaptured in 2009.

## 8.2 Intentional and Incidental "Take" of Bull Trout in 2009 (by activity, and cumulatively)

One bull trout was collected by gillnetting in 2009. This fish was captured on May 1, 2009 and was released on site (see Section 4.0). The bull trout was not entangled in the gillnet and there were no physical markings from the gillnet on the bull trout and no signs of stress. The bull trout was released in excellent condition.

# 9.0 Compliance with the Terms and Conditions of the Biological Opinion

The sections below provide the seven Terms and Conditions taken directly from FWS's Biological Opinion followed by a statement describing PPL Montana's actions of compliance.

## 9.1 Term and Condition TC1 - Upstream Passage:

The Biological Opinion states that:

> *a. During 2009 and 2010, PPL Montana will construct a fish passage facility (permanent fishway) to provide timely and efficient upstream passage at the right abutment of the main dam, as agreed to by the Service and through oversight of the TAC (as provided for in the interagency Thompson Falls MOU).*
>
> *b. During construction and cleanup, PPL Montana will follow permit procedures as required by the Service, the State of Montana, and U.S. Army Corps of Engineers so that minimal impacts to downstream aquatic resources occur during construction.*
>
> *c. PPL Montana will determine operational procedures for the passage facility and develop a written operation and procedure manual (SOP) by the end of 2010, with input from the TAC and approval by the Service, updated as needed.*
>
> *d. For the remaining term of the license (expiring December 31, 2025), PPL Montana will ensure that operation of the fish passage facility is adequately funded and conducted in compliance with the approved SOP; including activities such as biological studies, transport of bull trout (as needed), and assessment of ladder efficiency.*
>
> *e. During the Phase 2 evaluation period (2010 through 2020), PPL Montana will provide adequate funding for genetic testing to determine the likely natal tributary of origin of all adult bull trout which ascend the fishway and enter the sample loop, as well as those otherwise captured at the base of Thompson Falls Dam. In order to positively identify natal origin of bull trout at the project, PPL Montana will institute a permanent fish tagging system for all bull trout handled during monitoring and for other fisheries investigation activities in the Project area.*
>
> *f. During the Phase 2 evaluation period (2010 through 2020), PPL Montana will make a fish transport vehicle available, and provide staff to transport any adult bull*

*trout that is captured at Thompson Falls Dam and determined by the SOP to require transport to upstream waters.*

*g. In consultation with the TAC, PPL Montana will prepare by January 1, 2011, for Service approval, an action plan for Phase 2 of the evaluation period (2010 through 2020) to evaluate efficiency of the upstream passage facility. The goal will be to assess how effective the ladder is at passing bull trout, the potential length of any delay, the amount of fallback, and the optimal operational procedures to achieve the highest efficiency. During this Phase 2 evaluation period (2010 through 2020) a routine feedback loop will be established and used, as agreed to by the Service, to fine tune operations and will be combined with a variety of experimental and evaluative studies. It may be necessary to conduct research on surrogate species (e.g., rainbow trout) at the discretion of the TAC, in order to facilitate certain of these evaluations. At a minimum, for the remaining term of the license (through 2025), PPL Montana will support a sampling method to annually estimate the total numbers of all species passing through the ladder and adequately characterize the timing of such movements.*

*h. During the entire Phase 2 evaluation period (2010-2020), the TAC, subject to approval of the Service and with PPL Montana support, will provide adequate oversight of scientific aspects, surveys, studies, and protocols associated with the fish passage aspects of the Project. At the end of the Phase 2 evaluation period (2010-2020), and upon completion and adequate distribution and consideration of a comprehensive ten-year report (due December 31, 2020), PPL Montana will convene a structured scientific review of the project, guided by the TAC. This scientific review will be completed by April 1, 2021 and will develop a set of recommendations to be submitted to the Service for evaluation, modification, and approval; including specific conclusions as to whether the fishway is functioning as intended and whether major operational or structural modifications of the fishway are needed. The review process will culminate, by December 31, 2021, in a revised operating plan for the fishway during the remainder of the existing term of the FERC license (2022 through 2025).*

Construction of the upstream fish passage facility commenced in 2009. PPL Montana anticipates completion of the upstream fish passage in 2010 in compliance with TC1 (a). During construction and clean up, PPL Montana will follow all permitting procedures as defined in TC1 (b).

PPL Montana will develop a written operation and procedure manual (SOP) for FWS approval prior to the end of 2010. The SOP will be filed with the Commission by December 31, 2011.

PPL Montana will continue to stay in compliance with TC 1 (d) for the term of the License. PPL Montana will continue funding for the upstream fish passage facility and operate the facility in conformance with the approved SOP.

PPL Montana will develop the Phase 2 Evaluation Plan for FWS approval by the end of 2010. The Phase 2 evaluation will comply with TC 1(e, f, g, and h). The Phase 2 Evaluation Plan will be filed with the Commission by December 31, 2010.

## 9.2 TC2 – Downstream Passage

The Biological Opinion states that:

> *a. PPL Montana will provide annual funding to the TAC, as approved by the Service and specified in the Thompson Falls MOU, to conduct offsite habitat restoration or acquisition in important upstream bull trout spawning and rearing tributaries. The purpose is to boost recruitment of juvenile bull trout. This funding is provided to partially mitigate for incidental take of bull trout caused by downstream passage through the turbines and spillways. The annual $100,000 contribution specified for the first term of the MOU (2009-2013) is subject to renegotiation during succeeding terms of the MOU to run from 2014-2020.*

PPL Montana complied with these requirements by providing $100,000 in 2009. Three projects were proposed and addressed by TAC agencies and the results of these projects are in this annual report (see Section 7.0). Funding for the 2010 calendar year is in place; the TAC reviewed and approved proposals at the February 2010 meeting. TAC approved and funded projects for 2010 are described in Section 9.5.

## 9.3 TC3 – Gas Supersaturation

The Biological Opinion states that:

> *a. For the remainder of the license (through 2025), in consultation with the TAC and subject to Service approval, PPL Montana will develop and implement operational procedures to reduce or minimize the total dissolved gas production at Thompson Falls Dams during periods of spill. Future modifications to prescribed operations may be determined from ongoing evaluations, as necessary and determined appropriate by Montana Department of Environmental Quality.*
>
> *b. For the remainder of the license (through 2025), in consultation with the TAC and subject to Service approval, PPL Montana will continue to collaborate with MDEQ, Avista, MFWP, and other entities toward reducing the overall systemic gas supersaturation levels in the Clark Fork River, occurring from a point downstream of Thompson Falls Dam to below Albeni Falls Dam.*

*c. For the remainder of the license (through 2025), all bull trout detained through the sampling loop at the Thompson Falls Fish Ladder will routinely be examined for signs of gas bubble trauma; with results of such observations permanently recorded. Should GBT symptoms be discovered, then PPL Montana will consult the TAC on the need for immediate corrective actions and subsequently implement any new studies or potential operational changes (to the ladder or the dam) which may be required by the Service and DEQ, in order to mitigate GBT concerns.*

PPL Montana is in the process of preparing a TDG Study Plan, which will be submitted to the TAC, including MDEQ, for their review and comment. The plan will include a summary of previous year's studies, with a discussion of results, and lessons learned. A plan for ongoing TDG studies will be described.

PPL Montana will continue to collaborate with MDEQ through the remainder of the License to reduce overall gas supersaturation levels in the Clark Fork River. Eventually, the information from TDG studies will be used to craft an operational procedure that will comply with Montana's water quality regulations and the terms of the Biological Opinion.

## 9.4 TC4 – MOU and TAC:

The Biological Opinion states that:

*a. Upon completion of construction of the Thompson Falls Fish Ladder (currently scheduled for 2010) and concurrent with initiation of the Phase 2 review period (mid-2010 through 2020) PPL Montana will review the Thompson Falls MOU and collaborate with the signatory agencies as to the need to revise and restructure the MOU. Any such revision should be developed around the 2010-2020 Phase 2 evaluation period and may include appropriate changes to the TAC and its operation. Subsequent revision may occur again in 2021, or as needed based on adaptive principles and subject to approval of the Service and PPL Montana.*

PPL Montana will comply with these requirements by addressing the MOU at the annual TAC meeting in 2011.

## 9.5 TC5 – Thompson Falls Reservoir

The Biological Opinion states that:

*a. During the first five years of the Phase 2 evaluation (2010 through 2015) PPL Montana, with TAC involvement and Service approval, will conduct a prioritized 5-year evaluation of factors contributing to the potential loss or enhancement of migratory bull trout passage through Thompson Falls Reservoir. Goals and*

*objectives for this assessment and scientifically-based methodology will be developed through the TAC and approved by the Service no later than the end of 2010 and will focus at a minimum on better understanding temperature and water current gradients through the reservoir; travel time, residence time, and pathways that juvenile and subadult bull trout select in moving through the reservoir; and an assessment of impacts of predatory nonnative fish species on juvenile and subadult bull trout residing in or passing through the reservoir. The initial findings will be summarized and supported with scientifically based conclusions, no later than the end of 2015, with a goal of adaptively improving survival of juvenile bull trout in Thompson Falls Reservoir as they pass downstream or reside in the system. A second, more comprehensive summary of conclusions and recommendations regarding reservoir impacts will be submitted as part of the scientific review package by the end of 2020 (see TC1h).*

*b. Based on the interim Thompson Falls Reservoir Assessment (a., above), a timely evaluation of the site specific need for a nonnative species control program in Thompson Falls Reservoir will be conducted by PPL Montana, in collaboration with the TAC agencies (see TC7b., below), no later than the end of 2015, with final recommendations to be approved by the Service.*

PPL Montana will comply with requirements outlined in *Section a* by completing and submitting the Reservoir Plan by December 31, 2010. *Section b* will be completed by December 31, 2015.

## 9.6 TC6 – Systemwide Monitoring:

The Biological Opinion states that:

*a. For the remainder of the license (through 2025), PPL Montana will ensure that actions at the Thompson Falls Fish Ladder, including tagging, transport, and any tracking of fish movement, are adequately funded and fully coordinated with the Avista project and the management agencies MFWP, CSKT, and the Service. This coordination will include routine communications through the TAC and may require participation in special meetings or discussions to ensure that there is a single seamless fish passage effort for the lower Clark Fork projects.*

*b. For the remainder of the license (through 2025) PPL Montana will contribute a proportional amount of funding to ensure that fish sampled at the Thompson Falls Fish Passage Facility are processed, analyzed, and integrated into annual updates of the systemwide Clark Fork River genetic database.*

*c. In consultation with the TAC and with approval of the Service, for the remainder of the license (through 2025), PPL Montana will fund the technology required to track transmittered fish that pass the project as they move through the system. This may include an integrated PIT-Tag scanner at the fishway, mobile PIT-Tag scanning capabilities (wand(s) for use in the field), and radio implantation and tracking of bull trout that move through the sample loop in the ladder. Obligations for tracking transmittered fish by PPL Montana will include at a minimum the portions of the Lower Clark Fork Core Area upstream of Thompson Falls Dam (i.e., mainstem Clark Fork River from Thompson Falls Dam to the confluence of the Flathead River, including tributaries such as the Thompson River) Note: in the lower Flathead River, Jocko River, and other Flathead Reservation waters primary responsibility for tracking is assumed by the CSKT, but close coordination with the Tribes will be maintained by PPL Montana. Broader tracking needs upstream will be determined through cooperation with other entities in the basin (as in TC6a., above).*

PPL Montana will comply with these requirements by holding necessary TAC meetings (and sub-committee meetings) in 2010 to ensure compliance and to aggressively address the adaptive needs of the operations of the fish ladder. PPL Montana will submit a proposal to the TAC for 2010 genetic work in the Clark Fork River drainage at the annual meeting. Upon completion of the fishway, Biomark will install three antennas on weirs in the ladder. These antennas will monitor marked fish movement within the ladder. In addition a plan will be presented in the 2010 TAC meeting for monitoring of radio tagged bull trout in the Clark Fork and Flathead River above Thompson Falls Dam. Biologists working with PPL Montana have monitored radio tagged fish both below and above Thompson Falls Dam in the past. PPL Montana will continue to fund the tracking of radio tagged fish.

## 9.7 TC7 – Reporting

The Biological Opinion states that:

*a. Annually, by April 1 of each year for the remainder of the license (expires 2025), PPL Montana will prepare and submit to the Service for approval a report of the previous years activities, fish passage totals, and next year's proposed activities and other fisheries monitoring that may result in intentional as well as incidental take of bull trout. The report will quantify the number of bull trout proposed to be incidentally taken by each activity and summarize the cumulative extent of incidental take from all previous year activities.*

*b. By December 31, 2015, after the first five years of the Phase 2 evaluation period (as described per TC1g., above), PPL Montana will present to the TAC and the Service a comprehensive written assessment of the first five years of fishway operation. This report is partially for the purpose of assessing the need for major*

*mid-Phase 2 modifications to the facility and its operations as well as for consideration of the need for supporting additional bull trout passage or transport above the dam.*

*c. Annually, by April 1 of each year beginning in 2010 and for the remainder of the license (expires 2025), PPL Montana will archive electronic versions of all biological progress reports (described in TC 1 through TC 7 and dating back to 2005) generated through the Thompson Falls Project. PPL Montana will provide to TAC agencies at no cost, upon request, updated CDs or web-based access to those reports.*

*d. For the remainder of the license (expires 2025), upon locating dead, injured, or sick bull trout, or upon observing destruction of redds, notification must be made within 24 hours to the Service's Division of Law Enforcement Special Agent (Richard Branzell, P.O. Box 7488, Missoula, MT, 59807-7488; (406) 329-3000). Instructions for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement. Dead, injured, or sick bull trout should also be reported to the Service's Kalispell Field Office (406-758-6882).*

*e. For the remainder of the license (expires 2025), during project implementation the FERC or applicant shall promptly notify the Service of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.*

PPL Montana complied with these requirements by preparing this annual report for the work completed in 2009. PPL Montana will continue to submit annual reports of the previous year's activities, fish passage totals, and next year's proposed activities and other fisheries monitoring. The annual reports will be approved by the TAC and submitted to FERC by April 1 of each year for the remainder of the License.

In addition PPL Montana will archive electronic versions of all biological progress reports (dating back to 2005) annually by April 1.

Sections b, d, and e will be addressed as these situations occur.

# 10.0 Proposed Activities for 2010

## 10.1 Upstream Adult Fish Passage

Activities in 2010 for the upstream fish passage facility include the completion of construction, development of the operations and procedures manual (SOP), and development of the plan to evaluate the efficiency of the fish passage facility.

The construction of the upstream fish passage facility is anticipated to be complete in July 2010. Following the completion of construction, there will be on-site training for the operations of the upstream fish passage facility.

A SOP will be developed and submitted to FERC by December 31, 2010 in compliance with the Biological Opinion.

A Phase 2 Evaluation Plan will outline how PPL Montana plans to evaluate the efficiency of the upstream fish passage. The Phase 2 Evaluation Plan will be developed in consultation with TAC members and submitted for FERC approval by December 31, 2010.

## 10.2 Baseline Fisheries Data Collection

In 2010, PPL Montana will continue to collect baseline fisheries data as presented in Section 2 of this report. Baseline fisheries data will include spring and fall electrofishing and fall gillnetting. Data collected in 2010 will be summarized and presented in the 2010 Annual Report.

GBT monitoring in fish downstream of Thompson Falls Dam will also continue in 2010 assuming flows reach 50,000 cfs. When river flows downstream of Thompson Falls Dam reach or exceed 50,000 cfs, PPL Montana will sample fish and examine fish for signs of GBT. The data collected in 2010 will be summarized and presented in the 2010 Annual Report.

## 10.3 Water Quality Studies

In 2010, PPL Montana will continue to collect water quality data. These data will include monitoring of water temperature upstream and downstream of the Thompson Falls Dam and continued TDG data collection. Data collected in 2010 will be summarized and presented in the 2010 Annual Report.

## 10.4 Reservoir Studies

In 2009, PPL Montana and FWP sampled the Thompson Falls Reservoir and Island Complex to study northern pike. The northern pike data collected in 2009 is presented in Section 3 of this report.

PPL Montana proposes to continue to collect the baseline fisheries data with MFWP in 2010 and defer any reservoir specific studies in 2010 until the 5-year study plan is developed and approved by FWS as required in the FWS Biological Opinion TC 5.

A sub-committee including PPL Montana, FWP, and FWS will meet in 2010 to draft a 5-year Reservoir Plan as specified in the Biological Opinion TC 5. PPL Montana will consult with FWS to interpret the goals and objectives outlined in the Biological Opinion TC 5. In cases where data for specified goals and objectives in the Biological Opinion have already been recorded (e.g. retention time), this information will be summarized in the 5-year Reservoir Plan and will not require additional studies. PPL Montana will submit the 5-year Reservoir Plan for FWS and FERC approval by December 31, 2010.

## 10.5 2010 TAC Funded Projects

Thompson Falls TAC funded four of five proposals for 2010 activities. The four approved proposals are provided below and include the following projects, Fish Creek watershed rehabilitation, Oregon Gulch mine restoration, Big Rock Creek road rehabilitation, and bull trout DNA sampling in the Clark Fork River drainage.

### 10.5.1 Fish Creek Watershed Rehabilitation

Project Title: Fish Creek Watershed Rehabilitation Project
Proposal Submitted by: Robb Roberts, Trout Unlimited
Location of Proposed Project: Fish Creek, Mineral County, Montana
T13N, R25W, Sect 3, 13, 23, 24, 35
T13N, R24W, Sect 7, 9, 21, 29
Total Project Cost: $339,270
TAC Funds (Cost-Share) Requested: $37,770

I. Introduction

The Fish Creek watershed in Mineral County is the largest tributary to the Middle Clark Fork River subbasin. The watershed is valued for its important fish and wildlife habitat and high public recreation values. The Fish Creek drainage encompasses the Great Burn Inventoried Roadless Area, extensive spawning and rearing habitat for native coldwater fish and likely the largest remaining migratory bull trout population between the Bitterroot and Flathead

River confluences. The watershed is also a stronghold for fluvial and resident westslope cutthroat trout.

The Fish Creek watershed is in mixed ownership. Generally, the Lolo National Forest manages the upper elevations, while the valley bottom and foothills are owned by private interests, along with scattered sections managed by Montana Department of Natural Resources and Conservation (MDNRC). Approximately 41,000 acres were historically owned by the Champion Lumber Company, then sold to the Plum Creek Timber Company. The land was intensively harvested and roaded. In 2003, the Fish Creek/I-90 fire ripped through the Fish Creek drainage and severely burnt thousands of acres in the middle watershed.

On December 15, 2008, The Nature Conservancy (TNC) purchased 41,000 acres in the Fish Creek drainage from Plum Creek Timber Company, with the intent of transferring the land to public ownership. All of this acreage is surrounded by National Forest lands and is currently slated to be transferred to FWP in March, 2010. Prior to conveyance, the land has been stewarded and managed for sustainable timber harvest and improved fish and wildlife habitat. Since the land acquisition, TNC, Trout Unlimited (TU) and FWP have implemented significant road, culvert and weed control work within the Fish Creek Drainage to improve native fish and wildlife habitat. Accomplishments from the Fish Creek Watershed Rehabilitation – Phase I, completed in November 2009, include forty miles of road storage, decommissioning and/or maintenance, removal of forty-five large culverts and cross drains, weed treatment along open road systems and deconstructed roads, and revegetation of more than 3,500 feet of roadbank along the mainstem Fish Creek and South Fork Fish Creek corridor. In 2009, PPL Montana contributed $24,000 to this project, which was the primary funding source for fish passage enhancements (culvert removals) in Bear and Surveyors creeks.

