Thompson Falls Hydroelectric Project
FERC Project No. 1869

Final License Application

Volume II of IV (Public)
Exhibit E: Environmental Report

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List of Abbreviations and Acronyms

>	greater than
<	less than
~	approximately
°F	degrees Fahrenheit
ug/L	micrograms per liter
3D	three-dimensional
AA	Assessment Areas
ADA	Americans with Disabilities Act
Agreement	1988 Mitigation Agreement
AIS	aquatic invasive species
APE	Area of Potential Effect
ARM	Administrative Rules of Montana
Avista	Avista Corporation
BBH	Black Bullhead
BED	Baseline Environmental Document
BCC	Birds of Conservation Concern
BIA	U.S. Bureau of Indian Affairs
BGEPA	Bald and Golden Eagle Protection Act of 1940
BLM	Bureau of Land Management
BO	Biological Opinion
BULL	Bull Trout
CAISO	California Independent System Operator
CEII	Critical Electric Energy Infrastructure
CEQ	Council on Environmental Quality
CFD	computational fluid dynamics
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHRU	Columbia Headwater Recovery Unit
CHSU	Critical Habitat Subunit
CHU	Critical Habitat Units
City	city of Thompson Falls
Commission	Federal Energy Regulatory Commission
Council	Northwest Power and Conservation Council
Council's Program	Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program
COVID-19	an infectious disease caused by the SARS-CoV-2 virus
CSKT	Confederated Salish and Kootenai Tribes
CZMA	Coastal Zone Management Act
CWA	Clean Water Act
Determination	FERC's Determination on Study Modification Requests
DEQ	Montana Department of Environmental Quality
DLA	Draft License Application
DNA	Deoxyribonucleic acid
DNRC	Department of Natural Resources and Conservation
DO	dissolved oxygen
DSHA	Deterministic Seismic Hazard Analysis

EB	Brook Trout
E-coli	Escherichia coli bacteria
ECOS	Environmental Conservation Online System
eDNA	environmental deoxyribonucleic acid
EFH	Essential Fish Habitat
EIM	Energy Imbalance Market
EJ Study	Environmental Justice Study
EJC	environmental justice communities
El.	elevation
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FAC	facultative
FACU	facultative upland
FACW	facultative wetland
FERC	Federal Energy Regulatory Commission
fish passage facility	Thompson Falls upstream fish passage facility
FLA	Final License Application
FPA	Federal Power Act
fps	feet per second
FSR	Final Study Report
FWP	Montana Fish, Wildlife and Parks
FWS	United States Fish and Wildlife Service
g	gravity
GBT	Gas Bubble Trauma
GIS	geographic information system
GMCD	Green Mountain Conservation District
H-A&E	Historic Architectural-Engineering
HDR	HDR Engineering, Inc.
HDX	Half Duplex
HGM	Hydrogeomorphic
HPMP	Historic Properties Management Plan
HVJ	high velocity jet
HxCDD	Hexachlorodibenzo-p-dioxin
ILP	Integrated Licensing Process
IPaC	Information for Planning and Consultation
ISB	Intermountain Seismic Belt
ISR	Initial Study Report
ITRR	Institute for Tourism and Recreation Research
km	kilometer
KNF	Kootenai National Forest
kV	kilovolts
L WF	Lake Whitefish
Licensee	NorthWestern Energy
LL	Brown Trout
LMB	Largemouth Bass
LNF	Lolo National Forest
LNSU	Longnose Sucker
LSSU	Largescale Sucker
M	million
m/s	meter per second
mm	millimeters

MBTA	Migratory Bird Treaty Act
MBTRT	Montana Bull Trout Restoration Team
MDL	Main Dam left
MDR	Main Dam right
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^2	milligrams per meter squared
MNHP	Montana Natural Heritage Program
MOU	memorandum of understanding
MPC	Montana Power Company
MSDI	Montana Spatial Data Infrastructure
MT	Montana
MW	megawatt
MWAM	Montana Wetland Assessment Method
MWh	megawatt-hours
MWF	Mountain Whitefish
N/A	not applicable
ng/kg	nanograms per kilogram
NPMN	Northern Pikeminnow
NEPA	National Environmental Policy Act
new powerhouse	Unit No. 7 powerhouse
NHPA	National Historic Preservation Act of 1966
NISB	Northern Intermountain Seismic Belt
NMFS	National Marine Fisheries Service
NRI	Nationwide Rivers Inventory
NO3+NO2	Nitrate+Nitrite
NorthWestern	NorthWestern Energy
Northwest Power Act	Pacific Northwest Electric Power Planning and Conservation Act
NPL	EPA Superfund National Priorities List
NPMP	Northern Pikeminnow
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
OBL	obligate wetland
P&C	proposed and candidate
PAD	Pre-Application Document
PCBs	polychlorinated biphenyl
PEM1A	Palustrine, Emergent, Persistent, Temporarily Flooded
PGA	peak ground acceleration
pH	potential of hydrogen
PIT	passive integrated transponder
PM&E	Protection, Mitigation, and Enhancement
Project	Thompson Falls Hydroelectric Project
PSP	Proposed Study Plan
PUMP	Pumpkinseed
RB	Rainbow Trout
RB+ hybrids	Rainbow Trout and Rainbow x Cutthroat Trout
RBxWCT	Rainbow x Westslope Cutthroat Trout hybrid
Relicensing Participants	Local, state, and federal governmental agencies, Native American Indian Tribes, local landowners and residents, non-governmental organizations, and other interested parties.
RM	river mile

RSP	Revised Study Plan
SCC	species of conservation concern
Scientific Panel	Thompson Falls Scientific Review Panel
SCORP	Montana Statewide Comprehensive Outdoor Recreation Plan
SD	Scoping Document
SHPO	State Historic Preservation Officer
SKQ	Seli'š Ksanka Qlispe'
SLUA	Standard Land Use Article
SMB	Smallmouth Bass
SOC	Species of Concern
SSA	Species Status Assessment
SSS	special status species
T&E	threatened and endangered
TAC	Thompson Falls Technical Advisory Committee
TC	Term and Condition
TCDD	Tetrachlorodibenzo-p-dioxin
TCLP	Toxicity Characteristic Leaching Procedure
TDG	total dissolved gas
TEQ	HDR Engineering, Inc.
TDG	total dissolved gas
TEQ	total equivalence
Thompson Falls Project	Thompson Falls Hydroelectric Project
TN	total nitrogen
TP	total phosphorous
Trails Group	Thompson Falls Community Trails Group
UPL	upland
U.S.	United States of America
U.S.C.	United State Code
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USR	Updated Study Report
VQO	Visual Quality Objectives
WCT	Westslope Cutthroat Trout
WE	Walleye
WG	Wetland Group
WL	Wetland
WMA	Wildlife Management Area
WSE	water surface elevation
YP	Yellow Perch
ZOP	Zone of Passage

1. Introduction

1.1 Application

NorthWestern Corporation, a Delaware corporation, d/b/a NorthWestern Energy (NorthWestern or Licensee) is filing this Exhibit E with the Federal Energy Regulatory Commission (Commission or FERC) as part of the Final License Application (FLA) for the Thompson Falls Hydroelectric Project (Thompson Falls Project or Project). The current license for the Project expires December 31, 2025. NorthWestern is using FERC's default relicensing process, the Integrated Licensing Process (ILP), to prepare its relicensing application.

The Thompson Falls Project is located on the Clark Fork River in Sanders County, Montana. (**Figure 1-1**). 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 FERC under the authority of the Federal Power Act (FPA). Montana Power Company (MPC) 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 MPC 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 in 2014. An order amending the license was issued in 1990 allowing for construction of an additional powerhouse (new powerhouse), and generating unit, Unit No. 7, which was subsequently completed in 1995. With the addition of this new (second) powerhouse, the Project has a total authorized installed capacity of 92.6 megawatts (MW). NorthWestern is not proposing in this relicensing to increase capacity or construct any new facilities for the Project.

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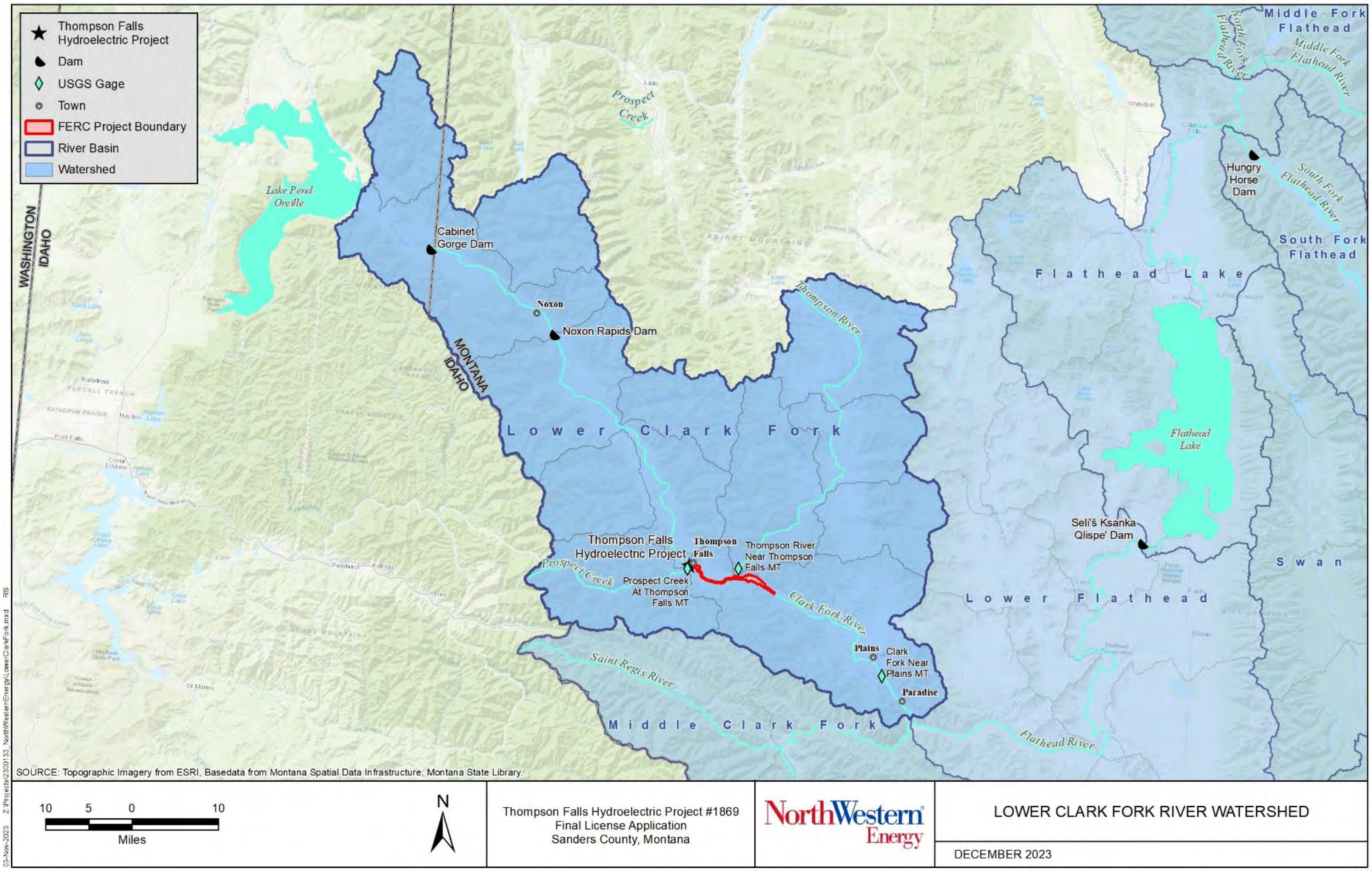
Figure 1-1. Project location and surrounding watersheds.



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1.2 Purpose of Action and Need for Power

1.2.1 Purpose of Action

In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the Project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., hydropower generation, flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

Issuing a new license for the Thompson Falls Project would allow NorthWestern to continue to generate electricity at the Project for the term of the new license, making electric power from a renewable resource available to its customers.

1.2.2 Need for Power

The Thompson Falls Project would provide hydroelectric generation to meet part of NorthWestern's obligations to serve the state of Montana's power requirements, resource diversity, and capacity needs. The Project would have an authorized installed capacity of 92.6 MW and generate approximately 475,379 megawatt-hours (MWh) per year.

Alternative sources of energy and capacity could in theory be obtained from short-term market purchases and long-term contracts with other entities in the region. However, the availability of the regional market to supply capacity and energy has been changing in recent years.

Resource adequacy is a top priority of NorthWestern. Currently, NorthWestern does not have adequate supply resources to fully serve load throughout the year. Due to inadequate supply, NorthWestern relies frequently on imported energy purchases to meet peak demand. Regionally, the Pacific Northwest is facing tight supply conditions which will likely persist into the future with projected coal retirements and the lack of adequate replacement capacity. NorthWestern cannot count on continued imports given the risk of declining generation regionally. An adequate portfolio would ensure that NorthWestern customers are less reliant on volatile and uncertain energy purchases and provide protection against transmission congestion which limits import availability (NorthWestern 2023).

The Project provides real power delivery to the local area, voltage support for the interconnecting transmission system, cost effective imbalance energy, and Frequency Reserve Response for the Western Interconnection. NorthWestern operates and maintains the Project in accordance with both the Western Electric Coordinating Council and the North American Reliability Council. NorthWestern is a registered transmission owner and operator and Balancing Authority through these entities and is responsible for grid stability and reliability. The Thompson Falls Project is interconnected into the NorthWestern system and located in its Balancing Authority Area.

NorthWestern currently participates in the Energy Imbalance Market (EIM) hosted by the California Independent System Operator (CAISO). The EIM is a voluntary inter-hour market established to share energy through load balancing for the purpose of grid stability and reliability. The Project is a participating resource in the EIM and provides imbalance energy to NorthWestern and participating entities in the CAISO EIM when there is an imbalance between supply and demand.

The Project provides real power delivery to the local area, voltage support for the interconnecting transmission system, cost effective imbalance energy, and Frequency Reserve Response for the Western Interconnection. If the Project's FERC license is not renewed, real power to support local area loading and reactive power to support transmission voltage would be required to flow from other interconnected resources or voltage control devices. These resources are not located close to the local area loads, thus real and reactive power flow would be subject to greater transmission losses, less efficient delivery to end users, and possibly frequency and voltage deviation.

In addition, if real and reactive power, provided by the Thompson Falls Project, was no longer available, it would drive the need for additional voltage control devices in the interconnecting area and inhibit the ability to take transmission system outages to complete local area transmission system maintenance. In addition, if generation from the Thompson Falls Project was not available, there would be a decline in the deployment for Frequency Reserves Response used to support the Western Interconnection and a decline in available capacity to support energy imbalance.

The power from the Project would help NorthWestern meet the need for power to serve their customers in both the short and long-term.

1.3 Statutory and Regulatory Requirements

FERC's issuance of a new license for the Thompson Falls Project is subject to numerous requirements under the FPA and other applicable statutes. The major requirements are described below. The actions NorthWestern has taken to address these requirements are also described below.

1.3.1 Federal Power Act

The FPA is the primary federal statute governing the regulation of nonfederal hydroelectric power. FERC has the responsibility and authority to license operation and construction of nonfederal hydropower projects under the FPA. FERC is the lead federal agency for regulating the relicensing of the Thompson Falls Project. The following sections of the FPA will apply to the relicensing.

1.3.1.1 Section 4(e) Conditions

The first proviso of FPA section 4(e), 16 U.S. Code (U.S.C.) § 797(e), provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The Project occupies federal lands within Lolo National Forest (LNF) that are administered by the U.S. Forest Service (USFS). FERC will solicit FPA section 4(e) conditions from LNF after the FLA is filed.

1.3.1.2 Section 10(j) Recommendations

Under Section 10(j) of the FPA, 16 U.S.C. § 803(j), each license issued by FERC must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the Protection, Mitigation, and Enhancement (PM&E) of fish and wildlife resources affected by the Project. FERC is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable laws. Before rejecting or modifying an agency recommendation, FERC is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. FERC will solicit FPA section 10(j) recommendations from the U.S. Fish and Wildlife Service (FWS) and Montana Fish, Wildlife and Parks (FWP) after the FLA is filed.

1.3.1.3 Section 18 Fishway Prescriptions

FPA section 18, 16 U.S.C. § 811, states that FERC is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the Interior. FERC will solicit FPA section 18 fishway prescriptions from FWS after the FLA is filed.

1.3.2 Clean Water Act Section 401

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state water pollution control agency verifying compliance with the applicable provisions of the CWA, unless the certification is waived. Therefore, a CWA section 401 water quality certification or waiver is required from the Montana Department of Environmental Quality (DEQ) as a prerequisite to FERC's issuance of a new license for the Project. Pursuant to 18 C.F.R. § 5.23(b), NorthWestern will request water quality certification from DEQ within 60 days of FERC's public notice that the FLA is ready for environmental analysis.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species.

On August 28, 2020, FERC designated NorthWestern as its non-federal representative for the purpose of initiating consultation with the FWS under ESA section 7. NorthWestern has engaged with FWS and determined that three federally listed species may occur within the vicinity of the Project. These species include the threatened Bull Trout (*Salvelinus confluentus*); threatened Grizzly Bear (*Ursus arctos horribilis*); and threatened Wolverine (*Gulo* gulo luscus).

Discussion of the Thompson Falls Project's effects on threatened and endangered species are provided in this **Exhibit E - Section 10 – Threatened and Endangered Species**.

1.3.4 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265) requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions that may adversely affect Essential Fish Habitat (EFH). EFH is only applicable to federally managed commercial fish species which live at least one component of their lifecycle in marine waters.

The Project does not include marine fisheries, and no EFH has been designated in the Project area, thus the Magnuson-Stevens Fishery Conservation and Management Act is not applicable to this Project.

1.3.5 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), FERC cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

Montana does not have a coastal zone or a coastal zone program; thus, the CZMA is not applicable.

1.3.6 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA), 54 U.S.C. § 306108, requires federal agencies to "take into account" how each of its undertakings could affect historic properties. "Historic properties" are defined as any district, site, building, structure, traditional cultural property, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (NRHP).

On August 28, 2020, FERC designated NorthWestern as its non-federal representative for the purpose of initiating consultation with the Montana State Historic Preservation Officer (SHPO) under Section 106 of the NHPA. As part of its role as FERC's non-federal representative, NorthWestern developed and conducted cultural resources studies in consultation with the SHPO and provided an opportunity for potentially affected Native American Tribes to participate in the development of these studies. The results of these studies and NorthWestern's analysis of historic and cultural resources are described in detail in this **Exhibit E - Section 12 – Cultural Resources**.

NorthWestern anticipates that FERC will meet its obligations under NHPA Section 106 through the execution of a programmatic agreement with SHPO that will require the implementation of an Historic Properties Management Plan (HPMP) that addresses the management and treatment of historic properties identified within the Project's Area of Potential Effects (APE). An HPMP, which has undergone multiple rounds of review and comment from SHPO and other participants in the NHPA Section 106 process, appears in Volume IV of this FLA.

1.3.7 Pacific Northwest Power Planning and Conservation Act

Under section 4 (h) of the Pacific Northwest Power Planning and Conservation Act, the Northwest Power and Conservation Council (Council) developed the Columbia River Basin Fish and Wildlife Program (Council's Program) to protect, mitigate, and enhance the operation of the hydroelectric projects within the Columbia River Basin. Section 4(h) states that responsible federal and state agencies should provide equitable treatment for fish and wildlife resources, in addition to other purposes for which hydropower is developed, and that these agencies shall take into account, to the fullest extent practicable, the Council's Program adopted under the Pacific Northwest Power Planning and Conservation Act.

As part of the Council's Program, the Council has designated over 40,000 miles of river in the Pacific Northwest region as not being suitable for hydroelectric development (protected area). The Project is not located within a protected area.

To mitigate harm to fish and wildlife resources, the Council has adopted specific provisions to be considered in the licensing or relicensing of non-federal hydropower projects, which are described in Appendix F of the Council's Program. NorthWestern submitted a request to the Council on April 8, 2024, requesting its review and comment on the Final License Application. The Council responded by letter dated April 25, 2024, which confirmed that the Project is not located in a protected area, and states that, "From the Council's perspective, NorthWestern is working appropriately to address the development standards in the Council's fish and wildlife program."

1.3.8 Wild and Scenic Rivers and Wilderness Acts

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to determine if the operation of the Project under the new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. The Project is not located within or adjacent to a river segment that is designated as part of, or under study for inclusion in, the National Wild and Scenic River System or Wilderness Area.

1.4 Public Review and Consultation

The Commission's regulations (18 Code of Federal Regulations [CFR], §§ 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

NorthWestern is using the ILP for relicensing of the Thompson Falls Project. 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, defined in the FERC Study Plan Determination, and to prepare the FLA.

FERC staff are active ILP participants during the pre-filing stage, providing oversight to the applicant and Relicensing Participants. National Environmental Policy Act (NEPA) scoping is conducted during the pre-filing phase of the ILP, allowing identification of issues and studies (per FERC criteria) that may be required.

Before filing a FLA with FERC, applicants are required to 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) gathering available information.

NorthWestern maintains a website[2] with up-to-date information about the relicensing of the Thompson Falls Project. Relicensing information, including meeting notices and presentations, reports, and other documents are available on this website.

1.4.1 Voluntary Early Outreach

NorthWestern proactively initiated relicensing outreach discussions with Relicensing Participants in 2018 (**Table 1-1**). The first activity was a training program, "FERC 101," which was held in Missoula, Montana on September 12, 2018. This program included FERC staff who presented information on the procedures used to relicense hydropower projects under the Commission's jurisdiction. NorthWestern also presented information on the Thompson Falls Project. The goal of the meeting was to inform Relicensing Participants of the relicensing process and schedule for the Thompson Falls Project. Presentations from this meeting, and all other Thompson Falls relicensing meetings, are posted on NorthWestern's website.

Next, NorthWestern voluntarily prepared a Baseline Environmental Document (BED) which was a compilation of existing resource information. This document was released for public comment

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

[2] https://northwesternenergy.com/TFallsRelicensing

on November 1, 2018, and is available on the Thompson Falls Project website. A workshop was held in Missoula to discuss the BED and identify any data gaps and resource issues on December 4, 2018 (Table 1-1). The presentations from that meeting are available on the website. NorthWestern received written comments on the BED from FWP and DEQ.

In October 2019, NorthWestern hosted a public meeting in Thompson Falls to further inform Relicensing Participants about the relicensing process and provide an update on an operational test and resource studies NorthWestern was conducting at the Project.

In March 2020, NorthWestern hosted a second public meeting in Thompson Falls to inform the Relicensing Participants of observations made during the October 2019 operational test, describe NorthWestern's Project operations, and provide an update on studies and the relicensing process.

All of these activities (summarized in **Table 1-1**) were done voluntarily by NorthWestern to engage the Relicensing Participants in advance of initiating the ILP. The goals of these extra efforts were to learn about potential concerns or gaps in data and to establish a common understanding among all the interested parties as to what is involved with relicensing the Project.

Table 1-1: Thompson Falls relicensing outreach and other activities conducted prior to filing the Pre-Application Document.

Thompson Falls Relicensing Outreach and Other Activities	Comment	Date
FERC 101 Relicensing Outreach Training, Missoula. Public invited.	FERC training on the procedures used to relicense hydropower projects.	Sept 12, 2018
Notified Relicensing Participants of availability of BED.	The BED described the hydroelectric Project and available fish, wildlife, water quality, cultural and recreation, operational and other Project specific information.	Nov 1, 2018
Workshop to discuss the relicensing (ILP) process and BED and identify data gaps and resource issues.	Workshop included small group breakout sessions to discuss fisheries, water resources and recreation/cultural issues.	Dec 4, 2018
Pre-relicensing data collection.	Included operations, water quality, fisheries, and recreation use data.	2018-2020
Public meeting in Thompson Falls for Relicensing Participants.	Included updates on studies and the relicensing process.	Oct 15, 2019
Public meeting in Thompson Falls for Relicensing Participants.	Included observations made during the operational test and updates on studies and the relicensing process.	March 11, 2020

In addition to the stakeholder consultation efforts, NorthWestern accelerated the schedule to conduct certain resource assessments and relicensing studies to better inform relicensing. Specifically, NorthWestern prepared a water quality monitoring plan which was implemented in 2019 to address data gaps that were noted during the preparation of the BED. The results of that study were submitted in the Pre-Application Document (PAD), filed with FERC on July 1, 2020, and are available on the Project website.

A Recreation Visitor Survey was conducted during the 2018 peak recreation season (Memorial Day weekend – Labor Day). In addition, the volume of use at five Project recreation sites was monitored during the 2019 peak recreation season using automatic traffic and trail counters. The results of that study were submitted in the PAD, filed with FERC on July 1, 2020, and available on the Project website.

The 2008 Biological Opinion (BO) issued by the FWS for the Project included a requirement for the Licensee to conduct Phase 2 fish passage evaluation studies from 2010 to 2020. At the end of the Phase 2 evaluation period, the Licensee was required to prepare a comprehensive 10-year report to file with the Commission.

The BO specified that the comprehensive report be completed by December 31, 2020. NorthWestern reviewed the relicensing schedule and found that some adjustments in the compliance reporting schedule could better align the compliance schedule with the relicensing schedule. Specifically, NorthWestern requested, and FWS concurred, that the comprehensive report described in the BO would be submitted a year early. The Comprehensive Phase 2 Fish Passage Report was prepared with guidance from the Thompson Falls Technical Advisory Committee (TAC) and filed with FERC on December 20, 2019. The Comprehensive Phase 2 Fish Passage Report summarizes the results of fish passage studies at the Project, conducted in compliance with the BO.

The BO also required that the Licensee conduct a scientific review to determine if the Thompson Falls Project upstream fish passage facility is functioning as intended, and whether operational or structural modifications are needed. The review was to also include a set of recommendations to be submitted to the FWS. The scientific review convened in January 2020, with the formation of the Thompson Falls Scientific Review Panel (Scientific Panel). The Scientific Panel included representatives from the FWS, FWP, and Water & Environmental Technologies, an environmental and engineering consulting firm. On March 27, 2020, the Scientific Panel issued a memo summarizing its evaluation of the upstream fish passage facility and providing recommendations on how to better evaluate the facility in the future. On April 16, 2020, NorthWestern received written confirmation from the FWS that the requirement for a scientific review, as expressed in Term and Condition (TC) TC1-h in the BO, had been met with the submittal of the memo summarizing the Scientific Panel's findings. The recommendations from the scientific review were adopted in NorthWestern's list of preliminary issues and studies, found in Section 14 of the PAD.

The Project is operated to provide baseload and flexible generation within the reservoir elevation and minimum flow requirements of the license. During flexible generation operations[3], the Licensee may use the top 4 feet of the reservoir from full pond while maintaining minimum flows. For several reasons, the full 4 feet has not been frequently used. NorthWestern has typically

[3] Flexible generation supports grid reliability by providing spinning reserve and load balancing as river and reservoir conditions allow, by lowering the reservoir to increase generation and raising the reservoir to reduce generation.

managed the reservoir within 1.5 feet of full pool, with only occasional deeper drawdowns to 4 feet.

In order to assess the effects using the Project's operational flexibility, an operational test was conducted in October 2019. Details of the operational test and observations made during the test are described in Section 14 of the PAD.

1.4.2 Preapplication Document and Scoping

1.4.2.1 Preparation of the PAD

The ILP has mandatory timelines and filing requirements to which NorthWestern, as the applicant, and all Relicensing Participants must adhere. The basic steps of the ILP pre-filing process appear in Table 1-1. Under section 15 of the FPA, 16 U.S.C. § 808, NorthWestern must file its FLA with FERC by no later than December 31, 2023, 2 years prior to the expiration of the current license (December 31, 2025) (**Table 1-2**).

Table 1-2: Thompson Falls Project pre-filing ILP activities (FERC activities in green, Relicensing Participant comment opportunities in orange).

Activity	Comment	CFR Title 18	Date
File PAD and NOI to Relicense with FERC. (Formal FERC process began with this filing)	Between 5 and 5.5 years prior to license expiration	§5.5 & 5.6	July 1, 2020
Tribal consultation meetings	With FERC staff	§5.7	Aug 1, 2020
Notice of Commencement, SD1	Within 60 days of PAD/NOI	§5.8	Aug 28, 2020
Scoping Meetings and Project Site Visit	Written comments solicited Site visit and scoping meeting waived due to restrictions associated with the COVID-19 pandemic	§5.8	Aug 28, 2020
PAD/SD1 Comments and Study Requests Due	60 days after Notice of Commencement	§5.9	Oct 27, 2020
SD 2	45 days after comment deadline on SD1	§5.10	Dec 9, 2020
File PSP based on Relicensing Participants input on PAD	45 days after comment deadline on SD1	§5.11	Dec 11, 2020
Study Plan Meetings	30 days after PSP filed	§5.11	Jan 6, 2021
Relicensing Participants Comments on PSP Due	90 days after PSP filed	§5.12	Mar 11, 2021
File RSP based on Relicensing Participants input on the PSP	30 days after comment deadline on PSP	§5.13	Apr 12, 2021
Relicensing Participants Comments on RSP Due	15 days after RSP filed	§5.13	Apr 27, 2021

Activity	Comment	CFR Title 18	Date
FERC Study Plan Determination[4]		§5.13	May 10, 2021
Initial Study Season		§5.15	Spring/Summer 2021
Initial Study Season Report	1 year after study plan determination	§5.15(c)(1)	April 28, 2022
Initial Study Report Meeting with Relicensing Participants	Within 15 days of study report	§5.15(c)(2)	May 5, 2022
Initial Study Meeting Summary	Within 15 days of study report meeting	§5.15(c)(3)	June 9, 2022
File Disagreements/Requests to Amend Study Plan	Relicensing Participants may file a disagreement concerning the applicant's meeting summary. This filing must also include any proposed modifications to ongoing studies or new studies proposed by the FERC staff or other participant.	§5.15(c)(4)	July 9, 2022
File Responses to Disagreements/Amendment Requests	Responses to any filings requesting modifications to ongoing studies or new studies.	§5.15(c)(5)	Aug 8, 2022
FERC Determination on Disagreements/Amendment Requests	FERC Director resolves the disagreement and amends the approved study plan as appropriate	§5.15(c)(6)	Sept 1, 2022
Second Study Season		§5.15	Spring/Summer 2022
Updated Study Report	2 years after study plan determination	§5.15(f)	May 10, 2023
Updated Study Report Meetings with Relicensing Participants	Within 15 days of study report	§5.15	May 24 & 25, 2023
Updated Study Report Meeting Summary	Within 15 days of Study Report meeting	§5.15(f)	June 9, 2023
File Disagreements/Requests to Amend Study Plan	Relicensing Participants may file a disagreement concerning the applicant's meeting summary. This filing must also include any proposed modifications to ongoing studies or new studies proposed by the FERC staff or other participants.	§5.15(f)	July 10, 2023

[4] Agencies and Tribes with mandatory conditioning authority may request the use of a formal dispute resolution process regarding FERC's Study Plan Determination. No requests for formal dispute resolution were filed.

Activity	Comment	CFR Title 18	Date
File Responses to Disagreements/Amendment Requests	Responses to any filings requesting modifications to ongoing studies or new studies.	§5.15(f)	Aug 8, 2023
FERC Determination on Disagreements/Amendment Requests	Determination on Disagreements/Amendments	§5.15(f)	Sept 7, 2023
DLA	No later than 150 days before filing of Final Application	§5.16	Aug 3, 2023
Comment period on DLA	90 days after DLA	§5.16	Nov 1, 2023
Filing of Final License Application	No later than 2 years prior to license expiration	§5.17	Dec 31, 2023

Notes: CFR = Code of Federal Regulations; COVID-19 = Novel Coronavirus Disease; DLA = Draft License Application; NOI = Notice of Intent; PAD = Pre-Application Document; PSP = Proposed Study Plan; RSP = Revised Study Plan; SD1 = Scoping Document 1

Under FERC regulations, NorthWestern was 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. The PAD is a document that describes the Project proposal and existing, relevant information that can be used to assess potential Project effects on natural, cultural, recreational, and Tribal resources. The PAD was prepared by NorthWestern, taking into consideration information in the BED, additional information collected through post-BED Relicensing Participant outreach (*refer to* **Table 1-1**), review of federal and state comprehensive plans filed with FERC and listed on FERC's website (Appendix A of the PAD), and additional data gathering.

An applicant is not required to conduct studies to generate information for the PAD but is expected to exercise due diligence to gather existing information. This includes contacting Relicensing Participants for information relevant to the Project, the local area environment, and potential Project effects. NorthWestern exceeded these requirements with its voluntary development and distribution of the BED and subsequent Relicensing Participant outreach, as described above.

1.4.2.2 Scoping

FERC conducted scoping to determine what issues and alternatives should be addressed. It issued Scoping Document (SD1) on August 28, 2020. It was noticed in the Federal Register on September 4, 2020. Due to the proclamation declaring a National Emergency concerning the Novel Coronavirus Disease (COVID-19), issued by the President on March 13, 2020, FERC waived section 5.8(b)(viii) of the Commission's regulations and did not conduct a public scoping meeting or site visit. Instead, FERC solicited written comments, recommendations, and information, on SD1. The following entities (**Table 1-3**) provided written comments:

Table 1-3: Comments submitted on Scoping Document 1

Commenting Entity	Filing Date
U.S. Forest Service	October 26, 2020

Commenting Entity	Filing Date
NorthWestern Energy	October 27, 2020
U.S. Environmental Protection Agency	October 27, 2020
U.S. Fish and Wildlife Service	October 27, 2020
Montana Fish, Wildlife, and Parks	October 28, 2020
U.S. Bureau of Reclamation	October 28, 2020

1.4.3 Integrated Licensing Process Environmental Studies

1.4.3.1 Preparation of Study Plan and Study Plan Determination

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 potential studies in the PAD.

In response to requests for studies submitted by the USFS and FWP, NorthWestern's Proposed Study Plan (PSP) (filed with FERC December 11, 2020) proposed one additional study to the eight proposed in the PAD, a study of Westslope Cutthroat Trout Genetics.

In accordance with 18 Code of Federal Regulations (CFR) § 5.11, NorthWestern held a study plan meeting on January 6, 2021, which was open to any interested party. At the meeting, NorthWestern presented its proposed studies and provided opportunities for participants to provide input and ask questions. Subsequent to the Study Plan Meeting, during the public comment period, NorthWestern met, sometimes multiple times, with representatives of FWP, FWS, USFS, and DEQ, to discuss the PSP, attempt to resolve any differences over study requests, and inform NorthWestern's development of the Revised Study Plan (RSP).

The public comment period on the PSP closed on March 11, 2021. The comments, and NorthWestern's responses, were included in the RSP, filed with FERC April 12, 2021. In response to requests for studies submitted by FWP, NorthWestern added 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.

On May 10, 2021, FERC issued a Study Plan Determination on studies to be conducted. The FERC Study Plan Determination required NorthWestern to conduct seven of the studies proposed in the RSP. The Study Plan Determination did not require NorthWestern to conduct the Water Quality Study, Downstream Transport of Bull Trout Study, Westslope Cutthroat Genetics Study, study of Distribution and Status of Westslope Cutthroat Trout, or the study of Heavy Metals and Organic Compounds in Thompson Falls Reservoir.

1.4.3.2 Conduct of Studies

The seven studies approved by FERC staff in its May 2021 FERC Study Plan Determination 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. 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).
4. 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.
5. Visitor Use Survey: A study surveying recreationists at recreation sites on or near the reservoir and the Clark Fork River below the dams.
6. 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 APE[5].
7. Updated Literature Review of Downstream Fish Passage: A literature review of information in the scientific literature published since 2007, regarding downstream passage survival of various size classes of fish, with respect to current Project configuration and operations.

Study reports on each of the seven studies were filed with FERC in an Initial Study Report (ISR) on April 28, 2022. The reports are also available on the Project website[6] and through the FERC eLibrary. The Visitor Use Survey and the Updated Literature Review of Downstream Fish Passage studies were 1-year studies, and thus the ISR contained the final reports for those two studies. The remainder of the studies were multi-year studies, so the ISR contained the results of the data collected in the first year.

NorthWestern held its ISR Meeting on May 5, 2022; and filed its ISR Meeting Summary on June 9, 2022. Section 5.15(c)(4) of the Commission's regulations, 18 CFR § 5.15(c)(4), provides that any participant or Commission staff may file disagreements concerning the applicant's study report meeting summary, modifications to ongoing studies, or propose new studies within 30 days of the study report meeting summary being filed (i.e., by July 9, 2022). NorthWestern received comments from FERC staff, USFS, FWS, FWP, and the Confederated Salish and Kootenai Tribes (CSKT), including proposed modifications to ongoing studies and proposed new studies.

[5] The Interim Study Report to identify areas where there is a high probability for the occurrence of prehistoric or historic archaeological properties within the proposed APE was filed with FERC on January 26, 2022. The updated inventory of the H-A&E was included in the ISR.

[6] https://northwesternenergy.com/TFallsRelicensing

On August 8, 2022, NorthWestern filed a response to the comments received on the ISR, proposing to conduct one additional study and modify one study. NorthWestern proposed to conduct an Environmental Justice Study to provide information that FERC staff stated they needed to assess Project effects. In addition, NorthWestern proposed to modify the Fish Behavior Study to extend the study into a third study season.

On September 1, 2022, FERC issued its determination on requests for study modifications. Modifications to Study 4 (Hydraulic Conditions), which were requested by USFS, FWS, and FWP, were not approved. FERC notified NorthWestern that they approved the proposed Environmental Justice study and the proposed modifications to the Fish Behavior Study.

On May 5, 2023, pursuant to 18 CFR § 5.15(f), NorthWestern filed the Updated Study Report (USR) for the relicensing of the Project. In accordance with Commission staff's September 1, 2022 Determination on Requests for Study Modifications, to the USR reported on the following:

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. TDG: A study of TDG in the Project reservoir, below the Main Channel Dam, and at the Birdland Bay Bridge.
3. Hydraulic Conditions: A three-dimensional (3D) hydraulics study to characterize water velocities and water depths between the Main Channel Dam and the High Bridge (below the Main Channel Dam).
4. 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.
5. Cultural Resources: Results of a field inventory of cultural resources in the Project's APE.
6. Environmental Justice: An evaluation to determine the presence of impacts of environmental justice communities (EJC) in the surrounding community, and an assessment of whether those impacts would be disproportionately high and adverse for minority and low-income populations.

The USR included an Executive Summary, described the six studies approved in the Commission staff's September 1, 2022, Determination on Requests for Study Modifications, identified minor variances from the approved Study Plan Determination, and presented results of the second season of studies (2022). With the filing of the USR, the studies required by the Commission-approved study plan for the relicensing of the Project are complete—except for the Fish Behavior Study, which continued in 2023. Except for the remaining work on the Fish Behavior Study, the USR contained a complete reporting of all studies and study plan modifications required by the Commission, including in its original May 10, 2021, Study Plan Determination, as well as its September 1, 2022, Determination on Requests for Study Modifications.

Relicensing Participants were notified of the filing and provided a link and the address for the NorthWestern's Project relicensing website where the USR is posted as well as instructions for accessing the reports through FERC's eLibrary. In addition, the notification invited Relicensing Participants to a USR meeting, as required under FERC's ILP regulations (18 C.F.R. §§ 5.15(f), (c)(2)). NorthWestern hosted two USR meetings, on Wednesday, May 24, 2023 at NorthWestern's Missoula, MT office, 1801 South Russell Street, from 9:00 AM until 2:00 PM Mountain Time and on May 25, 2023, from 6:00 PM to 8:00 PM (Mountain Time), at the Sanders County Courthouse, 1111 W Main St, Thompson Falls, MT 59873. Both meetings were accessible remotely via Zoom.

NorthWestern also sent separate notifications to Relicensing Participants inviting them to participate in a voluntarily-provided Project tour on the afternoon of May 25, 2023. Although attendance was not recorded, approximately 20 people attended the tour including resource agencies representatives, Commission staff, and local residents.

As required under FERC's ILP regulations (18 C.F.R. §5.15(f)) and the Commission's Process Plan and Schedule, NorthWestern filed a summary of the USR meeting on June 8, 2023. The meeting summary included the meeting agendas, attendee lists, and copies of the presentations given at the USR meeting. At FERC Staff's request, on June 28, 2023, NorthWestern filed an Updated Study Report Meeting Summary Supplement which included additional information on the USR meeting. Comments on the USR were due by July 10, 2023 (18 C.F.R. § 5.15(f). NorthWestern received comments from U.S. Bureau of Indian Affairs (BIA), CSKT, FWP, FWS, Green Mountain Conservation District (GMCD), Sanders County Park Board, SHPO, and 25 local landowners or residents.

NorthWestern filed the response to comments on August 8, 2023. Commission staff issued a Determination on Study Modification Requests (Determination) on August 24, 2023 (18 C.F.R. § 5.15(c)(6)). The Determination noted that most of the comments submitted on the USR did not specifically request modifications to the RSP or additional studies. The Determination only addressed specific recommendations to modify the approved study plan or conduct new studies. In the Determination, FERC did not recommend that NorthWestern conduct additional studies, specifically a sediment analysis requested by one commentor.

1.4.4 Comments on the Draft Application

The Draft License Application (DLA) was filed with FERC on August 3, 2023. The public comment period on the DLA closed on November 1, 2023. NorthWestern received written comments from the FERC, Avista Corporation (Avista), the U.S. Army Corps of Engineers and 16 private citizens. On November 29, 2023, NorthWestern received an email from DEQ stating their satisfaction with the most up-to-date copy of the proposed Water Quality Monitoring Plan being incorporated into the FERC license.

Exhibit E – Section 19 – Consultation Documentation contains a description of the comments received on the DLA, and NorthWestern's response to those comments.

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2. Proposed Action and Action Alternatives

2.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet. Thus, this description of the no-action alternative includes a description of the existing facilities and current authorized Project operation.

The Thompson Falls Project is located on the Clark Fork River in Sanders County, Montana. Preliminary development of the 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. By May 1917, an additional generation unit was placed in service bringing the total to six generating units. MPC acquired the Project in 1929. An order amending the license was issued to MPC by FERC in 1990 allowing for construction of an additional powerhouse and generating unit, subsequently completed in 1995, giving the Project a total generating capacity of 92.6 MW. A February 12, 2009, Project license amendment approved construction and operation of upstream fish passage facilities. The current license expires on December 31, 2025.

Non-federal hydropower projects in the U.S. are regulated by FERC under the authority of the FPA. The original license for the Project was issued effective January 1, 1938, and expired on December 31, 1975. The current FERC license was issued December 28, 1979. A major license amendment was issued April 30, 1990, approving the construction of a new powerhouse and extending the license term to 50 years. The Project was purchased by PPL Montana in 1999 and later purchased by NorthWestern in 2014. With each purchase, the Project's FERC license was transferred to the new owner.

2.1.1 Existing Project Facilities and Works

The Project consists of two curved concrete gravity dams (Dry Channel Dam and Main Channel Dam) with overflow spillways and two powerhouses, and a fish passage facility (**Photograph 2-1**). In this license application, all references to river right or left are based on the viewpoint of facing downstream. The original powerhouse contains six generating units and the new powerhouse contains one generating unit. Existing Project facilities are described in further detail in **Exhibit A – Project Description**.

The current Project boundary encompasses about 12 miles of river and reservoir, with a maximum width of about 1,800 feet. Active storage capacity of the Thompson Falls Reservoir is approximately 15,000 acre-feet between crest elevation (El.). 2380.0 feet and normal full operating level El. 2396.5 feet. The reservoir surface area is approximately 1,226 acres, not including the islands.

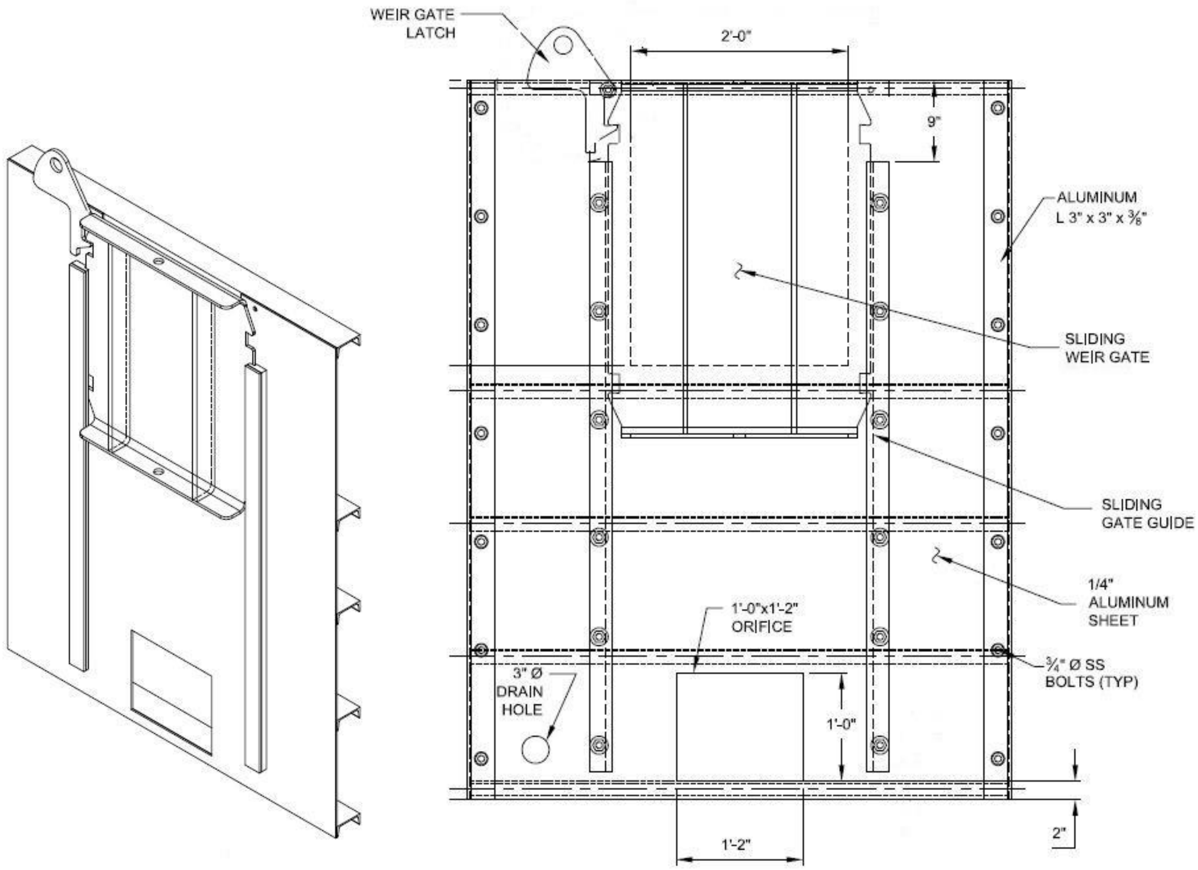
Photograph 2-1: Aerial photo of the Thompson Falls Project looking upstream.

2.1.1.1 Project Upstream Fish Passage Facility

The Thompson Falls upstream fish passage facility (fish passage facility) was designed in general accordance with the NMFS Criteria (2008), which was used by the FWS to provide input to the design of the upstream passage facility. The upstream fish passage facility design incorporates a fish ladder (ladder) with a series of 48 pools, each 6-foot-long by 5-foot-wide by 4-foot-deep.

Hydraulically, the ladder was designed to allow passage of a diverse population of fish over the Main Channel Dam. The ladder was designed with flexibility to allow operations of the ladder in one of two modes, “orifice” or “notch.” The ladder was not designed for operating with a combination of the two modes. Raising the central sliding weir gate allows pool-to-pool flow through the bottom orifice (orifice mode). Lowering the weir gate allows pool-to-pool flow through the top weir (notch mode) (**Figure 2-1**). The upper Pools, 46, 47, and 48 operate solely in orifice mode to reduce the effects of the forebay water level on the ladder hydraulics.

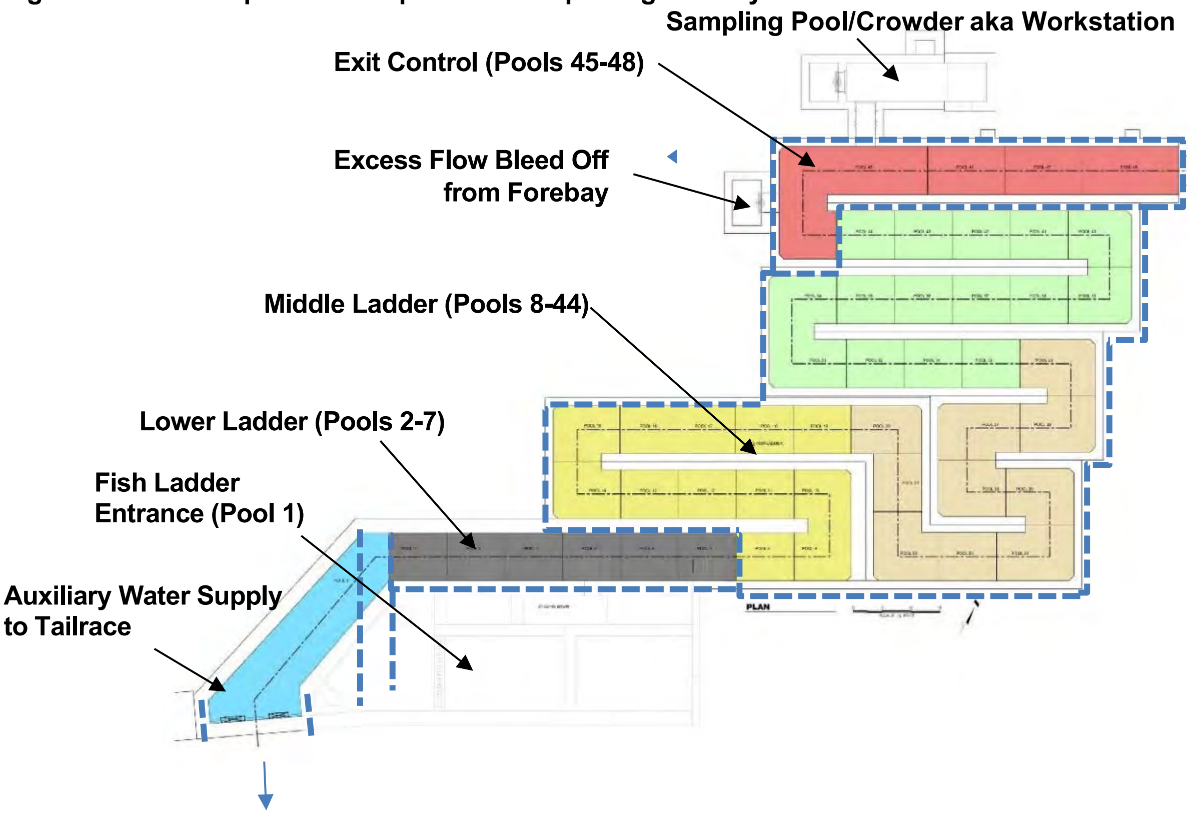
Figure 2-1: Isometric and front view of aluminum weir plates. By lowering the sliding weir gate down to cover the bottom orifice, the ladder is operated in notch mode.



By design, the upstream fish passage facility has four distinct areas, as follows (**Figure 2-2)**:

- Fish Ladder Entrance – Pool 1
- Lower Ladder Pools – Pools 2-7
- Middle Ladder Pools – Pools 8-44
- Exit Control Section – Pools 45-48

Figure 2-2: Thompson Falls upstream fish passage facility.



The upstream fish passage facility is operated from mid-March to mid-October. The ladder season ends (and the ladder is dewatered and shut down) when a fall weather freeze is imminent. Temporary closures during the season may occur due to high flows in the spring. The sampling/pool crowder (also referred to as the work station) has 3 cubic feet per second (cfs) flowing and the ladder has 6 cfs flowing pool-to-pool (*refer to* **Figure 2-2**). Attractant flows include options of 20 cfs from the high velocity jet (HVJ) and maximum of 54 cfs from the auxiliary water system. Thus, the passage facility may utilize between 9 and 83 cfs. In addition to these operating and attractant flows at the ladder, part of one Main Channel Dam spill panels near the upstream fish passage facility may be opened to provide an additional fish attractant flow of approximately 100 to 125 cfs.

An attractant flow study began in 2011 for the first three years of ladder operations (2011, 2012, 2013) to test variable attraction flows and learn best fish passage facility operational protocols. Based on observations in the first two years of study (2011, 2012), the Licensee, USFWS, FWP, and CSKT determined that during non-spill periods the high velocity jet and auxiliary water supply should be operated at maximum capacity in order to provide sufficient attraction flow and flow through the natural falls, immediately downstream of the Main Channel Dam (PPL Montana 2014). Attraction flows have been operated at or near the maximum throughout the operating season (March-October) since 2013.

Beginning in 2013, additional attraction flow was added by partially opening a spill panel to provide more flow through the natural falls, immediately below the Main Channel Dam. This flow facilitates fish movement during periods of non-spill. This additional attractant discharge has been variably located from gate 4 to gate 16. From 2019 to 2023 the location of the half panel has been gates 3, 4, or 5.

During 2020 NorthWestern, in cooperation with FWP, tested and evaluated the impact of the additional attractant flow on fish collection at the ladder. The results were dependent on fish species, but the data indicate the addition of attraction flow via the installation of the half panel along the right bank does not provide a significant increase in fish captured at the ladder during non-spill period (streamflow less than 23,000 cfs) (NorthWestern 2021).

Additional details of the upstream fish passage facility design and operations are provided in the Comprehensive Phase 2 Fish Passage Report[7] (NorthWestern 2019) and Standard Operations Manual[8] (PPL Montana 2010).

[7] http://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson-falls- other-reference-material/2020comprehensivefishladderreport.pdf

[8] http://www.northwesternenergy.com/docs/default-source/thompson-falls/thompson- falls-public-reference-file/thompson-falls-annual-reports-and-ferc- orders/thompson_falls_ferc_fish_ladder_approval-fishway_operations_manual_2011.pdf

2.1.1.2 Recreation Facilities

Table 2-1 includes a description of recreation sites that are in the Project vicinity.

Table 2-1: Recreation areas in Project vicinity.

Recreation Area	Site Amenities
Island Park	Day use site between Main Dam and Dry Channel Dam. Non-motorized access with adjacent parking areas, interpretation, picnic tables, benches, trails, fish passage viewing, garbage facilities, and vault toilets.
Cherry Creek Boat Launch	Day use boat launch site with picnic facilities and vault toilet.
South Shore Dispersed Recreation Area	Day use shoreline access area with dispersed parking and informational signs. Vault toilet and developed parking are nearby at the South Shore Parking Area.
Wild Goose Landing Park	Community park with boat launch and dock, swimming dock, toilets, informational signs, parking, garbage facilities, and picnic facilities.
Power Park	Community park with benches, tables, group use pavilion with running water, toilets, informational and interpretive signage, and parking.
Powerhouse Loop Trail	Non-motorized trail with benches, vault toilet, and adjacent parking.
Sandy Beach (dispersed)	Undeveloped beach area along the Powerhouse Loop Trail below the tailrace.
North Shore Boat Restraint	Undeveloped shoreline above the Main Dam with benches, picnic tables, a small dock, and parking.
North Shore Dispersed Use Area (including former sawmill site)	Undeveloped shoreline area along the northeast shoreline of the main reservoir, popular for dispersed shoreline fishing.

2.1.1.3 Project Boundary

The Thompson Falls Project boundary as defined in the FERC license extends approximately 0.3 mile downstream and 12 miles upstream of the Project's dams (**Figure 2-3**). The current Project boundary was established in the December 28, 1979, license (as amended). The current Project boundary encompasses a total of 2,001 acres, consisting of 1,226 acres of reservoir, not including islands, and 775 acres of non-reservoir. Federal land managed by the USFS (National Forest System Lands) includes 103.8 acres, which are largely open space forest lands (**Table 2-2**). The Thompson River, a major tributary to the Clark Fork River, enters the reservoir about 6.2 miles upstream of the dam. Its lower 0.3 mile is included within the Project boundary. The current Project boundary is a metes and bounds survey that incorporates some uplands in the area around the dams and powerhouse, and upstream from that point it approximates the reservoir's normal full operating level elevation.

Figure 2-3: Current Project boundary.

