Thompson Falls Hydroelectric Project
FERC Project No. 1869
NorthWestern Energy's Revised Study Plan

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List of Abbreviations and Acronyms

Acronym	Definition
1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-Hexachlorodibenzo-P-dioxin
2,3,7,8-TCDD	2,3,7,8-Tetrachlorodibenzo-P-dioxin
2D	two-dimensional
3D	three-dimensional
AMFA	Adaptive Management Funding Account
APE	Area of Potential Effect
ARM	Administrative Rules of Montana
BO	Biological Opinion
°C	degrees Celsius
CAD	Computer Aided Design
CFD	computational fluid dynamics
CFR	Code of Federal Regulations
cfs	cubic feet per second
CPUE	catch per unit effort
DEM	digital elevation model
DEQ	Montana Department of Environmental Quality
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
flow	Project discharge
ft/hr	feet per hour
FWP	Montana Fish, Wildlife and Parks
FWS	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
H-A&E	Historic Architectural and Engineering Properties
HAP	Historic Archaeological Properties
Hg	mercury
High Bridge	below the Main Channel Dam
ILP	FERC's Integrated Licensing Process
Licensee	NorthWestern Energy
LiDAR	Light Detecting and Ranging
Literature Review	Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project (GEI, 2007)
mm	millimeters
MW	megawatt
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
ng/kg	nanogram per kilogram
NorthWestern	NorthWestern Energy
PAD	Pre-Application Document
PAP	Prehistoric and Historic Archaeological Properties
PCB	polychlorinated biphenyl
PIT	passive integrated transponder
Project	Thompson Falls Hydroelectric Project
PSP	Proposed Study Plan
Relicensing Participants	local, state, and federal governmental agencies, Native American Tribes, local landowners, non-governmental organizations, and other interested parties.
RM	river mile
RSP	Revised Study Plan
RTK-GPS	Real-Time Kinematic Global Positioning System

Acronym	Definition
Scientific Panel	Thompson Falls Scientific Review Panel
SCORP	Montana Statewide Comprehensive Outdoor Recreation Plan
SD1	Scoping Document 1
SD2	Scoping Document 2
SHPO	Montana State Historic Preservation Office
SOI	Secretary of the Interior
TAC	Technical Advisory Committee
TCLP	Toxicity Characteristic Leaching Procedure
TCs	Terms and Conditions
TDG	total dissolved gas
TDG Plan	Total Dissolved Gas Control Plan
TEQ	total equivalence
Thompson Falls Project	Thompson Falls Hydroelectric Project
TIN	Triangular Irregular Networks
U.S.	United States
USFS	U.S. Forest Service
ZOP	zone of passage

1. Introduction

1.1 Project Background

The Thompson Falls Hydroelectric Project (Thompson Falls Project or Project) is located on the Clark Fork River in Sanders County, Montana. Preliminary development of the Thompson Falls Project began in June 1912, by the Thompson Falls Power Company. Construction commenced in May 1913 and the first generating unit was placed in service on July 1, 1915. The sixth generating unit was placed in service in May 1917. The Project has been operating continuously since 1915.

Non-federal hydropower projects in the United States (U.S.) are regulated by the Federal Energy Regulatory Commission (FERC) under the authority of the Federal Power Act. Montana Power Company acquired the Thompson Falls Project in 1929. The original License for the Thompson Falls Project was issued effective January 1, 1938 and expired on December 31, 1975. The current FERC License was issued to the Montana Power Company in 1979. The Project was purchased by (and FERC License transferred to) PPL Montana in 1999 and then purchased by (and FERC License transferred to) NorthWestern Corporation, a Delaware corporation, d/b/a NorthWestern Energy (NorthWestern or Licensee) in 2014. An order amending the License was issued in 1990 allowing for construction of an additional powerhouse and generating unit, which was subsequently completed in 1995. With the addition of this new (second) powerhouse, the Project has a total generating capacity of 92.6 megawatts (MW).

The current FERC License expires December 31, 2025. As required by the Federal Power Act and FERC's regulations, on July 1, 2020 NorthWestern filed a Notice of Intent to relicense the Thompson Falls Project using FERC's Integrated Licensing Process (ILP). Concurrently, NorthWestern filed a Pre-Application Document (PAD).

The ILP is FERC's default licensing process which evaluates effects of a project based on a nexus to continuing Project operations. In general, the purpose of the pre-filing stage of the ILP is to inform Relicensing Participants[1] about relicensing, to identify issues and study needs (based on a project nexus and established FERC criteria), to conduct those studies per specific FERC requirements which will be defined in the FERC Study Plan Determination, and to prepare the Final License Application.

[1] Local, state, and federal governmental agencies, Native American Tribes, local landowners, non-governmental organizations, and other interested parties.

1.2 Study Plan Development Process

Before filing a Final License Application with FERC, applicants conduct a pre-license application filing process that consists of 1) presenting the project to Relicensing Participants; 2) consulting with those Relicensing Participants; 3) identifying issues; and 4) conducting studies and gathering relevant information.

Under FERC regulations, NorthWestern is required to submit a PAD 5 to 5.5 years prior to the expiration of the current License (December 31, 2025). NorthWestern filed the PAD July 1, 2020.

On August 28, 2020, FERC issued Scoping Document 1 (SD1) which included a preliminary list of issues to be addressed in FERC's environmental analysis for its relicensing of the Project pursuant to the National Environmental Policy Act (NEPA). FERC provided an updated list of issues to be addressed in the NEPA document in Scoping Document 2 (SD2) issued December 9, 2020. SD2 states that it reflects revisions to SD1 based on written comments filed during the scoping process.

In SD1, FERC requested that Relicensing Participants identify studies that would provide pertinent information for the environmental assessment. The deadline for filing study requests was October 27, 2020.

As specified by 18 Code of Federal Regulations (CFR) § 5.9(b)(5) of FERC's ILP regulations, a study request must explain, "…how the study results would inform the development of License requirements." NorthWestern has concluded that the studies in this Revised Study Plan (RPS) will provide information which will assist in assessing effects of the Project and inform potential future License conditions.

FERC will make the final determination on studies to be conducted. FERC's process and schedule for making that determination is described in **Table 1-1**.

Table 1-1: Thompson Falls anticipated study plan determination schedule
(NorthWestern activities in white, FERC activities in green, Relicensing Participant participation opportunities in orange).

Activity	Comment	Date	Timeline
NorthWestern files Proposed Study Plan (PSP) incorporating Relicensing Participant input on PAD.	The PSP described NorthWestern's proposed methodologies for conducting studies and addressed PAD comments and study requests.	12/11/2020	45 days after comment deadline for SD1.
Study Plan Meetings.	For the purpose of discussing the PSP and any information gathering or study requests, and to resolve any outstanding issues with respect to the PSP.	1/6/2021	No later than 30 days after PSP filed.

Activity	Comment	Date	Timeline
Relicensing Participants Comments on PSP.	This filing must also include an explanation of any study plan concerns and any accommodations reached regarding those concerns.	3/11/2021	90 days after PSP filed.
NorthWestern Files RSP incorporating Relicensing Participants input on the PSP.	This RSP includes comments on the PSP and efforts made to resolve any differences over study requests. If NorthWestern does not adopt a requested study, an explanation is included in the RSP as to why the request was not adopted.	4/12/2021[2]	30 days after comment deadline on PSP.
Relicensing Participants Comments on RSP Due.	Comment period.	4/27/2021	15 days after RSP filed.
FERC Study Plan Determination[3].		5/12/2021	30 days after RSP filed.

FERC's Study Plan Determination will be based on the following seven study criteria (18 CFR § 5.9(b)), which must be met by the Licensee and Relicensing Participants in their proposed studies:

(1) Describe the goals and objectives of each study proposal and the information to be obtained;

(2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;

(3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;

(4) Describe existing information concerning the subject of the study proposal, and the need for additional information;

(5) Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;

[2] Deadline is 30 days after the comment period on the PSP, which was 4/10/2021, a Saturday. Therefore, the filing deadline moved to the next business day, 4/12/2021.

[3] Agencies and Tribes with mandatory conditioning authority may request the use of a formal dispute resolution process regarding FERC's Study Plan Determination. Within 20 days of the Study Plan Determination, any federal agency or Tribe with authority to include mandatory conditions in a license may file a notice of study dispute with respect to studies pertaining directly to the exercise of their authorities under sections 4(e) and 18 of the Federal Power Act or section 401 of the Clean Water Act.

(6) Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and

(7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

1.3 Proposed Study Plan

In the PAD, NorthWestern identified preliminary issues and studies based on existing and relevant information, baseline conditions, and current and proposed future operations. NorthWestern identified eight studies in the PAD. In response to requests for studies submitted by the U.S. Forest Service (USFS) and Montana Fish, Wildlife and Parks (FWP), NorthWestern's PSP proposed one additional study to the eight proposed in the PAD, a study of Westslope Cutthroat Trout Genetics. The purpose of the PSP was to describe NorthWestern's proposed methodologies for conducting studies and to address PAD comments and study requests.

The nine studies included in the PSP were:

1. Operations Study: A study of operational scenarios to provide flexible capacity and the potential impact of those operational scenarios on Project resources in the Project reservoir and below the powerhouses
2. Total Dissolved Gas (TDG): A study of TDG in the Project reservoir, below the Main Channel Dam, and at the Birdland Bay Bridge
3. Water Quality: A study of water temperature, water chemistry, and turbidity in the Project reservoir, below the powerhouses, and at the Birdland Bay Bridge
4. Hydraulic Conditions: A hydraulics study to characterize a depth-averaged velocity field and water depths between the Main Channel Dam and the High Bridge (below the Main Channel Dam)
5. Fish Behavior: Radio telemetry study of salmonids to evaluate movement paths/rates and behavior in response to hydraulic conditions, from downstream of the powerhouses to the Main Channel Dam
6. Downstream Transport of Bull Trout: A study to test collecting and transporting juvenile Bull Trout (a Federally-listed threatened species) from the Thompson River to Lake Pend Oreille
7. Visitor Use Survey: A study surveying recreationists at the 10 recreation sites related to the Project on or near the reservoir and the Clark Fork River below the dams

8. Cultural Resources: A study to update the inventory of the Historic Architectural and Engineering Properties (H-A&E) and to identify areas where there is a high probability for the occurrence of prehistoric or historic archaeological properties within the proposed Area of Potential Effect
9. Westslope Cutthroat Trout Genetics. A study to confirm visual identification of *Oncorhynchus* sp. and to assess the amount of hybridization of *Oncorhynchus* sp. collected in the fish passage facility.

1.4 Study Plan Meeting and Comments on the PSP

In accordance with 18 CFR § 5.11, NorthWestern held a study plan meeting on January 6, 2021 which was open to any interested party. Due to FERC travel restrictions and health and safety concerns related to the COVID-19 pandemic, the meeting was held virtually on the ZOOM platform. There was a daytime meeting, and an evening meeting for participants unable to attend during the day. At the meetings, NorthWestern Energy presented its proposed studies and provided opportunities for participants to provide input and ask questions. The evening meeting included the same content as the daytime meeting on an abbreviated schedule. The meeting agendas were:

Daytime Meeting Agenda January 6, 2021

Start Time	Topic
9:00 AM	Introduction and Zoom tips, Overview of the FERC Process
9:25 AM	Operations Study
10:25 AM	BREAK (10 minutes)
10:35 AM	Tailrace Fish Behavior and Hydraulic Conditions Studies
11:35 AM	Downstream Transport of Bull Trout Study
12:05 PM	Westslope Cutthroat Trout Genetics
12:25 PM	BREAK (30 minutes)
12:55 PM	Water Quality and Total Dissolved Gas
1:25 PM	Visitor Use Survey
1:45 PM	Cultural Resources Study
2:00 PM	Adjourn

Evening Meeting Agenda January 6, 2021

Start Time	Topic
6:00 PM	Introduction and Zoom tips
6:15 PM	Operations Study
6:45 PM	Tailrace Fish Behavior and Hydraulic Conditions Studies
6:55 PM	Downstream Transport of Bull Trout Study & Westslope Cutthroat Study
7:15 PM	Water Quality and Total Dissolved Gas
7:30 PM	Visitor Use Survey
7:45 PM	Cultural Resources Study
8:00 PM	Adjourn

NorthWestern posted the presentation from the daytime meeting here: https://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls-relicensing/meeting-summaries/20210106_psp_daytime_meeting_presentation.pdf.

The presentation from the nighttime meeting is posted here: https://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls-relicensing/meeting-summaries/20210106_psp_evening_meeting_presentation.pdf

Subsequent to the Study Plan Meeting, during the public comment period, NorthWestern met, sometimes multiple times, with representatives of Montana Fish, Wildlife and Parks (FWP), the U. S. Fish and Wildlife Service (FWS), the U.S. Forest Service (USFS), and Montana Department of Environmental Quality (DEQ), to discuss the PSP, attempt to resolve any differences over study requests, and inform NorthWestern's development of the RSP.

The public comment period on the PSP closed on March 11, 2021. NorthWestern received written comments from FWP, FWS, USFS, Susan LaMont, Robin Hagedorn, Montana Department of Transportation, Montana State Historic Preservation Office (SHPO), DEQ, and FERC[4]. The comments, and NorthWestern's responses, are included in Appendix A. Pursuant to 18 CFR § 5.12, comments were to include an explanation of any study plan concerns and any accommodations reached with NorthWestern regarding those concerns. All proposed modifications to the PSP are required to meet FERC's seven study criteria (18 CFR § 5.9(b)).

1.5 Revised Study Plan

The purpose of this RSP is to describe NorthWestern's proposed methodologies for conducting studies and to address PSP comments and revised study requests. The studies will yield information that will enable FERC to conduct its NEPA analysis for the relicensing of the Project and aid in the development of future License requirements.

[4] Comments from Robin Hagedorn, Montana Department of Transportation, SHPO, and DEQ were submitted to NorthWestern directly and were not filed with FERC. The correspondence is found in Appendix A.

The RSP is different from the PSP in several ways. In response to requests for studies submitted by FWP, NorthWestern is proposing to add one additional study to the nine proposed in the PSP, Study #10 - Updated Literature Review of Downstream Fish Passage. In addition, in response to various comments by Relicensing Participants, NorthWestern modified several of the study plans in the PSP. Specifically, this RSP reflects the following changes in response to Relicensing Participant study requests, comments, and consultation:

Study #1, Operations Study

- Clarified that the reservoir will be drawn down 2.5 feet in each phase of the study, in response to a question from FERC staff
- Clarified that shoreline erosion monitoring locations were selected to represent the broad variability in shoreline conditions in the reservoir, in response to a comment from Susan LaMont
- Clarified that if noticeable slope stability issues are observed outside the reference sites, then such observed slope stability issues would also be documented with notes and photos, in response to a comment from Susan LaMont.
- Added a monitoring protocol to record the presence or absence of the aquatic invasive plants curlyleaf pondweed, flowering rush, and yellow flag iris during wetland monitoring, in response to a comment from the USFS
- Clarified the wetland study plan regarding the methods that will be used to select study sites

Study #3, Water Quality

- Included updated DEQ (2019) standard methods in response to a comment from DEQ
- Added an additional study site, upstream of Thompson Falls Reservoir, at the suggestion of DEQ and FERC
- Included a detailed Water Quality Study Plan (Appendix B) which was approved by DEQ
- Added new information, not previously available, regarding sediment quality in Thompson Falls Reservoir

Study #4 Hydraulic Conditions

- Clarified the study area in response to a comment from the USFS
- Extended the study schedule and reporting plan to allow for a longer comment period and stakeholder input on the Phase 1 modeling, in response to a comment from the USFS

Study #5 Fish Behavior

In response to the comments received from the USFS, FWS, and FWP, and the existing data supporting feasibility of fish collection quantities, NorthWestern has revised Study #5 – Fish Behavior to include the following:

- Collect up to 40 Brown Trout, 60 Rainbow Trout, and 20 Largescale Sucker for radio tagging
- Split collection for Brown Trout and Rainbow Trout in 2021 and 2022
- Collect salmonids from the mainstem Clark Fork River upstream of Thompson Falls Dam, the lower 7 miles of Thompson River, and the upstream fish passage facility work station
- Collect Largescale Sucker in 2022 in the mainstem Clark Fork River upstream of Thompson Falls Dam
- Focus fish collection for radio tagging and transport during the spring months

The study plan was also expanded to include a summary of the history of fish passage development at the Project, in Section 6.5 (Existing Information and Need for Additional Information).

Study #6 Downstream Transport of Bull Trout

As a result of input from FWP and FWS, NorthWestern adopted additional details concerning the study. These details include:

- Tagging and genetic sampling protocols for Bull Trout greater than or equal to 100 mm
- Targeted sample size and locations of sampling
- Size range for juvenile Bull Trout eligible for transport from each sample location
- Contingency plan if the annual transport target for West Fork Thompson River cannot be met (or appears that it will not be met)
- Proportion of Bull Trout within the eligible transport size range to be transported and handling protocols for Bull Trout outside the eligible transport size
- Dates for operation of temporary weir traps, and trap monitoring protocols
- Electrofishing protocols

Study #7 Visitor Use Survey

- Clarification was added regarding the reasoning for the dates of the study season, in response to questions raised by a Relicensing Participant during the Study Plan Meeting

- In addition, the survey has been modified to include a question regarding familiarity with the no-wake zone regulations, in response to a comment from Susan LaMont

Study # 8 Cultural Resources Inventory, Evaluation, and Examination of Potential Effects

- Clarification that the inventory will include inventory and evaluation of all buildings and structures greater than 50 years old, in response to a comment from the SHPO

Overall, the RSP reflects NorthWestern's efforts since the PSP to review and consider all comments on the PSP and study requests, as summarized in Appendix A of this RSP, and to collaborate with federal and state resource agencies to better understand their comments and identify potential compromises to address their interests. For any requested study submitted as part of PSP comments that NorthWestern did not adopt in the RSP, NorthWestern explains the rationale for its decision, and when appropriate, a reference to FERC's study plan criteria. NorthWestern recognizes that due to the timeframes of the ILP, Relicensing Participants are required to dedicate substantial time and resources to study development under tight deadlines. NorthWestern greatly appreciates these efforts and believes that this RSP is improved as a result.

Study Schedule

FERC's regulations specify certain milestones in the implementation of a FERC Study Plan Determination, as shown in **Table 1-2**.

Table 1-2: Thompson Falls anticipated study plan implementation schedule
(NorthWestern activities in white, FERC activities in green, Relicensing Participant participation opportunities in orange).

Activity	Comment	Due Date	Timeline
FERC Issues Study Plan Determination	If no disputes are filed within 20 days of Study Plan Determination, the Study Plan Determination is considered final.	5/12/2021	Within 30 days from Filing Revised PSP
First Study Season	Studies required by the Study Plan Determination.	5/12/2021–5/12/2022	
Initial Study Report	NorthWestern prepares and files with FERC an Initial Study Report describing progress in implementing the study plan, data collected, and any variance from the study plan or schedule. The report must also include any modifications to ongoing studies or new studies proposed.	5/12/2022	No later than 1 year from Study Determination
Initial Study Report Meeting	Meeting with Relicensing Participants and FERC to discuss the study results and any proposals to modify the study plan.	5/27/2022	Within 15 days from Initial Study Report

Activity	Comment	Due Date	Timeline
Initial Study Report Meeting Summary	NorthWestern prepares and files a meeting summary, including any modifications to ongoing studies or new studies. Any proposal to modify an ongoing study or add a new study must be accompanied by a showing of good cause why the proposal should be approved.[5]	6/11/2022	Within 15 days from Study Meeting
Second Study Season	For those studies in the Study Plan Determination that require two study seasons.	5/12/2022–5/12/2023	2 years from Initial Study Determination
Updated Study Report Due	NorthWestern files an updated study report describing overall progress in implementing the study plan, data collected, including an explanation of any variance from the study plan and schedule. The report must also include any modifications to ongoing studies or new studies proposed by NorthWestern.	5/12/2023	2 years from Initial Study Determination
Updated Study Report Meeting	Same purpose as Initial Study Report Meeting	5/27/2023	Within 15 days from Updated Study Report
Updated Study Report Meeting Summary	Same purpose as Initial Study Report Meeting Summary[6]	6/12/2023	Within 15 days from Study Meeting

A study specific schedule is in **Table 1-3**. Details of the reporting schedule for each study are included in the study plans in Sections 2 through 11.

[5] Any participant or the FERC staff may file a disagreement concerning the applicant's meeting summary within 30 days, setting forth the basis for the disagreement. This filing must also include any modifications to ongoing studies or new studies proposed by FERC staff or other participant.

[6] The review, comment, and disagreement resolution provisions for the Initial Study Report apply to the Updated Study Report.

Table 1-3: Study plan schedule

Activity	1-Operations Study	2-Total Dissolved Gas	3-Water Quality	4-Hydraulic Conditions	5-Fish Behavior	6-Downstream Transport of Bull Trout	7-Visitor Use Survey	8-Cultural Resources Inventory, Evaluation, and Examination of Potential Effects	9-Westslope Cutthroat Trout Genetics	10-Updated Literature Review of Downstream Fish Passage
Preparatory Work	Baseline Shoreline Condition Assessment, Fall 2020	Set up of monitoring equipment, Spring 2021	Mar 2021 sampling	None anticipated	Planning, acquiring equipment, testing equipment and procedures Jan–May 2021	Operation of currently installed passive integrated transponder (PIT) tag antenna arrays	Finalize survey schedule, survey technician training, April–May 2021	None anticipated	Samples taken at fish passage facility in 2021	None anticipated
FERC Study Plan Determination anticipated May 12, 2021										
First Study Season	Test and monitor operational scenarios, Jul–Sep 2021	High flow TDG monitoring, May–Jun 2021	Quarterly sampling, Jun, Sep, and Dec, 2021	Bathymetry and Phase 1, 2D Modeling Aug–Nov 2021	Radio telemetry, Jun–Oct 2021	July through Aug: PIT tagging Bull Trout; Oct through Nov: juvenile Bull Trout capture and transport	Conduct survey, May–Sep 2021	Inventory H-A&E properties. Development of archeological model, Jun–Sep 2021	Samples taken at fish passage facility during the 2021 season	Prepare literature review
Interim Reporting	None anticipated	None anticipated	None anticipated	Phase 1 Modeling Report and Phase 2 Modeling Plan Feb 2022	None anticipated	None anticipated	None anticipated	Archeological model report Nov 2021	None anticipated	None anticipated
Initial (or Final) Study Report, 1 year after FERC Study Plan Determination (assumed to be May 12, 2022)	Results of operations study	Results of 2021 monitoring	Results of 2021 sampling	Phase 1 modeling results and scenarios for Phase 2 modeling	Results of radio tracking to-date	Results of study to-date	Results of data collected in 2021, and comparison to previous surveys	Results of re-inventory of H-A&E properties	Results of 2021 sampling	Addendum to 2007 Literature Review
Study Report Meeting, 15 days after Initial Study Report										
Study Report Meeting Summary, 15 days after Initial Study Report Meeting										

Activity	1-Operations Study	2-Total Dissolved Gas	3-Water Quality	4-Hydraulic Conditions	5-Fish Behavior	6-Downstream Transport of Bull Trout	7-Visitor Use Survey	8-Cultural Resources Inventory, Evaluation, and Examination of Potential Effects	9-Westslope Cutthroat Trout Genetics	10-Updated Literature Review of Downstream Fish Passage
Second Study Season	None anticipated	TDG monitoring during high flows, May–Jun 2022	Quarterly sampling Mar, Jun, Sep, and Dec, 2022	Phase 2 modeling Jun–Dec 2022	Radio telemetry, Mar–Oct 2022	Jul–Aug 2022: PIT tagging Bull Trout; Oct–Nov 2022: West Fork Thompson River, Fishtrap Creek juvenile Bull Trout capture and transport.	None anticipated	Inventory phase of Prehistoric and Historic Archaeological Properties (PAP and HAP) identification	None anticipated	None anticipated
Revised Study Report, 2 years after FERC Study Plan Determination	None anticipated	Results of TDG monitoring	Results of water quality sampling	Results of Phases 1 and 2 modeling	Final report on radio telemetry and literature review of fish swimming capabilities.	Final report on tagging and transport.	None anticipated	Results of PAP and HAP inventory	None anticipated	None anticipated
Study Report Meeting, 15 days after Revised Study Report										
Study Report Meeting Summary, 15 days after Revised Study Report Meeting										

2. Proposed Study 1 Operations Study

The Project is operated to provide baseload and flexible generation within the reservoir elevation and minimum Project discharge (flow) requirements of the License issued by FERC. During flexible generation operations, the Licensee may use the top 4 feet of the reservoir while maintaining minimum flows.

NorthWestern is proposing that the Project continue to provide the baseload generation and flexible capacity needs required by NorthWestern's electric system and further proposes using the top 2.5 feet of the reservoir to meet these requirements. While an authorized use of 2.5 feet is substantially less than the current authorized use of 4 feet, it will provide the flexibility needed.

NorthWestern is proposing a study of Project operations, including evaluating generation changes at multiple reservoir elevations for multiple durations, allowing the resulting reservoir fluctuations to be observed and studied for potential impacts on Project resources. Operational scenarios for the study will be within the 2.5 feet of flexible reservoir elevation while maintaining minimum flows.

2.1 Goals and Objectives of Study

The goal of the study is to understand the effects of Project operations authorized under the current License and to evaluate possible impacts on Project resources.

The following resource areas will be monitored during the study and evaluated as part of development of the Final License Application, with these specific objectives:

Operations: The study will simulate operational scenarios of flexible capacity that could be implemented at the Project. Objectives are to evaluate flexible operational scenarios to determine plant generation outputs, rate, and degree of reservoir elevation changes that may result from these flexible operations.

Shoreline Stability: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on shoreline stability around the reservoir. The objective of the monitoring is to identify Project-induced erosion, if any, associated with flexible operation and associated reservoir elevation changes.

Fisheries: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on fish populations, fish access to tributary streams, and to the operation of the Project's fish passage facility.

Recreation and Aesthetics: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on public and

private boat launches and docks within the Project boundary, and the aesthetic qualities of the reservoir.

Public Safety: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on the Project's public safety including changing water levels in the Project reservoir and below the powerhouses.

Water Quality: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on water quality in the Project reservoir, below the powerhouses and downstream at Birdland Bay Bridge.

Wetland/Riparian Habitats: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on wetland and riparian areas within and adjacent to the Project boundary.

Cultural: Data collected during this study will be evaluated to determine what, if any, effects the study's operational scenarios have on three previously recorded cultural properties located in the reservoir fluctuation zone[7] and exposed in shoreline embankments at the face of the backshore zone.[8]

2.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below. These same changes were noted in Section 1.5 and are repeated here for convenience.

- Clarified that the reservoir will be drawn down 2.5 feet in each phase of the study, in response to a question from FERC staff
- Clarified that shoreline erosion monitoring locations were selected to represent the broad variability in shoreline conditions in the reservoir, in response to a comment from Susan LaMont
- Clarified that if noticeable slope stability issues are observed outside the reference sites, then such observed slope stability issues would also be documented with notes and photos, in response to a comment from Susan LaMont.
- Added a monitoring protocol to record the presence or absence of the aquatic invasive plants curlyleaf pondweed, flowering rush, and yellow flag iris during wetland monitoring, in response to a comment from the USFS
- Clarified the wetland study plan regarding the methods that will be used to select study sites

[7] Fluctuation Zone refers to lands exposed by any reservoir drawdown.
[8] Backshore Zone refers to the lands lying beyond the full reservoir contour.

2.3 Study Description

The Operations Study will simulate operational scenarios of flexible capacity at the Project. The study will be implemented in three phases, each with different levels of generation and corresponding raising and lowering of the reservoir. Changes in operations for the purposes of the study will occur within the top 2.5 feet of the reservoir and will maintain a minimum flow of 6,000 cubic feet per second (cfs) downstream of the Project. The three phases of study will be scheduled when flows would typically allow for flexible operations at the Project. This will facilitate observation of resource impacts during the season when they would most likely occur.

Methods

The Operations Study will be implemented in three phases, each with differing magnitudes of operational changes in generation. Reservoir elevation will be reduced, increased, and held stable relative to the operational scenario being tested. By the end of the three-phase study, the reservoir will have been held static at every half foot elevation for the top 2.5 feet for extended observation (**Figures 2-1 – 2-3**). During each of the three study phases change in reservoir elevation will be observed and recorded. The public will be notified of the study dates prior to the study.

Methods for each resource area to be studied are described below.

Operations

Each phase will consist of multiple daily operations for a continuous week (7 days). A minimum of 2 weeks will be spaced between phases to reestablish a baseline condition in preparation for the subsequent phase of testing.

For each 7-day phase of the study, two to four specific operations, randomly ordered, will be conducted each day between 7 am and 5 pm (Mountain Standard Time). Discrete operations of short-term generational changes that may be implemented to simulate flexible generation for each phase of the study are described below. The discrete operations described for each phase will be mixed over the 7 days to simulate NorthWestern's needs for transmission grid regulation. A minimum of two 0.5-foot static hold elevations will be maintained for a minimum of 4 hours within each phase.

The following operations will be used for the purposes of this study:

<u>Phase 1 – 20 MW Generation change</u>

20 MW increase in generation for 30 minutes

20 MW increase in generation for 90 minutes

20 MW decrease in generation for 30 minutes

20 MW decrease in generation for 90 minutes

Phase 2 – 40 MW Generation change

40 MW increase in generation for 30 minutes

40 MW increase in generation for 90 minutes

40 MW decrease in generation for 30 minutes

40 MW decrease in generation for 90 minutes

Phase 3 – Maximum[9] Generation Capacity change

Maximum available increase in generation for 30 minutes

Maximum available increase in generation for 90 minutes

Maximum available decrease in generation for 30 minutes

Maximum available decrease in generation for 90 minutes

The following graphs are a simulation of what reservoir elevations may be during the three phases of the Operations Study based on observations during the October 2019 Operations Test. These graphs illustrate the random schedule of increasing and decreasing generation, combined with static holds to evaluate conditions at varying reservoir elevations.

[9] Maximum capacity change will be determined at the time of the test based on available units in the plant and river baseflow.

Figure 2-1. Example of potential reservoir elevations during Phase 1 of Operations Study.

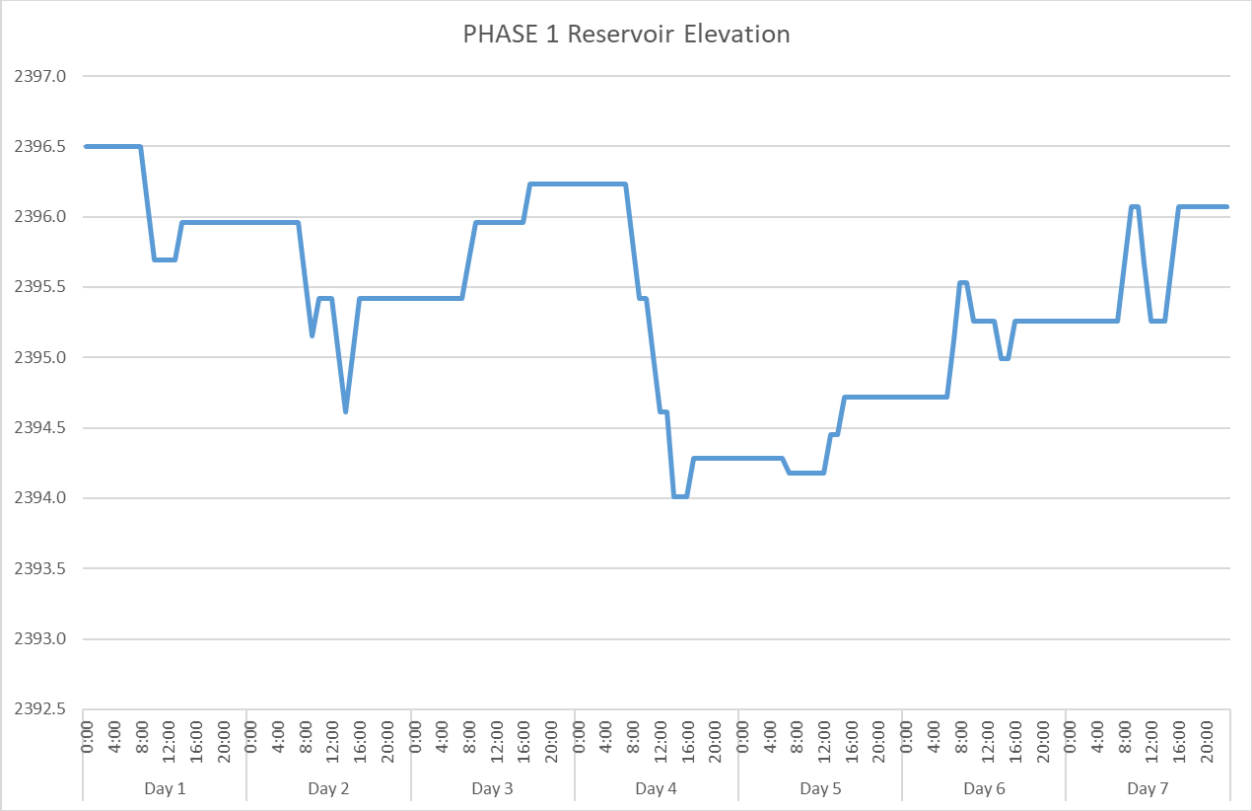


Figure 2-2. Example of potential reservoir elevations during Phase 2 of Operations Study.

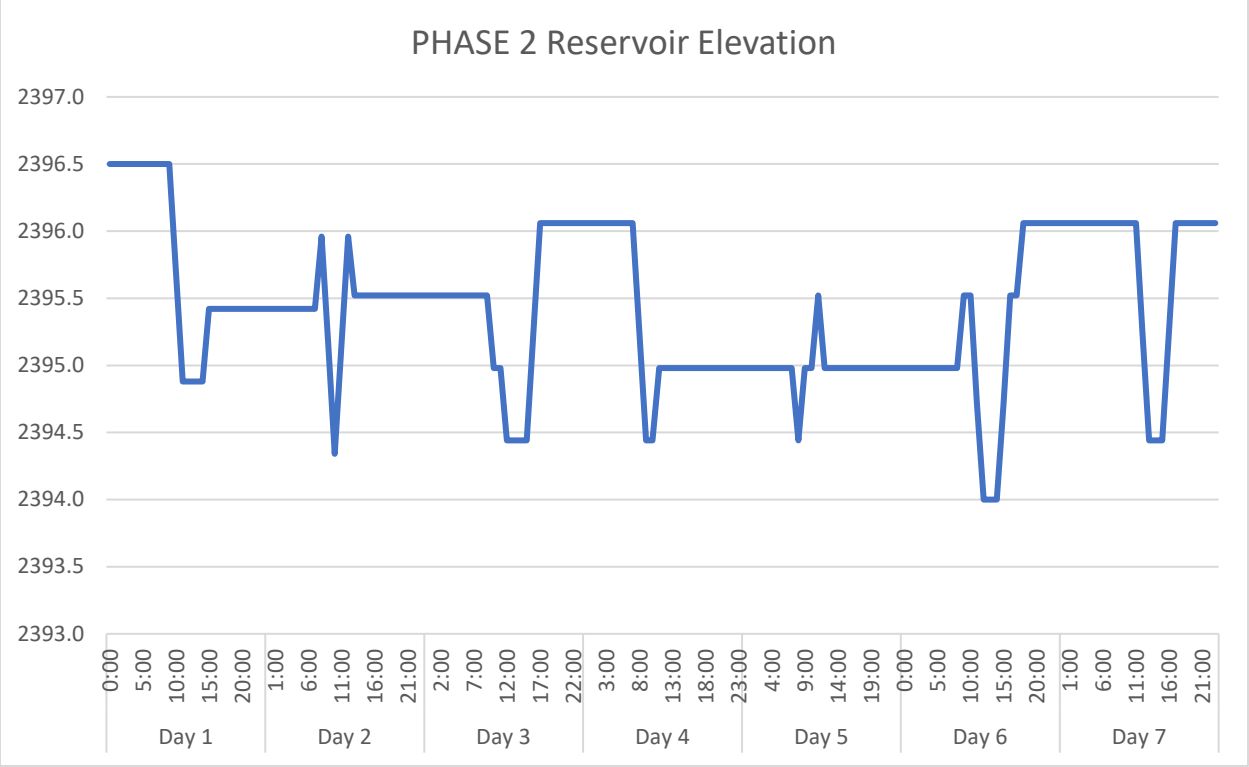
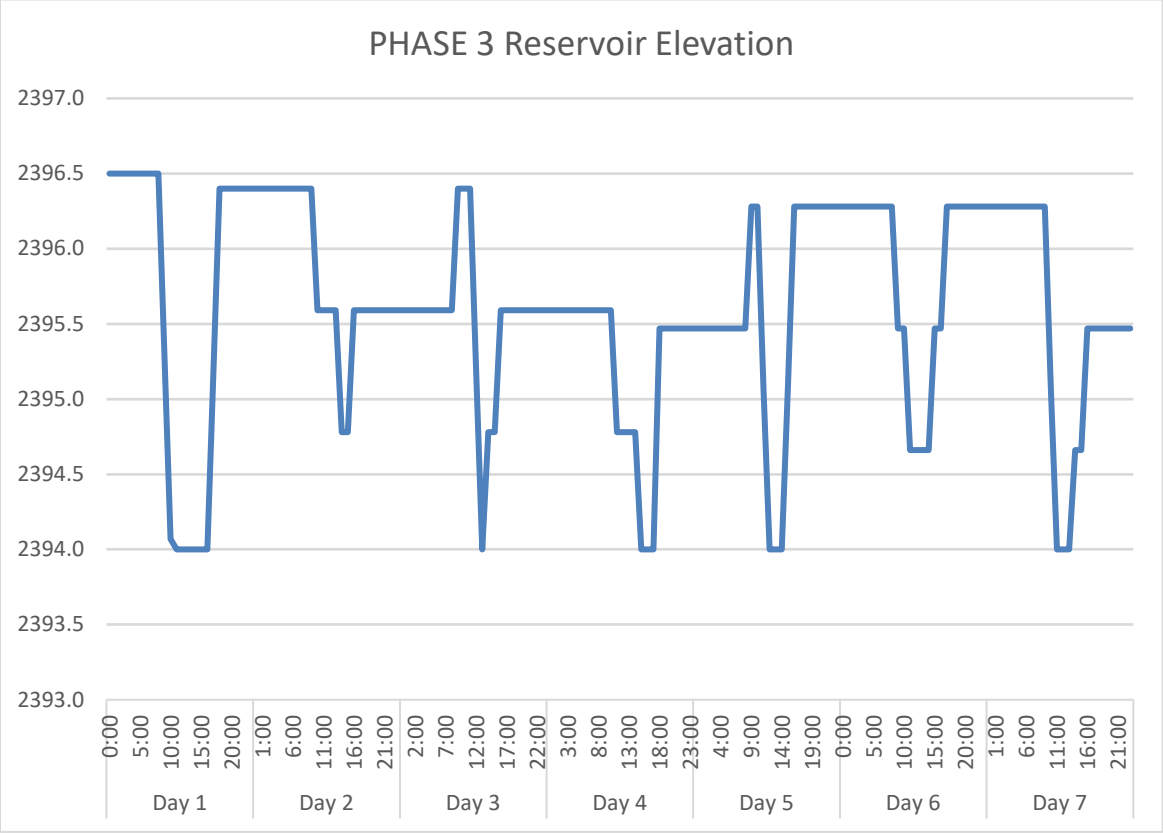


Figure 2-3. Example of potential reservoir elevations during Phase 3 of Operations Study.



The raising and lowering of the reservoir will be controlled by increasing or decreasing generation. Actual reservoir elevation changes will be dependent on the inflows to the Project at the time each phase is implemented. NorthWestern will adapt the specific operations scheme to assure utilization of the entire 2.5 feet of the reservoir.

Shoreline Stability

Study Area

As part of the Operations Study, NorthWestern will assess shoreline stability. The assessment will include reservoir shorelines extending from the dams upstream to the mouth of the Thompson River (**Figure 2-4**). This area captures the vast majority of developed lands that are potentially affected by Project-induced bank erosion. Above the Thompson River, the reservoir becomes more riverine with higher current velocities, increased presence of bedrock, and larger substrate, and thus more resilient to erosion. Below the dams, the river is bedrock-controlled, and shoreline erosion is not a concern.

Study Methods

Nine reference points have been established along the reservoir shoreline. **Figure 2-4** is a map showing the location of the reference points. Each reference point will be a 300-foot reach of shoreline. The reference points were chosen to represent the broad variability in soil types, landform, slope, aspect, vegetation, shoreline management, flow velocity and land use that in turn represent the variability in shoreline stability along the reservoir. The reference points will be monitored a number of times as discussed in Section 2.3 – Study Description, by making visual observations of the shoreline describing parameters such as presence or absence of erosion, type of erosion, magnitude of erosion, soil type, land management activities and shoreline erosion control measures (if any). The observations will be recorded electronically and entered into a database. Five photos will be taken at each reference point with three capturing the shoreline of the entire 300-foot reach and two photos taken from the mid-point of the reach, one facing upstream and the other facing downstream. If noticeable slope stability issues are observed to be occurring in real time, but which are not within the nine chosen reference sites, then such observed slope stability issues would also be documented with notes and photos.

The reference points were monitored on October 8, 2020 to gather baseline information. Two additional monitoring events will occur, one after ice-off and before high spring runoff and another after high spring runoff, in spring of 2021 (specific date to be determined based on flows) to gather additional baseline information before Phase 1 of the Operations Study. The goal of establishing a baseline is to estimate the amount of observed shoreline erosion during a period when the reservoir was held near full pool. The observed erosion during this baseline period (October 2020–spring 2021) will help document natural and anthropogenic factors influencing the shoreline, not related to operational fluctuations in reservoir elevation. Additional monitoring events will occur between Phases 1 and 2 and again between Phases 2 and 3 of the Operations Study, and the final monitoring event will occur in October of 2021 after Phase 3. During each shoreline monitoring event the

reservoir will be held near full pool. Results from each monitoring event will be compared to identify changes in shoreline stability, and whether or not the changes were related to the Operations Study, or baseline conditions, or a combination of both. Results will be presented in the Initial Study Report which will include data in geographic information system (commonly known as GIS) format.

Fisheries

The assessment of effects of operational fluctuations on fisheries will include evaluating the potential for fish stranding, habitat changes at the mouths of Cherry Creek and Thompson River, and impacts to the fish passage facility.

Study Area

In the Thompson Falls Reservoir, below the confluence with Cherry Creek, and near the islands above the Thompson River, fish stranding will be monitored on exposed island areas, and along exposed shoreline habitats (**Figure 2-5** for these study areas). In addition, photo points will be established at the confluences of Cherry Creek and Thompson River. Conditions in the fish passage facility will also be evaluated during this study.

Study Methods

Transects will be established to observe and measure fish stranding during different operational scenarios in the reservoir. Shallow habitats that are less than 2.5 feet deep at full pool will be the focus since these are areas where fish stranding is most likely with the fluctuating reservoir level. In the reservoir below Cherry Creek, three 200-foot-long transects will be surveyed on exposed mid-channel island areas, and three transects will be surveyed along exposed shoreline habitats. The reservoir near the islands above Thompson River will also be sampled with the same methodology, including three transects on exposed island areas and three along shoreline habitats. The transects are intended to capture the range of habitat characteristics where there is the potential for fish stranding. Observers will walk the transect and record species, total length, and weight of any fish observed within 30 feet (15 feet either side) of the transect line. If fish are observed trapped in small pools along the transect, they will be counted by species, and lengths estimated.

Cherry Creek and Thompson River are important spawning and rearing habitats for salmonids. Different reservoir elevations have the potential to modify the areas at the tributary/reservoir confluence and potentially modify or impede the migration of salmonids into and out of these streams. Photo points will be established during the Operations Study at the confluence and 500 feet upstream to visually capture any changes to habitats at different reservoir elevations. Level loggers will also be employed to measure elevation changes near the tributary confluences, and a cross sectional area of the tributary will be measured.

During the Operations Study the fish passage facility will be operated as normal, including flow in the step pools of the ladder and in the high velocity attraction jet. Operation of the workstation

pumps will be assessed. Observations of water levels in the fish ladder will be made and corresponding reservoir elevations recorded.

Recreation and Aesthetics

The effects of the study's operational fluctuations on public recreation facilities and privately-owned improvements used for recreation as well as aesthetic qualities will be observed during the study.

Study Area

Assessment of effects on recreation facilities will include facilities along the reservoir shoreline, from the dams upstream to the mouth of the Thompson River (*see* **Figure 8-1)**. This area includes the two publicly available boat launches at Wild Goose Landing Park and Cherry Creek Boat Launch, as well as facilities associated with private properties and subdivisions. There are no developed recreation facilities above the Thompson River or below the dams. However, there is dispersed recreation below the dams. Sandy Beach will be monitored for effects to accessibility when flows change.

Study Methods

Reference points will be established to monitor recreational access. These points will include a subset of docks that is representative of all docks located along reservoir shorelines and will include the two public boat launch sites (Wild Goose Landing Park and Cherry Creek Boat Launch), as well as the Salish Shores community subdivision boat launch. To establish the subset of monitoring locations, the reservoir will be divided into four segments:

1. From the boat barrier upstream to the upper end of Steamboat Island
2. From the upper end of Steamboat Island upstream to the Salish Shores boat launch
3. From the Salish Shores boat launch upstream to the Cherry Creek boat launch
4. From the Cherry Creek boat launch upstream to Thompson River

Due to the shallow and highly varied nature of shoreline access in the reservoir just above the dams, it is anticipated that docks closest to the dams would bear more impact than docks in the upper region of the reservoir, which is much deeper and more uniform. Therefore, all docks between the boat barrier and the upper end of Steamboat Island (approximately 10 docks) will be monitored. Upstream of Steamboat Island, 25 percent of docks (i.e., every fourth dock) will be monitored in each of the three segments, distributed between the North and South shorelines according to the distribution of all docks that exist at the time of the study. Monitoring every fourth dock in these three segments will result in the monitoring of approximately 30 docks in the upper sections and approximately 40 docks on the reservoir overall. These established reference points will each be evaluated during full pool prior to the first phase to establish baseline conditions, and then one time at each site when the reservoir is at the lowest elevation to observe any impacts to facilities that result from operational fluctuations. Observations will target changes to sediment

depth, the extent of exposed shoreline or vegetation, and changes to the usability of gangways and ramps that connect floating or stationary docks to on-shore abutments. In addition, the Sandy

Beach dispersed recreation site immediately downstream of the original powerhouse will be monitored during each phase of the Operations Study to determine the impact of changing water levels at that location.

At the public boat launch sites, reference points will include existing docks and the end of the boat ramps as well as established shoreline access points, if any, within the public recreation sites. These points will be photo-inventoried and measurements will be taken during each half-foot static hold to describe the depth of the water at the end of the boat ramps, the length of the submerged portion of the ramps, impacts to dock use or access, and the amount of exposed shoreline and vegetation at shoreline access points before and during the operational change. Since all phases of the Operations Study will result in the same maximum reservoir elevation change, it will only be necessary to measure the impacts to these public boat launch site reference points during one phase of the study.

The Salish Shores community subdivision boat ramp is a gravel ramp and determining the overall length of the ramp (and thus, where the ramp ends) is not feasible. Therefore, a distance of up to 20 feet extending from the upland edge of the concrete barriers alongside the ramp will be designated as the end of the gravel boat ramp. Assessments conducted at the public boat launches will be replicated at the community ramp.

Established reference points of privately-owned docks will be a representative sample of all existing docks and will include photo documentation and description of any observed impacts to the docks and gangways resulting from the Operations Study, including any alterations to sediment depth and exposed shoreline and vegetation. These impacts, along with any other observed impacts, will be documented and photographed for each reference point at the lowest reservoir elevation of the study. As with public and private boat launches, these impacts will be measured once since all phases of the Operations Study will result in the same water elevations.

Below the dams, water elevation changes will be monitored for any impacts to public recreation. Reference points along the upstream edge of Sandy Beach and adjacent to the natural pool at the beach will be established to monitor and observe the variation in water level and the rate at which those variations occur as well as any resulting changes in sediment depth. Since each phase of the study employs different magnitudes of operational changes, it will be necessary to evaluate the water elevation at Sandy Beach for all three phases of the study.

Effects on aesthetic qualities of the Project reservoir will be documented in much the same way. Reference points will be established and evaluated through photo documentation, observations and descriptions of influences from operational fluctuations. Reference points at common public viewing areas including the upper end of Island and Wild Goose Landing parks, the Canada Goose Rearing Area, and the Salish Shores and Cherry Creek boat launches will be established and photo inventories and descriptions of any changes to aesthetic qualities will be documented. These

reference points are anticipated to provide a representative sample of viewpoints along reservoir shorelines that will approximate views from public and privately-owned properties.

Public Safety

Impacts to public safety related to water elevation changes will be evaluated and monitored during the Operations Study.

Study Area

Water level changes at Sandy Beach (*see* **Figure 8-1**), below the original powerhouse, and high-traffic areas in Thompson Falls Reservoir, will be monitored for potential impacts relative to public safety.

Study Methods

In-water obstacles may become more or less apparent and may become more or less hazardous as water conditions change. To better understand the effect of changing reservoir elevations on in-water obstacles, Sandy Beach (below the original powerhouse) and high-traffic areas in Thompson Falls Reservoir will be monitored during the static hold times of the Operations Study. In general, these assessments aim to determine the extent of public safety risk, if any, associated with changing water levels at these locations. Areas of potential shallow water will be the areas of focus.

Water Quality

Water quality will be monitored during the Operations Study by measuring changes in water level stage, turbidity, and other water quality field parameters upstream and downstream of the Project's facilities. As reservoir levels decrease, the rate at which they decrease in conjunction with the reservoir pool level may have an effect on downstream turbidity.

Study Area

Water quality instruments will be deployed on the upstream face of the Dry Channel Dam, and downstream of the Project at Birdland Bay Bridge.

Onset water level recording instruments will be installed downstream of the powerhouse, at the mouth of the Thompson River, and at the island complex on the upstream end of the reservoir. Instrumentation permanently installed on the Main Dam will also collect reservoir level information. These sites were chosen to be consistent with the data collected during the 2019 operational testing period (**Figure 2-5**). These sites were originally chosen to provide a spatial distribution across the reservoir and to see how different areas of the reservoir respond to changes in pond elevation.

Figure 2-4. Shoreline stability reference points.

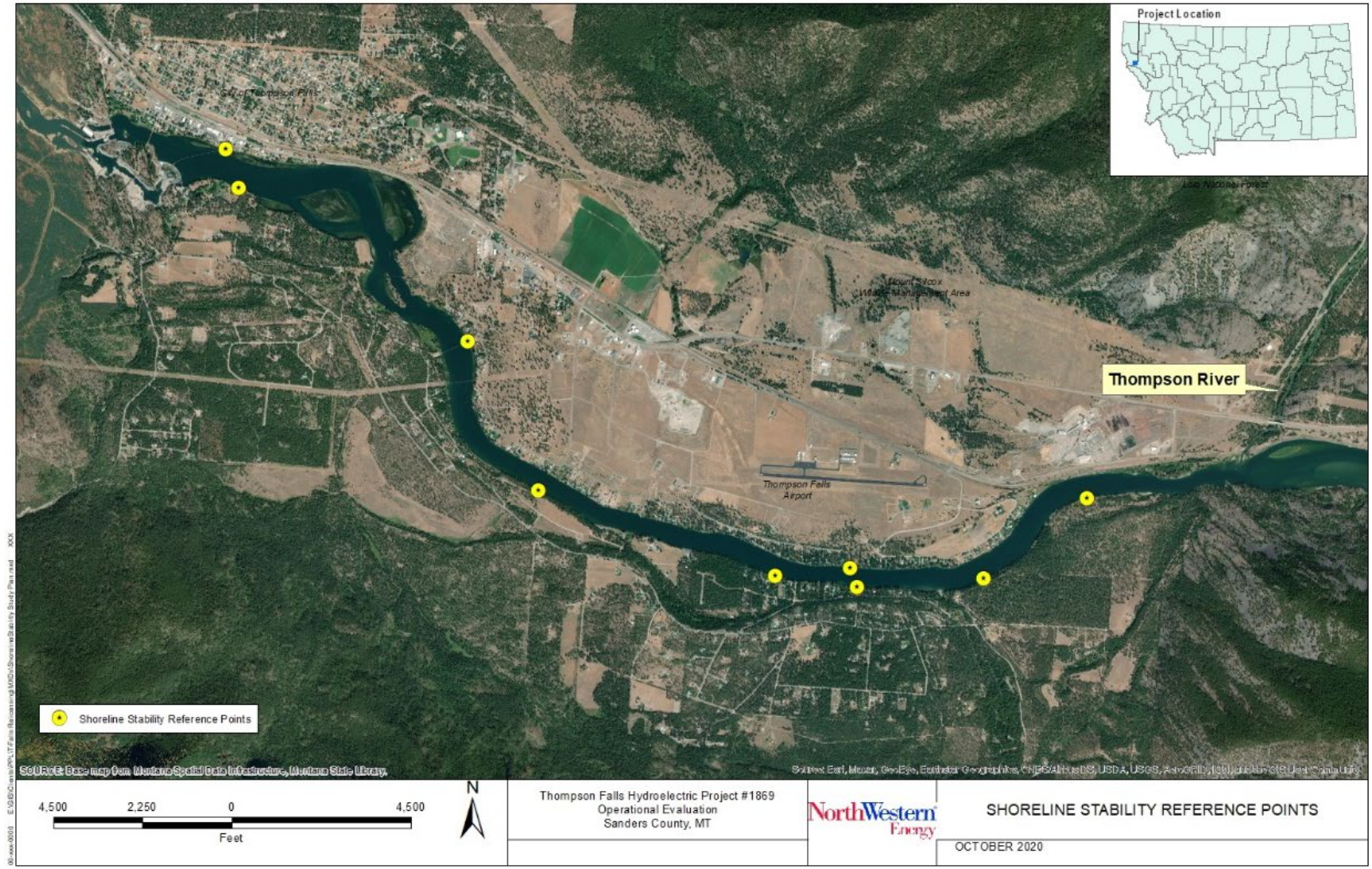
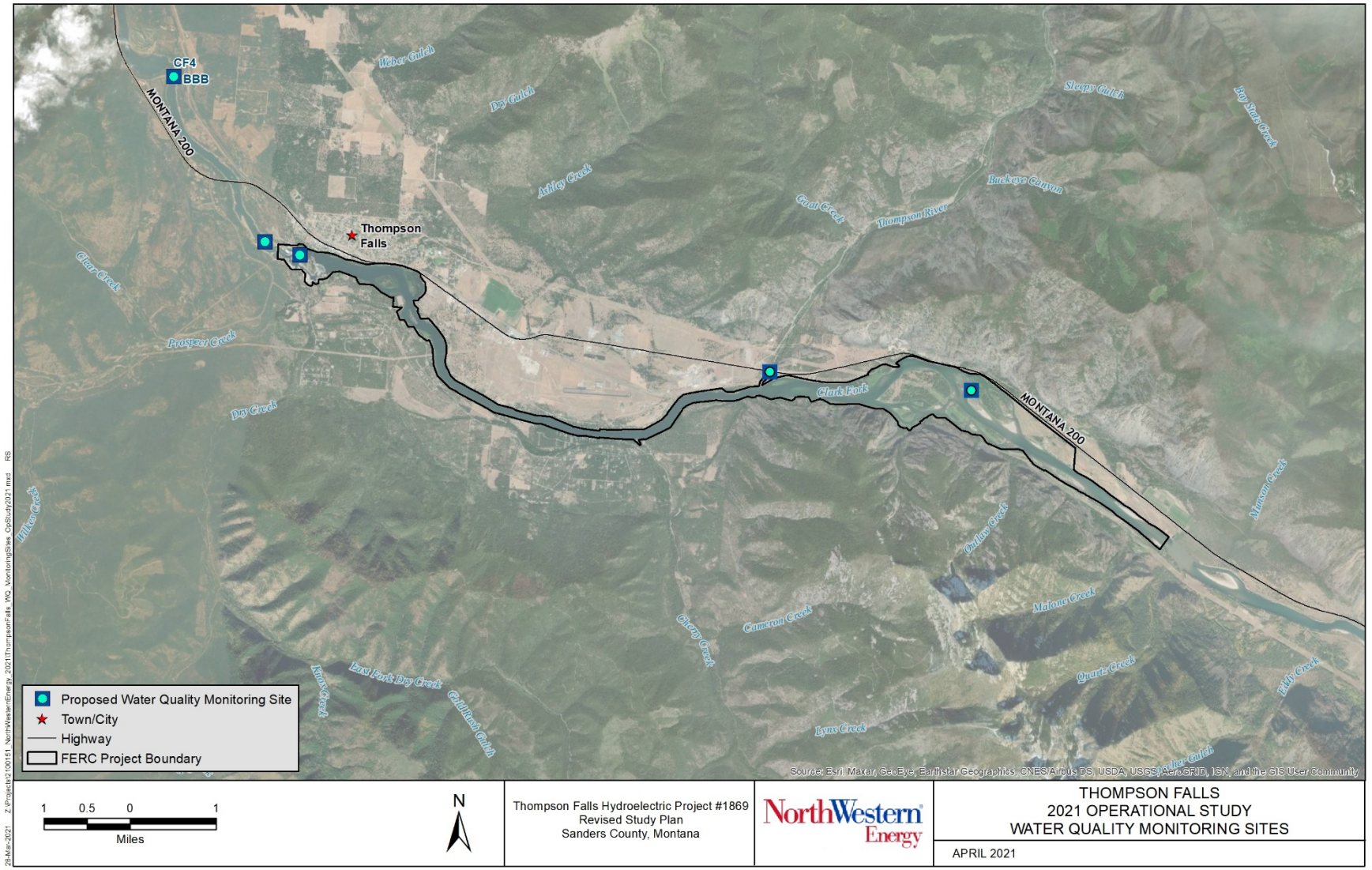


Figure 2-5. Water quality sampling locations for the Operational Study.