As mentioned earlier, a total of 17,640 acres of TNC land within Mineral County were burned by the Fish Creek and I-90 fires in 2003. Many of the drainages within the Fish Creek watershed experienced high fire severity and show very little vegetation re-growth after more than five years of recovery time. Furthermore, there are 230 miles of roads on these TNC lands - approximately 50% of roads currently require some degree of road surface treatment, drainage or other water flow improvement. Fire effects have significantly increased hillslope runoff and road stabilization resulting in erosion problems. Weeds have infested virtually every road surface and road side, as well as many mountainsides in the burned areas of the Fish Creek drainage. TU, MFWP and Salish and Kootenai Environmental Restoration (SKER) partnered with TNC to build upon the successful projects in 2009 by developing a plan to restore and reclaim nearly 95 miles of road in the Fish Creek drainage. These areas were prioritized based on extent of damage due to fire severity and their direct effects on fish and wildlife. The Fish Creek Watershed Rehabilitation – Phase II work has been funded by a $299,000 from MDNRC for Wildland Fire Rehabilitation and includes culvert removal, road

decommissioning, weed treatment, and riparian revegetation in the Thompson and Deer Creek drainages. These matching funds are strictly limited to on-the-ground work inside the burned area perimeter, which includes Thompson, Deer and portions of other watersheds. Implementation of Phase II will begin in April 2010.

This proposal to the PPL Montana Thompson Falls Bull Trout PM&E Fund is for $37,770 for Fish Creek Watershed Rehabilitation – Phase III. This phase of restoration activities in the Fish Creek watershed will address four of the six remaining priority areas that lie within TNC ownership on major coldwater tributaries within the Fish Creek drainage. These tributary watersheds represent cold, perennial streams that currently or historically supported bull trout, or represent connected rearing habitat adjacent to currently occupied reaches. Overall, the project will include road storage or decommissioning, removal of all stream crossings, revegetation, and selective weed treatment on 35.3 miles of roads in the drainage. The project is described in more detail below.

## II. Objectives

Overall, the Fish Creek drainage is one of the most intact coldwater tributaries in the Middle Clark Fork region. However, the extensive road matrix developed on former Plum Creek Timber lands are still considered limiting factors to native fish because of upstream passage barriers, high risk stream crossings, habitat modification, and sediment contribution.

Specific objectives for this project include the following:

- Improve tributary, riparian, and upland habitat quality at a watershed scale
- Improve road/ crossing stability and the long-term risk of failure during high flow events
- Reduce chronic sediment input

## III. Methods

During the summer and fall of 2009, MFWP, TU, and TNC staff surveyed the Fish Creek drainage, collecting data on road conditions, road barriers, stream and culvert conditions, and riparian vegetation condition. Since that time, project partners have worked together to prioritize project areas, investigate road easements and property ownership, and develop cost estimates for the remaining work to be done in 2010. Based on this planning effort, the Fish Creek drainage is divided into 6 priority areas, according to their importance to native fish, present condition, and other factors. Based on funding availability, TU plans to address four of the six remaining priority areas during this project. Locations are described in Table 10-1. Highlighted areas are the four areas to be addressed during this project.

**Table 10-1. Fish Creek Watershed Restoration, Priority Areas.**

| Priority | # of Miles | # of Culverts | Ripping /mile | Seeding/mile | Weed Trt/mile | Totals by Priority |
|---|---|---|---|---|---|---|
| 1 (Bear Creek Sec. 3) | 12.7 | 5 | $5,715.00 | $3,810.00 | $1,905.00 | $11,430.00 |
| 2 (Surveyor Creek Sec.35) | 4.9 | 6 | $2,205.00 | $1,470.00 | $735.00 | $4,410.00 |
| 3 (Thompson Crk Sec. 23) | 4.2 | 6 | $1,890.00 | $1,260.00 | $630.00 | $3,780.00 |
| 4 (Wig Creek Sec. 29) | 13.5 | 3 | $6,075.00 | $4,050.00 | $2,025.00 | $12,150.00 |
| 5 (Lion Creek Sec. 18,17) | 18 | 8 | $8,100.00 | $5,400.00 | $2,700.00 | $16,200.00 |
| 6 (South Fork FC Sec. 1) | 13.3 | 3 | $5,985.00 | $3,990.00 | $1,995.00 | $11,970.00 |
| **Total:** | **66.6** | **31** | **$29,970.00** | **$19,980.00** | **$9,990.00** | **$59,940.00** |

Specific on-the-ground treatments include road obliteration and ripping for long-term stability and storage, culvert/cross-drain removal, road revegetation and weed treatment. The activities are outlined in more detail below. Cost estimates are based on previous work in the drainage during the 2009 field season.

*Road Obliteration:* Obliteration of the road shall include full recontouring; excavating and placing fill material back onto the road prism to return the ground to its natural contour, reshaping stream crossings and draws to their natural contours, placing woody debris on the disturbed area, and seeding disturbed ground. Road obliteration will only occur in specific areas, such as road segments along streambanks or to control vehicle access.

*Road Ripping:* Road treatment will include ripping the entire road surface (de-compacting) to a minimum of 18" depth with a bulldozer, placement of woody debris on the road surface, and seeding shall be applied to the disturbed area. Road ripping is completed prior to seeding to help facilitate re-vegetation, reduce surface erosion, and to promote long-term stability. Road ripping is estimated at $600 per mile.

*Road Revegetation:* Seeding will be done through backpack broadcast seeding and include two different native mixes that will focus on upland road ripped areas. The quantity of seed will be at a rate of 50 pounds per ripped mile. Seeding is estimated at $300 per mile.

*Weed Treatment:* The use of chemical controls will include the use of Plateau herbicide on

the road treatments that will specifically target cheat grass *Bromus tectorum* and down into the conifer and mixed riparian areas. Rodeo (waterway approved glyphosate) will be used in the riparian areas. Mechanical weed control will consist of hand pulling around any installed or native plants.

*Culvert/Cross-drain Removal:* Small culverts are those where the existing fill height is less than 10 feet. Most of these crossings are undersized and (with no planned maintenance) have a high risk of clogging and failing. Culverts are to be removed and properly disposed of off-site by the contractor. Existing stream elevations and contours above and below the culvert removal site are to be matched by grading. Costs for removing small culverts and cross drains have been included in the Road Ripping cost estimate/per mile.

Revegetation: techniques for revegetation plots within the burned area perimeter will include hand planting using hoedads, picks or trenching shovels of bare root and containerized plants for both conifer revegetation sites and mixed riparian/ conifer sites. Planting will consist of up to the root collar depths, with the creation of a planting basin to allow for the summer watering and extra precipitation, to maximize water intake at the root level. Deep watering in July and August will encourage root growth which is included as part of the Maintenance component. Two different seed mixes at 30 pounds an acre which will be distributed through a broadcast seeding method will be conducted in the fall. The two native seed mixes will be used depending on whether it is a mixed riparian/conifer site or strictly a conifer site.

## IV. Schedule

The following is a timeline for activities for the Fish Creek Watershed Rehabilitation Project in the 2010 field season:

| | |
|---|---|
| Feb – Mar 2010: | Final planning/fundraising efforts |
| April 2010: | Final field reconnaissance |
| April 2010: | Equipment mobilization |
| Apr – Aug 2010: | Road decommissioning and culvert removal |
| Sep – Oct 2010: | Weed treatment |
| Oct – Nov 2010: | Road revegetation/seeding |

## V. Personnel

TU will primarily be responsible for contracting, grant reporting and project implementation; TNC will assist with project permitting and oversight; while FWP is involved in all aspects of planning as well as project oversight. The following are the specific project staff for each organization who will be involved in the project:

Robb Roberts, Trout Unlimited – Robb is the project leader and primarily responsible for project planning, construction oversight, and coordination with project partners. Robb is a full-time staff person for TU working on mine reclamation and native fish habitat restoration in the Middle Clark Fork River region.

Heather Whiteley, Trout Unlimited – Heather is responsible for GIS analysis, planning, and contracting. Heather is a full-time staff person for TU, working directly under Robb Roberts in the Middle Clark Fork River program.

Ladd Knotek, Montana Fish, Wildlife and Parks – Ladd is responsible for internal communications with MFWP and will be the project liaison for MFWP when ownership transfers. Ladd is responsible for all aspects of fisheries monitoring in Fish Creek.

Steve Kloetzel – Steve is responsible for internal communications with TNC, the landowner for the project area. Steve has also been involved with project planning and will be contributing in-kind hours to project oversight.

VI. Budget

**Table 10-2. Project Budget Fish Creek Watershed Restoration**

| Item | PPL Cost | Matched Cost & Contributor | Total Project Cost |
|---|---|---|---|
| *Direct Labor* | | | |
| Consultants | | $13,000 – MDNRC | $13,000 |
| TU staff | $2,000 | $11,000 – MDNRC | $13,000 |
| MFWP staff | | $2,000 – MFWP (In-kind) | $2,000 |
| **Direct Overhead** | $1,000 | $0 | $1,000 |
| **Travel and Living** | $1,000 | $500 – TU | $1,500 |
| **Phase II – Materials and Equipment** | $0 | $274,000 – MDNRC | $274,000 |
| Road reclamation – 95 miles | | | |
| Road revegetation – 95 miles | | | |
| Weed treatment – 95 miles | | | |
| Riparian Revegetation - 13 acres | | | |
| Weed treatment - 13 acres | | | |

| Item | PPL Cost | Matched Cost & Contributor | Total Project Cost |
|---|---|---|---|
| **Phase III – Materials and Equipment**<br>Road reclamation ($600/mile x 35.3 miles)<br>Road revegetation ($300/mile x 35.3 miles)<br>Mobilization (2 Units x $1,000) | $33,770 | $0 | $33,770 |
| **Total =** | **$37,770** | **$301,500** | **$339,270** |

VII. Deliverables

Deliverables resulting from Phase III of this project will include the reclamation of approximately 35.3 miles of former road prisms in the Fish Creek drainage. Overall, for Phases I-III of the Fish Creek Watershed Rehabilitation project, deliverables will include approximately 170 miles of road reclamation, 13 acres of revegetation within the riparian corridor, 3,500 linear feet of roadbank revegetation, and substantial weed treatment, and travel access management throughout the drainage.

Success of road improvements and storage will be monitored over time by evaluating the stability of former stream crossings, the establishment of planted vegetation, success of weed spraying, etc., on stored roads. All of these aspects will be part of MFWP's Management Plan which will be developed for the properties in 2010-2011.

The indirect success of the project will be monitored through long-term tracking of bull trout distribution and abundance in Fish Creek. MFWP has established annual bull trout redd survey sections, trout population estimate sections, and a baseline for species distribution in Fish Creek over the past 10 years which will serve as a basis for long-term fisheries monitoring.

VIII. Cultural Resources

Consultation with the Montana Historic Preservation Office has been initiated. No direct cultural impacts are anticipated because of the nature of the work which is limited to road and road related reclamation. No structures or other areas will be affected.

***TAC VOTE:*** **Unanimous Yes for $37,770.** USFWS & PPL Montana request photo points for comparison at future date.

### *10.5.2 Oregon Gulch Mine Restoration*

Project Title: Oregon Gulch Mine Restoration
Proposal Submitted by: Robb Roberts, Trout Unlimited and Ladd Knotek, MFWP

Location of Proposed Project: Oregon Gulch, Tributary of Cedar Creek near Superior, Montana. T16N, R27W, Section 21 (SE1/4)
Total Project Cost: $134,500
TAC Funds (Cost-Share) Requested: $51,500

I. Introduction

Oregon Gulch is a third order tributary of Cedar Creek, which flows into the Middle Clark Fork River near the town of Superior, Montana. Fluvial bull trout have been documented spawning in lower Oregon Gulch since 2002, and this area consistently produces the highest redd counts in the Cedar Creek watershed. Unfortunately, a heavily mined area near the confluence of Oregon Gulch and Lost Creek appears to prevent bull trout from migrating further upstream to spawning habitat on public land managed by the Lolo National Forest.

The private parcel is a patented mining claim that was heavily mined in the early 1960s by the Calmont Mining Company using floating dredges and draglines. The patented mining claim encompasses approximately 4 miles of stream bottom in Oregon Gulch. The major mining disturbance is located just downstream of the confluence of Oregon Gulch and Lost Creek. The stream channel has been straightened and bermed for about 600 feet, and the floodplain is dominated by large (15-20 feet high) piles of coarse dredge tailings in the lower 500 feet of the project section. The upper reaches of the project section are seasonally dewatered because of historic mining activity and the subsequent stream channel alignment. There are also multiple dredge ponds in the floodplain that are not connected to the stream channel and capture groundwater recharge. These disturbances have impaired native fish reproduction and likely create a seasonal barrier for bull trout migration.

In 2006, TU began establishing a working relationship with Dan Gull, the current landowner of the parcel (since 1993). During the summer of 2008, TU staff and volunteers collected physical survey data at the Oregon Gulch mine site. Measurements included 1,750 feet of stream longitudinal profile and six cross sections that characterized the disturbances to the stream channel and floodplain. This information was collected as a baseline to estimate project limits, fill quantities, extent of riparian disturbance, etc., and to ground-truth consultant proposals and cost estimates.

In January of 2009, TU received $15,000 from Montana PPL to produce a conceptual survey and design report that would guide project development and be used for fundraising and permitting activities. River Design Group was hired for those activities, and that document has been completed and attached to this proposal as an attachment. This proposal is for

$51,500 to match $83,000 in other grant and in-kind funds to complete this project and proceed with the implementation of the Oregon Gulch Mine Reclamation project. The overall goal of the project is to restore approximately 2,000 feet of stream channel.

## II. Objectives

The physical and hydrologic problems in Oregon Gulch stem largely from historic mining, which left behind piles of dredged material (gravel, large cobbles, etc.), approximately 15 to 20 feet in height, that occupy much of the valley bottom and impede natural floodplain function. Other remnant features include eroded hillsides and dredge ponds that intercept groundwater. The historic mining also nearly completely removed all old growth vegetation and in-channel large woody debris, as well as the current potential for quality large woody debris recruitment. Other concerns include straightened, overly confined, and incised stream channels, and a lack of in-stream fish habitat.

There are three principal objectives for the Oregon Gulch Mine Restoration project:

- To enhance and create high quality habitat conditions for fluvial bull trout (*Salvelinus confluentus*) and other native fish species
- To improve and restore channel-floodplain connectivity and adjacent riverine riparian wetland communities
- To improve soil conditions in order to increase the survival of plantings and to encourage natural plant colonization

## III. Methods

Montana PPL funds will be matched against a Future Fisheries grant and other funding sources for an estimated project commencement date in July 2010. Permitting will take place throughout the spring of 2010. TU will be responsible for fundraising, contracting, grant reporting, and project implementation. MFWP will assist with project permitting and oversight, and conduct fisheries and aquatic monitoring.

The most probable state of Oregon Gulch within the project area is a moderately entrenched channel characterized by riffle-pool morphology, low sinuosity, and coarse bed material (B3 stream type). Large wood and coarse bed material likely played a significant role in shaping the pre-disturbance morphology of Oregon Gulch, as observed in the surveyed reference reach. As such, the project aims to reintroduce and incorporate large wood and native alluvium to the greatest extent practical in order to provide interim vertical grade control and lateral stability. This site has high potential for natural colonization by native vegetation due to the available seed sources, substrate conditions, and residual rootstock.

The project is divided into two reaches with a bridge in the middle of the property serving as the dividing point. The existing bridge will be re-positioned to eliminate the high skew angle and increase both the bridge freeboard and conveyance capacity for larger flood events. This

would be accomplished by repositioning the bridge at the current location and improving the approach alignments of the existing road. Pre-fabricated concrete abutments will be installed outside of the bankfull channel to provide a minimum 24 foot bankfull channel width and 6 feet of constructed floodplain on both channel margins.

In Reach 1, wood and rock based structures would be installed to increase pool frequency, encourage pool tailout development, and to moderate velocities during higher flow stages. An existing berm along the streamchannel will also be removed to provide floodplain connectivity. A more aggressive restoration approach for Reach 1 including expanding floodplain areas through excavation of floodplain material and reconstructing portions of the channel to increase channel sinuosity was abandoned as an alternative because it would provide only marginal benefit to aquatic resources in the project area at a much great project cost.

Reach 2 includes full channel reconstruction to address the limiting factors and goals established by TU and FWP. A moderately entrenched channel characterized by riffle-pool bedforms and cobble substrate will be constructed on the surface of the historical floodplain. This alternative will re-establish hydrologic connectivity between the channel and historical floodplain by providing a minimum meander belt width of 60 feet. Additional benefits would be increased channel length, geomorphic stability, improved late-season water storage in the floodplain, and improved spawning, rearing, and overwintering habitat conditions.

The existing Oregon Gulch channel in Reach 2 will be partially filled and/or plugged with existing dredge pile materials and material generated from new channel construction. Rather than disturb the existing vegetated levee that separates the historical floodplain surface and existing channel, the project will utilize the approximately 4,500 cubic yards of dredge material for construction of the plugs and fill.

Please see the accompanying project design in Appendix B for a more completed description of project objectives, methods and budgeting.

IV. Schedule

The following is a timeline for activities related to the planning and design of the Oregon Gulch Mine Restoration project, with projections for project implementation:

| | |
|---|---|
| Jan – Feb 2010: | Fundraising (TU) |
| Jan – Mar 2010: | Final Design (RDG) |
| Mar – Apr 2010: | Permitting (TU and MFWP) |
| March – May 2010: | Project planning (TU and RDG) |
| June – July 2010: | Site preparation, project staking |
| Jul – Aug 2010: | Project construction |

2011-2015 Project monitoring

V. Personnel

Robb Roberts, Trout Unlimited – Robb is the project leader and primarily responsible for landowner consultation, contracting, fundraising, project management and construction oversight. Robb is a full-time staff person for Trout Unlimited working on mine reclamation and native fish habitat restoration in the Middle Clark Fork region.

Ladd Knotek, Montana Fish, Wildlife and Parks – Ladd is responsible for permitting requirements, monitoring, fundraising and project oversight.

John Muhlfeld, River Design Group – John is the project lead and is responsible for overseeing final design and construction oversight.

Jennifer Mickelson, Lolo National Forest – Jen is responsible for matters related to use of the forest road for tree acquisition, surveying, construction, and project implementation.

VI. Budget

**Table 10-3. Project Budget for Oregon Gulch Mine Restoration**

| Item | PPL Cost | Matched Cost & Contributor* | Total Project Cost |
|---|---|---|---|
| Direct Labor | | | |
| Consultant fees | $15,000 | $13,000 – Montana Future Fisheries | $28,000 |
| TU staff | $3,000 | $2,000 – Trout Unlimited | $5,000 |
| MFWP staff | | $2,000 – MFWP (In-kind) | $2,000 |
| Direct Overhead | $1,000 | $0 | $1,000 |
| Travel and Living | $500 | $2,000 – Montana Future Fisheries | $2,500 |
| Materials<br>-Trees (180)<br>- Rock (200 cy)<br>- Prefab Bridge abutments (4)<br>- Coir logs (60)<br>- Erosion fabric (600 ft)<br>- Grass seed (40 lbs)<br>- Reveg stock (1000) | $6,000 | $10,000 – Montana Future Fisheries<br>$14,000 – Private Landowner/USFS | $30,000 |
| Equipment<br>-200 Class Excavator (270 hours) | $26,000 | $40,000 – Montana Future Fisheries | $66,000 |

| Item | PPL Cost | Matched Cost & Contributor* | Total Project Cost |
|---|---|---|---|
| -Dump Truck<br>(208 hours)<br>-Skidsteer<br>(40 hours)<br><br>Total = | $51,500 | $83,000 | $134,500 |

* Matching funds include $65,000 from Montana Future Fisheries Program and $18,000 in-kind match from TU, MFWP; and $14,000 from the private landowner and/or Lolo National Forest.

VII. Deliverables

Deliverables resulting from this proposal will be a final design document for restoration and revegetation of 2,000 feet of stream channel and 5 acres of adjacent floodplain and implementation of that final design plan. Overall, 4,500 cubic yards of dredge tailings will be removed from the floodplain; 1,000 feet of new stream channel construction; 600 feet of streambank revegetation and stabilization; and 25 logjam structures created for habitat improvement.

The success of the project will be monitored through long term tracking of spawning activity by fluvial bull trout in Oregon Gulch. MFWP has 7 years of annual bull trout redd count surveys on Oregon Gulch. Post-project results will be compared with historical numbers to determine the effectiveness of the project in improving and expanding bull trout spawning habitat.

VIII. Cultural Resources

Consultation was initiated and completed with the Montana State Historic Preservation Office for this project in 2009.