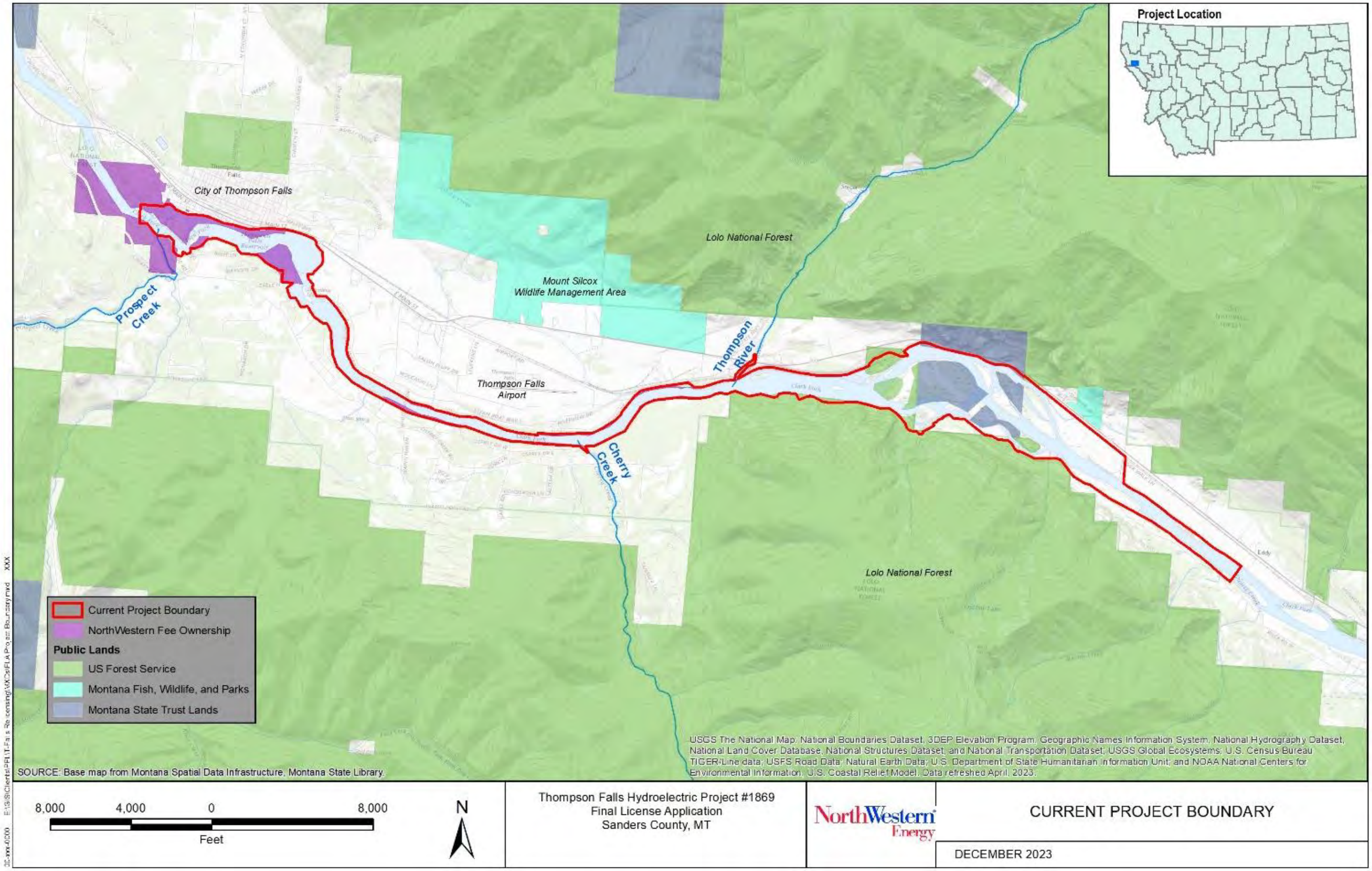


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Table 2-2: **Thompson Falls Project – federal lands within Project boundary.**

Towns hip	Range	Section	Subdivision	Acres	Agency
21N	28W	15	Government Lot 1	1.4	USFS
21N	28W	17	Government Lots 5-11	78.7	USFS
21N	28W	18	Government Lots 8-10	1.8	USFS
21N	28W	20	NENE	0.3	USFS
21N	28W	21	Government Lots 1-3, NWNW	3.3	USFS
21N	28W	22	Government Lots 3-5	18.3	USFS
		Total		**103.8**	

2.1.2 Project Safety

The Project has been operating for more than 45 years under the existing license and during this time, Commission staff have conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the Project has been inspected and evaluated every 5 years by an independent consultant and the most recent consultant's safety report was submitted to the Commission on November 1, 2021.

2.1.3 Existing Project Operation

2.1.3.1 Current Project Operations

The Project is operated to provide baseload and flexible generation within the reservoir elevation and minimum flow requirements of the license. Baseflow generation uses the river inflow by matching reservoir outflows to generate electricity while maintaining a stable reservoir elevation. Flexible capacity increases or decreases generation from the baseflow, raising or lowering the reservoir elevation as the flow through the units is changed to support flexible capacity needs. Under the current license, NorthWestern may use the top 4 feet of the reservoir from full pool while maintaining minimum flows. NorthWestern has typically managed the reservoir within 1.5 feet of full pool, with occasional deeper drawdowns up to 4 feet. **Figures 2-4 – 2-9** illustrate areas of the shoreline which are dewatered when the reservoir is 1.5 feet, 2.5 feet, and 4.0 feet below full pool.

Figure 2-4: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 1.

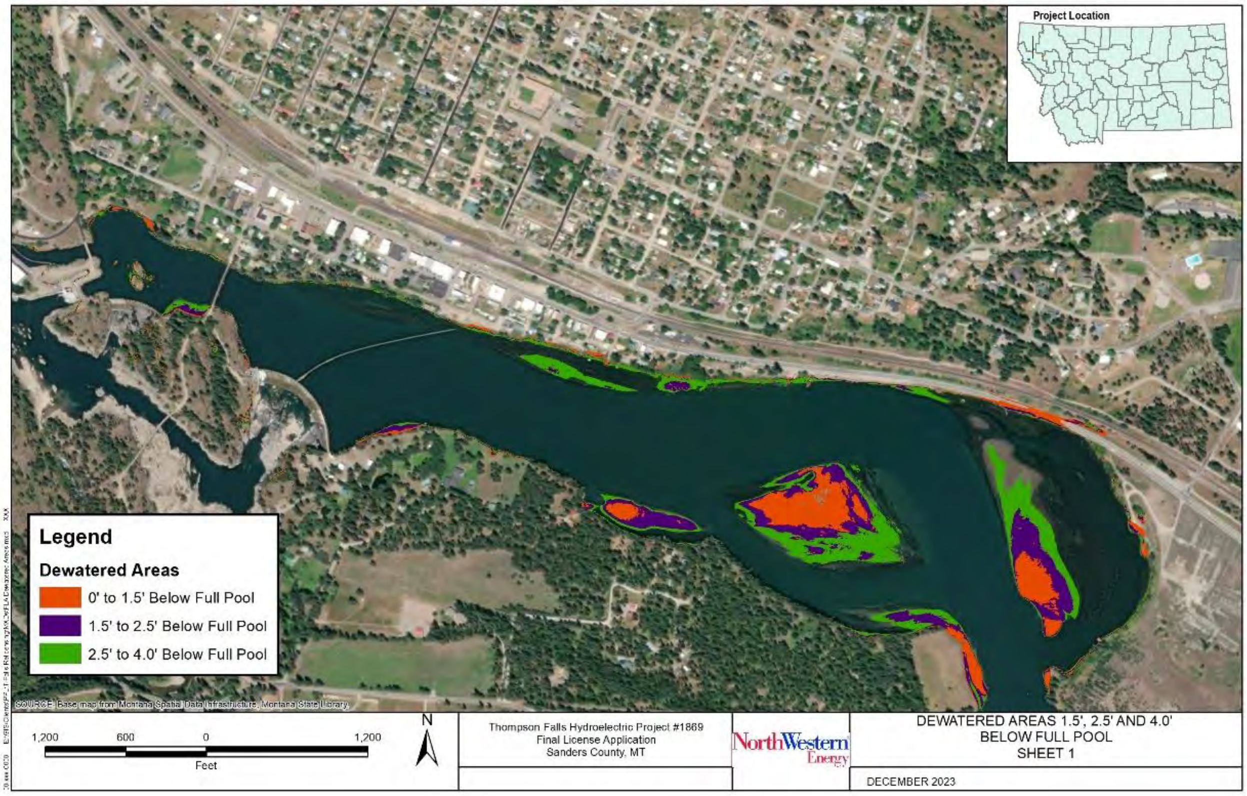


Figure 2-5: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 2.

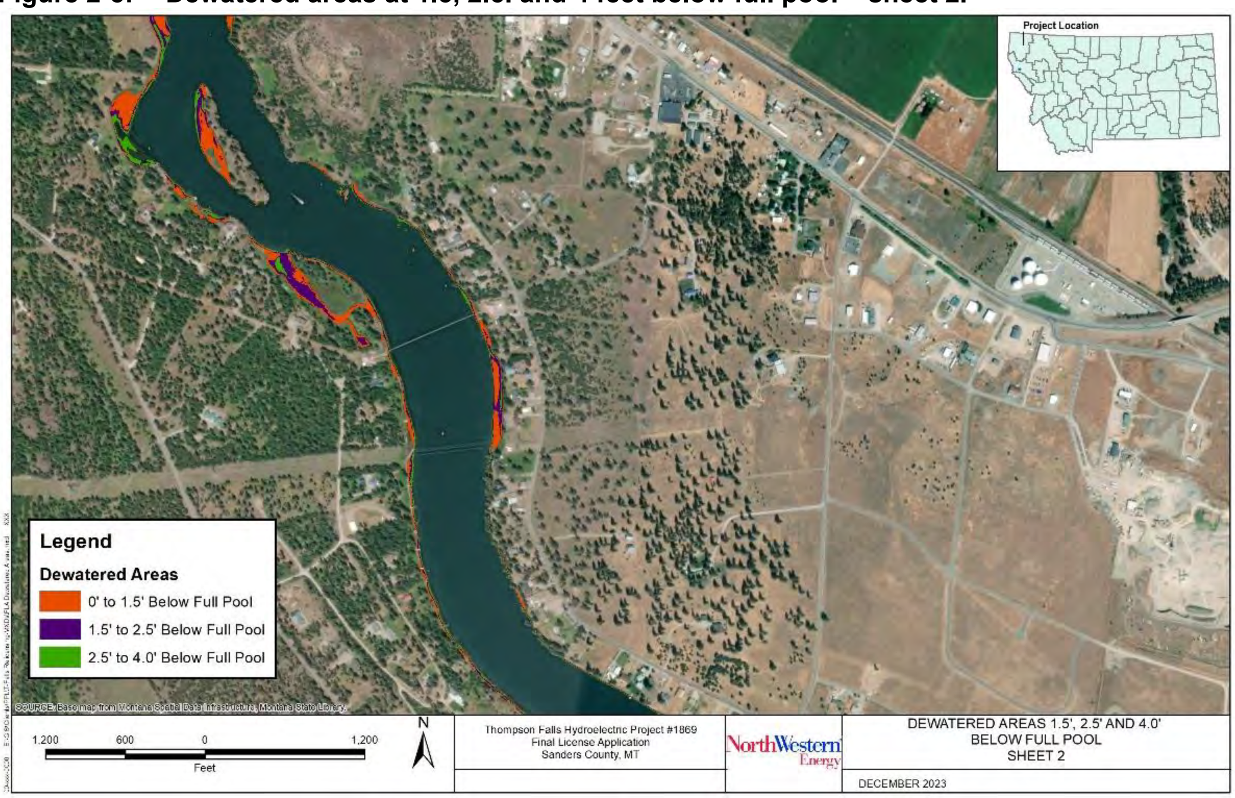


Figure 2-6: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 3.

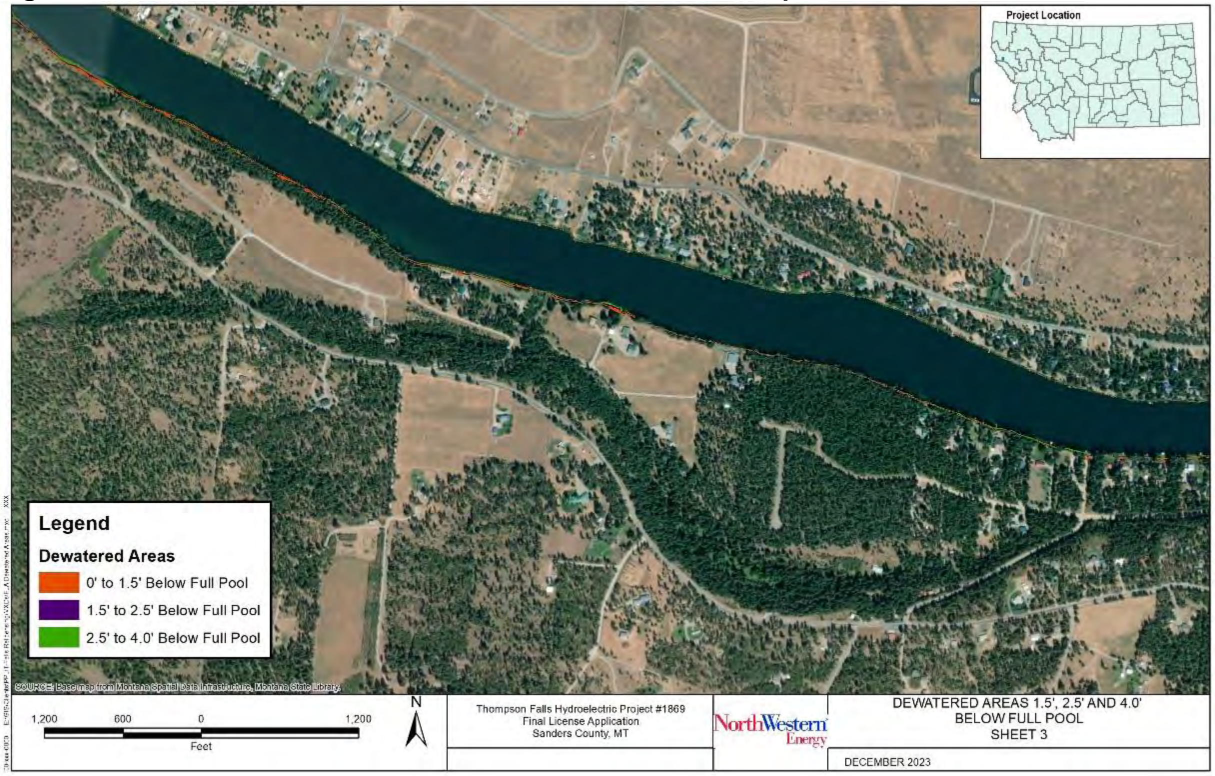


Figure 2-7: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 4.

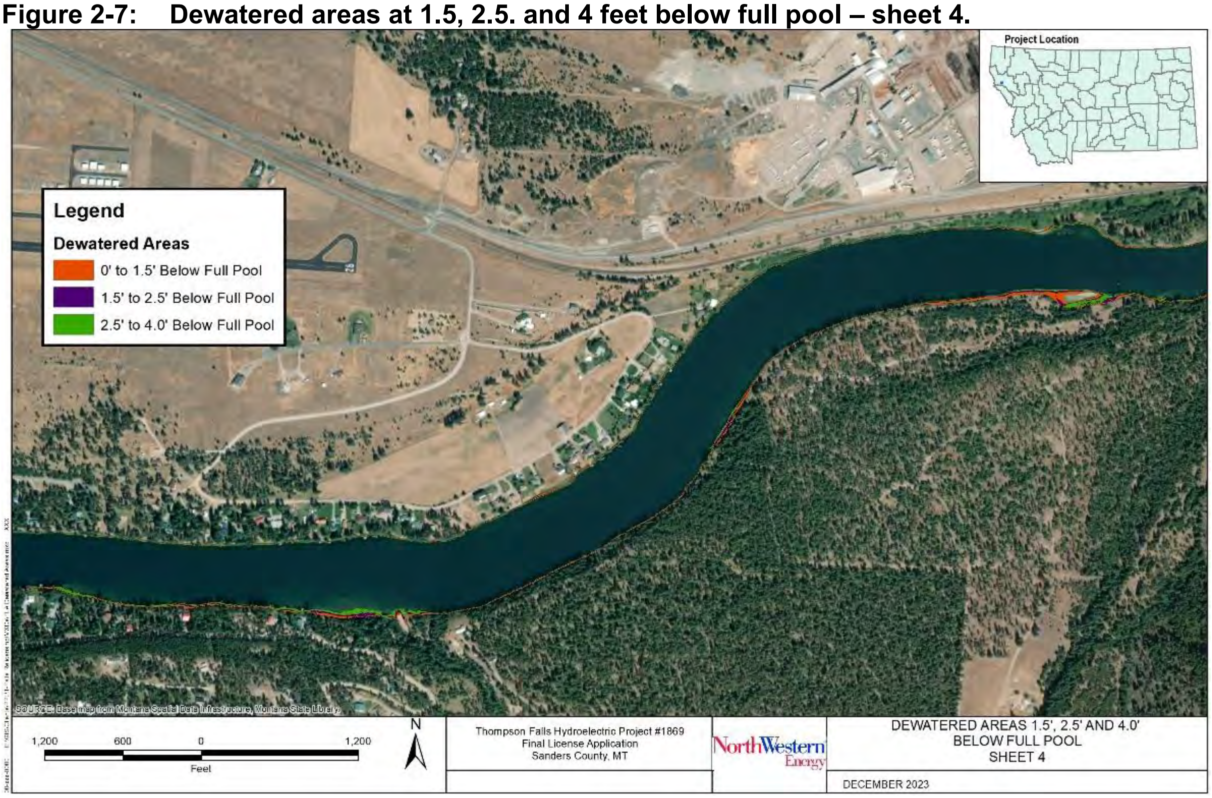


Figure 2-8: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 5.

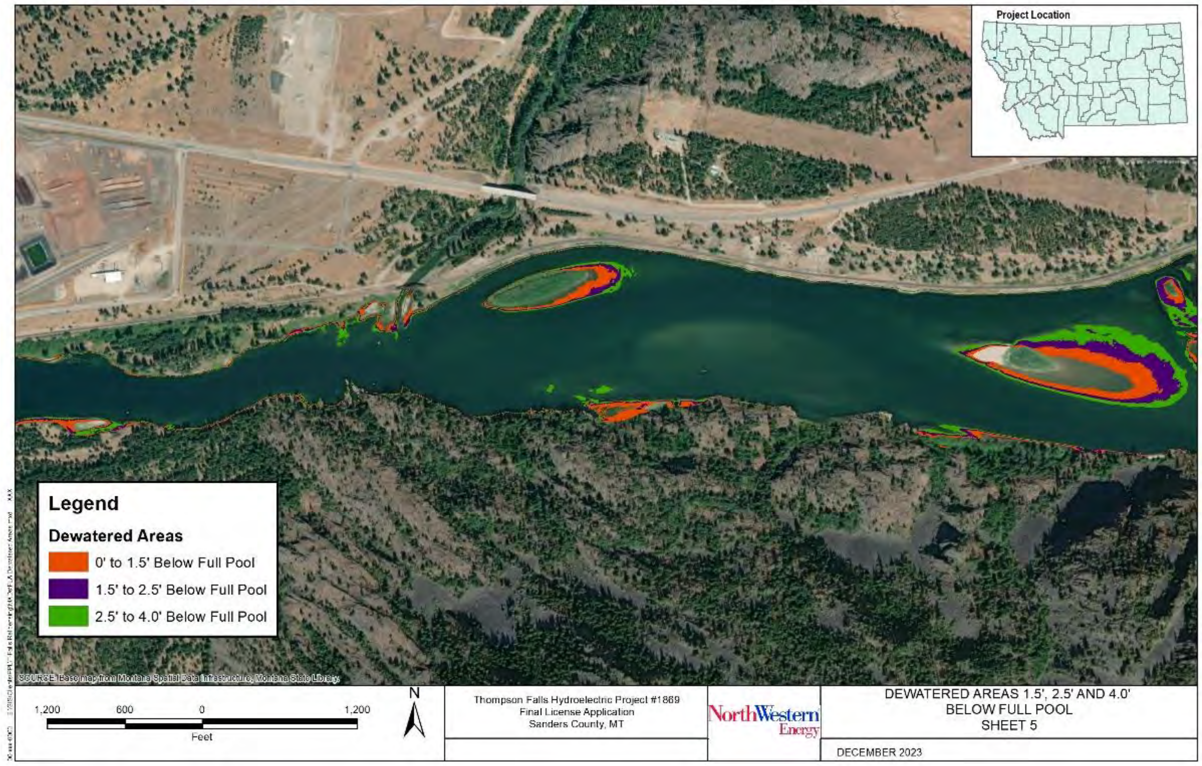
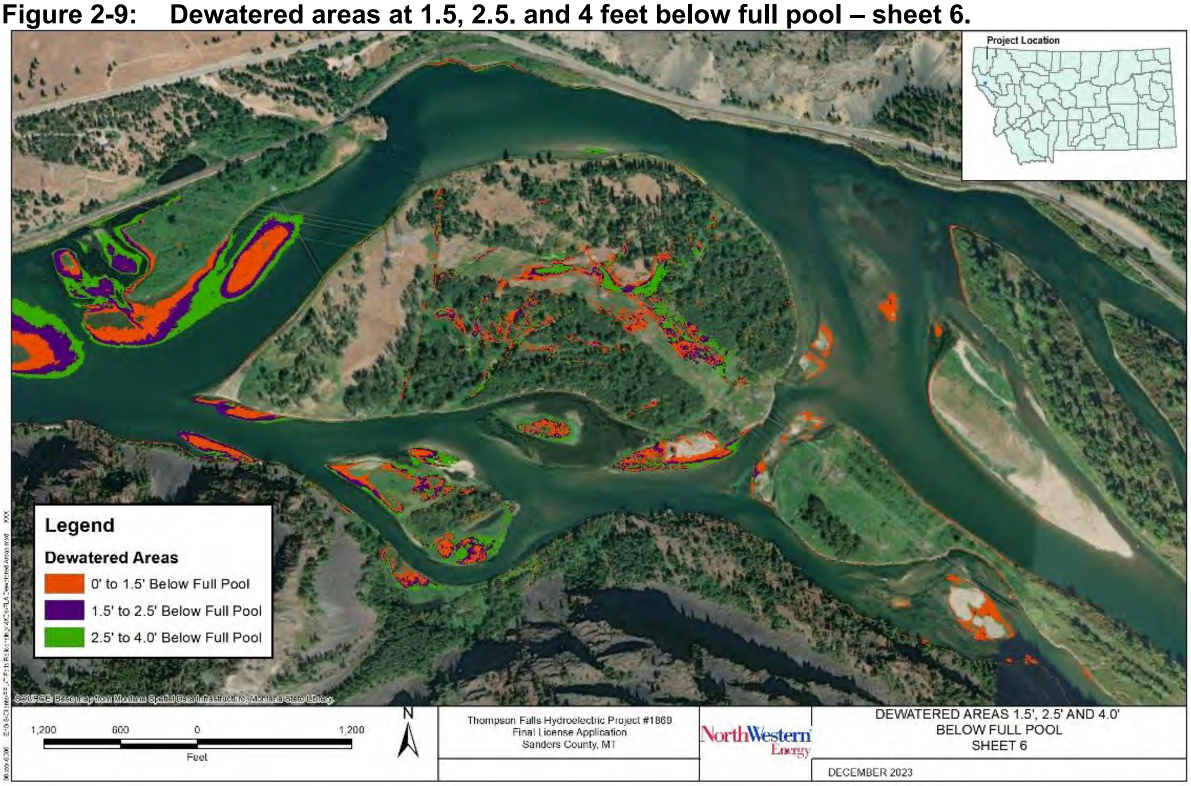


Figure 2-9: Dewatered areas at 1.5, 2.5. and 4 feet below full pool – sheet 6.



2.1.3.2 Maintenance Activities Requiring Lower Reservoir Levels – No Action Alternative

Certain maintenance activities require the reservoir be lowered outside of the typical operating window. The first is an unplanned event that would occur when spring flows exceed the capacity of the combination of the spillway radial gates (less reserve for plant capacity restoration) and the spillway roller panels. Prior to the installation of the new radial gates in 2019, high flows and debris required tripping of stanchions and spill bays approximately every 7 to 10 years. With the installation of the new radial gates it is estimated that the flow that will trigger stanchion tripping is approximately 112,000 cfs, but is also dependent on the amount of debris accumulating at the dam that cannot be passed through the radial gates or spillway bays.

When flows near or exceed 112,000 cfs, NorthWestern may have to activate the trippable stanchions to allow the spillway to pass additional flows. It is anticipated this flow capacity without tripping stanchions to be more than the 10-year flood event of 110,335 cfs but less than the 25-year flood event of 122,947 cfs. When the stanchions are tripped, NorthWestern has to draw the reservoir down to crest to execute repairs on the spillways. With the new radial gates, the frequency of deep drawdowns caused by the tripping of the stanchions will be far more rare.

The duration of the drawdown would be dependent on the inflow values. The reservoir would not be able to be maintained at crest to facilitate the repairs until inflows approach the total powerhouse capacity of 23,320 cfs at which time the reservoir would be drafted approximately 16.5 feet. Once inflows reach a manageable level, dam stanchion and board replacement would take 1 to 3 weeks depending on the number of bays in which stanchions were tripped.

The other primary event triggering operations outside of the typical fluctuation window would be a planned event to replace the timber stop-log flashboards which have a 25- to 30-year service life. Both events require the reservoir to be lowered about 16.5 feet, to a level near or slightly lower than the Main Channel Dam spillway crest. The duration the full depth of the drawdown must be maintained to complete a full flashboard replacement on the Main Channel Dam is approximately 3 weeks, the duration would be less to perform similar work on the Dry Channel Dam.

To reduce effects on the fish passage operations, the preferred timing of drawdowns to support maintenance activities is in the month of October. However, this timing is not achievable when the drawdown is in response to high spring flow conditions that require tripping of the flashboard stanchions.

2.1.3.3 Future Operation Under the No Action Alternative

Under the no action alternative, the Project would continue to operate under the existing license conditions. The Project would continue to be operated to provide baseload and flexible generation within the existing license's reservoir elevation and minimum flow requirements. NorthWestern may utilize the Project as needed to continue to meet NorthWestern's electric grid reliability demands using the capacity in the reservoir, up to the top 4 feet from full pool, for these purposes. NorthWestern may utilize the full authorized drawdown more frequently than in the past, in order to meet the need for operational flexibility, but would typically operate within the top 1.5 feet of the reservoir.

Under the no action alternative, many of the licensee's proposed measures or the resource agencies' recommendations and mandatory conditions would not be required. Several of the PM&E measures proposed by NorthWestern (including limiting flexible operations to the top 2.5 feet of the reservoir from full pond) would also not be implemented, and therefore few benefits from implementation of the new NorthWestern-proposed PM&E measures would be realized.

NorthWestern utilizes the Project to support grid reliability by providing spinning reserve and load balancing as river and reservoir conditions allow. These operational modes utilize the flexibility, as provided in the license, to vary reservoir elevations. The Project is typically operated to maximize peak generation efficiency across all units with available flows. Unit No. 7 is used as the primary unit for efficiency followed by Units 1 and 3, and finally Units No. 2, 4, 5, 6. Units are typically dispatched in this efficiency priority as flows allow.

When flow exceeds total powerhouse capacity (23,320 cfs), the spillway panels are used along with the radial gates to pass additional flow. As runoff increases, the 4- by 8-foot spillway panels on the Main Channel Dam are removed for additional spill capacity. As flows increase, more panels are removed to balance flows across the length of the Main Channel Dam Spillway. When the peak flood discharge is less than 70,000 cfs, spill is usually restricted to the Main Channel Dam section. If flows exceed 70,000 cfs, there are 72 Dry Channel Dam spill panels (each 4- x 8-foot) available to increase spill capacity. The Dry Channel Spillway has been used in 5 of the past 10 years (2010-2019).

Prior to the installation of the new radial gates on the Main Channel Dam Spillway (which became operational in 2019), flow exceeded the radial gate capacity for approximately 3 months in an average year, leading to a long period of manual spillway operations. The new radial gates reduce the need to manually remove spill panels, improve safety, and provide an additional avenue to flush debris that builds up on the upstream face of the dam. The new radial gates are also used for reservoir regulation and flow restoration in case of plant trips. The typical spillway opening sequence may be modified to optimize the use of the radial gates and minimize TDG as defined in the TDG Control Plan.

2.1.4 Existing Environmental Measures

This section describes environmental measures taken pursuant to the existing Project license. Some of these measures were one-time actions that have been completed while others are ongoing.

2.1.4.1 Completed Environmental Measures

In 1988, during the license amendment proceeding, the Licensee and FWP entered into the 1988 Mitigation Agreement (Agreement) for the Thompson Falls Project under which the Licensee agreed to pay $250,000 to FWP to provide full and complete mitigation as required under

Section 903(e)(6) of the Northwest Power Planning Council's Program for impacts caused by the construction and maintenance of the Project. This Agreement was signed on March 22, 1988, by FWP and the $250,000 payment was issued by the Licensee to FWP on March 31, 1988. FWP acknowledged that the $250,000 payment satisfied any responsibilities for mitigation under Section 903(e)(6) of the Program.

FWP also agreed that the $250,000 satisfied fisheries mitigation related to construction activities for expanding generation at the Project. FWP agreed to deposit the $250,000 provided by the Licensee into the Fish and Wildlife Mitigation Trust Fund and, as a Trustee, FWP was to use these funds to annually purchase 10,000 acre-feet of water from Painted Rocks Reservoir to enhance summer and fall flows for resident fish in the Bitterroot River. If requirements of the Program were amended, the funds could be used for amended purposes. The funds could also be used for other means of enhancing fish populations if, in the judgment of FWP, those means are more beneficial to enhancing the resident fisheries in the Montana portion of the Columbia River Basin; provided, however, that any use of the trust fund for purposes other than the purchase of water would not negate the full satisfaction of the Licensee's responsibilities under Section 903(e)(6) of the Program.

The 1990 license amendment states that, "…the agreement between the Licensee and FWP, is generally consistent with section 903(e)(6) of the Program. Since [the Licensee] has already completed with the agreement by depositing $250,000 in a trust fund, no license requirement, as requested by the Department of Natural Resources and Conservation (DNRC) is necessary."

In addition, in the 1990 license amendment incorporated, a wildlife management plan for the Project, prepared by FWP. The Licensee deposited $123,000 in a trust fund to finance implementation of the Plan. Additionally, the Licensee acquired the property for and developed a Canada goose brood rearing area which was successfully established.

The 1990 license amendment also included measures to mitigate for any resource impacts from the maximum daily fluctuations of up to 4 feet in the reservoir and 8.4 feet immediately downstream of the tailrace. Measures included an Erosion Control Plan (Article 401), a Revegetation Plan (Article 402), visual resources mitigation measures (Article 403), recreational development of Island Park (Articles 404 and 405) and provide other recreational facilities and signage (Article 407). The Licensee subsequently completed these requirements.

In 2008, a BO was prepared by FWS, which concluded that the Project may adversely affect the federally listed threatened species, the Bull Trout. The BO included seven mandatory terms and conditions which were incorporated into the 2009 license amendment.

On February 12, 2009, FERC issued a license amendment approving construction and operation of fish passage facilities. Ordering paragraph (B) of the license amendment required the licensee comply with the TCs 1 through 7 included in the FWS's November 4, 2008, Incidental Take Statement. NorthWestern has complied with the seven TCs of the FWS's 2008 BO, including implementing a Memorandum of Understanding (MOU), Facilitation and Funding of FERC license-based Consultation Process and Implementation of Minimization Measures for Bull Trout (January 15, 2008). The MOU provides terms and conditions regarding the collaboration between the licensee and the FWS, FWP, and CSKT and the implementation of minimization measures for Bull Trout.

Under the terms of the MOU, which expires on December 31, 2025, NorthWestern provides annual funding ($100,000) to the TAC to conduct offsite habitat restoration or acquisition in important upstream Bull Trout spawning and rearing tributaries. The purpose is to boost recruitment of juvenile Bull Trout. This funding is provided to mitigate for incidental take of Bull Trout caused by downstream passage through the turbines and spillways.

NorthWestern completed a shoreline stabilization pilot project in 2020. The pilot project was intended to test a bioengineering approach in the Thompson Falls Project vicinity. The key component of the project involved propagating plantings of native vegetation from cuttings, bareroot, and potted plantings. The goal of the pilot project was to scale back a nearly vertical bank to a slope less than or equal to 3:1 and to utilize native willow and dogwood cuttings to develop deep-binding root mass to stabilize the newly constructed bank. Bareroot and potted shrub species (red osier dogwood, northern choke cherry, and service berry) were planted on the upper two-thirds of the bank for increased bank stability and to provide shade and riparian habitats benefitting terrestrial bug species and songbirds. Results from the pilot project may be used to inform the approach, design, and suitability of plant species for potential projects around Thompson Falls Reservoir in the future.

The Licensee installed a new, low profile powerhouse and painted it gray to reduce visual impacts per the1990 license amendment.

2.1.4.2 Ongoing Environmental Measures

Under the existing license the following environmental measures are ongoing.

- Survey recreational use once every 6 years per license Article 406.
- Maintain the Island Park and the Wild Goose Landing Park recreation facilities, and the facilities at the south end of High Bridge per license Articles 404, 405 and 407 respectively.
- Address cultural resources management per license Article 408.
- Operate and maintain the upstream fish passage facility from mid-March through mid-October per FERC order issued on February 12, 2009.
- Upstream fish passage monitoring and reporting per FERC order issued on February 12, 2009.
- Fisheries population monitoring and reporting (filed with FERC) within the reservoir and portions of the river.
- Downstream fish passage mitigation per FERC order issued on February 12, 2009.

- Implement annual noxious weed control measures in high-use areas on NorthWestern's lands.
- Maintain and implement NorthWestern's *Standards for Design, Construction, Maintenance, and Operation of Shoreline Facilities* (NorthWestern 2020).
- Develop and implement operational procedures to reduce TDG production during periods of spill per FERC order issued on February 12, 2009. Procedures are described in the TDG Control Plan, 2010 (PPL Montana 2010).
- Maintain minimum instream flows downstream of the Project of 6,000 cfs or inflow, whichever is less per license Article 411.

2.2 Proposed Action

2.2.1 Proposed Project Facilities

NorthWestern is not proposing any new construction or redevelopment of the Project facilities.

2.2.2 Proposed Project Operations

NorthWestern proposes that the Project continue to provide baseflow generation and flexible capacity needs in the new license term. Baseflow generation matches reservoir inflows to generate electricity while maintaining a stable reservoir elevation. Flexible capacity increases or decreases generation from the baseflow, raising or lowering the reservoir elevation as the flow through the units is changed to support flexible capacity needs. Under normal operations, NorthWestern will maintain the reservoir between El. 2396.5 and 2394 feet (2.5 feet below normal full operating level). In the spring during periods of spill, the reservoir may be operated above El. 2396.5 but is maintained below El. 2397.0. The units may increase or decrease generation during normal operations within the above defined, reservoir elevations. Spill gates may be used to maintain reservoir elevation if needed in times of decreased generation.

In addition, NorthWestern will generally maintain minimum flow releases at the Project of 6,000 cfs or inflow, whichever is less. These releases may be temporarily modified if required by operating emergencies beyond NorthWestern's control and for short periods on mutual agreement between NorthWestern, FWS, DEQ and FWP. There are no ramping rates for the Project.

2.2.2.1 Maintenance Activities Requiring Lower Reservoir Levels – Proposed Action Alternative

As described in Exhibit E Section 2.1.3.2, certain maintenance activities require the reservoir to be lowered outside of the typical operating window. When spring flows exceed the capacity of the combination of the spillway radial gates (less reserve for plant capacity restoration) and the spillway roller panels, NorthWestern may have to activate the trippable stanchions to allow the spillway to pass additional flows. The reservoir would not be able to be maintained at crest to facilitate the repairs until inflows approach the total powerhouse capacity of 23,320 cfs at which time the reservoir would be drafted approximately 16.5 feet. Planned events to replace the timber stop-log flashboards also require the reservoir to be lowered to about 16.5 feet below full pool.

These maintenance activities would be required under the proposed action in the same manner as under the no action alternative. *Refer to* **Exhibit E Section 2.1.3.2**.

2.2.3 Proposed Project Boundary

The current Project boundary does not encompass all lands and waters needed for Project purposes. Thus, the **Exhibit G** maps included in this license application contain several refinements proposed to the Project boundary.

The proposed Project boundary was created using a combination of two methods. The first method was a contour elevation that encompasses the reservoir during normal full pool operations, and which allows for typical elevations above normal full pool operations during spring runoff. The second method is using specified courses and distances (metes and bounds), where necessary, to encompass lands that are necessary for Project operations and maintenance and for other Project purposes such as public recreation which are outside the full pool contours.

The rationale for modifying the current Project boundary is described below.

- The metes and bounds survey dates back to 1941 for the first 6 miles upstream of the dam, and to 1971 for the additional 6 miles upstream. At that time, survey standards and equipment were less advanced. This has created a situation whereby the metes and bounds survey does not always encompass Project lands and waters as intended. 18 CFR § 4.41(h)(2)(i)(A)(1) reflects a FERC preference that a contour elevation be used to describe the reservoir versus a metes and bounds survey.
- Portions of Project works, including Thompson Falls Reservoir, and recreation sites which include sites required by the current license, and sites that are being proposed for the new license, are not within or fully within the current Project boundary.
- The current Project boundary encompasses lands that are not Project-related. In particular, the Project boundary includes a number of oddly-shaped, narrow (0-20 feet in width) slivers of land upstream of the dam and above full pool elevation that are not Project-related. This is due to the fact that when the surveyor(s) established the metes and bounds description to approximate the reservoir, they established a survey line set back from the reservoir's edge a short distance so they could draw long straight lines, instead of surveying every curve in the shoreline.

2.2.3.1 Differences Between Proposed and Current Project Boundary

NorthWestern proposes that lands be added at some locations and removed from the current Project boundary in other locations. The result is a net decrease in size by 475 acres (**Table 2-3**). The current and proposed Project boundaries are both depicted on **Figure 2-10** for comparison purposes.

Table 2-3: Net change in Acreage, Proposed Project Boundary.

	Current Project Boundary (acres)	Proposed Project Boundary (acres)	Net Difference in acreage
Surface Water	1,226	1,094	-132
Recreational Lands	17	34	17
Other Land Use	758	398	-360
Total Project Boundary	**2,001**	**1,526**	**-475**

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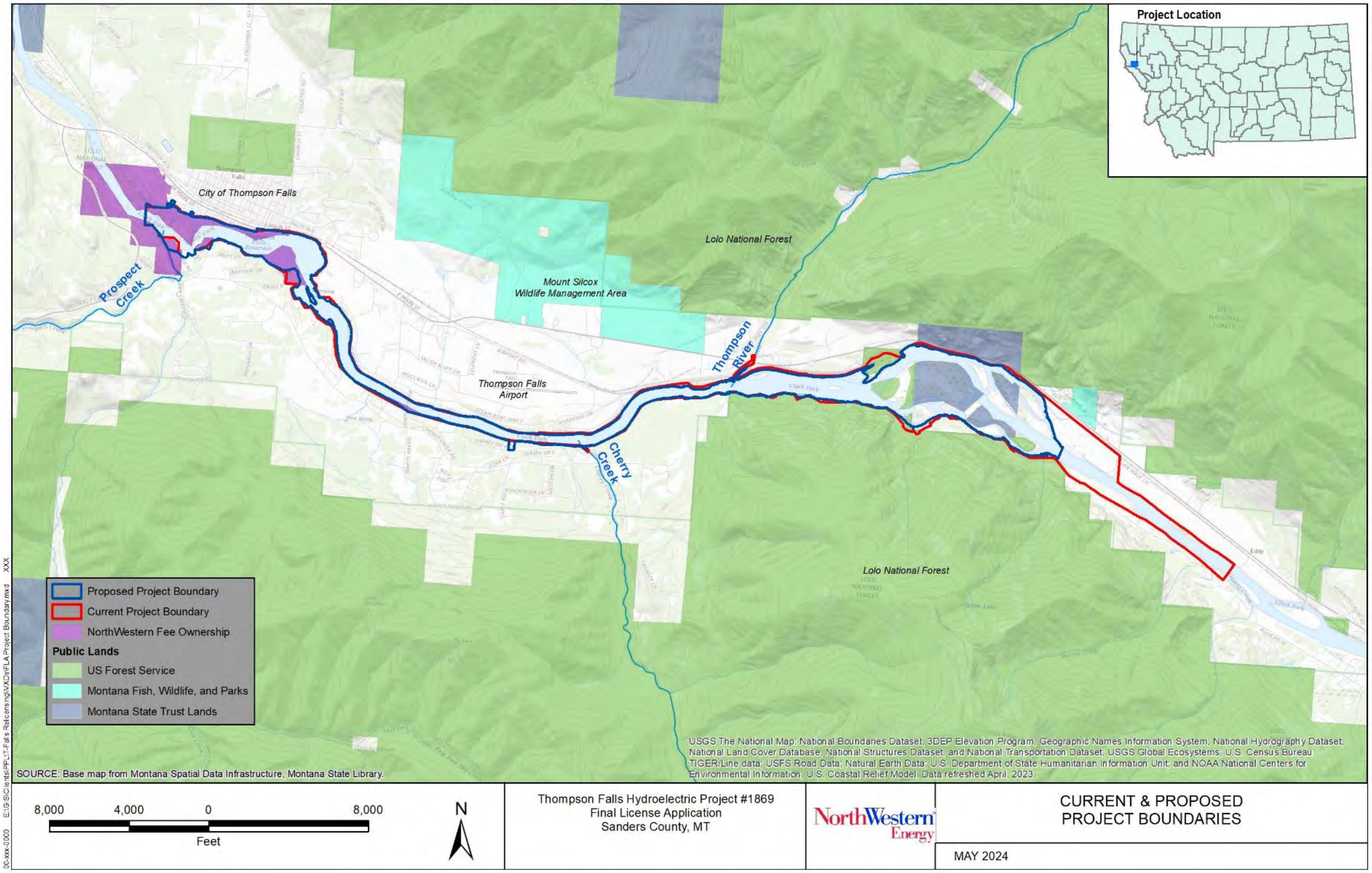
Figure 2-10: Current and Proposed Project boundary.



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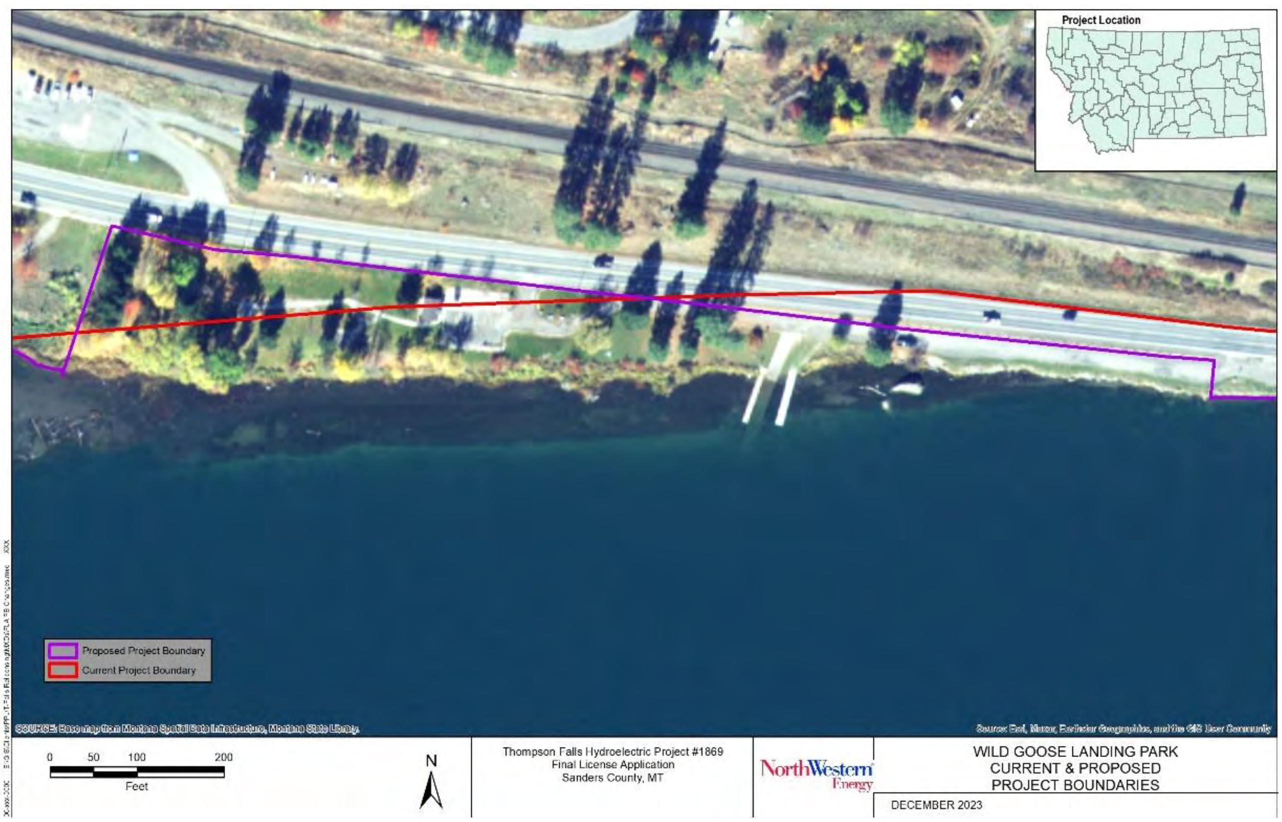
2.2.3.2 Lands Proposed to be Included in Project Boundary

NorthWestern's proposed Project boundary will encompass new and expanded recreation sites. Additional detail on recreation sites is found in this **Exhibit E - Section 11 – Recreation**. These additions to the Project boundary are generally described below:

2.2.3.2.1 Wild Goose Landing Park

Wild Goose Landing Park is a Project recreation site under the current license, but a portion of this recreation site is not within the current Project boundary. Thus, about 1 acre is being added to the Project boundary to encompass the entire site. The added land is owned by NorthWestern and the city of Thompson Falls (City). A portion of the boat ramp and boat dock are within the contour elevation discussed above, and the portion above the contour elevation is described by a separate metes and bounds description. **Figure 2-11** is a map showing the current and proposed Project boundary locations at Wild Goose Landing Park.

Figure 2-11: Current and Proposed Project boundary at Wild Goose Landing Park.



2.2.3.2.2 South Shore Dispersed Recreation Area

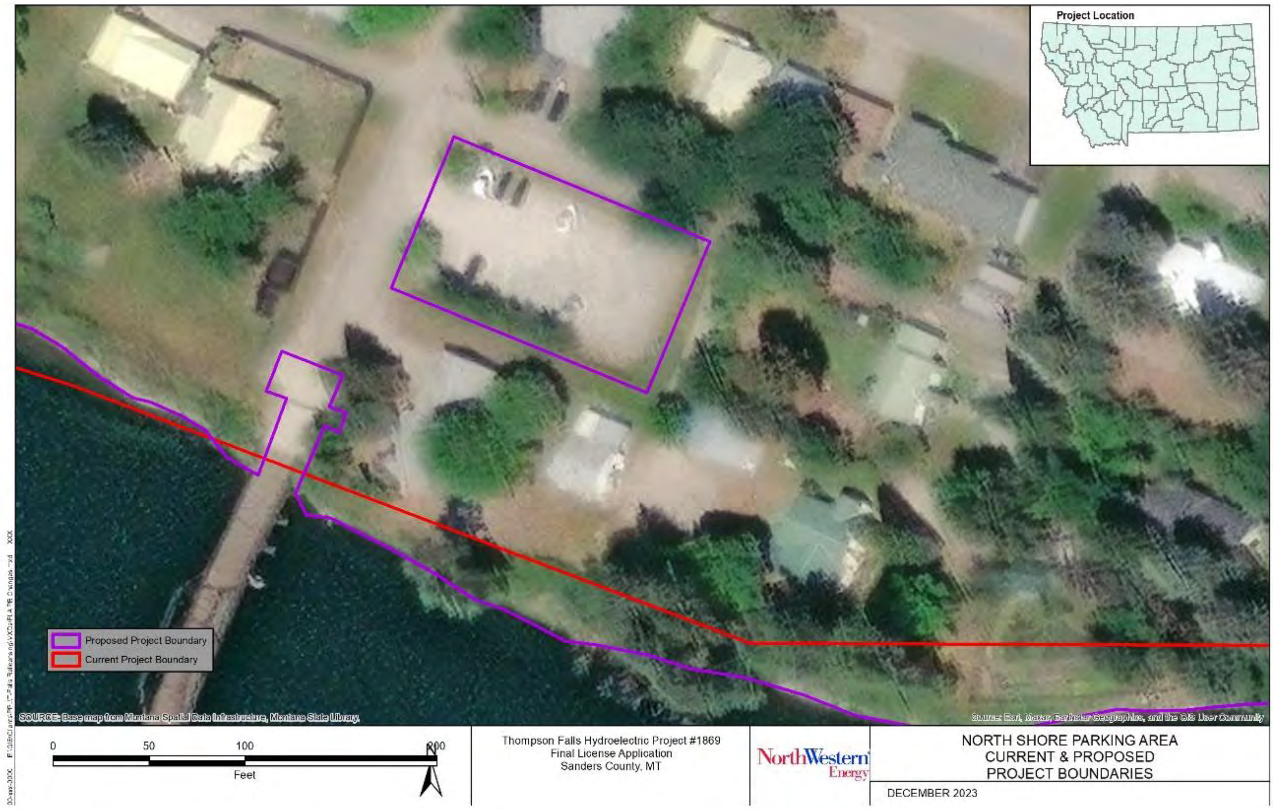
About 10 acres of land would be added to the Project boundary to encompass the South Shore Dispersed Recreation Area. The public has used this site for years for activities such as fishing and swimming since it provides access to the river below the dam, and for upland activities such as hiking. The South Shore Parking Area, which includes a paved parking area and latrine, is located adjacent to the South Shore Dispersed Recreation Area, and services both this site and Island Park. The land proposed to be added to the Project boundary is owned by NorthWestern. The South Shore Dispersed Area is described by a separate metes and bounds description. **Figure 2-12** is a map showing the current and proposed Project boundary locations at the South Shore Dispersed Recreation Area.

Figure 2-12: Current and Proposed Project boundary at the South Shore Dispersed Recreation Area.

2.2.3.2.3 North Shore Parking Area

About 0.3 acre of land would be added to the Project boundary for the North Shore Parking Area and Gallatin Street Bridge gate (which includes an Americans with Disabilities Act [ADA]-parking space). These parking locations serve Island Park. The added land is owned by NorthWestern (North Shore Parking Area) and the City (Gallatin Street Bridge gate and ADA-parking space). The main Island Park is already encompassed within the contour elevation and the metes and bounds description, but the North Shore Parking Area is not likewise encompassed; it is described by a separate metes and bounds description. **Figure 2-13** is a map showing the current and proposed Project boundary locations at the North Shore Parking Area.

Figure 2-13: Current and Proposed Project boundary at the North Shore Parking Area.



2.2.3.2.4 Power Park

About 0.6 acre of land would be added to the Project boundary for Power Park. The added land is mostly owned by NorthWestern, but part of the site is on an undeveloped City street right-of-way. Power Park is described by a separate metes and bounds description. **Figure 2-14** is a map showing the current and proposed Project boundary locations at Power Park.

Figure 2-14: Current and Proposed Project boundary at Power Park.

2.2.3.2.5 Cherry Creek Boat Launch

About 3 acres of land would be added to the Project boundary for the Cherry Creek Boat Launch Site. The added land is owned by Sanders County and NorthWestern has an easement that allows for use of the land as a recreation site. Cherry Creek Boat Launch is described by a separate metes and bounds description. **Figure 2-15** is a map showing the current and proposed Project boundary locations at the Cherry Creek Boat Launch Site.

Figure 2-15: Current and Proposed Project boundary at Cherry Creek Boat Launch Site

2.2.3.2.6 Prospect Creek Powerhouse

The historic Prospect Creek Powerhouse cultural site adds about 0.1 acre to the Project boundary. The added land is owned by NorthWestern. It is described by a separate metes and bounds description. **Figure 2-16** is a map showing the current and proposed Project boundary locations at the Prospect Creek Powerhouse.

Figure 2-16: Current and Proposed Project boundary at the Prospect Creek Powerhouse.

2.2.3.2.7 Access Roads

NorthWestern's proposed Project boundary adds about 0.9 acre to encompass two road segments that are solely used by NorthWestern for Project access. The added land is owned by NorthWestern. **Figure 2-17** is a map showing the current and proposed Project boundary locations at the access roads.

Figure 2-17: Current and Proposed Project boundary at access roads.

2.2.3.3 Lands Proposed to be Removed From Project Boundary

Lands are being proposed for removal for the specific reasons outlined in the sections below. In general terms, none of the lands proposed for removal serve any Project purpose. They do not encompass any existing or proposed recreation sites. They were inventoried for cultural resources and no National Register-eligible or -listed properties were identified. No Project facilities are located on these lands.

2.2.3.3.1 Federal Lands

NorthWestern's proposed Project boundary removes approximately 37 acres of National Forest System lands from the current Project boundary reducing the acreage from the current 103.78 acres to about 66.9 acres[9]. The current Project boundary is a metes and bounds description in its entirety, even around the reservoir. When the surveyor(s) established the metes and bounds description to approximate the reservoir, they established a survey line set back from the reservoir's edge a short distance so they could draw long straight lines, instead of surveying every curve in the shoreline. This resulted in including upland acreages not needed for Project purposes within the current Project boundary, including National Forest System lands. The proposed Project boundary for the reservoir is a contour elevation that follows the water's edge, which results in removing those

[9] The source of the data used to determine federal acres was the BLM Geospatial Business Platform, data file titled "BLM MT SMA Surface Ownership 2021 Polygon". This is the same source used by FERC in their April 19, 2023 "Request for Additional Information" for the Broadwater Hydroelectric Project (Project No. 2853-073).

upland acreages from the Project boundary. **Figure 2-18** is a map showing the current and proposed Project boundary location in an example area of National Forest System lands.

Figure 2-18: Current and Proposed Project boundary adjacent to National Forest System Lands.

2.2.3.3.2 Non-Federal Lands Not Necessary for Project Purposes

NorthWestern's proposed Project boundary removes the approximate 3-acre Steamboat Island from the current Project boundary. Steamboat Island is privately owned and mostly bedrock so its boundary is stable and not changing due to erosion and accretion. **Figure 2-19** is a map showing the current and proposed Project boundary locations at Steamboat Island.

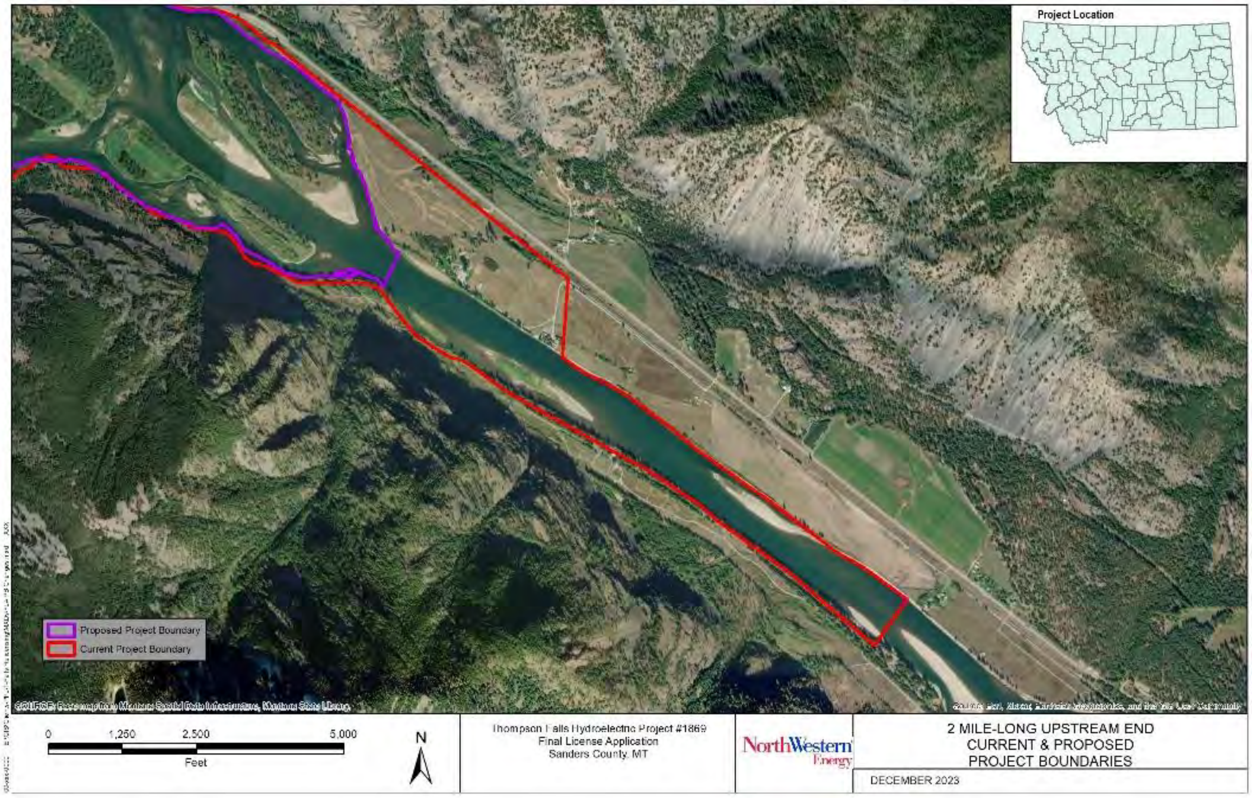
Figure 2-19: Current and Proposed Project boundary at Steamboat Island.

NorthWestern's proposed Project boundary removes an approximate 10-acre area designated as a Canada goose brood rearing area under the current Project boundary. Canada goose populations have increased significantly since the current license was issued in 1979. FWS data (FWS 2022) indicate a population of 24,200 individuals in 1979/80 for the Rocky Mountain area which encompasses the Project. That population increased about tenfold to 245,000 in 2021/22. In many areas, Canada geese are now considered a nuisance, occupying areas like golf courses and public parks, defecating, and otherwise making a mess of the area. Neither Relicensing Participants nor agency personnel have raised any issues or requested any studies related to Canada goose populations. **Figure 2-20** is a map showing the current and proposed Project boundary locations at the Canada goose brood rearing area.

Figure 2-20: Current and Proposed Project boundary at Canada goose brood rearing area.

NorthWestern's proposed Project boundary removes approximately 336 acres which is an approximate 2-mile-long section of the Clark Fork River and associated uplands from the upstream end of the current Project boundary. **Figure 2-21** is a map showing the current and proposed Project boundary locations in this 2-mile-long section.

Figure 2-21: Current and Proposed Project boundary, upstream end of project boundary.



Data collected by NorthWestern in 2022 for the Updated Study Report indicated that the Project has minimal, if any, influence on this 2-mile-long section of river (NorthWestern 2023). Instead, this 2-mile-long section is influenced by forces upstream of the Project such as spring runoff, heavy summer rainfall events, low summer flows due to drought-like conditions, and/or releases of water from the Seli'š Ksanka Qlispe' (SKQ) project all of which can significantly change river flow volume and elevations. **Figure 2-22** is data from the 2022 study that shows water elevations at various locations within the current Project boundary. *The Final Study Report (FSR) – Operations Study* provides the full details regarding this study (NorthWestern 2023). The bullet points below discuss the water elevation patterns at each location and whether or not the Project has an influence at that location.