Study Methods

Onset logging instruments will be programmed to record reservoir level in 5-minute intervals to provide data on how different parts of the reservoir respond to the lowering of the reservoir elevation. Reservoir inflows affect level changes, so by studying level changes at different inflows, reservoir level dynamics under different conditions can be better understood.

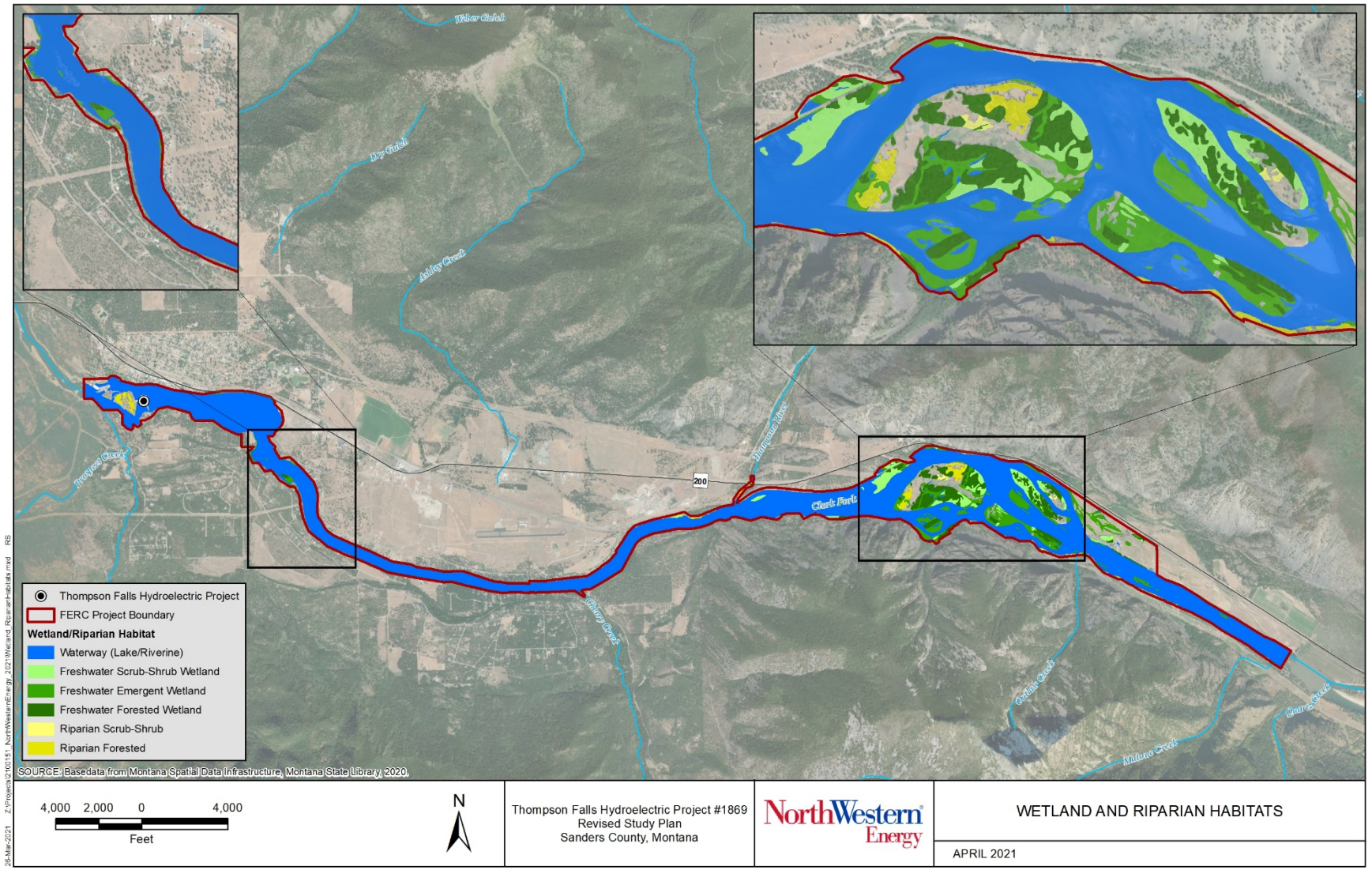
To evaluate turbidity, Hach Hydrolab water quality instruments will be deployed. The upstream instrument will track changes in turbidity coming from reservoir sediments being re-suspended, while the downstream instrument will track the ultimate fate of that turbidity as well as any increased turbidity that may be caused by altering the powerhouse discharges. These instruments will be set to record turbidity at fifteen-minute intervals and will track changes in water quality. Additional water quality parameters to be measured by the instruments are hydrogen ion concentration (commonly known as pH), specific conductivity, dissolved oxygen, temperature, and depth. The water quality data collected in this study will supplement water quality data to be collected in a separate water quality study proposed by NorthWestern which is described in further detail in Section 4 – Study #3 Water Quality.

Wetland/Riparian Habitats

Study Area

The Wetland/Riparian habitat study will be conducted along the shoreline of Thompson Falls Reservoir (**Figure 2-6**). Sites will be selected in the lower (adjacent to and downstream of Steamboat Island) and upper (upstream of the Thompson River confluence) portions of the reservoir where the majority of the wetland habitat exists.

Figure 2-6. Wetland/Riparian Habitat Study Areas.



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Study Methods

Wetlands and riparian habitats will be monitored during the Operations Study by measuring changes in water level and conducting visual observations of identified wetland and riparian areas. As the level of the reservoir decreases, the hydrological connection with adjacent wetlands and riparian areas has the potential to be altered.

A desktop exercise will be used to identify and prioritize potential wetland and riparian monitoring sites. Wetland and riparian areas will be identified using the Montana Spatial Data Infrastructure Wetlands Framework (2020). This information will be utilized to locate the approximate location of identified wetlands, and the type and extent of these areas adjacent to the reservoir. The desktop exercise will be used to rank sites as high, medium, or low risk. Risk will be determined by multiple factors including the surface water connection, soil type, slope, and distance from the ordinary high-water mark of the reservoir. Wetland sites that receive a low-risk rating are unlikely to be affected by reservoir operations and will not be considered as suitable monitoring sites for this study.

Wetland sites that receive a high or medium risk rating will be considered as potential sites for data collection as a part of this study. Ground-truthing of the high or medium risk rated sites will be used to validate the results of the desktop exercise and to identify sites for monitoring during the Operations Study.

Prior to the Operations Study, level loggers and/or piezometers will be deployed at four representative wetland monitoring sites to track water level changes in these areas throughout the duration of the study. One monitoring site will be selected in the lower portion of the reservoir near Steamboat Island, two sites will be selected in and around the island complex upstream of the confluence with the Thompson River, and one control site will be selected upstream of the reservoir. The purpose of the control site is to capture any natural environmental variability that may occur outside of the influence of dam operations. The control site will be of a similar wetland type and physical characteristics as the other three wetland sites chosen for this study. Visual observations will be used to identify any areas that become disconnected from the reservoir. Data collected will be analyzed to determine any potential operational impacts on wetland and riparian areas.

As described in the PAD, Section 7.1.3, aquatic invasive plants documented or observed in the Thompson Falls Reservoir include curlyleaf pondweed, flowering rush, and yellow flag iris. The presence or absence of these species will be recorded at each site.

Cultural

Study Area

The study area consists of the locations of known archaeological properties that lay at or near the reservoir high water line. These properties are Salish House (24SA0130), for which the specific

location is suspected but not verified, a prehistoric and historic artifact scatter (24SA0291), and a Chinese railroad encampment (24SA0593).

Study Methods

Effects of reservoir level changes at the three locations will be observed to the extent possible and recorded. Observations will be documented on site monitoring forms based on Project Archaeology's Montana Site Stewardship Program Site Monitoring Form[10].

Schedule

Preparatory Work

In order to evaluate the potential resource effects of Project operations within the ILP timeframe, NorthWestern is planning to voluntarily conduct limited work prior to the FERC Study Plan Determination. These efforts include identifying the baseline condition to enable the comparison of before and after conditions, establishing reference points for observation, identifying sampling sites, and preparing maps.

First Study Season

The availability of flexible capacity at the Project is based upon the seasonal snowmelt runoff dominated hydrograph of the Clark Fork River. Flexible generation is available when the flows are below the Project's generation capacity of 23,000 cfs and above minimum flows of 6,000 cfs. All three phases of study will be scheduled in this flow window and during the recreation season so that potential recreation impacts can be evaluated, between July 1 and September 30. Each phase of the study will be implemented in coordination with the other seven proposed studies. A prescribed daily schedule for each phase has been developed based on randomly selected operations that dictate the sequence of plant operations and resulting estimated reservoir elevations. This prescribed schedule will be adjusted before each Phase to accommodate for actual Project inflows to assure the operations utilize the top 2.5 feet of the reservoir.

Second Study Season

None, as this study will be completed during the first study season.

Reporting Plan

NorthWestern will complete a Final Study Report which will include data summaries, assessments of observations, photo documentation, and conclusions from resource evaluations as part of the study. The Final Study Report will be filed on or before May 12, 2022.

[10] Project Archaeology, Montana Site Stewardship Program, 2020. https://projectarchaeology.org/about/montana-site-stewardship-program.

2.4 Resource Management Goals

Section 4(e) and 10(a) of the Federal Power Act require FERC to consider multiple public uses and give equal consideration to all uses of the water on which a project is located. When reviewing a proposed action, FERC will consider the environmental, recreational, fish and wildlife, and other non-developmental values of the Project, as well as power and developmental values. This study will provide information on the potential impacts of Project operations on shoreline stability, fisheries, recreation, aesthetics, public safety, water quality, wetland and riparian habitat, and cultural resources. This information will assist the Licensee in development of a License Application which balances both developmental and non-developmental aspects of the Project.

2.5 Existing Information and Need for Additional Information

2019 Operations Test

In October 2019, NorthWestern conducted an operations test to assess the potential impacts of operating the Project within the 4-foot range authorized by the License. During the test, the reservoir elevation was lowered from normal full operating level down 4 feet, then raised in 1-foot increments. The plant was increased to full generation output to lower the reservoir. Level loggers were deployed in multiple locations to record water elevation changes. A time-lapse camera was deployed at a key location to capture visual changes at the mouth of the Thompson River. Resource professionals visited different locations to photograph conditions and make visual observations during active drawdown and at each elevation level for the test. Observations were made on:

- Operations – quantification of the flexible capacity available with the reservoir volume
- Shoreline Erosion – bank stability and erosion
- Fisheries – fish stranding, migration corridors to tributaries, and fish passage facility operations
- Recreation – effects to recreation site amenities including boat launches, boat docks and aesthetic conditions
- Public Safety – navigation hazards in the reservoir, rate of water elevation changes
- Water Quality – changes in water chemistry and/or physical properties
- Wetland/Riparian Habitats – available habitat relative to water level changes, duration of dewatering

Results of 2019 Operations Test

Reservoir level fluctuations during the test were relatively consistent throughout the reservoir. The location at the upstream islands was the only exception where change in water level was reduced relative to downstream sites above the dam. During the test, reservoir levels observed at the dam and upstream to the Thompson River area were close to 4 feet, whereas the water level at the upstream islands was about 3 feet.

During refill of the reservoir, all the sites upstream of the dam showed a very similar rise during the 4-foot test and little difference in elevation was observed between the sites.

Below the dam, the difference observed between the two monitored locations was larger than upstream. During the drawdown portion of the test, the difference between the locations was approximately 1.5 feet. This is most likely due to the characteristics of the monitoring site, where the channel is confined from the rest of the river by a retaining wall. The channel volume in this location is much reduced compared to the entire Clark Fork River channel. The magnitude and rate of change at this location would be expected to be greater due to this difference. During reservoir refill, the difference in elevation between the two sites was minimal.

Water surface elevation rates of change during the test were evaluated both above and below the dam. The rate of change upstream of the dam was the greatest at the dam location and was attenuated upstream at Thompson River and the islands. Maximum observed elevation rates of change were similar throughout the test and ranged from 1.2 feet per hour (ft/hr) at the dam, 1 ft/hr at the Thompson River, and 0.85 ft/hr at the islands.

Rate of change below the dam was very quick at the start of the test but was significantly reduced after approximately 1 hour. This is most likely a function of filling the channel capacity with the increased discharge through the powerhouse during the test. Once the channel capacity and elevation reached an inflection point, the water spilled over and was conveyed down river. Differences in rates observed between the two monitoring locations were observed during the initial hour and then were very similar during the remainder of the test.

Baseload generation prior to the test was 49 MW. Maximum full head output of the plant is rated at 92.6 MW and decreases as the elevation of the reservoir drops. The differential between the maximum capacity and the baseload generation dictates the flexible generation capacity of the plant and the rate of reservoir elevation change. The test showed a total availability of 147 MW-hours of flexible capacity provided with the full 4 feet of reservoir elevation. Additionally, no operational issues were found with any of the units that would prevent future normal operations in this manner.

Resource Impacts Observed During 2019 Operations Test

Observations concerning fishery resources during the October 2019 operations test included observations of the fish passage facility, reservoir habitats, and tributary connections. Little influence was seen on operation of the fish passage facility when pool elevations were within 0.5 foot of normal full operating level. As forebay elevations decreased below 0.5 foot, the fish passage facility was still operating and functioning, but outside of flow design standards. As forebay elevation neared 2 feet below normal full operating level the fish passage facility sampling loop became inoperable, pool to pool flow lacked sufficient water for effective capture, and the High Velocity Jet flow diminished considerably.

A variety of reservoir fish species were stranded during the operations test when the reservoir was drafted 4 feet. These included Largemouth Bass, Smallmouth Bass, Northern Pike, Pumpkinseed, Yellow Perch, Redside Shiner, Northern Pikeminnow, Black Bullhead, Yellow Bullhead, and Largescale Sucker. Most fish were less than 3 inches in total length but a few Northern Pike up to 10 inches were observed.

Water quality impacts were categorized into two main categories: shoreline erosion and water chemistry. When the elevation of the reservoir was lowered 4 feet from normal full operating level, some erosion occurred in areas of exposed un-vegetated reservoir sediment deposits and shoreline areas that became unstable due to previous manual removal of native vegetation. This operational regime did not result in significant changes in water chemistry at the downstream end of the reservoir, however at a reservoir elevation of 4 feet below normal full operating level, there was a slight increase in turbidity, total suspended solids, and total phosphorous.

Observations of recreation, aesthetic and land use impacts found that elevations at 3 and 4 feet below normal full operating level may limit or prevent some uses of public and private recreation facilities (i.e., docks) and waterway access. In addition, there was an odor associated with the exposed mud flats and gravel bars when the reservoir was drafted 4 feet.

Observations of two areas of the reservoir shoreline that were impacted by a 2018 deep drawdown (to crest elevation, a drawdown of 18 feet) were made in order to quantify if the locations experienced movement in response to a 4 feet drawdown. Evidence of previous slope movement at the respective sites was noted. No slope movement in response to the 2019 operations test was observed.

Impacts to shoreline areas and recreation facilities were not uniform throughout the Project, since the north shoreline tends to be a steep bank with rocky substrate, while the south shoreline tends to be more gradual slopes of looser, more erodible soil. Observations of shorelines during this test revealed a few isolated areas of shoreline erosion where the majority of changes consisted of the movement of recent sediment deposits in the near-shore area.

The observations of shoreline and near-shore bed stability during this one-time rapid lowering of the reservoir were valuable, but most likely do not reflect actual long-term (attenuated) effects of flexible operations. It is anticipated that some of the erosion of near-shore sediment deposits and shorelines would, over time, resolve into stabilized shorelines with less impact during elevation changes.

Evaluation of 2019 Operations Test Results

Based on the results of the October 2019 test, NorthWestern concluded that drafting Thompson Falls Reservoir the full 4 feet as described by the current License on a regular and frequent basis would have an unacceptable level of impact to resources including recreation, shoreline residents, fisheries and the community. Consequently, NorthWestern is proposing that Thompson Falls

continue to provide baseload generation and flexible capacity needs using 2.5 feet of the reservoir. During normal operations, the reservoir would be maintained between 2396.5 feet and 2394.0 feet.

Existing information to frame the study method and additional data needs are described below for each resource area.

Shoreline Stability

A geological evaluation of Thompson Falls Reservoir states that the various soil units along the reservoir display various degrees of erosional stability (Montana Power Company, 1989). It also states that some erosion occurs due to seasonal high flows and normal water and wave action. Only a small amount of shoreline erosion is occurring, principally in fine-grained alluvial soils which are predominantly on the south shore and on the islands upstream of the mouth of the Thompson River. Where erosion does occur, it can result in steep and sometimes undercut banks, generally less than 10 feet tall. The report states that erosion to date (as of 1989) has not caused significant changes to the reservoir shoreline or islands. Comparison of maps and aerial photos from 1964, 1980, 1988, and 1989 indicates only minor changes. The report also states that no shoreline erosion problems have been reported by landowners adjacent to the reservoir. In addition, the report states that not all erosion has been caused by reservoir/river processes, and that some erosion has been caused by snowmelt and high precipitation events which saturate the soils and result in caving of the steep banks. The report also states the greatest erosion potential is during periods of high velocity flows which occur in the spring and early summer when reservoir levels typically do not fluctuate.

NorthWestern recently collaborated with Green Mountain Conservation District on a shoreline stabilization pilot study, "Thompson Falls Reservoir Bank Stabilization Pilot Project" (Northwestern 2020), the results of which inform the Operations Study. The pilot study tested a bioengineering approach on the Thompson Falls Reservoir. The key components of this approach were to: 1) reshape parts of the shoreline to a less steep and less erosive slope; 2) incorporate woody debris at the toe of the slope to protect against erosion from flowing water, wave action, etc.; and 3) establish native vegetation from cuttings, bareroot, and containerized plantings. Results from the pilot study may be incorporated into the design recommendations during the permitting of any future similar projects around Thompson Falls Reservoir. The shoreline stabilization project for this pilot study was completed in the fall of 2019 on an eroding shoreline on the south shore a short distance downstream of Cherry Creek, and monitoring is currently in progress. This shoreline stabilization project is also within one of the shoreline stability reference points described in Section 2.3 – Study Description. Information from the pilot study in the form of a color brochure is currently available at: https://www.northwesternenergy.com/environment/thompson-falls-project/thompson-falls-other-reference-material. Additional evaluation of shoreline erosion will occur at the pilot study location as part of the Operations Study's shoreline erosion monitoring. Success and viability of the vegetation (plantings and cuttings) will be evaluated in 2021 after plants have had time to take root and grow for at least one growing season.

Wetland/Riparian Habitats

Existing mapping and survey information is available from the Montana State Library as part of the Montana Spatial Data Infrastructure (2020) to provide the initial stratification and risk assessment of the Project's wetland and riparian resources. More information is needed to determine if the operational scenarios being studied will have an effect on these areas, and the Operations Study intends to answer that question.

Cultural

Cultural observations were not included during the October 2019 operations test.

2.6 Nexus Between Project Operation and Effects

NorthWestern utilizes numerous operation modes to manage water at the Project. These include spilling at either the main or dry channel dams, increasing generation, decreasing generation, or holding generation steady. Different combinations of these operations amount to changes in water use through the Project resulting in conveyance of variable volumes of water downstream. If the total volume of water leaving the Project is different than the volume of inflow to the Project, the reservoir elevation will either increase or decrease in response.

Providing both baseload generation and flexible capacity with reservoir storage is essential and core to the value of the Project for NorthWestern customers and its obligations as a Transmission Balancing Authority, and it will continue to be in the future. An increasing need for flexible generation on the NorthWestern electric system is being driven primarily by the addition of new renewable and intermittent energy sources to the system.

2.7 Study Methodology Consistency with Generally Accepted Practice

Operations

The methodology proposed for plant operations was developed to closely simulate the unpredictable provision of flexible capacity from the Project. The transmission grid is very dynamic with constantly changing generation and load which requires flexible capacity needs. While no published methodology exists to test flexible capacity operations, the proposed methodology for this study will replicate the random nature of actual operations.

Shoreline Stability

The methodology proposed is common to other study plans for shoreline erosion that have been approved by FERC, such as the "Proposed Study Plan - Boundary Hydroelectric Project (FERC No. 2122)" by Seattle City Light, the "Shoreline & Bypass Reach Erosion Control Study Plan – Lake Chelan Hydroelectric Project – FERC Project No. 637" by Chelan Public Utility District and "Reservoir Shoreline Erosion Study Plan – Toledo Bend Relicensing Project – FERC Project No. 2305" by Sabine River Authority.

Fisheries

The methodology for study is consistent with other research for systematically evaluating stranding of fish, water level fluctuations at key migration points, and observations of fish passage facility functionality (Dauwalter et al. 2012, Bell et al. 2008, Saltveit et al. 2001).

Recreation and Aesthetics

Assessment of the changes in access to public recreation facilities during the Operations Study will most accurately be completed using a set of measurable parameters (water depth, amount of exposed sediment, slope of dock gangways, etc.) rather than prediction models that characterize acceptability. Since the composition and profile of the shoreline varies throughout the reservoir, documenting impacts to a sample of public and private facilities throughout the Project during the Operations Study will reveal the worst-case impacts as a result of elevation fluctuations. Measuring the depth of the water at boat ramps, for instance, will reveal their functionality under the operational scenarios' parameters, and monitoring the change in slope of dock gangways will determine at what elevation public and private docks will remain usable at the lowest proposed reservoir elevation.

Aesthetics, on the other hand, is far more qualitative and subjective since aesthetic characteristics are tied to human senses. While Visual Quality Objectives adopted by the USFS are commonly utilized to describe and document aesthetic qualities (Southern California Edison 2007), the Thompson Falls Project is located adjacent to the city of Thompson Falls, Montana Highway 200, a major railroad, and residential development. Therefore, descriptions of the changes to aesthetic qualities (sight, sound, and smell primarily) from the status quo during the Operations Study will be descriptive in nature regarding any perceived impacts to aesthetics by Project operations.

Public Safety

The size of this Project makes it possible to identify areas where in-water reservoir hazards may become more problematic under changing conditions. Based on the characteristics and size of the waterway, documenting these areas during the Operations Study is a cost-effective assessment of public safety since the assessment will describe conditions that are improved and conditions that are worsened under different water elevations. Similarly, documenting how flows and elevations change at areas downstream of the powerhouse will provide a model of predictable conditions during Project operations and evaluation of potential impacts to public safety.

Water Quality

The sampling methodology for this assessment conforms to the most current standard operating procedures used by the DEQ (Makarowski, 2019).

Wetland/Riparian Habitats

The methodology for this assessment conforms to generally accepted evaluations of wetland and riparian habitats. Site specific methods will be determined based on the physical characteristics at each wetland study site. A combination of piezometers and temperature/level monitors may be used to measure the connectivity and relationship of these riparian wetlands, shallow groundwater, and surface water (Anibas et. al 2011).

Cultural

The identification of previously identified cultural sites during opportunistic Project conditions is standard practice at hydropower reservoirs throughout the country[11]. The proposed methods for Thompson Falls follow the standard practice and are appropriate given the small number of known sites at or near the reservoir edge.

Level of Effort and Cost

The approximate cost to implement the Operations Study is $148,300

[11] *See* for example: Corcoran, Maureen K., Lawson M. Smith, and Paul R. Nickens, Columbia River System Operation Review, Final Environmental Impact Statement, Appendix D Exhibits, Exhibit A, Development of Geomorphology Based Framework for Cultural Resources Management, Dworshak Reservoir, Idaho, 1995. Bonneville Power Administration and U.S. Army Corps of Engineers.

3. Proposed Study 2 Total Dissolved Gas

NorthWestern is proposing a study to collect TDG data at the Project. These data will help characterize the current TDG contributions of the Project under different discharge scenarios.

3.1 Goals and Objectives of Study

The goal of this study is to gather data on TDG concentrations upstream and downstream of the Project throughout the spring runoff season to gain a better understanding of TDG concentrations in various discharge scenarios. The main objective is to collect additional information on whether and how the Project's new radial gates affect TDG concentrations downstream of the dams and powerhouses.

3.2 Changes from PSP

No changes were requested from Relicensing Participants on this study. No changes were made to this study plan.

3.3 Study Description

Background

The prior Licensee developed a TDG Control Plan in 2010 in consultation with the DEQ. The TDG Control Plan outlines operational practices used during the spring runoff period to minimize TDG concentrations in the Clark Fork River downstream of the Thompson Falls Project. The TDG Plan has been implemented annually.

In late 2018, construction was completed on two new radial spill gates, resulting in a total of four radial gates on the Main Channel Dam. These new radial gates are a change from the spill panels that were previously in use, so the effect on TDG from these radial gates is not yet fully understood. Data collection occurred in 2019 and 2020, and additional data will result in a further understanding of TDG concentrations at a wider range of discharge levels.

Study Area

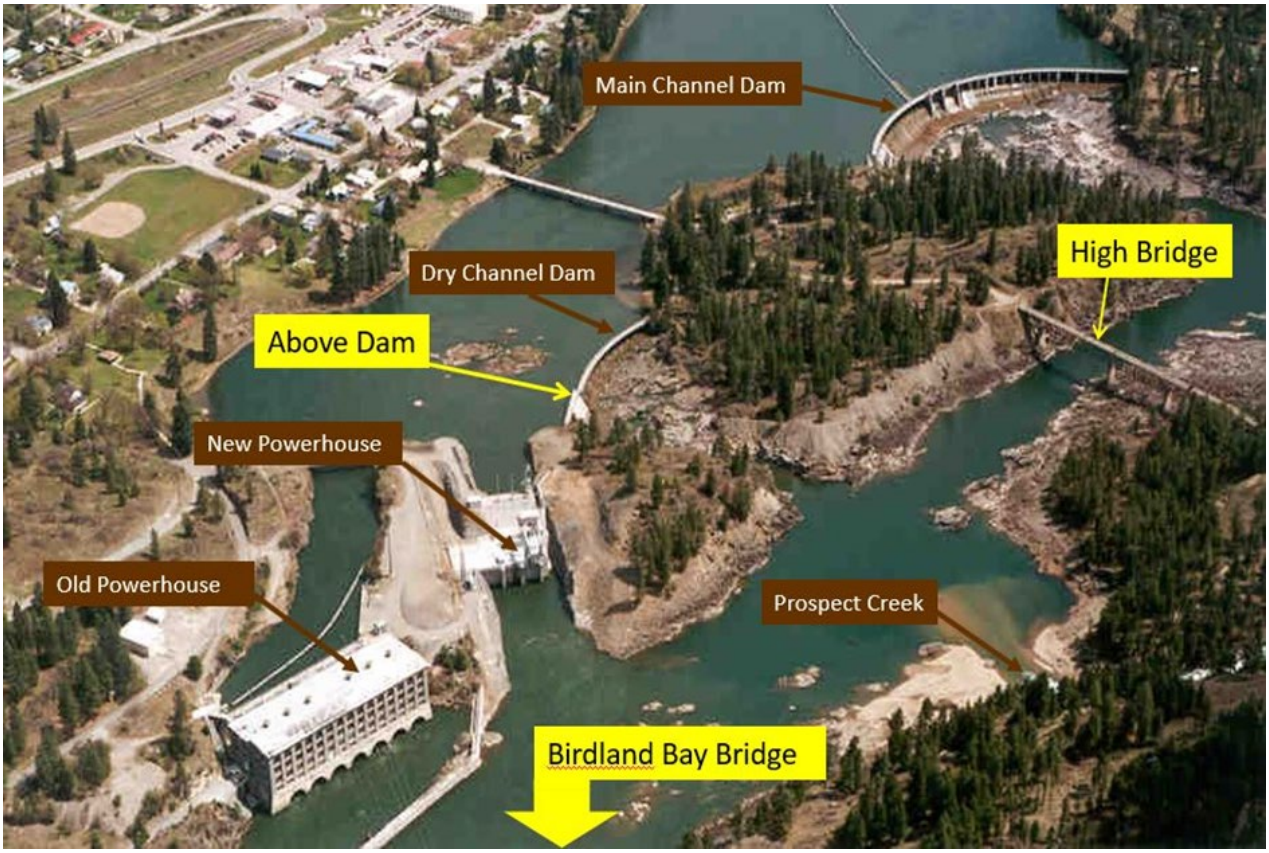
Hach Hydrolab instruments will be deployed at three locations to capture TDG concentrations above the dam, below the Main Channel Dam at the High Bridge, and downstream of the Project at Birdland Bay Bridge. **Table 3-1** provides the locations of each of these monitoring sites.

Table 3-1: Descriptions and latitude and longitude of TDG monitoring sites.

Site Description	Latitude	Longitude
Above Dam – Upstream face of the Dry Channel Dam	47.593131	-115.356904
High Bridge – Downstream of the Main Channel Dam	47.590720	-115.354920
Birdland Bay Bridge – Clark Fork River downstream of Project at Birdland Bay Bridge	47.621436	-115.391592

The monitoring locations were chosen to represent the TDG concentrations of incoming water upstream of the Project, TDG concentrations of the spill water downstream of the Main Channel Dam, and TDG concentrations leaving the Project which captures a mixture of water from the powerhouse discharge and the spillway discharge.

Figure 3-1. Total Dissolved Gas sampling locations.



Methods

The TDG study will consist of monitoring TDG concentrations during spring runoff season at multiple locations around the Project's facilities under different discharge scenarios. This study will use methods currently being used for TDG evaluation at the Project.

TDG data will be collected throughout the spring runoff season to capture the variability of TDG entrainment in relation to flow rate in the Clark Fork River. During this time, operators of the

Thompson Falls Project will test various configurations of spill through the Main Channel Dam using different combinations of the four radial gates. Each gate spill configuration will be held for approximately 4 hours to allow the downstream TDG levels to stabilize. This methodology is consistent with testing conducted in 2019 and 2020 and will be used to supplement the existing dataset. NorthWestern will analyze the data in developing the Final License Application.

Schedule

Preparatory Work

Hach Hydrolab instruments will be deployed at the start of runoff season as spill at the Project commences. The deployment schedule depends on weather and flow conditions but generally starts in the late April time period which is prior to the FERC Study Plan Determination.

First Study Season

TDG concentrations are highest during the spring runoff season, so data collection will occur during the spring runoff period, which usually occurs from early May through late June of each year.

Second Study Season

This study will be conducted during both study seasons, which will allow NorthWestern to capture data during a greater variety of discharge conditions.

Reporting Plan

The Initial Study Report will be filed on or before May 12, 2022 and will include the results of data collection during the 2021 season. The Final Study Report, including the 2021 and 2022 data, will be filed on or before May 12, 2023.

3.4 Resource Management Goals

Montana's Surface Water Quality Standards and Procedures includes language specific to dams. Administrative Rules of Montana (ARM) 17.30.602 defines "naturally occurring" as "conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from the reasonable operation of dams in existence as of July 1, 1971, are natural." ARM 17.30.636 (1) states that owners and operators of water impoundments that cause conditions harmful to prescribed beneficial uses of state water shall demonstrate to the satisfaction of the department that continued operations will be done in the best practicable manner to minimize harmful effects.

Water quality standards developed by the DEQ (Circular DEQ-7) (DEQ, 2019) sets a standard of 110 percent of saturation for TDG. This water quality standard was developed to protect fish from

high levels of TDG, which may cause gas bubble trauma (GBT). GBT can cause injury and, in severe cases, death to fish.

3.5 Existing Information and Need for Additional Information

NorthWestern and the prior Licensee frequently monitored TDG in the Clark Fork River during the 2003 to 2020 time period. These data have helped to inform NorthWestern on the optimal operations scenario to minimize TDG concentrations. Two years of data have been collected when the new radial gates were operating, which were installed in the fall of 2018 Additional data is needed at higher discharges above 80,000 cfs where TDG concentrations are typically at their highest. This study will help to fill data gaps that are missing in recent TDG data.

3.6 Nexus Between Project Operation and Effects

There is a nexus to Project operations and downstream water quality. Water that is either discharged through the powerhouse or through the spillway will have varying concentrations of TDG, and this study will help provide information on the downstream concentrations of TDG during spring runoff events.

3.7 Study Methodology Consistency with Generally Accepted Practice

This study maintains consistency with the prior TDG monitoring efforts at the Thompson Falls Project in that it uses the same monitoring locations and methodologies that have been used under the current TDG Control Plan. The TDG Control Plan was developed in consultation with DEQ and uses methodologies that are commonly accepted as standard monitoring procedures. By using the same monitoring locations and methodologies, NorthWestern will be able to compare data collected from this study with historical data.

3.8 Level of Effort and Cost

The approximate cost to implement proposed Study #2 – Total Dissolved Gas Monitoring is $50,600.

4. Proposed Study 3 Water Quality

NorthWestern is proposing a water quality study to collect data on waters directly affected by the Project and allow analysis of any Project-related effects on water quality.

4.1 Goals and Objectives of Study

The goal of this study is to gather data needed to evaluate the influence the Project has on water quality. Objectives of this study are to quantify Project-induced water quality changes, if any, and determine the source of those changes.

4.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below. These same changes were noted in Section 1.5 and are repeated here for convenience:

- Included updated DEQ (Makarowski, 2019) standard methods in response to a comment from DEQ.
- Added an additional study site, upstream of Thompson Falls Reservoir, at the suggestion of DEQ and FERC.
- Included a detailed Water Quality Study Plan (Appendix B) which was approved by DEQ
- Added new information, not previously available, regarding sediment quality in Thompson Falls Reservoir

4.3 Study Description

The study will characterize the current water quality of the Project. This will facilitate the identification of water quality trends and provide useful information as to the effects that Project operations may have on water quality.

Background

In 2019 and 2020, NorthWestern Energy conducted water quality monitoring at multiple locations across the Project. This initial data collection effort was intended to refine a list of monitoring locations and parameters to be collected at each location to best inform study design. Data collected in 2019 and 2020 will supplement the data collected in this study to help provide an assessment of the water quality at the Project over a range of seasons and flows.

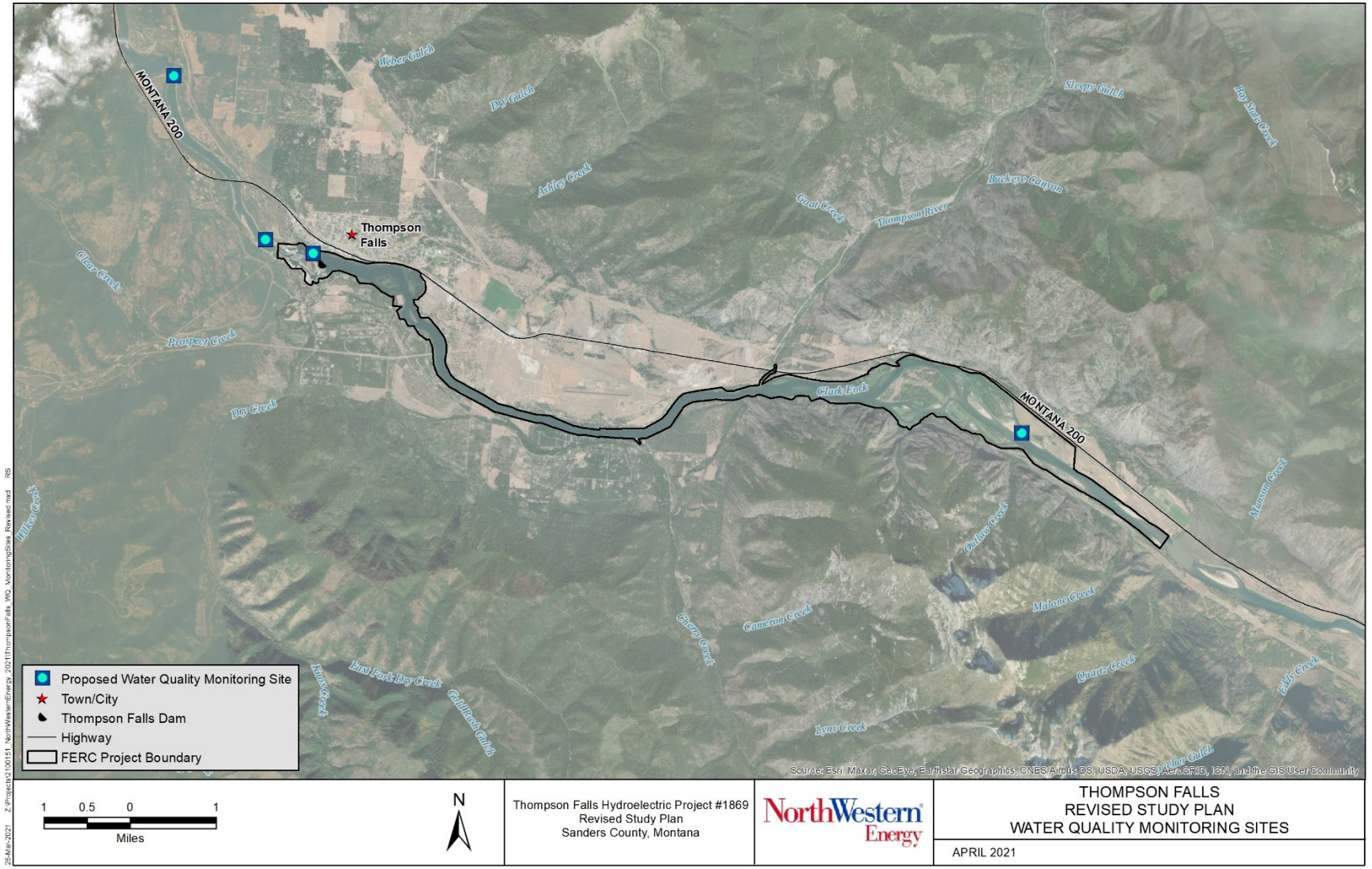
Study Area

Sampling will consist of multiple monitoring sites around the Project to characterize the incoming water quality from the Clark Fork River and the outgoing water quality downstream of Thompson Falls Dam to Birdland Bay Bridge. Four monitoring sites, identified in **Table 4-1** and on **Figure 4-1**, have been strategically chosen to capture the above-mentioned objectives. This study has been revised from the PSP to include an additional monitoring site on the Clark Fork River, upstream of Thompson Falls Reservoir.

Table 4-1: Descriptions and latitude and longitude of water quality monitoring sites.

Site Description	Sample Collection Method	Latitude	Longitude
Clark Fork River upstream of Thompson Falls Reservoir	Single point grab sample	47.569187	-115.167518
Clark Fork River upstream of powerhouse in Thompson Falls Reservoir	Equal width increment depth integrated composite sample	47.593502	-115.353699
Clark Fork River downstream of powerhouse	Single point grab sample	47.594303	-115.362777
Clark Fork River downstream of Project at Birdland Bay Bridge	Equal width increment depth integrated composite sample	47.621436	-115.391592

Figure 4-1. Water quality sampling locations.



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Study Methods

Sites will be sampled quarterly to understand the seasonality of water quality in the Project. Parameter groups to be analyzed include nutrients, metals, inorganics, and physical properties. Field parameters collected in-situ will also be measured as part of this sampling effort. Appendix B contains further details on the water quality parameters to be monitored, as well as laboratory methods and reporting limits for each parameter.

The water quality sampling will consist of collecting either single point depth integrated samples (at the Clark Fork River downstream of the powerhouse), or depth integrated equal width increment composites (at the other two monitoring locations). Grab samples will be collected from the bank in a well-mixed portion of the river, or from a bridge at equal width increments and composites. Sample bottles will be rinsed three times with native water (or filtered native water) prior to sampling. Samples will be taken in the upstream direction to avoid entrainment of sediment disturbed by wading. During sampling, the sampling device will be drawn through the water column once, carefully avoiding any disturbance of bottom sediments.

Samples will be transferred to a decontaminated Teflon churn splitter and sealed in a secure container until processing. Processing and splitting of sample aliquots into sample bottles will occur at the end of each day in a clean location. Filtration with a 0.45 micrometer filter for dissolved parameters will be done as a batch process within 8 hours of sampling. All sample bottles will be virgin polyethylene bottles. Samples will be clearly labeled with a waterproof marker or preprinted labels. Label information will include the site identification, date and time, sample type, preservative, and sampler's initials. Field notes will be collected at each location and completion of appropriate chain-of-custody forms. All samples will be immediately placed in a cooler chilled to 4 degrees Celsius (°C) for transport to the lab.

Quality control samples will also be analyzed for water quality parameters. These samples consist of one replicate sample and one equipment blank for each sampling event. The replicate is a sequential sample taken at one of the locations as a control measure of both field variability, sample processing procedures, and laboratory methodology. The equipment blank is a deionized water sample run through the sampling apparatus after standard decontamination procedures and analyzed for the full suite of water quality parameters. The blank primarily represents a quality control measure of lab methodology, but also integrates procedural aspects such as decontamination and sample handling.

Field parameters will be collected at each sampling site using a laboratory calibrated Hydrolab HL7 instrument. After 1 minute of stabilization, five measurements will be collected at 10-second intervals. The mean of these five measurements will be used as the value for that site. This file is saved electronically, as well as recorded in the field notebook.

Schedule

Preparatory Work

All monitoring sites were sampled in March 2021 to contribute to the baseline data.

First Study Season

All monitoring sites will be sampled once per quarter after the FERC Study Plan Determination is issued (June, September, December) in 2021, and each monitoring event will consist of collecting a sample and measuring field parameters at each site.

Second Study Season

All monitoring sites will be sampled once per quarter in 2022 (March, June, September, December), and each monitoring event will consist of collecting a sample and measuring field parameters at each site.

Reporting Plan

An Initial Study Report will be filed by no later than May 12, 2022 and will include the 2021 sampling data. The Final Study Report, including the 2021 and 2022 data, will be filed no later than May 12, 2023.

4.4 Resource Management Goals

Montana's Surface Water Quality Standards and Procedures includes language specific to dams. ARM 17.30.602 defines "naturally occurring" as "conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from the reasonable operation of dams in existence as of July 1, 1971, are natural." ARM 17.30.636 (1) states that, "owners and operators of water impoundments that cause conditions harmful to prescribed beneficial uses of state water shall demonstrate to the satisfaction of the DEQ that continued operations will be done in the best practicable manner to minimize harmful effects."

The Clark Fork River at the Thompson Falls Project is classified as B-1 in ARM 17.30.607, implemented by the DEQ. Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

4.5 Existing Information and Need for Additional Information

Water quality data currently exists for the Thompson Falls Project at these sites from 2019 and 2020. This study will provide additional data to the existing water quality dataset to capture a broader range of environmental conditions and account for variability from year to year.

Sediment sampling of Thompson Falls Reservoir was conducted in July 2020. These data have not been previously reported. NorthWestern Energy staff sampled four sediment bars in the lower portion of Thompson Falls Reservoir on July 13, 2020 using a core sampler. The reservoir was drafted 12-inches that day to assist in accessing the sediment deposits *via* boat. An attempt was made to sample maximum possible depth of sediment at each location. Sediment sample depths were generally limited by substrate hardness and composition. Each sediment bar was sampled at three locations and those three samples were composited into one representative sample for each sediment bar, which were analyzed by Energy Laboratories and Pace Analytical for metals, polychlorinated biphenyl (PCBs), and dioxins.

The location details and characteristics for each core sample, including the depth of the sample and the depth of water above the substrate at the sample location is found in **Table 4-2**. This information is useful in determining the reservoir elevation when that substrate becomes exposed.

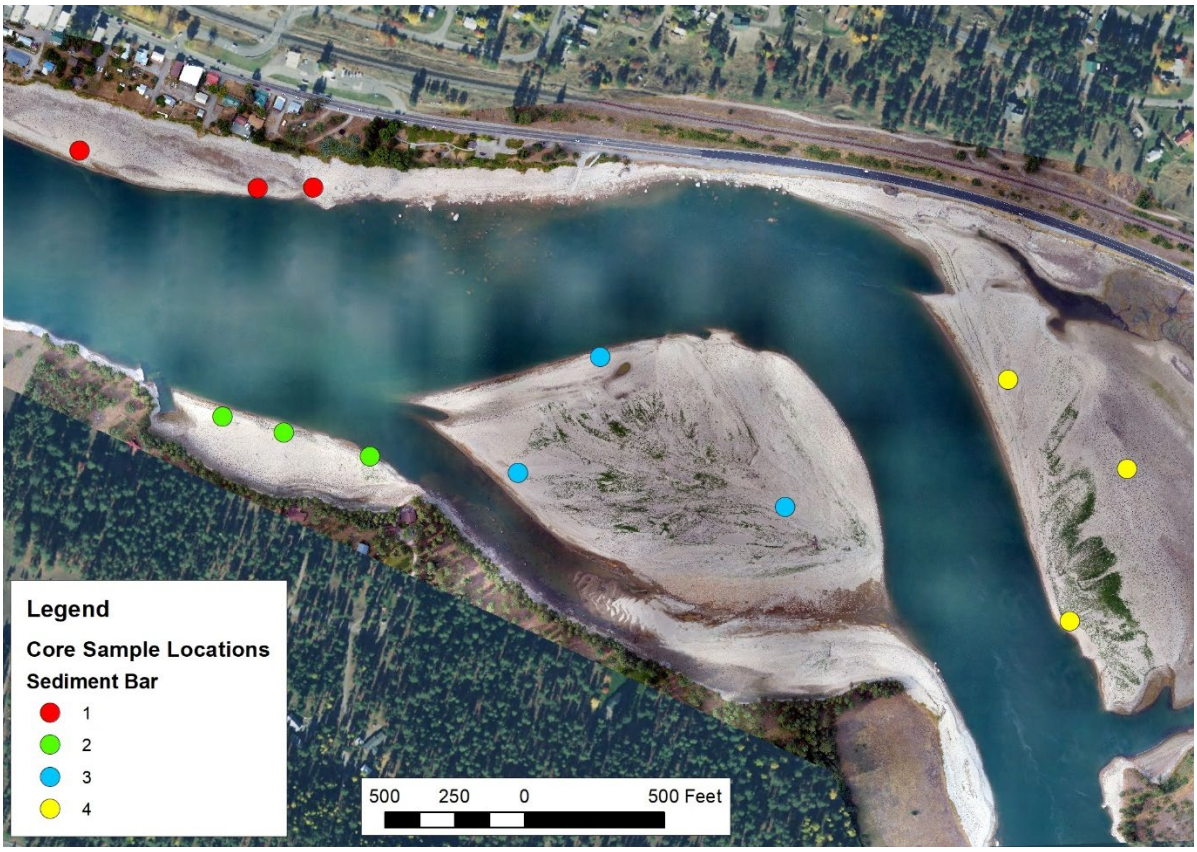
Table 4-2: Thompson Falls Reservoir sediment core sample characteristics, July 13, 2020.

Thompson Falls Sediment Core Sample Characteristics

Sediment Bar	Sample Number	Sample Depth (ft)	Water Depth (ft) After 12" Reservoir Draft	Latitude	Longitude
1	1	2.5	1.5	47.59211	-115.34028
1	2	2.5	1.5	47.59206	-115.34108
1	3	2.5	0.8	47.5923	-115.3437
2	1	1	1	47.5898	-115.34135
2	2	1	1.1	47.58969	-115.34044
2	3	1.5	0	47.58952	-115.33917
3	1	2	1	47.58947	-115.33701
3	2	1.3	0.5	47.59066	-115.33594
3	3	1	1.8	47.58933	-115.3331
4	1	2	1	47.59074	-115.33001
4	2	3	0	47.58842	-115.32886
4	3	1.5	1.4	47.58995	-115.32819

A map showing the locations of each core sample is found in **Figure 4-2**. The aerial imagery in **Figure 4-2** is from 2019 when the reservoir elevation was down to replace the stanchions on the dam and is not representative of the day that these samples were collected. This imagery was selected to show the extent of the sediment deposits in the lower reservoir, below Steamboat Island. At full pool, the locations of these sample sites are underwater.

Figure 4-2. Sediment core sampling locations.



Analytical results from the sediment core samples can be found in **Tables 4-3 through 4-5**. **Table 4-3** shows the results of the Toxicity Characteristic Leaching Procedure (TCLP) metals analysis for each composite sample. TCLP is an analysis used to determine the potential for the leaching of a toxic substance from soil particles and is useful in understanding the toxic risk associated with a particular sediment sample. All sample results reported were below detectable levels for TCLP metals.

Table 4-3: TCLP metals analysis results from Thompson Falls Reservoir sediment cores collected on July 13, 2020.

	Metals TCLP Extractable (mg/L)[1]							
Sediment Bar Sample	Mercury	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver
Bar 1	ND	ND	ND	ND	ND	ND	ND	ND
Bar 2	ND	ND	ND	ND	ND	ND	ND	ND
Bar 3	ND	ND	ND	ND	ND	ND	ND	ND
Bar 4	ND	ND	ND	ND	ND	ND	ND	ND

[1]ND indicates that the sample result was not found at a detectable concentration

Table 4-4 shows the results from the Polychlorinated Biphenyl (PCB) analysis conducted on each composite sediment sample. All samples were reported to be at non-detectable levels for PCBs.

Table 4-4: PCB analysis results from Thompson Falls Reservoir sediment cores collected on July 13, 2020

	Polychlorinated Biphenyls (PCBs) (mg/kg-Dry)[1]								
Sediment Bar Sample	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	Arochlor 1262	Arochlor 1268
Bar 1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bar 2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bar 3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bar 4	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]ND indicates that the sample result was not found at a detectable concentration

Each sample was also analyzed for dioxins, which are a group of toxic compounds that are generally found to originate from industrial activities. The two dioxin compounds of concern are 1,2,3,7,8,9-Hexachlorodibenzo-P-dioxin (1,2,3,7,8,9-HxCDD) and 2,3,7,8-Tetrachlorodibenzo-P-dioxin (2,3,7,8-TCDD), with 2,3,7,8-TCDD being the most toxic compound. Sample analysis results for both 1,2,3,7,8,9-HxCDD and 2,3,7,8-TCDD were at non-detectable levels (**Table 4-5**) for all samples.

Since 2,3,7,8-TCDD is the most toxic dioxin compound, all other remaining dioxins are grouped together and a total equivalence (TEQ) to 2,3,7,8-TCDD is calculated. For example, if a particular dioxin compound is 10 percent as toxic as 2,3,7,8-TCDD, then the measured concentration of that compound in nanogram per kilogram (ng/kg) is weighted by a factor of 0.1 and that number is added to the calculated toxic equivalencies of the other remaining dioxin compounds to calculate the overall TEQ for the sample.

The TEQ is used as a way to look at all of the combined toxicity of the remaining dioxin compounds, since all have varying levels of toxicity. The TEQ calculations for each composite sample were calculated by Pace Analytical, and the results can be found in **Table 4-5**. TEQ results for each composite sediment sample were well below the TEQ screening level of 22 ng/kg.

Table 4-5: Dioxin analysis results from Thompson Falls Reservoir sediment cores collected on July 13, 2020

	Dioxin Screening (ng/kg)		
Sediment Bar Sample	1,2,3,7,8,9-HxCDD	2,3,7,8-TCDD	TEQ[2]
Screening Level	*470*	*22*	*22*
Bar 1	ND	ND	0.52
Bar 2	ND	ND	0.59
Bar 3	ND	ND	0.51
Bar 4	ND	ND	0.57

[1]ND indicates that the sample result was not found at a detectable concentration

[2]TEQ (Total 2,3,7,8-TCDD Equivalence) calculated by Pace Analytical

Based on the analytical results of the sediment core samples collected from the lower portion of Thompson Falls Reservoir in July 2020, there does not appear to be any indication of toxicity related to the sediment collected at these sites. The sampling locations and core depths were representative of sediment deposits in the lower reservoir that might either be exposed and/or mobilized during proposed normal reservoir operations.

4.6 Nexus Between Project Operation and Effects

Proposed Project operations and routine operation and maintenance may affect water quality in the Project reservoir and downstream of the dams and powerhouses.

4.7 Study Methodology Consistency with Generally Accepted Practice

The sampling methodology for this study conforms to current standard operating procedures used by the DEQ (Makarowski, 2019). Proposed sampling methods are consistent with sampling conducted in 2019 and 2020 at the Project and are similar to water quality monitoring conducted and approved by DEQ at other NorthWestern hydropower projects.

Data quality assurance and quality control will be accomplished under this plan using methods described in the standard operating procedures used by the DEQ (Makarowski, 2019).

4.8 Level of Effort and Cost

The approximate cost to implement proposed Study #3 – Water Quality is $62,800.

5. Proposed Study 4 Hydraulic Conditions

NorthWestern is proposing to model hydraulic conditions downstream of the Main Channel Dam (site of the fish passage facility) to assess whether there are seasonal or site-specific velocity barriers to the utilization of the fish passage facility for upstream fish passage impacted by Project operation.

5.1 Goals and Objectives of Study

The goal of the proposed hydraulic modeling study is to assess the velocity field downstream of the fish passage facility to understand if the flow field created by discharge from the fish passage facility provides a sufficient behavioral cue (attraction flow) to Bull Trout and other species, and whether velocities are low enough as to not fatigue fish attempting to approach the fish passage facility entrance. The hydraulic model will provide velocity fields that can be used as indirect indicators of effectiveness of the fish passage facility. The modeling will include features such as below the Main Channel Dam and the natural falls area.

The study will involve comparing the swimming capabilities of Bull Trout and other species with the estimated velocity fields at or near the fish passage facility entrance to determine effectiveness. These data will be evaluated along with the data from the Fish Behavior Study (Study #5), to assess upstream fish passage effectiveness at the Project.

5.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below. These same changes were noted in Section 1.5 above, but are repeated here for convenience:

- Clarified the study area in response to a comment from the USFS
- Extended the study schedule and reporting plan to allow for a longer comment period and stakeholder input on the Phase 1 modeling, in response to a comment from the USFS.

5.3 Study Description

Background

Bull Trout (*Salvelinus confluentus*) were federally listed as a threatened species under the Endangered Species Act (ESA) in 1998. The prior Licensee-prepared 2003 Biological Evaluation concluded that the Project was likely adversely affecting Bull Trout. On November 4, 2008, the U.S. Fish and Wildlife Service (FWS) filed a Biological Opinion (BO) (FWS 2008) with FERC, concluding that continuing operations of the Project is likely to result in incidental 'take' of the Bull Trout in the form of harm and harassment, including mortality. The FWS further concluded

that the level of anticipated incidental 'take' is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. The BO included 'reasonable and prudent measures' which were deemed appropriate to minimize 'take', as well as terms and conditions for implementation of the reasonable and prudent measures.

The terms and conditions in the BO (FWS 2008) included a requirement for the Licensee to conduct Phase 2 fish passage evaluation studies. At the end of the Phase 2 evaluation period, the Licensee was required to prepare a comprehensive report for filing with FERC. The Comprehensive Phase 2 Fish Passage Report was prepared with guidance from the Thompson Falls Technical Advisory Committee (TAC)[12] and filed with FERC on December 20, 2019.

The BO (FWS 2008) also required that the Licensee conduct a scientific review to determine if the Thompson Falls fish passage facility is functioning as intended, and whether operational or structural modifications are needed. The scientific review convened in January 2020, with the formation of the Thompson Falls Scientific Review Panel (Scientific Panel). On March 27, 2020, the Scientific Panel issued a memo (Scientific Panel 2020) summarizing its evaluation of the fish passage facility and provided recommendations on how to better evaluate the facility in the future. The Scientific Panel suggested NorthWestern initiate two parallel studies to assist in the determination of the fish passage facility's attraction and entrance efficiency:

- Two-dimensional (2D) hydraulics study that incorporates measured or approximated bathymetry to determine, at a minimum, a depth-averaged velocity field and water depths in the near field downstream of the dam/Project.
- Telemetry (radio-tag) study using sufficient sample sizes of surrogates to posit movement paths/rates and behavior in response to hydraulic conditions in the near field (areas immediately downstream of the Main Channel Dam, to approximately the High Bridge); the telemetry should be augmented by a literature review of the relative swimming capacities and behaviors of Rainbow, Westslope Cutthroat, Brown and Bull trout.

This study plan defines the proposed hydraulics study recommended by the Scientific Panel. The proposed radio telemetry study is described in Section 6 – Study #5 – Fish Behavior.

Study Area

The study area includes the channel downstream of the Main Channel Dam to the High Bridge (*see* **Figure 6-1**).

[12] The TAC includes, among others, the Licensee, FWS, FWP, Avista, DEQ, USFS, and the Confederated Salish and Kootenai Tribes.

Study Methods

Task 1 – Bathymetric Surveying

The initial task for developing an understanding of the hydraulic conditions downstream of the fish passage facility includes performing a bathymetric survey of the study area to combine with publicly available Light Detecting and Ranging (LiDAR) data to develop a digital elevation model (DEM) of the Main Channel Dam, downstream river channel and surrounding terrain.

