NorthWestern Energy
Delivering a Bright Future

NWE-THF-3665

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

March 29, 2019

RE: NorthWestern Energy Files 2018 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 dated February 12, 2009, is NorthWestern Energy's 2018 Annual Activities, Fish Passage and Bull Trout Take Report for the Thompson Falls Project completed in consultation with the U.S. Fish and Wildlife Service (USFWS), Montana Fish, Wildlife and Parks, Montana Department of Environmental Quality and Confederated Salish and Kootenai Tribes. The 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,

3-29-19

Mary Gail Sullivan
Director, Environmental and Lands

CC: Kevin Aceituno, USFWS
Ben Conard, USFWS
Craig Barfoot, CSKT
Jason Garber, MDEQ
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Kristi Webb, New Wave

The USFWS has reviewed and by signature below, approves this Thompson Falls Project 2018 Annual Activity, Fish Passage and Bull Trout Take Report filing with the Commission.

By: Ben Conard

Title: Deputy Office Supervisor, USFWS
Montana Ecological Services Office

Date: 3/27/2019

2018 Annual Report
Fish Passage Project
Thompson Falls Hydroelectric Project
FERC Project Number 1869

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

Submitted by:
NorthWestern Energy Corporation
Butte, Montana

In Collaboration With:

U.S. Fish and Wildlife Service
Kalispell, Montana

Montana Fish Wildlife and Parks
Thompson Falls, Montana

Confederated Salish and Kootenai Tribes of the Flathead Nation
Pablo, Montana

Montana Department of Environmental Quality
Helena, Montana

With Assistance From:
GEI Consultants, Inc.
Portland, Oregon

New Wave Environmental Consulting, LLC
Missoula, Montana

March 2019

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List of Acronyms

%	percent
AMFA	adaptive management funding account
Avista	Avista Corporation
AWS	auxiliary water system
BO	Biological Opinion
BP	barometric pressure
BULL	Bull Trout
BL BH	Black Bullhead
°C	degrees Celsius
cfs	cubic feet per second
Ck	creek
Commission	Federal Energy Regulatory Commission
CPUE	catch per unit effort
CSKT	Confederated Salish and Kootenai Tribes of the Flathead Nation
EB	Brook Trout
EF	electrofishing
Evaluation Plan	10-Yr Fish Passage Facility Evaluation Plan, Phase 2 Action Plan, 2011-2020
FERC	Federal Energy Regulatory Commission
ft	feet
FDX	full-duplex
FWP	Montana Fish, Wildlife and Parks
FWS or Service	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
g	gram
HDX	half-duplex
HVJ	high-velocity jet
hrs	hours
kg	kilogram
km	kilometer
L	length
fish ladder or ladder	Thompson Falls Upstream Fish Passage Facility
LCFR	Lower Clark Fork River
Licensee	NorthWestern Energy Corporation
LL	Brown Trout
LT	Lake Trout
LMB	Largemouth Bass
LS SU	Largescale Sucker
LN DC	Longnose Dace
LN SU	Longnose Sucker
LWF	Lake Whitefish
MOU	Memorandum of Understanding

mbar	millibar
mm	millimeter
mmHg	millimeter of mercury
MDEQ	Montana Department of Environmental Quality
MWF	Mountain Whitefish
Msl	mean sea level
N	number
NRCS	Natural Resources Conservation Service
NorthWestern	NorthWestern Energy Corporation
NP	Northern Pike
NPMN	Northern Pikeminnow
PEA	Peamouth
PIT	passive integrated transponder
PPL Montana	PPL Montana, LLC
Project	Thompson Falls Hydroelectric Project
PUMP	Pumpkinseed
RB	Rainbow Trout
RBxWCT	Rainbow x Westslope Cutthroat Trout hybrid
RS SH	Redside Shiner
SMB	Smallmouth Bass
SOP	Operational and Procedural Manual
TAC	Technical Advisory Committee
TCs	Terms and Conditions
TDG	total dissolved gas
TFalls	Thompson Falls
TRiver	Thompson River
USGS	U.S. Geological Survey
WE	Walleye
Wt	weight
WCT	Westslope Cutthroat Trout
WF	West Fork
YP	Yellow Perch

Executive Summary

NorthWestern Energy Corporation (NorthWestern) is owner and operator of the Thompson Falls Hydroelectric Project (No. 1869) (Project), located on the Clark Fork River near Thompson Falls, Montana. The current Federal Energy Regulatory Commission (FERC or Commission) License was issued to the Montana Power Company in 1979 (purchased by PPL Montana in 1999 and subsequently purchased by NorthWestern in 2014) and is scheduled to expire on December 31, 2025.

In 1998, the Bull Trout (*Salvelinus confluentus*) was federally-listed under the Endangered Species Act as a threatened species (Federal Register, 1998). Critical habitat was proposed in 2005 and designated in 2010 (Federal Register 2005, 2010). The Licensee for Project 1869 conducted 5 years of studies (2003 start) and filed a Biological Evaluation with the Commission on April 7, 2008 discussing the effects of the 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 or Service) on May 1, 2008. On November 4, 2008 the FWS filed with the Commission a Biological Opinion (BO) (FWS, 2008) and an associated Incidental Take Statement, which includes reasonable and prudent measures, Terms and Conditions (TCs) and conservation recommendations 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 Project (FERC, 2009). This Order included the reasonable and prudent measures, TCs, and conservation recommendations from the BO. The Commission agreed with the FWS's conclusion that the Project is currently adversely affecting Bull Trout and Licensee's proposed conservation measures will reduce, but not eliminate, adverse impacts of the Project.

The 2009 Order requires the Licensee 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 TCs (FERC, 2009). In addition to the requirements stipulated in Term 7a, the annual report is required to address the Licensee's compliance with the FWS's TCs.

This report is intended to fulfill the annual reporting requirement, as specified in Term 7a of the BO, the requirements of the FERC Order (FERC, 2009), and summarizes the Licensee's 2018 activities (Sections 2.0 – 7.0); compliance with the FWS's TCs of the BO (Section 8.0); and proposed activities in 2019 (Section 9.0).

Baseline Fisheries Studies

Baseline fisheries data collection includes spring electrofishing in the Thompson Reservoir; fall electrofishing in the Clark Fork River above the islands and between Paradise to Plains, Montana; and fall gillnetting in the Thompson Reservoir. The baseline fisheries surveys were set up with the

intention of monitoring the impact of salmonids ascending the ladder and passed upstream of Thompson Falls Dam.

Fish species composition and catch rates from the 2018 baseline surveys remained within the range observed in past years. The number of fish caught gillnetting were lower than in recent years, but the general species composition remained the same. The lower number of fish captured is likely attributed to the reservoir drawdown during the summer (until August 9) to replace the stanchions on the two spillways (Main and Dry Channel dams), which were removed due to higher than normal spring flows. The removal of stanchions and subsequent drawdown in the reservoir also occurred in 2011, resulting in a lower number of fish during the subsequent gillnet survey.

During the 2018 baseline surveys, there were five ladder-fish (fish that ascended the fish ladder and released upstream of Thompson Falls Dam) detected. These ladder-fish included three Brown Trout in the upper section of the Thompson Reservoir during the spring survey and two Rainbow Trout in the above islands reach in the Clark Fork River during the fall survey. Since upstream fish passage began at Thompson Falls Dam, 29 ladder-fish (22 RB, 6 LL, 1 WCT) with a unique tag were subsequently recaptured during baseline surveys. This represents approximately 1 percent of the 2,644 uniquely tagged-fish released upstream of Thompson Falls Dam since 2011.

Upstream Fish Passage Evaluation

In 2018, the Thompson Falls upstream fish passage (also referred to as the fish ladder) was open from March 27 through November 15. The ladder was closed for 89 days between April 1 and August 8 due to high spring streamflows and maintenance efforts to replace the stanchions. Streamflows in 2018 were above average with peak flow at 103,000 cubic feet per second (cfs) on May 27 and 28 (Clark Fork River near Plains, USGS gage station 12389000). The peak flows were similar to the 2011 season but occurred about 2 weeks earlier. The ladder operated in notch mode most of the season (through October 23) before switching to orifice mode from October 24 through November 15.

There were 227 fish (206 salmonids; 21 non-salmonids) recorded ascending the ladder with one mortality of a Brown Trout in 2018. Thus, 226 fish were released upstream. No Bull Trout were detected in the ladder or recorded at the top of the ladder in 2018. This is the first year no Bull Trout were documented at the ladder.

Fallback was minimal with only two of the seven fallback fish (5 RB, 1 WCT, 1 LL) detected downstream of the dam within 30 days of their release upstream of the dam. Two of the fish were known to successfully move downstream through the turbines while others moved downstream either over the spillway or through the turbines.

There were 30,913 fish released upstream of Thompson Falls Dam since 2011. Approximately 80 percent of the salmonids and 3 percent of the non-salmonids were uniquely PIT-tagged prior to release upstream. Approximately 10 percent of the 2,610 PIT-tagged fish, including one Bull Trout, have returned to the ladder after being passed upstream and ascended the ladder at least

twice. On an annual basis, between 3 and 10 percent of the fish tagged in the previous year return the following year and ascend the ladder. Cumulatively and annually, about 30 percent of the fish tagged at the ladder and released upstream have been detected 6 miles upstream in the Thompson River, including four Bull Trout. Two of the four Bull Trout were also detected in critical spawning tributaries, Fishtrap Creek in 2018 and West Fork Thompson River in 2015.

The timing for fish movement at the ladder varies by species and can vary annually depending on river conditions (streamflow, stream temperature). Some species display a strong seasonal movement pattern, or a movement pattern related to stream temperatures, while others like Rainbow Trout, are detected in the ladder throughout the season. The movement patterns observed at the ladder since 2011 indicate fish are not always moving upstream for the purpose of spawning and are motivated by other factors.

Overall fish totals at the ladder has declined significantly during the last two years (2017-2018) of operation when the ladder operated primarily in notch mode. The primary decline has been in native fish species such as Largescale Sucker and Northern Pikeminnow. Tagged-fish (mostly salmonids) detected in the ladder and ascending the ladder show they generally ascend quicker in notch mode than in orifice mode. However, the notch mode may be selecting against some fish (e.g., weaker swimmers) from ascending the ladder.

NorthWestern proposes to operate the ladder in orifice mode in 2019 and 2020 for the remaining Phase 2 evaluation period to maximize fish passage opportunity for native species and nonnative salmonid sport fish that will in turn best achieve the management objectives identified by FWS and Montana Fish, Wildlife and Parks (FWP) for upstream fish passage.

Bull Trout Incidental "Take"

In 2018, no Bull Trout were sampled by NorthWestern at the Thompson Falls fish ladder or during other baseline fisheries surveys. The total number of Bull Trout recorded ascending the ladder between 2011 and 2018 is 16 Bull Trout (*representing 15 individuals*). This includes one Bull Trout that ascended the ladder twice. During the second ascent (2012), the Bull Trout jumped out of a pool and died. This is the only documented Project-related mortality. A cover was initially installed over the holding pool (pool 45) that was later replaced with a screen installed around the railing above the holding pool to mitigate the potential for this to occur in the future.

Over the last 8 years, NorthWestern has recorded 31 individual Bull Trout in the Project area. Sampling has included collecting Bull Trout via electrofishing efforts upstream and downstream of Thompson Falls Dam, as well as Bull Trout recorded at the ladder. Sampling efforts in the Thompson River drainage are not included in this total because these data are collected and reported by FWP.

Avista Bull Trout Passage and Monitoring

Avista Corporation (Avista) provides annual technical reports summarizing their comprehensive transport program (Bernall and Duffy, 2018). This report focuses on Bull Trout captured by Avista downstream of Cabinet Gorge Dam, genetically assigned to Region 4 and subsequently transported and released into Region 4 (upstream of Thompson Falls Dam).

Avista Corporation (Avista) has captured 106 Bull Trout downstream of Cabinet Gorge Hydroelectric Project that were genetically assigned to Region 4 (upstream of Thompson Falls Dam) and transported 75 of these Bull Trout to Region 4 since 2009. Annually, Avista transports an average of eight Bull Trout to Region 4 (Bernall and Duffy, 2018; S. Bernall, Avista, personal communication, March 2019).

In 2018, Avista captured five Bull Trout from downstream of Cabinet Gorge Dam and transported them to Region 4, releasing the fish upstream of Thompson Falls Dam. Two of the Bull Trout transported and released in the Thompson River were detected in Fishtrap Creek via the remote tag array in September and October.

Fourteen of the Bull Trout transported by Avista and released upstream in Region 4 have been detected by the mainstem array in the Thompson River since September 2014.

Total Dissolved Gas Monitoring

The Thompson Falls Technical Advisory Committee (TAC) agreed that NorthWestern will monitor total dissolved gas (TDG) when the lower Clark Fork River runoff forecast is at or above 125 percent on April 1. In 2018, this threshold was exceeded and NorthWestern monitored TDG from April 19 through July 18.

Similar to past years, TDG in 2018 was lowest upstream of the Project, highest at the first measurement site downstream of the Project (at the High Bridge), and intermediate at the most downstream site at the Birdland Bay Bridge. TDG levels declined downstream of the High Bridge as a result of mixing with river flow coming through the powerhouse and, potentially, some degassing as the river moves downstream.

TDG upstream of the Project peaked at approximately 108 percent of saturation during 2018. TDG levels at the High Bridge approached 127 percent of saturation. The peak TDG at the Birdland Bay Bridge site is unknown as the sensor was not operating during peak discharge at that site.

This year (2018) was the first year since 2011 that the stanchions were tripped at the Project. It appears that in 2018, tripping the stanchions resulted in an increase in TDG of about 5 percent at the High Bridge site. Results from 2018 show a similar pattern as was observed in 2011.

No electrofishing was conducted in the Thompson Falls tailrace during the 2018 spill period to monitor for potential gas bubble trauma (GBT) in fish. During the TDG monitoring period, the

ladder was open and operational for 23 days with 11 ladder checks resulting in 22 fish (15 RB, 5 WCT,1 RBxWCT, 1 LL). No GBT was noted in any of the fish monitored at the fish ladder during the spill period.

TAC-Funded Projects

In 2013, the Licensee renewed the Memorandum of Understanding (MOU, 2013) for a 7-year term (January 1, 2014 – December 31, 2020). The MOU was approved and signed by FWS, FWP, Confederated Salish and Kootenai Tribes of the Flathead Nation (CSKT), and the Licensee. The Licensee will provide an Adaptive Management Funding Account (AMFA) designated for implementation of downstream passage minimization measures in addition to Project License required studies, monitoring activities, reports, upstream fish passage minimization measures, gas abatement monitoring, predator control measures, and other means to reducing impacts on Bull Trout caused by operation of the Project. The Licensee will provide $100,000 annually for 7 years and allow a maximum of $250,000 to accrue in a TAC Reserve Account from unspent or transferred annual TAC funds.

In 2018, the NorthWestern consulted with FWS and FERC and proposed to modify BO Term and Condition 2 (FWS, 2008) that addresses funding of offsite habitat restoration, or acquisition in important upstream Bull Trout spawning and rearing tributaries, with the purpose of boosting recruitment for juvenile Bull Trout. NorthWestern consulted with FWS and TAC members and agreed it was important to include areas of the Prospect Creek watershed occupied by Bull Trout, a tributary with Bull Trout critical habitat designation located immediately downstream of the Main Dam, eligible for TAC funding. FWS also indicated the BO did not need to be modified because Prospect Creek is within the action area analyzed in the 2008 BO. FERC approved the proposed modification in a letter dated May 8, 2018. Thus, the Prospect Creek PIT Tag Array and Crow Creek Reconstruction Design projects proposed during the November 2017 TAC meeting were approved for funding in 2018.

In 2018, the following TAC-funded projects were implemented:

- Koch Property Acquisition
- Rattlesnake Dam Removal, Phase 1
- Crow Creek Reconstruction Design, Phase 1
- Prospect Creek PIT Tag Array
- Thompson River Watershed Coordinator
- Beartrap Culvert Removal
- Emergency/Contingency Funding

In November 2018, the Thompson Falls TAC approved funding for implementation in 2019 for the following projects:

- Rattlesnake Dam Removal, Phase 2
- Crow Creek Reconstruction, Phase 2

- West Fork Fishtrap Creek Road Realignment
- Thompson River Watershed Coordinator
- Emergency/Contingency Funding

NorthWestern will continue to coordinate with TAC members throughout the year and any proposal(s) submitted during the year will be distributed to the TAC members for review and approval.

1.0 Introduction

1.1 Background

NorthWestern Energy Corporation (NorthWestern) is owner and operator of the Thompson Falls Hydroelectric Project (No. 1869) (Project), 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 in 1979 (purchased by PPL Montana in 1999 and subsequently purchased by NorthWestern in 2014) and is scheduled to expire on December 31, 2025.

In 1998, the Bull Trout (*Salvelinus confluentus*) was federally-listed under the Endangered Species Act as a threatened species (Federal Register, 1998). Critical habitat was proposed in 2005 and designated in 2010 (Federal Register, 2005, 2010). The U.S. Fish and Wildlife Service (FWS or Service) proposed a revision to the Critical Habitat Designation on January 13, 2010. The Final Critical Habitat Designation Rule for Bull Trout was submitted by FWS on September 30, 2010 and was effective as of November 17, 2010. The Project area is within the designated critical habitat for Bull Trout. Because Bull Trout are present within the Project area, a draft Biological Evaluation was prepared for the Project and submitted to FWS and FERC in 2003.

After 5 years of studies (2003-2008), the Licensee filed an updated Biological Evaluation with the Commission, discussing the effects of the Project on Bull Trout and proposed conservation measures with the Commission on April 7, 2008. The 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 subsequent access to spawning habitat by the Project was identified as a major concern. Consequently, the Licensee 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 the Licensee, the Confederated Salish and Kootenai Tribes of the Flathead Nation (CSKT), Montana Fish, Wildlife and Parks (FWP), and FWS (MOU, 2008). On November 11, 2013, the Licensee filed the renewed MOU with the Commission. The renewed MOU was developed in consultation with CSKT, FWP, and FWS and is effective from January 1, 2014 through December 31, 2020 (MOU, 2013). 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.

In 2008, the Commission concluded that the Project is adversely affecting Bull Trout and the proposed conservation measures will reduce, but not 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 FWS on May 1, 2008.

1.2 Biological Opinion

On November 4, 2008 the FWS filed with the Commission a Biological Opinion (BO) and associated Incidental Take Statement, which includes reasonable and prudent measures and Terms and Conditions (TCs) to minimize incidental take of Bull Trout. The FWS concluded in its BO that the Project is currently adversely affecting Bull Trout and the Licensee's proposed conservation measures will reduce, but not eliminate, adverse impacts of the Project (FWS, 2008).

1.3 FERC Order Approving Construction and Operation

On February 12, 2009 the Commission issued an Order Approving Construction and Operation of Fish Passage Facilities for the Thompson Falls Project (FERC, 2009). This Order included the reasonable and prudent measures, TCs, and conservation recommendations from the FWS's BO (2008).

The FERC Order (February 12, 2009) requires the Licensee to file with the Commission for approval, after development and approval by the FWS and the Thompson Falls Technical Advisory Committee (TAC), study and operational plans referenced in the FWS's TCs 1 through 7. For the Commission to ensure compliance with the FWS's TCs, the Licensee 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 TCs (*see* Section 8.1 for details).

1.4 Phase 2 Evaluation Period (2011-2020)

For the Thompson Falls Project, Phase 2 (2011-2020) is the evaluation period of the Thompson Falls Upstream Fish Passage Facility. As stated in the FWS BO (2008), Phase 2 will,

> *…evaluate the 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.*

The February 2009 FERC Order required the Licensee develop an upstream fish passage evaluation plan. In cooperation with the TAC and approval by FWS, the *10-year Fish Passage Facility Evaluation Plan, Phase 2 Action Plan, 2011-2020* (Evaluation Plan) (PPL Montana, 2010) was submitted to the Commission in 2010. FERC issued an Order on June 9, 2011 approving the Licensee's Evaluation Plan.

The Evaluation Plan outlines the Licensee's strategy for evaluating the effectiveness of fish ladder through various studies to be conducted to assess the ability of Bull Trout and other fish to locate the ladder entrance and ascend the ladder.

The Evaluation Plan identified the following objectives:

- Assess the effectiveness of the upstream fish ladder to pass Bull Trout
- Determine the optimal operational procedures to achieve the highest efficiency for upstream Bull Trout passage
- Assess the potential length of delay for upstream Bull Trout passage and devise strategies to minimize that delay
- Assess the amount of "fallback"

Effectiveness of the fish ladder will be a qualitative assessment and evaluated based on annual fish passage, including enumeration of fish using the facility, species using the facility, range and average length and weight of species using the facility, and the timing of upstream passage by species (PPL Montana, 2010). Effectiveness of the ladder operations to provide fish passage will be evaluated based on the weir mode studies and optimal attractant flow. These studies will also provide data to allow the Licensee to fine-tune the operation of the ladder to optimize fish passage with the ultimate goal of volitional fish passage.

As stated in the Evaluation Plan, results will be included in the Annual Report filed April 1 to FERC each year, as well as the 10-year (2011-2020) comprehensive report scheduled for completion by December 31, 2020. The annual reports provide information which facilitates development of ladder operational protocols to optimize upstream fish passage of Bull Trout and other migratory species. The Evaluation Plan identifies the Annual Report will include, at a minimum, a summary of the following information:

- Total number of fish and species ascending the ladder
- Total number of fish and species passed to Thompson Reservoir
- Most active period(s) for fish and various species ascending the ladder
- Results from the weir *vs.* orifice study and attraction flow studies (when applicable)
- Total number of fallback
- Bull trout genetic sampling and tributary assignment

1.5 FERC Compliance and Annual Reporting

This annual report is intended to fulfill the annual reporting requirement, as specified in Term 7a of the BO and the requirements of the FERC Order. This report summarizes the Licensee's 2018 activities in Sections 2.0 through 7.0; NorthWestern's compliance with the FWS's TCs of the BO (Section 8.0); and NorthWestern's proposed activities in 2019 (Section 9.0).

2.0 Baseline Fisheries Studies

The baseline fisheries surveys were set up with the intention of monitoring the impact of salmonids passed upstream of Thompson Falls Dam. Baseline fisheries data collection includes fall gillnetting in the Thompson Reservoir, electrofishing the Thompson Reservoir (upper and lower sections) in the spring, and electrofishing two reaches in the Clark Fork River (above the islands and between Paradise and Plains, Montana) in the fall. The location of each reach is shown in Figures 2-1 and 2-2. Gillnetting in the Thompson Reservoir has occurred annually each October, since 2004. Monitoring via electrofishing began in 2010. In 2016 the TAC agreed to modify the frequency of the baseline surveys starting in 2017. Gillnet sampling continues to be annual, but electrofishing occurs every other year, with the most recent sample event completed in 2018 and the next one scheduled for 2020.

The objective for these sampling efforts is to establish baseline information on species composition and relative abundance within and upstream of the Thompson Reservoir. This information helps track annual and long-term changes to the fish community, which is especially important with operation of the full-height fish ladder at the Project and upstream passage of over 30,000 fish since 2011.

Figure 2-1. Electrofishing and gillnetting sampling locations near Thompson Falls, Montana.

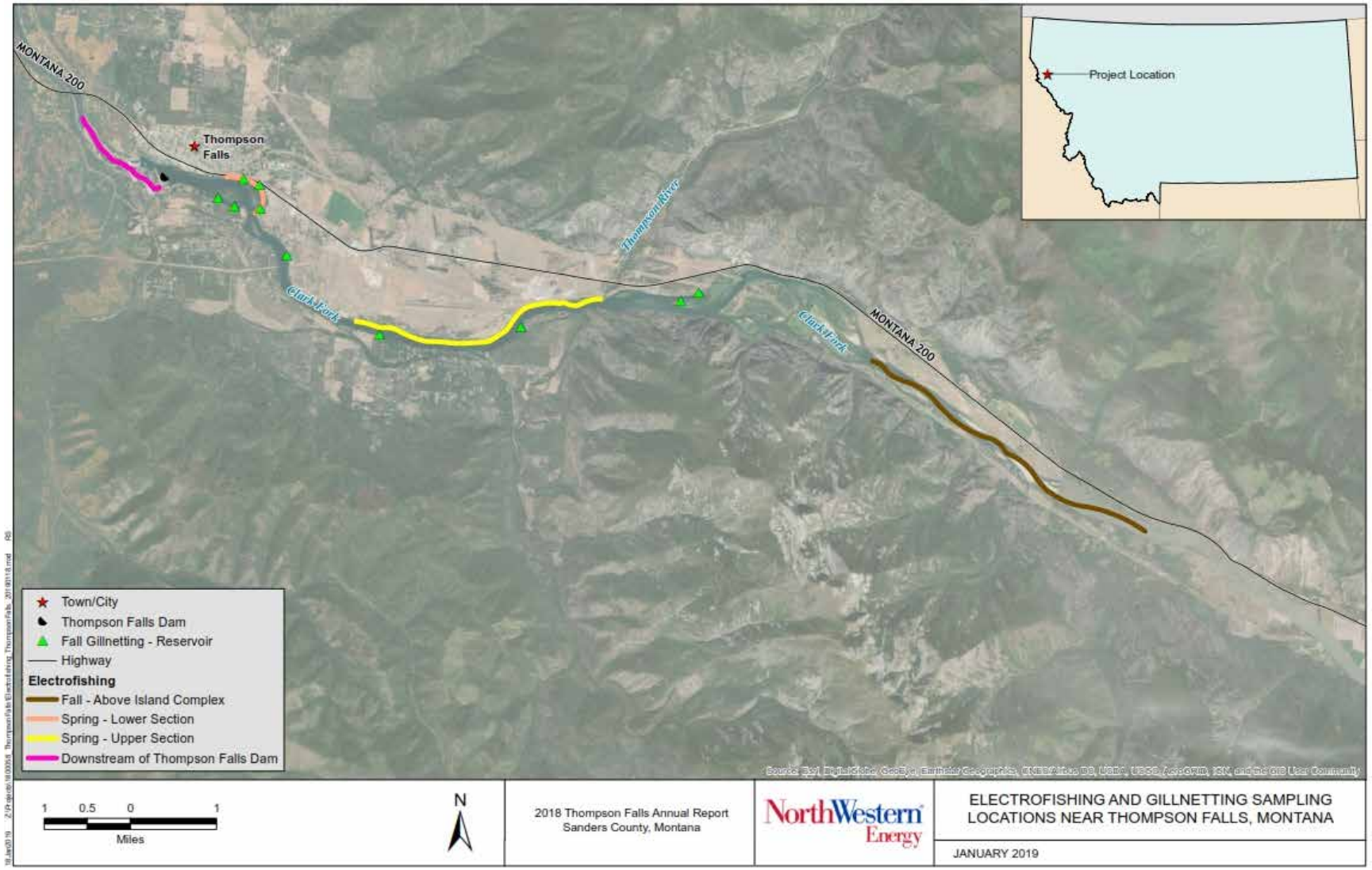
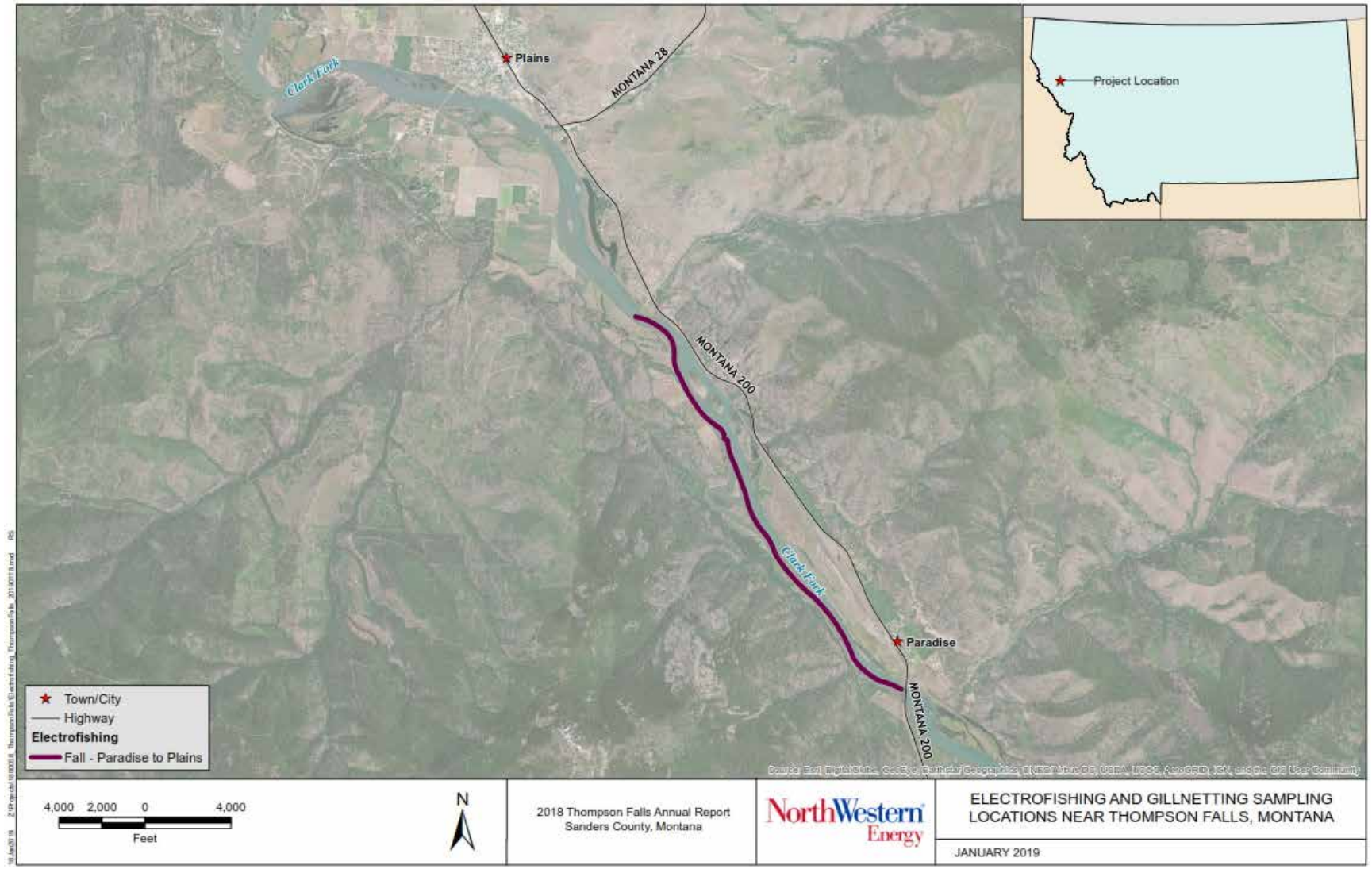


Figure 2-2. Electrofishing reach between Paradise and Plains, Montana.



2.1 Fish Abbreviations

Fish recorded through the baseline fisheries data and upstream fish passage results are listed in Table 2-1 along with each species abbreviation, common name, and scientific name. Tables and figures in this report refer to the species abbreviation provided in Table 2-1.

Table 2-1. Summary of abbreviations for fish identification, species common name, and scientific name.

Fish Abbreviation	Common Name	Scientific Name
BL BH	Black Bullhead	*Ameiurus melas*
BULL	Bull Trout	*Salvelinus confluentus*
EB	Brook Trout	*Salvelinus fontinalis*
LL	Brown Trout	*Salmo trutta*
LMB	Largemouth Bass	*Micropterus salmoides*
LN DC	Longnose Dace	*Rhinichthys cataractae*
LN SU	Longnose Sucker	*Catostomus castostomus*
LS SU	Largescale Sucker	*Catostomus macrocheilus*
LT	Lake Trout	*Salvelinus namaycush*
L WF	Lake Whitefish	*Coregonus clupeaformis*
MWF	Mountain Whitefish	*Prosopium williamsoni*
NP	Northern Pike	*Esox lucius*
N PMN	Northern Pikeminnow	*Ptychocheilus oregonensis*
PEA	Peamouth	*Mylocheilus caurinus*
PUMP	Pumpkinseed	*Lepomis gibbosus*
RB	Rainbow Trout	*Oncorhynchus mykiss*
RBxWCT	Rainbow x Westslope Cutthroat Trout hybrid	*Oncorhynchus clarkii lewisi and Oncorhynchus mykiss*
RS SH	Redside Shiner	*Richardsonius balteatus*
SMB	Smallmouth Bass	*Micropterus dolomieu*
WCT	Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*
WE	Walleye	*Sander vitreus*
YP	Yellow Perch	*Perca flavescens*
YL BL	Yellow Bullhead	*Ameiurus natalis*

2.2 Spring Electrofishing

Spring electrofishing in the Thompson Reservoir consists of two locations, the lower section located immediately upstream of the Project and the upper section located immediately downstream of the confluence with the Thompson River (Figure 2-1). Spring electrofishing is conducted using boat-mounted electrofishing equipment. The boat is navigated slowly along the shoreline at night. The lower section is parallel with Highway 200 from the Wild Goose Landing boat launch, upstream to a location approximately 750 feet above the pump house. The upper section is on the right bank of the Clark Fork River from the confluence of the Thompson River to

about 1 mile downstream of the Cherry Creek boat launch. The upper section has riverine characteristics, with noticeable flowing water, average widths around 459 feet, little to no aquatic vegetation, and some recreational docks. The lower section has substantially lower water velocity, mean widths near 1,673 feet, abundant aquatic vegetation, and is off the main river channel. In 2018 sampling occurred on April 17 and 18, similar to the sampling dates from previous years. Table 2-2 summarizes sampling events since 2009, water temperature in Celsius (°C), and streamflow (cubic feet per second or cfs) at the U.S. Geological Survey (USGS) gage #12389000.

Table 2-2. Summary of the sample dates, water temperature, duration of electrofishing efforts, and streamflows (USGS gage #12389000) completed in the lower and upper sections of the Thompson Reservoir 2009-2018.

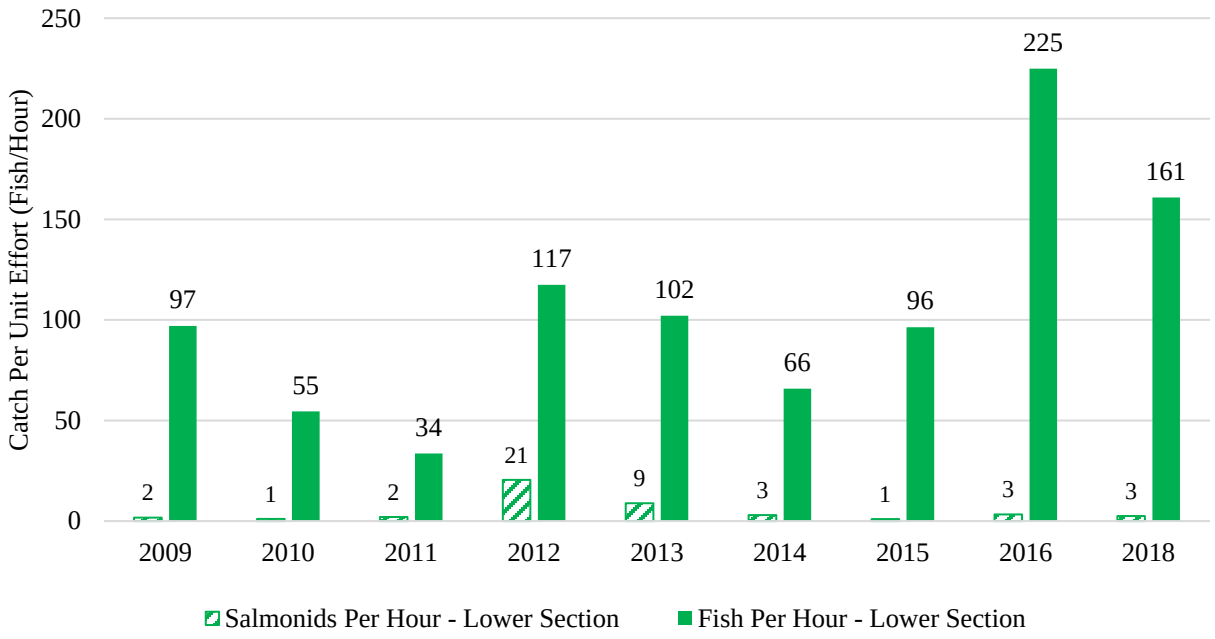
Lower Section			Upper Section			USGS Gage
Date	Water Temperature ºC	Duration of Electrofishing (hrs)	Date	Water Temperature ºC	Duration of Electrofishing (hrs)	Streamflow (cfs)
4-20-09	10.0	0.6	**4-21-09**	10.5	0.6	17,000 - 18,200
4-28-10	9.0	0.9	**4-29-10**	7.5	2.1	14,300 - 14,600
4-13-11	5.8	1.0	**4-14-11**	5.1	1.9	24,500 - 25,100
4-16-12	7.4	0.8	**4-17-12**	7.2	1.9	14,400 - 14,900
4-11-13	7.0	0.9	**4-10-13**	7.0	1.9	21,000 - 21,800
4-14-14	7.0	1.0	**4-15-14**	7.0	2.1	27,800 - 27,500
4-14-15	6.4	1.0	**4-13-15**	7.0	2.1	24,900 - 25,200
4-12-16	11.0	0.9	**4-11-16**	10.7	1.9	20,800 - 22,600
No Sampling in 2017						
4-18-18	5.5	0.8	**4-17-18**	5.5	2.0	26,700 - 27,800
Total hours		**7.9**	**Total hours**		**16.5**	

2.2.1 Lower Section

In 2018, spring electrofishing in the lower section captured 131 fish representing seven species, including two salmonid species (LL, MWF). The most common species observed in 2018 were Yellow Perch (n=62), Pumpkinseed (n=24), Black Bullhead (n=23), and Largemouth Bass (n=15). The lower section was surveyed annually from 2009 through 2016 with subsequent sampling scheduled for every other year (2018, 2020, etc.). Since 2009, surveys have observed between 34 and 207 individual fish, representing between seven and 15 species caught per sampling event. Non-salmonids are more common in the lower section than salmonids (Figure 2-3).

Since baselines surveys began in 2011, four uniquely tagged ladder fish (3 RB, 1 WCT) were recorded in the lower section with two fish detected in 2016 and two fish in 2013. Three of the four were subsequently detected in the Thompson River, located about 6 miles upstream of Thompson Falls Dam after their release upstream of Thompson Falls Dam. There were no tagged ladder fish recorded in 2018.

Figure 2-3. Summary of the 2009-2016, 2018 annual catch rate for salmonids and all fish species captured during spring electrofishing efforts in the lower section of the Thompson Reservoir.

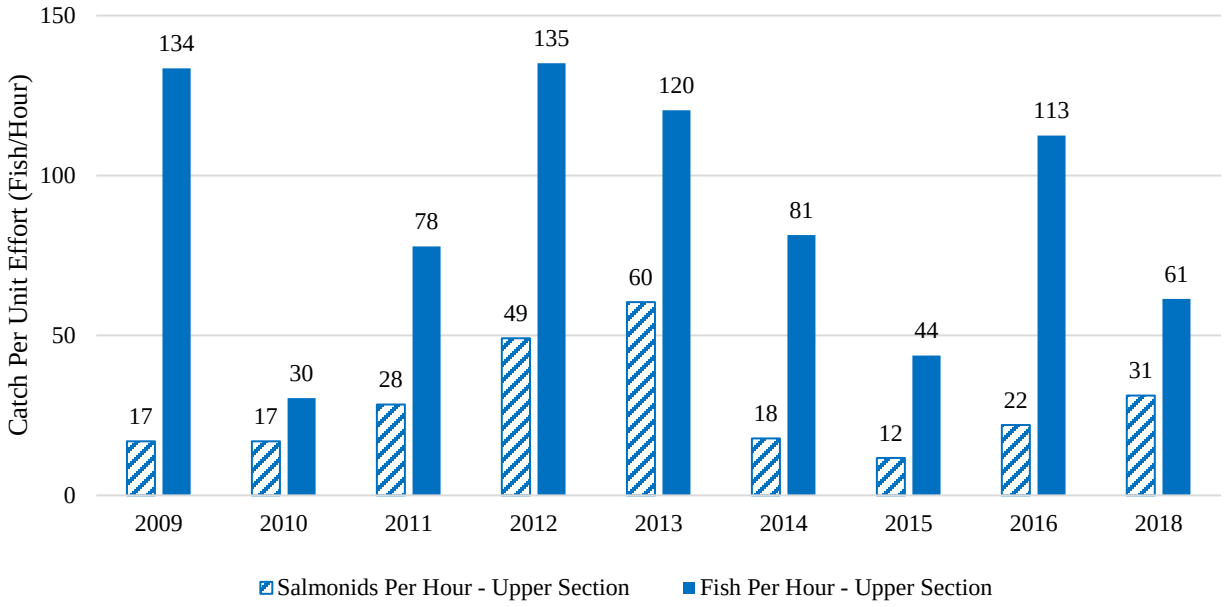


2.2.2 Upper Section

The 2018 sampling of the upper section resulted in 122 fish captured representing seven non-salmonid species and four salmonid species. Since spring surveys began in 2009, the number of fish captured per sample event has ranged from 63 to 253 individual fish representing nine to 13 species. Salmonids are more common in the upper section, varying from a low of 10 salmonids in 2009 to a high of 115 salmonids in 2013. Catch per unit effort (fish per hour) for salmonids and all fish species has varied annually as shown in Figure 2-4. The salmonid catch rate in the upper section in 2018 was 50 percent of the total catch rate. The average salmonid catch rate during 2009-2016 was about one-third of the total catch rate.

In 2018 there were three uniquely tagged ladder fish, all Brown Trout, captured in the upper section. The three Brown Trout were similar lengths, 430 to 452 mm and weighted between 754 to 902 g. Two Brown Trout initially ascended the ladder in 2017 (1 in July; 1 in October) and one Brown Trout was recorded at the ladder (and released upstream) in June 2015, June 2016, and August 2018. Two of the three fish were also detected in the Thompson River. Since the ladder began operations in 2011, seven fish (4 LL; 3 RB) recorded ascending the ladder (receiving a unique tag and released upstream) were subsequently detected during spring electrofishing in the upper section.

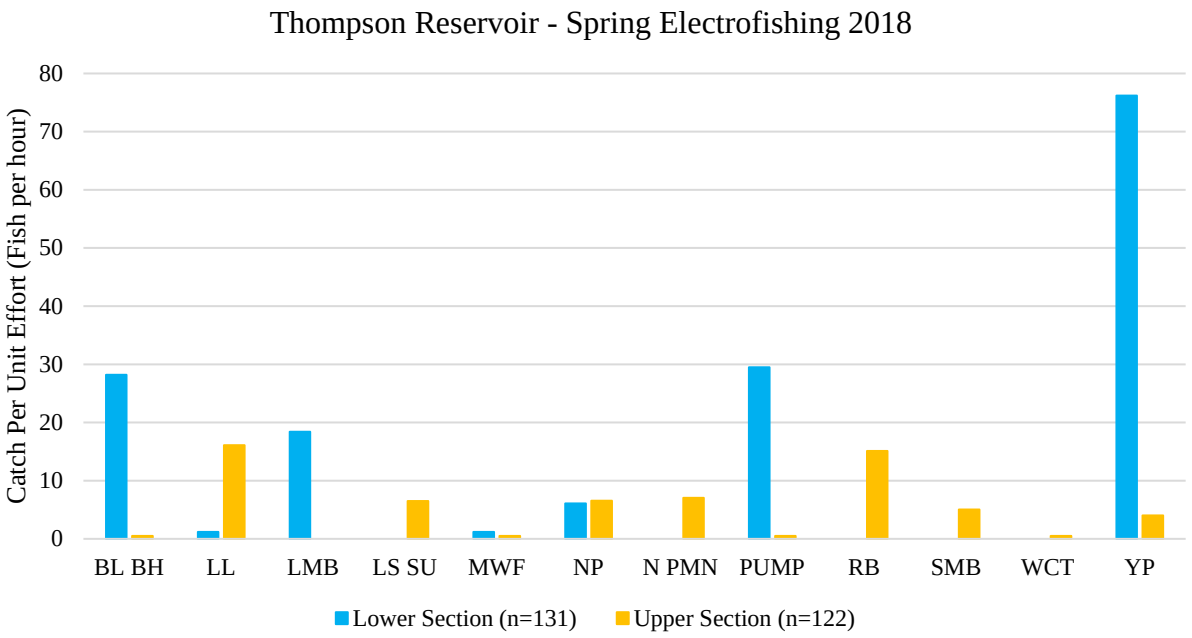
Figure 2-4. Summary of the 2009-2018 annual catch rate for salmonids and all fish species captured during spring electrofishing efforts in the upper section of the Thompson Reservoir.



2.2.3 Spring Electrofishing Summary

The catch per unit effort (CPUE) of salmonids remains greatest in the upper section, averaging 29 salmonids per hour (2009-2018). The lower section averages five salmonids per hour (2009-2018). Non-salmonids such as Largemouth Bass, Northern Pike, Pumpkinseed, and Yellow Perch are on average the most common species captured in the lower section; whereas, species such as Largescale Suckers, Northern Pikeminnow, and Rainbow Trout are on average the most common species captured in the upper section. In 2018, Black Bullhead were also among the most abundant species in the lower section. Brown and Rainbow Trout were among the most abundant species in the upper section (Figure 2-5). The differences in species composition and abundance of salmonids is likely related to habitat conditions in each survey section. The upper sampling section is more of a riverine environment. The lower sampling section, which is closer to Thompson Falls Dam, is more lacustrine (lake-like).

Figure 2-5. Summary of the 2018 catch rate for all fish species captured during spring electrofishing efforts in the lower and upper section of the Thompson Reservoir.



2.3 Autumn Electrofishing

During the autumn of 2018, NorthWestern and FWP surveyed two reaches of the Clark Fork River, the above the island complex reach and the Paradise-to-Plains reach. The dates and approximate streamflow (based on the USGS gage #12389000 near Plains) during each survey year since 2009 are summarized in Table 2-3.

Table 2-3. Summary of autumn electrofishing efforts in the Above Islands reach and Paradise-to-Plains reach 2009-2018, including the year, date(s), duration of sample in hours (hrs), approximately streamflow during sample event.

	Above Islands			Paradise to Plains		
Year	Date(s)	Duration of Electrofishing (hrs)	Approx. USGS Streamflow (cfs)	Date	Duration of Electrofishing (hrs)	Approx. USGS Streamflow (cfs)
2009	10/20-21	5.6	10,700	NA	-	-
2010	10/12-13	4.3	9,950	10/19	3.6	9,380
2011	10/5-6	4.6	9,225	10/20-21	3.5	16,150
2012	10/22-23	4.1	11,100	10/30	3.9	14,000
2013	10/22-23	4.4	10,900	NA	-	-
2014	9/25 & 9/29	4.1	8,320	10/22 & 10/28	4.1	12,850
2015	10/19-20	4.7	8,280	NA	-	-
2016	10/12-13	3.7	12,400	10/5 10/20	2.0 1.8	10,100 13,700
2018	10/16-17	3.5	10,300-10,900	10/15	3.3	10,900

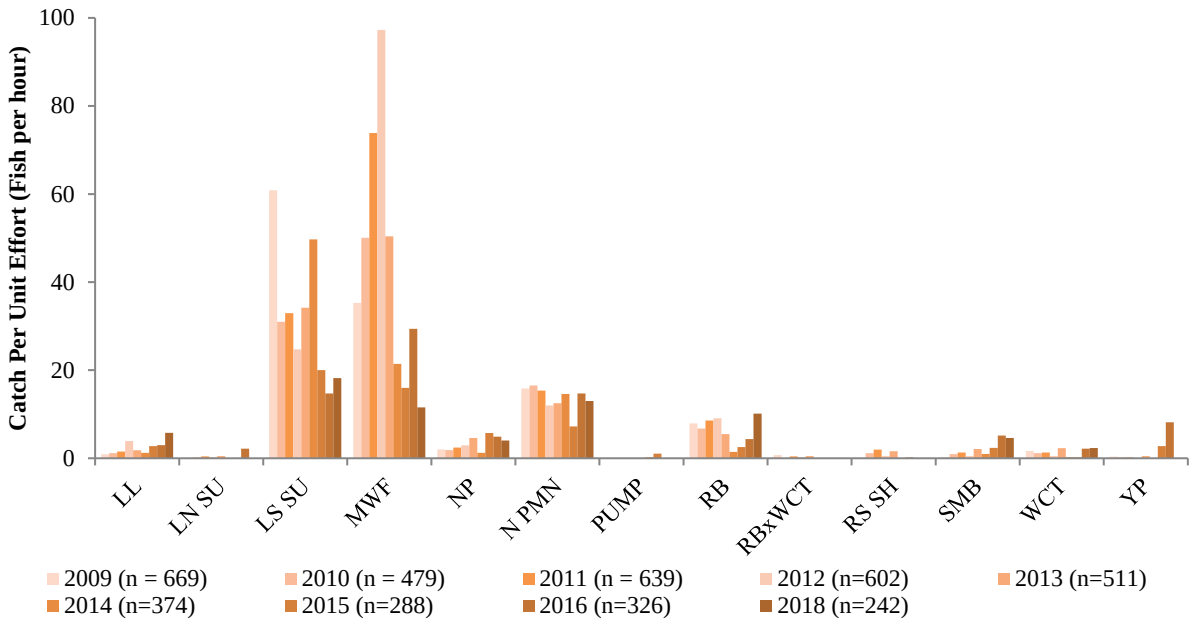
2.3.1 Electrofishing Above the Island Complex

In 2018 electrofishing efforts in the Clark Fork River were completed from the confluence with Eddy Creek downstream to the island complex, also known as the above the island complex reach (*refer to* Figure 2-1). The above the island complex reach is characterized as riverine habitat. The 2018 survey covered the same length of reach surveyed annually since 2010. In 2009, electrofishing efforts started at the confluence with Eddy Creek and extended further downstream to the confluence of the Thompson River. Approximately 2 miles of the 5-mile section were not sampled in 2010 due to poor habitat and few captures from the downstream end of the island complex to the Thompson River.

In 2018, river right was electrofished the night of October 16 and river left was electrofished the night of October 17. Stream temperatures were approximately 8 °C. The sampling efforts resulted in 274 fish recorded (125 fish from the right bank; 149 fish from the left bank) representing nine species. There were 103 salmonids represented by four species (40 MWF, 35 RB, 20 LL, 8 WCT). Two of the Rainbow Trout (PIT ID# 989001006029105; 989001007069905) captured had previously ascended the Thompson Falls ladder in 2018.

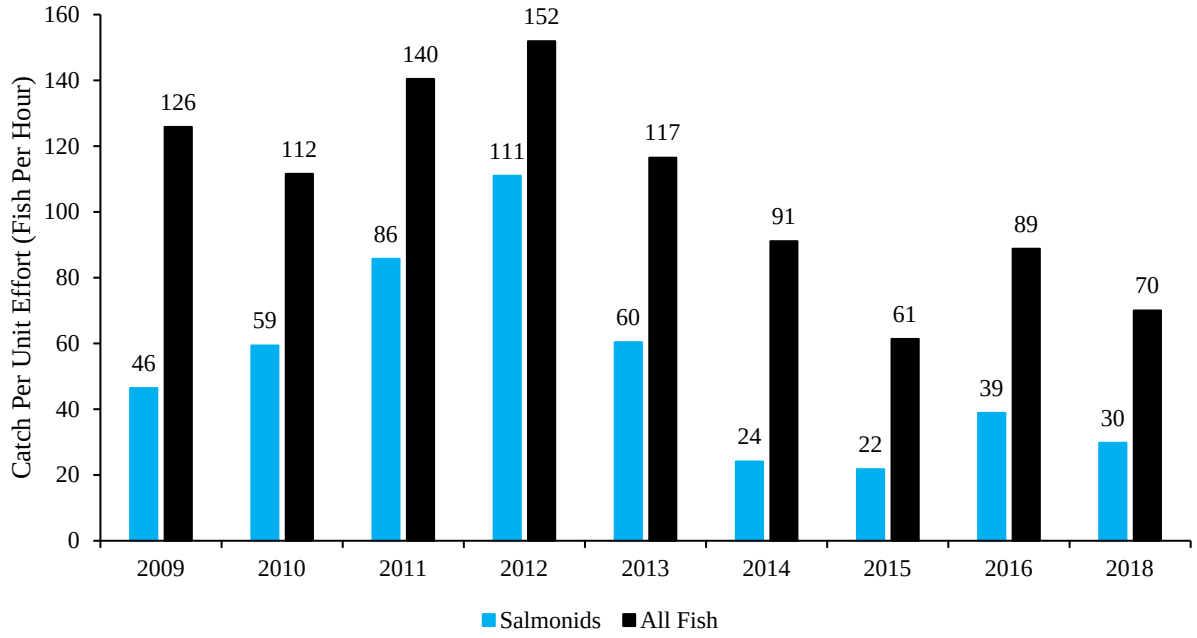
The species composition resulting from the 2018 sampling efforts were similar to previous years with the majority of fish represented by Largescale Suckers, Mountain Whitefish, and Northern Pikeminnow (Figure 2-5).