- The orange dashed line in Figure 2-21 is the inflow of Clark Fork River as it entered the upstream end of the Project. This site represented the natural river flow and water surface elevation not influenced by Project operations.
- The blue line in Figure 2-21 is the water surface elevation at the Main Channel Dam. The elevation fluctuated about 2 feet during the course of the study, which reflected the flexible operations that NorthWestern employed during the study. Water surface elevations at this location were influenced by Project operations.
- Proceeding about 8.5 miles upstream from the Main Channel Dam, the next location was the Islands Complex, the gold line on Figure 2-22**.** Water surface elevation fluctuated about

6 feet during the course of the study. Most of that elevation change occurred during the tail end of the spring runoff. By mid-summer, water surface elevation fluctuations closely mirrored the fluctuations at the Main Channel Dam, indicating this location is influenced by Project operations.

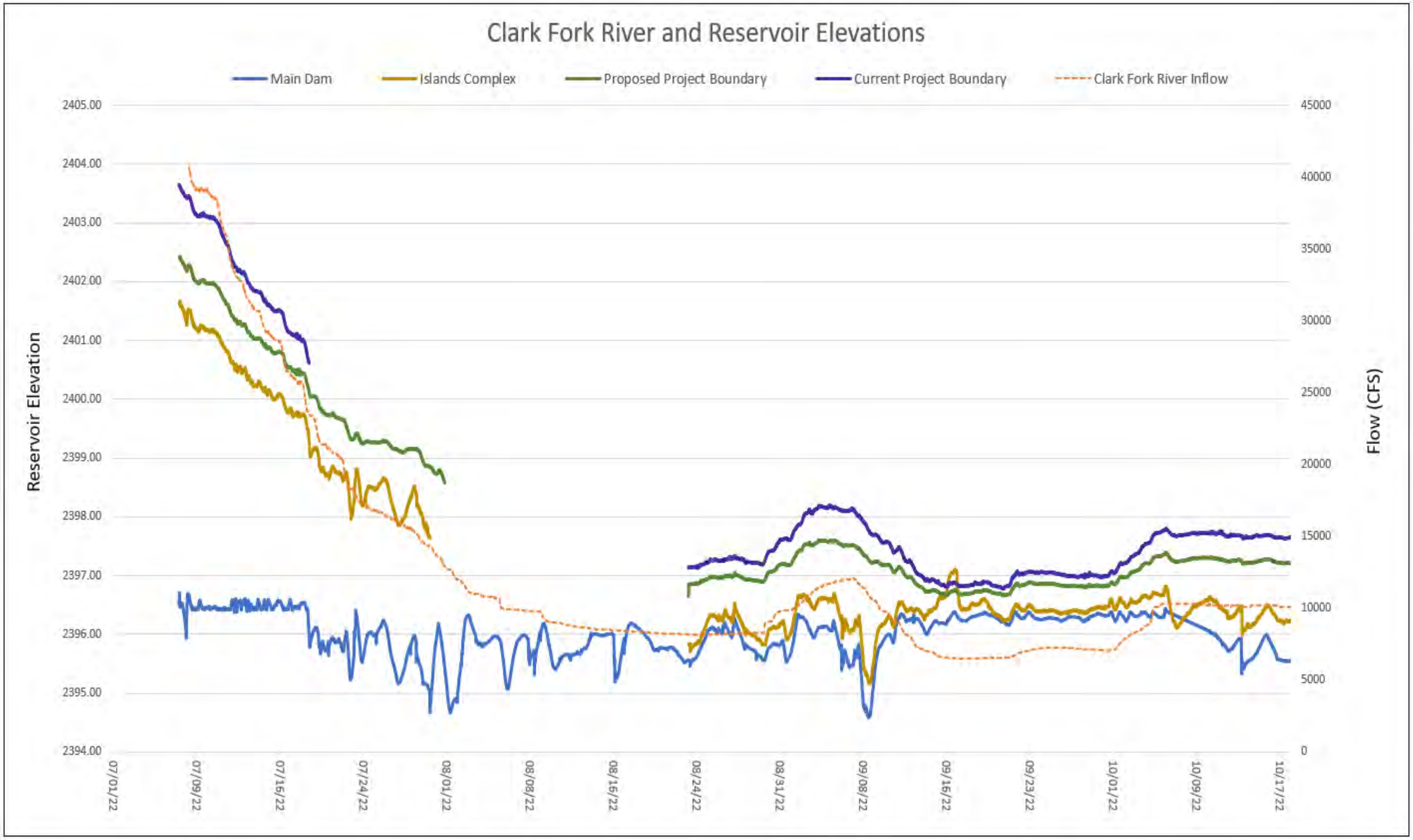
  - As the water level dropped during spring runoff, the instrumentation used to measure elevation became dewatered, resulting in missing data. The instrument was relocated in mid-summer to a watered site to resume data collection.

- Proceeding 1.5 miles upstream from the Island Complex, the next location is the proposed Project boundary, the green line on Figure 2-21. Upstream (2 miles) from the proposed Project boundary is the current Project boundary, the purple line on Figure 2-21. The 2-mile-long stretch of river proposed for removal from the Project boundary is the area between these 2 locations (green and purple lines). Water surface elevation fluctuated about 6-7 feet at these 2 locations. Most of that elevation change occurred in the tail end of spring runoff. By mid-summer, the elevation fluctuated about 1 foot at these 2 locations.

  - Throughout the course of the entire study, the fluctuations at these 2 locations closely mirrored the fluctuations of the Clark Fork River inflows as opposed to fluctuations at the Main Channel Dam caused by Project operations. These locations, and the 2-mile-long stretch between the two locations, are not influenced by Project operations.

  - The instrumentation at the proposed and current Project boundary locations also became dewatered and had to be relocated.

Figure 2-22: Reservoir elevation and flow data at various locations during 2022 study.



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The proposed Project boundary extends approximately 0.3 mile downstream and 10 miles upstream of the Project's dams (*refer to* Figure 2-10). The proposed Project boundary encompasses a total of 1,526 acres, consisting of 1,094 acres of reservoir and 432 acres of non- reservoir. Federal land managed by the USFS (National Forest System Lands) includes 66.9 acres, which are largely open space forest lands (**Table 2-4**). The Thompson River, a major tributary to the Clark Fork River, enters the reservoir about 6.2 miles upstream of the dam. The lower 0.2 mile of the Thompson River is included within the proposed Project boundary. The proposed Project boundary is a combination of a contour elevation of El. 2,397 feet at the dam (elevation of contour increase proceeding upstream) for most of the reservoir and a metes and bounds description that incorporates areas above the contour elevation to encompass Project facilities, recreation sites and a cultural resource site.

Table 2-4: Thompson Falls Project – federal lands within proposed Project boundary.

Township	Range	Section	Subdivision	Acres	Agency
21N	28W	15	Government Lot 1	0.3	USFS
21N	28W	17	Government Lots 5-11	49.6	USFS
21N	28W	18	Government Lots 8-10	4.3	USFS
21N	28W	21	Government Lot 1	1.45	USFS
21N	28W	22	Government Lots 3-4	11.25	USFS
			Total	**66.9**	

2.2.4 Proposed Environmental Measures

NorthWestern is proposing to implement the PM&E measures described below. These measures may be further refined as a result of ongoing engagement between NorthWestern, federal and state resource agencies, Tribes, and other Relicensing Participants.

2.2.4.1 Fisheries

- The Licensee will develop a Fisheries and Aquatic Resources PM&E Plan for purposes of reducing adverse effects on Bull Trout and other native fish species caused by the operation of the Project. The Plan will provide for the continuation of the adaptive management principles set forth in the January 15, 2008, MOU among the Licensee, FWS, FWP and the CSKT, including the TAC. The Plan will add the USFS as a voting member of the TAC and will include, at a minimum, the following measures:
    - Improvements to upstream passage for native species, specifically:
        - Over the first 5 years of implementation, the Fisheries and Aquatic Resources PM&E Plan will involve deployment of up to eight submersible PIT antenna within logistical and safe conditions below the Main Channel Dam to evaluate finer scale fish movements in the near field of the fish passage facility.

    - At the end of the first 5-year period, the Licensee will prepare a summary report discussing results of the 5-year study period. The summary report will be prepared in consultation with the TAC and filed with FERC.
    - The Licensee shall prepare an Upstream Passage Improvement Plan for the second 5-year period based on the results of the first 5 years. The Upstream Passage Improvement Plan will include further evaluations to improve capture efficiencies of the upstream fish passage facility, any proposed operational changes, and a plan and schedule to complete any facility modifications proposed by the Licensee in consultation with the TAC determined necessary to improve upstream passage efficiency. The Upstream Passage Improvement Plan will be prepared in consultation with the TAC and filed with FERC for approval.
    - Improvements to downstream passage of Bull Trout at the Project.

The Licensee shall prepare the Fisheries and Aquatic Resources PM&E Plan in consultation with the FWS, USFS, FWP, and CSKT, and will file the plan for approval by the Commission within 1 year of the issuance of the new License.

- The Licensee shall continue to operate and maintain the upstream fish passage facility in accordance with TAC guidance. The following measures for operation will include:
    - Seasonally operate the fish passage facility from approximately March – October.
    - Spring closures when total river discharge is within 48,000 to 65,000 cfs, as approved by the TAC.
    - Adequate staff to operate and maintain the fish passage facility.
    - An engineered solution to provide adequate flow to the upstream fish passage facility at all water surface elevations down to 2.5 feet below full pool. This work will be completed prior to NorthWestern’s implementation of flexible generation between 2.0-2.5 feet below full pool during periods when the fish passage facility is operating.
    - Compile data collected at the fish passage facility into NorthWestern's database following quality control and quality assurance review.
    - An annual report summarizing upstream passage activities and results to be provided to the TAC for review.
- For the first 5 years of the New License term, the Licensee shall implement fisheries population monitoring in the Thompson Falls Reservoir and Clark Fork River as specified below. These measures may be extended beyond the first 5 years of the New License term as agreed by the TAC.
    - Fall gillnetting annually in Thompson Falls Reservoir.

  - One spring electrofishing section in the lower reservoir from Wild Goose Landing Park upstream along HWY 200 to the pump house in even years (2026, 2028).
  - Fall electrofishing sections on even years (2026, 2028) immediately above islands and one downstream of Paradise.
- The Licensee will generally maintain minimum flow releases at the dam of 6,000 cfs or inflow whichever is less. These releases may be temporarily modified if required by operating emergencies beyond the Licensee's control and for short periods on mutual agreement between the Licensee, FWS, DEQ, and FWP.

2.2.4.2 Water Quality

- The Licensee shall implement the Thompson Falls Water Quality Monitoring Plan (Appendix C), which was developed in consultation with DEQ.
- The Licensee will implement the updated TDG Control Plan (Appendix G), which was developed in consultation with DEQ.

2.2.4.3 Terrestrial Resources

- The Licensee will implement annual noxious weed control measures, as appropriate, in high-use areas on Project lands owned by the Licensee.
- The Licensee will manage the shoreline pursuant to FERC's Standard Land Use Articles, in coordination with the Green Mountain Conservation District in implementing Montana's Natural Streambed and Land Preservation Act.

2.2.4.4 Geology

- Within 2 years of the new License, the Licensee, will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The Plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, SHPO, and USFS. Development of the Drawdown Management Plan will involve work internally and with consultants to review the data collected during previous drawdowns in order to develop appropriate drawdown rates, monitoring plans, and emergency response protocols. The monitoring measures in the Drawdown Management Plan are likely to include visual monitoring during the drawdown, installation and monitoring of temporary arrays of monitoring pins during the drawdown, and monitoring of slope stability by boat. The Drawdown Management Plan will include specific measures to be implemented at different elevations, with more intensive monitoring at elevations that are more likely to result in slope instability.

2.2.4.5 Recreation

- The Licensee shall implement the Recreation Management Plan (Exhibit E-Appendix D). This Recreation Management Plan includes the following elements:

- Periodic visitor and site monitoring over the new License term.
- Add Power Park as a Project recreation site, including maintenance of the group-use pavilion and plumbed restroom facility, drinking water station, picnic tables, and benches.
- Add Cherry Creek Boat Launch as a Project recreation site, including improvements to the boat launch, and maintenance of the picnic facilities, vault toilet restroom, boat launch and dock.
- Continue to operate and maintain Island Park and the North Shore and South Shore Parking Areas as Project recreation sites, including the parking areas, interpretive information and the upstream fish passage facility viewing platform, as well as benches, picnic tables, and vault latrines throughout Island Park and parking areas. This excludes the Historic High Bridge which is owned and maintained by Sanders County.
- Continue to operate and maintain Wild Goose Landing Park as a Project recreation site, including a new floating boat launch dock to accommodate reservoir fluctuations down to 2.5 feet and bathroom improvements. Annual maintenance of the boat ramp, swimming dock, picnic facilities, bathrooms, parking areas, garbage service, and general site and facility upkeep.
- Continue to operate and maintain the South Shore Dispersed Recreation Area as a Project recreation site with an expanded boundary, including dispersed parking and regulatory signage to maintain the site as a primitive day use area.

2.2.4.6 Cultural Resources

- The Licensee will implement the HPMP (Volume IV-Privileged), which was developed in consultation with the SHPO and Tribes.

2.3 Alternatives Considered but Dismissed from Detailed Study

2.3.1 Federal Government Takeover of the Project

Under Section 14(a) of the FPA, the federal government may take over any project licensed by the FERC upon the expiration of the original license. In accordance with 18 CFR § 16.14 of FERC regulations, during Project scoping a federal department or agency may file a recommendation that the U.S. exercise its right to take over a hydroelectric power project with a license that is subject to Sections 14 and 15 of the FPA. During the scoping period for the Project, no federal department or agency filed any such recommendation. No agency or interested party has recommended a federal takeover of the Project pursuant to Section 14 of the FPA and no federal agency has expressed an interest in operating the Project. Therefore, federal government takeover of the Project was considered but dismissed from further consideration.

2.3.2 Issuing a Non-Project License

A non-power license is a temporary license that FERC would terminate when it determines that another governmental agency is authorized and willing to assume regulatory authority and supervision over the lands and facilities covered by the non-power license. No governmental agency has suggested an interest, willingness, or ability to take over the Project, and NorthWestern is seeking a power license.

2.3.3 Retiring the Project

Project retirement would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions.

In SD2, FERC stated, "As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing in most cases. NorthWestern Energy is not proposing decommissioning, nor does the record to date demonstrate there are serious resource concerns that cannot be mitigated if the Project is relicensed; as such, there is no reason, at this time, to include decommissioning as a reasonable alternative to be evaluated and studied as part of staff's NEPA analysis."

NorthWestern seeks to retain and operate the Project. No participant has suggested that dam removal would be appropriate in this case, and there is no basis for recommending it.

The power generated at the Thompson Falls Project helps NorthWestern balance the production and delivery of other emission-free variable sources of power generation, such as wind and solar, to the power grid. Thus, dam removal is not a reasonable alternative to relicensing the Project as proposed.

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3. Cumulative Effects

According to the Council on Environmental Quality's (CEQ 2020) regulations that implement NEPA (40 C.F.R. § 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

In Scoping Document 1 (SD1), FERC staff identified fisheries and aquatic resources as resources that could be cumulatively affected by the proposed continued operation and maintenance of the Thompson Falls Project in combination with other hydroelectric projects and other activities in the Lower Clark Fork watershed.[10]

FERC subsequently published SD 2, which stated that,

> While they had not yet determined just how far downstream the effects of Project operation would extend, the analysis of Project effects would not likely include the entire length of the Clark Fork River and all adjacent tributaries as suggested by the USFS, FWS, and FWP because some of these areas are either too geographically remote or any effects occurring there are the product of a lengthy causal chain making any such analysis meaningless[11].

3.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effect on the resources, and (2) contributing effects from other hydropower and non-hydropower activities within the basin. There are five major dams in the Clark Fork River basin. The federal Hungry Horse Dam and the SKQ Hydroelectric Project (FERC Project P-5) are 191 and 109 miles upstream of Thompson Falls in the Flathead River drainage, respectively, far beyond the geographic scope of potential cumulative effects of the Thompson Falls Project. There are no other major water control facilities in the Clark Fork River basin upstream of the Project.

Downstream of the Project on the Clark Fork River is Avista's Clark Fork River Project (FERC Project P-2058) consisting of Noxon Rapids Dam (built in 1959), located immediately downstream of the Project (with the Noxon Dam approximately 38 miles downstream of the Project) in

[10] *See* FERC's Scoping Document 1 for the Thompson Falls Project No. 1869, (issued Aug. 28, 2020).
[11] *See* FERC's Scoping Document 2 for the Thompson Falls Project No. 1869 (issued Dec 9, 2020).

Montana, and Cabinet Gorge Dam (built in 1952), approximately 19 miles downstream of Noxon Rapids Dam in Idaho.

The geographic scope the cumulative effects analysis for fisheries includes the Clark Fork River from Thompson Falls Reservoir downstream to where the Clark Fork River enters Lake Pend Oreille in Idaho, approximately 7 miles downstream of Cabinet Gorge Dam. Operations and fish passage measures at the Thompson Falls Project, in combination with Avista's Clark Fork Hydroelectric Project, FERC Project No. 2058, may affect fish resources in this approximate 65-mile reach of the Clark Fork River.

3.2 Temporal Scope

The temporal scope of the cumulative effects analysis includes a discussion of past, present, and reasonably foreseeable future actions and their effects on fisheries and aquatic resources that could be cumulatively affected. Based on the potential term of a new license, the temporal scope looks 40 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion is, by necessity, limited to the amount of available information for the resource.

3.3 Cumulative Effects Analysis - Fisheries and Aquatic Resources

Inland freshwater fish often utilize a multitude of habitats to complete specific life history stages, from headwater streams (e.g., Thompson River, Prospect Creek) to large river system (e.g., Clark Fork River) or lake such as Lake Pend Oreille. The interruption of habitat connectivity and modification of riverine habitats to lentic habitats has cumulatively affected fisheries and aquatic resources.

Past activities in the lower Clark Fork River basin, including development of the three Clark Fork River dams, mining activities, timber harvest and road systems, and historic forest fires all contributed to the current condition of the existing landscape and historic impacts to fisheries and aquatic resources. Physical changes to the landscape from these activities have cumulatively impacted various life history stages of migratory fish species, suitable habitat availability of species reliant on migratory fish species (e.g., freshwater mussel), and access and quality of river channel migratory corridors, and access to tributary spawning habitat.

The three hydropower projects in the lower Clark Fork River have converted approximately 65 miles of the lower Clark Fork River from lotic to lentic habitat. The change in habitat type has created beneficial habitats for some species but been detrimental for others. Introductions of nonnative fish species in the lower Clark Fork River system has altered fish species composition, often to the detriment of native species. Twenty-four fish species plus three hybrids have been recorded in recent years in the Project area (*see* Table 7-2), including 11 natives and 16 nonnatives. Several non-native species such as Walleye, Largemouth, and Smallmouth bass, are well suited to reservoir habitats. These species have the potential and appear to impact populations of native species in the region.

Current operations and maintenance of the three hydroelectric projects on the lower Clark Fork River continue to have a cumulative impact on fisheries and aquatic resources through impacts to habitat and fish passage.

Fish moving downstream face increased potential for injury and mortality when traveling through turbines or over the spillway at all three hydroelectric projects. Fish moving downstream (from upstream of Thompson Falls Dam) with the goal of reaching Lake Pend Oreille will either pass over the spillway during high flow or through the turbine at the three hydroelectric facilities. Data collected from tagging studies and angler reports in the Project area demonstrate that fish can survive passage over or through the three hydropower projects. As described in the *Downstream Fish Passage Literature Review FSR* (NorthWestern 2022), downstream survival is estimated to be 94 percent through the new Powerhouse (Kaplan turbine), 85 percent survival through the original Powerhouse (Francis turbine), and 98 percent over the spillway. Fish must repeat this process through two additional facilities, with uncertain survival rates, before reaching Lake Pend Oreille.

Currently, upstream fish passage is limited in the lower Clark Fork River. Avista operates a trap and haul facility seasonally at Cabinet Gorge Dam, providing upstream fish passage to Bull Trout and Westslope Cutthroat Trout. Other fish species are not transported upstream of Cabinet Gorge Dam. Bull Trout collected downstream of Cabinet Gorge Dam are genetically tested and assigned to spawning tributaries of most likely origin. These fish are then directly transported to the respective region and their natal tributary. Fish genetically assigned upstream of Thompson Falls are transported upstream of Thompson Falls and do not utilize the fish passage facility at Thompson Falls Dam.

There is no upstream fish passage facility at Noxon Rapids Dam. Fish located within Cabinet Gorge Reservoir have no upstream fish passage option at Noxon Rapids Dam

There is an upstream fish passage facility at Thompson Falls Dam which is designed to provide seasonal volitional passage. However, the presence of undesirable fish species downstream of Thompson Falls Dam prevents the opening of the fish passage facility to volitional passage. All fish which ascend the fish passage facility are manually sorted, and Walleye, Brook Trout, Brook x Bull Trout hybrid, Lake Trout, and Smallmouth Bass are not passed upstream. The Thompson Falls upstream fish passage facility is only available for fish present in the 25-mile-long Noxon Reservoir and connected tributaries.

Water quality studies have found the Project operations do not contribute to cumulative impacts of water quality downstream. Water quality changes vary little across the Project from upstream to downstream. This is mostly due to the very short residence time of the reservoir (3-17 hours) and lack of thermal stratification in Thompson Falls Reservoir.

No additional future foreseeable actions in the lower Clark Fork River drainage were identified that may cumulatively impact fisheries and aquatic resources.

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4. General Description of River Basin

The Project is located at approximately River Mile 65 on the Clark Fork River in Sanders County, Montana. The Clark Fork River is the largest river in the state of Montana based on flow. The Clark Fork River is approximately 320 miles long, with headwaters in southwest Montana, and the terminus at Lake Pend Oreille, Idaho. Outflows from the Lake Pend Oreille create the Pend Oreille River, which ultimately reaches its confluence with the Columbia River. The Columbia River Drainage Basin is estimated to have a drainage area of 258,000 square miles.

The drainage area upstream of the Project is 20,904 square miles (USGS StreamStats 2018) and includes upstream flow from the Thompson, Flathead, Blackfoot, and Bitterroot rivers, among other tributaries (**Table 4-1**).

Table 4-1: Regional watershed drainage area.

Tributary	Area (acres)	Area (miles^2)
Blackfoot	1,480,174	2,313
Middle Clark Fork	1,270,130	1,985
North Fork Flathead	1,002,762	1,567
Middle Fork Flathead	726,346	1,135
Flathead Lake	762,183	1,191
South Fork Flathead	1,072,560	1,676
Swan	466,557	729
Lower Flathead	1,285,636	2,009
Lower Clark Fork	1,495,418	2,337
Upper Clark Fork	1,199,997	1,875
Flint-Rock	1,164,568	1,820
Bitterroot	1,828,993	2,858
Regional Watershed Total	**13,755,324**	**21,495**

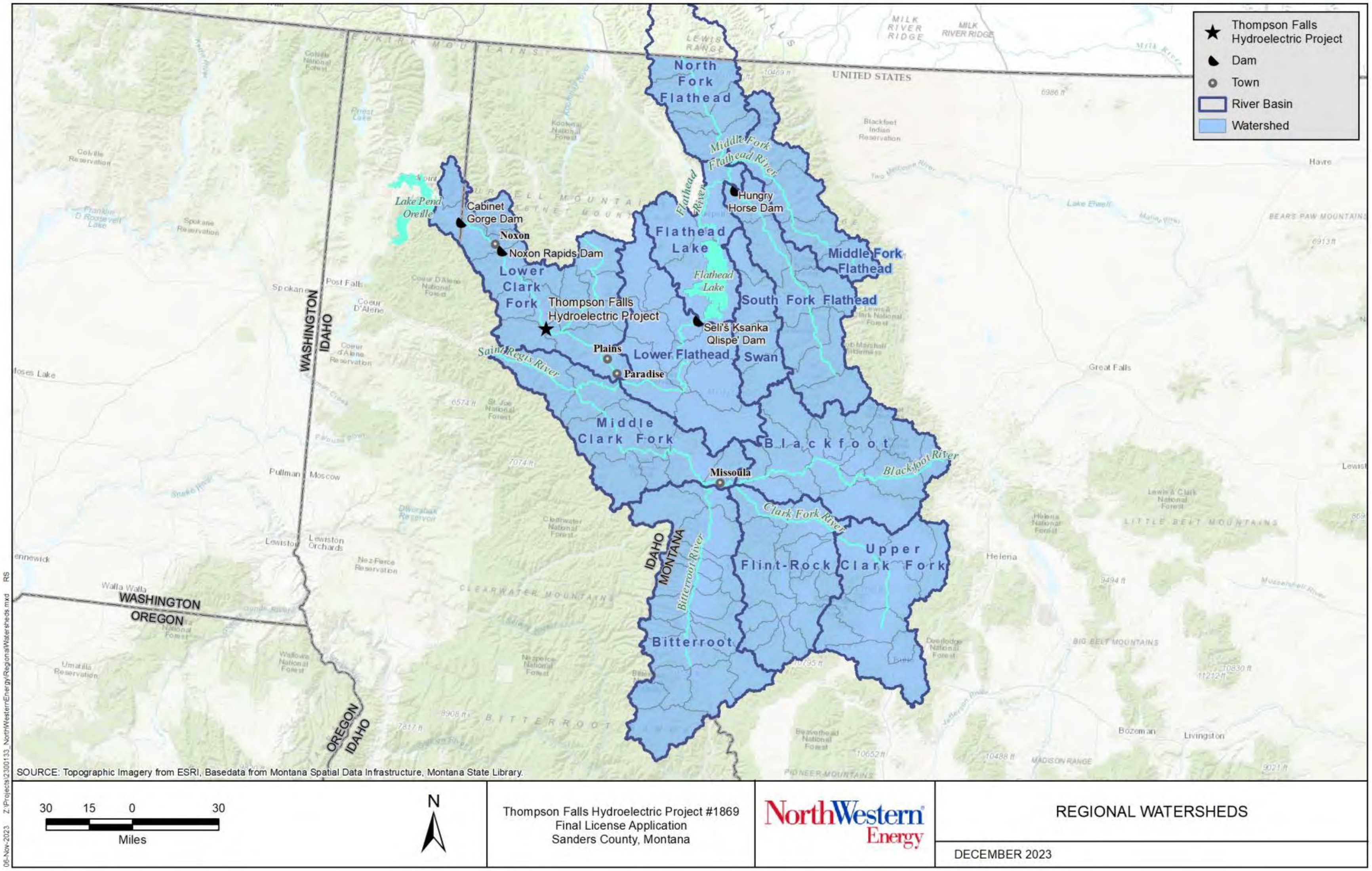
The Project is located in the lower Clark Fork River subbasin which contains 180 miles of perennial stream. In general, the ascending limb of the hydrograph in the lower Clark Fork River begins between mid- and late March, peaks between late May and mid-June, and descends to base flow levels around mid-August.

There are five major dams in the Clark Fork River basin (**Figure 4-1**). The furthest upstream is Hungry Horse Dam on the South Fork of the Flathead River, managed by the U.S. Bureau of Reclamation. The South Fork of the Flathead River is a tributary to the Flathead River which in turn is a tributary to the Clark Fork River. Downstream of Hungry Horse Dam on the Flathead River is the SKQ Hydroelectric Project (FERC Project P-5). The CSKT are owners and its wholly owned, federally chartered corporation, Energy Keepers, Inc. is operator of the SKQ Project. The

SKQ Project is approximately 109 miles upstream of the Project. There are no other major water control facilities in the Clark Fork River basin upstream of the Project.

Downstream of the Project on the Clark Fork River is Avista's Clark Fork River Project (FERC Project P-2058) consisting of Noxon Rapids Dam, located approximately 38 miles downstream of the Project in Montana, and Cabinet Gorge Dam, approximately 19 miles downstream of Noxon Rapids Dam in Idaho.

Figure 4-1: Regional watersheds.



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The Project boundary as currently defined in the FERC license extends approximately 0.3 mile downstream and 12 miles upstream of the Project. Thompson Falls Reservoir covers 1,226 acres at a normal pool El. 2,396.5 feet, not including the islands. The Project has a perimeter length of about 27 miles (**Figure 4-2**).

The primary tributaries of the Clark Fork River within the Project area are the Thompson River and Cherry and Prospect creeks (Figure 4-2). Prospect Creek originates in the mountain range separating Idaho and Montana and flows eastward into the Clark Fork River downstream of the Main Channel Dam. The Thompson River flows into the Clark Fork River approximately 6 miles upstream of the Main Channel Dam. Cherry Creek flows northward and enters Thompson Falls Reservoir approximately 4 miles upstream of the Main Channel Dam. Other streams in the Project area are ephemeral drainages which flow subsurface when they reach the valley alluvium.

The project boundary for the Noxon Rapids Hydroelectric Project is contiguous with the Thompson Falls Project boundary immediately downstream of the original powerhouse. The actual backwater of Noxon Rapids Dam varies depending on flow in the Clark Fork River and the operation at Noxon powerhouse. Influence from the downstream Noxon Rapids Hydroelectric Project on the tailrace of the Thompson Falls Project is observed when Noxon Reservoir is operated near full pool and Clark Fork River Flows are near baseflow. However, the Birdland Bay Bridge is typically considered the upstream end of Noxon Reservoir (NorthWestern 2023). The gradient of the reach between the Project and Noxon Rapids Reservoir was determined through geographic information system (GIS) analysis from downstream of the Main Channel Dam to the Birdland Bay Bridge, 3.2 miles downstream. The water surface elevation in this reach is estimated to be approximately - 0.04 percent.

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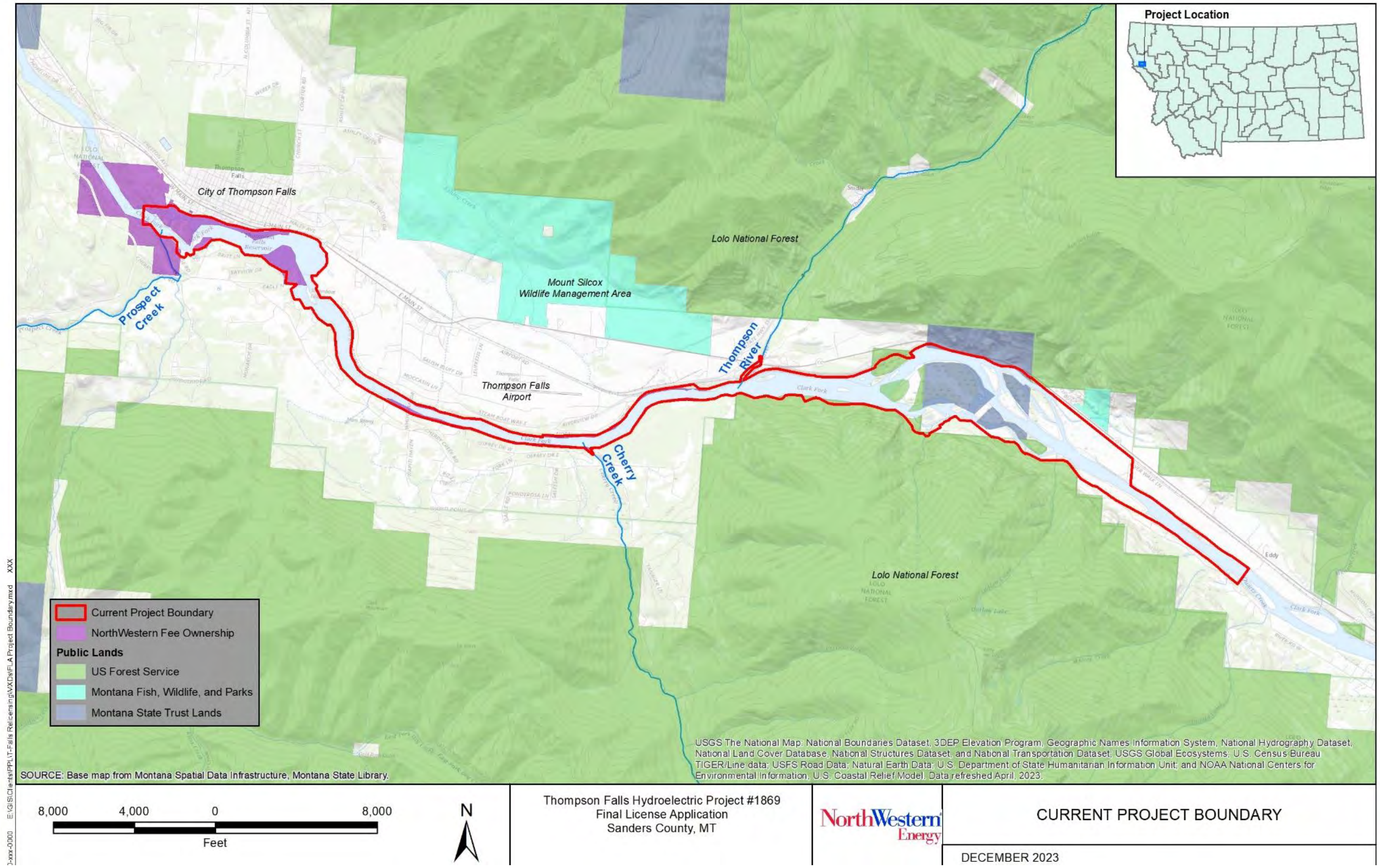
Figure 4-2: Thompson Falls Hydropower Project current FERC Project boundary.



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4.1 Topography

The topography in Project area consists of a U-shaped river valley at approximately 2,400 feet, bounded by steep mountainous terrain that exceed 6,000 feet. The Cabinet Mountains border the north and the Coeur d'Alene Mountains, part of the northernmost extent of the Bitterroot Range, along the south side of the Clark Fork River. The Clark Fork River flows northwest into Lake Pend Oreille.

4.2 Climate

The Project can be described as a cold temperate climate with freezing, snowy and mostly cloudy winters and short, clear, warm and dry summers. Average monthly temperatures vary from 23 degrees Fahrenheit (°F) during the winter to 84°F during the summer, and it is rarely below 6°F or above 92°F (Weather Spark 2022). On average, Thompson Falls receives about 23 inches of rain and 42 inches of snow per year. The warm season lasts about 2.6 months, June 22 to September 10 while the cold season extends from November 12 to March 1 (Weather Spark 2022). The region's growing season is about 130 days long (National Gardening Association 2018).

4.3 Major Land Uses

The 2,001-acre Project boundary consists of 1,226 acres of reservoir, and 775 acres of non-reservoir. Lands in the area include about 17 acres of recreation land uses and 758 acres associated with non-recreational land use.

Of the 758 non-recreational acres in the current Project boundary, NorthWestern owns about 40 acres, with the majority under and adjacent to the dams and powerhouse used for Project operations, as well as narrow slivers on the edge of the reservoir in various locations. Private lands consisting of a mix of large parcels, subdivision lots, and city lots comprise about 419 acres of non-recreational lands. Many private lands contain residential buildings. The state of Montana owns, and Montana's Department of Natural Resources and Conservation manages about 176 acres, which are largely open space. National Forest System lands include 103.8 acres which are largely open space forest lands. Railroad right-of-way and state of Montana lands managed by the Montana Department of Transportation as Montana Highway 200 right-of-way comprise the approximate remaining 17 acres and 2 acres, respectively.

4.4 Economic Activities

The local economy is based on a variety of sources including forestry, mining, agriculture, outdoor recreation, and mining.

Thompson Falls had been a logging community for many years, but reductions in timber harvest coupled with decreased lumber production have reduced logging projects (Bureau of Business and Economic Research [BBER] 2019). Transition away from the timber industry amidst the recession of 2008 to 2010 was slow. The economic state that resulted is reflected in Sanders County's

Distressed Communities Index[12] rating. The county ranked last in the state, accumulating 91 out of 100 possible points as averaged from 2007 to 2011 giving it a "distressed" ranking. However, that ranking improved for the timeframe 2012 to 2016, when the index fell 28.6 points to 62.4 putting it in the "at risk" ranking, reflecting improved economic conditions. As of June of 2023, there was further improvement with the index dropping to 52.5 points putting it in the "mid-tier" ranking (Economic Innovation Group 2023).

Mining in the area historically occurred in the Thompson River drainage, which flows into Thompson Falls Reservoir about 6 miles upstream of Thompson Falls Dam. There were a limited number of mines, still the district represented one of the largest mining districts in Sanders County. The district produced 943 tons of ore, including gold, silver, copper, lead, and zine from 1906 to 1958 (Crowley 1963).

According to 2017 Census of Agriculture data, Sanders County encompasses 642,640 acres of farmland, accounting for 36.4 percent of land area in the county. These lands include nearly 400,000 acres of large-tract woodlands for timber production, while the remaining 240,000 acres (approximately) can be considered true farms (USDA National Agricultural Statistics Service 2019). These smaller farm operations are typically not self-sustaining, and their owners use off-farm employment to support themselves.

The area is popular among Montana residents and nonresident visitors for outdoor recreation. Outdoor recreation, including hunting and fishing, and contribute significantly to Sanders County's economy. Big game hunters spent $12.7 million (M) in Sanders County in 2016; $6.2M by nonresidents and $6.5M by Montana residents. Elk hunters accounted for 52 percent of these expenditures, while deer hunters accounted for 48 percent (FWP 2017). The FWP and angling pressure survey in 2020 estimated 2,607 angler use days of Montana residents on Thompson Falls Reservoir (League and Caball 2020).

Travel-related spending in Sanders County in 2018 was estimated at $54M. Expenditures by out-of-state visitors are estimated at $17.9M (Institute for Tourism and Recreation Research [ITRR] 2018), while Montana resident travel spending totaled $36.1M in the county (65% on day trips, 35% on overnight trips; Grau et. al. 2018).

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[12] The Distressed Communities Index (DCI) combines seven complementary economic indicators into a single measure of community well-being, ranging from 0 to 100. Scores over 80 are considered distressed.

5. Geology, Topography, and Soils

5.1 Affected Environment – Geology

5.1.1 Geologic and Physiographic Setting

The Project is located in the Rocky Mountain Physiographic Province on the west side of the Continental Divide near the Montana and Idaho border. The region is characterized by rugged mountainous terrane that is interrupted by relatively narrow valleys that interconnect intermontane basins. Many of the rivers and tributary drainages in the region follow ancient bedrock faults that tend to have a northwest trending pattern. The Project resides along the Clark Fork River. The Clark Fork River generally trends east-west through the Project area, and then flows northwesterly downstream of the Project along the Hope Fault Zone. The western part of the Project near the town of Thompson Falls, where the dams and powerhouses are located, is within a relatively flat-floored 3-mile-wide section of the river valley. The upstream portion of the Project east of the confluence with the Thompson River is markedly narrower (referred to as Eddy Narrows) and flanked on either side by precipitous valley walls. The nominal elevation of the valley floor is 2,400 feet and the neighboring peaks are in excess of 6,000 feet.

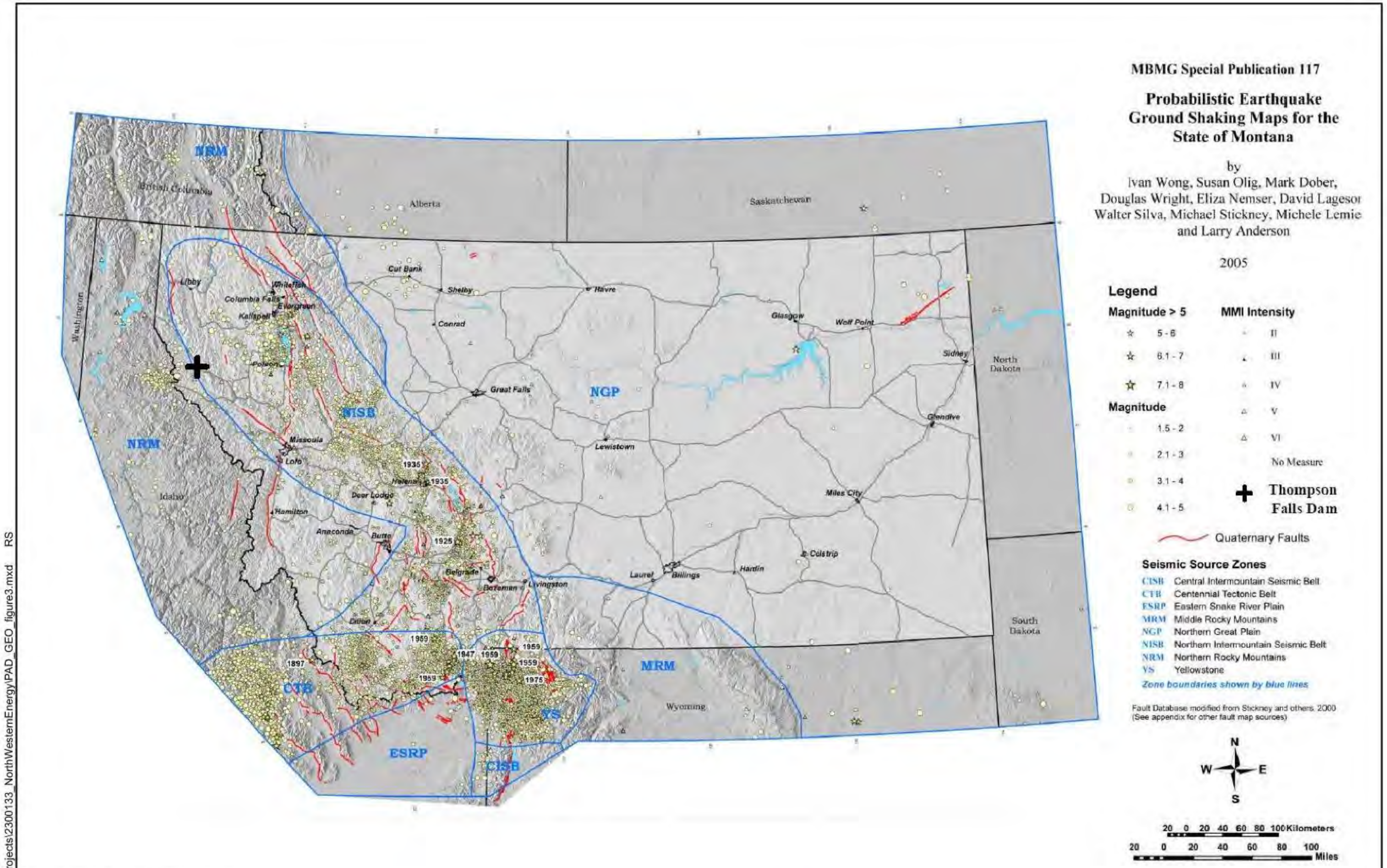
5.1.2 Tectonic Setting

The Project resides within the Northern Intermountain Seismic Belt (NISB), which is a sub-region of the more extensive Intermountain Seismic Belt (ISB). The ISB is characterized as a broad north-south trending zone of interplate seismicity that extends from northern Arizona to northwestern Montana. The ISB is principally deforming in response to ongoing tectonic extension within the North American Plate. The late-Quaternary normal faulting generally is associated with diffuse shallow (less than [<] 15 kilometers [km]) seismicity with surface ruptures resulting from earthquakes that range from **M** 6.5-7.5. Proximal to the Project, within the NISB in western Montana, seismicity is diffuse with generally small magnitude (**M** ≤ 4.0) events, with some larger (**M** ≥ 6.0) events (URS Corporation 2011).

Within the ISB is the Basin and Range Province, the Project is within a portion of the northern Basin and Range Province. The Yellowstone hotspot migration in the late Cenozoic that is associated with Snake River Plain, is considered the boundary between the northern and southern Basin and Range regions. The northern region has a somewhat different tectonic signature than the southern. Typically, the northern region is characterized as north-northwest trending ranges bound on one or more sides by steeply dipping normal faults. The basins formed by the down-dropping are then filled with broad alluvial sediments. The southern Basin and Range also has these similar mountain range geometries, however, listric normal faults that sole into “master” low angle detachments are more common (Arabasz et a. 1992).

The conspicuous Quaternary age normal faulting along the north-northwest trending range-fronts and historical seismicity in the northern Basin and Range Province suggests crustal extension rates of 2 millimeters (mm) per year that are observed in the southern region may be characteristic for this northern region as well (URS 2011). There are three principal seismic regimes that contribute to the ground motions at the Project: NISB, Centennial Tectonic Belt, and Yellowstone (**Figure 5-1**). Other regimes that could contribute to the ground shaking hazard in western Montana are the Central ISB, and the Northern and Middle Rocky Mountains.

Figure 5-1: Historical seismicity 1809–2001.



Source: Figure extracted from URS (2011)

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03-Nov-2023

	Thompson Falls Hydroelectric Project #1869 Final License Application Sanders County, Montana	NorthWestern Energy	HISTORICAL SEISMICITY 1809-2001, QUATERNARY FAULTS, AND REGIONAL SEISMIC SOURCE ZONES DECEMBER 2023

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5.1.3 Bedrock

A detailed geologic map of the Project is the USGS Wallace Quadrangle presented at a scale of 1:250,000 by Harrison et al. (1986) (**Figure 5-2**). The Project is entirely within Middle Proterozoic (approximately [~] 1.5 billion years ago) bedrock. The downstream portion of the Project area, including the dam site, is underlain by the Wallace Formation, which is a thick sequence of carbonate-bearing laminated black and white argillite, green argillaceous siltite, and minor limestone and dolomite (MPC 1982). Rock of the underlying Ravalli group are exposed at the mouth of Eddy Canyon at the upstream end of the Thompson Falls Reservoir.

A geologic characterization of the dam site was completed when MPC was planning to expand the Project in the early 1980s (MPC 1982). This involved mapping and characterization of the dominant discontinuity (i.e., bedding, joints, shears, etc.) sets. The rock near the dam was described as a dark gray argillite of the Wallace Formation. The rock has been subjected to metamorphism several times during its history, resulting in tilted and folded bedding that has also been faulted. Generally, the rock is hard, massive to blocky jointed and not severely weathered (MPC 1982). Near the dam site MPC (1982) found the predominant dip of the bedding to be at a low angle dipping obliquely downstream with localized variation due to folding. A secondary joint set was observed to be near vertical in a NE-SW direction, which is cut by steeply dipping northwest-southeast primary joints and shears. A fourth set is roughly flat lying, occasionally breaking preferentially along flat lying bedding planes. This last set was interpreted to be an exfoliation joint that is the result of crustal unloading.

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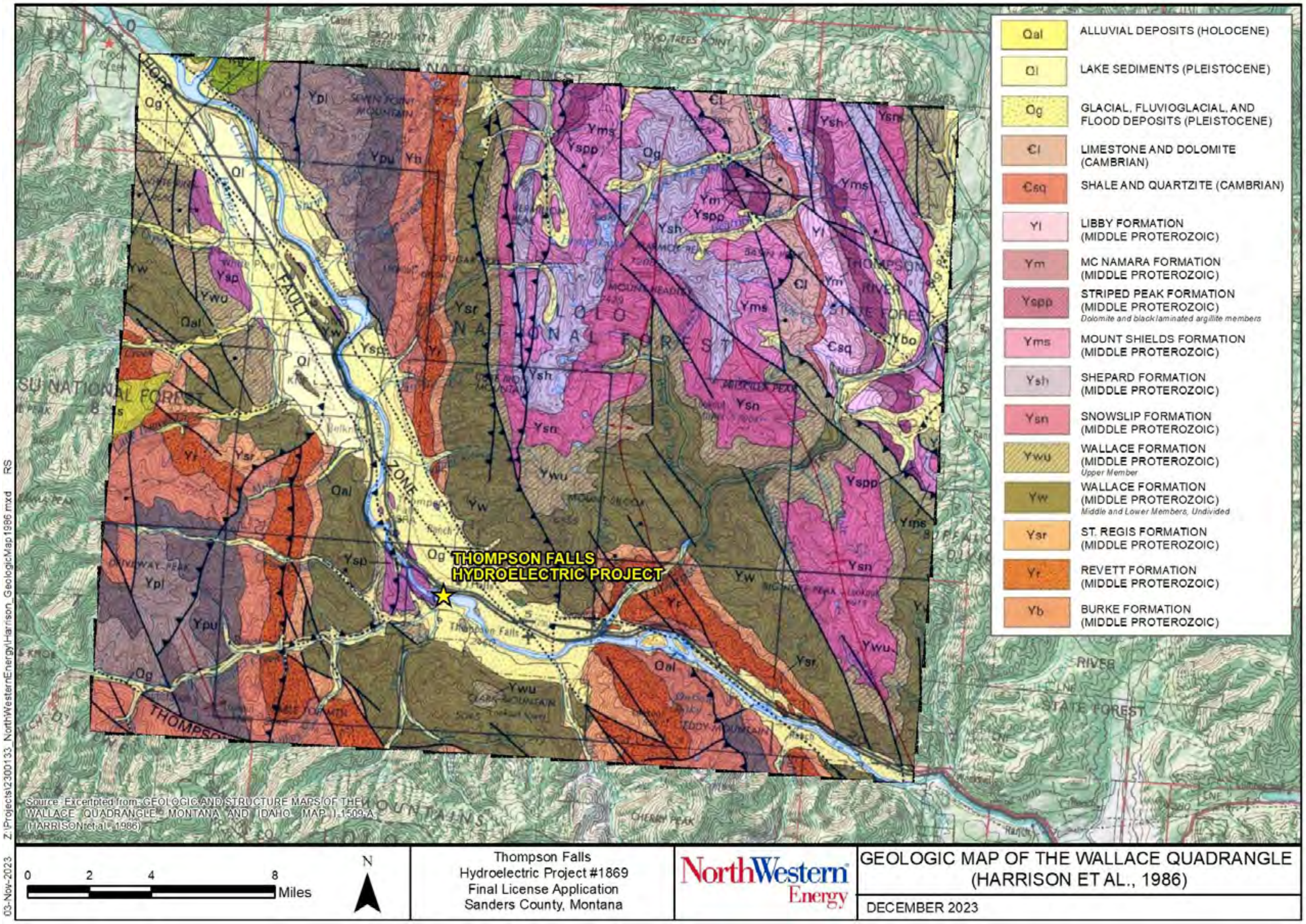
Figure 5-2: Geologic map of Project Area.



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5.1.4 Seismicity and Ground Motions

In 2011 there was a site-specific seismic hazard study performed by URS. The following is an excerpt from that study and summary included in NorthWestern's 2016 18 CFR Part 12 report.

Of the considered seismic sources, the Thompson Valley Fault was considered to be the most significant. Although relatively short (~10 km) the proximity to the site (~30 km) increases the significance of the fault structure. The Thompson Valley Fault is not well characterized; however, it is possible that surface rupture has occurred as recent as 30,000 years ago (Ostenaa et al. 1990). URS (2011) considered a preferred maximum magnitude for the Thompson Valley Fault of M 6.2 in the PSHA, and a M 6.6 in the DSHA, which is typically considered the threshold for surface rupture.

The results from the 2011 Deterministic Seismic Hazard Analysis (DSHA) for the Project found the maximum seismic event to correspond to a M 6.6 earthquake on the Thompson Valley fault at a rupture distance of 26.6 km. The 84th percentile deterministic peak ground acceleration (PGA) is 0.15 gravity (g). The results of the PSHA for Thompson Falls Dam estimated PGA at the dam site for return periods of 1,000, 3,000, and 5,000 years, and the resulting PGAs are estimated to be 0.14, 0.22, and 0.26 g, respectively. For the low hazard Thompson Falls Project, the Safety Evaluation Earthquake recommended by URS in 2011 and used as the basis for the 2014 dam analyses has a return period of 2,500 years and PGA of 0.22 g in accordance with national practice.

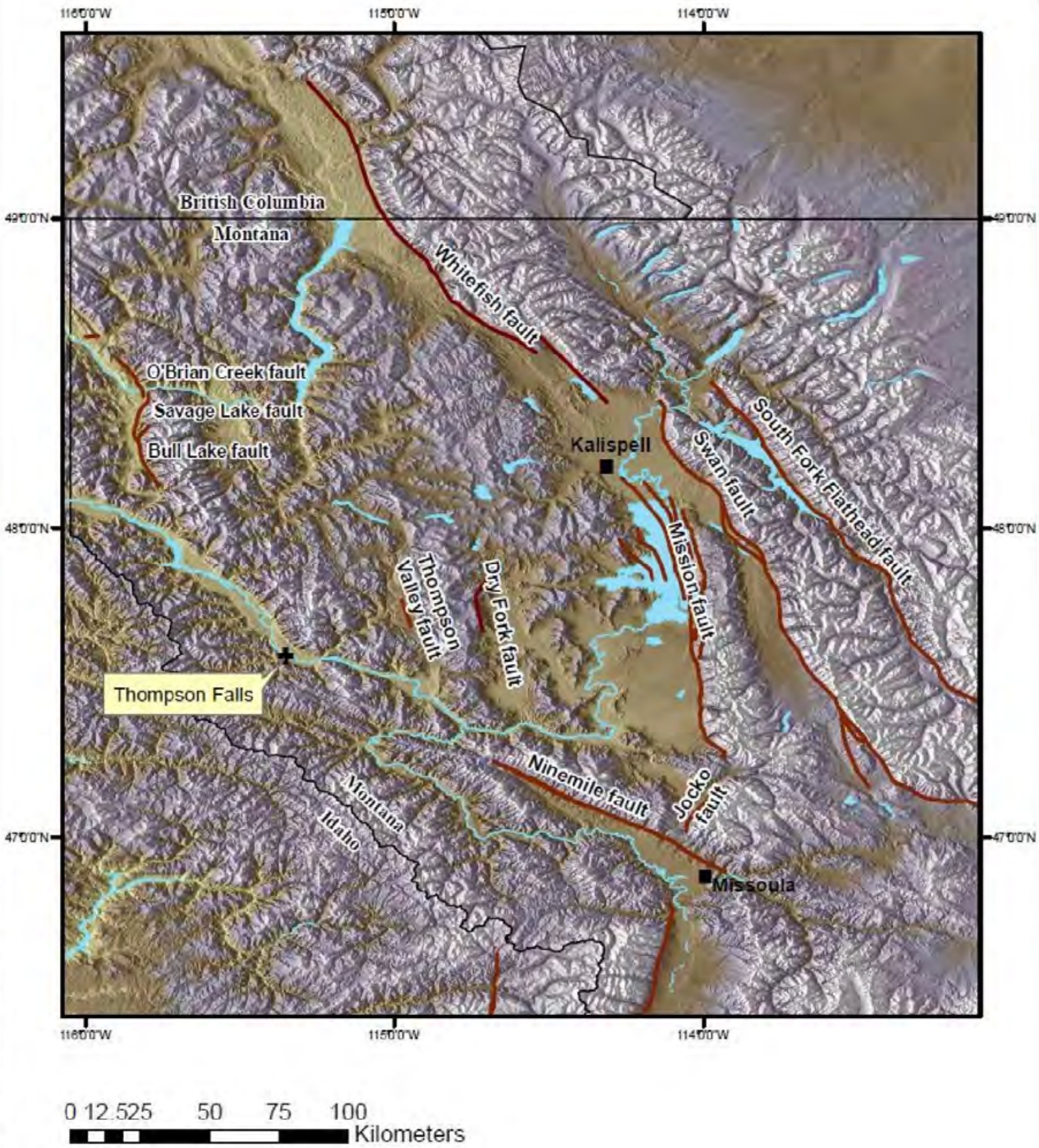
As part of the 2011 URS analysis, it considered nine Quaternary active faults and one background source as potential contributors to the seismic hazard. A summary of the seismic sources is included in **Table 5-1** and shown on **Figure 5-3**.

Table 5-1: Seismic hazards at Thompson Falls Hydroelectric Project.

Fault/Source	Maximum Rupture Length(s) (km)	Most Recent Movement
Thompson Valley Fault	9.6	<130,000 years
Ninemile Fault	70.1	<1,600,000 years
Bull Lake, Savage Lake, and O'Brien Creek faults	46 (unsegmented), 21 (Bull Lake), 17 (Savage Lake), 15 (O'Brien Creek)	<1,600,000 years
Dry Fork Fault	19	Middle or Late Quaternary
Jocko Fault	15.8	<130,000 years
South Fork Flathead Fault	75 (unsegmented), 40 (Firefighter Mountain Section), 70 (Hungry Horse Reservoir Section), 50 (Big Salmon Lake Section)	<1,600,000 years (?)
Swan Fault	75 (unsegmented), 65 (Lake Blaine Section), 90 (Condon Section)	<1,600,000 years
Whitefish Fault	110 (unsegmented), 84 (Northern Section), 30 (Southern Section)	<1,600,000 years (?)
Mission Fault	104 (unsegmented), 67 (Flathead Lake Section), 40 (Mission Valley)	<15,000 years
Background Earthquakes	N/A	N/A

Note: Table adapted and modified from URS (2011); < = less than; (?) = indicates additional uncertainty in the age of the most recent movement along the fault source.

Figure 5-3: Quaternary faults in Project Area.



SOURCE: Figure extracted from URS (2011)

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Thompson Falls Hydroelectric Project #1869
Final License Application
Sanders County, Montana

NorthWestern Energy

QUATERNARY FAULTS NEAR THOMPSON FALLS DAM

DECEMBER 2023

5.1.5 Historical Seismicity

Minimal seismogenic instrumentation monitoring coverage existed in Montana prior to 1972, reducing the certainty in locating epicenters of older events. It is estimated that about a dozen earthquakes of M 6.0 or greater have occurred since 1900. Of these significant earthquakes one occurred in or near eastern Montana in 1909, and the others have occurred along the ISB and Centennial Tectonic Belt in western Montana (URS 2011). Historical earthquakes of note that are indicative of the seismogenic potential in the ISB are: 1925 M 6.6 Clarkston Valley Earthquake, 1935 M 6.3 Helena Earthquake, 1959 M 7.3 Hebgen Lake earthquake, and the 1983 M 6.8 Borah Peak earthquake. These earthquakes generated significant damages in their respective regions. Of note is the 1925 Clarkston Valley event, as it is considered the "typical background earthquake". Background earthquakes are considered "floating" earthquakes that are not attributed to a specific known mapped fault. Historical seismicity near Thompson Falls is shown in **Figure 5-4**.