***TAC VOTE:*** **Unanimous Yes for $51,500.** TAC requested TU ask the private land owner about his future plans for project and that FWS requests some agreement to ensure project benefits for longevity. TU will provide update to TAC on conversation with private landowner.

### *10.5.3 Big Rock Creek Road Rehabilitation*

Project Title: Big Rock Creek Road Rehabilitation
Proposal Submitted by: Jon Hanson, MFWP

Location of Proposed Project: Big Rock Creek, tributary to the Thompson River, Montana. T24N, R26W, Section 6, NW

Total Project Cost: $15,350
TAC Funds (Cost-Share) Requested: $6,000

I. Introduction

Big Rock Creek is a tributary of Thompson River located approximately 27 miles upstream of the Thompson River confluence with the Lower Clark Fork River. In July of 2008 USFS fisheries workers completed a snorkel survey on one reach in Big Rock Creek. They observed westslope cutthroat trout and bull trout. This was the first instance of bull trout recorded in this tributary and in any tributary to the Thompson River, above Fishtrap Creek. To follow up, a reach was sampled using backpack electrofishing methods in 2009, and confirmed the presence of bull trout, capturing a 195 mm individual and 410 mm individual. This is an important find as it establishes the presence of bull trout in the upper portion of the Thompson River drainage. It is unknown if the current bull trout population is resident or fluvial. In July 2010 FWP and USFS biologist will intensively sample this drainage to determine the full distribution of bull trout and other species, and collect fin clips to include in the baseline bull trout genetic assignment database.

Previous to 2009, a county road paralleled the lower mile of the stream, often infringing within the flood plain and only a few feet from the active stream channel. The road crossed the channel via an undersized double culvert, and ran parallel to the stream about 10 feet from the wetted channel. In the spring of 2007, with the recommendation from FWP, the county removed the two culverts in anticipation of them failing. Shortly after the recommendation was made, a portion of the road washed out, restricting access to the upper basin for recreation and timber management needs. Through the 124 permitting process a bridge has replaced the undersized culverts, and a 300 foot section of road that infringed upon the stream has been relocated away from the banks and out of the floodplain. This work was funded by both Sanders County and a grant from the USFS for the bridge replacement. It would be beneficial to provide stability and habitat to a meander bend that washed a portion of the road out, and to scarify and heavily revegetate the remnant road.

II. Objectives

A large part of the past instability and seasonal fish passage problems within this immediate area have been rectified with the installation of the bridge. Relocating a portion of the adjacent road will also improve floodplain connectivity, natural stream processes, and

sediment inputs. The additional tasks needed to complete the overall, larger project focus on improving instream habitat, bank stabilization, and providing overhead cover for fish. This is an excellent example of a transportation-driven project that can be expanded to provide even more benefit to aquatic resources.

Specific objectives for this restoration project are:

- Stabilize the existing road washout to minimize sediment inputs and provide instream cover for fish. This action will lead to increasing numbers of bull trout and westslope cutthroat trout by improving near bank cover and decreasing fine sediment inputs.

- Improve the channel form and function through bank stabilization and creation of a viable riparian area. Planting the abandoned road will increase overhead cover, assist in decreasing water temperatures, and minimize fine sediment contributions to Big Rock Creek.

III. Methods

The eroding meander bend will be stabilized using Large Woody Debris (LWD) structures anchored within the bank. This effort will protect the adjacent banks by reducing the localized shear stress and move the thalweg to a more natural position within the reach. Stabilizing and shaping this meander will increase the natural stream process that was inhibited by the now-abandoned road. Instream habitat will be improved with the creation of pools and cover, and a reduction in fine sediment.

A barrier will be constructed on the abandoned road to curb vehicle and ATV traffic. Additionally a 300-foot section of road, nearest the stream will be planted with native vegetation. The road material will be loosened or removed, a native grass seed applied, cottonwood, willow, and dogwood planted, and protected from browse with fencing. 500 cuttings will be collected in February 2010 by MFWP and USFS personnel and sent the USFS Coeur D'Alene Nursery, where they will grow for eight months before planting onsite in the fall. Once planted 6-foot fencing will be installed to curb browse damage, as this is often a limiting factor in revegetation success. Future revegetation maintenance of the site will be conducted by MFWP.

IV. Schedule

Instream work will be completed during the July 15 to September 1, 2010 timeframe. Revegetation efforts will occur during the fall when there is less stress on plants.

V. Personnel

Jon Hanson, Montana Fish, Wildlife & Parks – Jon is the project leader and responsible for project oversight, permitting requirements, construction, and monitoring.

Jennifer Mickelson, Lolo National Forest – Jen is responsible for project oversight and construction.

VI. Budget

**Table 10-4. Project Budget for Big Rock Creek Road Rehabilitation**

| Item | Estimated Quantity | PPL Cost | Matched Cost | Total Project Cost |
|---|---|---|---|---|
| **Direct Labor** | | | | |
| -MFWP staff | | | $3,000- MFWP (In-kind) | $3,000 |
| -USFS staff | | | $3,000- USFS (In-kind) | $3,000 |
| **Direct Overhead** | | $0 | $0 | $0 |
| **Travel and Living** | | | 500- MFWP (In-kind) | $500 |
| **Materials** | | | | |
| Excavator time | 40 hrs @ $125/hr | $5,000 | | $5,000 |
| Logs with rootballs | 8 | | $1600- Sanders County/Plum Creek | $1,600 |
| Rock | onsite | | $600- Sanders County | $600 |
| Dogwood/willow/cottonwood | 500 | | $750- USFS | $750 |
| Browse protection | | $800 | | $700 |
| Native grass | | $200 | | $200 |
| **Other** | | $0 | | |
| **Total** | | **$6000** | **$9450** | **$15,350** |

VII. Deliverables

An end-of-the-year project report will be completed documenting the actions taken, and before-and-after photographs. Photo points will be recorded yearly for up to 5 years to document changes in the restoration and revegetation components.

Success for this project will be demonstrated through creating a stabile bank leading to an increase in holding cover for adult bull trout. Revegetation success will be demonstrated through bank stability and mature vegetation providing shade and overhead cover. Fisheries sampling will occur pre- and post- restoration to determine bull trout use of this reach.

VIII. Cultural Resources

Consultation with Plum Creek Timber Company and Sanders County will occur to ensure there are no cultural resource concerns in the area. None are expected given previous disturbance (road) to the area.

**TAC Vote: Unanimous Yes for $6,000.**

### *10.5.4 Bull Trout Genetic Monitoring*

Project Title: Bull Trout Genetic monitoring
Proposal Submitted by: Brent Mabbott, PPL Montana

Location of Proposed Project: Funding may be used with cost-share opportunities and with the TAC's approval. Funding boundaries are the Clark Fork River and tributaries, upstream of Thompson Falls Dam. Sampling areas may include upstream of Thompson Falls Dam, below Rattlesnake Creek, and will not include Flathead River drainage.

Total Project Cost: Unknown.
TAC Funds (Cost-Share) Requested: $5,000

I. Introduction

DNA data is needed to continue or update bull trout mapping in the Clark Fork River. This funding will be used to generate or update that bull trout DNA data where needed within the boundaries noted above.

II. Objectives

The objective of this project is to provide funding to enable or update genetic analysis for bull trout populations in the Clark Fork Drainage above Thompson Falls Dam.

III. Methods

Bull trout tissue samples will be collected from 30 to 50 fish for each donor population to determine whether they are genetically pure and to determine genetic mapping for each Clark Fork tributary.

IV. Schedule

Funding will be for approved TAC work in 2010.

V. Personnel

Principle investigators will be identified with each proposal for genetic funding.

VI. Budget

$5,000

FWP and Avista may be asked to cost share, to be determinate based on sampling location.

VII. Deliverables

A detailed analysis/summery report submitted to the TAC for its next annual report.

VIII. Cultural Resources

There will be no ground disturbing actions associated with this activity

**TAC VOTE: Unanimous YES for $5,000.**

# 11.0 References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Federal Register, 2005. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Populations of Bull Trout; Final Rule. September 26, 2005.

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# Appendix A - Fish Data Collected in 2009

**Table A-1. Avista Corporation Fish Transport Program 2009, Bull Trout Collected in 2009.**

| Capture Date | Capture Method | PIT Tag Number | Length (mm) | Weight (g) | Release Site | Release Date & Time | Comments | Most Likely Pop. of Origin | Second Most Likely Pop. of Origin | Confidence | Radio Frequency and Code | Detections through 6/15/09 | Detections through 7/15/09 | Detections through 7/27/09 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/26/2009 | Night E-fishing | 985121001907962 | 516 | 1361 | Thompson River | 5/29/2009 12:47 | | Fishtrap Creek (Region 4) | Upper Rock Creek (Region 4) | 3,000,000 | N/A | | | |
| 6/7/2009 | Night E-fishing | 985121001829048 | 580 | 1616 | Paradise MT - LCFR | 6/10/2009 13:30 | Missing right pectoral fin | Monture Creek (Region 4) | Cedar Creek (Region 4) | 7.93 | 148.500-55 | Fish detected moving up the Flathead River; last detected in the mainstem Flathead River near the town of Dixon | Fish detected in the lower portion of the Jocko River approx. 1/2 mile upstream of confluence with Flathead on 7/2/09; undetected since this detection | Fish has not been detected since 7/2/09 |
| 6/11/2009 | Hook-n-line sampling | 985120029215361 | 710 | 3686 | Thompson River | 6/15/2009 12:00 | Previously captured in Trestle Creek weir as adult in 2006 (up on 9/15 and down on 9/29) | Fishtrap Creek (Region 4) | Copper Creek (Region 4) | 18,731,200 | N/A | | | Fish was captured during stream electrofishing activities on 7/21/09 in Fishtrap Creek (paired up with another bull trout) |
| 6/11/2009 | Night E-fishing | 985121001869178 | 660 | 2722 | Thompson River | 6/15/2009 12:00 | | Fishtrap Creek (Region 4) | Upper Rock Creek (Region 4) | 3,000,000 | N/A | | | |
| 9/15/2009 | Fish Ladder | 985121017314384 | 563 | 1815 | St. Regis | 9/18/09 @ 13:30 | | Cedar Creek (Region 4) | Morris Creek (Region 1) | 1.14 | N/A | | | |
| 9/21/2009 | Fish Ladder | 985121015961762 | 600 | 1845 | St. Regis | 9/23/09 @ 14:45 | | Fish Creek (Region 4) | Rattlesnake Creek (Region 4) | 2.21 | N/A | | | |
| 9/21/2009 | Fish Ladder | 985121017312262 | 610 | 2041 | St. Regis | 9/23/09 @ 14:45 | | Upper Rock Creek (Region 4) | Cedar Creek (Region 4) | 22.95 | N/A | | | |
| 9/21/2009 | Hook-n-line sampling | 985121016754113 | 585 | 1701 | St. Regis | 9/23/09 @ 14:45 | | Rattlesnake Creek (Region 4) | Cedar Creek (Region 4) | 1.83 | N/A | | | |
| 9/22/2009 | Fish Ladder | 985121015942027 | 646 | 2382 | Fishtrap Creek | 9/25/09 @ 15:20 | | Fishtrap Creek (Region 4) | Cooper Gulch (Region 4) | 207,537,000 | N/A | | | |
| 9/22/2009 | Hook-n-line sampling | 985121015639163 | 490 | 964 | Fishtrap Creek | 9/25/09 @ 15:20 | | Thompson River (Region 4) | Cooper Gulch (Region 4) | 2,000,000 | N/A | | | |
| 9/23/2009 | Fish Ladder | 985121001925944 | 592 | 2100 | Fishtrap Creek | 9/25/09 @ 15:20 | | Fishtrap Creek (Region 4) | Rock Creek (Region 2) | 254.1 | N/A | | | |
| 9/28/2009 | Fish Ladder | 985121016755149 | 700 | 3289 | Clark Fork River ~ 400m below the mouth of St. Regis | 9/30/09 @ 14:20 | | Cedar Creek (Region 4) | Upper Rock Creek (Region 4) | 1.3 | | | | |

| # | Date | Species | Length(mm) | Weight(g) | Sex | Mark | Contents/comments | Sampling Method | IC or TFR | Location |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4/24/09 | NP | 230 | 80 | | Too small to floy tag | too small to lavage | EF | IC | |
| 2 | 4/30/09 | NP | 228 | 66 | | n | n | EF | IC | |
| | | | | | | | | | | |
| 1 | 4/1/2009 | NP | 525 | n | M | O floy 00005 | | angled | IC | abover TR Islands |
| 2 | 4/6/2009 | NP | 456 | 650 | UK | floy 00007 | insects | angled | IC | above TR/islands |
| 3 | 4/6/2009 | NP | 466 | 620 | M/ripe | floy 00010 | empty | angled | IC | above TR/islands |
| 4 | 4/6/2009 | NP | 490 | n | M/ripe | floy 00008 | insects | angled | IC | above TR/islands |
| 7 | 4/9/2009 | NP | 535 | 1030 | M/ripe | o floy 00020 | empty | angled | IC | above TR/islands |
| 5 | 4/6/2009 | NP | 496 | 910 | UK | O floy 00013 | frog | angled | IC | above TR/islands |
| 6 | 4/9/2009 | NP | 520 | 960 | M/ripe | o floy 00022 | empty | angled | IC | above TR/islands |
| 8 | 4/9/2009 | NP | 712 | 2650 | m | o floy 00023 | empty | angled | IC | above TR/islands |
| 9 | 5/8/2009 | NP | 486 | 775 | M/ripe | O floy 00109 | six 25 mm. fish | angled | IC | above TR/islands |
| 10 | 4/17/2009 | NP | 538 | 1450 | F | o floy 00028 | empty | angled | TFR | angled/smelt |
| | | | | | | | | | | |
| 1 | 4/24/09 | NP | 857 | 5620 | Female | O floy 00057 | empty | EF | IC | |
| 2 | 4/24/09 | NP | 521 | 1056 | Male/ripe | O floy 00058 | empty | EF | IC | |
| 3 | 4/24/09 | NP | 515 | 822 | Male/ripe | O floy 00059 | NPM 75mm. | EF | IC | |
| 4 | 4/24/09 | NP | 540 | 978 | Male/ripe | O floy 00060 | empty | EF | IC | |
| 5 | 4/24/09 | NP | 512 | 880 | | O floy 00061 | empty | EF | IC | |
| 6 | 4/24/09 | NP | 591 | 1474 | Male/ripe | O floy 00065 | empty | EF | IC | |
| 7 | 4/24/09 | NP | 492 | 750 | Male/ripe | O floy 00066 | sample # 4 - 3 unknown 20 mm | EF | IC | |
| 8 | 4/24/09 | NP | 630 | 2018 | | O floy 00067 | sample # 5 - Onc. Unknown | EF | IC | |
| 9 | 4/24/09 | NP | 640 | 2216 | | O floy 00068 | MWF 245mm, 106g. Grass | EF | IC | |
| 10 | 4/24/09 | NP | 552 | 1004 | Male/ripe | O floy 00069 | empty | EF | IC | |
| 11 | 4/24/09 | NP | 620 | 1618 | Male/ripe | O floy 00070 | grass | EF | IC | |
| 12 | 4/24/09 | NP | 562 | 1572 | Male/ripe, broken back | O floy 00071 | grass | EF | IC | |
| 13 | 4/24/09 | NP | 515 | 1020 | Male/ripe | O floy 00072 | sample # 6 - Onc. Unknown | EF | IC | |
| 14 | 4/24/09 | NP | 585 | 1230 | Male/ripe | O floy 00073 | empty | EF | IC | |
| 15 | 4/24/09 | NP | 755 | 3324 | Male/ripe | O floy 00074 | grass | EF | IC | |
| 16 | 4/24/09 | NP | 585 | 1506 | Male/ripe | O floy 00075 | empty | EF | IC | |
| 17 | 4/24/09 | NP | 550 | 1256 | | O floy 00076 | empty | EF | IC | |
| 18 | 4/24/09 | NP | 512 | 914 | | O floy 00077 | empty | EF | IC | |
| 19 | 4/24/09 | NP | 530 | 960 | Male/ripe | O floy 00078 | empty | EF | IC | |
| 20 | 4/24/09 | NP | 565 | 1354 | | O floy 00079 | insect (water tiger) | EF | IC | |
| 21 | 4/24/09 | NP | 320 | 964 | Male/ripe | O floy 00080 | MWF 170mm. 44g., stonefly nymph | EF | IC | |
| 22 | 4/24/09 | NP | 562 | 1092 | | O floy 00325 | empty | EF | IC | |
| 23 | 4/30/09 | NP | 572 | 1322 | Male/ripe | O floy 00085 | empty | EF | IC | |
| 24 | 4/30/09 | NP | 535 | 1022 | Male/ripe | O floy 00086 | LSS 80mm. | EF | IC | |
| 25 | 4/30/09 | NP | 560 | 1388 | Male/ripe | O floy 00087 | empty | EF | IC | |
| 26 | 4/30/09 | NP | 515 | 840 | Male/ripe | O floy 00088 | empty | EF | IC | |
| 27 | 4/30/09 | NP | 540 | 1054 | | O floy 00089 | sample # 7 - 10 NPM, 1 stonefly nymph | EF | IC | |
| 28 | 4/30/09 | NP | 562 | 1170 | Male/ripe | O floy 00090 | photo 1 small fish | EF | IC | |
| 29 | 4/30/09 | NP | 607 | 1570 | Female/ripe | O floy 00091 | photo 2 small fish | EF | IC | |
| 30 | 4/30/09 | NP | 716 | 2770 | Male/ripe | O floy 00096 | empty | EF | IC | |
| 31 | 4/30/09 | NP | 810 | 4520 | | O floy 00097 | empty | EF | IC | |
| 32 | 5/15/09 | NP | 595 | 1284 | Male/ripe | O floy 00118 | Sample # 8 3 small fish 25mm. | EF | IC | |
| 33 | 5/15/09 | NP | 720 | 2982 | Male/ripe | O floy 00119 | empty | EF | IC | |
| 34 | 5/15/09 | NP | 585 | 1380 | Male/ripe | O floy 00120 | Sample # 8: 4 small fish 25mm. | EF | IC | |
| 35 | 5/15/09 | NP | 611 | 1622 | | O floy 00121 | 15 small fish | EF | IC | |
| 36 | 5/15/09 | NP | 618 | 1690 | | O floy 00122 | Sample # 9: Possible trout 155mm. 42g., 1 small fish, 2 leeches, 1 stone fly nymph | EF | IC | |
| 37 | 5/15/09 | NP | 785 | 4110 | | O floy 00123 | empty | EF | IC | |
| 38 | 5/15/09 | NP | 856 | 5650 | | O floy 00124 | Sample # 10 - 2 LSS | EF | IC | |
| 39 | 5/15/09 | NP | 580 | 1440 | | O floy 00125 | Pocket gopher, 3 small fish, 1 35mm. Sucker | EF | IC | |
| 40 | 5/15/09 | NP | 790 | 3666 | Belly abrasion 6 inches | O floy 00126 | empty | EF | IC | |
| 41 | 5/15/09 | NP | 603 | 1406 | | O floy 00127 | 4 small fish | EF | IC | |