Figure 2-5. Summary of the catch rate (fish per hour) annually in the Clark Fork River – Above the Island Complex, 2009-2018.



Catch rates for all species has varied from a low of 61 fish per hour in 2015 to a high of approximately 152 fish per hour in 2012 (Figure 2-6). Catch rates for salmonids have varied from a low of 22 salmonids per hour in 2015 to a high of 111 salmonids per hour in 2012. In 2018, the total CPUE was 70 fish per hour and about 30 salmonids per hour.

Figure 2-6. Summary of the 2009-2018 annual catch rate for all salmonids and all fish captured in the Clark Fork River – Above the Island Complex.



The variability in catch rates among the sampling years (Figure 2-6) may be related to several factors, including but not limited to the timing of each annual sampling event, streamflow, stream temperatures, etc. Sampling in the above islands section is generally completed the third week in October each year. However, sampling has occurred anytime between late September and the end of October, depending on availability of personnel and equipment. Conditions during the autumn vary annually with respect to streamflow and water temperature, which may contribute to the observed annual variability in catch rates.

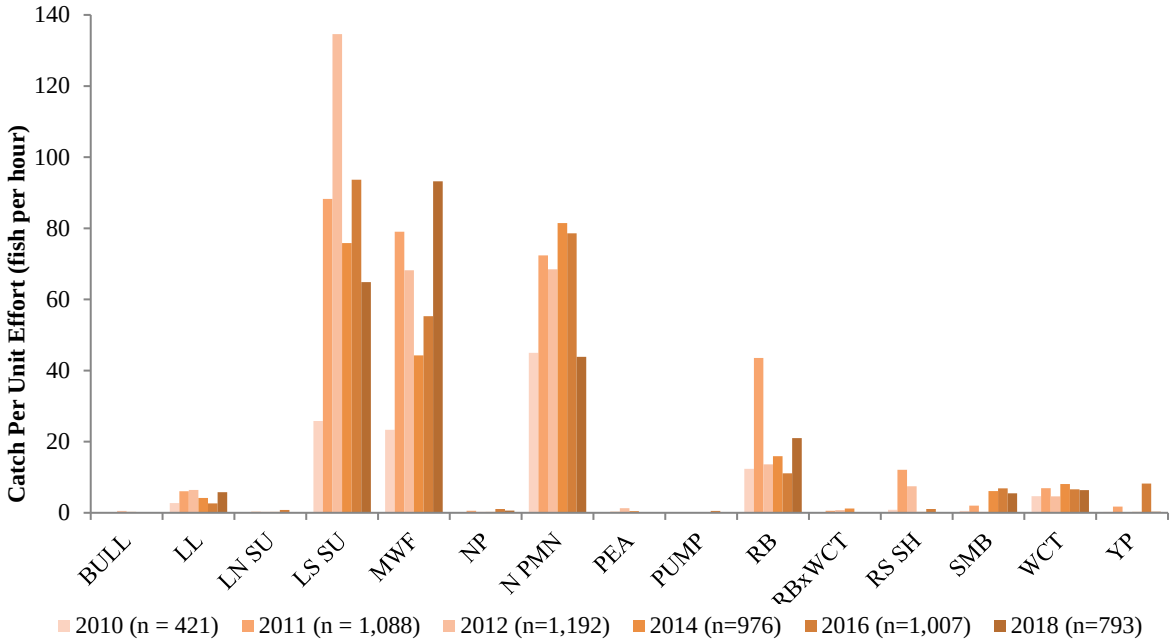
2.3.2 Electrofishing Paradise to Plains

In 2010, a new electrofishing sampling section between the towns of Paradise and Plains was added to acquire basic species composition in the Clark Fork River approximately 35 miles upstream of the Project. This reach was sampled again in 2011, 2012, 2014, 2016, and 2018. Electrofishing began approximately 1.5 miles downstream of the Clark Fork/Flathead River confluence, immediately downstream of Montana Highway 200 bridge at the town Paradise and ended at the USGS gage station #12389000 located near the town of Plains, approximately 4 miles downstream (*see* Figure 2-2).

There were 793 fish, representing five non-salmonid species (LS SU, NP, NPMN, SMB, YP) and four salmonid species (LL, MWF, RB, WCT), sampled in the Paradise-to-Plains reach on October 15, 2018. There were no PIT-tagged fish recorded during the survey. The predominant species recorded in 2018 were Mountain Whitefish (n=306) followed by Largescale Sucker (n=213), Northern Pikeminnow (n=144), Rainbow Trout (n=69), Westslope Cutthroat Trout (n=21), Brown Trout (n=19), and Smallmouth Bass (n=18). Species less commonly observed (n≤ 2) in the Paradise to Plains section included Northern Pike and Yellow Perch.

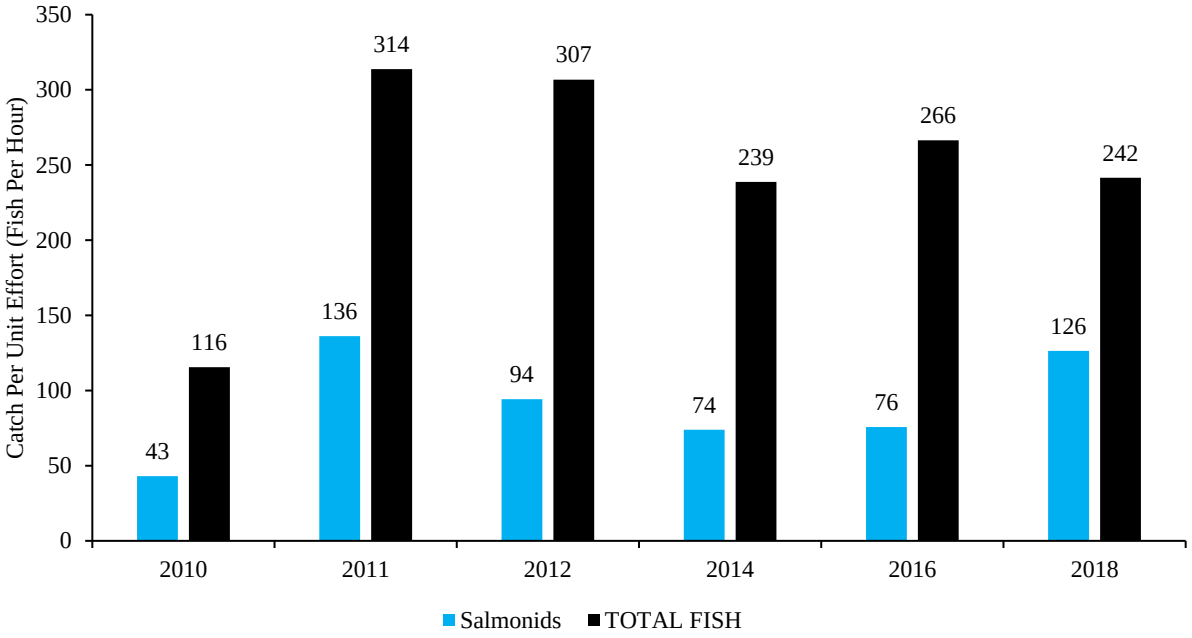
Fish species composition and catch rates observed in 2018 were typical of previous sample years (Figure 2-7). Largescale Suckers, Mountain Whitefish, and Northern Pikeminnow remained the most common species in 2018, as was observed in previous sample years.

Figure 2-7. Summary of annual CPUE for each species during the Clark Fork River autumn electrofishing between Paradise and Plains, 2010 through 2018.



The CPUE results from 2018 (242 fish per hour) sampling in the Paradise-to-Plains reach were similar to previous years, ranging from 116 to 314 fish per hour (Figure 2-8). Since sampling commenced in 2010, salmonids represent approximately 28 to 52 percent of the fish recorded in the Paradise to Plains reach (Figure 2-8). The 2018 sample had the highest proportion of salmonids (52%) of all sampling events. The catch rate for salmonid species, primarily represented by Mountain Whitefish (54-74% of salmonids), has varied between 43 and 136 fish per hour. The catch rate for all species has varied between 115 to 314 fish per hour.

Figure 2-8. Summary of the annual catch rate for all salmonids and all fish captured in the Clark Fork River Paradise to Plains, 2010-2018.



2.3.3 Autumn Electrofishing Summary

The autumn electrofishing results for 2018 were within the range of catch rates observed in previous years. The species composition remained similar to previous years with the dominant species represented by Largescale Suckers, Mountain Whitefish, and Northern Pikeminnow. Out of 518 salmonids (103 salmonids in the above the islands reach, 415 salmonids in the Paradise to Plains reach), there were two fish (both Rainbow Trout) captured with PIT tags that were previously documented at the Thompson Falls fish ladder in 2018.

2.4 Autumn Gillnetting

The established gillnet sampling sites in the Thompson Reservoir are shown in Figure 2-1. FWP deploy nylon multifilament experimental sinking gillnets, 125 feet long and 6 feet deep, with five separate 25-foot panels consisting of 0.75-inch, 1-inch, 1.25-inch, 1.5-inch, and 2-inch bar-measure square mesh each October. Except for 2004, 10 nets are deployed annually with results varying between 33 to 231 fish representing six to nine species (Table 2-4).

In 2018, nets were set on October 10 between 14:42 and 15:57 and pulled approximately 17.4 to 17.6 hours later between 8:10 and 9:26 the morning of October 11. There were 50 fish captured representing seven species. The catch per net, by species from 2018 compared to the average, minimum and maximum catch per net between 2004 and 2017 is shown in Table 2-5.

Table 2-4. Summary of gillnetting in Thompson Reservoir from 2004-2018.

Year	# Gillnets	Date Net Set	Date Net Pulled	Total # of Fish Captured	# of Species
2004	6	10/13	10/14	48	8
2005	10	10/13	10/14	79	7
2006	10	10/12	10/13	116	7
2007	10	10/11	10/12	122	9
2008	10	10/8	10/9	59	7
2009	10	10/19	10/20	55	6
2010	10	10/14	10/15	50	9
2011	10	10/5	10/6	33	9
2012	10	10/12	10/13	53	7
2013	10	10/22	10/23	40	6
2014	10	10/15	10/16	62	8
2015	10	10/13	10/14	231	9
2016	10	10/12	10/13	130	6
2017	10	10/11	10/12	188	8
2018	**10**	**10/10**	**10/11**	**50**	**7**

Table 2-5. Catch per net, by species, during annual October gillnetting series on Thompson Reservoir in 2018 and the 2004-2017 average, minimum, and maximum catch per net. A dash indicates no (zero) fish of that species was captured.

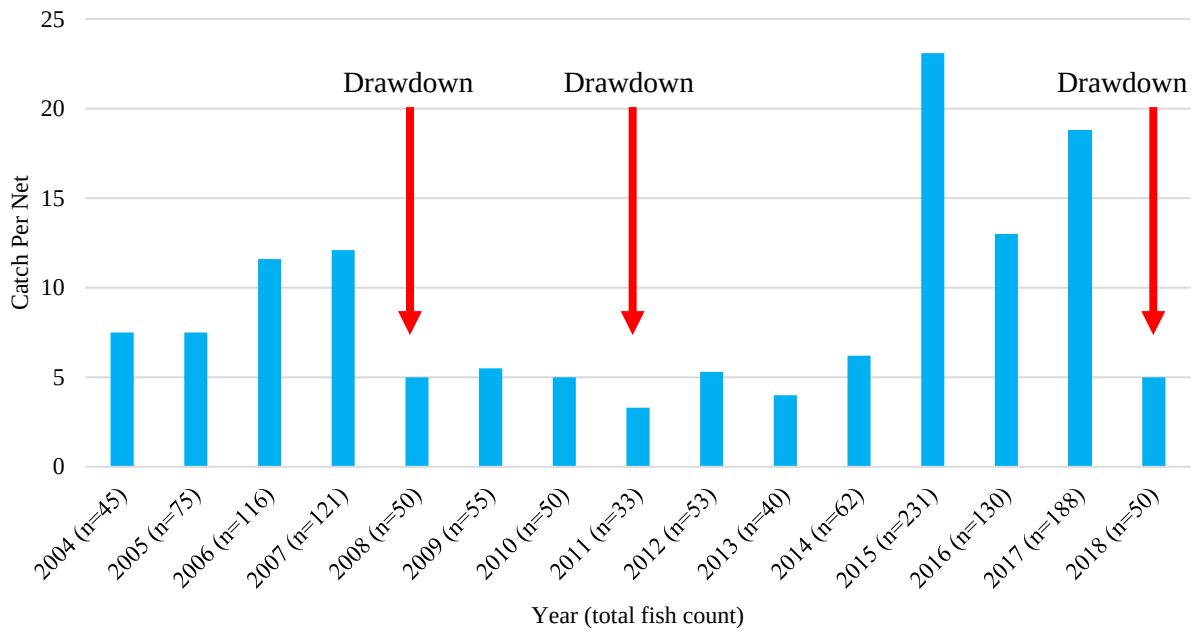
Species	2018	2004-2017		
		Avg	Min	Max
BL BH	**1.4**	3.8	-	14.1
LL	**-**	-	-	0.2
LMB	**-**	0.1	-	0.3
LN SU	**-**	0.1	-	0.5
LS SU	**0.6**	0.8	0.2	1.3
NP	**1.9**	2.5	1.0	4.9
N PMN	**0.1**	0.5	-	1.0
PEA	**-**	-	-	0.1
PUMP	**0.2**	0.3	-	1.8
RB	**-**	0.1	-	0.4
SMB	**0.5**	0.2	-	0.5
WCT	**-**	-	-	0.2
YP	**0.3**	0.8	0.1	1.8
YL BL	**-**	-	-	0.1
Total	**5**	**9.1**	**3.3**	**23.1**

During the summer of 2018, Thompson Reservoir was below full pool (2396 ft) between June 19 and August 9. Operators started to pull stanchions on the Dry Channel Dam on May 8 and on the

Main Dam on May 12 due to high streamflows. Stanchions were replaced and the reservoir was filled to normal pool by August 9.

Species presence and abundance resulting from gillnetting efforts in Thompson Reservoir appear to be influenced by extended drawdowns occurring in the summer months prior fall sampling. A summary of annual gillnetting results since 2004, including the 3 years (2008, 2011, 2018) when there were extended drawdowns during the summer months prior to the autumn sampling is shown in Figure 2-9. In each drawdown year, total fish caught and catch per net declined from the previous year which has been primarily related to a decline in Black Bullhead (NorthWestern, unpublished data). Northern Pike catch per net also declined from 4.2-4.9 fish per net between 2015 and 2017 to 1.9 fish per net in 2018, which may have also been a response to the drawdown.

Figure 2-9. Summary of the Thompson Reservoir gillnetting efforts 2004-2018. Substantial drawdowns occurred in the summer of 2008, 2011, 2018 prior to the autumn sampling for that year.



3.0 2018 Upstream Fish Passage Evaluation

Following construction of the Thompson Falls Upstream Fish Passage Facility, FWS required the Licensee to complete Phase 2, a 10-year (2011-2020) evaluation period of the fish ladder. As stated in the FWS BO (2008), Phase 2 will,

> *…evaluate the 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.*

In 2010, the Licensee submitted the *10-year Fish Passage Facility Evaluation Plan, Phase 2 Action Plan, 2011-2020* (Evaluation Plan) (PPL Montana, 2010) that was subsequently approved by FERC on June 9, 2011. The Evaluation Plan outlines the seasonal ladder operations, fish tagging and marking protocols, genetic testing for Bull Trout, and the data the Licensee will collect annually at the ladder. The following data are collected annually to evaluate fish passage effectiveness per the Evaluation Plan (PPL Montana, 2010) and in compliance with the FWS BO (2008):

- Ladder operations
- Clark Fork River hydrology
- Water temperature in the ladder
- Total number of fish and species ascending the ladder and passed upstream
- Fish metrics (length, weight)
- Number of fish returning to the ladder
- Number of "fallback" fish after release upstream of the Thompson Falls Dam
- Timing/duration for fish to ascend the ladder
- Timing/movement patterns of ladder fish moving upstream into the Thompson River
- Weir operations (notch or orifice)
- Attractant flow

These data are collected at the ladder to 1) qualitatively evaluate the effectiveness of upstream fish passage at the ladder, 2) evaluate operational procedures (e.g., weir mode and attractant flow), 3) assess the potential for delay, and 4) assess fallback (PPL Montana, 2010).

The Thompson Falls upstream fish passage facility (ladder) became operational in 2011 and has operated for 8 seasons (2011-2018). The following sections focus primarily on results from 2018 with some comparisons to previous years.

3.1 2018 Ladder Operations

Since the ladder commenced operations in 2011, the operational season typically starts in mid-March and extends into October. In 2015 and 2018, the season extended into November. The operational season depends on weather conditions and when air temperatures are above freezing to allow for equipment to operate properly. Ladder closures during the season are generally a result of maintenance issues or high spring streamflows that deposit debris and sediment in the ladder. As in previous years, the holding pool at the top of the ladder (pool 45) was typically checked daily (in the morning), except for weekends and holidays (no ladder check).

In 2018, the ladder operated for 145 days (with 92 ladder checks) between March 27 and November 15. The weirs operated in notch mode (fish passage is oriented at the top of the weir where there is a notch for overflow) for most of the season (March 27 – October 23) before switching to orifice mode (fish passage is oriented at the bottom of the weir where there is an opening) from October 24 through November 15. There were 89 days between April 30 and August 9 when the ladder was not operating and was shut down during high spring flows and subsequent repairs to the stanchions. For a brief period, between June 8 and 18, the ladder was operational while pool elevations were at levels that allowed for water to flow through the ladder.

High spring streamflows (excess of 70,000 cfs) in 2018 required the stanchions on the two spillways to be removed in May. The high streamflows and the removal of the dam stanchions resulted in an extended period of reservoir draw down and subsequent ladder shut down. Dam stanchions were replaced in early August and the reservoir returned to normal pool elevation allowing for the ladder to commence operations on August 9, 2018. Events in 2018 were similar to the 2011 season when spring streamflows were above 104,000 cfs, also requiring the removal of the stanchions resulting in ladder shut down for 84-days between May 25 and August 21. Once stanchions are removed, the operators must wait until streamflows decline to draw down the reservoir to a level that allows for safe access and manual replacement and repair of the stanchions. After the recent installation of two new radial gates at the Main Dam, operators will have increased spill capacity at the Main Dam without removing the stanchions and the frequency of stanchion removal should decline.

A summary ladder operations is provided in Table 3-1.

Table 3-1. Summary of when the ladder was in operation, 2011-2018.

Year	Ladder Season (date opened and closed)	# of Days Ladder Operational During Season	# of Days Ladder Closed During Season	# of Days Ladder was Checked	% of Season When Ladder Operating, Ladder is Checked	% of Ladder Checks with No Fish	Weir Mode (notch and/or orifice)
2011	Mar 17–Oct 17	131	84	114	87%	31%	Alternating Notch and Orifice Mode
2012	Mar 13–Oct 15	194	22	164	85%	43%	
2013	Mar 13–Oct 15	203	14	147	72%	29%	Orifice Mode Only
2014	Mar 28–Oct 21	192	16	132	69%	25%	
2015	Mar 16–Nov 9	230	8	141	61%	10%	
2016	Mar 13–Oct 31	231	None	144	62%	9%	Mostly Orifice Mode Except for 2 weeks in Notch Mode (Jun 30–Jul 6; Jul 13–20)
2017	Mar 21–Oct 31	210	14	131	62%	43%	Notch Mode Only
2018	**Mar 27 – Nov 15**	**145**	**89 (May 1 – Jun 7; Jun 19 – Aug 8)**	**92**	**63%**	**39%**	**Notch Mode Mar 27-Oct 23, Orifice Mode Oct 24-Nov 15**

3.2 River Conditions

3.2.1 Clark Fork River Streamflow

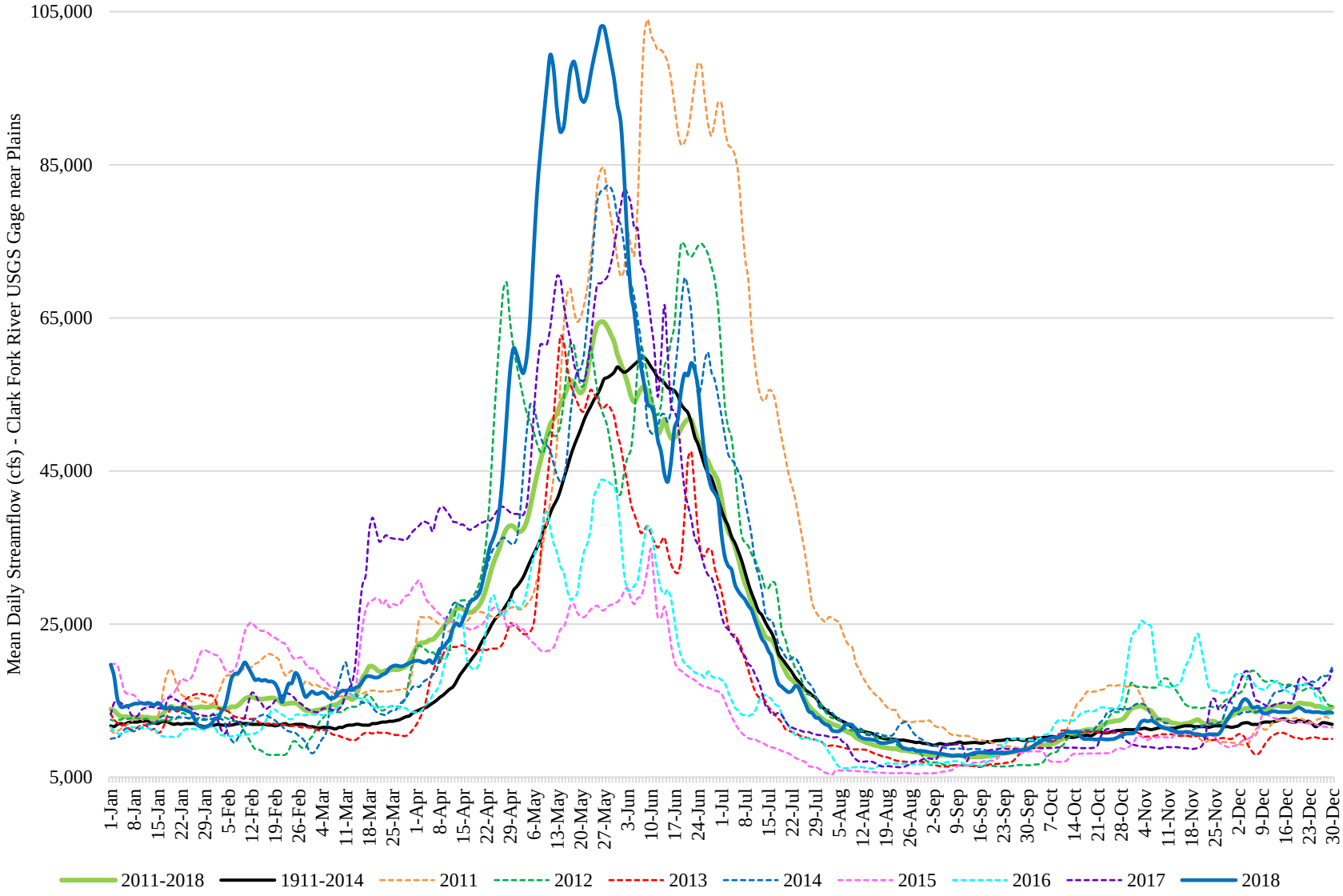
Mean daily streamflow data are collected by the USGS gage station #12389000 on the Clark Fork River near Plains, Montana (~ 30 miles upstream of the Project). The annual hydrograph in the lower Clark Fork River has varied greatly since ladder operations commenced in 2011 (Figure 3-1). The area has experienced higher than average streamflows in 2011 and 2018, lower than average streamflows in 2013, 2015, and 2016, and closer to average streamflows in 2012, 2014, and 2017. The mean daily streamflow between 2011-2018 (years the ladder has operated) and the long-term average (1911-2014) have similar peaks around 60,000 to 65,000 cfs. However, the 2011-2018 average indicates the baseflows from February through April are slightly higher and the ascending limb of the hydrograph is occurring earlier in more recent years in contrast to the long-term average (Figure 3-1). This trend is most apparent when comparing the 2011 and 2018 hydrographs. In both years, streamflows exceeded 100,000 cfs, but the peak streamflow in 2018 occurred 2 weeks earlier than in 2011 (Figure 3-1, Table 3-2).

Table 3-2. Summary of the annual peak streamflow in the Clark Fork River (USGS gage #12389000) near Plains, 2011-2018.

Year	Peak Streamflow	Peak Streamflow Date
2011	104,000	June 10
2012	75,300	June 20
2013	63,700	May 15
2014	82,800	May 29
2015	36,600	June 11
2016	44,100	May 27
2017	82,100	June 3
2018	**103,000**	**May 27 & 28**

The long-term (1911-2014) average peak streamflow is approximately 60,000 cfs and occurs between the end of May and early June. Peak streamflows between 2011 and 2018 vary, occurring as early as May 15 in 2013 and as late as June 20 in 2012 (Table 3-2). Actual peak flows at Thompson Falls Dam are slightly higher than measurements at the USGS station near Plains with the contribution of other sources such as tributaries (e.g., Thompson River) and groundwater. Since 2011 peak flows in the Thompson River (USGS gage #12389500) have ranged from 1,460 cfs to 4,590 cfs.

Figure 3-1. Annual mean daily streamflow at the USGS gage 12389000 for the Clark Fork River near Plains for 2011-2018, the average during years the ladder has operated 2011-2018, and the long-term average 1911-2014 (USGS, 2018).

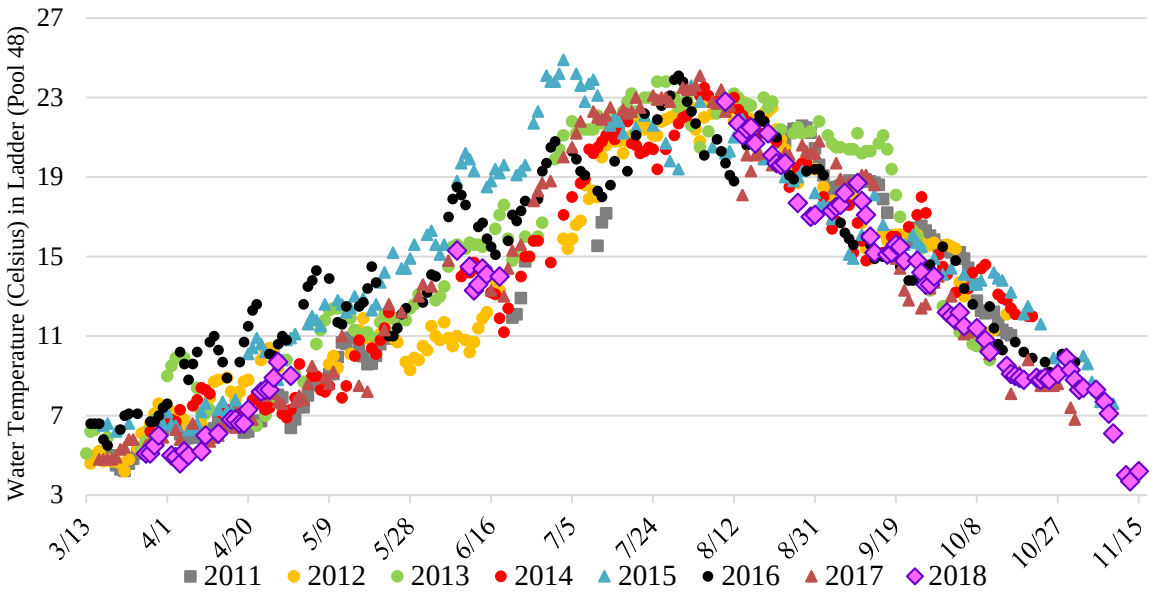


3.2.2 Water Temperature in the Ladder

During each operating season, water temperature in the ladder (pool 48) and air temperature were recorded through a combination of a single measurement coinciding with each ladder check and data loggers. Due to technical issues with the data loggers in 2018, continuous water and air temperature data were not available.

Water temperature data coinciding with each ladder check in 2018 are compared to previous years in Figure 3-2. When the ladder was shut down, no temperature data was recorded. Spring water temperatures in 2018 were cooler than previous years and water temperatures also declined sharply in early November. During the summer (August) when the ladder was operating, water temperatures were within the range observed in previous years.

Figure 3-2. Summary of annual water temperatures in Thompson Falls Fish Ladder (Pool 48) recorded during each ladder check, 2011-2018.



3.3 Fish Count

The ladder has operated for 8 years (2011-2018) recording 31,072 fish ascending and 30,913 fish passed upstream of Thompson Falls Dam. Those fish not released (n=159) included Lake Trout (n=9) and Walleye (n=2) that are not authorized by FWP to be released upstream and fish mortalities documented at the ladder (n=148). Fish mortalities at the ladder were primarily attributed to mechanical issues, which have been addressed. The majority of the fish mortalities at the ladder occurred in 2011 (n=82) and significantly declined in subsequent years (1 to 27 fish mortalities per year).

Annual fish counts at the ladder has varied from 227 fish in 2018 to 11,647 fish in 2015. A total of 14 species and three hybrids have ascended the ladder since 2011. A summary of all fish species recorded at the ladder each year and by weir mode (notch or orifice) is provided in Table 3-3.

In 2018, there were 227 fish recorded at the ladder representing seven species and one salmonid hybrid. There was one Brown Trout mortality observed while the remaining 226 live fish were released upstream of the dam. A total of 32 fish ascended the ladder at least once prior to the 2018 season and five of the 32 returning fish ascended the ladder twice in 2018. A total of 215 individual fish (199 salmonids; 16 non-salmonids) with a unique PIT-tag was released upstream of Thompson Falls Dam. Nearly 30 percent of the PIT-tagged salmonids (58 of 199 salmonids) released upstream in 2018 were detected in the Thompson River (via remote PIT tag array) in 2018. More details on fish detected in the Thompson River is provided in Section 4.3 of this report.

Bull Trout were recorded at the ladder each year except for 2018. Based on past years, Bull Trout presence in the ladder has peaks in April, May, and early June. During 2018, the ladder was closed the month of May and most of June. No Bull Trout was detected in the ladder via the remote PIT tag arrays in pool 7 or 8 or in the holding pool (top of the ladder). With a low sample size of Bull Trout at the ladder (n=16) over the years it is difficult to assess and determine contributing factors resulting in attracting Bull Trout to the ladder or successful ascents of Bull Trout to the top of the ladder.

Available data indicate most Bull Trout recorded at the ladder enter between April and June with a few observations in August, September, and October (NorthWestern, 2018). Based on information collected to date, it is likely the long period of ladder closure was a primary reason Bull Trout were not observed in 2018. As for weir operations, all but one of the 16 Bull Trout recorded ascending to the top of the ladder did so in orifice mode. Due to the small sample size, there is insufficient data to conclude whether the weir operation in notch mode contributed to no Bull Trout in the ladder in 2018. A summary of Bull Trout recorded at the ladder in previous years and in the Project area is presented in Section 5.0 (this report).

Table 3-3. Summary of all fish species recorded at the ladder annually, as well as weir mode, notch or orifice. (Note: LT and WE not authorized by FWP for release upstream).

Year	2011	2012	2013	2014	2015	2016	2016	2017	2018	2018	TOTAL
Weir Mode	**Weir Modes Alternated Weekly**		**Orifice only**				**Notch (Jun 30-Jul 6; Jul 13-20)**	**Notch only**	**Notch (Mar 27-Oct 23)**	**Orifice (Oct 23-Nov 15)**	**2011-2018 All Modes**
Species											
BULL	2	2	5	1	2	3	-	1	-	-	**16**
EBxBULL	-	-	-	-	-	1	-	-	-	-	**1**
EB	-	-	-	1	2	1	-	-	-	-	**4**
RB	164	208	213	187	281	292	74	181	111	13	**1,724**
RBxWCT	9	7	13	12	4	5	-	1	1	-	**52**
WCT	21	21	48	36	37	32	4	14	8	6	**227**
LL	28	42	111	81	184	157	47	108	39	24	**821**
LS SU	418	1,403	3,041	2,802	6,327	2,270	-	34	6	-	**16,301**
LN SU	10	0	2	1	26	6	-	-	-	-	**45**
MWF	17	24	2	254	54	8	-	-	2	2	**363**
NPMN	1,000	926	387	1,003	3,356	697	10	66	10	-	**7,455**
PEA	-	-	-	-	120	2	-	-	-	-	**122**
PEAxNPMN	-	-	-	-	2	13	-	2	-	-	**17**
SMB	135	34	8	1,356	1,244	986	21	123	5	-	**3,912**
LMB	-	-	-	-	-	1	-	-	-	-	**1**
LT	1	1	-	1	6	-	-	-	-	-	**9**
WE	-	-	-	-	2	-	-	-	-	-	**2**
Native Fish	**1,468**	**2,376**	**3,485**	**4,097**	**9,924**	**3,031**	**14**	**117**	**26**	**8**	**24,546**
Salmonids	**242**	**305**	**392**	**573**	**570**	**499**	**125**	**305**	**161**	**45**	**3,217**
Non-Salmonids	**1,563**	**2,363**	**3,438**	**5,162**	**11,077**	**3,975**	**31**	**225**	**21**	**0**	**27,855**
TOTAL	**1,805**	**2,668**	**3,830**	**5,735**	**11,647**	**4,474**	**156**	**530**	**182**	**45**	**31,072**

3.4 Species Composition

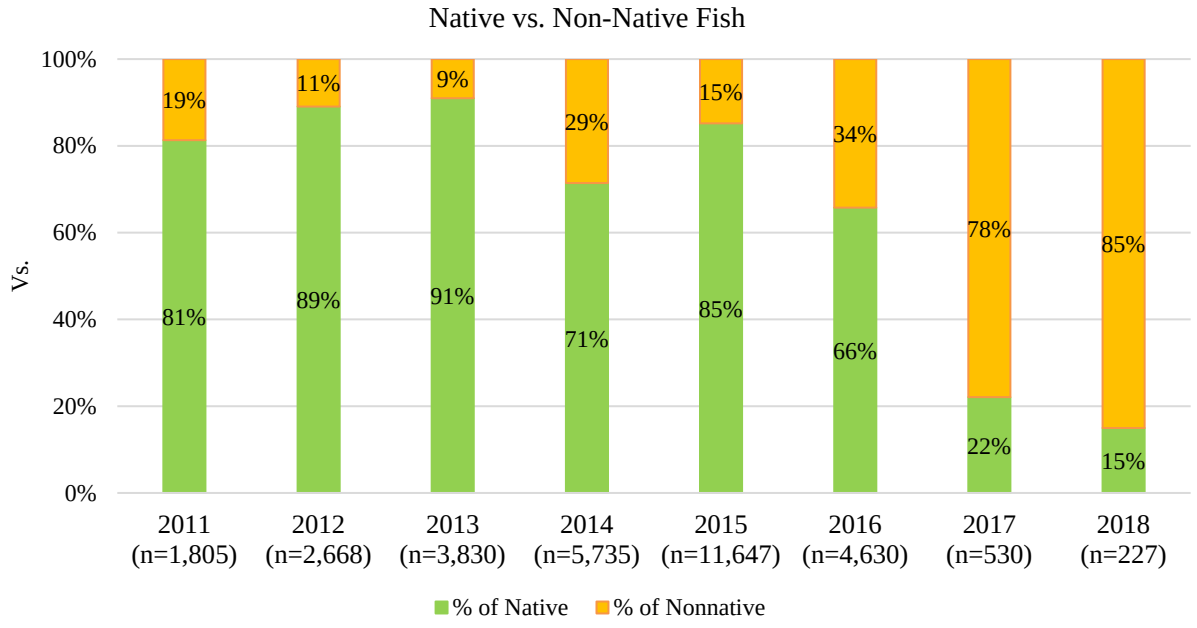
There were 31,072 fish recorded at the ladder representing 14 species and three hybrids since ladder operations began in 2011 (*refer to* Table 3-3). The majority (30,913 fish) were released upstream of Thompson Falls Dam except for Walleye, Lake Trout, and fish mortalities at the ladder.

Species composition has been categorized by native and non-native species (Figure 3-3) and by salmonid and non-salmonid species (Figure 3-4). Native species recorded at the ladder are represented by seven species plus one hybrid including Bull Trout, Westslope Cutthroat Trout, Mountain Whitefish, Largescale Sucker, Longnose Sucker, Northern Pikeminnow, Peamouth, and Peamouth x Northern Pikeminnow hybrid.

Salmonids are represented by seven species plus two hybrids including Bull Trout, Brook Trout, Rainbow Trout, Westslope Cutthroat Trout, Brown Trout, Lake Trout, Rainbow x Westslope Cutthroat hybrid, and Brook x Bull Trout hybrid. Non-salmonids are represented by seven species plus one hybrid including Largescale Sucker, Longnose Sucker, Northern Pikeminnow, Peamouth, Smallmouth Bass, Largemouth Bass, Walleye, and Peamouth x Northern Pikeminnow hybrid.

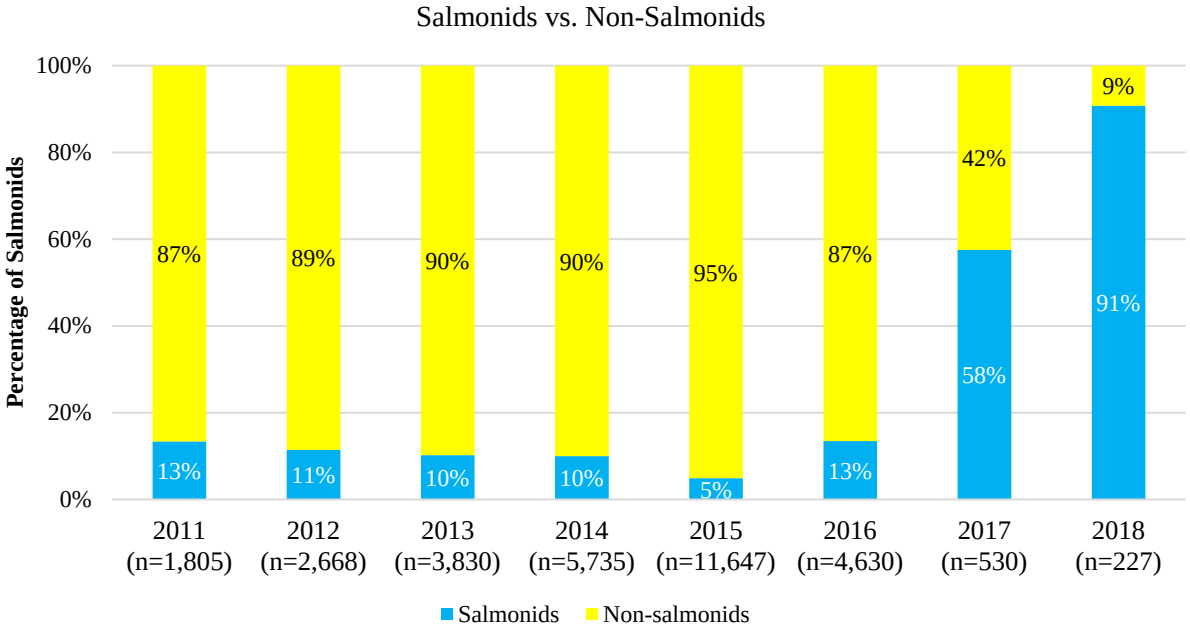
Between 2011 and 2016, native species such as Largescale Sucker and Northern Pikeminnow represented the majority of the fish recorded at the ladder (Figure 3-3). In 2017 and 2018, most fish recorded at the ladder were Rainbow or Brown Trout, both non-native species.

Figure 3-3. Composition of native *versus* non-native species that ascended the Thompson Falls fish ladder annually, 2011-2018.



The composition of salmonids and non-salmonids recorded at the ladder remained steady between 2011 and 2016 with the majority of the fish (87% or more) represented by non-salmonids (Figure 3-4). Even as the total number of fishes varied among years (2011-2016), the percentage of salmonids and non-salmonids remained consistent. This trend changed in 2017 and 2018 with a decline in total fish number and a smaller proportion of non-salmonids represented each year, 42 percent in 2017 and 9 percent in 2018.

Figure 3-4. Composition of salmonid *versus* non-salmonids species that ascended the Thompson Falls fish ladder annually, 2011-2018.



Species composition for salmonids and non-salmonids is illustrated in Figures 3-5 and 3-6, respectively. Over the last 8 years (2011-2018) of ladder operations, the composition of salmonid species remained relatively steady regardless of weir mode. Rainbow and Brown Trout continue to be the most abundant salmonid species except for a spike in Mountain Whitefish in 2014 (Figure 3-5). The annual presence of Mountain Whitefish at the ladder has fluctuated greatly and is not as consistent as other salmonid species (Figure 3-5).

Non-salmonids are predominately represented by Largescale Sucker, Northern Pikeminnow, and Smallmouth Bass with some variability in their respective proportions from year to year (Figure 3-6). Largescale Sucker represent over half of all fish recorded at the ladder since 2011 (n=16,301). Northern Pikeminnow represent nearly a quarter of all fish recorded at the ladder since 2011 (n=7,455) and Smallmouth Bass represent 12.5 percent of all fish recorded at the ladder since 2011 (n=3,912). Compared to years when the ladder operated in orifice mode, the presence of these three species is far lower in notch mode (*see* Table 3-3).

Figure 3-5. Composition of salmonid species that ascended the Thompson Falls fish ladder annually, 2011-2018.

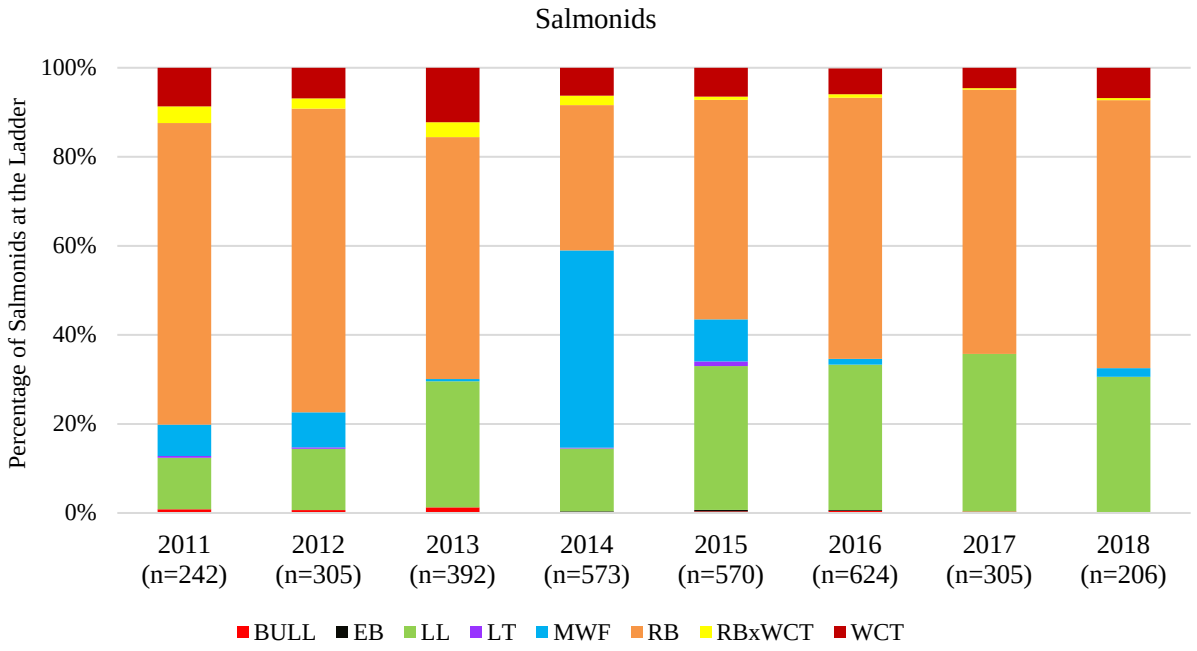
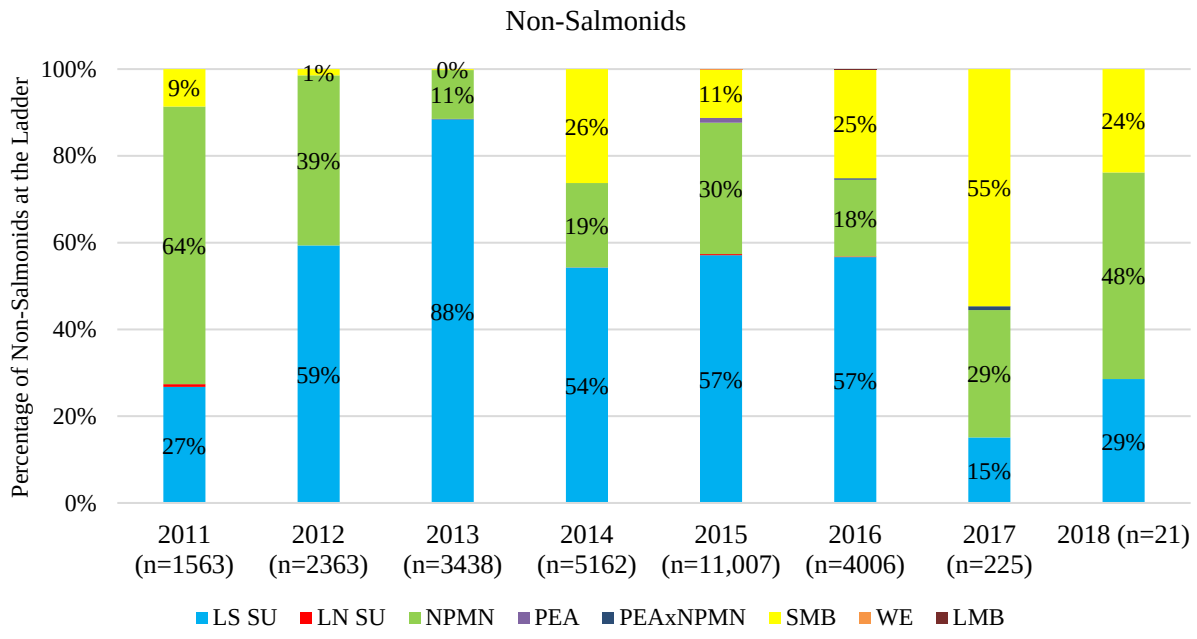


Figure 3-6. Composition of non-salmonid species that ascended the Thompson Falls fish ladder annually, 2011-2018.



3.5 Fish Metrics

Fish measurement protocols at the ladder have been consistent since 2011, with the goal of measuring all salmonids ascending the ladder for total length in millimeters (mm) and weight in grams (g). Non-salmonids are also measured for total length and weight, with sub-samples applied when large groups of non-salmonids enter the ladder at once.

For the last 8 seasons (2011-2018), length and weight measurements were documented for approximately 37 percent of the 31,072 fish recorded at the ladder. Between 2011 and 2018, the size of salmonids (3,194 fish measured) recorded at the ladder range from a minimum of 98 mm to a maximum of 785 mm. The size of non-salmonids (8,376 fish measured) recorded at the ladder range from a minimum of 69 mm to a maximum of 610 mm. Overall minimum and maximum lengths for all fish measured at the ladder each year is summarized in Table 3-4.

Table 3-4. Summary of the minimum and maximum length of fish recorded each year, 2011-2018.

Year	Length (mm)	
	Minimum	Maximum
2011	82	630
2012	197	615
2013	169	675
2014	107	685
2015	107	785
2016	144	620
2017	90	584
2018	69	699

In 2018, the smallest fish measured at the ladder was a Smallmouth Bass (69 mm) and the largest fish measured was a Brown Trout (699 mm). A summary of the 2018 mean and range of length and weight measurements collected for each fish species is provided in Table 3-5.

Table 3-5. Summary of the mean and range of lengths (mm) and weights (g) for each fish species recorded at the ladder in 2018.

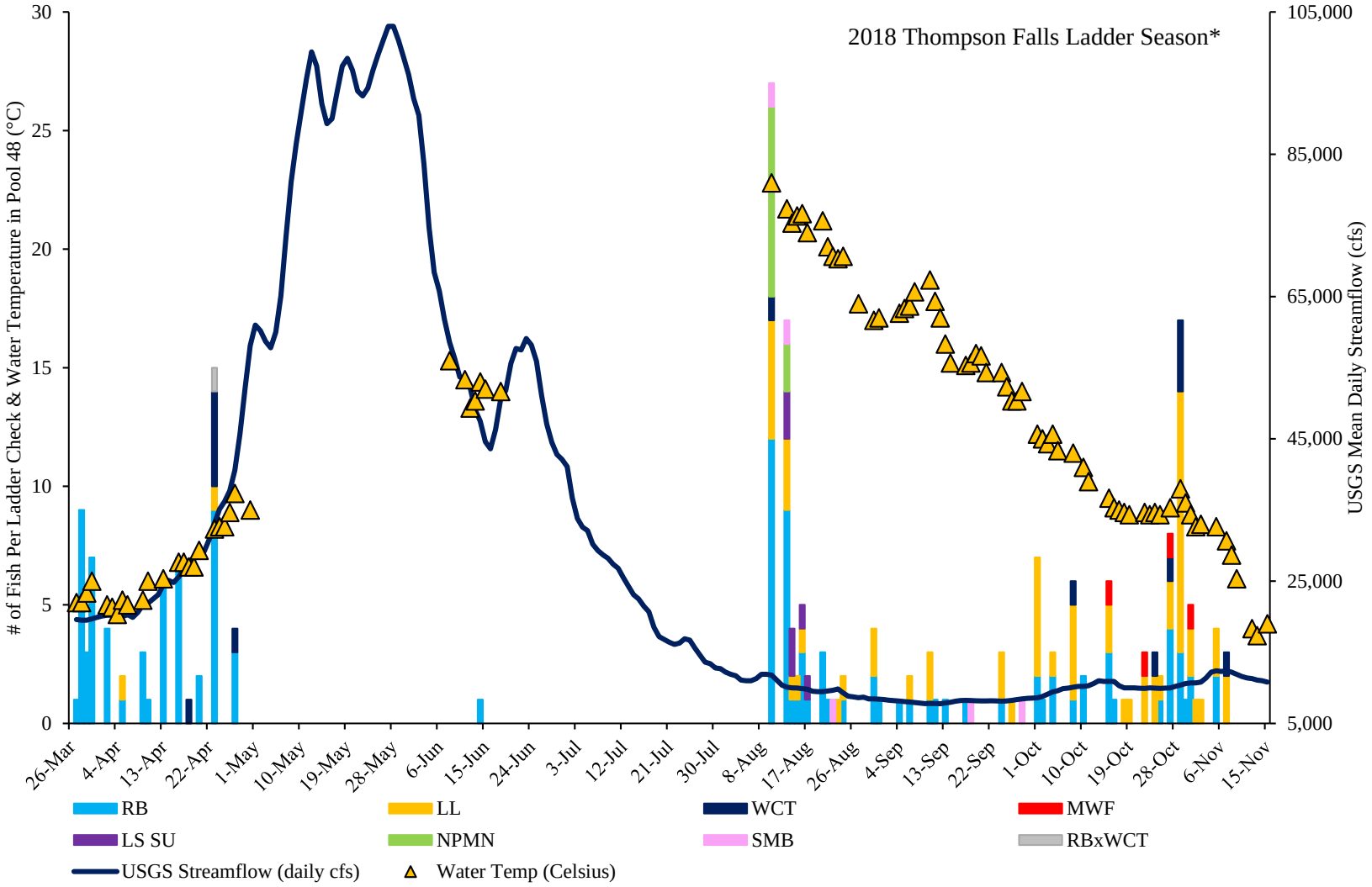
Species	Count	Mean Length (mm)	Length (mm) Range	Mean Weight (g)	Weight (g) Range
LL	63	421	201-699	765	80-3272
RB	124	433	98-632	873	10-3608
RBxWCT	1	505	-	1390	-
WCT	14	350	267-446	462	184-1020
MWF	4	390	352-441	542	380-766
NPMN	10	443	351-510	750	364-1110
LS SU	6	447	397-478	863	568-1044
SMB	5	166	69-255	79	4-182

3.6 Movement Patterns

In the Evaluation Plan, one component of evaluating fish passage effectiveness includes an analysis of each species timing of movement and upstream passage (PPL Montana, 2010). Figures of species movement patterns at the ladder in past years (2011-2017) compared to 2018 are presented in Appendix A. These data show how some species like Rainbow and Brown Trout are observed throughout the operational season with peak presence in June/July (coinciding with the declining limb of the hydrograph) and other species such as Mountain Whitefish, Largescale Sucker, Peamouth, and Smallmouth Bass show a preference to specific times of year that may coincide with other factors such as streamflow and/or water temperature. The movement patterns of individual species show fish movement at the ladder is unlikely to be solely motivated by or related to migration for spawning, but may also be related to other factors such as food availability, predator-prey relationships, seasonal refugia, etc. Fish movement is likely influenced by a myriad of elements such as, but not limited to, thermal regime, hydrologic regime, life history cycle, attractant flow at the ladder, ladder operations (e.g., closures or weir mode), and/or other physical or biological factors.