Task 1 will be accomplished by establishing ground control points and conducting the bathymetric survey with a single beam echo-sounder that is configured with a Real-Time Kinematic Global Positioning System (RTK-GPS). This will provide data in XYZ format of riverbed elevations at accuracies limited by the equipment (e.g., 1-centimeter accuracy of echo-sounder and 3-centimeter accuracy of RTK-GPS). To efficiently capture a complete bathymetric coverage of the riverbed, the RTK-GPS equipped echo-sounder will be attached to a motorized boat that will circle the river channel at approximately 25-foot spacings at survey speed (i.e., 2-4 kilometers per hour). To ensure an accurate bathymetric survey, the echo-sounder data will be compared against multiple RTK-GPS depths taken from the traditional rod method. The final subtask will be combining the land and bathymetric surveys into a single DEM. This will be accomplished by merging the datasets into a single-point cloud, and creating a surface using a Triangular Irregular Networks (TIN) and breaklines (spillway structure, water surface elevations, etc.). This TIN will then be converted into raster format (also known as geoTIFF) and 1-foot contours for use in this study.

Task 2 – Hydraulic Modeling

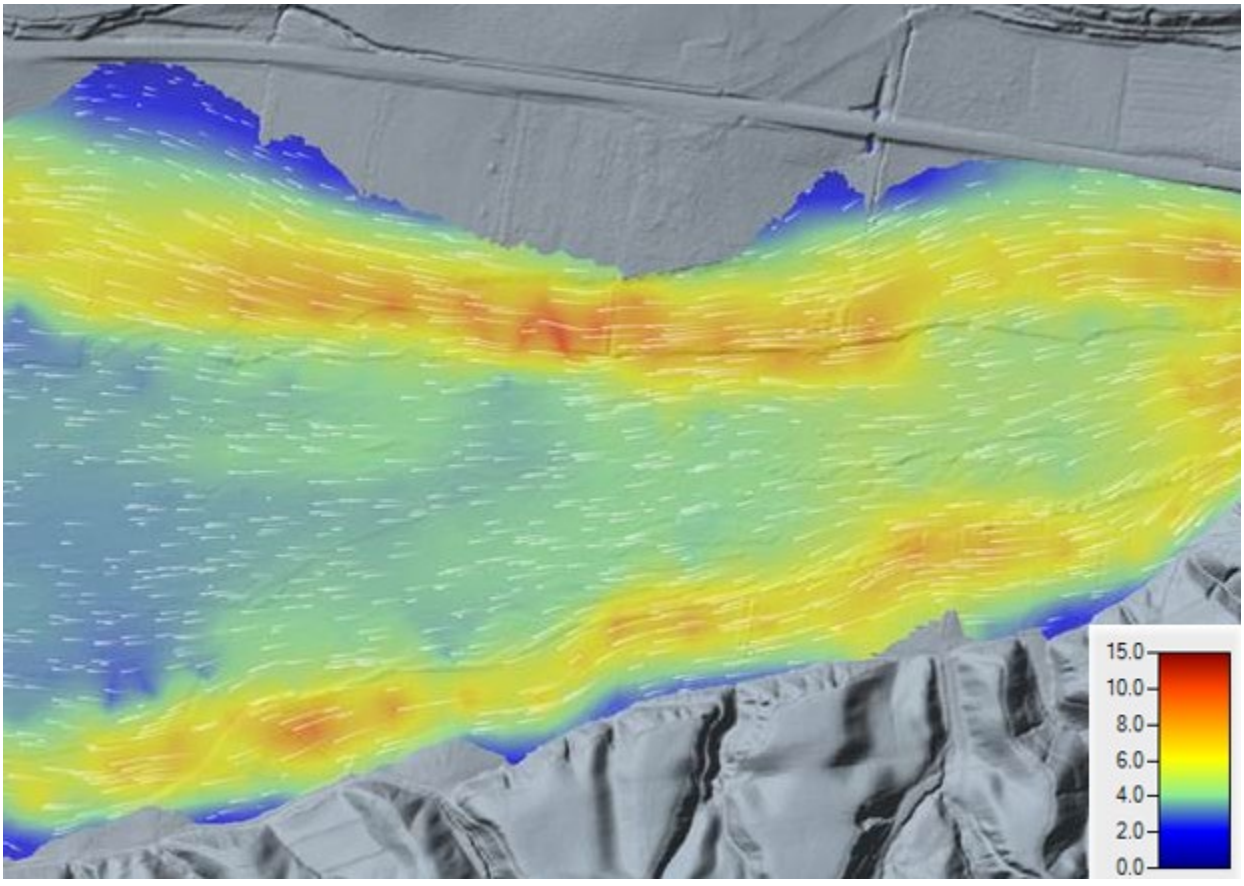
A computational fluid dynamics (CFD) model will be developed of the existing Thompson Falls Main Channel Dam and river downstream of the dam using Flow-3D software. Flow-3D can perform both Shallow Water methods (a sophisticated 2D modeling method) and highly resolved three-dimensional (3D) modeling of the river flow, using 3D topography, bathymetry, structures geometry and the surrounding terrain. Flow-3D can simulate fully 3D and transient flow to examine important parameters like velocity, mixing, pressure, turbulence intensity and dissipation, and free water surface profiles. NorthWestern proposes a two-phase approach to the hydraulic modeling. The first phase will be performed using 2D simulations to provide an overview of the river channel hydraulics and will evaluate a wider range of flow rates to identify areas in the river channel to focus and refine the hydraulic modeling and to identify the critical flow rates. Once there is a better understanding of the overall river channel hydraulics, 3D simulations will be performed at key identified flow rates to provide a comprehensive evaluation of the velocity's spatial and vertical variation in the water column.

Based on available Project information and collected survey data, a 3D Computer Aided Design (CAD) model will be created of the spillway, downstream river channel and surrounding terrain. The downstream river channel will extend to just upstream of the High Bridge, or approximately 1,500 feet downstream of the dam. The 3D CAD model will be imported into the CFD model and

a computational mesh will be developed to capture the relevant geometric features of the spillway and river channel configuration.

Phase 1 – The CFD model will be used to simulate 2D flow with depth averaged velocities. The simulations will be performed for up to four flow rates, which may include a low flow condition, two intermediate flow rates and the maximum flow rate at which the fish passage facility is operational. Model results will be reviewed and compared with available operational data to validate the model results with known flow rates and depths. Model adjustments may be performed to calibrate the model to observed conditions if needed. An evaluation will be conducted of the flow depths and depth average velocities at the approach of the fish passage facility and along the margins of the river to account for the Bull Trout's preference to move in lower velocity margins. These 2D depth and velocity raster results for each flow scenario will be combined with collected telemetry data to provide valuable insight into the effectiveness of the fish passage facility in both the far and near fields. An example of anticipated results from the 2D model is included below in **Figure** 5-1. This image shows the velocity field with particle tracing overlaid on the high-resolution model terrain. A similar raster output is produced for each parameter measured within the model such as depth and water surface elevation.

Figure 5-1. 2D model results example. Colors represent water velocity in feet per second.



Phase 2 – Once the 2D CFD model is established, and results reviewed and validated, NorthWestern will perform 3D CFD modeling to provide a comprehensive evaluation of the flow conditions in the river channel. The 3D CFD modeling will be performed for two identified flow conditions to be determined after review of the 2D CFD modeling results. NorthWestern will refine the mesh in key areas of such as the fish passage facility entrance and the falls to identify the vertical velocity distribution in the water column. This will identify particular depths that may influence the movement of the fish. Velocity and depth raster results and water surface profiles at key locations will be provided for the evaluated flow rates. These results will be compared to collected telemetry data to provide information on the effectiveness of the fish passage facility.

The hydraulic analyses and evaluations will be documented in an Initial Study Report with supporting figures and appendices.

Schedule

Preparatory Work

The hydraulic study will commence following the FERC Study Plan Determination anticipated by May 12, 2021.

First Study Season

Task 1: Bathymetric Survey will be conducted in the mid to late summer of 2021, when the river flows are low, and a small boat can access the area between the powerhouse and the majority of the reach below the spillway. These data will supplement the available LiDAR data. NorthWestern anticipates that bathymetry data collection will be complete by August 1, 2021 (**Table 5-1**).

Task 2: Phase 1 of the hydraulic modeling (2D) will be conducted from August 2021 to November 2021.

NorthWestern proposes to supplement the ILP reporting requirements for this study by issuing an Interim Report. The Interim Report will provide results from the 2D modeling and recommendations for the specific scenarios to model with the 3D modeling. The Interim Report will be completed by February 1, 2022 and distributed to Relicensing Participants for a 30-day review and comment period.

The Interim Report will be revised based on comments received, as appropriate, and the Initial Study Report will be filed by May 12, 2022. The Initial Study Report will include a response to comments received on the Interim Report, and specific scenarios for 3D modeling.

Table 5-1: Summary of First Study season schedule.

Timing	Activity
July–Aug 2021	Bathymetric survey
Aug–Nov 2021	Phase 1 hydraulic modeling
Feb 1, 2022	Interim Report distributed to Relicensing Participants (2D)
March 1, 2022	Comments due to NorthWestern on Interim Report
March 2022	Meeting with Relicensing Participants to discuss Interim Report
May 12, 2022	Initial Study Report distributed to Relicensing Participants

Second Study Season

Phase 2 of the hydraulic modeling (3D) will be conducted between June 2022 and December 2022.

The Final Study Report will be filed by May 12, 2023.

Table 5-2: Summary of Second Study season schedule.

Timing	Activity
June – Dec 2022	Phase 2 hydraulic modeling
May 12, 2023	Final Study Report distributed to Relicensing Participants

Reporting Plan

NorthWestern proposes to supplement the ILP reporting requirements for this study by issuing an Interim Study Report that will document the results of the first phase of hydraulic modeling and make recommendations on scenarios for the second phase of hydraulic modeling.

NorthWestern will document the results of both phases of the hydraulic analyses and evaluations in a Final Study Report and will document the methodology, parameter selections, flow rate that was evaluated, and assumptions used for modeling. The Final Study Report will include figures to present the findings and appendices to support the analyses performed. The Final Study Report will be filed no later than May 12, 2023 (*refer to* **Table 5-2**).

5.4 Resource Management Goals

The FWS manages Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015), the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity. The ultimate goal of the FWS recovery strategy is to manage threats and ensure sufficient distribution and abundance to improve the status of Bull Trout throughout their extant range in the coterminous U.S. so that protection under the ESA is no longer necessary.

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population

and engage in general fisheries management for all other species. The 2019 to 2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

The Thompson Falls TAC collaboratively defined the priorities for fish passage at the Thompson Falls fish passage facility as:

- Pass Bull Trout
- Pass native species
- Pass non-native salmonid sport fish, but not to the detriment to the first two objectives. (e.g., if Brown Trout expansion extends into Bull Trout systems)
- Overarching goal is volitional passage

The overarching goal for the fish passage facility is volitional passage, however, volitional passage has not been approved by FWP due to the presence of Walleye (*Sander vitreus*) downstream of the Project and the absence of an established Walleye population upstream. FWP maintains the management authority to specify the fish species NorthWestern may pass upstream at the fish passage facility.

This study will provide information on the ability of fish to locate the fish passage facility entrance under different flow conditions and consistent with the FWS and FWP Resource Management Goals.

5.5 Existing Information and Need for Additional Information

A TDG Control Plan (TDG Plan) has been in place since 2011. The TDG Plan describes a spillway opening schedule for the Project intended to maximize fish attraction to the upstream adult fish passage facility at discharge less than 48,000 cfs. At discharge in excess of 48,000 cfs, the spillway opening schedule was designed to minimize the level of TDG in the river downstream. The fish attraction spill schedule was developed based on visual observations of hydraulic conditions downstream of the Main Channel Dam.

Topographic and bathymetric surveys will provide detailed information to prepare a digital elevation model for hydraulic modeling and a better understanding of the hydraulics of the river channel immediately downstream of the Project.

5.6 Nexus Between Project Operation and Effects

Operations of the Main Channel Dam modify hydraulic conditions downstream, potentially influencing the ability of fish to locate the entrance to the fish passage facility.

5.7 Study Methodology Consistency with Generally Accepted Practice

The study methodology will utilize the CFD modeling to understand the hydraulics of the river channel between the Main Channel Dam and the High Bridge. CFD modeling will be performed using Flow3D software, which is a widely used and accepted software platform for performing CFD modeling.

5.8 Level of Effort and Cost

The approximate cost to implement proposed Study #4 – Hydraulic Conditions is $78,000.

6. Proposed Study 5 Fish Behavior

The fish passage facility was designed and constructed to address upstream fish passage for the federally threatened Bull Trout. Other fishes also use and benefit from the fish passage facility.

The goals and objectives of the upstream fish passage facility were reviewed by the TAC and specifically defined, in order of importance:

- Pass Bull Trout
- Pass native fish species
- Pass nonnative salmonid sport fish, but not to the detriment of the other two objectives

The fish passage facility was constructed with the overarching goal of volitional passage. Volitional passage is currently not approved by FWP due to the presence of Walleye in the system downstream of the Project, but not upstream of the Project. FWP maintains the management authority to specify the fish species NorthWestern may pass upstream at the fish passage facility.

From 2011 through 2020, the fish passage facility provided upstream fish passage to over 33,700fish representing 14 species (plus 3 hybrids), including 18 Bull Trout (NorthWestern 2021).

This study proposes using radio telemetry to quantify the effectiveness of upstream fish passage at the Project (**Figure 6-1**). NorthWestern is proposing to monitor Rainbow and Brown trout and Largescale Sucker. Due to the rarity of Bull Trout in the Project area, NorthWestern is proposing to use Rainbow and Brown Trout as a surrogate for Bull Trout.

6.1 Goals and Objectives of Study

The goal of this study is to evaluate fish movement through the Project's zone of influence which is defined by the zone of passage (ZOP) concept (FWS 2017). The ZOP concept defines discrete areas for analysis of the pathway fish use to move through the influence of the Project. These areas include far field, near field, entry, internal fish passage facility, exit, and upstream (*see* **Figure 6-2** for ZOP concept and definitions). The ZOP concept provides a method to measure passage effectiveness and identify attributing causes and influences (Project and non-project related) to upstream passage effectiveness. This study will focus on fish movement in the far field, near field, and fish passage facility entrance, as illustrated in **Figures** 6.1 and 6.2 below. Internal fish passage facility efficiency continues to be evaluated annually *via* the remote PIT tag arrays located in the ladder, which is reported in the annual reports. This study will focus on what proportion of radio tagged fish enter the ZOP, find the fish passage facility entrance, and measure the duration of time and pathway(s) of these movements by species during various flow conditions.

The study objectives are to assess the effectiveness of upstream fish passage and Project influences, if any.

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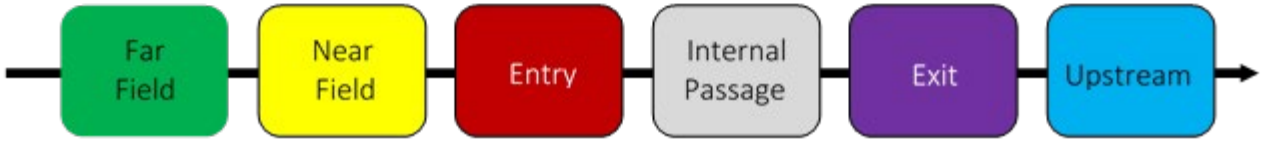
Figure 6-1. Study Area for Study # 5 – Fish Behavior.

Figure 6-2. Zone of Passage Concept (Note: figure not to scale).



Far Field	Downstream of fish passage facility/dam where powerhouse and spill serve as primary attraction to migrating fish
Near Field	In proximity to fish passage facility where fish passage facility attraction flow may lure fish to entrance
Entry	Immediately downstream of entrance channel/gate where fish passage facility discharge dominates hydraulics/velocity field/fish behavior
Internal Passage	Hydraulics, structure, and fish movement with the fish passage facility (i.e., entrance channel, pools, trap, exit channel)
Exit	Immediate upstream of the fish passage facility exit gate/exit channel where inflow into fish passage facility dominates hydraulics/velocity field/fish behavior
Upstream	Beyond the influence of the fish passage facility into the reservoir/impoundment

6.2 Changes from PSP

In response to the comments received from the USFS, FWS, and FWP, and the existing data supporting feasibility of fish collection quantities, NorthWestern has revised Study #5 – Fish Behavior to include the following:

- Collect up to 40 Brown Trout, 60 Rainbow Trout, and 20 Largescale Sucker for radio tagging
- Split collection for Brown and Rainbow trout in 2021 and 2022
- Collect salmonids from the mainstem Clark Fork River upstream of Thompson Falls Dam, the lower 7 miles of Thompson River, and the upstream fish passage facility work station
- Collect Largescale Sucker in 2022 in the mainstem Clark Fork River upstream of Thompson Falls Dam
- Focus fish collection for radio tagging and transport during the spring months

The study plan was also expanded to include a summary of the history of fish passage development at the Project, in Section 6.5 (Existing Information and Need for Additional Information).

6.3 Study Description

Background

In compliance with the terms and condition (TC) 1-h in the BO (FWS 2008) and 2009 License amendment (FERC 2009), NorthWestern, in collaboration with the TAC, formulated a Scientific Panel to evaluate the fish passage facility, with emphasis on Bull Trout (*see* Section 6.4 – Existing Information and Need for Additional Information, for more background information about the Scientific Panel). This study is proposed to address the questions the Scientific Panel raised in their 2020 report by providing quantitative results and analysis for the proportion of "motivated" fish entering the ZOP and finding the fish passage facility entrance (Scientific Panel 2020). The goals and objectives of the upstream fish passage facility were reviewed by the TAC and specifically defined. The TAC determined that Bull Trout are the highest priority for upstream fish passage at the fish passage facility. Native species are the second priority group for upstream fish passage. Largescale Sucker comprise 68 percent of native fish recorded at the fish passage facility (18,124 of 26,662 fish) and over half the total number of fish recorded at the fish passage facility (18,124 of 34,622 fish) over the last 10 years (NorthWestern 2021). Non-native game fish such as Rainbow and Brown trout are the third priority group for fish passage and represent 82 percent of the salmonids recorded at the fish passage facility (3,340 out of 4,036 fish) over the last 10 years.

NorthWestern proposes the use of radio telemetry to monitor upstream fish migration downstream of the Project in 2021 and 2022 (*refer to* **Figure 6-2)**. Following the recommendation of the Scientific Panel, NorthWestern is proposing the use of surrogate species to better understand

upstream fish passage efficacy for Bull Trout and proposes tagging Rainbow and Brown trout for this purpose (Scientific Panel 2020). NorthWestern also recognizes the importance of studying Rainbow and Brown trout as individual species, and the importance of studying native species such as Largescale Sucker. This study proposal expands on the Scientific Panel's recommendation and includes Largescale Sucker to be radio tagged and monitored. The 2021 season will focus on collecting and monitoring Rainbow and Brown trout. The 2022 season will focus on collecting and monitoring Rainbow and Brown trout and Largescale Sucker.

Methods for fish collection, tagging, and transport are proposed to be the same in 2021 and 2022. Fish collection sites will include the mainstem Clark Fork River upstream of Thompson Falls Dam, the lower section of the Thompson River (downstream of the confluence with West Fork Thompson River), and the upstream fish passage facility. Fish collection and radio-tagging will be focused on spring months (June 2021 and March–June 2022) when water temperature meets the specified standard (described below, in Study Methods). Fish collection locations will also be dependent on streamflows and ability to capture sufficient individuals for tagging.

This study will assess criteria developed for upstream fish passage facilities (FWS 2017) with emphasis on effective passage. Effective passage is delineated into three components: overall passage through the ZOP and passage facility, attraction efficiency to the passage facility entrance, and internal fish passage. This study will focus primarily on attraction efficiency. Internal fish passage facility efficiency for salmonids is approximately 75 percent (NorthWestern, 2019) and will continue to be monitored and reported annually by NorthWestern in the Thompson Falls Fish Passage Program Annual Report through the term of the existing License (2025).

The 2021 and 2022 telemetry monitoring efforts will focus on assessing attraction efficiency, the fish movement by species through the ZOP upstream to the entrance of the fish passage facility, including:

- Travel time from the far field to the near field
- Travel time from the near field (the falls area) to the entrance of the fish passage facility
- Movement patterns (e.g., left bank, right bank) in the near field (Main Channel Dam area)
- Proportion of fish that enter the ZOP and locate the entrance of the fish passage facility entrance
- Locations where fish hold within the ZOP

The movement patterns described above will be informative about potential delay within the ZOP, duration of migration, pathway of migration, number of migration/forays attempts between near and far field, and fish passage facility entry behavior.

The results of the study will be reviewed in concert with the CFD model (*refer to* Section 5 – Study #4 – Hydraulic Conditions) to assess near field hydraulics and identify potential hydraulic influences on fish upstream movement patterns. Also included will be a literature review of relative swimming capabilities and behaviors of species recorded at the fish passage facility.

Internal fish passage will continue to be monitored by PIT and reported in Annual Reports per FERC (2009) and BO (FWS 2008) compliance requirements. A summary of available 2021 and 2022 internal fish passage findings will be included in the final study report as well. Additionally, attractant flows available through fish passage facility operations (e.g., high velocity jet) or dam operations (i.e., spill configuration at the Main Channel Dam) will continue to operate as in past years during this study.

Study Area

This study will focus on fish movement in the far field, near field, and fish passage facility entrance (*see* **Figure 6-2**).

Study Methods

Species

This study will involve tagging Rainbow and Brown trout, as surrogates for Bull Trout, along with Largescale Sucker. Low numbers of Bull Trout in the Project area, and their federally threatened status preclude using them in the proposed study. Although a perfect surrogate for Bull Trout does not exist, as they are behaviorally unique, Rainbow Trout may serve as a comparison for the spring migration period and the tendency to use channel margins during high, turbid flows. Brown Trout may be more closely sized to Bull Trout so jumping and swimming abilities may be more similar. Brown Trout also tend to migrate in summer and fall, which indicates that they could be effective surrogates for a fall migration period.

Fish Collection

Trout will be collected from (1) the mainstem Clark Fork River upstream of the dam; (2) the lower section of the mainstem Thompson River (downstream of the confluence with the West Fork Thompson River, **Figure 6-3**); and (3) the upstream fish passage facility. Largescale Sucker will be collected from the mainstem Clark Fork River upstream of the dam.

Fish collection will begin in June during 2021 and March through June in 2022 but will be contingent on accessibility of the sampling areas and water temperature necessary to allow for optimal recovery of fish post-surgery. Timing of sampling may vary depending on river conditions. Field conditions and related safety considerations for the field crew will determine when sampling can occur. Collection of fish will occur *via* boat electrofishing and angling.

In 2021, NorthWestern proposes to collect a maximum of 50 fish with 60 percent representing Rainbow Trout and 40 percent representing Brown Trout. In 2022, NorthWestern proposes to collect a maximum of 70 fish, replicating the 2021 numbers for trout and adding 20 Largescale Sucker.

Fish collected for this study will be anesthetized, tagged (PIT and radio), and then transported downstream of the dam prior to their release. Fish will be released approximately 4 miles

downstream of the Project at the Flat Iron boat launch (**Figure 6-3**). Subsequent upstream fish movement will be monitored at stationary receivers located throughout the study area as well as *via* manual tracking efforts (**Figure 6-4**).

Tagging

The radio tag will be internally implanted through the intra-peritoneal (body cavity) following the methods described in Mizell and Anderson (2015). Radio transmitters MCFT3 series manufactured by Lotek Wireless are proposed for this study, as they are best suited to address the goals and objectives of the study. Radio tags will be equipped with depth and activity sensors and will be selected to adhere to the 2 percent tag to body weight ratio. The MCFT3 tag life (assuming 5-second burst rate) will range from 1.5 or 8 months depending on the tag size (6.8 or 11 grams, respectively).

Fish sampled for this study will also receive a PIT tag (full duplex) implanted in the muscle tissue ventral to the dorsal fin. PIT tags have a greater retention time when implanted in the muscle tissue (Mamer and Meyer 2016). Remote PIT tag array stations are currently operating in: Prospect Creek, a tributary located immediately downstream of the Main Channel Dam; the two fish passage facility entrances, the lower pools and the top holding pool; and the mainstem of the Thompson River, a tributary located about 6 miles upstream of the dam. The same PIT tag methods implemented at the work station at the fish passage facility will be followed for this study.

Training and Testing Procedures

Field crews will be trained regarding methods to be implemented during radio tagging fish surgeries, including anesthetizing, surgery procedure, and recovery process for fish prior to transport and release in the Clark Fork River.

Telemetry fixed receiving stations and antennas will be installed prior to the start of radio tagging fish. Fixed receiver stations will be tested to determine tag detection efficiency, power supply systems, adequate data downloading, and that quality assurance and quality control systems are in place.

Sampling and Transporting Temperature Thresholds

NorthWestern will coordinate with FWP to identify the threshold for the acceptable temperature differential from the sampling location (Thompson River) and release site (Clark Fork River). Sampling, tagging, and transport of fish will only occur when water temperatures are less than or equal to 16 °C (60.8 °F). NorthWestern will coordinate with FWP if there is a need to re-assess the established temperature threshold if, for example, Brown Trout appear to be able to tolerate a higher temperature.

Monitoring Procedures

The fixed stations and conceptual radio telemetry monitoring zones are shown in **Figure 6-4**. These stations will be calibrated and tested in spring 2021 and again in spring 2022. Test radio tags will be utilized throughout the monitoring season to confirm detection efficiency of the fixed stations. The fixed telemetry stations will record data continuously throughout each study season (June–October 2021 and March–October 2022). Data from the fixed stations will be downloaded weekly during the monitoring season.

Manual radio telemetry monitoring will occur at variable intervals during each study season. The frequency of manual tracking will depend on fish detections in the ZOP and may vary from multiple times a week, to daily, or multiple times a day. The goal of the manual tracking will be to confirm where a fish may be located between fixed stations and provide higher resolution of the location for an individual fish within the ZOP. Manual tracking will be a critical tool in monitoring fish movement in the ZOP. Manual tracking will extend from Flat Iron boat launch (release site) upstream to Thompson Falls Dam. The existing PIT tag arrays in Prospect Creek, the fish passage facility, and the Thompson River operate remotely, and data are remotely accessed. The data from these stations will be downloaded and reviewed at a minimum weekly. PIT-tag detections from fish collected for this study will be summarized in the study reports.

Data Analysis

In 2021, fish movement data for Rainbow and Brown trout will be collected from June through October. These data will be analyzed to assess fish movement through a range of flow conditions, including high spring flows. The fish radio tagged in 2021 will not be transmitting data in the 2022 season. The maximum tag life is approximately 255 days.

In 2022, fish movement data for Rainbow and Brown trout and Largescale Sucker will be collected in the spring and monitored through October. As in 2021, these data will be analyzed to assess fish movement during a range of flow conditions, including high spring flows.

The evaluation of fish movement behaviors will focus on attraction efficiency (FWS 2017) by assessing the following:

- Travel time from the far field to the near field (entry of ZOP to falls below the Main Channel Dam)
- Travel time from the near field to the entrance of the fish passage facility
- Proportion of fish that enter the ZOP and locate the entrance of the fish passage facility entrance
- Movement patterns (e.g., left bank, right bank) in the near field (Main Channel Dam area)
- Locations where fish hold within the ZOP

The movement patterns described above will be informative regarding potential delay within the ZOP, duration for migration, pathway of migration, number of migration/forays attempts between near and far field, and fish passage facility entry behavior.

The hydraulic model will identify Project operations that may influence upstream fish passage. Following the completion of the telemetry study, these data will be evaluated in conjunction with the CFD modeling (Proposed Study #4 – Hydraulic Conditions) to assist in evaluating potential hydraulic influences on upstream fish movement in the near field. The objective of combining the behavioral data and hydraulic modeling data will be to help identify potential Project influences (e.g., velocity fields) in the near field that may affect conditions for upstream fish passage. In addition, a literature review of the relative swimming capacities and behaviors of the fish species recorded at the fish passage facility will be completed to gain further understanding of combining the behavioral and hydraulic modeling results and included as part of this fish behavior study.

Schedule

Preparatory Work

Study planning, acquiring equipment, and testing equipment and procedures will take place in April and May 2021, in order to begin the study in June 2021.

First Study Season

The anticipated activities and schedule are depicted in **Table 6-1**.

Table 6-1: First Study season schedule.

Timing	Activity
Jun and Sep (if water temperature allows) 2021	Sampling and tagging up to 30 Rainbow and 20 Brown trout and release downstream of study area
Jun–Oct 2021	Monitor fish movement in ZOP
Nov–Apr 2022	Analyze data and prepare Initial Study Report
May 12, 2022	Initial Study Report for 2021 Results

Second Study Season

The anticipated activities and schedule are depicted in **Table 6-2**.

Table 6-2: Second Study season schedule.

Timing	Activity
Spring 2022	Sampling and tagging up to 30 Rainbow Trout, 20 Brown Trout, 20 Largescale Sucker and release downstream of study area
Mar–Oct 2022	Monitoring fish movement
Nov 2022–Apr 2023	Analyze data and prepare Final Study Report
May 12, 2023	Final Study Report of 2021 and 2022 results

Figure 6-3. Fish sampling location (Thompson River) and release location (4 miles downstream of dam) in relation to Study Area.

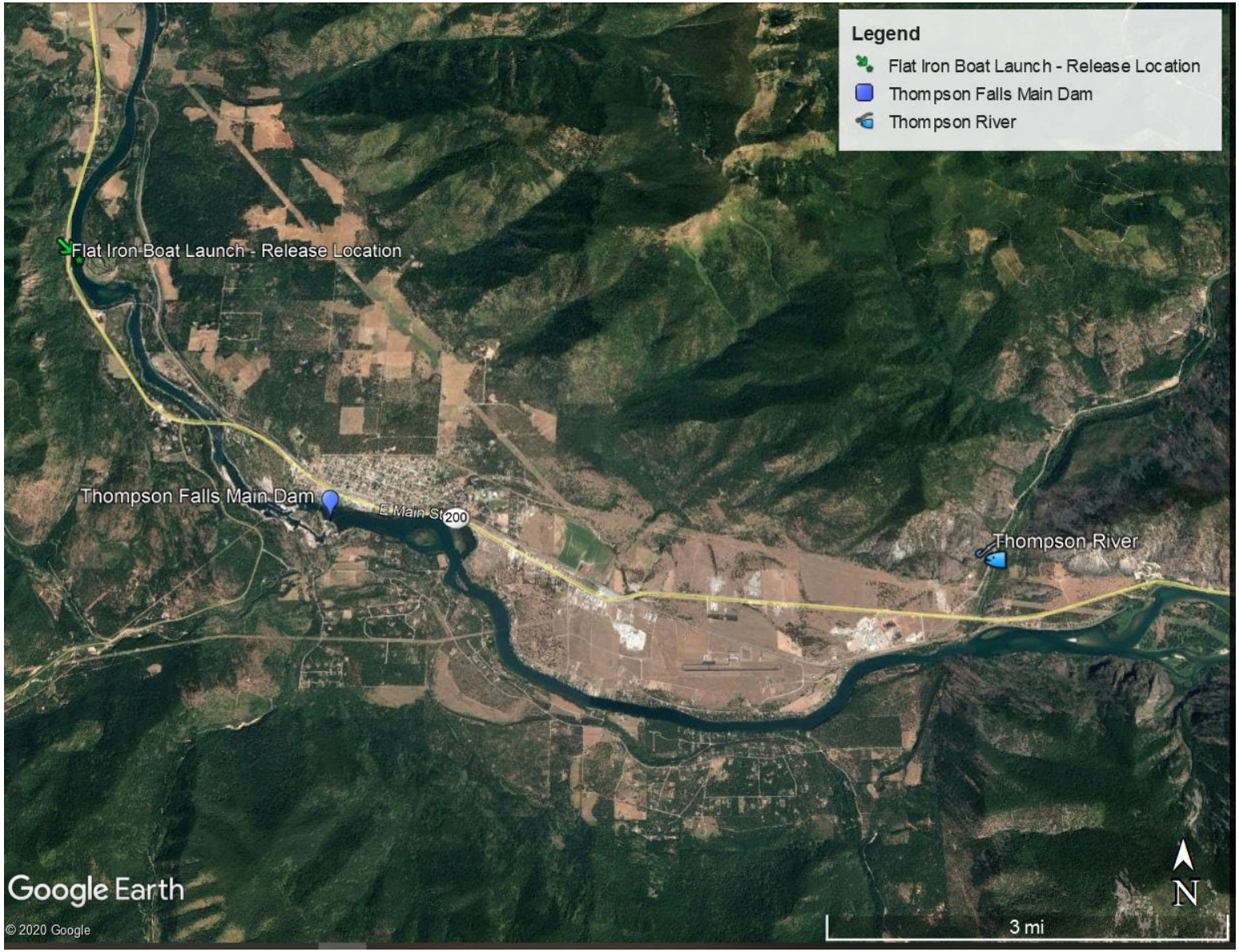


Figure 6-4. Conceptual radio telemetry monitoring zones.

Reporting Plan

The Initial Study Report for 2021 monitoring results of Rainbow and Brown trout will be prepared and filed no later than May 12, 2022. A Final Study Report summarizing the results of Rainbow Trout, Brown Trout, and Largescale Sucker upstream movements will be filed no later than May 12, 2023. The Final Study Report will also evaluate fish movement trends in conjunction with the hydraulics analysis and results from the CFD modeling (*refer to* Section 5 – Proposed Study #4 – Hydraulic Conditions), and the literature review of fish swimming capabilities.

6.4 Resource Management Goals

The FWS manages Bull Trout under the ESA. In the FWS Bull Trout Recovery Plan (2015), the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity. The fish passage facility helps to meet the goal of restoring connectivity, and this study intends to measure the efficacy of the fish passage facility. The FWS views safe, timely, and effective fish passage as important components in the operation of an upstream fish passage facility and restoring connectivity.

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population. The 2019-2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

6.5 Existing Information and Need for Additional Information

Thompson Falls Upstream Fish Passage Development History

Since 2003, the Licensee has coordinated with the TAC to identify conservation measures to mitigate Project adverse impacts to Bull Trout (**Table 6-3**). The Licensee prepared the Thompson Falls Dam Fish Passage Study Plan (Pre-Design Phase Plan) to develop upstream adult fish passage at the Project and identified the need for additional fish behavior and Project operations data prior to the development of a permanent fish passage facility (Gillin and Pizzimenti 2003b). Subsequent studies to implement the Pre-Design Phase Plan were developed cooperatively with the TAC.

Radio-telemetry studies were designed and completed in 2004 with focus on fish behavior in the tailrace (Gillin and Haddix 2005); in 2005 to assess the relationship between fish behavior and streamflow/spill in the Project (Haddix and Gillin 2006); and in 2006 to further evaluate the optimal location for an entrance to a fish passage facility at the Main Channel Dam (GEI 2007). Fish behavior studies focused on Bull Trout, but because the number of Bull Trout sampled in any given year was low, other fish such as native Westslope Cutthroat Trout and non-native sport-fish, Brown Trout, Rainbow Trout, and Rainbow x Westslope Cutthroat hybrids were included in the

telemetry studies. In this time period (2004-2006), between 30-40 fish were radio tagged for these studies. A summary of the 2004-2006 telemetry studies is also available in Section 5.3 of the Thompson Falls Baseline Environmental Document (NorthWestern 2018) which can be found here: http://www.thompsonfallsfishpassage.com/pdf_2018/BED_Final-sm-PW.pdf .

The fisheries telemetry work concluded that fish were moving upstream to the upstream-most terminus of available fish passage, the Main Dam spillway, during the ascending limb of the hydrograph and would leave the area and move downstream at peak flows. Fish were not sedentary and were constantly on the move. Initial monitoring efforts showed more fish moving to the left abutment than the right abutment. However, it was found that spill could be configured to attract fish to the right abutment (GEI 2007). Based on the results of the fish behavior and movement studies (GEI 2007), it was determined that the optimal location of the fish passage facility was the uppermost terminus of available fish passage, the Main Dam spillway.

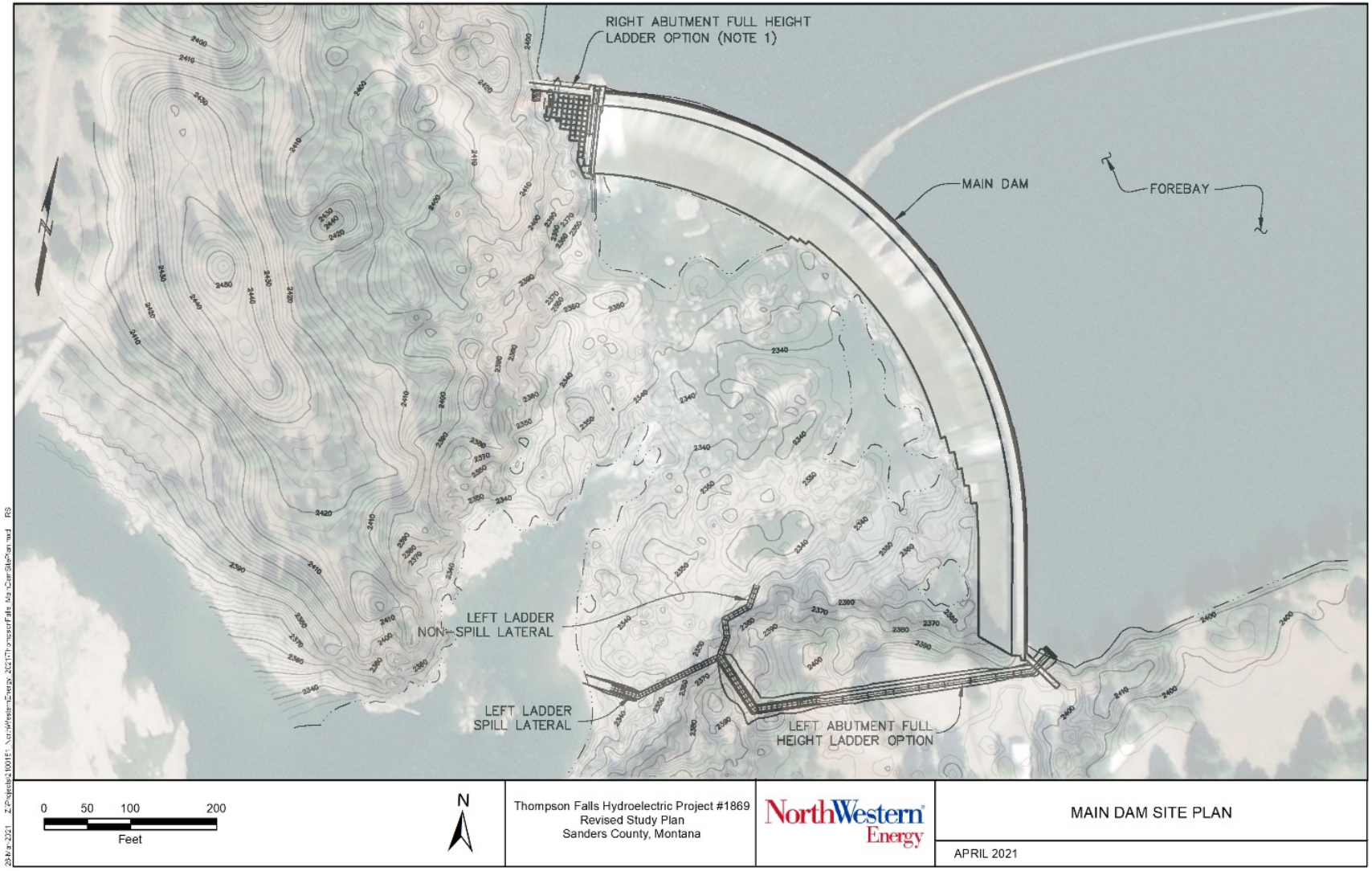
In 2006, FWS and FWP provided clarification on target species for the upstream fish passage facility at Thompson Falls. FWS stated the target species and size ranges for the fish passage facility included: Bull Trout, Westslope Cutthroat Trout, and Mountain Whitefish over 4 inches (>100 millimeters [mm]) in length (GEI 2007). FWP goals were to maintain and enhance native fish as much as possible and to enhance recreational fishing in general (including non-native trout).

Next, the Licensee conducted a feasibility study and evaluated alternatives. The feasibility study incorporated fish behavior and movement data, input from the TAC and guidance from FWS and FWP on target species, and the National Marine Fisheries Service 2008 Anadromous Salmonid Passage Facility Design Criteria (adopted by FWS for use in design of Bull Trout fish passage facilities through the Pacific Northwest) (GEI 2007b). The 2008 criteria were established for anadromous salmonids in the Columbia River system. There were no guidelines or previous projects specific to inland Bull Trout.

The feasibility study evaluated three alternatives: 1) full-height ladder along the right abutment at the Main Dam, 2) full-height ladder along the left abutment at the Main Dam, and 3) a fish lock trap and haul facility. The draft feasibility study was reviewed and discussed by the TAC and the preferred alternative (right bank, full height fish ladder) was documented in the final feasibility study (GEI 2007b).

The right bank was selected as the location because the fish passage facility could be constructed downstream of the non-overflow section of the spillway, providing protection of the fish passage facility site (**Figure 6-5**). In addition, the right bank, full height fish ladder alternative had limited upstream tunneling construction needs, space available for fish sampling facilities, limited imported fill placement/removal, a small amount of rock excavation, and relatively low operations and maintenance requirements (GEI 2007b).

Figure 6-5. Fish Passage Facility alternative locations evaluated during fish passage planning at the Project.



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The left bank location was rejected because the steep gradient along the left shoreline is a barrier to fish during spill. Therefore, to successfully pass fish in both spill and non-spill seasons, two fish passage facility entrances were needed, both a fair distance downstream of the spillway apron, and separated from each other. The entrance pool designed for use during spill operations would have discharged into a tailwater pool immediately downstream of the left shoreline bend. This is the upstream terminus for migrating fish approaching the Main Dam spillway along the left shoreline during spill.

The non-spill operations entrance would have been located downstream of the Main Dam apron, in the large backwatered pool that extends upstream from the two powerhouses (**Figure 6-5**). The non-spill fish passage facility entrance would have been submerged at typical peak spring discharge, and thus the non-spill fish passage facility entrance would be exposed to structural damage from coarse debris. During transition periods between spill and non-spill, there would be a risk that fish would migrate past both the fish passage facility entrances, and then not drop back to enter the fish passage facility. Other disadvantages of the left bank alternative were the extensive rock excavation required and greater expected maintenance and repair needs (GEI 2007b).

During the planning and development phase of the fish passage facility, volitional upstream fish passage was a priority by the agencies and the trap and haul alternative was not preferred by FWS. FWS preferred the full-height ladder on the right abutment (with some type of trapping option) and recommended the left bank fish passage facility was too risky and should be abandoned. FWP was also more comfortable with the full-height ladder on the right bank and thought the left bank option would not be effective at all the variable flows. FWP was also concerned about Walleye passage and wanted an option to monitor fish at the fish passage facility. The Licensee was concerned about greater operations and maintenance issues likely associated with the trap and haul facility and the left bank fish passage facility. The group concluded the full-height ladder along the right bank was the preferred alternative.

In 2008, the Licensee filed an updated Biological Evaluation (BE) (PPL Montana 2008) and 90 percent Design Plans for the Fishway with the Commission. The BE discussed the effects of the Project on Bull Trout and proposed conservation measures. The 2008 BE was adopted as the Commission's Final Biological Assessment (BA) and submitted to FWS on May 1, 2008. The BA 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 key milestones leading to the construction of the Upstream Fish Passage facility are provided in **Table 6-3** and beginning with the federal listing of Bull Trout as an endangered species in 1998.

Table 6-3: Major fish passage milestones at Thompson Falls Hydroelectric Project.

Year	Milestone	Source(s)
1998	Bull Trout federally listed under the Endangered Species Act	Federal Register 1998
1999-2001	Preliminary radio telemetry and trapping studies in Project area	FWP unpublished
2003	Draft Biological Evaluation submitted to FWS and FERC and concluded Project is "likely to adversely affect" Bull Trout. Initiation of informal consultation with FWS.	Gillin and Pizzimenti 2003
2003-2004	PPL Montana prepares plan to develop upstream adult fish passage and identifies the need for additional fish behavior and Project operations data prior designing a permanent fish passage facility	Gillin and Pizzimenti 2003b
2004-2006	Radio-Telemetry Studies to identify fish behavior (Bull Trout, Westslope Cutthroat Trout, Rainbow Trout) and determine optimal location for fish passage facility	Gillin and Haddix 2005; Haddix and Gillin 2006; GEI 2007
2005-2006	Review fish behavior studies, operational flexibility at the Project, and identify optimal fish passage facility location	Gillin and Haddix 2005; Haddix and Gillin 2006; GEI 2007; GEI 2006
2006	FWS and FWP clarify position on target species for upstream fish passage facility at Thompson Falls Dam	GEI 2007
2006	Site Selection Letter Report, Fishway Tour of Columbia River sites (Umatilla, Oregon and Yakima, Washington) with FWS, FWP, and PPL Montana., Upstream Fishway Feasibility Study for three fishway alternatives	GEI 2006; 2007b
2007	Preliminary Fish Design 30%	GEI 2007a
2008	Biological Evaluation	PPL Montana 2008
2008	FWS Biological Opinion	FWS 2008
2009	FERC Order issued Approving Construction and Operation of the Fish Passage Facility for the Project, February 12, 2009	FERC 2009
2009-2010	Upstream Fish Passage Facility Construction Period	

Preliminary Fish Behavior Studies

Fish movement and behavior studies were conducted during the planning of the fish passage facility. Radio telemetry studies to monitor salmonid upstream migrations downstream of the dams and powerhouses were completed in 2004 (Gillin and Haddix 2005), in 2005 (Haddix and Gillin 2006), and in 2006 (GEI 2007). The objective of these studies was to monitor fish behavior and movement downstream of the dams and powerhouses and determine the placement of the fish passage facility.

Over the course of the 3-year study, 113 fish were radio tagged. The majority of the fish were Rainbow Trout collected *via* electrofishing downstream of the dam and in a Denil trap (located immediately downstream of the Main Channel Dam) during the spring (March, April, and early

May). Radio-tagged fish were released about 6 miles downstream of the dam and approximately 70 percent of all the radio-tagged fish were subsequently detected in the Project area (Gillin and Haddix 2005, Haddix and Gillin 2006, GEI 2007). The 3-year study concluded the majority of fish were detected below the Main Channel Dam prior to the spring freshet. A summary of the annual radio-tagged (spring and fall) by species, and number of fish detected in the study area is provided in **Table 6-4**.

Table 6-4: Total number of fish, by species, radio-tagged and detected in the Study Area in 2004, 2005, 2006.

Species	Year		
	2004	2005	2006
Bull Trout	3	1	3
Rainbow Trout	19	28	17
Westslope Cutthroat Trout	7	9	5
Rainbow/Westslope Cutthroat Trout Hybrids	-	2	12
Brown Trout	2	2	3
Total Radio-Tagged	31	42	40
Detected in Study Area	21	25	32

As previously mentioned, fish movement and behavior related to spill regimes at the Main Channel Dam were successfully modified *via* manipulation of flashboard operations resulting in the movement of fish from the left bank to the right bank (GEI 2007). The results of the 3-year telemetry study, along with physical construction constraints, were used to define the location and entrance of the fish passage facility that was placed in operation in 2011.

Scientific Panel Review of Fish Passage Facility Efficiency

In compliance with the terms and condition (TC) 1-h in the BO (FWS 2008) and 2009 License amendment (FERC 2009), NorthWestern, in collaboration with the TAC, formulated a Scientific Panel to evaluate the fish passage facility. The goal and objective of the Scientific Panel was to evaluate whether the fish passage facility is functioning as intended (with primary focus on the target species, Bull Trout), and whether operational or structural modifications are needed. The Scientific Panel consisted of members from FWS, FWP, and an independent consultant. The Scientific Panel reviewed available material from fish passage facility operations from 2011 through July 1, 2019 and prepared a Memorandum (Scientific Panel 2020) with their findings and recommendations.

The Scientific Panel was challenged with a low sample size of the target species, Bull Trout (likely attributed to low abundance in the system), the lack of quantitative measurements regarding fish movement in the ZOP, and hydraulic data to evaluate attraction efficiency (far field) or entrance efficiency (near field).

The Scientific Panel concluded that the available data on upstream fish passage did not provide quantifiable measurements to evaluate effectiveness of upstream fish passage and make determinations of whether the fish passage facility is functioning as intended. This study is a direct result of the recommendations from the Scientific Panel.

6.6 Nexus Between Project Operation and Effects

Upstream fish passage for federally threatened Bull Trout and other fishes is impacted by the Project and effectiveness of the fish passage facility. In compliance with 2009 FERC License amendment and BO (FWS 2008), NorthWestern is tasked with evaluating upstream fish passage efficiency.

6.7 Study Methodology Consistency with Generally Accepted Practice

Many fish studies in riverine systems utilize radio telemetry to monitor fish movement. In the literature cited a list of references is included that were reviewed for development of this study. They support the selection of radio telemetry as an appropriate method to achieve the goals and objectives identified.

6.8 Level of Effort and Cost

The approximate cost to implement proposed Study #5 – Fish Behavior is $225,000.

7. Proposed Study 6 Downstream Transport of Bull Trout

NorthWestern is proposing a study to evaluate the feasibility of collecting and transporting suitable numbers of juvenile Bull Trout downstream. The study entails collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille. The long-term goal (beyond the time frame of this study) is to assess whether or not downstream transport of juvenile Bull Trout from the Thompson River to Lake Pend Oreille would increase the spawning population of adfluvial Bull Trout in the Thompson River drainage. The proposed study will evaluate and focus on the feasibility of collecting and transporting juvenile Bull Trout, goals that are attainable in the ILP 2-year study period timeframe.

7.1 Goals and Objectives of the Study

The goal of the study is to evaluate the feasibility of collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille.

During the 2-year relicensing study, NorthWestern will:

- Attempt to determine the most efficient and effective capture methods, capture locations, and seasonal capture timing of juvenile Bull Trout in Fishtrap Creek and West Fork Thompson River
- Assess downstream transport feasibility
- Evaluate juvenile Bull Trout survival during transport

7.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below. These same changes were noted in Section 1.5 above but are repeated here for convenience.

As a result of input from FWP and FWS, NorthWestern adopted additional details concerning the study. These details include:

- Tagging and genetic sampling protocols for Bull Trout greater than or equal to 100 mm
- Targeted sample size and locations of sampling
- Size range for juvenile Bull Trout eligible for transport from each sample location
- Contingency plan if the annual transport target for West Fork Thompson River cannot be met (or appears that it will not be met)

- Proportion of Bull Trout within the eligible transport size range to be transported and handling protocols for Bull Trout outside the eligible transport size
- Dates for operation of temporary weir traps, and trap monitoring protocols
- Electrofishing protocols

7.3 Study Description

Background

Bull Trout are listed as threatened by the FWS under the ESA and populations in the Lower Clark Fork are suppressed from historic levels. The Thompson River flows into Thompson Falls Reservoir 6 miles upstream of Thompson Falls Dam. The West Fork Thompson River and Fishtrap Creek are known Bull Trout spawning tributaries to the Thompson River where Bull Trout are consistently found. Previous studies have documented the existence of both resident and migratory populations in these tributaries (Liermann 2003, Zymonas 2006, Huston 1994, Glaid 2017).

Historically, juvenile adfluvial Bull Trout in the Clark Fork River drainage outmigrated from tributary streams to feed and mature in Lake Pend Oreille. The adults would then migrate upstream from Lake Pend Oreille to the natal streams to spawn. This migration pattern has been disrupted by the construction of Cabinet Gorge, Noxon Rapids, and Thompson Falls dams. Today, Bull Trout passage in the Lower Clark Fork drainage is, in part, facilitated by Avista's trap and transport programs. Avista captures a portion of juvenile Bull Trout within their natal streams, implants them with PIT tags, and transports them to Lake Pend Oreille. Avista seasonally collects adult Bull Trout upstream of Lake Pend Oreille near the vicinity of Cabinet Gorge Dam[13]. A fin clip from each Bull Trout is genetically tested to determine their natal stream so they can be transported to (or near) their tributary of origin. Avista has operated the adult Bull Trout transport program since 2001. Transport of Bull Trout upstream of Thompson Falls Dam began in 2007. For the last 12 years, Avista has annually transported an average 37 Bull Trout upstream of Cabinet Gorge Dam with about 21 percent (7 Bull Trout) transported upstream of Thompson Falls. A portion of the adults captured at Cabinet Gorge Dam are fish that were previously transported downstream as juveniles. Avista's downstream trap and transport program does not include tributaries upstream of Thompson Falls Dam.

The Thompson River is designated critical habitat for migratory (adfluvial/fluvial) and resident Bull Trout. Outmigrating juvenile Bull Trout from the Thompson River may pass downstream of Thompson Falls Dam and take up residence in Noxon Rapids Reservoir. As adults, they can migrate upstream to their natal stream using the fish passage facility at Thompson Falls Dam. Alternatively, they may continue their downstream movement to Cabinet Gorge Reservoir, or further to Lake Pend Oreille. There is no upstream fish passage facility or program at Noxon

[13] Bull Trout have been collected for the transport program *via* trapping, electrofishing, and angling downstream of Cabinet Gorge Dam. An upstream fish passage facility is currently under construction at Cabinet Gorge Dam.

Rapids Dam, so Bull Trout that take up residence in Cabinet Gorge Reservoir cannot return to tributaries upstream.

NorthWestern proposes a study to collect and transport juvenile Bull Trout from the Thompson River to Lake Pend Oreille. The study would help evaluate the feasibility of collecting and transporting suitable numbers of juvenile Bull Trout downstream from the Thompson River drainage.

Study Area

The study area for this study is the West Fork Thompson River and Fishtrap Creek, known Bull Trout spawning tributaries to the Thompson River (**Figure 7-1**).

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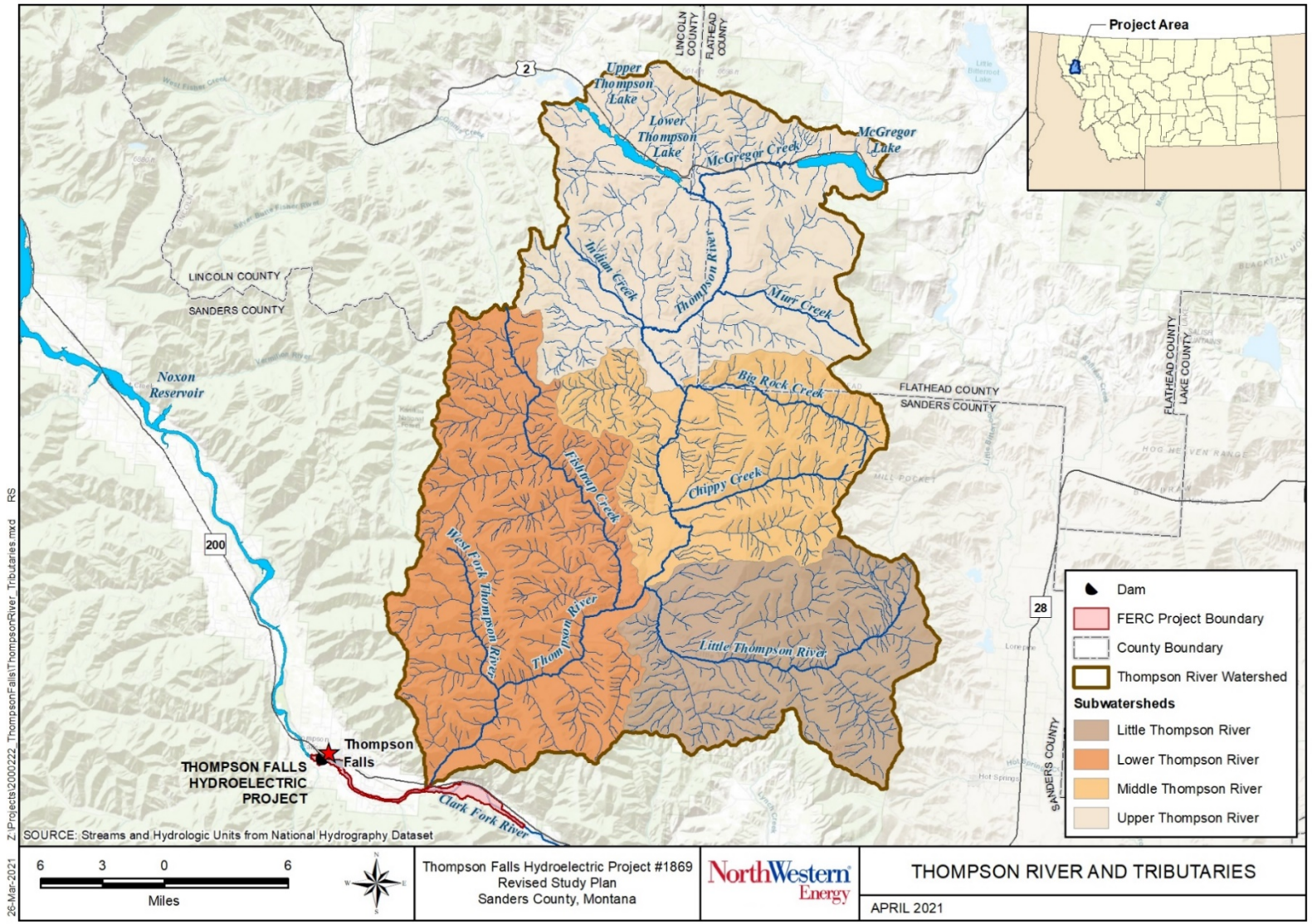
Figure 7-1. Thompson River rrainage. West Fork Thompson River and Fishtrap Creek are located in the Lower Thompson River subwatershed.