| # | Date | Species | Length(mm) | Weight(g) | Sex | Mark | Contents/comments | Sampling Method | IC or TFR | Location |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 5/15/09 | NP | 830 | 4550 | Male/ripe | O floy 00128 | Sample # 11 - flesh & spine | EF | IC | |
| 43 | 5/15/09 | NP | 610 | 1510 | Male/ripe | O floy 00129 | empty | EF | IC | |
| 44 | 5/15/09 | NP | 360 | 298 | | O floy 00130 | n | EF | IC | |
| 45 | 5/20/09 | NP | 695 | 3018 | | O floy 00131 | MWF 365mm. 264g. | EF | IC | |
| 46 | 5/20/09 | NP | 685 | 2386 | Spent F. | O floy 00132 | Fish parts | EF | IC | |
| 47 | 5/20/09 | NP | 696 | 2982 | | O floy 00133 | PM 400mm. 478g. | EF | IC | |
| 48 | 5/20/09 | NP | 580 | 1180 | Male/ripe | O floy 00134 | empty | EF | IC | |
| 49 | 5/20/09 | NP | 608 | 1708 | | O floy 00135 | sample 13:four 30mm. Fish - 4 NPM | EF | IC | |
| 50 | 5/20/09 | NP | 525 | 1116 | | O floy 00136 | NPM 177mm. 28g. | EF | IC | |
| 51 | 5/20/09 | NP | 570 | 1410 | | O floy 00137 | LSS 250mm. 102g. | EF | IC | |
| 52 | 5/20/09 | NP | 592 | 1352 | Male/ripe | O floy 00138 | 13 little fish 30mm. | EF | IC | |
| 53 | 5/20/09 | NP | 525 | 920 | Male/ripe | O floy 00139 | empty | EF | IC | |
| 54 | 5/20/09 | NP | 801 | 3768 | | O floy 00851 | n | EF | IC | |
| 55 | 5/20/09 | NP | 485 | 752 | | O floy 00852 | n | EF | IC | |
| 56 | 5/27/09 | NP | 750 | 2712 | Male/ripe | O floy 00853 | n | EF | IC | |
| 57 | 5/27/09 | NP | 835 | 5150 | Spent F. | O floy 00854 | n | EF | IC | |
| 58 | 5/27/09 | NP | 820 | 3775 | Spent F. | O floy 00855 | n | EF | IC | |
| 59 | 5/27/09 | NP | 307 | 180 | | O floy 00856 | n | EF | IC | |
| 60 | 5/29/09 | NP | 685 | 2630 | | O floy 00141 | MWF 342 mm. | EF | IC | |
| 61 | 6/18/09 | NP | 569 | 1342 | | O floy 00142 | empty | EF | IC | |
| 62 | 6/18/09 | NP | 970 | 6680 | Hook wound, fins eroded, open wounds on dorsal side of peduncle | O floy 00143 | empty | EF | IC | |
| 63 | 6/18/09 | NP | 303 | 172 | | O floy 00144 | n | EF | IC | |
| 64 | 4/20/09 | NP | 292 | 152 | | O floy 00039 | n | EF | TFR | |
| 65 | 4/20/09 | NP | 330 | 226 | | O floy 00040 | n | EF | TFR | |
| 66 | 4/20/09 | NP | 539 | 1182 | | O floy 00041 | leech, LSS 245 | EF | TFR | |
| 67 | 4/20/09 | NP | 562 | 1702 | | O floy 00042 | MWF 326mm., 254g. | EF | TFR | |
| 68 | 4/20/09 | NP | 600 | 2212 | | O floy 00043 | RBT/WCT 300mm., 200g | EF | TFR | |
| 69 | 4/20/09 | NP | 589 | 1372 | Male/ripe | O floy 00044 | UK jar #4 - Unknown 80 mm | EF | TFR | |
| 70 | 4/20/09 | NP | 644 | 2302 | caught 5/2/09 | O floy 00045 | empty | EF | TFR | |
| 71 | 4/20/09 | NP | 628 | 1984 | | O floy 00046 | MWF 314mm. 220g., MWF 18g. | EF | TFR | |
| 72 | 4/20/09 | NP | 588 | 1534 | Male/ripe | O floy 00047 | empty | EF | TFR | |
| 73 | 4/20/09 | NP | 640 | 2154 | caught 5/15/09 | O floy 00048 | empty | EF | TFR | |
| 74 | 4/27/09 | NP | 605 | 1600 | 2 hooks found, 1 removed, part of jaw missing | O floy 00081 | empty | EF | TFR | |
| 75 | 4/27/09 | NP | 555 | 1156 | | O floy 00082 | empty | EF | TFR | |
| 76 | 4/27/09 | NP | 595 | 1484 | Male/ripe, 1hook found and removed | O floy 00083 | empty | EF | TFR | |
| 77 | 5/1/09 | NP | 563 | 1286 | | O floy 00098 | Insects | EF | TFR | |
| 78 | 5/1/09 | NP | 500 | 670 | | O floy 00103 | empty | EF | TFR | |
| 79 | 5/28/09 | NP | 775 | 3440 | | O floy 00140 | empty | EF | TFR | |
| | | | | | | | | | | |
| 1 | 4/6/2009 | NP | 327 | 220 | UK | O floy 00009 | n | Gill Net | IC | above TR/islands |
| 2 | 4/24/2009 | NP | 332 | 236 | UK | o floy 00055 | n | Gill Net | IC | above TR/islands |
| 3 | 4/24/2009 | NP | 438 | 590 | UK | o floy 00056 | empty | Gill Net | IC | above TR/islands |
| 4 | 4/20/2009 | NP | 459 | 680 | M/ripe | o floy 00037 | sample 3 - NPM, LSS | Gill Net | IC | above TR/islands |
| 5 | 4/24/2009 | NP | 461 | 544 | UK | o floy 00063 | LSS172mm | Gill Net | IC | above TR/islands |
| 6 | 4/6/2009 | NP | 482 | 730 | UK | floy 00012 | empty | Gill Net | IC | above TR/islands |
| 7 | 4/9/2009 | NP | 487 | 790 | M/ripe | o floy 00018 | empty | Gill Net | IC | above TR/islands |
| 8 | 4/1/2009 | NP | 490 | 850 | UK | O floy 00006 | MWF 223mm | Gill Net | IC | above TR |
| 9 | 4/6/2009 | NP | 505 | 830 | M/ripe | floy 00011 | empty | Gill Net | IC | above TR/islands |
| 10 | 4/15/2009 | NP | 512 | 2170 | M/ripe | o floy 00027 | empty | Gill Net | IC | above TR/islands |
| 11 | 4/20/2009 | NP | 512 | 1080 | UK | o floy 00036 | fish stomach limna | Gill Net | IC | above TR/islands |
| 12 | 4/24/2009 | NP | 520 | 1002 | M/ripe | o floy 00062 | empty | Gill Net | IC | above TR/islands |
| 13 | 4/9/2009 | NP | 533 | 940 | UK | y floy16403 | sample 2 - unknown flesh & spein | Gill Net | IC | above TR/islands |

| # | Date | Species | Length(mm) | Weight(g) | Sex | Mark | Contents/comments | Sampling Method | IC or TFR | Location |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 4/9/2009 | NP | 539 | 1130 | M/ripe | o floy 00021 | empty | Gill Net | IC | above TR/islands |
| 15 | 4/9/2009 | NP | 540 | 1020 | M/ripe | o floy 00019 | empty | Gill Net | IC | above TR/islands |
| 16 | 4/20/2009 | NP | 548 | 1080 | M/ripe | o floy 00033 | empty | Gill Net | IC | above TR/islands |
| 17 | 4/9/2009 | NP | 552 | 1240 | UK | o floy 00025 | YP186/# 1 - NPM | Gill Net | IC | above TR/islands |
| 18 | 4/15/2009 | NP | 576 | 1430 | F | o floy 00026 | 39mmspine | Gill Net | IC | above TR/islands |
| 19 | 4/9/2009 | NP | 594 | 1470 | M/ripe | o floy 00024 | empty | Gill Net | IC | above TR/islands |
| 20 | 4/20/2009 | NP | 727 | 3240 | M/ripe | o floy 00034 | empty | Gill Net | IC | above TR/islands |
| 21 | 4/20/2009 | NP | 757 | 3730 | F/ripe | o floy 00038 | empty | Gill Net | IC | above TR/islands |
| 22 | 3/27/2009 | NP | 759 | 3580 | F | O floy 00003 | Y/empty | Gill Net | IC | Island complex above TR |
| 23 | 4/1/2009 | NP | 782 | 4900 | M | O floy 00004 | Y bone | Gill Net | IC | abover TR Islands |
| 24 | 4/20/2009 | NP | 791 | 4035 | F/ripe | o floy 00035 | empty | Gill Net | IC | above TR/islands |
| 25 | 4/6/2009 | NP | 887 | 6110 | F | floy 00014 | empty | Gill Net | IC | above TR/islands |
| 26 | 3/27/2009 | NP | 1088 | 12000 | F | O floy 00002 | Y/empty | Gill Net | IC | below 2nd island above TR |
| 27 | 4/30/2009 | NP | 480 | 825 | M/ripe | o floy 00092 | BLT 150mm. | Gill Net | IC | above TR/islands |
| 28 | 4/30/2009 | NP | 790 | 4790 | F/ripe | o floy 00093 | empty | Gill Net | IC | above TR/islands |
| 29 | 4/30/2009 | NP | 1080 | 11310 | spent Female | o floy 00094 | empty | Gill Net | IC | above TR/islands |
| 30 | 4/30/2009 | NP | 820 | 5000 | UK | o floy 00095 | empty | Gill Net | IC | above TR/islands |
| 31 | 5/4/2009 | NP | n | n | n | O floy 00104 | n | Gill Net | IC | above TR/islands |
| 32 | 5/8/2009 | NP | 622 | 1530 | M/ripe | O floy 00110 | empty | Gill Net | IC | Above TR/islands |
| 33 | 5/8/2009 | NP | 642 | 1865 | M/ripe | O floy 00111 | fish back bone 130 mm., insect | Gill Net | IC | Above TR/islands |
| 34 | 5/8/2009 | NP | 467 | 710 | M/ripe | O floy 00112 | 4 25mm. Fish | Gill Net | IC | Above TR/islands |
| 35 | 5/8/2009 | NP | 547 | 1340 | UK | O floy 00113 | LSS 237mm. | Gill Net | IC | Above TR/islands |
| 36 | 5/8/2009 | NP | 494 | 840 | M/ripe | O floy 00114 | empty | Gill Net | IC | Above TR/islands |
| 37 | 5/8/2009 | NP | 630 | 2055 | UK | O floy 00115 | bones | Gill Net | IC | Above TR/islands |
| 38 | 7/7/2009 | NP | 517 | 916 | n | O floy 00145 | empty/view data sheet for additional comments | Gill Net | IC | Above TR/islands |
| | | | | | | | | | | |
| 1 | 3/26/2009 | NP | 801 | 4810 | F | O floy 00001 | Y/empty | Gill Net | TFR | opposite Wild Goose |
| 2 | 4/8/2009 | NP | 290 | 200 | UK | O floy 00015 | n | Gill Net | TFR | north of pump house 80m |
| 3 | 4/17/2009 | NP | 538 | 1450 | F | o floy 00028 | empty | Gill Net | TFR | bay west of Steamboat Island |
| 4 | 4/17/2009 | NP | 290 | 150 | UK | o floy 00029 | n | Gill Net | TFR | south of pump house 70m |
| 5 | 4/17/2009 | NP | 617 | 2030 | F | o floy 00030 | empty | Gill Net | TFR | opposite Wild Goose |
| 6 | 4/17/2009 | NP | 588 | 1560 | M/ripe | o floy 00031 | empty | Gill Net | TFR | NE corner of pond |
| 7 | 4/17/2009 | NP | 556 | 1330 | M/ripe | o floy 00032 | empty | Gill Net | TFR | NE corner of pond |
| 8 | 4/22/2009 | NP | 311 | 250 | UK | O floy 00054 | n | Gill Net | TFR | NE corner of pond |
| 9 | 4/27/2009 | NP | 342 | 296 | UK | o floy 00084 | n | Gill Net | TFR | bay west of Steamboat Island |
| 10 | 5/1/2009 | NP | 555 | 1226 | UK | O floy 00099 | insects | Gill Net | TFR | opposite Wild Goose |
| 11 | 5/1/2009 | NP | 308 | n | UK | O floy 00100 | n | Gill Net | TFR | bay west of Steamboat Island |
| 12 | 5/1/2009 | NP | 572 | 1306 | UK | O floy 00101and O floy 00102 | insects | Gill Net | TFR | opposite Wild Goose |
| 13 | 5/7/2009 | NP | 630 | 2010 | UK | O floy 00105 | empty | Gill Net | TFR | opposite Wild Goose |
| 14 | 5/7/2009 | NP | 442 | 640 | M/ripe | O floy 00106 | empty | Gill Net | TFR | opposite Wild Goose |
| 15 | 5/7/2009 | NP | 552 | 1140 | M/ripe | O floy 00107 | empty | Gill Net | TFR | opposite Wild Goose |
| 16 | 5/7/2009 | NP | 613 | 1610 | M/ripe | O floy 00108 | empty | Gill Net | TFR | opposite Wild Goose |
| 17 | 5/11/2009 | NP | 734 | 2900 | M/ripe | O floy 00117 | empty | Gill Net | TFR | opposite Wild Goose |
| | | | | | | | | | | |
| 1 | 4/24/09 | NP | n | n | Female Ripe | Recap O floy 00002 | empty | EF | IC | |
| 2 | 4/30/09 | NP | 528 | 964 | Male/ripe | Recap O floy 00005 | empty | EF | IC | |
| 3 | 4/30/09 | NP | 462 | 710 | | Recap O floy 00007 | grass | EF | IC | |
| 4 | 5/15/09 | NP | 597 | 1426 | Hook in gullet | Recap O floy 00065 | empty | EF | IC | |
| 5 | 5/15/09 | NP | 581 | 1246 | | Recap O floy 00073 | empty | EF | IC | |
| 6 | 5/15/09 | NP | 785 | 4420 | | RecapO floy 00035 | MWF 390mm. | EF | IC | |
| 7 | 5/15/09 | NP | 542 | 1074 | | RecapO floy 00089 | 13 leeches, 35-50 mm. | EF | IC | |
| 8 | 5/20/09 | NP | 605 | 1434 | | Recap O floy 00075 | LSS 30 mm. | EF | IC | |
| 9 | 5/20/09 | NP | 618 | 1654 | | Recap O floy 00091 | Fish parts | EF | IC | |
| 10 | 5/27/09 | NP | n | n | | Recap O floy 00002 | n | EF | IC | |
| 11 | 5/27/09 | NP | n | n | Right side wound | Recap O floy 00034 | n | EF | IC | |
| 12 | 5/27/09 | NP | 870 | n | | Recap O floy 00057 | n | EF | IC | |
| 13 | 5/27/09 | NP | n | n | | Recap O floy 00131 | n | EF | IC | |
| 14 | 5/29/09 | NP | n | n | | Recap O floy 00002 | n | EF | IC | |
| 15 | 5/29/09 | NP | n | 11400 | | Recap O floy 00094 | empty | EF | IC | |
| 16 | 6/18/09 | NP | 635 | 1576 | | Recap O floy 00070 | empty | EF | IC | |
| 17 | 6/18/09 | NP | 487 | 734 | | Recap O floy 00112 | empty | EF | IC | |
| 18 | 4/27/09 | NP | n | n | Above TR Islands | Recap O floy 00030 | empty | EF | TFR | |
| 19 | 4/27/09 | NP | n | n | | Recap O floy 00047 | empty | EF | TFR | |

| # | Date | Species | Length(mm) | Weight(g) | Sex | Mark | Contents/comments | Sampling Method | IC or TFR | Location |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 4/24/2009 | NP | n | n | M/ripe | Recap o floy 00034 | empty | Gill Net | IC | above TR/islands |
| 21 | 5/4/2009 | NP | n | n | n | Recap O floy 00094 | n | Gill Net | IC | above TR/islands |
| 22 | 5/7/2009 | NP | 642 | 2050 | UK | Recap O floy 00048 | Bones 25 mm. | Gill Net | TFR | NE corner of pond |
| 23 | 5/7/2009 | NP | n | n | n | Recap O floy 00103 | empty | Gill Net | TFR | opposite Wild Goose |
| 24 | 5/29/09 | NP | 775 | 3660 | | Recap Y floy 16760 | empty | EF | IC | |
| | | | | | | | | | | |
| **October 2009 Sampling** | | | | | | | | | | |
| 1 | 10/9/2009 | NP | 320 | 208 | n | n | n | Gill Net | IC | Above TR/islands |
| 2 | 10/9/2009 | NP | 616 | 1700 | n | O Floy 00301 | n | Gill Net | IC | Above TR/islands |
| 3 | 10/9/2009 | NP | 363 | 345 | n | O Floy 00302 | n | Gill Net | IC | Above TR/islands |
| 4 | 10/9/2009 | NP | 310 | 192 | n | n | n | Gill Net | IC | Above TR/islands |
| 5 | 10/9/2009 | NP | 283 | 160 | n | n | n | Gill Net | IC | Above TR/islands |
| 6 | 10/9/2009 | NP | 315 | 200 | n | n | n | Gill Net | IC | Above TR/islands |
| 7 | 10/9/2009 | NP | 302 | n | n | n | n | Gill Net | IC | Above TR/islands |
| 8 | 10/16/2009 | NP | 295 | 160 | n | n | n | Gill Net | IC | Above TR/islands |
| 9 | 10/16/2009 | NP | 334 | 218 | n | n | n | Gill Net | IC | Above TR/islands |
| 10 | 10/16/2009 | NP | 279 | 130 | n | n | n | Gill Net | IC | Above TR/islands |
| 11 | 10/16/2009 | NP | 319 | 164 | n | n | n | Gill Net | IC | Above TR/islands |
| 12 | 10/16/2009 | NP | 342 | 226 | n | n | n | Gill Net | IC | Above TR/islands |
| 13 | 10/16/2009 | NP | 308 | 156 | n | n | n | Gill Net | IC | Above TR/islands |
| 14 | 10/16/2009 | NP | 309 | 178 | n | n | n | Gill Net | IC | Above TR/islands |
| 15 | 10/16/2009 | NP | 512 | 826 | n | n | Y | Gill Net | IC | Above TR/islands |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5/1/2009 | BLT | 271 | 174 | n | PIT tag # 985121009494278 | Genetic Vial # 024 | Gill Net | TFR | NE Corner of Pond |

Appendix A

Table A-3. Age data estimated for northern pike captured in the Thompson Falls reservoir and island complex in 2009.