The timing of when fish were recorded at the ladder in 2018 related to streamflow and water temperature is illustrated in Figure 3-7. Due to the extended (89-day) shut down of the ladder in 2018 (all of May, most of June, all of July, and early August), the seasonal movement patterns observed may not represent the time frame when fish would elect to move but rather when the ladder was open and available for fish to ascend.

Figure 3-7. Fish, by species recorded at the ladder in 2018, including mean daily streamflow in the Clark Fork River (USGS gage near Plains) and water temperature in the ladder (pool 48) coinciding with ladder checks.



*Open March 27, 2018 in notch, Closed May 1-August 8, Reopen Aug 9 - Oct 23 in notch, Oct 24- Nov 15 in orifice

Over the last 8 years (2011-2018) of ladder operations, temporal or seasonal trends in fish movement at the ladder are apparent even with the annual variability in the number of fish observed at the ladder and physical river conditions (streamflow and water temperatures). Salmonids and non-salmonids recorded at the ladder between 2011 and 2018 display distinct and different movement strategies (*refer to* Appendix A for detailed figures for each species). Bull Trout have been observed ascending the ladder in several months of operation (April, May, June, August, September), peak movement has been observed in April, May, and June. Collectively, salmonids have ascended the ladder in all months of operation but peak following the descending limb of the hydrograph in early summer (June/July). Non-salmonids are most common in warmer water months (May – August, depending on the year) and less common in the spring and fall months when water temperatures are cooler. A summary of the monthly fish count for salmonids and non-salmonids is shown in Figures 3-8 and 3-9, respectively.

Figure 3-8. Total salmonid count per month, by year at Thompson Falls Fish Ladder, 2011-2018.

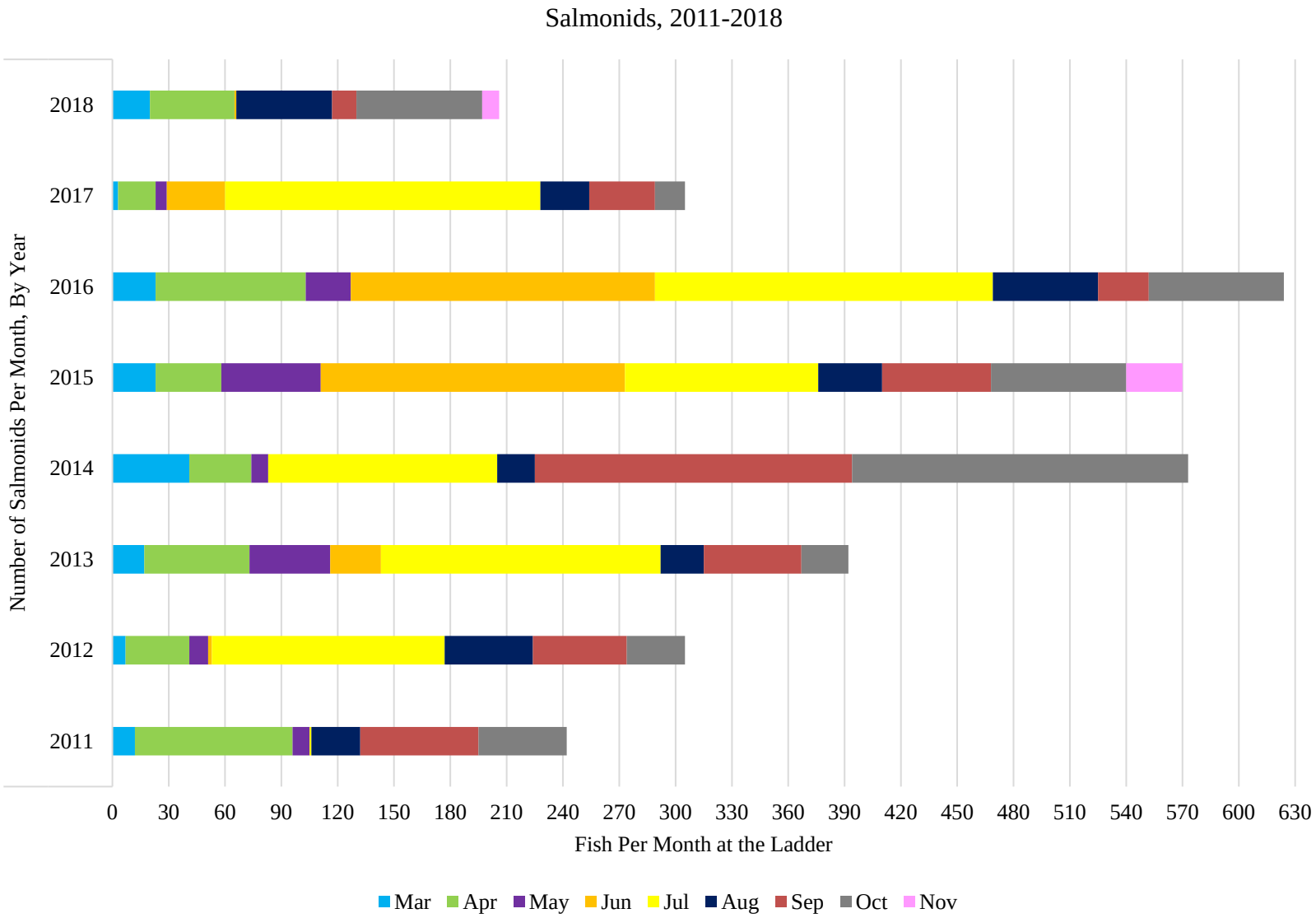
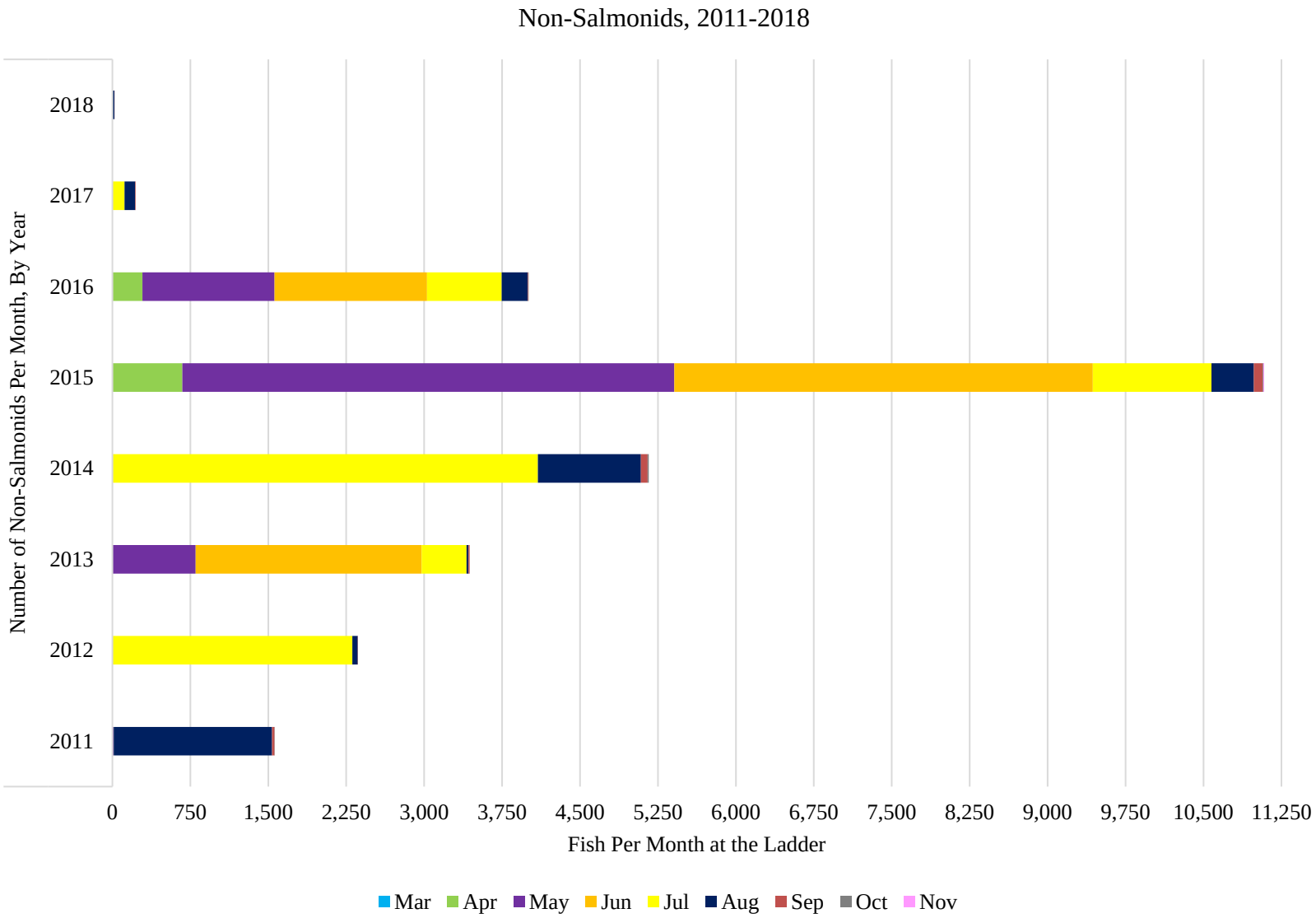


Figure 3-9. Total non-salmonid count per month, by year at Thompson Falls Fish Ladder, 2011-2018.



3.7 Ladder Design Limitations and Fish Passage

The fish ladder was designed to pass fish with streamflows up to 48,000 cfs. Since the ladder was operational in 2011, streamflows have exceeded this threshold annually except for the 2015 and 2016 seasons. In 2018, there were 55 days during the season when streamflows exceeded 48,000 cfs in the Clark Fork River near Plains, Montana (USGS gage station). The ladder was operational for 9 days during this period and there were only five ladder checks resulting in zero fish recorded.

Between 2011 and 2018, the ladder was checked 111 times (out of 1,124 total ladder checks) when streamflows exceeded 48,000 cfs. Fish were recorded during 28 of the ladder checks, with 50 fish representing six species, including two Bull Trout. Ladder checks were completed with streamflows varying between 48,000 and 95,700 cfs. The highest mean daily streamflow measured concurrent with a Bull Trout recorded at the ladder was 51,600 cfs in 2012.

Table 3-6 provides a summary of the number ladder checks that occurred annually when streamflows (measured in Plains) exceeded 48,000 cfs, the number of fish and species recorded during these higher flow periods, and the time of year when these flows were recorded.

Table 3-6. Summary of ladder checks and the number of fish (and species) recorded when streamflows exceeded 48,000 cfs at the USGS gage #12389000 in Plains during ladder operations, 2011-2014, 2017, 2018. Streamflows did not exceed 48,000 cfs in 2015 or 2016.

	2011	2012	2013	2014	2017	2018
USGS Peak Streamflow (cfs)	104,000	75,300	63,700	82,800	82,100	103,000
Number of Ladder Checks when Flows >48,000 cfs	14	34	16	27	15	5
# of Ladder Checks with Flows > 48,000 cfs with Fish Recorded in Ladder	4	8	6	8	2	0
Species Recorded (Total Number)	3 RB, 3 LS SU, 3 NPMN (9)	2 BULL, 9 RB, 1 WCT, 1 LS SU (13)	12 LS SU, 1 NPMN (13)	1 RB, 1 LL, 4 WCT, 4 LS SU (10)	5 RB (5)	-
Range of Flows (>48,000cfs) with Fish Recorded at Ladder	55,900-69,000	49,600-63,300	52,200-61,800	50,300-58,300	57,800 & 79,700	-
Max Streamflow During Ladder Check	95,700	74,800	62,600	66,700	79,700	58,600
Total # of Fish Recorded at Ladder	**1,805**	**2,668**	**3,830**	**5,735**	**525**	**227**

3.8 Fish Tagging History and Multiple Ladder Ascents

NorthWestern has uniquely tagged 4,427 individual fish (3,300 PIT and 1,127 Floy tags) either at the fish ladder or immediately downstream of Thompson Falls Dam since 2011. Prior to 2017, only non-salmonids and primarily Smallmouth Bass received Floy tags at the ladder. Starting on July 11, 2017, Northern Pikeminnow and Largescale Sucker were implanted with a PIT tag and a blank Floy tag to indicate the fish should be checked for a PIT tag at the ladder prior to release upstream. Additionally, salmonids started to receive a secondary Floy tag at the ladder prior to release upstream to study angler exploitation by FWP in July 2017. Note that the total number of tagged fish discussed in this report are tallied with respect to their primary tag (i.e., PIT tag) and not the secondary tag (i.e., Floy tag) to avoid duplication.

Since 2011, there were 3,718 fish tagged (2,610 PIT and 1,108 Floy) after ascending the ladder and 790 fish (690 PIT and 19 Floy) tagged during electrofishing efforts immediately downstream of Thompson Falls Dam (see Figure 2-1). No tagging was implemented downstream of Thompson Falls Dam by NorthWestern in 2018. Only 34 fish initially tagged downstream of the dam have ascended the ladder (NorthWestern, 2018). A complete summary of past tagging efforts downstream of Thompson Falls Dam is provided in Section 3.9.2 in the *2017 Annual Report* (NorthWestern, 2018). This report focuses on fish tagged at the Thompson Falls fish ladder.

Annually tagging efforts of fish at the ladder is summarized in Table 3-7. The 3,718 uniquely-tagged fish represent 10 species and one salmonid hybrid. Tagging efforts have resulted in about 12 percent of all fish (30,913) released upstream of the dam since 2011 receiving a unique tag (PIT or Floy tag). Approximately 80 percent of the salmonids released upstream of the dam received a PIT-tag and about 0.3 percent of the non-salmonids received a PIT-tag (Table 3-8).

This season (2018) 226 fish were released upstream of Thompson Falls Dam. All but six fish (1 RB, 5 SMB) were PIT-tagged. Of the 220 tagged-fish (representing 215 unique individuals) released upstream, 188 fish (175 salmonids and 13 non-salmonids) were “new” fish to the ladder, ascending for the first time and received a PIT tag prior to their release upstream of Thompson Falls Dam (Table 3-8) while five fish (all RB) ascended the ladder twice in 2018.

Table 3-7. Summary of the number of fish, by species, with unique PIT or Floy tag implanted annually in fish at the Thompson Falls fish ladder prior to release upstream between 2011 and 2018.

Species	Tag Type	2011	2012	2013	2014	2015	2016	2017	2018	Total
BULL	PIT	2	-	4	1	2	3	1	-	13
EB	PIT	-	-	-	1	2	1	-	-	4
LL	PIT	27	40	97	67	153	169	86	56	695
RB	PIT	141	189	186	144	238	310	171	103	1,482
RBxWCT	PIT	9	7	12	11	1	4	1	-	45
WCT	PIT	20	20	45	34	33	32	11	13	208
MWF	PIT	17	-	-	-	54	6	-	3	80
N PMN	PIT	2	-	-	-	-	-	53	7	62
N PMN	FLOY	1	-	-	-	-	-	-	-	1
LN SU	PIT	1	-	-	-	-	-	-	-	1
LS SU	PIT	6	-	-	-	-	-	8	6	20
SMB	FLOY	73	30	7	23	974	-	-	-	1,107
Subtotal	**PIT**	**225**	**256**	**344**	**258**	**483**	**525**	**331**	**188**	**2,610**
Subtotal	FLOY	74	30	7	23	974	-	-	-	1,108
TOTAL	**All Tags**	**299**	**286**	**351**	**281**	**1,457**	**525**	**331**	**188**	**3,718**

Table 3-8. Summary of the annual totals between 2011 and 2018 for the number of fish recorded at the ladder, total number of salmonids and non-salmonids at the ladder, the total number of PIT tags implanted in salmonids and non-salmonids per year, and the number of fish released upstream.

Year	Total Fish Count	Total Salmonids Count	Total Non-Salmonids Count	Salmonids with New PIT Tags	Non-Salmonids with New PIT Tags	Number of Fish Released Upstream
2011	1,805	242	1,563	216	9	1,723
2012	2,668	305	2,363	256	-	2,660
2013	3,830	392	3,438	344	-	3,818
2014	5,735	573	5,162	258	-	5,733
2015	11,647	570	11,077	483	-	11,620
2016	4,630	624	4,006	525	-	4,611
2017	530	305	225	270	61	522
2018	**227**	**206**	**21**	**175**	**13**	**226**
TOTAL	**31,072**	**3,217**	**27,945**	**2,527**	**83**	**30,913**

From 2011 to 2018, PIT-tag data collected at the ladder indicate a minimum of 10 percent of the PIT-tagged fish released upstream of the dam (264 out of 2,644 tagged-fish) returned and ascended the ladder a second, third, fourth, or sixth time (Table 3-9). These 264 fish include one Bull Trout, 164 Rainbow Trout, 73 Brown Trout, 12 Westslope Cutthroat Trout, six Rainbow x Westslope Cutthroat hybrids, four Mountain Whitefish, three Northern Pikeminnow, and one Largescale Sucker. Additionally, about 6.5 percent of the 1,107 Smallmouth Bass Floy-tagged from 2011 to 2015 ascended the ladder two or more times with two fish ascending the ladder three times, one fish ascending the ladder four times, and one fish ascending the ladder five times (NorthWestern, 2018).

Table 3-9. Summary of the multiple ladder ascents by PIT-tagged fish, including PIT-tagged fish at the ladder plus fish PIT-tagged downstream of Thompson Falls Dam and released upstream, 2011-2018.

Species	Total Number PIT-Tagged at Ladder and Released Upstream, 2011-2018	Fish PIT-Tagged Below Dam and Released Upstream of Dam, 2011-2018	Frequency of Ladder Ascents				
			2x	3x	4x	5x	6x
BULL	13	1	1	-	-	-	-
EB	4	-	-	-	-	-	-
LL	695	6	59	10	3	-	1
RB	1482	18	140	18	6	-	-
RBxWCT	45	-	5	1	-	-	-
MWF	80	1	4	-	-	-	-
WCT	208	3	10	2	-	-	-
LS SU	20	5	1	-	-	-	-
LN SU	1	-	-	-	-	-	-
NPMN	62	-	3	-	-	-	-
TOTAL	**2,610**	**34**	**223**	**31**	**9**		**1**

On an annual basis, between 3 and 10 percent of the salmonids PIT-tagged in a given year, return to the ladder the following year (Table 3-10). For example, in 2017, there were 270 newly PIT-tagged salmonids released upstream of the ladder and 5 percent of the salmonids (9 RB; 4 LL) returned to the ladder in 2018.

After 8 years of ladder operations, the PIT-tagging program has shown several fish return to the ladder and ascend the ladder multiple times over their lifetime, sometimes on an annual basis and sometimes on a less frequent interval. Cumulatively, the PIT-tagged fish returning to the ladder in 2018 had records of ascending the ladder in 2013, 2015, 2016, 2017, and 2018. Interestingly, there were two fish that had first ascended the ladder in 2013, including one Rainbow x Westslope Cutthroat Trout and one Brown Trout. The Rainbow x Westslope Cutthroat Trout (PIT ID# 985121027478593) first ascended the ladder in July 2013, then in June 2016, and most recently in April 2018 and was detected in the Thompson River once in 2015. The Brown Trout (PIT ID#

985121009492908) has ascended the ladder six times and was first recorded at the ladder in September 2013, then two ascents in 2015 (June and September), one ascent in June 2016, October 2017, and October 2018. This fish was also subsequently detected in the Thompson River following each release upstream of the dam in since September 2015.

Table 3-10. Summary of the number of salmonids PIT-tagged each year and the percentage of the PIT-tagged salmonids recorded at the ladder the following year, 2011-2018.

Year	# of Salmonids PIT-tagged at Ladder	% of PIT-Tagged Salmonids Recorded in Ladder the Following Year
2011	216	3%
2012	256	7%
2013	344	9%
2014	258	10%
2015	483	10%
2016	525	3%
2017	270	5%
2018	175	To be calculated in 2019

3.8.1 Other Ladder Fish Detections

There are three locations NorthWestern monitors for PIT-tag detections:

- Prospect Creek, a tributary to the Clark Fork River located immediately downstream of the Main Dam,
- in the ladder in pools 7,8, and the holding pool,
- and in the mainstem Thompson River located about 6 miles upstream of Thompson Falls Dam.

These locations have remote PIT-tag arrays installed. The Prospect Creek PIT-tag array was recently installed in 2018 and partially funded by TAC funds.

In summary, there were 171 individual ladder-fish detected in 2018 at the three remote array sites, during baseline fisheries surveys, or by anglers reporting to FWP (Table 3-11). Details of these fish detected in 2018 are summarized in Section 3.9 for fish detected in the lower and upper pools in the ladder, in Section 4.1 for ladder-tagged fish recaptured during baseline fisheries surveys and angler reports, in Section 4.2 for Prospect Creek, and in Section 4.3 for the Thompson River. The fish detected in the ladder represent individual fish detected entering the lower pools and/or ascending to the holding pool.

Table 3-11. Summary of the number of individual ladder-fish with a PIT-tag or Floy-tag detected in 2018 at the remote array locations, fisheries surveys upstream of Thompson Falls Dam, and by anglers. (NA – not applicable)

Species	Prospect Creek	Ladder Arrays	Baseline Fisheries Surveys	Thompson River	Anglers	Total
BULL	-	-	-	1	-	1
LL	1	7	3	48	1	60
RB	-	17	2	74	-	93
RBxWCT	-	1	-	-	-	1
MWF	-	2	-	4	-	6
WCT	-	2	-	1	1	4
NPMN	-	3	-	1	-	4
LS SU	-	1	-	-	-	1
SMB	NA	NA	-	NA	1	1
Total	**1**	**33**	**5**	**129**	**3**	**171**

3.9 Upstream Passage Efficiency

The Licensee submitted an Evaluation Plan (PPL Montana, 2010) to evaluate the efficiency of upstream fish passage and assess the effectiveness of passing Bull Trout, assess any potential delay, assess any potential fallback, and identify optimal operations to achieve the highest efficiency of Bull Trout passage. The focus for the Evaluation Plan was Bull Trout because of their federal status, but fish passage effectiveness for other native fish and non-native sport salmonids is also a priority for the TAC. The intent of the annual report has been to evaluate efficiency of upstream fish passage per the Evaluation Plan (PPL Montana, 2010).

Data collection methods at the Project, agreed to by the TAC, limit the ability to evaluate the three key components identified in the FWS *Fish Passage Engineering Design Criteria* (2017) regarding safe, timely, and effective fish passage. Effective fish passage is further delineated into three sub-categories: efficiency, attraction efficiency, and passage efficiency. Effectiveness includes both qualitative and quantitative components. Refer to FWS criteria (2017) for details.

Many of the assessments on effective passage require the quantitative measure of the proportion of the population motivated to pass a barrier (i.e., motivated population) that successfully moves through the entire zone of passage; or the proportion of the motivated population that is successfully attracted to the fishway; or the proportion of the motivated population that successfully ascends the fishway, also referred to as internal fishway efficiency (FWS, 2017).

A challenge at the Thompson Falls fish ladder is quantifying the “motivated” fish population. Spawning habitat exists both upstream and downstream of the dam, so there is no way to assess the desired destination of fish in the Project area unless the fish was previously captured, tagged, and a genetic analysis was completed. Bull Trout most commonly enter the ladder in the spring

(April-June), even though they spawn in early fall, so their movements into the ladder may be 'motivated' by drivers other than a desire to return to their natal stream. In addition, Bull Trout do not necessarily spawn annually, so the motivation of any given fish's movement is uncertain.

At the Thompson Falls fish ladder, the movement of PIT-tagged fish from the lower pools to the holding pool of the ladder can be quantified and is the current available method to evaluate internal fishway efficiency. The evaluation includes ladder ascent time and percentage of fish ascending the ladder after entry. These calculations require a tagged fish, most likely tagged at the ladder after its initial ascent, to enter the ladder a second time in order to be detected by the remote arrays in the ladder. In other words, this evaluation is based on data collected on non-naïve fish.

3.9.1 Ladder Ascents

The remote antennas and detection data were used to calculate the length of time it took an individual fish to ascend the ladder between the lower pools 7/8 and the holding pool (pool 45). In 2018 all but one tagged fish detected in the ladder was initially tagged after previously ascending to the top of the ladder. One Largescale Sucker was initially PIT-tagged downstream of Thompson Falls Dam in April 2012.

In 2018, there were 34 fish (representing 33 individuals) detected entering the ladder (Table 3-12). One Rainbow Trout was initially tagged at the ladder in 2016 and detected ascending the ladder twice in 2018. Of the 34 fish detected entering the ladder, there were 30 fish that ascended to the top (holding pool); 23 fish (14 RB, 3 LL, 1 RBxWCT, 1 MWF, 1 WCT, 3 NPMN) ascended during notch mode (March 27 – October 23) operations and seven fish (4 RB, 3 LL) ascended during orifice mode operations (October 24 – November 15). Ascent times were available for 28 fish (Table 3-12). Two Rainbow Trout that ascended in notch mode and were recorded at the work station and released upstream evaded detection by the remote array in the holding pool, thus had no ascent time.

Table 3-12. Summary of each species including the number of fish detected entering the ladder and the median, minimum and maximum range of time (hours) spent ascending the ladder while operating in notch mode in 2018.

Species	Number of Fish Detected in Ladder	Number of Fish Ascend to Top	Number with Ascent Time	Median Ascent Time	Average Ascent Time
RB	18	18	16	1.6	2.7
RBxWCT	1	1	1	1.2	1.2
WCT	2	1	1	1.1	1.1
LL	7	6	6	1.7	1.8
MWF	2	1	1	3.6	3.6
NPMN	3	3	3	1.0	1.0
LS SU	1	-	-	-	-
TOTAL	**34**	**30**	**28**	**1.5**	**2.3**

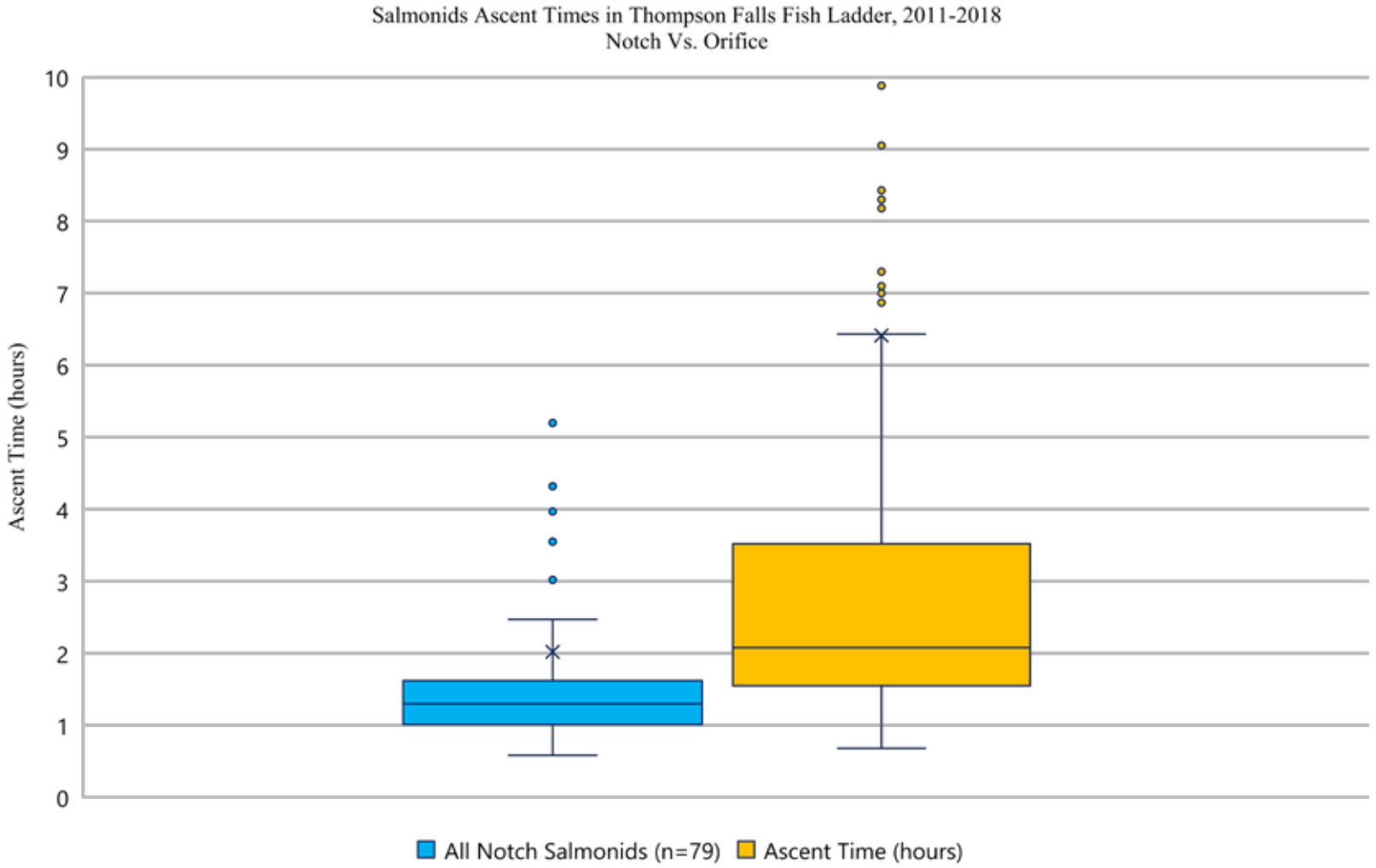
In 2018, ascent times varied from 0.7 hours to 17.2 hours with an average of 2.3 hours for all 28 fish. There were 21 ascent times for fish ascending the ladder in notch mode (including three non-salmonids) and seven ascent times for salmonids ascending in orifice mode. Ascent times during notch mode operations ranged from 0.7 to 17.2 hours with a median of 1.2 hours (average of 2.3 hours). Ascent times during orifice mode operations ranged from 0.7 to 4.4 hours with a median of 2.0 hours (average of 2.3 hours).

The majority of the ascent data is derived from tagged-salmonids returning to the ladder. Between 2011 and 2018, NorthWestern has collected ascent times for 299 salmonids, 220 ascending in orifice mode and 79 ascending in notch mode (Table 3-13). Data for non-salmonids is less consistent from year to year, does not represent all non-salmonids species, and is a relatively low sample size with data for 39 Largescale Sucker and three Northern Pikeminnow (Table 3-13). Maximum ascent times for salmonids and non-salmonids for each year and each operating mode are shown in Table 3-13. Details of the salmonid ascent times (notch *vs.* orifice) are illustrated in the box-and-whisker plot in Figure 3-10. Note there were some outliers (ascent times exceeding 10 hours) during orifice and notch mode that were excluded from Figure 3-10.

Table 3-13. Annual summary of 299 salmonids and 42 non-salmonids with ascent times during orifice and notch mode operations, 2011 – 2018.

Year	Weir Mode	Salmonids			Non-Salmonids		
	Orifice or Notch	Fish Count	Median Time (hrs)	Maximum Time (hrs)	Fish Count	Median Time (hrs)	Maximum Time (hrs)
2011	Orifice	12	4.5	19.7	1	3.6	3.6
	Notch	4	1.3	1.8	-		
2012	Orifice	10	3.1	3.0	4	6.6	8.3
	Notch	2	2.3	5.2	-		
2013	Orifice	42	1.8	40.8	10	8.2	31
2014	Orifice	32	1.6	6.4	-		
2015	Orifice	49	2.2	209	20	9.1	31
2016	Orifice	68	2.2	259	4	4.2	5.5
	Notch	20	1.2	4.3	-		
2017	Notch	35	1.4	27.6	-		
2018	Notch	18	1.4	17.2	3	1.0	1.1
	Orifice	7		4.4	-		
All years	**Orifice**	**220**	**2.1**	**259**	**39 (LS SU)**	**7.5**	**31**
	Notch	**79**	**1.3**	**27.6**	**3 (NPMN)**	**1.0**	**1.1**

Figure 3-10. Box-and-Whisker Plot for salmonids ascending in orifice (n=220) and notch (n=79) mode in Thompson Falls ladder, 2011-2018. Maximum value for notch mode was 27.6 hours and maximum value for orifice mode was 259 hours. Outliers beyond 10 hours are excluded from this graph. "x" shows the mean.



Based on the ascent time data, most salmonids ascend the ladder more quickly than non-salmonids. The maximum time any fish took to ascend the ladder was 259 hours (10 days) in June 2016, orifice mode. This fish was a Brown Trout (PIT ID# 985121009492908) with a history of ascending the ladder six times in 5 different years (2013, 2015, 2016, 2017, 2018). This Brown Trout had five ascent times recorded ranging from 58 minutes to 259 hours and was detected in the lower pools in the ladder for extended periods prior to ascending in 2017 (21 days) and 2018 (4 days). It ascended the ladder in the spring and fall months, ascended more quickly in notch mode than orifice mode, and was detected in the Thompson River annually since 2015. The ascent time (0.97 to 259 hours) did not appear to impede this Brown Trout's ability to continue migrating upstream and into the Thompson River after its release upstream of Thompson Falls Dam.

After several years of analysis of ascent times, the question remains as to why fish ascend at different rates, such as the Brown Trout previously discussed. The speed at which fish ascend the ladder may reflect hydraulic conditions within the ladder that vary depending on the weir operating mode (notch *vs.* orifice), or the condition of the fish when it arrives to the ladder, and/or other factors. Notch mode results in higher velocities and reduction in areas of slack or calm water compared to orifice mode (NorthWestern, 2018a). Therefore, faster ascent times do not necessarily translate into more fish or greater opportunity for upstream fish passage for all species. The faster ascent time may indicate limitations of access and potentially selection against some species to ascend the ladder in notch *versus* orifice mode.

3.9.2 Ladder Efficiency – Fish Entering and Ascending

Remote arrays installed in the lower pools (pools 7, 8) and the holding pool (the top of the ladder) of the ladder detect PIT-tagged fish that swim through. Efficiency of these remote arrays is not 100 percent but is assumed to be very high. These arrays only collect data from fish previously handled and PIT-tagged. The majority of PIT-tagged fish detected were initially tagged after their first ladder ascent.

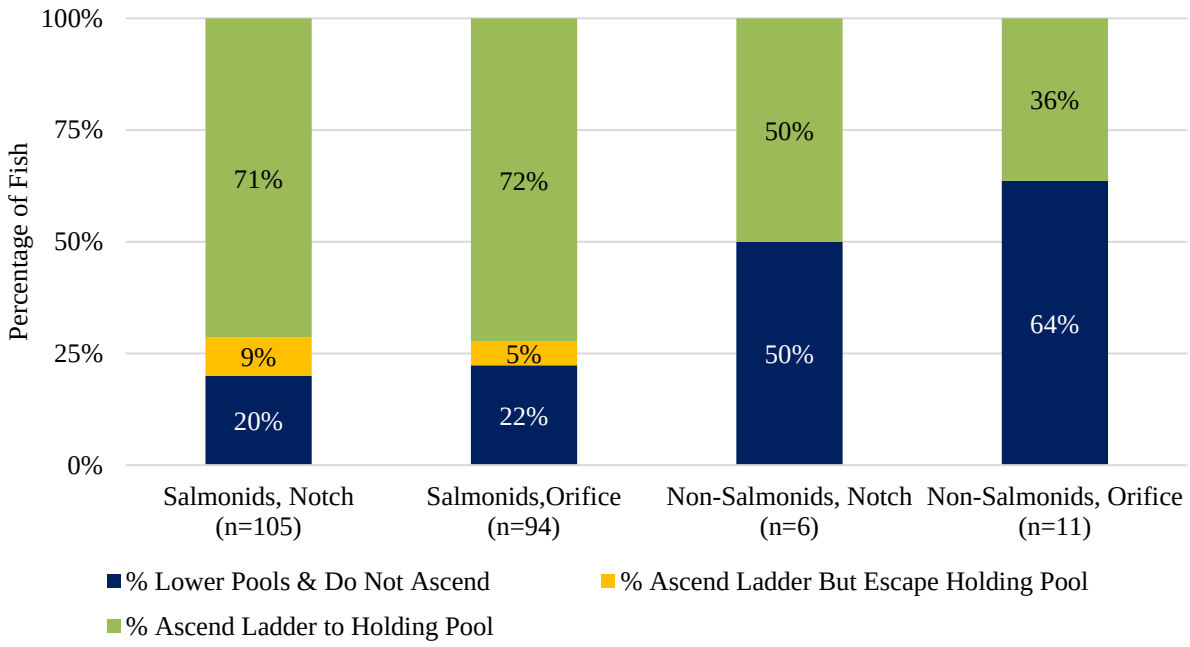
Between 2011 and 2015, it was estimated 23 percent of the 213 PIT-tagged fish detected entering the ladder were not recorded at the holding pool or work station (NorthWestern, 2016). Since 2016, remote tag array data storage was improved and automated such that every tag-detection in pools 7 and 8 and the holding pool are saved in a cloud-database, thus all fish detection records at pools 7, 8, and 45 were available for analysis reducing the potential for missed detections as in the past.

For the last 3 years (2016-2018), data collected via the remote PIT-tag arrays, as well as fish recorded at the ladder work station, were used to investigate how many tagged fish entering the ladder were ascending to the top (the holding pool); how many fish ascending to the holding pool escaped the holding pool; and how many fish were only detected in the lower pools of the ladder (not ascending to the top). Note measures were taken in the holding pool to modify the opening/entrance to the holding pool to minimize the potential for a fish to exit/escape in 2017, thus the reduction in escapes is not a reflection of weir mode operations.

In 2016, the ladder operated primarily in orifice mode except for 2 weeks in July. In 2017, the ladder operated in notch mode only. In 2018, the ladder operated primarily in notch mode except for the last 23 days of the season (October 24 – November 15). While operations were primarily in notch mode during this period, there was a similar number of tagged salmonids and a similar number of non-salmonids detected for each weir mode (Figure 3-11). However, tagged non-salmonids under-represented the total number of non-salmonids recorded at the ladder by mode in comparison to salmonids.

The number of tagged-salmonids represented about 17 percent of all salmonids recorded at the ladder work station in each weir mode (2016-2018). Although the number of tagged non-salmonids was similar between modes (6 non-salmonids in notch and 11 non-salmonids in orifice), these tagged-fish represented 0.2 percent of the non-salmonids in orifice mode and 2 percent of the non-salmonids in notch. The percentage of salmonids and non-salmonids entering the lower pools (and not ascending the ladder), ascending the ladder but escaping the holding pool, and ascending to the holding pool in orifice and notch mode between 2016 and 2018 is illustrated in Figure 3-11.

Figure 3-11. Percentage of salmonids and non-salmonids detected in the lower pools of the ladder and that ascended to the top of the ladder (holding pool) during notch mode (2016, 2017, 2018) and orifice mode (2016, 2018) operations.



The percentage of salmonids effectively ascending the ladder in either weir mode (notch/orifice), including those fish that ascend to the top and escape the holding pool, were essentially the same when evaluating all salmonids detected between 2016 and 2018 (Figure 3-11). The data indicate there is annual variability, but on average PIT-tagged salmonids entering the ladder have at least a 70 percent chance of ascending to the top of the ladder and released upstream of the dam in either

weir mode. Most of the ladder ascent data represent Rainbow and Brown Trout, the more abundant salmonid species recorded ascending the ladder.

The detection data of tagged non-salmonids show the percentage of non-salmonids ladder ascents in orifice is less than notch (Figure 3-11). However, when evaluating the number of all non-salmonids recorded at the ladder work station during notch and orifice modes since 2016, it is clear there were significantly more non-salmonids ascending the ladder in orifice mode (3,975 non-salmonids) than in notch mode (277 non-salmonids). The number of fish recorded at the ladder work station indicate non-salmonids ability to ascend the ladder in notch mode is significantly reduced compared to orifice mode (NorthWestern, 2018).

3.10 Fallback

Fallback is defined as a fish that ascends the ladder, receives a PIT, Floy, or other unique identification tag, is released upstream, and then is later recaptured either downstream of the Thompson Falls Dam or at the ladder again that same year. The objective of evaluating "fallback" is to assess whether these fish are moving through the turbines or over the spillway and if there are operational modifications that could improve fish movement upstream after release into the Thompson Reservoir.

The combined capacity of the seven generating units at the Project is approximately 23,000 cfs. When river inflows exceed this capacity (except during plant trips or when any number of the generating units are offline), spill is initiated at the Main Dam spillway. Therefore, when streamflows are less than 23,000 cfs, it is assumed that all downstream fish passage is through the turbines. When streamflows are above 23,000 cfs, fish can pass downstream through the turbines or over the spillway. In 2018, streamflows exceeded 23,000 cfs between April 11 and July 15. In addition, stanchions were removed at the Main and Dry Channel dams in early May and not replaced until August 4 which allowed for spill to continue into early August.

Detecting a fallback is limited to when a fish returns to the ladder or when a fish is recaptured/detected during sampling efforts downstream of the Thompson Falls Dam. Therefore, the number of fallback fish reported represents a minimum value. Also, the duration between the time a fish is released upstream of the dam and when it moves downstream of the dam is an estimate since tags are not detected moving over the spillway or at the turbines.

In 2018, there were seven fallback fish including five Rainbow Trout, one Brown Trout, and one Westslope Cutthroat Trout (Table 3-14). The majority of these fallback fish first ascended the ladder in March or April and then returned to the ladder in the fall months. One Rainbow Trout ascended the ladder on April 23 and immediately returned downstream and was redetected in the lower pools of the ladder on April 26. Four of fallback fish were also detected in the Thompson River either after the initial release upstream of Thompson Falls Dam in the spring; following the second release upstream of the dam; or following both the first and second release upstream of the

dam (Table 3-14). Two fallback fish (WCT, LL) did not ascend the ladder again after detection downstream. The Westslope Cutthroat Trout ascended the ladder on April 23 and was detected downstream (190 days later) in the lower pools of the ladder during the evening hours on October 30. The Brown Trout ascended the ladder on September 24 and was detected downstream of the dam 30 days later in Prospect Creek. Interestingly, the same Brown Trout (PIT ID# 989001006029320) ascended the ladder on August 16, 2017 and detected downstream in the lower pools of the ladder in 71 days later, October 26 and 27. In both 2017 and 2018, this Brown Trout moved downstream through the turbines based on streamflows (less than 23,000 cfs).

Table 3-14. Summary of fallback fish released upstream of Thompson Fall Dam and returning to the ladder in 2018 with dates of the first and second detections in the ladder, duration between detections at the ladder, Thompson River detections, and downstream passage through the turbines or spillway.

Species	Date of First and Second Ladder Ascent 2018	Duration between ladder visits	Did Fish Ascend Ladder on 2nd Visit?	Was Fish Detected in the Thompson River after 1st or 2nd Ladder Ascent?	Downstream through Turbines or Spillway
RB	3/28, 11/5	222 days	Yes	Yes after 1st	Unknown
RB	3/28, 10/29	215 days	Yes	Yes after 1st & 2nd	Unknown
RB	4/16, 10/27	194 days	Yes	Yes after 1st	Unknown
RB	4/23, 4/26	3 days	Yes	Yes after 2nd	Unknown
WCT	4/23, 10/30	190 days	No	No	Unknown
RB	8/10, 9/27	48 days	Yes	No	Turbines
LL	9/24 (10/14 in Prospect)	30 days	NA	NA	Turbines

Salmonid fallback data from 2014 through 2018 show 43 percent (18 out of 42 fallback fish) were detected in the Thompson River one or more times. Because the tag array in the Thompson River was not set up until September 2014, fallback data for 2011-2013 salmonids (n=19) were not included in this analysis. Some fallback fish (2014-2018) ascended the ladder multiple times and subsequently migrated into the Thompson River each time, while other fish that ascended the ladder and were released upstream remained upstream for multiple years based on multiple tag detections in the Thompson River. Overall the data show salmonids can survive downstream passage, either through the turbines or over the spillway, returning to the ladder (sometimes multiple times a year), and continuing to move upstream into the Thompson River or other locations.

FWP has indicated the greatest concern is for fallback fish detected downstream of Thompson Falls Dam within 30 days of being released upstream of the dam. Based on this classification, the two Bull Trout identified as fallback in Table 3-15 would not be included. The two Bull Trout in Table 3-15 ascended the ladder in the spring, May 2014 and April 2016, respectively and were detected 5-6 months later downstream of the Thompson Falls Dam in October, one re-captured in Noxon Reservoir by FWP during a gillnet survey, and one detected entering the lower pools of the

ladder. The overall percentage of tagged-salmonids detected downstream of the dam within 30 days of their release upstream of the dam is low (Table 3-15).

Table 3-15. Summary of the annual fallback of salmonids, 2011-2018.

Salmonid Fallback	2011	2012	2013	2014	2015	2016	2017	2018
Total Salmonid Fallback	13	2	4	8	6	19	2	**7**
Bull Trout Fallback	-	-	-	1	-	1	-	**-**
# of PIT Tagged Salmonids	216	256	344	258	483	525	270	**175**
% of Tagged Salmonids Detected within 30 days of Release Upstream	4.6	-	-	1.2	0.4	1.5	0.4	**1.1**

3.11 Weir Mode Analysis

Ladder operations over the last 8 seasons (2011-2018) are summarized in Table 3.1. Existing weir data includes 2 consecutive years (2011,2012) of alternating the weir mode (notch and orifice) weekly, 4 consecutive years (2013-2016) operating the entire season in orifice mode apart from 2 weeks in July 2016 when the weirs were switched to notch mode, and 2 seasons operating primarily in notch mode (2017-2018).

In 2018, the ladder operated in notch mode from March 27 through October 23. Between October 24 and November 15, the ladder operated in orifice mode with the assumption that the orifice operating mode would provide an opportunity for more fish and more fish species to ascend the ladder if present based on data gathered since 2011. During notch mode, October 1 through 23 (23 days), there were 31 fish (all salmonids) that ascended the ladder. In the last 8 days of October when the ladder operated in orifice mode, 36 salmonids ascended the ladder. In November, water temperatures declined from around 8 to 4 °C and fish activity in the ladder also ceased once temperatures were below 7 °C (after November 7). A total of nine fish (6 LL; 2 RB; 1 WCT) ascended the ladder between November 1 and 7 and no fish ascended the ladder from November 8 to 15 (ladder closed).

As shown in the Figure 3-1, the ladder has operated under varying hydrologic conditions since 2011. The variable river conditions and periods when the ladder has been closed likely contribute to the total number of fish that migrate upstream in any given year. However, the proportion of fish (native *vs.* non-native; salmonid *vs.* non-salmonid) recorded at the ladder remained consistent between 2011 and 2016 before notably changing in 2017 and 2018 (*see* Figures 3-3 and 3-4, respectively). The shifts in species composition and decline in total number of fish recorded at the ladder appear to be related to ladder operations, specifically the weir mode (*see* Table 3-3). Notch mode appears to select against the weaker swimmers so fewer native fish such as Suckers and Northern Pikeminnow ascend the ladder. Although the number of salmonids remain relatively constant during notch and orifice operations, notch mode appeared to select for salmonids capable

of ascending the ladder more quickly than observed in orifice mode (*refer to* Section 3.9.1 in this report). These results may indicate notch mode selects against some salmonids.

In line with the objectives and goals identified by FWS and FWP to maximize fish passage for Bull Trout and other native species (specifically Westslope Cutthroat Trout and Mountain Whitefish) as well as recreational game fish such as nonnative Rainbow and Brown Trout, but excluding Lake Trout and Walleye, weir mode testing at the ladder shows orifice mode will maximize opportunity for native fishes and nonnative game fish.

3.12 Attractant Flow

The auxiliary water system (AWS) routes water from the forebay to augment the ladder pool-to-pool flow and provides the majority of flow at the ladder entrance and into the tailrace to attract fish. Additionally, another 20 cfs can be discharged directly into the tailrace in the form of a high-velocity jet (also referred to as the HVJ or attractant flow). Its purpose is to improve fish attraction to the ladder, as needed. The HVJ is designed to discharge 20 cfs through control valve CV-1. The jet discharges through a 14-inch-diameter orifice, which produces a discharge jet velocity of approximately 19 feet per second into the tailrace. The HVJ is designed to operate during spill (occurs when streamflow exceeds 23,000 cfs) but can also be operated during non-spill periods. Other attraction alternatives during non-spill include partially opening an adjacent spillway lift gate near to the ladder entrance to provide approximately 125 cfs (L. Mabbott, NorthWestern, personal communication, January 25, 2018).

Observations of tailrace conditions at the Thompson Falls Dam indicate that, during non-spill periods, additional flow is needed to allow fish to migrate upstream through the natural falls that are present downstream of the Main Dam (L. Mabbott, NorthWestern, personal communication, 2014). For this reason, both the AWS and the HVJ were operated throughout the non-spill season in 2018 (as has been implemented since 2012) to allow fish to reach the entrance to the ladder.

3.12.1 New Radial Gates at the Main Dam

In 2017, NorthWestern started construction on the installation of two new radial gates near the left abutment on the Main Dam, the opposite side of the existing fish passage facility. The new gates are of similar size and configuration as the existing radial gates located in the center of the Main Dam. The radial gates will be controlled utilizing an automated system that can be managed remotely and will address safety concerns with respect to the manual efforts required to manage reservoir levels and debris build up. Each radial gate will allow a maximum of approximately 10,000 cfs to flow through. With the new gates installed, the capacity for spill will be nearly doubled with just over 40,000 cfs for all four gates. Construction was completed in 2018 and the new radial gates will be operational, as needed during spring flows in 2019.

4.0 Ladder Fish Detections – Up and Downstream

Fish receiving a unique tag at Thompson Falls fish ladder and released upstream are referred to as "ladder" fish. The detection of the ladder fish after being released upstream of Thompson Falls Dam is limited to baseline fisheries surveys, angler reports, and the remote PIT-tag arrays in Prospect Creek, in the lower and upper pools in the ladder, and the Thompson River drainage. A summary of fish tagging efforts is provided in Section 3.8 in this report. This section summarizes baseline fisheries detections, angler detections, Prospect Creek, and Thompson River detections.