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Methods

This study would involve capturing juvenile Bull Trout from Fishtrap Creek and West Fork Thompson River and inserting a PIT into their dorsal sinus cavity. Based on findings from similar efforts in the Lower Clark Fork basin (Avista 2016) backpack electrofishing and picket weir traps would be employed in October and November (weather allowing) to capture Bull Trout in the lower half of Fishtrap Creek and West Fork Thompson River. A target sample size of up to 100 individuals from Fishtrap Creek and 100 from West Fork Thompson River is the goal for 2021 fall collection efforts. In 2022 another 200 total fish would be targeted for fall PIT tagging. Based on previous electrofishing and trapping efforts (Glaid 2017) it is uncertain if the sample size goal of 100 individuals in the West Fork Thompson River is attainable. For this reason, NorthWestern proposes flexibility to capture and tag up to 150 fish in Fishtrap Creek. Of the Bull Trout over 120 mm total length captured, 75 percent would be transported by truck downstream to a release site in Lake Pend Oreille, and 25 percent would be released on site in the tributaries after capture and tagging. A minimum effort of 10 days (5 days per stream) of electrofishing between October and mid-November in the lower portions of Fishtrap Creek and West Fork Thompson River would occur. Temporary weir traps would be operated on both streams during weekdays between mid-October and the end of November. Weirs would be operated and checked daily on weekdays and partially disassembled on Fridays to allow volitional passage through the weekend.

Permanent PIT tag antenna stations would continue to be operated at the mouths of Fishtrap Creek, West Fork Thompson River, and Thompson River mainstem. Tagged fish immigrating to and emigrating from this system would be detected by these systems allowing information on movement timing in and out of tributaries.

As a result of input from FWP and FWS, NorthWestern adopted additional details concerning the study. Those are as follows:

- All Bull Trout greater than or equal to 100 mm will be PIT tagged in the dorsal sinus cavity and a tissue sample will be taken for genetic analysis.
- A targeted sample size of 100 fish from West Fork Thompson River and 100 fish from Fishtrap Creek will be captured and transported in the fall of 2021 and 2022 (200 fish each year, total of 400 fish). The size range for juvenile Bull Trout eligible for transport will be 120-200 mm (total length) from the West Fork Thompson River and 120-250 mm from Fishtrap Creek.
- If the annual transport target for West Fork Thompson River cannot be met (or appears that it will not be met), up to 150 juvenile Bull Trout may be captured from Fishtrap Creek. This limit on transported fish from Fishtrap Creek may be increased at any time during the study in response to site-specific observations and catch-rates in each stream and will be determined through consultation among NorthWestern and FWS and FWP.
- Of the captured Bull Trout within the eligible transport size range, 75% would be transported downstream to Lake Pend Oreille, and 25% would be released on site following

tagging and genetics sampling. Fish less than 120 mm will not count toward either quota (i.e., transported or left on site) and young-of-year fish should avoid being handled, aside from ensuring they are safely returned to the water.

- Temporary weir traps on Fishtrap Creek and West Fork Thompson River will operate from October 1 – November 15 in both 2021 and 2022. However, the precise dates of operation may vary depending on environmental conditions and site-specific catch rates relative to transport targets. Precise beginning and end dates for temporary weir trapping will be determined through consultation among NorthWestern, FWS, and FWP. Weir traps will be checked daily during the weekdays and disabled to allow for volitional passage on weekends. Weir traps will be checked in the morning to best ensure fish are handled in a timely and safe manner. The trap boxes will be reinforced in order to prevent fish loss by mink and other predators. Game cameras will be used to monitor predation at each weir.
- Fall electrofishing may occur up to a maximum of five days per stream and will be conducted after Bull Trout redd counts have been completed and all putative redds have been identified within the specified sampling areas in each stream. Electrofishing in the West Fork Thompson River may occur from river mile (RM) 1.2 at the confluence of Honeymoon Creek downstream to the mouth. In Fishtrap Creek, electrofishing may occur from RM 2.5 (at the boundary between sections 16 & 21) downstream to the mouth. Electrofishing will not occur near documented or suspected Bull Trout redds, and will avoid complex habitats, such as debris jams, where adults could be present.

Schedule

Preparatory Work

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader (**Table 7-1**).

First Study Season

In the first study season, juvenile Bull Trout will be captured from the West Fork Thompson River and Fishtrap Creek and transported downstream in October through November.

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader throughout the study season.

Second Study Season

In the second study season, juvenile Bull Trout will be captured from the West Fork Thompson River and Fishtrap Creek and transported downstream in October through November.

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader throughout the study season.

Table 7-1: Summary of study schedule.

Timing	Activity
2020–2023	Operate existing PIT-tag antenna arrays
Oct–Nov 2021 and 2022	Capture and transport juvenile Bull Trout from West Fork Thompson River and Fishtrap Creek
April 1, 2022 and 2023	Include data on PIT-tag detections in annual License compliance monitoring
May 12, 2022 and 2023	Initial and Final Study Reports

Reporting Plan

Interim Reporting – to be filed in annual License compliance reports no later than April 1, 2022 and April 1, 2023 – will include ongoing efforts to maintain PIT antenna arrays in the Thompson River drainage and will provide results related to adult returns. This reporting will be part of the annual Thompson Falls upstream fish passage compliance reporting, due annually April 1 (*refer to* **Table 7-1**).

Initial Study Report – to be filed no later than May 12, 2022 – will include a summary of all Bull Trout tagged, transported, released on site and any recapture events or PIT detections acquired. A summary of catch per unit effort for electrofishing efforts and weir trapping will be provided and a proposal for the second study season capture efforts and methodology.

Final Study Report – to be filed no later than May 12, 2023 – reporting on total number of fish PIT tagged, transported or released on site and a summary of any adult returns from any PIT tagged Bull Trout detected in the Thompson River drainage[14].

7.4 Resource Management Goals

The FWS manage Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015) the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity.

FWP manages and monitors fish populations in Montana. The stated fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population. The 2019 to 2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

[14] Results regarding Bull Trout survival-to-adulthood in Lake Pend Oreille post-transport will not be known until after this study is completed.

7.5 Existing Information and Need for Additional Information

Existing information related to movement of juvenile Bull Trout in the Thompson River drainage most recently includes a graduate study completed in 2017 by Glaid. This work evaluated out-migration characteristics of subadult Bull Trout throughout the drainage to increase the understanding of the local population. PIT tags and acoustic transmitters were employed to track fish outmigration from Fishtrap Creek, West Fork Thompson River, and Thompson River. From July through December 2015, approximately 10 percent of all PIT tagged Bull Trout out-migrated from the Thompson River tributaries, with peak out-migration occurring in late October. Only 13.5 percent of all Bull Trout that entered the Thompson River entered Thompson Falls Reservoir, with peak out-migration occurring in December. Bull Trout demonstrated low out-migration rates in the Thompson River drainage and prolonged habitation of the mainstem Thompson River.

The low outmigration demonstrated in this study and other previous weir and screw trapping efforts (Liermann 2003, Zymonas 2006) illustrate that multiple life history forms exist in the drainage, although they point toward a low adfluvial/fluvial population. Based on recent tagging studies, the percentage of juvenile Bull Trout found to outmigrate from the Thompson River drainage to the Clark Fork River is less than 7 percent (NorthWestern 2019). Furthermore, genetic studies of adult Bull Trout collected below Cabinet Gorge Dam have found Bull Trout in Lake Pend Oreille with genetic markers indicating that the Thompson River is their natal stream. This is evidence that Bull Trout do successfully migrate downstream through the three hydroelectric projects (DeHaan et al. 2011). However, the number of Bull Trout able to complete their life cycle with current passage impediments is small. This study will test the ability to collect juvenile Bull Trout and transport them downstream into more suitable habitat for maturation.

7.6 Nexus Between Project Operation and Effects

Continued operation and maintenance of the Project has the potential to affect adfluvial and fluvial Bull Trout in the Clark Fork River through entrainment and altered river habitat conditions. Transporting juvenile Bull Trout eliminates the need to pass through Thompson Falls Reservoir (and the 2 Avista-operated downstream reservoirs). These reservoirs contain abundant non-native predator fishes and summer water temperatures in excess of thermal optimums for Bull Trout.

7.7 Study Methodology Consistency with Generally Accepted Practice

Proposed methods to monitor movement of Bull Trout are common with the use of PIT tags and associated antenna arrays in tributary systems. These methods have been used in the past within Thompson River and continue to be utilized in Thompson River and other tributaries in the Lower Clark Fork River. This is a relatively non-invasive method to get substantial information on an ESA-listed species. The practice of transporting juvenile salmonids around dams is widespread and has occurred in the Pacific Northwest for decades with salmon and steelhead (National Oceanic and Atmospheric Administration 2019). A similar downstream truck and transport program for Bull Trout is active in the lower Clark Fork River drainage, managed by Avista.

7.8 Level of Effort and Cost

The approximate cost to implement proposed Study #6 – Downstream Transport of Bull Trout is $25,000.

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8. Proposed Study 7 Visitor Use Survey

NorthWestern is proposing to conduct a recreation visitor survey in the Project area from Memorial Day weekend through Labor Day weekend 2021. The data provided by the visitor survey will provide information about recreational use during the peak recreation season.

8.1 Goals and Objectives of Study

The goal of the visitor use survey is to monitor recreational use to help determine whether Project-induced recreation is being adequately accommodated. The study objectives are to collect and update information about use of recreation sites associated with Thompson Falls Reservoir and the Clark Fork River immediately upstream and downstream of the Project.

8.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below (*refer to* Section 1.5) but are repeated here for convenience.

This study plan was modified to include clarification regarding the reasoning for the dates of the study season, in response to questions raised by a Relicensing Participant during the Study Plan Meeting. In addition, the survey has been modified to include a question regarding familiarity with the no-wake zone regulations, in response to a comment from Susan LaMont.

8.3 Study Description

Background

The 2021 visitor use study will replicate previous studies, which will allow trends and patterns in recreation use to be evaluated. Information will be sought regarding:

- Previous use of site (number of years, visits in past year, typical trip duration)
- Current use of site (length of visit, group size)
- Recreation activities at site
- Reasons for visiting site
- Opinions on adequacy of site facilities and/or need for change
- Perceptions of site crowding
- Satisfaction with site and amenities/conditions
- Problems encountered at site, if any
- Awareness of other areas associated with the Thompson Falls Project

- Use of trails and satisfaction
- Familiarity with no-wake zone regulations
- Geographic origin
- Socio-demographic characteristics

Study Area

The 2021 Thompson Falls Visitor Survey will be administered to interview visitors at nine recreation sites associated with the Project (**Table 8-1** and **Figure 8-1**). Six of the sites are managed, entirely or in part, by NorthWestern.

Table 8-1: Visitor Survey sites

Recreation Area	Property Ownership and Managing Entity	Inside FERC Project Boundary?	Surveyed Areas
Island Park	Located on NorthWestern property. Managed by NorthWestern.	Yes.	All areas within park.
Cherry Creek Boat Launch	Located on Sanders County property. Managed by Sanders County.	Partially.	Water access site on south shore of reservoir at Cherry Creek.
South Shore Dispersed Recreation Area	Located on NorthWestern property. Managed by NorthWestern.	Partially.	Undeveloped and informal use area along south shore of the river between High Bridge and the mouth of Prospect Creek.
Wild Goose Landing Park	Located on NorthWestern and city property. Managed by city under management agreement with NorthWestern.	Partially.	All areas within park.
Power Park	Located on NorthWestern property. Managed by NorthWestern.	No.	All areas within park.
Powerhouse Loop Trail	Located on NorthWestern and other private property, and within Highway 200 right-of-way. Managed by Thompson Falls Community Trails Group.	Partially. Part of this trail is within the Project boundary for Avista's Clark Fork River Project, P-2058.	Trail segment from Power Park downstream to Rimrock Lodge.
Sandy Beach (dispersed)	Dispersed beach area located on NorthWestern property adjacent to Powerhouse Loop Trail.	No. This site is within the Project boundary for Avista's Clark Fork River Project, P-2058.	Undeveloped and informal use area downstream of the original powerhouse on the north side of the river.
North Shore Boat Restraint	Located on NorthWestern property. Managed by NorthWestern.	Partially.	Undeveloped and informal use area along shoreline at the north end of boat restraint.

Recreation Area	Property Ownership and Managing Entity	Inside FERC Project Boundary?	Surveyed Areas
North Shore Dispersed Use Area (including former sawmill site)	Dispersed shoreline access partially located on NorthWestern property and within Highway 200 right-of-way, and partially on private property.	Partially.	Undeveloped and informal use area along north shoreline (and Highway 200) between abandoned mill site and Wild Goose Landing Park.

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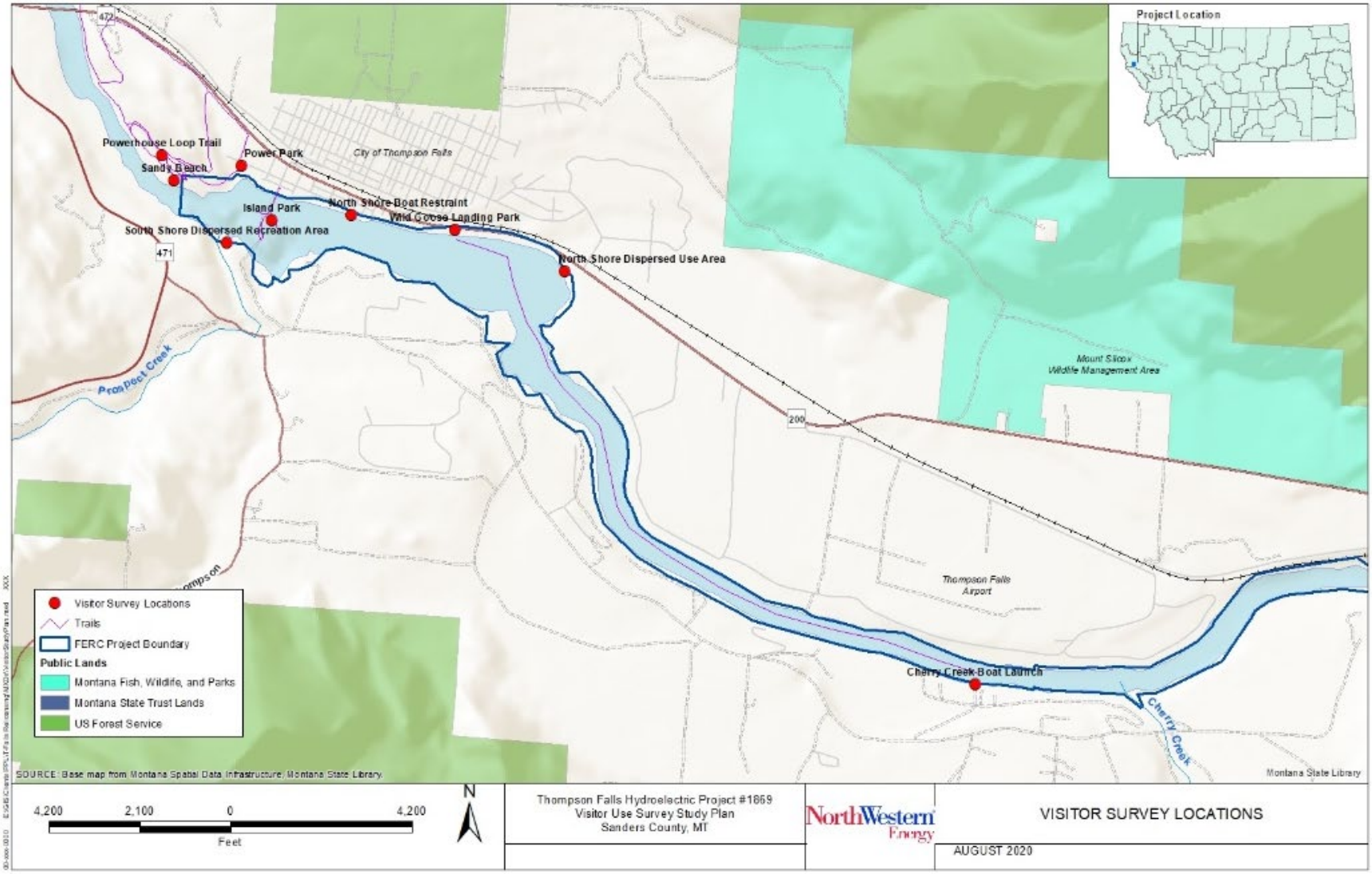
Figure 8-1. Visitor Survey locations.



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Study Methods

The study methodology and questionnaire will largely replicate previous studies conducted at regular intervals (most recently in 1999, 2003, 2008, 2014, and 2018). The methodology was developed in cooperation with the city of Thompson Falls, Sanders County, USFS, and FWP.

Visitor sampling will occur on 60 randomly selected days between the beginning of the Memorial Day weekend through Labor Day, 2021 (May 28–Sep 6), which is the peak recreation season. Each recreation site will be sampled at various times of the day between 8:00 am and 9:00 pm. Systematic random sampling will be used to select locations and times to provide a representative sample of times of the day and days of the week over the course of the 102-day study period. The primary objective of the sampling schedule is to arrive at a sample that is representative of typical recreation use during the study period.

As in past studies, the study timeframe includes the peak recreation season in order to obtain input from recreationists during the time of year that facilities are most widely utilized. Recreation sites host the largest proportion of visitors during the peak recreation season when water conditions and weather conditions are most ideal for recreation activities, and when all facilities are open for public use. Since the floating docks at Wild Goose Landing and Cherry Creek boat launches are installed in the water after spring runoff and then stored out of the water beginning in early fall to prevent ice damage, satisfaction with these facilities can only be gauged during the timeframe when they are installed. Additionally, while boat launches may be utilized outside of the peak recreation season, their functionality does not vary with the season of use; launching in the spring, summer, fall, or winter all carry the same requirement of a submerged ramp. Conducting the visitor survey during the peak recreation season will reveal whether the available facilities are meeting the needs of the recreating public.

During the study timeframe, reasonable attempts will be made to include in the sample one individual from every group of visitors present at the recreation site during the sampling event. A recreation group is defined as any group of individuals, such as family, friends, or tour group visiting the recreation site together. Non-recreationists, such as NorthWestern employees, will be excluded from the sample.

Groups of visitors will be approached by the survey technician on site, briefly informed of the survey's purpose, and asked to participate. The survey respondent will be randomly chosen from the group by selecting the person (aged 16 or older) with the most recent past birthday. If the selected person opts not to participate, the survey technician will choose the person with the next most recent birthday, and so on. If no one in the group agrees to participate in the study, the survey technician will note the group refusal for survey response rate calculation.

In order to limit the amount of participation of any one person or group in the study and aid in acquiring a diverse sample, the same person will only be interviewed once at each recreation site during the study period. In other words, once a person had been interviewed at a site at any time, they will be eliminated from future sampling at that site but could be included again at other sites.

The survey technician will use a tablet computer to administer the survey. The survey questionnaire will be programmed into the tablet and will lead the survey technician through the sequence of questions; visitor responses will be entered directly into the device.

Schedule

Preparatory Work

In April and May 2021, NorthWestern will finalize the survey schedule and conduct the survey technician training. The visitor survey will begin by May 28, 2021.

First Study Season

The visitor survey will be conducted May 28 through September 6, 2021. Data analysis and report preparation will be completed in the fall and winter of 2021 through 2022.

Second Study Season

None, as the study will be completed during the first study season.

Reporting Plan

Results will be included in the Final Study Report which will be filed no later than May 12, 2022.

8.4 Resource Management Goals

Section 4(e) and 10(a) of the Federal Power Act requires FERC to give equal consideration to all uses of the water on which a project is located. When reviewing a proposed action, FERC will consider the environmental, recreational, fish and wildlife, and other non-developmental values of the project, as well as power and developmental values. Documenting visitor satisfaction with available recreation opportunities and amenities, as well as patterns of use of those facilities, will ensure that visitor needs are met under a new License.

The 2020-2024 Montana Statewide Comprehensive Outdoor Recreation Plan (SCORP) identified the need to expand or ensure access to outdoor recreation opportunities for mobility-impaired or otherwise disabled visitors, encouraging participation in outdoor recreation for its physical and mental benefits, and maintaining recreation facilities and infrastructure along with access to public lands and waters as priorities moving ahead. The SCORP also called for initiation of data collection efforts and mapping to increase awareness and evaluate management actions, as well as balancing recreational use of Montana's natural resources with protection of those resources into the future while planning for adaptations driven by factors such as natural climate change.

FWP maintains four Fishing Access Sites between the lower Flathead River and the Clark Fork River down to Thompson Falls. FWP also works with the Forest Service to provide access at many other sites in the broader region through extensive road and trail systems. Water-based recreational access and experiences are an important component of outdoor recreation overall.

8.5 Existing Information and Need for Additional Information

The study will replicate previous studies conducted at regular intervals (in 1999, 2003, 2008, 2014, and 2018). As described in the PAD, recent visitor surveys have shown a high level of satisfaction with the existing recreational facilities. The 2021 visitor use survey is proposed as an update to the 2018 visitor survey, which was conducted to provide current visitor use information for the relicensing process. Unusual environmental conditions existed during the 2018 visitor survey that affected the availability of water-related recreation opportunities and, in turn, reduced on-water and shoreline-based activity participation (boating, fishing and swimming). Repeating the study in 2021 will provide data on more typical patterns of use and visitor opinions.

8.6 Nexus Between Project Operation and Effects

Many public recreation opportunities available and sought after at Thompson Falls are directly related to the existence of Thompson Reservoir and the Clark Fork River upstream and downstream of the Project. Access areas that support shoreline-based uses (swimming, fishing, etc.) as well as on-water launching facilitate public use of the waterway. Key amenities that offer comfort and conveniences (restrooms, picnic facilities, designated trails etc.) contribute to positive visitor experiences. Additional features that demonstrate the link between the resource and the generating capacity of the Project, as well as historical materials and operational information (interpretive panels, fish passage facility viewing platform, etc.) help visitors understand the nexus between the Project, the waterway, and the recreation amenities they enjoy. Monitoring visitor use of and satisfaction with these opportunities and amenities through the visitor survey ensures that information on the public need for various types of access and amenities is available for evaluation in the Final License Application.

8.7 Study Methodology Consistency with Generally Accepted Practice

Visitor use and satisfaction surveys have been conducted regularly at the Thompson Falls Project (most recently in 1999, 2003, 2008, 2014, and 2018) and at other hydroelectric projects throughout the region. Avista Corporation conducts visitor use surveys at recreation sites on Noxon and Cabinet Gorge Reservoirs, immediately downstream of the Thompson Falls Project, at 10-year intervals (most recently in 2012). NorthWestern Energy also conducts visitor use and satisfaction surveys at their Missouri-Madison Project (FERC No. 2188) and Mystic Lake Project (FERC No. 2301) at regular intervals, most recently in 2014 and 2019, respectively. Replicating the Thompson Falls visitor survey in 2021 as it was conducted in previous years will produce current results as well as trend information to determine if use is changing over time.

8.8 Level of Effort and Cost

The approximate cost to implement proposed Study #7 – Visitor Use Survey is $75,000.

9. Proposed Study 8 Cultural Resources Inventory, Evaluation, and Examination of Potential Effects

NorthWestern is proposing to update inventories completed in 1982 and 1986 of H-A&E, and to develop a model to identify the high probability locations of Prehistoric and Historic Archaeological Properties (PAP and HAP) within the Study Area. The latter will be followed by field inventory of identified high probability areas.

9.1 Goals and Objectives

The goal of this study is to provide baseline data in aid of determining Project effects, if any, on archaeological resources and historic buildings and structures eligible for or listed in the National Register of Historic Places (National Register). Objectives in support of this goal are: 1) identification and documentation of H-A&E and PAP and HAP within the Area of Potential Effect (APE); and 2) for those properties that may be affected by the Project, evaluation of their eligibility for listing in the National Register. The resource management goal of all tasks in this study is to provide the baseline data to develop a Historic Properties Management Plan under the new License.

9.2 Changes from PSP

In response to comments and collaboration with the Relicensing Participants, the major revisions from the PSP to this study plan are explained below (*refer to* Section 1.5) above but are repeated here for convenience.

This study was modified to included language that explicitly states the inventory will include inventory and evaluation of all buildings and structures greater than 50 years old, in response to a comment from the SHPO.

9.3 Study Description

The cultural resources study will include two tasks:

- Update the inventories of H-A&E properties
- Develop a high probability model for PAP and HAP, followed by field inventory of all identified high probability areas within the APE

Background

The original inventory of H-A&E properties at the Project was undertaken in 1982 under the sponsorship of the prior Licensee, Montana Power Company (Bowers and Hanchette 1982). Four years later, the Thompson Falls Hydroelectric Dam Historic District was listed in the National

Register as a district within the Thompson Falls Multiple Resource Area (the latter of which includes buildings in the commercial district of Thompson Falls; Koop 1986).

Study Area

The study area for this study is the Project's proposed APE. NorthWestern expects FERC to establish the APE in consultation with Section 106 consulting entities, as part of its review and approval of NorthWestern's Proposed Study Plan. NorthWestern proposes the following definition of the APE:

> The APE for this undertaking includes all lands within the FERC-approved Project boundary. The APE also includes lands or properties outside the Project boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.

In addition to the lands within the Project boundary, the above proposed definition of the APE would encompass lands outside of the Project boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, as informed by research studies conducted by NorthWestern and others.

The proposed APE definition above captures lands and properties directly affected by the Project, such as areas that are subject to ground disturbance, including those areas used for construction and staging areas, as well as the reservoir. The APE also includes lands associated with indirect Project effects, such as areas potentially subjected to the introduction of or changes to visual or audible elements from the Project that may diminish the integrity or character of a nearby historic property.

Methods

Update Inventories of H-A&E Properties: Because 34 years have passed since the listing and several contributing elements to the district have been altered or demolished, NorthWestern proposes to update the 1982/1986 inventory and evaluation of H-A&E properties within the APE. The study will provide information to clarify current National Register status of each element and determine if there are other buildings or structures within the district boundary that are now 50 years or older but were not identified in the original inventory. The re-evaluation will result in an official amendment to the existing National Register listing under the new License.

The update to the inventories of H-A&E properties will be undertaken on-site by a person qualified under the U.S. Secretary of the Interior (SOI) Standards for Professionals in Architectural History or History with experience in the inventory and evaluation of such properties. This study task will re-examine the existing National Register listing and prepare an amendment using the National Park Service's National Register Bulletin 15 (1995). The H-A&E re-inventory will include

examination of both the architectural and engineering elements (including historic equipment systems) within the Thompson Falls Hydroelectric Dam Historic District.

Develop a High Probability Model for PAP and HAP, followed by field inventory of high probability areas within the APE: This will involve determining the locations, types, and importance of currently undocumented PAP and HAP that may exist in the APE. Inventories of PAP and HAP to date have covered 28 percent of the total non-reservoir (dry) lands within the existing Project License boundary. Intensive inventory of some remaining dry land acreage is impractical due to the steep terrain at much of the reservoir edge, annual inundation, and/or the narrowness of parcels. Additionally, inventory of near-shore lands within the current fluctuation zone has not occurred, primarily due to lack of access during brief and unscheduled drawdowns. Consequently, NorthWestern proposes to develop an archaeological model to identify high PAP and HAP probability areas within the APE that are on uninventoried dry land and near-shore land that is most sensitive to reservoir fluctuation. The model will rely heavily on properties (location, type, landform, and distance to surface water) of known PAP and HAP in the Project vicinity (defined as within 0.5-mile of the Project boundary). Following its development and review, those high probability areas that may be subject to Project effects will be inventoried.

The development and application of a model to identify high probability areas for PAP or HAP will be undertaken by an individual qualified under the SOI's Standards for Professionals in Archaeology. The model will integrate existing data on the locations and nature of these types of properties in and adjacent to the Project, as well as other relevant reports on prehistoric and historic preferences for occupation areas in the Clark Fork River valley and across northwest Montana. It will consider such environmental factors as slope, distance to major tributaries of the Clark Fork, recent sedimentation, erosivity potential, and historic and modern changes to local topography. Previous research in at least two Montana reservoir settings has shown that PAP and HAP located below the high-water line lack cultural stratigraphy and exhibit artifact displacement (Dickerson 2009; Dickerson 2010). Therefore, the model will cover dry lands and those that are near shore in the fluctuation zone only.

Prior to completion of the draft model, a field test will be conducted to gauge its accuracy. A sample of high and low probability areas (up to 3% of total dry and near shore land within the APE) will be examined where impacts attributable to Project operations are most likely to occur. The results will be used to further refine the model, if necessary. Upon completion of the final draft model, it will be distributed for 30-day review by the SHPO, Lolo National Forest cultural resource staff, Native American Tribes and Nations, and Montana Department of Natural Resources and Conservation cultural resource staff.

Once all parties agree on the strategy to be employed, a person or persons qualified under the SOI Standards for Professionals in Archaeology will undertake an on-site inventory of NorthWestern-owned and public lands in the APE. Privately-owned land will be included in the inventory when explicit permission is given. This inventory will be limited to pedestrian inspection of high probability areas. Standard archaeological procedures for work in Montana, as stipulated in the

SHPO's "Guidelines and Procedures," will be employed, as they apply. These cover such protocols as pedestrian transect spacing, GPS mapping, feature and artifact photography, and site form completion (SHPO 2020).

Schedule

Preparatory Work

None is anticipated.

First Study Season

The first task, updating the inventories of H-A&E properties at the Project, will be completed in 2021, with the preparation of the National Register document amendment beginning in the fall. This entire task will be completed in early 2022 and reported fully in the Initial Study Report (**Table 9-1**).

The second task will be initiated with development and refinement of the high PAP and HAP probability model. The draft final model will be submitted to reviewers by October 1, 2021. It is expected that review comments will be incorporated, as necessary, by December 1, 2021.

Second Study Season

The subsequent inventory of PAP and HAP based on the high probability model will be initiated and completed in summer 2022 and fully reported in the 2023 Final Study Report.

Table 9-1: Summary of Study Schedule.

Timing	Activity
May 2021–February 2022	Update inventories of H-A&E properties
May–Sept 2021	Develop and refine high PAP and HAP probability model and submit to reviewers
Oct 1, 2021–Oct 31, 2021	Review period for high probability model
Dec 1, 2021	Model updated to incorporate review comments
May 12, 2022	Initial Study Report
Summer 2022	Inventory of PAP and HAP
May 12, 2023	Final Study Report

Reporting Plan

The Initial Study Report detailing cultural work conducted in 2021 and study results to date will be filed no later than May 12, 2022. For the updates to the existing inventories of H-A&E properties, the report will be in the form of a National Register form amendment to be submitted to the SHPO and forwarded to the National Register. For the inventory of PAP and HAP, narrative

in the Initial Study Report will explain the archaeological model, any received reviewer comments, and responses and modifications (*refer to* **Table 9-1**).

The Final Study Report will incorporate the results of the inventory phase of the PAP and HAP identification task. This report will be prepared in accordance with the SHPO's "Guidelines and Procedures" (SHPO 2020) and filed no later than May 12, 2023.

9.4 Resource Management Goals

FERC must comply with Section 106 of the National Historic Preservation Act, as amended, which requires it to take into account the effect of issuing a new License on historic properties. Additionally, the Lolo National Forest Plan identifies the need for cultural resource inventories and avoidance on Forest lands where disturbance is anticipated (Lolo National Forest 1986:II-20). Finally, the SHPO in its 2018-2022 State Plan encourages survey of uninventoried public and private properties where they may be at risk (SHPO 2017).

9.5 Existing Information and Need for Additional Information

As noted above, the National Register listing of H-A&E properties at the Project (within the Thompson Falls Hydroelectric Dam Historic District) needs to be amended to reflect current integrity and condition. Previous inventories for PAP and HAP covered 28 percent of the Project's dry lands and do not include all areas of high probability within the APE. Additional inventory work is required to ensure that Project effects on National Register-eligible PAP and HAP are routinely considered during the term of the new License.

9.6 Nexus Between Project Operation and Effects

The H-A&E and PAP and HAPs to be addressed in this study may be affected by Project operations and/or actions associated with the implementation of the License. These include (but are not necessarily limited to) alterations or changes to the elements of H-A&E properties in the Thompson Falls Hydroelectric Dam Historic District and to PAP and HAP during proposed recreation, land use, or other resource developments or actions. Effects can be either direct or indirect, in accordance with regulations of the Advisory Council on Historic Preservation (36 CFR Part 800). These studies will provide data necessary for compliance with Section 106 of the National Historic Preservation Act. They will guide development of a future Historic Properties Management Plan.

9.7 Study Methodology Consistency with Generally Accepted Practice

Study methods for all tasks will comply with professional methods and practices, consistent with the Secretary of the Interior's Standards and those outlined by the Montana SHPO (2020), USFS (2008), and Montana Department of Natural Resources and Conservation (Rennie 2013).

9.8 Level of Effort and Cost

The approximate cost to implement proposed Study #8 – Cultural Resources Inventory, Evaluation, and Examination of Potential Effects is $84,000.

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10. Proposed Study 9 Westslope Cutthroat Trout Genetics Study

Westslope Cutthroat Trout (*Oncorhynchus clarki*) are a salmonid native to the Clark Fork River drainage and are designated as a sensitive species by the USFS and as a Species of Special Concern by the state of Montana. These state and federal designations are due to the species being at risk because of limited or potentially declining population numbers and reduced range and/or habitat, making them vulnerable to extirpation in the state. Since 2011 the Thompson Falls fish passage facility has been capturing and passing 14 to 48 Westslope Cutthroat Trout per year that were phenotypically identified as Westslope Cutthroat Trout. One of the threats to Westslope Cutthroat Trout is hybridization with introduced Rainbow Trout (*Oncorhynchus mykiss*). Ensuring that fisheries personnel are correctly identifying and classifying these species is important for future management decisions related to fish passage facility operations.

10.1 Goals and Objectives of Study

The goal of the proposed study is to characterize the amount of hybridization in visually identified Westslope Cutthroat Trout and Westslope Cutthroat x Rainbow Trout hybrids that are captured at the Thompson Falls fish passage facility.

Objectives:

1) Utilize a standard approach of phenotypic characteristics to visually identify Westslope Cutthroat Trout and hybrids that are captured at the fish passage facility.
2) Take a genetic sample (fin clip) from all Westslope Cutthroat Trout and hybrids that are visually identified and recorded at the fish passage facility work station to determine the level of genetic purity or hybridization of individuals ascending at the fish passage facility.

10.2 Changes from PSP

FWP requested an additional study of Westslope Cutthroat Trout genetics in their comment letter dated March 10, 2021. NorthWestern has declined to adopt this study request, for reasons described in Section 12.3.

This study plan has not been materially modified from the PSP.

10.3 Study Description

Background

Westslope Cutthroat Trout are native to the Clark Fork River drainage in western Montana and are a recreationally important and highly sought-after sportfish species. Historically, migratory life

history forms (fluvial- riverine; adfluvial-lake dwelling) used the Clark Fork River-Lake Pend Oreille system both as a migratory corridor as well as foraging, maturation and overwintering habitat; and were observed to be abundant in many tributaries to the lower Clark Fork River in Montana (Pratt and Huston 1993). The construction of three mainstem dams on the lower Clark Fork River (Thompson Falls in 1915, Cabinet Gorge in 1952, and Noxon in 1958) fragmented the river-lake ecosystem for migratory Westslope Cutthroat Trout. Beginning in 2011, the Thompson Falls fish passage facility commenced operations to seasonally improve upstream connectivity. Over the last 10 years just over 2,000 Westslope Cutthroat Trout, hybrids, and Rainbow Trout ascended the fish passage facility and were released upstream of the dam, as directed by FWP.

FWP fish population estimates in the mainstem Clark Fork River near Superior, Montana show between 237 and 303 Rainbow Trout per mile (FWP, unpublished file data, 2020) while catchable Westslope Cutthroat Trout numbers are generally too low to estimate (Berg, 1989). Rainbow Trout and their hybrids generally make up 70 to 80 percent of the trout population within the middle Clark Fork River reach (FWP 2019b). Westslope Cutthroat Trout are present in moderate numbers and throughout all reaches of the middle Clark Fork River drainage (FWP 2019b). The quantity of introgression of the Westslope Cutthroat Trout that utilize the fish passage facility is currently unknown.

Study Area

The study area is the fish passage facility work station, where fish ascending the fish passage facility are worked up prior to release upstream (*see* **Figure 6-1**, the yellow pin shows the location of the Main Channel Dam, with the pin location at the fish passage facility.)

Methods

To address a standard approach to identifying Westslope Cutthroat Trout a guide will be developed using phenotypic characteristics that include slash intensity, body spotting, anal fin spotting, head spotting, and body colorations. Additional visual aids of pure and hybrid fish will be available for reference as well. Work by others in the region have shown preliminary success in this approach and techniques would be adapted from that approach (Personal communications, C. Barfoot, Confederated Salish and Kootenai Tribes (CSKT); S. Bernal, Avista; and R. Kreiner, FWP). The standardized approach will be used by those operating the fish passage facility to consistently make identification determinations.

All Westslope Cutthroat Trout and hybrids captured at the fish passage facility will have a small fin clip taken and preserved in alcohol. Upon closing the fish passage facility in the fall these will be sent to the Conservation Genetics Lab at the University of Montana. Genetic analysis will follow standard lab protocols and a summary report from the lab will be provided to FWP and NorthWestern.

Schedule

Preparatory Work

NorthWestern proposes to take genetic samples from Westslope Cutthroat Trout and hybrids during the 2021 operating season. This sampling began when the fish passage facility was opened in March.

First Study Season

NorthWestern proposes to take genetic samples from Westslope Cutthroat Trout and hybrids throughout the 2021 operating season (March–October). Upon closing the fish passage facility in October, the samples will be sent to the Conservation Genetics Lab at the University of Montana for analysis. A summary report from the lab would be received by early spring 2022 and provided in the May 2022 Final Study Report.

Second Study Season

None, as this study will be completed during the first study season.

Reporting Plan

The Final Study Report will be filed by May 12, 2022. The report will include results from the genetic analysis for each fish and also a review of the accuracy of the phenotypic identification determinations.

10.4 Resource Management Goals

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River drainage is to monitor the Westslope Cutthroat Trout population. The 2019 to 2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility.

In 2007 a Memorandum of Understanding (MOU) and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana was signed by state, federal, and tribal agencies that was developed to expedite implementation of conservation measures for Cutthroat Trout. This agreement serves to document Montana's efforts as part of coordinated multi-state, range wide efforts to conserve Cutthroat Trout.

10.5 Existing Information and Need for Additional Information

Minimal information exists on the genetic purity of Westslope Cutthroat Trout that are captured in the fish passage facility. From 2011 to 2019, Westslope Cutthroat Trout and hybrids were phenotypically identified by different biologists or fishery technicians without a consistent identification protocol. Genetic samples were not taken during this timeframe.

During 2020 fish passage facility operations a genetic sample was taken from all fish identified as Westslope Cutthroat Trout. Twenty-three samples were collected and have been sent to the Conservation Genetics Lab at the University of Montana and are pending analysis. A larger sample size is needed to better characterize the genetic composition of *Oncorhynchus* sp. that are captured in the fish passage facility.

10.6 Nexus Between Project Operation and Effects

Continued operation and maintenance of the fish passage facility has the potential to affect migratory Westslope Cutthroat Trout in the Clark Fork River. Correctly identifying genetically pure Westslope Cutthroat Trout or fish introgressed with Rainbow Trout and better understanding the mainstem population could be useful for future management decisions.

10.7 Study Methodology Consistency with Generally Accepted Practice

Collecting genetic samples to determine hybridization levels is a common action for *Oncorhynchu*s sp. Although no peer reviewed, published papers were found during a literature search on phenotypic Westslope Cutthroat Trout traits and genetic purity, a number of local fish biologists are utilizing the approach described in this study.

10.8 Level of Effort and Cost

The approximate cost to implement this study is $1,500.

11. Proposed Study 10 Updated Literature Review of Downstream Fish Passage

Bull Trout were federally listed as a threatened species under the ESA in 1998. The prior Licensee prepared a Biological Evaluation in 2003 and concluded that the Project was likely adversely affecting Bull Trout. As part of the subsequent ESA consultation, FWS requested the Licensee address downstream fish passage risk at the Project. In 2007, the Licensee prepared a Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project (GEI, 2007) (Literature Review). The Literature Review is available for download at:

https://northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls-other-reference-material/thompson_falls_literature_review_of_downstream_fish_passage_issues_2007.pdf

The Literature Review included specific consideration of federally listed Bull Trout and Westslope Cutthroat Trout, a sensitive species and Montana Species of Special Concern (GEI, 2007). NorthWestern is proposing to prepare an addendum to the Literature Review, in response to comments from FWP.

11.1 Goals and Objectives of Study

The proposed addendum will review information in the scientific literature published since 2007, as requested by FWP in their letter dated March 10, 2021 (Appendix A). FWP stated they were looking for, "more resolution of survival of different fish sizes, any turbine or generator upgrades after 2007, spillway changes with the new radial gates, and operational changes that may be more relevant to current and foreseeable future conditions." Although not all of these changed circumstances occurred at the Project, the addendum will provide updates, as available, to estimates of downstream passage survival of various size classes of fish, with respect to current Project configuration and operations.

11.2 Changes from PSP

This study was not included in the PSP. It has been added in response to a comment from FWP.

11.3 Study Description

Background

At the Thompson Falls Project, when water is spilling over or through the dams, fish can migrate downstream *via* the spillways, outlet works, or through the turbines. During non-spill periods, the primary means of downstream passage is through the turbines. Studies done on anadromous fishes have generally indicated that passage *via* spill poses less risk than *via* turbine (Muir et al. 2001).

Fish mortality is typically 0 to 2 percent for standard spill bays and 5 to 15 percent for turbine passage, with Kaplan turbines generally at the lower end of this mortality range and Francis turbines generally greater (Whitney et al. 1997). However, mortality at a specific facility can vary depending on the specific configuration of the turbines and spillways and type and timing of fish being passed.

Study Area

Downstream fish migration can occur at four locations at the Project, which defines the study area. The four locations include the two spillways (the Main Dam and the Dry Channel Dam) and the two powerhouses (original and new [completed in 1995]) (*refer to* **Figure 6-1**).

Methods

The addendum to the 2007 literature review (GEI, 2007) will focus on downstream fish passage literature published since 2007. The scientific literature on downstream fish passage will be screened for relevance for species and size classes of fish and turbine configurations found in the Project area. Survival studies conducted at similar hydroelectric facilities with similar turbine types and hydraulic capacities will be examined and discussed to estimate fish survival through the turbines at the Project. The addendum will also include an update on current Project operations and configuration.

Schedule

Preparatory Work

None is anticipated.

First Study Season

The addendum will be developed during the first study season with a report prepared and filed with FERC by May 12, 2022.

Second Study Season

None, as this study will be completed during the first study season.

Reporting Plan

The Final Study Report will be filed by May 12, 2022.

11.4 Resource Management Goals

Section 4(e) and 10(a) of the Federal Power Act require FERC to consider multiple public uses and give equal consideration to all uses of the water on which a project is located. When reviewing a proposed action, FERC will consider the environmental, recreational, fish and wildlife, and other

non-developmental values of the project, as well as power and developmental values. This study will provide information on the potential impacts of Project operations on fisheries. This information will assist the Licensee in development of a License Application which balances both developmental and non-developmental aspects of the Project.

The FWS manage Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015) the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity.

FWP manages and monitors fish populations in Montana. The stated fisheries management direction for the Lower Clark Fork River Drainage is to conserve Bull Trout and monitor distribution and status of all other species.

11.5 Existing Information and Need for Additional Information

2007 Literature Review – Downstream Fish Passage Survival Estimates

The Literature Review (GEI 2007) calculated overall survival for downstream trout passage through the Project based on the following assumptions:

- Spillway effectiveness is 1:1 so fish will pass the Project in numbers proportional to flow. That is, if 50% of the flow is through the spillway then 50% of the fish will pass over the spillway
- Fish will also pass the two powerhouses in proportion to flow
- Survival estimates are: Kaplan turbine (Unit 7 in new powerhouse) 94%, Francis turbines (Units 1-6 in original powerhouse) 85%, and Spillway 98%

The Literature Review concluded that, based on combined survival estimates for passage through the Francis turbines, the Kaplan turbine, and the spillway, the average downstream passage survival at the Project for trout measuring greater than 100 mm is likely 91 to 94 percent. The BO issued by the FWS October 28, 2008 concurred with the survival estimate in the Literature Review. The BO included Term and Condition #2 for downstream passage which stated that the Licensee would provide annual funding to the TAC to conduct offsite habitat restoration or acquisition in important Bull Trout spawning and rearing tributaries. The purpose of the offsite habitat restoration or acquisition is to boost juvenile Bull Trout recruitment. The BA explicitly states that the funding was to partially mitigate for incidental take of Bull Trout caused by downstream passage through the turbines and spillways.

Downstream Passage Mitigation Activities at the Project

In 2008, the Licensee signed a MOU with FWP, FWS, and the CSKT. That MOU included provisions for the Licensee to establish an Adaptive Management Funding Account (AMFA) for the implementation of downstream passage minimization measures approved by the TAC that meet the requirements of the BO. The MOU was renewed in 2013 and 2021 and is effective

through the term of the License (2025). The Licensee has funded the AMFA with $100,000 annually since the original MOU was signed in 2008. AMFA projects must benefit Bull Trout recruitment in tributaries upstream of the Thompson Falls Project or in Prospect Creek. Projects to be funded are approved by a vote of the TAC. The Thompson Falls Fish Passage Annual Reports include a summary of new projects proposed for funding, and a report on projects funded in prior years.

Documentation of Downstream Passage at the Project

NorthWestern has documented downstream fish movement through the Project since the construction and operation of the upstream fish passage facility commenced in 2011. Salmonids, and some non-salmonids, passed upstream are tagged with a PIT tag. Subsequent recaptures of tagged fish have demonstrated that adult salmonids can survive downstream passage at the Project. From 2011 to 2018, PIT-tag data collected at the fish passage facility 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 fish passage facility a second, third, fourth, or sixth time. 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 (NorthWestern 2019). Additionally, about 6.5 percent of the 1,107 Smallmouth Bass Floy-tagged ascended the fish passage facility two or more times with two fish ascending the fish passage facility three times, one fish ascending the fish passage facility four times, and one fish ascending the fish passage facility five times (NorthWestern 2018).

On an annual basis, an average of 8 percent (between 3 and 13.5%) of the salmonids PIT-tagged in a given year, return to the fish passage facility the following year. For example, in 2019, there were 543 PIT-tagged fish (341 salmonids; 202 non-salmonids) released upstream of the fish passage facility and 8 percent of the salmonids (18 Rainbow Trout; 9 Brown Trout; 1 Mountain Whitefish) and 6 percent of the non-salmonids (10 Northern Pikeminnow, 2 Largescale Sucker) returned to the fish passage facility in 2020 (NorthWestern unpublished data).

PIT tagged adult and juvenile Bull Trout have been detected in tributaries both upstream and downstream of the Project (NorthWestern 2019; 2019a), also indicating that they have survived downstream passage through the Project.

Determining whether a fish moved downstream over the spillway or through the turbines depends on streamflow conditions. The combined capacity of the seven generating units at the Project is approximately 23,000 cfs. When river inflows exceed this capacity, 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 turbines. When streamflows are above 23,000 cfs, fish can pass downstream through the turbines or over the spillway. Data indicate Rainbow and Brown trout, as well Largescale Sucker have survived migrating downstream through the turbines. Additional detection data collected from 10 years of fish passage facility operations indicate Bull Trout, Rainbow Trout, Westslope Cutthroat Trout, Rainbow hybrids, Brown Trout, Northern

Pikeminnow, Largescale Sucker, and Smallmouth Bass have all successfully migrated downstream of Thompson Falls Dam, either through the turbines or over the spillway.

While it is not possible using PIT tag data to directly quantify downstream passage survival at the Thompson Falls Project, the available data demonstrate that fish are successfully passing both upstream and downstream of the Project, and that some fish make the loop multiple times over the years. This study to update the Literature Review will inform the relicensing of any new scientific data on downstream fish passage efficiency at hydropower facilities.

11.6 Nexus Between Project Operation and Effects

Continued operation and maintenance of the Project has the potential to affect downstream migratory fish in the Clark Fork River.

11.7 Study Methodology Consistency with Generally Accepted Practice

This is a generally accepted approach to the evaluation of downstream fish passage at hydroelectric projects, which has been employed at FERC-licensed projects around the U.S.

11.8 Level of Effort and Cost

The approximate cost to implement proposed Study #10 – Updated Literature Review of Downstream Passages study is $13,000.

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12. Study Requests Received

Under FERC's ILP regulations at 18 CFR § 5.12, comments on NorthWestern's PSP, including any revised information or study requests, were due within 90 days after the PSP was filed, which was March 11, 2021. The regulations require this filing include an explanation of any study plan concerns and any accommodations reached with the applicant regarding those concerns. Any proposed modifications to the applicant's PSP must address the criteria in 18 CFR § 5.9(b).

In March 2021 comment letters, USFS and FWP each requested two studies, for a total of four study requests received (**Table 12-1**). The study requests and NorthWestern's responses are described below.

Table 12-1: Summary of Studies requested by USFS and FWP

Study Request Agency and Number	Study Requests	Adopted in Whole or In Part	Studies Not Adopted
USFS Study #1	Fluid Dynamic Effects on Fisheries Movement Behavior at Thompson Falls Dam	X	
USFS Study #2	Fish Study with a PIT Array on St. Regis River		X
FWP Study #1	Distribution and Genetic Status of Westslope Cutthroat Trout		X
FWP Study #2	Heavy Metals and Organic Compounds Assessment of Fish in Thompson Falls Reservoir		X

12.1 USFS Study #1 – Fluid Dynamic Effects on Fisheries Movement Behavior at Thompson Falls Dam

USFS requested a study of hydraulic conditions and fish movement in the Clark Fork River. This study request was initially requested by the USFS in its October 2020 study requests, and subsequently revised and included in its March 2021 comments on the PSP. NorthWestern is adopting portions of the USFS Study Request #1 relating to hydraulic conditions and fish behavior downstream of the Main Channel Dam as part of Study #4 – Hydraulic Conditions, which is a hydraulics study to characterize a depth-averaged velocity field and water depths between the Main Channel Dam and the High Bridge, and Study #5 – Fish Behavior, which is a radio telemetry study of salmonids to evaluate movement rates and behavior in response to hydraulic conditions from downstream of the powerhouses to the Main Channel Dam.

Except for the reservoir area immediately upstream of the Main Channel Dam (within approximately 100 feet) which will be included in the modeling, in order to accurately depict model boundary conditions during spill, NorthWestern is not proposing to adopt USFS's request to conduct hydraulic modeling in the reservoir. The reason is this component of USFS Study #1

lacks any nexus to Project operations and would not yield information to inform the development of License conditions as required by 18 CFR § 5.9(b)(5). Even during high flow periods, there are no velocity barriers in Thompson Falls Reservoir and the reservoir is easily passable by upstream migrating fish. The previous Licensee monitored fish moving upstream of the dams as part of a telemetry study in 2001 and 2002. A total of 21 fish were captured in the spring 2001 (13 Westslope Cutthroat, 6 Rainbow Trout, 2 Bull Trout) and monitored into fall 2002. No impediments to movement through Thompson Falls Reservoir were noted. Bull Trout moved an average of 16.5 miles upstream and were detected in Thompson River. The Rainbow Trout moved an average of 36 miles (range 2-57 miles) upstream and were detected in the Flathead River and tributary, Jocko River; the Thompson River; and middle Clark Fork River. Westslope Cutthroat Trout moved an average of 30 miles (range 0.1-82 miles) upstream and were documented in the St. Regis River, Cedar Creek, Combest Creek, Cherry Creek, and the Thompson River and tributary, Fishtrap Creek (Gillin and Pizzimenti, 2003).

More recent information is also available on the speed in which Brown, Bull, and Rainbow trout move through the reservoir based on PIT tagging. Fish have been recorded moving upstream 6 miles from Thompson Falls Dam to the Thompson River in 5.5 hours, and generally move into the Thompson River within 1 to 5 days following an individual's release upstream of the dam (NorthWestern 2019). In addition, angler tag returns indicate that fish passed upstream at Thompson Falls Dam migrate upstream long distances and disperse widely (**Figure 12-1**)

NorthWestern is also not proposing to model thermoclines or water density as proposed in USFS Study #1 because existing data indicates that Thompson Falls Reservoir does not stratify (*refer to* Section 4.9.2 of the PAD). The Clark Fork River downstream of the dams is sufficiently turbulent that thermal stratification does not occur. This component of USFS Study #1, therefore, does not meet either study criterion 4 or 5 under the Commission's regulations. 18 CFR 5.9(b)(4), (5).

NorthWestern is proposing to use radio telemetry technology in Study #5 – Fish Behavior, rather than Vemco VR2W Positioning System technology (acoustic technology) as suggested by the USFS. Radio telemetry is preferred in shallow, freshwater environments, where radio signals are capable of traveling greater distances (DeCelles and Zemeckis 2014). In addition, radio tags can be monitored with stationary receivers mounted on land. Acoustic receivers would be at risk of being lost in the high velocity, highly turbulent conditions found during high flows in areas downstream of the Thompson Falls dams.

The USFS study request includes comments and questions regarding in-ladder fish passage efficiency. Existing information which addresses those questions can be found in NorthWestern (2019), the Comprehensive Phase 2 Final Fish Passage Report, and 2020 Annual Report (NorthWestern 2021). The Phase 2 report is available on NorthWestern's Thompson Falls Project webpage: https://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls-other-reference-material/2020comprehensivefishladderreport.pdf.

As described in Section 3.3.4 of that report, orifice mode has been found to maximize passage for native species. NorthWestern is not proposing additional studies of the ladder operational mode. NorthWestern installed a remote PIT tag antenna at the two entrances of the fish passage facility in March 2021. These new remote arrays are operational and information collected will promote a better understanding of fish movement within the ladder and will be included in the next Annual Report, as described in Section 6.3. Thus, these components of USFS Study #1 do not meet study criterion 4. 18 CFR § 5.9(b)(4).

12.2 USFS Study #2 – Fish Study with PIT Array on the St. Regis River

This study request was initially requested by the USFS in its October 2020 study requests, and subsequently revised and included in its March 2021 comments on the PSP. USFS Study #2 requests that NorthWestern install a PIT tag antenna array in the St. Regis River. NorthWestern is not adopting USFS Study #2 based on existing information, lack of nexus to the Project, focus on mitigation measures, technical challenges in implementing the study, and the cost of such a study. 18 CFR § 5.9(b)(4), (5), (6), (7).

The USFS suggests that the Project nexus for this study is to provide a scientific basis for prioritizing TAC mitigation proposals, including bypass flow, habitat improvement, or other mitigation measures. NorthWestern does not believe a study is necessary for this purpose or that the results of the study would inform mitigation, as required by study criterion 5. 18 CFR §5.9(b)(5). It is well established that salmonids passed upstream at Thompson Falls occasionally migrate long distances upstream, including to the St. Regis River. As shown in **Figure 12-1**, salmonids PIT and floy tagged at the upstream fish passage facility and released upstream have been found to range over a wide area. To date, no Bull Trout passed at the Thompson Falls fish passage facility, have been found to migrate into the St. Regis River, but studies of Westslope Cutthroat Trout radio tagged downstream of Thompson Falls Dam and released upstream were found to have moved into the St. Regis River (Gillin and Pizzimenti, 2003; PPL Montana, 2008)

The establishment of a PIT antenna array at the mouth of the St. Regis River will not provide information that has not already been established through previous studies, and, as such, USFS Study #2 does not meet study criterion 4. 18 CFR §5.9(b)(4). Further, once fish are passed at the Thompson Falls facility and traverse through the reservoir, NorthWestern has no operational ability to influence how or where fish travel, let alone to a tributary more than 60 miles upstream. NorthWestern cannot foresee how data from this study would inform a mitigation measure related to bypass flow. Habitat improvement projects in the St. Regis River are currently eligible to receive funding through the Thompson Falls AMFA account. Therefore, this information would not inform the development of License requirements, as required by study criterion 5. 18 CFR §5.9(b)(5).