| Index # | Species | Collection Date | Total Length mm | Weight g. | Est Age | Section | Capture Method | Floy |
|---|---|---|---|---|---|---|---|---|
| 127 | NP | 10/9/2009 | 283 | 160 | 0 | IC | Gill Net | No Floy |
| 92 | NP | 4/30/2009 | 228 | 66 | 1 | IC | Electro fish | No Floy |
| 72 | NP | 4/24/2009 | 230 | 80 | 1 | IC | Electro fish | No Floy |
| 15 | NP | 4/8/2009 | 290 | 200 | 1 | TFR | Gill Net | O floy 00015 |
| 28 | NP | 4/17/2009 | 290 | 150 | 1 | TFR | Gill Net | O floy 00029 |
| 48 | NP | 4/21/2009 | 292 | 154 | 1 | TFR | Electro fish | O floy 00050 |
| 117 | NP | 5/27/2009 | 307 | 180 | 1 | IC | Electro fish | O floy 00856 |
| 50 | NP | 4/21/2009 | 308 | 182 | 1 | TFR | Electro fish | O floy 00052 |
| 93 | NP | 5/1/2009 | 308 | 176 | 1 | TFR | Gill Net | O floy 00100 |
| 52 | NP | 4/22/2009 | 311 | 250 | 1 | TFR | Gill Net | O floy 00054 |
| 9 | NP | 4/6/2009 | 327 | 220 | 1 | IC | Gill Net | O floy 00009 |
| 38 | NP | 4/20/2009 | 330 | 226 | 1 | TFR | Electro fish | O floy 00040 |
| 53 | NP | 4/24/2009 | 332 | 236 | 1 | TFR | Gill Net | O floy 00055 |
| 83 | NP | 4/27/2009 | 342 | 296 | 1 | TFR | Gill Net | O floy 00084 |
| 110 | NP | 5/15/2009 | 360 | 298 | 1 | IC | Electro fish | O floy 00130 |
| 54 | NP | 4/24/2009 | 438 | 590 | 2 | IC | Gill Net | O floy 00056 |
| 96 | NP | 5/7/2009 | 442 | 640 | 2 | TFR | Gill Net | O floy 00106 |
| 98 | NP | 5/8/2009 | 486 | 775 | 2 | IC | Angled | O floy 000109 |
| 94 | NP | 5/1/2009 | 500 | 670 | 2 | TFR | Electro fish | O floy 00103 |
| 65 | NP | 4/24/2009 | 515 | 1020 | 2 | IC | Electro fish | O floy 00072 |
| 60 | NP | 4/24/2009 | 520 | 1002 | 2 | IC | Gill Net | O floy 00062 |
| 79 | NP | 4/24/2009 | 530 | 960 | 2 | IC | Electro fish | O floy 00078 |
| 78 | NP | 4/24/2009 | 320 | 964 | 2 | IC | Electro fish | O floy 00080 |
| 7 | NP | 4/6/2009 | 456 | 650 | 3 | IC | Gill Net | O floy 00007 |
| 36 | NP | 4/20/2009 | 459 | 680 | 3 | IC | Gill Net | O floy 00037 |
| 10 | NP | 4/6/2009 | 466 | 620 | 3 | IC | Gill Net | O floy 00010 |
| 86 | NP | 4/30/2009 | 480 | 825 | 3 | IC | Gill Net | O floy 00092 |
| 12 | NP | 4/6/2009 | 482 | 730 | 3 | IC | Gill Net | O floy 00012 |
| 16 | NP | 4/9/2009 | 487 | 790 | 3 | IC | Gill Net | O floy 00018 |
| 6 | NP | 4/1/2009 | 490 | 850 | 3 | IC | Gill Net | O floy 00006 |
| 63 | NP | 4/24/2009 | 492 | 750 | 3 | IC | Electro fish | O floy 00066 |
| 13 | NP | 4/6/2009 | 496 | 910 | 3 | IC | Angled | O floy 00013 |
| 11 | NP | 4/6/2009 | 505 | 830 | 3 | IC | Gill Net | O floy 00011 |
| 26 | NP | 4/15/2009 | 512 | 2170 | 3 | IC | Gill Net | O floy 00027 |
| 35 | NP | 4/20/2009 | 512 | 1080 | 3 | IC | Gill Net | O floy 00036 |
| 58 | NP | 4/24/2009 | 512 | 880 | 3 | IC | Electro fish | O floy 00061 |
| 76 | NP | 4/24/2009 | 512 | 914 | 3 | IC | Electro fish | O floy 00077 |
| 59 | NP | 4/24/2009 | 515 | 822 | 3 | IC | Electro fish | O floy 00059 |
| 56 | NP | 4/24/2009 | 521 | 1056 | 3 | IC | Electro fish | O floy 00058 |
| 51 | NP | 4/21/2009 | 522 | 930 | 3 | TFR | Electro fish | O floy 00053 |
| 5 | NP | 4/1/2009 | 525 | n | 3 | IC | Angled | O floy 00005 |
| 47 | NP | 4/21/2009 | 532 | 1300 | 3 | TFR | Electro fish | O floy 00049 |
| 75 | NP | 4/24/2009 | 550 | 1256 | 3 | IC | Electro fish | O floy 00076 |
| 73 | NP | 4/24/2009 | 552 | 1004 | 3 | IC | Electro fish | O floy 00069 |
| 81 | NP | 4/27/2009 | 555 | 1156 | 3 | TFR | Electro fish | O floy 00082 |
| 74 | NP | 4/24/2009 | 562 | 1092 | 3 | IC | Electro fish | O floy 00325 |
| 77 | NP | 4/24/2009 | 565 | 1345 | 3 | IC | Electro fish | O floy 00079 |
| 84 | NP | 4/30/2009 | 572 | 1322 | 3 | IC | Electro fish | O floy 00085 |
| 71 | NP | 4/24/2009 | 585 | 1230 | 3 | IC | Electro fish | O floy 00073 |

Appendix A

Table A-3. Age data estimated for northern pike captured in the Thompson Falls reservoir and island complex in 2009.

| Index # | Species | Collection Date | Total Length mm | Weight g. | Est Age | Section | Capture Method | Floy |
|---|---|---|---|---|---|---|---|---|
| 82 | NP | 4/27/2009 | 595 | 1484 | 3 | TFR | Electro fish | O floy 00083 |
| 41 | NP | 4/20/2009 | 600 | 2212 | 3 | TFR | Electro fish | O floy 00043 |
| 80 | NP | 4/27/2009 | 605 | 1600 | 3 | TFR | Electro fish | O floy 00081 |
| 97 | NP | 5/7/2009 | 613 | 1610 | 3 | TFR | Gill Net | O floy 00108 |
| 61 | NP | 4/24/2009 | 461 | 544 | 4 | IC | Gill Net | O floy 00063 |
| 101 | NP | 5/8/2009 | 467 | 710 | 4 | IC | Gill Net | O floy 00112 |
| 19 | NP | 4/9/2009 | 520 | 960 | 4 | IC | Angled | O floy 00022 |
| 24 | NP | 4/9/2009 | 533 | 940 | 4 | IC | Gill Net | Y floy 16403 |
| 18 | NP | 4/9/2009 | 535 | 1030 | 4 | IC | Gill Net | O floy 00020 |
| 27 | NP | 4/17/2009 | 538 | 1450 | 4 | TFR | Angled | O floy 00028 |
| 20 | NP | 4/9/2009 | 539 | 1120 | 4 | IC | Gill Net | O floy 00021 |
| 17 | NP | 4/9/2009 | 540 | 1020 | 4 | IC | Gill Net | O floy 00019 |
| 57 | NP | 4/24/2009 | 540 | 978 | 4 | IC | Electro fish | O floy 00060 |
| 32 | NP | 4/20/2009 | 548 | 1080 | 4 | IC | Gill Net | O floy 00033 |
| 31 | NP | 4/17/2009 | 556 | 1330 | 4 | TFR | Gill Net | O floy 00032 |
| 40 | NP | 4/20/2009 | 562 | 1702 | 4 | TFR | Electro fish | O floy 00042 |
| 67 | NP | 4/24/2009 | 562 | 1572 | 4 | IC | Electro fish | O floy 00071 |
| 25 | NP | 4/15/2009 | 576 | 1430 | 4 | IC | Gill Net | O floy 00026 |
| 66 | NP | 4/24/2009 | 585 | 1506 | 4 | IC | Electro fish | O floy 00075 |
| 30 | NP | 4/17/2009 | 588 | 1560 | 4 | TFR | Gill Net | O floy 00031 |
| 42 | NP | 4/20/2009 | 589 | 1372 | 4 | TFR | Electro fish | O floy 00044 |
| 62 | NP | 4/24/2009 | 591 | 1474 | 4 | IC | Electro fish | O floy 00065 |
| 21 | NP | 4/9/2009 | 594 | 1470 | 4 | IC | Gill Net | O floy 00024 |
| 85 | NP | 4/30/2009 | 607 | 1570 | 4 | IC | Electro fish | O floy 00091 |
| 29 | NP | 4/17/2009 | 617 | 2030 | 4 | TFR | Gill Net | O floy 00030 |
| 70 | NP | 4/24/2009 | 620 | 1618 | 4 | IC | Electro fish | O floy 00070 |
| 99 | NP | 5/8/2009 | 622 | 1530 | 4 | IC | Gill Net | O floy 00110 |
| 44 | NP | 4/20/2009 | 628 | 1984 | 4 | TFR | Electro fish | O floy 00046 |
| 95 | NP | 5/7/2009 | 630 | 2010 | 4 | TFR | Gill Net | O floy 00105 |
| 46 | NP | 4/20/2009 | 640 | 2154 | 4 | TFR | Electro fish | O floy 00048 |
| 68 | NP | 4/24/2009 | 640 | 2216 | 4 | IC | Electro fish | O floy 00068 |
| 100 | NP | 5/8/2009 | 642 | 1865 | 4 | IC | Gill Net | O floy 00111 |
| 43 | NP | 4/20/2009 | 644 | 2302 | 4 | TFR | Electro fish | O floy 00045 |
| 90 | NP | 4/30/2009 | 716 | 2770 | 4 | IC | Electro fish | O floy 00096 |
| 23 | NP | 4/9/2009 | 552 | 1240 | 5 | IC | Gill Net | O floy 00025 |
| 45 | NP | 4/20/2009 | 588 | 1534 | 5 | TFR | Electro fish | O floy 00047 |
| 104 | NP | 5/15/2009 | 595 | 1284 | 5 | IC | Electro fish | O floy 00118 |
| 64 | NP | 4/24/2009 | 630 | 2018 | 5 | IC | Electro fish | O floy 00067 |
| 102 | NP | 5/8/2009 | 630 | 2055 | 5 | IC | Gill Net | O floy 00115 |
| 120 | NP | 5/29/2009 | 685 | 2630 | 5 | IC | Electro fish | O floy 00141 |
| 111 | NP | 5/20/2009 | 695 | 3018 | 5 | IC | Electro fish | O floy 00131 |
| 33 | NP | 4/20/2009 | 727 | 3240 | 5 | IC | Gill Net | O floy 00034 |
| 69 | NP | 4/24/2009 | 755 | 3324 | 5 | IC | Electro fish | O floy 00074 |
| 3 | NP | 3/27/2009 | 759 | 3580 | 5 | IC | Gill Net | O floy 00003 |
| 118 | NP | 5/28/2009 | 775 | 3440 | 5 | TFR | Electro fish | O floy 00140 |
| 119 | NP | 5/29/2009 | 775 | 3660 | 5 | IC | Electro fish | y floy 16760 |
| 34 | NP | 4/20/2009 | 791 | 4035 | 5 | IC | Gill Net | O floy 00035 |
| 91 | NP | 4/30/2009 | 810 | 4520 | 5 | IC | Electro fish | O floy 00097 |
| 112 | NP | 5/20/2009 | 685 | 2386 | 6 | IC | Electro fish | O floy 00132 |

Appendix A

Table A-3. Age data estimated for northern pike captured in the Thompson Falls reservoir and island complex in 2009.

| Index # | Species | Collection Date | Total Length mm | Weight g. | Est Age | Section | Capture Method | Floy |
|---|---|---|---|---|---|---|---|---|
| 113 | NP | 5/20/2009 | 696 | 2982 | 6 | IC | Electro fish | O floy 00133 |
| 22 | NP | 4/9/2009 | 712 | 2650 | 6 | IC | Angled | O floy 00023 |
| 103 | NP | 5/11/2009 | 734 | 2900 | 6 | IC | Gill Net | O floy 00117 |
| 114 | NP | 5/27/2009 | 750 | 2712 | 6 | IC | Electro fish | O floy 00853 |
| 37 | NP | 4/20/2009 | 757 | 3730 | 6 | IC | Gill Net | O floy 00038 |
| 4 | NP | 4/1/2009 | 782 | 4900 | 6 | IC | Gill Net | O floy 00004 |
| 106 | NP | 5/15/2009 | 785 | 4110 | 6 | IC | Electro fish | O floy 00123 |
| 87 | NP | 4/30/2009 | 790 | 4790 | 6 | IC | Gill Net | O floy 00093 |
| 108 | NP | 5/15/2009 | 790 | 3666 | 6 | IC | Electro fish | O floy 00126 |
| 1 | NP | 3/26/2009 | 801 | 4810 | 6 | TFR | Gill Net | O floy 00001 |
| 89 | NP | 4/30/2009 | 820 | 5000 | 6 | IC | Gill Net | O floy 00095 |
| 116 | NP | 5/27/2009 | 820 | 3775 | 6 | IC | Electro fish | O floy 00855 |
| 109 | NP | 5/15/2009 | 830 | 4550 | 6 | IC | Electro fish | O floy 00128 |
| 14 | NP | 4/6/2009 | 887 | 6110 | 6 | IC | Gill Net | O floy 00014 |
| 88 | NP | 4/30/2009 | 1080 | 11310 | 6 | IC | Gill Net | O floy 00094 |
| 105 | NP | 5/15/2009 | 720 | 2982 | 7 | IC | Electro fish | O floy 00119 |
| 115 | NP | 5/27/2009 | 835 | 5150 | 7 | IC | Electro fish | O floy 00854 |
| 107 | NP | 5/15/2009 | 856 | 5650 | 7 | IC | Electro fish | O floy 00124 |
| 2 | NP | 3/27/2009 | 1088 | 12000 | 8 | IC | Gill Net | O floy 00002 |

# Appendix B - Oregon Gulch Stream Restoration Conceptual Design Report

# OREGON GULCH STREAM RESTORATION CONCEPTUAL DESIGN REPORT (DRAFT)

Superior, Montana

*The Oregon Gulch stream restoration project area.*

**Submitted To:**

Trout Unlimited
Rob Roberts, Mine Restoration Coordinator
425 East Spruce Street, Unit 1
Missoula, Montana 59802

**Submitted By:**

River Design Group, Inc.
5098 Highway 93 South
Whitefish, Montana 59937

WestWater Consultants
1112 Catherine Lane
Corvallis, Montana 59828

November 2009

## TABLE OF CONTENTS

# 1 Introduction

River Design Group, Inc. (RDG) and WestWater Consultants, Inc. (WWC) were retained by Trout Unlimited (TU) to develop a conceptual level stream and floodplain restoration design for Oregon Gulch, a tributary to Cedar Creek in the Middle Clark Fork River drainage near Superior, Montana (Figure 2-1). The project area is located on private land in Township 26 North, Range 27 West, Section 21, on a patented mining claims that encompasses approximately four miles of Oregon Gulch. The project area includes approximately 2,200 ft of stream channel and associated floodplain.

Oregon Gulch is presently characterized by simplified aquatic habitat conditions, channel entrenchment, and seasonal dewatering due to loss of channel-floodplain connectivity. To address these limiting factors, the following design objectives were developed by TU in consultation with Montana Fish, Wildlife & Parks (FWP):

- ✓ To enhance and create high quality habitat conditions for fluvial bull trout (*Salvelinus confluentus*) and other native fish species,
- ✓ To improve and restore channel-floodplain connectivity and adjacent riverine riparian wetland communities,
- ✓ To improve soil conditions in order to increase the survival of plantings and to encourage natural plant colonization, and
- ✓ To avoid impacting the landowner's proposed building site and to maintain one mine tailings pile and existing pond as historical artifacts.

This report summarizes information used to develop the Oregon Gulch Conceptual Stream Restoration Plan (CSRP), which is included as Attachment A to this report.

# 2 Existing Project Area Conditions

## 2.1 Hydrology

The Oregon Gulch project area drains approximately 29.2 square miles, with elevations ranging from 4,000 feet at the confluence with Lost Creek to over 7,400 feet at the watershed divide at Lost Peak. A majority of the watershed is managed by the Lolo National Forest. Basin average annual precipitation upstream of the project area is estimated to be 62.3 inches. A majority of the precipitation occurs as snow, which melts between April and June in most years, although mid-winter rain-on-snow events occur periodically and can produce floods of significant magnitude. Due to local geology and climate, streams of this area of the Lolo National Forest have naturally evolved under an above average bedload

supply and high runoff regime. These conditions have resulted in stream types that are very dynamic in that they adjust to facilitate the deviations in flow and sediment produced within the watershed.

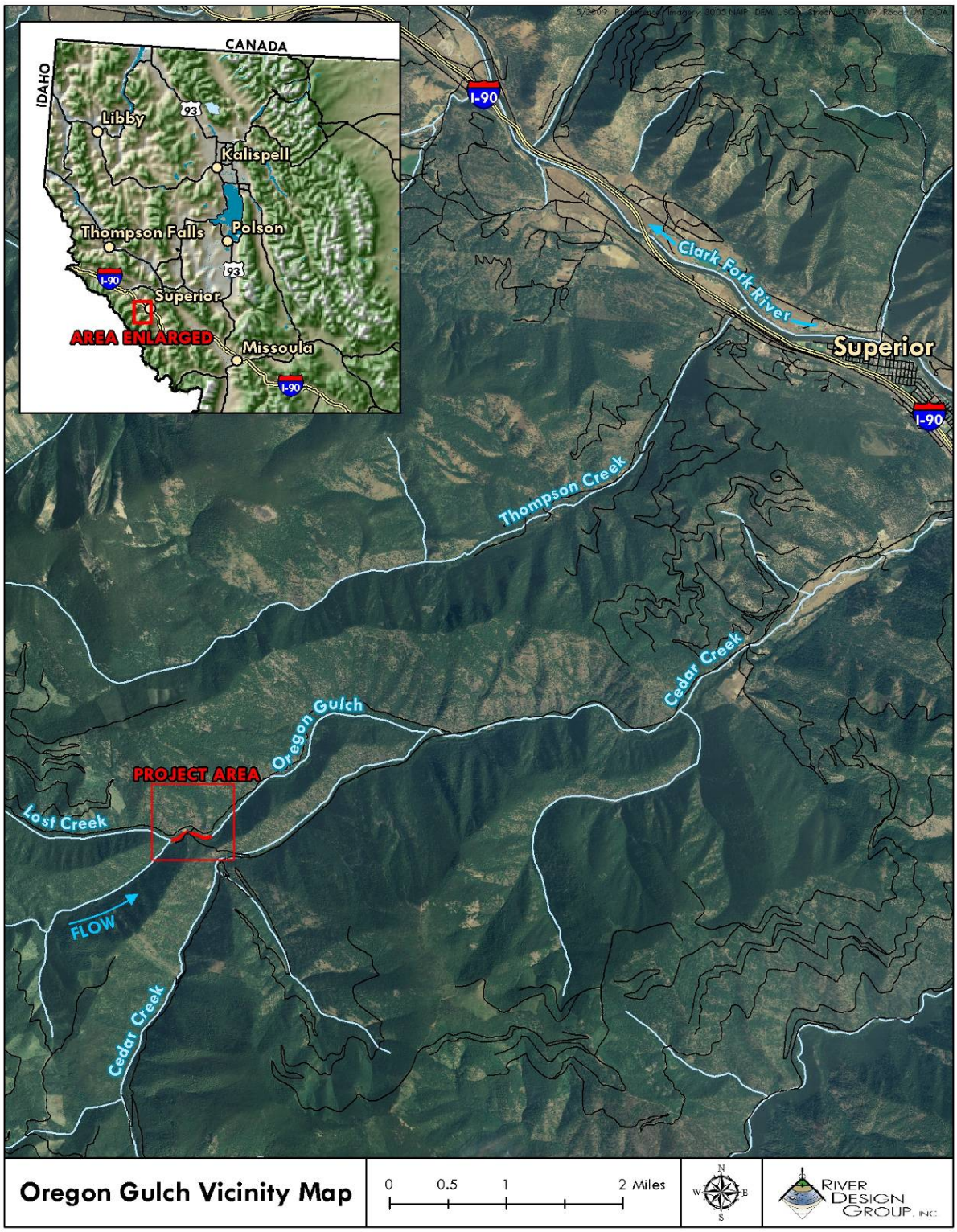


**Figure 2-1.** The Oregon Gulch project vicinity map.

For preliminary design and assessment purposes, a flood frequency analysis was conducted for the project area. The analysis was performed based on methods outlined in the United States Geological Survey Water Resources Investigations Report 03-4308. Using Geographic Information System auto-delineation software, drainage area was determined to be 29.2 $mi^2$. Mean (weighted) annual precipitation is 62.3 inches, with a percent forest cover estimate of 77.3. Results were reported for three regression equations and methods including: 1) basin characteristics including watershed area, mean weighted precipitation, and percent forest cover, 2) active channel width as observed in the reference reach, and 3) bankfull channel width as determined from reference cross-sections surveyed upstream of the project area in a relatively undisturbed reach of Oregon Gulch. Results are summarized in Table 2-1.

**Table 2-1.** Flood frequency analysis results for the Oregon Gulch watershed as delineated at the project area boundary (reported in cubic feet per second).

| Recurrence Interval (yrs) | Method 1 Basin Characteristics | Method 2 Project Area Channel Width | Method 3 Reference Channel Width | Average |
|---|---|---|---|---|
| 2 | 467 | 413 | 236 | 372 |
| 5 | 643 | 629 | 379 | 550 |
| 10 | 789 | 809 | 476 | 691 |
| 25 | 933 | 988 | 608 | 843 |
| 50 | 1,072 | 1,168 | 734 | 991 |
| 100 | 1,228 | 1,327 | 847 | 1,134 |

Preliminary estimates of the bankfull or the channel forming discharge were computed applying at-a-section hydraulic analyses. Stable riffles were selected from the reference reach survey with bankfull cross-sectional areas ranging from 22.6 $ft^2$ to 25.4 $ft^2$. Modeled velocities ranged from 5.8 feet per second (fps) to 7.0 fps. For the purpose of developing conceptual restoration design plans, a preliminary range of 130-175 cfs was selected as the channel forming or bankfull discharge.