4.1 Baseline Fisheries Surveys and Angler Reports of Ladder-Fish

Between 2011 and 2018, 66-tagged (PIT and Floy) ladder-fish were recaptured during baseline fisheries surveys (29 fish) or by anglers (37 fish). About 92 percent (61 fish) of the ladder-fish were recaptured upstream of Thompson Falls Dam.

4.1.1 Baseline Fisheries – Ladder Fish Recaps

The baseline fisheries surveys between 2011 and 2018 (no survey completed in 2017) resulted in the recapture of 29 previously-tagged salmonids (22 RB; 6 LL; 1 WCT). Of the 29 recaptured salmonids, 11 ladder-fish were recaptured during spring electrofishing efforts (Thompson Reservoir upper and lower sections), 16 ladder-fish were recaptured during autumn electrofishing efforts (above islands or Paradise-to-Plains sections), and two ladder-fish were recaptured during autumn gillnetting (in 2012). No Bull Trout recorded at the ladder or released upstream were recaptured during annual baseline fisheries surveys.

Details of five ladder fish sampled during the 2018 baseline surveys is provided in Table 4-1, while the 24-ladder fish sampled between 2011 and 2016 are summarized in Table 2-10 of the *2016 Annual Report* (NorthWestern, 2017).

Table 4-1. Summary of the five-ladder fish captured in 2018 during baseline fisheries surveys.

Survey Year	Spring/Fall Sampling	Sp.	L (mm)	Detection Date(s) & Location(s) History
2018	Spring	LL	430	7/7/2017 - TFalls Ladder 4/17/18 – Thompson Reservoir Upper Section
2018	Spring	LL	432	10/2/17 - TFalls Ladder 4/17/18 – Thompson Reservoir Upper Section 6/8-10/18 – Thompson River 10/26/18-11/05/18 – TFalls Ladder lower pools
2018	Spring	LL	452	6/26/15, 6/28/16, 8/23/17 TFalls Ladder 8/24/17 – Thompson River 4/17/18 Thompson Reservoir Upper Section
2018	Fall	RB	302	8/10/18 – TFalls Ladder 10/16/18 – CFR Above Islands

Survey Year	Spring/Fall Sampling	Sp.	L (mm)	Detection Date(s) & Location(s) History
2018	Fall	RB	415	7/5/17 – TFalls Ladder 9/7-9/8/17 – Thompson River 9/24/18 – TFalls Ladder 10/16/18 – CFR Above Islands

4.1.2 Angler Reports – Ladder Fish Recaps

Prior to 2017, angler reports to FWP were limited to Smallmouth Bass with Floy-tags. Since 2011, 1,107 Smallmouth Bass, initially tagged at the ladder, were released upstream of Thompson Falls Dam. Most of the Smallmouth Bass were tagged in 2015 (n=974). Since 2015, self-reporting anglers have notified FWP of capturing 34 Smallmouth Bass (10 in 2015; 18 in 2016; 5 in 2017; 1 in 2018). The majority (n=29) of these Smallmouth Bass were captured upstream of Thompson Falls Dam with at least five fish in the lower Flathead River, including two fish near Kerr Dam located approximately 100 miles upstream of Thompson Falls Dam. Details of the 29 Smallmouth Bass are provided in Table 3-18 in the *2016 Annual Report* (NorthWestern, 2017).

In September 2017, salmonids started to receive a secondary tag (Floy) at the ladder prior to release upstream (Table 4-2). The secondary tag (Floy) allows FWP to evaluate angling exploitation for salmonids. A total of 217 salmonids (Table 4-2) have received a secondary Floy-tag and FWP has received reports of three fish (RB in 2017; WCT and LL in 2018) captured by anglers (M. Terrazas, FWP, personal communication, January 10, 2019).

Table 4-2. Summary of Floy tags implanted in salmonids at the fish ladder in 2017 and 2018 prior to upstream release for angler exploitation study.

Species	Floy tagged in 2017	Floy tagged in 2018	# of Fish Anglers Reported (2017-2018)
LL	10	57	1
RB	13	116	1
RBxWCT	-	1	
WCT	2	14	1
MWF	-	4	
TOTAL	**25**	**192**	**3**

In 2017 and 2018, anglers reported to FWP capturing nine ladder-fish (6 SMB; RB; LL; WCT). One of these fish (SMB) ascended the ladder in July 2015 and was recaptured downstream of Thompson Falls Dam in Sqaylth-Kwum Creek, formerly Squaw Creek (October 26, 2018). The other eight fish reported by anglers to FWP in 2017 and 2018 were located upstream of Thompson Falls Dam (Table 4-3).

Since 2011, all but one species, Longnose Sucker, tagged at the ladder and released upstream of the dam (*see* Table 3-7 for list of species) have been subsequently detected at least once upstream of Thompson Falls Dam in the Clark Fork River as far upstream as Petty Creek (near Alberton, Montana) and in the lower Flathead River as far upstream as Buffalo Bridge (immediately downstream of Seli'š Ksanka Qlispe' Dam).

Table 4-3. Summary of ladder-fish reported by anglers in 2017 and 2018 starting with the furthest upstream location, including the date recaptured, the location, river miles upstream of Thompson Falls Dam, date ascended Thompson Falls fish ladder and released upstream, species, and duration between detections.

Location of Ladder Fish Detection	Date Detected	Approximate River Miles Upstream of Thompson Falls Dam	Date Released Upstream of Thompson Falls Dam	Species (TAG ID)	Duration Between Release at Dam and Angler Recap
Buffalo Bridge – Lower Flathead River	10/4/2017	103	7/15/2015	SMB (Y-0355)	> 2 years
Sloan Bridge – Lower Flathead River	10/12/2017	82	9/20/2017	RB (TAG 6029565)	23 days
Perma – Lower Flathead River	7/10/2017	48	8/7/2015	SMB (Y-1070)	~ 2 years
St. Regis River	5/30/2018	65	4/23/2018	WCT (TAG 6029234)	37 days
Petty Creek (near Alberton, MT)	10/1/2018	52	unknown	LL (unknown)	Unknown
Paradise Fishing Access Site (FAS), Clark Fork River	8/26/2017	36	7/22/2015	SMB (Y-0343)	> 2 years
Steamboat, Thompson Reservoir	9/29/2017	1-2	613/2015	SMB (Y-1540)	> 2 years
Wild Goose, Thompson Reservoir	9/21/2017	<1	6/22/2015	SMB (Y-16989)	> 2 years

In addition to the angler reports, the Thompson River remote PIT-tag array system, located approximately 6 miles upstream of Thompson Falls Dam detected 770-individual ladder-fish that have been released upstream of the dam between 2011 and 2018 representing the following eight species plus one hybrid (BULL, EB, LL, LS SU, NPMN, MWF, RB, WCT, RBxWCT). More details of Thompson River fish detections are provided in Section 4.3 of this report.

4.2 Prospect Creek Remote Tag-Array

Prospect Creek is a tributary to the Clark Fork River located about one-half mile downstream of the Main Dam (*see* Figure 6-1). In 2018, NorthWestern and Avista funded the installation of a PIT-tag array in Prospect Creek with the capability to detect directionality of upstream or downstream fish movement. The remote-tag array system was installed in August 2018 and

operating by August 28. A report prepared by Biomark with details of the installation is provided in Appendix B.

Between the end of August and December 31, 2018, seven fish (3 BULL; 3 WCT; 1 LL) were detected. A summary of these fish is provided in Table 4-4 including their initial tagging date and location as well as subsequent detections.

Table 4-4. Summary of Prospect Creek array detections, August – December 2018.

Date Detected in Prospect	Species	Date Tagged	Length (mm) at Tagging	Location Tagged	Other Detections
8/28/2018	WCT	8/7/2018	195	Upper Prospect Creek - salvage	NA
9/8/2018	BULL	4/14/2015	558	Downstream Cabinet Gorge Dam – Avista Transport to Region 4 (1km downstream of Thompson River)	5/22/2015 Thompson River - array
9/12/2018	BULL	11/10/2015	159	Fishtrap Creek - Fishtrap Weir (Glaid, 2017)	10/14/2017 Thompson River - array
9/27/2018	BULL	7/5/2013	555	Prospect Weir Trap	NA
10/24/2018; 11/13/2018	LL	8/16/2017	485	Thompson Falls Dam Fish Ladder- Released Upstream	10/26/2017 Thompson Falls ladder - lower pools only, 11/16/2017 in Graves Creek; 9/24/2018 TFalls Dam and released upstream; 10/24/2018 - 30 days later detected in Prospect after release upstream
11/2/2018	WCT	8/6/2018	220	Upper Prospect Creek - salvage	NA
12/28/2018	WCT	8/6/2018	207	Upper Prospect Creek - salvage	NA

There was only one ladder fish (LL) detected in Prospect Creek in 2018. This fish had ascended the Thompson Falls fish ladder previously in 2017 and 2018 and was also detected in Graves Creek, approximately 8 river miles downstream of Thompson Falls Dam in 2017. The Westslope Cutthroat Trout were all tagged in upper Prospect Creek by FWP earlier in the year (2018).

Three Bull Trout were detected by the Prospect Creek array in 2018. Two Bull Trout were genetically assigned to the Thompson River drainage (Region 4) and the genetic assignment of the third Bull Trout is unknown (K. Duffy, Avista, personal communication, March 13, 2019). The detection data did not provide directionality for these fish. It is unknown if they were moving upstream or downstream at the time of detection.

One Bull Trout (PIT ID #989001004500631) that was captured as a juvenile upstream of Thompson Falls Dam in a weir trap in Fishtrap Creek in November 2015, 2 years later detected in the mainstem Thompson River tag array October 2017, and 1-year later detected in Prospect Creek in September 2018. There is no information or data available to indicate if this fish attempted to approach the fish ladder while it was shutdown.

The second Bull Trout (PIT ID #900226000730599) was initially captured downstream of Cabinet Gorge Dam April 2015 and transported to Region 4 and released in the Clark Fork River approximately 1 km downstream of the confluence with the Thompson River. This fish was genetically assigned to Fishtrap Creek. This Bull Trout was detected approximately 1 month after its release in Region 4 in the mainstem Thompson River (via the remote array). Just over 3 years later, the same Bull Trout was detected in Prospect Creek, September 2018. There were no detections of this fish between May 2015 and September 2018. It is unknown when this fish moved downstream of Thompson Falls Dam.

The third Bull Trout was initially captured and tagged by Avista in Prospect Creek in July 2013 with the subsequent detection September 2018. In 2013, Avista took a fin clip for genetic analysis, however at the time of this report, there was no genetic assignment was available and is pending further investigation of Avista's data files (K. Duffy, Avista, personal communication, March 13, 2019).

NorthWestern and Avista will continue to operate the remote tag array system in Prospect Creek in 2019.

4.3 Thompson River Drainage Remote Tag-Arrays

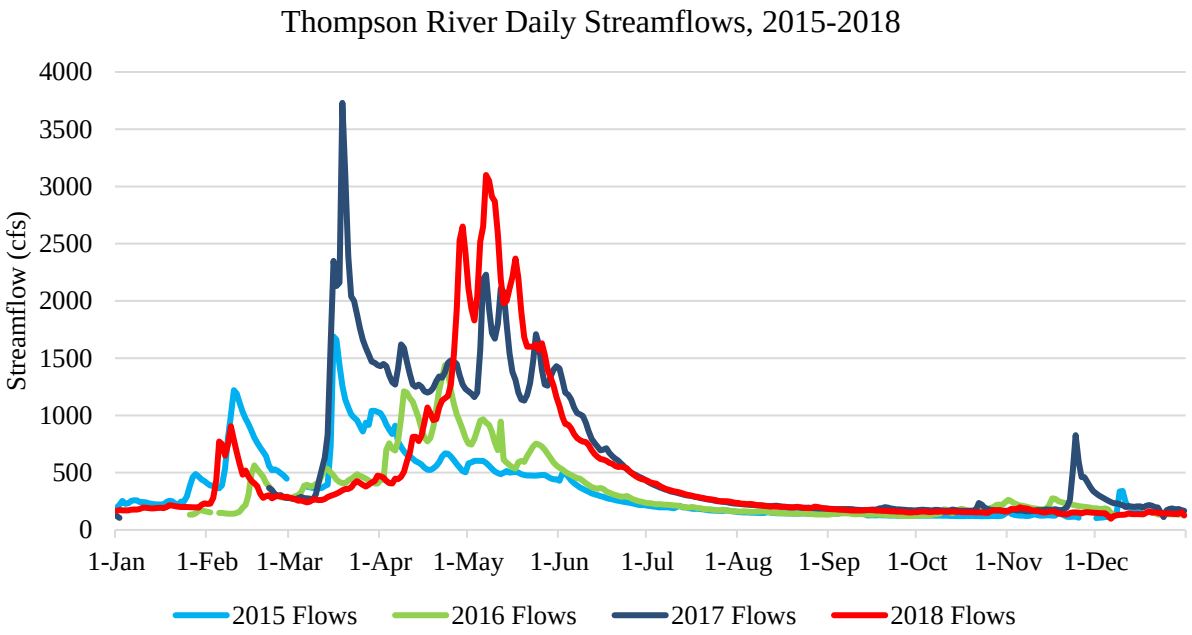
A remote PIT-tag antenna array was installed in the mainstem of the Thompson River on September 26, 2014. The periods of operation and data collection were between September 26 and December 22, 2014; between February and December 2015; between January and December 2016, 2017, and 2018. Data continues to be collected in 2019 and will be summarized in the next annual report.

Although the array cannot detect directionality of fish, the entry of fish into the drainage can be assumed by cross-referencing the release date upstream of the ladder and the first detection recorded in the Thompson River. A fish detection represents the first record of an individual fish in the Thompson River and is assumed to indicate entry into the Thompson River drainage. During the initial evaluation of tag detection efficiency by the array in 2014, it was concluded that the array in the mainstem Thompson River detected both HDX and FDX PIT tags, but the detection range for the FDX tag was greater than the HDX tag (J. Glaid, Montana State University, personal communication, December 4, 2014). Although tag detection is high, there are still a few fish that go undetected thus evaluation of array detections provided in this section represent minimum values. Additionally, between May 15 and September 26, 2017, antenna #5 (1 of 7 antennas) along

the mainstem array was not functioning properly and not detecting fish. It is likely some fish passed through antenna #5 and were not recorded during this time in 2017.

Hydrologic conditions have varied annually in the Thompson River (Figure 4-1). Between 2015 and 2017, peak streamflows in the Thompson River ranged from 1,440 to 3,710 cfs and occurred in March and April. In 2018, peak flows were slightly above 3,000 cfs and occurred in May, which was representative of the normal occurrence for peak streamflow.

Figure 4-1. Thompson River hydrograph, 2015-2018 (USGS gage #12389500).



4.3.1 Fishtrap Creek and West Fork Thompson River Arrays and Ladder Fish Detections

NorthWestern and FWP also installed one PIT-tag array in Fishtrap Creek and in West Fork Thompson River, both critical Bull Trout spawning tributaries in the Thompson River. These arrays have functioned sporadically since installation (2014 in West Fork Thompson River and 2015 in Fishtrap Creek) due to various technical challenges. FWP is leading the data collection effort in the tributaries and provides annual updates on the results of the fish detections in the two tributaries. This report only summarizes ladder fish detected in the tributaries.

A total of 17 ladder fish have been detected in the two tributaries since 2014 with eight individual ladder fish (1 BULL, 4 LL, 3 RB) detected in West Fork Thompson River and nine individual ladder fish (1 BULL, 4 LL, 2 RB, 2 WCT) detected in Fishtrap Creek. The Bull Trout in West Fork Thompson River was detected in July 2015 after ascending the ladder and being released upstream of Thompson Falls Dam on June 3, 2015. The Bull Trout in Fishtrap Creek was detected

in June 2018 and September 2018 after ascending the ladder and being released upstream of Thompson Falls Dam on September 18, 2017.

4.3.2 Thompson River Array – Ladder Fish Detections

Between 2011 and 2018 there were 2,644 uniquely PIT-tagged fish (*refer to* Table 3-9) released upstream of Thompson Falls Dam. Although the Thompson River array was not in place until autumn 2014, the detection data (2014-2018) indicate a minimum of 29 percent of the 770 individually tagged-fish that ascended the ladder and released upstream of the dam were later detected in the mainstem of the Thompson River, including 4 of the 15 tagged-Bull Trout. A summary of the species these 770 individual fish represent and percentage of the respective species PIT-tagged at the dam (released upstream) and subsequent detection in the Thompson River is provided in Table 4-5.

Fish detections of unique PIT-tagged fish in the mainstem Thompson River are recorded on a daily (24-hr) interval. Between 2014 and 2018, there were 2,531 daily ladder-fish detections documented by the 770-individual ladder-fish (Figure 4-2). Fish detections increased from 66 daily ladder-fish detections (44 individuals) at the end 2014 to 688 daily ladder-fish detections (282 individuals) in 2015 and 856 daily ladder-fish detections (290 individuals) in 2016 before declining to 482 daily ladder-fish detections (198 individuals) in 2017 and 427 daily ladder-detections (129 individuals) in 2018. The decline in individual ladder-fish detected in the Thompson River in 2017 and 2018 may be related to the substantial decline in salmonids PIT-tagged and released upstream of the dam in those years compared to 2015 and 2016. There were 483 and 525 salmonids tagged at the ladder in 2015 and 2016, respectively and only 270 and 175 salmonids tagged at the ladder in 2017 and 2018, respectively.

Table 4-5. Summary of 770 individual ladder-fish detected by the remote array in the Thompson River, 2014-2018 and percentage of species tagged at the ladder (2011-2018) detected in the Thompson River, 2014-2018.

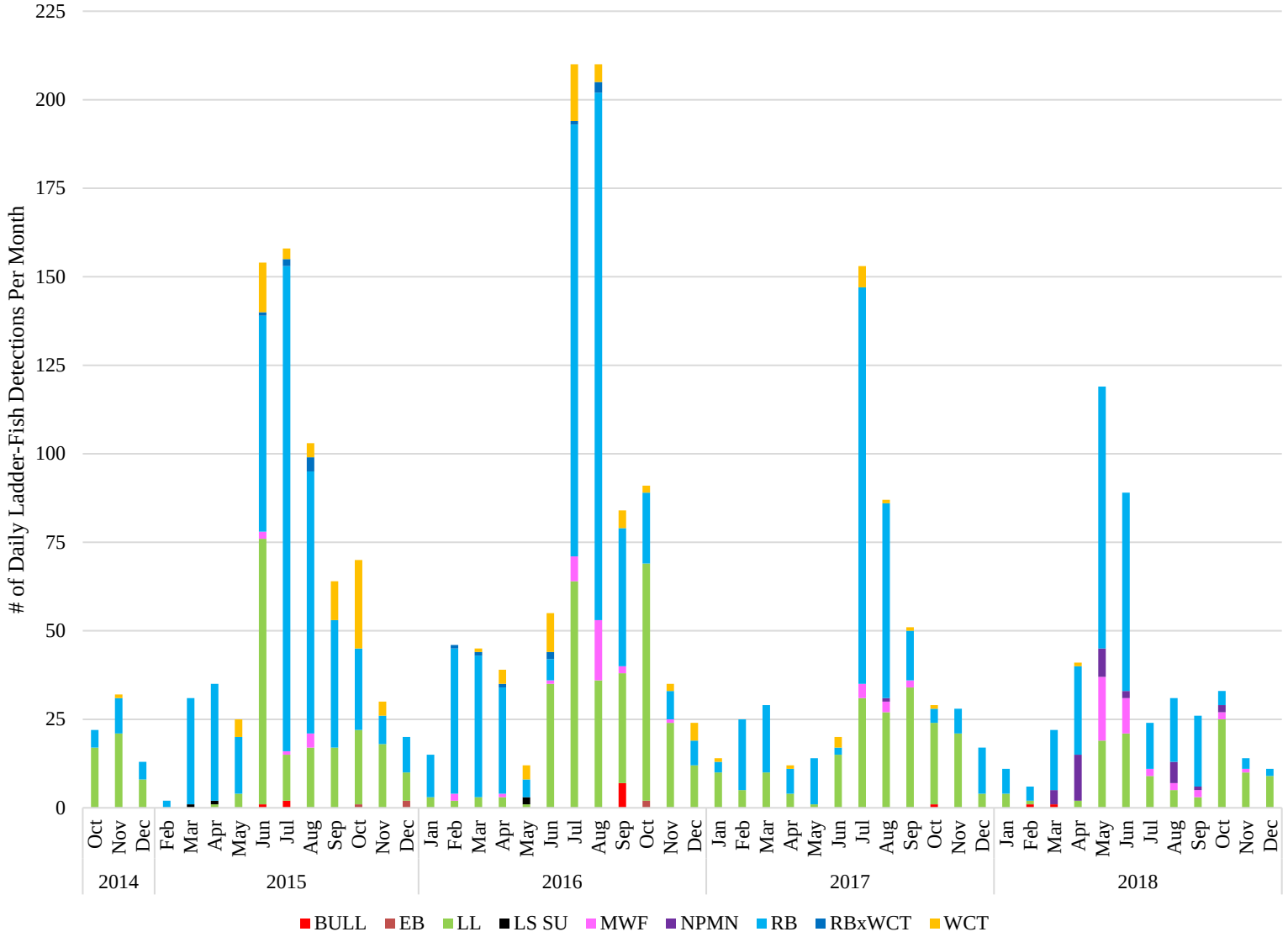
Species	# of Ladder Fish Detected in the Thompson River, 2014-2018	% of Species PIT-tagged and Released Upstream of Thompson Falls Dam
BULL	4	26.7%
EB	2	50%
LL	304	43.3%
LS SU	2	8%
MWF	9	11%
NPMN	1	1.6%
RB	388	25.9%
RBxWCT	9	20%
WCT	48	22.7%
Unknown	3	NA
Total	**770**	**29.1%**

Ladder-fish detections in the Thompson River are primarily Rainbow and Brown Trout, which is expected because these two species represent just over 83 percent of the tagged-fish released upstream of the dam since 2011. Figure 4-2 shows peak detections of ladder-fish occurring in June and July in 2015, July and August in 2016 and 2017, and May and June in 2018.

Four Bull Trout released upstream of Thompson Falls Dam after ascending the ladder were detected in the mainstem Thompson River in June and July 2015, September 2016, October 2017, February and March 2018 as well as in two critical spawning tributaries, Fishtrap Creek in 2018 and West Fork Thompson River in 2015. These four Bull Trout represent 26.6 percent of tagged-Bull Trout released upstream of the dam since 2011.

The remote tag-array data indicate Thompson River provides important habitat (e.g., spawning, foraging, migration, overwintering) and likely thermal refugia for several species throughout the year.

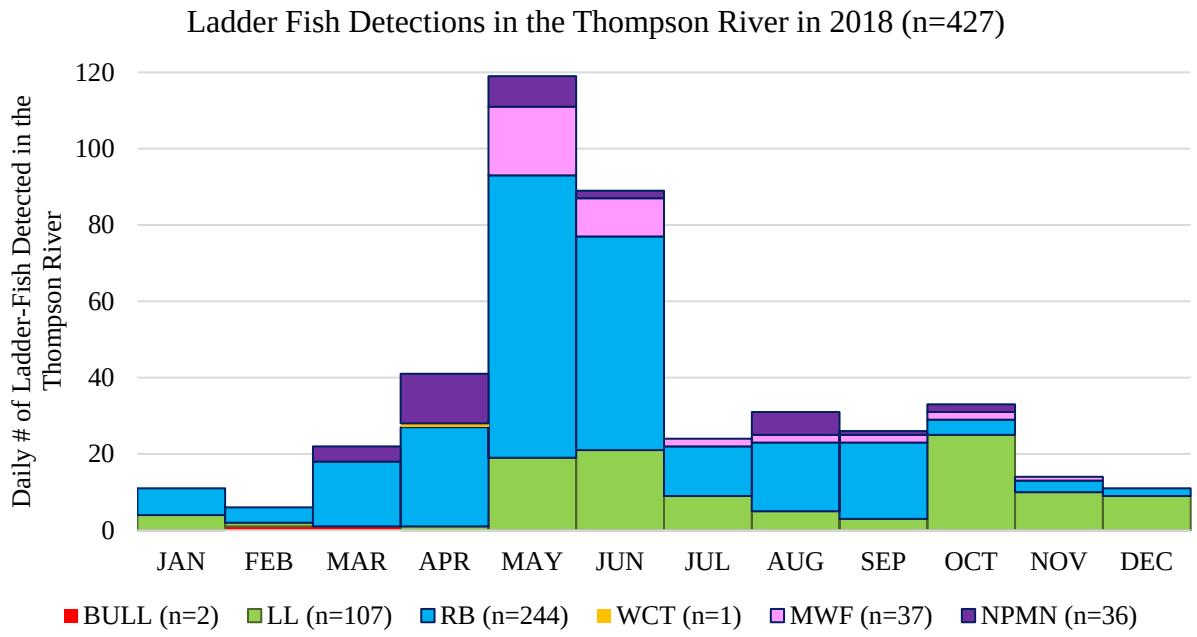
Figure 4-2. Summary of all 2,531 daily detections representing 770 individual ladder-fish in the Thompson River, 2014-2018.



4.3.3 Thompson River Ladder-Fish Detections, 2018

In 2018, there were 427 daily ladder-fish detections representing 129 individuals. Figure 4-3 summarizes, by month, the fish detections in 2018. One Bull Trout that ascended the ladder in September 2017 was detected in the Thompson River in February and March 2018.

Figure 4-3. Summary of all daily detections of ladder-fish in the Thompson River in 2018.



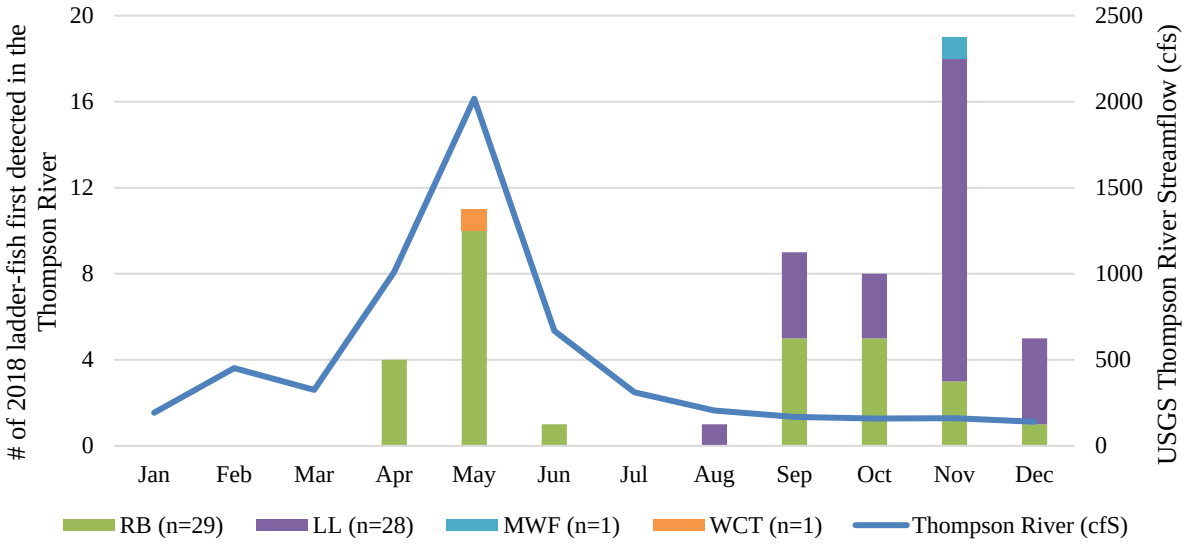
The majority (71%) of the 129-individual ladder-fish detected in the Thompson River were last recorded at Thompson Falls fish ladder in 2018 or 2017, but there was at least one Rainbow Trout that had remained upstream of Thompson Falls Dam for 6 years and one Brown Trout that had remained upstream for at least 5 years (Table 4-6). In addition, five Rainbow Trout had ascended the ladder and migrated into the Thompson River once prior (1 in 2016; 2 in 2017; 1 made two trips in 2018).

Table 4-6. The last year each of the 129 ladder-fish detected in the Thompson River in 2018 were recorded at Thompson Falls fish ladder and released upstream.

Species	2012	2013	2014	2015	2016	2017	2018	Total
BULL	-	-	-	-	-	1	-	1
LL	-	1	1	1	8	9	28	48
MWF	-	-	-	3	-	-	1	4
NPMN	-	-	-	-	-	1	-	1
RB	1	-	1	4	17	23	28	74
WCT	-	-	-	-	-	-	1	1
Total	**1**	**1**	**2**	**8**	**25**	**34**	**58**	**129**

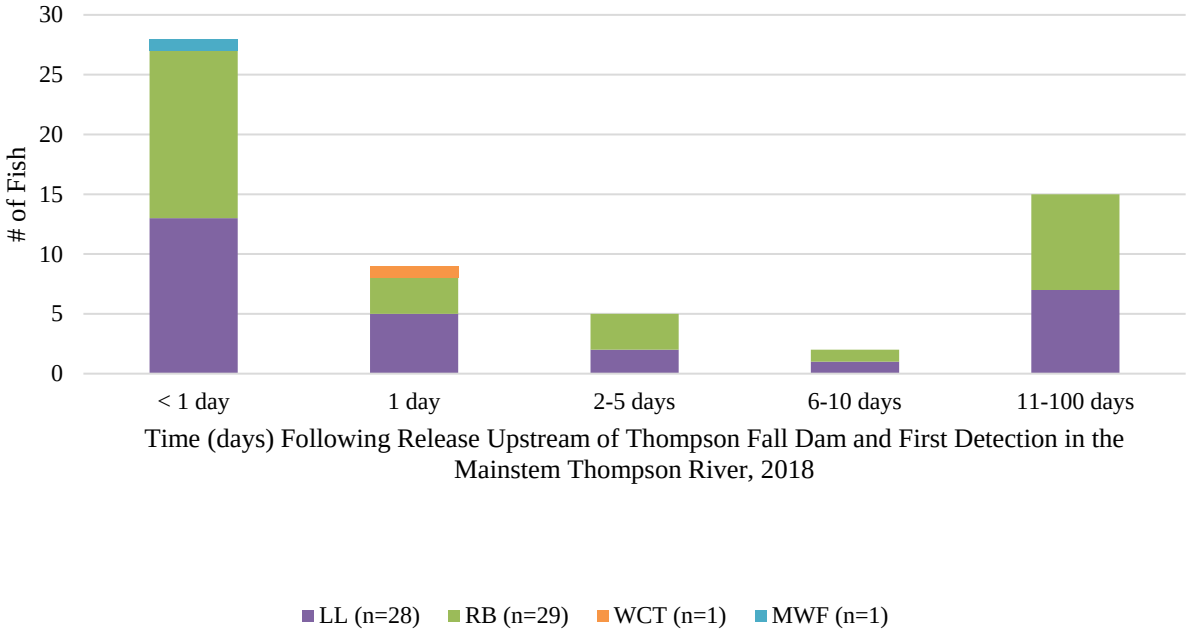
There were 59 ladder-fish (all salmonids) released upstream of the dam in 2018 that were subsequently detected in the Thompson River in 2018 (Figure 4-4). One Rainbow Trout ascended the ladder twice in 2018 (April and October) and was detected in the Thompson River following each release upstream of the dam. Therefore, the data in Figure 4-4 represent 58 individual fish. The ladder was shut down for most of the time between May and early August, which may have attributed to the low number of ladder-fish detected during the summer months.

Figure 4-4. Summary of 2018 the 59 ladder-fish detected in the Thompson River in 2018.



The duration (in days) that the 59 ladder-fish took to navigate 6-miles of the Clark Fork River between Thompson Falls Dam and the Thompson River is shown in Figure 4-5. Upstream fish movements between the dam and the Thompson River varied from about 6.5 hours to 83 days. The majority (over 60%) of the 2018-ladder fish detected in the Thompson River were detected within 1-day of their release upstream of Thompson Falls Dam and most of those fish spent less than 1-day to reach the Thompson River.

Figure 4-5. Duration (in days) fish spent after release upstream of Thompson Falls Dam in 2018 to migrate to the Thompson River.



5.0 Bull Trout

The primary target species for upstream fish passage at Thompson Falls Dam is the federally-threatened Bull Trout. The BO (FWS, 2008) requires the Licensee to report the number of Bull Trout recorded at the ladder annually, captured during sampling efforts in the Project area, and/or any incident of take. The BO Term and Condition 1(e) also requires the Licensee to complete genetic testing of adult Bull Trout that ascend the ladder and those fish captured immediately downstream of Thompson Falls Dam to determine the likely natal tributary of origin (FWS, 2008).

In the Project area Bull Trout have been recorded entering and ascending the fish ladder, detected upstream in the Thompson River and its tributaries (Fishtrap Creek and West Fork Thompson River) after being released upstream of Thompson Falls Dam, and detected downstream of Thompson Falls Dam after being released upstream of the Thompson Falls Dam. In addition to Bull Trout observed, recorded, and uniquely-tagged by the Licensee, other uniquely-tagged Bull Trout (not tagged by the Licensee) have been detected entering the ladder, in the Thompson River drainage, or in Prospect Creek. Some of these Bull Trout were tagged in upstream of Thompson Falls Dam (Region 4) in Thompson River tributaries, Fishtrap Creek, and West Fork Thompson River as part of the juvenile Bull Trout out-migration study (Glaid, 2017; Section 5.4 in NorthWestern, 2018) or during annual mainstem Thompson River fisheries surveys by FWP. Other Bull Trout were initially tagged downstream of Thompson Falls Dam by Avista in support of their various monitoring, tagging, and transport programs downstream of Cabinet Gorge Dam or in Region 3 (Noxon Reservoir and associated tributaries).

The following sections summarize Bull Trout recorded entering and ascending Thompson Falls fish ladder, Bull Trout recorded during baseline fisheries surveys, Bull Trout genetics for fish sampled at the ladder and during baseline fisheries studies, PIT-tagged Bull Trout detected upstream of Thompson Falls Dam in the Thompson River, Bull Trout detected downstream of Thompson Falls Dam in Prospect Creek, and Avista's upstream fish passage program and Bull Trout transports upstream of Thompson Falls Dam into Region 4. A summary of Bull Trout incidental take is provided in Section 8.2 of this report.

5.1 Thompson Falls Ladder

Since ladder operations began in 2011, between one and five Bull Trout ascended the ladder annually except in 2018 when no Bull Trout ascended. To date 16 Bull Trout have ascended the ladder representing 15 individuals (Table 5-1). One fish ascended the ladder in 2011 and again in 2012. There have been two mortalities reported. One Bull Trout died after jumping out the ladder pool in 2012 and a second Bull Trout (that ascended the ladder in spring 2014 and was released upstream alive) died as a result of a fall gillnet survey completed by FWP downstream of the Project area in the Noxon Reservoir.

All 15 individual Bull Trout recorded at the ladder between 2011 and 2017 (Table 5-1) were genetically assigned to Region 4, upstream of Thompson Falls Dam. The majority of the 15 fish that ascended the ladder were genetically assigned to Fishtrap Creek (n=8) or West Fork Thompson River (n=2), both tributaries to the Thompson River and the remaining five Bull Trout were assigned to Fish Creek (n=2), North Fork Fish Creek (n=2), and Meadow Creek (n=1), all tributaries in Region 4.

5.1.1 Timing

Most Bull Trout (14 of 16 ascents) ascended the ladder between April and June, while one Bull Trout was recorded ascending the ladder on August 9, 2013 and another Bull Trout was recorded ascending the ladder on September 18, 2017. Based on data collected between 2011 and 2017, the peak ladder use by Bull Trout (7 of 16 ascents) occurred in May when streamflows ranged from approximately 22,000 to 56,100 cfs and water temperatures ranged from 11.1 to 13.8 ºC. No Bull Trout were detected at the ladder in March, July, or November. Details of the streamflow and water temperature when Bull Trout have entered or ascended the ladder are provided in Figures 5-1 and 5-2 in the *2017 Annual Report* (NorthWestern, 2018). No Bull Trout were detected in the ladder in 2018, thus no changes were made to the results from 2017.

Between 2011 and 2016, all 15 Bull Trout ladder ascents occurred while the ladder operated in orifice mode. In 2011, one Bull Trout, presumably ascending the ladder, was captured in pool 23 during a mode switch from orifice to notch mode (H. Carlsmith, FWP, personal communication, August 20, 2017). The Bull Trout recorded in 2017 represented the first Bull Trout to ascend the ladder in September and ascend in notch mode.

Table 5-1. Summary of 15 individual Bull Trout that ascended the ladder, 2011-2017. No Bull Trout detected or recorded in the ladder in 2018.

Date	Length (mm)	Weight (g)	Water Temp (°C)	USGS #12389000 Mean Daily Streamflow (cfs)	Most likely population of Origin	Detections (updated January 2019)
4/13/2011	365	364	6.6	24,500	WF Thompson River (R4)	Released live upstream of TFalls Dam; no additional detections
4/26/2011 5/21/2012	547 563	1438 1404	7.8 11.1	25,900 56,100	Fishtrap (R4)	4/26/2011 captured in ladder pool 23 during switch in weir mode operations – did not ascend to the holding pool in 2011; 5/21/2012 ascended to holding pool **Mortality** (jumped out of pool)
5/15/2012	510	1172	11.3	51,000	Meadow Ck (R4)	5/31/2011 first observed below TFalls Dam electrofishing; 5/15/2012 ascended TFalls Ladder and released live upstream of TFalls Dam; 7/7/2013–8/13/2013 detected downstream of TFalls Dam by Avista in Prospect Creek
4/30/2013	598	2306	8.9	25,100	Fish Ck (R4)	Released live upstream of TFalls Dam; no additional detections
5/6/2013	576	1694	10.6	24,000	Fishtrap (R4)	Released live upstream of TFalls Dam; 9/21/2014 detected downstream of TFalls Dam by Avista in Prospect Creek; 5/5 & 5/13/2015 detected in the lower pool in the Thompson Falls fish ladder
5/7/2013	478	978	11.3	25,000	Fishtrap (R4)	Released live upstream of TFalls Dam; no additional detections
6/7/2013	596	1926	15.5	38,100	Fishtrap (R4)	Released live upstream of TFalls Dam; no additional detections
8/9/2013	482	1058	22.3	8,680	Fishtrap (R4)	Released live upstream of TFalls Dam; no additional detections
5/16/2014	523	1264	10.8	44,000	Fish Ck (R4)	Released live upstream of TFalls Dam; 10/13/2014 recaptured during 2014 annual reservoir monitoring led by FWP in Noxon Reservoir on via gillnet **(Mortality)**
5/17/2015	519	1334	12.9	26,400	Fishtrap (R4)	Released live upstream of TFalls Dam; 6/2/2015 recaptured (543mm, 1348g) during 2015 FWP electrofishing in Big Hole Section of Thompson River and released live in Thompson River

Date	Length (mm)	Weight (g)	Water Temp (°C)	USGS #12389000 Mean Daily Streamflow (cfs)	Most likely population of Origin	Detections (updated January 2019)
6/3/2015	520	1112	15.6	29,900	Fishtrap (R4)	Released live upstream of TFalls Dam; 7/15/2015 detected in West Fork Thompson River
4/18/2016	413	602	9.7	19,500	Fishtrap (R4)	4/18/2016 released live upstream of TFalls Dam; **10/2/2016 detected in the lower pool in the Thompson Falls fish ladder**
5/18/2016	615	1934	13.4	29,500	NF Fish Ck (R4)	5/18/2016 released live upstream of TFalls Dam; 9/18-19, 9/21, 9/24, 9/26-18 (2016) detected in the Thompson River; 9/20/2017 detected in Graves Creek (entered and exited system on the same day)
6/6/2016	618	1950	17.0	32,000	NF Fish Ck (R4)	Released live upstream of TFalls Dam; no additional detections
9/18/2017	408	422	15.1	8,270	West Fork Thompson River (R4)	9/18/2017 released live upstream of TFalls Dam; 10/23/2017 detected In Thompson River

5.1.2 Ladder Detections

As discussed earlier in this report, fish detections in the ladder require a fish to have a unique PIT-tag. The majority of fish detected in the ladder were initially tagged after ascending the ladder.

With respect to Bull Trout, 14 Bull Trout were initially tagged at the ladder after their first ascent and one Bull Trout that ascended the ladder was initially tagged during an electrofishing survey downstream of the Thompson Falls Dam. In 2011, 2012, and 2014, the Licensee PIT-tagged six Bull Trout downstream of Thompson Falls Dam and one of the six Bull Trout entered and subsequently ascended the ladder (NorthWestern, 2018).

Other sources of PIT-tagged Bull Trout in the system originate from Avista's tagging efforts downstream of the Project or from Glaid's (2017) study of juvenile Bull Trout in the Thompson River, upstream of the Project.

The total number of Bull Trout entering the ladder and ascending the ladder is a minimum value because no data are available for untagged fish that may enter the ladder and not ascend to the top. Table 5-2 summarizes the 24 Bull Trout known to have entered the ladder and the 16 Bull Trout that ascended to the top of the ladder since 2011. If an untagged Bull Trout ascended to the top of the ladder, it was included in the total number of fish that entered the ladder.

Table 5-2. The number of Bull Trout enter ladder and the number of Bull Trout that ascend to the top of the Thompson Falls fish ladder annually, 2011-2018.

Year	Number of Bull Trout	
	Enter Ladder	Ascend to Top of Ladder
2011	2	2
2012	2	2
2013	5	5
2014	1	1
2015	7	2
2016	6	3
2017	1	1
2018	-	-
Total	24	16

There were eight PIT-tagged Bull Trout that entered the ladder and did not ascend, five fish in 2015 and three fish in 2016 (Table 5-2). Five of these bull trout were genetically assigned to Region 4, two Bull Trout were genetically assigned to Region 3, and one Bull Trout was genetically assigned to Region 2. The Bull Trout genetically assigned to Region 2 was initially captured as a

juvenile in Prospect Creek, Region 3. The history of these fish includes the following (NorthWestern, 2018):

- Two Bull Trout were initially tagged after previously ascending the Thompson Falls fish ladder and were returning fish that did not ascend.
- Two Bull Trout were initially PIT-tagged as juveniles in either Graves or Prospect creeks by Avista.
- One Bull Trout was initially PIT-tagged as an adult in Prospect Creek by Avista.
- One Bull Trout was initially PIT-tagged downstream of Cabinet Gorge Dam by Avista and transported and released into Graves Creek.
- Two Bull Trout were initially PIT-tagged downstream of Cabinet Gorge Dam by Avista and transported upstream of Thompson Falls Dam to the Thompson River drainage 2-years prior to each fish's respective detection in the Thompson Falls fish ladder.

5.2 Baseline Fisheries Surveys

The Licensee has recorded 17 individual Bull Trout during annual spring and fall baseline fisheries surveys upstream of Thompson Falls Dam and electrofishing surveys immediately downstream of Thompson Falls Dam since 2011 (Table 5-3). One of the fish initially captured and tagged downstream of Thompson Falls Dam electrofishing in 2011 was later recorded ascending the ladder in 2012.

The enumeration of fish at Thompson Falls fish ladder and baseline fisheries studies since 2011 has resulted in 33 Bull Trout (*representing 31 individuals*) sampled by the Licensee since 2011. Note the number of individuals was corrected from 32 individuals reported in the *2017 Annual Report* (NorthWestern, 2018) to 31 individuals due to one Bull Trout (PIT ID# 98512021877906) counted twice. There were 17 individual Bull Trout sampled in the Project area excluding the ladder. However, one of those Bull Trout is also represented in the 15 individual Bull Trout recorded ascending the ladder. Therefore, there are only 31 unique individual fish sampled in the Project area. It is also important to note that the summary of Bull Trout in Tables 5-1 and 5-2 in the *2017 Annual Report* (NorthWestern, 2018) is correct and account for all sample events, including individual fish sampled more than once, and remain unchanged in this report.

Table 5-3. Summary of 17 individual Bull Trout sampled during baseline fisheries surveys or electrofishing downstream and upstream of Thompson Falls Dam, 2011-2016. No Bull Trout sampled in 2017 or 2018. NA – not any.

Initial Date Captured	Length (mm)	Weight (g)	PIT Tag #	Method & Location	Most Likely Population of Origin	Subsequent Detection Date(s)	Location(s)
Bull Trout Sampled Downstream of Thompson Falls Dam							
5/31/2011	482	966	985121021877906	Spring EF Downstream TFalls Dam	Meadow Creek (R4)	5/15/2012; 7/7/2013	TFalls Ladder Prospect Ck
5/31/2011	180	50	985121021907887	Spring EF Downstream TFalls Dam	Fishtrap Creek (R4)	NA	
5/31/2011	247	130	985121021914545	Spring EF Downstream TFalls Dam	Fishtrap Creek (R4)	NA	
4/10/2012	272	150	985121027393272	Spring EF Downstream TFalls Dam	Graves Creek (R3)	NA	
4/7/2014	520	1500	No PIT Tag (no genetics)	Spring EF Downstream TFalls Dam	NA	NA	
5/28/2014	567	1640	985121021203256 982000357016106	Spring EF Downstream TFalls Dam (initial tagging by Avista LCFR-ID and released to Vermilion Bay 6/2/2011 with radio tag 38 frequency 148.500)	Fishtrap Creek (R4)	9/18/2014	Prospect Ck
6/3/2014	509	1224	982000357016241	Spring EF Downstream TFalls Dam	Fishtrap Creek (R4)	NA	
Bull Trout Sampled Upstream of Thompson Falls Dam							
4/16/2012	222	76	985121027360192	Spring EF Lower Section – TFalls Reservoir	Fishtrap Creek (R4)	NA	
4/17/2012	260	140	985121027402995	Spring EF Upper Section – TFalls Reservoir	Fishtrap Creek (R4)	NA	
10/30/2012	472	800	982000357016135	Autumn EF Paradise – Plains	Monture Creek (R4)	NA	
10/30/2012	444	678	982000357016066	Autumn EF Paradise – Plains	Fish Creek (R4)	NA	
4/10/2013	260	108	982000357016097	Spring EF Upper Section – TFalls Reservoir	Fishtrap Creek (R4)	NA	

Initial Date Captured	Length (mm)	Weight (g)	PIT Tag #	Method & Location	Most Likely Population of Origin	Subsequent Detection Date(s)	Location(s)
4/15/2014	577	1446	900226000035846	Spring EF Upper Section – TFalls Reservoir (initial tagging by Avista Below Cabinet Gorge Dam & transport to R4, 6/9/2013)	Fishtrap Creek (R4)	NA	
10/28/2014	315	260	982000357016111	Autumn EF Paradise – Plains	NF Jocko (R4)	NA	
4/13/2015	219	88	989001004067249	Spring EF Upper Section – TFalls Reservoir	Fishtrap Ck (R4)	NA	
10/20/2015	651	1966	900226000730577	CFR – Above Islands (initial tagging by Avista Below Cabinet Gorge Dam & transport R4 4/14/2015)	Fishtrap Ck (R4)	NA	
4/11/2016	247	124	989001005372235	Spring EF Upper Section – TFalls Reservoir	WF Thompson River (R4)	NA	

5.3 Genetic Assignments

Genetic samples of Bull Trout collected in association with the Project, were submitted to Abernathy Fish Technology Center Conservation Genetics Laboratory (Abernathy) for analysis. The summary Tables 5-1 and 5-3 include the respective genetic assignment for each Bull Trout sampled by the Licensee. Since the 2016 Annual Report (NorthWestern, 2017), one Bull Trout (#989001005372235) genetic sample was reanalyzed and the updated genetic assignment (now West Fork Thompson River, Region 4) is included in Table 5-3. The initial genetic assignment for this Bull Trout was the East Fork Bull River (Region 2). Historic data indicate FWP collected Bull Trout eggs in the Bull River in 1942 and 1944, Creston National fish hatchery incubated eyed eggs and stocked fingerlings in the Thompson River basin (Pratt and Huston, 1993). This historical stocking event may explain the genetic assignment of this Bull Trout to Region 2 (Bull River drainage) even though the fish is known to originate in Region 4. Therefore, because the Bull Trout was sampled in Region 4 in the upper section of the Thompson Reservoir and had no history downstream of Thompson Falls Dam, the sample was reanalyzed for genetic assignment. However, in the second analysis, Regions 3 and 4 tributaries were included as potential streams of origin and the analysis resulted in a genetic assignment of Prospect Creek (Region 3) as the most likely population of origin and West Fork Thompson River (Region 4) as the second most likely population of origin (Adams et al., 2017). After further discussions with Avista and Abernathy regarding the origin of the Bull Trout in Region 4, the analysis was analyzed a third time and only included Region 4 tributaries with the genetic assignment result identifying West Fork Thompson River as the most likely population of origin (S. Bernall, Avista, personal communication, January 29, 2018). The third and most recent population assignment is reflected in Abernathy's 2017 report (Adams et al., 2018).

5.4 Downstream Detections, Prospect and Graves Creek

Prospect Creek is about a half-mile downstream of the Main Dam and Graves Creek is about 8 miles downstream of Thompson Falls Dam. Prospect Creek has periodically had a tag array system operating in the drainage with a new system installed in 2018. Fish movement in Graves Creek is monitored by Avista via a remote array system and juveniles trapping program.

Six individual Bull Trout that ascended the ladder and were released upstream of Thompson Falls Dam were subsequently detected downstream of the dam, either re-entering the ladder (in one instance in the same year, 2016), in Noxon Reservoir, and/or in Prospect or Graves Creek (*see* Table 5-1). Three Bull Trout were detected re-entering the ladder with one fish ascending the ladder a second time. One of the Bull Trout that re-entered the ladder and did not ascend the ladder and was later detected in Prospect Creek. A second Bull Trout was also detected in Prospect Creek. Of the remaining two Bull Trout, one was detected in Graves Creek and one Bull Trout was captured in Noxon Reservoir.

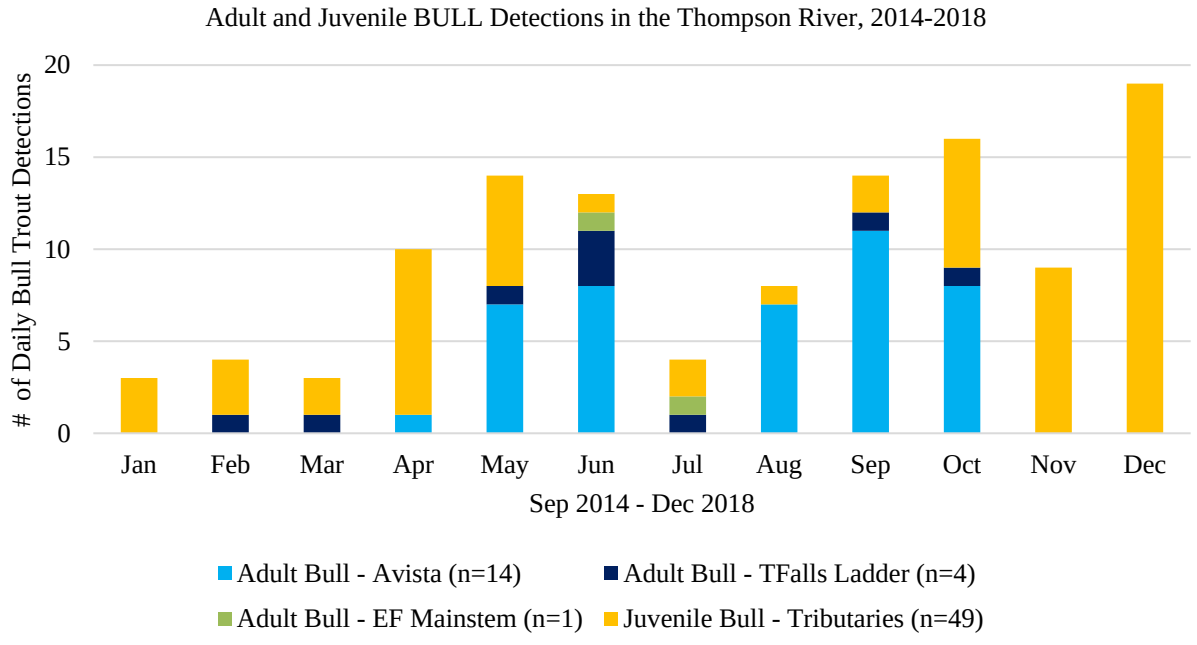
5.5 Upstream Detections, Thompson River

Between 2014 and 2018, there were 122 daily Bull Trout detections in the mainstem Thompson River representing 68 unique fish, 19 adults and 49 juveniles/sub-adults (Figure 5-1). These Bull Trout represent 49 juveniles that were initially captured and tagged in the tributaries, Fishtrap Creek or West Fork Thompson River; four adult Bull Trout that ascended the Thompson Falls fish ladder and were released upstream; 14 adult Bull Trout Avista transported from downstream of Cabinet Gorge Dam upstream to Region 4 (and some upstream in the Thompson River); and one adult Bull Trout (775 mm) caught electrofishing in the mainstem Thompson River.