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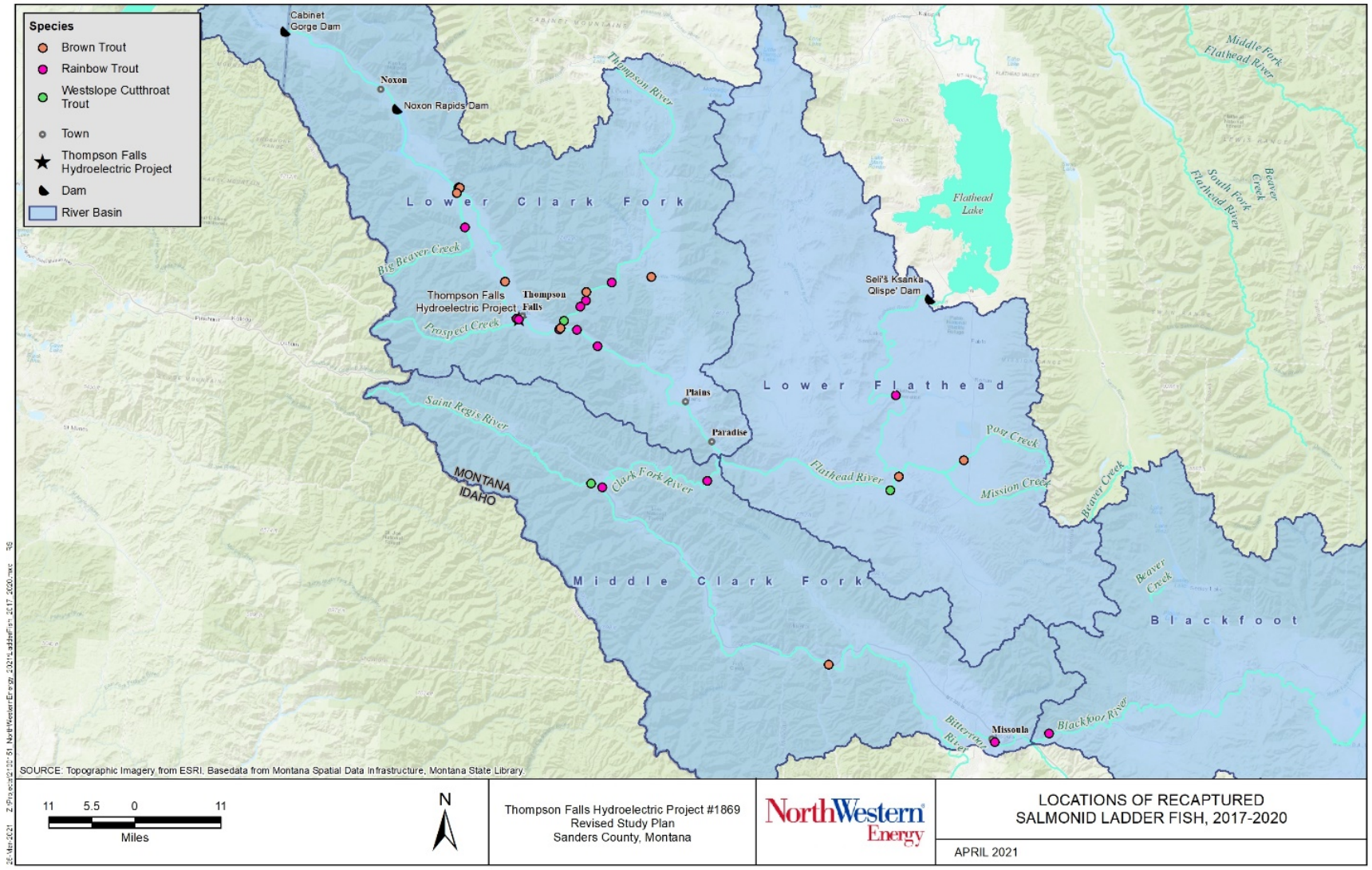
Figure 12-1: Locations of salmonids recaptured after release upstream of the Thompson Falls Fish Passage Facility.



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Further, there are significant technical challenges to implementing the proposed study. It may not be feasible to install, maintain, and operate an effective PIT tag antenna array in a river as hydrologically dynamic as the St Regis River. Flows in the St. Regis river vary annually from around 60 CFS to over 2,500 CFS (USGS 12354000 St. Regis River near St. Regis, MT). Additionally, the cost of this study is significantly underestimated. NorthWestern experience managing the existing PIT tag arrays at the Project is that the cost of the proposed PIT tag antenna array hardware would be well over $50,000. Labor costs to site the facility, install the equipment, maintain the site, and process the data are far in excess of the 16 hours estimated by the USFS. Installation of the site alone is estimated to take four people approximately 40 hours to mount the antennas into the river bed, and wire and mount the data logger and controls. Based on experience with PIT antenna systems in the Thompson River, these sites take approximately 4 to 8 hours per week to maintain, download and process data. Such an expenditure is not justified, especially since existing data has already documented several species of fish that pass through the fish passage facility migrate long distances upstream. For these reasons, USFS Study #2 does not meet criteria 6 or 7. 18 CFR § 5.9(b)(6), (7).

Notably, on p. 13 of SD2, FERC states, "Response: We have added the confluence of where the Thompson River flows into Thompson Falls Reservoir and the confluence of where Prospect Creek flows into the bypassed reach to the scope of aquatic resource issues in Section 4.1.3 of SD2. Assessing water levels, water quality, and aquatic habitat upstream of the confluences is unrelated to Project effects, speculative, and beyond the scope of the environmental analysis."

For all of these reasons, NorthWestern is not adopting this study as the cost is not justified, the study does not have a nexus to the Project, and the data collected would not inform future License conditions. Thus, USFS Study #2 does meet several ILP study criteria and should not be approved by the Commission in its study plan determination.

12.3 FWP Study #1 – Distributional and Genetic Status of Westslope Cutthroat Trout

This study request was initially requested by FWP in its October 2020 study requests, and subsequently revised and included in its March 2021 comments on the PSP. FWP Study #1 is focused on identifying the distributional extent of Westslope Cutthroat Trout in Prospect Creek, the Thompson River, and tributaries to the Clark Fork River between the Project and the Flathead River for protection, mitigation, and enhancement (PM&E) prioritization purposes. The study would entail collecting 730 genetic samples of Westslope Cutthroat trout from 24 stream reaches. FWP proposes to prepare a report that would include updated distributional information on Westslope Cutthroat Trout and their non-native competitors and prioritize PM&E measures at the stream or reach level.

NorthWestern is not adopting FWP Study Request #1. NorthWestern is proposing to study Westslope Cutthroat Trout genetics, as described in Study #9 – Westslope Cutthroat Trout Genetics. This study is limited to an analysis of the genetics of *Oncorhynchus* sp. collected at the

fish passage facility. Currently, NorthWestern and FWP identify the *Oncorhynchus* sp. collected at the fish passage facility using visual identification. In order to confirm the accuracy of the visual identification, NorthWestern began collecting genetic samples of Westslope Cutthroat Trout collected at the Thompson Falls fish passage facility in 2020. NorthWestern proposes to continue this activity as described in Study #9 – Westslope Cutthroat Trout Genetics. This study will provide information on the specific species mix and genetic composition of the *Oncorhynchu*s sp. passed at the fish passage facility to provide information to FWP for fisheries management decisions regarding passage at Thompson Falls.

While NorthWestern is proposing to collect *Oncorhynchus* sp. genetic data at the Project site, NorthWestern is not proposing to collect genetic information in tributaries upstream and downstream of the Project for the following reasons:

First, FWP states that the Project nexus is that the number of Westslope Cutthroat passed in contemporary times is a small fraction of the fish that used the river and its tributaries historically, and that the low numbers are due, in part, to over 100 years of life history suppression from the impoundment of the river. NorthWestern disagrees that this meets the definition of nexus to the Project. Current conditions, not historical, is the appropriate baseline for relicensing studies, as described in FERC's SD 2, "existing operation is the baseline against which any proposed measures will be evaluated" (FERC, 2020). *See Am. Rivers v. FERC*, 187 F.3d 1007, *reh'g denied*, 201 F.3d 1186 (9th Cir., 1999); *Conservation Law Found. v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

FWP acknowledges current conditions in its statement, "it is very likely that the dam continues to suppress the migratory life history of the species." However, FWP provides no evidence to support this claim. To the contrary, as supported in findings by the Scientific Panel, conclusions regarding passage efficiency cannot reasonably be made, until NorthWestern concludes Study #4 – Hydraulic Conditions and Study #5 – Fish Behavior. The Hydraulic Conditions and Fish Behavior studies will address these assumptions FWP states in its Study Request #1, and also the concerns about passage efficiency at differing flows (*see* Appendix A Response to Comments, FWP Comment #7).

Further, FWP's goes on to say, "that the number of fish passed at the upstream fish passage facility is inefficient during much of the spring hydrograph". This is also not a valid assumption and is not supported by evidence. During radio telemetry studies conducted during upstream fish passage planning, the number of fish found in areas downstream of the Main Channel Dam and natural falls were found to decrease during high flows (GEI, 2007b). The river reach downstream of the spillways has a high gradient, and at high flows is a highly turbulent environment (**Figures 12-2** and **12-3**).

Figure 12-2: Photographs of the Clark Fork River downstream of the Main Channel Dam at high flow (between 68,400 and 76,450 cfs)


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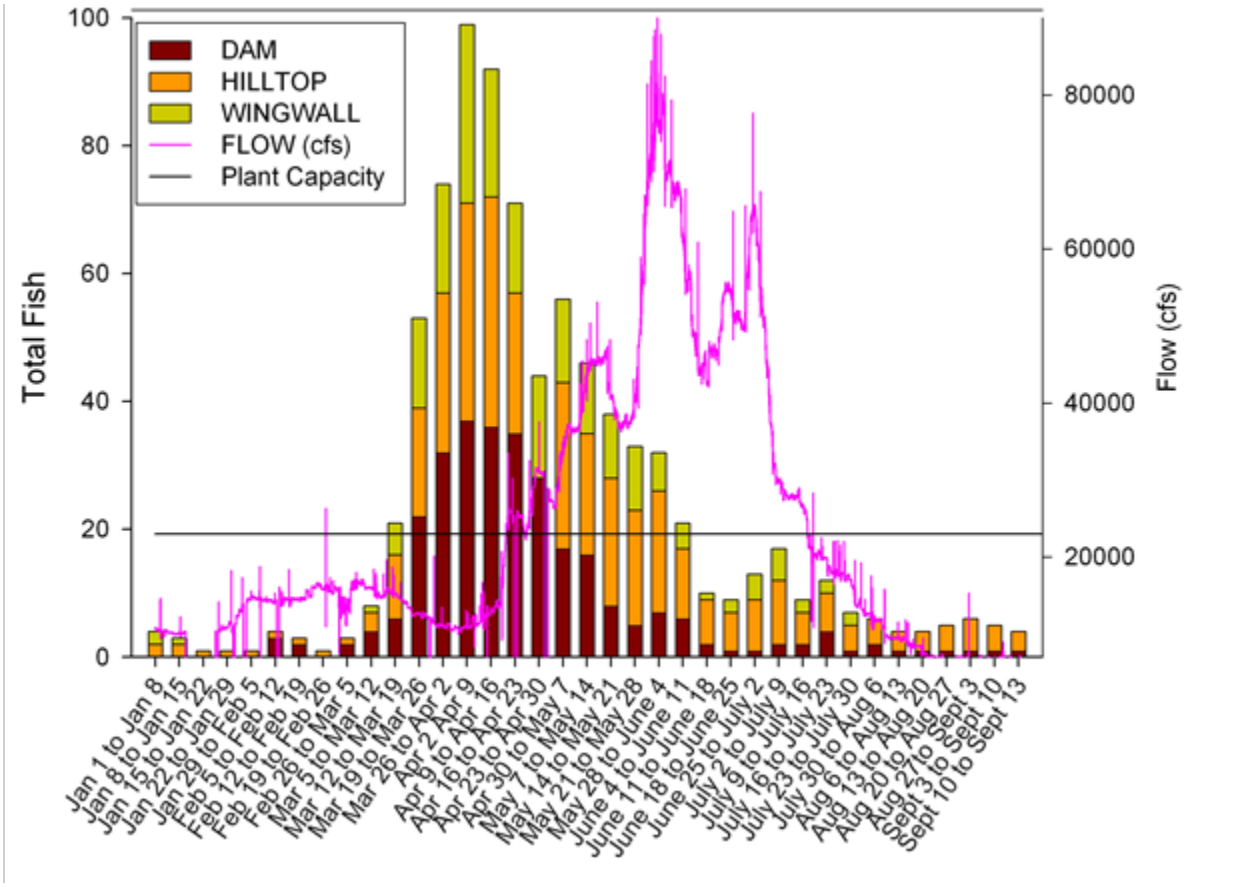
Figure 12-3: Photographs of the Clark Fork River downstream of the Dry Channel Dam in 2010 at high flow, approximately 50,000 cfs.

These previous radio telemetry studies found that peak fish activity was greatest around the Main Channel Dam and hilltop area prior to spill (**Figure 12-4**). Although fish activity declined significantly in Main Channel Dam and natural falls area during spill season, some fish activity continued to be detected. However, the majority of activity during peak flow season was detected by the hilltop stationary receiver, which was located downstream of the High Bridge and downstream of the natural falls. There are relatively quiescent areas in this portion of the river that are suitable holding habitat for trout during runoff. It is likely that many fish left the Main Channel Dam and natural falls area during spill to avoid turbulent and high velocity conditions (GEI 2007b).

For these reasons, FWP Study Request #1 does not meet study criteria 5. 18 CFR § 5.9(b)(5).

Figure 12-4: Total number of tagged fish (Bull, Westslope, Cutthroat, Brown, and Rainbow trout) detected at each remote station (Main Channel Dam, Hilltop, Wingwall) at Thompson Falls in 2006. (*Source*: GEI, 2007b)



Second, under Relevant Resource Management Goals and Public Interest, FWP describes the numerous threats to Westslope Cutthroat Trout including hybridization with Rainbow Trout. To be clear, FWP manages the middle Clark Fork River (upstream of the Project) as a wild trout fishery (native and non-native) and the amount of existing data on the fishery is substantial. Rainbow Trout are the most abundant trout species and most abundant fish in angler creels within the section of the Clark Fork River near Superior, between Thompson Falls and Missoula (Peters and Schmetterling 1996). Rainbow Trout and their hybrids make up 70 to 80 percent of the trout population in this reach of the river (FWP 2019b). FWP fish population estimates in the mainstem Clark Fork River near Superior show between 237 and 303 Rainbow Trout per mile (FWP, unpublished file data, 2020). Based on fish surveys in the Thompson River and Prospect Creek, relatively high densities of Rainbow Trout already inhabit these systems as well. For example, a 2019 survey of the Thompson River estimated Rainbow Trout abundance at 327 (in the Big Hole section) and 40 per mile (in the 19-Mile section) (FWP 2019b). Historic stocking documents indicate approximately 3.7 million Rainbow Trout were stocked in the Clark Fork River from 1931-1988 and tributaries such as Thompson River and Prospect Creek received 763,084 and 403,022 respectively. (FWP, MFISH stocking records). In addition, the FWP management plan calls for supporting a wild Rainbow Trout population in the Thompson River to provide angling

opportunity for larger trout with restrictive regulations and minimize impacts on native fish (FWP, 2019). Restrictions in the Thompson River below its confluence with the Little Thompson River limit fishing to catch and release only for Cutthroat and Rainbow trout year-round. These management decisions and their basis are the responsibility of FWP, not the Licensee of the Project.

The fact is, approximately 175 Rainbow Trout passed at the fish passage facility annually are a very small fraction of the number of Rainbow Trout already present in the Clark Fork River upstream of the Project. In light of the species composition of the Clark Fork River upstream of the Project, and based on existing data, there is no demonstrated effect of the Project on Rainbow Trout and Westslope Cutthroat Trout hybridization. For these reasons, FWP Study #1 does not meet study criteria 4 and 5. 18 CFR § 5.9(b)(4),(5).

Third, in the Proposed Methodology, some of the stream reaches proposed for study are upstream of seasonal or potentially permanent fish passage barriers. Westslope cutthroat trout in the Thompson Falls Project area do not have access to these sites, regardless of the efficiency of fish passage facilities at Thompson Falls. Once fish are captured and passed at the fish passage facility they can volitionally migrate to where they choose. This, combined with the fact the genetic composition of *Oncorhynchus sp.* in tributaries upstream of the Project is unrelated to the operation of the Project, demonstrates that the study lacks a nexus to the Project as required by study criterion 5. 18 CFR § 5.9(b)(5).

Fourth, in the Existing Information and Need for Additional Information section, FWP explains the genetic status of Westslope Cutthroat trout are not fully understood but if they were, the information could be used for development of PM&E measures. Merely alleging that an issue is not well understood without demonstrating a nexus to the Project does not satisfy the study criteria. FERC has consistently maintained that a License applicant's study plan should not require the applicant to search for an alleged problem, but that the requestor carries the burden to establish a nexus to the Project. *City of Centralia v. FERC*, 213 F.3d 742 (D.C. Cir. 2000); 18 CFR § 5.9(b)(5). Also, FWP does not provide an explanation of why existing information combined with NorthWestern's proposed studies is inadequate for relicensing. 18 CFR § 5.9(b)(4)(6).

Fifth, the estimated cost and effort for the study is understated by orders of magnitude. It includes the cost of laboratory analysis but assumes NorthWestern compliance expenditures for labor (under the current License) could be automatically re-assigned to this study at no cost and that others would contribute (Avista and USFS) to the effort for free. That is simply not the case. This is a very expensive study that is not justifiable and so does not meet study criterion 7. 18 CFR § 5.9(b)(7).

For these five reasons, a study of *Oncorhynchus sp*. in the tributaries upstream of the Project is not proposed. NorthWestern's proposes that Study #9 – Westslope Cutthroat Trout Genetics, Study #5-– Fish Behavior, Study #6 – Downstream Transport of Bull Trout, and Study #10 – Updated Literature Review of Downstream Fish Passage will provide the information required to identify Project impacts to fisheries in areas that have a nexus to the Project.

12.4 FWP Study #2 – Heavy Metals and Organic Compounds Assessment of Fish in Thompson Falls Reservoir

FWP Study #2 was not previously requested in the study requests submitted in October 2020. The proposed study goals and objectives is stated to be a "more comprehensive study of heavy metals and organic compounds in the sediments and biota tissue to assess the impacts of hydropower operations and the influence of impoundments on contaminant accumulation and impacts to the fishery."

NorthWestern does not agree that this study meets the FERC study criteria, specifically to fill an information gap that would help inform relicensing and nexus to the Project. As such, NorthWestern not proposing to include this study in the RSP. The basis for NorthWestern's decision follows:

The description of existing data provided by FWP is incomplete. As described in the PAD Section 5.10, FWP samples and analyzes fish tissue samples for mercury (Hg) concentrations in the Lower Clark Fork River reservoirs every 5 years (Selch 2017). Elevated levels of Hg were detected in various size groups and species in 2005, 2010, and 2015 in the lower Clark Fork reservoirs (Thompson Falls, Noxon Rapids, Cabinet Gorge).

Northern Pike Hg concentrations in Thompson Falls Reservoir are substantially lower than levels found in Noxon Rapids and Cabinet Gorge reservoirs for larger size groups of fish (26-30 and 30+ inches) (Selch 2017). Thompson Falls Reservoir fish also consistently contain lower Hg concentrations in smaller size groups (Selch 2017). One single Smallmouth Bass was sampled in 2010 in Thompson Falls Reservoir. The Hg concentration was two-to-three times lower than similar fish collected in Noxon Rapids and Cabinet Gorge reservoirs in 2005, 2010, and 2015 (Selch 2017). Yellow perch in Thompson Falls Reservoir had lower Hg concentrations compared to Noxon Rapids and Cabinet Gorge reservoirs (Selch 2017).

In fall 2014, two Northern Pike were sampled from the Thompson Falls Reservoir and analyzed for dioxins and furans (co-planar PCBs were not analyzed) (Selch 2015). Results found low levels of dioxins and furans (0.002 ng/kg wet weight) in a single Northern Pike composite (number=2, 26–30 inches) (Selch 2015).

Subsequent to the preparation of the PAD, NorthWestern collected sediment samples from Thompson Falls Reservoir. The results of this evaluation are found in Section 4.4 of this RSP. Based on the analytical results of the sediment core samples collected from the lower portion of Thompson Falls Reservoir in July 2020, there does not appear to be any indication of toxicity related to the sediment collected at these sites. The sampling locations and core depths were representative of sediment deposits in the lower reservoir that might either be exposed and/or mobilized during normal reservoir operations.

Thus, the existing data do not support the contention that Thompson Falls Reservoir likely serves as a catchment basin for contaminants in the basin. High levels of metals and PCBs are found in

fish tissue in Noxon Rapids Reservoir downstream, but Thompson Falls Reservoir is a much smaller water body with a short retention time. Hydraulic conditions which result in contaminant deposition and associated accumulation of high levels of contaminants in fish tissues downstream are not likely present in Thompson Falls Reservoir. In addition, NorthWestern does not have any plans for construction which would disturb the sediments in Thompson Falls Reservoir, so there is no clear nexus to Project activities which would result in increased contaminants in fish tissue.

NorthWestern consulted with DEQ about the need to monitor for and identify potential upstream Superfund site sourced contaminants in the Thompson Falls Project, as the current information demonstrates very little concern for contaminants present in the sediments or water in the Thompson Falls Project. Rather, DEQ is coordinating a group of diverse stakeholders to develop a monitoring plan to identify and evaluate contaminants utilizing a Clark Fork River basin-wide approach as part of the Columbia River Toxics Reduction Action Plan.[15] NorthWestern intends to engage in continued dialogue with DEQ and other involved stakeholders regarding a potential basin-wide approach to identify sources and evaluate the fate of contaminants as they move through the Clark Fork River Basin in Montana.

FWP's proposal for fish tissue evaluation includes collection of 6 to 10 individual fish per size class for each of these species: Northern Pike, Rainbow Trout, Smallmouth Bass, and Yellow Perch. NorthWestern reviewed 8 years (2013-2020) of Thompson Falls Reservoir gillnetting data to determine the feasibility of collecting 6 to 10 individual fish per species per size class. The results of the average, minimum, and maximum number of fish, by species and size classes are summarized in **Table 12-2**. Data show gillnetting does not result in the proposed sample size for Rainbow Trout or Smallmouth Bass and is consistently below the adequate sample size for Yellow Perch. NorthWestern is already concerned about collecting enough Rainbow Trout to implement Study #5 – Fish Behavior (Section 6) and does not support prioritizing fish tissue sampling over Study #5 during the 2021 and 2022 study seasons. NorthWestern believes that supplemental sampling using electrofishing or hook and line during the summer could collect some Smallmouth Bass, but not in sufficient numbers by size class as requested by FWP. In summary, in addition to there being practical challenges to conducting this study as described above, the fish tissue study does not have a nexus to Project operations, nor would it help to inform future License conditions, as required by 18 CFR § 5.9(b)(5).

[15] https://www.epa.gov/columbiariver/columbia-river-basin-toxics-reduction-action-plan#:~:text=The%20Columbia%20River%20Toxics%20Reduction%20Action%20Plan%20identifies%2061%20actions%20to%3A&text=Increase%20toxic%20reduction%20actions.,%2C%20multi%2Dagency%20research%20program

Table 12-2: Summary of gillnetting efforts in the Thompson Falls Reservoir, 2013-2020 and the average, minimum, and maximum number of fish caught in each size class identified in FWP's Proposed Study.

Species	Size Classes (inches)	Number of Fish Sampled Gillnetting from 2013-2020 that would be Suitable for Tissue Collection		
		Average Number of Fish/Gillnet Year	Minimum Number of Fish/Gillnet Year	Maximum Number of Fish/Gillnet Year
Northern Pike	***14-18"***	7	2	20
	18-22"	8	4	17
	22-26"	6	1	14
	26-30"	3	0	7
Smallmouth Bass	***10-14"***	1.3	0	4
Yellow Perch	***6-10"***	5.3	1	16
Rainbow Trout	***10-14"***	<1	0	1
	14-18"	<1	0	1

NorthWestern is not responsible for the presence of heavy metals and other compounds and, in any event, existing information does not demonstrate high concentrations of these substances in tissue sampling of fish in the Project area. For this reason, FWP Study #2 lacks a nexus to the Project and would not assist FERC in developing any license measures to address any contamination issues. 18 CFR § 5.9(b)(5).

Moreover, the cleanup of the sites that presumably are the cause of elevated concentrations of heavy metals is occurring under the statutorily designated processes, focusing on Potentially Responsible Parties and the statutory mechanisms of Comprehensive Environmental Response, Compensation, and Liability Act. These issues are not relevant to the Commission's relicensing of the Thompson Falls Project.

It is NorthWestern's position that existing data provides sufficient information to develop the Final License Application. NorthWestern does support development of a basin-wide approach to identify sources of contaminants and to evaluate the fate of contaminants as they move through the Clark Fork River Basin in Montana, as the DEQ is undertaking, separately from this licensing process.

12.5 Master Response to Comments on Study #5 Fish Behavior

NorthWestern met individually (virtually) with FWS, FWP, USFS, and the CSKT to discuss the proposed study plans filed with the Commission on December 11, 2020. A considerable portion of the discussions was dedicated to the details of Study #5 – Fish Behavior. By March 11, three agencies (FWS, FWP, and USFS) filed comments with FERC that included specific requests regarding Study #5. There were some common themes in the comments. Therefore, NorthWestern is providing this master response regarding Study #5 – Fish Behavior to address these common themes for the convenience of the reader. The details for Study #5 – Fish Behavior covered in this response include:

- Timing of fish collection for radio tagging
- Total number of fish proposed to be collected and cost
- Fish size and radio tag options
- Location of fish collection for radio tagging
- Species of fish to be studied and radio tagged

Agency Recommendations

In the PSP, NorthWestern proposed collecting 50 Brown Trout in 2021 and 50 Rainbow Trout in 2022, all from the Thompson River. Agency comments included:

- FWS requested not limiting the total number of radio tags to 100; if additional trout were available to be tagged beyond the 50 total per year, this should occur. In addition, FWS recommendations included specific size classes of fish.
- FWP requested adding 60 tags for native, non-game species (at least 20 per species) including Northern Pikeminnow, Mountain Whitefish, and Largescale Sucker. In addition, FWP also requested tagging 60 Rainbow and 40 Brown Trout to represent the proportion of the species observed at the fish passage facility; split tagging of salmonids 50/50 upstream of the Thompson Falls Dam and from the upstream fish passage facility; and, prioritizing tagging in the mainstem Clark Fork River upstream of the dam and the upstream fish passage facility before collecting from the lower 7 miles of the Thompson River. In addition, FWP requested tagging occur in the spring.
- USFS requested increasing the number of fish tagged by 100. USFS also requested that a mix of Brown and Rainbow trout be tagged from the Thompson River and from downstream of the Thompson Falls Dam. USFS also requested tagging include Largescale Sucker and Mountain Whitefish.

A summary of agency comments on the quantity of fish, fish species, and fish collection location is found in **Table 12-3**.

Table 12-3: Agency requests for radio tagging by species and total quantity during study plan period, 2021-2022. NA = not any

Agency	Brown Trout	Rainbow Trout	Largescale Sucker	Mountain Whitefish	Northern Pikeminnow	TOTAL	Collection Location
NorthWestern Proposed Study #5 – Fish Behavior	50	50	NA	NA	NA	**100**	Thompson River
FWP	40	60	20	20	20	**160**	1/2 Upstream of Thompson Falls Dam in the mainstem Clark Fork River or lower Thompson River, 1/2 fish passage facility
FWS	100	100	NA	NA	NA	**100+**	All Upstream of Thompson Falls Dam
USFS	100	100	Yes – quantity undefined	Yes – quantity undefined	NA	**>200**	1/2 Thompson River, 1/2 Downstream of Thompson Falls Dam

Evaluation of Recommendations and Existing Fish Collection Data

Timing of fish collection for radio tagging

FWP recommended sampling occur during spring months to provide cooler water temperatures for fish, thus reducing stress. NorthWestern has modified Study #5 – Fish Behavior to include spring fish collection.

Total number of fish proposed to be collected and cost

NorthWestern gathered information on tag costs in order to inform the response to the agency's requests for additional tagged fish. Each radio tag costs $426 for MCFT3 series radio tags with two sensors (pressure and activity). The cost for additional tagging is in **Table 12-4**. There would also be additional effort in fish collection efforts, monitoring, data processing and report preparation that is not included in **Table 12-4**.

Table 12-4: Summary of the increased radio transmitter costs based on each agency's comments.

Agency	Number of Additional Radio Transmitters	Additional Tag Costs ($426 per Tag)
FWS	Opportunistic	$426 per fish
FWP	60	$25,560
USFS	>100	>$42,600

NorthWestern also considered signal/code collision of tagged fish when evaluating sample size. Tag collision occurs when more than one transponder reflects back a signal at the same time, confusing the reader. Code collision can compromise the integrity of the data. Lotek indicated code collision is a consideration in any study design. Code collision is primarily an issue with releases of 20 or more fish that move together. Code collision can also occur when fish move quickly through a detection zone and there are only a few transmissions to capture the tag identification. Code collision significantly impacts detection efficiency. NorthWestern will coordinate with Lotek to minimize the occurrence of code collision and has also revised the Study #5 – Fish Behavior with consideration of this concern. Detection efficiency and data integrity is a high priority and there is potential that too many tagged fish moving during similar times within the 0.7 miles zone of passage could experience code collision.

NorthWestern has concluded that the requests for additional tagging of salmonids is not cost justifiable (for both equipment and labor) and will lead to potential risks associated with code collision. In addition, there is a practical concern of being able to collect this many fish of the appropriate size for tagging, which is described in detail below. However, NorthWestern is proposing to increase the number of fish tagged by 20, in order to tag 20 Largescale Sucker, as requested by USFS and FWP, and described below.

Fish Size and Radio Tag Options

NorthWestern accepts FWS's request to tag fish of multiple size classes and will endeavor to do so. However, the lifespan of the radio tag and the objective of monitoring individual fish through the season may limit the size classes available to study for some species.

NorthWestern proposes to use Lotek's MCFT3 series tags. These tags provide both pressure (depth) and activity sensors. NorthWestern and agency partners agree the pressure sensor is critical to understanding three-dimensional movement of fish in the zone of passage. Lotek's MCFT3 tag provides two options with these sensors, an 11-gram tag with a maximum 255-day lifespan (with a 5-second burst rate) and a 6.8-gram tag with a maximum 43-day lifespan (5-second burst rate) or 59-day lifespan (10-second burst rate).

FWP has requested fish collection occur during the spring months. NorthWestern agrees with the desire to radio tag fish in the spring. However, tagging in the spring means that a larger tag with longer battery life is needed to monitor fish through the season.

The revised Study #5 – Fish Behavior assumes an individual fish needs to weigh a minimum of 550 grams when using the larger 11-gram radio tag with the longer battery life, to be near the 2 percent tag to body weight ratio. There is potential for using the 6.8-gram tag for fish collection occurring during late-spring and for early spring moving fish. However, capture data at the fish passage facility indicate Rainbow Trout and Largescale Sucker, movement may vary depending on stream temperatures and river flow, and can extend from spring to summer and even into fall months for some Rainbow Trout. The larger tags with extended battery life are preferred because they allow for prolonged tracking time.

For these reasons, NorthWestern is proposing to primarily use the 11-gram radio tag, with options for using the 6.8-gram tag when a shorter battery life is acceptable or smaller fish are available for tagging.

Location of fish collection for radio tagging

The following information assesses the feasibility of capturing fish to radio tag, assuming the longer battery life 11-gram radio tag size will be used and therefore fish will need to preferably weigh 550 grams or greater.

Spring Electrofishing Upstream of Thompson Falls Dam

With the seasonal limitation on fish collection, NorthWestern reviewed 10 years (2009-2020) of spring electrofishing data from the Thompson Falls Reservoir to assess the feasibility and level of effort likely needed to capture appropriately sized fish for radio tagging. NorthWestern typically conducts night electrofishing (*via* boat) in mid-April to monitor fisheries in the upper and lower sections of Thompson Falls Reservoir. The upper sampling site begins at the confluence of the Thompson River (6 miles upstream of Thompson Falls Dam) and proceeds downstream about 1 mile on the right riverbank. The lower sampling site extends from the boat launch at Wild Goose Landing upstream approximately 750 feet.

Upper and lower section electrofishing data were reviewed for the years between 2009-2020. Rainbow Trout, Brown Trout, Mountain Whitefish, Largescale Sucker, and Northern Pikeminnow catch rates for fish of suitable size for radio tagging were evaluated. Catch rates for salmonids in the upper section average three times more than the Lower section.

The lower section resulted in an average 0.6 Rainbow Trout per hour; 0.1 Brown Trout per hour; zero Mountain Whitefish per hour; 2.8 Largescale Sucker per hour; and 0.6 Northern Pikeminnow per hour. The data indicate the lower section is not a suitable sampling site and will not provide adequate numbers of fish for radio tagging for the number of fish NorthWestern is proposing, let alone the number of fish the agencies requested.

Data from the upper section indicate collection of adequate sample sizes of fish is more feasible, but the level of effort required to capture the number of fish NorthWestern is proposing is high. For example, based on 2020 electrofishing data (**Table A-3**) it would take 91 hours of

electrofishing to capture 100 Brown Trout and 56 hours to capture 100 Rainbow Trout of adequate size for radio tagging. Mountain Whitefish were not present in adequate numbers for tagging. Largescale Sucker and Northern Pikeminnow would take 5 to 6 hours of electrofishing to capture 20 of each species 550 grams or greater. One night of sampling includes about 2 hours of electrofishing. This time frame is based on sampling fish for weight and length, but not surgery for radio tagging or transporting fish approximately 10 miles downstream from the sample site. The summary of individual fish 550 grams or larger captured per hour in the Upper section since 2009 are presented in **Table 12-5**.

Table 12-5: Catch per unit effort (CPUE) of fish 550 grams or heavier during spring electrofishing in the upper Thompson Falls Reservoir section.

Year	Effort (electrofishing hours)	Rainbow Trout (CPUE)	Brown Trout (CPUE)	Mountain Whitefish (CPUE)	Largescale Sucker (CPUE)	Northern Pikeminnow (CPUE)
2009	1.5	0.0	0.7	0.0	4.6	1.3
2010	2.1	1.9	0.0	0.0	2.9	0.5
2011	1.8	4.5	0.0	0.0	1.1	0.6
2012	1.9	7.5	1.9	0.0	30.0	16.9
2013	1.9	2.1	1.0	1.1	7.6	0.7
2014	1.2	1.7	0.8	0.0	16.5	20.6
2015	2.1	2.3	1.9	0.0	3.3	4.7
2016	1.9	4.7	1.0	0.5	12.6	6.3
2018	2.0	5.0	3.0	0.0	0.0	1.5
2020	2.7	1.8	1.1	0.4	3.7	3.3
2009-2020	**Mean CPUE**	**3.2**	**1.1**	**0.2**	**8.2**	**5.6**
	Min CPUE	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	Max CPUE	**7.5**	**3.0**	**1.1**	**30.0**	**20.6**

Further upstream in the Clark Fork River where habitat is more riverine, NorthWestern hypothesizes that catch rates during the spring would be similar for salmonids and substantial effort (30+ nights) would be required to capture adequate numbers that NorthWestern is proposing, much less the additional numbers the agencies requested.

Upstream Fish Passage Facility - Spring Salmonid Count

FWP recommended half of the salmonids radio tagged be collected from the upstream fish passage workstation. Upstream fish passage data is available from 2011 to 2020. The average number of fish (of all sizes) for the months March through May collected at the fish passage facility are 61 Rainbow Trout, 8.7 Brown Trout, and 0.2 Mountain Whitefish. Rainbow Trout are the most consistent salmonid present at the fish passage facility during the spring months and likely do not pose a sampling challenge. However, Brown Trout are not common at the fish passage facility during the spring months and the number recorded at the fish passage facility during the spring months vary considerably year to year and averages less than nine individuals. It is unlikely that sampling half of the 25, 50, or even 100 individual Brown Trout proposed by the agencies can occur from the upstream fish passage workstation.

Electrofishing Downstream of Thompson Falls Dam

USFS recommended 100 fish (mix of Rainbow and Brown trout) be sampled downstream of the Project. During radio telemetry efforts in 2006 in the Project area (GEI 2007b), the Licensee tagged a total 27 salmonids over an 11-night electrofishing effort downstream of the Project. A total of 78 trout were captured over the sampling duration and only 27 met the size requirements for tagging in 2006. In addition to electrofishing, the Licensee operated a temporary Denil trap (no longer in operation) in the tailrace and captured an additional 13 salmonids for a total of 40 radio tagged fish (17 Rainbow Trout, 12 Rainbow hybrids, 5 Westslope Cutthroat, 3 Brown Trout, and 3 Bull Trout).

There is an additional concern that fish collected downstream of the Project may not be motivated to move upstream, which would reduce the possibility of meeting the objective of the study. The Scientific Panel recommended an approach to capture Brown, Westslope, and Rainbow trout, upstream of the dam in the Clark Fork or Thompson River, implant them with radio transmitters and release them downstream of the project area and track their movements upstream. They stated that, "By superimposing fish from one population (upstream) onto another (downstream population), fish should return to their capture population (upstream)" (Scientific Panel, 2020). NorthWestern has concluded there is a greater probability that a fish captured upstream of the Thompson Falls Dam or at the upstream fish passage facility are likely to be motivated to move upstream after being transported and released downstream.

In addition, there are safety considerations with downstream electrofishing during the spring months that will preclude fishing under high streamflow and remove night sampling as an option.

Data described above from past electrofishing efforts downstream of the Project depict the challenges that exist with the amount of effort necessary to capture suitable sized individuals for radio tagging. The costs associated with increasing the number of tags and potential risk of not obtaining information on fish movement from fish in the 0.7-mile zone of passage is not justifiable.

Therefore, for the reasons described above, NorthWestern is not proposing to radio tag fish collected downstream of the Project. Considering the time constraints for fish collection, study seasons, reporting timelines, cost of potential tag loss (i.e., fish moving out of the 0.7 miles study area), in addition to sampling challenges to capture suitable sized individuals for radio tagging, NorthWestern plans to focus fish collection and tagging efforts upstream of the dam. Therefore, NorthWestern proposes in Study #5 – Fish Behavior to collect fish in the spring, with the flexibility to sample cumulatively from the mainstem Clark Fork River, the lower Thompson River, and the upstream fish passage workstation without limitations.

Species of Fish to be Studied and Radio Tagged

Evaluation of Request to Radio Tag Largescale Sucker

FWP and USFS have requested native species be radio-tagged and included in this study. USFS did not provide a specific number for radio tagging. FWP requested 20 individuals of each of three species, including Largescale Sucker. NorthWestern has modified Study #5 – Fish Behavior to include radio tagging of 20 Largescale Sucker. A review of the data indicates it will be possible to collect 20 Largescale Sucker of suitable size for the 11-gram tag. In addition, based on FWP tagging work upstream in the Clark Fork River drainage, Largescale Sucker appear to be less sensitive to surgery than Northern Pikeminnow and Mountain Whitefish.

NorthWestern believes there is less mortality risk than with other species in radio tagging 20 Largescale Sucker and proposes to include the 20 Largescale Sucker in the revised Study #5 – Fish Behavior. This addition will result in an increase of $8,520 in tag costs.

Evaluation of Request to Radio Tag Mountain Whitefish

NorthWestern is not proposing to radio tag Mountain Whitefish as part of Study #5 – Fish Behavior.

Mountain Whitefish are generally not observed at the upstream fish passage facility until September or later in the fall. The upstream fish passage facility is typically closed by mid-to-late-October due to winter conditions. Therefore, it will not be possible to collect Mountain Whitefish for spring tagging at the upstream fish passage facility. For spring tagging, it would be necessary to collect Mountain Whitefish by electrofishing. However, as described above, Mountain Whitefish are not present in adequate numbers for tagging in the reservoir, so this is not a viable option.

In addition, Mountain Whitefish are very sensitive to electrofishing and radio tagging surgeries even during optimal thermal conditions. Data reported by Wyoming Game and Fish Department (Edwards 2014), found Mountain Whitefish require about 48 percent reduced power for electrofishing compared to other salmonids. A recent study completed in the Upper Green River in Wyoming by C. Brown (personal communication, 2021) found Mountain Whitefish radio tagging mortality was 40 percent even with all precautions and preventative measures taken such as providing optimal thermal conditions, less than 15 °C. Brown (2021) also noted mortality rates were reduced once water temperatures were around 10 °C, but not when temperatures were between 13 and 15 °C.

In addition to concerns about fish mortality and the opportunity to successfully collect the recommended number of Mountain Whitefish, NorthWestern is concerned about the ability to collect suitable numbers of the appropriate size of Mountain Whitefish. If fish collection is limited to the early spring months to provide optimal thermal conditions for Mountain Whitefish survival, then the larger radio transmitter tag with longer battery life would be necessary to capture fall

movement behavior. NorthWestern reviewed data from the fish passage facility to assess the likelihood of collecting suitable numbers of Mountain Whitefish for tagging with the 11-gram tag. The numbers of Mountain Whitefish collected annually at the fish passage facility have varied greatly, from zero to 254 fish. Mountain Whitefish measured at the fish passage facility average 404 grams (median weight 394 grams); only 24 fish out of 319 weighed (10 years of data) were suitable for the 11-gram radio-tag.

In conclusion, NorthWestern is concerned about the sensitivity of Mountain Whitefish to electrofishing and surgery as well as the challenge to live-capture 20 Mountain Whitefish weighing 550 grams or greater. NorthWestern disagrees with FWP Comment #6 that "…these species may not be as resilient to tagging, however that does not mean that it should not be attempted." Besides both NorthWestern and FWP's concern that this species is not resilient to tagging, NorthWestern does not believe it is cost justifiable, coupled with low survival and little potential to collect meaningful data specific to study objectives.

For the purposes of Study #5 – Fish Behavior, NorthWestern proposes to complete a literature review of swimming capabilities that will include Mountain Whitefish. The literature review combined with information gained from other salmonid movement and the hydraulic modeling (Study #4 – Hydraulic Conditions), should provide insight into upstream fish passage conditions experienced by Mountain Whitefish and identify potential velocity barriers within the zone of passage that may impact Mountain Whitefish movement.

Evaluation of Request to Radio Tag Northern Pikeminnow

FWP and USFS have requested native species be radio-tagged and included in this study. USFS did not provide a specific number for radio tagging and FWP requested 20 individuals of Northern Pikeminnow. NorthWestern is not proposing to radio tag Northern Pikeminnow in Study #5 – Fish Behavior.

FWP has indicated they have observed higher than average sensitivity in Northern Pikeminnow from surgeries to implant radio transmitters (D. Schmetterling, personal communication). Baxter (2001) completed a radio tagging study of Largescale Sucker and Northern Pikeminnow study in the Salmo River, a tributary to the Pend Oreille River in British Columbia. The study observed both species were prone to hemorrhaging at the incision, needle insertion point, and suture location during the surgery (Baxter 2001).

Concerns about fish mortality, coupled with the additional cost to collect, tag, and analyze the data is not justifiable.

As previously mentioned, NorthWestern proposes to complete a literature review of fish swimming capabilities, including Northern Pikeminnow. The literature review combined with radio telemetry information gained from Study #5 – Fish Behavior and the hydraulic modeling (Study #4 – Hydraulic Conditions) should provide insight into upstream fish passage conditions

experienced by Northern Pikeminnow and identify potential velocity barriers within the zone of passage that may impact Northern Pikeminnow movement.

Summary of Modifications to Study #5 Fish Behavior

In response to the comments received from the agencies, the existing data supporting feasibility of fish collection quantities, and considering cost, NorthWestern has revised Study #5 – Fish Behavior to include the following:

- Collect up to 40 Brown Trout, 60 Rainbow Trout, and 20 Largescale Sucker for radio tagging
- Split collection for Brown Trout and Rainbow Trout in 2021 and 2022
- Collect salmonids from the mainstem Clark Fork River upstream of Thompson Falls Dam, the lower 7 miles of Thompson River, and the upstream fish passage facility workstation
- Collect Largescale Sucker in 2022 in the mainstem Clark Fork River upstream of Thompson Falls Dam
- Collect fish for radio tagging and transport during the spring months.

These details are included in the revised Study #5 – Fish Behavior.

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Appendix A Comments and Response to Comments on the Proposed Study Plan.

The public comment period on the PSP closed on March 11, 2021. NorthWestern received written comments from FWP, the FWS, USFS, Susan LaMont, Robin Hagedorn, Montana Department of Transportation, SHPO, DEQ, and FERC. The comments, and NorthWestern's responses, are included in **Table A-1**.

Table A-1: Comments on the PSP and NorthWestern response

Agency	Comment Number	Comment and NorthWestern response
FERC	Intro	After reviewing the proposed study plan for the Thompson Falls Hydroelectric Project (P-1869-060), and participating in the January 6, 2021, study plan meeting, Commission staff has comments on the proposed Operations Study. The comments on the proposed study are included in the enclosed Schedule A. If you have any questions, please contact Mike Tust at (202) 502-6522 or via e-mail at michael.tust@ferc.gov.
FERC		**NorthWestern response:** Thank you for your comments, NorthWestern appreciates the careful review and thoughtful suggestions.
FERC	1	At the study plan meeting, you noted that five total monitoring events would be conducted, two to establish baseline conditions and one occurring after each test phase. However, your proposed study plan only identifies four monitoring events (i.e., one baseline site visit conducted in October 2020, another baseline site visit planned to occur in the spring of 2021 prior to Phase 1, between Phases 1 and 2, and following Phase 3. It is unclear why you do not propose to monitor the shoreline sites between Phases 2 and 3, particularly since Phase 3 would involve testing the maximum generation capacity changes during the study. We suggest you revise the study plan to include the additional monitoring event between Phases 2 and 3 or explain your reasoning why monitoring the shoreline sites between Phases 2 and 3 is not needed.
FERC		**NorthWestern response:** NorthWestern intends to monitor the shoreline between Phases 2 and 3. Study #1 Operations Study has been edited to make this clarification.
FERC	2	Your proposed study plan includes three graphs (Figures 2-1, 2-2, 2-3) that simulate the change in reservoir elevations that may occur under each of the three operation test phases. Figure 2-1 illustrates a potential scenario where the reservoir drops only 2.2 feet over the course of Phase 1 due to the random ordering of specific operations rather than the expected 2.5 feet. Please clarify whether the reservoir would be drawn down 2.5 feet under all three operational scenarios.
FERC		**NorthWestern response:** NorthWestern intends to lower the reservoir elevation 2.5 feet in each phase of the study. The Study #1 Operations Study has been edited to make this clarification.

FERC	3	Please also clarify at what level the reservoir will be held during baseline erosion monitoring and during the two-week period between each operational phase.
FERC		**NorthWestern response:** NorthWestern intends to hold the reservoir near full pool during the baseline monitoring and the 2-week period between operational phases. The RSP has been updated to include this information.
FERC	4	The proposed study plan indicates that a small amount of erosion, principally in fine-grained alluvial soils on the south shore, occurs along the reservoir shoreline due to wave action from recreational boating. In your revised study plan, please indicate how you will distinguish erosion effects from recreational boating from effects caused by changes in operation.
FERC		**NorthWestern response:** NorthWestern's shoreline erosion monitoring includes establishing a baseline condition which will include observations of shoreline erosion between the fall of 2020 and before the operations testing will start July of 2021. This baseline condition will include observations of changes in shoreline stability from multiple erosional factors including wave action, current velocity, geologic sensitivity, shoreline management, and ice but will not include factors related to Project operations of fluctuating the reservoir elevation more than our current operations. Additionally, monitoring events associated with each operation test phase will be timed to capture observations directly preceding and following the reservoir fluctuations during each phase. This approach will not eliminate erosion from wave action from watercraft but will minimize that factor by limiting the time window between monitoring events. Evaluations of the shoreline erosion observations will estimate the total erosion and factor in the amount of erosion expected through the establishment of a baseline condition.
USFS	intro	NorthWestern Energy filed the Proposed Study Plan (PSP) with the Federal Energy Regulatory Commission on December 11, 2020. The Commission has solicited comments on the PSP, scoping document 2, and identification of issues and associated study requests. We have specific comments to the PSP (Enclosure 1) and two proposed resource studies necessary to assess the potential Project effects on environmental resources (Enclosure 2). The resource study proposals have been revised and reduced in scope from the original five studies submitted in October in response to the pre-application document. The study revisions are based on information provided in the PSP, study plan meetings, and subsequent collaboration with the Licensee. The Lolo National Forest continues to be primarily interested in studies on the spatial and temporal effects of Project operations on riparian resources due to changes in the Clark Fork River system. The requested studies will provide the Forest Service with the necessary information to determine the need for and type of mitigation necessary for the adequate protection and utilization of the Forest as required under the Federal Power Act. Thank you for the consideration of this information. Please contact Robin Jermyn, Realty Specialist, Lolo National Forest, by phone at (406) 499-2734 or by email at robin.jermyn@usda.gov if you have any questions.
USFS		**NorthWestern response:** Thank you for the comments. NorthWestern greatly appreciates the efforts that the USFS staff made to meet and discuss the PSP in detail over the last several months. NorthWestern looks forward to continuing to work cooperatively with the USFS during the implementation of the relicensing studies.

USFS	1	**PSP Section 2, Proposed Study 1 Operations Study page 11:** The second paragraph describes that NorthWestern is proposing that the project continue to provide the baseload generation and flexible capacity needs by using the top 2.5 ft. of the reservoir opposed to the current authorized 4 ft. Literature examples discuss the benefits to native species and control of non-native species from reservoir level manipulation. Keeping the flexibility of using the top 4 ft. could aid resource needs.
USFS		**NorthWestern response:** NorthWestern agrees with USFS that there are benefits to retaining the flexibility to use the top 4 ft of the reservoir and appreciates USFS sharing its insights and expertise on this issue in this relicensing record. NorthWestern is proposing to operate within the top 2.5 feet of the reservoir at this time. NorthWestern will consider the input of USFS and other LPs on this issue as the relicensing proceeds and the License application is developed.
USFS	2	**PSP Section 2, Proposed Study 1 Operations Study page 12:** Under the goal and objectives of this study in the Wetland/Riparian Habitats section, the Forest Service recommends the study include evaluating the data collected to also determine the effects on current and future invasive species (as recognized on the Montana invasive species list) in regards to riparian habitat.
USFS		**NorthWestern response:** As described in the PAD, Section 7.1.3, aquatic invasive plants documented or observed in the Thompson Falls Reservoir include curlyleaf pondweed, flowering rush, and yellow flag iris. In response to this request, Study #1 Operations Study has been modified to note that NorthWestern will record the presence or absence of these species during the Operations Study.
USFS	3	**PSP Section 2.2, Proposed Study 1 Operations Study page 16:** Has NorthWestern Energy considered utilizing remote sensing as a study method for Shoreline Stability information in order to set the baseline for the next license period.
USFS		**NorthWestern response:** NorthWestern did consider using remote sensing for this study. In 2018, the National States Geographic Information Council initiated a project funded by the United States Geological Survey to develop a guide for state lidar planning. Montana and seven other states were selected as pilots to participate in the Project. As part of the pilot Project, Sanders County was flown with QL2 LiDAR in the fall of 2020. However, the data is expected to be delivered in 2022, too late to be incorporated into the relicensing study. NorthWestern believes that the data collection proposed in Study #1 is sufficient to assess Project effects.
USFS	4	**PSP Section 2.2, Proposed Study 1 Operations Study page 19:** The PSP states “the assessment of effects of operational fluctuations on fisheries will include evaluating the potential for fish stranding, habitat changes at the mouths of Cherry Creek and Thompson River, and impacts to the fish passage facility.” The Forest Service identifies these areas as good locations for producing a bathymetric map to be used as a baseline for fill and depositional patterns and rates. These locations would also be well suited for pike spawning where reservoir flow operations (i.e. reservoir levels, flow rates and draw downs) and stranding could target pike mortality and be favorable for native species.
USFS		**NorthWestern response:** The fisheries component of the Operations Study is focused on areas near the mouths of tributaries to ensure that fish passage in and out of these tributaries remain undeterred. USFS does not explain why having a baseline for fill and depositional patterns and rates is needed to meet the objectives of the Operations Study. Impacts on specific resources like

		fisheries, cultural resources, recreation, etc. will be assessed in Study #1 – Operations Study. Existing information and data collected implementing the RSP will be sufficient to analyze Project effects. NorthWestern has existing data for shallow areas of the reservoir. In late May through early June 2018 the Thompson Falls Reservoir pool was lowered about 15 feet in order to execute repairs of the flashboard stanchions on the spillways. Following the reservoir drawdown, NorthWestern collected a hi-resolution Unmanned Aerial Vehicle (UAV) survey of the reservoir rim with the water surface at around elevation 2,381 feet. This imagery shows that the tributary streams remain connected to the reservoir at the 15-foot drawdown. Therefore, consistent with 18 CFR § 5.9(b)(4), additional bathymetric mapping at the mouths of the tributaries is unnecessary. With regard to USFS comment on Northern Pike, this species spawns in the reservoir during the late spring which typically correlates to high flow periods when NorthWestern has little ability to control reservoir water levels. Controlling reservoir water level in pike spawning areas during this time is not typically operationally feasible. Northern Pike are common far upstream of Thompson Falls Reservoir, so a source population (from the Lower Flathead River and further upstream in the Clark Fork River) is ever-present. Therefore, even if reservoir drawdowns could be used to disrupt Northern Pike spawning, the population in Thompson Falls Reservoir would be re-seeded from upstream populations. Furthermore, FWP's management direction does not call for reduction in Northern Pike populations in Thompson Falls Reservoir. For these reasons, NorthWestern has concluded controlling Northern Pike does not have a nexus to the Project ((18 CFR § 5.9(b)(5))
USFS	5	**PSP Section 2.2, Proposed Study 1 Operations Study page 28:** Under the study methods for the Wetland/Riparian Habitats the PSP states "Wetland and Riparian areas will be identified using the Montana Spatial Data Infrastructure Wetlands Framework (2020). This information will be utilized to locate the approximate location of identified wetlands, and the type and extent of these areas adjacent to the reservoir. The risk to each wetland and riparian area altered hydrological connection due to reservoir fluctuations will be ranked as high, medium, or low. Risk will be determined by multiple factors including the surface water connection, soil type, slope, and distance from the ordinary high-water mark of the reservoir. Ground-truthing will be used to validate the results of the mapping stratification." This methodology may be able to be expanded to generate a bathymetric map and evaluate the percent of suitable pike spawning habitat that would be dewatered/disconnected by dropping water levels. In addition, it may inform the percent of the reservoir that could be dried up to control invasive plant species.
USFS		**NorthWestern response:** *See* response to comment 4 regarding existing data, timing of Northern Pike spawning, and operational constraints during high water periods. The areas selected for the Operations Study are locations within the reservoir that have the largest expanses of shallow water. Moreover, pike mortality is not related to an objective of this study nor has USFS raised this issue in the context of studies it has requested. There is no reasonable Project nexus (18 CFR § 5.9(b)(5)) associated with this request, as the objective is the responsibility of resource management agencies to inform resource management decisions and are not appropriate to study as part of relicensing.