## 2.2 Project Area Description

The Oregon Gulch project area occurs within a patented claim that was heavily mined in the early 1960s using floating dredges and draglines. Encompassing approximately 2,200 ft of channel, mining disturbances were concentrated in areas located just downstream of the confluence of Oregon Gulch and Lost Creek. Sections of the channel were bermed and straightened resulting in a highly entrenched channel state. Approximately 600 feet of Oregon Gulch were relocated to the south side of the valley floor. Mined dredge piles and alluvium excavated during relocation efforts bracket and confine the channel, isolating the historical floodplain surface from the active channel. Downstream of the bermed section, the channel area and width expand resulting in a decrease in sediment transport capacity and competency. The channel is aggrading in this vicinity due to the high width-to-depth ratio condition and decreasing channel slope.

The historical floodplain surface is presently characterized by a decadent shrub community dominated by mountain alder, dogwood, willow and conifers. Approximately 90 percent of the historical floodplain surface was modified during mining activities resulting in a highly disturbed surface with few remaining relict channel features and very coarse soils with low soil moisture holding capacity. Numerous dredge piles averaging 25 ft in height exist on the floodplain surface and comprise approximately 4,500 cubic yards of coarse mine tailings. Numerous dredge ponds fed by groundwater occur on the surface and contribute an additional three to five cubic feet per second (cfs) of streamflow to Oregon Gulch. These springs are a critical component to the restoration plan as areas of Oregon Gulch have seasonally dewatered, resulting in habitat fragmentation during low flow periods for spawning fluvial bull trout.

To describe the existing project area conditions, two sub-reaches were delineated in the project area. The Rosgen stream classification system (Rosgen 1994) was used to characterize physical features of Oregon Gulch. In general, the project area exhibited B and F stream types. These dominant stream types are described below.

**Rosgen B Stream Type**

Rosgen B stream types are moderately steep (between 1 and 4 percent), with rapids and riffles common and scour pools irregularly spaced. Pools are commonly pocket pools rather than more expansive pools typically associated with outside meanders. These stream types are moderately entrenched (narrow floodplain relative to the bankfull channel width – 1.4 to 2.2), with moderate width-to-depth ratios (>12) and sinuosity (>1.2). Vegetation has a moderate influence in determining channel stability. B channel types are characterized by low to moderate sensitivity to disturbance and low streambank erosion. Fish habitat in B stream types is often associated with large woody debris that contributes to scour pool formation and cover (Rosgen 1996). Using the Montgomery and Buffington classification system (1997), B stream types are typically defined as plane bed morphology streams.

**Rosgen F Stream Type**

The F stream type occurs sporadically throughout the study area in locations where the floodplain is restricted by topography, levees, or where the stream has a more unstable form as a result of disturbances. The F stream types are entrenched, with most flood flows confined to the channel. This stream type is typically creating a new floodplain at a lower elevation than the historical floodplain. This process leads to high levels of bank erosion, bar development, and sediment transport. Because of the entrenchment and high width-to-depth ratio, velocities can reach relatively high levels at flood flows because the floodplain is not developed enough to dissipate energies.

Table 2-2 summarizes dominant stream types for each of the respective reaches in the project area. Reach 1 extends from the confluence of Lost Creek and Oregon Gulch downstream to the private bridge crossing. Reach 2 includes the bermed and relocated section of Oregon Gulch to the downstream terminus of the project area.

| **Table 2-2.** Dominant channel types (Rosgen 1994) present in the Oregon Gulch project area vicinity. | |
|---|---|
| Project Station (ft) | Dominant Channel Type |
| Reach 1 | F3 |
| Reach 2 | F3 / B4 |
| Reference Reach | B3 |

**Reach 1**

Reach 1 is characterized by moderately entrenched (B3 stream type) to entrenched (F3 stream type) channel conditions. The existing forest road and floodplain berms restrict the channel belt width and floodprone area. Large wood was limited in this sub-reach and channel morphology was primarily characterized by elongated riffles with minimal available pool habitat. Due to the loss of channel roughness such as large wood, stream power and velocities are likely greater than historical conditions resulting in a coarse streambed and simplified aquatic habitat. The riparian community has a mixed deciduous and coniferous species overstory with an understory assemblage comprised of willow and dogwood.

Despite the well-vegetated floodplain corridor (primarily young age classes of shrubs), primary limiting factors include loss of floodplain connectivity and pool forming structure. Figure 2-2 presents existing condition photos of Reach 1.

**Figure 2-2.** Oregon Gulch has been channelized in Reach 1 of the project area. Floodplain berms and the existing bridge constrict the channel and confine the belt width of Oregon Gulch, altering hydraulics and channel-floodplain connectivity.

The existing bridge in Reach 1 of the project area consists of steel railcar stringers, wooden decking and rock abutments with a 42 ft freespan. Bankfull freeboard is limited and likely results in periodic debris and ice blockages at the bridge inlet. Upstream of the bridge inlet, Oregon Gulch is confined by cobble berms and extensive floodplain fill. The fill is positioned

at the bankfull channel margin, resulting in an entrenched condition. Bankfull channel width upstream of the bridge averages 24 ft. Figure 2-3 represents a typical valley cross-section upstream of the bridge in Reach 1.

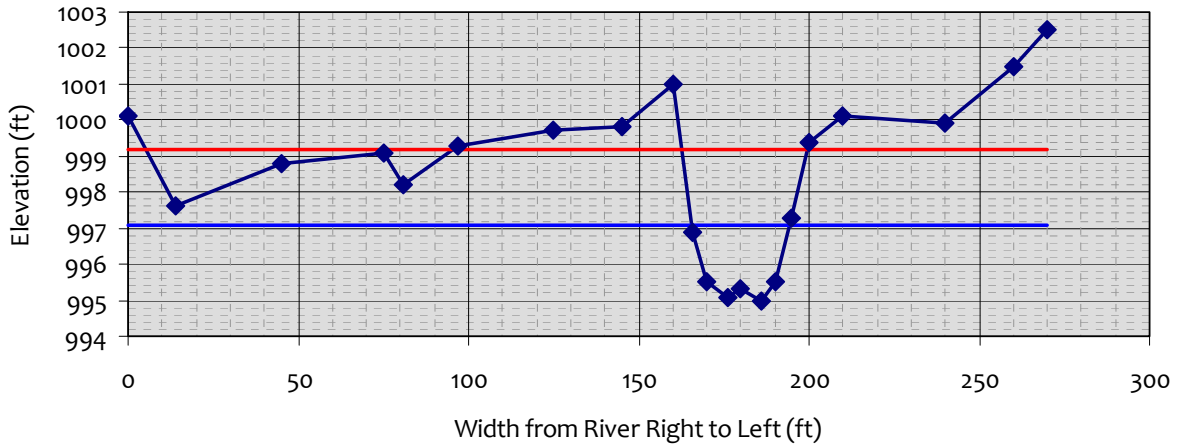


**Figure 2-3.** Typical existing channel-floodplain conditions in Reach 1 of the project area (data courtesy of Trout Unlimited). The valley cross-section depicts the confined nature of the channel and existing berms. The blue line indicates the approximate bankfull water surface elevation. The red line denotes the floodprone elevation.

The combined effects of the floodplain levees and straightened channel have likely improved hydraulic performance of the bridge at lower recurrence interval discharges by decreasing floodplain contraction losses and locally increasing in-channel velocity and shear stress. However, at higher flow stages, bridge and channel stability are likely compromised due to altered sediment transport and hydraulic characteristics. Overflow culverts located adjacent to the bridge provide additional flood conveyance capacity that is necessary to compensate for the undersized bridge.

### Reach 2

Oregon Gulch in Reach 2 was relocated to the south side of the valley to accommodate mining practices in the historical floodplain corridor. The channel straightening increased the channel slope creating a higher energy environment with increased sediment transport capacity and competency. The channel is simplified and characterized by elongated riffles with randomly spaced step sequences. Due to the armored nature of the channel and lack of large wood, pool development is extremely limited in Reach 2.

**Figure 2-4.** The Reach 2 historical floodplain is characterized by relict channels scars (left photo) and mining dredge piles and ponds (right photo).

Historical floodplain disturbances are concentrated in Reach 2 of the project area. A series of dredge piles and ponds characterize the abandoned floodplain surface (Figure 2-4). The ponds are hydrologically connected to a series of groundwater contact springs that discharge to Oregon Gulch at the downstream terminus of the project area. Approximately 4,500 cubic yards of coarse mine tailings comprise the dredge piles.

Figure 2-4 includes a typical valley cross-section in Reach 2 of the project area.

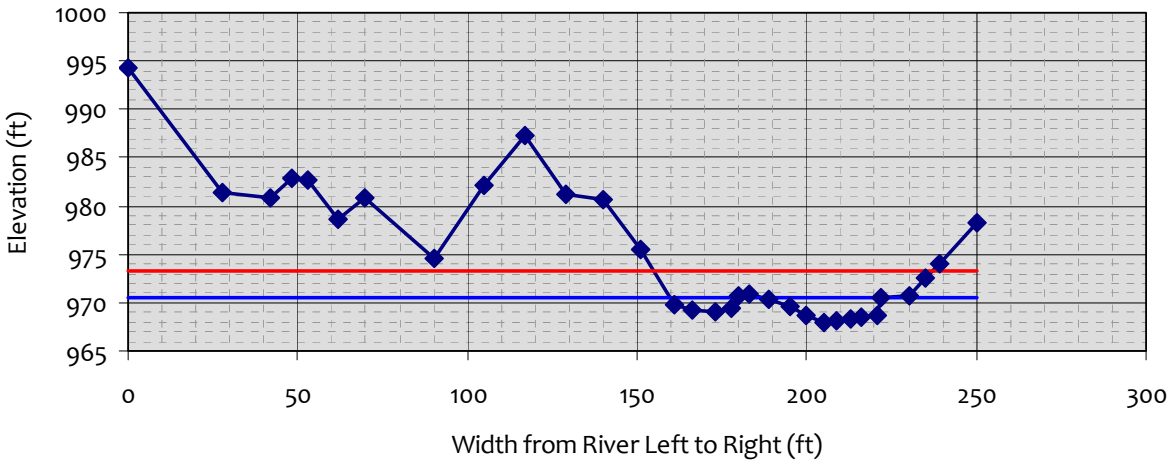


**Figure 2-5.** Typical existing channel-floodplain conditions in Reach 2 of the project area (data courtesy of Trout Unlimited). The blue line indicates the approximate bankfull water surface elevation. The red line denotes the floodprone elevation. The floodplain berm is visible at STA 1+20.

### 2.2.1 Reference Channel Conditions in the Oregon Gulch Watershed

A reference reach was established 0.25 miles upstream of the project area and classified as a B3 stream type, which is the probable state or stable form of Oregon Gulch within the project area. Channel cross-section dimensions for riffle and pool channel units are summarized in Table 2-3. A typical riffle cross-section surveyed in the reference reach is presented in Figure 2-6.

**Table 2-3**. Cross-section dimensions and dimensionless ratios for riffle (n=2) and pool (n=2) cross-sections in the Oregon Gulch reference reach.

| Cross-Section Dimensions Metric | Min | Mean | Max | Cross-Section Dimensionless Ratios | Min | Mean | Max |
|---|---|---|---|---|---|---|---|
| Floodprone Width (ft) | 56.7 | 57.0 | 57.3 | Wfpa / Wbkf | 3.21 | 3.23 | 3.25 |
| Riffle Area ($ft^2$) | 22.6 | 24.0 | 25.4 | Riffle Area / Abkf | 0.94 | 1.00 | 1.06 |
| Max Riffle Depth (ft) | 2.1 | 2.1 | 2.1 | Max Riffle Depth / Dbkf | 1.50 | 1.53 | 1.54 |
| Mean Riffle Depth (ft) | 1.3 | 1.4 | 1.4 | Mean Riffle Depth / Dbkf | 0.97 | 1.00 | 1.02 |
| Riffle Width (ft) | 16.2 | 17.6 | 19.1 | Riffle Width / Wbkf | 0.92 | 1.00 | 1.08 |
| Pool Area (Sq ft) | 36.0 | 37.1 | 38.2 | Pool Area / Abkf | 1.50 | 1.55 | 1.59 |
| Max Pool Depth (ft) | 3.0 | 3.0 | 3.0 | Max Pool Depth / Dbkf | 2.18 | 2.19 | 2.20 |
| Mean Pool Depth (ft) | 1.7 | 1.7 | 1.7 | Mean Pool Depth / Dbkf | 1.20 | 1.23 | 1.25 |
| Pool Width (ft) | 21.0 | 22.1 | 23.1 | Pool Width / Wbkf | 1.19 | 1.25 | 1.31 |

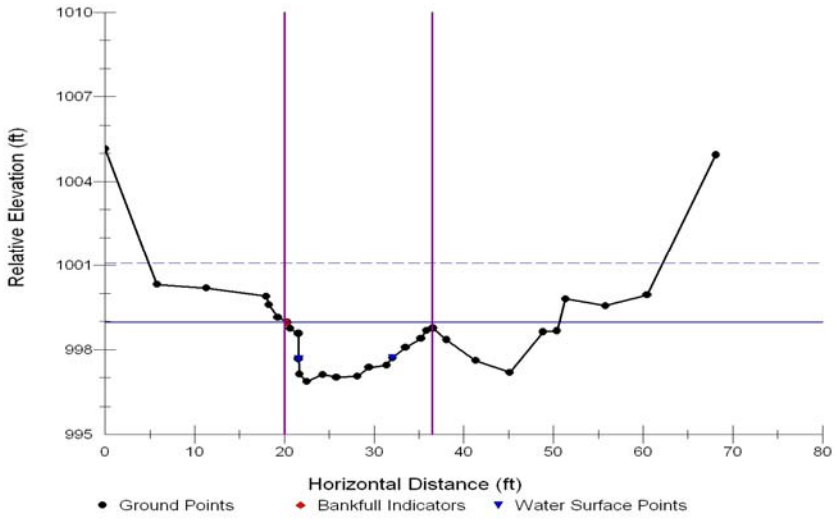


**Figure 2-6**. Oregon Gulch Reference Reach, Cross-Section 3; riffle. The solid, horizontal line represents bankfull elevation and the dashed line represents the floodprone area. The vertical lines limit the hydrologic calculations to the enclosed active channel.

**Figure 2-7**. Oregon Gulch Reference Reach, Cross-Section 3, riffle. View across channel (left) and downstream (right).

As summarized in Table 2-3, bankfull riffle widths ranged from 16.2 ft to 19.1 ft with an average cross-sectional area of 24.0 $ft^2$. Pool bankfull widths ranged from 21.0 ft to 23.1 ft with maximum depths of 3.0 ft. Pool to pool spacing averaged 113 ft in the reference reach, or approximately one pool per 6.5 bankfull channel widths. Pools were characterized by localized contractions in the channel cross-section which initiated bed scour and pool tailout development. Roughness elements such as boulders and wood aggregates were the pool forming structures in the reach.

**Figure 2-8.** Typical pool morphology in the Oregon Gulch reference reach.

Appendix A of this report includes a geomorphic data summary report of collected data, including channel cross-sections, Wolman pebble counts, and a longitudinal profile. Data are reported as actual values and in dimensionless ratio form. The purpose of the reference reach survey was to collect a sufficient level of information necessary to support conceptual restoration planning efforts. The CSRP is further described in Section 3 of this report.

# 3 Conceptual Stream Restoration Plan

Naturally stable streams exist in harmony with a number of influences. They maintain a particular shape and pattern that is related to their geomorphologic setting and physical inputs. Streams balance their shape (width and depth), their gradient and meander pattern in response to changes in stream flow, sediment inputs, and other disturbances. In general, as the valley becomes flatter, the stream becomes more sinuous. Streams flatten their gradient by becoming more meandering, which increases channel length for a given straight line valley distance. For any geomorphic setting, streams exist in a "most probable state" that defines the general channel shape, pattern and stability characteristics. The most probable state includes ranges of values for most hydraulic geometry variables that are most likely to occur in natural settings.

The most probable state of Oregon Gulch within the project area is a moderately entrenched channel characterized by riffle-pool morphology, low sinuosity, and coarse bed material (B3 stream type). Large wood and coarse bed material likely played a significant role in shaping the pre-disturbance morphology of Oregon Gulch, as observed in the surveyed reference reach. As such, the CSRP aims to reintroduce and incorporate large wood and native alluvium to the greatest extent practical in order to provide interim vertical grade control and lateral stability. This site has high potential for natural colonization by native vegetation due to the available seed sources, substrate conditions and residual rootstock.

Attachment A contains a preliminary CSRP that will be supplemented with additional information following input from the project stakeholders. The following report sections describe the CSRP alternatives and restoration concepts.

## 3.1 Reach 1

### Actions Common to Alternative A and Alternative B

Under Alternative A and Alternative B for Reach 1, the existing bridge would be re-positioned to eliminate the high skew angle and increase both the bridge freeboard and conveyance capacity for larger flood events. This would be accomplished by repositioning the bridge at the current location and improving the approach alignments of the existing road. The existing bridge span measures 42 ft. Pre-fabricated concrete abutments would be installed outside of the bankfull channel to provide a minimum 24 ft bankfull channel width and six feet of constructed floodplain on both channel margins. This configuration would allow for construction of a stable channel and floodplain under the bridge. The existing 36-inch corrugated metal relief pipes would be installed at floodplain elevation in the right and left approach fills to provide additional floodplain relief.

An alternative and more costly approach would be to replace the existing bridge with a pre-fabricated bridge of adequate capacity to convey the normal annual flows and flood peaks. Preliminary investigations of the crossing indicate the need for a minimum free span of 45 ft

to adequately convey flood peaks without compromising channel stability or sediment transport characteristics. In addition to replacing the bridge, the channel would be reconstructed to eliminate the skew angle and improve floodplain connectivity through the crossing. This would ensure a more direct flow angle approach to the bridge while adding capacity.

**Alternative A. Improve Habitat Complexity**

Alternative A would improve habitat complexity in Reach 1 of the project area. This alternative would not include channel reconstruction or expanding the floodplain upstream to address other limiting factors. Wood and rock based structures would be installed to increase pool frequency, encourage pool tailout development, and to moderate velocities during higher flow stages. Example photos of these techniques are included in Figure 2-9 from a similar stream system in the Lower Clark Fork River watershed. Attachment A includes typical design drawings.

**Figure 2-9.** Example habitat improvement structures including low stage log and rock step-pools (left photo) and self-ballasted large wood aggregates.

Based on a treated channel length of 575 ft, Alternative A would include installing approximately five to seven channel structures to increase pool frequency and habitat complexity. The work would be accomplished using a spyder excavator to minimize disturbance to the channel and riparian vegetation.

**Alternative B. Expand Floodplain, Reconstruct Portions of the Channel, and Improve Habitat Complexity**

Alternative B would include a more aggressive restoration approach including: 1) expanding or creating new floodplain areas through removal of floodplain berms, levees and fills, 2) reconstructing portions of the channel to increase channel sinuosity, and 3) installing habitat and channel-bank structures similar to Alternative A to increase aquatic habitat complexity and channel stability. This alternative would be significantly more costly than Alternative A

with only marginal benefit to aquatic resources in the project area. For these reasons, Alternative B is not recommended.

## 3.2 Reach 2

### Recommended Alternative

The preferred alternative for Reach 2 is full channel reconstruction to address the limiting factors and goals established by TU and FWP. A moderately entrenched channel characterized by riffle-pool bedforms and cobble substrate would be constructed on the surface of the historical floodplain, as shown in Drawing PV-1 in Attachment A. This alternative would re-establish hydrologic connectivity between the channel and historical floodplain by providing a minimum meander belt width of 60 ft. Additional benefits would be increased channel length, geomorphic stability, improved late-season water storage in the floodplain, and improved spawning, rearing, and overwintering habitat conditions.

The existing Oregon Gulch channel in Reach 2 would be partially filled and/or plugged with existing dredge pile materials and material generated from new channel construction. Rather than disturb the existing vegetated levee that separates the historical floodplain surface and existing channel, RDG recommends maintaining this feature and utilizing the ~4,500 cubic yards of dredge material for construction of the plugs and fill.