As previously mentioned, the arrays system in the Thompson River does not provide directionality but the data do provide some indication of when Bull Trout are in the mainstem Thompson River and near the confluence of the Clark Fork River. The data collected from September 2014 through December 2018 indicate juvenile Bull Trout are moving in the mainstem in all months but are more common in the mainstem Thompson River in the spring (April-May) and late-fall to early winter (October - December). These detections support observations of spring and fall emigration similar to pulses of juveniles in Trestle Creek (Idaho) into Lake Pend Oreille (Idaho), more than 65 miles downstream of the Project (Downs et al., 2006). However, a recent study on Bull Trout juvenile out-migration in the Thompson River drainage found a large proportion of juvenile Bull Trout overwintered in the Thompson River (Glaid, 2017).

In contrast to juvenile presence in the mainstem, adult Bull Trout have not been detected between November and January and were most commonly detected later in the spring (May-June) and late summer to early fall (August-October).

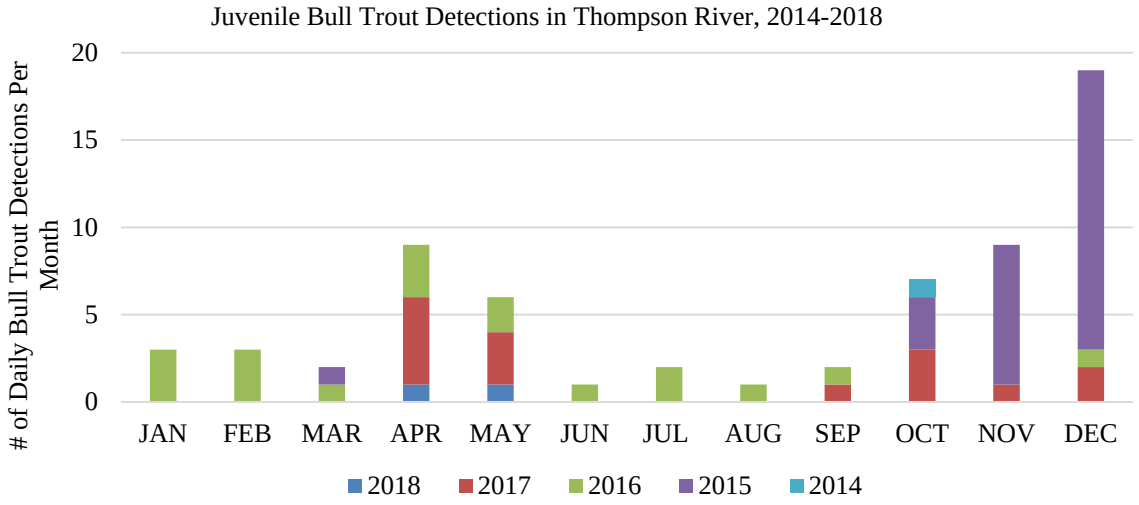
Figure 5-1. Depicts daily Bull Trout detections in the Thompson River, 2014-2018. (Note: EF = electrofishing)



Most of the tagged-juvenile Bull Trout in Fishtrap and West Fork Thompson River were initially PIT-tagged in 2014 and 2015 in support of the juvenile out-migration study (Glaid, 2017). In total there were 754 juveniles PIT-tagged in 2014 and 2015 (NorthWestern, 2018). Since then, FWP has continued to PIT-tag juveniles in subsequent years but on a much-reduced scale. The juvenile Bull Trout detections in the Thompson River by year are shown in Figure 5-2. The majority (44%) of the detections occurred in 2015, then in 2016 (28%) and in 2017 (23%). There were very few juveniles detected in 2014 (2%) or in 2018 (3%).

Two juvenile Bull Trout initially captured and tagged in Fishtrap Creek, located upstream of Thompson Falls Dam in 2015 were detected downstream of Thompson Falls Dam; one in Prospect Creek in 2018 (*see* Table 4-4) and one in Graves Creek in March 2016.

Figure 5-2. Summary of the juvenile Bull Trout detections by month, 2014-2018. A total of 64 juvenile Bull Trout detections representing 49 unique fish.



5.6 Avista's Upstream Bull Trout Passage Program

Avista continued their trap and haul upstream fish passage program in 2018. Bull trout captured downstream of Cabinet Gorge Hydroelectric Project were genetically tested using rapid response genetic identification methodology (Adams et al., *in prep*). The rapid response genetic testing provides population assignment within 24 hours after receipt of fish tissue samples. The analysis predicts, with varying degrees of confidence, the natal stream of origin of each Bull Trout. The genetic results help guide decisions on transport or release of Bull Trout. Bull trout with a genetic assignment upstream of the Thompson Falls Hydroelectric Project are referred to as "Region 4" fish.

A summary of the total number of Bull Trout captured annually since 2009 downstream of Cabinet Gorge Dam, genetically assigned to Region 4, and transported to Region 4 (Thompson River drainage or other locations) is provided in Table 5-4 (J. Johnson, Avista, personal communication,

2018; Bernall and Duffy 2018). The number of individual Bull Trout recorded ascending the Thompson Falls fish ladder between 2011 and 2018 is also included in Table 5-4.

Table 5-4. Summary of adult Bull Trout (≥ 300mm) captured by Avista downstream of Cabinet Gorge Dam, genetically assigned to Region 4 (R4) and transported to Region 4 since 2009, and Bull Trout ascending Thompson Falls fish ladder from 2011-2018.

Year	# Below Cabinet Gorge Dam	# Genetically Assigned R4	# Transported to R4 (Between TFalls Dam and the Thompson River Drainage)	# Transported R4 Locations upstream of Thompson River	# of Bull Trout ascending TFalls Ladder (not Avista transport fish)
2018	**64**	**7**	**4**	**1**	**-**
2017	48	6	4	1	1
2016	26	2	2	-	3
2015	54	11	7	2	2
2014	75	15	10	2	1
2013	47	12	7	1	5
2012	40	11	8	-	2
2011	64	18	4	1	2
2010	35	11	9	-	NA
2009	47	13	6	6	NA
Average	**50**	**11**	**6**	**1**	**2**
Total	**500**	**106**	**61**	**14**	**16**

Not all Bull Trout genetically assigned to Region 4 were transported to Region 4. For example, some Bull Trout were initially captured by Avista as juveniles in other regions (downstream of Region 4) and thus after being recaptured downstream of Cabinet Gorge Dam were transported and released to their natal stream even if the genetic assignment was Region 4 (S. Bernall, Avista, personal communication, 2017). In addition, if Bull Trout did not meet the minimum length requirement of ≥350 mm, they were not transported upstream.

In 2011, there were 11 Bull Trout captured downstream of Cabinet Gorge Dam between April 19 and July 5 and genetically assigned to Region 4. However, these fish were transported and released in Region 3 (near the Vermilion River), approximately 22 river miles downstream of Thompson Falls Dam, to monitor and evaluate movement to the Thompson Falls fish ladder. Seven of the 11 Bull Trout were redetected in 2011, including five Bull Trout downstream of the release location (one fish detected near Marten Creek, two fish detected near or in Graves Creek, two fish detected downstream of Noxon Rapids Dam) and two Bull Trout upstream of the release location in/near Prospect Creek (located immediately downstream of Thompson Falls Dam). Four Bull Trout were never detected again after their release in Region 3. One of the Bull Trout detected in Prospect Creek was also detected immediately downstream of the Main Dam at Thompson Falls Dam when flows exceeded 70,000 cfs in early June 2011 at a time when the fish ladder was closed.

Thompson Falls fish ladder was closed between May 25-June 20; June 25-July 10; July 14 – August 21 during the 2011 season. Extreme high streamflows reduced ladder operations. None of the 11 Bull Trout released 22 miles downstream of Thompson Falls Dam in Vermilion Bay were detected in the ladder in 2011.

5.6.1 Avista's Upstream Transport of Bull Trout in 2018

In 2018, Avista captured 64 unique adult Bull Trout (≥ 300 mm) downstream of the Cabinet Gorge Hydroelectric Project. There were seven Bull Trout genetically assigned to Region 4 however, two fish were initially captured as juveniles in Graves Creek and thus were transported back to Graves Creek (Region 3). A total five Bull Trout were transported upstream to Region 4 (upstream of Thompson Falls Dam) (J. Johnson, Avista, personal communication, November 6, 2018). The five Bull Trout transported to Region 4 were released in the Thompson River at ACM bridge (n=4) and the Thompson Reservoir at the Salish Shore boat ramp (n=1).

A summary of Bull Trout captured downstream of Cabinet Gorge Dam between 2009 and 2018 and genetically assigned to Region 4 and transported to Region 4, and in some instances Region 3 is provided in Table 5-5. A summary of Avista's Upstream Fish Passage Program from 2018 is available in Bernall and Duffy (*in prep*.).

Table 5-5. Summary of the Bull Trout captured by Avista downstream of Cabinet Gorge Dam in 2018 assigned to Region 4 and released in Region 3 or 4 (S. Bernall and J. Johnson, Avista, personal communication 2018). Note: EF = electrofishing, LCFR = Lower Clark Fork River. Subsequent detections from radio telemetry and remote array stations.

Capture Date	Capture Method	Length (mm)	Weight (g)	Release Date	Release Site	Most Likely Pop. of Origin	Subsequent Detections (January 2019)
5/3/2018	Night E-fish	682	3314	5/9/2018	Thompson River – ACM Bridge	Fishtrap Creek	5/30 & 6/3/18 Thompson River; 10/1/18 Fishtrap; 10/2/18 Thompson River
6/14/2018	Night E-fish	532	1426	6/15/2018	Graves Creek (Region 3) – hole below weir trap (juveniles transport from Graves 11/3/13	West Fork Thompson River	NA
7/1/2018	Night E-fish	626	2236	7/5/2018	Thompson River – ACM Bridge	Fishtrap Creek	9/23/18 Fishtrap 10/9/18 Thompson River
7/12/2018	Night E-fish	744	3796	7/13/2018	Graves Creek (Region 3) -hole below weir trap (juvenile transport form Graves 10/24/14	North Fork Jocko River	NA
7/17/2018	Night E-fish	553	1398	7/20/2018	Thompson River – ACM Bridge	West Fork Thompson River	NA
8/14/2018	Night E-fish	601	1996	8/17/2018	Thompson River – ACM Bridge	West Fork Thompson River	10/3/18 Thompson River
10/1/2018	Cabinet Gorge Hatchery Fish Ladder	631	2336	10/1/2018	Thompson Reservoir – Salish Shore boat ramp	South Fork Little Joe Creek	NA
4/21/2016	LCFR-ID Night EF	592	2466	4/27/2016	Thompson Reservoir @ Cherry Creek boat ramp		

6.0 Total Dissolved Gas Monitoring

In 2010, the *Total Dissolved Gas Control Plan* (TDG Control Plan) (PPL Montana, 2010a) for the Thompson Falls Hydroelectric Project (Project) was submitted to the Montana Department of Environmental Quality (MDEQ). NorthWestern proposes to continue to collaborate with the MDEQ, Avista, FWP, and other entities with a long-term goal of reducing the overall systemic gas supersaturation levels in the Clark Fork River, occurring from a point downstream of the Project to below Albeni Falls Dam per the TDG Control Plan.

In typical years, NorthWestern makes the decision whether to monitor TDG in consultation with the TAC agencies based upon runoff forecasts on April 1, annually. The Licensee has set up the following protocol for Total Dissolved Gas (TDG) monitoring:

- Consult with the TAC agencies regarding monitoring TDG depending on the Natural Resources Conservation Service (NRCS) runoff forecasts on April 1, annually
- If the April 1 forecast is for runoff at or above 125 percent of normal, the Licensee will monitor for TDG
- If the April 1 forecast is for runoff below the 125 percent of normal, the Licensee will not monitor for TDG
- The final decision to be made by the FWS and MDEQ in consultation with the Licensee

NorthWestern notified the TAC via email on April 20, 2018 that based on DNRC's runoff forecast exceeding the 125 percent threshold, NorthWestern would be monitoring TDG. In addition, with the ongoing construction and installation of two new radial gates on the Main Dam in 2018, NorthWestern would be operating a modified spill schedule opening the Dry Channel Dam spillway first and then the Main Dam spillway.

The two spillways (Main Dam and Dry Channel) at the Project have removable panels that are 4-foot by 8-foot and can be lifted with a crane-mounted on the spillway. These are used to pass routine amounts of spill during the runoff season. However, for exceptionally high discharges, the dam operators can trip the stanchions on the spillway and open an additional panel to pass high water. This is rarely done (roughly once every 10 years or less), as it is generally unnecessary and requires drawing the reservoir down to crest to repair the stanchions and return the spillway to its typical operating configuration. In 2018, as a result of extreme high flow and debris, the stanchions were tripped (removed) on the Dry Channel Dam on May 9 and additional stanchions were tripped on the Main Dam on May 12.

6.1 TDG Monitoring Methods

The Licensee has monitored TDG in the Clark Fork River in the Project area for 13 years between 2003 and 2018. All field work and data gathering are conducted by the Licensee's personnel.

Hydrolab Series 4 and 5 DataSondes fitted with TDG sensors and are used to collect TDG data. DataSonde TDG sensors are calibrated by the manufacturer, Hydrolab, every 2 to 3 years. At the beginning of the year, TDG sensors are compared to each other for accuracy and calibrated within 1 millimeter of mercury (mmHg) of each other, if necessary. Sensor membranes are pressure tested to approximately 1,000 mmHg at the beginning of the spill season. Each membrane is used once during the spill season.

TDG is monitored during the high flow season, typically from April until July, with exact dates varying slightly every year. In 2018, TDG was monitored from April 19 to July 18. Deployment periods for the DataSonde units were 3 to 4 weeks. Biological and sediment fouling is not a problem at the water temperatures found at the Project site over this length of time. All parameters including pH, specific conductivity, dissolved oxygen, and turbidity are calibrated at the beginning of each deployment period. During calibrations, sensors are cleaned, and batteries replaced. Time and date are checked. The stated accuracy of the TDG sensor is +/- 1.5 mmHg over a range of 400 to 1,400 mmHg.

Barometric pressure (BP) is measured by an Onset Computer Corp HOBO Microstation Barometric Pressure Smart Sensor with a stated error of +/- 1.5 millibar (mbar) = 1.1 mmHg at 25˚C and a maximum error of +/- 2.5 mbar = 0.9 mmHg over the temperature range -10˚C to +60˚C. The barometer is located at the fish ladder in the storage shed.

Monitoring sites have varied in some years, but in 2018 the sites monitored were 1) Above Dam, 2) High Bridge, and 3) Birdland Bay Bridge (Figure 6-1). The High Bridge monitoring site captures information on TDG at a location that is downstream of the Main Dam spillway and the falls but is upstream where the Dry Channel Dam spill enters the river channel. The Birdland Bay Bridge monitoring site captures information on the level of TDG entering Noxon Rapids Reservoir. The Birdland Bay Bridge and High Bridge sensors suffered failures during some periods during the 2018 monitoring season. However, the data recovery is sufficiently complete to draw conclusions on TDG in the Clark Fork River during 2018.

No electrofishing was conducted in the Thompson Falls tailrace during the 2018 spill period to monitor for potential gas bubble trauma (GBT) in fish. During the TDG monitoring period (April 19 – July 18), the ladder was open and operational for 23 days (April 19 – 30; June 8 – 18) with 11 ladder checks resulting in 22 fish (15 RB, 5 WCT,1 RBxWCT, 1 LL). No GBT was noted in any of the fish monitored at the fish ladder during the spill period.

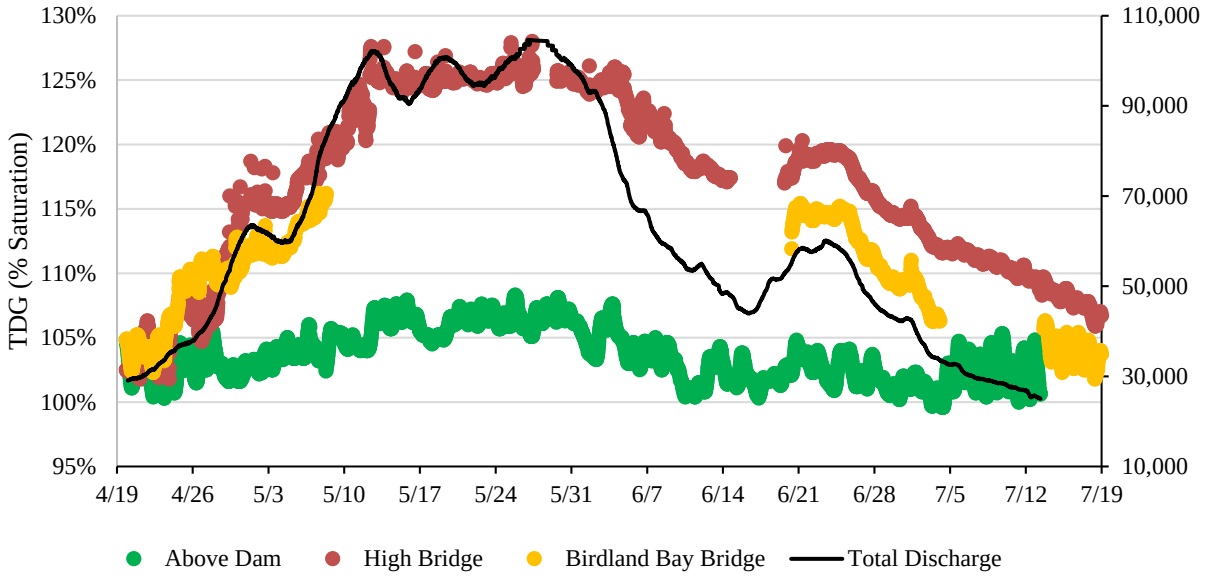
Figure 6-1. Monitoring locations for total dissolved gas at the Thompson Falls Hydroelectric Project site.

6.2 2018 TDG Monitoring Results

Peak discharge in the Clark Fork River in the Project area in 2018 was higher than the long-term average of 60,000 cfs (*refer to* Figure 3-1), reaching approximately 104,640 cfs on May 26, 2018 (as measured by the sum of the flow measured by USGS at Plains, Montana Station #12389000 and in the Thompson River at Thompson Falls, Montana Station #12389500). Similar to past years, TDG in 2018 was lowest upstream of the Project, highest at the first measurement site downstream of the Project (at the High Bridge), and intermediate at the most downstream site at the Birdland Bay Bridge (Figure 6-2). TDG levels declined downstream of the High Bridge as a result of mixing with river flow coming through the powerhouse and, potentially, some degassing as the river moves downstream.

TDG upstream of the Project peaked at approximately 108 percent of saturation during 2018. TDG levels at the High Bridge approached 127 percent of saturation. The peak TDG at the Birdland Bay Bridge site is unknown as the sensor was not operating during peak discharge at that site.

Figure 6-2. Total Dissolved Gas (% of saturation) and discharge (cfs) as measured by the U.S. Geological Survey in the Clark Fork River upstream and downstream of the Thompson Falls Hydropower Project in 2018.



In 2018, the mean TDG at discharge was within the range observed in previous years. Tables 6-1 and 6-2 describe maximum and mean TDG over a range of discharge for each year of the study. Maximum and mean TDG at the Birdland Bay Bridge was comparable to previous years.

Table 6-1. Maximum TDG recorded over a range of discharge at the Birdland Bay Bridge on the Clark Fork River, Montana. 2003-2018.

Total Flow (thousand cfs)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014	2017	Mean 2003-2017	2018
>23, <30	111.5	109.6	107.6	106.7	105.6	113.1	109.5	106.0	107.6	103.6	104.1	106.0	107.6	106.2
>30, <40	112.6	109.2	112.7	111.1	108.3	114.8	108.9	111.3	108.3	107.7	107.0	107.8	110.0	111.0
>40, <50	111.1	108.9	113.3	115.0	112.8	115.3	112.9	113.8	109.0	111.3	111.3	112.3	112.3	112.1
>50, <60	113.9	N/A	114.4	116.7	N/A	119.5	114.6	113.2	112.4	116.3	115.3	117.5	115.4	115.4
>60, <70	114.0	N/A	115.1	117.0	N/A	118.2	113.1	N/A	116.4	116.0	116.9	117.9	116.1	115.2
>70, <80	114.1	N/A	114.0	117.0	N/A	116.6	N/A	N/A	116.9	115.8	117.4	118.0	116.2	116.2
>80, <90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	120.8	112.6	118.7	118.0	117.5	116.2
>90, <100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	122.3	N/A	N/A	N/A	N/A	N/A
>100, <110	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	121.8	N/A	N/A	N/A	N/A	N/A
>110, <120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	121.7	N/A	N/A	N/A	N/A	N/A

Table 6-2. Mean TDG recorded over a range of discharge at the Birdland Bay Bridge on the Clark Fork River, Montana, 2003-2018.

Total Flow (thousand cfs)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014	2017	Mean 2003-2017	2018
>23, <30	102.1	103.5	103.6	103.6	102.5	102.2	102.6	102.0	102.9	102.3	102.7	103.0	102.7	104.0
>30, <40	104.7	105.0	107.1	106.7	105.2	105.6	105.2	106.6	105.8	104.4	104.7	105.2	105.5	106.8
>40, <50	109.5	107.5	110.4	110.6	109.0	110.6	109.2	110.9	108.1	108.8	108.6	108.7	109.3	110.1
>50, <60	111.0	N/A	112.7	114.3	N/A	114.9	113.0	111.6	111.0	111.2	111.5	113.9	112.5	113.3
>60, <70	112.9	N/A	114.1	115.7	N/A	116.0	113.1	N/A	113.5	113.0	114.8	115.2	114.3	112.5
>70, <80	113.2	N/A	114.0	115.7	N/A	115.9	N/A	N/A	116.0	112.7	115.4	115.6	114.8	115.0
>80, <90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	116.8	112.5	116.2	116.6	115.5	115.7
>90, <100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	119.7	N/A	N/A	N/A	N/A	N/A
>100, <110	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	120.6	N/A	N/A	N/A	N/A	N/A

Typically, TDG downstream of the Project increases with increasing flow, up to about 60,000 cfs. At flows higher than 60,000 cfs, TDG downstream of the Project continues to increase, but a lower rate. In 2011, an unusual pattern was detected in the TDG measurements at the highest level of river discharge at both the Birdland Bay Bridge and the High Bridge where some TDG measurements were noticeably higher than others at the same level of discharge. The reason for this anomaly cannot be determined with certainty; however there appears to have been a change in TDG after peak discharge occurred on June 9, 2011. PPL Montana concluded that it appeared that the tripping of the stanchions may have created a larger plunge of water over the spillway and resulted in increased TDG in the river downstream of the Project (PPL Montana, 2012).

This year (2018) was the first year since 2011 that the stanchions were tripped at the Project. We evaluated the TDG data to assess whether tripping the stanchions in 2018 resulted in higher levels of TDG, similar to the phenomenon in 2011. Figure 6-3 shows TDG by discharge in 2018 at the three measurement locations. Figure 6-4 shows TDG levels by discharge, before and after May 12 when the stanchions on both spillways were pulled. It appears that in 2018, tripping the stanchions resulted in an increase in TDG of about 5 percent at the High Bridge site. The data set is incomplete at the Birdland Bay Bridge site, but the increased TDG levels are apparent at that site as well. Results from 2018 show a similar pattern as was observed in 2011.

Figure 6-3. Total Dissolved Gas (% of saturation) and discharge (cfs) (as measured at the USGS gages at Plains and on the Thompson River), in the Clark Fork River in 2018.

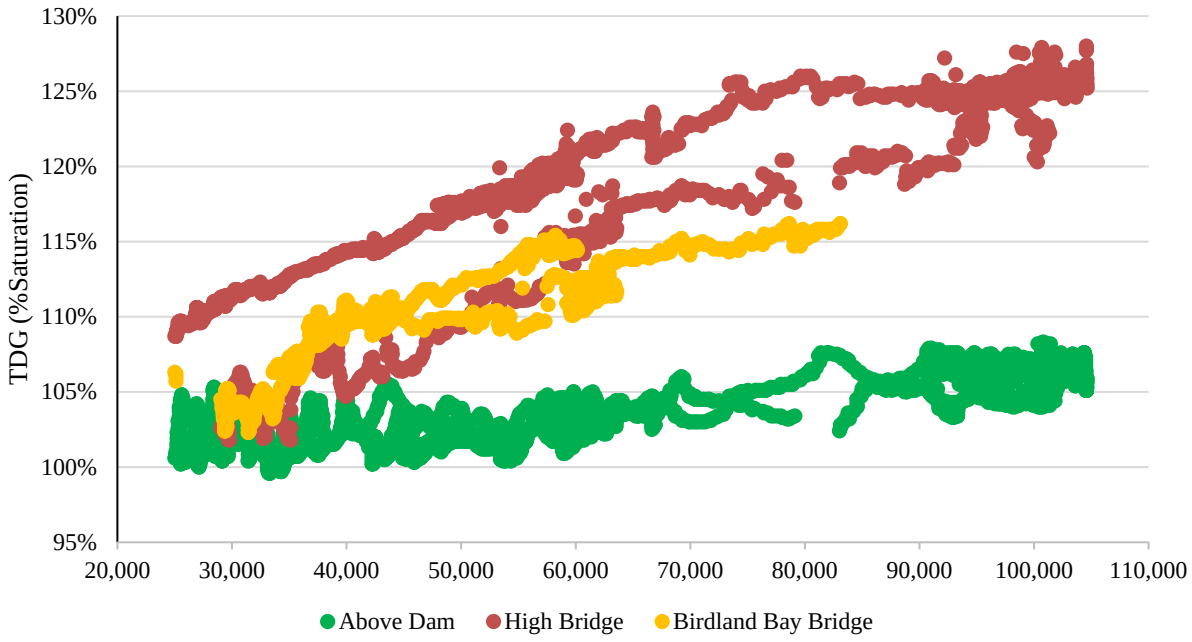
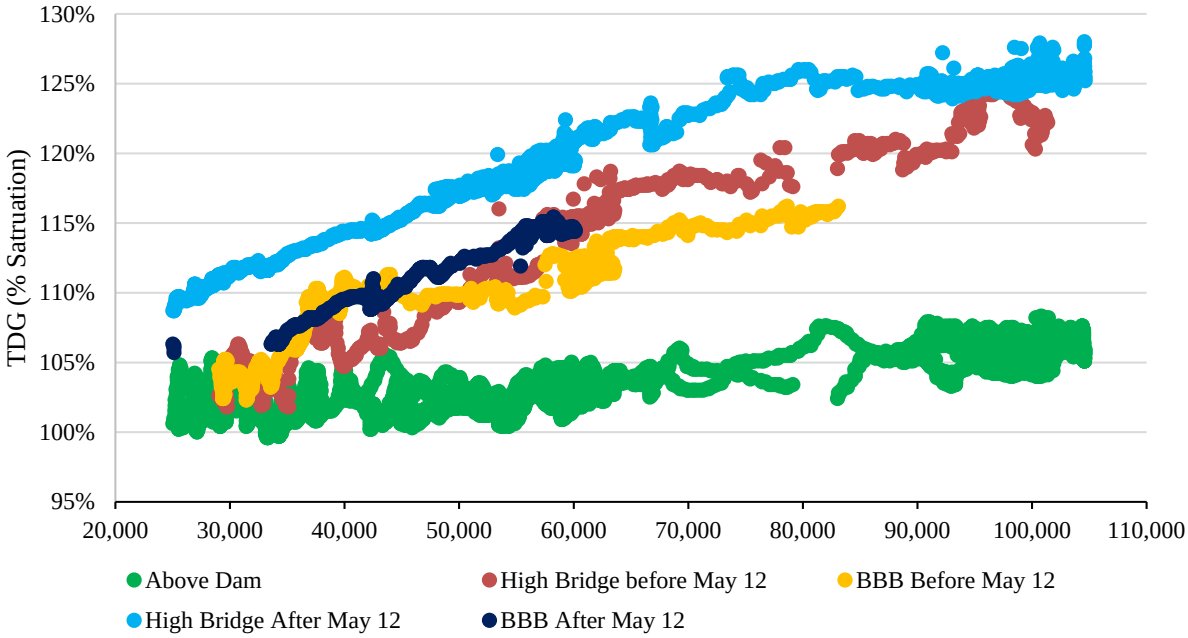


Figure 6-4. Total Dissolved Gas (% of saturation) and discharge (cfs) (as measured at the USGS Gages at Plains and on the Thompson River), in the Clark Fork River in 2018.



NorthWestern completed construction of two new radial gates on the Main Dam in 2018. These new gates were installed, in part, to improve spillway capacity at the Main Dam. This will result in less frequent need to trip the stanchions on the Project's spillways in the future, and thus reduce the frequency that TDG levels will increase from the phenomenon observed in 2011 and 2018.

7.0 TAC Funding

In 2013, the Licensee renewed the Memorandum of Understanding (MOU, 2013) for a 7-year term (January 1, 2014 – December 31, 2020). The MOU was approved and signed by FWS, FWP, CSKT, and the Licensee. The Licensee will provide an Adaptive Management Funding Account (AMFA) designated for implementation of downstream passage minimization measures in addition to Project License required studies, monitoring activities, reports, upstream fish passage minimization measures, gas abatement monitoring, predator control measures, and other means to reducing impacts on Bull Trout caused by operation of the Project. The Licensee will provide $100,000 annually for 7 years and allow a maximum of $250,000 to accrue in a TAC Reserve Account from unspent or transferred annual TAC funds.

7.1 2018 Funded Projects and Status Reports

In 2018, the NorthWestern consulted with FWS and FERC and proposed to modify BO Term and Condition 2 (FWS, 2008) that addresses funding of offsite habitat restoration, or acquisition in important upstream Bull Trout spawning and rearing tributaries, with the purpose of boosting recruitment for juvenile Bull Trout. NorthWestern consulted with FWS and TAC members and agreed it was important to include areas of the Prospect Creek watershed occupied by Bull Trout, a tributary with Bull Trout critical habitat designation located immediately downstream of the Main Dam eligible for TAC funding. FWS also indicated the BO did not need to be modified because Prospect Creek is within the action area analyzed in the 2008 BO. FERC approved the proposed modification in a letter dated May 8, 2018. Thus, the Prospect Creek PIT Tag Array and Crow Creek Reconstruction Design projects proposed during the November 2017 TAC meeting were approved for funding in 2018.

The following projects receiving TAC funding were implemented in 2018:

- Koch Property Acquisition ($60,000)
- Rattlesnake Dam Removal, Phase 1 ($20,000)
- Crow Creek Reconstruction Design ($30,000)
- Beartrap Creek Culvert Removal (approved in 2017, $11,000)
- Prospect Creek PIT Tag Array ($30,000)
- Thompson River Watershed Coordinator ($16,500)
- Bull Trout Genetics Analysis ($10,000)
- Emergency/Contingency Funding ($10,000)

A progress report for each project is provided in Appendix B.

7.2 2019 Proposals Approved for TAC Funding

NorthWestern facilitated the annual Thompson Falls TAC meeting on November 28, 2018. The TAC approved funding for the following projects:

- Rattlesnake Dam Removal, Phase 2 ($50,000)
- Crow Creek Reconstruction Phase 2 ($51,500 max)
- West Fork Fishtrap Creek Road Realignment ($30,627)
- Thompson River Watershed Coordinator ($9,900)
- Emergency/Contingency Funding, includes Bull Trout genetic analysis and Prospect Creek PIT tag array maintenance ($10,000)

The project proposals approved for TAC funding in 2019 are included in Appendix C. A progress report for each project will be provided and included in the next annual report.

8.0 Compliance with the Biological Opinion

8.1 Compliance with Terms and Conditions of the BO

A summary of the FWS's BO Terms and Conditions (TCs) 1 through 7 is provided in Table 8-1. The table includes the BO's TC followed by a statement describing the Licensee's actions of compliance. The language in the BO (FWS, 2008) refers to PPL Montana, the Licensee at the time the BO was prepared. All references to PPL Montana and compliance requirements in the BO apply to NorthWestern. As of November 18, 2014, NorthWestern is the Licensee of the Thompson Falls Hydroelectric Project (FERC No. 1869) and is responsible for compliance with the TCs in the BO.

Table 8-1. Summary of FWS's Biological Opinion (2008) Terms and Conditions (TC) 1 through 7 and compliance status by the Licensee.

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 1 - Upstream Passage		
TC 1(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).	Activity is Complete
TC 1(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.	Activity is Complete
TC 1(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.	Activity is Complete -The FERC approved the Licensee's Thompson Falls Fish Ladder – Fishway Operations Manual 1.0 (SOP) in an Order issued on June 17, 2011.
TC 1(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.	NorthWestern will continue funding for the ladder and operate the facility in conformance with the approved SOP.
TC 1(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 Hydroelectric Project. 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.	The Licensee provides annual funding in support of genetic testing for Bull Trout in the vicinity of the Project.
TC 1(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	To date, fish transport via vehicle has not been requested or identified as a need. The Licensee will

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
	Bull Trout that is captured at Thompson Falls Hydroelectric Project and determined by the SOP to require transport to upstream waters.	continue to evaluate this need and provide support as appropriate annually.
TC 1(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.	The Licensee developed and submitted the FWS-approved *Fish Passage Evaluation Plan*, *Phase 2 Action Plan, 2011-2020* (PPL Montana, 2010) to FERC on October 14, 2010. FERC issued an Order approving the Evaluation Plan on June 9, 2011. Data collected annually at the ladder is summarized and reporting in the Annual Report that is approved by FWS prior to filing with the Commission each year.
TC 1(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 10-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)	Annual data collection of fish passage results continues. The 10-year comprehensive report pursuant to TC 1(h) is scheduled to be addressed in 2020, followed by the scientific review (guided by the TAC) and revised operations plan for the remainder of the license (2022-2025) by December 31, 2021.

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 2 - Downstream Passage	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.	On November 11, 2013, the Licensee electronically filed the renewed 7-year (effective January 1, 2014 through December 31, 2020) MOU, dated September 20, 2013, for the Project to the Commission. The renewed MOU received approval from FWS, FWP, CSKT, and the Licensee and was filed in compliance with the FWS's BO TC2 and FERC Order issued on February 12, 2009. The AMFA started with $150,000 in the Reserve Account on January 1, 2014. The Licensee will provide $100,000 annually for 7 years and allow a maximum of $250,000 to accrue in the Reserve account from unspent or transferred annual TAC funds.
TC 3 - Gas Supersaturation		
TC 3 (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 (MDEQ).	The Licensee prepared a *Total Dissolved Gas Control Plan* (PPL Montana, 2010a) (TDG Control Plan) in collaboration with the TAC in October 2010 and submitted the TDG Control Plan to the MDEQ. The TDG Control Plan recommends continued monitoring of TDG at the Project, and also recommends a spillway operating plan for the Main Dam Spillway. The recommended spillway operating plan for the Main Dam Spillway has been implemented annually since 2011.
TC 3 (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, FWP, 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.	NorthWestern will continue to collaborate with the MDEQ, Avista, FWP, and other entities toward reducing the overall systemic gas supersaturation levels in the Clark Fork River.

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 3 (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 MDEQ, in order to mitigate GBT concerns.	Past GBT monitoring (2008-2014) below Thompson Falls Dam has resulted in limited findings of fish with symptoms indicating GBT. Bull trout recorded at the ladder or downstream of the Thompson Falls Dam annually between 2011 and 2017 have not shown any external symptoms of GBT. No Bull Trout were recorded at the ladder in 2018.
TC 4 - MOU and TAC	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.	The current MOU expires on December 31, 2020. NorthWestern will coordinate with the TAC and FWS to revisit the terms of the MOU in 2020, prior to the expiration of the current agreement.
TC 5 - Thompson Reservoir		
TC 5 (a)	During the first 5 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 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 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).	In compliance with TC 5a, the Licensee collaborated with TAC members and prepared the 5-Year (2011-2015) Reservoir Monitoring Plan, which was approved by FWS and submitted to the FERC on June 17, 2010. FERC issued an Order approving the 5-Year Reservoir Monitoring Plan on February 9, 2011. NorthWestern implemented the reservoir monitoring plan and because of an ongoing study in 2014 and 2015 requested modifications to the initial filing requirements outlined in FWS' BO. Summary of 2014 and 2015 study has been posted on the Project website (Glaid, 2017). FERC authorized request to postpone recommendations until 2020 (FERC 2015).

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 5 (b)	Based on the interim Thompson Reservoir Assessment (a., above), a timely evaluation of the site-specific need for a nonnative species control program in Thompson 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.	In 2014, the Licensee consulted with FWS and proposed to modify filing requirements specified in the FWS' BO TCs 5a, 5b, and 7b. A letter of concurrence from FWS, along with the proposed changes, was filed with the Commission on December 17, 2014. FERC issued a letter approving the proposed modifications on February 25, 2015. The approved modifications include: 1) removing the 5-year comprehensive summary of activities associated with the Reservoir Monitoring Plan (due in 2015) and combining the final report (due in 2020) required by TC 5a with reporting requirements in TC 5b; 2) postponing the reporting deadline for the nonnative species (in the Thompson Reservoir) control recommendations in TC 5b to December 31, 2020; and 3) waive the 5-year interim reporting requirement under TC 7b while continuing annual reporting required by TC 7a until 2019. After the 2019 ladder season is complete, NorthWestern will be responsible for compiling conclusions and recommendations per TC 5a and 5b reporting requirements and compiling the findings from the annual reports (2011-2019) into one comprehensive report that will be filed with FWS and the Commission by December 31, 2020.
TC 6 - System-wide Monitoring		
TC 6(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 FWP, 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.	The Licensee collaborates with TAC members to proactively address the adaptive needs of the operations of the ladder each season, as well as holding annual TAC meetings where the Licensee provided an overview of findings at the ladder for the year and an open forum for the TAC and FWS to discuss any needs for changes in operations.

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 6(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 system wide Clark Fork River genetic database.	The Licensee continues to provide annual funding available for Bull Trout genetic analysis.
TC 6(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).	With the construction of the fish ladder, three remote antennas were installed on the weirs (pools) that detect HDX and FDX PIT-tagged fish. These remote antennas detect PIT tags as fish move through the ladder. A remote PIT-tag array was also installed on the mainstem of the Thompson River in 2014 and continues to be utilized to track PIT-tagged fish released upstream of Thompson Falls Dam. These data are compiled annually and summarized in the respective annual report. NorthWestern will continue to collaborate and coordinate with local biologists regarding the need to track fish movement.
TC 7 - Reporting		
TC 7(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 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.	The Licensee has filed annually (since 2011) by April 1, a report summarizing previous year's activities, fish passage totals, and proposed activities for the following year. A summary of cumulative incidental take of Bull Trout since 2009 by the Licensee is provided in Table 8-2 in this report.
TC 7(b)	By December 31, 2015, after the first 5 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 5 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.	NorthWestern filed a letter, with FWS's support, to FERC on December 17, 2014 proposing TC 7b no longer be required because the comprehensive reporting has been continually provided in the annual reports. FERC approved this proposal on February 25, 2015. No major modifications to the facility were identified or proposed.

Term and Condition (TC)	TC Requirement from Biological Opinion (FWS 2008)	Compliance Status by Licensee
TC 7(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.	The Licensee has archived report (dating back to 2005) annually on the Project website: http://www.thompsonfallsfishpassage.com/reference.html
TC 7(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).	No incidents to report in 2018
TC 7(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.	No incidents to report in 2018

8.2 Bull Trout Incidental Take Summary 2009-2018

In compliance with FWS's BO TC 7a, this section provides a summary of the cumulative extent of incidental take from previous years' activities (2009-2018) in support of the upstream fish passage at the Project. Between 2009 and 2018, the Licensee sampled 33 individual Bull Trout (Table 8-2). Note that content and information provided in Table 8-2 remains unchanged from last year's report, but the total number of individual Bull Trout sampled has been corrected from 34 individuals as reported in the *2017 Annual Report* (NorthWestern, 2019) to 33 individuals. There was one Bull Trout (PIT ID# 985121021877906) that was counted twice by mistake (captured via electrofishing downstream of Thompson Falls Dam and recorded at the ladder). No Bull Trout were handled or sampled by NorthWestern in 2018.

Since 2009, sampling has included collecting Bull Trout via electrofishing efforts upstream and downstream of Thompson Falls Dam as well as Bull Trout recorded at the Thompson Falls fish ladder. Since 2011, 16 Bull Trout, representing 15 individual fish were recorded at the Thompson Falls fish ladder. One Bull Trout ascended the ladder twice and during the second ascent in 2012, the Bull Trout jumped out of one of the pools and died. This mortality has been the only occurrence in the Project area and subsequently, a cover was placed over the holding pool to mitigate the potential for this to occur again. In 2014, the Bull Trout that ascended the ladder was released alive upstream of the dam; it was later captured downstream of Thompson Falls Dam and the Project area during the annual reservoir monitoring activities led by FWP in Noxon Reservoir. The Bull Trout was captured via gillnet on October 13, 2014 resulting in a mortality.

Table 8-2. Cumulative incidental "take" of Bull Trout for the Thompson Falls Project area located in the Lower Clark Fork River drainage, since January 1, 2009. Note: No Bull Trout sampled in 2018; EF = electrofishing; L = length; Wt = weight.

Date	Method of Capture	Location	Action	Personnel	L (mm)	Wt (g)	Genetic Assignment	Condition at time of release
9/18/17	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	408	522	West Fork Thompson River (R4)	Alive
6/6/16	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	618	1950	NF Fish Creek (R4)	Alive
5/18/16	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	615	1934	NF Fish Creek (R4)	Alive
4/18/16	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	413	602	Fishtrap (R4)	Alive
4/11/16	EFISH	Upper TFalls Reservoir (CFR)	Long-term Population Monitoring	Licensee FWP	247	124	Prospect Ck (R3)	Alive
10/20/15	EFISH	Clark Fork River, upstream of Island Complex	Long-term Population Monitoring	Licensee FWP	651	1966	Fishtrap Creek (R4)	Alive
6/3/15	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	520	1112	Fishtrap Creek (R4)	Alive
5/17/15	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	519	1334	Fishtrap Creek (R4)	Alive
4/13/15	EFISH	Upper TFalls Reservoir (CFR)	Long-term Population Monitoring	Licensee FWP	219	88	Fishtrap Creek (R4)	Alive
10/28/14	EFISH	Paradise-Plains	Long-term Population Monitoring	Licensee FWP	315	260	NF Jocko (R4)	Alive
6/3/14	EFISH	Below TFalls Dam	Fish Passage Studies	Licensee FWP	509	1224	Fishtrap Creek (R4)	Alive
5/28/14	EFISH	Below TFalls Dam	Fish Passage Studies	Licensee FWP	567	1640	Fishtrap Creek (R4)	Alive

Date	Method of Capture	Location	Action	Personnel	L (mm)	Wt (g)	Genetic Assignment	Condition at time of release
5/16/14	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	523	1264	Fish Creek (R4)	Alive (later captured via gillnet in Noxon Reservoir resulting in a mortality)
4/15/14	EFISH	Upper TFalls Reservoir (CFR)	Long-term Population Monitoring	Licensee FWP	577	1446	Fishtrap Creek (R4)	Alive
4/7/14	EFISH	Below TFalls Dam	Fish Passage Studies	Licensee FWP	520	1500	NA	Alive
8/9/13	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	482	1058	Fishtrap Creek (R4)	Alive
6/7/13	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	596	1926	Fishtrap Creek (R4)	Alive
5/7/13	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	478	978	Fishtrap Creek (R4)	Alive
5/6/13	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	576	1694	Fishtrap Creek (R4)	Alive
4/30/13	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	598	2306	Fish Creek (R4)	Alive
4/10/13	EFISH	Upper TFalls Reservoir (CFR)	Long-term Population Monitoring	Licensee FWP	260	108	Fishtrap Creek (R4)	Alive
10/30/12	EFISH	Paradise-Plains	Long-term Population Monitoring	Licensee FWP	472	800	Monture Creek (R4)	Alive
10/30/12	EFISH	Paradise-Plains	Long-term Population Monitoring	Licensee FWP	444	678	Fish Creek (R4)	Alive
5/21/12 4/26/11	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	563 547	1404 1438	Fishtrap Creek (R4)	Mortality (2012) Alive (2011)
5/15/12 5/31/11	Ladder EFISH	TFalls Dam Below TFalls	Fish Passage Studies	Licensee FWP	510 482	1172 966	Meadow Creek (R4)	Alive 2012 Alive 2011

Date	Method of Capture	Location	Action	Personnel	L (mm)	Wt (g)	Genetic Assignment	Condition at time of release
4/17/12	EFISH	TFalls Reservoir (Upper Section)	Long-term Population Monitoring	Licensee FWP	260	140	Fishtrap Creek (R4)	Alive
4/16/12	EFISH	TFalls Reservoir (Lower Section)	Long-term Population Monitoring	Licensee FWP	222	76	Fishtrap Creek (R4)	Alive
4/10/12	EFISH	Below TFalls	Fish Passage Studies	Licensee FWP	272	150	Graves Creek (R3)	Alive
5/31/11	EFISH	Below TFalls	Fish Passage Studies	Licensee FWP	482	966	Meadow Creek (R4)	Alive
5/31/11	EFISH	Below TFalls	Fish Passage Studies	Licensee FWP	180	50	Fishtrap Creek (R4)	Alive
5/31/11	EFISH	Below TFalls	Fish Passage Studies	Licensee FWP	247	130	Fishtrap Creek (R4)	Alive
4/13/11	Ladder	TFalls Dam	Fish Passage Studies	Licensee FWP	365	364	Thompson River (R4)	Alive
10/12/10	EFISH	Clark Fork River, upstream of Island Complex	Long-term Population Monitoring	Licensee	325	240	SF Jocko River (R4)	Alive
5/1/09	Gillnet	TFalls Reservoir	Long-term Population Monitoring	Licensee	271	174	Fishtrap Creek (R4)	Alive

9.0 Proposed Activities for 2019

9.1 Baseline Fisheries Data Collection

NorthWestern and FWP reviewed baseline fisheries data and propose to continue autumn gillnetting surveys on an annual basis and alternate electrofishing (both spring and autumn surveys) every other year. Baseline fall gillnetting effort is scheduled for 2019 with the next electrofishing effort scheduled for 2020. In 2020, electrofishing efforts will include the Thompson Reservoir (spring sampling), above the island complex (autumn sampling), and Paradise to Plains (autumn sampling). The sample locations and methods will remain unchanged. Gillnetting efforts in 2019 will be summarized in next year's annual report. Based on prior year's sampling in the Clark Fork River and Thompson Reservoir, it is conservatively estimated that incidental take of Bull Trout for 2019 autumn gillnetting efforts will be no more than five Bull Trout. Any fish evaluations in the Thompson River drainage will be managed by FWP, thus any incidental take of Bull Trout will be reported by FWP.

9.2 Upstream Adult Fish Passage Studies

In 2019, NorthWestern will continue to implement 10-year *Fish Passage Facility Evaluation Plan, Phase 2 Action Plan, 2011-2020* (PPL Montana, 2010) (Evaluation Plan) that was developed and submitted to the FERC on October 18, 2010 and approved on June 9, 2011. NorthWestern will continue to collect biological and operational data during ladder operations in 2019. NorthWestern will summarize the following information, as available, for next year's annual report:

- Total number of fish and species ascending the ladder
- Total number of fish and species passed to Thompson Reservoir
- Most active period(s) for fish and various species ascending the ladder
- Number of Bull Trout that fallback after passing the Thompson Falls Dam
- Bull trout genetic sampling and tributary assignment

As was implemented in 2018, NorthWestern proposes to check the ladder at a minimum of once a day when and if water temperatures reach or exceed 23 ºC. NorthWestern also proposes to operate the ladder in orifice mode throughout the duration of the 2019 season.

Several studies outlined in the Evaluation Plan will occur over multiple years (2011-2020). A list of the studies and their respective schedule is provided in Table 9-1. Based on prior year's sampling in the Thompson Falls tailrace it is conservatively estimated that incidental take of Bull Trout during 2019 upstream adult fish passage studies will be no more than 10 Bull Trout.

Table 9-1. Summary of the objectives, studies, and reporting requirements for the Evaluation Plan (2011-2020). Annual activities are indicated by an "x." A dash (-) indicates no action will be taken for the year. TBD = "to be determined." (Table was modified from the *Evaluation Plan*, 2010.)

Objective	Study	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Effectiveness of the Ladder	Annual Fish Passage	x	x	x	x	x	x	x	x	x	x
	Annual Movement Patterns (timing)	x	x	x	x	x	x	x	x	x	x
	Bull Trout Genetic Testing	x	x	x	x	x	x	x	x	x	x
Operational Procedures for Effectiveness	Weir Modes Notch *vs.* Orifice	x	x	Orifice Mode Only			Orifice; then alternating modes 4 weeks when water > 19 °C	Notch Mode Only	Notch Mode Only	Orifice Mode Only	Orifice Mode Only
	Attractant Flow (AF) & Radio Telemetry (RT)	x (no RT)	x (no RT)	x (max AF, no RT)							
Length of Delay	Upstream Movement Patterns, Timing & Behavior (Delay)	x	x	x	x	x	x	x	x	x	x
Fallback	Fallback	x	x	x	x	x	x	x	x	x	x
Reporting Requirements	Annual Reporting (April 1 – FERC Submittal)	x	x	x	x	x	x	x	x	x	x
	5-year Fish Passage Evaluation Plan Report	Accomplished through Annual Reports – No Longer a Separate Requirement for 2015[1]					-	-	-	-	-
	10-year Fish Passage Evaluation Plan Report (Dec 31, 2020 – TAC/FWS Submittal)	-	-	-	-	-	-	-	-	-	x

[1] NorthWestern and FWS concur that the 5-year Fish Passage Evaluation Plan, per TC 7b and scheduled for submittal in 2015, was not necessary due to the comprehensive annual reporting. NorthWestern filed a letter to the Commission on December 17, 2014 summarizing the modifications that FWS and NorthWestern discussed and agreed to implement with regards to the upstream fish passage terms and conditions described in the BO. FERC issued a letter on February 25, 2015 approving the modifications.

9.2.1 Effectiveness of Upstream Fish Passage

Effectiveness of the ladder will continue to be evaluated based on annual upstream fish passage. For the Thompson Falls ladder, Bull Trout remain the primary target species for upstream fish passage. The biological data collected at the ladder's work station will be used to summarize overall upstream fish passage, including enumeration of fish using the facility; the species using the facility; range, average size, and weight of species using the facility; and the timing of movement and passage by each species.

The ladder was initially designed to operate with flows up to 48,000 cfs. Subsequently, the ladder has operated with streamflows exceeding 48,000 cfs in 6 of the 8 years (*see* Table 3-6) with 28 fish ascending, including two Bull Trout, ascending the ladder at these higher flows. However, the ability to attract fish appears to decline when streamflows exceed 43,000 cfs (NorthWestern, 2018). Ladder operations during higher spring flows is primarily dependent on debris and sediment loading. As in previous years, the ladder will be operated in 2019 during the spill season for as long as operationally practicable, and data collected on fish movements into the ladder through this range of flow.