5.1.6 Structural Features

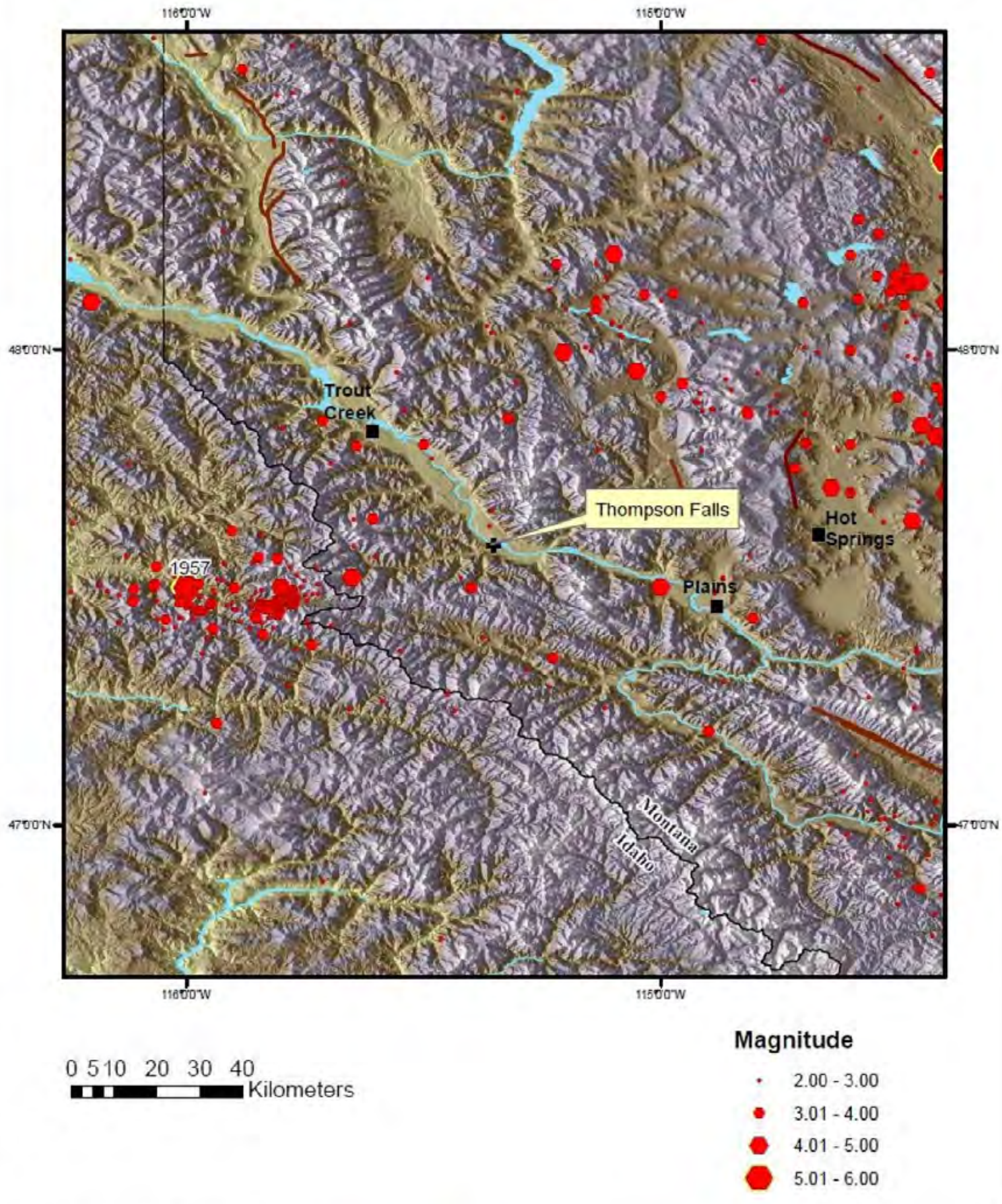
The Project lies on the southwest limb of a northwest trending anticlinorium (MPC 1982). The anticlinal axis can be traced from Eddy Canyon at the Oak Fork drainage across the Thompson River to the northwest, crossing the Thompson River 2 miles upstream from the confluence of the Thompson and Clark Fork rivers (MPC 1982). The Revett quartzite located near the mouth of Eddy Canyon and the Thompson River strikes northwest, parallel to the axis of the major anticlinal system. The Revett quartzite lies on the southwest dipping limb of the anticline (*refer to* **Figure 5-2**).

The Hope fault zone lies along the relatively straight escarpment forming the north wall of the Clark Fork Valley at Thompson Falls (MPC 1982). The trace of the fault is buried beneath the valley fill upstream from Thompson Falls. The Hope fault leaves the Clark Fork Valley at Cherry Creek and follows that drainage to the southeast. Geologic evidence indicates that right-lateral strike-slip movement occurred along the Hope fault during the Precambrian.

The widening drainage pattern of the Clark Fork River Valley below the mouth of the Thompson River suggests that the river has eroded into a basin-and-range type graben structure (MPC 1982). The north and east walls of the valley are anomalously straight, indicating fault scarps on the up thrown horst blocks. The valley thus resides within a relatively small graben block upstream of the dam site. Water well records show that the portion of the valley upstream from Thompson Falls has been eroded to El. 2,050 feet, compared to a bedrock El. of 2,350 to 2,400 feet on the upthrown block at the dam site and under the bench north of Thompson Falls. This relative upward movement on the downstream side of the graben at Thompson Falls created a bedrock step (Thompson Falls, at the location of the present dam).

Evidence of ancient thrust faulting is found on the north-northwest-trending parallel faults mapped at the Thompson Falls Project (MPC 1982). Both strike and dip-slip movement are found on these structures. The orientation of drag folds and slicken-sided bedding plane features associated with these faults suggest that at least minor thrusting has occurred (MPC 1982). The relative movement on these faults indicates a slight thrusting of the horst over the western portion of the graben at the Thompson Falls dam site. Historical seismicity in the valley is generally very low (**Figure 5-4**), further indicating these are ancient structures rather than active faults.

Figure 5-4: Historical seismicity near Project Area.



SOURCE: Figure extracted from URS (2011)

Thompson Falls Hydroelectric Project #1869 Final License Application Sanders County, Montana	NorthWestern Energy	HISTORICAL SEISMICITY NEAR THOMPSON FALLS DAM DECEMBER 2023

5.1.7 Surficial Geology

The distribution and types of Quaternary (last 2.6M years) deposits within the Project area have a complex history. The entire Project area is within the inundation zone of the Pleistocene (0.126–2.6M years ago) age Glacial Lake Missoula. The lake was formed when the Purcell Lobe terminated near the basin of Pend Oreille Lake, thus crowding the valley of the Clark Fork River and impounding water in the Clark Fork Valley to a maximum El. 4150 feet, which is approximately 1,750 deep at the Project (Pardee 1942). The ice dam was breached catastrophically and was reestablished tens of times in the Late Pleistocene (12.6-130 thousand years ago) (Baker 1981).

Quaternary mapping of the Project area was conducted by Pardee in 1942. His mapping suggested that following the breach of the ice dam(s) the flood waters of Glacial Lake Missoula likely took days, possibly a week to recede from the Project area. The flood waters were estimated to be as high as 1000 feet above the valley floor within Eddy Narrows at the east end of the Project and cover the entire width of the Clark Fork Valley in which Thompson Falls resides. These enormous flood events command stream powers not demonstrated in modern times. Within the east end of the Project the velocities were high enough to presumably strip any remnant Glacial Lake Missoula fine grained slack water deposits leaving a thin cover of alluvium that ranges from gravel and sand to large boulder sized clasts. Where the flood waters emptied to the Clark River Valley of Thompson Falls, the energy dissipated but was generally swift, also likely striping away any Glacial Lake Missoula slack water deposits and blanketing the floor with stratified sand, gravel, and boulder deposits (Pardee 1942).

Following these epic flooding events in the Late Pleistocene there have been a series of river terraces (straths) cut into the older Missoula Flood deposits. The stepwise downcutting during late Pleistocene and recent times has produced four major erosional terrace levels with numerous small intermediate levels (MPC 1982). Alden (1953) identified two Latest Pleistocene (12.6-16 thousand years ago) age terraces. Two additional lower level terraces mapped by Geo West (1981) were inferred to be recent (Holocene) in age. Much of the development adjacent to the Project reservoir resides on these younger alluvial deposits that are cored at depth by the older coarse-grained flood deposits. In places such as at the dam site and near Steamboat Island 1.3 miles upstream of the dam, bedrock crops out above the alluvium. However, a water well at the Thompson River Lumber (located just west of the confluence of the Thompson River and the Clark Fork River) penetrated 432 feet of alluvium before encountering bedrock (MPC 1989). This demonstrates the considerable variability in alluvial depth throughout the Project area.

Quaternary geomorphic mapping specific to the Project was conducted by Geo West (1981). GeoWest mapped a series of units along the Project defined as "land facets." The land facets are divided based on the geomorphic characteristics (fluvial terrace, alluvial fans, etc.), topographic position, as well as the material properties of the land facet verified through test pitting (**Figure 5-5**). The younger terraces, channels, and point bars often have a veneer of sand that is typically thin (<1-foot) but reaches thicknesses of 7 to 10 feet locally (MPC 1982). These finer grained sediments indicate a relative lower energy depositional environment compared to the Pleistocene age higher energy sediments. The Agricultural cultivation activity is confined to the sandy depositional terraces. The soils are classified as sandy loams.

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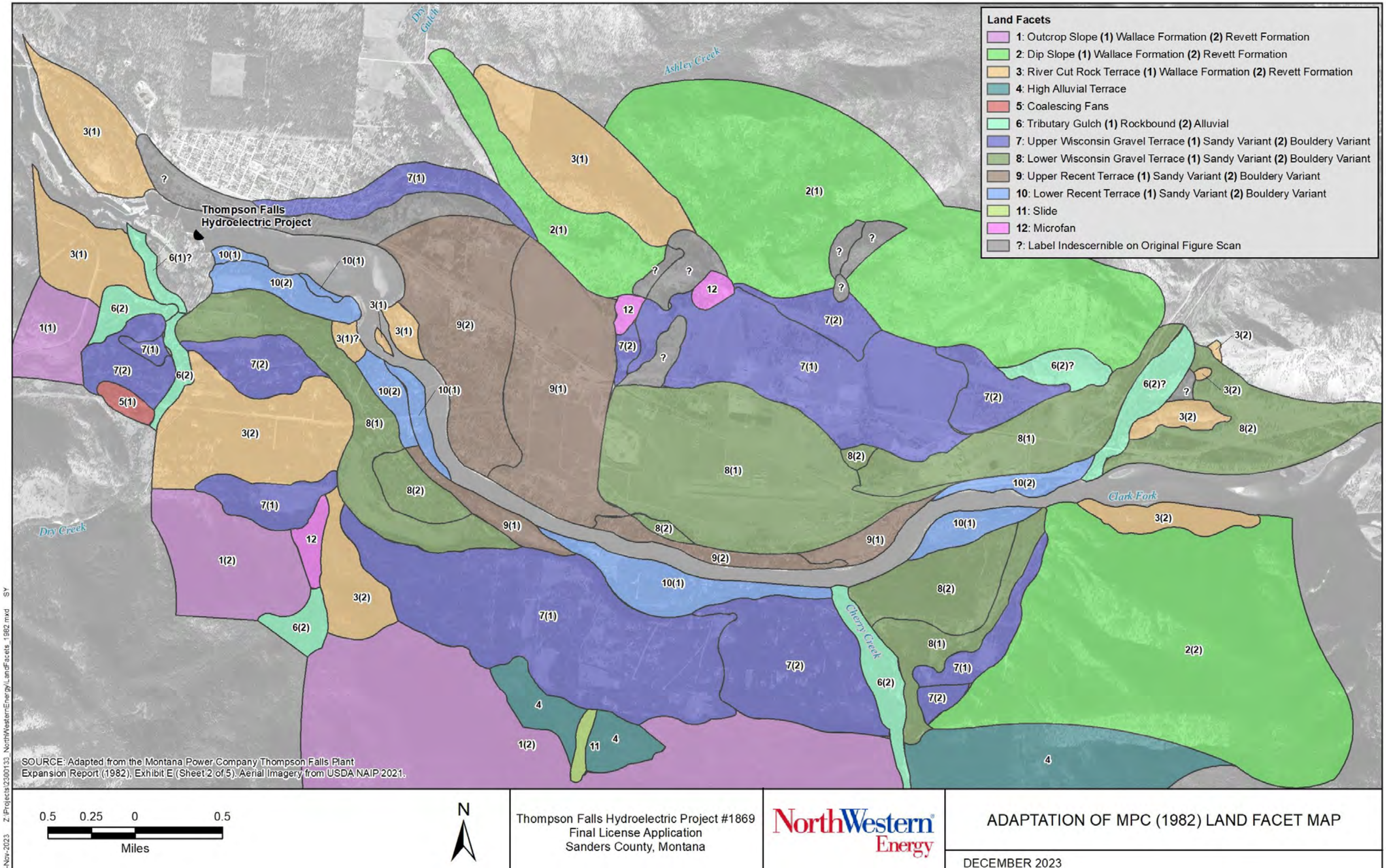
Figure 5-5: Land facet map, Thompson Falls, Montana.



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5.1.8 Mineral Resources

The Wallace Formation at the Project does not have significant mineralization potential (MPC 1990).

5.2 Affected Environment – Topography

The topography in Sanders County, Montana consists of rugged mountain ranges, and broad intervening drainages that provide substantial local relief. The Cabinet and Salish mountains, and Bitterroot Range occupy the northern and southern parts of the county, respectively. These two mountain regimes are separated by the northwest flowing Clark Fork River.

5.3 Affected Environment – Soils

This section characterizes soils within and near the Project. The term, "soil" when used in this section refers to the upper topsoil.

5.3.1 Soil Type and Occurrence

Soil types found within the Project are shown in **Figure 5-6**. Horseplains fine sandy loam are the most common soils found within the Project. This type of soil is found upstream of the confluence with Thompson River as islands within the Thompson Falls Reservoir. Generally, the soil types in the Project are sandy-skeletal and loamy-skeletal which are moderately to well drained. The soils, where they occur, are usually less than 0.5-foot-thick (MPC 1982).

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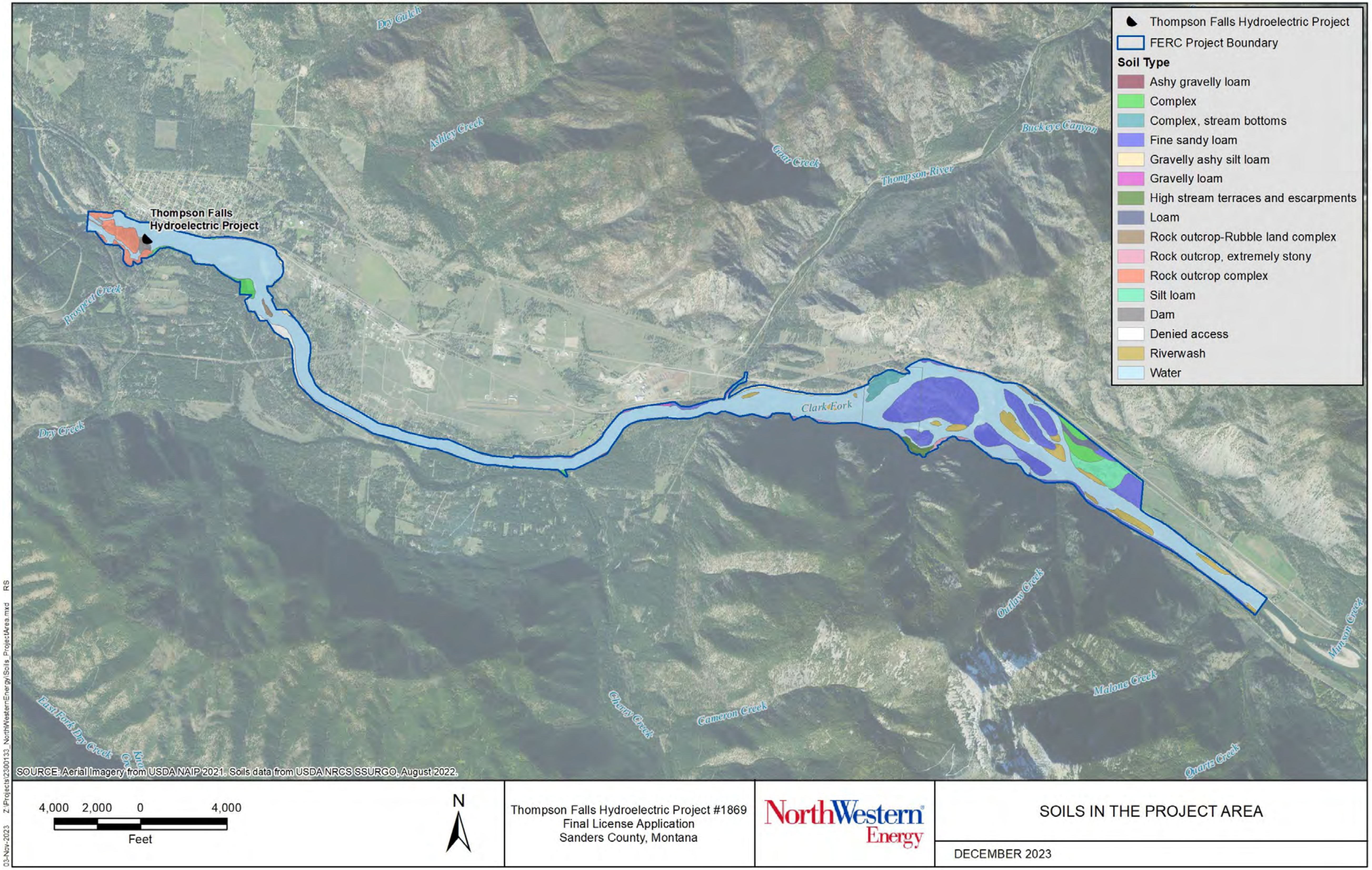
Figure 5-6: Soils in the Project Area.



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5.3.2 Physical and Chemical Characteristics

The soils near the Project are of the Mollisol order of soils (MPC 1982). As described by MPC (1982), due to the shallow soil depths found at many of the sites investigated, much of this area is not suitable for crop production. There were a few cultivated sites investigated, but most were capable of sustaining range grasses only, and several of those would require limited grazing.

Using the Natural Resources Conservation Service's system of land classification, most of the classifications were represented in this investigation (MPC 1982). The extremes vary from Class II to Class VIII, based upon a scale of I (good crop production) to VIII (limited use due to severe limitations).

5.3.3 Erodibility

Previous characterizations of the Project by Geo West (1981), MPC (1982, 1989) found that in general the soils typically are a thin veneer overlying coarse grained alluvium parent material. The thin nature of the topsoil does not present a geohazard due to its limited volume. Moreover, the coarse-grained soils that are found at depth typically resist erosion. Recent operations testing performed in October 2019 found that the historical reservoir infill sediment is susceptible to localized slumping. However, visual observation by NorthWestern staff during the 2019 drawdown observed that the slumping appears surficial and does not typically extend into native alluvium that the reservoir infill sediment is overlying. High spring flows are the largest contributing source of erosion within the Project boundary. Spring flows can be more than 100,000 cfs of inflow to the Project.

5.3.4 Existing Soil Instability

Shallow raveling and minor slumps typically occur in finer grained soil types (i.e., sandy deposits or 'Sandy Variant' [MPC 1982]). These finer grained deposits are less resistant to being undercut by wave action that results from dominant wind patterns and increased fetch distances, whereas the more bouldery and gravelly dominated deposits are more resistant to erosion and maintain a steeper angle of repose. In 1982, MPC reported that two terraces along the southern shoreline of the Thompson Falls Reservoir had experienced relatively more erosion than elsewhere within the reservoir. These two surfaces are referred to as, "Land Facet 10(1): Lower Recent Terrace, Sandy Variant" and "Land Facet 8(2): Lower Wisconsin Terrace, Bouldery Variant" (*refer to* Figure 5-5). They noted erosion to the boulder variant was anomalous and attributed it to increased fetch distances. The exact locations described by MPC (1982) are not certain. More recently, NorthWestern staff has observed minor bank erosion along the south side of the reservoir. It is not clear if these are the same locations observed by MPC. Stabilization measures that NorthWestern promotes for these relatively shallow slope failures include bioengineered stabilization measures. This approach entails strategic planting of native vegetation to stabilize slopes with deep-binding root structure to create a stable and resilient bank capable of withstanding wave action and other localized forces that may cause erosion (NorthWestern 2020).

The second type of slope instabilities observed are related to deep drawdowns that are necessary to facilitate spillway repairs and after large, infrequent flooding events. A deep drawdown in 2018 was noted to result in several smaller, shallow, slumps below the normal full pool level in what appeared to be fine-grained recent reservoir infilling. These slumps did not impact the reservoir rim stability. However, in two locations additional movements occurred that encroach outboard from the reservoir rim, notably upstream of the original powerhouse, near Power Park.

5.4 Environmental Measures

5.4.1 Existing Environmental Measures

NorthWestern maintains Shoreline Standards: *Standards for the Design, Construction, Maintenance, and Operation of Shoreline Facilities on NorthWestern Hydroelectric Projects* (Standards) (NorthWestern 2020). The Standards, together with FERC's Standard Land Use Article, serve to guide the design and construction of shoreline facilities, shoreline bank stabilization projects, as well as management of shoreline facilities. The purpose of the Standards is to provide general direction such that shoreline facilities are designed, constructed, maintained, and operated in a safe, and environmentally friendly manner to protect and/or enhance adjacent recreation and natural aesthetic resources.

Since the 2018 drawdown, two new 18 feet high radial gates have been installed on the Main Channel Dam Spillway. These gates provide a discharge capacity of 20,000 cfs (10,000 cfs each). The addition of the gates adds substantial reservoir operational control by reducing the frequency of tripping stanchions to pass high flows, resulting in less frequent deep drawdowns of the reservoir.

5.4.2 Proposed Environmental Measures

Within 2 years of the new License, the Licensee, will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The Plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, SHPO, and USFS.

Development of the Drawdown Management Plan will involve work internally and with consultants to review the data collected during previous drawdowns in order to develop appropriate drawdown rates, monitoring plans, and emergency response protocols. The monitoring measures in the Drawdown Management Plan are likely to include visual monitoring during the drawdown, installation and monitoring of temporary arrays of monitoring pins during the drawdown, and monitoring of slope stability by boat. The Drawdown Management Plan will include specific measures to be implemented at different elevations, with more intensive monitoring at elevations that are more likely to result in slope instability.

5.5 Environmental Effects

5.5.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

5.5.1.1 Slope Movement – Routine Operations

Under the current license, reservoir water level fluctuations to 4 feet below full pool could occur periodically. NorthWestern identified two potential adverse impact from this fluctuation in the pool level: 1) relatively larger slope failures that extend into the older native alluvium (reservoir rim stability), and 2) localized shoreline erosion and slumping of post Project reservoir sediment infill.

To evaluate the potential impacts of these slope hazards, a drawdown operations test was conducted in October 2019. The test included maximum generation and the associated drafting the reservoir level the full 4 feet as authorized by the current license, then raising the level in 1 foot-increments. To evaluate localized shoreline erosion during the drawdown test NorthWestern staff patrolled the reservoir by boat to observe and document the degree to which localized shoreline erosion was occurring. Generally, the visual observations noted that historical reservoir sediment infill, and some limited areas of fine-grained alluvium that is less compact, experienced some surficial slumping. Transects monitored at several locations detected no measurable ground movement during the 4-foot drawdown.

5.5.1.2 Slope Movement – Deep Drawdowns

Deeper drawdowns (down to crest elevation) have resulted in slumps which, in two locations, encroached outboard from the reservoir rim. During the 2018 deep drawdown, NorthWestern acquired Unmanned Aerial Vehicle imagery for the Project. The data included a high resolution georectified aerial image, and a structure-from-motion (photogrammetric) derived point cloud data set and associated digital elevation model.

The 2018 deep drawdown resulted in several smaller, shallow, slumps below the normal full pool level in what appeared to be fine-grained recent reservoir infilling. These slumps do not impact the reservoir rim stability. However, in two locations additional movements occurred that encroach outboard from the reservoir rim, notably upstream of the original powerhouse, near Power Park. At these two locations, erosion outside of the Project boundary was not observed.

To evaluate reservoir drawdown induced movement of relatively larger slope failures, specific areas that were judged to be the most susceptible to movement were monitored in detail during a planned deep drawdown in October 2023. The monitoring included a series of transects through slide observation areas. Slope movement was observed that encroached outboard of the reservoir rim. NorthWestern is conducting further research into these sites (planned for 2024) and will implement control measures if needed as a matter of Project maintenance.

To the extent that larger slope movements are associated with deeper drawdowns, they will occur less frequently than in the past, as a result of the installation of new radial gates on the Main Channel Dam.

As described in **Exhibit E - Section 2.1.3.2 – Maintenance Activities Requiring Lower Reservoir Levels – No Action Alternative**, these deep drawdowns are necessary, on occasion, for Project operations and maintenance, and would occur under both the no action and the proposed action alternatives.

5.5.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations.

Proposed modifications to the Project boundary incorporate the lands and water that are needed for Project purposes. The proposed modification will have no impact on geological resources.

5.5.2.1 Slope Movement – Routine Operations

In 2021 and 2022, NorthWestern conducted a study of shoreline stability under flexible generation within a 2.5-foot range of full pool (NorthWestern 2023). Similar observations that were made during the 4-foot drawdown were also observed during the 2.5-foot drawdown. The most commonly observed shoreline erosion was sloughing of the recent reservoir sediment infill. The fluctuating water levels due to Project operations did not appear to appreciably change the amount, type, or cause of erosion.

In addition to the sloughing of the recent reservoir sediment, there were some locations of shoreline erosion at areas that are use-based impacts such as human or wildlife footpaths, or natural events such as spring runoff, runoff in response to rain events, or wind-toppled trees. Much of the reservoir bed near the shoreline is armored with rock, cobble, gravel, woody material and/or aquatic vegetation. Thus, lowering the reservoir results in the water's energy being exerted on these armored areas which are generally stable and resistant to erosion.

5.5.2.2 Slope Movement – Deep Drawdowns

Deeper drawdowns (down to crest elevation) have resulted in slumps which, in two locations, encroached outboard from the reservoir rim. NorthWestern is conducting further research into these sites (planned for 2024) and will implement control measures if needed as a matter of Project maintenance. The Drawdown Management Plan, which will be prepared prior to planned deep drawdowns, will include measures to reduce environmental effects of these drawdowns. As described in **Exhibit E - Section 2.1.3.2 – Maintenance Activities Requiring Lower Reservoir Levels – No Action Alternative,** these deep drawdowns are necessary, on occasion, for Project operations and maintenance, and would occur under both the no action and the proposed action alternatives.

5.6 Unavoidable Adverse Impacts

Raveling and minor localized slumps in finer grained reservoir soils are likely to occur during flexible generation. Particularly, the young reservoir infill sediment that has little compaction and intrinsic strength will be subject to localized mobilization.

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6. Water Quantity and Quality

6.1 Affected Environment – Water Resources

Section 6.1 describes and characterizes the water resources and water quality of the Project. For a description of the entire river basin, *refer to* **Exhibit E - Section 4.0 – General Description of River Basin**.

6.1.1 Major Land and Water Use in Project Area

The Project boundary (*refer to* Figure 4-1) encompasses about 2,001 acres, which is about 0.01 percent of the river basin. The Project is 1,226 acres of reservoir and 775 acres of non-reservoir. Of the 775 acres that are non-reservoir, about 17 acres are associated with recreational land uses, and the remaining 758 acres are associated with non-recreational land use. The acreage includes 40 acres owned in fee by NorthWestern, 103.8 acres of federal lands managed by the USFS, and the rest of the acres are various public and private owners.

A more detailed description of these land uses is in **Exhibit E – Section 13 – Land Use**.

6.1.2 Dams and Diversion Structures in the Clark Fork River Basin

Upstream of the Project is the SKQ Project (formerly known as Kerr Dam, FERC Project P-5), located on the Flathead River, approximately 100 miles upstream (*refer to* Figure 4-1). The Flathead River is a tributary to the Clark Fork River. The CSKT are owners and its wholly owned, federally chartered corporation, Energy Keepers, Inc. is operator of the SKQ Project. The only other major dam in the watershed upstream of the Thompson Falls Project is Hungry Horse Dam on the South Fork of the Flathead River, managed by the U.S. Bureau of Reclamation (*refer to* Figure 4-1).

Downstream of the Project, is Avista's Clark Fork River Project (P-2058), including Noxon Rapids Dam and Cabinet Gorge Dam.

6.1.3 Potentially Affected Tributary Rivers and Streams

The primary tributaries of the Clark Fork River within the Project area are the Thompson River and Cherry and Prospect creeks. Prospect Creek originates in the mountain range separating Idaho and Montana and flows eastward into the Clark Fork River downstream of the Main Channel Dam. The Thompson River flows into the Clark Fork River approximately 6 miles upstream of the dam. Cherry Creek flows northward and enters Thompson Falls Reservoir approximately 4 miles upstream of the dam. Other streams in the Project area are ephemeral drainages which flow subsurface when they reach the valley alluvium. No artesian conditions are known to occur within the Project area.

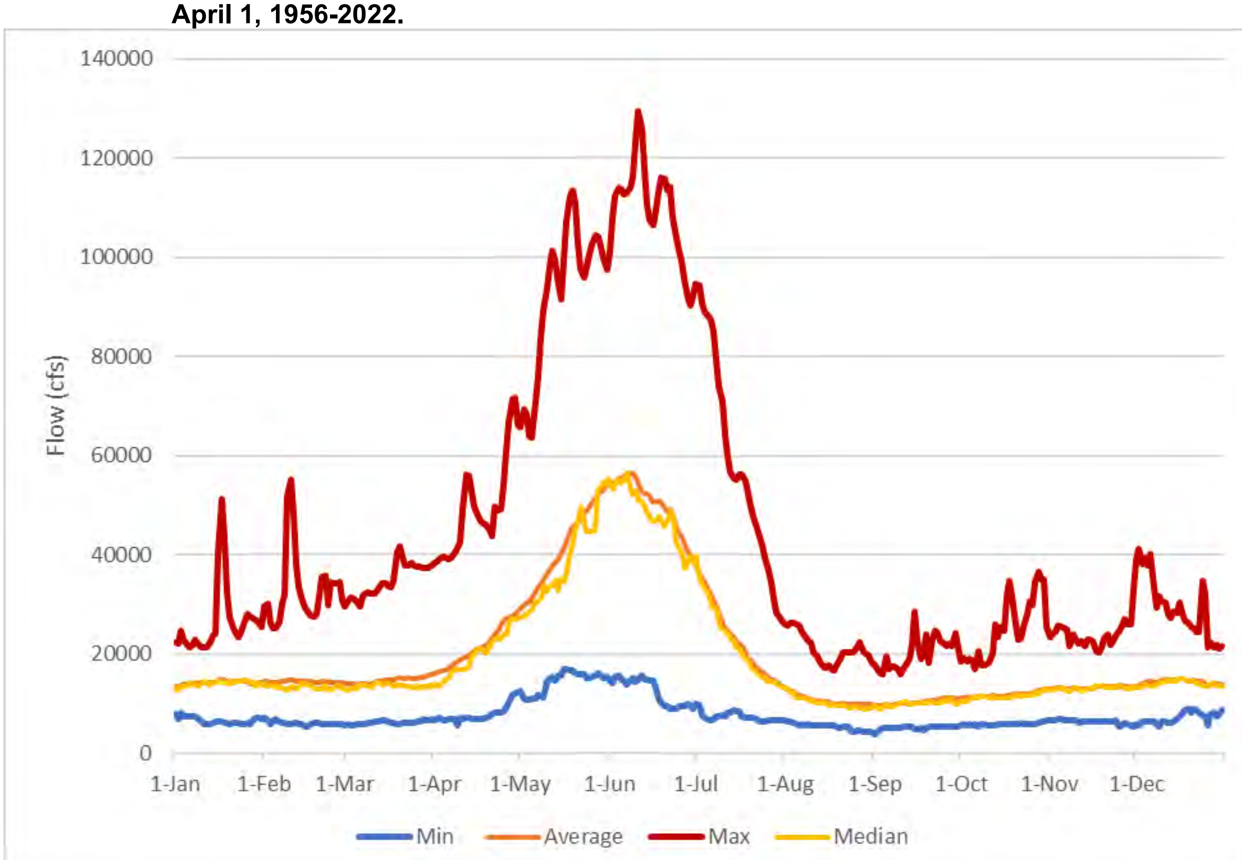
6.2 Affected Environment - Clark Fork River Flow

6.2.1 Adjusted Minimum, Mean, and Maximum Recorded Flows

The Clark Fork River is gaged near Plains, MT approximately 30 miles upstream of the Project. There is only one tributary with appreciable flow between the Plains gage station and the Project, the Thompson River. The Thompson River contributes on average 2.0 percent of the flow in the Clark Fork River with a range of 0.7 percent up to 5.4 percent. The USGS also maintains a gage on the Thompson River. Flow statistics were derived by combining USGS gages on Clark Fork River at Plains, Montana (USGS gage 12389000) with Thompson River near Thompson Falls (USGS gage 12389500), to calculate streamflow in Clark Fork River at the Project (**Figure 6-1**).

Mean daily streamflow data was recorded at the USGS gage on the Clark Fork River at Plains from October 1, 1910, to present. The Thompson River near Thompson Falls flow data was recorded from March 1 to September 29, 1911, and from April 1, 1956, to present. To ensure that the hydrograph is representative of current conditions, Figure 6-1 represents the minimum, maximum, median, and mean daily flows from April 1, 1956 to 2022. This period of record allows complete datasets for both USGS gages (Clark Fork River at Plains and Thompson River near Thompson Falls) to be analyzed and provides representative data of upstream flows since the construction of upstream dams on the Flathead River.

Figure 6-1: Daily minimum, maximum, median, and mean streamflow at Thompson Falls Project, April 1, 1956-2022.



Source: USGS, Gage Stations 12389000 and 12389500

The ascending limb of the hydrograph begins between mid- and late March, peaks between late May and mid-June, and descends to base flow levels around mid-August (*refer to* Figure 6-1).

A summary of the minimum, maximum, and mean daily streamflow from the Clark Fork River at Plains and Thompson River near Thompson Falls gages combined for the most recent 5-year period (2018-2022) appears in **Table 6-1**. Minimum daily streamflow showed little variation, while both mean and maximum daily streamflow showed substantial variation. Mean daily flows were greater in 2018 and 2022 compared to the long-term average.

Mean daily streamflow in recent years ranged from 16,481 cfs (2021) to 25,467 cfs (2018) and maximum daily streamflow ranged from 59,229 cfs (2021) to 104,475 cfs (2018).

Table 6-1: Summary of estimated minimum, mean, median, and maximum daily mean streamflow at Thompson Falls Project for Water Years[13] 2018, 2019, 2020, 2021, and 2022 and from historic 67-year data (1956-2022).

Water Year	Minimum Daily Streamflow (cfs)	Mean Daily Streamflow (cfs)	Median Daily Streamflow	Maximum Daily Streamflow (cfs)
2018	7,895	25,467	16,182	104,475
2019	6,925	16,910	12,088	69,169
2020	7,577	19,712	12,039	79,778
2021	7,164	16,481	12,785	59,229
2022	6,685	20,880	15,662	84,312
1956-2022	**3,806** (1958)	**20,067**	**14,426**	**129,510** (1964)

Notes: cfs = cubic feet per second; Year of streamflow record in parentheses.
Source: USGS, Gage Stations (12389000 and 12389500).

The maximum daily streamflow for the period of record was 129,510 cfs on June 11, 1964, and the minimum daily streamflow for the period of record was 3,806 cfs on September 1, 1958. The average daily streamflow from 1956 to present was calculated from the combined streamflow data of the two recorded USGS gage data to be 20,067 cfs. September has the lowest mean and median daily flows, and June has the highest (**Table 6-2**).

[13] A Water Year is defined as October 1 – September 30.

Table 6-2: Summary of estimated minimum, maximum, and mean daily mean streamflow by month, 1956-2022.

Month	Minimum Daily Streamflow (cfs)	Median Daily Streamflow (cfs)	Mean Daily Streamflow (cfs)	Maximum Daily Streamflow (cfs)
January	5,688	14,108	14,154	51,130
February	5,216	13,285	14,328	55,170
March	5,607	13,515	14,599	41,780
April	5,435	19,595	21,605	71,650
May	10,632	37,010	41,996	113,450
June	8,771	47,838	50,633	129,510
July	6,257	19,643	23,118	94,590
August	4,141	10,112	10,592	26,301
September	3,806	9,859	10,276	28,534
October	5,179	11,386	11,735	36,439
November	5,295	13,083	13,222	32,980
December	5,295	14,001	14,379	41,140
1956-2022	**3,806** (1958)	**14,427**	**20,067**	**129,510** (1964)

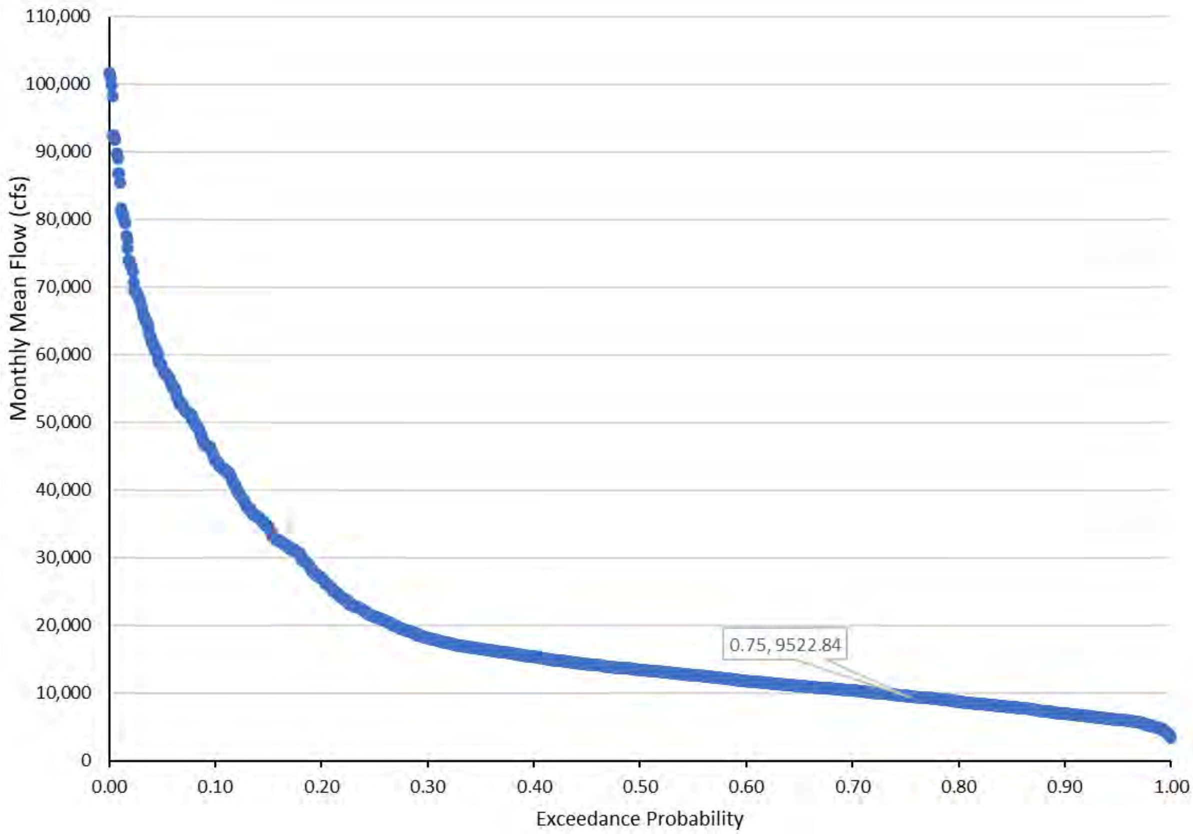
6.2.2 Monthly Flow Duration Curve

The monthly flow duration curve data[14] is from USGS gages on Clark Fork River at Plains, Montana (USGS gage 12389000) and Thompson River near Thompson Falls (USGS gage 12389500) combined (**Figure 6-2**).

The total capacity of the two powerhouses at Thompson Falls is approximately 23,320 cfs. River flow in excess of this amount is routed over the spillways. Typically, spill begins in late April, peaks in early June, and ends in mid-July. Approximately 80 cfs is passed downstream of the Main Channel Dam Spillway during the fish passage season (March – October) to enhance operation of the fish passage facility and fish attraction flow. The minimum flow for the plant for power generation is 6,000 cfs or inflows to the plant, whichever is less. The typical operational range of the plant for power generation is 6,000 to 23,320 cfs.

[14] The flow-duration curve is a cumulative frequency curve that shows the percent of time specified discharges were equaled or exceeded during a given period. It combines in one curve the flow characteristics of a stream throughout the range of discharge, without regard to the sequence of occurrence. These curves are often used to predict the distribution of future flows.

Figure 6-2: Monthly flow duration curve of the Clark Fork River at Thompson Falls Project from October 1911 – February 2023.



Source: USGS, Sum of Flow at Gage Stations 12389000 and 12389500, 2023

6.3 Affected Environment - Existing and Proposed Water Uses and Upstream and Downstream Requirements

The largest consumptive water use in the Clark Fork River basin is for irrigation, which accounts for about 93 percent of all diversions. The other 7 percent is a combination of public water supply, domestic, stock water use, and industrial. The largest consumption of water occurs in the agricultural areas of the Mission (Lower Flathead), Bitterroot, Upper Clark Fork, and Blackfoot valleys, upstream of the Project area (*refer to* Figure 4-1) (DNRC 2014).

Water use in the Clark Fork watershed upstream of Noxon, Montana indicates that 1,651,784 acre-feet of water is diverted to service the estimated 456,455 acres of irrigation. Only a portion of the water diverted for irrigation uses is consumed. The volume of water diverted from groundwater and surface water to meet the irrigation demands of crops is typically three times the actual volume of water consumed by the crop. This is due to conveyance losses, efficiencies of the irrigation method, and irrecoverable losses. Ultimately, a significant portion of diverted water is returned to the source *via* surface flows or groundwater. The timing of when the water is returned can vary greatly depending on location and local hydrogeologic conditions. On average during the irrigation season in the Clark Fork basin, 5 percent (448,685 acre-feet) of water is diverted and consumed, 13 percent (1,203,099 acre-feet) is diverted and not consumed, and 80 percent (7,079,909 acre-feet) is not diverted. Reservoir evaporation is 2 percent of water use (155,000 acre-feet) (DNRC 2014).

Hydropower generation and instream flow rights for fisheries are the primary non-consumptive water uses in the Clark Fork Basin. The largest water storage projects in the basin are for flood control and hydropower and include Hungry Horse, SKQ (upstream of the Project) and Noxon Rapids and Cabinet Gorge Dams (downstream of the Project) (DNRC 2014).

Instream flow water rights, temporary leases and storage contracts are used in the Clark Fork Basin for the purpose of fish and wildlife. FWP is the largest holder of water rights, leases, and contracts for environmental uses. Conservation groups and private citizens also hold water rights, leases, and contracts for environmental uses (DNRC 2014).

Downstream of Thompson Falls, hydropower is the primary water use in the lower Clark Fork River.

6.4 Affected Environment - Existing Instream Flow Uses and Water Rights

NorthWestern holds eight water right claims from the Clark Fork River for power generation, totaling 30,967 cfs. Additionally, NorthWestern holds one water right claim for domestic use at the Project.

6.5 Affected Environment - Reservoir

The current Project boundary encompasses about 12 miles of river and reservoir which is 400 to 1,800 feet wide. Active storage capacity of the reservoir is approximately 15,000 acre-feet and the total storage is approximately 20,400 acre-feet. At the normal maximum reservoir level El. 2,396.5, the reservoir surface area is approximately 1,226 acres, not including the islands. The maximum depth of the reservoir is approximately 90 feet. Bathymetric maps of the reservoir are found in **Figures 6-3** through **6-8**.