## 3.3 Channel and Aquatic Habitat Structures

A variety of channel and bank structures would be incorporated in the project design, as shown in Attachment A. In general, it would be necessary to provide interim vertical and lateral channel stability controls until planted or existing vegetation matures and provides for long-term channel and floodplain stability. Structure descriptions are provided in the following section.

### Floodplain Restoration

The historically active floodplain in Reach 2 has been significantly disturbed by past mining activities. The numerous ponds and dredge piles will be integrated with the CSRP to ensure the design is compatible with project goals and objectives. Floodplain and backwater enhancements would include maintaining existing flood relief channels where appropriate, and ensuring remaining floodplain ponds remain disconnected from the active channel to prevent fish entrainment. Since the CSRP proposes 1,325 ft of new channel construction on the historical floodplain surface, excavation will be required to lower and/or expand existing habitats so that channels access groundwater or are hydraulically connected with Oregon Gulch at baseflows and high frequency flood events. These actions would increase juvenile rearing habitat and flood refugia. Channel and pond shaping would replicate naturally occurring habitats that provide the range of desired habitats.

To the greatest extent practical, the new channel alignment is proposed to be located in forested or shrub-dominated areas of the floodplain. The floodplain forest and shrub communities would shade the channel, contribute organic material and woody debris, and provide stability through root structures. A range of elevations would also be created. Excavation would minimize disturbance to adjacent vegetation and floodplain surfaces. Excavated materials would either be shaped on the floodplain (creating topography) or hauled to the existing channel and used as fill. Construction would be completed in one pass (excavation and habitat materials placement) to speed construction and reduce the project footprint.

Attachment A includes typical detail sheets for the following structures: 1) meander structure layout (DT-2), 2) riffle construction (DT-3), 3) engineered log jam (DT-4), 4) log weir (DT-5), 5) boulder energy dissipater (DT-6), and 6) boulder grade control (DT-7). Structure descriptions for the primary structures are provided in the following paragraphs.

**Engineered Log Jams**

Engineered log jams (ELJs) are installed for bank stabilization, flow deflection, and mainstem habitat. ELJs will provide complex cover for juvenile and adult fish. ELJs will be constructed with approximately 8 to 10 trees including rootwads, whole trees, and tree tops (Figure 2-10). To provide structure ballast, approximately 5 $yd^3$ of large rock will be placed within each structure. The ELJs are also backfilled with native alluvium to reduce the potential for intra-structure piping.

**Figure 2-10.** An ELJ constructed on the Jocko River in western Montana following two run-off events.

**Vegetated Soil Lifts**

Vegetated soil lifts are a bioengineering technique that combines layers of dormant willow cuttings and/or containerized willows with fabric-wrapped soil to revegetate and stabilize stream banks and slopes (Figure 2-11). Vegetated soil lifts are proposed for stabilizing bank erosion sites where a new bank face will be constructed. To construct a vegetated soil lift, a coarse cobble toe is first established. The first soil lift incorporates a high density coir log backed with soil and wrapped within two layers of biodegradable coconut (coir) fiber fabric. Dormant willow cuttings or containerized plants and a native seed mix are placed on each lift. The cuttings or plants are placed horizontally to extend into the stream channel. Cuttings should be placed so that only ¼ of the cutting is exposed. A two to three-inch layer of top soil is placed between each lift to reduce air pockets and provide rooting medium for the willow cuttings. The coir fabric holds the soil in place while vegetation becomes established in the relatively high stress land/water interface. Vegetated soil lifts will provide near-term bank protection until mature shrubs and trees become established at the site.

**Figure 2-11.** A vegetated soil lift and constructed ELJ following spring runoff and at the start of the growing season.

**Constructed Riffles and Submerged Boulder Energy Dissipater Structures**

Constructed riffles and submerged boulder energy dissipaters are rock based structures that mimic natural riffle sections of streams. Constructed riffles will be used to provide grade control and increase pool frequency throughout the Oregon Gulch project area. The structure is comprised of four habitat units including: 1) an upstream glide section, 2) a crest transition, 3) a riffle section, and 4) a downstream run section. The treatment will consist of a graded matrix of large (e.g. D84 size material) and smaller diameter material to form continuous, morphologically stable riffle and run channel units. These structures are non-discernable compared to a rock vane structure that dissipates stream energy along a discrete row of interlocked rocks. The proposed constructed riffles provide grade control redundancy throughout the entire profile, thereby minimizing risk of downcutting while providing large roughness elements necessary to moderate high flow velocities and stream power.

Constructed riffles and submerged energy dissipater structures will be incorporated throughout Reach 2. Existing dredge pile material will be screened and/or sorted to construct the riffles and submerged structures. Figure 2-12 includes a natural example of

these structure concepts downstream of Reach 2 in Oregon Gulch, and an example constructed riffle and boulder energy dissipater structure on a B3 stream type in Montana.

**Figure 2-12.** A naturally occurring riffle in the Oregon Gulch project area provides vertical channel stability while moderating mean channel velocities (left photo). An example constructed riffle and submerged boulder energy dissipater structure on a B3 stream type in Montana (right photo).

# 4 Cost Estimate

A preliminary cost estimate has been developed based on the CSRP presented in Attachment A and described in this report. Table 4-1 includes a summary of the cost estimate.

**Table 4-1.** Preliminary final design and construction cost estimate for the Oregon Gulch Restoration Project.

| Item | Cost ($) | Percent of Budget (%) |
|---|---|---|
| Project Final Design and Administration | 8,000 | 5.1 |
| Construction Stakeout and Management | 20,176 | 12.7 |
| Equipment and Labor | 78,340 | 49.4 |
| Materials | 52,071 | 32.8 |
| Total Cost Estimate | 158,586 | 100% |

# APPENDIX A
# GEOMORPHIC DATA SUMMARY REPORT

# OREGON GULCH STREAM

# RESTORATION CONCEPTUAL DESIGN

# REFERENCE REACH DATA

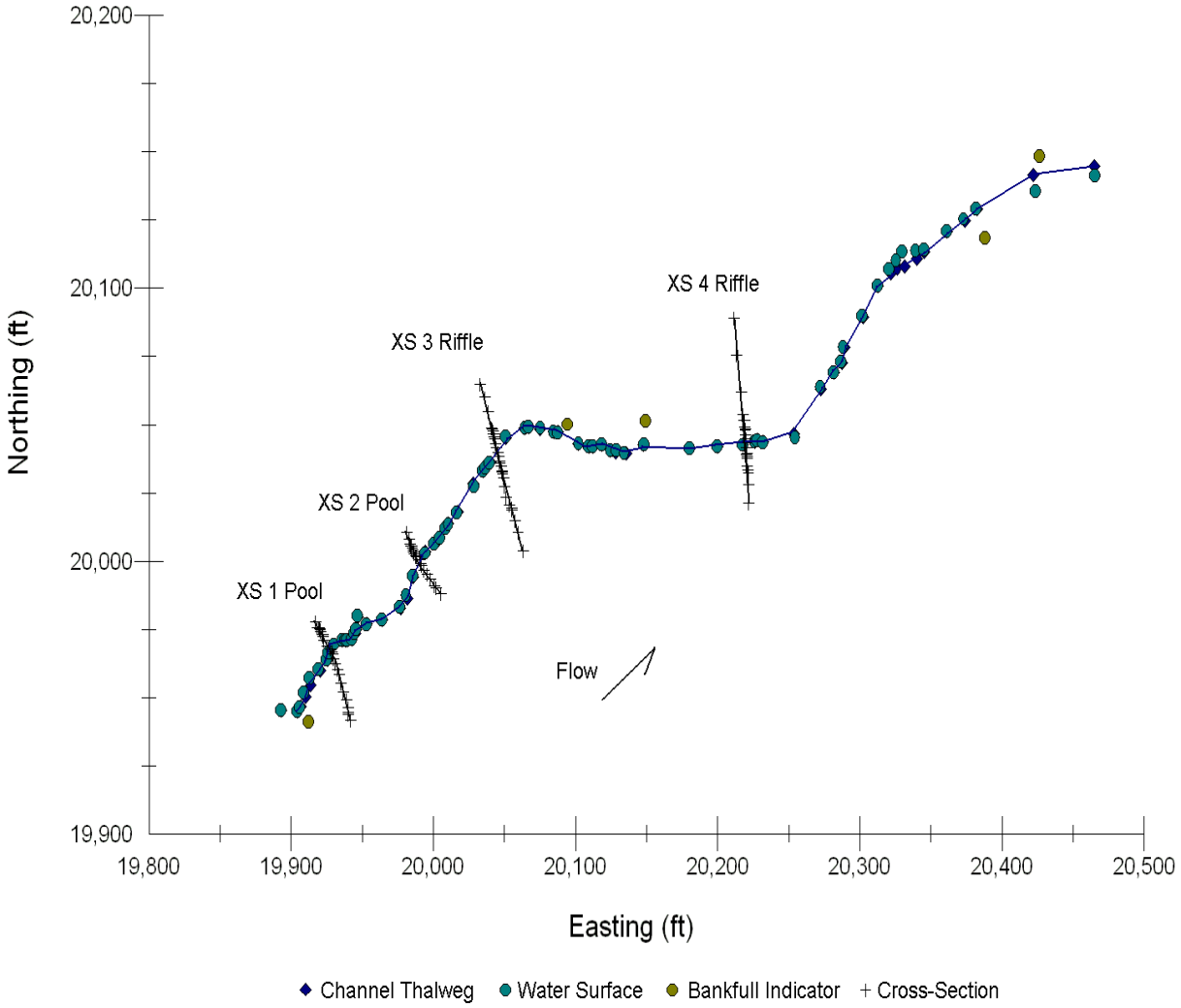


**Figure 1**. Planview of surveyed points in the Oregon Gulch Reference Reach, a Rosgen B3 stream type.

## Longitudinal Profile Dimensions

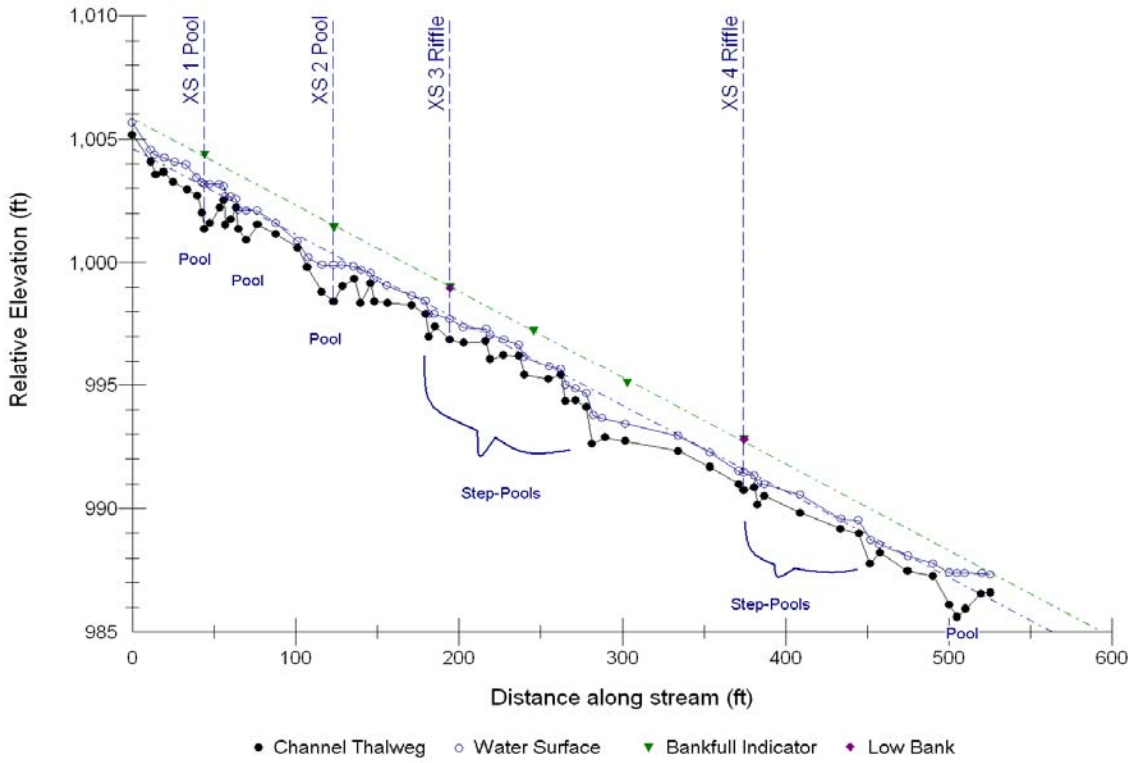


**Figure 2**. Longitudinal profile of the Oregon Gulch reference reach survey, a Rosgen B3 stream type.

**Table 1**. Level III longitudinal profile dimensions and dimensionless ratios for the reference reach survey in Oregon Gulch, a B3 stream type.

| Profile Dimensions Metric | Min | Mean | Max | Profile Dimensionless Ratios | Min | Mean | Max |
|---|---|---|---|---|---|---|---|
| S riffle (ft/ft) | 0.0267 | 0.0362 | 0.0561 | S riffle / S bkf (ft/ft) | 0.76 | 1.03 | 1.60 |
| S pool[1] (ft/ft) | 0.0013 | 0.0022 | 0.0046 | S pool / S bkf (ft/ft) | 0.04 | 0.06 | 0.13 |
| S run (ft/ft) | 0.0098 | 0.0222 | 0.0291 | S run / S bkf (ft/ft) | 0.28 | 0.63 | 0.83 |
| S glide (ft/ft) | 0.0046 | 0.0103 | 0.0193 | S glide / S bkf (ft/ft) | 0.13 | 0.29 | 0.55 |
| P – P[1] (ft) | 24.7 | 115 | 222 | P - P / W bkf (ft) | 1.40 | 6.51 | 12.6 |
| P length (ft) | 12.0 | 18.3 | 23.2 | P length / W bkf (ft) | 0.68 | 1.04 | 1.31 |
| R length | 12.4 | 33.9 | 66.7 | R length / W bkf (ft) | 0.70 | 1.92 | 3.78 |
| Dmax riffle (ft) | 1.6 | 1.8 | 2.1 | Dmax riffle / D bkf (ft) | 1.18 | 1.28 | 1.50 |
| Dmax pool[1] (ft) | 2.5 | 2.9 | 3.4 | Dmax pool / D bkf (ft) | 1.84 | 2.12 | 2.47 |
| Dmax run (ft) | 2.2 | 2.4 | 2.7 | Dmax run / D bkf (ft) | 1.61 | 1.74 | 2.00 |
| Dmax glide (ft) | 1.5 | 1.7 | 1.9 | Dmax glide / D bkf (ft) | 1.10 | 1.23 | 1.39 |
| Low Bank Ht (ft) | 2.2 | 2.2 | 2.2 | Low Bank Ht / Dmax riff (ft) | 1.23 | 1.24 | 1.25 |
| Bankfull Slope (ft/ft) | | 0.0351 | | Bankfull Slope (ft/ft) | | 0.0351 | |

[1] Pool values reflect well-developed, channel–spanning features with established pool tailout areas that maintain water surface slopes and elevations.

**Table 2**. Level III longitudinal profile dimensions and dimensionless ratios for step pool features within the reference reach survey in Oregon Gulch, a B3 stream type.

| Profile Dimensions Metric | Min | Mean | Max | Profile Dimensionless Ratios | Min | Mean | Max |
|---|---|---|---|---|---|---|---|
| S pool (ft/ft) | 0.0174 | 0.0236 | 0.0287 | S pool / S bkf (ft/ft) | 0.50 | 0.67 | 0.82 |
| S run (ft/ft) | 0.0589 | 0.1456 | 0.2529 | S run / S bkf (ft/ft) | 1.68 | 4.16 | 7.22 |
| P - P (ft) | 7.4 | 43.6 | 102 | P - P / W bkf (ft) | 0.42 | 2.47 | 5.79 |
| P length (ft) | 5.0 | 8.5 | 14.9 | P length / W bkf (ft) | 0.28 | 0.48 | 0.85 |
| R length (ft) | 2.3 | 3.4 | 7.5 | R length / W bkf (ft) | 0.13 | 0.19 | 0.42 |
| Dmax pool (ft) | 2.2 | 2.5 | 3.4 | Dmax pool / D bkf (ft) | 1.62 | 1.81 | 2.45 |
| Dmax run (ft) | 1.7 | 1.9 | 2.3 | Dmax run / D bkf (ft) | 1.21 | 1.40 | 1.66 |
| Bankfull Slope (ft/ft) | | 0.0351 | | Bankfull Slope (ft/ft) | | 0.0351 | |

**Figure 3.** Oregon Gulch Reference Reach, a Rosgen B3 stream type.

## Cross-Section Dimensions

**Table 3**. Cross-section dimensions and dimensionless ratios for riffle (n=2) and pool (n=2) cross-sections in the Oregon Gulch Reference Reach.

| Cross-Section Dimensions Metric | Min | Mean | Max | Cross-Section Dimensionless Ratios | Min | Mean | Max |
|---|---|---|---|---|---|---|---|
| Floodprone Width (ft) | 56.7 | 57.0 | 57.3 | Wfpa / Wbkf | 3.21 | 3.23 | 3.25 |
| Riffle Area (Sq ft) | 22.6 | 24.0 | 25.4 | Riffle Area / Abkf | 0.94 | 1.00 | 1.06 |
| Max Riffle Depth (ft) | 2.1 | 2.1 | 2.1 | Max Riffle Depth / Dbkf | 1.50 | 1.53 | 1.54 |
| Mean Riffle Depth (ft) | 1.3 | 1.4 | 1.4 | Mean Riffle Depth / Dbkf | 0.97 | 1.00 | 1.02 |
| Riffle Width (ft) | 16.2 | 17.6 | 19.1 | Riffle Width / Wbkf | 0.92 | 1.00 | 1.08 |
| Pool Area (Sq ft) | 36.0 | 37.1 | 38.2 | Pool Area / Abkf | 1.50 | 1.55 | 1.59 |
| Max Pool Depth (ft) | 3.0 | 3.0 | 3.0 | Max Pool Depth / Dbkf | 2.18 | 2.19 | 2.20 |
| Mean Pool Depth (ft) | 1.7 | 1.7 | 1.7 | Mean Pool Depth / Dbkf | 1.20 | 1.23 | 1.25 |
| Pool Width (ft) | 21.0 | 22.1 | 23.1 | Pool Width / Wbkf | 1.19 | 1.25 | 1.31 |

N/A: Metric and/or dimensionless ratio not applicable

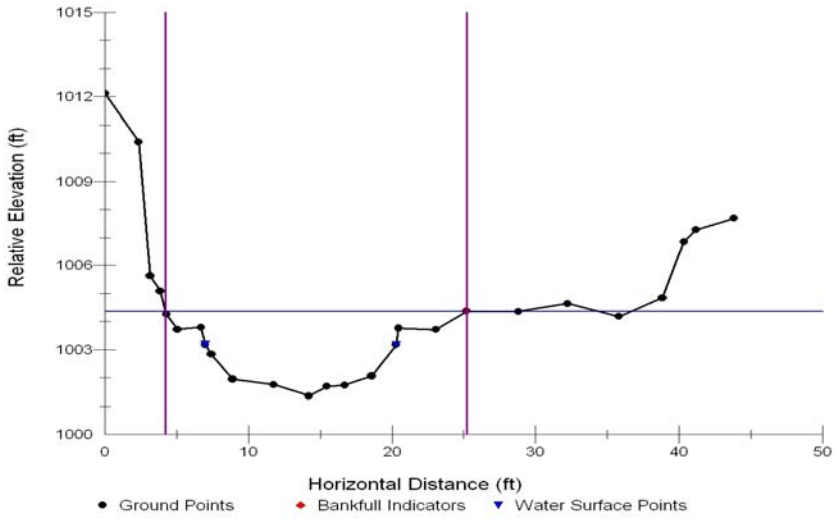


**Figure 4**. Oregon Gulch Reference Reach, Cross-Section 1; pool. The solid, horizontal line represents bankfull elevation and the vertical lines limit the hydrologic calculations to the enclosed active channel.