Effectiveness of the operational procedures of the ladder to pass fish upstream has been based primarily on evaluating weir modes (notch *vs.* orifice). In 2011 and 2012, weir modes were alternated weekly throughout each season. Between 2013 and 2016, the weir mode was operated primarily in orifice except for 2 weeks in July 2016 when the weir mode was switched to notch as part of a short-term experiment (NorthWestern, 2017). In 2017, the weir mode was set in notch for the entire season. In 2018, the ladder operated in notch mode until the end of the season (October 23) when the weir mode was switched to orifice for the remainder of the season (October 24 – November 15). In 2018, the weir mode was switched from notch to orifice with the assumption that the orifice mode would provide a greater opportunity for salmonids (specifically targeting Mountain Whitefish) to ascend the ladder. Although there was no significant movement of Mountain Whitefish in 2018, there were 36 salmonids that ascended the ladder in orifice mode in 1 week (October 24 – 31) compared to 31 salmonids that ascended the ladder in notch mode over a 3-week period (October 1 – 23). The cumulative results from operating in orifice *versus* notch weir mode indicate fish ascend the ladder in both modes, but more fish and a greater variety of species, including more native species are likely to pass in orifice mode.

The TAC reviewed the 2017 results and agreed to operate the ladder in notch mode in 2018 and 2019 to verify 2017 findings and test the notch mode under the natural streamflow and stream temperature variability for a better comparison to orifice operations (2013-2016). Following the 2019 season, operations would resume in orifice mode for 2020. After review of the 2018 fish passage results, NorthWestern determined it was appropriate to modify the operation plan and switch weir mode to orifice in 2019 and 2020. The data clearly show orifice mode addresses upstream fish management goals of FWS and FWP maximizing upstream fish passage opportunity for native species and non-native salmonid game fish.

Attractant flow was also evaluated for opportunities to improve upstream fish passage effectiveness. The attractant flow study began in 2011. The Licensee originally proposed to use the first 3 years of ladder operations (2011-2013) to test variable attraction flows and learn operations. Based on observations in the first 2 years of study, the Licensee concluded that during non-spill time periods, the HVJ and AWS should be operated at maximum capacity to provide sufficient flow to allow fish to migrate upstream through the natural falls, which is present downstream of the Main Dam. NorthWestern has continued this practice since 2013 and proposes to continue to use near maximum attractant flow during 2019 and 2020 operations.

9.2.2 Evaluation of Fish Movement Patterns, Timing, and Behavior

Fish movement patterns, timing, and behavior are evaluated through biological data collected at the ladder and Thompson River. The assessment of fish movement patterns, timing, and behavior will be conducted by monitoring fish PIT-tagged at the ladder and monitoring PIT tag detections via the remote array in the mainstem of the Thompson River. These studies will allow for an assessment of the length of time for Bull Trout to ascend the ladder and movement patterns. No radio telemetry studies have been identified by the TAC since operations began in 2011. No radio telemetry studies are proposed for 2019. In addition, no electrofishing or tagging of fish below Thompson Falls Dam is proposed for 2019.

Any fish evaluations in the Thompson River drainage will be managed by FWP, and any incidental take of Bull Trout will be reported by FWP.

9.2.3 Evaluation of Fallback

The potential fallback of Bull Trout after ascending the ladder and moving into the Thompson Reservoir will be evaluated on an annual basis. Bull trout are PIT tagged at the ladder prior to being released upstream. The remote arrays in the ladder will be used to monitor for previously PIT-tagged fish and to evaluate fallback.

9.3 Thompson Reservoir Monitoring Plan

The Licensee was scheduled to submit a comprehensive report to FWS in 2015 to summarize data collected between 2010 and 2015, as well as provide recommendations for improving emigrating juvenile Bull Trout survivorship and evaluate the site-specific need for a nonnative species control program in the Thompson Reservoir per the TCs 5a and 5b in the BO. However, the schedule for the summary report in 2015 and recommendations for any additional programs and/or efforts was modified. In 2014, the Licensee consulted with FWS and proposed to modify filing requirements specified in the FWS' BO TCs 5a, 5b, and 7b. A letter of concurrence from FWS along with the proposed changes, were filed with the Commission on December 17, 2014. FERC approved the proposed modifications in a letter dated February 25, 2015. The modifications include removing the comprehensive summary of activities associated with the 5-Year Reservoir Monitoring Plan (due at the end of 2015) because this requirement was achieved through the annual reports since 2011 and postponing the development of any recommendations, "for a nonnative species control

program in the Thompson Reservoir…" from the end of 2015 until December 31, 2020 (formal filing to the Commission) to allow for the completion and full review of the results from the 2014 to 2015 study evaluating out migration of juvenile Bull Trout from the Thompson River.

Glaid (2017) completed a detailed analysis of the results from the 2014 and 2015 field data collection and submitted his thesis to the TAC in 2017, which is also available on the Project website. The TAC will review the results and collaborate to identify recommendations, "…for a nonnative species control program in the Thompson Reservoir…" that will be included in the 10-year comprehensive report scheduled to be submitted by December 31, 2020 (formal filing to the Commission).

Any additional fish evaluations in the Thompson River drainage will be managed by FWP, thus any incidental take of Bull Trout will be reported by FWP.

9.4 Total Dissolved Gas Control Plan

In 2010, the *Total Dissolved Gas Control Plan* (PPL Montana, 2010a) (TDG Control Plan) for the Project was submitted to the MDEQ. With the TDG Control Plan, NorthWestern proposes to continue to collaborate with the MDEQ, Avista, FWP, and other entities with a long-term goal of reducing the overall systemic gas supersaturation levels in the Clark Fork River, occurring from a point downstream of the Project to below Albeni Falls Dam.

In 2019, NorthWestern will monitor TDG regardless of spring snowpack conditions. This monitoring will be useful for assessing the potential impact that the new radial gates have on TDG levels downstream of the Main Dam Spillway. No GBT monitoring in fish downstream of Thompson Falls Hydroelectric Project is proposed for 2019.

9.5 2019 TAC Funded Projects

TAC-approved proposals for 2019 are listed below. The proposals approved for TAC funding are included in Appendix C.

- Rattlesnake Dam Removal, Phase 2
- Crow Creek Reconstruction, Phase 2
- West Fork Fishtrap Creek Road Realignment
- Thompson River Watershed Coordinator
- Emergency/Contingency Funding

10.0 Acknowledgements

This report was prepared by Kristi Webb, New Wave Environmental Consulting, LLC and Ginger Gillin, GEI Consultants, Inc. for NorthWestern. The report was developed in coordination with stakeholder groups representing NorthWestern, FWP, FWS, CSKT, USFS, MDEQ, Avista, and Weyerhaeuser. We would like to thank everyone and their organizations for their time and dedication with regards to their collaborative efforts in monitoring and reporting findings in support of improving fish passage in the lower Clark Fork River. Previous annual reports prepared in support of the Thompson Falls Project are available on the website at http://thompsonfallsfishpassage.com/. Please contact NorthWestern Energy in Butte, Montana for any data requests.

11.0 References

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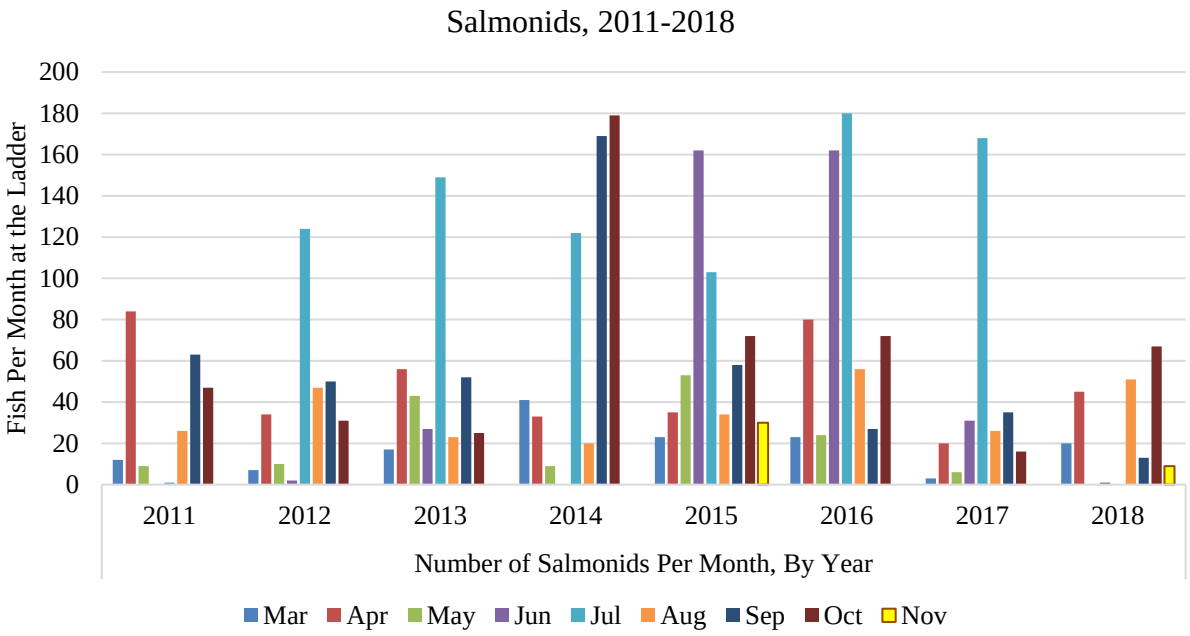
Appendix A – Fish Movement Patterns at the Ladder, 2011-2018

The following summarizes monthly counts of fish, grouped by salmonids and non-salmonids recorded at the ladder annually, 2011-2018.

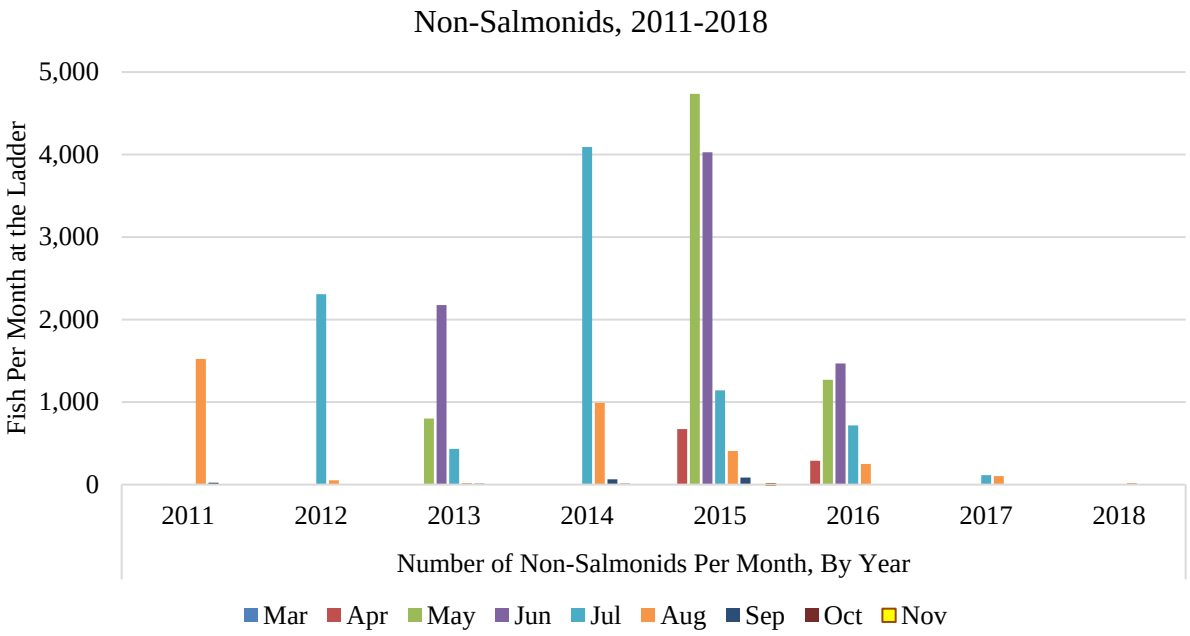
Monthly Salmonid Count at the Ladder, 2011-2018



Summary of the monthly total for salmonids recorded at the ladder annually, 2011-2018.

Month	Number of Salmonids Per Month								
	2011	2012	2013	2014	2015	2016	2017	2018	Totals
Mar	12	7	17	41	23	23	3	20	**146**
Apr	84	34	56	33	35	80	20	45	**387**
May	9	10	43	9	53	24	6	closed	**154**
Jun	0	2	27	0	162	162	31	1	**385**
Jul	1	124	149	122	103	180	168	closed	**847**
Aug	26	47	23	20	34	56	26	51	**283**
Sep	63	50	52	169	58	27	35	13	**467**
Oct	47	31	25	179	72	72	16	67	**509**
Nov	closed	closed	closed	closed	30	closed	closed	9	**39**
Totals	**242**	**305**	**392**	**573**	**570**	**624**	**305**	**206**	**3,217**

Monthly Non-Salmonid Count at the Ladder, 2011-2018

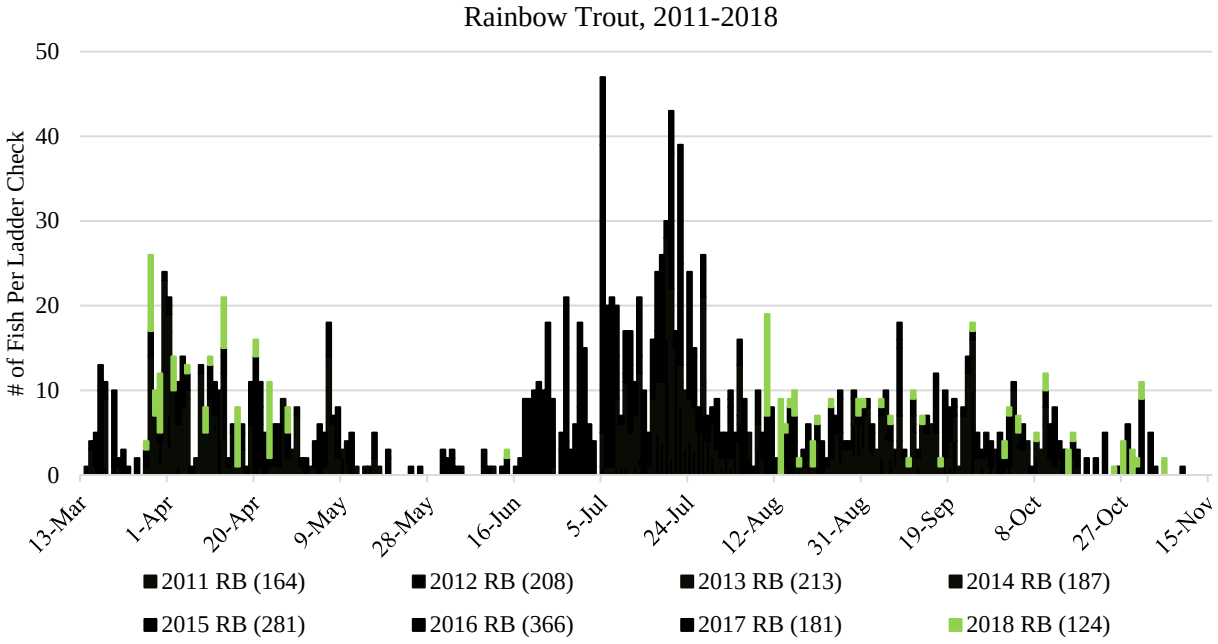


Summary of the monthly total for non-salmonids (bottom table) recorded at the ladder annually, 2011-2018.

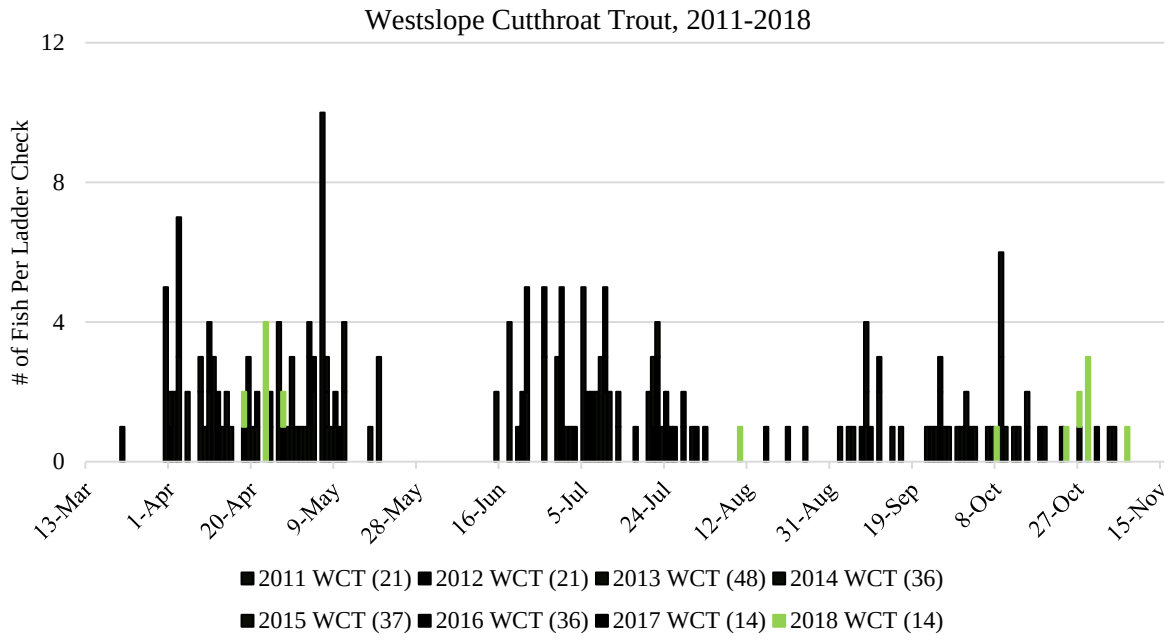
Month	Number of Non-Salmonids Per Month								
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Totals**
Mar	1	0	0	0	0	0	1	0	**2**
Apr	2	0	0	0	673	289	0	0	**964**
May	8	1	801	2	4,735	1,271	0	closed	**6,818**
Jun	0	0	2,175	2	4,027	1,468	2	0	**7,674**
Jul	2	2,308	432	4,091	1,142	718	114	closed	**8,807**
Aug	1,523	52	19	991	408	251	103	19	**3,366**
Sep	24	2	11	64	85	5	5	2	**198**
Oct	3	0	0	12	6	4	0	0	**25**
Nov	closed	closed	closed	closed	1	closed	closed	0	**1**
Totals	**1,563**	**2,363**	**3,438**	**5,162**	**11,077**	**4,006**	**225**	**21**	**27,855**

The following figures are stacked bar graphs depicted the number of fish (by species) recorded at the fish ladder per ladder check each year. Not all fish were observed ascending the ladder annually. For example, Largemouth Bass was only recorded in 2016 and Walleye were only observed in 2015. The annual fish count at the ladder is provided in parenthesis (#) within each graph. Note that not all species were observed at the ladder in 2018. Refer to Table 3-3 for a numeric summary of species recorded annually at the ladder. Data from 2011 through 2017 are the same color and 2018 is in green. These graphs were prepared to show the timing of when species were recorded at the ladder over time compared to 2018 data.

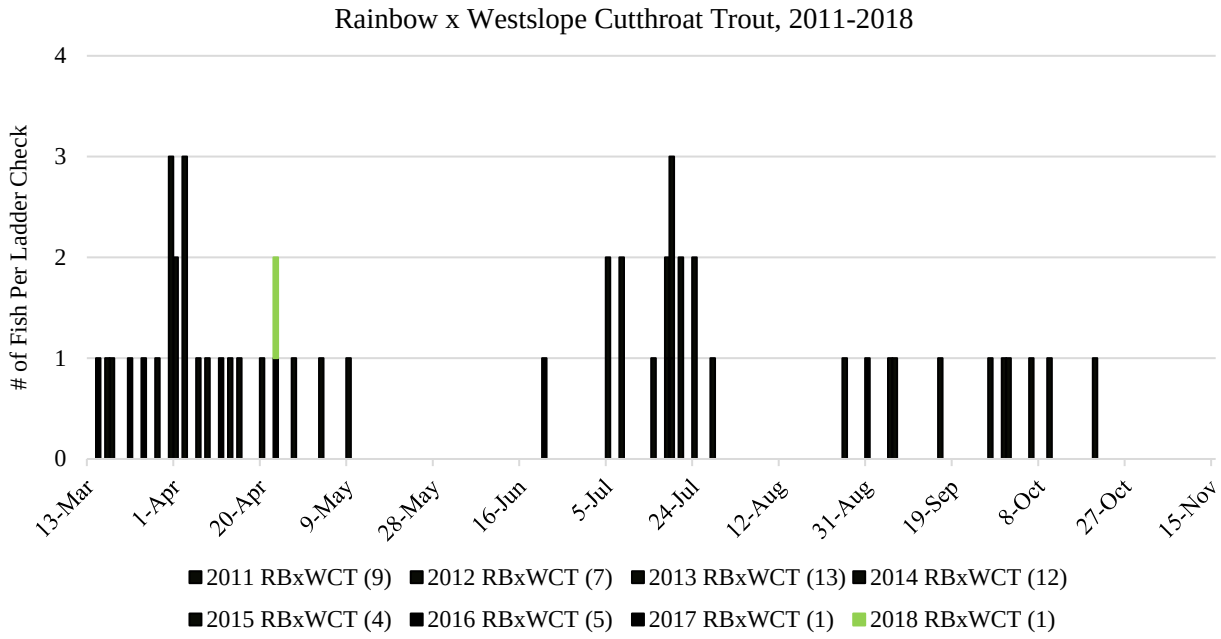
Rainbow Trout



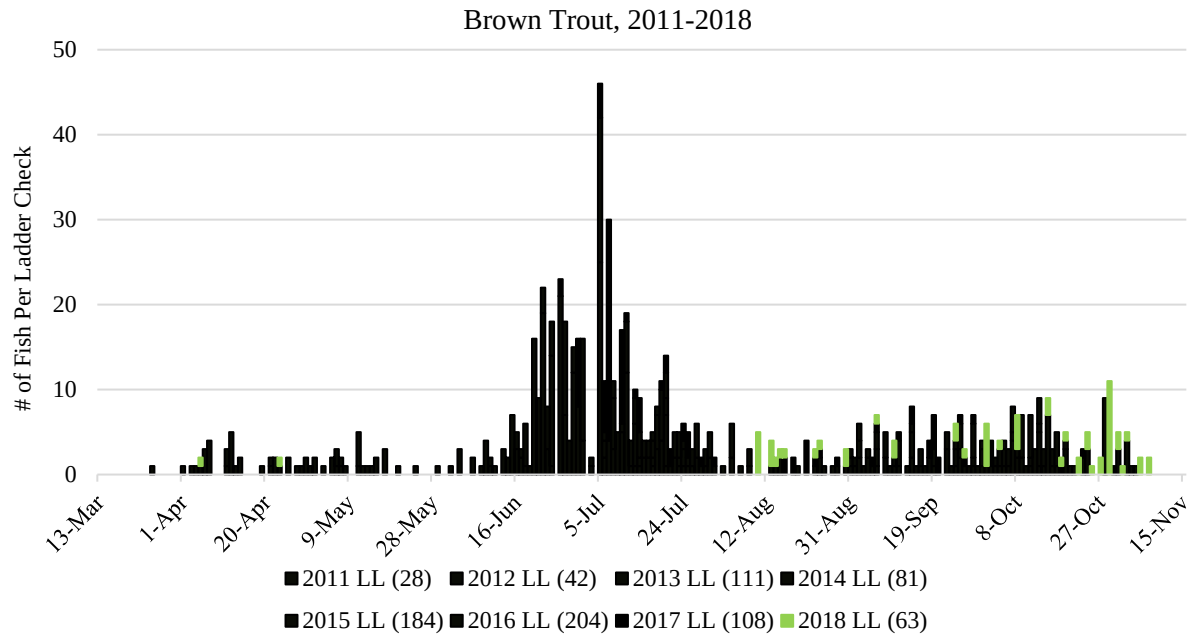
Westslope Cutthroat Trout



Rainbow x Westslope Cutthroat Trout

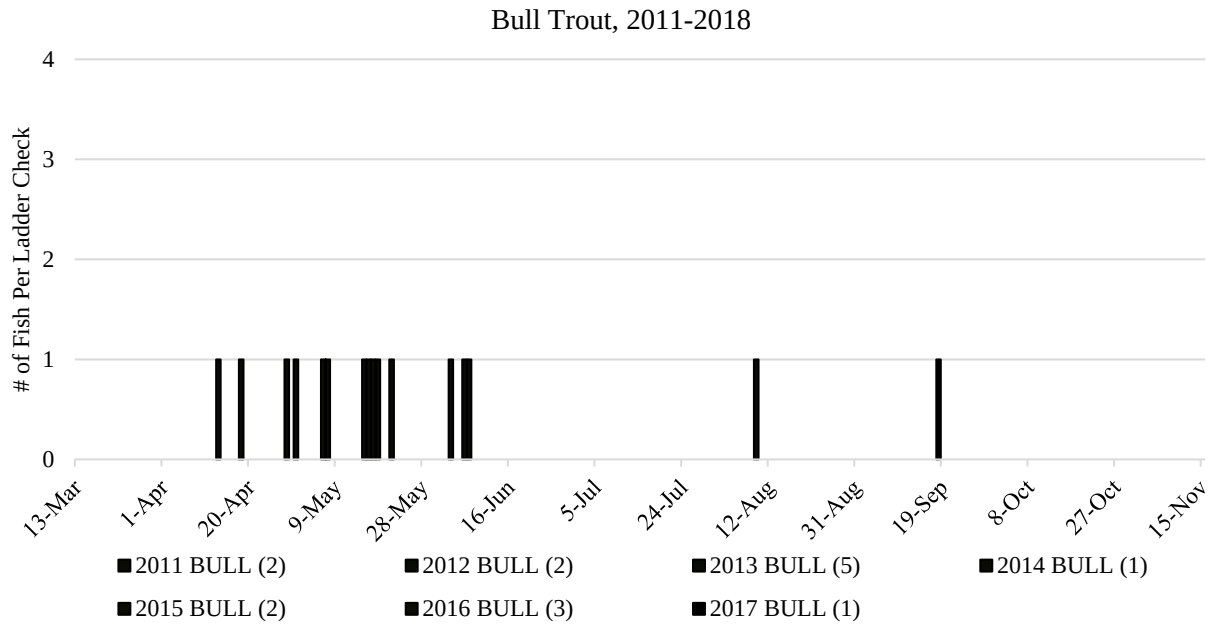


Brown Trout



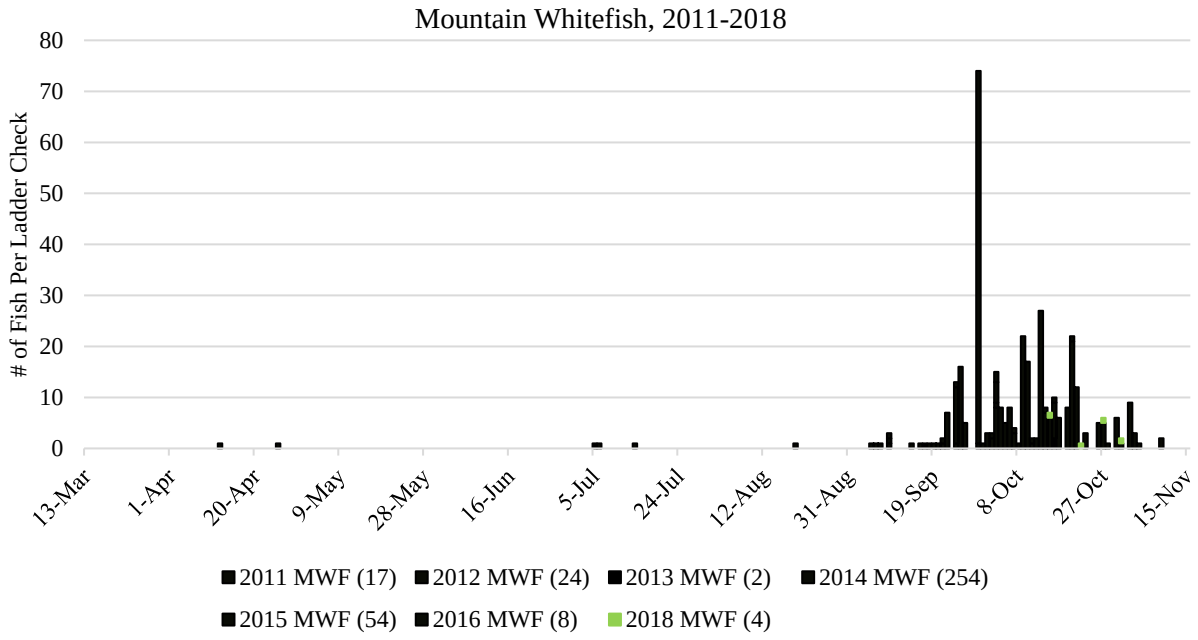
Bull Trout

None recorded in 2018.



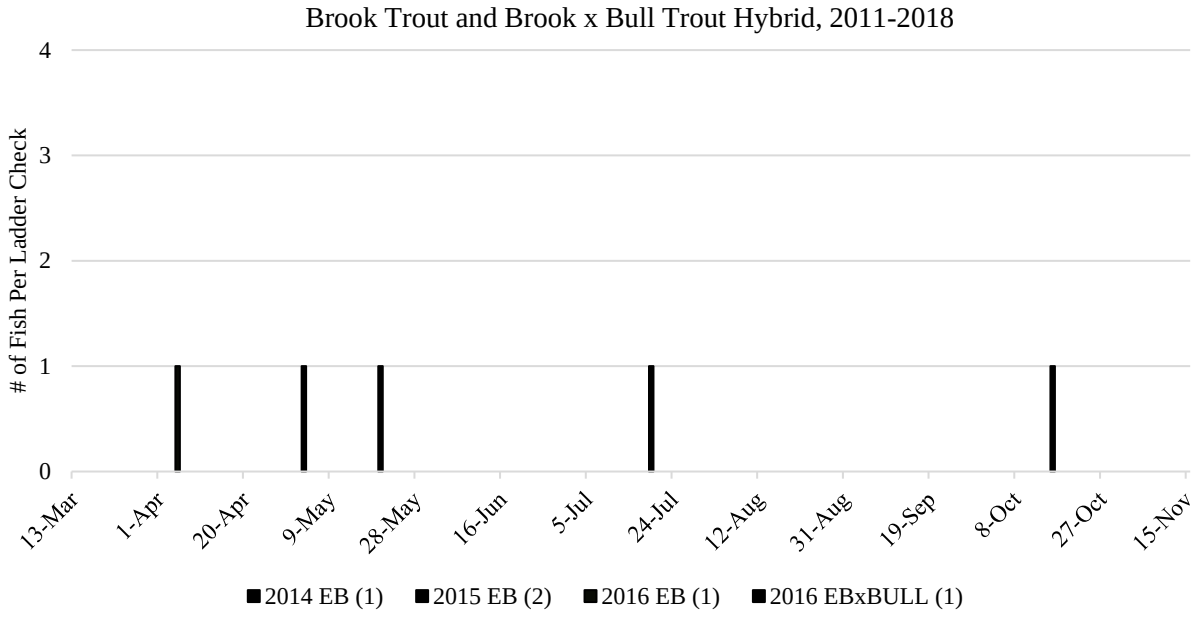
Mountain Whitefish

None recorded in 2017.



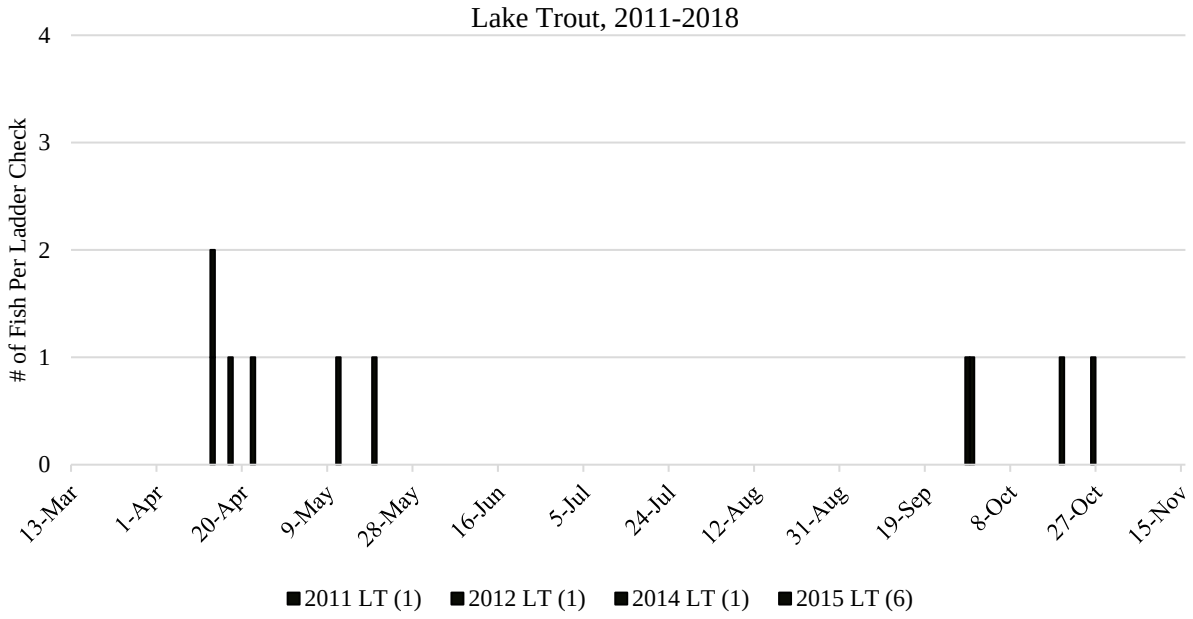
Brook Trout (and Brook x Bull Trout hybrid)

None recorded in 2011-2013, 2017, or 2018.

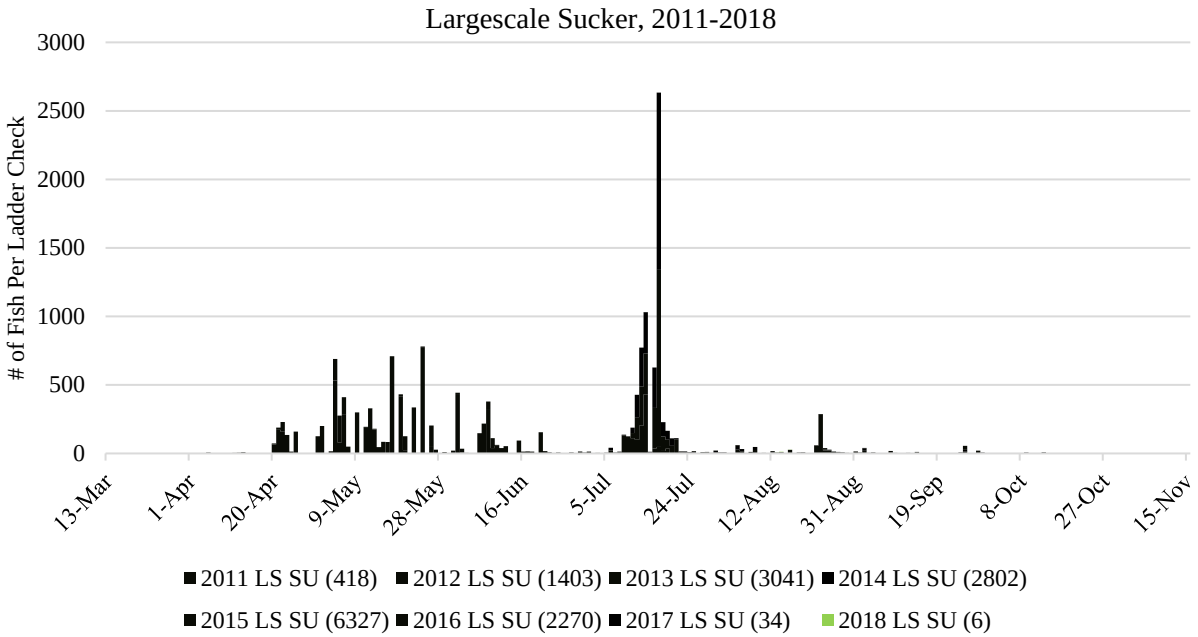


Lake Trout

None recorded in 2013, 2016-2018.

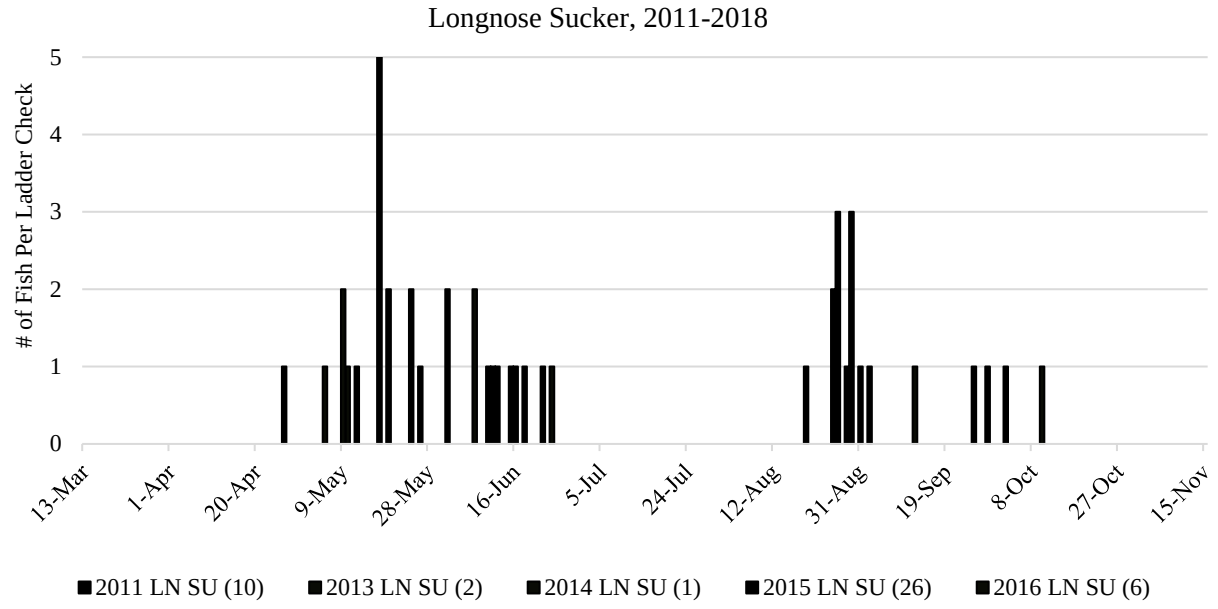


Largescale Sucker

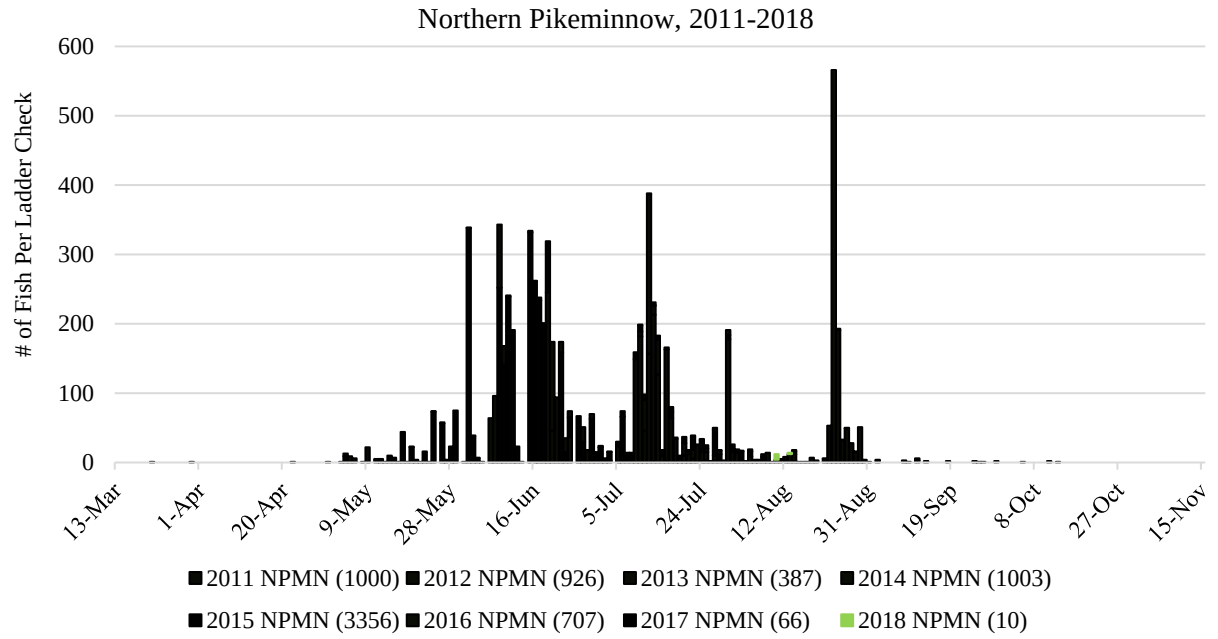


Longnose Sucker

None recorded in 2012, 2017, or 2018.

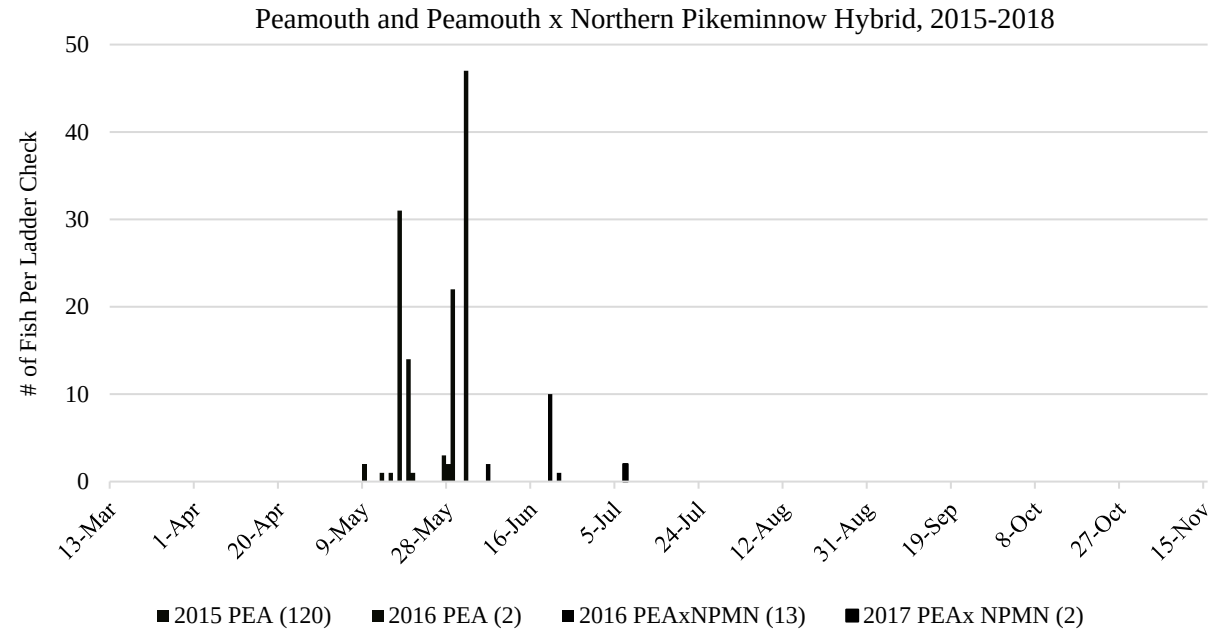


Northern Pikeminnow

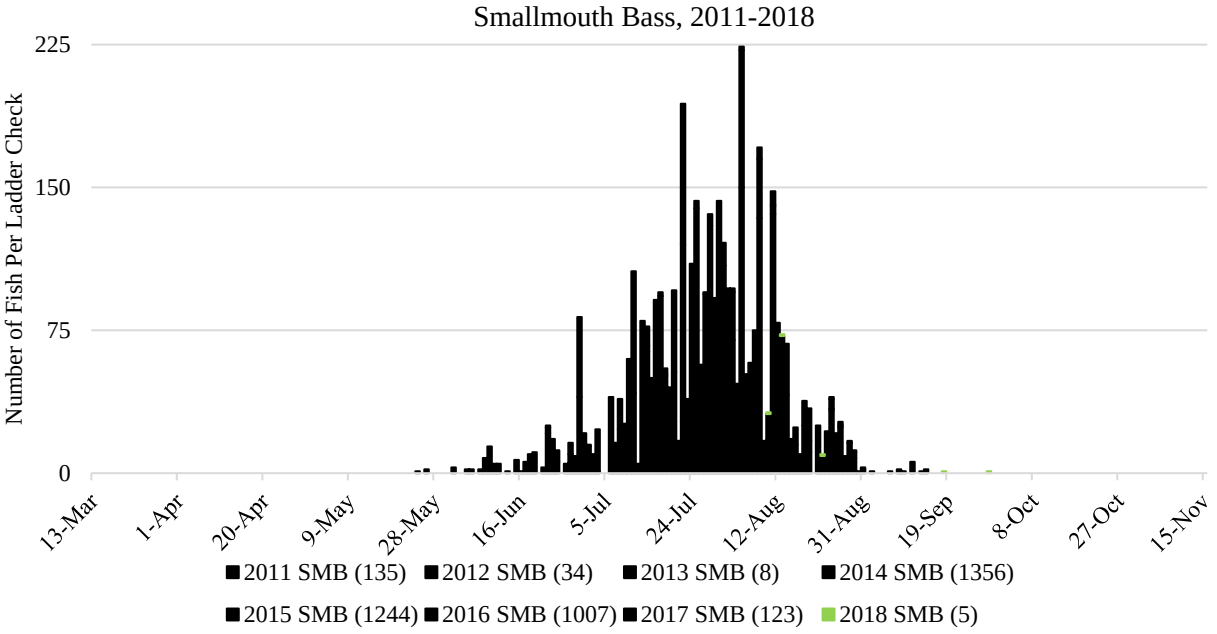


Peamouth and Peamouth x Northern Pikeminnow

None recorded in 2011-2014 or 2018.

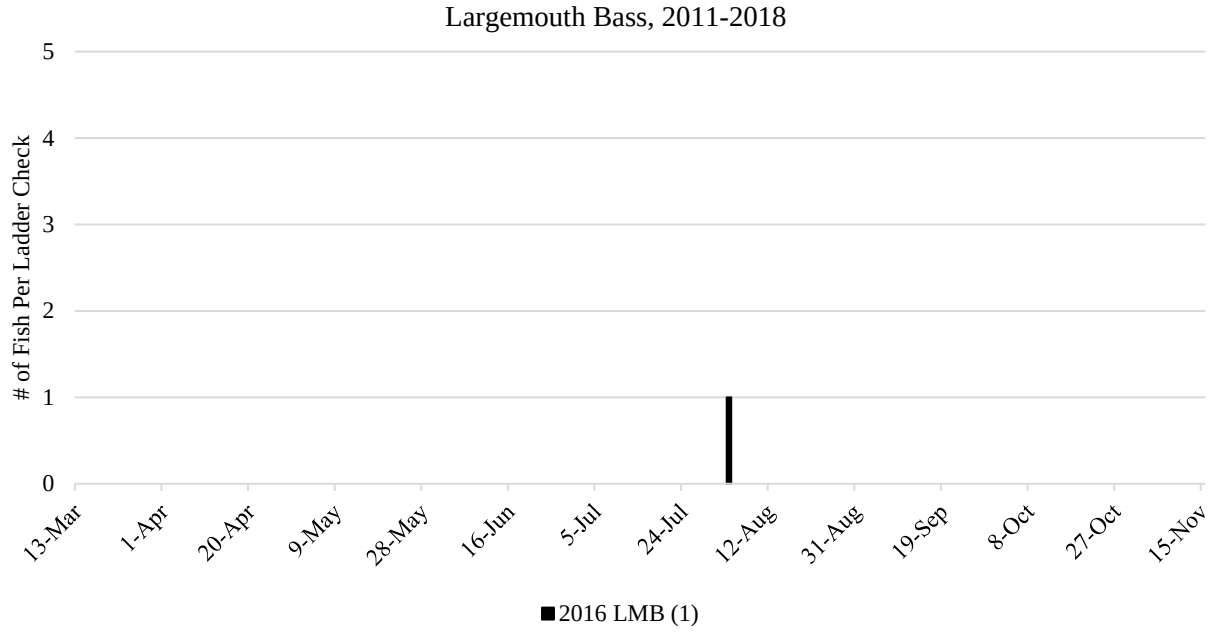


Smallmouth Bass



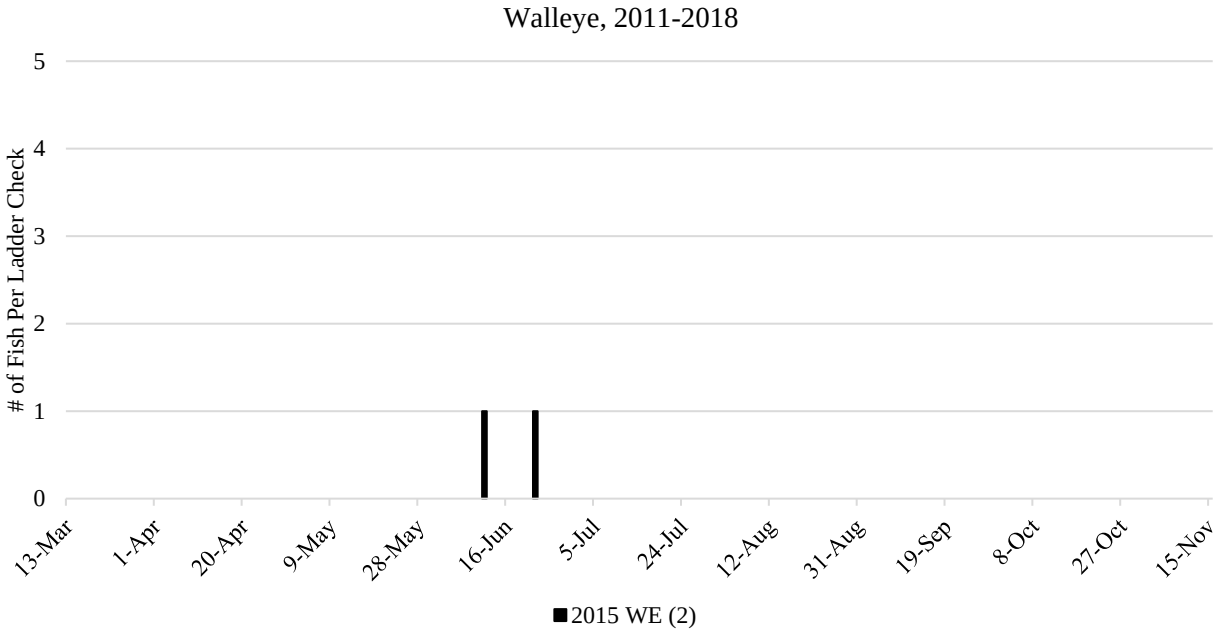
Largemouth Bass

None recorded in 2011-2015 or 2017-2018.



Walleye

None recorded in 2011-2014 or 2016-2018.



Appendix B – 2018 Progress Reports

Progress reports for TAC funded projects (Table B-1) that were implemented in 2018 are provided in the following sections.

Table B-1. Summary of TAC funded projects implemented in 2018, including TAC funding approved and budget spent as of December 31, 2018.