USFS	6	**PSP Section 2.4, Proposed Study 1 Operations Study page 31:** Under the section regarding resource impacts observed during the 2019 operations test the second paragraph states “A variety of reservoir fish species were stranded during the operations test when the reservoir was drafted 4 feet. These included Largemouth Bass, Smallmouth Bass, Northern Pike, Pumpkinseed, Yellow Perch, Redside Shiner, Northern Pikeminnow, Black Bullhead,Yellow Bullhead, and Largescale Sucker. Most fish were less than 3 inches in total length but a few Northern Pike up to 10 inches were observed.” The Forest Service would like to note that an improved understanding of depth/bathymetry coupled with water depths could be refined to target intended mortality of invasive species.
USFS		**NorthWestern response:** *See* response to comment 4 regarding existing data. The Operations Study will include stranding surveys and wetlands evaluations which will provide information on where certain species may be most susceptible to stranding. Additional studies of bathymetry are not necessary to identify potential Project impacts. Targeting the mortality of pike and other non-plant invasive species is not related to an objective of this study nor has USFS raised this issue in the context of studies it has requested.
USFS	7	**PSP Section 2.4, Proposed Study 1 Operations Study page 32-33:** The report for Shoreline Stability following the 2019 operations test has improbable interpretation of results. It is very uncommon for forested environments (of various geology and soil horizons) to present erosion and "caving" upon snow melt as described. The erosion/caving is likely associated in some manner to reservoir impacts either from current operations and/or from reservoir presence since formation. Most erosion in forested, and even many natural grassland environments, occurs only when flow is concentrated or when there is significant loss of vegetative cover and compromised rooting depths/strengths. The erosion and bank caving should be further assessed relative to revegetation/mitigation opportunities with a datum of reference conditions that are representative of forest, stream, and lake shore conditions outside of reservoir context.
USFS		**NorthWestern response:** Historical documentation and current observations document the largest influence on shoreline erosion is geology and associated underlying substrate along the reservoir. For example, substrates and near shore soils contain a significant composition of cobble and large gravel on the north side of the reservoir and provide armoring, promoting a more stable shoreline. Much of the south side of the reservoir is comprised primarily of sand or smaller-sized substrate. Even where mature vegetation exists, erosion is observed because of the limited stability and protection these smaller particles provide, which is a natural process and outside NorthWestern’s control. Shoreline monitoring during the operations study will include frequency and type of erosion observed. NorthWestern has also conducted an experimental bank stability project along the reservoir using a combination of techniques including properly sloping a bank, adding toe wood into the bank for protection, and planting over 1,400 willow and dogwood cuttings and hundreds of native rooted stock. NorthWestern has been monitoring this project since it was completed in fall of 2019 to assess if the approach used could be effective in other locations.
USFS	8	**PSP Section 5.1, Proposed Study 4 Hydraulic Conditions page 47:** The goals and objectives stated in this section only address the velocity field hydraulics downstream of the fish passage facility. This is inconsistent with details later in the proposal that address hydraulics much more comprehensively along the dam face and key features. The section as written

		appears to be singularly focused on the fish passage facility and also doesn't address the important synchronous work with the fisheries telemetry component (and discussed later in the PSP). The Forest Service recommends that the goal should be to understand hydraulics (velocity, thermal, and density) in the near field and far field, as well as along features of the dam and beyond. We specifically propose the following: Two-dimensional and/or three-dimensional fluid dynamic model outcomes representing hydrologic conditions of 80-90% movement capability for targeted fish species within the dam influence zone (including upstream and downstream of dam as appropriate, dam face, radial gate, spillways, and fish passage facility). In addition, we propose addressing means and methodologies used to validate model outcomes per state-of-technology procedures and known limitations.
USFS		**NorthWestern response:** The goals and objectives of Study #4 – Hydraulic Conditions have been revised to clarify that the modeling will include features such as below the Main Channel Dam and the natural falls area. NorthWestern's modeling approach will use the state-of-technology procedures and be conducted within known limitations. As described in Section 12.1, NorthWestern is not proposing to complete hydraulic modeling upstream of dam structures except immediately upstream (~100 feet) of the Main Channel Dam. This will be done to define the model boundary.
USFS	9	**PSP Section 5.2, Proposed Study 4 Hydraulic Conditions page 48:** The Study area defined includes the channel downstream of the Main Channel Dam to the High Bridge. The Forest Service recommends the study includes extending the area upstream to include the reservoir. This would gain an understanding of the flat areas related to drawdown possibilities, and how drawdown relates to fisheries and fill rates.
USFS		**NorthWestern response:** NorthWestern is not proposing to conduct hydraulic modeling of Thompson Falls Reservoir because Thompson Falls Reservoir is not a barrier to fish passage, as described in Section 12.1. The reservoir is entirely passable at all flows. Also note response to Comment 4 regarding existing data. USFS has not demonstrated why hydraulic modeling in the reservoir would help inform License conditions as required by 18 CFR § 5.9(b)(5).
USFS	10	**PSP Section 5.2, Proposed Study 4 Hydraulic Conditions page 49:** The Task 2 - Hydraulic Modeling section addresses overall river channel hydraulics opposed to just focusing on the fish passage facility. This is strongly supported by the Forest Service. It is recommended that the timing and range of discharges studied represent flows that are within the target timing for fish passage 80-90% of the time. Specifically: Given appropriate surrogate fish species, identify stream discharges and seasonal timing that encompass and represent 80-90% of the fish behavioral movement needs through the dam influence zone (ie. upstream, downstream, dam face, radial gate, spillways, and fish passage facility). Typically, federal and state agencies define an upper and lower design flow as the river flows that are equaled or exceeded 5% and 95% of the time, respectively. Fishways should function under these conditions and be effective during 90% of the migratory period. Taking bull trout as an example and based on a migratory period of March 15 through October 15, the 5% exceedance (i.e., high design flow) at Thompson Falls is 66,000 cfs.
USFS		**NorthWestern response:** NorthWestern is pleased that USFS supports NorthWestern's approach in proposed Study #4 – Hydraulic Conditions. Study #4 states that, "The 3D CFD modeling will be performed for two flow conditions to be determined after review of the 2D CFD modeling results." "The Interim Report will provide results from the 2D modeling and recommendations for the

		specific scenarios to model with the 3D modeling." Flows to be modeled will be identified in consultation with Relicensing Participants based on results of the 2D modeling effort. NorthWestern looks forward to working with USFS and other Relicensing Participants to identify specific flows to be modeled.
USFS	11	**PSP Section 6, Proposed Study 5 Fish Behavior page 53:** The PSP states the goals and objectives of the upstream passage of fish are in order or importance: 1. Bull Trout; 2. Native fish species; 3. Nonnative salmonid sport fish. With native fish species being the second priority, it is recommended that some non-game species are tagged at the fish passage facility and tracked through the reservoir. This would maximize the value of existing infrastructure by having other tags in the system and would provide additional data on how other species interact with the hydraulic information in the near and far field environments.
USFS		**NorthWestern response:** *See* Section 12.5 Master Response to Comments on Study #5 – Fish Behavior.
USFS	12	**PSP Section 6, Proposed Study 5 Fish Behavior page 53:** NorthWestern's PSP states that this study will provide a quantitative approach to evaluating the effectiveness of upstream fish passage at the "Project", which would involve upstream through the reservoir. This is strongly supported by the Forest Service, as a project level approach is much preferred over just evaluating the fish passage facility.
USFS		**NorthWestern response:** NorthWestern is not proposing to track fish upstream of the dams. USFS has not demonstrated why existing information is inadequate per 18 CFR § 5.9(b)(4). *See* existing information described in Section 12.1 and response to USFS Comment 13 for more information. Moreover, the USFS has not demonstrated why the cost is justified per 18 CFR § 5.9(b)(7).
USFS	13	**PSP Section 6.2, Proposed Study 5 Fish Behavior page 56:** Paragraph 2 of the Study Description states that NorthWestern proposes the use of radio telemetry to monitor upstream fish migration *downstream of the Project*. The Forest Service recommends additional manual tracking within the reservoir, accompanied by the FS proposed hydraulic modeling, since tagged fish would provide data regarding movement, cover and dynamics. It is recognized that Northwestern monitored fish movement upstream through the reservoir in 2002 and 2003, but with this data now being 20 years old, the Forest Service is recommending studies be conducted that will provide an updated baseline to better inform the next 50 year license period.
USFS		**NorthWestern response:** As the USFS mentions, fish moving upstream of the dams were monitored as part of a telemetry study in 2001 and 2002 (PPL Montana, unpublished). A total of 21 fish were captured in the spring 2001 (13 Westslope Cutthroat, 6 Rainbow Trout, 2 Bull Trout) and monitoring into fall 2002. Bull Trout moved an average of 16.5 miles upstream and were detected in Thompson River. The Rainbow Trout moved an average of 36 miles (range 2-57 miles) upstream and were detected in the Flathead River and tributary, Jocko River; the Thompson River; and middle Clark Fork River. Westslope Cutthroat Trout moved an average of 30 miles (0.1-82 miles) upstream and were documented in the St. Regis River, Cedar Creek, Combest Creek, Cherry Creek, and the Thompson River and tributary, Fishtrap Creek. More recent information is also available on the speed in which Brown, Bull, and Rainbow trout move through the reservoir based on PIT tagging. Fish have been recorded moving upstream 6 miles from Thompson Falls Dam to

		the Thompson River in 5.5 hours, and generally move into the Thompson River within 1 to 5 days following an individual's release upstream of the dam (NorthWestern, 2019). In addition, angler tag returns indicate that fish passed upstream at Thompson Falls Dam migrate upstream long distances and disperse widely (*refer to* **Figure 12-1**) NorthWestern does not concur that additional data collection is warranted. USFS has not demonstrated why this existing information is inadequate per 18 CFR § 5.9(b)(4). USFS has not identified any changes in conditions since 2002-2003 that would undermine the usefulness of this data or otherwise justify the cost and effort needed to conduct new data collection (5.9(b)(7)).
USFS	14	**PSP Section 6.2, Proposed Study 5 Fish Behavior page 57:** The study area identified would focus on fish movement in the far field, near field, and fish passage facility entrance. The Forest Service recommends the exit and upstream areas through the reservoir also be included for at least one study year with at least, if not targeted, opportunistic tracking within the reservoir
USFS		**NorthWestern response:** NorthWestern is not proposing to track fish upstream of the dams. *See* response to USFS Comment 13 for more information. USFS has not demonstrated why this information is needed. Further, as indicated above, existing NorthWestern data is sufficient and the cost and effort needed to conduct new data collection is not justified (5.9(b)(7)).
USFS	15	**PSP Section 6.2, Proposed Study 5 Fish Behavior page 57:** The PSP Study Methods section identifies that fish will be collected from the Thompson River and states the assumption that Thompson River fish will be motivated to return upstream after transport and release downstream of dam. If this assumption is inaccurate, data will be not be valid. The Forest Service recommends an increase in the sample size (100 from Thompson River and 100 from downstream) as well as tagging of captured fish from both the Thompson River and downstream areas. This would decrease assumptions of upstream return motivation. If Brown Trout and Rainbow Trout populations are not adequate to capture 200 fish, substitute with Sucker or Whitefish from the downstream capture.
USFS		**NorthWestern response:** NorthWestern appreciates the USFS concerns about assumptions related to the surrogates motivation to migrate upstream. To reduce this risk, NorthWestern proposes to collect and tag approximately half the fish from upstream of the dam in the Clark Fork River and lower Thompson River and the other half from fish captured in the fish passage facility. This approach is consistent with generally acceptable practices (5.9(b)(6)) and is the appropriate level of effort and cost needed to adequately meet study objectives (5.9(b)(7)). Regarding the request to double the sample size and add additional species, *see* Section 12.5 Master Response to Comments on Study #5 – Fish Behavior.
USFS	16	**PSP Section 6.2, Proposed Study 5 Fish Behavior page 58:** Given the timing windows for the studies to be conducted and each species (Brown Trout and Rainbow Trout) respectively only being collected and tagged one year, the Forest Service recommends that a portion of the tags ordered be larger in size with longer battery life for increased data collection. These larger tags would be used in the larger fish captured. In addition, we also add that tagging large non-game fish such as mountain white fish and largescale sucker could likely assist (we undoubtedly recognize distinct differences in fish species and behaviors; however, many unknowns remain and leveraging this effort towards expanding to other species beyond brown and rainbow trout could lead to very

		insightful findings and add a much greater comprehensive understanding of fish movement and overall behaviors)
USFS		**NorthWestern response:** Larger tags would have to be placed in larger fish because tag weight must be limited to be no more than 2% of the fishes' body weight. NorthWestern is concerned that it will not be able to capture enough larger fish. There are only a few options of sizes of radio tags that include a pressure sensor. The 11-gram tags proposed in the study plan will have battery life of approximately 230 days. NorthWestern is also proposing to use a portion of radio tags that are smaller and have a much shorter battery life in order to increase the probability of collecting enough fish to meet the desired sample size. *See* Section 12.5 Master Response to Comments on Study #5 – Fish Behavior. NorthWestern has revised proposed Study #5 to include Largescale Sucker to the study. Given what is known about the size of the fish to be studied, this approach is consistent with generally acceptable practices (5.9(b)(6)) and is the appropriate level of effort and cost needed to adequately meet study objectives (5.9(b)(7)).
USFS	17	**PSP Section 6.2, Proposed Study 5 Fish Behavior page 59:** Under the Data Analysis section the Forest Service recommends including language to include at least mountain whitefish and largescale sucker, if recommendation to also capture and tag these species is adopted as suggested above.
USFS		**NorthWestern response:** NorthWestern has revised proposed Study #5 – Fish Behavior to include Largescale Sucker to the study. *See* response to USFS Comment 16 and the master response on the fish behavior study.
USFS	Study Requests	**NorthWestern response**: Responses to USFS additional study requests are included in Sections 12.1 and 12.2.
FWS	1	**PSP Section 5.1, page 47:** The first paragraph indicates that the proposed study is to assess the velocity field downstream of the fish passage facility. The U.S. Fish and Wildlife Service (Service) recommends that this study assess areas beyond the area directly downstream of the fish passage facility. The purpose of this recommendation is to allow this study to determine if there are areas in the zone of passage that may be attracting fish to parts of the project that do not have any capability of providing fish passage (e.g., areas near Prospect Creek, the old power house or the new powerhouse). These areas could potentially serve as "dead ends" for fish attempting to move upstream of the project.
FWS		**NorthWestern response:** NorthWestern is not proposing to include areas downstream of the High Bridge in Hydraulic Modeling Study #4 – Hydraulic Conditions. However, if results from the first year of the fish behavior investigation Study #5 find areas downstream of the powerhouses or Dry Channel Dam concentrate or impede radio tagged salmonid movements, then additional limited areas for hydraulic modeling will be considered. This will be addressed in the interim report that includes 2D modeling and recommendations for 3D modeling. By NorthWestern's estimate, expanding the hydraulic modeling to the entire area downstream to the old powerhouse would increase the costs of this study threefold. Furthermore, the complexities of the area with two powerhouses, the

		Dry Channel Dam, and mouth of Prospect Creek would reduce the resolution of the model because of these highly complex features.
FWS	2	**PSP Section 5.2, page 50:** The sixth paragraph indicates that NorthWestern will complete an interim report that includes the results of the 2D modeling, as well as recommendations for the extent of 3D modeling. This report will be distributed to relicensing participants for a 30-day review and comment period. The Service recommends that NorthWestern convene with interested relicensing participants prior to revising the interim report to ensure that all interested relicensing participants are satisfied that the extent of 3D modeling will meet the overall objectives of this study.
FWS		**NorthWestern response:** NorthWestern agrees with this recommendation and will plan to discuss results of the 2D modeling and recommendations for 3D modeling with the interested Relicensing Participants prior to finalizing the interim report.
FWS	3	The 2015 Final Recovery Plan for the Coterminous United States Population of Bull Trout identifies “Connectivity Impairment” in the Lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. This threat was identified due to large mainstem dams in the Clark Fork River, including the Thompson Falls Dam. Further, the Recovery Plan specifically identifies NorthWestern Energy’s participation in re-establishing habitat connectivity as an action that will address the primary demographic threat to bull trout recovery in the Lake Pend Oreille A Core Area. As such, the Service fully recommends that the Hydraulic Conditions Study proposed by NorthWestern Energy is included during this relicensing process. This study will fill existing data gaps associated with providing safe, timely and effective fish passage for bull trout and other native fish species, as well as provide information necessary to provide mitigation for continuing effects of the Thompson Falls Hydroelectric Project on downstream fish passage.
FWS		**NorthWestern response:** NorthWestern concurs that Study #4 – Hydraulic Conditions will fill existing data gaps associated with providing safe, timely, and effective fish passage. NorthWestern appreciates FWS's input into the development of the study plan and is pleased with FWS's endorsement of NorthWestern’s proposal and finding that it will “fill existing data gaps associated with providing safe, timely and effective fish passage for Bull Trout and other native fish species, as well as provide information necessary to provide mitigation for continuing effects of the Thompson Falls Hydroelectric Project on downstream fish passage.”
FWS	4	**PSP Section 6.2, page 57:** The last paragraph (under “Species” heading) indicates that NorthWestern will radio tag fish greater than 350mm in total length. The Service recommends that radio tags be allocated to a variety of size classes above 350mm (if fish are available). This recommendation is to ensure that telemetry data obtained from tagged fish represents a variety of age and size classes of fish that may exhibit different behavior and have differing swimming abilities.
FWS		**NorthWestern response:** Northwestern concurs that radio tags will be allocated to a variety of size classes above 350 mm if fish are available. Study Plan #5 has been revised to reflect that NorthWestern will make reasonable efforts to allocate the radio tags to a variety of size classes above 350mm. As

		FWS acknowledges, this may not be possible. *See* Section 12.5 Master Response to Comments on Study #5 – Fish Behavior.
FWS	5	**PSP Section 6.2, page 58:** The first paragraph (under "Fish Collection" heading) indicates that NorthWestern proposes to collect and tag 50 brown trout in June, July and/or September, 2021, and 50 rainbow trout in March, April and/or May, 2022. The Service recommends that this study also include collecting and tagging rainbow trout in 2021 (to the extent possible given timing restrictions), and brown trout in 2022. Additional sampling of each species should not come at the expense of lowering the already proposed sample size (50 for each species). Rather, the additional rainbow trout tagged in 2021 should be equivalent to what will be tagged in 2022, and additional brown trout tagged in 2022 should be equivalent to what will be tagged in 2021. Collection and tagging rainbow trout and 2021 and brown trout in 2022 would be possible given that the final study report is not due until May 2023.
FWS		**NorthWestern response:** *See* Section 12.5 Master Response to Comments on Study #5 Fish Behavior.
FWS	6	This current study proposal only includes one study period for spring spawning salmonids (rainbow trout) and one study season for fall spawning salmonids (brown trout). This effectively turns a two-year study period into a one-year study period. Collecting and tagging rainbow trout in 2021 and brown trout in 2022 would provide an additional year of study on each surrogate species compared to what is currently being proposed. Further, flow and temperature conditions in the Clark Fork River typically vary from year to year depending annual precipitation and snow fall, and seasonal weather patterns. An additional study season will allow this study to posit fish movements in a wider range of conditions.
FWS		**NorthWestern response:** Study Plan #5 has been modified in response to this FWS comment. *See* Section 12.5 Master Response to Comments on Study #5 Fish Behavior.
FWS	7	As presented above, the Service considers connectivity impairment due to large main-stem dams (including the Thompson Falls Dam) on the lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Further, the Service specifically identified NorthWestern Energy's participation in re-establishing habitat connectivity as an action that will address the primary demographic threat to bull trout recovery in the Lake Pend Oreille A Core Area. Ensuring that this study is included in the relicensing process will provide information critical to carrying out these actions. As such, the Service fully recommends that the Fish Behavior Study (with study plan amendments) be adopted during this relicensing process.
FWS		**NorthWestern response:** NorthWestern concurs that Study #5 – Fish Behavior should be adopted in the FERC Study Plan Determination. NorthWestern appreciates FWS's input into the development of the study plan and is pleased with FWS's endorsement of NorthWestern's proposal.

FWS	8	The Service recommends that the "Methods" section of this proposed study be amended to include the following: *Juvenile Bull Trout Capture Targets, Handling Protocols and Transport Criteria* • All bull trout greater than or equal to 100 mm will be PIT tagged in the dorsal sinus cavity and a tissue sample will be taken for genetic analysis. • A sample size of 100 fish from West Fork Thompson River and 100 fish from Fishtrap Creek will be captured and transported in the fall of 2021 and 2022 (200 fish each year, total of 400 fish). The size range for juvenile bull trout eligible for transport will be 120-200 mm (total length) from the West Fork Thompson River and 120-250 mm from Fishtrap Creek. • If the annual transport target for West Fork Thompson River cannot be met (or appears that it will not be met), up to 150 juvenile bull trout may be captured from Fishtrap Creek. This limit on transported fish from Fishtrap Creek may be increased at any time during the study in response to site-specific observations and catch-rates in each stream and will be determined through consultation between NorthWestern Energy and the appropriate natural resource management agencies (i.e., the Service and Montana Fish, Wildlife and Parks)*. • Of the captured bull trout within the eligible transport size range, 75% would be transported downstream to Lake Pend Oreille, and 25% would be released on site following tagging and genetics sampling. Fish less than 120 mm will not count toward either quota (i.e., transported or left on site) and young-of-year fish should avoid being handled aside from ensuring they are safely returned to the water. *The Service highly recommends the inclusion of operational flexibility with this study. Adaptive implementation will provide further assurance that the objectives of this study will be met. *Weir Traps* Temporary weir traps on Fishtrap Creek and West Fork Thompson River will operate from October 1 to November 15 in both 2021 and 2022. However, the precise dates of operation may vary on an annual basis depending on environmental conditions and site-specific catch rates relative to transport targets*. Precise beginning and end dates for temporary weir trapping will be determined through consultation between NorthWestern Energy and the appropriate natural resource management agencies (i.e., the Service and Montana Fish, Wildlife and Parks). Weir traps will be checked daily during the weekdays and disabled for volitional passage on weekends. Weir traps will be checked in the morning to best ensure fish are handled in a timely and safe manner. The trap boxes will be reinforced in order to prevent fish loss by mink and other predators. At least two game cameras should be deployed at each weir to monitoring predation. *The Service highly recommends the inclusion of operational flexibility with this study. Exact annual operation windows will need to depend on environmental conditions such as flows and cold weather. In some years, extreme fall rain events may occur, and weirs may need to be temporarily pulled to avoid damage or loss. Additionally, catch rates may decline rapidly in the fall with colder weather meaning it may be prudent to cease operations if no fish are being captured or detected. These decisions are best made during the 2021 and 2022 trapping seasons via discussions among NorthWestern Energy, the Service, and Montana Fish, Wildlife and Parks. *Electrofishing* Fall electrofishing may occur up to a maximum of five days per stream and may only be conducted after bull trout redd counts have been completed and

		all putative bull trout redds have been identified within the specified sampling areas in each stream. Electrofishing in the West Fork Thompson River may occur from river mile (RM) 1.2 at the confluence of Honeymoon Creek downstream to the mouth. In Fishtrap Creek, electrofishing may occur from RM 2.5 (sections 16 & 21 boundary line) downstream to the mouth. Electrofishing will not occur near documented or suspected bull trout redds and will avoid complex habitats such as debris jams where adult bull trout could be present. A minimum of four people (two backpack electrofishing units) is recommended for these electrofishing efforts given the large size and/or steep gradient of these streams. A blocknet should be used at the downstream extent of the sampling reach at all sites to maximize capture and two-pass depletions should be carried out at most sites. As previously described, the Service considers connectivity impairment due to large main-stem dams (including the Thompson Falls Dam) on the lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Additionally, the Service considers non-native fish species in artificially created reservoirs (including Thompson Falls Reservoir) as a primary threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Artificially created reservoirs provide habitat that allows many species of illegally introduced fish species to thrive. Many of these species are high piscivorous (e.g., northern pike, smallmouth bass, largemouth bass) and present a significant threat to downstream migrating juvenile bull trout, as well as other native fish species. As such, the Service fully recommends that the Downstream Transport of Bull Trout Study (with study plan amendments) be adopted during this relicensing process to assess efforts NorthWestern Energy can undertake or fund to mitigate for the negative impacts of the project on native fish species.
FWS		**NorthWestern response:** *See* Study Plan #6 Downstream Transport of Bull Trout which incorporates these comments. NorthWestern appreciates FWS's input into the development of the study plan and is pleased with FWS's endorsement of NorthWestern's proposal.
DEQ	Email from Keenan Storrar, DEQ	I'm fine with how we've been working on the monitoring plan through our conversations and emails. I don't plan to submit comments through the official March 11 deadline at this time. I sent the draft water monitoring plan over to Elizabeth McWilliams in WQP/MA. You can see her input below, Let me know what you think and if you'd like to use the new version of the Chemistry SOP for the monitoring plan.
DEQ		**NorthWestern response:** The Study # 3 Water Quality has been updated to include the new version of the Chemistry Standard Operating Procedures. *See* also Appendix B.
DEQ	Email from Keenan Storrar, DEQ	This is the draft water monitoring plan for NorthWestern Energy's Thompson Falls dam FERC license on the Clark Fork River. I've taken a look at the draft monitoring plan and it appears to accurately account for any water quality influence the dam may have on the river. Since you took a look at the monitoring plan for Northern Lights Lake Creek project I'm wondering if you'd like to review this plan and provide feedback? If you don't have time would you mind pointing me in the direction of someone in your program who would be able to look over it?
DEQ		**NorthWestern response:** NorthWestern appreciates DEQ's review and has made the requested modifications to Study #3 Water Quality.

DEQ	1	Once it's updated can you send the finalized plan back to me? I'll file it with our T-Falls records.
DEQ		**NorthWestern response:** The finalized plan was submitted to DEQ, as requested, on March 2, 2021. It is also included as Appendix B of this RSP.
DEQ	2	After finding the parameter table in Appendix A. The only thing that comes to mind is that they are referencing the outdated field manual. I'd let them know that we have phased that out and the chemistry sampling protocols can be found in the Chemistry SOP. These can be found under Monitoring Protocols on the same page.
DEQ		**NorthWestern response:** NorthWestern made the requested edits to the plan, found in Appendix B of this RSP
MDT	1	Comment: The Montana Department of Transportation (MDT) staff would like to thank you for the opportunity to provide input on the Proposed Study Plan (PSP) for the relicensing of the Thompson Falls Hydroelectric Project (FERC Project No. 1869). It does not appear that the proposed study plan or FERC relicensing will impact MDT facilities. Please contact Steve Felix, the Missoula District Maintenance Chief, at 406-523-5803, if the project will impact MDT facilities.
MDT		**NorthWestern response:** Thank you for providing the contact information, NorthWestern will keep MDT on our mailing list. NorthWestern concurs that the Project will not impact MDT facilities.

FWP	intro	Thank you for the opportunity to provide input on the NorthWestern Energy's (NWE) proposed studies relating to the relicensing of the Thompson Falls Hydroelectric Project (P-1869-060). We begin by describing our statutory trust responsibilities and management direction, followed with summary of coordination efforts and agreements reached and remaining concerns. We then finish with one revised study request and one new study request that we feel are necessary for us to manage the fishery resource at Thompson Falls Project under a relicensing scenario. The mission of the Montana Department of Fish, Wildlife & Parks (FWP) is to provide for the stewardship of the fish, wildlife, parks and recreational resources of Montana, while contributing to the quality of life for present and future generations. FWP is charged with the public trust obligation to protect fish and wildlife in Montana and their habit. Management direction for the fishery in the Clark Fork River drainage is articulated in the 2019-2027 Statewide Fisheries Management Program and Guide (FWP 2019) but notably includes enhancing fluvial populations of Bull Trout and Westslope Cutthroat Trout and ensuring adequate connectivity with tributaries for Rainbow trout and Brown trout in the Clark Fork River drainage. Open tributary systems in this stretch include the Thompson River, St. Regis River, Cedar Creek, Trout Creek, Fish Creek, Rattlesnake Creek, Ninemile Creek and many smaller systems, and management direction for these streams is to conserve and enhance migratory and resident population of all of the same trout species. Recent studies have also linked fish impacted by Thompson Falls Dam upstream to the Bitterroot and Blackfoot Rivers and Rock Creek in the vicinity of Missoula as well as downstream to Lake Pend Oreille in Idaho. Altogether, this open system above Thompson Falls Dam is more than 450 miles of mainstem river and tributaries being managed for migratory fish that are important to the region's economy and environmental conservation. Fish passage is a major aspect of two FERC licenses at two dams immediately downstream of Thompson Falls Dam; Noxon Rapids and Cabinet Gorge Dams owned by Avista Utilities. Milltown Dam, near Missoula was decommissioned and removed, restoring fish passage. The fish passage measures at Thompson Falls Dam are important pieces of restoring the fish migration in the Clark Fork River drainage. It is therefore critical that the Environmental Assessment evaluate the impact of the dam on these migratory species and how those impacts may compromise our ability to optimize their populations. NorthWestern Energy met with FWP five times between their Proposed Study Plan Meeting held on January 6 and this letter. FWP personnel spent numerous hours making recommendations to improve and resolve identified issues. The intent of the meetings was to share ideas and content, build shared understanding for study needs, and resolve disagreements with open communication. FWP appreciates the applicant's time in these efforts though agreement was not reached on all topics. **Agreements** The agreements reached in conversation with NorthWestern were specific to their proposed study plans as they are drafted in the PAD document. Comments listed below detail the revisions necessary to match the agreements in the same order the plans were numbered.
FWP		**NorthWestern response:** Thank you for the comments. NorthWestern greatly appreciates the efforts that the FWP staff made to meet to discuss the PSP in detail over the last several months. NorthWestern looks forward to continuing to work cooperatively with FWP during the implementation of the relicensing studies.

FWP	1	*NorthWestern's Study Plan 1: Operations Study* FWP is looking for more resolution of survival of different fish sizes, any turbine or generator upgrades after 2007, spillway changes with the new radial gates, and operational changes that may be more relevant to current and foreseeable future conditions. NWE agrees to update the literature review as an addendum to the 2007 Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project.
FWP		**NorthWestern response:** NorthWestern has included the requested study as Study #10 Updated Literature Review of Downstream Fish Passage, *see* Section 11.
FWP	2	*NorthWestern's Study Plan 5: Fish Behavior Study* FWP worked extensively with NWE on their fish behavior proposal to combine ideas of similar proposed studies (NWE study 5, FWP study 5). This was prioritized based on concerns that the short duration allowed for this study in a system so influenced by environmental conditions, such as flow regimes influencing optimal ladder operation, cannot be encountered in two seasons. Below are the agreed upon guidelines for the proposal: • Tagging of salmonids to be split proportional to what has been documented at the ladder (60/40) rainbow to brown trout. • Tagging of salmonids to be split 50/50 above the dam and in the ladder • Primary tagging locations are the mainstem Clark Fork River above the dam and fish that reach the top of the fish ladder, the lower 7 miles of the Thompson River, below the West Fork Thompson River, is a secondary option for captures above the dam. • Tagging efforts in 2021 should not exceed 25% of total tags available unless the telemetry stations are fully calibrated and operational.
FWP		**NorthWestern response:** *See* RSP #5 Fish Behavior which was revised in response to FWP's comment, and also *see* Section 12.5 Master Response to Comments on Study #5 Fish Behavior.
FWP	3	*NorthWestern's Study Plan 6: Downstream Transport of Bull Trout Study* FWP disagrees with portions of this proposed study including location of capture (electrofishing), timing of capture (weirs/electrofishing), level of effort (weirs/electrofishing) and size of fish to be collected from each stream. FWP provides the essential context and agreements, starting on page five of this letter, as they were too detailed to capture here.
FWP		**NorthWestern response:** *See* revised Study #6 which incorporates comments provided by FWP.
FWP	4	Last, to fully disclose all agreements reached, FWP agrees to not resubmit the Roving Creel and Upstream fish movement (i.e., tag and follow fish upstream of the dam) studies at this time. However, this wasn't decided because it lacked importance but rather, they would serve better to be considered for articles of protection, mitigation and enhancement at a later date.
FWP		**NorthWestern response:** NorthWestern appreciates FWP's decision to rescind its proposed Roving Creel and Upstream Fish Movement study.
FWP	5	FWP still believes an alternative is needed that emphasizes operating procedures and conditions that are favorable or optimal for all desirable migratory fish species as outlined in our October 27 letter. FWP prioritizes more species, looking at more options for moving fish, and is not just interested in potential improvements to the current ladder which was built with the intention of passing bull trout.

FWP		**NorthWestern response:** The purpose of the Study #4 – Hydraulic Conditions and Study #5 – Fish Behavior is to assess current fish passage conditions at the Project. Study #5 includes study of native fish as well as game fish which are surrogates for Bull Trout. The Comprehensive Phase 2 Fish Passage Report (NorthWestern, 2019) found that between 2011 and July 1, 2019, the upstream fish passage facility passed 32,130 fish of 14 species and three hybrids. The majority of the fish passed (76%) were native species. Most of the non-native species were desirable game fish. The upstream fish passage facility is clearly functional for providing passage for 'desirable migratory fish'. FWP has not provided justification for needing additional information (18 CFR § 5.9(b)(4) and the comment contains PME requests and as such does not constitute appropriate actions for this stage of the ILP.
FWP	6	Though both parties acknowledged there is limited data to fully characterize the native fish species movement and behavior from the far field to the near field of the fish passage facility, FWP believes that more tags need to be implanted in native, non-game species (northern pike minnow, mountain whitefish, and largescale suckers) to better assess this impact (at least 20 per species identified). NWE's original study proposal did not propose tagging any non-game fish species even though the second defined priority for the fish ladder beyond passing bull trout, is to pass natives (NWE PAD pg.51). FWP understands that these species may not be as resilient to tagging, however that does not mean that it should not be attempted. We also suggest tagging these species in March-April 2022 will help minimize any tagging mortality.
FWP		**NorthWestern response:** Study Plan #5 Fish Behavior has been modified to include Largescale Sucker. *See* Section 12.5 Master Response to Comments on Study #5 – Fish Behavior.
FWP	7	*NorthWestern's Study Plan 9: Westslope Cutthroat Trout Genetics Study* FWP is unsure how NWE will be successful in their proposed Study Plan for WCT (#9) when previous studies have not been able to correctly identify hybrids, and how it would inform management as all salmon ids are currently passed at the ladder. While FWP does have interest in quantifying the number of pure and hybrid Westslope Cutthroat Trout (WCT) that are passed at Thompson Falls Dam as per NWE's Proposed Study, FWP believes additional WCT genetic sampling is warranted in tributary streams that enter within and above the defined project area. FWP still holds concerns about what impacts the dam has on the migratory life history for WCT and knowing where the genetically pure WCT populations are upstream and in the vicinity of the dam as detailed in FWP's October submission of study proposals. This concern however was not resolved in conversations with NWE, so we are providing a revised study proposal (below, Study Plan #1). Our concerns are mainly with the suppressed migratory life history of WCT by the dam, that passage efficiency has not been quantified for any species, relatively few fish are passed above 30,000 cubic feet per second (cfs), the ladder shuts down above 60,000 cfs which is the time-frame WCT are most likely to move, and the lack of information on distribution.
FWP		**NorthWestern response:** NorthWestern appreciates FWP's support of Study #9 – Westslope Cutthroat Genetics. As for FWP's comment concerning additional genetics testing, *see* NorthWestern's response to the study request for a Westslope Cutthroat Trout genetics study found in Section 12.3.
FWP	8	Further, NorthWestern states that since the fish ladder opened in 2011, over 2,000 WCT, Rainbow Trout (RB) and their hybrids have been passed at Thompson Falls Dam (NWE PAD pg. 87). As a point of clarity, it should be noted that 282 putative WCT have been passed at the ladder between 2011

		and 2020 (NorthWestern 2021). Genetic testing was first employed in 2020 but results of this work are still pending. Over 2,100 Rainbow Trout (RB) and about 50 putative WCT X RB hybrids were also passed from 2011 to 2020 (NWE 2021).
		NorthWestern response: NorthWestern acknowledges this information.
FWP	Study Requests	NorthWestern's response to FWP's study requests are found in Sections 12.3 and 12.4.
SHPO	1	I was thinking about the Thompson Falls Project after the meeting today. You mentioned doing an update for the district (24SA0165) and considering if the site may no longer be Eligible or if features have been destroyed or lost integrity and need to be removed as contributing features. I believe you should also consider if you should extend the period of significance or add features that were not considered significant 30 years ago but may be considered so today. Just a passing thought when you get to that step in the process. Feel free to reach out to me or John.
SHPO		**NorthWestern response:** Northwestern has included language in revised Study #8 that explicitly states the inventory will include inventory and evaluation of all buildings and structures greater than 50 years old.
SHPO	2	Thanks for the chat conversation during the meeting. I double checked and Kyle Felsman's position with the CSKT has not been permanently filled yet. Michael Durglo Jr is our current contact for their THPO. But that could change once the position is filled.
SHPO		**NorthWestern response:** Northwestern has received notice that new the CSKT THPO is Kathryn McDonald. To date, she has raised no concerns about the project, but CSKT has stated they reserve the right to comment in the future. NorthWestern will continue to inform the CSKT about all aspects of project relicensing.
SHPO	3	I'm looking forward to seeing what you come up with on your predictive model. I think there is the potential for some interesting sites out there, but there simply hasn't been enough inventory work to verify.
SHPO		**NorthWestern response:** SHPO has offered suggestions about variables that might be considered in predictive model development and about the work of others that have prepared similar models in-state. Those suggestions will be incorporated, where appropriate, as model development progresses later this year.
Hagedorn	1	What steps would need to be taken to have the upper Thompson Dam reservoir dredged? It is filling in and the mud islands are getting larger each year. It allows more of the weeds to grow and limits water sport use on the river in that area. Does Northwestern Energy control the dredging or is that a Federal issue? Any information would be appreciated. I would just like to *see* the upper reservoir look as great as the lower.
Hagedorn		**NorthWestern response:** NorthWestern has no plans to dredge the reservoir and so has not assessed in detail what regulatory requirements would be involved.

LaMont	1	Slope stability is an important issue because it directly impacts hundreds of privately-owned land parcels adjacent to the reservoir. The issue was very briefly described in the Baseline Environmental Document (BED, page 23). The entire discussion on slope stability in the BED consisted of two short paragraphs. The first paragraph has two sentences regarding soil types, and the soil map referenced in the first sentence displays almost no information for the reservoir between Steamboat Island and Thompson River. The second paragraph reads as follows: “In 1990, MPC stated that water level fluctuations associated with existing operations have affected two terraces along the southern shoreline of the Thompson Falls Reservoir (MPC 1990). The sand terrace has been undercut by wave action, while the boundary terrace has been subjected to dry ravel and minor slippage where it is exposed as a high bank.” There is no mention of the current condition in this 2018 baseline analysis.
LaMont		**NorthWestern response:** The intent of the BED was to summarize information that was already on hand, versus collecting/creating new data. The intent of the Study Plan, when approved by FERC and implemented, is to collect/create new data. NorthWestern’s Study #1 Operations Study will evaluate slope stability related to proposed reservoir operations.
LaMont	2	The reservoir is causing slope instability as evidenced by mass slope failures, terraced slopes and undercut slopes throughout the reservoir's shoreline. While some of these signs of erosion are present upstream in the river section, they are not of the same magnitude. I have owned property on the reservoir for 10 years and have seen many instances of erosion during that time.
LaMont		**NorthWestern response:** NorthWestern understands the concern about slope stability however, it does not concur that slope failure and reservoir shoreline erosion is attributable to project operations. In general, erosion is a natural process that can be caused by many factors including wind, ice scour, recreational activities, operational activity, and shoreline development. NorthWestern’s Study #1 Operations Study will evaluate slope stability related to proposed reservoir operations.
LaMont	3	Many factors are contributing to slope instability such as soil type, topography, strong water currents during spring runoff, and wake action from boats. Management of water levels in combination with these factors can have a cumulative effect and contribute to instability.
LaMont		**NorthWestern response:** NorthWestern concurs that many factors contribute to shoreline instability, but many of these factors are outside of NorthWestern’s control.
LaMont	4	For example: When the reservoir is at low water levels the shoreline has more rock surfaces and a lower slope angle so a strong current has less erosive impact. In contrast, holding the reservoir at full pool during spring runoff keeps the strong current next to the shoreline vegetation where there is exposed soil and steeper slopes. The strong current, in combination with the water level being held at full pool, have the cumulative effect of increased erosion rate.
LaMont		**NorthWestern response:** During high flow periods in the spring, NorthWestern has limited capacity to influence the reservoir level. Thompson Falls Reservoir has limited storage capacity, and it is not possible to complete a significant drawdown to absorb spring runoff and associated full pool conditions.

LaMont	5	Holding the reservoir at full pool during July and August can aggravate erosion. Boats specifically designed to create wakes large enough for surfing now frequent the reservoir, along with people on jet skis/ Sea-Doos jumping self-induced wakes. These activities create large wakes that hit both sides of this narrow “run-of-the-river” reservoir with high intensity, eroding soil from the shoreline. Along most of its length (between Steamboat Island and Thompson River) the reservoir is barely 400 feet wide, the width of its no-wake zones.
LaMont		**NorthWestern response**: There is no evidence at this point that holding the reservoir at full pool during July and August is contributing to erosion. NorthWestern’s Study #1 Operations Study will evaluate slope stability related to proposed reservoir operations.
LaMont	6	Further, there has been a substantial increase in the number boats, most operating in violation of the no-wake zone, which is also contributing to erosion. Many are persistent violators of the no-wake zone, not simply boaters passing through the area. The photos below show a wake boat with a surfer and the resulting sediment flush after the wave hits the shoreline – fine soil particles are being flushed out from underneath the rocks. Eventually the rocks slide down the steep bank, exposing plant roots, the plants die, trees fall into the reservoir, and the slope slumps. The cumulative effect of boat wakes while the reservoir is at full pool is a major contributor to slope instability and should be addressed in the study plan.
LaMont		**NorthWestern response:** NorthWestern has no authority to enforce laws or regulations regarding watercraft use (other than, for example, safety matters such as installing the boat barrier). This authority is with FWP. NorthWestern’s Study #1 Operations Study will evaluate slope stability related to proposed reservoir operations.
LaMont	7	For a better understanding of the current condition, the shoreline could be mapped according to presence and character/type of erosion. Use of even general categories would be beneficial, e.g. mass failure, terracing, undercutting, and no sign of erosion. This would help describe the severity of the problem and document the impacts of current management on slope stability. Over time (maybe once every 5 or 10 years) the analysis could be repeated to track how conditions are changing. Relying on only 9 sample points and only one sample year, as proposed in the study plan, will not provide a thorough description of current condition.
LaMont		**NorthWestern response:** The nine chosen reference sites in Study #1 – Operations Study represent the broad variability in soil types, landform, slope, aspect, vegetation, erosion type/severity, shoreline management, flow velocity and other factors present along the reservoir shoreline. NorthWestern does not believe mapping the entire reservoir is warranted and would not be cost justifiable. If noticeable slope stability issues are observed to be occurring in real time during implementation of Study #1 Operations Study, but which are not within the nine chosen reference sites, then such observed slope stability issues would also be documented with notes and photos as part of the Study Plan. This additional aspect has been added to Study #1 in response to this comment.
LaMont	8	A more detailed description of current condition would also be useful for determining the number and location of sample points necessary for the purpose of measuring erosion. Each type of erosion (as listed above) should have at least a couple of sample points. The photo below is of the south shoreline where there is evidence of mass failure, but the proposed study plan doesn't indicate that areas with mass failure are being sampled.

		The photo below is on the north side where the shoreline is being undercut. Rocks and roots are being exposed due to erosion. Again, sample points in this type of location would be useful.
LaMont		**NorthWestern response:** *See* response to LaMont Comment 7. Study #1 Operations Study meets generally accepted practice for evaluation of shoreline erosion *see* Section 2.7. The results of the RSP, in conjunction with existing data, will provide the information needed for the relicensing. 18 CFR § 5.9(b)(4), (7).
LaMont	9	Another area of concern is between Cherry Creek and Thompson River Lumber (between proposed sample points 8 & 9) where the slope has multiple terraces from erosion. Perhaps adding sample points in areas with sandy soils would help track erosion rates.
LaMont		**NorthWestern response:** *See* response to LaMont Comments 7 and 8.
LaMont	10	Erosion can be a slow steady process or an abrupt process attributable to a single event. Relying on a single season's-worth of data is thus a gamble -- it's possible that the proposed study will be conducted in a year of atypical erosion activity. If erosion is detected in the one year study, was it due to wake action or to changes in water level? As an option, a multiple year study plan could be used to generate multiple data points over time. Multiple data points provide a better description of erosion rates from the current management (the existing condition), and erosion rates from the proposed changes in management
LaMont		**NorthWestern response:** NorthWestern's Study #1 Operations Study will evaluate slope stability related to proposed reservoir operations. NorthWestern's methodology and timeframe for the shoreline stability component of the Operations Study is consistent with generally accepted practices as required by 18 CFR § 5.9(b)(6). Further, a multi-year study would not meet the ILP study time frame or be cost justifiable 18 CFR § 5.9(b)(7).
LaMont	11	The study plan could also address the effectiveness of possible mitigations that could be incorporated into management to reduce impacts on slope instability. For example, Would reducing reservoir height during spring runoff or peak boat season help reduce the rate of erosion? Perhaps the study plan could evaluate how much the water level would need to be lowered to have a beneficial effect of reducing rate of erosion.
LaMont		**NorthWestern response:** *See* response to LaMont Comment 4. Per the ILP, once Study #1 Operations Study is complete and the study results are analyzed, any appropriate PMEs to address resource effects caused by erosion will be considered at that time.
LaMont	12	In the fall of 2019 a slope stability restoration project was implemented on private land as documented in a NorthWestern Energy brochure (2020 NWE). Will the restored shoreline become undercut over time? The study plan could evaluate the long term slope stability at the restoration site. Information from long term monitoring would help NorthWestern Energy assist other private landowners with design recommendations, cost estimates and funding assistance for similar restoration projects.
LaMont		**NorthWestern response:** NorthWestern intends to continue monitoring the Pilot Project which is not part of NorthWestern's RSP.

LaMont	13	Would education and enforcement of the no-wake zone reduce the rate of erosion? Currently there is no enforcement of the no-wake zone, so there is little compliance with this regulation. The study plan could evaluate if the associated cost of enforcement and education are effective in increasing compliance with the no-wake regulation.
LaMont		**NorthWestern response:** NorthWestern has no authority to enforce laws or regulations regarding watercraft use (other than, for example, safety matters such as signage or installing the boat barrier). Enforcement of the no-wake zone lies with FWP.
LaMont	14	Property owners and recreationalists (with two potentially disparate viewpoints) could be surveyed for knowledge of and compliance with the no-wake zone regulation. Another source of information may be AVISTA, who helps fund education and enforcement activities in the nearby Noxon Reservoir.
LaMont		**NorthWestern response:** NorthWestern does not intend to add a study to survey of property owners to the RSP. However, Study #7 – Visitor Survey has been modified to include a question regarding familiarity with the no-wake zone regulations. *See* response to LaMont Comment 13.
LaMont	15	I do realize and appreciate that NorthWestern Energy has tried to educate the public about the no-wake zones. However, the current signs are very small and need to be revised. To make the no-wake zone enforceable the signs need to be more visible, show the boundaries of the no-wake zone on a map, and define a wake (see Montana wake definition referenced below). Also, there is a need to post aquatic invasive species prevention requirements at all boat ramps (including North Shore and Steamboat private launch sites). Owners of the private launch sites would likely support the installation of new signs at these sites.
LaMont		**NorthWestern response:** *See* response to LaMont Comments 13 and 14. NorthWestern already posts the State-approved Aquatic Invasive Species signs at the public boat launches. Per the ILP, once the studies are complete and the study results are analyzed, any appropriate PMEs will be considered at that time.

Comment Letters Received

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
March 3, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1869-060 – Montana
Thompson Falls Hydroelectric Project
NorthWestern Energy

Mary Gail Sullivan
Director, Environmental & Lands Permitting & Compliance
NorthWestern Energy
11 East Park Street
Butte, Montana 59701

VIA FERC SERVICE

Reference: Comments on Proposed Studies

Dear Ms. Sullivan:

After reviewing the proposed study plan for the Thompson Falls Hydroelectric Project (P-1869-060), and participating in the January 6, 2021, study plan meeting, Commission staff has comments on the proposed Operations Study. The comments on the proposed study are included in the enclosed Schedule A.

If you have any questions, please contact Mike Tust at (202) 502-6522 or via e-mail at michael.tust@ferc.gov.

Sincerely,

David Turner, Chief
Northwest Branch
Division of Hydropower Licensing

Enclosures: Schedule A

Project No. 1869-060
Schedule A

ADDITIONAL INFORMATION AND COMMENTS ON PROPOSED STUDIES

Operations Study

Monitoring Shoreline Sites Between Test Phases

Your proposed Operations Study would evaluate three operation scenarios (test phases) consisting of different levels of generation and corresponding raising and lowering of the reservoir within your proposed 2.5-foot operating band.[1] In addition to evaluating changes in generation, you propose to evaluate effects of each of the different operational scenarios on shoreline stability, fish (i.e., stranding potential, access to tributary streams, and operation of fish passage facility), recreation and aesthetics, public safety, water quality, wetland/riparian habitats, and cultural resources. To evaluate effects on shoreline stability around the project reservoir, you propose to visually monitor nine sites along the reservoir shoreline noting the presence or absence of erosion, type of erosion, magnitude of erosion, soil type, land management activities and shoreline erosion control measures (if any). At the study plan meeting, you noted that five total monitoring events would be conducted, two to establish baseline conditions and one occurring after each test phase. However, your proposed study plan only identifies four monitoring events (i.e., one baseline site visit conducted in October 2020, another baseline site visit planned to occur in the spring of 2021 prior to Phase 1, between Phases 1 and 2, and following Phase 3. It is unclear why you do not propose to monitor the shoreline sites between Phase 2 and Phase 3, particularly since Phase 3 would involve testing the maximum generation capacity changes during the study. We suggest you revise the study plan to include the additional monitoring event between Phases 2 and 3 or explain your reasoning why monitoring the shoreline sites between Phase 2 and Phase 3 is not needed.

FERC #1

[1] Under each test phase, the reservoir elevation would be reduced, increased, and held stable at increasing magnitudes and you state that by the end of the three-phase study, the reservoir will have been held static at every half-foot elevation for the top 2.5-feet for extended observations. Each test phase would be conducted for a continuous week (7 days) and a minimum of two weeks will be spaced between phases to reestablish a baseline condition in preparation for the subsequent phase of testing.

Reservoir Levels

Your proposed study plan includes three graphs (figures 2-1, 2-2, 2-3) that simulate the change in reservoir elevations that may occur under each of the three operation test phases. Figure 2-1 illustrates a potential scenario where the reservoir drops only 2.2 feet over the course of Phase 1 due to the random ordering of specific operations rather than the expected 2.5 feet. Please clarify whether the reservoir would be drawn down 2.5 feet under all three operational scenarios. Please also clarify at what level the reservoir will be held during baseline erosion monitoring and during the two-week period between each operational phase.

FERC #2

FERC #3

Recreational Boating Effects

The proposed study plan indicates that a small amount of erosion, principally in fine-grained alluvial soils on the south shore, occurs along the reservoir shoreline due to wave action from recreational boating. In your revised study plan, please indicate how you will distinguish erosion effects from recreational boating from effects caused by changes in operation.

FERC #4

USDA United States Department of Agriculture | Forest Service | Region One

Northern Region
26 Fort Missoula Road
Missoula, MT 59804

File Code: 2770
Date: March 9, 2021

Mary Gail Sullivan
Director, Environmental & Lands Permitting & Compliance
Northwestern Energy
11 East Park Street
Butte, MT 59701

Re: USDA Forest Service Comments on NorthWestern Energy Proposed Study Plan Document and Forest Service Study Requests for FERC relicensing of Thompson Falls Hydroelectric Project, FERC Project No. 1869-060

Dear Ms. Sullivan:

NorthWestern Energy filed the Proposed Study Plan (PSP) with the Federal Energy Regulatory Commission on December 11, 2020. The Commission has solicited comments on the PSP, scoping document 2, and identification of issues and associated study requests.

We have specific comments to the PSP (Enclosure 1) and two proposed resource studies necessary to assess the potential Project effects on environmental resources (Enclosure 2). The resource study proposals have been revised and reduced in scope from the original five studies submitted in October in response to the pre-application document. The study revisions are based on information provided in the PSP, study plan meetings, and subsequent collaboration with the Licensee. The Lolo National Forest continues to be primarily interested in studies on the spatial and temporal effects of Project operations on riparian resources due to changes in the Clark Fork River system. The requested studies will provide the Forest Service with the necessary information to determine the need for and type of mitigation necessary for the adequate protection and utilization of the Forest as required under the Federal Power Act.

Thank you for the consideration of this information. Please contact Robin Jermyn, Realty Specialist, Lolo National Forest, by phone at (406) 499-2734 or by email at robin.jermyn@usda.gov if you have any questions.

Sincerely,

JOSEPH ALEXANDER
Digitally signed by JOSEPH ALEXANDER
Date: 2021.03.10 16:30:27 -07'00'

for LEANNE M. MARTEN
Regional Forester

Enclosure 1: PSP comments
Enclosure 2: Study Requests
cc: FERC Service List; Mary Gail Sullivan, Northwestern Energy

Thompson Falls Hydroelectric Project, FERC No. 1869-060

USDA Forest Service
Lolo National Forest

Comments on NorthWestern Energy's Proposed Study Plan (PSP)

PSP Section 2, Proposed Study 1 Operations Study page 11: The second paragraph describes that NorthWestern is proposing that the project continue to provide the baseload generation and flexible capacity needs by using the top 2.5 ft. of the reservoir opposed to the current authorized 4 ft. Literature examples discuss the benefits to native species and control of non-native species from reservoir level manipulation. Keeping the flexibility of using the top 4 ft. could aid resource needs. USFS #1

PSP Section 2, Proposed Study 1 Operations Study page 12: Under the goal and objectives of this study in the Wetland/Riparian Habitats section, the Forest Service recommends the study include evaluating the data collected to also determine the effects on current and future invasive species (as recognized on the Montana invasive species list) in regards to riparian habitat. USFS #2

PSP Section 2.2, Proposed Study 1 Operations Study page 16: Has NorthWestern Energy considered utilizing remote sensing as a study method for Shoreline Stability information in order to set the baseline for the next license period. USFS #3

PSP Section 2.2, Proposed Study 1 Operations Study page 19: The PSP states "the assessment of effects of operational fluctuations on fisheries will include evaluating the potential for fish stranding, habitat changes at the mouths of Cherry Creek and Thompson River, and impacts to the fish passage facility." The Forest Service identifies these areas as good locations for producing a bathymetric map to be used as a baseline for fill and depositional patterns and rates. These locations would also be well suited for pike spawning where reservoir flow operations (i.e. reservoir levels, flow rates and draw downs) and stranding could target pike mortality and be favorable for native species. USFS #4

PSP Section 2.2, Proposed Study 1 Operations Study page 28: Under the study methods for the Wetland/Riparian Habitats the PSP states "Wetland and Riparian areas will be identified using the Montana Spatial Data Infrastructure Wetlands Framework (2020). This information will be utilized to locate the approximate location of identified wetlands, and the type and extent of these areas adjacent to the reservoir. The risk to each wetland and riparian area altered hydrological connection due to reservoir fluctuations will be ranked as high, medium, or low. Risk will be determined by multiple factors including the surface water connection, soil type, slope, and distance from the ordinary high-water mark of the reservoir. Ground-truthing will be used to validate the results of the mapping stratification." This methodology may be able to be expanded to generate a bathymetric map and evaluate the percent of suitable pike spawning habitat that would be dewatered/disconnected by dropping water levels. In addition, it may inform the percent of the reservoir that could be dried up to control invasive plant species. USFS #5

PSP Section 2.4, Proposed Study 1 Operations Study page 31: Under the section regarding resource impacts observed during the 2019 operations test the second paragraph states "A variety of reservoir fish species were stranded during the operations test when the reservoir was drafted 4 feet. These included Largemouth Bass, Smallmouth Bass, Northern Pike, Pumpkinseed, Yellow Perch, Redside Shiner, Northern Pikeminnow, Black Bullhead, Yellow Bullhead, and Largescale Sucker. Most USFS #6

fish were less than 3 inches in total length but a few Northern Pike up to 10 inches were observed." The Forest Service would like to note that an improved understanding of depth/bathymetry coupled with water depths could be refined to target intended mortality of invasive species. USFS #6

PSP Section 2.4, Proposed Study 1 Operations Study page 32-33: The report for Shoreline Stability following the 2019 operations test has improbable interpretation of results. It is very uncommon for forested environments (of various geology and soil horizons) to present erosion and "caving" upon snow melt as described. The erosion/caving is likely associated in some manner to reservoir impacts either from current operations and/or from reservoir presence since formation. Most erosion in forested, and even many natural grassland environments, occurs only when flow is concentrated or when there is significant loss of vegetative cover and compromised rooting depths/strengths. The erosion and bank caving should be further assessed relative to revegetation/mitigation opportunities with a datum of reference conditions that are representative of forest, stream, and lake shore conditions outside of reservoir context. USFS #7

PSP Section 5.1, Proposed Study 4 Hydraulic Conditions page 47: The goals and objectives stated in this section only address the velocity field hydraulics downstream of the fish passage facility. This is inconsistent with details later in the proposal that address hydraulics much more comprehensively along the dam face and key features. The section as written appears to be singularly focused on the fish passage facility and also doesn't address the important synchronous work with the fisheries telemetry component (and discussed later in the PSP). The Forest Service recommends that the goal should be to understand hydraulics (velocity, thermal, and density) in the near field and far field, as well as along features of the dam and beyond. We specifically propose the following: Two-dimensional and/or three-dimensional fluid dynamic model outcomes representing hydrologic conditions of 80-90% movement capability for targeted fish species within the dam influence zone (including upstream and downstream of dam as appropriate, dam face, radial gate, spillways, and fish passage facility). In addition, we propose addressing means and methodologies used to validate model outcomes per state-of-technology procedures and known limitations. USFS #8

PSP Section 5.2, Proposed Study 4 Hydraulic Conditions page 48: The Study area defined includes the channel downstream of the Main Channel Dam to the High Bridge. The Forest Service recommends the study includes extending the area upstream to include the reservoir. This would gain an understanding of the flat areas related to drawdown possibilities, and how drawdown relates to fisheries and fill rates. USFS #9

PSP Section 5.2, Proposed Study 4 Hydraulic Conditions page 49: The Task 2 – Hydraulic Modeling section addresses overall river channel hydraulics opposed to just focusing on the fish passage facility. This is strongly supported by the Forest Service. It is recommended that the timing and range of discharges studied represent flows that are within the target timing for fish passage 80-90% of the time. Specifically: Given appropriate surrogate fish species, identify stream discharges and seasonal timing that encompass and represent 80-90% of the fish behavioral movement needs through the dam influence zone (ie. upstream, downstream, dam face, radial gate, spillways, and fish passage facility). Typically, federal and state agencies define an upper and lower design flow as the river flows that are equaled or exceeded 5% and 95% of the time, respectively. Fishways should function under these conditions and be effective during 90% of the migratory period. Taking bull trout as an example and based on a migratory period of March 15 through October 15, the 5% exceedance (i.e., high design flow) at Thompson Falls is 66,000 cfs. USFS #10

PSP Section 6, Proposed Study 5 Fish Behavior page 53: The PSP states the goals and objectives of the upstream passage of fish are in order or importance: 1. Bull Trout; 2. Native fish species; 3. Nonnative salmonid sport fish. With native fish species being the second priority, it is recommended USFS #11

that some non-game species are tagged at the fish passage facility and tracked through the reservoir. This would maximize the value of existing infrastructure by having other tags in the system and would provide additional data on how other species interact with the hydraulic information in the near and far field environments. USFS #11

PSP Section 6, Proposed Study 5 Fish Behavior page 53: NorthWestern's PSP states that this study will provide a quantitative approach to evaluating the effectiveness of upstream fish passage at the "Project", which would involve upstream through the reservoir. This is strongly supported by the Forest Service, as a project level approach is much preferred over just evaluating the fish passage facility. USFS #12

PSP Section 6.2, Proposed Study 5 Fish Behavior page 56: Paragraph 2 of the Study Description states that NorthWestern proposes the use of radio telemetry to monitor upstream fish migration *downstream of the Project*. The Forest Service recommends additional manual tracking within the reservoir, accompanied by the FS proposed hydraulic modeling, since tagged fish would provide data regarding movement, cover and dynamics. It is recognized that Northwestern monitored fish movement upstream through the reservoir in 2002 and 2003, but with this data now being 20 years old, the Forest Service is recommending studies be conducted that will provide an updated baseline to better inform the next 50 year license period. USFS #13

PSP Section 6.2, Proposed Study 5 Fish Behavior page 57: The study area identified would focus on fish movement in the far field, near field, and fish passage facility entrance. The Forest Service recommends the exit and upstream areas through the reservoir also be included for at least one study year with at least, if not targeted, opportunistic tracking within the reservoir. USFS #14

PSP Section 6.2, Proposed Study 5 Fish Behavior page 57: The PSP Study Methods section identifies that fish will be collected from the Thompson River and states the assumption that Thompson River fish will be motivated to return upstream after transport and release downstream of dam. If this assumption is inaccurate, data will be not be valid. The Forest Service recommends an increase in the sample size (100 from Thompson River and 100 from downstream) as well as tagging of captured fish from both the Thompson River and downstream areas. This would decrease assumptions of upstream return motivation. If Brown Trout and Rainbow Trout populations are not adequate to capture 200 fish, substitute with Sucker or Whitefish from the downstream capture. USFS #15

PSP Section 6.2, Proposed Study 5 Fish Behavior page 58: Given the timing windows for the studies to be conducted and each species (Brown Trout and Rainbow Trout) respectively only being collected and tagged one year, the Forest Service recommends that a portion of the tags ordered be larger in size with longer battery life for increased data collection. These larger tags would be used in the larger fish captured. In addition, we also add that tagging large non-game fish such as mountain white fish and largescale sucker could likely assist (we undoubtedly recognize distinct differences in fish species and behaviors; however, many unknowns remain and leveraging this effort towards expanding to other species beyond brown and rainbow trout could lead to very insightful findings and add a much greater comprehensive understanding of fish movement and overall behaviors) USFS #16

PSP Section 6.2, Proposed Study 5 Fish Behavior page 59: Under the Data Analysis section the Forest Service recommends including language to include at least mountain whitefish and largescale sucker, if recommendation to also capture and tag these species is adopted as suggested above. USFS #17

USDA Forest Service, Lolo National Forest
Study Requests to NorthWestern Energy,
Thompson Falls Hydroelectric Project, FERC No. P-1869
March 11, 2021

Study Request No. 1: Fluid Dynamic Effects on Fisheries Movement Behavior at Thompson Falls Dam

Goal and Objectives

Assess and delineate the spatial and temporal effects of fluid dynamic alterations (i.e., thermal, density, and hydraulics) caused by the dam presence and hydropower operations on native fish (non-salmonid and salmonid) movement and behavior under hydrologic conditions occurring for 80-90 percent of the migratory fisheries movements.