Figure 6-3: Bathymetric Map Thompson Falls Reservoir Sheet 1 of 6

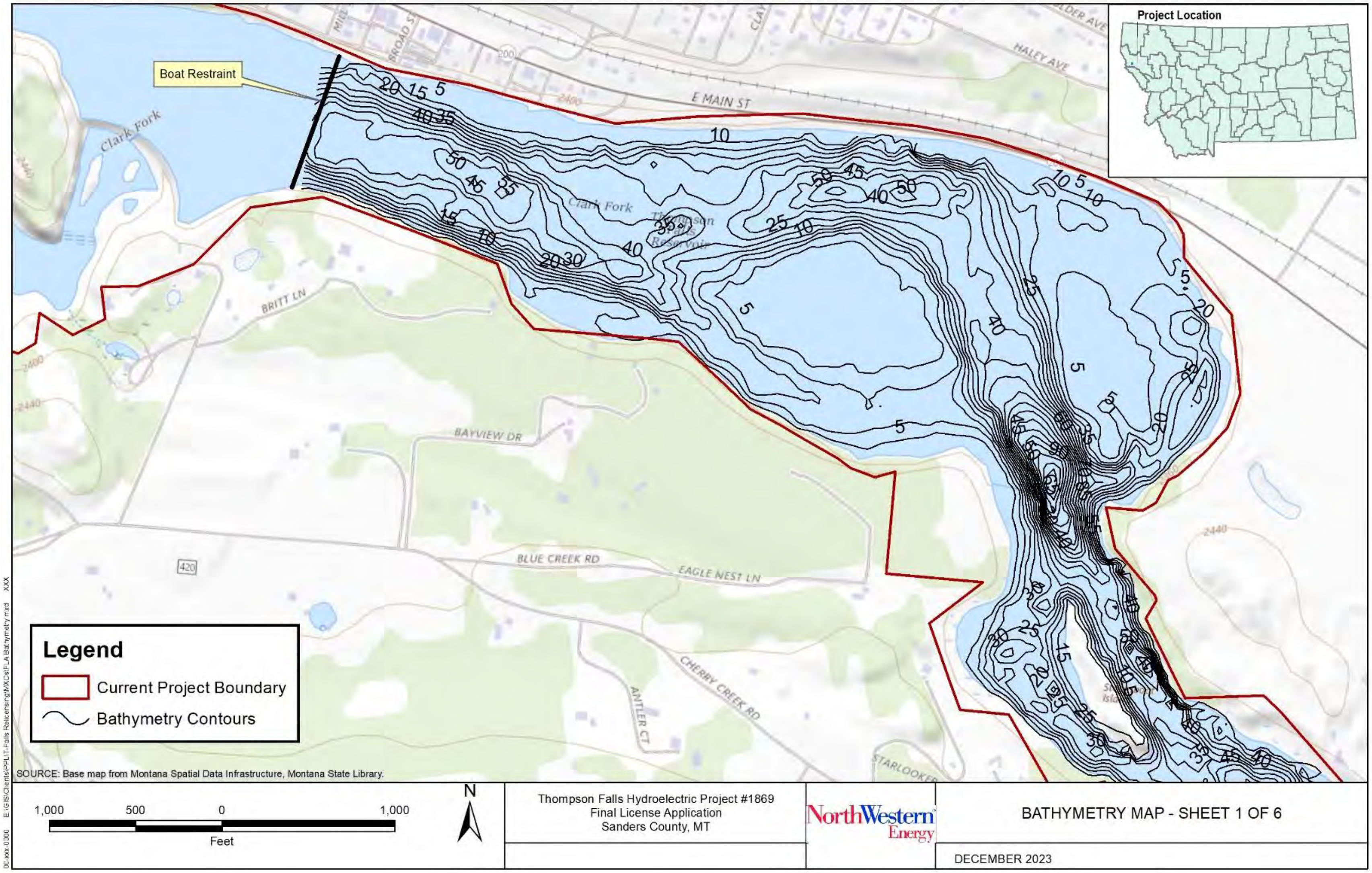


Figure 6-4: Bathymetric Map Thompson Falls Reservoir Sheet 2 of 6

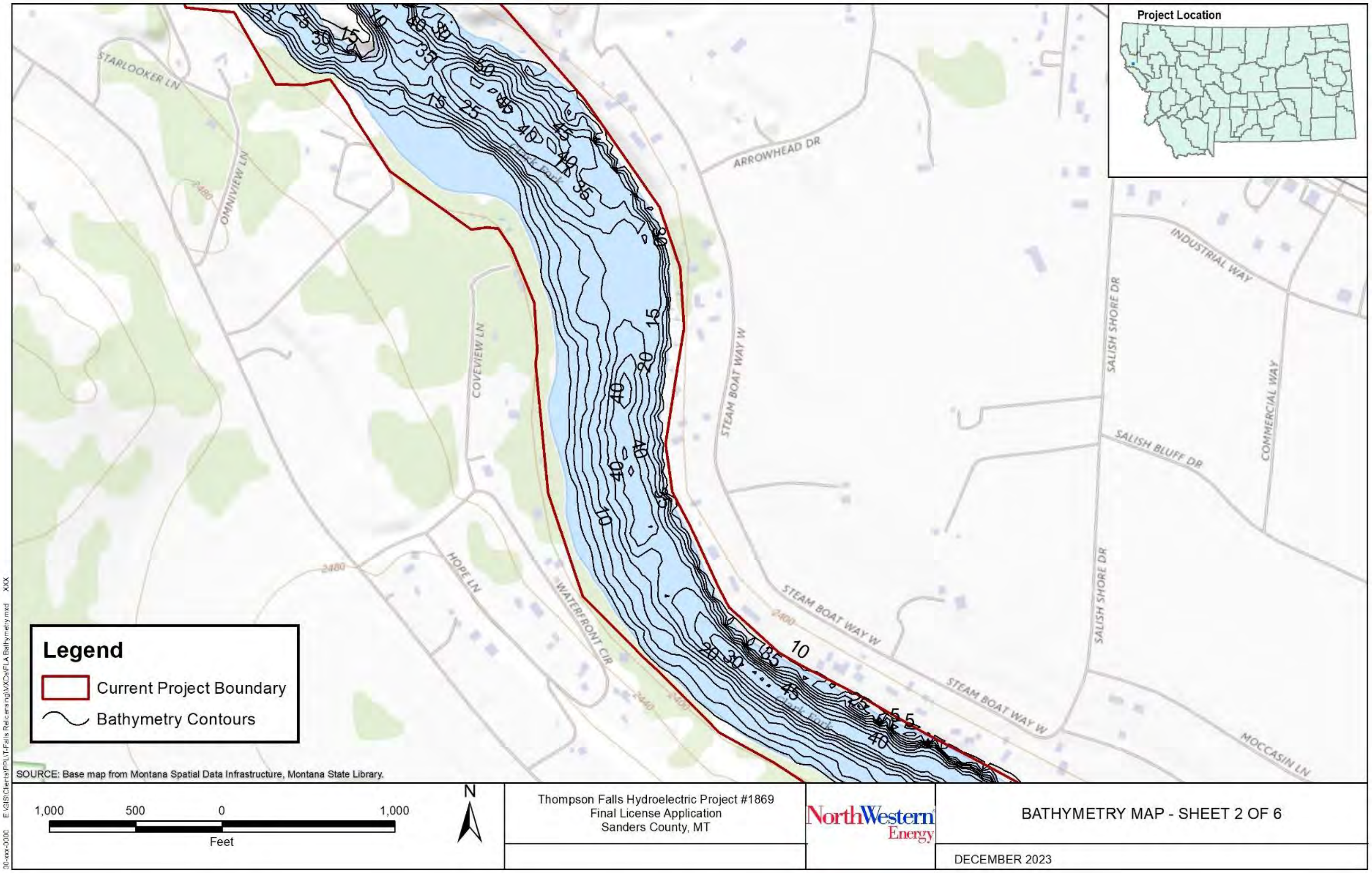


Figure 6-5: Bathymetric Map Thompson Falls Reservoir Sheet 3 of 6

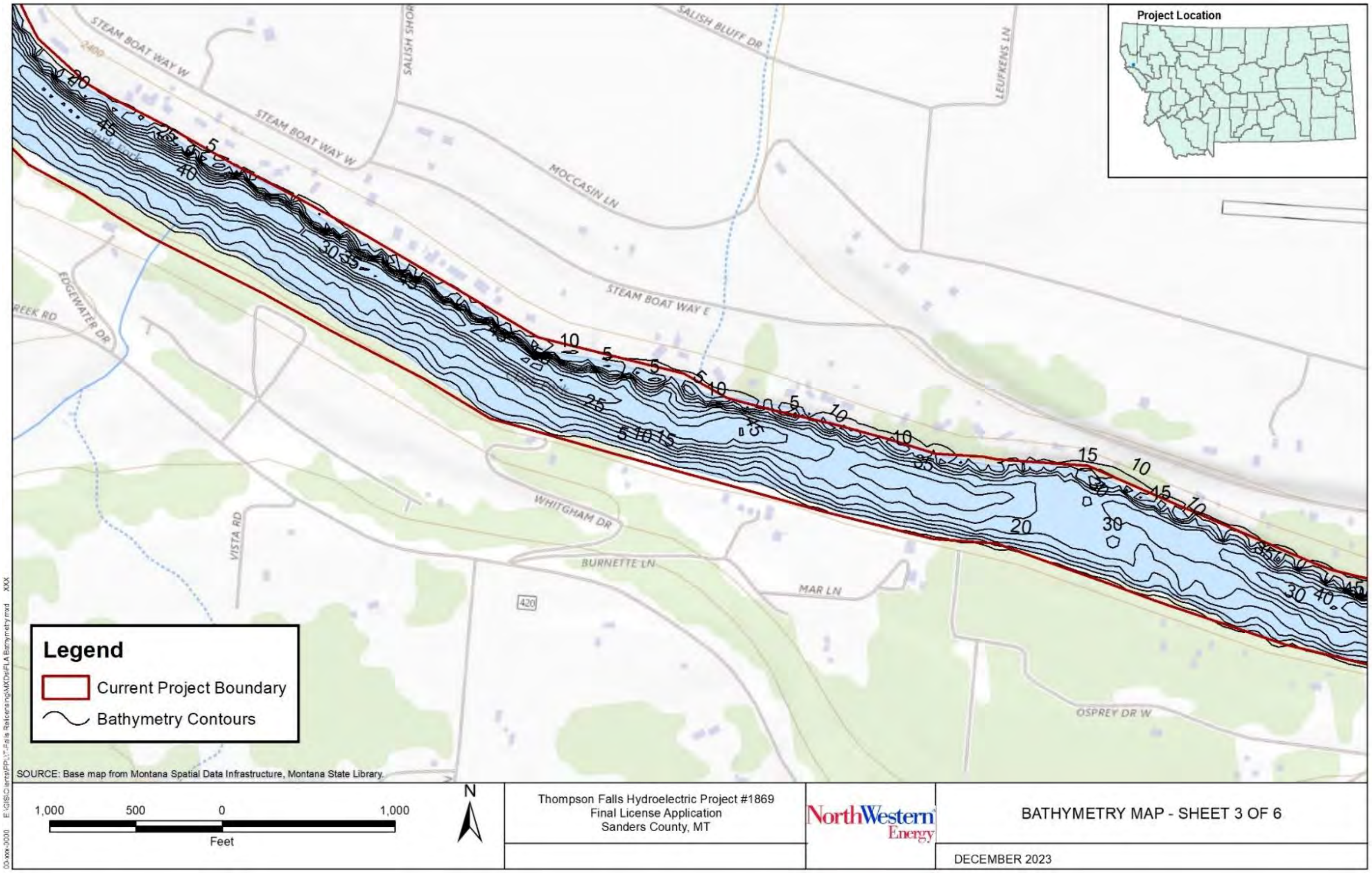


Figure 6-6: Bathymetric Map Thompson Falls Reservoir Sheet 4 of 6

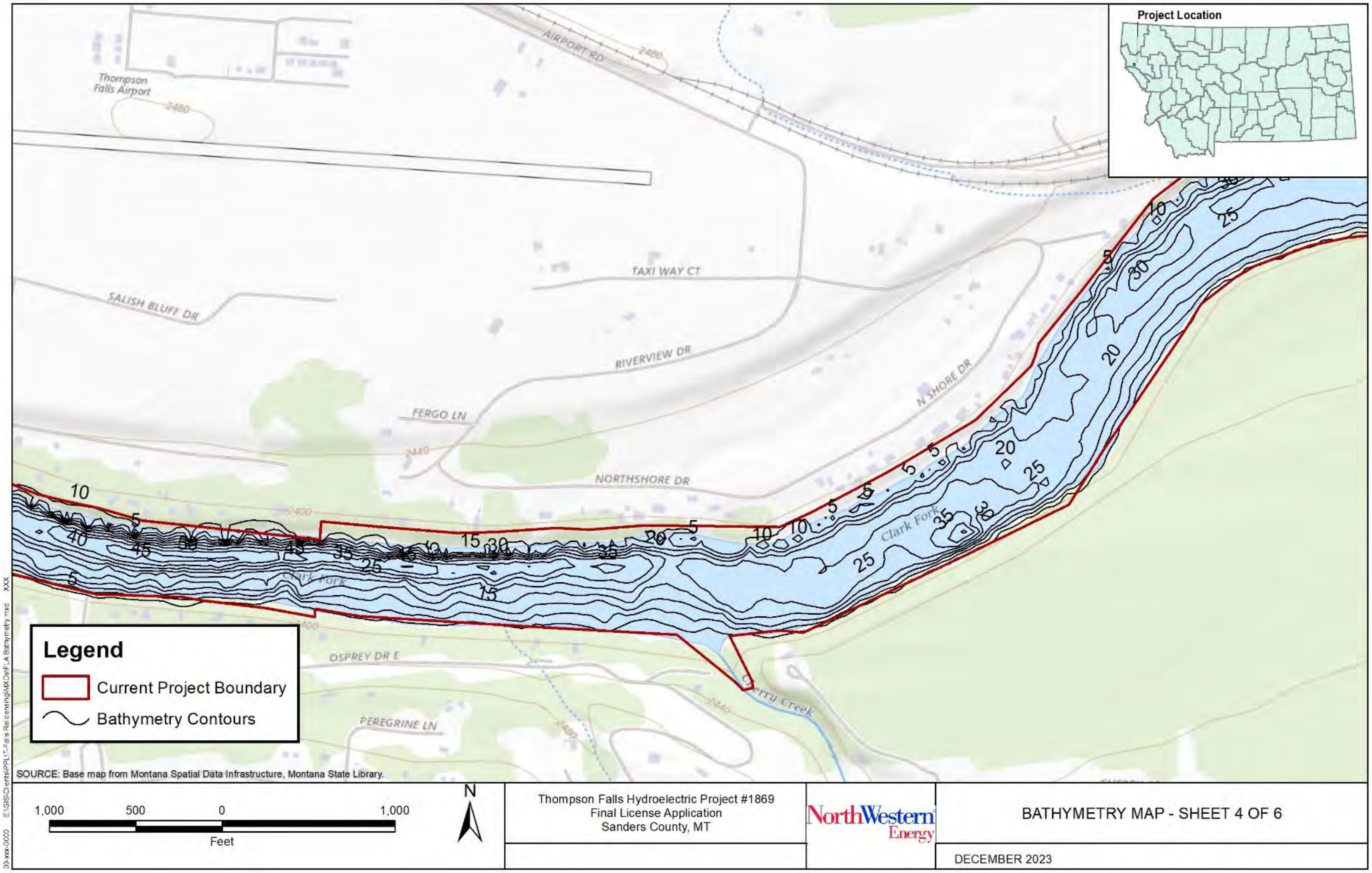


Figure 6-7: Bathymetric Map Thompson Falls Reservoir Sheet 5 of 6

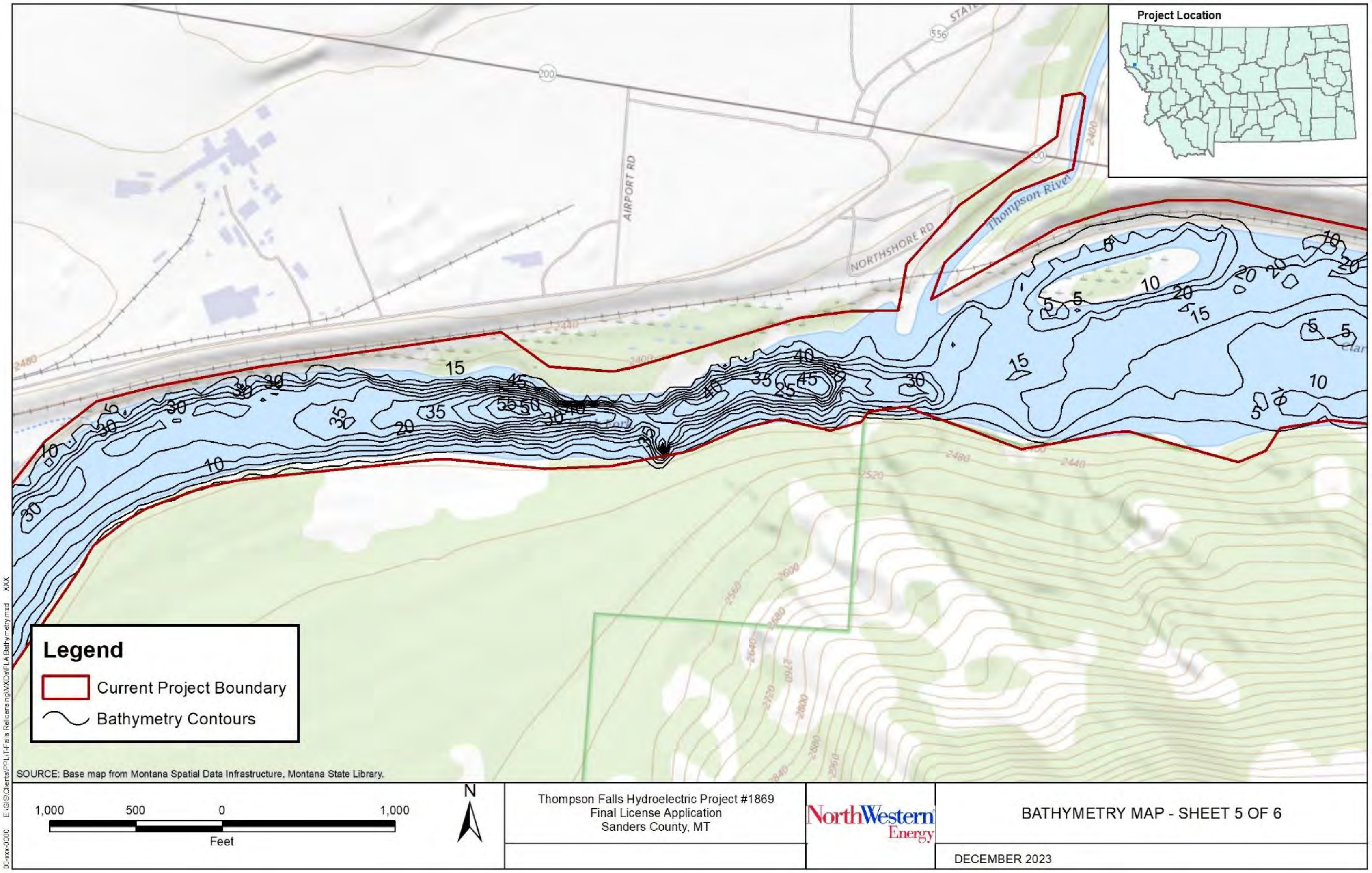
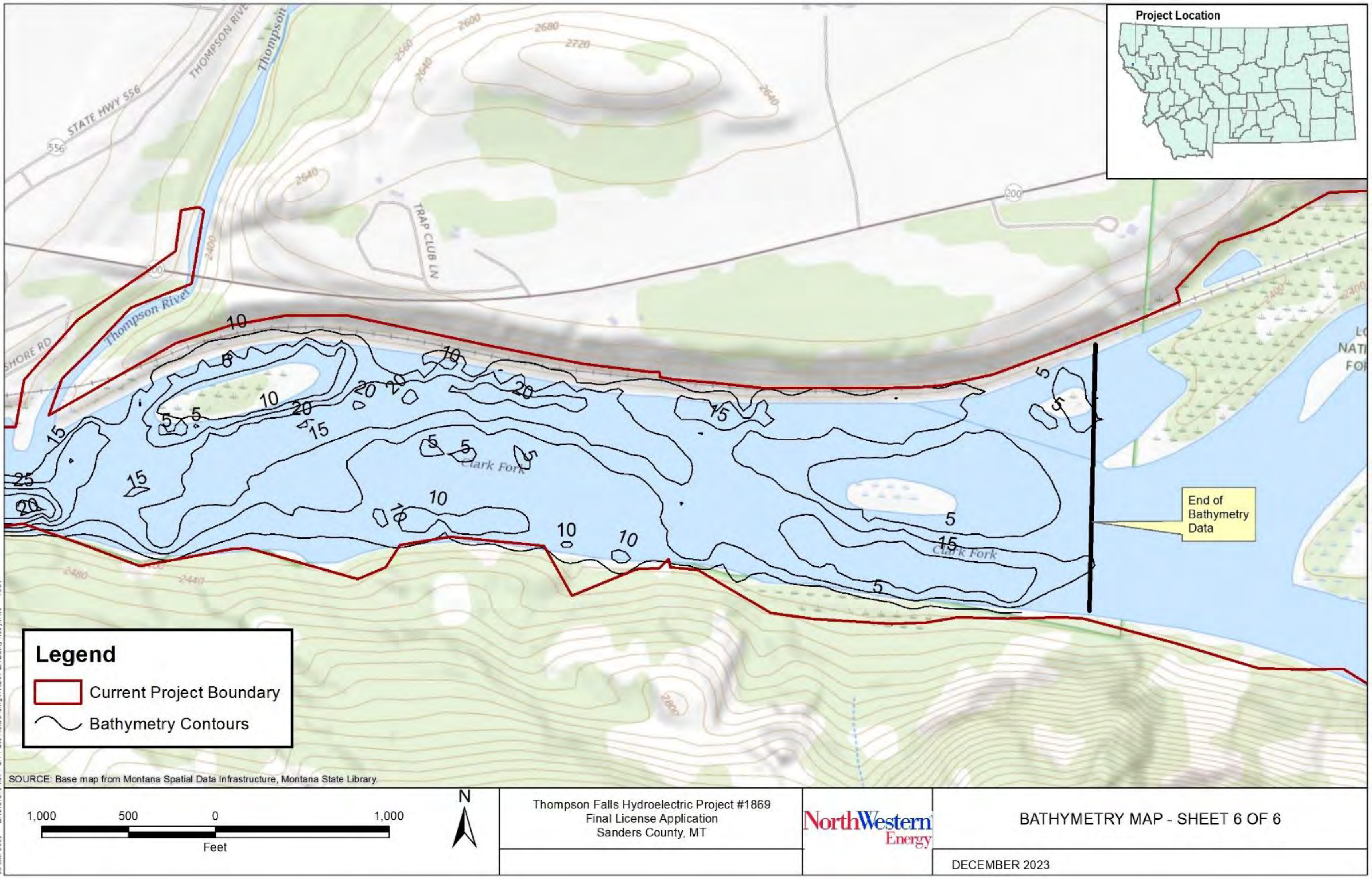
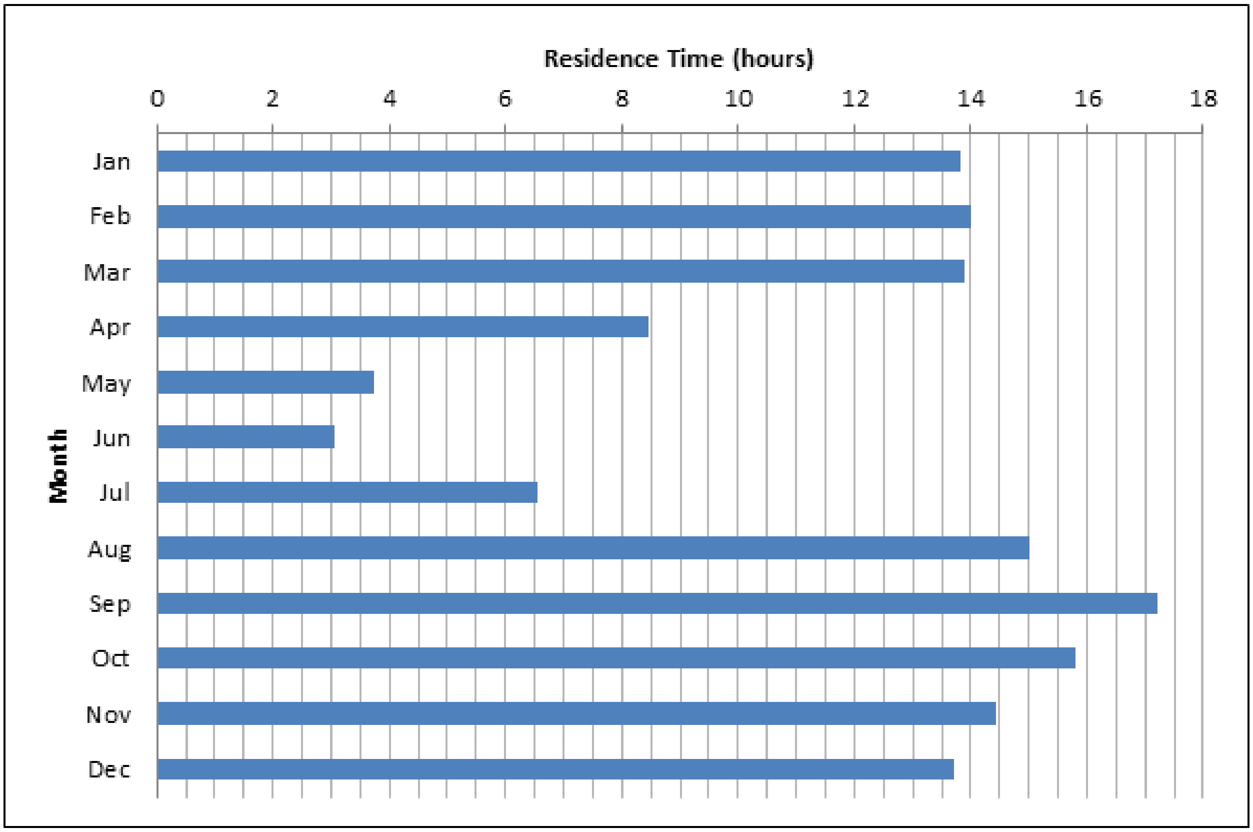


Figure 6-8: Bathymetric Map Thompson Falls Reservoir Sheet 6 of 6



The monthly average residence time (flushing rate) is displayed in **Figure 6-9**. The results indicate that residence time in Thompson Falls Reservoir is very short, particularly in the spring when residence time is, on average, less than 4 hours. The residence time ranges from less than 4 hours (June) to approximately 17 hours (September).

Figure 6-9: Estimated average monthly residence time in Thompson Falls Reservoir



6.6 Affected Environment - Reservoir Substrate

6.6.1 Substrate Composition

The substrates in Thompson Falls Reservoir include a combination of alluvial material and fine sediments from upstream sources, as well as several bedrock outcroppings. The upstream end of the reservoir is more riverine in nature with the south shore being dominated by large bedrock outcroppings. The middle section of the reservoir is fairly homogeneous and riverine, while the lower reservoir contains two large bedrock islands and depositional areas of fine sediment.

6.6.2 Substrate Quality

In Montana there are 17 U.S. Environmental Protection Agency (EPA) Superfund National Priorities List (NPL) sites (EPA 2018). Five NPL sites are located upstream of Thompson Falls Dam including one NPL site, Anaconda Aluminum Co. Columbia Falls Reduction Plan (listed in September 2016) located along the Flathead River in Columbia Falls, Montana and four sites located along or near tributaries to the Clark Fork River. The four NPL sites located in the Clark Fork River basin include Milltown Reservoir Sediments located at the former Milltown Dam upstream of Missoula (listed in 1983), Anaconda Co. Smelter in Anaconda (listed in 1983), Silver Bow Creek/Butte Area (listed in 1983), and Montana Pole and Treating in Butte (listed in 1987). Details of these NPL sites are available on the EPA's Superfund NPL site: https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#MT.

In addition to the NPL sites, the Smurfit-Stone Frenchtown Mill site is proposed for NPL listing and is located adjacent to the Clark Fork River near Frenchtown, Montana which is about 111 miles upstream of the Project. The Smurfit-Stone Mill site was a former pulp and paper mill site that operated from 1957 to 2010. This site is being actively investigated and monitored, and details are available on the EPA's Superfund site for Smurfit-Stone Mill Frenchtown: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0802850.

Although the Project is over 100 miles downstream, before Milltown Dam was removed as part of the remediation of the Milltown Dam Sediments' NPL site, sediment quality (arsenic and copper) in Thompson Falls Reservoir was characterized in May 2006 to establish a baseline. Characterization of the sediment concluded that sediment in the Thompson Falls Reservoir was not of concern for human or ecological receptors (HDR Engineering, Inc. [HDR] 2008).

Following the Baseline Study, sediment traps were established in locations where hydraulic conditions were conducive to sedimentation. The sediment traps were used to monitor the effects of remedial work at the Milltown Site on metal concentrations in sediments transported to Thompson Falls Reservoir. Samples of total arsenic, cadmium, copper, lead, and zinc were analyzed. Results showed all metal concentrations increased and remained elevated after the 2007 spring runoff event and through the end of 2007, except for arsenic (HDR 2008). The average concentration in Thompson Falls Reservoir sediment trap samples from the four sampling events between May and October 2007 was 14 milligrams per kilogram (mg/kg) of arsenic and 195 mg/kg of copper (HDR 2008).

Surface water chemical data (arsenic, copper, lead, and zinc) collected on June 20, 2007, around the Milltown work area were used along with USGS flow data to perform a mass balance resulting in an estimate of metal loading originating from the Milltown Reservoir (HDR 2008). The results suggest a significant portion of metal load measured below Milltown Dam originated from the Milltown Reservoir on the sampling day, June 20, 2007. This evidence indicates that the increases in contaminant concentrations observed in the Thompson Falls Reservoir sediment result from the Milltown remediation.

Sediment sampling conducted after 2007 showed a spike in metal concentrations in sediment in Thompson Falls Reservoir in spring/summer of 2008, just after the breaching of Milltown Dam. Subsequent sediment sampling found that the concentration of metals arriving at the Thompson Falls Reservoir steadily decreased and eventually returned to at or near baseline conditions (unpublished file data maintained by NorthWestern).

In 2020, sediment sampling was conducted in Thompson Falls Reservoir (NorthWestern 2022). Four sediment bars were sampled in the lower portion of the reservoir using a core sampler to characterize the sediment in the lower reservoir. The reservoir was lowered 1 foot from normal full pool level that day to assist in accessing the sediment deposits *via* boat, and an attempt was made to sample the 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.

Figure 6-10 is a map showing the locations of each core sample from the lower reservoir in relation to the City. The aerial imagery in Figure 6-10 is from 2018 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. Under normal full-pool reservoir elevations the locations of these sample sites are underwater.

Figure 6-10: Sediment core sample locations in Thompson Falls Reservoir on 7/13/20.

Analytical results from the sediment core samples are shown in **Table 6-3** through **Table 6-5**, below. Table 6-3 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 6-3: TCLP metals analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20. Metals TCLP Extractable (mg/L).

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

Notes: mg/L = milligrams per liter; ND = that the sample result was not found at a detectable concentration; TCLP = Toxicity Characteristic Leaching Procedure

Table 6-4 shows the results from the PCB analysis conducted on each composite sediment sample. All samples were reported to be at non-detectable levels for PCBs.

Table 6-4: PCB analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20.

Polychlorinated Biphenyls (PCBs) (mg/kg-Dry)									
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

Notes: mg/kg-Dry = milligrams per kilogram dry weight; ND = 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 HxCDD[15] and 2,3,7,8-TCDD[16], 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 6-5**) 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 nanograms per kilogram (ng/kg) is weighted by a factor of 0.1 and that number is

[15] Hexachlorodibenzo-p-dioxin
[16] Tetrachlorodibenzo-p-dioxin

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 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 6-5. TEQ results for each composite sediment sample were well below the TEQ screening level of 22 ng/kg.

Table 6-5: Dioxin analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20.

Dioxin Screening (ng/kg)			
Sediment Bar Sample	**1,2,3,7,8,9-HxCDD**	**2,3,7,8-TCDD**	**TEQ**
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

Notes: HxCDD = Hexachlorodibenzo-p-dioxin; ND = the sample result was not found at a detectable concentration; ng/kg = nanograms per kilogram; TCDD = Tetrachlorodibenzo-p-dioxin; 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 on July 13, 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.

6.7 Affected Environment – Water Quality

Under Montana Code Annotated 75-5-301 et. seq. the DEQ establishes classification of all state waters in accord with their present and future most beneficial uses. The Clark Fork River at the Thompson Falls Project is classified as B-1 in the Administrative Rules of Montana (Administrative Rules of Montana [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.

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 department that continued operations will be done in the best practicable manner to minimize harmful effects.

Montana's water quality standards include numeric and narrative criteria as well as non-degradation policy that applies to any activity of humans resulting in a change in existing water quality occurring on or after April 29, 1993. The numeric surface water quality standards were developed for numerous parameters to protect human health and aquatic life and are located in the Circular DEQ-7 (DEQ 2019). The acute and chronic freshwater aquatic life and human health standards for certain metals are included in **Table 6-6**.

Table 6-6: Summary of acute and chronic freshwater aquatic life and human health standards for metals (in *u*g/L).

Metals	Aquatic Life Standards		Human Health Standards	
	Acute	Chronic	Surface Water	Ground Water
Aluminum	750	87	-	-
Arsenic	340	150	10	10
Cadmium	0.49*	0.25*	5	5
Chromium (III)	579*	27.7*	100	100
Chromium (IV)	16	11	-	-
Copper	3.79*	2.85*	1,300	1,300
Iron	-	1000	-	-
Lead	13.98*	0.545*	15	15
Mercury	1.7	0.91	0.05	2
Nickel	145*	16.1*	100	100
Selenium	20	5	50	50
Silver	0.374*	-	100	100
Zinc	37*	37*	7,400	2,000

Notes: * Metals are expressed as a function of total hardness (mg/L, $CaCO_3$); table values were calculated using a total hardness of 25 mg/L; *u*g/L = micrograms per liter; CaCO3 = calcium carbonate; dash [-] = the lack of a standard; mg/L = milligrams per liter

Source: DEQ 2019.

The DEQ Department Circular DEQ-12A contains the base numeric nutrient standards and their implementation (DEQ 2014). Nutrient standards, including total nitrogen (TN) and phosphorus for the Clark Fork River downstream of the Flathead River confluence, have not been developed, so the narrative standard in ARM 17.30.637(1)(e) applies. The narrative standard states, "…surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create conditions which produce undesirable aquatic life" (DEQ 2019). For reference, the numeric nutrient standards for the Clark Fork River from the confluence of the Blackfoot River to the confluence of the Flathead River (upstream of the Project area) are as follows: Total Phosphorus = 39 micrograms per liter (*u*g/L), Total Nitrogen = 300 *u*g/L, Chlorophyll-a = 100 milligrams per meter squared (mg/m^2) (summer mean) and 150 mg/m^2 (maximum). These standards apply seasonally from June 21 to September 21 (ARM 17.30.631(2)(b)).

Numeric nutrient standards for wadeable streams like the Thompson River were developed based on Ecoregion, and for the Northern Rockies Ecoregion, the following nutrient standards apply: Total Phosphorus = 25 *u*g/L, Total Nitrogen = 275 *u*g/L, Chlorophyll-a = 125 mg/m^2 (DEQ 2014). There is not currently a numeric nutrient standard for Nitrate+Nitrite (NO_3+NO_2), but DEQ recommends using a NO_3+NO_2 concentration of 100 *u*g/L for a water quality target in wadeable streams (DEQ 2014).

For waters classified as B-1, a 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32 to 66ºF; within the naturally occurring range of 66º to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5°F or greater, the maximum allowable increase in water temperature is 0.5°F. A 2 °F per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55º to 32°F (ARM 17.30.623(e)).

The freshwater aquatic life standards for dissolved oxygen (DO) for the Clark Fork River at the Thompson Falls Project are presented in **Table 6-7** (DEQ 2019). The early life stage water column concentrations are the concentrations recommended to achieve the required inter-gravel DO concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the numerical values in the parentheses apply. Early life stages include all embryonic and larval stages and all juvenile fish for 30 days following hatching. Note that early life stages in the vicinity of the Thompson Falls Project are found in the water column, therefore the relevant standards for "Early Life Stages" (Table 6-7) are those that are in parentheses.

Table 6-7: Freshwater aquatic life standards for Dissolved Oxygen (mg/L) for the Clark Fork River around the Thompson Falls Project.

	Early Life Stages[1,2]	**Other Life Stages**
30 Day Mean	N/A[3]	6.5
7 Day Mean	9.5 (6.5)	N/A[3]
7 Day Mean Minimum	N/A[3]	5.0
1 Day Minimum[4]	8.0 (5.0)	4.0

Notes: mg/L = milligrams per liter
[1] These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the numerical values in parentheses apply.
[2] Includes all embryonic and larval stages and all juvenile forms of fish for 30 days following hatching.

[3] N/A = not applicable
[4]All minima should be considered as instantaneous concentration to be achieved at all times.
Source: DEQ 2019

Montana Water Quality Standards Circular DEQ-7 (DEQ 2019) sets a standard of 110 percent of saturation for total dissolved gas (TDG) in the Clark Fork River near the Project. This water quality standard was developed to protect fish from high levels of TDG, which may cause gas bubble trauma (GBT). ARM 17.30.637(7) also includes a TDG standard, "no pollutants may be discharged, and no activities may be conducted which, either alone or in combination with other wastes or activities, result in the total dissolved gas pressure relative to the water surface exceeding 110 percent of saturation."

The water quality standard for *Escherichia coli* bacteria (E-coli) varies according to season. From April 1 through October 31, the geometric mean number of E-coli may not exceed 126 colony forming units per 100 mm and 10 percent of the total samples may not exceed 252 colony forming units per 100 mm during any 30-day period. Additionally, from November 1 through March 31, the geometric mean number of E-coli may not exceed 630 colony forming units per 100 mm and 10 percent of the samples may not exceed 1,260 colony forming units per 100 mm during any 30-day period (ARM 17.30.623(a)).

The maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units (NTU) except as permitted in 75-5-318, MCA (ARM 17.30.623(d)).

Montana's standard restrictions on induced variation of hydrogen ion concentration (potential of hydrogen (pH)) within the range of 6.5 to 8.5 must be less than 0.5 pH. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0 (ARM 17.30.623(c)).

There is to be no increase of concentrations of sediment or suspended sediment, settable solids, oils, or floating solids above naturally occurring concentrations (ARM 17.30.623(f)). The color cannot be increased more than five color units about the naturally occurring[17] color (ARM 17.30.623(g)). Concentrations of carcinogenic, bioconcentrating, toxic, radioactive, nutrient, or harmful parameters may not exceed the applicable standards set forth in the 2017 DEQ-7, unless a nutrient standards variance has been granted in the Department Circular DEQ-12A (ARM 17.30.623(h)).

[17] As stated above, "Naturally occurring" means 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 17.30.602(17)).

6.7.1 Water Chemistry

6.7.1.1 Water Chemistry Methods

Water chemistry was monitored at nine sites in and around the Project from 2019 through 2021 (**Figure 6-11**). These nine sites included four recurring monitoring sites on the Clark Fork River, three additional sites downstream of Project infrastructure for source assessment purposes, and two tributary sites. The tributary monitoring sites were located on the Thompson River, which enters Thompson Falls Reservoir near the upstream end of the Project, and Prospect Creek, which enters the Clark Fork River downstream of Project infrastructure.

The water quality sampling consisted of the collection of either single point depth integrated samples, or depth integrated equal width increment composites at each monitoring location. Grab samples were collected from the bank in a well-mixed portion of the river, or from a bridge at equal width increments and composited in a Teflon churn splitter. The sampling methodology and quality assurance/quality control conforms to current standard operating procedures used by the DEQ (Makarowski 2019).

Table 6-8 includes a description of the purpose, methods, and parameters measured at each of the water chemistry monitoring sites. For further details of the sampling methodology, *refer to* **Appendix A – Water Quality Monitoring Report**.

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Figure 6-11: Map showing locations of the Thompson Falls water quality monitoring sites.

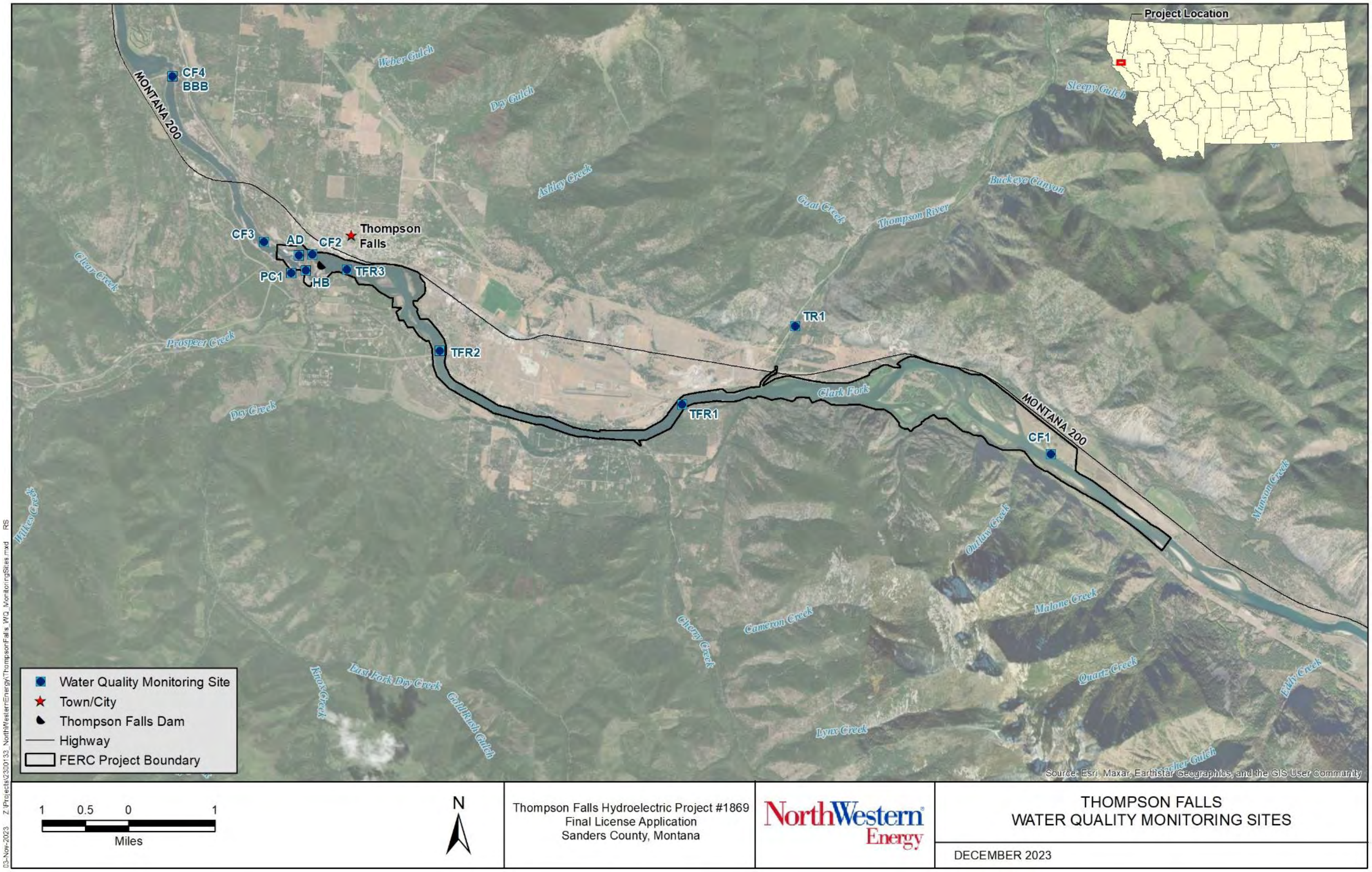

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Table 6-8: Description of purpose, methods, and parameters measured at water chemistry monitoring sites.

Site Name	Site Purpose	Sampling Method	Analyte Groups
CF1	Incoming water quality to the Project	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature, Chlorophyll-*a*
CF2	Water quality leaving the reservoir, upstream of the powerhouses	Equal width increment composite sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
CF3	Water quality downstream of the old powerhouse	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature, Chlorophyll-*a*
CF3.1	Water quality downstream of the new powerhouse (Metals source assessment)	Single point grab sample	Metals
CF3.2	Water quality near the HWY 200 bridge (Metals source assessment)	Single point grab sample	Metals
CF3.3	Water quality near Thompson Falls State Park (Metals source assessment)	Single point grab sample	Metals
CF4	Water quality leaving the Project	Equal width increment composite sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
TR1	Water quality of the Thompson River	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
PC1	Water quality of Prospect Creek	Single point grab sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters

Water Chemistry Monitoring Results

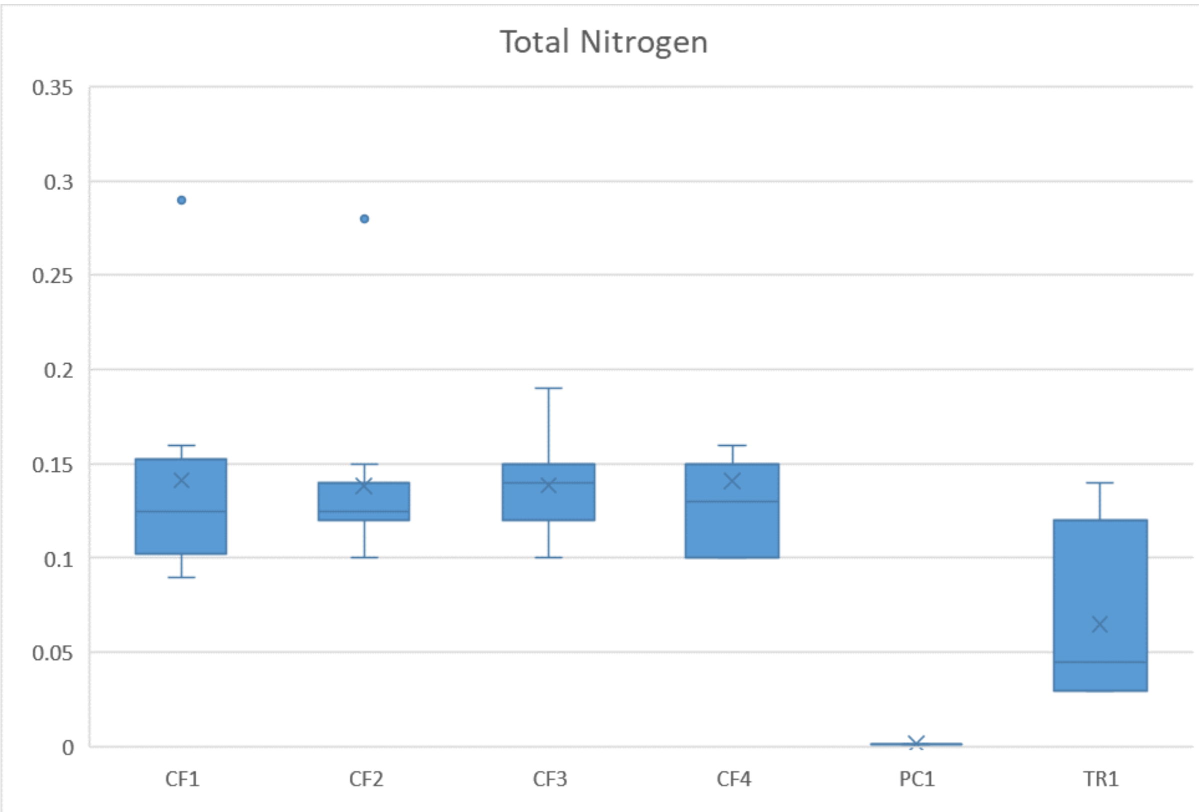
6.7.1.1.1 Nutrients

Nutrients within the Thompson Falls Project are generally low in concentration, which is reflected in both the water chemistry data as well as the biological data. Water chemistry samples were collected throughout the year, so nutrient concentrations may reflect conditions outside of the summertime window of July 1 through September 1 when most of the biological growth is occurring in the waterbody. Outside of this summertime window, nutrient concentrations in the water column are typically higher because they are not being consumed by biological growth as readily.

Total Nitrogen

Total nitrogen concentrations remain consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), but are lower at the two tributary monitoring sites (PC1 and TR1) (**Figure 6-12**). There are relatively few nitrogen inputs between the upstream end of the Project boundary (CF1) and the upstream end of Noxon Reservoir (CF4), which is reflected in the data.

Figure 6-12: Total nitrogen concentrations across all water quality monitoring sites (in mg/L).

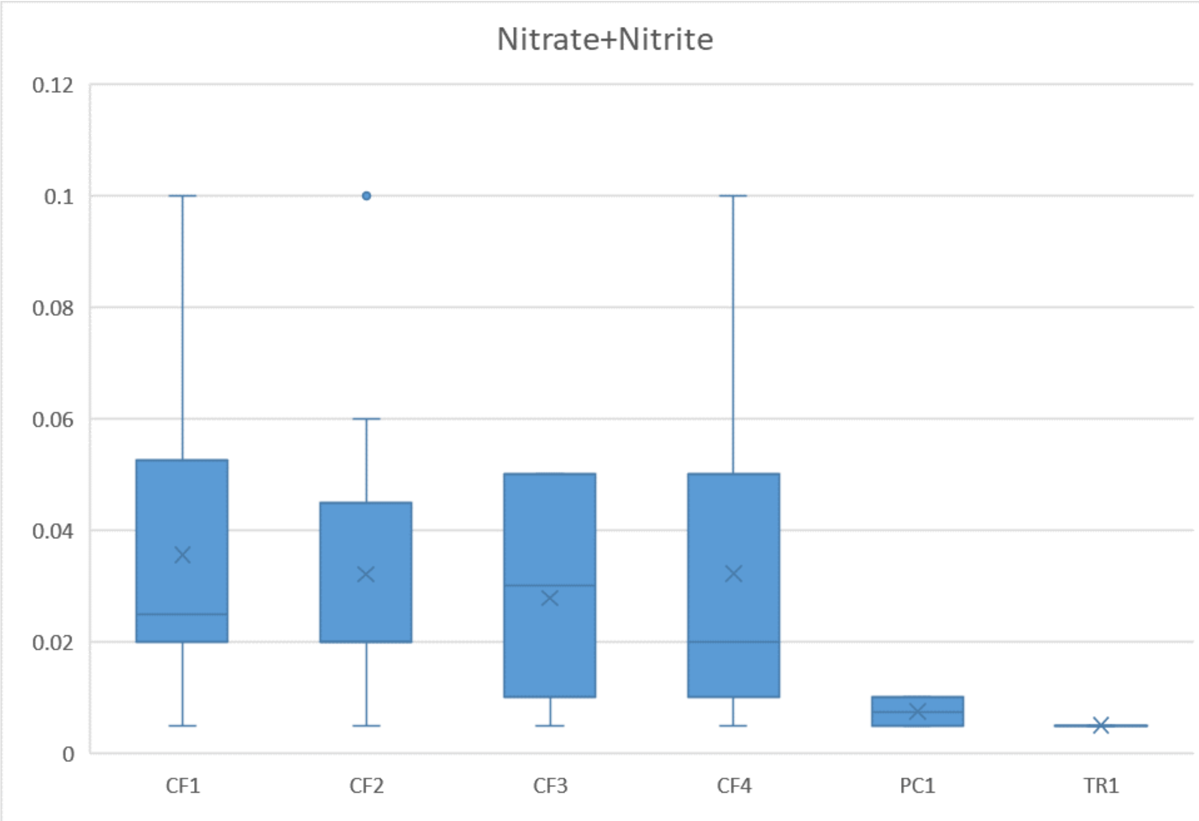


Note: mg/L =milligrams per liter

Nitrate+Nitrite

Nitrate+Nitrite (NO_3+NO_2) concentrations show a similar pattern to TN concentrations, with little to no change across the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4). As with TN, the tributary sites (PC1 and TR1) also showed lower concentrations of NO_3+NO_2. **Figure 6-13** shows the NO_3+NO_2 concentrations across all monitoring sites.

Figure 6-13: Nitrate+Nitrite concentrations across all water quality monitoring sites (in mg/L).

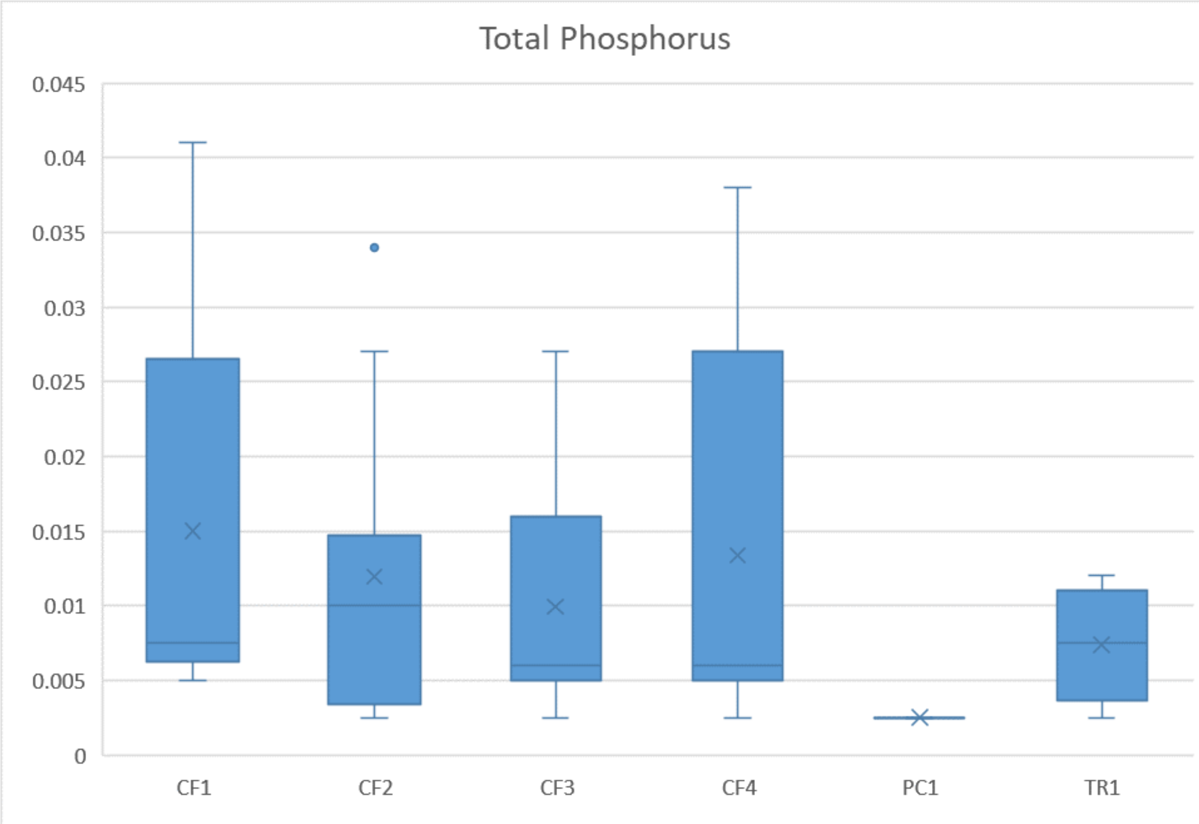


Note: mg/L =milligrams per liter

Total Phosphorus

Total phosphorus (TP) concentrations follow a similar pattern to TN and NO_3+NO_2 concentrations across the Project. The lowest TP concentrations on the Clark Fork sites (CF1, CF2, CF3, and CF4) were found at sites CF2 and CF3, which are located just upstream and downstream of the dams and powerhouses respectively (**Figure 6-14**). Phosphorus has a tendency to bind tightly to soil particles, many of which settle out in the reservoir, which would explain the slightly lower TP concentrations found at sites CF2 and CF3 as compared to site CF1, which is located at the upstream end of the reservoir. As with TN and NO_3+NO_2, the concentrations of TP were found to be lower at the tributary sites (PC1 and TR1) than at the Clark Fork sites.

Figure 6-14: Total phosphorus concentrations across all water quality monitoring sites (in mg/L).

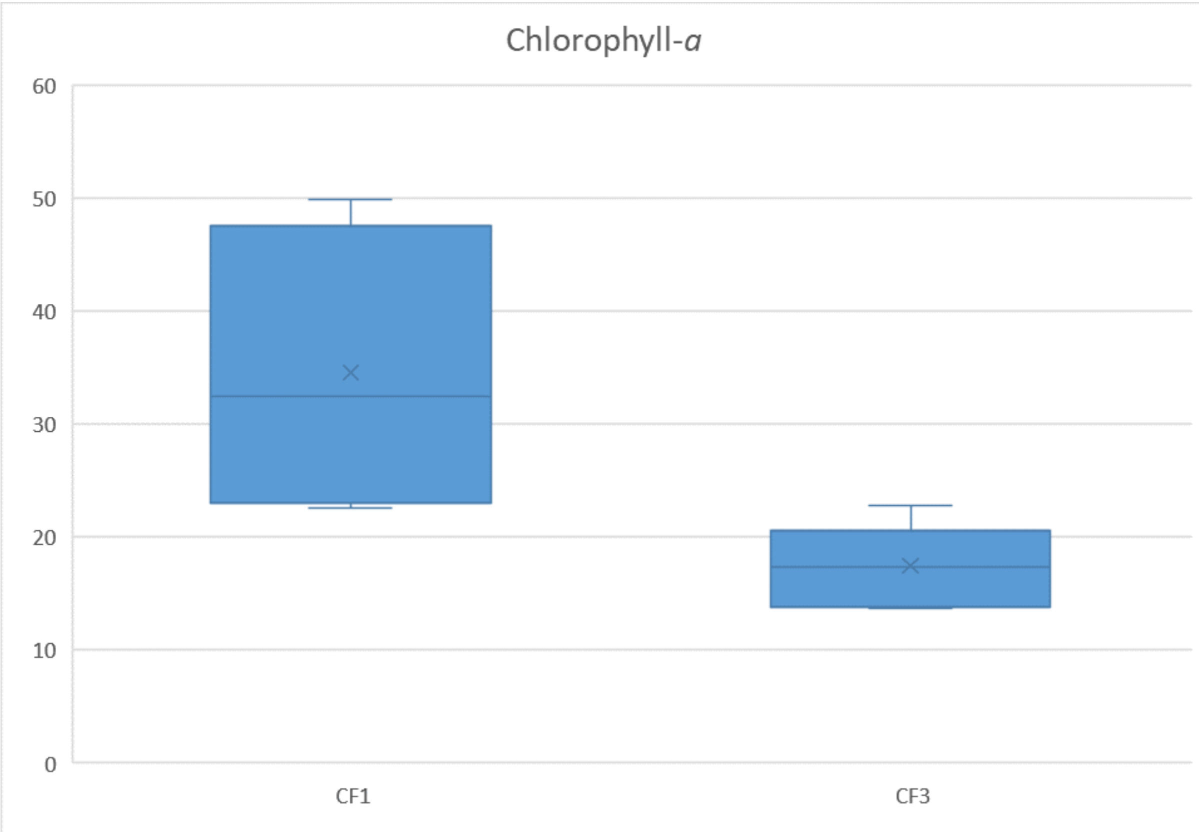


Note: mg/L =milligrams per liter

Chlorophyll-a

Chlorophyll-*a* samples were collected at two locations in 2019; site CF1 to represent conditions upstream of Thompson Falls Reservoir and site CF3 to represent conditions downstream of Thompson Falls Reservoir. Upstream chlorophyll-*a* concentrations were found to be higher at site CF1 *versus* the downstream chlorophyll-*a* concentrations at site CF3 (**Figure 6-15**). This likely indicates that some nutrient uptake and attenuation is occurring in Thompson Falls Reservoir, and therefore less nutrients are available downstream to be consumed by phytoplankton.

Figure 6-15: Chlorophyll-*a* concentrations upstream and downstream of Thompson Falls Reservoir (in mg/m^2).



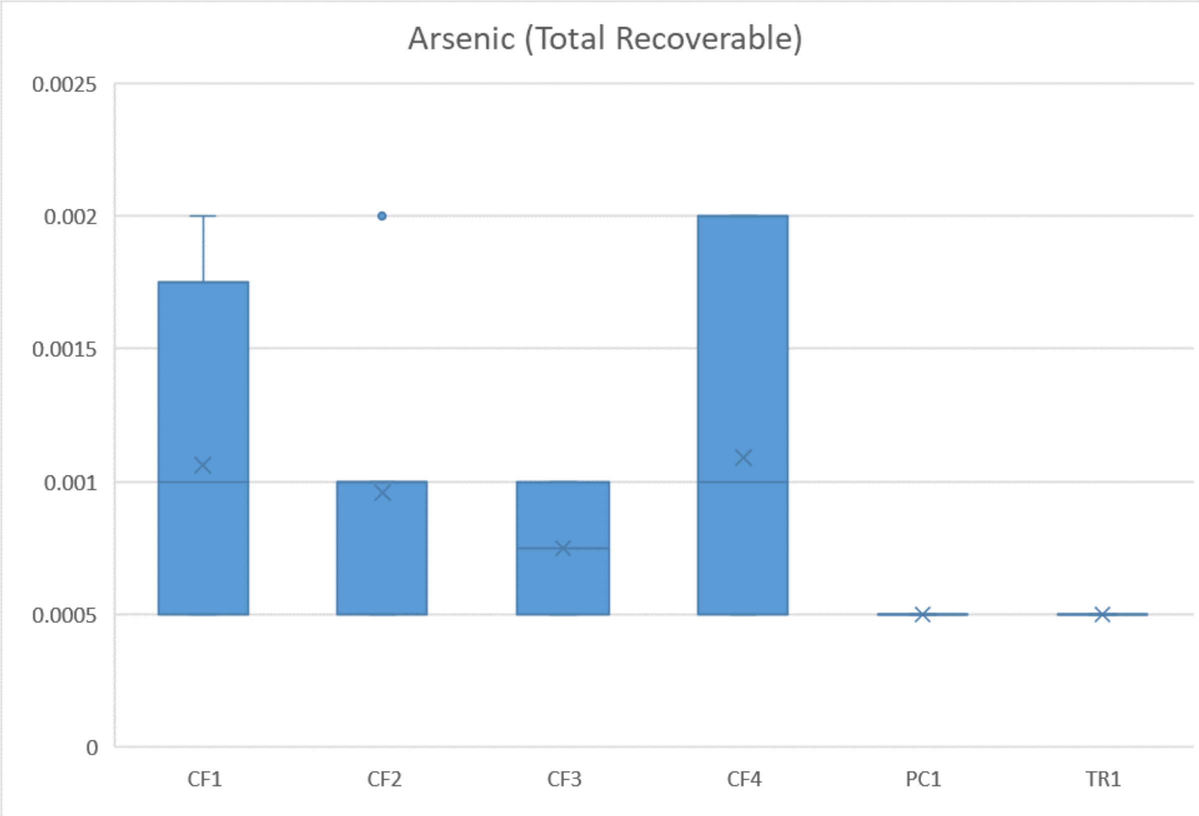
6.7.1.1.2 Metals

Generally, aqueous metal concentrations within the Project are meeting water quality standards at all sites with the exception of three samples from Birdland Bay Bridge (site CF4) which showed lead levels exceeding the water quality standard for chronic aquatic life. Site CF4 is located downstream of the Project and is used to characterize the water quality as it enters Noxon Reservoir. These three samples were collected during both high and low flow periods, and the source of the lead is unknown because all other sites had low or non-detectable concentrations of lead. Additional source assessment sampling for lead was conducted in the fall of 2020 and detailed in this section below. All other metals analyzed were found to be at concentrations below water quality standards.

Arsenic

Arsenic concentrations at all sites were below water quality standards and remain fairly consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), with a greater variation in sample concentrations found at sites CF1 and CF4 (**Figure 6-16**). Tributary site (PC1 and TR1) arsenic concentrations were found to be at non-detectable levels.

Figure 6-16: Arsenic concentrations across all water quality monitoring sites (in mg/L).



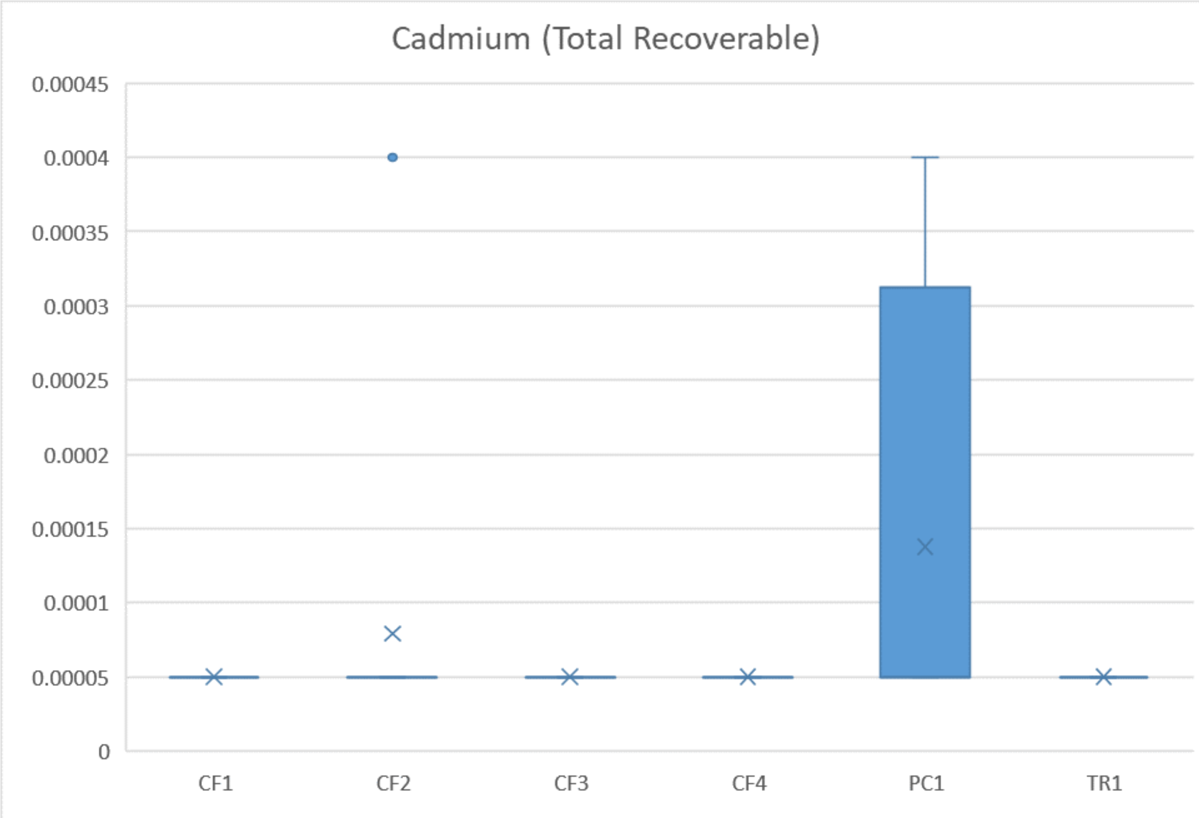
Note: mg/L =milligrams per liter

Cadmium

Cadmium concentrations at all Clark Fork sites (CF1, CF2, CF3, and CF4) were below water quality standards and remain generally consistent throughout the Clark Fork monitoring sites. All of the Clark Fork samples, with the exception of two samples at site CF2, were found to be at non-detectable concentrations of cadmium (**Figure 6-17**). Cadmium toxicity is dependent on water hardness, and when the hardness of the Clark Fork River is factored in, the two cadmium detections at site CF2 were below water quality standards for aquatic life.

Cadmium concentrations in the Thompson River were non-detectable, but cadmium concentrations in Prospect Creek exceeded the water quality standard for chronic aquatic life when the water hardness of Prospect Creek is factored in. Prospect Creek has a history of mining in the watershed, so mining activity is a potential source of cadmium in Prospect Creek. Prospect Creek enters the Clark Fork River downstream of the Main Channel Dam, and therefore has no influence on the water quality of Thompson Falls Reservoir.

Figure 6-17: Cadmium concentrations across all water quality monitoring sites (in mg/L).

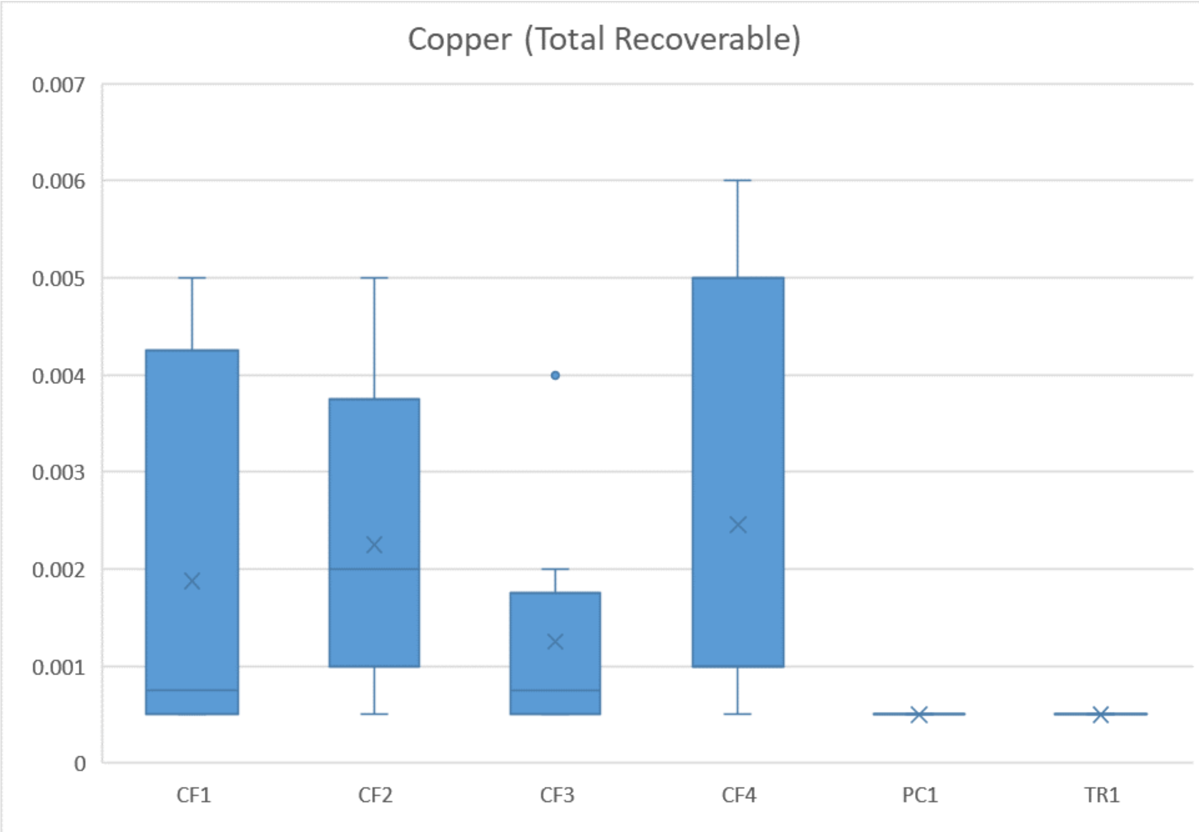


Note: mg/L =milligrams per liter

Copper

Copper concentrations remain consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), with the lowest concentrations found at site CF3, downstream of the old powerhouse (**Figure 6-18**). Copper toxicity is dependent on water hardness, and when the hardness is factored in, the copper concentrations at all sites were below water quality standards for aquatic life. Tributary site (PC1 and TR1) copper concentrations were found to be at non-detectable levels.