Agency/Entity Submitting Proposal	Proposal Description	TAC Funding Approved	Budget Spent
FWP (Knotek)	Koch In-holding Acquisition Lower Fish Creek	$60,000	$60,000
TU/FWP (Roberts)	Rattlesnake Dam Removal Project, Phase 1	$20,000	$20,000
Lower Clark Fork Watershed Group (Olson)	2018 Thompson River Coordinator	$16,500	$7,494.83
FWP (Kreiner)	Crow Creek Stream Reconstruction Design	$30,000	$19,441.16
NorthWestern/Avista (Biomark)	Prospect PIT Tag array	$30,000	$29,418
USFS (Hanson)	Beartrap Ck Culvert Replacement (approved in 2017)	$11,000	$13,500
NorthWestern (Mabbott)	BULL Genetics	$10,000	$0
NorthWestern (Mabbott)	Emergency Fund	$10,000	$7,752.04

Koch Property Acquisition on Lower Fish Creek within the Fish Creek Wildlife Management Area

Summary Submitted to Thompson Falls Dam Mitigation Technical Advisory Committee (TAC)

December 2018

Montana Fish, Wildlife & Parks

Region 2 Office
3201 Spurgin Road, Missoula, MT 59804

PROJEC SUMMARY

Montana Fish, Wildlife & Parks (FWP) acquired a 160-acre addition to the Fish Creek Wildlife Management Area (FCWMA), through a fee title land purchase from Randy Koch (private landowner). The 'Main Stem Parcel' acquisition is considered a key addition to the existing 35,041-acre FCWMA, which is bordered by lands owned by the Montana Department of Natural Resources and Conservation (DNRC) and United States Forest Service (USFS).

Among FWP's purposes for purchasing the land is the objective to enhance fish and wildlife species, and prevent this habitat from potentially being subdivided for development. More specifically, to "protect some of the last and best remaining habitat for bull trout and westslope cutthroat trout in the Clark Fork region by securing 1.2 miles of stream frontage and riparian habitat along Fish Creek."

These objectives aligned with offsite bull trout enhancement goals associated with mitigation funds for Thompson Falls Dam (provided by Northwestern Energy). Accordingly, the Thompson Falls TAC allocated funds for the public land acquisition project in 2017 and this document summarizes the project that was completed in 2018.

Purpose and Need for the Acquisition

This project represented a unique opportunity for FWP and partners to conserve a private inholding of vital native fish and wildlife habitat in Fish Creek and to consolidate FWP ownership and management of the Fish Creek WMA. The property fills in a crucial gap in public ownership that protects key habitat for bull trout and westslope cutthroat trout. The Fish Creek drainage is a priority watershed for allocation of Thompson Falls Dam Offsite Mitigation funds targeting enhancement of affected bull trout populations.

Fish Creek is also a Tier 1 aquatic regional focal area, the most hydrologically intact tributary watershed in Mineral County, and the most valuable stronghold for federally protected bull trout (also a MT Species of Greatest Conservation Need) in the Middle Clark Fork region. This stream system supports the largest fluvial bull trout population in the middle Clark Fork River drainage and typically contains more redds than the rest of the tributaries in this region combined. The main stem project reach provides a key migratory corridor and sub-adult rearing area for migratory trout, as well as a high value public fishery that currently supports > 3,000 angler-days annually.

The main stem Fish Creek parcel acquired contains approximately 78 acres of riparian habitat and more than 6,000 feet of the Fish Creek channel. Acquiring this inholding property eliminated the threat of development, which could have compromised the ecological integrity of lower Fish Creek. Public ownership also ensures access for public hunting, fishing and other recreational opportunities.

Funding Summary

US Fish & Wildlife Service (Pittman-Robertson)		$622,500
FWP (Habitat Montana)		$207,500
Northwestern Energy		$60,000
Montana Trout Unlimited		$10,000
	Total	$900,000

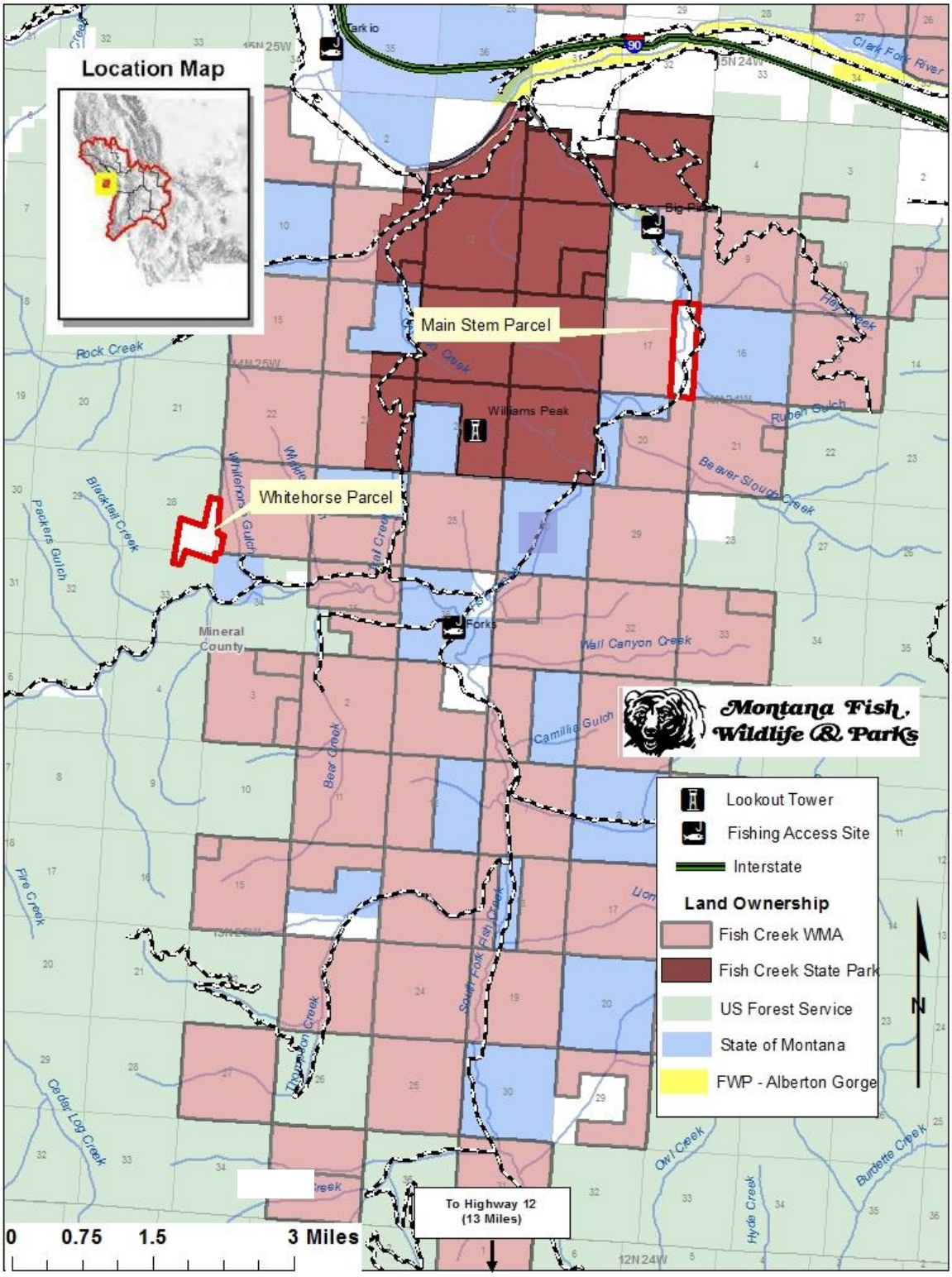


Figure 1. Location map of Fish Creek WMA and State Park and the proposed acquisition (Koch properties).

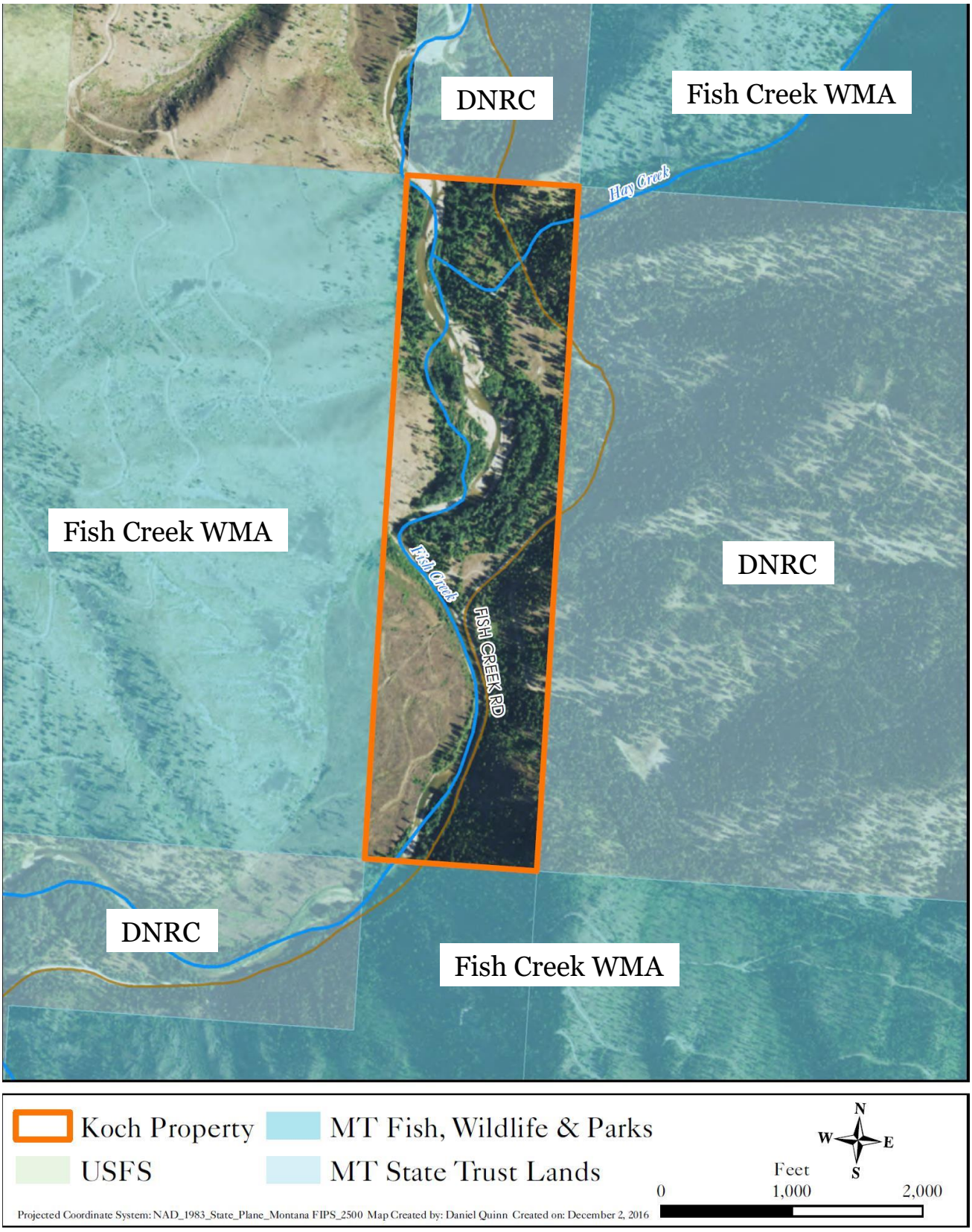


Figure 3. Aerial view of the main stem Fish Creek Koch acquisition

GENERAL INFORMATION

Project Title: Rattlesnake Dam Removal Project, Phase I		
Sponsor: Trout Unlimited		
Contact Name: Rob Roberts	**Email:** rroberts@tu.org	
Address: 312 N. Higgins Ave, Suite 200 Missoula, MT 59802	**Phone:** 406-540-2944	**Fax:** 406-543-6080

Section 1.0 Executive Summary

Trout Unlimited was awarded $20,000 by Northwestern Energy/Thompson Falls Mitigation Fund in 2017 to fund field data collection and the development of conceptual designs for the removal of the lower Rattlesnake Creek Dam and restoration of the stream and floodplain at the project site. Phase I of the Rattlesnake Creek Dam Removal Project is currently 100% completed. The Site Assessment and Conceptual Restoration Design document was completed in February 2018.

Section 2.0 Background

The lower Rattlesnake Creek Dam was constructed in 1901 to be the primary water source for Missoula by impounding more than 3 million gallons of water in an adjacent constructed reservoir. In the early 1980s, Rattlesnake Creek water became contaminated with giardia because of beaver populations in the middle reaches, which led to giardia outbreaks in the city's water system. As a result, in 1983 the Mountain Water Company stopped using the Rattlesnake Watershed system as the primary water supply and began maintaining it as the city's backup supply.

Since that time the Dam has served no water storage or delivery purpose (and is no longer even viable as a back-up municipal system) but has continued to impact fish migrations and river processes (e.g. floodplain connections, sediment transport). Although construction of a fish ladder at the site in 2003 helped to mitigate fish passage impacts, recent structural modifications at the dam have compromised benefits to some species (including bull trout). With the recent acquisition of the Dam and associated infrastructure by the City of Missoula (in June 2017), a partnership between Montana FWP, the City of Missoula and Trout Unlimited was developed to evaluate the deteriorating dam structure and develop alternatives for mitigating or removing the structure. TU requested partial funding of Phase I project expenses including survey, data analysis, and design activities.

Section 3.0 Goals

The project includes the following goals and objectives:

- **Objective 1:** Provide unobstructed upstream fish passage for native trout populations, including fluvial bull trout. Rattlesnake Creek is considered a Tier II priority for investment of Thompson Falls Dam Bull Trout Mitigation funds.
- **Objective 2:** Promote passage and habitat conditions that support all life stages of native fish and aquatic organisms. Incorporate habitat heterogeneity and connectivity for terrestrial wildlife on the site.
- **Objective 3:** Rehabilitate stream, floodplain and hillslope processes to approximate reference conditions
- **Objective 4:** Include future use of the site for public recreation into the dam removal design and construction process
- **Objective 5:** Reduce public safety hazards and/or eliminate potential liability hazards

Section 4.0 Activities

The following activities and tasks have been completed since the inception of this project:

Task 1: Data Collection and Analysis

Task 1 Description: TU hired River Design Group and Morison Maierle Inc to serve as technical experts and engineers for the project. The team first compiled known data sources for fisheries, water quality, site history, feasibility and other supporting documentation and developed a list of data gaps. Field data collection completed for the site included infrastructure and utility surveys, geomorphic investigations including channel morphology, substrate and site hydrology stream bathymetry, LiDAR topographic data acquisition, and vegetation and wetland surveys.

Task 2: Conceptual Design and Report

Task 2 Description: A conceptual design document was developed for the project and delineated four conceptual restoration alternatives. The report was organized into the following sections and appendices:

- ***Section 1 Introduction*** describes the project context, goals, timeline and document scope;
- ***Section 2 Site Assessment*** provides a summary of existing conditions including a watershed overview, description of site infrastructure and summary of existing stream and floodplain conditions;
- ***Section 3 Restoration Alternatives*** presents restoration concepts and describes the development and evaluation of infrastructure removal and restoration alternatives;
- ***Section 4 Example Restoration Treatments*** provides descriptions, illustrations and photographs of example restoration treatments.
- ***Section 5 Design and Implementation Considerations*** summarizes considerations for future project phases.
- ***Section 5 Design and Implementation Considerations*** summarizes considerations for future project phases.

- ***Appendices*** provides restoration data summary, infrastructure data summary and budget cost summary.

Task 3: Public Scoping

Task 3 Description: On March 20th, 2018, a public open house was held at the Missoula International School to gather input on the Lower Rattlesnake Dam site restoration project. Representatives from Missoula Water, Missoula Parks and Recreation, Trout Unlimited, and Montana Department of Fish, Wildlife, and Parks presented information about the proposed project and were available to answer questions from the public. A public questionnaire was also provided at the open house and subsequently posted online in order to collect input from attendees as well as other interested citizens.

Task 4: Phase II Scope of Work Development

Task 4 Description: Trout Unlimited negotiated a Phase II contract with River Design Group and Morrison Maierle to continue the design process and further analysis. Scope for the Phase II design work includes preliminary design activities such as data mapping, plan set development, restoration hydraulic modeling, design analysis and development of preliminary design specifications and cost estimates.

Section 5.0 Finances

The following budget represents the expenses for the project to date.

Item	NWE Cost	Match Cost	Total Cost
Direct Labor -			
LiDAR Imagery	$ 0	$ 12,500	$ 12,500
Data Collection and Analysis	$ 5,000	$ 35,000	$ 40,000
Conceptual Design and Report	$ 14,000	$ 27,500	$ 41,500
Direct Overhead - 5%	$ 1,000	$ 5,000	$ 6,000
Travel and Living	$ -	$ -	$ -
Material and Equipment	$ -	$ -	$ -
Totals	**$ 20,000**	**$ 80,000**	**$ 100,000**

TU has expended the entirety of the $100,000 in the original budget. Matching funds for the topographic survey, data collection, project design effort and other activities were acquired from the Westslope Chapter of Trout Unlimited, Hewlett Foundation, and Stockman's Bank.

Coordination in the Thompson River Drainage

Report to the Thompson Falls Technical Advisory Committee (TAC), submitted 01/03/2019

Project Sponsor: Lower Clark Fork Watershed Group (LCFWG)
PO Box 1329, Trout Creek, MT 59874

Project Contact(s): Brita Olson, LCFWG Coordinator
brita@lowerclarkforkwatershedgroup.org
(208) 304-3852

Ryan Kreiner, Fisheries Biologist
Montana Fish, Wildlife & Parks (MFWP)
rkreiner@mt.gov
(406) 827-9320

Project Location: Thompson River Drainage

Background/project description:

Since May 2016, NorthWestern has provided ongoing funding for the Lower Clark Fork Watershed Group (LCFWG), a 501(c)(3) non-profit that works to facilitate collaborative restoration in the tributaries of the lower Clark Fork River for the benefit of water quality and native fish and wildlife. The purpose of these funds is to develop on-the-ground restoration projects to benefit Bull Trout in the Thompson River, by supporting a portion of the LCFWG Coordinator's time focused on the Thompson River drainage. The role of the LCFWG in this process is to coordinate the many elements that must fall into place in order to carry out a quality, impactful project. This involves connecting with and gaining support of key stakeholders, developing landowner support and involvement, ensuring environmental compliance and permitting is in place, piecing together funding, implementing or contracting for the implementation of the project, and providing adequate monitoring and follow-through to ensure the long-term success of a project.

In 2016, the Coordinator's focus in the Thompson River drainage was connecting with stakeholders and developing relationships throughout drainage, laying crucial groundwork for future on-the-ground projects. In 2017, the focus of the LCFWG's efforts in the Thompson River drainage was the development of the Thompson River Watershed Restoration Plan (WRP). As a part of this planning process, LCFWG staff reviewed available reports and assessments, gathered direct input from stakeholders, and developed a plan that both met the needs and priorities of those working in the drainage, and also met the state and federal requirements for a WRP. Having an approved WRP for a watershed is very valuable because it qualifies any tributaries included in it for Clean Water Act, Section 319 funding. The Thompson River WRP was accepted by Montana Department of Environmental Quality and finalized in March 2018. More information on the watershed restoration planning process is available at: lcfwg.org/what-we-do/wrp/tr-wrp/.

In 2016 and 2017, additional cash contributions to Thompson River projects and the development of the WRP (match for the 2016 and 2017 cost-share proposals for Coordination in the Thompson River Drainage) included: $10,419.85 from the Soil and Water Conservation Districts of Montana, $5,000 from the Lolo National Forest, and $2,500 from the Department of Natural Resources and Conservation 223 Program. In-kind contributions to this project were made by many stakeholders as well, totaling $18,257.48.

2018 accomplishments:

In 2018, partnerships formed through the development of the Thompson River WRP were strengthened and translated into project planning and development, as well as on-the-ground implementation. Additional match funds were also raised to increase the impact of this coordination and other cost-share projects funded through the Thompson Falls TAC.

Project planning and development: LCFWG worked to coordinate stakeholders in the Thompson River drainage to support the development of on-the-ground projects. This year, stakeholders made multiple site visits in the drainage, following up and investigating projects that were initially identified in the WRP. For example, in April, representatives from all major landowners/land managers (Lolo National Forest, Weyerhaeuser, and Montana Department of Natural Resources), MFWP, and LCFWG met in the Fishtrap Creek drainage to discuss project ideas, which include the West Fork Fishtrap Road Realignment Project (shown in Photo 1 below), which is planned for implementation in 2019. This project will relocate the junction of forest road #7609 with the main Fishtrap road #516, establishing functional floodplain, and enhanced fish habitat along approximately 600 feet of mainstem Fishtrap Creek. Additional projects, such as Large Woody Debris (LWD) enhancement projects along mainstem Fishtrap Creek from the West Fork confluence downstream to the Beatrice Creek confluence were also discussed. The goal of these projects would be to increase habitat diversity, as well as rearing and/or spawning habitat. This idea will be further refined and designed in 2019, with implementation (if consensus among stakeholders is reached and funding acquired) planned for 2020. These projects will furthermore be supported by the Lolo National Forest's Native Fish Restoration Project, which includes projects identified above in Fishtrap Creek as well as other projects on the Lolo National Forest. A decision for this project is expected in November 2018.

Photo 1. Left to right: Ryan Kreiner (MFWP), Brian Sugden (Weyerhaeuser), Mike Anderson (DNRC), and Jon Hanson (USFS) discuss the West Fork Fishtrap Road Realignment Project while standing on the section of the road that will be removed as a part of this project.

On-the-ground implementation: Also, in 2018, funds were acquired for the Loneman Creek Riparian Fencing Project, which was implemented in fall 2018. Loneman Creek supports an entirely Westslope Cutthroat Trout population and is a tributary to the Little Thompson River, which is 303(d) listed for sediment and nutrients. Elevated summer water temperatures in the Little Thompson River also negatively impact the mainstem Thompson River. Monitoring of temperature in Loneman Creek indicates that summer water temperatures are elevated compared to a nearby reference stream (Partridge Creek). Prior to the Loneman Creek fencing project, cattle had unmitigated access to the creek, but with exclusion fencing installed the riparian area will have the opportunity to recover which will result in improved habitat, shade, reduced stream temperatures, and reduced sediment and nutrient inputs. This project was identified by Weyerhaeuser, and implemented largely by the grazer, Rebel Carr, who leases the allotment which encompasses Loneman Creek. Thompson Falls TAC funds contributed to this project through LCFWG's Coordination funds, which provided the capacity for the LCFWG to coordinate project partners, help Weyerhaeuser acquire a 310 permit, acquire funding for all fencing materials, support implementation and monitoring efforts, and complete reporting. Beyond this project's immediate impact to water quality in the Little Thompson River drainage, it also established a precedent for partnership with Weyerhaeuser in the Thompson River and may lead to other successful joint projects in places such as Fishtrap Creek where Weyerhaeuser is also a major landowner.

Total match funding for this project (to-date) includes: $2,000 from the MFWP Future Fisheries Improvement Program, $2,000 from the Soil and Water Conservation Districts of Montana's Ranching for Rivers program (accessible because of the accepted WRP for the Thompson River drainage), $1,364.90 contributed by Weyerhaeuser in fencing materials, a hardened cattle crossing on the upstream end of the exclosure, and in-kind time, and $3,131.97 contributed by Rebel in in-kind labor, materials and equipment.

Photo 2. Downstream end of the Loneman Creek fencing project taken from the Little Thompson River Road.

Additional match: In addition to the match funds contributed by stakeholders and other funding programs to the development of the Thompson River WRP and the Loneman Creek Riparian Fencing Project, the LCFWG also partnered with Trout Unlimited to develop a proposal to the

Bureau of Reclamation's Cooperative Watershed Management Program. The LCFWG was awarded $100,000 for project development, planning, and design. Trout Unlimited will partner with the LCFWG to provide additional technical assistance and complete restoration design. Additional restoration design will also be contracted out to private firms. These funds will be used to develop and design projects identified in the Lolo National Forest's Native Fish Restoration Project, focusing on the development of projects in the Thompson River drainage (such as the LWD enhancement projects in Fishtrap Creek mentioned above). These funds will enable the LCFWG, and partner Trout Unlimited, to develop multiple "shovel-ready" projects over the next two years and create restoration momentum in the Thompson River drainage.

Budget:
Funds received in 2016 and 2017 for Coordination in the Thompson River Drainage have been fully expended. The balance remaining in 2018 Coordination funds are shown in the table below, as of December 31, 2018. Funds for Coordination in the Thompson River Drainage were originally approved in summer 2016, so the funding cycle has been summer to summer with carry-over between calendar year. The request for 2019 Coordination funds was modified to align this project with the Thompson Falls TAC's annual funding cycle.

2018 Coordination funds	Opening balance	Spent to date (December 31, 2018)	Remaining balance
Coordination (staff time)	$ 13,000.00	$ 6,016.91	$ 6,983.09
Mileage and equipment	$ 1,000.00	$ 905.30	$ 94.70
Education and training	$ 1,000.00	$ 572.62	$ 427.38
Total	$ 15,000.00	$ 7,494.83	$ 7,505.17

Coordination (staff time): Coordination expenses to-date included payroll expenses from August-December 2018 related to the coordination of Thompson River projects. These funds generally support on average 40 hours/month of coordination related to the Thompson River drainage.

Mileage, equipment and operation expenses: Mileage, equipment and operation expense were expended solely on mileage making site visits in the Thompson River drainage (Fishtrap Creek, Loneman Creek, and Little Rock Creek) and related planning meetings.

Education and training: To-date, education and training funds supported LCFWG staff attendance of the Montana Watershed Coordination Council's Watershed Symposium in Whitefish, MT. Staff presented on the Thompson River WRP, networked with local, state, and federal entities involved in watershed coordination, as well as attended many training sessions.

Crow Creek Stream Reconstruction Design

Report to the Thompson Falls Technical Advisory Committee (TAC), submitted 01/09/2019

Project Sponsor: Lower Clark Fork Watershed Group (LCFWG)
PO Box 1329, Trout Creek, MT 59874

Project Contact(s): Brita Olson, LCFWG Coordinator
brita@lowerclarkforkwatershedgroup.org
(208) 304-3852

Jason Blakney, Fisheries Biologist
Montana Fish, Wildlife & Parks (MFWP)
jblakney@mt.gov
(406) 827-9282

Project Location: Crow Creek (Tributary to Prospect Creek)

Background/project description:

Crow Creek is a tributary to upper Prospect Creek, which has its confluence approximately thirteen miles upstream from the Clark Fork River. Lengthy intermittent sections of stream near the confluence provide a seasonal barrier that has enabled Crow Creek to retain an entirely native fish species assemblage of Westslope Cutthroat Trout, Bull Trout, and Cedar Sculpin. Currently, two major power line corridors (NorthWestern Energy-NWE and Bonneville Power Administration-BPA) travel up the drainage and have adversely affected the riparian area. Installation and maintenance of these utility corridors have resulted in persistent loss of old growth riparian conifers in Crow Creek. As a result of the loss of woody debris, the channel became over-widened, shallow, and lacked pools, shade, and complexity. Large cedar stumps beneath the power lines provide evidence of the historical condition of Crow Creek. In upstream areas of the East and West Forks Crow Creek, decadent stands of large diameter cedar and fir still dominate riparian areas.

In 2018, the Thompson Falls TAC funded the design of a 600 foot channel and floodplain restoration project in Crow Creek, immediately downstream from the first phase of restoration that occurred in 2007 and has shown positive results. This was following a formal request to FERC to recognize the Prospect Creek drainage as an appropriate location for NWE to expend mitigation funds associated with the Thompson Falls Project.

2018 accomplishments:

In early 2018, Brita Olson (LCFWG), Jason Blakney (FWP), and other partners, such as Jon Hanson from the Lolo National Forest (LNF) developed a request for qualifications (RFQ), which was issued on March 19. Five responses were received by April 13, from Clearwater Restoration, Confluence Consulting, Intermountain Aquatics, River Design Group, and Restoration Engineering. A review panel (with representatives from LCFWG, FWP, and LNF) met on April 24 to review and rank responses. River Design Group (RDG) was selected as the

highest-ranking submitter. A kick-off meeting on-site was held on June 15. A contract for the design of Crow Creek Channel Restoration – Phase II was negotiated and finalized between RDG and LCFWG on August 27, 2018.

The contract for design, in addition to Project Management, Field Work, Engineering Design and Hydraulic Modeling, Environmental Compliance and Permitting, and Bid Document Development and Construction Management funded by NorthWestern, also included funding for a LiDAR flight to inform the survey and design work. This portion of design was funded through Avista's Clark Fork Settlement Agreement, as was coordination and project management provided by LCFWG. Additional in-kind contributions have been contributed by other partners and technical advisors, notably FWP and LNF.

The LiDAR flight as well as on-the-ground survey work (completing geomorphic channel surveys, reviewing downstream reference conditions, collecting high resolution aerial photos, completing wetland delineation field work, and assessing vegetation to support revegetation design) took place in late August and early September. Alternatives for channel alignment were developed in the fall, and stakeholders (LCFWG, LNF, FWP, and RDG) met on November 19 to discuss the pros and cons of each option. The preferred alternative was selected, and Preliminary Design Concepts were prepared in late November. A full design is expected in early January for stakeholder review and comment. Permitting applications and bid documents will also be prepared in anticipation of implementation in 2019.

Budget:

Crow Creek – Phase II Design	Opening balance / funds available	Expended to-date (December 31, 2018)*	Remaining balance
2018 NWE Funds	$ 30,000.00	$ 10,641.16	$ 19,358.84
2018 CFSA Funds (LiDAR flight)	$ 8,800.00	$ 8,800.00	$ 0
Total project cost	$ 38,800.00	$ 19,441.16	$ 19,358.84

*To-date, RDG has invoiced only for time, expenses, and subcontractor fees accrued from August 28, 2018 through September 17, 2018.

Biomark
SPECIALISTS IN IDENTIFICATION SOLUTIONS

Northwestern Energy/Avista Corporation

Prospect Creek PIT Array

PIT-Tag Interrogation Array Installation Report

August 28, 2018

PIT Tag Interrogation Array Installation Report

Site Name: Prospect Creek PIT Array
PTAGIS Site Code: N/A
Site Location: 100ft upstream from USGS Prospect Creek Gauge Station.
47.585879°, -115.354905°
Site Operational Date: 08/28/2018
Biomark POC: Steve Anglea
Technical POC: Dave Thompson (Biomark)
Data Steward: Eric Oldenburg (Avista)/Brent Mabbott (Northwestern Energy)
IP Address: 166.167.166.3
Port Address: 10001
Port Address:
CSI Interface Board: N/A

Site Description:

The site is located on Prospect Creek approximately 100 ft upstream from USGS Prospect Creek Gauge station. The site is accessed through private land, Brent Mabbott (Northwestern Energy) has the contact information. The IS1001-Master Controller (IS1001-MC), battery box/PCB switcher are located on river right bank.

The site consists of 6-20 ft HDPE antennas, arranged in 2 separate arrays of 3 antennas each. The antennas are constructed of fusion welded 4 inch HDPE pipe. Each antenna is driven by a Biomark IS1001 reader located in a submersible canister attached to the antenna. The readers are controlled by a Biomark IS1001-MC located in an enclosure on river right bank.

The antennas are anchored to the streambed with a “through-strut” method using DB-88 earth anchors attached to stainless steel threaded rod. The anchors are driven to a depth of 20-30 inches into the river bed. The IS1001 readers are connected to the IS1001-MC via Biomark Can-bus cable. All cables are covered by flexible non-metallic conduit.

Power for the system is AC power supplied from the private property, via an extension cord that is plugged into the house then run to the PCB switcher. The AC power is connected directly into a Biomark PCB battery switcher which charges/powers the Biomark electronics enclosure; houses the Biomark IS1001-MC, and batteries. The site is connected remotely via Cloudgate LTE wireless modem.

Attachments:

Installed Components Table
Serial Number Table
Read Range Table
Site Map
Wiring Map
Equipment Installation Photos
Antenna Installation Photos
Controller/Reader Initial Settings
Controller/Reader Manual
Additional Equipment Manuals (Digital Copy Only)

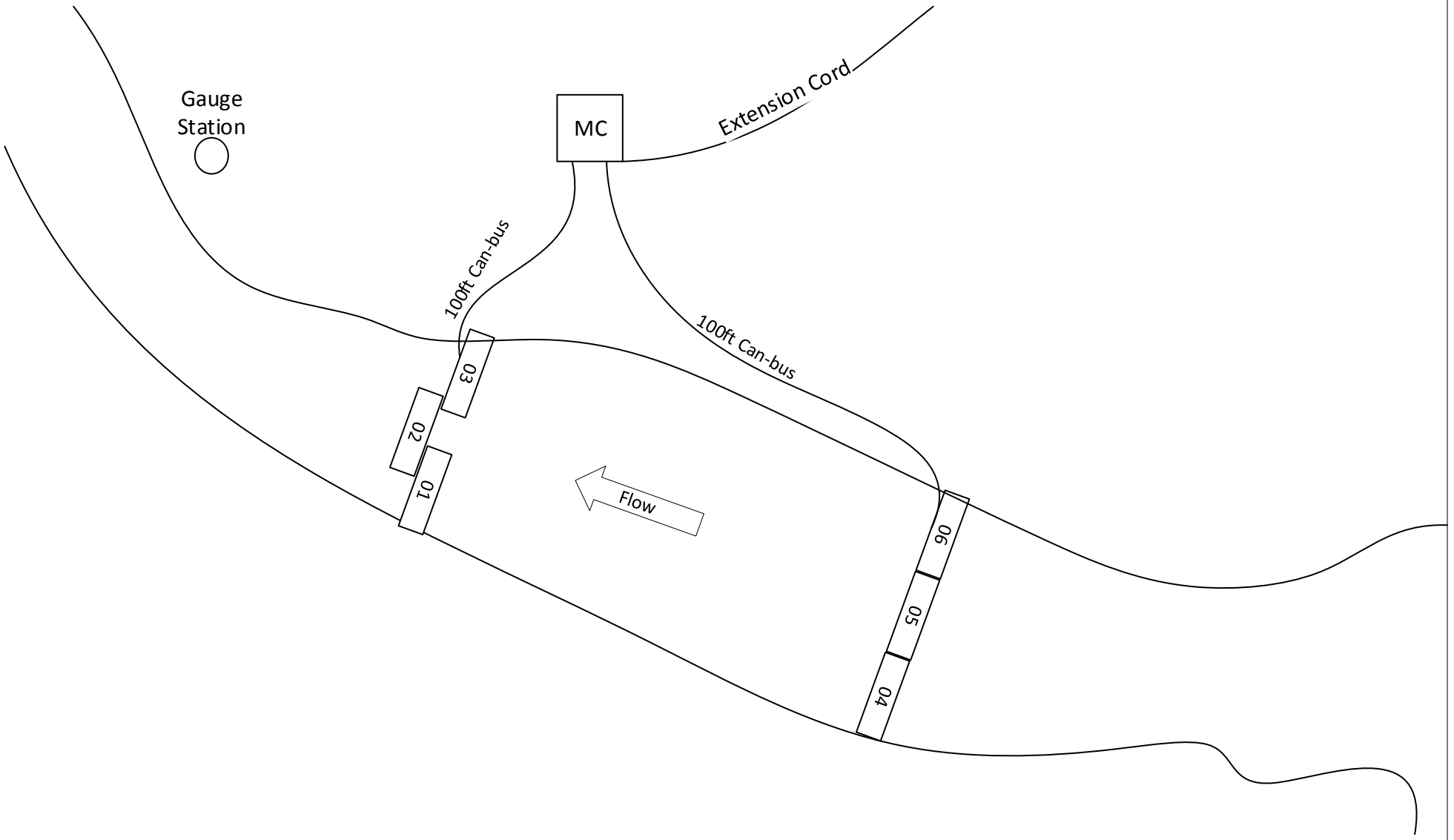
Table of Installed Components, Serial Number, Read Ranges

Quantity	Item	Description	Location	Included Document
48	Anchors	Thru Strut Style Anchor	8 per 20ft antenna	N/A
6	Antenna Connectors	Subconn 3 pin IL3	One female/male per antenna	Spec sheet
6	Reader Connectors	8 pin subconn IL8	One Male/Female per instream Antenna	Spec Sheet
6	Antennas	20ft HDPE pipe antennas	2 arrays of 3 antennas	N/A
280	Cabling	Biomark Can-bus Cabling	100ft to each array, 20ft between antennas	Spec sheet
1	Battery Box	Blue Kobalt Box	Base of enclosure pole	N/A
1	Enclosure	Hoffman 36x30 CSD36308 w/locks	Mounted to pole river right bank	Spec sheet
1	Switcher	Biomark PCB Battery Switcher/Charger	In blue Kobalt box	N/A
4	Battery	12V 115Ah battery	In blue Kobalt box	N/A
6	Reader Enclosures	Biomark Submersible thermo plastic	One mounted on each instream antenna	N/A
6	Reader	Biomark IS1001	In submersible reader enclosure	Spec sheet
1	Controller	Biomark IS1001 MC controller	In enclosure mounted to pole	Spec sheet
1	Power Supply	DC-DC Supply 18-75C28NT620	In MC Enclosure	Spec sheet
1	Cell Modem	Cloudgate Cell Modem	In enclosure mounted to pole	Spec Sheet

Table of Installed Components, Serial Number, Read Ranges

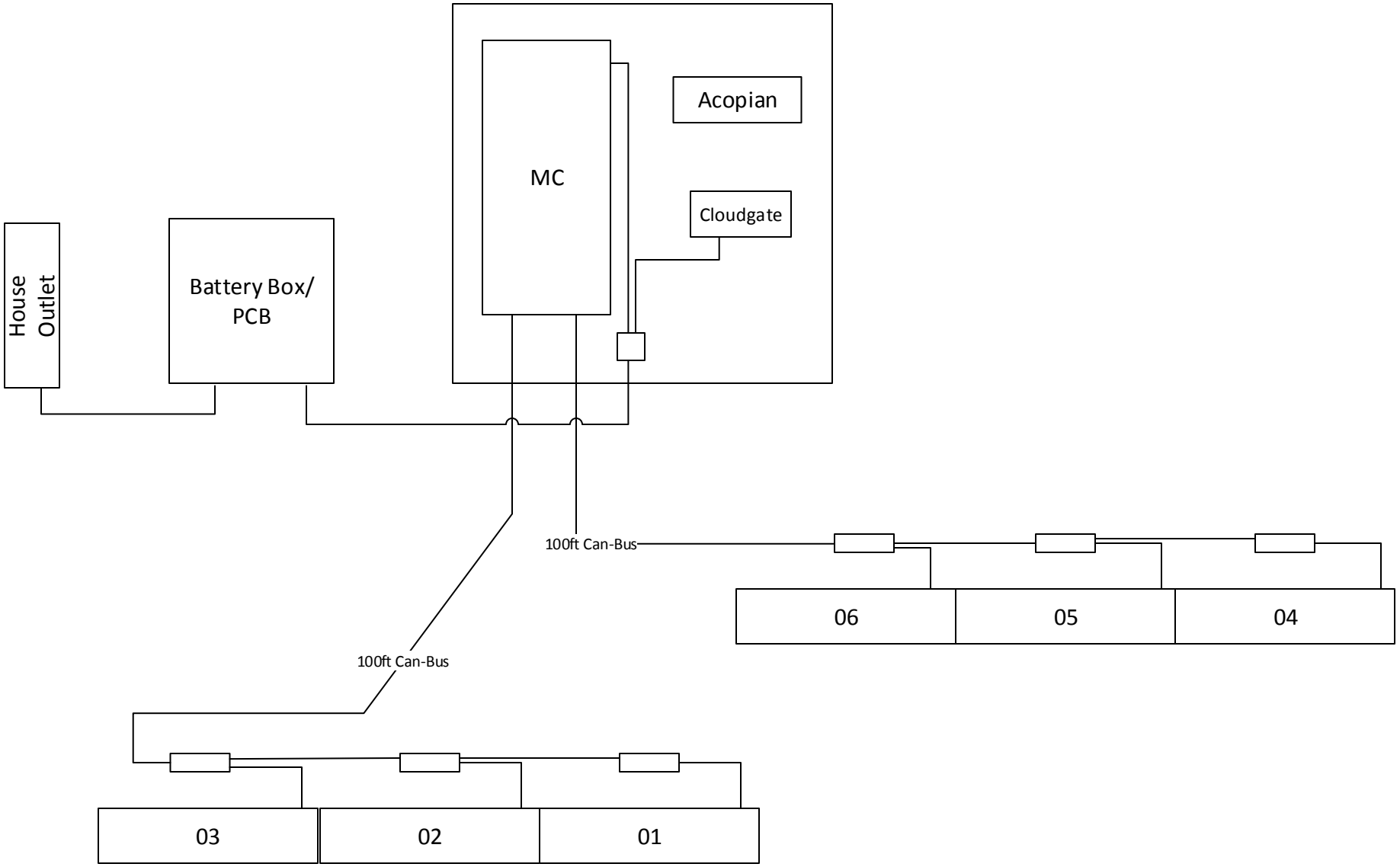
Item	ID	Position	Location	Serial Number	Firmware Version at Installation
MC	A0	N/A	Right bank	1828.0318	1.6.3
IS1001	01	A1	Downstream left bank	1814.2495	1.6.3
IS1001	02	A2	Downstream middle	1814.2494	1.6.3
IS1001	03	A3	Downstream right bank	1814.2493	1.6.3
IS1001	04	B1	Upstream left bank	1814.2492	1.6.3
IS1001	05	B2	Upstream middle	1814.2491	1.6.3
IS1001	06	B3	Upstream right bank	1814.2490	1.6.3
Antenna	N/A	A1	Downstream left bank	18-389	N/A
Antenna	N/A	A2	Downstream middle	18-387	N/A
Antenna	N/A	A3	Downstream right bank	18-371	N/A
Antenna	N/A	B1	Upstream left bank	17-630	N/A
Antenna	N/A	B2	Upstream middle	17-656	N/A
Antenna	N/A	B3	Upstream right bank	18-385	N/A

Date	MC ID	Antenna ID	Read Range (inches)	Test Location	Tag Type
8/18/2018	A0	A1	32	lower half, middle of antenna	Biomark APT 12
8/18/2018	A0	A2	29	lower half, middle of antenna	Biomark APT 12
8/18/2018	A0	A3	27	lower half, middle of antenna	Biomark APT 12
8/18/2018	A0	B1	29	lower half, middle of antenna	Biomark APT 12
8/18/2018	A0	B2	24	lower half, middle of antenna	Biomark APT 12
8/18/2018	A0	B3	28.5	lower half, middle of antenna	Biomark APT 12



Drawing Not To Scale

Biomark	Title: Prospect Creek PIT Array Project: TS1349 Client: Eric Oldenburg	Prepared By: Thompson, Dave Date: August 30, 2018	Notes:



Drawing Not To Scale

Biomark	Title: Prospect Creek PIT Array Project: TS1349 Client: Eric Oldenburg	Prepared By: Thompson, Dave Date: August 30, 2018	Notes:

Driving anchors near shore on upper array

Power pack on tarp as a result of Hoot Owl fire restriction

Upper array installed and ready to backfill

Panorama from enclosure site, lower array has to be backfilled still.

Reader Initial Settings

Controller:				
ID:	01	N/A	N/A	1
Input Power Mode:	24 V	N/A	N/A	24 V
Sync. Mode:	Standalone	N/A	N/A	Standalone
Sync. of Cycle:	Disabled	N/A	N/A	Disabled
Beeper:	Enabled	N/A	N/A	Enabled
Tag Display Format:	HEX	N/A	N/A	HEX
LCD Backlight Mode:	Saving	N/A	N/A	Saving
Initiation Delay:	Disabled	N/A	N/A	Disabled
Automatic Standby Voltage:	18 V, 19 V	N/A	N/A	18 V, 19 V
Auto Standby Start Time:	0:00	N/A	N/A	0:00
Auto Standby Duration:	Disabled	N/A	N/A	Disabled
Idling Time:	Disabled	N/A	N/A	Disabled
Alarms:				
Tuning Cap. High Alarm:	970	N/A	N/A	970
Tuning Cap. Low Alarm:	50	N/A	N/A	50
Alarms Unique Delay:	3600 Sec	N/A	N/A	3600 Sec
Detection:				
HDX Tag Detection:	Enabled	N/A	N/A	Disabled
FDXB Fastag Detection:	Disabled	N/A	N/A	Disabled
Detection Counter:	Enabled	N/A	N/A	Enabled
FDXB Detection Scan Time:	120 ms	N/A	N/A	120 ms
Automatic VTT Delay:	60 Min	N/A	N/A	60 Min
Network:				
Primary Sequence:	01,02,03, 04,05,06, --,--,--, --,--,--	N/A	N/A	01,02,03, 04,05,06, 07,08,09, 0A,0B,0C
Secondary Sequence:	--,--,--, --,--,--, --,--,--, --,--,--	N/A	N/A	--,--,--, --,--,--, --,--,--, --,--,--
Communication:				
Local Port Speed:	115200	N/A	N/A	115200
Tags Comm. To Local Port:	Enabled	N/A	N/A	Enabled
Alarms Comm. To Local Port:	Enabled	N/A	N/A	Enabled
Messages Comm. To Local Port:	Enabled	N/A	N/A	Enabled
Remote Port Speed:	115200	N/A	N/A	115200
Remote Port Protocol:	ASCII	N/A	N/A	ASCII
Remote Port AES-256 Comp.:	Disabled	N/A	N/A	Disabled
Memory:				
Store Virtual Tags To Memory:	Enabled	N/A	N/A	Enabled
Ext. Storage File Duration:	24 Hrs	N/A	N/A	24 Hrs
Reports:				
Automatic Noise Report Delay:	Disabled	N/A	N/A	Disabled
Automatic Status Report Delay:	10 Min	N/A	N/A	60 Min

Reader Initial Settings

Reader Node 01 Settings:				
Exciter Voltage Level:	2	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled
Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%
Reader Node 02 Settings:				
Exciter Voltage Level:	2	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled
Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%
Reader Node 03 Settings:				
Exciter Voltage Level:	3	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled
Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%
Reader Node 04 Settings:				
Exciter Voltage Level:	3	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled
Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%
Reader Node 05 Settings:				
Exciter Voltage Level:	3	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled

Reader Initial Settings

Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%

Reader Node 06 Settings:

Exciter Voltage Level:	3	N/A	N/A	1
Dynamic Tuning:	Enabled	N/A	N/A	Enabled
Tuning Target Phase:	390	N/A	N/A	390
Phase Deviation Threshold:	10	N/A	N/A	10
Unique Mode:	Delay	N/A	N/A	Disabled
Unique Delay:	60 Sec	N/A	N/A	60 Sec
VTT Level:	128	N/A	N/A	128
Beeper:	Disabled	N/A	N/A	Disabled
Antenna Current Low Alarm:	1.0 Amp	N/A	N/A	1.0 Amp
Noise High Alarm:	50%	N/A	N/A	20%

Component Documents

Beartrap Fork Creek Culvert Removal

The Beartrap Fork Culvert removal was completed in summer 2018. The culvert was removed, banks were stabilized, and grade control structures were placed within the channel. The work took 1 day, and all fill was hauled off site and stabilized. The area was mulch and seeded, and then later planted with willows and alder in the fall. A gate was relocated to ensure the public did not drive through the stream as well. Unfortunately, upon revisiting the site in the fall someone had illegally driven past the gate and cut out stabilizing wood along the sloped back banks, and driven through the stream. While the primary goal of fish passage for all life stages and at all times of the year has been accomplished, the Forest Service intends to revisit the site in 2019 and further block illegal passage around the gate and complete any necessary repairs.

Pre-removal

Post-removal

Post illegal access

Bull Trout Genetics

No Bull Trout genetic samples were collected or analyzed in 2018.

Emergency – Contingency Fund

NorthWestern utilized the emergency/contingency funding in 2018 in support of equipment, maintenance, and installation costs associated with PIT Tag arrays in Fishtrap Creek and Prospect Creek. A summary of expenses is provided in the table below.

2018 FY	**Amount**	**Description of Expense**
18-Jan	$844.98	Generator for Fishtrap PIT antenna
22-Jan	$198.86	Supplies for generator
6-Apr	$890.00	PIT antenna - Fishtrap
5-Apr	$497.45	Batteries for Fishtrap PIT reader
29-Jun	$337.60	Labor - permit for Prospect Creek
16-Aug	$451.35	Antenna - Prospect Creek
29-Aug	$300.00	Electricity from Private Land Owner at Prospect Creek
7-Sep	$3,015.00	Reader for Mobile antenna
17-Sep	$1,036.80	Electrician time- Prospect Creek
TOTAL	**$7,572.04**	

Appendix C – 2019 Proposals Approved for TAC Funding

A summary of the TAC approved projects for 2019 are listed in Table C-1. The following sections include each project proposal.

Table C-1. Summary of TAC approved projects for 2019.

Agency/Entity	Project Proposal 2019	TAC Funding Requested	TAC Vote
TU/FWP (Roberts/Knotek)	Rattlesnake Dam Removal Project, Phase I1	$50,000	FWP Yes FWS Yes CSKT Yes NorthWestern Yes
FWP (Kreiner)	Crow Creek Stream Reconstruction Phase II	$51,500 (Max request)	FWP Yes FWS Yes CSKT Yes NorthWestern Yes – notify by email to group of final funding
USFS (Hanson)	WF Fishtrap Ck Rd Realignment (Design complete) (NEPA in progress)	30,627.15	FWP Yes FWS Yes CSKT Yes NorthWestern Yes
FWP (Kreiner)	2019 Thompson River Coordinator	$9,900	FWP Yes FWS Yes CSKT Yes NorthWestern Yes
NorthWestern (Mabbott)	Emergency/Contingency Fund (Prospect Creek PIT, Bull Trout Genetics, etc).	$10,000	FWP Yes FWS Yes CSKT Yes NorthWestern Yes
TOTAL Approved		$152,027.15	

Region 2 Headquarters
3201 Spurgin Road
Missoula, MT 59804
Phone 406-542-5506
November 9, 2018

RE: Support Letter
Trout Unlimited, City of Missoula, and FWP Proposal
Rattlesnake Dam Removal and Site Restoration

Dear Committee Members:

This letter in written in support of funding requests for remediation work planned at the Rattlesnake Dam site in Missoula. This facility was previously owned by a private water company (Mountain Water Co.) until the recent purchase by the City of Missoula, which transferred all facilities and water rights to public ownership. The Rattlesnake Dam site was originally constructed and modified to supply water (and power) to Missoula. However, this site has not been used for public water supply or any significant public service for more than 40 years and these facilities are no longer needed.

The Rattlesnake Dam has significantly impact fisheries and stream function on Rattlesnake Creek since its construction nearly a century ago. Rattlesnake Creek provides the primary spawning and rearing habitat for trout comprising the Clark Fork River fishery in the Missoula area. It also supports the only viable tributary bull trout population in the area. Unfortunately, the dam and associated infrastructure still significantly impede trout spawning migrations and limit seasonal movement for several other fish species.

For more than a decade, Montana Fish, Wildlife & Parks (MFWP) and partners have attempted to mitigate fisheries impacts at Rattlesnake Dam through research projects, manual fish passage and construction of a fish ladder. As these projects have been implemented, some impacts to fish migration have been mitigated. However, it has become obvious that removal of the dam and associate infrastructure is the best long term, comprehensive option for enhancing fish populations and restoring natural stream function in this drainage. To date, more than $300,000 has already been spent in attempts to reduce fisheries impacts at the site.

The current project proposed by Montana Trout Unlimited, Missoula Water and MFWP in the stream reach containing Rattlesnake Dam and Reservoir is the most important stream enhancement project in the Missoula area. The project has overwhelming public support from a broad range of interest groups in western Montana (see summary of comments in public scoping) and also includes the potential to dedicate nearly 50 cfs of water rights to instream flow for the benefit of aquatic life. Please join these groups and local public agencies in their efforts to restore this reach of Rattlesnake Creek and restore all of the natural benefits it can provide.

Please don't hesitate to contact me if you would like more information about the project or the associated natural resources in the Rattlesnake watershed.