The Proposed Study Plan (PSP) submitted by NorthWestern Energy would inform much of the FS Study Request No. 1 goals and objectives described herein, specifically from the results of their proposed Study 5, Fish Behavior. The FS requests that the Licensee modify their study plans in the PSP to provide the Forest Service with the information necessary to fully assess the potential Project effects on this resource. The FS needs the information to determine the need for and extent of mitigation necessary for the adequate protection and utilization of the Forest as required under the Federal Power Act.

- Objective 1 - Assess and determine the most strategic and appropriate surrogate fish species to represent major movement needs within the Clark Fork River for (1) bull trout, (2) other salmonids, and (3) non-salmonids for a typical range of native fish dynamics/behaviors/abilities (e.g. avoidance, staging, attractive, etc.).
- Objective 2 - Use applicable state-of-technology and professional standards to identify the most appropriate numerical modeling scheme(s) and fidelity (e.g. 2D or 3D hydrodynamic modeling) to assess and quantify a baseline of how the Thompson Falls Dam (upstream, downstream, dam face features, and ladder) alters fluid dynamics (e.g. turbulence, density currents, etc.) and thermal regimes as compared to natural river conditions.
- Objective 3: Using the most applicable numerical model (2D or 3D) and telemetry/fish position data (e.g. VPS, PIT), assess and delineate suitable and non-suitable dam-related hydraulic and habitat conditions for native fisheries that correspond to hydrologic conditions representing 80-90% movement timing needs, necessary cover, and attraction flows to the fish passage facility, or other as appropriate.
- Objective 4: Develop prioritized strategies (dam operational or physical changes) for meaningful structural dam modifications, operational changes, or other mitigation measures that would assist bull trout recovery and fulfill westslope cutthroat trout (WCT) protections, coupled with an acceptable implementation schedule.

There is likely inter-agency overlap and opportunities to coordinate on the study goals and objectives between Montana Fish Wildlife and Parks, U.S. Fish and Wildlife Service, and Confederated Salish and Kootenai Tribes. Modifications to study proposals that increase efficiencies and effectiveness in achieving the goals should be embraced along with regular coordination and communication. Study outcomes and deliverables would include, but not be limited to the following:

- 2-D and 3-D fluid dynamic model outcomes representing hydraulic conditions (depth and velocity) of 80-90% movement capability and needs for surrogate fish species within the dam influence zone (including upstream, downstream, dam face features, and ladder)
- Telemetric/fish position outcomes of the surrogate fish species during stream discharges of typical natural movement needs through the dam project zones, especially targeting dam face, radial gate, spillways, and fish passage facility, but also including continuity through the reservoir.
- Assessments and comprehensive reporting on at least the following:
  a. Which computational fluid dynamic (CFD) model(s) (2D or 3D) meets the standards of practice to address specific issues/conditions in the future for optimized effectiveness and cost considerations;
  b. Identified surrogate fish species are adequate to allow inference to the total native fish population dynamics and uncertainties;
  c. If temperature and water density profiles are necessary to provide further explanation of fish dynamics following hydraulic assessment;
  d. A prioritized implementation plan for actions that would contribute to recovery and/or protections for non-salmonids and salmonids, including but not limited to modifications to the reservoir, dam face, radial gate, fish passage facility and spillway; and fish capture and movement needs, or other mitigations necessary to offset dam effects; and
  e. A prioritized list of additional data needs and mitigation support to accomplish recovery and protections within the regulatory frameworks described herein.

This information and associated tiered, strategic mitigation approaches are instrumental to bull trout recovery efforts, as well as WCT. This information would also help ensure viability of all native fish assemblages and be helpful to other resource areas such as recreation and valued public use (i.e. upstream mudflat deposition and downstream loss of sand and gravel "beach" deposition).

Relevant Resource Management Goals and Public Interest Considerations

The Forest Service is responsible for implementing laws and policies that have bearing on the "health" of wetlands, streams, and riparian areas including but not limited to the following:

1. The Organic Act
2. Multiple use Sustained Yield Act
3. Clean Water Act
4. Safe Drinking Act
5. Endangered Species Act
6. Federal Land Planning Management Act
7. National Forest Management Act

Forest Service Manual on National Species Viability and TES Management Direction:

- FSM 2670.22 states: Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. A viable population is further defined by FSM 2670.5 as one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.

- FSM 2670.12 - Secretary of Agriculture's Policy on Fish and Wildlife Departmental Regulation 9500-4 directs the Forest Service to:
    1. Manage "habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species."
    2. Conduct activities and programs "to assist in the identification and recovery of threatened and endangered plant and animal species."
    3. Avoid actions "which may cause a species to become threatened or endangered."

Endangered Species Act, Section 7(a)(1): "All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act."

Lolo National Forest Plan

- *Section B, Objective 1*: "The Forest Plan provides habitat for viable populations of diverse wildlife and fish species on the Forest with special attention given to species dependent on snags, old growth areas, and riparian zones."
- *Section II (A)(7)*: "For threatened and endangered species occurring on the Forest, including the grizzly bear, gray wolf, peregrine falcon, and bald eagle, manage to contribute to the recovery of each species to non-threatened status."
- *Section E. Standard 27*: "Management practices in essential habitat of threatened and endangered species must be compatible with habitat needs of the species….consistent with the goal of recovery to nonthreatened status…..Cooperate with future interagency efforts to recover those species….For plant and animal species that are not threatened or endangered, but where viability is a concern (i.e. sensitive species, manage to maintain population viability."
- *Section E. Standard 28*: "Land management practices shall be designed to have a minimum impact on the aquatic ecosystem, free from permanent or long-term unnatural imposed stress."

Inland Native Fish Strategy (INFISH, 1995): This decision amended the Lolo National Forest Plan with at least the following provisions directly relating to management responsibilities pertaining to the Thompson Falls FERC Relicensing (LH-1) "Require…During relicensing of hydroelectric projects, provide written and timely license conditions to the Federal Energy Regulatory Commission (FERC) that require fish passage and flows and habitat conditions that maintain/restore riparian resources and channel integrity. Coordinate relicensing projects with the appropriate State agencies".

Forest Service Manual, 2670.21 (1): "Manage National Forest System habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided under the Endangered Species Act are no longer necessary."

Existing Information and Need for Additional Information

With a statutory focus on ESA and bull trout, both the U.S. Forest Service (2013) and U.S. Fish and Wildlife Service (2015) state that current and projected dam influences are affecting upstream migrations between Lake Pend Oreille and the Clark Fork River above Thompson Falls, and are contributing to population declines of bull trout within the Clark Fork system. To varying degrees, effects of the dam and its operations on population declines are likely substantial for the array of native non-salmonid and salmonid fish species present in the

Clark Fork River; however, little to no information is available. It is well understood, however, that bull trout require a large part of the Clark Fork stream network at various stages in their life cycle.

While the fish passage facility has been shown to be partially functional and has successfully passed several bull trout upstream (avg = 2.3 fish/year from 2011 – 2017), it is not 100% effective at providing upstream passage of motivated bull trout. This is supported by passive integrated transponder (PIT) array detections of bull trout entering the lower ladder but not ascending to the holding tank where they could be passed upstream. Between 2015 and 2016, eight bull trout entered the lower ladder but did not initially ascend to the top; two ascended at a later date while six never ascended (indicating an issue at/in the ladder, and likely undesirable hydraulics). These six fish represent a fairly large proportion of total number of bull trout detected at the ladder since 2011 (16 passed and 6 not passed = 22 total for a 27% non-passage rate). It is not clear whether all six of these bull trout were sexually mature and would otherwise have spawned upstream if not for the delay/confusion at the ladder, but that may have been the case for some. Perhaps more importantly, the fish ladder can only function within a set range of flow and temperature parameters; the ladder may be closed during peak flows in May/June at the time bull trout are attempting to reach spawning tributaries. Fish ladder reports from 2011-2017 show upstream passage of 213 WCT; avg = 30.4/year; NWE 2018), likely well below historic levels.

A Scientific Review Panel Memorandum (2020) to NorthWestern Energy (NWE) and the Thompson Falls Dam Technical Advisory Committee provides a good summary of some of the information that is lacking. Their findings concluded the following:

A. "Additional studies are needed to assess effectiveness" of ladder operations
B. "Two needs in particular are critical: telemetry and CFD"
C. "At this time, there is insufficient information to determine if the flow and velocity are not adequate to attract fish to the ladder"
D. "In the past, Bull Trout have been used to understand fish movements around the dam, but the sample size was too small, and the reason for their upriver movements was not clear."
E. "…no information on the velocity fields at or near the entrance is available."
F. "Telemetry was performed prior to ladder construction, and thus, offers no insight."
G. "Swimming performance of Bull Trout is not well known. However, more information is available on Rainbow Trout, which may serve as a (swimming capacity) surrogate for Bull Trout."
H. "Due to the lack of biological evaluation and hydraulic data on the ladder entrance, the Panel cannot offer an opinion on the ladder entrance effectiveness at this time."

With these and other large data gaps indicating a lack of understanding of hydraulics identified for bull trout - a mandated species of focus - it signifies how little information there is available for all native fish species.

Project Nexus

Fluvial/ adfluvial bull trout life history forms require extensive amounts of connected riverine habitat to sustain viable, self-sustaining populations (Rieman and McIntyre 1993a). While some bull trout do exhibit resident life histories within smaller drainages, these isolated populations are likely at risk of losing genetic diversity and are extremely vulnerable to disturbance events (Rieman et al. 1993b). Moreover, it is likely that strictly resident-only populations did not exist naturally as they do today because fluvial/adfluvial fish would periodically, if not annually, migrate into these smaller drainages to spawn. Fluvial WCT have similar life history needs to bull trout.

NWE is collecting useful information towards improving our understanding of dam impedance on multiple fish species. Although all fish species are affected, several appear to be affected more than others and more information needed to clearly understand behavioral patterns as they relate to fluid dynamics under various critical stream flows. Between 2011 and July 1, 2019, roughly 32,000 fish ascended the ladder, including 17 bull trout (NWE 2019). The numbers of bull trout passing through the ladder are not sufficient to determine passage efficiency (annual number of bull trout captured at the ladder range from 0-5). Over that same period, 3,217 salmonids were recorded at the ladder, with rainbow trout (RBT) being the most abundant salmonid (1,600 RBT (228.6/year; NWE 2018). The number of RBT passed upstream is an order of magnitude larger than the number of WCT, which have similar migratory requirements to bull trout. There are also many non-salmonids that pass through the ladder, but the number passing is likely a fraction of what would have passed naturally. Comparisons can be made to the Milltown Dam removal on the Clark Fork River. It appears sucker rejuvenation is affecting entire trophic levels in the Upper Clark Fork River, as ospreys and other prey species have substantively increased their consumption of sucker species (Hendrickson, personal communication, 2020). At Thompson Falls Dam, there are counts of non-salmonid fish through the ladder, but there is no data on population-based non-salmonid movement needs and/or emphasis relative to upstream ecosystem linkages, especially considering stresses under climate change scenarios.

Although overall fisheries movement through the dam has documented barriers to passage, all information, including expert panel recommendations, indicates that subject matter experts could study surrogate fish species (non-salmonid and salmonid) during important seasonal movements and integrate telemetry work with CFD modeling (2D, 3D) to supplement current information and provide insight to movement patterns (e.g. bull trout are known to move within channel margins (Erickson et. al, 2020)). Studying both salmonid and non-salmonids use of channels and channel margins may improve our understanding of hydraulic barriers to bull trout movement. In addition, it is known that flow separation likely produces an adverse behavioral reaction in bull trout, but exactly where and under what flow conditions is not well understood. There is also a question of whether the ladder may not be in the most ideal location, and this uncertainty and lack of data indicate that hydraulic modeling and telemetry are foundational to our understanding.

Entrance and attraction flow efficiency can be determined from radio telemetry, passive integrated transponders, hydro-acoustics, and other biological evaluations, if surrogate fish species of adequate sample size can be studied. This information can then be extrapolated to similar mechanics and behaviors of other fish species. Hydraulics, and more specifically velocity fields, can be used as indirect indicators of effectiveness of fish passage infrastructure. For example, species-specific swimming capabilities can be compared with velocity fields at or near the ladder entrance to evaluate effectiveness. There is less information available on bull trout swimming performance as compared to Pacific salmon, but it is reasonable to assume that bull trout performance (like many salmonids) is related to body size, especially length.

Improving our understanding of how fluid dynamics at dams' affect native fish passage is also important because of overall ecosystem linkages and large-scale effects of what is both known and unknown about population viability and linkages between species.

The Forest Service manages the majority of the land and stream habitat necessary for multiple life stages of native fisheries within the Lower Clark Fork River (NWE 2018), creating a direct relationship between agency management directives and fisheries recovery, conservation, and protection. In addition to bull trout ESA

listing and federal responsibilities, Region 1 of the Forest Service has designated WCT as a Sensitive Species which affords the highest protections of any species not federally listed by the Endangered Species Act.

The FS requests that the Licensee modify their existing study plan, as delineated in the PSP, to provide all the information to the FS and other stakeholders to fully assess the potential Project effects on this environmental resource. The FS needs the information to determine the need for and extent of mitigation necessary for the adequate protection and utilization of the Forest as required under the Federal Power Act. Thompson Falls Dam directly affects the fluvial populations of bull trout and WCT existence in waters and the outcomes, directives, and emphasis on the stream habitats managed within the jurisdiction of the Lolo National Forest. Information obtained from this study would inform future habitat management decisions on Lolo National Forest.

Moreover, the impacts of climate change are affecting stream conditions on the Lolo National Forest (Wade et. al, 2016); therefore, it is imperative that fisheries and overall management are informed and guided by species viability information and conservation measures that can be realistically achieved within our jurisdiction. The

Proposed Methodology

Identify surrogate fish species, appropriate sample size, and study period (i.e. years) necessary to utilize state-of-the-art radio telemetry efforts (VPS after Wyman, et. al. 2017); common PIT, etc.) to conduct the following:

a. Using surrogate fish species, inference/extrapolation to other species including bull trout, WCT, and non-salmonid/non-game fish behavior moving from natural stream conditions upstream, downstream, and through the fish passage facilities at the dam.
b. Identify cover/holding/staging areas, routes, and timing of fish movements and relevant behaviors such as attraction, movement, fatigue, etc.
c. Identify movement delays and deviations from natural behavioral and movement patterns
d. Identify areas between abutments or other features and associated hydraulic conditions that tend to attract or dissuade specific surrogate movement and timing
e. Determine optimal quantification, visualization, and extrapolation methods as well as verify that surrogate species and sample size are adequate

Given appropriate surrogate fish species, identify stream discharges and seasonal timing that encompass and represent 80-90% of the fish behavioral movement needs through the dam influence zone (i.e., upstream, downstream, dam face features, and ladder). Typically, federal and state agencies define an upper and lower design flow as the river flows that are equaled or exceeded 5% and 95% of the time, respectively. Fishways should function under these conditions and be effective during 90% of the migratory period. Using bull trout as an example and based on a migratory period of March 15 through October 15, the 5% exceedance flow (i.e., high design flow) at Thompson Falls Dam is 66,000 cfs.

Once surrogates, seasonal timing, and stream discharges of interest have been identified, perform CFD modeling (2-D or 3-D) of a comprehensive suite of variables deemed most pertinent, including considerations for, but not limited to: velocities, turbulence zones and intensities, Reynolds stresses, thermoclines, depths/bathymetry. Critically noting: “We don’t know what we don’t know, and as such, this proposal is comprehensive on the approach to gain as much information as possible to facilitate future studies and actions most effectively and cost-efficiently. It is critical that the radio telemetry efforts and fluid dynamic modeling be appropriately integrated in rigor, timing, and scale.

At a minimum, produce assessments and comprehensive reporting on the following:

a. stratify results from surrogates based on similarities and differences between the surrogate species bull trout, cutthroat, and non-salmonid/non-game. Provide a summary of predictions for how the results should affect these species.
b. Determine what CFD model(s) (2D or 3D) is/are most useful to address specific issues/conditions in the future for optimized effectiveness and costs, and conduct appropriate modeling efforts, as well as necessary validations of model outcomes. Determine if surrogate fish species are adequate for inference/extrapolation towards understanding of total native fish population dynamics and viability under climate change scenarios.
c. Determine the most appropriate telemetry/fish position technology as it relates to collecting the most appropriate data for baseline conditions and for most effective use over the duration of the next licensing period. Assess VPS technology (Wyman et. A, 2017 and Hardy, 2020) in addition to common PIT technologies.
d. Determine if temperature and water density profiles are necessary to provide further explanation in fish dynamics following hydraulic assessment.
e. A prioritized implementation plan meeting acceptable recovery and/or protections for non-salmonids and salmonids including but not limited to dam face, radial gate, ladder, spillway alterations, fish capture and movement needs, or other mitigations necessary to offset dam effects.
f. A prioritized list of additional data needs and mitigation support to accomplish recovery and protections within the regulatory frameworks described herein.

The need for multiple surrogates is clear. The expert panel concluded that:

- Bull trout are the largest salmonid, migrate at night, adhere to the river margins more than other salmonids and have a more protracted migration period (bimodal).
- Rainbow trout (RBT) migration period is earlier than bull trout, so timing might be restrictive. RBT are smaller in body length than bull trout, so jumping ability and maximum swim velocity would be lower. RBT migrate in the daytime, so lights, and other nighttime disturbances might not be a factor. The migration period is shorter than bull trout (i.e., another surrogate like cutthroat or brown trout, in addition to RBT is needed). RBT use margins during high turbid flows but may use mid channel locations more during lower or less turbid flows than bull trout.
- WCT migration period is later than RBT and coincides more closely to bull trout but occurs in the spring.
- Brown trout may be of similar size to bull trout so jumping, and swimming abilities may be similar. They also migrate in summer and fall, so they may be an effective surrogate for bull trout which migrate in the fall (September- October).
- In recent studies, there are no examples of surrogates being used for non-salmonids/non-game species, which supports the need to identify a surrogate and conduct a study to further understand these important fish species.
- Conducting telemetry on bull trout is not likely to be very informative because of the small number available.

Additional information that is important for developing the methodology can be found in the Expert Panel report and is summarized as follows (Erickson et. al. 2020):

- The Zone of Passage (ZOP) Concept defines discrete areas for analysis at the fish ladder and may be advantageous in identifying how and where to measure effectiveness, and attributing causes and influences (project and non-project related) to effectiveness issues.
- The current practice is to partition effectiveness into attraction efficiency, entrance efficiency, and internal efficiency.
- Current methods to assess the flow and velocity fields include direct measurement (using acoustic doppler velocimetry or comparable technologies) or CFD. Development of a 2D (depth averaged) CFD model to assess the velocity field downstream of a fishway would assist NWE and stakeholders in understanding if the flow field created by discharge from ladder creates a sufficient behavioral cue for bull trout (and other species), and determine whether velocities are low enough to prevent fatigue of fish attempting to approach the ladder entrance.
- Other important questions to address: Are there recommendations for running the ladder in orifice or notch mode to maximize the catch of bull trout? Are additional studies needed (not already planned) to assess ladder operations? Are the PIT tag antenna arrays within the ladder capturing sufficient data to determine fish movement within the ladder? Are multiple PIT loops needed to evaluate both entrance modes, and multiple loops within the ladder to quantify ascent rate? Is fallback an issue, and if so, how many and which species?
- Caution is recommended in installing PIT loops (especially using wood/metal antenna support frames in the path of fish); PIT installations cannot interfere with hydraulics or movement of fish.
- Virtually all fishways create some delay in movement (though ideally the delay is not biologically significant). In general, a 24 to 48-hour delay is considered acceptable. A 48 to 72-hour delay is typically something to avoid; however, this is species dependent. Salmonid migrations are more episodic than other species, thus more forgiving of minor delays as fish search for the entrance.

Level of Effort and Cost

Effort and cost would primary be incurred through both staff time and consulting fees. Additional staff time would likely be required for research, literature reviews, and document preparation.

Table 1. Estimated Costs for Hydraulic Modeling, Validation, and Fish Behavior Tracking Efforts

Effort	Cost (based on review of similar studies and NWE PSP)
Hydraulic and Telemetry Efforts	$75,000 - $100,000

References

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United States Forest Service (USFS). 2013. Conservation Strategy for Bull Trout on USFS Lands in Western Montana. U.S. Department of Agriculture, Northern Region.

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USDA Forest Service. February 1995. Inland Native Fish Strategy, Environmental Assessment. Intermountain, Northern and Pacific Northwest Regions. Attachment A—Inland Native Fish Strategy Selected Interim Direction. 15 p.

Wade, A.A., C. Brick, S. Spaulding, T. Sylte, and J. Louie. March 2016. Watershed Climate Change Vulnerability Assessment: Lolo National Forest. Publication Number R1-16-05. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region and Lolo National Forest. 130 p.

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Study Request No. 2: Fish Study with a PIT Array on St. Regis River

Goals and Objectives

Goal: Determine if a significant number of salmonids processed during Thompson Falls fish ladder operations move upstream to the St. Regis River after passage. The St. Regis River is the next major cold-water tributary system approximately 55 miles upstream of the Thompson River. This is relevant because fish management agencies recognize the importance of the Thompson River system for bull trout recovery partly based on Passive Integrated Transponder (PIT) data that indicate approximately one-third of PIT tagged salmonids enter the Thompson River after passage (NWE 2018). However, these data also highlight a sizable information gap regarding the movement of the reaming two-thirds of salmonids passed during Thompson Falls fish ladder operations. It is therefore important to better understand fish movement beyond the zone-of-passage concept included in the PSP to identify potential effects of Project operations that could inform future fish ladder operations by learning how fish utilized the St. Regis River. These may include development of alternate upstream release locations, re-prioritization of geographic criteria for Technical Advisory Committee (TAC) proposals, and protection/mitigation/enhancement funding allocation.

Objective: Install a PIT antenna near the mouth of the St. Regis River to determine the proportion of salmonids affected by Thompson Falls fish ladder operations that utilize this system after upstream passage. These data would be included in NorthWestern Energy's annual fisheries reports alongside the PIT data from the Thompson River and would help fill the information gap identified in the Baseline Environmental Document (i.e., destination of approximately two-thirds of ladder-passed salmonids). Furthermore, these results would directly address the Goals of this study and could potentially inform project operational conditions or mitigation to minimize the effects of the Project on fish behavior upstream of the dam.

Relevant Resource Management Goals and Public Interest Considerations

The Forest Service manages 83 percent of the land within the Lower Clark Fork River watershed (NWE 2018) which contains a substantial amount of available fish habitat. This overlap between fish habitat and Forest Service land ownership provides a direct relationship between agency management directives (listed below) and native/non-native fish occupancy of streams that originate on or pass through Lolo-managed watersheds. Results that would be obtained from this study request would therefore substantially inform future habitat management decisions on Lolo National Forest in relation to Thompson Falls fish ladder operations.

Lolo National Forest Plan, Section II (A)(2): "Provide habitat for viable populations of all indigenous wildlife species…"

Lolo National Forest Plan, Section II (B)(1): "The Forest Plan provides habitat for viable populations of the diverse wildlife and fish species on the Forest, with special attention given to species dependent on snags, old growth areas, and riparian zones)."

Lolo National Forest Plan, Section II (E)(27): "…For plant and animal species that are not threatened or endangered, but where viability is a concern (i.e., sensitive species), manage to maintain population viability…"

Forest Service Manual, 2670.22 (1-3): "(1) Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions; (2) Maintain viable

populations of all native and desired nonnative wildlife, fish, and plant species in habitat distributed throughout their geographic range on National Forest System lands; (3) Develop and implement management objectives for populations and/or habitat of sensitive species."

Inland Native Fish Strategy (INFISH, 1995): This decision amended the Lolo National Forest Plan with at least the following provisions directly relating to management responsibilities pertaining to the Thompson Falls FERC Relicensing (LH-1) "Require…During relicensing of hydroelectric projects, provide written and timely license conditions to the Federal Energy Regulatory Commission (FERC) that require fish passage and flows and habitat conditions that maintain/restore riparian resources and channel integrity. Coordinate relicensing projects with the appropriate State agencies".

In addition to the FS Resource Management plans listed above, the FWS manage Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015) the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity. The results of the proposed study could inform the connectivity and life history strategies of bull trout passing the Project or surrogate native species.

Likewise, FWP manages and monitors fish populations in Montana. The stated fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population. The 2019-2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout. The results of the proposed study could inform the effects of the Project operations on connectivity and fish behavior following dam passage.

Existing Information and Need for Additional Information

Fish and habitat management agencies sample fish in the St. Regis River watershed via electrofishing and eDNA, but the sampling is sporadic, and the electrofishing does not include scanning for PIT tags. As a result, there is no system currently in place to evaluate Thompson Falls fish ladder operations on fish movement in this river system.

NorthWestern Energy also sampled fish in the Thompson Falls Reservoir and the Clark Fork River upstream to the Flathead River confluence via gill nets and electrofishing (NWE 2018). However, these efforts have never extended upstream to the St. Regis River such that they do not provide data on fish movement into this cold-water tributary.

NorthWestern Energy and MT Fish, Wildlife, and Parks currently maintain two PIT antennas in the Thompson River and one PIT antenna in Prospect Creek. Data from the Thompson River PIT antennas are the reason it is known that approximately 33% of salmonids entered the Thompson River within their first year after release upstream of the Thompson Falls dam (Figure 1; NWE 2018), and have helped inform the decision to rank the Thompson River as the highest priority geographical area for protection/mitigation/enhancement funds. And because PIT data has already influenced past Project operations regarding the Thompson River, it is plausible that PIT data from the St. Regis River could likewise be used to influence future Project operations.

Table 5-5: Summary of the PIT-tagged salmonids released upstream of Thompson Falls Dam in 2015, 2016, 2017 detected in the Thompson River in the same year as they were released. NA = not applicable.

	% of Tagged Salmonids Released Upstream of Dam and Detected in the Thompson River in the Same Year		
Species	2015	2016	2017
BULL	100%	33%	100%
EB	50%	100%	NA
LL	56%	44%	44%
RB	37%	25%	25%
RBxWCT	50%	40%	NA
WCT	32%	46%	38%
MWF	-	17%	NA
Total	39%	33%	33%

Figure 1. This table from NorthWestern Energy's Baseline Environmental Document displays the PIT antenna results for ladder-passed fish in the Thompson River (NWE 2018).

An additional data source that provides some insight into fish affected by Project ladder operations is the genetic assignment of bull trout captured by Avista in the lower Clark Fork River. Several captured bull trout have been genetically assigned to St. Regis River tributaries as the 'most likely population of origin' (North Fork Little Joe and South Fork Little Joe creeks; Avista 2019). While it has not yet occurred, it is probable that a bull trout will eventually be affected by NorthWestern Energy during fish ladder operations that will assign to a St. Regis River bull trout population. This method of tracking salmonids to the St. Regis is extremely limited as it is currently only available for the combinations of species (i.e., bull trout) and local populations (i.e., North Fork and South Fork Little Joe) for which these genetic protocols have been established, and cannot be done with other species of management interest or other tributaries within the St. Regis.

Project Nexus

The information provided by this study would establish the relative impact that operation of the Project has on fish passage and upstream movement, which would provide the scientific basis for prioritizing TAC proposals over the duration of the Project License including potential bypass flows, habitat improvements, or other mitigation measures. The requested study will provide the Forest Service with the necessary information to determine the need for and type of mitigation necessary for the adequate protection and utilization of the Forest as required under the Federal Power Act and other statutes governing the management of Forest Service administered resources, as well as meet goals and objectives under the Lolo National Forest Land and Resource Management Plan (1986). Additionally, NorthWestern Energy acknowledges the nexus for this project in the BED: "Monitoring fish counts at the ladder and fisheries surveys upstream provide the Licensee and resource managers the ability to track potential system-wide changes with fish passing into the Thompson Falls Reservoir from downstream" (NWE 2018; underline emphasis added).

Proposed Methodology

A PIT antenna would be installed near the mouth of the St. Regis River during low flow months in 2021. The antenna would be placed downstream of the Little Joe Creek confluence pending landowner permission, otherwise on Forest Service land downstream of Twomile Creek. NorthWestern Energy staff and Lolo National Forest fisheries biologist would coordinate maintenance and data downloads. The same basic protocols that NorthWestern Energy uses to manage the Thompson River PIT antennas would likely be applicable to this St. Regis antenna. Data obtained during the 2021 - 2022 operating period would be considered by NorthWestern Energy and fish management agencies to determine if it would be desirable to maintain the St. Regis PIT antenna beyond this study period.

Level of Effort and Cost

Effort and cost would be primarily incurred through purchase of one PIT antenna array. NorthWestern Energy and Lolo National Forest fish biologist time would be required for maintenance and downloads.

Table 1. Potential effort and cost figures for installation of one PIT array in the St. Regis River.

Event	Time/Cost
PIT Antenna	$10,000
Field Time	2d x 8h = 16h

References

Avista 2019. Upstream Fish Passage Program – Bull Trout. Annual Project Update – 2018. Fish Passage/Native Salmonid Restoration Plan.

NorthWestern Energy (NWE). 2018. Baseline Environmental Document. Thompson Falls Hydroelectric Project, Federal Energy Regulatory Commission Project Number 1869.

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United States Forest Service (USFS). 2005. Forest Service Manual; Series 2600 Wildlife, Fish, and Sensitive Plant Habitat Management. USDA Forest Service National Headquarters, Washington, DC.

CERTIFICATE OF SERVICE

I, Makary A. Hutson, Natural Resource Specialist, Interregional Hydropower Team for the Forest Service, hereby certify that on this 11th day of March 2021, I have served a copy of the foregoing document electronically per Commission direction or by First Class U.S. Mail, postage prepaid, upon each person designated on the official service lists compiled by the Secretary of the Commission, and that the same document was electronically filed with the Commission this same day.

/s/ Makary A. Hutson
Makary A. Hutson

Thompson Falls Hydroelectric Project (P-1869-060)

U.S. Fish and Wildlife Service Comment on Thompson Falls Hydroelectric Project December 2020 Proposed Study Plan Document

Comments Provided by:

U.S. Fish and Wildlife Service
Montana Ecological Services Office
Kalispell, Montana

Comments on December 2020 Proposed Study Plan (PSP) by NorthWestern Energy

Proposed Study 4: Hydraulic Conditions

PSP Section 5.1, page 47:
The first paragraph indicates that the proposed study is to assess the velocity field downstream of the fish passage facility. The U.S. Fish and Wildlife Service (Service) recommends that this study assess areas beyond the area directly downstream of the fish passage facility. The purpose of this recommendation is to allow this study to determine if there are areas in the zone of passage that may be attracting fish to parts of the project that do not have any capability of providing fish passage (e.g., areas near Prospect Creek, the old power house or the new powerhouse). These areas could potentially serve as "dead ends" for fish attempting to move upstream of the project. FWS #1

PSP Section 5.2, page 50:
The sixth paragraph indicates that NorthWestern will complete an interim report that includes the results of the 2D modeling, as well as recommendations for the extent of 3D modeling. This report will be distributed to relicensing participants for a 30-day review and comment period. The Service recommends that NorthWestern convene with interested relicensing participants prior to revising the interim report to ensure that all interested relicensing participants are satisfied that the extent of 3D modeling will meet the overall objectives of this study. FWS #2

The 2015 Final Recovery Plan for the Coterminous United States Population of Bull Trout identifies "Connectivity Impairment" in the Lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. This threat was identified due to large mainstem dams in the Clark Fork River, including the Thompson Falls Dam. Further, the Recovery Plan specifically identifies NorthWestern Energy's participation in re-establishing habitat connectivity as an action that will address the primary demographic threat to bull trout recovery in the Lake Pend Oreille A Core Area. As such, the Service fully recommends that the Hydraulic Conditions Study proposed by NorthWestern Energy is included during this relicensing process. This study will fill FWS #3

existing data gaps associated with providing safe, timely and effective fish passage for bull trout and other native fish species, as well as provide information necessary to provide mitigation for continuing effects of the Thompson Falls Hydroelectric Project on downstream fish passage. FWS #3

Proposed Study 5: Fish Behavior

PSP Section 6.2, page 57:

The last paragraph (under "Species" heading) indicates that NorthWestern will radio tag fish greater than 350mm in total length. The Service recommends that radio tags be allocated to a variety of size classes above 350mm (if fish are available). This recommendation is to ensure that telemetry data obtained from tagged fish represents a variety of age and size classes of fish that may exhibit different behavior and have differing swimming abilities. FWS #4

PSP Section 6.2, page 58:

The first paragraph (under "Fish Collection" heading) indicates that NorthWestern proposes to collect and tag 50 brown trout in June, July and/or September, 2021, and 50 rainbow trout in March, April and/or May, 2022. The Service recommends that this study also include collecting and tagging rainbow trout in 2021 (to the extent possible given timing restrictions), and brown trout in 2022. Additional sampling of each species should not come at the expense of lowering the already proposed sample size (50 for each species). Rather, the additional rainbow trout tagged in 2021 should be equivalent to what will be tagged in 2022, and additional brown trout tagged in 2022 should be equivalent to what will be tagged in 2021. Collection and tagging rainbow trout and 2021 and brown trout in 2022 would be possible given that the final study report is not due until May, 2023. FWS #5

This current study proposal only includes one study period for spring spawning salmonids (rainbow trout) and one study season for fall spawning salmonids (brown trout). This effectively turns a two-year study period into a one-year study period. Collecting and tagging rainbow trout in 2021 and brown trout in 2022 would provide an additional year of study on each surrogate species compared to what is currently being proposed. Further, flow and temperature conditions in the Clark Fork River typically vary from year to year depending annual precipitation and snow fall, and seasonal weather patterns. An additional study season will allow this study to posit fish movements in a wider range of conditions. FWS #6

As presented above, the Service considers connectivity impairment due to large main-stem dams (including the Thompson Falls Dam) on the lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Further, the Service specifically identified NorthWestern Energy's participation in re-establishing habitat connectivity as an action that will address the primary demographic threat to bull trout recovery in the Lake Pend Oreille A Core Area. Ensuring that this study is included in the relicensing process will provide information critical to carrying out these actions. As such, the Service fully recommends that the Fish Behavior Study (with study plan amendments) be adopted during this relicensing process. FWS #7

Proposed Study 6: Downstream Transport of Bull Trout

PSP Section 7.2, page 70:
The Service recommends that the "Methods" section of this proposed study be amended to include the following:

Juvenile Bull Trout Capture Targets, Handling Protocols and Transport Criteria

- All bull trout greater than or equal to 100 mm will be PIT tagged in the dorsal sinus cavity and a tissue sample will be taken for genetic analysis.

- A sample size of 100 fish from West Fork Thompson River and 100 fish from Fishtrap Creek will be captured and transported in the fall of 2021 and 2022 (200 fish each year, total of 400 fish). The size range for juvenile bull trout eligible for transport will be 120-200 mm (total length) from the West Fork Thompson River and 120-250 mm from Fishtrap Creek.

- If the annual transport target for West Fork Thompson River cannot be met (or appears that it will not be met), up to 150 juvenile bull trout may be captured from Fishtrap Creek. This limit on transported fish from Fishtrap Creek may be increased at any time during the study in response to site-specific observations and catch-rates in each stream and will be determined through consultation between NorthWestern Energy and the appropriate natural resource management agencies (i.e., the Service and Montana Fish, Wildlife and Parks)*. FWS #8

- Of the captured bull trout within the eligible transport size range, 75% would be transported downstream to Lake Pend Oreille, and 25% would be released on site following tagging and genetics sampling. Fish less than 120 mm will not count toward either quota (i.e., transported or left on site) and young-of-year fish should avoid being handled aside from ensuring they are safely returned to the water.

*The Service highly recommends the inclusion of operational flexibility with this study. Adaptive implementation will provide further assurance that the objectives of this study will be met.

Weir Traps
Temporary weir traps on Fishtrap Creek and West Fork Thompson River will operate from October 1 to November 15 in both 2021 and 2022. However, the precise dates of operation may vary on an annual basis depending on environmental conditions and site-specific catch rates relative to transport targets*. Precise beginning and end dates for temporary weir trapping will be determined through consultation between NorthWestern Energy and the appropriate natural resource management agencies (i.e., the Service and Montana Fish, Wildlife and Parks). Weir traps will be checked daily during the weekdays and disabled for volitional passage on weekends. Weir traps will be checked in the morning to best ensure fish are handled in a timely and safe manner. The trap boxes will be reinforced in order to prevent fish loss by mink and other predators. At least two game cameras should be deployed at each weir to monitoring predation.

*The Service highly recommends the inclusion of operational flexibility with this study. Exact annual operation windows will need to depend on environmental conditions such as flows and cold weather. In some years, extreme fall rain events may occur, and weirs may need to be temporarily pulled to avoid damage or loss. Additionally, catch rates may decline rapidly in the fall with colder weather meaning it may be prudent to cease operations if no fish are being captured or detected. These decisions are best made during the 2021 and 2022 trapping seasons via discussions among NorthWestern Energy, the Service, and Montana Fish, Wildlife and Parks.

Electrofishing

Fall electrofishing may occur up to a maximum of five days per stream and may only be conducted after bull trout redd counts have been completed and all putative bull trout redds have been identified within the specified sampling areas in each stream. Electrofishing in the West Fork Thompson River may occur from river mile (RM) 1.2 at the confluence of Honeymoon Creek downstream to the mouth. In Fishtrap Creek, electrofishing may occur from RM 2.5 (sections 16 & 21 boundary line) downstream to the mouth. Electrofishing will not occur near documented or suspected bull trout redds and will avoid complex habitats such as debris jams where adult bull trout could be present. A minimum of four people (two backpack electrofishing units) is recommend for these electrofishing efforts given the large size and/or steep gradient of these streams. A blocknet should be used at the downstream extent of the sampling reach at all sites to maximize capture and two-pass depletions should be carried out at most sites. FWS #8

As previously described, the Service considers connectivity impairment due to large main-stem dams (including the Thompson Falls Dam) on the lower Clark Fork River as the primary demographic threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Additionally, the Service considers non-native fish species in artificially created reservoirs (including Thompson Falls Reservoir) as a primary threat to the recovery of bull trout in the Lake Pend Oreille A Core Area. Artificially created reservoirs provide habitat that allows many species of illegally introduced fish species to thrive. Many of these species are high piscivorous (e.g., northern pike, small mouth bass, large mouth bass) and present a significant threat to downstream migrating juvenile bull trout, as well as other native fish species. As such, the Service fully recommends that the Downstream Transport of Bull Trout Study (with study plan amendments) be adopted during this relicensing process to assess efforts NorthWestern Energy can undertake or fund to mitigate for the negative impacts of the project on native fish species.

Tollefson, Jordan

From: Storrar, Keenan <Keenan.Storrar@mt.gov>
Sent: Tuesday, March 02, 2021 1:02 PM
To: Tollefson, Jordan
Subject: [EXTERNAL] RE: Draft Thompson Falls Water Quality Monitoring Plan

Great thanks. Once it's updated can you send the finalized plan back to me? I'll file it with our T-Falls records. | DEQ #1

Thanks again,
Keenan Storrar
401/318 Coordinator
Water Protection Bureau
P: (406) 444-2734
1520 E. 6th Ave.
Helena, MT 59601
DEQ Montana Department of Environmental Quality

From: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>
Sent: Tuesday, March 2, 2021 12:41 PM
To: Storrar, Keenan <Keenan.Storrar@mt.gov>
Subject: [EXTERNAL] RE: Draft Thompson Falls Water Quality Monitoring Plan

Thanks for the feedback Keenan. I'll update the references in our monitoring plan to reflect the new Chemistry SOP.

Jordan

From: Storrar, Keenan <Keenan.Storrar@mt.gov>
Sent: Tuesday, March 02, 2021 11:38 AM
To: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>
Subject: [EXTERNAL] FW: Draft Thompson Falls Water Quality Monitoring Plan

Hi Jordan,

I'm fine with how we've been working on the monitoring plan through our conversations and emails. I don't plan to submit comments through the official March 11 deadline at this time.

I sent the draft water monitoring plan over to Elizabeth McWilliams in WQP/MA. You can see her input below. Let me know what you think and if you'd like to use the new version of the Chemistry SOP for the monitoring plan.

Thanks,
Keenan Storrar
401/318 Coordinator
Water Protection Bureau
P: (406) 444-2734
1520 E. 6th Ave.
Helena, MT 59601
DEQ Montana Department of Environmental Quality

From: McWilliams, Elizabeth <Emcwilliams@mt.gov>
Sent: Friday, February 26, 2021 4:37 PM
To: Storrar, Keenan <Keenan.Storrar@mt.gov>
Subject: RE: Draft Thompson Falls Water Quality Monitoring Plan

After finding the parameter table in Appendix A. The only thing that comes to mind is that they are referencing the outdated field manual. I'd let them know that we have phased that out and the chemistry sampling protocols can be found in the Chemistry SOP. These can be found under Monitoring Protocols on the same page. DEQ #2

It looks like CF3 and CF4 are considered to be a part of the Noxon Reservoir, which doesn't have an assessment unit. Doubt that's important for this sampling's purpose, but that would be why you couldn't find it.

Let me know if any monitoring questions come up.

Elizabeth McWilliams
Water Quality Specialist
DEQ/WQD/WQPB/MAS
406-444-6723

From: Storrar, Keenan <Keenan.Storrar@mt.gov>
Sent: Wednesday, February 24, 2021 1:04 PM
To: McWilliams, Elizabeth <Emcwilliams@mt.gov>
Subject: RE: Draft Thompson Falls Water Quality Monitoring Plan

Thanks Elizabeth! Yes, that timeline works great.

Keenan Storrar
401/318 Coordinator
Water Protection Bureau
P: (406) 444-2734
1520 E. 6th Ave.
Helena, MT 59601
DEQ Montana Department of Environmental Quality

From: McWilliams, Elizabeth <Emcwilliams@mt.gov>
Sent: Wednesday, February 24, 2021 1:01 PM
To: Storrar, Keenan <Keenan.Storrar@mt.gov>
Subject: RE: Draft Thompson Falls Water Quality Monitoring Plan

Hi Keenan,

I can look over the draft. Would a review by the end of this Friday work for your timeline?

Happy to help!
Elizabeth

From: Storrar, Keenan <Keenan.Storrar@mt.gov>
Sent: Friday, February 19, 2021 5:02 PM
To: McWilliams, Elizabeth <Emcwilliams@mt.gov>
Subject: FW: Draft Thompson Falls Water Quality Monitoring Plan

Hi Elizabeth,

This is the draft water monitoring plan for NorthWestern Energy's Thompson Falls dam FERC license on the Clark Fork River. I've taken a look at the draft monitoring plan and it appears to accurately account for any water quality influence the dam may have on the river. Since you took a look at the monitoring plan for Northern Lights Lake Creek project I'm wondering if you'd like to review this plan and provide feedback? If you don't have time would you mind pointing me in the direction of someone in your program who would be able to look over it?

I can only find the upstream section of river on CWAIC:
http://svc.mt.gov/deq/dst/#/app/cwaic/report/cycle/2020/auid/MT76N001_010

Thanks for the help.

--
Keenan Storrar
401/318 Coordinator
Water Protection Bureau
P: (406) 444-2734
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Helena, MT 59601
DEQ Montana Department of Environmental Quality

From: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>
Sent: Friday, February 19, 2021 10:28 AM
To: Storrar, Keenan <Keenan.Storrar@mt.gov>
Subject: [EXTERNAL] Draft Thompson Falls Water Quality Monitoring Plan

Keenan,

Attached is the updated version of our draft water quality monitoring plan for Thompson Falls for 2021. Please let me know if you have any comments on this, and I will send you a final copy for your records once we get this finalized. Thanks!

Jordan

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From: Sullivan, Mary Gail
To: Gillin, Ginger; Andy Welch; John Tabaracci
Subject: [EXT] Fwd: [EXTERNAL] MDT Response - Request for Comment- Thompson Falls Hydroelectric Project #1869-060
Date: Wednesday, December 23, 2020 11:15:14 AM

---------- Forwarded message ----------

From: Hughey, Jason <jhughey@mt.gov>
Date: December 23, 2020 at 7:43:42 AM MST
Subject: [EXTERNAL] MDT Response - Request for Comment- Thompson Falls Hydroelectric Project #1869-060
To: Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>

Ms. Sullivan,

The Montana Department of Transportation (MDT) staff would like to thank you for the opportunity to provide input on the Proposed Study Plan (PSP) for the relicensing of the Thompson Falls Hydroelectric Project (FERC Project No. 1869).

It does not appear that the proposed study plan or FERC relicensing will impact MDT facilities. Please contact Steve Felix, the Missoula District Maintenance Chief, at 406-523-5803, if the project will impact MDT facilities. MDT #1

Please let me know if you have any questions.

Thanks,
Jason

Jason Hughey
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Fisheries Division
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March 10, 2021

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

Re: Thompson Falls Hydroelectric Project (P-1869-060)

Dear Secretary Bose:

Thank you for the opportunity to provide input on the NorthWestern Energy's (NWE) proposed studies relating to the relicensing of the Thompson Falls Hydroelectric Project (P-1869-060). We begin by describing our statutory trust responsibilities and management direction, followed with summary of coordination efforts and agreements reached and remaining concerns. We then finish with one revised study request and one new study request that we feel are necessary for us to manage the fishery resource at Thompson Falls Project under a relicensing scenario.

The mission of the Montana Department of Fish, Wildlife & Parks (FWP) is to provide for the stewardship of the fish, wildlife, parks and recreational resources of Montana, while contributing to the quality of life for present and future generations. FWP is charged with the public trust obligation to protect fish and wildlife in Montana and their habit.

Management direction for the fishery in the Clark Fork River drainage is articulated in the 2019-2027 Statewide Fisheries Management Program and Guide (FWP 2019) but notably includes enhancing fluvial populations of Bull Trout and Westslope Cutthroat Trout and ensuring adequate connectivity with tributaries for Rainbow trout and Brown trout in the Clark Fork River drainage. Open tributary systems in this stretch include the Thompson River, St. Regis River, Cedar Creek, Trout Creek, Fish Creek, Rattlesnake Creek, Ninemile Creek and many smaller systems, and management direction for these streams is to conserve and enhance migratory and resident population of all of the same trout species. Recent studies have also linked fish impacted by Thompson Falls Dam upstream to the Bitterroot and Blackfoot Rivers and Rock Creek in the vicinity of Missoula as well as downstream to Lake Pend Oreille in Idaho.

Altogether, this open system above Thompson Falls Dam is more than 450 miles of mainstem river and tributaries being managed for migratory fish that are important to the region's economy and environmental conservation. Fish passage is a major aspect of two FERC licenses at two dams immediately

downstream of Thompson Falls Dam; Noxon Rapids and Cabinet Gorge Dams owned by Avista Utilities. Milltown Dam, near Missoula was decommissioned and removed, restoring fish passage. The fish passage measures at Thompson Falls Dam are important pieces of restoring the fish migration in the Clark Fork River drainage. It is therefore critical that the Environmental Assessment evaluate the impact of the dam on these migratory species and how those impacts may compromise our ability to optimize their populations.

NorthWestern Energy met with FWP five times between their Proposed Study Plan Meeting held on January 6 and this letter. FWP personnel spent numerous hours making recommendations to improve and resolve identified issues. The intent of the meetings was to share ideas and content, build shared understanding for study needs, and resolve disagreements with open communication. FWP appreciates the applicant's time in these efforts though agreement was not reached on all topics.

Agreements

The agreements reached in conversation with NWE were specific to their proposed study plans as they are drafted in the PAD document. Comments listed below detail the revisions necessary to match the agreements in the same order the plans were numbered.

NorthWestern's Study Plan 1: *Operations Study*

FWP #1

FWP is looking for more resolution of survival of different fish sizes, any turbine or generator upgrades after 2007, spillway changes with the new radial gates, and operational changes that may be more relevant to current and foreseeable future conditions.

NWE agrees to update the literature review as an addendum to the 2007 *Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project*.

NorthWestern's Study Plan 5: *Fish Behavior Study*

FWP worked extensively with NWE on their fish behavior proposal to combine ideas of similar proposed studies (NWE study 5, FWP study 5). This was prioritized based on concerns that the short duration allowed for this study in a system so influenced by environmental conditions, such as flow regimes influencing optimal ladder operation, cannot be encountered in two seasons. Below are the agreed upon guidelines for the proposal:

FWP #2

- Tagging of salmonids to be split proportional to what has been documented at the ladder (60/40) rainbow to brown trout.
- Tagging of salmonids to be split 50/50 above the dam and in the ladder
- Primary tagging locations are the mainstem Clark Fork River above the dam and fish that reach the top of the fish ladder, the lower 7 miles of the Thompson River, below the West Fork Thompson River, is a secondary option for captures above the dam.
- Tagging efforts in 2021 should not exceed 25% of total tags available unless the telemetry stations are fully calibrated and operational.

NorthWestern's Study Plan 6: *Downstream Transport of Bull Trout Study*

FWP #3 FWP disagrees with portions of this proposed study including location of capture (electrofishing), timing of capture (weirs/electrofishing), level of effort (weirs/electrofishing) and size of fish to be collected from each stream. FWP provides the essential context and agreements, starting on page five of this letter, as they were too detailed to capture here.

FWP #4 Last, to fully disclose all agreements reached, FWP agrees to not resubmit the Roving Creel and Upstream fish movement (i.e., tag and follow fish upstream of the dam) studies at this time. However, this wasn't decided because it lacked importance but rather, they would serve better to be considered for articles of protection, mitigation and enhancement at a later date.

Concerns

FWP #5 FWP still believes an alternative is needed that emphasizes operating procedures and conditions that are favorable or optimal for all desirable migratory fish species as outlined in our October 27 letter. FWP prioritizes more species, looking at more options for moving fish, and is not just interested in potential improvements to the current ladder which was built with the intention of passing bull trout.

FWP #6 Though both parties acknowledged there is limited data to fully characterize the native fish species movement and behavior from the far field to the near field of the fish passage facility, FWP believes that more tags need to be implanted in native, non-game species (northern pike minnow, mountain whitefish, and largescale suckers) to better assess this impact (at least 20 per species identified). NWE's original study proposal did not propose tagging any non-game fish species even though the second defined priority for the fish ladder beyond passing bull trout, is to pass natives (NWE PAD pg.51). FWP understands that these species may not be as resilient to tagging, however that does not mean that it should not be attempted. We also suggest tagging these species in March-April 2022 will help minimize any tagging mortality.

NorthWestern's Study Plan 9: *Westslope Cutthroat Trout Genetics Study*

FWP #7 FWP is unsure how NWE will be successful in their proposed Study Plan for WCT (#9) when previous studies have not been able to correctly identify hybrids, and how it would inform management as all salmonids are currently passed at the ladder. While FWP does have interest in quantifying the number of pure and hybrid Westslope Cutthroat Trout (WCT) that are passed at Thompson Falls Dam as per NWE's Proposed Study, FWP believes additional WCT genetic sampling is warranted in tributary streams that enter within and above the defined project area. FWP still holds concerns about what impacts the dam has on the migratory life history for WCT and knowing where the genetically pure WCT populations are upstream and in the vicinity of the dam as detailed in FWP's October submission of study proposals. This concern however was not resolved in conversations with NWE, so we are providing a revised study proposal (below, Study Plan #1). Our concerns are mainly with the suppressed migratory life history of WCT by the dam, that passage efficiency has not been quantified for any species, relatively few fish are passed above 30,000 cubic feet per second (cfs), the ladder shuts down above 60,000 cfs which is the time-frame WCT are most likely to move, and the lack of information on distribution.

FWP #8

Further, NWE states that since the fish ladder opened in 2011, over 2,000 WCT, Rainbow Trout (RB) and their hybrids have been passed at Thompson Falls Dam (NWE PAD pg. 87). As a point of clarity, it should be noted that 282 putative WCT have been passed at the ladder between 2011 and 2020 (NWE 2021). Genetic testing was first employed in 2020 but results of this work are still pending. Over 2,100 Rainbow Trout (RB) and about 50 putative WCT X RB hybrids were also passed from 2011 to 2020 (NWE 2021).

Thanks for your consideration of these comments on the proposed studies.

We look forward to continued engagement in the relicensing of the Thompson Falls Hydroelectric Project to ensure the fish and aquatic resources of Montana are protected while providing a viable electric power supply.

Sincerely,

Eileen Ryce
Fisheries Division Administrator

Context and agreements on NorthWestern's Study Plan 6: *Downstream Transport of Bull Trout Study*

The following represent methods that have been agreed upon by NWE, USFWS and FWP since these study proposals were initially submitted by both FWP and NWE.

Genetic data collection

Genetic data will be used as an additional tool to monitor Thompson River Bull Trout populations in the future and will complement redd count and electrofishing data. This will allow for the estimation of Nb (number of breeders that produced a given cohort); relative contribution of upstream transport fish, stream residents and fluvial fish (parentage); connectivity/gene flow within and between populations and spawning tributaries; and provide a window into genetic diversity relative to other local populations

Genetic information will be collected from all age-1 and older Bull Trout captured during this project via fall electrofishing and weirs as well as through routine population monitoring (which is not part of this proposed study). These data will be collected for the next several years, archived and eventually analyzed by FWP's geneticist. The minimum amount of genetic material will be collected from each individual to minimize stress and injury.

Fall weirs

Weirs will begin fishing around October 1 and will run through approximately November 15 depending on environmental conditions such as stream discharge and cold weather. In some years, extreme fall rain events may occur, and weirs may need to be temporarily pulled to avoid damage or loss. Catches typically decline drastically with colder weather thus it makes sense to stop fishing weirs after a certain date if few or no fish are being captured or detected.

The USFWS, NWE and FWP agrees that a good deal flexibility is needed on the timing of when weirs can be fishing or disable during the sampling period. This could work in either direction; if no fish are being caught for a period of time and the weather is terrible trapping could end early. Alternatively, if fall rains come late, weather conditions are still amendable and fish start moving beyond mid-November trapping could be extended (with the caveat no trapping will occur over Thanksgiving break -Wednesday through Sunday). NWE will work with management agencies (USFWS, FWP) on trapping if a situation should arise that would deviate from the 6-week trapping window.

Weirs will be checked daily during the weekdays and disabled for volitional passage on weekends. They will be checked in the morning to best ensure fish are handled in a timely and safe manner, especially given most Bull Trout movement occurs during crepuscular periods.

The trap boxes will be reinforced in order to prevent fish loss by mink and other predators. At least two game cameras should be deployed at each weir to monitoring predation, given the 2020

predation that was observed on Bull Trout by mink at the Graves Creek permanent weir. FWP fisheries staff has been granted the ability to lethally remove mink at trap sites if they become an issue.