Figure 6-18: Copper concentrations across all water quality monitoring sites (in mg/L).

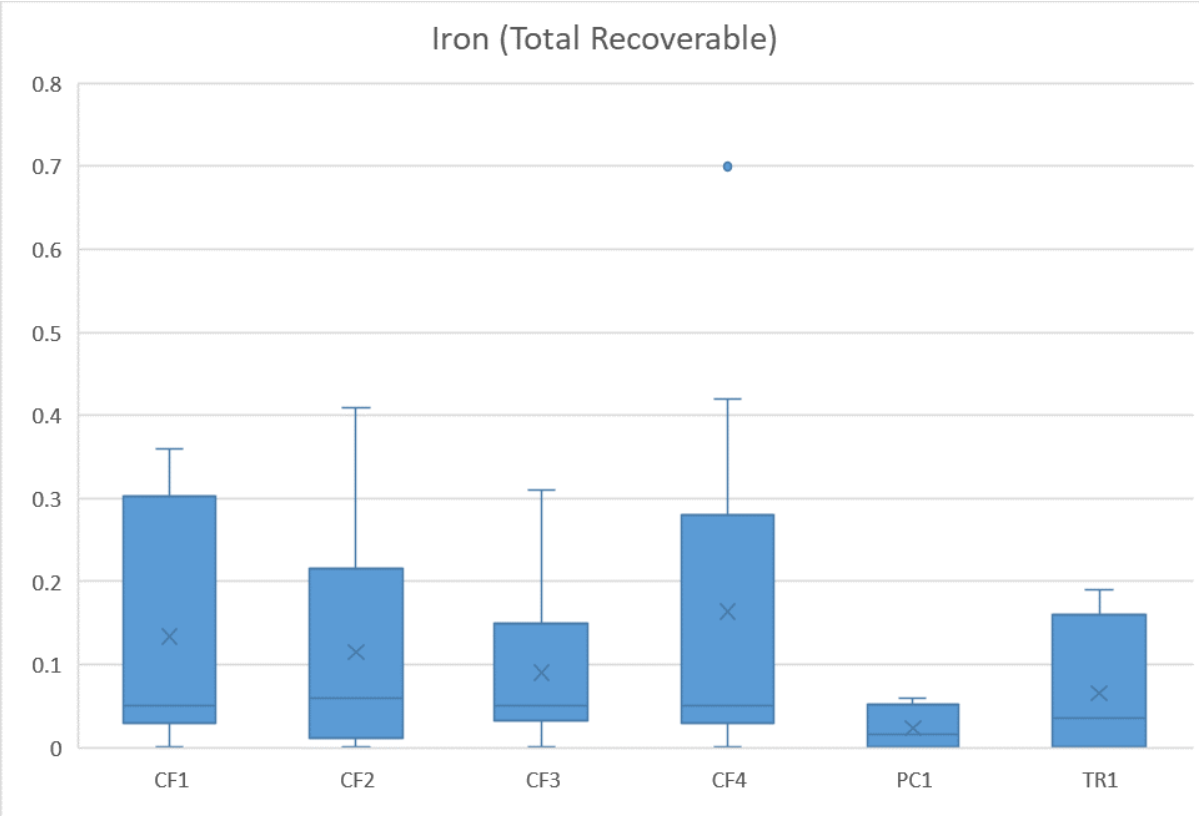


Note: mg/L =milligrams per liter

Iron

Iron concentrations at all sites were below water quality standards and remain fairly consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4) (**Figure 6-19**). Tributary site (PC1 and TR1) iron concentrations were also found to be at low levels, with the Thompson River having slightly higher concentrations of iron than Prospect Creek.

Figure 6-19: Iron concentrations across all water quality monitoring sites (in mg/L).

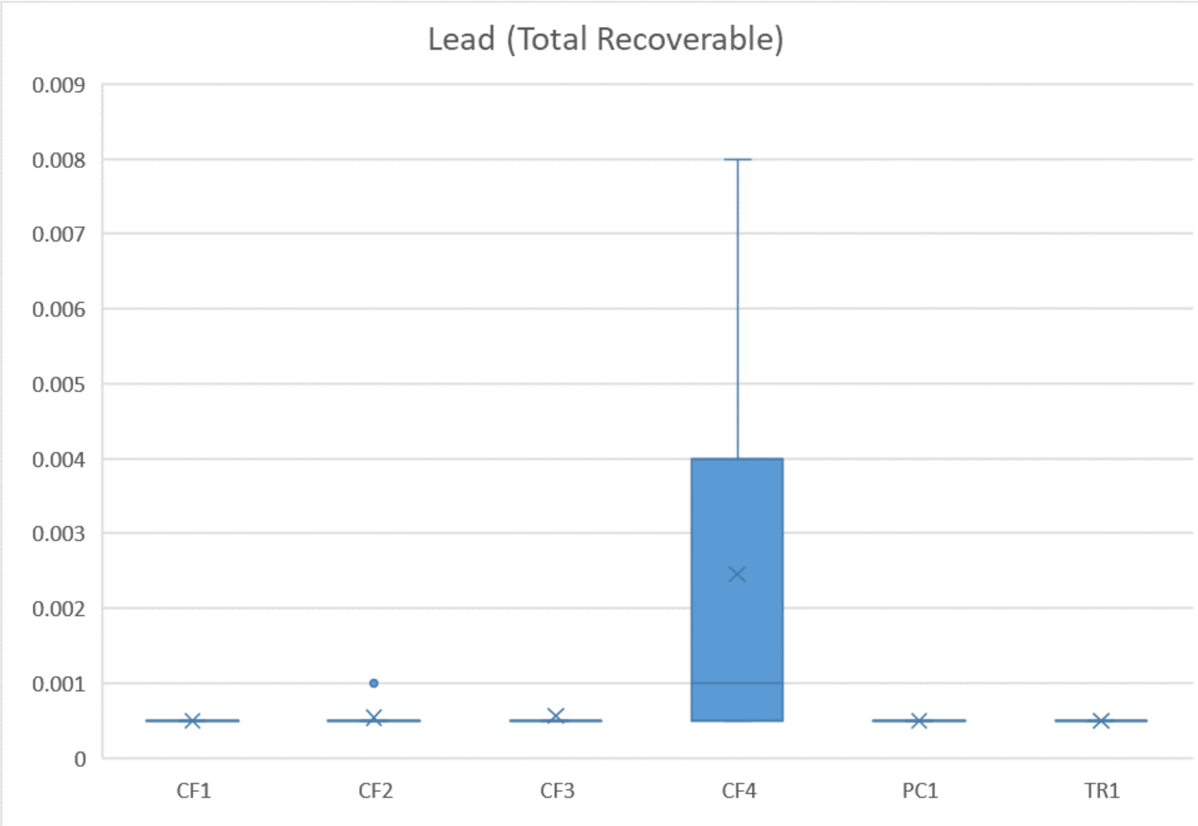


Note: mg/L =milligrams per liter

Lead

Lead concentrations were at low to non-detectable levels at all sites except site CF4 (**Figure 6-20**). Lead toxicity is dependent on water hardness, and when the hardness of the Clark Fork River is factored in, three lead samples at site CF4 were above water quality standards for chronic aquatic life. Site CF4 is located at Birdland Bay Bridge, which is downstream of the Project (*refer to* Figure 6-11).

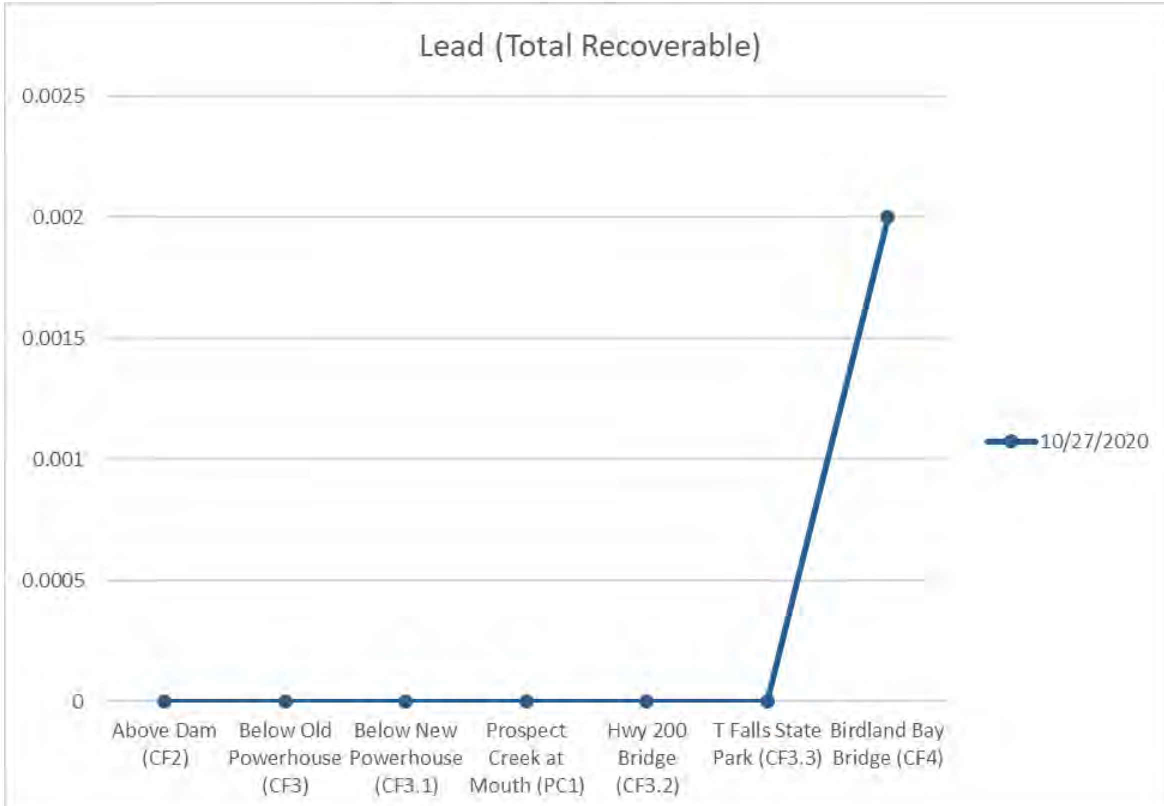
Figure 6-20: Lead concentrations across all water quality monitoring sites (in mg/L).



Note: mg/L =milligrams per liter

In response to the initial lead detection in 2019, additional monitoring sites were added at Prospect Creek (PC1) and downstream of the old powerhouse (CF3) for the 2020 monitoring season. With continued lead detections at site CF4 in 2020, and no clarity on potential lead sources, a synoptic monitoring event was conducted in October 2020 to provide information for a more detailed source assessment. This monitoring event included samples at site CF2 (above the dam), site PC1 (Prospect Creek), site CF3 (below the old powerhouse), site CF3.1 (below the new powerhouse), site C3.2 (near the Highway 200 bridge), site CF3.3 (near Thompson Falls State Park), and site CF4 (Birdland Bay Bridge). The results of this monitoring event showed that lead was found at non-detectable concentrations at all sites except site CF4 (**Figure 6-21**). The potential source of lead at site CF4 still remains unknown but has been isolated to the area between Birdland Bay Bridge and upstream 0.65 mile. This source area is located downstream of the Project, and there is no evidence to suggest the source of lead at site CF4 is related to the Project or Project operations.

Figure 6-21: Lead concentrations from an upstream to downstream orientation for the synoptic monitoring event on October 27, 2020 (in mg/L).

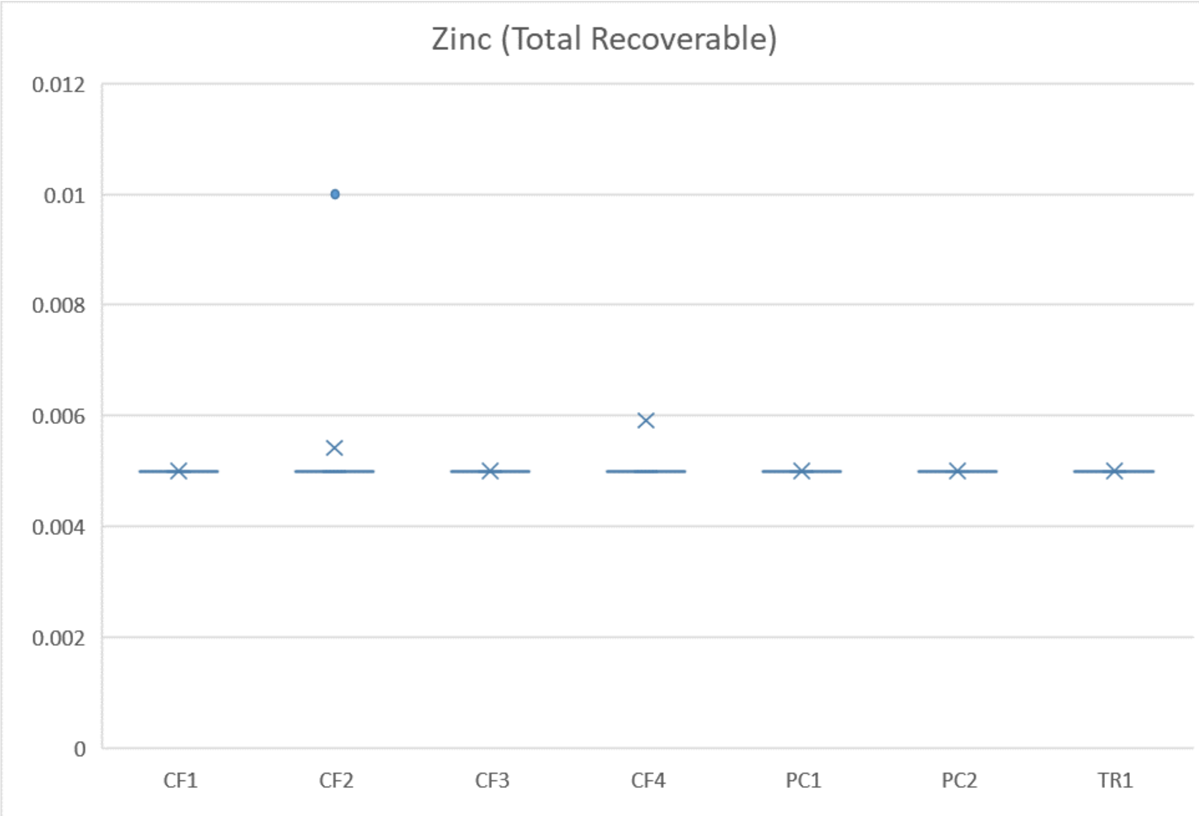


Note: mg/L =milligrams per liter

Zinc

Zinc concentrations in the Project were at low to non-detectable levels at all monitoring sites (**Figure 6-22**). Zinc toxicity is dependent on water hardness, and when the hardness is factored in, all samples containing detectable concentrations of zinc were below water quality standards for aquatic life.

Figure 6-22: Zinc concentrations across all water quality monitoring sites (in mg/L).



Note: mg/L =milligrams per liter

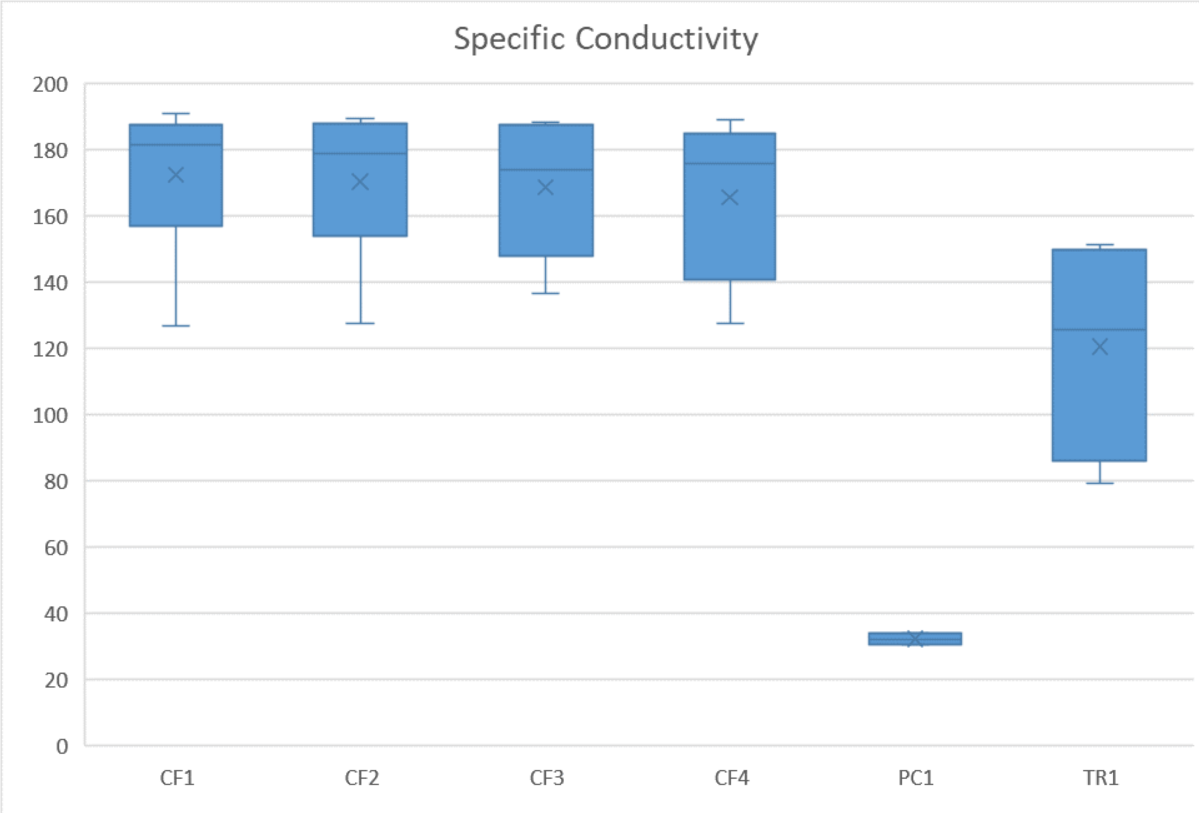
6.7.2 Field Parameters

Field parameters were collected during each water chemistry monitoring event using a Hydrolab HL7 sonde as a part of the overall site characterization. Parameters measured included depth, water temperature, specific conductivity, pH, turbidity, and DO. The Hydrolab sonde was laboratory calibrated prior to each monitoring event to ensure instrument accuracy. TDG monitoring was also conducted in 2021 and 2022 as a separate FERC approved study. The results of the 2022 TDG study can be found in the FSR, TDG Study that was submitted to FERC in May 2023 (NorthWestern 2023).

6.7.2.1 Specific Conductivity

Specific conductivity changed very little across the Clark Fork sites (CF1, CF2, CF3, and CF4) (**Figure 6-23**), but was significantly lower at the tributary sites (PC1 and TR1). Prospect Creek had the lowest conductivity values of all sites, and the conductivity of the Thompson River was slightly lower than the Clark Fork sites.

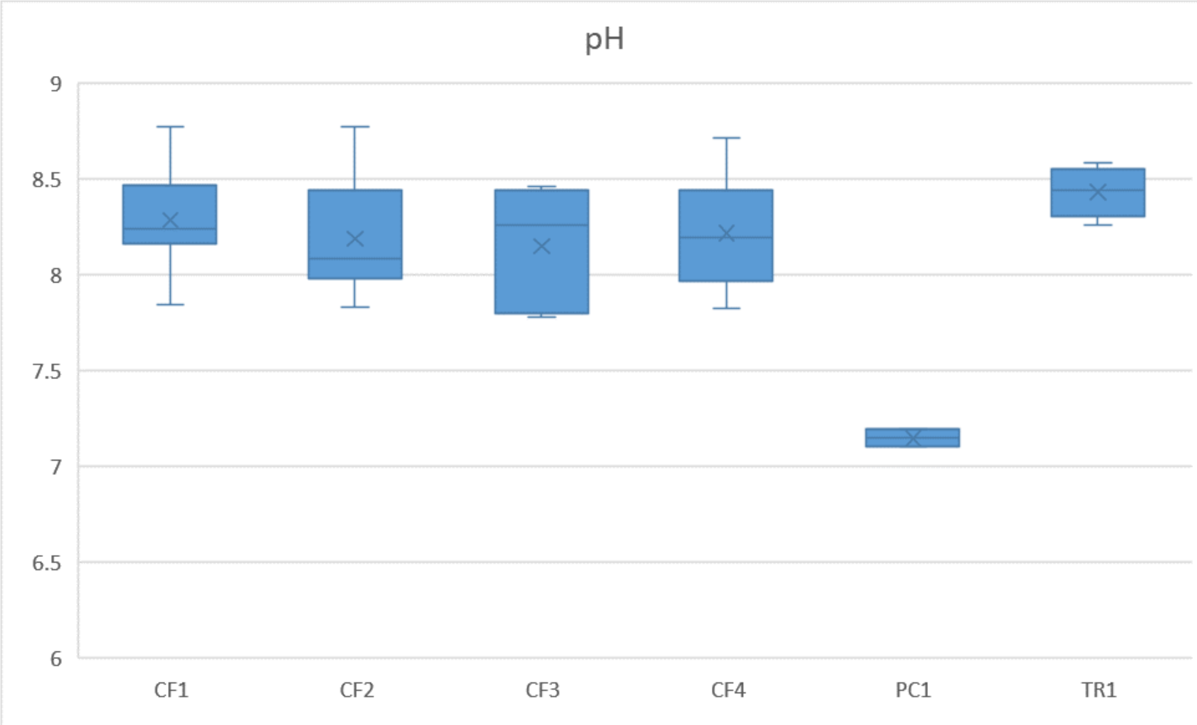
Figure 6-23: Specific conductivity across all water quality monitoring sites (in µS/cm).



6.7.2.2 pH

The measurement of pH at the Clark Fork sites (CF1, CF2, CF3, and CF4) showed relatively little change in pH from site to site, but the pH of Prospect Creek was significantly lower than the Clark Fork sites, and the pH of the Thompson River was more similar to the pH of the Clark Fork sites (**Figure 6-24**). The pH of Prospect Creek is closer to a neutral pH of 7, whereas all other sites have a high pH generally falling in the 8-8.5 range.

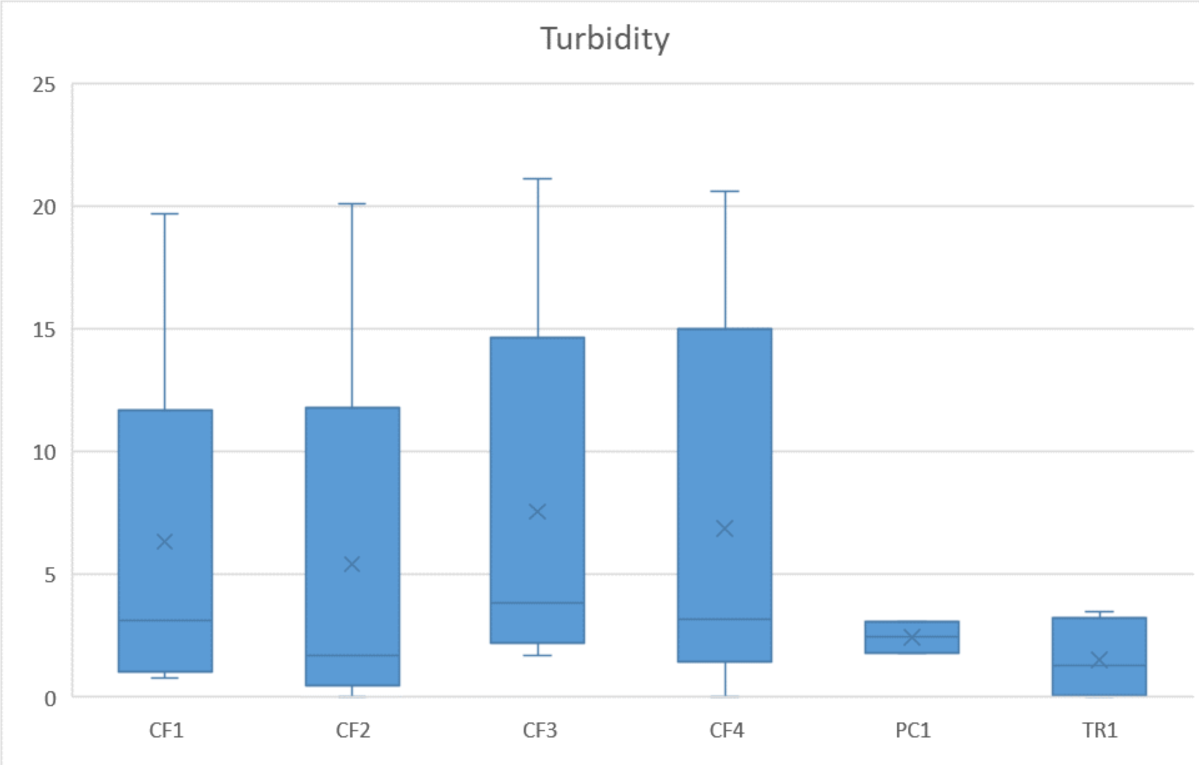
Figure 6-24: pH measurement across all water quality monitoring sites (in units).



6.7.2.3 Turbidity

Turbidity, or the measure of relative clarity in water, remained consistent throughout the Clark Fork sites (CF1, CF2, CF3, and CF4) with elevated turbidity (~20 NTU) occurring during the spring runoff period, and low to no turbidity (<1 NTU) occurring throughout the rest of the year (**Figure 6-25**). Turbidity measurements in Prospect Creek and the Thompson River remained low (<5 NTU) throughout the entire monitoring period.

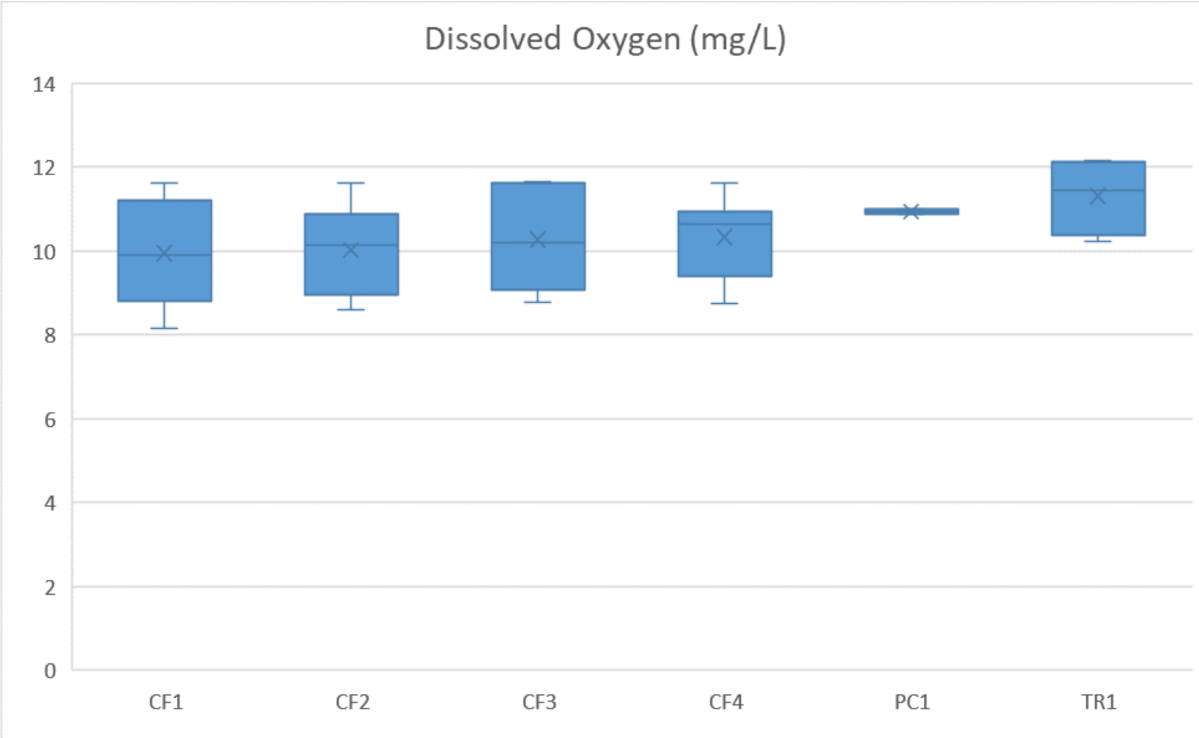
Figure 6-25: Turbidity measurement across all water quality monitoring sites (in NTU).



6.7.2.4 Dissolved Oxygen

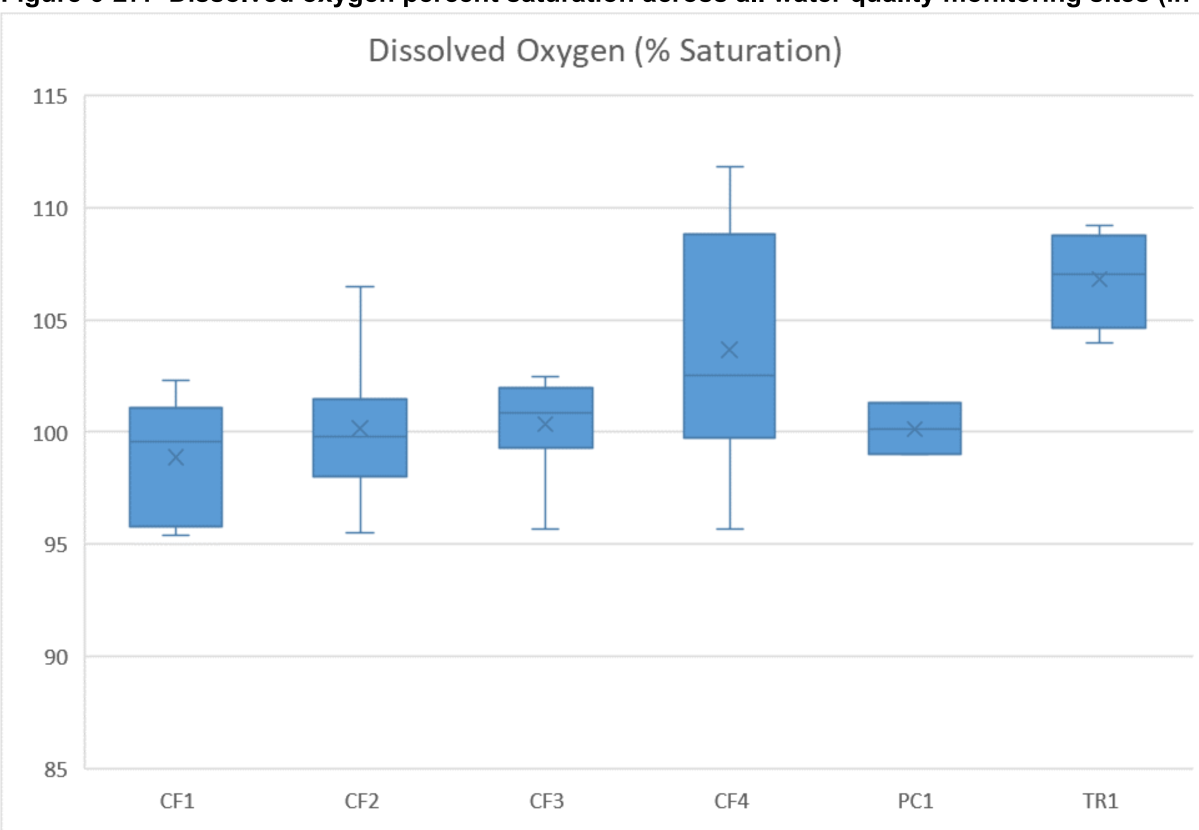
DO is measurement of the amount of oxygen that is present in water and can be represented as a concentration (in milligrams per liter [mg/L]) or as a saturation percentage. Concentrations of DO showed little change across the Clark Fork sites (CF1, CF2, CF3, and CF4), while DO concentrations in the Thompson River were slightly higher than the other sites, and Prospect Creek DO concentrations were similar to those of the Clark Fork sites (**Figure 6-26**). DO percent saturation values showed a similar pattern to the measured DO concentrations except the range of DO percent saturation at site CF4 was much greater than the other sites (**Figure 6-27**). This is likely due to the influence of spillway water during periods of high flow.

Figure 6-26: Dissolved oxygen concentration across all water quality monitoring sites (in mg/L).



Note: mg/L =milligrams per liter

Figure 6-27: Dissolved oxygen percent saturation across all water quality monitoring sites (in %).



6.7.3 Water Temperature

In 2019 and 2021, water temperature data were collected at multiple locations throughout the Project to characterize the existing thermal regime of the reservoir, its inputs and outputs. After high river flows receded, thermographs were placed at four locations in 2019 and seven locations in 2021 (**Table 6-9**) across the Project and monitored water temperature at 15-minute intervals throughout the summer months. Instantaneous maximum water temperatures were reported as the warmest instantaneous measurement for the dataset. 7-day maximum water temperatures were calculated and reported as an average of the daily maximum temperatures for the 7 warmest consecutive days.

In 2019, the instantaneous and 7-day maximum water temperatures in the Clark Fork River upstream of Thompson Falls Reservoir were just slightly higher than the comparable measurements collected downstream of the Project at the Birdland Bay Bridge (Table 6-9, **Figures 6-28 and 6-29**). Water temperature in the Thompson River is cooler than water temperature in the Clark Fork River, with the 7-day maximum water temperature being significantly lower than the comparable measurement in the Clark Fork River (Table 6-9). This pattern was consistent throughout the summer of 2019, with the Thompson River being cooler than the Clark Fork River from late June until early October (Figure 6-28). In addition, the three measurement sites on the Clark Fork River all had very similar water temperatures from late June until early October (**Figure 6-29**). These data support the conclusion that water temperature is consistent from upstream to downstream of the Project.

Monitoring in 2021 included the same sites as 2019, but data were also collected at additional sites as a part of the FERC approved Thompson Falls Relicensing Operations Study. The additional monitoring sites included a site at the furthest upstream extent of the Project boundary, a site located in the island complex downstream of site CF1, and site CF3, which is located directly downstream of the old powerhouse (*refer to* Figure 6-12). Similar to 2019, water temperatures remained relatively stable throughout the Clark Fork monitoring sites and the Thompson River was significantly cooler than the Clark Fork River (Table 6-9, **Figures 6-30 and 6-31**).

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Table 6-9: Summary of 2019 and 2021 water temperature data

Site Name	Site Description	Variable	2019 Date of Sample	2019 Temp (°F)	2021 Date of Sample	2021 Temp (°F)
Upstream Project Boundary	Clark Fork River at the edge of the upstream Project boundary	Instantaneous Maximum Temperature	N/A		7/31/21	77.28
		7-Day Maximum	N/A		7/29/21-8/4/21	76.53
CF1	Clark Fork River upstream of Thompson Falls Reservoir	Instantaneous Maximum Temperature	8/8/19	74.79	7/31/21	77.28
		7-Day Maximum	8/3/19-8/9/19	73.93	7/29/21-8/4/21	76.28
Island Complex	Clark Fork River in the Island complex downstream of CF1	Instantaneous Maximum Temperature	N/A		7/31/21	77.10
		7-Day Maximum	N/A		7/29/21-8/4/21	76.20
CF2	Clark Fork River upstream of dam in Thompson Falls Reservoir	Instantaneous Maximum Temperature	8/9/19	73.75	8/1/21	76.88
		7-Day Maximum	8/3/19-8/9/19	73.33	7/30/21-8/5/21	75.93
CF3	Clark Fork River downstream of old powerhouse	Instantaneous Maximum Temperature	N/A		7/31/21	77.28
		7-Day Maximum	N/A		7/29/21-8/4/21	76.28
CF4	Clark Fork River at Birdland Bay Bridge	Instantaneous Maximum Temperature	8/7/19	73.47	8/1/21	76.40
		7-Day Maximum	8/3/19-8/9/19	73.15	7/30/21-8/5/21	75.51
TR1	Thompson River at mouth	Instantaneous Maximum Temperature	8/3/19	65.85	7/29/21	65.55
		7-Day Maximum	8/1/19-8/7/19	65.00	7/29/21-8/4/21	63.78

Note: °F = degrees Fahrenheit

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Figure 6-28: Thompson Falls Project water temperatures from June 27 – October 6, 2019

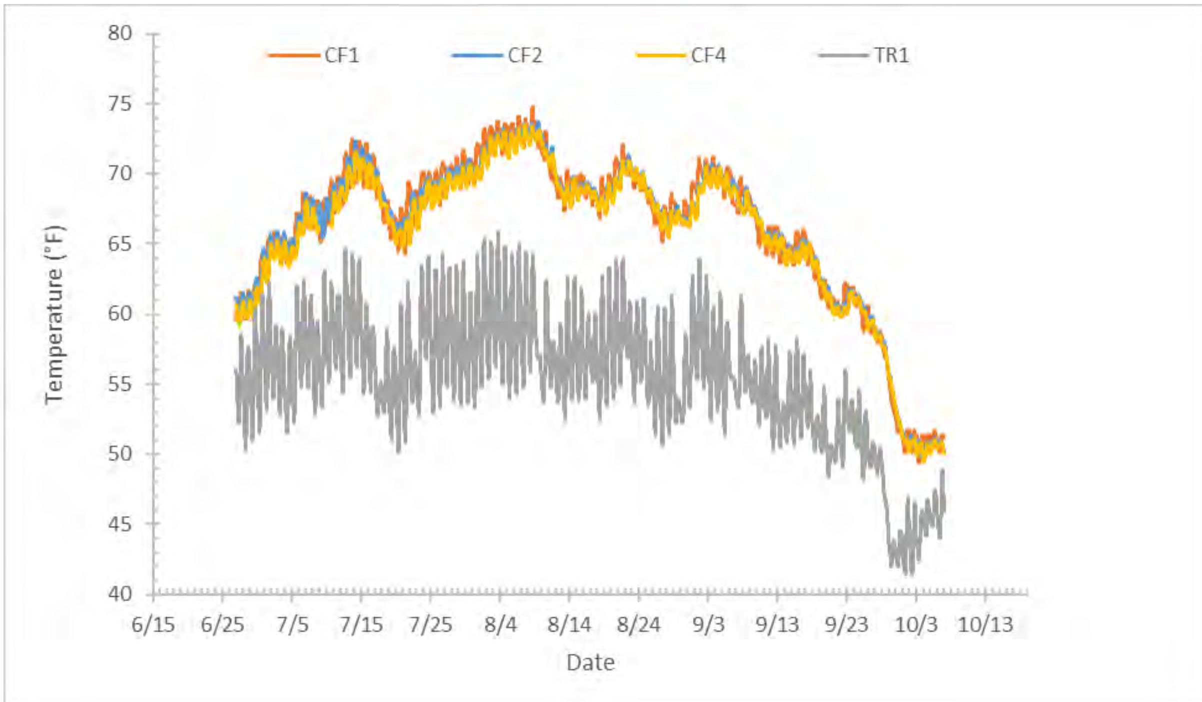


Figure 6-29: Upstream and downstream water temperature comparison from June 27 – October 6, 2019

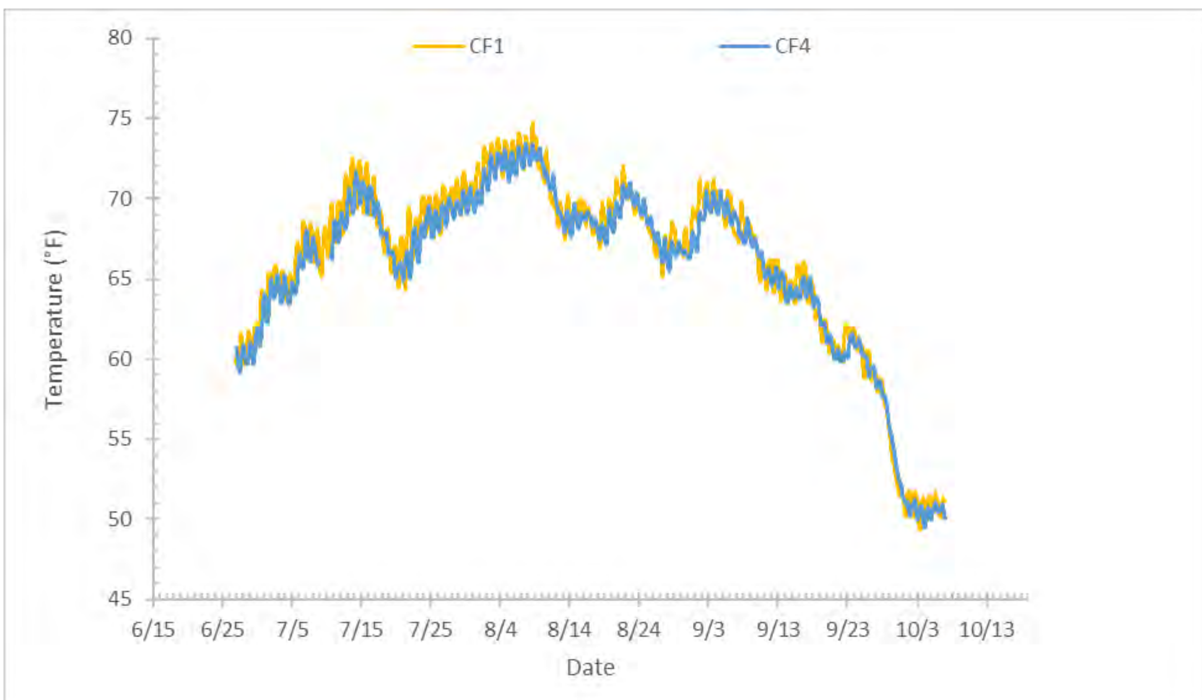


Figure 6-30: Thompson Falls Project water temperatures from July 15 – September 15, 2021

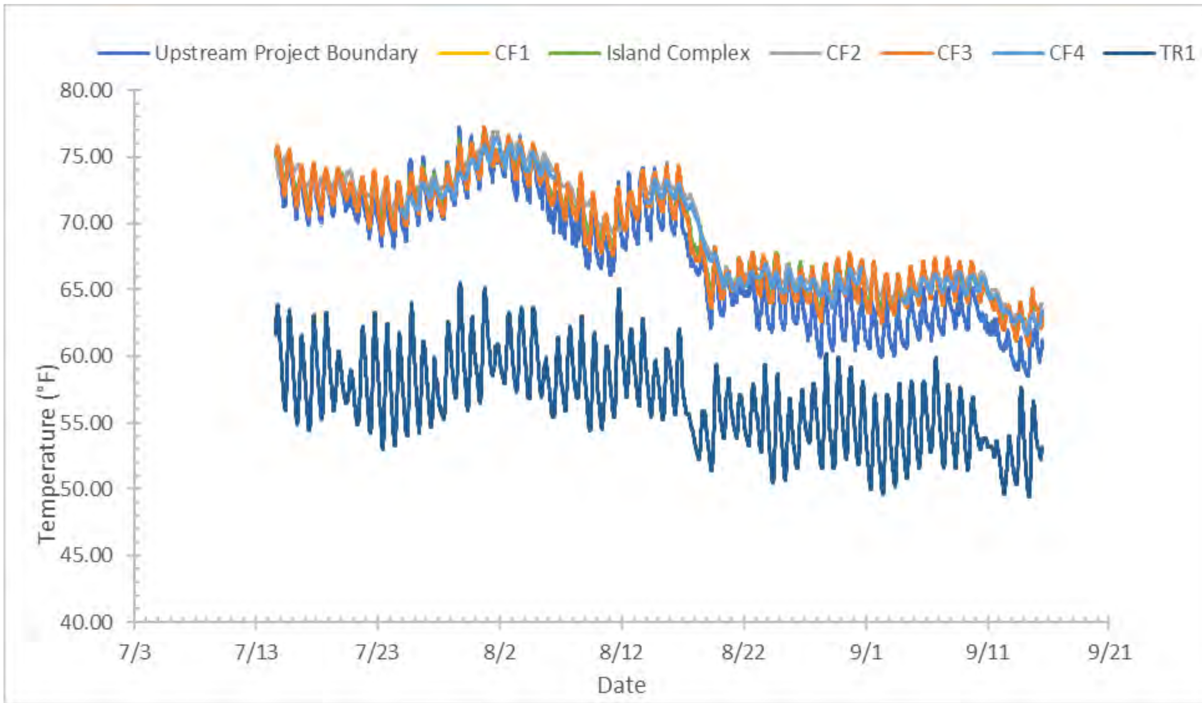
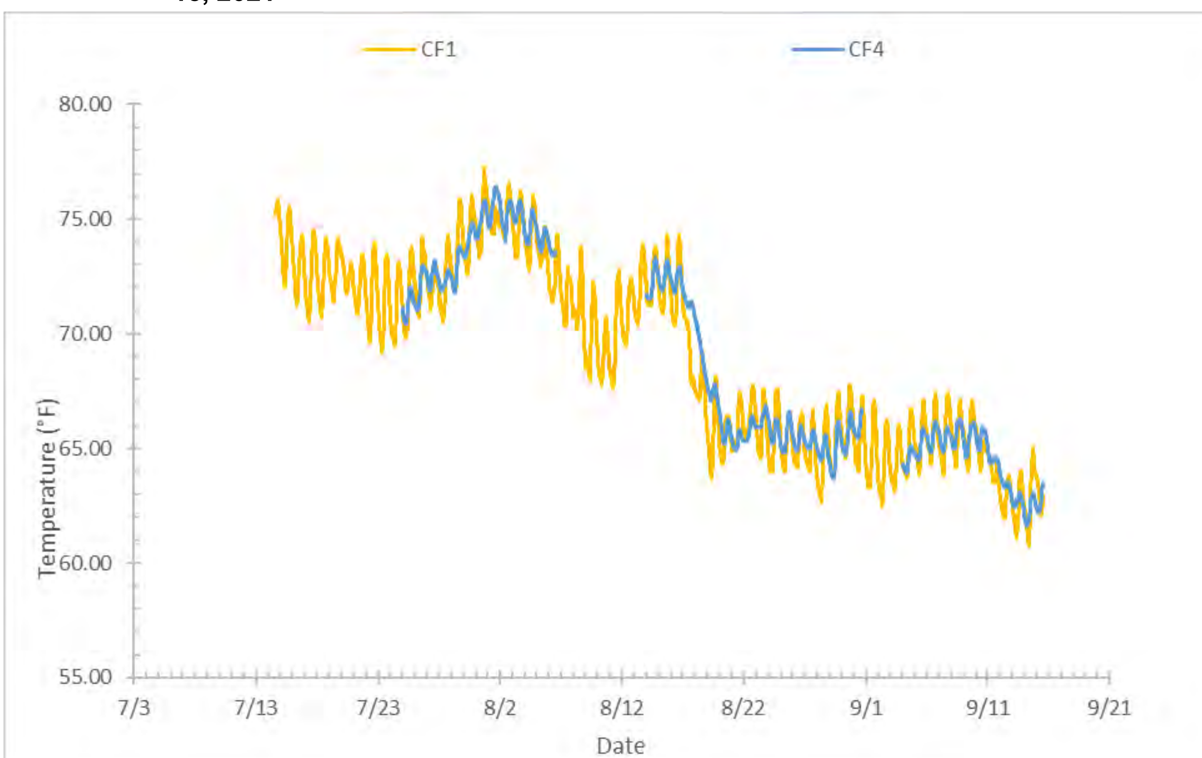


Figure 6-31: Upstream and downstream water temperature comparison from July 15 – September 15, 2021



6.7.4 Total Dissolved Gas

Total dissolved gas, or TDG, is a measurement of the total concentration of atmospheric gas saturation in water. This can occur naturally from hydraulic features in a waterbody or from human actions on the environment. When water plunges into a pool, air becomes entrained regardless of whether the plunge is a natural waterfall or a dam spillway (Weitkamp and Katz 1980). Supersaturation at hydroelectric projects is primarily caused by water containing gas that was dissolved under a higher than atmospheric pressure. The DEQ has set the water quality standard for TDG at 110 percent of saturation (DEQ 2019). The 110 percent of saturation water quality standard was developed to protect fish from high levels of TDG, which may cause gas bubble trauma (GBT), a condition that affects many aquatic organisms residing in fresh or marine waters which are supersaturated with atmospheric gases. GBT can cause injury and, in severe cases, death to fish. Montana's Surface Water Quality Standards and Procedures include 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 department that continued operations will be done in the best practicable manner to minimize harmful effects."

At many dams, water passing over the dam (known as spill) plunges into a deep armored stilling basin. Stilling basins are designed to confine energy dissipation in the armored zone, so that erosion does not scour and undermine the spillway. As spill plunges, a turbulent energy dissipation zone is created, characterized by unsteady flow and high shear forces. Vertical circulation cells often take turbulence aeration to depth, where hydrostatic pressure collapses bubbles, forcing gas into solution and elevating TDG levels (gas absorption).

At the Thompson Falls Project, the spillway is built on bedrock. Therefore, scour is not a concern and thus there is no formal spillway stilling basin and no plunge pool. The depth of the bedrock shelf immediately downstream of the spillway apron appears not to be deep enough for appreciable gas absorption to occur on the basis of required hydrostatic pressure. The rock shelf extends downstream to a waterfall which has a deeper downstream pool where there is enough depth for appreciable TDG uptake.

The Project was built on a natural river falls (**Photographs 6-1, 6-2**). No data on TDG during the pre-Project time period are available. However, the natural waterfalls likely elevated TDG in the Clark Fork River.

Photograph 6-1: **View of Thompson Falls, Montana (in background) and the Clark Fork River (in foreground), at the site of the Main Channel Dam of the Thompson Falls Project. Circa 1908. Woodworth Photo. Photo courtesy of the University of Montana, K. Ross Toole Archives).**

Photograph 6-2: View of Thompson Falls, Montana (in background) and the Clark Fork River (in foreground), circa 1908. Woodworth Photo. Photo courtesy of the University of Montana, K. Ross Toole Archives.

TDG carrying capacity depends on temperature and ambient pressure. TDG supersaturation is an unstable condition, and if the river channel downstream of a spillway is sufficiently wide and shallow, and with an appreciable enough hydraulic gradient, channel boundary roughness will force flow to "tumble" in a manner where there is increased water surface exposure of ambient air conditions. Where these kinds of open-channel flow conditions occur, TDG levels rapidly drop back to near the stable, 100 percent saturation level. The distance that is required for this to happen varies from site to site.

However, if there is a downstream reservoir impounded near the powerhouse tailrace, as is the case at the Project, the normal river gradient is reduced, and the flow regime becomes more stable. Lower reservoir velocities result in less turbulence, and elevated TDG levels often persist above saturation after entering the impoundment. If there are elevated wind levels, enough shear can be created to induce the vertical circulation necessary to reduce TDG levels. Otherwise, the elevated reservoir TDG levels wane slowly, by delayed replenishment by lower level TDG inflows.

6.7.4.1 TDG Monitoring

NorthWestern and the prior licensee monitored TDG in the Clark Fork River most years from 2003 to 2022. These data have helped to inform the optimal operations scenario to minimize TDG concentrations. The prior Licensee developed a TDG Control Plan in 2010 in consultation with the DEQ (PPL 2010**)**. 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 Project. Since 2010, the TDG Control 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. Because these new radial gates are a change from the spill panels that were previously in use, NorthWestern proposed additional TDG monitoring to assess the effect on TDG from the new radial gates. Data collection occurred in 2019, 2020, 2021, and 2022. These data have resulted in a better understanding of TDG concentrations at a wider range of discharge levels.

Hydrolab instruments (through 2021) and Eureka Manta instruments (2022) were 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 6-10** provides the locations of each of these monitoring sites.

Table 6-10: Description of TDG Monitoring Sites

Site Name	Site Description
Above Dam (AD)	Upstream face of the Dry Channel Dam
High Bridge (HB)	Downstream of the Main Channel Dam
Birdland Bay Bridge (BBB)	Clark Fork River downstream of Project at Birdland Bay Bridge

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. **Figures 6-32 and 6-33** show the location of the TDG monitoring sites in relation to Project infrastructure.

Figure 6-32: TDG monitoring locations.

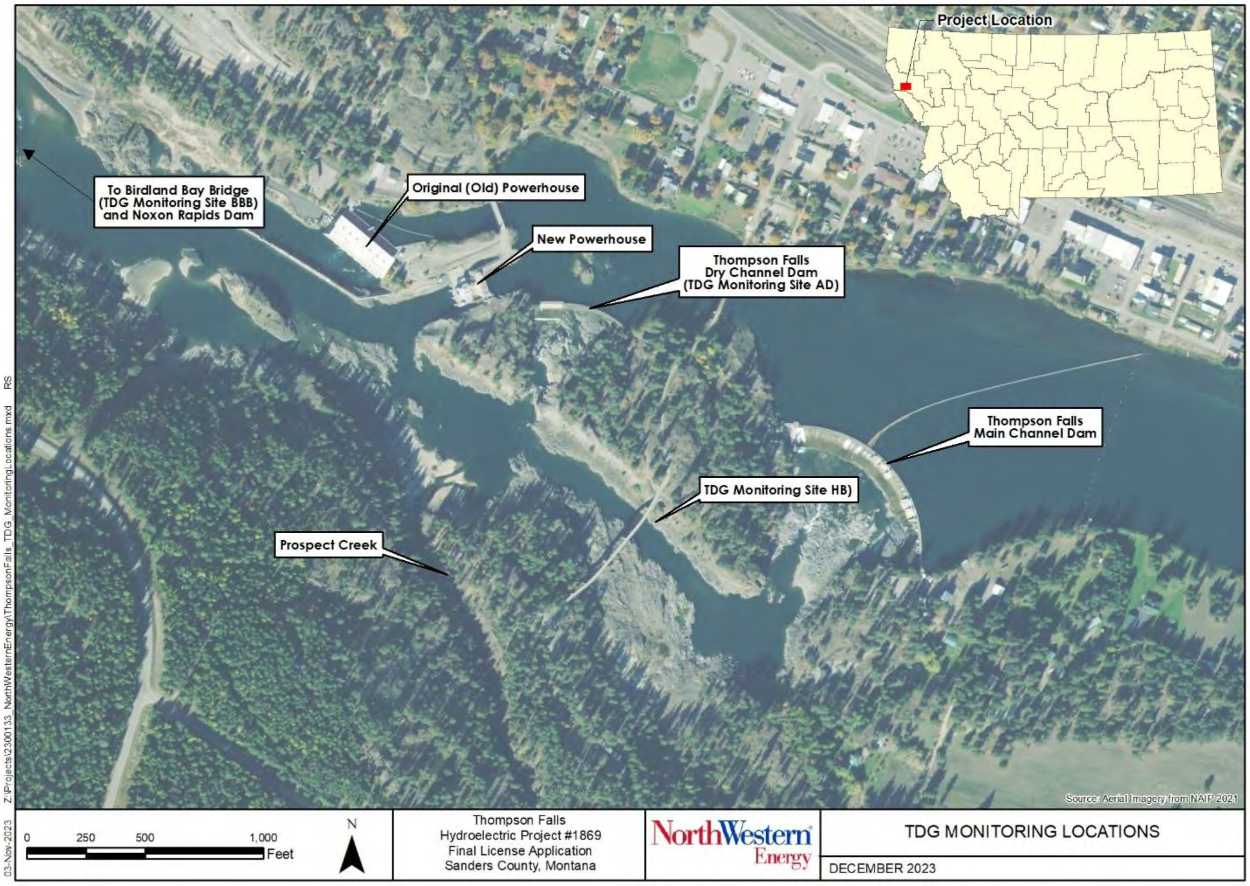
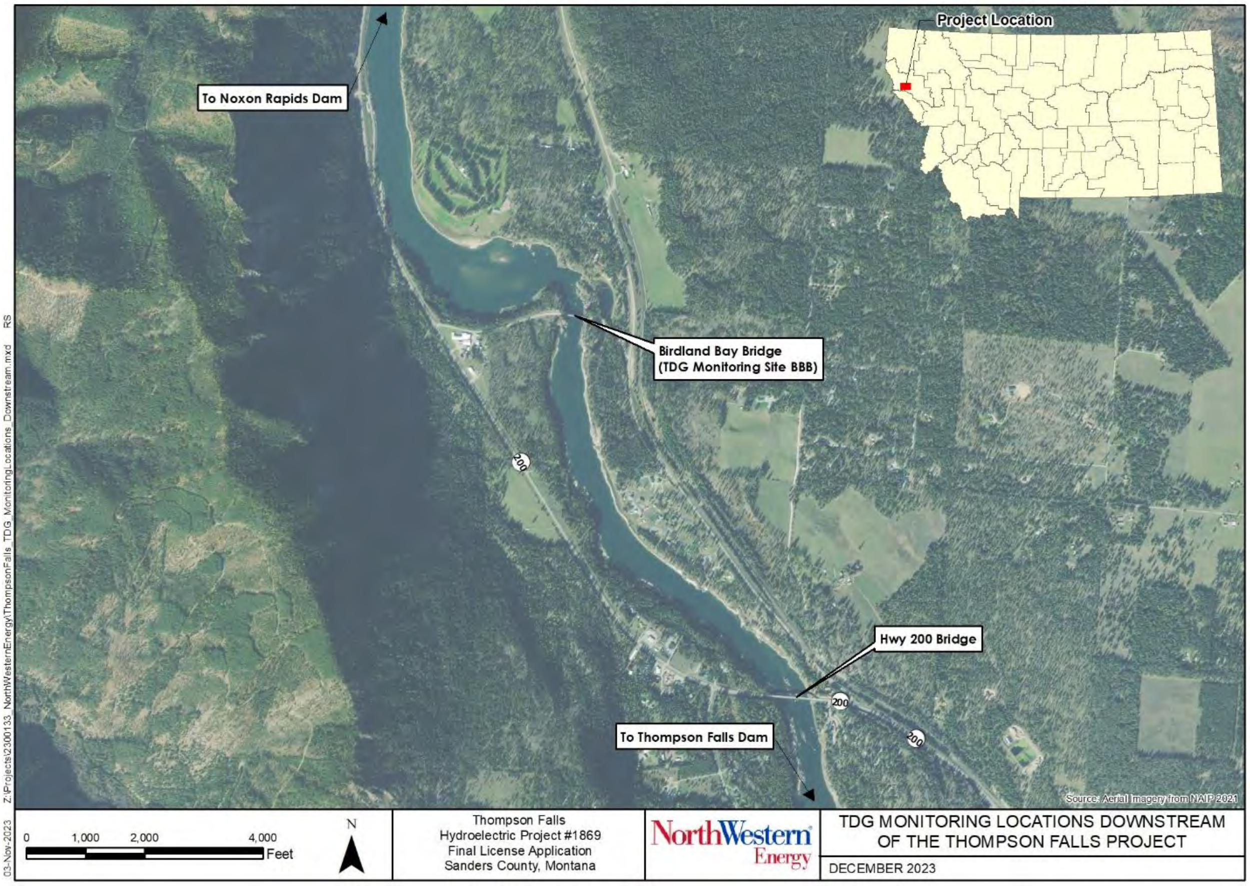


Figure 6-33: TDG monitoring locations downstream of the Thompson Falls Project.