**Table 4**. Oregon Gulch Reference Reach, Cross-Section 1, pool summary data.

| Metric | Result |
|---|---|
| Floodprone Width (ft) | N/A |
| Bankfull Width (ft) | 21.0 |
| Entrenchment Ratio | N/A |
| Mean Depth (ft) | 1.7 |
| Maximum Depth (ft) | 3.0 |
| Width/Depth Ratio | 12.3 |
| Bankfull Area (sq ft) | 36.0 |
| Wetted Perimeter (ft) | 22.9 |
| Hydraulic Radius (ft) | 1.6 |

**Figure 5**. Oregon Gulch Reference Reach, Cross-Section 1, pool. View across channel (left) and upstream (right).

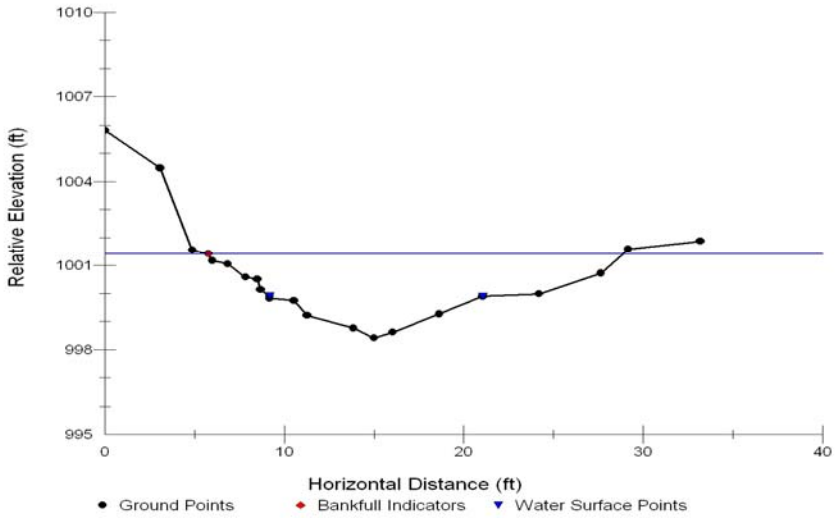


**Figure 6**. Oregon Gulch Reference Reach, Cross-Section 2; pool. The solid, horizontal line represents bankfull elevation.

**Table 5**. Oregon Gulch Reference Reach, Cross-Section 2, pool summary data.

| Metric | Result |
|---|---|
| Floodprone Width (ft) | N/A |
| Bankfull Width (ft) | 23.1 |
| Entrenchment Ratio | N/A |
| Mean Depth (ft) | 1.7 |
| Maximum Depth (ft) | 3.0 |
| Width/Depth Ratio | 14.0 |
| Bankfull Area (sq ft) | 38.2 |
| Wetted Perimeter (ft) | 24.4 |
| Hydraulic Radius (ft) | 1.6 |

**Figure 7**. Oregon Gulch Reference Reach, Cross-Section 2, pool. View across channel (left) and upstream (right).

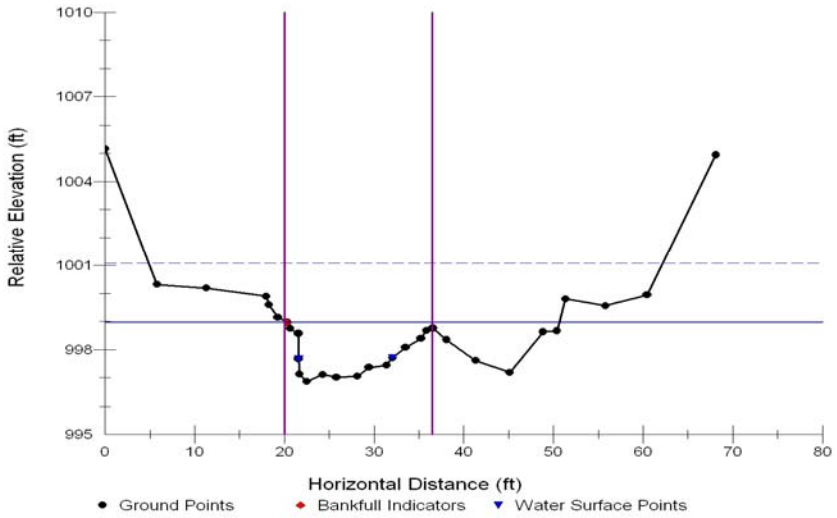


**Figure 8**. Oregon Gulch Reference Reach, Cross-Section 3; riffle. The solid, horizontal line represents bankfull elevation and the dashed line represents the floodprone area. The vertical lines limit the hydrologic calculations to the enclosed active channel.

**Table 6**. Oregon Gulch Reference Reach, Cross-Section 3, riffle summary data.

| Metric | Result |
|---|---|
| Floodprone Width (ft) | 57.3 |
| Bankfull Width (ft) | 16.2 |
| Entrenchment Ratio | 3.5 |
| Mean Depth (ft) | 1.4 |
| Maximum Depth (ft) | 2.1 |
| Width/Depth Ratio | 11.6 |
| Bankfull Area (sq ft) | 22.6 |
| Wetted Perimeter (ft) | 18.1 |
| Hydraulic Radius (ft) | 1.3 |

**Figure 9**. Oregon Gulch Reference Reach, Cross-Section 3, riffle. View across channel (left) and downstream (right).

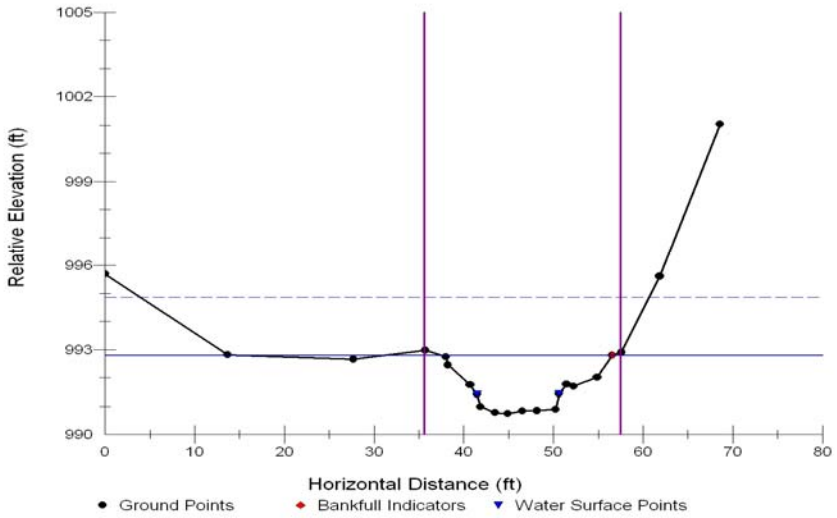


**Figure 10**. Oregon Gulch Reference Reach, Cross-Section 4; riffle. The solid, horizontal line represents bankfull elevation and the dashed line represents the floodprone area. The vertical lines limit the hydrologic calculations to the enclosed active channel.

**Table 7**. Oregon Gulch Reference Reach, Cross-Section 4, riffle summary data.

| Metric | Result |
|---|---|
| Floodprone Width (ft) | 56.7 |
| Bankfull Width (ft) | 19.1 |
| Entrenchment Ratio | 3.0 |
| Mean Depth (ft) | 1.3 |
| Maximum Depth (ft) | 2.1 |
| Width/Depth Ratio | 14.4 |
| Bankfull Area (sq ft) | 25.4 |
| Wetted Perimeter (ft) | 20.1 |
| Hydraulic Radius (ft) | 1.3 |

**Figure 11**. Oregon Gulch Reference Reach, Cross-Section 4, riffle. View downstream (left) and upstream (right).

## Substrate Particle Size Distribution

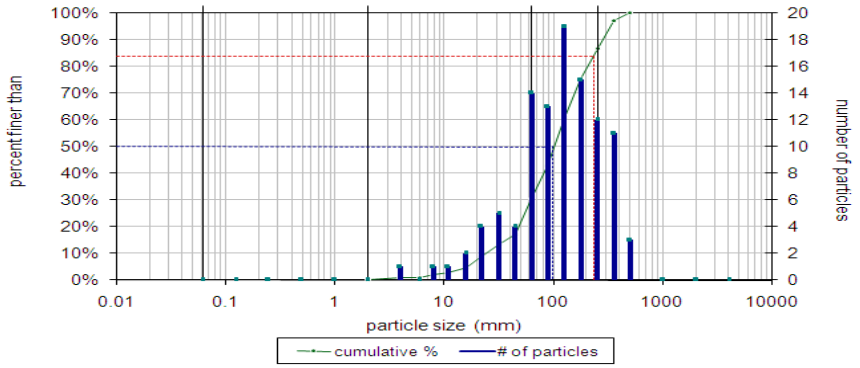


**Figure 12**. Riffle substrate particle size distribution at cross-section 3.

**Table 8**. Riffle particle size percentile distribution at cross-section 3.

| Percentile | millimeters | inches |
|---|---|---|
| $D_{16}$ | 41 | 1.6 |
| $D_{35}$ | 72 | 2.8 |
| $D_{50}$ | 100 | 3.9 |
| $D_{65}$ | 140 | 5.5 |
| $D_{84}$ | 240 | 9.4 |
| $D_{95}$ | 340 | 13.4 |

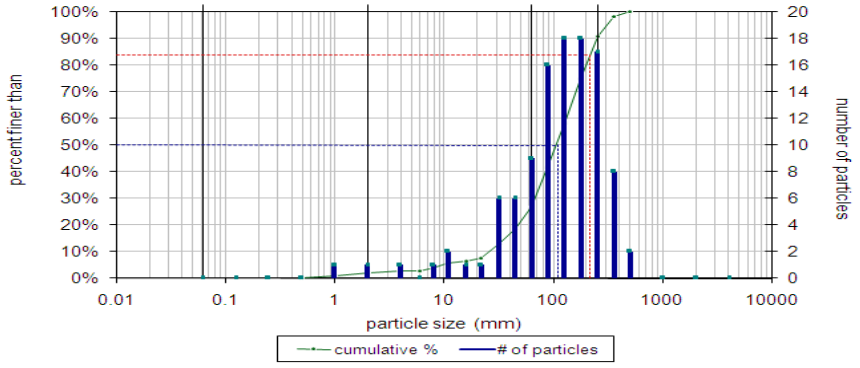


**Figure 13**. Riffle substrate particle size distribution at cross-section 4.

**Table 9**. Riffle particle size percentile distribution at cross-section 3.

| Percentile | millimeters | inches |
|---|---|---|
| $D_{16}$ | 39 | 1.5 |
| $D_{35}$ | 77 | 3.0 |
| $D_{50}$ | 110 | 4.3 |
| $D_{65}$ | 150 | 5.9 |
| $D_{84}$ | 220 | 8.7 |
| $D_{95}$ | 310 | 12.2 |

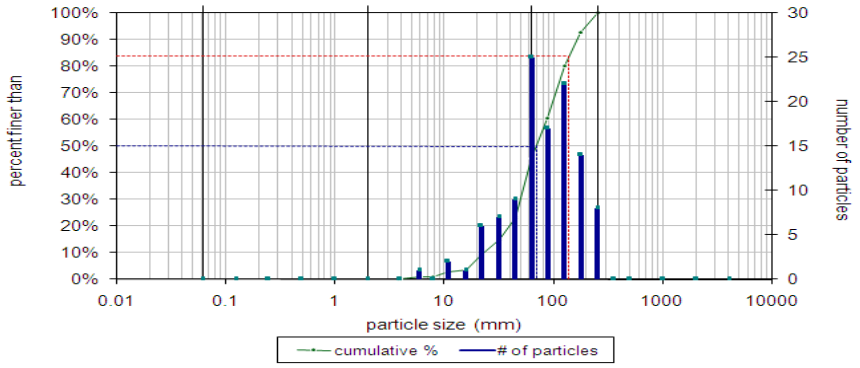


**Figure 14**. Riffle substrate particle size distribution upstream of the bridge within the project area.

**Table 10**. Riffle particle size percentile distribution upstream of the bridge within the project area.

| Percentile | millimeters | inches |
|---|---|---|
| $D_{16}$ | 33 | 1.3 |
| $D_{35}$ | 54 | 2.1 |
| $D_{50}$ | 71 | 2.8 |
| $D_{65}$ | 97 | 3.8 |
| $D_{84}$ | 140 | 5.5 |
| $D_{95}$ | 200 | 7.9 |

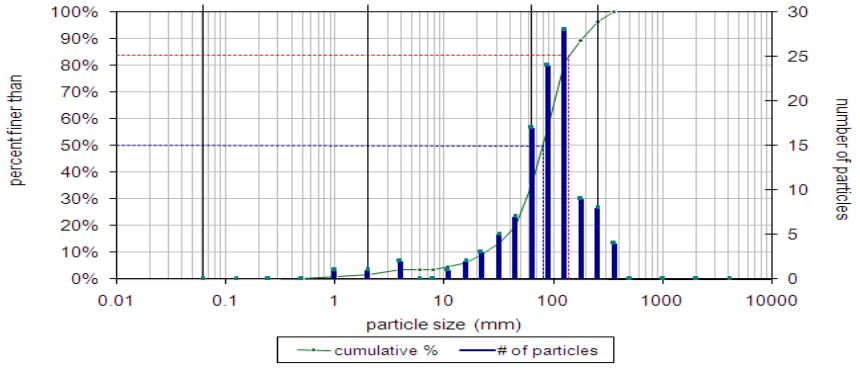


**Figure 15**. Riffle substrate particle size distribution adjacent to the ponds within the project area.

**Table 11**. Riffle particle size percentile distribution adjacent to the ponds within the project area.

| Percentile | millimeters | inches |
|---|---|---|
| $D_{16}$ | 37 | 1.5 |
| $D_{35}$ | 64 | 2.5 |
| $D_{50}$ | 81 | 3.2 |
| $D_{65}$ | 100 | 3.9 |
| $D_{84}$ | 140 | 5.5 |
| $D_{95}$ | 240 | 9.4 |

# APPENDIX B
# PRELIMINARY FINAL DESIGN & CONSTRUCTION COST ESTIMATE

**Project:** Oregon Gulch Conceptual Restoration Plan - Preferred Alternative
**Title:** Provisional / Draft Construction Cost Estimate
**Client:** Trout Unlimited
**Description:** Cost estimate based on 50% conceptual restoration plan
**Date:** 18-Nov-09

| Item | Quantity | Unit Cost | Cost |
|---|---|---|---|
| **1. Project Management & Coordination** | | | |
| Administration | 8 hrs | $50 | $ 400 |
| Hydrologist/Geomorphologist | 8 hrs | $100 | $ 800 |
| | | | **$ 1,200** |
| **2. Final Design** | | | |
| Survey - CAD Technician | 40 hrs | $80 | $ 3,200 |
| Hydrologist | 40 hrs | $90 | $ 3,600 |
| | | | **$ 6,800** |
| **3. Construction Stakeout** | | | |
| Survey Technician | 24 hrs | $80 | $ 1,920 |
| Fisheries Biologist | 24 hrs | $100 | $ 2,400 |
| Senior Water Resources Engineer | 0 hrs | $110 | $ - |
| Lodging and Per diem | 4 days | $80 | $ 320 |
| Mileage | 347 miles | $.65 /mi | $ 226 |
| | | | **$ 4,866** |
| **4. Construction Administration** | | | |
| Senior Water Resources Engineer | 0 hrs | $110 | $ - |
| Hydrologist | 80 hrs | $85 | $ 6,800 |
| Hydrology Technician | 80 hrs | $75 | $ 6,000 |
| Lodging and Per diem | 20 days | $80 | $ 1,600 |
| Mileage | 1400 miles | $.65 /mi | $ 910 |
| | | | **$ 15,310** |
| **5. Construction Cost Estimate** | | | |
| **MOBILIZATION AND DEMOBILIZATION** | 200 miles | $5 /mile | **$ 1,000** |
| **SITE PREP / CLEANUP** | | | **$ 1,840** |
| - 200 Class Excavator with thumb and bucket | 8 hrs | $145 /hr | $ 1,160 |
| - Off-road Dump Truck | 8 hrs | $85 /hr | $ 680 |
| **PREP ACCESS ROADS AND CLEARWATER DIVERSIONS** | 10 hrs | $145 /hr | **$ 1,450** |
| **EARTHWORK** | | | |
| Channel Reconstruction | 6000 cy | $4 /cy | **$ 24,000** |
| - 200 Class Excavator with thumb and bucket | 92 hrs | $145 /hr | $ 13,340 |
| - Off-road Dump Truck | 92 hrs | $85 /hr | $ 7,820 |
| - Laborer 1 | 92 hrs | $30 /hr | $ 2,760 |
| **STRUCTURE INSTALLATION** | | | |
| Engineered Debris Jams (10 Tree Pieces / 10 cy Boulders) | 15 EDJs | $750 /EDJ | **$ 11,250** |
| - 200 Class Excavator with thumb and bucket | 4 hrs | $145 /hr | $ 580 |
| - Off-road Dump Truck | 2 hrs | $85 /hr | $ 170 |
| Constructed Riffles | 10 Riffle | $920 /Riffle | **$ 9,200** |
| - 200 Class Excavator with thumb and bucket | 4 hrs | $145 /hr | $ 580 |
| - Off-road Dump Truck | 4 hrs | $85 /hr | $ 340 |
| Large Wood Habitat Structure (3 Tree Pieces / 5 cy Boulders) | 10 LWHS | $375 /LWHS | **$ 3,750** |
| - 200 Class Excavator with thumb and bucket | 2 hrs | $145 /hr | $ 290 |
| - Off-road Dump Truck | 1 hrs | $85 /hr | $ 85 |
| Vegetated Soil Lifts (1-Tier, Labor Cost Only, Unit Cost) | 600 lf | $19.75 /lft | **$ 11,850** |
| - 200 Class Excavator with thumb and bucket | 50 hrs | $145 /hr | $ 7,250 |
| - Off-road Dump Truck | 25 hrs | $85 /hr | $ 2,125 |
| - Laborer 1 | 50 hrs | $25 /hr | $ 1,250 |
| - Laborer 3 | hrs | $25 /hr | $ - |
| **REVEGETATION (incl Sod and Willow Collection & Transplant)** | | | **$ 4,000** |
| Skidsteer Plant Salvage and Transplant | 40 hrs | $85 /hr | $ 3,400 |
| - Laborer 1 - Harvest and Plant 5 ft willow cuttings | 10 hrs | $30 /hr | $ 300 |
| - Laborer 2 - Harvest and Plant 5 ft willow cuttings | 10 hrs | $30 /hr | $ 300 |
| **BRIDGE RETROFIT (SUPER SILL ABUTMENTS, RE-SET BRIDGE ALIGN, NEW DECK)** | LS | | **$ 10,000** |
| - 200 Class Excavator with thumb and bucket | 0 hrs | $145 /hr | $ - |
| - Off-road Dump Truck | 0 hrs | $85 /hr | $ - |
| - Laborer 1 | 0 acres | $25 /hr | $ - |
| **MAINTENANCE WATERING** | | | **$ -** |
| - Laborer 1 | hrs | $30 /hr | $ - |
| - Laborer 2 | hrs | $30 /hr | $ - |
| - Pump | hrs | $25 /day | $ - |
| - Vehicle | hrs | $50 /day | $ - |
| **DAM AND DIVERSION MODIFICATIONS** | | | **$ -** |
| - 200 Class Excavator with thumb and bucket | 0 hrs | $145 /hr | $ - |
| - Off-road Dump Truck | 0 hrs | $85 /hr | $ - |
| - Laborer 1 | hrs | $30 /hr | $ - |
| - Laborer 2 | hrs | $30 /hr | $ - |
| FISH RETURN PIPE | | | |
| **MATERIALS (Trees, Rock, Bioengineering, Erosion Control Cost and Delivery)** | 1 ls | $ 52,071 | **$ 52,071** |

| | | |
|---|---|---|
| Project Administration and Permitting Total | 0.053 % of Total Budget | $ 8,000 |
| Construction Administration Total | 0.134 % of Total Budget | $ 20,176 |
| Construction Equipment and Labor Total | | $ 78,340 |
| Construction Materials Total | | $ 52,071 |
| | **Construction Total:** | **$ 150,586** |
| | **Total Project Cost** | **$ 158,586** |
| | **Treated Channel Length** | **2000 ft** |
| | **Project Construction Cost per Foot** | **$ 79** |