Fall Electrofishing

Fall electrofishing may occur up to a maximum of five days per stream and may only be conducted after redd counts have been completed and all putative redds have been identified within the specified sampling areas in each stream.

The USFWS, NWE and FWP agree that a good deal of flexibility is needed on the timing of when fall electrofishing may occur based on crew personnel availability, weather conditions, redd counts, other priorities work, etc. Therefore, electrofishing could begin as early as September 20 and end as late as November 15. It will be important for electrofishing crews from late September into October to be very cognizant of adult fish and redds, as redd construction has been observed into mid-October in tributaries to the lower Clark Fork River in Montana.

Electrofishing in the West Fork Thompson River may occur from river mile (RM) 1.2 at the confluence of Honeymoon Creek downstream to the mouth. In Fishtrap Creek, electrofishing may occur from RM 2.5 (sections 16 & 21 boundary line) downstream to the mouth.

Electrofishing will not occur near documented or suspected redds and will avoid complex habitats such as debris jams where adult fish could be present.

A minimum of four people (two backpack electrofishing units) is recommend for these electrofishing efforts given the large size and/or steep gradient of these streams. A blocknet should be used at the downstream extent of the sampling reach at all sites to maximize capture and two-pass depletions should be carried out at most sites. Two reaches can easily be sampled in a day using this methodology and crew size. At least one FWP personnel must be present for these electrofishing efforts.

Bull Trout transport conditions

Electrofishing efforts will try to stay clear of sampling or capturing adult Bull Trout. This will include avoiding sampling complex habitats such as logjams where adults may not be readily visible but could be present. Out-migrating, post-spawn adults captured in weirs will receive a PIT tag (if feasible) and length measurement but will not be anesthetized.

Bull Trout handled during fall capture efforts that are greater than or equal to 100 mm will be PIT tagged.

The goal will be to capture approximately 100 fish to transport from each stream, however given the wide range of fluctuations we observe in native trout populations in the area, it is likely that there will be significant yearly variation in the number of appropriately sized Bull Trout that may be encountered in the lower reaches of these streams.

If more than 100 fish are captured in either stream, through a combination of electrofishing and weir trapping, NWE will work with management agencies (USFWS, FWP) on the collection of additional fish with a cap of 150 fish from Fishtrap Creek. Should some circumstance rise where higher numbers of fish appear to be out-migrating from that stream, NWE will need to consult with management agencies (USFWS and FWP) on the take of additional fish.

A total of 25% of fish will be released on site from both electrofishing and weir trapping efforts. It will be best to release 25% of fish captured each day, with the recognition that a slightly higher or lower percentage may be released on a given day depending on the number captured. Fish within the appropriate transport size range that will be released on sight will be randomly chosen.

The size range for juvenile fish eligible for transport will be 120-200 mm (total length) from the West Fork Thompson River and 120-250 mm from Fishtrap Creek. Fish less than 120 mm will not count toward either quota (i.e., transported or left on site) and young-of-year fish should avoid being handled aside from ensuring they are safely returned to the water.

Transported fish will be combined with Bull Trout from other drainages being moved to the lower Clark Fork River in Idaho, upstream of its confluence with Lake Pend Oreille and will be handled and released the same way.

REVISED AND NEW PROPOSED STUDIES

Revised Study Request #1. Distribution and genetic status of Westslope Cutthroat Trout

Goals and Objectives

Goal - The goal of this project is to collect genetic information to prioritize future protection, mitigation and enhancement(PM&E) measures for Westslope Cutthroat Trout (WCT) populations in tributary streams that enter within and above the Thompson Falls Hydroelectric Project boundary (FERC No. 1869), located on the Clark Fork River in northwest Montana.

Objectives - The objective of this proposed study is to collect baseline or updated genetic information on WCT populations in this area to 1) identify the presence of genetically pure fish, hybrid zones and community composition in select streams where WCT still occur or are believed to occur in the Prospect Creek and Thompson River drainages as well direct tributaries to the Clark Fork River upstream of Thompson Falls Dam to the confluence with the Flathead River, and to 2) use information collected in Objective 1 coupled with other fisheries, stream habitat and genetic monitoring data to outline and prioritize future protection, mitigation and enhancement measures for WCT associated with NorthWestern Energy's (NWE) future FERC license for the Thompson Falls Hydroelectric Project.

Background- Westslope Cutthroat Trout are native to the Clark Fork River drainage in western Montana and are a recreationally important and highly sought-after sportfish species. Historically, migratory life history forms (fluvial- riverine; adfluvial-lake dwelling) used the Clark River-Lake Pend Oreille system both

as a migratory corridor as well as foraging, maturation and overwintering habitat (FMO); and were observed to be abundant in many tributaries to the lower Clark Fork River in Montana (Pratt and Huston 1993). The construction of three mainstem dams on the lower Clark Fork River (Thompson Falls 1915, Cabinet Gorge 1952, Noxon 1958) fragmented the river-lake ecosystem for migratory WCT along with other native fish species. Interviews of local residents that inhabited the lower Clark Fork River drainage in Montana (pre-1952) documented spawning runs of 16 to 20 inch redbellies (i.e. local name for the species today known as WCT) in nearly all the river's tributaries including in Prospect Creek (Pratt and Huston 1993) which enters the Clark Fork River in the bypass channel reach between the main channel dam and the powerhouse , adjacent to the dry channel dam (Figure 2; NWE-FERC Scoping Document 1). Today, low numbers of migratory WCT occur in Clark Fork River drainage upstream of Thompson Falls Dam, although some WCT (n=14-48, 2011-2020) are captured and passed each year at the fish ladder at Thompson Falls Dam (putative WCT passed in 2020 are currently being genetically tested). The continued presence of the dam and the habitat it has created has further suppressed the migratory life history and the current level of passage efficiency for this species and others has not been quantified. Information gathered on another native salmonid below the dam that is known to migrate across the spring hydrograph, Bull Trout, has shown inefficiencies in passing this imperiled species at the fish ladder (PPL MT 2012; NWE 2016).

The decline of WCT in the Clark Fork River basin has been caused by a cascade of anthropogenic factors including fragmentation and physical habitat alteration of rivers used as migratory corridors and FMO habitat by dams; loss or degradation of tributary habitat by numerous landscape disturbances such as mining, logging, road building and urbanization; overharvest; hybridization with introduced Rainbow Trout (RB) and Yellowstone Cutthroat Trout; and displacement through competition and predation by non-native Brown Trout and Brook Trout.

Genetically pure WCT populations are presently most common in the stream resident life-history form and are believed to still occur in several streams within the proposed study. Resident life history forms of salmonids have been shown to give rise to migratory life history forms and vice versa (Christie et al 2011; Courter et al. 2013), and therefore the identification of genetically pure fish through this proposed study would inform future actions to protect populations in tributaries stream that could produce offspring of resident and migratory life histories. It is likely that many of the migratory WCT that use the mainstem Clark Fork River have trickled out of small streams across the basin, outlining the importance of the preservation of as many genetically pure stocks as possible. These local populations are most threatened by hybridization and displacement by non-native salmonids. Introgression with RB and Oncorhynchus hybrids is a widespread threat to remaining pure WCT populations in the proposed study area. For example in the Thompson River drainage, 95% of know populations of WCT populations are believed to be vulnerable to hybridization (Kreiner and Terrazas 2018) and recent genetics work has documented that hybridization has advanced farther up tributary streams over the past 30 years, including above what were previously believed to be fish barriers (Leary 1994; Kovach 2019). Non-native trout are dominant in the mainstem Thompson River and lower Prospect Creek and appear to be moving farther up local

tributary streams which are often WCT strongholds (FWP unpublished data, Kreiner and Terrazas 2018, Blakney and Tholl 2019). Displacement of native cutthroat trout subspecies by introduced trout species has been well documented in Montana and across the Western U.S (Shepard 2004; Al-Chokhachy and Sepulveda 2019).

Relevant Resource Management Goals and Public Interest

Westslope Cutthroat Trout are designated as Species of Special Concern (S2) in Montana because the species is at risk due to very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to extirpation in the state. Federal natural resource management agencies such as the U.S. Forest Service and Bureau of Land Management recognize WCT as Sensitive. Genetically pure WCT are estimated to inhabit only about 2-4% of their historic stream distribution (McIntyre and Rieman 1995). Numerous projects have occurred across the species native range in Montana over recent years to protect existing populations and/or to expand the species distribution including within the proposed project area. In 2020 Montana Fish, Wildlife and Parks (FWP), carried out the first introduction of genetically pure WCT into fishless habitat above a waterfall in the Thompson River drainage as part of a five-year project to protect local genetics by establishing populations in suitable, unoccupied habitats.

This proposed study would help to offset current and future, direct and indirect impacts of Thompson Falls Dam on WCT and supports FWP management objectives for the species in the lower Clark Fork River drainage (ex., Montana Statewide Fisheries Management Plan-2019-2027, FWP 2019; 2020 Montana Fishing Regulation, FWP 2020) and are consistent with multi-agency, collaborative conservation planning in the state (ex., Memorandum of Understanding and Conservation Agreement for WCT in Montana; FWP 2007).

Existing Information and Need for Additional Information

A substantial of amount of fisheries and genetic data has been collected in the proposed study area through routine FWP inventories, as part of native salmonid monitoring through the Avista hydroelectric mitigation program (FERC No. 2058) and through monitoring efforts and studies funded and supported by NWE and PPL Montana (ex., Kreiner and Terrazas 2018; Blakney and Tholl 2019). However, the genetic status of WCT populations are not fully understood or needs to be updated in some tributary streams or reaches. An example of gaps in genetic and distributional data (i.e., presence of hybridized WCT) exist in the Prospect Creek drainage, a stream that is dominated by non-native salmonids in the lower reaches but is considered a native trout refugia in its middle and upper reaches. Low-levels of introgression with RBT have been documented in a WCT population in Crow Creek (a tributary to middle Prospect Creek) in 2002 and 2017 (Blakney and Tholl 2019), however it is unclear if hybridization has progressed to upstream populations (i.e., Cox Gulch, Evans Gulch, Twentyfour Mile Creek, upper mainstem Prospect Creek and Glidden Gulch) given the observed connectivity between Bull Trout population in the middle-upper drainage that are isolated for a portion of each year due to natural intermittency (Oldenburg et al. 2015; DeHaan and Bernall 2017; Adams et al. 2017). Several tributaries of lower Prospect Creek have natural stream intermittency and/or barrier culverts in their lower reaches. Westslope Cutthroat Trout are known

to be present in upstream reaches in several of these tributaries however most of the populations have never been genetically tested (ex., upper Clear Creek, Wilkes Creek, Brush Gulch, Daisy Creek and Therriualt Gulch). Similar gaps in genetic and distributional information also occur in the Thompson River drainage and direct tributaries to the Clark Fork River. The proposed study would outline genetically pure populations at risk of hybridization or displacement that may need direct management intervention and would identify source populations for translocation efforts and rank populations in need of genetic rescue.

Project Nexus

The fish ladder at Thompson Falls dam has passed between 14 and 48 putative WCT per year from 2011 to 2020. The genetic composition of WCT passed at ladder was not attempted to be described until 2020, and those results are pending analysis. Passage efficiency has not been quantified for WCT or other species at Thompson Falls Dam, and it is very likely that all WCT are not being passed especially because ladder catches of salmonids drop off above 30,000 cubic feet per second (cfs) and because the ladder is closed once the river reaches about 60,000 cfs (NWE 2016; NWE 2021). Westslope Cutthroat Trout are known to spawn on the descending limb of the spring hydrograph, typically in May or June, and begin spawning migrations as melting snow elevates discharge in rivers and streams. Therefore, it is very likely that the dam continues to suppress the migratory life history of the species.

The number of WCT passed in contemporary times represents just a small fraction of fish that used this portion of the river and its tributaries based on historical accounts of the species prevalence in many local tributaries by area residents prior to the river's impoundment (Pratt and Huston 1993). Both migratory and resident life history forms of WCT rely on tributary habitat for spawning and rearing. Due in part to fragmentation from hydroelectric dams, migratory WCT are presently rare yet the stream resident form is still relatively abundant in some tributary habitats within the proposed study area. Avista relicensed their two lower Clark Fork River dams in 1999 (FERC No., 2058, Avista 1999) and through the relicensing process mitigation measures were agreed upon that recognized the importance of carrying out PM&E measures in tributary streams as these areas typically had (and still have) the highest abundance of native salmonids (Bull Trout, WCT and Mountain Whitefish) in the project area, including the resident life history form. It was in these tributary streams to Noxon and Cabinet Gorge reservoirs where local partners felt they could best mitigate for the long-term and continued deleterious impacts the lower Clark Fork dams and the poor habitat these impoundments created for native salmonid species.

The nexus is clear between the Thomson Falls Hydroelectric project and this proposed project to update genetic information on remaining populations WCT impacted by the dam. Low numbers of migratory WCT and Bull Trout presently occur in the Clark Fork River basin compared to historical accounts, in part, due to over 100 years life history suppression and as a result of changes in habitat and fish species community composition from the impoundment of the river. Life history suppression for both of these imperiled native fish species is ongoing through inefficient passage during much of the spring hydrograph (i.e., few salmonids caught at the ladder above 30,000 cfs, no passage above 60,000 CFS) and unquantified passage efficiency for all species including Bull Trout and WCT when the fish ladder is in operation. As is with the

case with the Avista hydroelectric mitigation program downstream on the Clark Fork River, much of the emphasis to conserve WCT populations will need to occur in tributary streams that enter the Clark Fork River within or above the project area. This proposal is analogous to the Bull Trout transport proposal that both MFWP and NWE submitted through the FERC relicensing process in that both propose work in tributary streams on imperiled native salmonid species that are impacted by the dam and dependent on those headwaters habitats to carry out their life cycle and both studies seek to inform future PM&E's and license articles associated with Thompson Falls Dam. The stream resident life history form of both Bull Trout and WCT have sustained these species distribution in tributaries that enter within the hydroelectric project area (i.e., Prospect Creek and Thompson River drainages).

Proposed Methodology

In the summer and fall of 2021 and 2022, FWP can commit to working with NWE to update all exiting genetic data, including information on the distribution and presence of non-native trout species in the proposed survey streams (Table 1). Genetic and distributional data would be collected through single pass backpack electrofishing or spot shocking efforts to acquire this information in the most efficient means possible. Existing data will be used to identify data gaps and to help narrow down specific sample locations in study streams. For some streams, distributional data is up to date and genetic samples have been collected but have not been analyzed.

Genetic samples will be analyzed following standard protocols at the Conservation Genetics Lab at the University of Montana, which is a cost share between the University and FWP. The results of genetic data coupled with updated distributional information on WCT and their non-native competitors will be drafted into a report that outlines and prioritizes protection, mitigation and enhancement measures at the stream or even reach level.

Table 1. Proposed Westslope Cutthroat Trout (WCT) genetic data collection by drainage, stream, reach (collection location), sample size, date of last genetic data collection and know presence of WCT.

Drainage	Stream	Collection Location (s)	Sample Size	Last Sample Collection	WCT Present
Prospect Cr.	upper Clear Cr.	upper perennial reach above RM 8.0	30	none	yes
Prospect Cr.	upper Wilkes Cr.	upper perennial reach above RM 1.3, including forks	30	none	yes
Prospect Cr.	Bush Gulch	perennial reach above RM 0.8	30	none	yes
Prospect Cr.	Daisy Cr.	perennial reach above RM 0.7	30	none	yes
Prospect Cr.	Therriualt Gulch	perennial reach above RM 0.3	30	none	yes

Prospect Cr.	Cox Gulch	perennial reach above RM 0.7	30	none	yes
Prospect Cr.	Evans Gulch	perennial reaches above RM 0.7	30	1994	yes
Prospect Cr.	Twentyfour Mile Cr.	up to falls at RM 1.2	30	none	yes
Prospect Cr.	Glidden Gulch	upstream of RM 0.8	30	2007	yes
Little Thompson R.	Mudd Creek and tribs	includes Mudd, Loneman, Partridge and Todd Creeks (10 samples/stream)	40	none	yes
Little Thompson R.	upper Alder Cr.	above and in irrigation diversion	30	none	yes
Little Thompson R.	McGinnis Cr.	upstream of RM 3.0	30	none	yes
Little Thompson R.	Little Rock Cr.	above diversion, samples collected in 2020 (n=30)	30	2007	yes
Thompson R.	Indian Cr.	above intermittent reach, samples collected in 2020 (n=30)	30	none	yes
Thompson R.	Twin Lakes Cr.	upstream of RM 1.0	30	none	yes
Thompson R.	Whitney Cr.	no sampling records	30	none	unknown
Thompson R.	Meadow Cr.	no sampling records	30	none	unknown
Thompson R.	Lazier Cr.	upstream of RM 3.0	30	none	unknown
Thompson R.	Beartrap Cr.	lower and upper perennial reaches, samples collected in 2020 (n=30)	30	none	yes
Thompson R.	Goat Cr.	upstream of HWY. 556 culvert	30	2003	yes
Clark Fork R.	Swamp Cr. tribs	above intermittent reaches in West Fork Swamp Cr., Dee Cr. and Beemish Cr.	30	1993	yes
Clark Fork R.	Weeksville Cr. Tribs	Spring Cr. and Teppe Cr., above lower intermittent reaches	30	none	unknown
Clark Fork R.	upper Lynch & tribs	includes Lynch Cr., Clark Cr., Cedar Cr. & Hinchwood Cr., no sampling records	30	none	unknown
Clark Fork R.	Miller Cr.-Combest Cr.	no sampling records	30	none	unknown

Level of Effort and Cost

The only cost for this project will be the analyses of genetic samples, where up to 730 samples would be collected from approximately up to 24 streams/stream reaches (Table 1; Table 2). The price per fish to run and analyze samples is $40 and samples can be collected from 1 to 5 stream reaches per day, depending on location and level of technician assistance. Northwestern Energy funds 1.5 FTE per year for FWP technicians based in Thompson Falls and these two positions along with the local management biologist can collect a good portion of the data. The U.S. Forest Service may also be able to assist in sample collection. It is likely that the cost for the genetic analyses in Prospect Creek could be split between NWE and Avista's mitigation program.

Table 2. Estimated project cost.

Item	Cost
WCT genetic samples ($40 x 730)	Up to $29,200
Total	Up to $29,200

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New Proposed Study Plan #2. Heavy metals and organic compounds assessment of fish in Thompson Falls Reservoir.

Goals and Objectives

Based on the NorthWestern's (NWE) proposed study 3 -Water Quality, FWP advises a more comprehensive study of heavy metals and organic compounds in the sediments and biota tissue to assess the impacts of hydropower operations and the influence of impoundments on contaminant accumulation and impacts to the fishery.

Agency Resource Management Goals

Montana Fish, Wildlife & Parks (FWP) has trust responsibilities for managing Montana's fish and wildlife resources under Montana law (MCA 87-1-201). The Federal Power Act requires the Federal Energy Regulatory Commission to consider resource agency recommendations. Management direction for the fishery in the Clark Fork River drainage is articulated in the 2019-2027 Statewide Fisheries Management Program and Guide (FWP 2019) but notably includes enhancing fluvial populations of Bull Trout and Westslope Cutthroat Trout and ensuring adequate connectivity with tributaries for Rainbow trout and Brown trout in the Clark Fork River drainage. Monitoring for heavy metals such as Mercury (Hg), Selenium (Se), Lead (Pb), and Arsenic (As), and organic compounds like dioxins, furans, and Polychlorinated Biphenyls (PCBs) in the sediments and biota tissues is a necessary component of assessing the impacts of hydropower operations and the influence of impoundments on contaminant accumulation.

Public Interest Considerations

FWP is the state resource agency charged with managing and protecting fish and wildlife and their habitats in Montana.

Existing Information and Need

Numerous State and Federal Super fund sites exist on the Clark Fork River upstream of Thompson Falls Reservoir. These sites have been designated due to contamination by heavy metals, dioxins, furans, and PCBs (aroclor mixtures and co-planer). More specifically, the Flint Creek drainage is a significant source of mercury to the Clark Fork River, while the Bonner Mill and former Smurfit Stone Container (SSC) Mill sites are potential sources for PCBs and dioxins and furans.

Sampling conducted on the Clark Fork River in 2018-19 by the EPA (in coordination with FWP) identified elevated concentrations of toxicity equivalent quotient (TEQ) for dioxins, furans, and co-planer PCBs in northern pike immediately downstream of the former SSC Mill site (TEQ concentrations up to 3.7 ng/g ww), and concentrations in rainbow trout increasing downstream of the Mill, with the highest concentrations found at the most downstream sampling location near St. Regis (EPA 2020a,b). This sampling resulted in "avoid" consumption guidance for all fish being issued in December (2020) on the Clark Fork River from the confluence Bitterroot River to the confluence with the Flathead River.

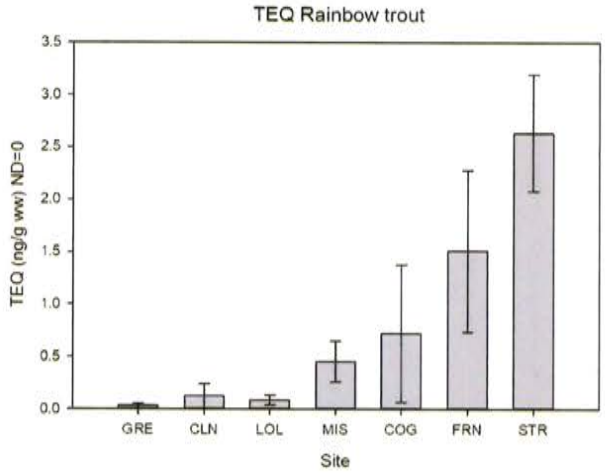

Figure 1. Concentrations of TEQ (dioxins, furans and co-planer PCBs) from 10-14 inch rainbow trout collected in 2018-19 in the Clark Fork River surrounding the Stone Container Mills Site. GRE-Greenough Blackfoot River, CLN-Clinton Clark Fork, MIS-East Missoula Clark Fork, LOL-Lolo Bitterroot, COG-Council Groves Clark Fork, FRN-Frenchtown (Mill site) Clark Fork, and STR-St. Regis Clark Fork.

Sampling conducted at Noxon Reservoir in 2014, found elevated concentrations of dioxins, furans, and co-planer PCBs in northern pike and smallmouth bass, warranting an "avoid" consumption guidance for the largest size group of northern pike, and reduced consumption guidance for smallmouth bass (Selch 2015). Mercury sampling in Noxon and Cabinet Gorge reservoirs in 2015 suggest "avoid" consumption guidance for the largest size groups of lake trout, northern pike, smallmouth bass, brown trout, and walleye (Selch 2017).

Due to the bio-accumulative nature and high toxicity of dioxins, it is common to get non-detections in water concentrations, and low or non-detections in sediment samples and still find elevated concentrations in fish. Dioxins and PCBs are hydrophobic compounds that are sensitive to laboratory detections limits and are variable between laboratories and individual batches of samples.

Recent sampling conducted for dioxin TEQ on the Clark Fork River near Frenchtown, MT identified non-detects in water samples, and low detections in sediment (less than a part per trillion, ppt), yet northern pike and rainbow trout contained concentrations of dioxin TEQ deemed unsafe for consumption. This phenomenon was also reported in other studies with dioxin contamination in water, sediments, and fish tissues (Swanson et al. 1996). Given dioxins have been documented upstream and immediately downstream of Thompson Falls Reservoir, it follows that sampling with the Reservoir in fish tissues is warranted.

It is very likely there will be a proposal this fall for dioxins and PCBs monitoring, but it will likely be a basin-wide proposal. A basin-wide approach wouldn't have the ability to do the targeted effort this request details, and therefore wouldn't be adequate to evaluate impacts of Thompson Falls Hydroelectric Project.

Project Nexus

There are Superfund sites located nearly 100 miles upstream of Thompson Falls Reservoir. Thompson Falls Hydroelectric Project and resulting reservoir is the first lentic environment that likely serves as a catchment basin for contaminants in the basin. Elevated levels of contaminants have already been documented both upstream and downstream of the Reservoir. Heavy metals like Hg methylate in lentic environments rapidly accumulate in higher trophic level organisms and top-level piscivores. Dioxins, furans, and PCBs are highly bio-accumulative, hydrophobic compounds that bind to sediment particles as they move through the system and bioaccumulate up the food-chain. Concentrations of dioxins that are barely detectable in sediment (and often non-detect in water) can accumulate to concentrations in fish that warrant "avoid" consumption guidance.

Monitoring for heavy metals (such as Hg, Se, Pb, and As) and organic compounds (dioxins, furans, and PCBs) in the sediments and biota tissues is a necessary component of assessing the impacts of hydropower operations and the influence of impoundments on contaminant accumulation. Monitoring concentrations of contaminants in sediments inform State (Department of Environmental Quality - DEQ) and Federal (Environmental Protection Agency - EPA) regulatory agencies in assessment of waters for impairments,

while monitoring fish muscle tissues inform fish consumption guidance for recreational and tribal consumers utilizing the fisheries resources.

Study Methodology

Collect northern pike, rainbow trout, smallmouth bass, and yellow perch from Thompson Falls Reservoir to obtain adequate numbers and tissues samples for Dioxin/Furan and co-planer PCB analyses. Fish will be processed to extract fillet-on muscle samples in accordance with EPA 2019 Sampling and Analysis Plan/Quality Assurance Project Plan: 2019 Fish Tissue Study. Sampling listed below would match sampling collected upstream in 2019, and would allow for fish consumption guidelines assessment.

(1) Collect (6-10) northern pike from each of 4 size groups, including 14-18, 18-22, 22-26, and 26-30 inches. Within each size group, fish muscle tissues will be excised and composited for analysis (2 composites of 3-5 fish per size group).
(2) Collect (6-10) rainbow trout from each of 2 size groups, including 10-14 and 14-18 inches. Within each size group, fish muscle tissues will be excised and composited for analysis (2 composites of 3-5 fish per size group)
(3) Collect (6-10) smallmouth bass from each of 1 size group, including 10-14 inches. Within each size group, fish muscle tissues will be excised and composited for analysis (2 composites of 3-5 fish per size group)
(4) Collect (6-10) yellow perch from each of 1 size group, including 6-10 inches. Within each size group, fish muscle tissues will be excised and composited for analysis (2 composites of 3-5 fish per size group)
(5) Tissue samples will be shipped on dry ice to ALS Environmental, 1317 South 13th Ave, Kelso, WA 98626 for Dioxin/Furan (method HRGC/HRMS 1613B) and co-planer PCB (GC/ECD – 8082A) analyses.
(6) Completely chain of custody form will be submitted to ALS laboratory instructing lab to analyze fish listed above for Dioxins/Furans and co-planer PCBs. A blind duplicate sample from one of the largest size groups will also be submitted for quality control.

Level of Effort

This study would require a relatively low level of field work conducted during 2021-2022. In total 8 species/size group composites (2 replicates per species/size group) for 16 total fish samples, one blind duplicate, and one field blank for a total of 18 analyses. ALS analysis for dioxins/furans ($425.00), co-planer PCBs ($250.00), compositing ($15.00), freeze dry ($35.00), homogenization ($35.00), TOTAL cost per sample: $760.00. Total cost of study $13,680.00 + time and effort = approximately $20,000.

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From: Evilsizer, Laura
To: mitzi.rossillon@gmail.com
Cc: Sullivan, Mary Gail
Subject: [EXTERNAL] Thompson Falls Hydro Project
Date: Wednesday, January 6, 2021 3:39:24 PM

Mitzi,

I was thinking about the Thompson Falls Project after the meeting today. You mentioned doing an update for the district (24SA0165) and considering if the site may no longer be Eligible or if features have been destroyed or lost integrity and need to be removed as contributing features. I believe you should also consider if you should extend the period of significance or add features that were not considered significant 30 years ago but may be considered so today. Just a passing thought when you get to that step in the process. Feel free to reach out to me or John. SHPO #1

Thanks for the chat conversation during the meeting. I double checked and Kyle Felsman's position with the CSKT has not been permanently filled yet. Michael Durglo Jr is our current contact for their THPO. But that could change once the position is filled. SHPO #2

I'm looking forward to seeing what you come up with on your predictive model. I think there is the potential for some interesting sites out there, but there simply hasn't been enough inventory work to verify. SHPO #3

Have a great day!

Laura Evilsizer, M.A.
Review and Compliance Officer
State Historic Preservation Office
Montana Historical Society
P.O. Box 201202/1301 E. Lockey Avenue
Helena, MT 59620-1201
Laura.Evilsizer@mt.gov
(406) 444-7719
www.montanahistoricalsociety.org

From:	Sullivan, Mary Gail
To:	John Tabaracci; Gillin, Ginger; Andy Welch
Subject:	[EXT] FW: [EXTERNAL] RE: Thompson Falls Hydroelectric Project No. 1869: Invitation to Virtual Study Plan Meeting
Date:	Thursday, December 31, 2020 12:51:04 PM

From: Sullivan, Mary Gail
Sent: Thursday, December 31, 2020 1:50 PM
To: 'Hagedorn Land Surveying ' <hagedornls@blackfoot.net>
Subject: RE: [EXTERNAL] RE: Thompson Falls Hydroelectric Project No. 1869: Invitation to Virtual Study Plan Meeting

Robin,

Thank you for your email concerning the Thompson Falls Reservoir. At this time, NorthWestern has no plans to dredge the reservoir. As such, we have not assessed what regulatory requirements would be involved. My initial thought, however, is that dredging would require Federal Energy Regulatory Commission, U.S. Army Corps of Engineers, State of Montana, and possibly the Conservation District approval. Undoubtedly, these approvals would require studies to understand the consequences of dredging, including the potential environmental effects, long-term benefits, and costs.

Regards,

Mary Gail

Mary Gail Sullivan
Director, Environmental & Lands Permitting & Compliance
marygail.sullivan@northwestern.com
O: 406-497-3382
C: 406-490-1838
11 E Park
Butte, MT 59701

From: Hagedorn Land Surveying <hagedornls@blackfoot.net>
Sent: Tuesday, December 29, 2020 1:53 PM
To: Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>

Subject: [EXTERNAL] RE: Thompson Falls Hydroelectric Project No. 1869: Invitation to Virtual Study Plan Meeting

Mary Gail;
Let me introduce myself. I am the secretary for the Thompson Falls Chamber of Commerce and the owner, with my husband, of Hagedorn Land Surveying in Thompson Falls.
I have a general question for you.
What steps would need to be taken to have the upper Thompson Dam reservoir dredged? It is filling in and the mud islands are getting larger each year. It allows more of the weeds to grow and limits water sport use on the river in that area.
Does Northwestern Energy control the dredging or is that a Federal issue?
Any information would be appreciated.
I would just like to see the upper reservoir look as great as the lower.
Thanks in advance for any information you can provide.
Robin Hagedorn

Hagedorn #1

From: Sullivan, Mary Gail [mailto:MaryGail.Sullivan@northwestern.com]
Sent: Friday, December 18, 2020 9:46 AM
Subject: Thompson Falls Hydroelectric Project No. 1869: Invitation to Virtual Study Plan Meeting

Dear Relicensing Participant,

Please find attached an invitation to a meeting to discuss NorthWestern's Proposed Study Plan for the Thompson Falls Hydroelectric Project Relicensing. The meeting will be held virtually on the Zoom platform. Details on the schedule and how to access the meeting are on the invitation.

If you would like to be removed from this mailing list, feel free to email or call me.

Thank you,

Mary Gail

Mary Gail Sullivan
Director, Environmental & Lands Permitting & Compliance
marygail.sullivan@northwestern.com
O: 406-497-3382
C: 406-490-1838

11 E Park
Butte, MT 59701

February 19, 2021

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

RE: Thompson Falls Hydroelectric Project #1869-060
Response to Proposed Study Plan – slope stability

Greetings,

Thank you for keeping the public informed on hydroelectric project #1869-060 and for taking comments on the proposed study plan. As a property owner on the reservoir I have a strong interest in this project. I have attended many of the public scoping meetings, and have read parts of the Baseline Environmental Document and parts of the Proposed Study Plan Project No. 1869. Please include my comments below in the project analysis.

Slope stability is an important issue because it directly impacts hundreds of privately-owned land parcels adjacent to the reservoir. The issue was very briefly described in the Baseline Environmental Document (BED, page 23). The entire discussion on slope stability in the BED consisted of two short paragraphs. The first paragraph has two sentences regarding soil types, and the soil map referenced in the first sentence displays almost no information for the reservoir between Steamboat Island and Thompson River. The second paragraph reads as follows: "In 1990, MPC stated that water level fluctuations associated with existing operations have affected two terraces along the southern shoreline of the Thompson Falls Reservoir (MPC 1990). The sand terrace has been undercut by wave action, while the boundary terrace has been subjected to dry ravel and minor slippage where it is exposed as a high bank." There is no mention of the current condition in this 2018 baseline analysis. LaMont #1

The reservoir is causing slope instability as evidenced by mass slope failures, terraced slopes and undercut slopes throughout the reservoir's shoreline. While some of these signs of erosion are present upstream in the river section, they are not of the same magnitude. I have owned property on the reservoir for 10 years and have seen many instances of erosion during that time. LaMont #2

Many factors are contributing to slope instability such as soil type, topography, strong water currents during spring runoff, and wake action from boats. Management of water levels in combination with these factors can have a cumulative effect and contribute to instability. For example: LaMont #3

1. When the reservoir is at low water levels the shoreline has more rock surfaces and a lower slope angle so a strong current has less erosive impact. In contrast, holding the reservoir at full pool during spring runoff keeps the strong current next to the shoreline vegetation where there is LaMont #4

exposed soil and steeper slopes. The strong current, in combination with the water level being held at full pool, have the cumulative effect of increased erosion rate. LaMont #4

2. Holding the reservoir at full pool during July and August can aggravate erosion. Boats specifically designed to create wakes large enough for surfing now frequent the reservoir, along with people on jet skis / Sea-Doos jumping self-induced wakes. These activities create large wakes that hit both sides of this narrow "run-of-the-river" reservoir with high intensity, eroding soil from the shoreline. Along most of its length (between Steamboat Island and Thompson River) the reservoir is barely 400 feet wide, the width of its no-wake zones. LaMont #5

   Further, there has been a substantial increase in the number boats, most operating in violation of the no-wake zone, which is also contributing to erosion. Many are persistent violators of the no-wake zone, not simply boaters passing through the area. The photos below show a wake boat with a surfer and the resulting sediment flush after the wave hits the shoreline – fine soil particles are being flushed out from underneath the rocks. Eventually the rocks slide down the steep bank, exposing plant roots, the plants die, trees fall into the reservoir, and the slope slumps. The cumulative effect of boat wakes while the reservoir is at full pool is a major contributor to slope instability and should be addressed in the study plan. LaMont #6

To make the study plan more meaningful, here are a few suggestions:

1.) For a better understanding of the current condition, the shoreline could be mapped according to presence and character/type of erosion. Use of even general categories would be beneficial, e.g. mass failure, terracing, undercutting, and no sign of erosion. This would help describe the severity of the problem and document the impacts of current management on slope stability. Over time (maybe once every 5 or 10 years) the analysis could be repeated to track how conditions are changing. Relying on only 9 sample points and only one sample year, as proposed in the study plan, will not provide a thorough description of current condition. LaMont #7

2.) A more detailed description of current condition would also be useful for determining the number and location of sample points necessary for the purpose of measuring erosion. Each type of erosion (as listed above) should have at least a couple of sample points. The photo LaMont #8

below is of the south shoreline where there is evidence of mass failure, but the proposed study plan doesn't indicate that areas with mass failure are being sampled.

LaMont #8

The photo below is on the north side where the shoreline is being undercut. Rocks and roots are being exposed due to erosion. Again, sample points in this type of location would be useful.

Another area of concern is between Cherry Creek and Thompson River Lumber (between proposed sample points 8 & 9) where the slope has multiple terraces from erosion. Perhaps adding sample points in areas with sandy soils would help track erosion rates.

LaMont #9

3.) Erosion can be a slow steady process or an abrupt process attributable to a single event. Relying on a single season's-worth of data is thus a gamble -- it's possible that the proposed study will be conducted in a year of atypical erosion activity. If erosion is detected in the one year study, was it due to wake action or to changes in water level? As an option, a multiple year study plan could be used to generate multiple data points over time. Multiple data points provide a better description of erosion rates from the current management (the existing condition), and erosion rates from the proposed changes in management. LaMont #10

4.) The study plan could also address the effectiveness of possible mitigations that could be incorporated into management to reduce impacts on slope instability. For example,

a. Would reducing reservoir height during spring runoff or peak boat season help reduce the rate of erosion? Perhaps the study plan could evaluate how much the water level would need to be lowered to have a beneficial effect of reducing rate of erosion. LaMont #11

b. In the fall of 2019 a slope stability restoration project was implemented on private land as documented in a NorthWestern Energy brochure (2020 NWE). Will the restored shoreline become undercut over time? The study plan could evaluate the long term slope stability at the restoration site. Information from long term monitoring would help NorthWestern Energy assist other private landowners with design recommendations, cost estimates and funding assistance for similar restoration projects. LaMont #12

c. Would education and enforcement of the no-wake zone reduce the rate of erosion? Currently there is no enforcement of the no-wake zone, so there is little compliance with this regulation. The study plan could evaluate if the associated cost of enforcement and education are effective in increasing compliance with the no-wake regulation. LaMont #13

Property owners and recreationalists (with two potentially disparate viewpoints) could be surveyed for knowledge of and compliance with the no-wake zone regulation. Another source of information may be AVISTA, who helps fund education and enforcement activities in the nearby Noxon Reservoir. LaMont #14

I do realize and appreciate that NorthWestern Energy has tried to educate the public about the no-wake zones. However, the current signs are very small and need to be revised. To make the no-wake zone enforceable the signs need to be more visible, show the boundaries of the no-wake zone on a map, and define a wake (see Montana wake definition referenced below). Also, there is a need to post aquatic invasive species prevention requirements at all boat ramps (including North Shore and Steamboat private launch sites). Owners of the private launch sites would likely support the installation of new signs at these sites. LaMont #15

I hope these comments will lead to a more meaningful study and better management of the reservoir.

Respectfully yours,

Susan LaMont

PO Box 1135
Thompson Falls, MT 59873
72steamboat@gmail.com

Cc: NorthWestern Energy - marygail.sullivan@northwestern.com
NorthWestern Energy – andrew.welch@northwestern.com
Montana Fish and Recreation - fwpgen@mt.gov, fwprg12@mt.gov
Green Mountain Conservation District – gmcd@blackfoot.net

References

1.) Montana No-Wake - http://www.mtrules.org/gateway/ruleno.asp?RN=12.11.115

2.) Montana Wake definition - http://www.mtrules.org/gateway/ruleno.asp?RN=12.11.101

3.) Thompson Falls Reservoir Bank Stabilization Pilot Project. NorthWestern Energy 2020. - https://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls-other-reference-material/4068_tfalls_reservoir_bank_stabilization_bro.pdf

Appendix B – Water Quality Study Plan

Thompson Falls Project No. 1869
Water Quality Monitoring Plan

2021 Monitoring Season

Final Version 3/2/21

NorthWestern® Energy

Delivering a Bright Future

Table of Contents

Section 1.0 – Introduction

NorthWestern Energy Corporation (NorthWestern) is the 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) 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 preparation for renewal of the FERC License for the Project, NorthWestern has developed a water quality monitoring plan to collect baseline water quality data on the Project. This data will help characterize the current water quality of the Project and serve as a baseline for the new FERC license period. This baseline will help NorthWestern track water quality trends over time and provide useful information as to the effects that Project operations may have on water quality in the Clark Fork River.

The Project is located in the lower portion of the Clark Fork watershed (**Figure 1-1**) with two dams upstream of the Project on the Flathead River, a major tributary of the Clark Fork River, and two dams downstream of the Project on the Clark Fork River. The Flathead River is a regulated system with the flow regime being manipulated by the operations of Hungry Horse and SKQ Dams. The Clark Fork River upstream of the confluence with the Flathead River is not regulated by dams, and therefore is more representative of a natural river system in regards to its hydrograph. The Clark Fork River downstream of Thompson Falls Dam runs for approximately 3.2 miles before it reaches the impounded area of Noxon Rapids Dam.

In 2018, a Baseline Environmental Document (BED) was developed for the Project to describe existing and relevant information about Project hydro facilities and operation, area water quantity and quality, fisheries, wildlife, vegetative, aesthetic, socioeconomic, and cultural and public recreation resources (NorthWestern Energy, 2018). Water quality data gaps were identified in the BED, and this document attempts to address those data gaps by providing a framework for water quality data collection.

Water quality data was collected at the Project by NorthWestern in 2019 and 2020, and the data collected for this study is intended to supplement the previously collected data to help provide an overall picture of existing water quality conditions.

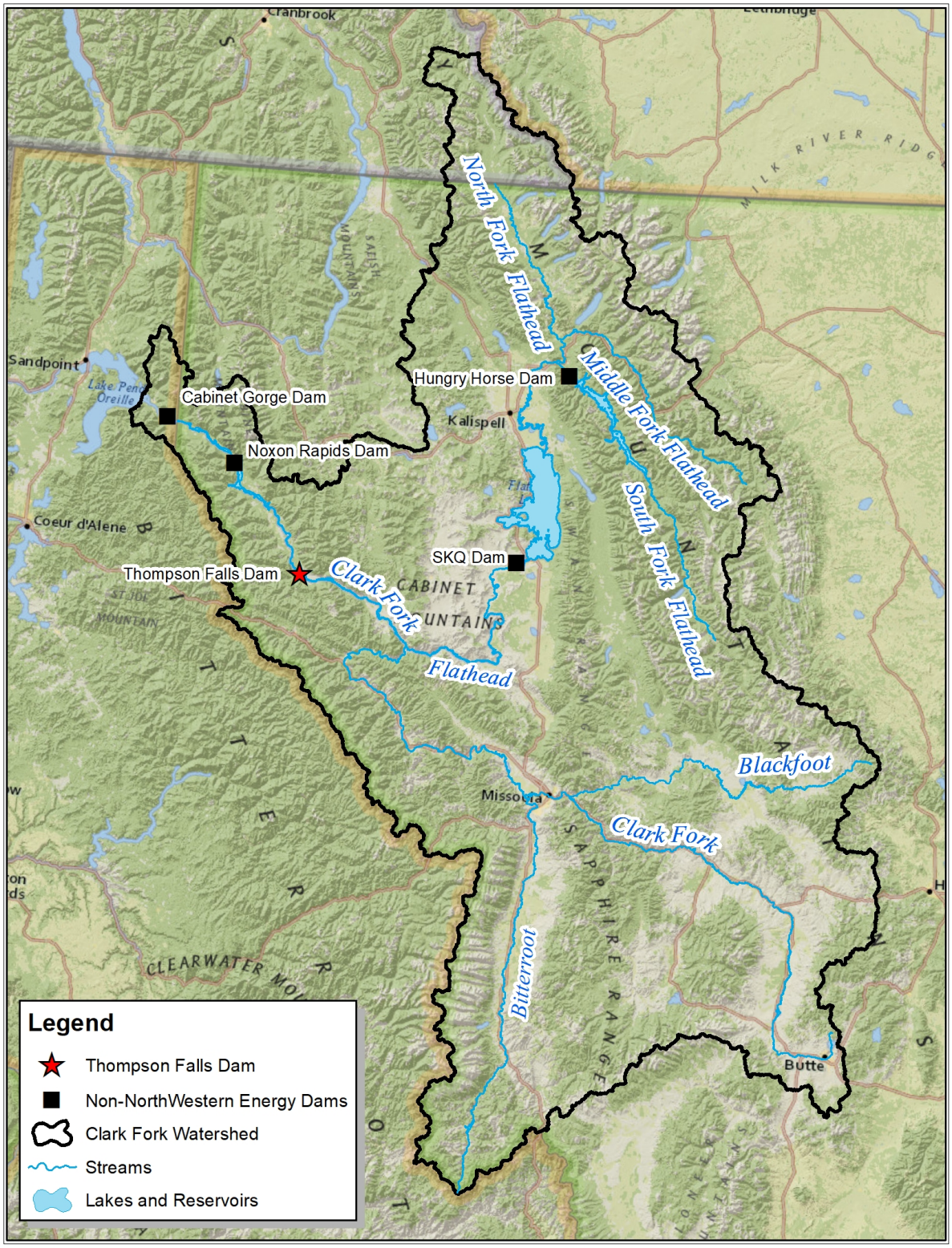

Figure 1-1. Map showing the location of Thompson Falls Dam in the Clark Fork River watershed.

Section 2.0 – Water Quality Monitoring

Water quality monitoring outlined in this document for the Thompson Falls Hydroelectric Project will include water chemistry sampling and field parameters measured in-situ. **Figure 2-1** is a map showing the location of all proposed water quality monitoring sites for the Project. The below sections describe the 2021 sampling effort in detail.

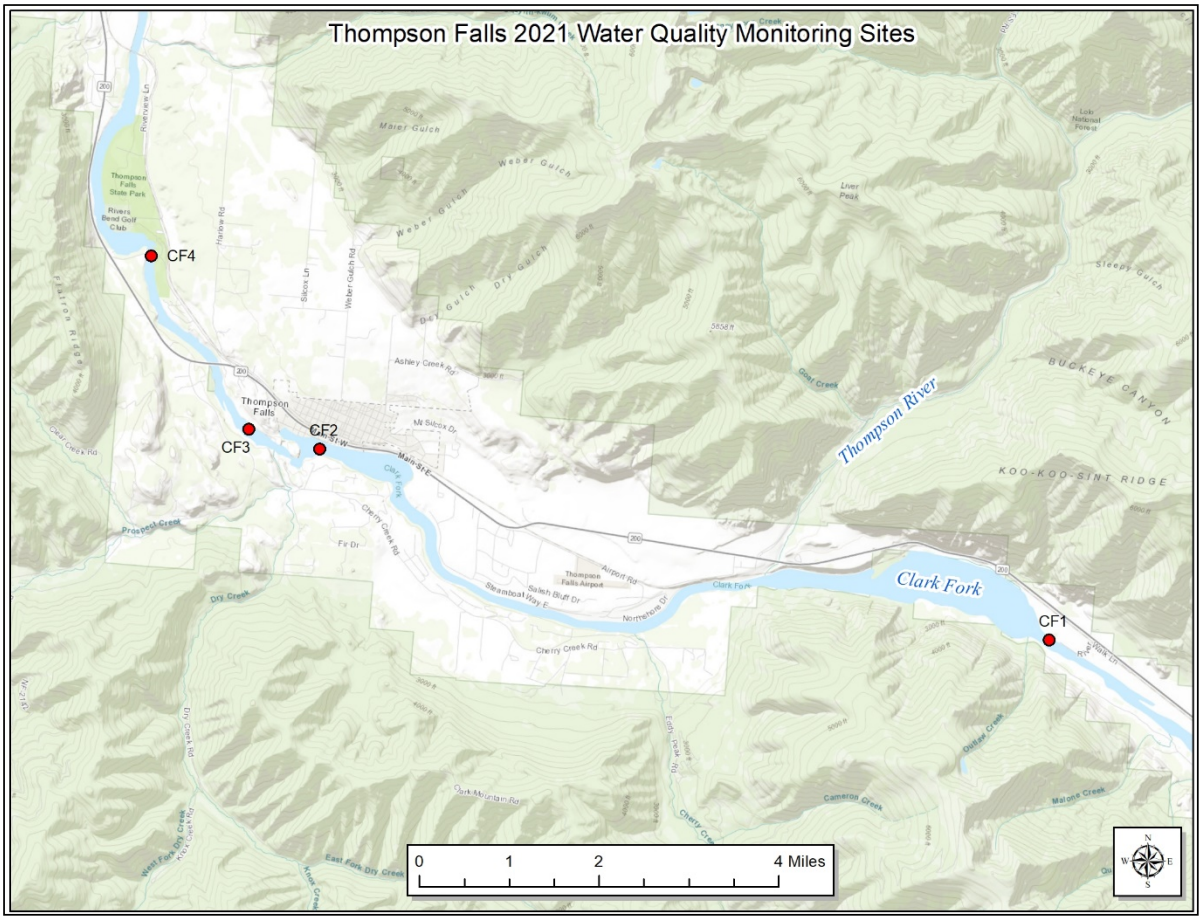

Figure 2-1. Map showing all water quality monitoring sites proposed for 2021.

Section 2.1 – Water Chemistry and Field Parameters

Water chemistry sampling will consist of multiple monitoring sites around the Project to attempt to characterize the incoming water quality from the Clark Fork River and the outgoing water quality downstream of Thompson Falls Dam.

Four monitoring sites and timeframes have been strategically chosen to capture the above-mentioned objectives. Sites will be sampled quarterly to understand the seasonality of water quality in the Project. Sampling is planned for March, June, September, and December, as well as continuous data collection at some sites. Parameter groups to be analyzed include nutrients, metals, inorganics, and physical properties. Field parameters collected in-situ will also be measured as a part of this sampling effort.

Section 2.1.1 – Monitoring Sites

Four water chemistry monitoring sites have been identified in this plan, and the names and locations of these sites can be found in **Table 2-1**.

Table 2-1. Descriptions and locations of water chemistry monitoring sites.

Site Name	Site Description	Latitude	Longitude
CF1	Clark Fork River upstream of Thompson Falls Reservoir	47.569187	-115.167518
CF2	Clark Fork River upstream of Dam in Thompson Falls Reservoir	47.593502	-115.353699
CF3	Clark Fork River downstream of powerhouse	47.594303	-115.362777
CF4	Clark Fork River downstream of Dam at Birdland Bay Bridge	47.621436	-115.391592

Section 2.1.2 – Monitoring Timeframe and Method

Monitoring sites CF1, CF2, CF3, and CF4 will be monitored four times in 2021, and each monitoring event will consist of collecting a grab sample and measuring field parameters at each site. **Table 2-2** describes the sampling time frames and parameter groups collected for each sampling event. For greater detail on parameters analyzed and laboratory methods, please see **Table A-1** and **Table A-2** in **Appendix A**.

Table 2-2. Description of timeframe, methods, and parameters measured at water chemistry monitoring sites.

Site Name	March 2021	June 2021	September 2021	December 2021	Continuous Monitoring	Sampling Method	Analyte Groups
CF1	X	X	X	X	X (temperature only)	Single point grab sample, Hydrolab HL7 Sonde, Onset HOBO Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
CF2	X	X	X	X		Equal width increment composite sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters
CF3	X	X	X	X		Single point grab sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters
CF4	X	X	X	X	X (temperature and field parameters only)	Equal width increment composite sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature

The water quality sampling will consist of the collection of either single point depth integrated samples, or depth integrated equal width increment composites at each monitoring location. Grab samples will be collected from the bank in a well-mixed portion of the river, or from a bridge at equal width increments and composited. Sample bottles will be rinsed with native water (or filtered native water) prior to sampling. Samples will be taken in the upstream direction to avoid entrainment of sediment disturbed by wading. During sampling, the sampling device will be drawn through the water column once, carefully avoiding any disturbance of bottom sediments.

Samples will be transferred to a decontaminated Teflon churn splitter and sealed in a secure container (wrapped in plastic in a soft cooler) until processing. Processing and splitting of sample aliquots into sample bottles will occur at the end of each day in a clean indoor location. Filtration with a 0.45 µm filter for dissolved parameters will be done as a batch process within 8 hours of sampling. All sample bottles will be virgin polyethylene bottles supplied by Energy Labs.

Samples will be clearly labeled with a waterproof marker or preprinted labels. Label information will include the site identification, date and time, sample type, preservative, and sampler's initials. Field notebooks will be completed for each location along with appropriate chain-of-custody forms. All samples will be immediately placed in a cooler chilled to 4°C for transport to the lab.

Quality control samples will also be analyzed for water quality parameters. These samples consist of one replicate and one equipment blank for each sampling event. The replicate is a sequential sample taken at one of the locations as a control measure of both field variability, sample processing procedures, and laboratory methodology. The equipment blank is a deionized water sample run through the sampling apparatus after standard decontamination procedures and analyzed for the full suite of water quality parameters. The blank primarily represents a quality control measure of lab methodology, but also integrates procedural aspects such as decontamination and sample handling.

The sampling methodology described above conforms to current standard operating procedures used by the Montana DEQ (Makarowski, 2019).

Field parameters will be collected at each sampling site using a laboratory calibrated Hydrolab HL7 sonde. After one minute of stabilization, five measurements will be collected at ten second intervals. The mean of these five measurements will be used as the value for that site. This file is saved electronically, as well as recorded in the field notebook.

Continuous water temperature monitoring will occur at various locations across the project at sites CF1 and CF4. This data will provide insight as to the effects of the Project operations on water temperature. At site CF1, an Onset Hobo thermograph will be deployed in June and will collect continuous water temperature data through October. Site CF4 is an established Total Dissolved Gas (TDG) monitoring site, and the instrumentation deployed at that site will collect continuous water temperature data.

Section 3.0 – Data Quality Assurance/Quality Control

Data quality assurance and quality control (QA/QC) will be accomplished under this plan using methods described in the standard operating procedures used by the Montana DEQ (Makarowski, 2019). These methods include:

1. Validation: reviewing analytical laboratory techniques including lab duplicate, matrix spikes, blanks, and surrogate recoveries to determine if the methods are within acceptable limits.
2. Replicates: each sampling event will include the collection of one replicate sample. Replicate variability will be analyzed using standard methods with objective of obtaining Relative Percent Differences ("RPD's") within 10% for values greater than 5 times the method detection limit.
3. Splits: Splits will be collected using a churn splitter to achieve equal aliquots, and samples will be analyzed for the full suite of parameters.
4. Field methodology: field blanks will be collected for each water quality event to monitor field methodology. Methods and field sampling forms will be reviewed to assure consistency.
5. Individual data which fails to achieve QA/QC objectives will be flagged with appropriate qualifiers in the database.
6. If QA/QC review suggests widespread problems with QA/QC for a sampling run, the sampling run (or individual samples) may be repeated at the discretion of the project manager.

Quality control measures will also be employed for any statistical analyses. These measures will include:

1. Testing the data for normality and adjusting for seasonal and flow effects.
2. For water quality, assigning one-half the detection limit to non-detect values and evaluating the methodology/detection limits to assure the analyses are valid.
3. Addressing missing values and trend analyses in a consistent manner that avoids biasing the results.

References

Makarowski, Kathryn. 2019. Standard Operating Procedure for Sample Collection for Chemistry Analysis: Water, Sediment, and Biological Tissue. WQDWQPBFM-02, Version 1.0. Helena, MT: Montana Department of Environmental Quality, Water Quality Planning Bureau.

NorthWestern Energy. 2018. Thompson Falls Hydroelectric Project Baseline Environmental Document. NorthWestern Energy, Butte, Montana.

Appendix A

Table A-1. List of water chemistry analyses performed for 2021 water samples.

Analyte Group	Analyte	Method	Reporting Limit
Physical Properties	pH	A4500-H B	0-0.1 s.u.
Physical Properties	Total Dissolved Solids	A2540 C	10 mg/L
Physical Properties	Total Suspended Solids	A2540 D	10 mg/L
Inorganics	Alkalinity	A2320 B	4 mg/L
Inorganics	Anions by Ion Chromatography	E300.0	1 mg/L
Nutrients	Nitrogen, Nitrate+Nitrite	E353.2	0.01 mg/L
Nutrients	Nitrogen, Total Persulfate	A4500 N-C	0.01 mg/L
Nutrients	Phosphorus, Total	E365.1	0.005 mg/L
Metals, Dissolved	Arsenic	E200.7_8	0.001 mg/L
Metals, Dissolved	Cadmium	E200.7_8	0.0001 mg/L
Metals, Dissolved	Calcium	E200.7_8	1 mg/L
Metals, Dissolved	Copper	E200.7_8	0.001 mg/L
Metals, Dissolved	Iron	E200.7_8	0.03 mg/L
Metals, Dissolved	Lead	E200.7_8	0.001 mg/L
Metals, Dissolved	Magnesium	E200.7_8	1 mg/L
Metals, Dissolved	Manganese	E200.7_8	0.001 mg/L
Metals, Dissolved	Potassium	E200.7_8	1 mg/L
Metals, Dissolved	Sodium	E200.7_8	1 mg/L
Metals, Dissolved	Zinc	E200.7_8	0.01 mg/L
Metals, Total Recoverable	Arsenic	E200.7_8	0.001 mg/L
Metals, Total Recoverable	Cadmium	E200.7_8	0.0001 mg/L
Metals, Total Recoverable	Copper	E200.7_8	0.001 mg/L
Metals, Total Recoverable	Iron	E200.7_8	0.03 mg/L
Metals, Total Recoverable	Lead	E200.7_8	0.001 mg/L
Metals, Total Recoverable	Manganese	E200.7_8	0.001 mg/L
Metals, Total Recoverable	Zinc	E200.7_8	0.01 mg/L

Table A-2. List of water chemistry field parameters to be collected in 2021.

Analyte Group	Analyte	Method
Field Parameters	pH	Hydrolab HL7 Sonde
Field Parameters	Turbidity	Hydrolab HL7 Sonde
Field Parameters	Dissolved Oxygen	Hydrolab HL7 Sonde
Field Parameters	Temperature	Hydrolab HL7 Sonde
Field Parameters	Specific Conductance	Hydrolab HL7 Sonde
Field Parameters	Depth	Hydrolab HL7 Sonde