TDG concentrations are highest during spring runoff, so data collection is focused on the early May through early July period. Current TDG monitoring methods have been used since the TDG Control Plan was put in place in 2010. Per the 2010 TDG Control Plan, NorthWestern monitors TDG when the April 1 Natural Resource Conservation Service most probable (50%) runoff forecast for the Clark Fork River is at or above 125 percent. The decision to monitor dissolved gas outside of the runoff forecast conditions is made annually by the TAC.

TDG data are collected throughout the spring runoff season to capture the variability of TDG entrainment in relation to flow rate in the Clark Fork River. Datasondes are used to measure TDG on 15-minute intervals throughout this monitoring period and are calibrated on a bi-weekly basis to ensure sensor accuracy.

As a part of the FERC approved TDG study, operators of the Project tested various configurations of spill through the Main Channel Dam using different combinations of two of the four radial gates for the purposes of measuring changes in TDG. Two gates were tested at a time to represent potential future operating conditions. Under normal spill operation, two radial gates will remain closed and held "in reserve" for the purposes of flow restoration below the dam in the event of a plant trip at the powerhouse, or if needed for reservoir elevation control. The other two remaining radial gates will be used for spill operations. Each gate spill configuration was held for approximately 4 hours to allow the downstream TDG levels to stabilize.

6.7.4.2 TDG Monitoring Results

TDG upstream of the Thompson Falls Project, measured in the forebay, is generally between 100 and 108 percent of saturation regardless of river flow (NorthWestern 2019, 2023).

The Project routes flow through the powerhouses at a discharge less than 23,000 cfs, with no need to operate the spillways except a small discharge released at the Main Channel Dam for fish passage purposes. TDG measurements collected above the Project and below the powerhouses in 2003 found that TDG in the powerhouse tailrace was generally 1 to 2 percent lower than TDG in the forebay (PPL Montana 2010). Therefore, passing flow through the powerhouses results in slight de-gassing of the flow. For this reason, during the time periods when the spillways are not in use, TDG as measured at the Birdland Bay Bridge is generally equal to or slightly less than the TDG measured above the dams (PPL Montana 2010).

When river discharge exceeds the capacity of the powerhouses, flow passes over the spillways, then passes over the natural falls, adding TDG at both points. Higher flows create higher levels of TDG, up to a point, though the relationship between flow and TDG is non-linear. At the highest levels of discharge, TDG at sites downstream of the Project increases with increasing discharge, but at a much slower rate.

During the highest discharge, the tailwater elevation downstream of the spillway and falls rises enough to backwater the falls, and there is a reduced plunging action into the deep pool below the falls. During peak discharge time periods, when spill over the Project's dams exceeds 60,000 cfs, TDG exceeds 120 percent at the High Bridge, which is downstream of the Main Channel Dam but upstream of the powerhouses' tailrace channels.

TDG dissipates downstream of the High Bridge. In addition, low TDG water from the powerhouses mixes with higher TDG water that has passed over the spillways and falls. Therefore, TDG is lower at the Birdland Bay Bridge than it is at the High Bridge. While the levels of TDG with discharge varies from year to year, as shown in **Table 6-11**, there does not appear to be a pattern of changing TDG over time.

During the 2021 and 2022 study seasons, testing was conducted on various configurations of spill through the Main Channel Dam using different combinations of the four radial gates (**Figure 6-34**). Each gate spill configuration was held for approximately 4 hours to allow the downstream TDG levels to stabilize. TDG was measured below the main channel dam at the High Bridge site to monitor changes in TDG concentrations as radial gate configurations were tested. **Table 6-12** shows a summary of the results of this testing as well as data from previous testing conducted in 2019 and 2020.

Overall, the study found that while the radial gate operational scenario that entrained the least amount of TDG differed at various river flows, opening non-adjacent radial gates generally entrains less TDG downstream than opening adjacent radial gates. While opening non-adjacent radial gates during spill operations will most likely reduce the amount of TDG entrained downstream, operation in this manner may not be practical at all times due to the need to flush large woody debris from the trash boom to prevent the debris from building up on the face of the dams.

The buildup of large woody debris on the upstream faces of the Main Channel and Dry Channel dams can lead to situations where the stanchions need to be removed to ensure adequate flow passage and to maintain the structural integrity of the dams. The stanchions hold the dam panels in place which control reservoir elevation. When the stanchions are removed, NorthWestern loses the ability to control reservoir elevation as well as the ability to operate the fish ladder until spring runoff recedes and the dams have been repaired.

In previous instances where the removal of the stanchions has occurred, there was a large increase in the percent of TDG entrained downstream due to uncontrolled releases through the dam. In 2018, which was the last time the stanchions were removed, there was a 5 percent increase in TDG at the High Bridge site following the stanchion removal (NorthWestern 2019). The drastic increase in TDG entrainment from stanchion removal is far more significant than the differences in TDG entrainment from operating adjacent radial gates vs non-adjacent radial gates, therefore radial gate operations should be conducted in a way to facilitate passage of debris and minimize the need for emergency stanchion removal.

Table 6-11: Mean TDG (%) recorded over a range of discharge at the Birdland Bay Bridge on the Clark Fork River, Montana, 2003-2022

Total Flow (thousand cfs)	>23, <30	>30, <40	>40, <50	>50, <60	>60, <70	>70, <80	>80, <90	>90, <10	>100, <110	>110, <120
2003	102.1	104.7	109.5	111.0	112.9	113.2	N/A	N/A	N/A	N/A
2004	103.5	105.0	107.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2005	103.6	107.1	110.4	112.7	114.1	114.0	N/A	N/A	N/A	N/A
2006	103.6	106.7	110.6	114.3	115.7	115.7	N/A	N/A	N/A	N/A
2007	102.5	105.2	109.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2008	102.2	105.6	110.6	114.9	116.0	115.9	N/A	N/A	N/A	N/A
2009	102.6	105.2	109.2	113.0	113.1	N/A	N/A	N/A	N/A	N/A
2010	102.0	106.6	110.9	111.6	N/A	N/A	N/A	N/A	N/A	N/A
2011	102.9	105.8	108.1	111.0	113.5	116.0	116.8	119.7	120.6	119.9
2012	102.3	104.4	108.8	111.2	113.0	112.7	112.5	N/A	N/A	N/A
2014	102.7	104.7	108.6	111.5	114.8	115.4	116.2	N/A	N/A	N/A
2017	103.0	105.2	108.7	113.9	115.2	115.6	116.6	N/A	N/A	N/A
2018	104.0	106.8	110.1	113.3	112.5	115.0	115.7	N/A	N/A	N/A
2019	102.5	104.6	110.5	112.9	113.2	N/A	N/A	N/A	N/A	N/A
2020	102.5	105.5	109.1	112.0	114.3	115.8	116.1	N/A	N/A	N/A
2021	102.9	105.1	108.7	111.8	N/A	N/A	N/A	N/A	N/A	N/A
2022	102.6	105.1	108.9	113.0	115.5	117.5	117.0	118.1	N/A	N/A
Mean 2003-2022	**102.8**	**105.5**	**109.4**	**112.5**	**114.1**	**115.2**	**115.8**	**118.9**	**120.6**	**119.9**

Notes: > = greater than; > = less than; N/A = data not available at that flow range

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Figure 6-34: View of the Thompson Falls Main Channel Dam Radial Gates Looking Upstream.

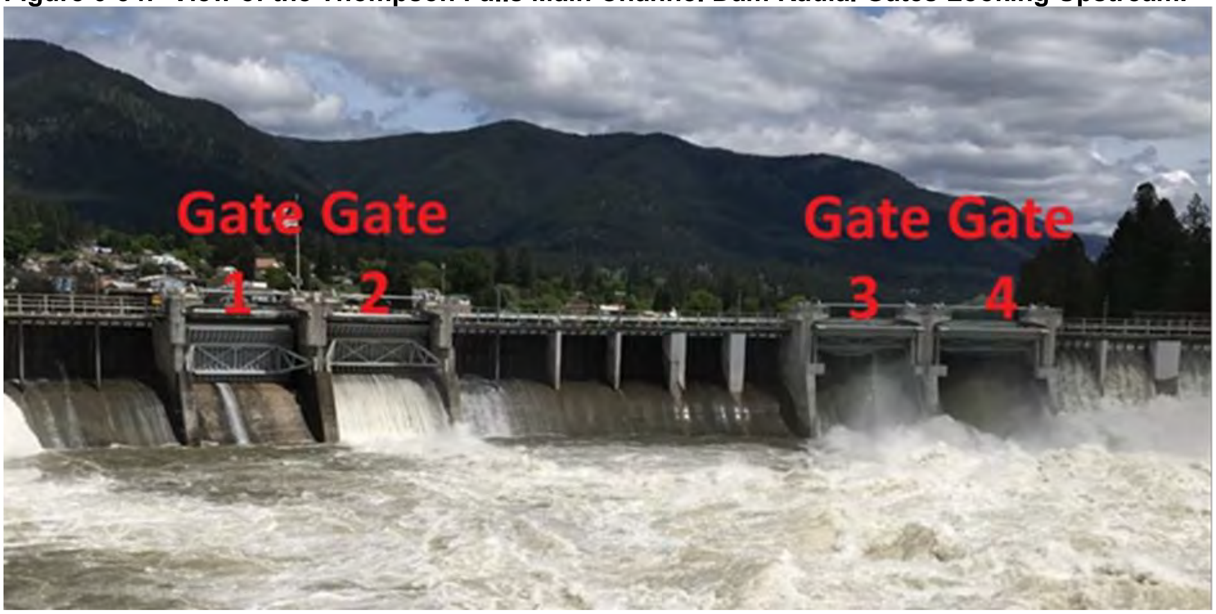

Table 6-12: Maximum and minimum TDG by flow range at the High Bridge, 2019-2022

Total Flow Range (cfs)	Max TDG at HB (% saturation)	Gate Setting at Max TDG	Min TDG at HB (% saturation)	Gate Settings Min TDG
30,000-35,000	112.5	1 full open, 2 4' open	107.5	4-partially open
40,000-45,000	114.4	1 and 2 open	111.7	1 and 4 open
45,000-50,000	118.8	1 and 4 open	116.2	2 and 4 open
[1]55,000-60,000	121.6	3 and 4 open	119.6	1 and 2 open
[2]55,000-60,000	122.2	1 and 2 open	119.9	2 and 4 open
65,000-70,000	122.7	3 and 4 open	119.8	1 and 3 open
75,000-80,000	123.1	1 and 2 open	121.2	2 and 3 open
80,000-85,000	124.1	3 and 4 open	120.6	1 and 3 open

Notes: cfs = cubic feet per second; HB = High Bridge; TDG = Total Dissolved Gas
[1] Partial testing was conducted in 2019
[2] Full testing was conducted in 2022

6.7.5 Biological Monitoring

Biological indicators are an important part of monitoring the overall ecological health of a waterbody. These biological indicators typically respond to changes in water quality and can be studied to see a response to changing water quality conditions.

Aquatic macroinvertebrates and periphyton, the assemblage of aquatic organisms that attach to substrate, are strong bioindicators of stream health. Healthy streams support diverse macroinvertebrate communities of mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), caddisflies

(*Trichoptera*), true flies (*Diptera*), beetles (*Coleoptera*), and many others. Macroinvertebrate and periphyton assemblages reflect cumulative impacts of all pollutants, such as toxic substances, organic pollution, or excessive sediment loading.

Zooplankton found in a lake or reservoir can be an important food source for fish and other aquatic organisms. Their presence and species composition can be used as an indicator of biological community health of a lake or reservoir.

Fish species can accumulate environmental contaminants in their muscle tissue over time through bioaccumulation. Typically, top trophic level predator species have the highest concentrations of contaminants, while lower trophic level prey species have the lowest concentrations of contaminants. Monitoring and tracking the concentrations in fish tissue contaminants over time can be used as an indicator of the environmental health of a waterbody.

6.7.5.1 Biological Monitoring Methods

Biological monitoring occurred at two sites for macroinvertebrate and periphyton collection, three sites for zooplankton collection, and a reservoir-wide sampling effort for fish tissue biocontaminants (**Table 6-13**).

In 2019, macroinvertebrate and periphyton samples were collected at sites CF1 and CF3 to determine if there were any changes in the biological community upstream and downstream of the reservoir (**Figure 6-35**). Macroinvertebrate sampling methods used were consistent with NorthWestern's large river macroinvertebrate sampling methodologies. Sites CF1 and CF3 were chosen because the riffle habitat at these sites was the only appropriate habitat available in the Project area that meets the large river sampling criteria.

In addition to the macroinvertebrate and periphyton samples collected upstream and downstream of the reservoir, zooplankton samples were also collected at three sites on the reservoir, TFR1, TFR2, and TFR3 to determine the existing species composition and densities (Figure 6-36). These sites were chosen to be representative of the upper, middle, and lower areas of Thompson Falls Reservoir. Vertical plankton tows were collected using an 80 µm (commonly known as micron, or micrometer) mesh Wisconsin plankton net, and tow lengths were from the reservoir bed to the water surface.

Fish tissue samples were collected in the fall of 2019 as a part of NorthWestern's Thompson Falls Reservoir fisheries surveys. Gillnets were placed at multiple locations in the reservoir to capture representative fish populations throughout the reservoir. An attempt was made to analyze tissue from multiple species including both predator species and bottom-dwelling prey species. Multiple fish were collected of each species and each predator fish (Rainbow Trout and Northern Pike) was filleted and the fillets were composited by species to run as one representative composite sample per species. Bottom-dwelling prey species (Largescale Sucker) were processed whole and composited for one representative sample for that species.

Table 6-13: Description of methods and parameters measured at water chemistry monitoring sites.

Site Name	Site Purpose	Sampling Method	Samples Collected
CF1	Biological communities upstream of the reservoir	Kicknet, Scrape method	Macroinvertebrates, Periphyton
CF3	Biological communities downstream of the reservoir	Kicknet, Scrape method	Macroinvertebrates, Periphyton
TFR1	Upper reservoir sampling site	Wisconsin plankton net	Zooplankton
TFR2	Middle reservoir sampling site	Wisconsin plankton net	Zooplankton
TFR3	Lower reservoir sampling site	Wisconsin plankton net	Zooplankton
Thompson Falls Reservoir	Representative fish community sample	Gillnet	Fish tissue

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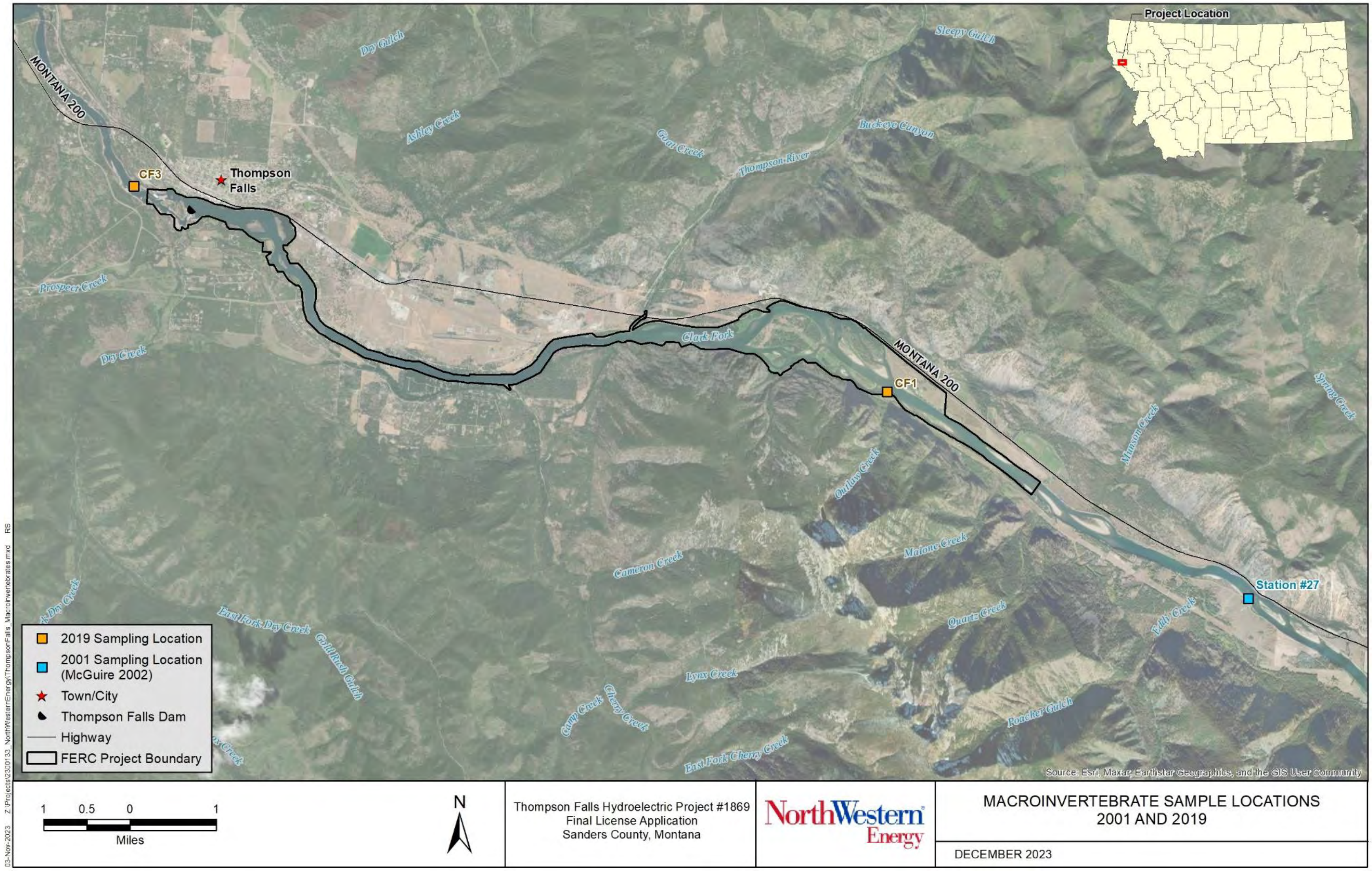
Figure 6-35: Locations of 2019 macroinvertebrate sampling (CF1, CF3) and McGuire's (2002) sampling in 2001 (Station #27).



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6.7.5.2 Benthic Macroinvertebrates

Macroinvertebrate data were collected upstream (site CF1) and downstream (site CF3) of Thompson Falls Reservoir in 2019 to compare the biological communities and look at any effects on those communities from the Project. **Table 6-14** shows a comparison of the macroinvertebrate data collected at monitoring sites CF1 and CF3. The 2019 biological monitoring found that the Clark Fork River upstream (CF1) and downstream of Thompson Falls (CF3) support very similar macroinvertebrate benthic densities. Late-July density estimates at CF3 reported 5,560 (±563) benthic macroinvertebrates per square meter (1,390 per sample), while upstream (CF1) densities averaged 5,115 (±950) per m^2.

In years of higher-than-normal discharge, macroinvertebrate densities are typically lower due to the flushing effect of high flows. Higher flows can reduce benthic macroinvertebrate densities by directly removing less velocity tolerant organisms (scuds, snails) or by removing silt in the gravels that favor midges and aquatic worms. Although higher than normal flows were observed in 2018 and 2019, midges (Diptera family: *Chironomidae*) still dominated the samples at both sites (Montana Biological Survey/Stag Benthics 2019).

Table 6-14: Mean macroinvertebrate values for 8 metrics used in the bioassessment scores for 2019 samples.

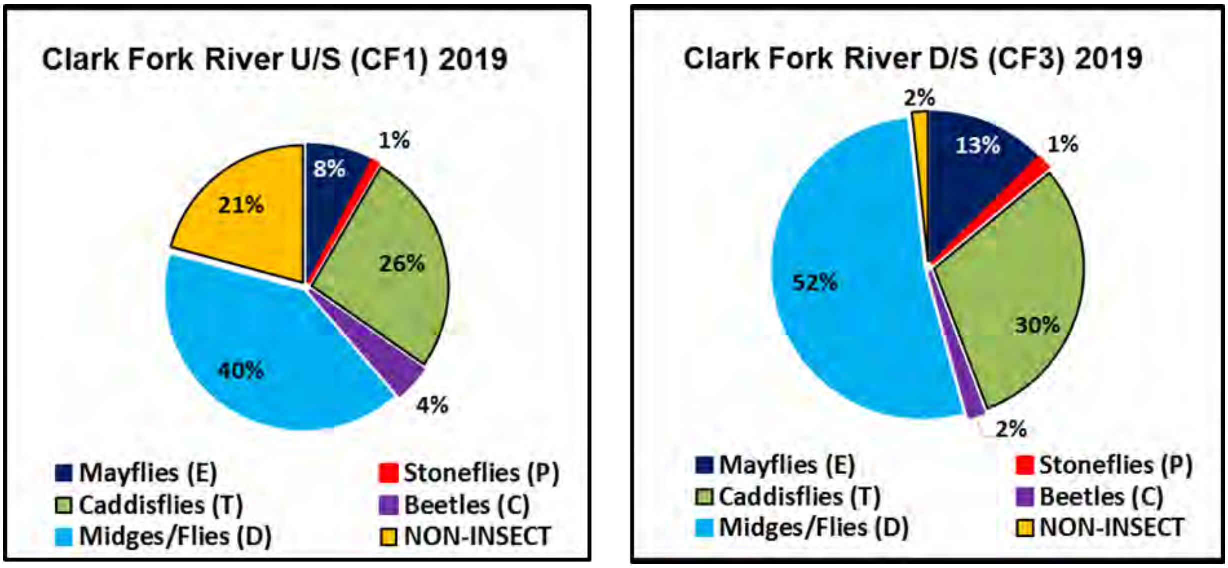
Metric	CF1	CF3
Taxa Richness	37	38.4
EPT Richness	16.4	19.6
Shannon Diversity (log2)	3.6	3.4
Biotic Index	5.3	5.0
% EPT	36%	44%
% Chironomidae	40%	48%
% Filterers	49%	67%
EPT/EPTC	47%	48%
Mean Densities (per m^2)	5,115 (± 956)	5,568 (± 563)
Metals Tolerance Index	2.5	2.9

Note: An average of 37 benthic macroinvertebrate taxa, including 16 EPT (*Ephemeroptera*, *Plecoptera*, and *Tricoptera*) species were collected per sample upstream of Thompson Falls, while 38 total taxa and 20 EPT taxa were collected downstream in 2019

Macroinvertebrate community composition was also fairly similar upstream and downstream of Thompson Falls Dam except for a higher relative abundance of non-insect taxa reported at the CF1 site (**Figure 6-36**). The large non-insect taxa component at CF1 was largely comprised of *Lymnaeidae* and *Physidae* snails in the genera *Fossaria* and *Physella*, respectively. Dipterans accounted for 40 and 52 percent of the benthic community composition for CF1 and CF3 in 2019, respectively; this was largely composed of the midges, *Chironomidae*. Riffle beetles (*Coleoptera*:

family *Elmidae*) made up a small, but not insignificant, component of the benthic community at each Clark Fork River site (Montana Biological Survey/Stag Benthics 2019).

Figure 6-36: Macroinvertebrate community composition for sites CF1 and CF3.



Mayflies and caddisflies are important components of the Clark Fork River benthic community and to the bioassessment metrics, while Stoneflies represent a relatively small component (~1%) (*refer to* Figure 6-36). Caddisflies were the most abundant of the EPT taxa in the Clark Fork River samples collected in 2019, representing 26 and 30 percent of the upstream (CF1) and downstream (CF3) communities, respectively. Of the 11 species of caddisflies collected at these sites, populations of three net-spinning caddisflies (*Cheumatopsyche, Hydropsyche occidentalis* and *H. morosa gr.*) were most abundant below the dam at site CF3, while the net-spinner, *Cheumatopsyche* and the long-horned caddisflies, *Ceraclea* and *Oecetis* were most abundant upstream of the reservoir at site CF1 (Montana Biological Survey/Stag Benthics 2019).

Mayflies were the third most abundant invertebrate group at the downstream site (CF3) in 2019, while upstream (CF1) they were the fourth most abundant group (*refer to* Figure 6-36). Of the 13 species of mayflies reported at site CF3, the most common were Tricos (mayflies in the genera *Tricorythodes*), *Tricorythodes minutus,* Blue-winged Olives *Acentrella and Baetis tricaudatus* and *Macaffertium* in the family *Heptageniidae*. A few *Attenella margarita* have been collected at this site. Site CF1 reported 8 species of mayflies with the dominant being Tricos, two *Heptageniidae* species, *Macaffertium* and *Heptagenia* and *Attenella margarita* (Montana Biological Survey/Stag Benthics 2019).

6.7.5.3 Periphyton

In the periphyton assemblage, there were two predominant taxa found upstream and downstream of the reservoir, *Achnanthidium minutissimum* and *Achnanthidium subatomus*. These two species comprised 57.17 percent of the upstream sample and 55.97 percent of the downstream sample.

There was little change between the upstream and downstream metric scores, which ranged from good to excellent (**Table 6-15**).

Table 6-15: 2019 Clark Fork periphyton metric scores upstream and downstream of Thompson Falls Reservoir.

Site Name	Site Description	Date of Sample	Metric	Value	Rating
CF1	Clark Fork River upstream of Thompson Falls Reservoir	7/31/19	Shannon H	3.394	Excellent
			Species Richness	44	Excellent
			Dominant Taxon Percent	40.82%	Good
			Siltation Taxa Percent (Sediment)	11.24%	Excellent
			Pollution Index (Nutrients)	2.792	Excellent
			Disturbance Taxa Percent (Metals)	40.82%	Good
			Abnormal Cells Percent (Metals)	0.00%	Excellent
			Bioindex (DEQ Mountains)	N/A	Good
CF3	Clark Fork River downstream of Old Powerhouse	7/31/19	Shannon H	3.670	Excellent
			Species Richness	52	Excellent
			Dominant Taxon Percent	30.22%	Good
			Siltation Taxa Percent (Sediment)	9.83%	Excellent
			Pollution Index (Nutrients)	2.729	Excellent
			Disturbance Taxa Percent (Metals)	30.22%	Good
			Abnormal Cells Percent (Metals)	0.00%	Excellent
			Bioindex (DEQ Mountains)	N/A	Good

6.7.5.4 Zooplankton

Zooplankton were collected at three sites in Thompson Falls Reservoir in July 2019, using a vertical plankton tow. Results of the zooplankton tows are displayed in **Table 6-16**. Zooplankton concentrations in the reservoir were quite low, which is not surprising given the short residence time of water in the reservoir. Reservoir residence times of greater than 18 days are generally required to support a sustainable zooplankton population (Brook and Woodward 1956). This time is needed for the zooplankton to successfully reproduce before being flushed downstream. Typical residence times of water in Thompson Falls Reservoir range from less than 4 hours in June to approximately 17 hours in September (*refer to* **Figure 6-9**).

Table 6-16: Zooplankton data collected from Thompson Falls Reservoir in 2019.

Taxon		Site TFR1 (Upstream end of TF Reservoir) 2019		Site TFR2 (Mid TF Reservoir) 2019		Site TFR3 (Downstream end of TF Reservoir) 2019	
		Count	Cells / ml	Count	Cells / ml	Count	Cells / ml
Cladocera	Chydoridae	0	0	0	0	1	0.00000161
Copepoda	Cyclopoida	1	0.00000189	4	0.00000821	5	0.00000804
Copepoda	Harpacticoida	0	0	1	0.00000205	0	0
Rotifera	Conochilus	0	0	2	0.00000411	0	0
Rotifera	Euchlanis	3	0.00000568	9	0.00001848	6	0.00000965
Rotifera	*Filinia longiseta*	2	0.00000378	0	0	0	0
Rotifera	*Filinia terminalis*	0	0	4	0.00000821	7	0.00001126
Rotifera	*Gastropus hyptopus*	1	0.00000189	0	0	1	0.00000161
Rotifera	*Kellicottia longispina*	9	0.00001703	3	0.00000616	4	0.00000643
Rotifera	*Keratella cochlearis*	5	0.00000946	1	0.00000205	4	0.00000643
Rotifera	*Keratella testudo*	9	0.00001703	0	0	7	0.00001126
Rotifera	Lecane	0	0	0	0	2	0.00000322
Rotifera	Monostyla lunaris	0	0	0	0	1	0.00000161
Rotifera	Pompholyx	0	0	2	0.00000411	3	0.00000483
Rotifera	Rotifera	4	0.00000757	6	0.00001232	8	0.00001287
Rotifera	Synchaeta	1	0.00000189	0	0	0	0
Rotifera	*Trichotria tetractis*	1	0.00000189	0	0	0	0

6.7.5.5 Fish Tissue Biocontaminants

In the fall of 2019, fish tissue samples were collected in Thompson Falls Reservoir for the purpose of quantifying concentrations of biocontaminants in fish. Eleven fish in total were collected as a part of this effort. Lengths and weights were recorded for each fish, and the fish from each species were composited into a single representative sample for the species (**Table 6-17**). Two predator species were represented in this sampling, Northern Pike and Rainbow Trout, and one bottom-dwelling prey species was represented, Largescale Sucker for a total of three representative composite samples.

Table 6-17: Individual fish length and weight data for composited fish tissue samples collected in 2019.

Fish Species	Length (mm)	Weight (g)
Largescale Sucker	230	140
Largescale Sucker	265	222
Largescale Sucker	260	218
Largescale Sucker	250	196
Northern Pike	720	3238
Northern Pike	640	2592
Northern Pike	625	2138
Northern Pike	530	908
Northern Pike	495	723
Rainbow Trout	420	1098
Rainbow Trout	460	1080

Notes: g = gram; mm = millimeter

Results of the fish tissue analysis are shown below in **Table 6-18**. These data were provided to FWP to supplement their fish consumption advisory dataset. FWP samples Thompson Falls Reservoir once every 5 years to maintain and update any fish consumption advisories that may be in place. Currently, there are fish consumption advisories for Northern Pike, Rainbow Trout, Smallmouth Bass, and Yellow Perch from Thompson Falls Reservoir due to the presence of Mercury (FWP 2021).

Table 6-18: 2019 Fish tissue biocontaminant analysis results by species.

Analyte	Rainbow Trout	Northern Pike	Largescale Sucker
Strontium	ND	0.8	26.2
Copper	1	1	4
Manganese	ND	2	36
Nickel	ND	ND	ND
Zinc	17	18	61
Arsenic	ND	ND	0.4
Cadmium	ND	ND	ND
Chromium	ND	ND	0.4
Selenium	0.9	0.6	0.7
Mercury	0.32	0.57	ND
Aluminum	ND	ND	47
Iron	30	17	115
Lead	ND	ND	ND

Notes: ND = that the sample result was not found at a detectable concentration. All results are presented in mg-kg dry

6.8 Environmental Measures

6.8.1 Existing Environmental Measures

The Licensee has frequently monitored TDG in the Clark Fork River from 2003 to 2022. NorthWestern has also conducted fisheries monitoring to assess the frequency of occurrence of GBT. In 2010, a TDG Control Plan was developed to reduce TDG in the tailrace, while maintaining operational safety and maximizing attraction flow for fish passage. The TDG Control Plan has been followed since.

6.8.2 Proposed Environmental Measures

NorthWestern is proposing to implement the PM&E measures described below:

- The Licensee shall implement the Thompson Falls Water Quality Monitoring Plan (Appendix C), which was developed in consultation with DEQ.
    - The Licensee will implement the updated TDG Control Plan (Appendix G), which was developed in consultation with DEQ.

6.9 Environmental Effects

6.9.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section – 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented, including limiting reservoir level fluctuations by only 2.5 feet. In addition, the Water Quality Monitoring Plan would not be implemented.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Under the no action alternative, reservoir water level fluctuations to 4 feet below full pool could occur periodically. A minor increase in turbidity was found when the reservoir was drawn down below 3 feet. No other impacts to water quality were detected in the assessment of the 4-foot drawdown during the 2019 operation's test.

The TDG Control Plan would continue to be implemented, and no additional impacts to TDG would be expected to occur. NorthWestern will continue to monitor TDG levels during periods of high flow in the Clark Fork River.

Changes in water quality can occur when a reservoir is drawn down due to changing velocities and their erosional forces on bed sediments as the reservoir volume is reduced. The October 2023 drawdown allowed NorthWestern an opportunity to study and characterize any water quality changes. The largest potential impact to water quality from a reservoir drawdown is the re-suspension of bed sediments and the potential to move those sediments into the riverine environment downstream, and severity of impacts can generally be correlated with the rate of the drawdown and depth of the drawdown.

During the October 2023 drawdown, NorthWestern collected turbidity and water chemistry data to capture any potential water quality changes from the drawdown. The results of this monitoring effort indicated that very low levels of turbidity were measured during the drawdown, with pre-drawdown turbidity being less than 2 NTU and turbidity throughout the drawdown measuring approximately 5 NTU or less. Turbidity increased to about 5 NTU when the reservoir reached an elevation of 2,390 feet and remained at that level until the drawdown was completed. Water chemistry samples were collected upstream of the dam and downstream of the original powerhouse, which was being used to draw the reservoir down. Both samples were analyzed for metals, PCBs, and dioxins and the upstream and downstream water quality were found to be similar upstream and downstream. All metal concentrations were below water quality standards, no PCBs were found at detectable levels, and Dioxins were found to be below screening levels.

As described in **Exhibit E - Section 2.1.3.2 – Maintenance Activities Requiring Lower Reservoir Levels – No Action Alternative**, these deep drawdowns are necessary, on occasion, for Project operations and maintenance, and would occur under both the no action and the proposed action alternatives.

6.9.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations.

Implementation of the proposed alternative is not expected to affect water quality. To assess potential effects of continuing operations of the Project on water quality over the duration of the license term, NorthWestern proposes that water quality monitoring be conducted to develop long-term trends in accordance with the Water Quality Monitoring Plan (Appendix C), which includes provisions for routine monitoring for nutrients and TDG. This plan was developed in consultation with DEQ and will be implemented upon the issuance of the new license. In addition, sediment quality monitoring will occur as warranted prior to any permitted sediment disturbance or removal of reservoir bed sediments. If changes in water quality are observed during routine monitoring, NorthWestern will work with DEQ to evaluate if the observed changes are Clark Fork basin-wide from upstream sources, or if they may be related to Project operations.

Operation of the Project results in TDG levels in excess of 110 percent during periods of high flow. However, no significant adverse impacts to fish have been found during GBT monitoring efforts between 2008 and 2014 (see Exhibit E - Section 7.1.1.2 – Clark Fork River Downstream of Thompson Falls Dams) as a result of the TDG levels at the Project. NorthWestern will continue to monitor TDG levels during periods of high flow in the Clark Fork River. Implementation of the proposed alternative is not anticipated to have any additional impacts on fish as a result of TDG.

From 2019 through 2022, NorthWestern conducted tests to determine what effect radial gate configurations had on TDG during high flow conditions in the spring. NorthWestern used this information, in conjunction with the TDG data collected during periods of normal operation, to update the 2010 TDG Control Plan in consultation with DEQ. NorthWestern proposes to implement the TDG Control Plan, as described in **Exhibit E - Section 6.8.2 – Proposed Environmental Measures**, to guide operations during periods of spill.

Proposed modifications to the Project boundary incorporate the lands and water that are needed for Project purposes. The proposed Project boundary modification will have no impact on water resources.

6.10 Unavoidable Adverse Impacts

Normal operation of the Project during limited periods of high streamflow that result in spill conditions, TDG may exceed the water quality standard of 110 percent. However, the standard has an exemption for reasonable operation of the Project being considered natural (MCA 75-5-306(2)).

7. Fisheries and Aquatic Resources

7.1 Affected Environment

This Section describes the fish and aquatic resources within and outside of the FERC Project boundary. Some of the fish species in this Project area are migratory, therefore this Section includes a description of the Lower Clark Fork River Drainage upstream and downstream of the Project boundary, as well as Prospect Creek, Thompson River, and Cherry Creek, important tributaries (**Figure 7-1**).

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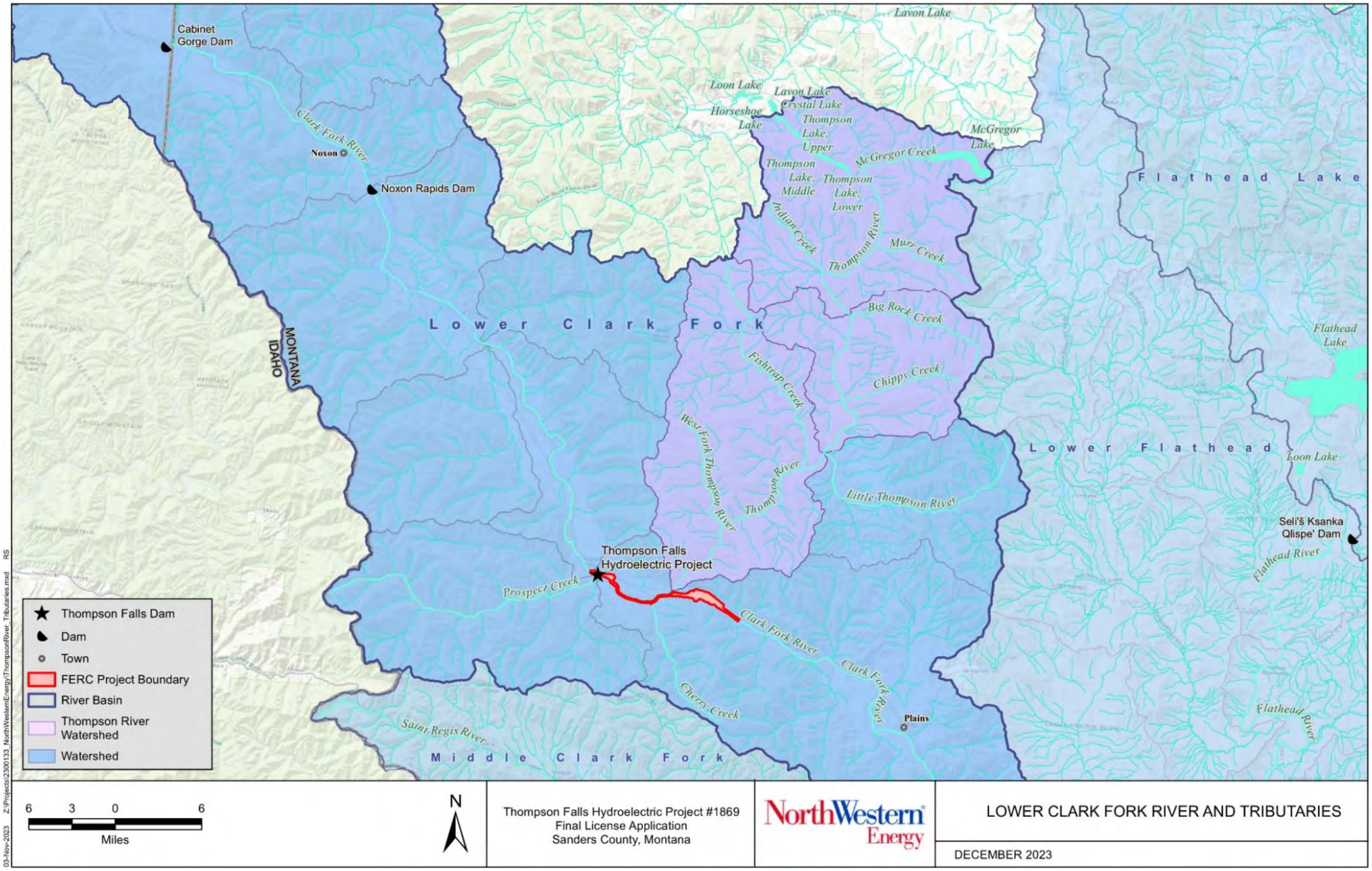
Figure 7-1: Lower Clark Fork River drainage.



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7.1.1 Aquatic Habitat

7.1.1.1 Thompson Falls Reservoir

The current Project boundary encompasses about 12 miles of river and reservoir. The maximum depth of the reservoir is approximately 90 feet. For bathymetric maps of the reservoir *refer to* Figures 6-4 through 6-9.

The reservoir is 400 to 1,800 feet wide. The downstream 6 miles of the reservoir provides lacustrine (lake-like) habitat, and the upstream half (6-12 miles upstream) provides lotic (riverine-like) habitat.

The downstream section has substantially lower water velocity, mean widths near 1,673 feet and abundant aquatic vegetation. The upstream section of the reservoir has noticeable flowing water, average widths around 459 feet and minimal aquatic vegetation. These differing habitat characteristics influence the fish species community between the upper and lower reservoir.

Water temperature data collected in Thompson Falls Reservoir indicate that the reservoir does not stratify in the summer months and is generally thermally homogeneous. The Project does not modify water temperatures, as incoming water temperatures to the reservoir have been shown to be the same as those leaving the Project below the dam and powerhouse (*refer to* **Exhibit E - Section 6.7.3 –Water Temperature**). The cool water influence of the Thompson River extends downstream in Thompson Falls Reservoir a short distance, approximately 328 feet downstream of the Thompson River confluence and 50 feet from the right bank. Additional water temperature data indicate there may also be some cool water potentially from groundwater inflow, near Cherry Creek, approximately 2 miles downstream from the Thompson River. However, these small areas of cool water do not extend throughout the reservoir but appear to be highly localized. It does not appear that there are large cool water zones in Thompson Falls Reservoir.

Tributaries that feed into the Thompson Falls Reservoir include Cherry Creek and the Thompson River (*refer to* **Figure 7-1**). Cherry Creek enters on the south side of the reservoir and is known to provide habitat for salmonids. Cherry Creek is a relatively small tributary and averages 16 feet across at its mouth and quickly narrows to 11 feet across within about 200 feet upstream of its confluence with the Clark Fork River. Where Cherry Creek enters the reservoir there is a large plunge pool that is greater than 5 feet deep (NorthWestern 2023d).

The Thompson River flows into Thompson Reservoir approximately 6 miles upstream of the Thompson Falls dams. Approximately 0.3 mile of the Thompson River at the confluence with the Clark Fork River are within the FERC Project boundary. The Thompson River is a considerably larger tributary than Cherry Creek and has more variable habitat at the confluence with the Thompson Falls Reservoir (**Photograph 7-1**).

The Thompson River has several major tributaries including the West Fork Thompson River, Fishtrap Creek, the Little Thompson River, Chippy Creek, Murr Creek, and Big Rock Creek. The confluence of the Little Thompson River is near the 17-Mile Bridge, and both Fishtrap Creek and the West Fork Thompson River join the Thompson River downstream of the mouth of the Little Thompson River. The West Fork Thompson River and Fishtrap Creek support Bull Trout spawning and rearing habitat.

Photograph 7-1: Aerial view of the confluence of the Thompson River with the Clark Fork River.

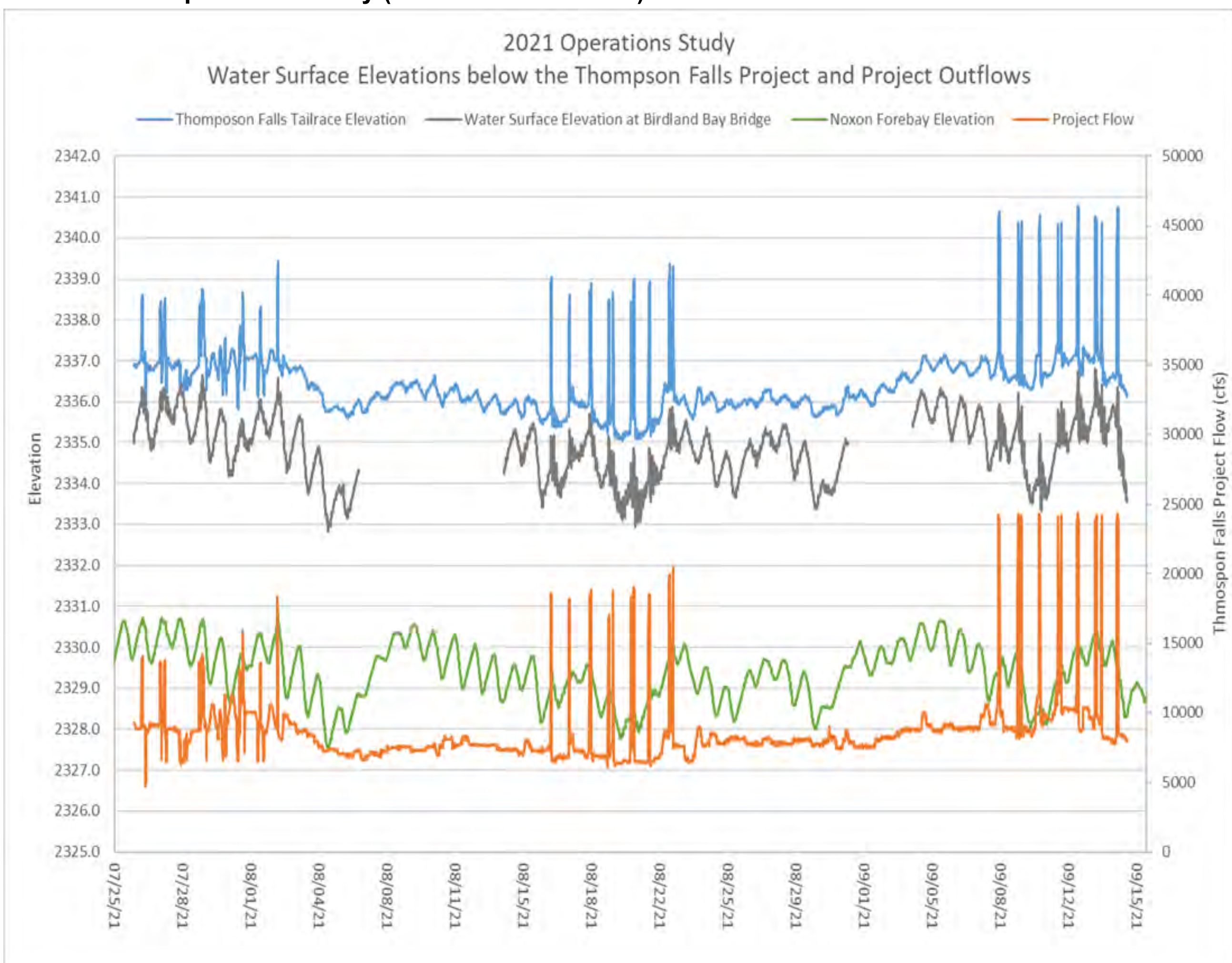
7.1.1.2 Clark Fork River Downstream of Thompson Falls Dams

Downstream of the Thompson Falls Project is Noxon Rapids Reservoir, part of Avista's Clark Fork River Project (FERC Project P-2058). Noxon Rapids Reservoir is the largest reservoir in the Lower Clark Fork River basin, impounding an area of approximately 8,000 acres at full pool (FWP 2019).

The habitat in the reach of the Clark Fork River downstream of the Project is classified as riverine, but habitat conditions are influenced by the operations of Noxon Rapids Dam. Tailrace elevations immediately downstream of the Project are related to the total volume of water passing through the Project. The tailrace elevation rises with increased flow through the Project while reduced flows result in lower tailrace elevations (**Figure 7-2**). However, natural Clark Fork River channel features act as grade control in this reach, rapidly attenuating the influence of Project outflows downstream.

In addition, Noxon Rapids Reservoir operations have an influence on Clark Fork River flows all the way upstream to the tailrace of the Project. At Birdland Bay Bridge, 3.2 miles downstream of the Project, water surface elevations are relatively stable and influenced predominantly by operations of Avista's Noxon Rapids Dam (NorthWestern 2023e). **Figure 7-2** shows water surface elevation (WSE) data from the 2021 Operations Study that NorthWestern conducted and reported on in the Operations Study - ISR (NorthWestern 2022e). Changes in WSE at Birdland Bay Bridge closely mirror WSE changes at the Noxon Rapids forebay. Birdland Bay Bridge is within the Clark Fork Project No. 2058 project boundary and is generally regarded as the upstream extent of the area impounded by Noxon Rapids Dam. Therefore, the resulting changes in WSE and their close association with Noxon Rapids forebay elevation are expected.

Figure 7-2: Water surface elevations and Project flow measured during the 2021 Thompson Falls Operations Study (NorthWestern 2022e)



The influence of operations at Noxon Rapids Dam on WSE in the Project tailrace are also observed but are attenuated relative to WSE at Birdland Bay Bridge. This is demonstrated in Figure 7-2 on August 5th-9th, 2021, when outflow from the Project was relatively constant, but a noticeable increase in WSE at the Noxon Rapids forebay is also observed in the Project tailrace WSE. Similar changes in WSE of the Project tailrace in response to Noxon Rapids Reservoir operations can again be observed on August 20 and September 11, 2021. Prospect Creek flows into the Clark Fork River about 2,600 feet downstream of the Main Channel Dam and directly across from the Dry Channel Dam (**Photograph 7-2**). Prospect Creek provides a cold-water refuge for salmonids during the warm summer months as compared to the mainstem Clark Fork River (Isaak et al. 2017). The *ISR -Fish Behavior Study* observed radio-tagged fish holding in the Clark Fork River near the outlet of Prospect Creek in 2021 during a seasonably warm summer (NorthWestern 2022a). Additionally, water temperature profiles in the Clark Fork River found cooler water available at lower depths at the outlet of Prospect Creek in contrast to profiles taken upstream at the High Bridge or Dollar Hole (NorthWestern 2022a, 2023a).

Photograph 7-2: Aerial of Thompson Falls Hydroelectric Project and Prospect Creek, June 2017.

As described in **Exhibit E - Section 6.10 – Unavoidable Adverse Impacts**, during high flows when the Project is spilling in the spring TDG in the Project tailrace may exceed 110 percent, as measured at the Birdland Bay Bridge site. Mean TDG is more than 115 percent at the Birdland Bay Bridge for short periods in the highest flow years. TDG exceeds 120 percent at the High Bridge infrequently, and rarely occurs at the Birdland Bay Bridge site. When high streamflow results in tripping of the stanchions on the Main Channel and Dry Channel dams for dam safety, TDG may exceed 120 percent (at High Bridge and Birdland Bay Bridge) due to uncontrolled spill. Based on the 20 years of TDG monitoring, this situation was observed and documented in 2011 when TDG reached a maximum of 120.6 percent at Birdland Bay Bridge when streamflows were between 100,000 and 110,000 cfs (*refer to* Table 6-11).

Dissolved gas super-saturation can cause GBT, a variety of physiological symptoms, which can be harmful or fatal to fish and other aquatic organisms. The risk to aquatic life from elevated levels of TDG increases with dosage and exposure (Weitkamp and Katz 1980). In addition, the level of TDG that salmonids can tolerate varies depending on species, body size, general physical condition, swimming depth and water temperature (Johnson et al. 2005). Weitkamp and Katz (1980) concluded that a dramatic change occurs in both the number of deaths and the time to death at approximately 120 to 125 percent TDG in shallow water (3 feet or less). At gas pressures below this general level, a low incidence of GBT will be found in juvenile salmonids, and deaths will occur at a low rate. Above 120 to 125 percent TDG, mortality due to GBT increases dramatically. More recent studies confirm these conclusions in natural waters. Weitkamp et al. (2003) evaluated the incidence of GBT below Cabinet Gorge Dam on the Clark Fork River and found that continuous supersaturation exceeding about 125 to 130 percent of saturation for prolonged periods produced GBT in at least some fish in the lower Clark Fork River. However, intermittent exposure to 120 to 130 percent TDG produced GBT signs in a very small number of Largescale Sucker and Yellow Bullhead. Backman and Evans (2002) examined 4,667 adult Chinook Salmon (*Oncorhynchus tshawytscha)*, 1,878 Sockeye Salmon (*O. nerka*), and 1,431 Steelhead (*O. mykiss*) at Bonneville Dam for incidences of GBT at Bonneville Dam on the Columbia River. They found GBT symptoms were uncommon (<0.5%) among all species when TDG remained below 125 percent. The severity of GBT increased as TDG increased, but most symptoms were minor. Severe symptoms were observed only when TDG exceeded 126 percent.

Data collected in the area have not observed significant physical impacts to fish attributable to TDG. In 2008, 2009, 2011, 2012, and 2014 fish were captured *via* electrofishing during high flow downstream of the Thompson Falls Project and upstream of the Highway 200 Bridge. Peak flows during the sampling years varied from 57,700 cfs to more than 100,000 cfs. Fish were captured and visually inspected for signs of GBT before being released. The gills, lateral line, dorsal fin, and caudal fin were visually examined for blistering, bubbling, boils, or discoloration of the gills. The sampling efforts recorded 11 to 16 species recorded each sampling year and between 0.4 to 9 percent of the fish showing signs of GBT symptoms during a sample event (**Table 7-1**).

Additionally, the number of fish accessing the upstream fish passage declines substantially when flow reach or exceed 50,000 cfs, which coincides with the higher TDG levels measured downstream of the Project. Additionally, fish telemetry studies (2004-2006, 2021-2023) indicate fish move out of the Project area (downstream of Main Channel Dam and High Bridge) during peak flows, thus reducing fish exposure to potentially elevated TDG during peak flows and concentrations more than 110 percent (NorthWestern 2023e).

Table 7-1: Gas bubble trauma in fish collected downstream of the Thompson Falls Project, 2008-2014.

Year	Peak Flow (cfs)	# of Fish	# of Species	# of Fish with GBT Symptoms (% of fish sampled)	Species with Symptoms
2008	75,600	220	16	1 (0.4%)	L WF
2009	57,700	276	14	0	None
2010	58,000	No Sampling	-	-	-
2011	104,000	949	15	67 (7%)	RB, L WF, LS SU, PUMP, N PMN, LL
2012	75,300	295	11	3 (1%)	LS SU, SMB, RB
2013	63,700	No Sampling	-	-	-
2014	96,020	340	13	31 (9%)	RB, LL, L WF, MWF, SMB

Notes: cfs = cubic feet per second; LL = Brown Trout; N PMN = Northern Pikeminnow; LS SU =Largescale Sucker; PUMP = Pumpkinseed; L WF = Lake Whitefish; RB = Rainbow Trout; MWF = Mountain Whitefish; SMB = Smallmouth Bass

7.1.1.3 Clark Fork River Upstream of Thompson Falls Reservoir

Riverine portions of the Clark Fork River (downstream of Flathead River confluence) provide angling opportunities for Smallmouth Bass and Northern Pike. Native suckers, minnows, and whitefish are most common in this reach. Trout are limited due to warm summer water temperatures.

7.1.2 Fish Species and Distribution

7.1.2.1 Fish Populations in the Project Vicinity

Native species present in the Project area include salmonids (Westslope Cutthroat Trout, Bull Trout, and Mountain Whitefish) and non-salmonids (Longnose and Largescale sucker, Northern Pikeminnow, Peamouth, Longnose Dace, Redside Shiner, and Sculpin spp.). FWP's native species management focuses on native salmonids with emphasis on the federally threatened Bull Trout (FWP 2013a, 2019) and Westslope Cutthroat Trout, Montana Species of Concern. Bull Trout are discussed in detail in **Exhibit E - Section 10 – Threatened, Endangered, Proposed, and Candidate Species**. Westslope Cutthroat Trout are discussed in detail in **Exhibit E - Section 7.1.2.2 – Special Status Fish Species.**

Restoration, maintenance, and protection of native species and their habitats is one of FWP's high priorities under their fisheries management program (FWP 2019). Some of the more common nonnative species present in the Project vicinity include game fish such as Largemouth Bass, Smallmouth Bass, Northern Pike, Yellow Perch, Rainbow Trout, and Brown Trout (FWP 2013a, 2019). Walleye (nonnative and illegally introduced), another popular sportfish for anglers, are established downstream of the Project.

NorthWestern conducts routine fisheries surveys. These surveys include fall gillnetting in Thompson Falls Reservoir since 2004, spring electrofishing in Thompson Falls Reservoir and fall electrofishing in two reaches of the Clark Fork River since 2009. The objective for these fisheries surveys is to collect information on species composition and relative abundance. Annual reports of results are submitted to FERC. This information helps track annual and long-term changes in the fish community. Fish species known to be present downstream and upstream of the Project are summarized in **Table 7-2**.