Sincerely,

W. Ladd Knotek
Fisheries Management Biologist

Project Title: Rattlesnake Dam Removal Project, Phase II

Proposal Submitted by: Rob Roberts, Trout Unlimited and Ladd Knotek, Montana FWP

Location of Proposed Project: Rattlesnake Creek, Missoula County, Montana

Total Project Cost: $907,512.44

TAC Funds (Cost-Share) Requested: $50,000

I. Introduction

Rattlesnake Creek is an 82 square-mile drainage that originates in the Rattlesnake Wilderness and joins the Clark Fork River in downtown Missoula, Montana. The watershed is designated as Bull Trout Critical Habitat and is considered a Tier II priority with respect to Thompson Falls Dam bull trout mitigation funds. This stream supports a robust trout community consisting of both native and wild trout populations. The Rattlesnake Creek corridor is a recreation hub for Missoulians and visitors, with a large network of mountain bike and hiking trails. Further, the confluence of Rattlesnake Creek and the Clark Fork was historically one of the largest and most important fish camps for the native Salish people.

Rattlesnake Creek Dam was constructed in 1901 to be the primary water source for Missoula by impounding more than 3 million gallons of water in an adjacent constructed reservoir. In the early 1980s, Rattlesnake Creek water became contaminated with giardia because of beaver populations in the middle reaches, which led to giardia outbreaks in the city's water system. As a result, in 1983 the Mountain Water Company stopped using the Rattlesnake Watershed system as the primary water supply and began maintaining it as the city's backup supply.

Since that time the Dam has served no water storage or delivery purpose (and is no longer even viable as a back-up municipal system), but has continued to impact fish migrations and river processes (e.g. floodplain connections, sediment transport). Although construction of a fish ladder at the site in 2003 helped to mitigate fish passage impacts, recent structural modifications at the dam have compromised benefits to some species (including bull trout). With the recent acquisition of the Dam and associated infrastructure by the City of Missoula (in June 2017), we now have a unique – and immediate – opportunity to decommission the obsolete municipal water system and remove the dam.

The City of Missoula, Trout Unlimited and Montana Fish, Wildlife and Parks are invested in restoring habitat for native fish and terrestrial wildlife, improving water quality in Rattlesnake Creek, reducing maintenance costs and providing additional scenic open space and recreational opportunities for the Missoula community. Therefore, the City, MFWP and TU are working collaboratively to plan and implement a restoration project at the dam that will remove existing man-made infrastructure and fully re-naturalize the site. Following restoration of the site the land will be managed as City Open Space in conjunction with the greater Rattlesnake Greenbelt system of Conservation Lands.

TAC funds previously provided $20,000 for Phase I data collection and design activities, which was matched by more than $175,000 in other state, federal and private sources. This proposal requests partial funding of Phase II of this project for dam demolition and restoration activities. TU has secured nearly 700,000 in matching funds for Phase II project costs. This implementation stage will take through 2019 and 2020.

II. Objectives

The project will include the following elements and associated outcomes:

- **Objective 1:** Provide unobstructed upstream fish passage for native trout populations, including fluvial bull trout. Rattlesnake Creek is considered a Tier II priority for investment of Thompson Falls Dam Bull Trout Mitigation funds.
- **Objective 2:** Promote passage and habitat conditions that support all life stages of native fish and aquatic organisms. Incorporate habitat heterogeneity and connectivity for terrestrial wildlife on the site.
- **Objective 3:** Rehabilitate stream, floodplain and hillslope processes to approximate reference conditions
- **Objective 4:** Include future use of the site for public recreation into the dam removal design and construction process
- **Objective 5:** Reduce public safety hazards and/or eliminate potential liability hazards

III. Methods

The Rattlesnake Creek Dam spillway is a concrete gravity dam spanning about 65 feet across the active channel of Rattlesnake Creek. The spillway section is 10 feet tall from its base, has a 4-foot crest, upstream face slope of 0.6:1 (H:V), and downstream face slope of 1:1. The earthen embankment to the east of the creek retains the reservoir area that originally stored water for the City's municipal water supply. The approximately 15-foot tall embankment extends from the spillway retaining wall to the east about 200 feet to the high terrace slope and is about 120 feet wide. A 540-foot long concrete retaining wall separates the active channel of Rattlesnake Creek and the 1.9- acre reservoir that stored about 3 million gallons of water for the City until it was abandoned in 1983.

There are debris screen houses on both sides of the dam with abandoned equipment. The screen houses are constructed from concrete and timber framing. From the west side screen house there is a tunnel through the hillside that runs about 60 feet to a concrete pipe terminal. From this pipe terminal, a buried 30-inch diameter steel pipeline runs south about 185 feet to a blind flange disconnection on the surface. The abandoned steel pipe runs about 900 feet south to an active underground water storage reservoir. There are 3 drain valves along the abandoned section of 30-inch steel pipe at the pipe terminal, chlorine building, and near the active storage reservoir. All drains outlet to Rattlesnake Creek.

On the west side of the dam there are two additional buildings. A timber frame building to house chorine treatment equipment is located near the pipeline. A chlorine injection pipe connects to the 30-inch steel pipe from this building. A cinder block building is located further south along the access road and contains the backup generator for the water system equipment. There is a buried 1,000-gallon propane tank located about 8 feet east of the building. Overhead power lines cross the site in several locations. An Infrastructure Map and more supporting documentation is provided in the *Attachments*.

With input and assistance from TU, FWP and the City of Missoula, River Design Group and Morrison-Maierle, Inc developed a restoration design plan for the site. The project plan will remove all infrastructure on the dam site, including both sides of the Rattlesnake Creek. The dam spillway and adjacent apron would be removed from Rattlesnake Creek. Both abutment walls and infrastructure would also be removed. The reservoir retaining wall, diversion sill, and intake will all be removed to allow restoration of the reservoir area. The entire earthen embankment will be used as fill material for the reservoir area and screened to produce gravel, cobble and boulders for the stream reconstruction portions

of the project. Both screen houses, and old fish ladder will all be removed as well. The overhead power lines and utilities that ran to the cabin will be removed. The west side buried 30-inch steel pipe will be removed along with the embankment materials between the abutment wall and hillslope. The chlorine and generator buildings will be removed or deconstructed as well, along with demolition or relocating the caretaker cabin. As a result, the restoration of Rattlesnake Creek will be possible on a footprint similar to reference valley widths. The channel and floodplain restoration will utilize the full valley width of approximately 270 feet.

Post dam removal stream restoration will begin approximately 300 feet upstream of the reservoir intake and tie in 200 feet downstream of the dam on City property, for a total of approximately 2,000 feet of streamchannel reconstruction and bank treatments. The reservoir will require approximately 14,000 cubic yards of fill material to raise the surface elevation to floodplain level. Material from the dam embankment holds approximately 20,000 cubic yards will be pushed into this area. The rest of the embankment will be screened for stream substrate material. The constructed channel will meander into the floodplain located east of the existing channel. The channel profile will be gradually raised to improve floodplain connection in the stream corridor. The historic channel will be filled with excavated fill material and converted to off-channel habitat features.

The constructed stream channel will be a moderately-entrenched riffle-pool stream type with a sinuosity of 1.1 and slope of 1.3 percent. The bankfull design width is approximately 50 feet and mean depth is approximately 2 feet. The streambed will be constructed from similar materials found in adjacent reaches including alluvial gravels, cobbles and boulders. The streambanks will be constructed from alluvial materials, logs, brush and live plant material. The constructed channel will include complex in-stream and off-channel habitats including side channels, alcoves, large wood, boulder clusters and wetlands.

The constructed floodplain through the reservoir will be a gradually-sloping, terraced feature that supports riparian and upland vegetation. Disturbed areas including the new floodplain, floodplain terrace, and upland features will be revegetated with native plant species. Riparian shrubs will also be salvaged from the constructed channel alignment and transplanted in the fill placed in the existing channel. Plants will be protected with either individual browse protectors or fencing exclosures to limit wildlife browse for at least three growing seasons following planting. Prior to planting, the new floodplain will be roughened with partially buried brush and microtopography grading in the form of small furrows and ridges. In addition, a robust native seeding plan will be developed for all disturbed areas, including materials staging areas and temporary access routes. A more complete list of streambed, streambank, floodplain and vegetation treatments and photos are provided as an attachment to this document.

Access to the project site is available through the existing access road to the facility. The access road is suitable for mobilizing equipment to the project site and no improvements are anticipated. The access road passes through private property via an existing access agreement. It will be necessary to coordinate with the property owners before and during construction to limit potential construction disturbances and agree upon mitigation requirements for returning the road to pre-project conditions. Access control, site security and signage will be required to protect public safety and prevent unauthorized access to the site.

The project will be implemented during the in-stream work window identified by the USFWS and MFWP. Based on past projects, it is expected that the in-stream work window will be July 15th through October 1st with a possible extension pending the presence of bull trout in the project area. The lowest seasonal flows in Rattlesnake Creek coincide with the in-stream work window and typically occur between August and October.

IV. Anticipated Schedule

The following is a timeline for planning and construction activities for the Rattlesnake Dam Removal Project:

- Environmental Assessment – January/February 2019
- Final Design and Bid Package Development – February/March 2019
- Final Planning and Fundraising – April/June 2019
- Permitting – June/August 2019
- Site Preparation and Building Deconstruction – August/October 2019
- Dam Demolition and Stream Restoration – July/October 2020

V. Personnel

Trout Unlimited will primarily be responsible for project development, contracting, grant reporting and project implementation. Montana FWP is involved in all aspects of planning as well as technical oversight. The following are the project staff for each organization that will be involved in the project:

Rob Roberts, Trout Unlimited – Rob is the project leader and primarily responsible for project planning and coordination with project partners. Rob is a full-time staff person for TU and has 15 years experience working on mine reclamation and native fish habitat restoration in the Clark Fork River basin.

Paul Parson, Trout Unlimited – Paul is a Civil Engineer with over thirteen years of experience in water resources related projects, surveying and construction oversight. Paul specializes in floodplain analysis and modeling, erosion control, hydraulic and hydrologic models, stream simulation and stabilization.

Ladd Knotek, Montana Fish, Wildlife and Parks – Ladd is the Montana FWP Region 2 Fisheries Biologist. Ladd is responsible for various aspects of fisheries and aquatic management on Rattlesnake Creek, including long term monitoring, fishing regulations, and stream permitting.

Matt Daniels and John Muhlfeld, River Design Group – River Design Group, along with Morrison-Maierle, Inc were hired to provide data collection and technical support for project design.

VI. Budget for Phase I –

Item	PPL Cost	Match Cost	Total Cost
Direct Labor -	$ 0	$ 0	$ 0
Direct Overhead - 5%	$ 2,500	$ 0	$ 0
Travel and Living	$ 0	$ 0	$ 0
Material and Equipment*	$ 47,500	$ 857,512.44	$ 905,012.44
Totals	**$ 50,000**	**$ 857,512.44**	**$ 907,512.44**

*Please see attached budget for more information on construction costs

VII. Deliverables

Deliverables resulting from this Phase II of the Rattlesnake Dam Removal Project will include the following:

- Removal of lower Rattlesnake Creek Dam and associated infrastructure
- Restoration and reconstruction of approximately 2,000 feet of streamchannel
- Creation of approximately 2 acres of wetland and side channel habitat
- Reconnection of nearly 20 miles of Rattlesnake Creek from Clark Fork River to headwaters

VIII. Cultural Resources

TU has hired Jeff McDonald from Heritage Preservation to complete a historic and cultural resource survey and evaluation for the site. The background investigation for this project will include a comprehensive review of all available historic resource documentation associated with the Rattlesnake Dam location. The report will be completed by December 31, 2018.

Along with literature and archival research, a thorough field inventory and pedestrian survey will additionally examine material, cultural, and contextual considerations, and present greater analysis and evaluation of the Rattlesnake Dam site for potential eligibility to the National Register of Historic Places.

This project will further seek to coordinate any specific details within the research design or project deliverables with Montana SHPO, along with meeting NRHP evaluation requirements.

To meet the identified project goals, cultural resources research and fieldwork will include:

- A thorough review of all available background literature, photographic documentation, and previously assembled research as compiled by Trout Unlimited and partners

- Consultation with Montana SHPO on project requirements and deliverables, along with Montana CRIS/CRABS database research into previous cultural resource surveys and documented sites

- Field Inventory and Pedestrian Survey of the Rattlesnake Dam site and historic site boundaries, to include written and photographic documentation of historic and cultural features

- Coordinate specific project goals in consultation with state, federal and tribal agency staff as needed or appropriate

- Submit Montana historic site form, cultural resources report, and formal evaluation of National Register of Historic Places eligibility to Montana SHPO

IX. Attachments

1. Cost Estimate
2. Existing Conditions Photos
3. Infrastructure Map
4. Access and Diversion Plan
5. Demolition Plan
6. Grading Plan and Profile
7. Planview and Structure Layout
8. Planting and Seeding Plan
9. Restoration Treatments

2019 Northwestern Energy TAC Proposal

Phase II Crow Creek Stream and Riparian Restoration Project

Project Contacts

Jason Blakney, Montana Fish, Wildlife and Parks (MFWP), (406) 827-9282, jblakney@mt.gov
Brita Olson, Lower Clark Fork Watershed Group (LCFWG), (208) 304-3852, brita@lowerclarkforkwatershedgroup.org

Introduction

This is a new project that is anticipated to be funded by Northwestern Energy (NWE), Avista and external funding sources. The Northwestern Energy (Technical Advisory Committee) TAC provided funding to complete the design of this channel reconstruction project in 2017. In August of 2018, Avista funded a LiDAR flight that was needed to inform final design and construction work given the complex topography of the site. In the spring of 2017, Avista through the Clark Fork Settlement Agreement funded the Lolo National Forest-Plains/Thompson Falls Ranger District's Native Salmonid Habitat Restoration Assessment and Planning efforts which includes environmental review and associated National Environmental Policy Act (NEPA) requirements for this project. That task is on track to be completed in 2018.

The project will be administered by the Lower Clark Fork Watershed Group (LCFWG), with the coordination time to implement this project funded by Avista. The LCFWG will work with the project design and implementation contractor, River Design Group (RDG), as well as Montana Fish, Wildlife and Parks (MFWP), the U.S. Forest Service and other participating partners. Proposals for outside funding sources are in progress and if received would decrease the costs for both NWE and Avista.

Crow Creek is a tributary to upper Prospect Creek, which enters the drainage approximately 13 miles upstream from the Clark Fork River at upper Noxon Reservoir. Lengthy intermittent sections of stream near the Crow Creek confluence provide a seasonal barrier that has enabled the stream to retain an entirely native fish species assemblage of Westslope Cutthroat Trout, Bull Trout and Cedar Sculpin. Two major power line corridors owned by Bonneville Power Administration (BPA) and NWE travel up the drainage and have adversely affected the stream and riparian area. Installation and maintenance of utility corridors have resulted in persistent loss of old growth riparian conifers in Crow Creek over approximately 1/3 of a mile of riparian forest. As a result, the channel is over-widened, shallow, braided, and lacking pools, shade, and habitat complexity associated with inputs of large and small woody debris. Historically, the Crow Creek valley bottom was comprised of a dark riparian forest (RDG and USFS 2004). Large cedar stumps beneath the power lines provide evidence of this historical condition. In upstream areas of the East and West Forks of Crow Creek, decadent stands of large diameter cedar and fir still dominate riparian areas. Restoration in Crow Creek ranked second highest after Cooper Gulch among the 40 sub-watersheds assessed in the lower Clark Fork River. The stream was designated as a "focus area" based on the fish community present, the quality of spawning and rearing habitat and opportunities for restoration/enhancement (GEI 2005).

After a half country of degradation, approximately1,200 feet of new channel was constructed

beneath the BPA power lines just downstream of the confluence of the East and West Forks of Crow Creek in 2007. Grade control structures including native cobble patches, boulder clusters, log and rock cross-vanes, and log j-hook vanes were installed to maintain the designed channel dimensions until riparian vegetation can establish and lend permanence to the constructed project. Large woody debris structures were added to dissipate energy in meander bend pools and to enhance aquatic habitat. Single and double soil lifts were incorporated into the project to enhance bank stability and promote riparian vegetation growth. Approximately 1,750 willow cuttings were added to the 670 linear feet of soil lifts constructed. An additional 1,250 root stock were planted near stream banks, primarily alder and dogwood species. From 2016 through 2018, MFWP and LCFWG built ten exclosures and planted an additional 900 riparian shrubs in the restoration reach to supplement the original plantings. All of the aforementioned work has been at least partially funded by Avista through the Clark Fork Settlement Agreement (CFSA).

Post-restoration fisheries monitoring associated with the 2007 restoration project has shown positive results including steady increases of both abundance and biomass of Westslope Cutthroat Trout (FIGURES 1 and 2) (All figures are attached is supplemental document). In 2016 and 2017, a study was conducted to quantify habitat variables and assess their influence on Bull Trout abundance in Crow Creek and a neighboring stream, Cooper Gulch (Blakney, *In prep*). Cooper Gulch has a comparably robust Bull Trout population and one of the major objectives of this study was to determine factors important to the species abundance to better direct future restoration in the upper Prospect Creek watershed, including this proposed project in Crow Creek. Preliminary results indicate that the two sites within the 2007 restoration reach had the highest abundance of both Bull Trout and Westslope Cutthroat Trout observed in the entire Crow Creek drainage in 2017 (FIGURES 3 and 4).

The legacy effects of removing one-third mile of large riparian conifers are still evident in the Crow Creek drainage (FIGURES 5–7). Below the restored reach, approximately 600 feet of adversely impacted stream channel still exist before the creek re-enters an intact cedar forest. This channel lacks meanders, pools, shade, and complexity similar to the upstream reach prior to restoration. It is expected that restoration of this reach would result in a similar, positive response from the native fish community.

Objectives

The objective of this project is to complete the physical construction work for the second phase of a channel reconstruction project in Crow Creek. This project begins directly adjacent and downstream to a reach of Crow Creek where channel restoration was completed in 2007.This project will improve channel pattern and profile, sinuosity, habitat diversity and complexity. Ultimately, this restoration project will create more stable habitat conditions that benefit stream function and is anticipated to increase the carry capacity of the reach for the entirely native fish community that resides in the stream.

Methods

1. Project administration and oversight: Design-build contractor coordination with LCFWG, private entities, and agencies; monthly progress reports; subcontracting; administration.

2. Construction oversight: Design-build contractor oversight of on-the-ground

implementation of design; quality control; and oversight of all on-the-ground work completed in association with this project.

3. Project construction: Subcontracted (1 or more contracts) work to qualified excavation and construction firm to complete all on-the-ground work in line with approved project designs.

4. Riparian area revegetation: Additional labor, plants, and materials for re-vegetation of riparian area and floodplain not completed as a part of constructions (i.e. not immediate bank treatments such as vegetated soil lifts or wood matrices).

5. As-built monitoring: Post-construction as-built survey and construction documentation, and completion of all monitoring required by permitting agencies.

Schedule

- Submittal of relevant permits (MFWP/Conservation District 310/124, Army Corps 404 and MTDEQ 318)- February 2019
- Final design and cost estimate- March 2019
- Implement instream work- August through October 2019
- As-built monitoring report – March 2020

Budget

Task	Item	2019 Budget Request
All tasks	Northwestern Energy cost-share of Crow Creek Channel Restoration – Phase II implementation*	$51,500
	Total budget request from Northwestern Energy	$51,500

*Additional match from Avista ($51,500) and possibly other external sources, such as Montana Fish, Wildlife & Parks and The Yellowstone Pipeline Company. Preliminary cost estimates from the contractor were submitted as a supplement to this proposal, and final cost estimates are expected in March 2019 or before.

Personnel

The LCFWG coordinator will administer the contract for this project with RDG.

Deliverables

- Implement instream work- August through October 2019
- As-built monitoring report – March 2020

Cultural Resources

Cultural resource evulations for this project is covered under the NEPA currenlty beinbg finalized by the Lolo National Forest.

Literature Cited

Blakney, J. *In prep*. Factors influencing abundance and biomass of native salmonids in neighboring headwater streams, Crow Creek and Cooper Gulch. Including a synopsis of Bull Trout in the Crow Creek drainage. Montana Fish, Wildlife, and Parks, Thompson Falls, Montana. Report to Avista Corporation, Noxon, Montana and Montana Fish, Wildlife and Parks, Helena, Montana

Geotechnical, Environmental, and Water Resource Engineers (GEI). 2005. Lower Clark Fork River Drainage Habitat Problem Assessment. Submitted to Avista Corporation, Natural Resources Field Office, Noxon, Montana.

River Design Group (RDG) and U.S. Forest Service(USFS). 2004. Final Prospect Creek Watershed Assessment and Water Quality Restoration Plan. Prepared for: Prospect Creek Watershed Council and Green Mountain Conservation District, Trout Creek, Montana.

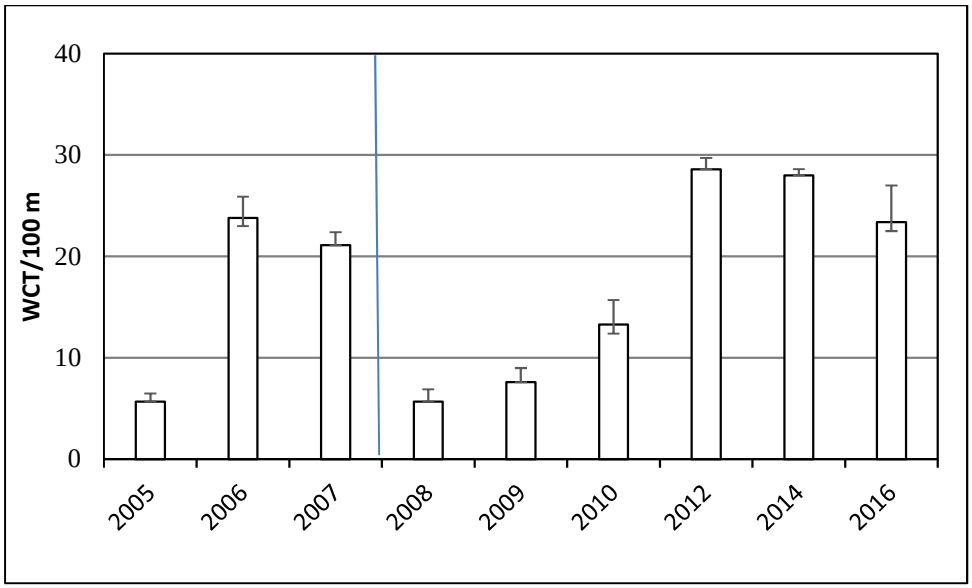


FIGURE 1. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) sampled within the 2007 restoration reach in Crow Creek. The blue line represents the timing of the restoration work.

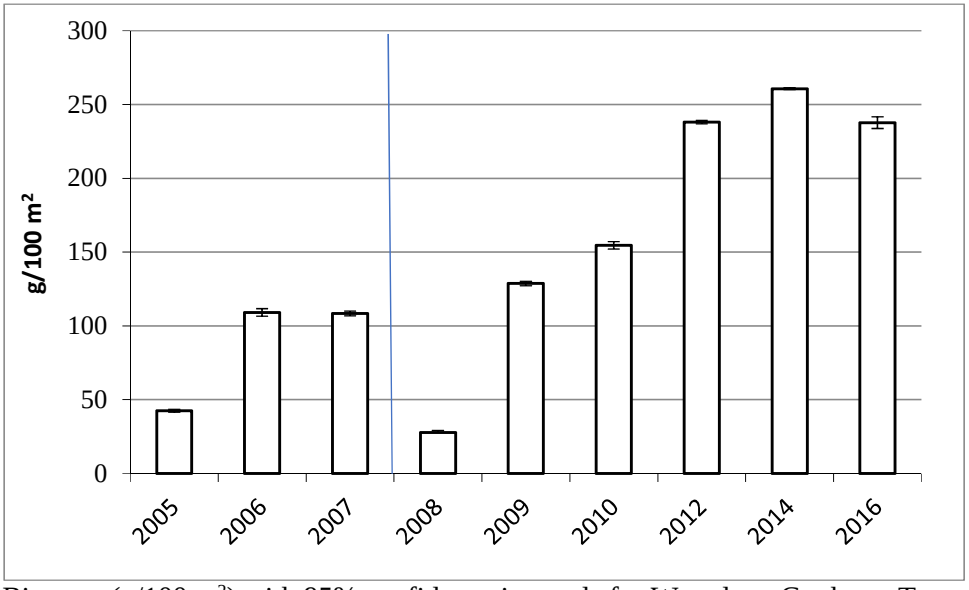


FIGURE 2. Biomass (g/100 m^2) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) sampled within the 2007 restoration reach in Crow Creek. The blue line represents the timing of the restoration work.

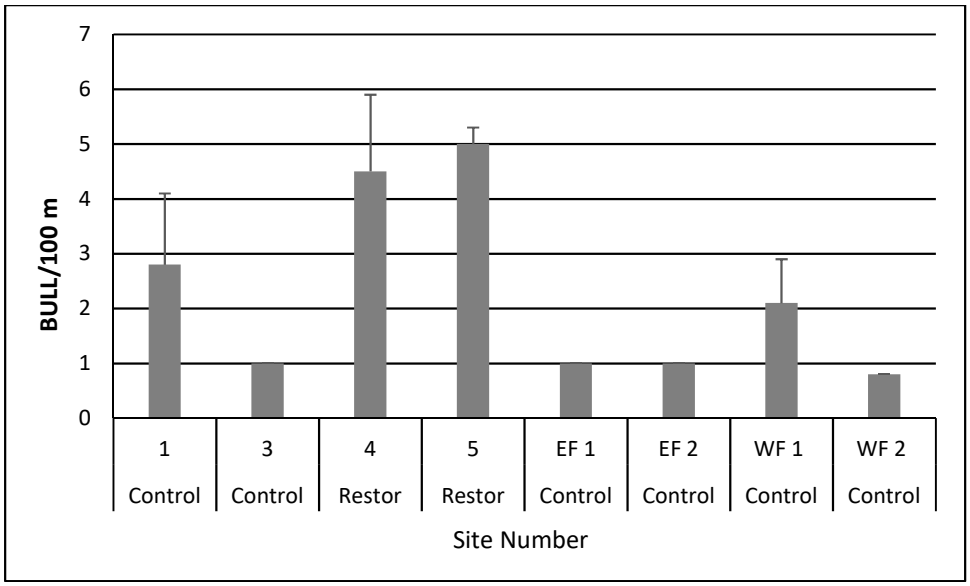


FIGURE 3. Standardized linear abundance estimates (#/100m) for Bull Trout (>75 mm) sampled in the Crow Creek drainage in 2017. Sites located within the 2007 restoration reach are labeled "Restor", while all other sites are labeled "Control".

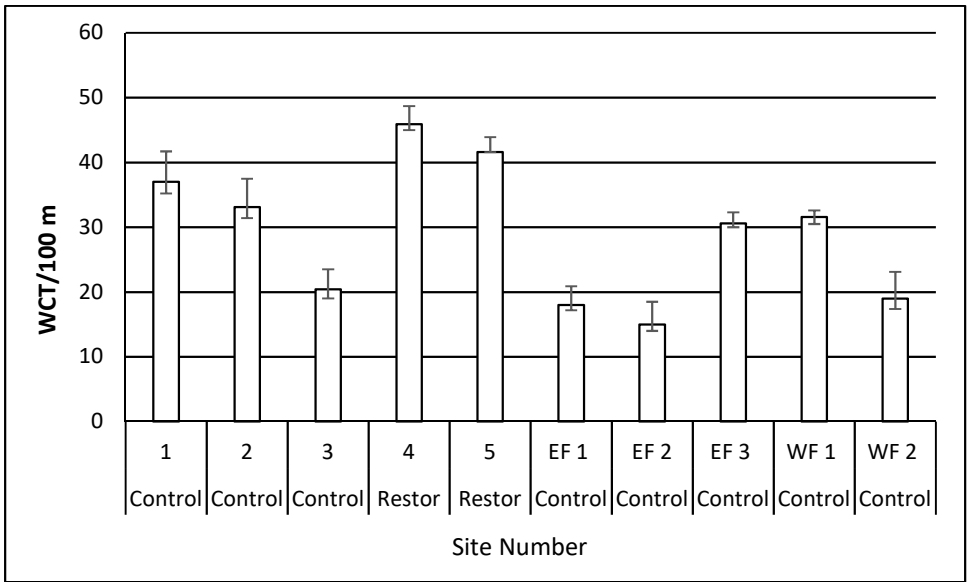


FIGURE 4. Standardized linear abundance estimates (#/100m) for Westslope Cutthroat Trout (>75 mm) sampled in the Crow Creek drainage in 2017. Sites located within the 2007 restoration reach are labeled "Restor", while all other sites are labeled "Control".

FIGURE 5. Unstable, braided channel in proposed restoration reach.

FIGURE 6. Recent removal of large streamside cedars within the proposed restoration reach.

FIGURE 7. Over-widened, low complexity channel within the proposed restoration reach.

9-Nov-18

CROW CREEK PHASE 2 PROVISIONAL COST ESTIMATE

RDG

Engineers' Estimate

BID ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION, GPS EQUIPMENT, CREW PER DIEM	1	LS	$10,000.00	$10,000.00
2	CLEAR AND GRUB	1	LS	$1,500.00	$1,500.00
3	CONSTRUCT AND DECOMMISSION CLEARWATER DIVERSIONS	1	EA	$1,500.00	$1,500.00
4	SALVAGE, PRESERVE AND TRANSPLANT EXISTING VEGETATION	1	LS	$2,500.00	$2,500.00
5	CONSTRUCT AND IMPROVE ROADS AND STAGING AREAS	1	LS	$1,000.00	$1,000.00
6	EARTHWORK	2,500	CY	$3.00	$7,500.00
7	COLLECT AND INSTALL WILLOW CUTTINGS	6,000	EA	$1.00	$6,000.00
8	CONSTRUCT CHANNEL STREAMBED	500	LF	$25.00	$12,500.00
9	CONSTRUCT LARGE WOOD STRUCTURES	10	EA	$1,250.00	$12,500.00
10	CONSTRUCT VEGETATED WOOD MATRIX TYPE 1	900	LF	$15.00	$13,500.00
11	CONSTRUCT VEGETATED WOOD MATRIX TYPE 2	150	LF	$20.00	$3,000.00
12	CONSTRUCT VEGETATED WOOD MATRIX TYPE 3	150	LF	$5.00	$750.00
13	CONSTRUCTION MANAGEMENT	1	LS	$16,250.00	$16,250.00
14	INSTALL BEAVER DAM ANALOGS	2	EA	$250.00	$500.00
15	INSTALL CHANNEL LOG STEP POOLS	8	EA	$1,250.00	$10,000.00
16	INSTALL FLOODPLAIN ROUGHNESS AND WOODY DEBRIS	2.0	AC	$2,000.00	$4,000.00
	Subtotal				**$103,000.00**
		TOTAL BID PRICE: ($)			**$103,000.00**

TOTAL BID PRICE (in Words):

AC = Acres EA = Each SY = Square Yards Kgal = 1,000 Gallons
CY = Cubic Yards LF = Linear Feet LS = Lump Sum

Cost-Share Proposal using NorthWestern Energy's
Thompson Falls Bull Trout PM&E Funding

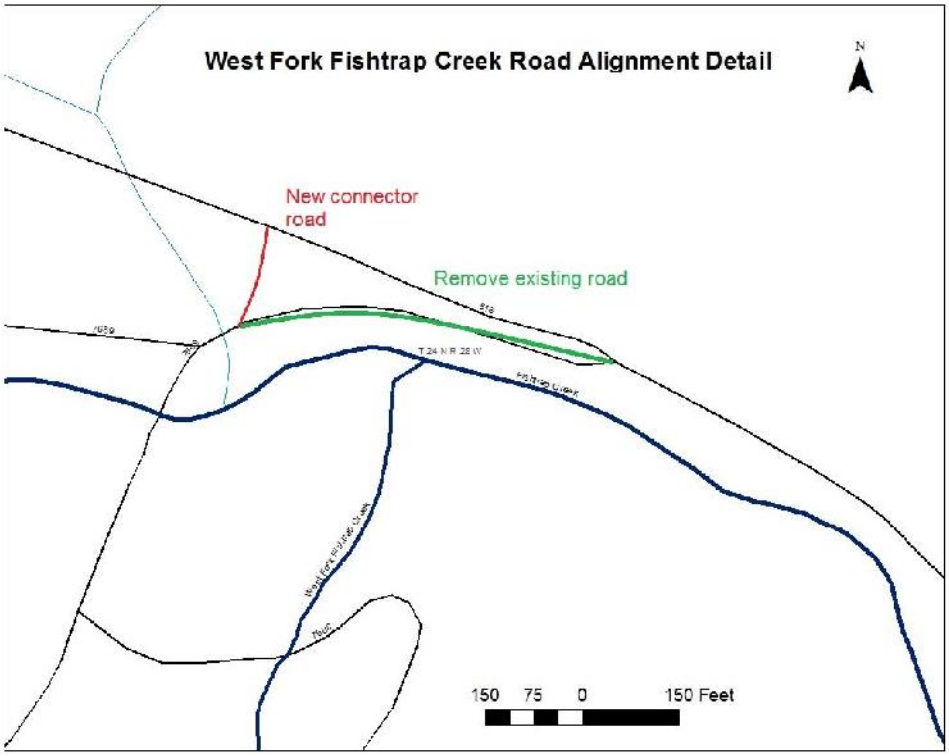
Project Title:	West Fork Fishtrap Creek Road Realignment
Proposal Submitted by:	Lower Clark Fork Watershed Group (LCFWG) PO Box 1329, Trout Creek, MT 59874
Project Contact(s):	Brita Olson, LCFWG Coordinator brita@lowerclarkforkwatershedgroup.org (208) 304-3852 Jon Hanson, Fisheries Biologist Lolo National Forest jrhanson@fs.fed.us (406) 822-3919
Location of Proposed Project:	West Fork Fishtrap Creek confluence with the mainstem
Total Project Cost:	$40,000+
TAC Funds Requested:	$30,627.15

All proposals must include the following information:

I. Introduction. Fishtrap Creek is the most important Bull Trout stream in the Thompson River drainage. It was identified by stakeholders in the Thompson River Watershed Restoration Plan (WRP) as a priority for native fish habitat conservation. Fishtrap Creek also contains the higher road densities any other any other Bull Trout drainage in the lower Clark Fork (LCF) Riverwatershed. There are over 900 kilometers of road in the drainage, and over 85% of stream channel has a road located in the riparian area (GEI 2005).

One of the specific projects identified in the Thompson River WRP development process over the last two years was to investigate road/stream interactions in Fishtrap Creek and look for projects that reduce road densities and/or the impact of road on streams and riparian areas in the drainage. Since the completion of the WRP, stakeholders identified such an opportunity at the confluence of West Fork and mainstem Fishtrap Creeks. This project will restore approximately 600 linear feet of riparian habitat along Fishtrap Creek by removing the existing road entrance and relocating it to higher ground. We will do this by relocating the junction of the West Fork Fishtrap road #7609 with the main Fishtrap road #516 about 600 feet to the north (Map 1). The abandoned road segment will be decommissioned and the floodplain created and enhanced using log structures, willow cuttings and plantings to protect banks and provide fish habitat. The newly constructed segment of Road #7609 will be oriented perpendicular to Fishtrap Creek rather than parallel to it (Photo 1). This will reduce the length of road directly adjacent to Fishtrap Creek,

reduce sediment delivery potential and allow for more vegetation to grow and eventually provide shade and future woody debris recruitment to the stream.



Map 1. Detail of the relocation of the junction of the West Fork Fishtrap road (#7609) with the main Fishtrap road (#516). The project will maintain motorized access while improving stream conditions at the confluence of Fishtrap Creek and West Fork Fishtrap Creek.

Photo 1. Approximately 600 feet of West Fork Fishtrap Creek road #7609 (left) adjacent to Fishtrap Creek will be decommissioned.

II. Objectives.

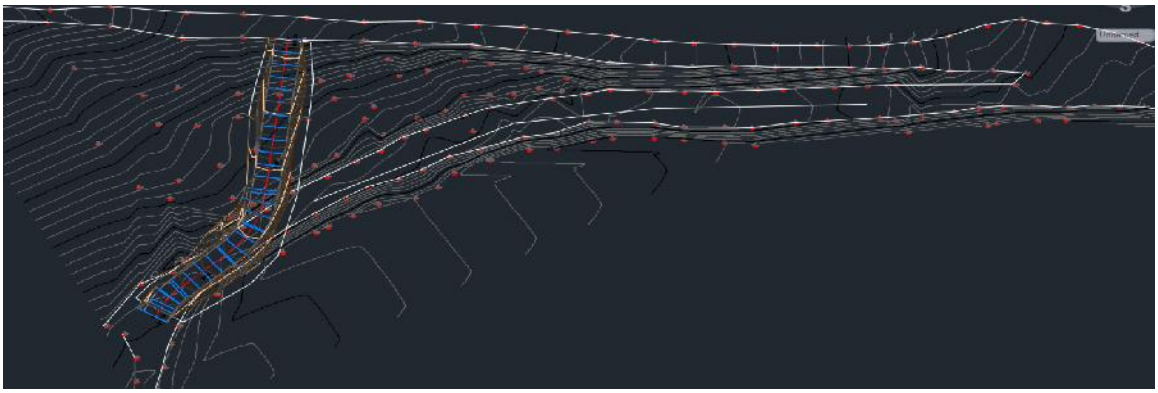
1. Build new connector road between existing roads #7609 and #516 perpendicular to Fishtrap Creek.
2. Decommission approximately 600 feet of existing road #7609 parallel to mainstem Fishtrap Creek.

3. Reconstruct floodplain and stabilize newly constructed streambank and floodplain with large woody debris placement and woody vegetation.

III. Methods.

This project will be accomplished through partnership between the LCFWG, Lolo National Forest, and other partners. The LCFWG will acquire funds to finalize design and implement the West Fork Fishtrap Road Realignment Project, solicit bids from and select a qualified contractor to build and decommission roads as well as complete related stream and floodplain enhancement work, ensure contractor is overseen by qualified forest service personnel and/or restoration ecologists as appropriate, document implementation, and complete additional related administrative tasks.

The Lolo National Forest has completed design for the road-related portion of this project (Map 2), has completed environmental and cultural resource compliance documentation with a record of decision for the project expected in November 2018, and will provide construction oversight with the road building and decommissioning portions of the project.



Map 2. Lolo National Forest's design for the West Fork Fishtrap Creek Road Relighment Project.

In addition, the LCFWG and Lolo National Forest will partner with Trout Unlimited to complete all required permitting (124/310, 404, etc.) for the project, finalize streambank, floodplain, and revegetation design, provide construction oversight, implement revegetation efforts, and complete monitoring and permit compliance work.

IV. Schedule.

4th Quarter 2018	Finalize road design; record of decision; prepare funding proposals
1st Quarter 2019	Prepare and sign partnership/funding agreements; finalize streambank, floodplain, and revegetation design; prepare and submit permitting applications; prepare bid documents
2nd Quarter 2019	Collect bids and select contractor(s); pre-project monitoring
October/November 2019	Construction: Road decommissioning, construction and revegetation
3rd Quarter 2019	As-built monitoring

4th Quarter 2019	Complete final reporting and invoicing
2nd Quarter 2020	Post-runoff monitoring

V. Personnel.

Brita Olson, LCFWG, will be the project manager for this project and coordinate all funding, partners, contractors, reporting, etc.

Jared Koskela, West Zone Engineer for the Lolo National Forest, will oversee the road construction and decommissioning aspects of this project.

Jon Hanson, Fisheries Biologist for the Lolo National Forest, will oversee the habitat enhancement aspects of this project.

Christine Brissette and Paul Parson, both project managers with Trout Unlimited, will work with Hanson to supplement the forest's design with appropriate techniques / treatments for the floodplain and streambank that promote stream function and native fish habitat. They will also complete permitting, provide construction oversight, implement revegetation efforts, and complete permit compliance work.

VI. Budget must include amounts for the following items:

Item Description	**Quantity**	**Unit**	**Price**	**Amount**
Wetland delineation	1	Lump sum	$3,500.00	$3,500.00
Subtotal wetland delineation contract				$3,500.00
Mobilization	1	Lump Sum	$2,500.00	$2,500.00
Traffic Control	1	Lump Sum	$250.00	$250.00
Soil Erosion and Pollution Control	1	Lump Sum	$1,000.00	$1,000.00
Clearing and Grubbing	1	Lump Sum	$1,500.00	$1,500.00
Roadway Excavation and Embankment	600	Cubic Yard	$15.00	$9,000.00
Pit Run Aggregate (Government Furnished Source)	88	Cubic Yard	$15.00	$1,320.00
Equipment Rental, Excavator with Thumb	30	Hour	$125.00	$3,750.00
Equipment Rental, Dump Truck	5	Hour	$100.00	$500.00
Subtotal construction contract				$19,820.00
Road/revegetation oversight	48	Hour	$50.00	$2,400.00
Seeding, Fertilizer and Mulching, Dry Method	1	Lump Sum	$200.00	$400.00
Willow cuttings	2400	Cutting	$1.00	$2,400.00
Plants	200	Plants	$2.50	$500.00
Travel	270	Miles	$0.545	$147.15
Labor for revegetation effort	2	Day	$1,000.00	$2,000.00
Subtotal for restoration oversight and revegetation (subaward to Trout Unlimited)				$7,847.15
Total cost				**$30,627.15**

Other funding (cost-share and partners):

Approx. $2,000: LCFWG staff wages and mileage expenses related to this project will be support through a separate TAC-supported project, Coordination in the Thompson River drainage. This funding supports a portion of the LCFWG's position which is dedicated to project planning, development, and administration in the Thompson River drainage.

Approx. $500: Trout Unlimited staff wages and travel for initial site visits and preliminary planning supported by a Watershed Management Grant through the Montana Department of Natural Resources.

Approx. $5,000: Additional funds awarded jointly to the LCFWG and Trout Unlimited from the Bureau of Reclamation's Cooperative Watershed Management Program (CWMP) will contribute to the preliminary planning and design costs of this project, beginning in the January 2019. This will support both LCFWG and Trout Unlimited's efforts in finalizing design plans (including revegetation), acquiring permits, permit compliance monitoring, etc.

In-kind: Lolo National Forest has already provided in-kind contributions to this project which include the road design and cost estimates, as well as NEPA compliance work. Lolo National Forest staff will provide further in-kind contributions in the form of agreement set-up, and construction oversight.

VII. Deliverables.

- Construction of the West Fork Fishtrap Road Realignment Project – September 1, 2019
- Revegetation efforts related to the West Fork Fishtrap Road Realignment Project – October 2019
- Annual report – January 15, 2020
- Project summary and completion report – June 2020

VIII. Cultural Resources.

Cultural Resource Management (CRM) requirements will be completed by the Lolo National Forest as a part of their Native Fish Restoration Project. A decision for this project is expected in November, after review from agency specialists (including CRM).

IX. References.

GEI (GEI Consultants, Inc.). 2005. Lower Clark Fork River drainage habitat problem assessment. Report to Avista Corporation, Spokane, Washington. GEI Consultants, Inc. Missoula, Montana.

Cost-Share Proposal using NorthWestern Energy's Thompson Falls Bull Trout PM&E Funding

Project Title: Coordination in the Thompson River Drainage

Proposal Submitted by: Lower Clark Fork Watershed Group (LCFWG)
PO Box 1329, Trout Creek, MT 59874

Project Contact(s): Brita Olson, LCFWG Coordinator
brita@lowerclarkforkwatershedgroup.org
(208) 304-3852

Ryan Kreiner, Fisheries Biologist
Montana Fish, Wildlife & Parks (MFWP)
rkreiner@mt.gov
(406) 827-9320

Location of Proposed Project: Thompson River Drainage

Total Project Cost: >$9,900, with match anticipated through a Bureau of Reclamation Cooperative Watershed Management Program Grant

TAC Funds Requested: $9,900

I. Introduction.

The Lower Clark Fork Watershed Group (LCFWG) is a 501(c)(3) non-profit that works to facilitate collaborative restoration in the tributaries of the lower Clark Fork River for the benefit of water quality, native fish and wildlife. Since its formation in 2004, the LCFWG has been an active player in habitat restoration projects throughout the lower Clark Fork River area working with partners involved in local watershed conservation: local watershed councils, Green Mountain Conservation District, Montana Fish, Wildlife and Parks, Forest Service, Natural Resource Conservation Service, and Avista Corporation. In 2016, the LCFWG began working with NorthWestern Energy to identify stream restoration and enhancement opportunities in the Thompson River. In 2017, the LCFWG began developing the Thompson River Watershed Restoration Plan which incorporated input from stakeholders throughout the drainage, and was completed in March 2018. Multiple projects were developed in 2018: one (a riparian fencing project in Loneman Creek) was implemented, while others are expected to be implemented in 2019 and 2020.

In 2019, a focus will be finalizing designs and securing funding for the implementation of the West Fork Fishtrap Road Realignment Project (to be implemented summer 2019). Another priority will be investigating opportunities for large woody debris (LWD) additions along mainstem Fishtrap Creek, with the goal of developing a project for implementation in 2020. In addition to this coordination proposal, these efforts will be supported by a Bureau of Reclamation Cooperative Watershed Management Program Grant which will provide funds for these projects to be designed in-house by partners at Trout Unlimited or contracted to a private firm. Additionally, the LCFWG Coordinator will follow up with stakeholders who participated in the development and review of the Thompson River Watershed Restoration Plan, share progress to-date, and identify additional projects to pursue.

This proposal requests continued support from the Thompson Falls TAC for coordination in the Thompson River drainage. If approved, this will assist LCFWG with operational costs associated with project planning, coordination, and other annual expenses related to habitat restoration projects in line with NorthWestern Energy's efforts to recover Bull Trout in the Thompson River.

II. Objectives.

a. Develop design for LWD enhancement along mainstem Fishtrap Creek
b. Compile annual update and provide progress report on Watershed Restoration Plan implementation to Thompson River Watershed stakeholders.
c. Identify next priority projects in Watershed Restoration Plan in line with Northwestern Energy's efforts to recover Bull Trout in the Thompson River to pursue in parallel to or after projects in Fishtrap Creek identified above.

III. Methods. Description of how the objectives will be accomplished.

In 2019, the LCFWG will continue implementation of the Thompson River Watershed Restoration Plan, in partnership with many stakeholders including MFWP, Lolo National Forest, and Weyerhaeuser. Continued support from NorthWestern will be instrumental in making this possible. The LCFWG will develop project ideas identified in the plan and move on-the-ground projects forward—completing activities such as connecting key stakeholders, identifying opportunities for collaboration, securing funding, obtaining permits, and hiring contractors. The LCFWG's work will also include key maintenance, monitoring, and follow-through post-implementation that is necessary for a project's success into the future. Now that the Thompson River Watershed Restoration Plan is complete and accepted, the LCFWG efforts are focused on project development and implementation.

If approved, LCFWG staff would continue to dedicate an average of 40 hours/month to drainages within the Thompson Falls project area. This request would also fund mileage, equipment and operational expenses associated with this work in the Thompson River drainage (crucial support allowing the LCFWG to have an on-the-ground presence) and provide a small stipend for continuing education and pertinent training which will help increase the efficacy and impact of the LCFWG's work.

IV. Schedule.

January 2019 – December 2019. Funds requested in this proposal will be used after funds from 2018 proposal are expended.

V. Personnel.

The project leader will be the LCFWG Watershed Coordinator, Brita Olson. The Coordinator's hourly work on Thompson River projects will be supported through this proposal, over the course of 2019.

VI. Budget

LCFWG coordination in the Thompson River	$7,000*
LCFWG mileage, equipment and operational expenses	$1,500
LCFWG education and training	$500
LCFWG administration	$900
Total project cost	$9,900

* Request reduced from previous years to account for 2018 carry-over, and align project with the Thompson Falls TAC's annual funding cycle. Annual funding was first approved in the summer of 2016, so funding has been offset from the Thompson Falls TAC's schedule.

Other funding (cost-share and partners):
Other funding in support of Thompson River projects is expected. This proposal is meant to be provide the "seed" money and additional impetus for obtaining additional funds, either for additional LCFWG staff time (if needed) or for project implementation funds. For example, over 2019 and 2020, project planning, development, and design efforts in the Thompson River will be supplemented by a $100,000 funding award from the Bureau of Reclamation's Cooperative Watershed Management Program.

VI. Deliverables.

a. Annual report (January 15, 2020)
b. Fishtrap Creek LWD enhancement design (November 15, 2019)
c. Thompson River implementation plan 2020-2022 (November 15, 2019)

VII. Cultural Resources.

The activities to be funded by this proposal do not involve any land disturbing activity. A plan for meeting Cultural Resource Management requirements will be included in habitat restoration project-specific proposals. The West Fork Fishtrap Road Realignment Project and Fishtrap Creek LWD Enhancement are including in Lolo National Forest's Native Fish Habitat Restoration Project, for which the forest is currently completing environmental and cultural resource consultation. A decision for this project is expected in November 2018.

2018 Cost-Share Proposal Form for NorthWestern Energy (NWE) Thompson Falls TAC Projects

Project Title: Emergency/contingency fund

Date: 11/21/2018

This fund will be used for, but not be limited to, emergency purchasing of equipment, scoping potential stream rehab proposals, and support of 2019 approved proposals.

During ongoing operations and proposal work there are times when this approved proposal would allow for immediate funding of equipment, stream restoration assessments or other conditions that may require immediate attention. This proposal will eliminate (within the $10,000 limit) the need for TAC approval of a new proposal for spending of TAC funds.

Project Sponsor (submitted by): Brent Mabbott, NorthWestern Energy

Location of Proposed Project: Within TAC approved proposal boundaries.

Total Project Cost: $10,000

TAC Funds (Cost-Share) Requested for Project: $10,000

I. Introduction; Contingency funding to be used in emergency situations

II. Objectives; To have TAC approved funding for emergency situations as noted above.

III. Methods; Funding will used for situations as noted above.

IV. Schedule; Used when needed during 2019

V. Personnel; Brent Mabbott will determine and report usage of funding.

VI. Project budget must include amounts for the following:

Direct Labor
Travel and Living
Materials…yes
Other Direct Expenses…yes
Direct Overhead
All cost-share sources and amounts, including estimation of "in-kind" contributions

VII. Deliverables; describe work product (reports, habitat restoration, etc.) which will result from this Project. Spending will be reported at annual meeting.

VIII. Cultural Resources. Cultural Resource Management (CRM) requirements for any activity related to this Project must be completed and documented to NWE as a condition of any TAC grant. TAC funds may not be used for any land-disturbing activity, or the modification, renovation, or removal of any buildings or structures until the CRM consultation process has been completed. Agency applicants must submit a copy of the proposed project to a designated Cultural Resource Specialist for their agency. Private parties or non-governmental organizations are encouraged to submit a copy of their proposed project to a CRM consultant they may have employed. Private parties and non-governmental organizations may also contact the NWE representative for further information or assistance. Applications submitted without this section completed, will be held by the TAC, without any action, until the information has been submitted.

Generally NA but maybe used for this if needed

Summarize here how you will complete requirements for Cultural Resource Management: NA

IX. Water Rights. For projects that involve development, restoration or enhancement of wetlands, please describe how the project will comply with the Montana DNRC's "Guidance for Landowners and Practitioners Engaged in Stream and Wetland Restoration Activities", issued by the Water Resources Division on 9March2016. NA

Summarize here how you will comply with Montana water rights laws, policies and guidelines:
NA

All TAC Project proposals should be 7 pages or less and emailed (as a WORD file) to each of:

- Andrew.Welch@Northwestern.com
- Brent.Mabbott@northwestern.com

Further questions about TAC proposals or Project 2188 license requirements or related issues may be addressed to: Andy Welch, Leader Hydro License Compliance, NorthWestern Energy, 1315 N Last Chance Gulch, Helena, MT 59601; 406-444-8115 (office); 406-565-7549 (cell); Andrew.Welch@northwestern.com.