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Table 7-2: Summary of fish recorded downstream of Thompson Falls Dam, at the upstream fish passage facility, and upstream of Thompson Falls Dam

			Downstream of Thompson Falls Dam	Thompson Falls Upstream Fish Passage Facility	Upstream of Thompson Falls Dam (downstream of confluence with the lower Flathead River)	
Fish	**Common Name**	**Scientific Name**	**Noxon Reservoir**	**Work Station**	**Thompson Falls Reservoir**	**Clark Fork River (Above Islands and Paradise to Plains)**
NATIVE SPECIES						
BULL	Bull Trout	*Salvelinus confluentus*	P	P	P	P
LN DC	Longnose Dace	*Rhinichthys cataractae*	P	-	-	P
LN SU	Longnose Sucker	*Catostomus castostomus*	P	P	P	P
LS SU	Largescale Sucker	*Catostomus macrocheilus*	P	P	P	P
MWF	Mountain Whitefish	*Prosopium williamsoni*	P	P	P	P
N PMN	Northern Pikeminnow	*Ptychocheilus oregonensis*	P	P	P	P
PEA	Peamouth	*Mylocheilus caurinus*	P	P	P	P
NPMN x PEA	Northern Pikeminnow x Peamouth	*Ptychocheilus oregonensis x Mylocheilus caurinus*	P	P	-	-
RS SH	Redside Shiner	*Richardsonius balteatus*	P	-	P	P
WCT	Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	P	P	P	P
COT	Sculpin spp.	*Cottus spp.*	P	-	P	P
NONNATIVE SPECIES						
BL BH	Black Bullhead	*Ameiurus melas*	P	-	P	-
BULL x EB	Bull x Brook Trout Hybrid	*Salvelinus confluentus x S. fontinalis*	P	P*	-	-
EB	Brook Trout	*Salvelinus fontinalis*	P	P*	-	-
LL	Brown Trout	*Salmo trutta*	P	P	P	P
KOK	Kokanee	*Oncorhynchus nerka*	P	P	-	-
LMB	Largemouth Bass	*Micropterus salmoides*	P	P	P	-
LT	Lake Trout	*Salvelinus namaycush*	P	P*	P	-
L WF	Lake Whitefish	*Coregonus clupeaformis*	P	-	-	-
NP	Northern Pike	*Esox lucius*	P	-	P	P
PUMP	Pumpkinseed	*Lepomis gibbosus*	P	-	P	P
RB	Rainbow Trout	*Oncorhynchus mykiss*	P	P	P	P
RBxWCT	Rainbow x Westslope Cutthroat Trout hybrid	*Oncorhynchus clarkii lewisi x O. mykiss*	P	P	P	P
SMB	Smallmouth Bass	*Micropterus dolomieu*	P	P*	P	P
WE	Walleye	*Sander vitreus*	P	P*	-	-
YP	Yellow Perch	*Perca flavescens*	P	-	P	P
YL BL	Yellow Bullhead	*Ameiurus natalis*	P	-	P	-

Notes: P = present; - = not observed; *= not passed upstream of the upstream fish passage facility.
Source: J. Blakney, FWP, personal communication, March 21, 2018; PPL Montana 2010, 2010a, 2011--2014; NorthWestern 2015-2018, 2019a, 2022c, 2023c.

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7.1.2.2 Special Status Fish Species

The federally-listed threatened Bull Trout are discussed in **Section 10 – Threatened, Endangered, Proposed, and Candidate Species**, of this Exhibit E. There are two additional special status fish species, the Westslope Cutthroat Trout, and Columbia River Redband Trout. Westslope Cutthroat Trout are present in the Project vicinity but are not common. The Columbia River Redband Trout is known to occur in the Kootenai National Forest (KNF) and Kootenai River drainage but has not been documented in the Lower Clark Fork River drainage (Muhlfeld et al. 2015). Therefore, only the Westslope Cutthroat Trout is discussed in detail.

Westslope Cutthroat Trout are designated as a sensitive species by the USFS Region 1 (2011) and they are also a Montana Species of Concern (SOC). In October 2023, LNF identified species of conservation concern (SCC), but Westslope Cutthroat Trout were not included on the SCC list. In the LNF, the SCC list replaces the USFS Region 1 (2011) list per 2012 Planning Rule. These designations are due to the decline in historic range that is attributed to hybridization, most notably with Rainbow Trout, habitat loss and fragmentation, diversion and dam construction, competition from nonnative species, and overfishing and harvesting (Shepard et al. 2005; FWS 1999; Montana Natural Heritage Program [MNHP] and FWP 2018). Historically Westslope Cutthroat Trout were prevalent in headwater streams on both sides of the Continental Divide (~33,000 miles in Montana) and are now estimated to be present in about 13,000 miles (39%) of their historical range in Montana (Shepard et al. 2003; 2005).

Hybridization between Rainbow Trout and Westslope Cutthroat Trout has occurred throughout the Lower Clark Fork River drainage as a result of historic Rainbow Trout stocking efforts in the mainstem Clark Fork River and tributaries. Both visual identification and genetic testing of individuals have confirmed that hybrid Westslope Cutthroat Trout x Rainbow Trout are located within the Project area.

Westslope Cutthroat Trout life history traits and habitat requirements have been well documented (GEI 2005; FWS 1999; McIntyre and Rieman 1995; Shepard et al. 1984, 2003; COSEWIC 2006; 2016a). In the Lower Clark Fork River drainage, Westslope Cutthroat Trout are either migratory (fluvial/adfluvial) or resident fish. Migratory life forms are either fish that spend most of their adult lives in lakes (adfluvial) or rivers (fluvial) and migrate into tributaries to spawn. Resident Westslope Cutthroat Trout are fish that generally spend their entire lives in the tributaries in which they were born and are usually much smaller in size than their migratory counterparts.

Stream temperature is a key factor in determining distribution and persistence of Westslope Cutthroat Trout (Bear et al. 2005). Westslope Cutthroat Trout prefer clean and cold waters and have optimal growth temperatures, 56.5°F (Bear et al. 2005), similar to Bull Trout, 55.8°F (Selong et al. 2001). In general, juvenile Westslope Cutthroat Trout prefer temperatures ranging between 44.6° and 60.8°F in the tributaries and adult Westslope Cutthroat Trout prefer temperatures less than 60.8°F (McIntyre and Rieman 1995; Sloat 2001). The upper incipient lethal temperature for Westslope Cutthroat Trout (the temperature that is lethal to 50% of the test fish) was 67.3°F (95%

confidence interval, 66.4° – 67.8°F) (Bear et al. 2007). The salmonid fishery in Thompson Falls Reservoir appears to be concentrated at the mouths of the Thompson River and Cherry Creek, as reported by anglers (Terrazas and Kreiner 2017). These confluence areas have cooler water temperatures from the inflow of the cool tributaries and are thus more conducive to summer use by salmonids.

Migratory Westslope Cutthroat Trout home to their natal streams and have been observed traveling over 120 miles in the Flathead River drainage (Shepard et al. 1984) and between 2.6 to 70 miles in the Upper Clark Fork River drainage (Schmetterling 2001). NorthWestern has also documented long range migratory movements of Westslope Cutthroat Trout after ascending the Project's upstream fish passage facility. After release upstream, Westslope Cutthroat Trout have been reported over 60 river miles (RM) upstream from the Project in the St. Regis River and nearly 100 RM upstream in the South Fork Jocko River in the lower Flathead River drainage. Westslope Cutthroat Trout floy tagged at the upstream fish passage facility have also been found in the middle Clark Fork River upstream of the town of Paradise and in the Thompson River drainage (NorthWestern 2023c). Westslope Cutthroat Trout have also been recorded making multiple ascents at the fish passage facility following these long upstream and then downstream migrations. After 12 years of operations (2011-2022), a total of 310 Westslope Cutthroat Trout (259 of which were tagged with passive integrated transponder tags [PIT tags]) have ascended the fish passage facility with a range of nine to 48 per year measuring between 180 to 486 mm. Westslope Cutthroat Trout are observed at the fish passage facility in the spring before peak streamflows in March to May, after the peak streamflows subside in June and July, occasionally in August, and again in the fall months (September and October) before the fish passage facility closes for the season (NorthWestern 2018a; unpublished data). In 2014, a remote PIT tag array sensor was installed in the Thompson River and has operated year-round to present. The array has detected 54 unique Westslope Cutthroat with a history of ascending the fish passage facility and three of these fish were also detected in Fishtrap Creek, a Thompson River tributary. An average of 19 Westslope Cutthroat Trout were PIT tagged annually (2014-2022) at the fish passage facility and released upstream with about one-quarter (5) detected moving upstream and entering the Thompson River (NorthWestern unpublished data).

Although Westslope Cutthroat Trout have been collected at the fish passage facility and passed upstream into Thompson Falls Reservoir, they are rarely found in the reservoir. Summer water temperatures in the mainstem Clark Fork River, upstream and downstream of the Project are elevated (*refer to* **Exhibit E - Section 6.7.3 – Water Temperature**), and not conducive for Westslope Cutthroat Trout. PIT and floy tagging efforts at the upstream fish passage facility show that most tag returns occur in tributaries to the Clark Fork River. Only three Westslope Cutthroat Trout were captured in annual gillnetting surveys between 2005 and 2017, one in 2011 and two in 2017, providing evidence that Westslope Cutthroat Trout spend little time in Thompson Falls Reservoir, and primarily migrate quickly through this suboptimal habitat.

7.1.2.3 Fisheries Downstream of Thompson Falls Dam

Downstream of the Project is Avista's Clark Fork River Project (P-2058), including Noxon Rapids Dam (immediately downstream of the Project) and Cabinet Gorge Dam (downstream of Noxon Rapid Dam). Noxon Rapids Reservoir supports a popular cool water fisheries for Yellow Perch, Northern Pike, Smallmouth Bass and Largemouth bass. Noxon Rapids Reservoir hosts up to seven bass fishing tournaments annually, and currently holds the state record for Northern Pikeminnow. Native suckers and minnow have declined dramatically in Noxon Rapids Reservoir in recent years (FWP 2019).

Walleye were illegally introduced into Noxon Reservoir in the late-1980s or early-1990s and multiple introductions were reported throughout the 1990s (FWP 2019). Annual gill net surveys over the last 20 years (2000-2021) show changes in the fish community since the establishment of a naturally reproducing Walleye population in the early 2000s (FWP 2013b). Walleye abundance in Noxon Rapids Reservoir has increased over the last 20 years while other native species like Largescale Sucker, Northern Pikeminnow, and Peamouth have decreased.

Walleye have not been documented upstream of Thompson Falls Dam in the Clark Fork River, and they are considered by FWP to be an undesirable species in the lower and middle Clark Fork River drainage. For this reason, the Thompson Falls fish passage facility is not operated as a volitional fish passage facility. Each fish that is collected at the fish passage facility is handled, so that undesirable species, such as Walleye, can be prevented from passing upstream.

The decline in native species in Noxon Rapids Reservoir may also be reflected in the fish collections at the Thompson Falls fish passage facility. A decline in native species captures at the upstream fish passage facility has been observed since the start of operations in 2011 (NorthWestern 2023c).

7.1.2.4 Thompson Falls Reservoir Fisheries

October gillnetting has been completed annually since 2004 in Thompson Falls Reservoir. Methods include fishing 10 nylon multifilament experimental sinking gillnets, 125 feet long and 6 feet deep, with five separate 25-foot panels consisting of 0.75-, 1-, 1.25-, 1.5-, and 2-inch bar-measure square mesh for approximately 24 hours. The nets are distributed from the City, upstream to the island complex (**Figure 7-3**). The catch per net in 2022 (the most recent survey), along with the average, minimum and maximum catch per net between 2004 and 2021 is found in **Table 7-3**.

In general, salmonids are rarely observed in Thompson Falls Reservoir gillnet catches. The most common species captured by gillnetting in Thompson Falls Reservoir is Black Bullhead, with Northern Pike being the second-most common species (Table 7-3). In 2022, the most common species captured in the reservoir was Northern Pike followed by Yellow Perch, Pumpkinseed, Northern Pikeminnow, Smallmouth Bass, and Black Bullhead. Since upstream fish passage facility operations commenced in 2011, three PIT tagged fish passed upstream of the fish passage facility have been collected in the reservoir gillnetting (1 Rainbow Trout in 2012 and 2021, and 1 Brown Trout in 2012).

Figure 7-3: The ten gillnet sampling sites and electrofishing site in Thompson Falls Reservoir

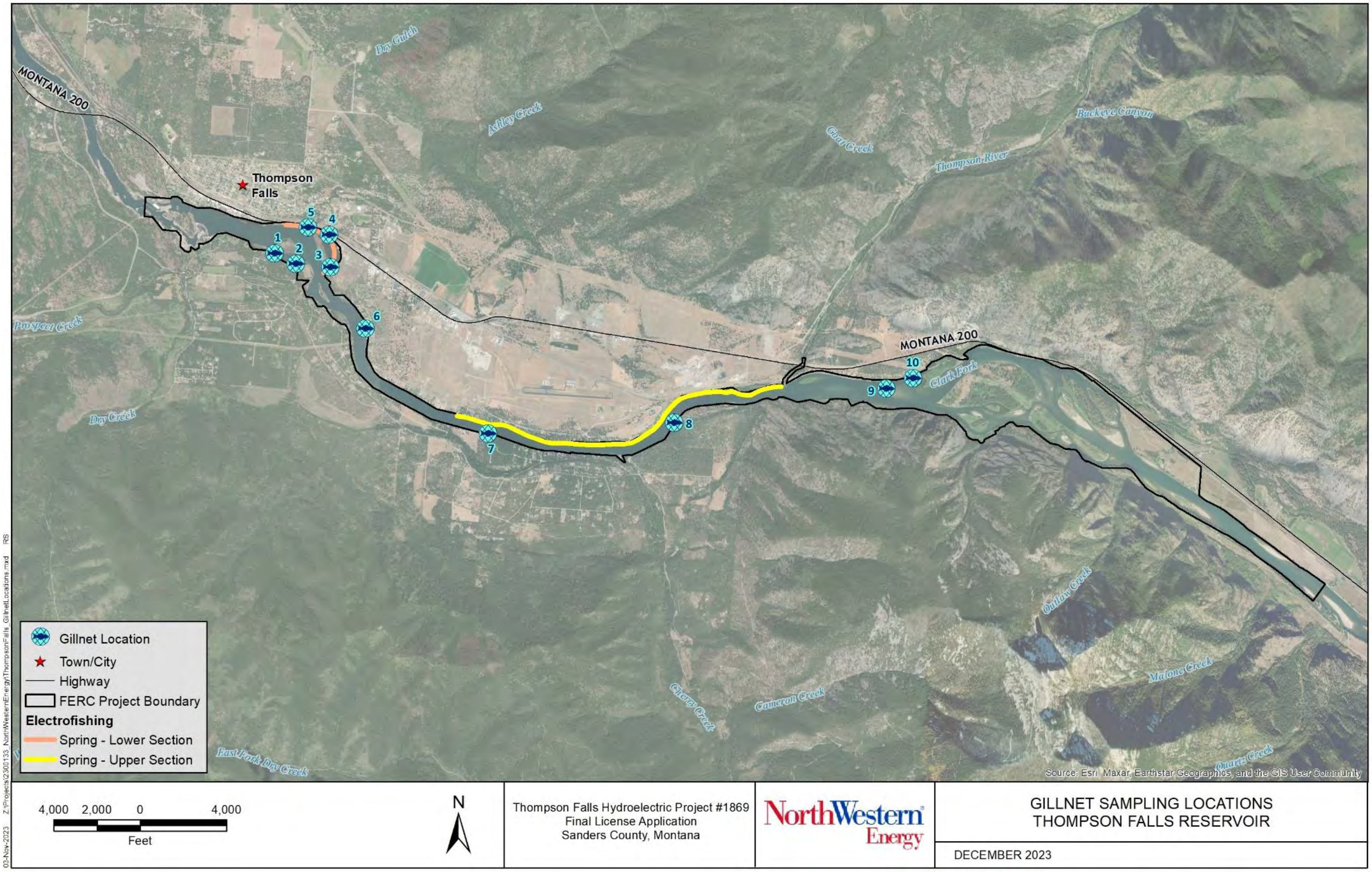

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Table 7-3: Catch per net, by species, during annual October gillnetting, Thompson Falls Reservoir.

Species	2022 Catch per Net	2004-2021 Catch Per Net		
		Avg	Min	Max
Black Bullhead	0.5	3.1	-	14.1
Brown Trout	-	-	-	0.2
Largemouth Bass	0.1	0.1	-	0.3
Longnose Sucker	-	-	-	0.5
Largescale Sucker	0.1	0.7	0.1	1.3
Lake Whitefish	-	-	-	0.1
Mountain Whitefish	0.1	-	-	-
Northern Pike	3.7	2.7	1.0	4.9
Northern Pike Minnow	0.7	0.4	-	1.0
Peamouth	-	-	-	0.1
Pumpkinseed	0.9	0.3	-	1.8
Rainbow Trout	-	0.1	-	0.4
Smallmouth Bass	0.6	0.2	-	0.5
Westslope Cutthroat Trout	-	-	-	0.2
Yellow Perch	1.1	0.7	0.1	1.8
Yellow Bullhead	-	-	-	0.1
Total	**7.8**	**8.2**	**3.3**	**23.1**

Note: A dash indicates no (zero) fish of that species was captured

In addition to gillnetting, nighttime electrofishing has been completed since 2009 to supplement gillnetting efforts and further describe the fish population in Thompson Falls Reservoir. Two reaches are sampled, with one in the lower reservoir along Highway 200, and one from the mouth of Thompson River downstream (**Figure 7-4**). The electrofishing catch per unit effort of salmonids is greater in the upstream section (29 salmonids per hour) than the downstream section (5 salmonids per hour).

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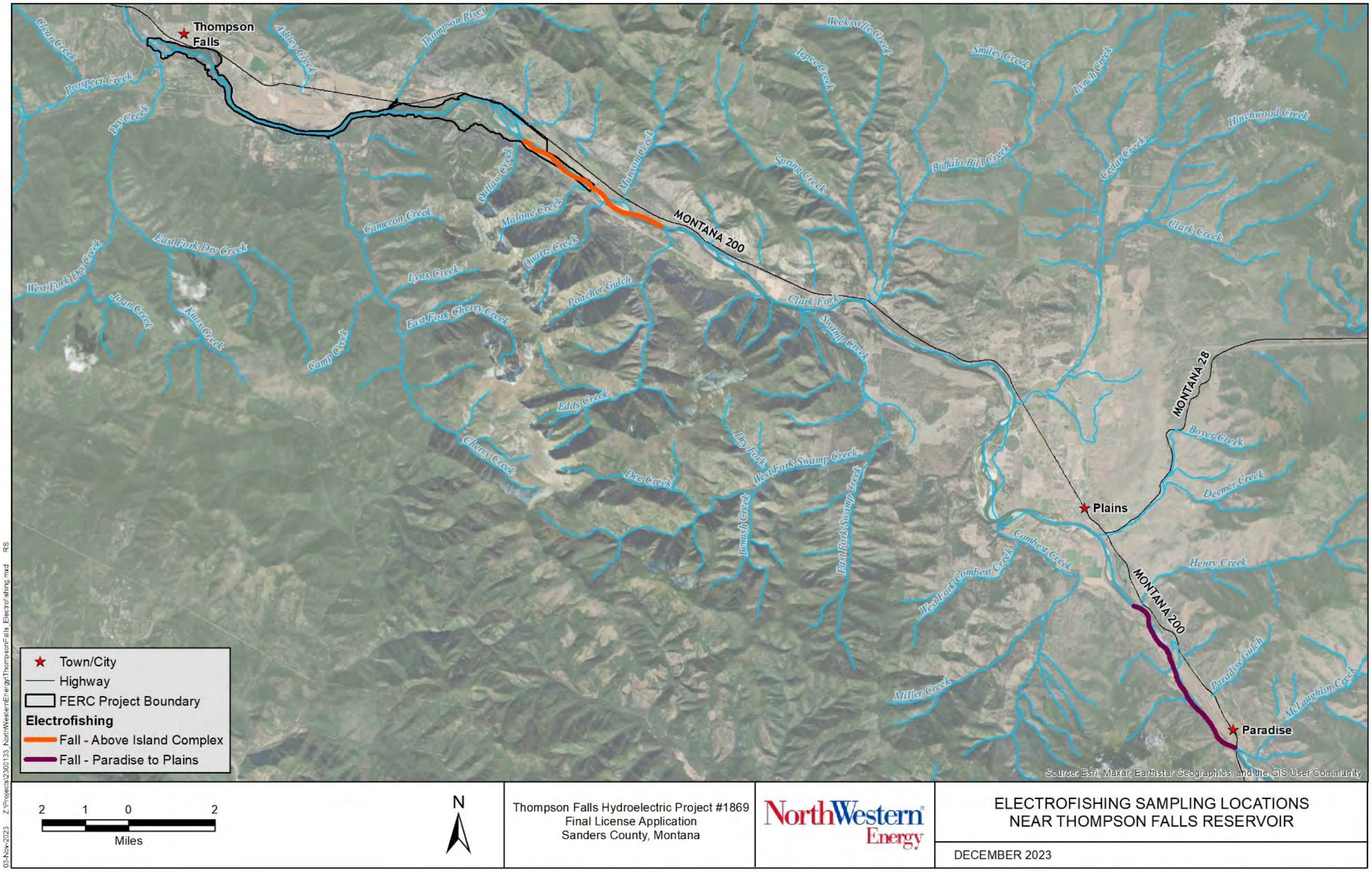
Figure 7-4: Upstream electrofishing sections on the Clark Fork River.



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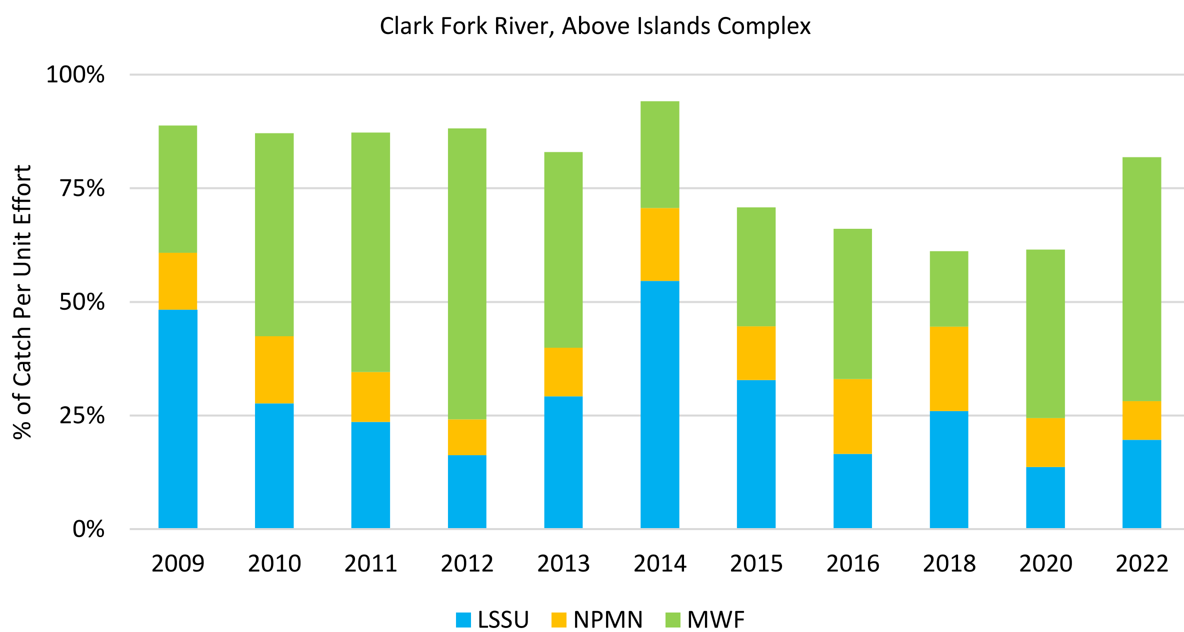
Non-salmonids such as Largemouth Bass, Northern Pike, Pumpkinseed, and Yellow Perch are on average the most common species captured in the downstream section. Largescale Suckers, Northern Pikeminnow, and Rainbow Trout are on average the most common species captured in the upstream section. The differences in species composition and abundance of salmonids are likely related to varying habitat conditions. The upstream sampling section is more of a riverine environment and the downstream sampling section is more lacustrine (lake-like).

7.1.2.5 Clark Fork River Upstream of Thompson Falls

Upstream of the confluence with the Thompson River, NorthWestern completes routine electrofishing surveys in two locations in the Clark Fork River, the Above Islands complex reach, and the Paradise to Plains Reach *(refer to* Figure 7-4). The above islands reach is located within the existing Project boundary, and the Paradise to Plains Reach is approximately 20 miles upstream, and outside of the Project boundary.

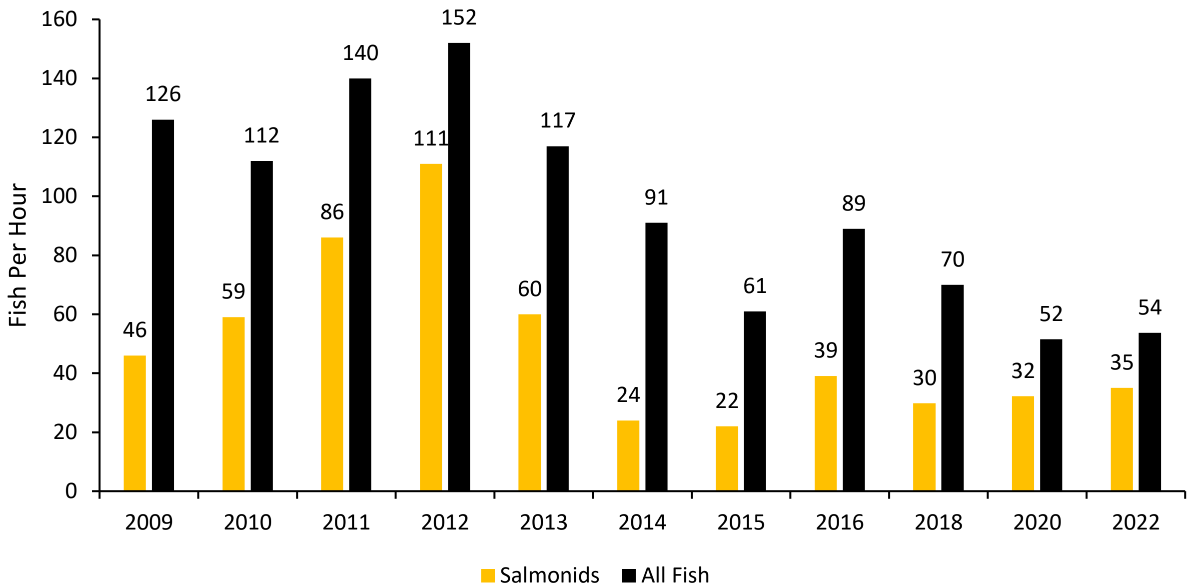
The Above Island complex reach is characterized as riverine habitat and has been surveyed 11 times since 2009. 15 species plus one hybrid, including Bull Trout, Brown Trout, Rainbow Trout and hybrid, Westslope Cutthroat Trout, Mountain Whitefish, Longnose Sucker, Largescale Sucker, Longnose Dace, Northern Pikeminnow, Northern Pike, Peamouth, Smallmouth Bass, Redside Shiner, Yellow Perch, and Yellow Bullhead have been found in the reach. The species composition in the Above Islands reach has remained consistent since sampling began in 2009 with native Largescale Sucker, Mountain Whitefish, and Northern Pikeminnow most common (**Figure 7-5**).

Figure 7-5: Percentage of Largescale Sucker (LSSU), Northern Pikeminnow (NPMN), and Mountain Whitefish (MWF) in electrofishing surveys, Above Islands reach, 2009-2022.



Between 2009 and 2022, the number of fish captured in the Above Islands' reach ranged between 219 fish and 699 fish. Catch rates for salmonids varied from a low of 22 salmonids per hour in 2015 to a high of 111 salmonids per hour in 2012 (**Figure 7-6).** Catch rates for all species has varied from a low of 52 fish per hour in 2020 to a high of approximately 152 fish per hour in 2012 (NorthWestern 2023c).

Figure 7-6: Annual catch rate for all salmonids and all fish captured in the Clark Fork River – Above the Island Complex, 2009-2022.



In the Paradise to Plains reach the species composition has remained relatively consistent over the 6 years of sampling**.** As in the Above Islands complex, Largescale Sucker, Northern Pikeminnow, and Mountain Whitefish (all native species) remain the most common species (**Figure 7-7)**. Other species recorded less frequently include Bull Trout, Brown Trout, Longnose Sucker, Northern Pike, Peamouth, Pumpkinseed, Rainbow Trout and hybrid, Redsided Shiner, Smallmouth Bass, Westslope Cutthroat Trout, and Yellow Perch. Summary of annual catch rate for salmonids and all fish is provided in **Figure 7-8**. Salmonids represent approximately 28 to 43 percent of the fish recorded in the Paradise-to-Plains reach since sampling commenced in 2010 (Figure 7-8). The catch rate for salmonid species, primarily represented by native Mountain Whitefish, has varied between 43 and 136 fish per hour. The catch rate for all species has varied between 38 fish per hour (in 2020) to 314 fish per hour (in 2011) (NorthWestern 2023c).

Figure 7-7: Percentage of Largescale Sucker (LSSU), Northern Pikeminnow (NPMN), and Mountain Whitefish (MWF) from electrofishing surveys, Paradise to Plains reach, 2010-2022

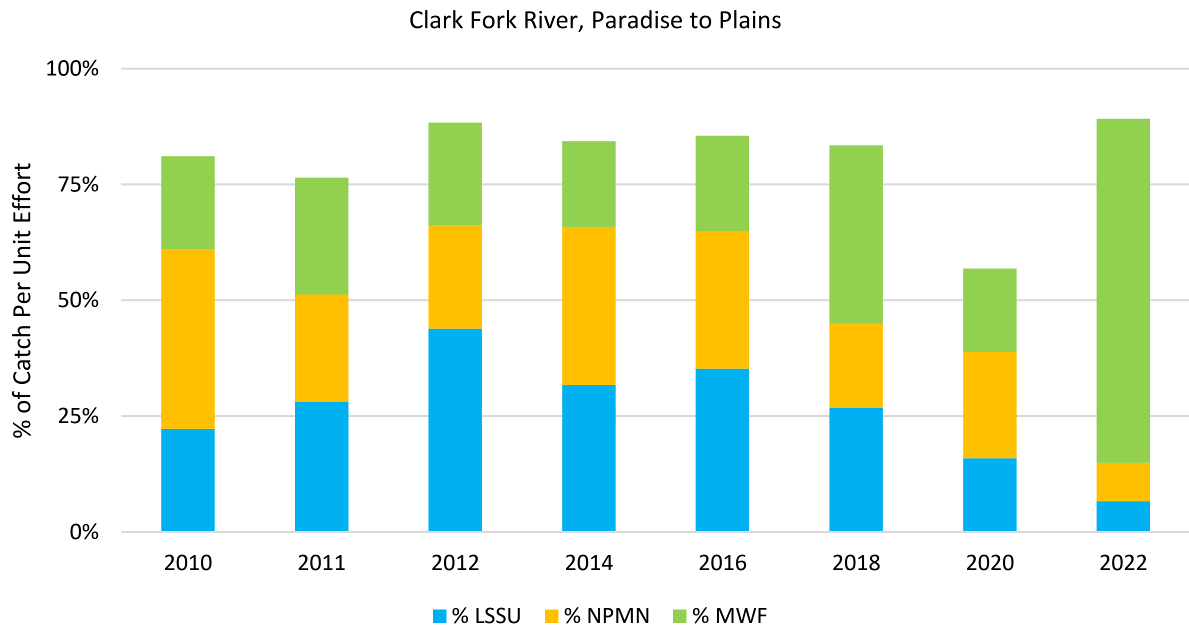
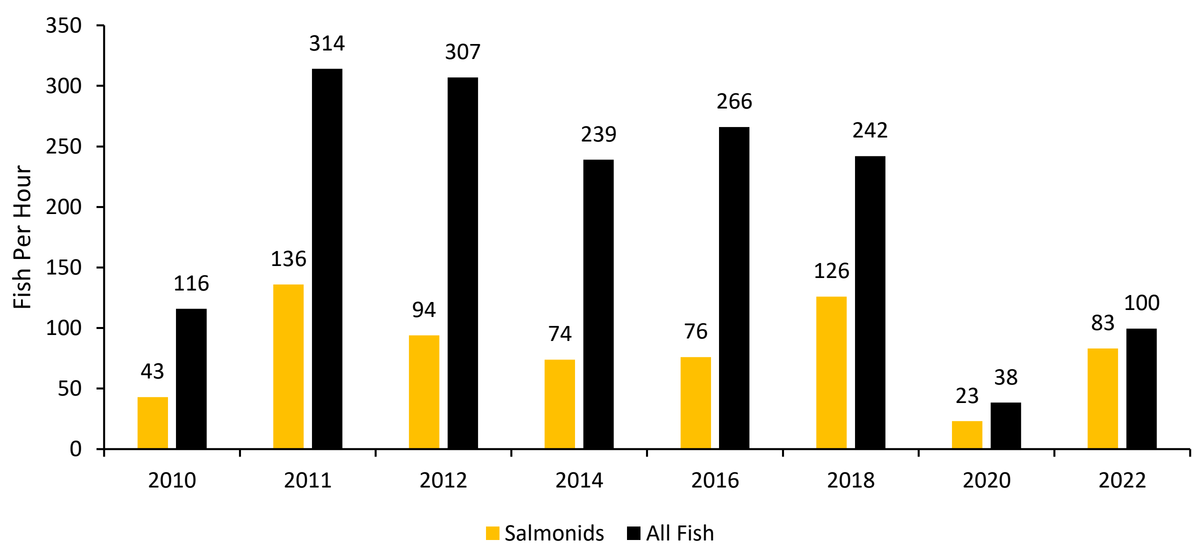


Figure 7-8: Annual catch rate for all salmonids and all fish captured in the Clark Fork River between Paradise and Plains, 2010-2022



7.1.2.6 Tributary Fisheries

7.1.2.6.1 Prospect Creek Fisheries

Prospect Creek is located about 0.5 mile downstream of the Main Channel Dam. Prospect Creek provides important spawning and rearing habitat for native salmonids and sculpin. The fisheries community includes native species such as resident and migratory Bull Trout and Westslope

Cutthroat Trout, as well as Mountain Whitefish and Cedar Sculpin (*Cottus schitsuumsch*). The upstream portion of the drainage is dominated by native trout (Bull Trout and Westslope Cutthroat Trout). The downstream mainstem and tributaries are dominated by nonnative species, Rainbow Trout, Rainbow x Westslope Cutthroat trout hybrid, Brown Trout, and Brook Trout. Abundance and distribution of these fish from data collected in 2003 and 2012 by Avista are available in Moran and Storaasli (2013).

In August 2018, NorthWestern and Avista partnered to fund and install a remote PIT-tag array system in Prospect Creek (near the confluence with the Clark Fork River) with the capability of detecting directionality of upstream and downstream fish movement. The results indicate a small fraction of PIT-tagged salmonids (Rainbow Trout, Brown Trout, Westslope Cutthroat Trout) with a history of ascending the upstream fish passage facility have also entered Prospect Creek. Some of the PIT-tagged fish detected in Prospect Creek were also detected further downstream in Graves Creek, a tributary to Noxon Rapids Reservoir. During the first 3 years the PIT tag array was operating (2018-2020), approximately 2 percent (15 of 756) of tagged salmonids with a history at the upstream fish passage facility were detected in Prospect Creek.

7.1.2.6.2 Thompson River Fisheries

The Thompson River and its tributaries contain native resident and migratory Bull Trout, Westslope Cutthroat Trout, and Mountain Whitefish as well as native suckers and sculpins. Other common nonnative recreational fish in the Thompson River include Rainbow Trout and Brown Trout, and to a lesser extent Brook Trout (Copenhaver et al. 2006; Katzman 2006; GEI Consultants, Inc. and Steigers 2013; NorthWestern 2015; NorthWestern 2016; NorthWestern 2017; NorthWestern 2018a; NorthWestern 2019a; NorthWestern 2022c; NorthWestern 2023c; Kreiner and Terrazas 2018).

The Thompson River is popular for fishing with about 13,000 angler days reported in 2015 with an average of 8,229 angler days per year (FWP 2019). In the 1950s and 1960s, anglers reported Rainbow, cutthroat, Brook Trout, and Mountain Whitefish as the most abundant catch (FWP 2019). Currently, Brown Trout are the most abundant game species in the upper section of the Thompson River (FWP 2019).

The Thompson River also provides designated Critical Habitat for migratory (adfluvial/fluvial) and resident Bull Trout, including spawning and rearing habitat in Fishtrap Creek and West Fork Thompson River as well as important habitat for adfluvial/fluvial and resident Westslope Cutthroat Trout. Glaid (2017) tagged 566 subadult Bull Trout and evaluated their outmigration from Fishtrap Creek and West Fork Thompson River from fall 2014 through spring 2016. This study concluded that few subadults emigrated from the tributary drainages to the mainstem Thompson River. Of the 566 subadult Bull Trout PIT-tagged, 26 were detected outmigrating to Thompson Falls Reservoir (Glaid 2017). Of the out-migrating subadults, peak outmigration from the tributaries occurred in October and peak movement through the reservoir was December. The study also showed subadult Bull Trout outmigrating from the tributaries utilized portions of the mainstem

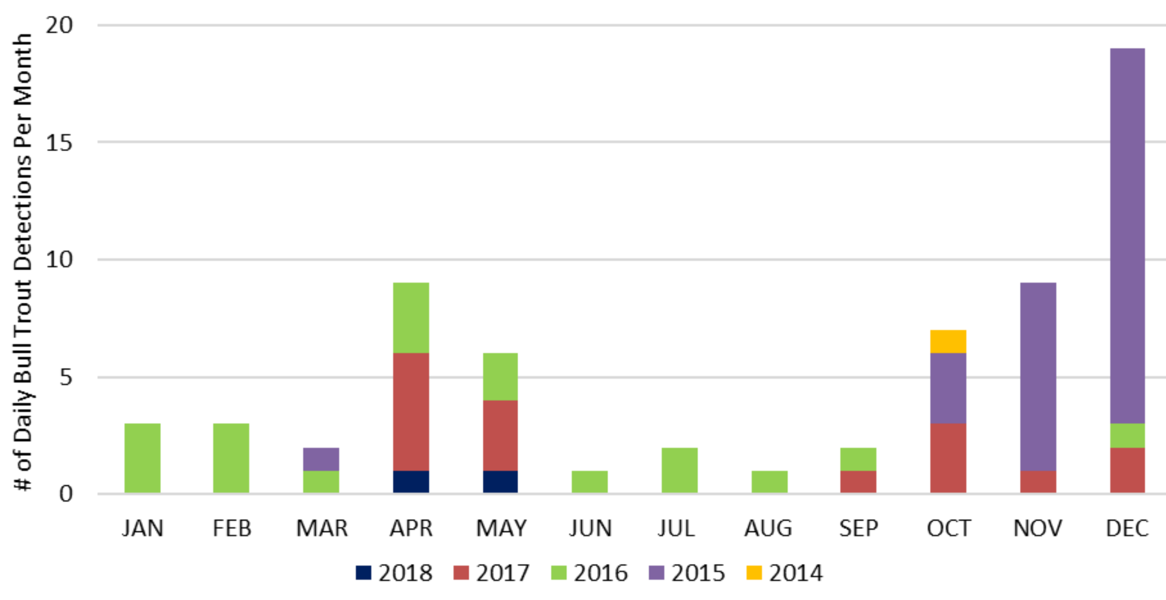
Thompson River for extended periods and did not only use the Thompson River as a migratory corridor.

Predation by mink was documented and avoidance of predation may explain why subadult Bull Trout movement was greatest at night.

The low occurrence of outmigration of subadult Bull Trout to the Thompson Falls Reservoir may be attributed to record low streamflow in 2015 compared to historic (1957-2015) data. However, Glaid (2017) noted the median daily discharge for 2014 and 2015 were within the variable bounds of observations observed in recent history, potentially indicating recent trends may be more representative of a 'new normal.'

FWP tagged an additional 188 juvenile Bull Trout in Fishtrap and West Fork Thompson River, following Glaid's study, resulting in a total of 754 PIT-tagged juvenile Bull Trout in the drainage (NorthWestern 2019b). Juvenile Bull Trout detections in the Thompson River between 2014 and 2018 are shown in **Figure 7-9**, which display data from 64 juvenile Bull Trout detections representing 49 unique fish (NorthWestern 2019b). The majority (44%) of the detections occurred in 2015, 2016 (28%), and 2017 (23%). There were very few juveniles detected in 2014 (2%) or in 2018 (3%) (NorthWestern 2019a).

Figure 7-9: Juvenile Bull Trout monthly detections by the mainstem Thompson River array, 2014-2018.



Source: NorthWestern 2019b

PIT tag monitoring in the Thompson River drainage through 2018 indicate the Bull Trout migratory life history form in the Thompson River drainage is less abundant than expected (Glaid 2017; Kreiner and Terrazas 2018; NorthWestern 2019b).

Since 2014, a PIT-tag antenna array located at the mouth of the Thompson River has been operated and detected 927 unique individual fish, 922 salmonids and 5 non-salmonids. These fish are predominantly Brown and Rainbow trout. The percentage of the PIT-tagged fish which previously ascended the fish passage facility (known as 'ladder fish') (2011-2021) by species detected in the Thompson River between 2014 and 2021 is presented in **Table 7-4**. The values provide a minimum estimate of the proportion of ladder fish entering the Thompson River. The annual review of the Thompson River PIT tag array system indicates about one-third of the salmonids tagged at the fish passage facility and released upstream enter the Thompson River.

Table 7-4: Percentage and Number of 2011-2021 PIT-tagged ladder fish detected by the remote array in the Thompson River 2014-2021.

Species	% Of PIT Tagged Ladder Fish (2011-2021) Detected in Thompson River, 2014-2021	# Of Individual Ladder Fish Detected in Thompson River, 2014-2021
Bull Trout	36	5
Brown Trout	40	402
Rainbow Trout	24	442
Westslope Cutthroat Trout	21	53
Rainbow x Westslope Cutthroat Trout hybrid	13	7
Mountain Whitefish;	12	11
Brook Trout	50	2
Salmonids	**28**	**922**
Northern Pikeminnow	1	2
Largescale Sucker	2	3
Non-Salmonids	**2**	**5**
Total	**26**	**927**

NorthWestern installed PIT-tag antennae arrays in Fishtrap Creek and in West Fork Thompson River in 2014. These arrays are operated year-round but have functioned sporadically since installation due to challenges with batteries and access. The number of ladder fish detected in these tributaries remains relatively low, one to eight salmonids a year (**Table 7-5)**.

Table 7-5: Summary of ladder fish, by species, detected in Fishtrap Creek and West Fork Thompson River, 2014-2022.

Year	BULL	WCT	RB	LL	Total
2014	-	-	-	1	**1**
2015	1	-	-	1	**2**
2016	-	-	2	5	**7**
2019	-	1	1	2	**4**
2020	-	1	3	-	**4**
2021	1	2	3	2	**8**
2022	2	1	3	1	**7**
Total	4	5	12	12	**33**

Source: NorthWestern 2023

The importance of the Thompson River to salmonids in the Thompson Falls Project has been affirmed by the number of fish that have been found to migrate into the Thompson River after passing the fish passage facility.

7.1.3 Upstream Fish Passage

7.1.3.1 Fish Species Recorded Ascending Fish Passage Facility

Since the upstream fish passage facility opened in 2011, nearly 39,000 fish representing 16 species and three hybrids have ascended the fish passage facility (**Table 7-6**). Fish ascending the upstream fish passage facility are collected and recorded at the work station. The majority (36,213 fish) were subsequently released upstream, except for Walleye, Lake Trout, Brook Trout (starting in 2016), Brook x Bull Trout hybrid, fish mortalities at the work station, and Smallmouth Bass starting in 2019 (NorthWestern 2023c). Cumulatively, most fish recorded at the fish passage facility are native Largescale Sucker followed by native Northern Pikeminnow.

Range of lengths recorded for each species observed at the work station is provided in **Table 7-7**. Total length and weight measurements were documented for nearly all salmonids and approximately one-third of the non-salmonids captured at the upstream fish passage facility. The length of salmonids captured range from a 98 mm Rainbow Trout to a 785 mm Lake Trout. The size of non-salmonids ranged from a 69 mm Smallmouth Bass to a 610 mm Northern Pikeminnow.

Fish data collected at the upstream fish passage facility indicate the fish passage facility provides safe and timely passage for numerous species, having successfully passed over 36,200 fish since 2011 (NorthWestern 2023c).

The goals and objectives of the fish passage facility were developed by the TAC consisting of NorthWestern, FWS, FWP, and the CSKT. The TAC determined the highest priority for upstream fish passage are Bull Trout, followed by native species and non-native game salmonids. These goals and objectives have informed how the fish passage facility is operated and the seasonal timing of its operation.

Fish recorded at the upstream fish passage facility are categorized into two general groups, salmonids (trout species and mountain whitefish) and non-salmonids. To date, 16 species and 3 hybrids have ascended the fish passage facility.

In general, non-salmonids are more common and represent about 87 percent (34,035) of the fish recorded ascending the fish passage facility from 2011 to 2022. Of the non-salmonids, Largescale Sucker (58%), Northern Pikeminnow (23%) and Smallmouth Bass (19%) are the most common.

Salmonids represent about 13 percent (4,941) of the fish recorded at the fish passage facility with Rainbow (and hybrids) and Brown trout representing 53 to 32 percent of the trout recorded ascending the fish passage facility. Mountain Whitefish and Westslope Cutthroat Trout represent eight to six percent, respectively, over the last 12 years. Bull trout represent about 0.4 percent (21 of 4,941 salmonids).

Through monitoring efforts such as PIT tagging and floy tagging much has been learned about the movement patterns of fish utilizing the fishway. Many fish released upstream of the dam have been detected in tributaries during spawning season (Thompson, St. Regis, middle Clark Fork, lower Flathead rivers). Many individuals either remain upstream for multiple years or return downstream of the dam and repeat their upstream journey (via the upstream fish passage facility) for 1 or more years.

Table 7-6: **Total fish count, by species, for each year the fish passage facility operated, 2011-2022.**

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
Largescale Sucker	418	1403	3041	2802	6327	2270	34	6	1018	805	823	631	**19,578**
Northern Pikeminnow	1000	926	387	1003	3356	707	66	10	180	41	150	35	**7,861**
Smallmouth Bass	135	34	8	1356	1244	1007	123	5	339	347*	856*	953*	**6,407**
Rainbow Trout	164	208	213	187	281	366	181	124	186	222	213	191	**2,536**
Brown Trout	28	42	111	81	184	204	108	63	210	123	249	195	**1,598**
Mountain Whitefish	17	24	2	254	54	8	-	4	4	11	3	6	**387**
Westslope Cutthroat Trout	21	21	48	36	37	36	14	14	21	33	20	9	**310**
Peamouth	-	-	-	-	122	2	-	-	-	-	-	-	**124**
Rainbow x Cutthroat hybrid	9	7	13	12	4	5	1	1	1	2	8	3	**66**
Longnose Sucker	10	-	2	1	26	6	-	-	-	-	-	-	**45**
Peamouth x Northern Pikeminnow hybrid	-	-	-	-	-	13	2	-	-	-	-	-	**15**
Bull Trout	2	2	5	1	2	3	1	-	1	1	1	2	**21**
Lake Trout	1	1	-	1	6	-	-	-	2	1	2	1	**15**
Brook Trout	-	-	-	1	2	1	-	-	-	1	1	-	**6**
Walleye	-	-	-	-	2	-	-	-	1	-	1	-	**4**
Largemouth Bass	-	-	-	-	-	1	-	-	-	-	-	-	**1**
Brook Trout x Bull Trout hybrid	-	-	-	-	-	1	-	-	-	-	-	-	**1**
Kokanee	-	-	-	-	-	-	-	-	-	-	1	-	**1**
Salmonids	**242**	**305**	**392**	**573**	**570**	**624**	**305**	**206**	**425**	**394**	**498**	**407**	**4,941**
Non-Salmonids	**1,563**	**2,363**	**3,438**	**5,162**	**11,077**	**4,006**	**225**	**21**	**1,538**	**1,193**	**1,830**	**1,619**	**34,035**
Grand Total	**1,805**	**2,668**	**3,830**	**5,735**	**11,647**	**4,630**	**530**	**227**	**1,963**	**1,587**	**2,328**	**2,026**	**38,976**

Notes: "-" = zero fish recorded for that year; * = fish were not passed upstream so fish count includes fish returning and ascending the fish passage facility multiple times during the season.

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Table 7-7: Range of fish lengths (total length) recorded at the upstream fish passage facility, 2011-2022.

Species	Range of Total Lengths (mm)
Bull Trout	365-620
Bull Trout X Brook Trout*	248
Kokanee	365
Longnose Sucker	262-477
Largescale Sucker	128-568
Mountain Whitefish	225-441
Northern Pikeminnow	82-610
Peamouth	272-380
Northern Pikeminnow X Peamouth	295-390
Westslope Cutthrout Trout	180-486
Brook Trout	354-420
Brown Trout	107-699
Largemouth Bass	180
Lake Trout	463-785
Rainbow Trout	98-632
Rainbow Trout X Cutthroat Trout	193-610
Smallmouth Bass	69-480
Walleye	282-419

Note: mm = millimeters

7.1.3.2 Timing of Upstream Fish Passage

At the time when the Thompson Falls fish passage facility was designed, the broad seasonality of upstream fish movement at this site was not well understood. Most upstream movement of adult fish was assumed to be associated with spawning migration. The record of fish (2011-2022) indicated a much more complex pattern of movement for both Bull Trout and other species. Some species show more specificity to seasonal movement trends (e.g., Smallmouth Bass, Largescale Sucker, Mountain Whitefish) than other species (e.g., Rainbow and Brown trout) that appear to ascend the fish passage facility throughout the entire operating season (March–October).

Fish species recorded at the fish passage facility display distinct and different movement strategies. Salmonids have ascended the fish passage facility in all months of operation but peak following the descending limb of the hydrograph in early summer (June/July). This peak movement for salmonids is observed for spring spawners (Rainbow and Westslope Cutthroat Trout and hybrids) and fall spawners (Bull Trout, Brown Trout, and Mountain Whitefish).

Radio telemetry of Rainbow and Brown Trout conducted in 2021, 2022, and 2023 found little evidence of salmonid presence in the Zone of Passage (ZOP) during high flows. The data indicate that during spill at the Main Channel Dam, the detection of fish in the ZOP was limited. Rainbow

Trout were essentially absent from the ZOP once spill started at the Main Channel Dam, and for the remainder of the season (**Figures 7-10 and 7-11**). Brown Trout that were present in the ZOP during the spring appeared to leave the ZOP during spill, and then returned in the fall (**Figures 7-12** and **7-13**). Past telemetry studies conducted in the study area from 2004-2006 also found that few fish were present in the study area during the peak of spring runoff (GEI 2007a). While the telemetry data indicate that many fish leave the study area during high flow, a few fish remain and manage to find the fish passage facility. Fish are known to ascend the fish passage facility in limited numbers during high flows.

Figure 7-10: Monthly manual tracking of 23 individual Rainbow Trout, March-June 2022. No Rainbow Trout were recorded July–October. Number of individual fish detected in the ZOP each month provided.

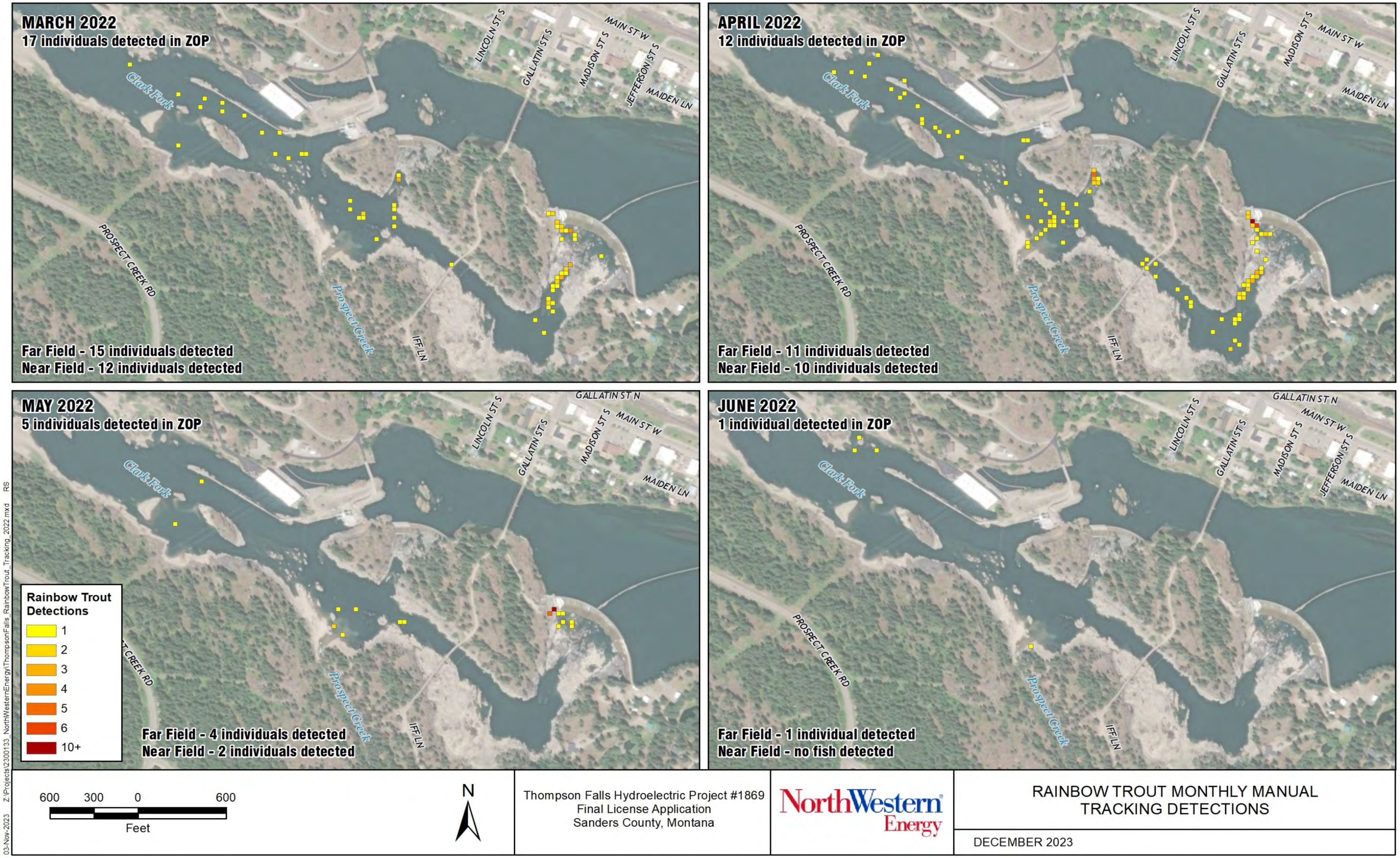


Figure 7-11: Monthly manual tracking of 30 individual Rainbow Trout, March-July 2023. Tracking ended July 31, 2023. Number of individual fish detected in the ZOP each month provided.

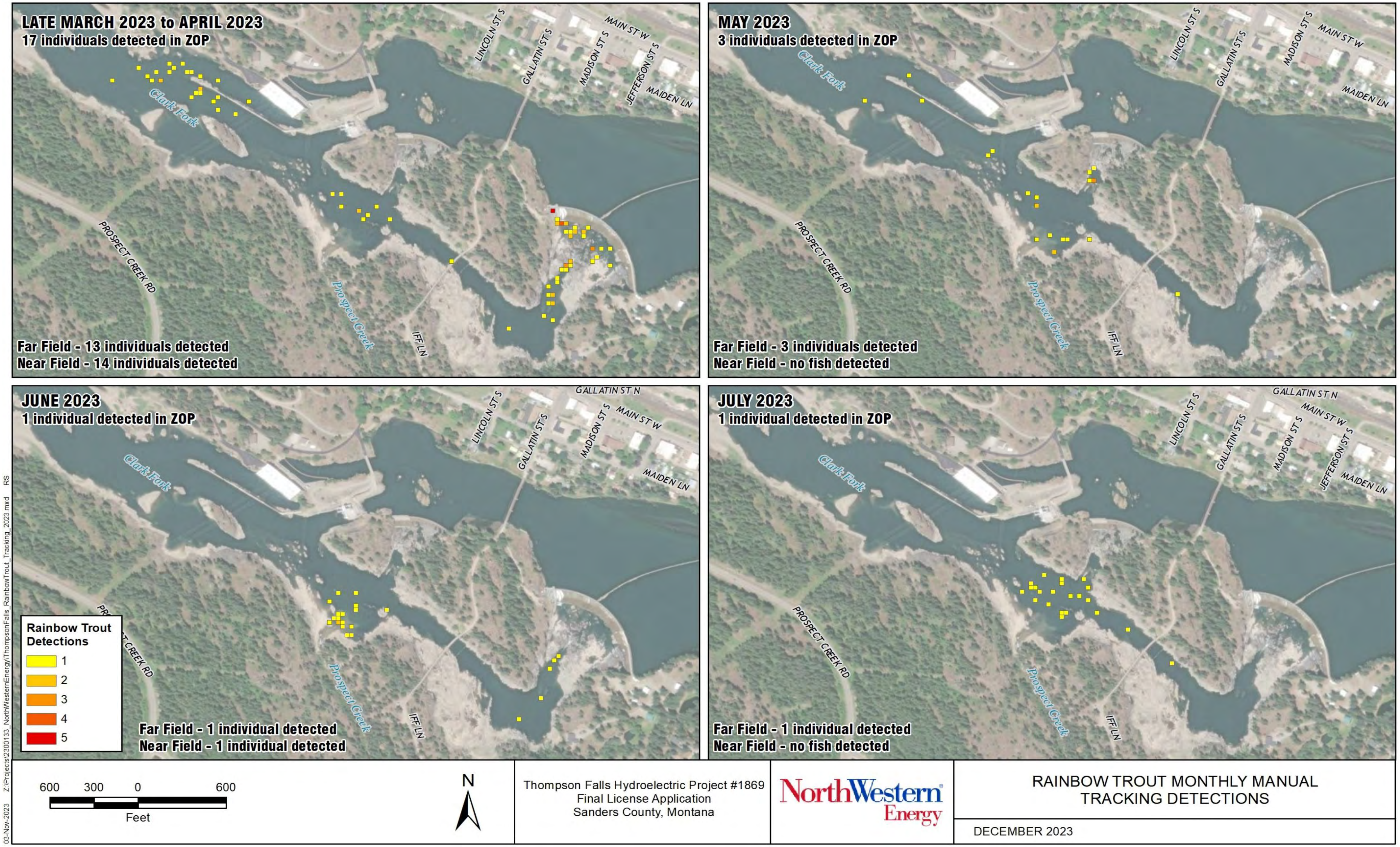


Figure 7-12: Monthly manual tracking of Brown Trout, March – June 2022. Number of individual fish detected in the ZOP each month provided.

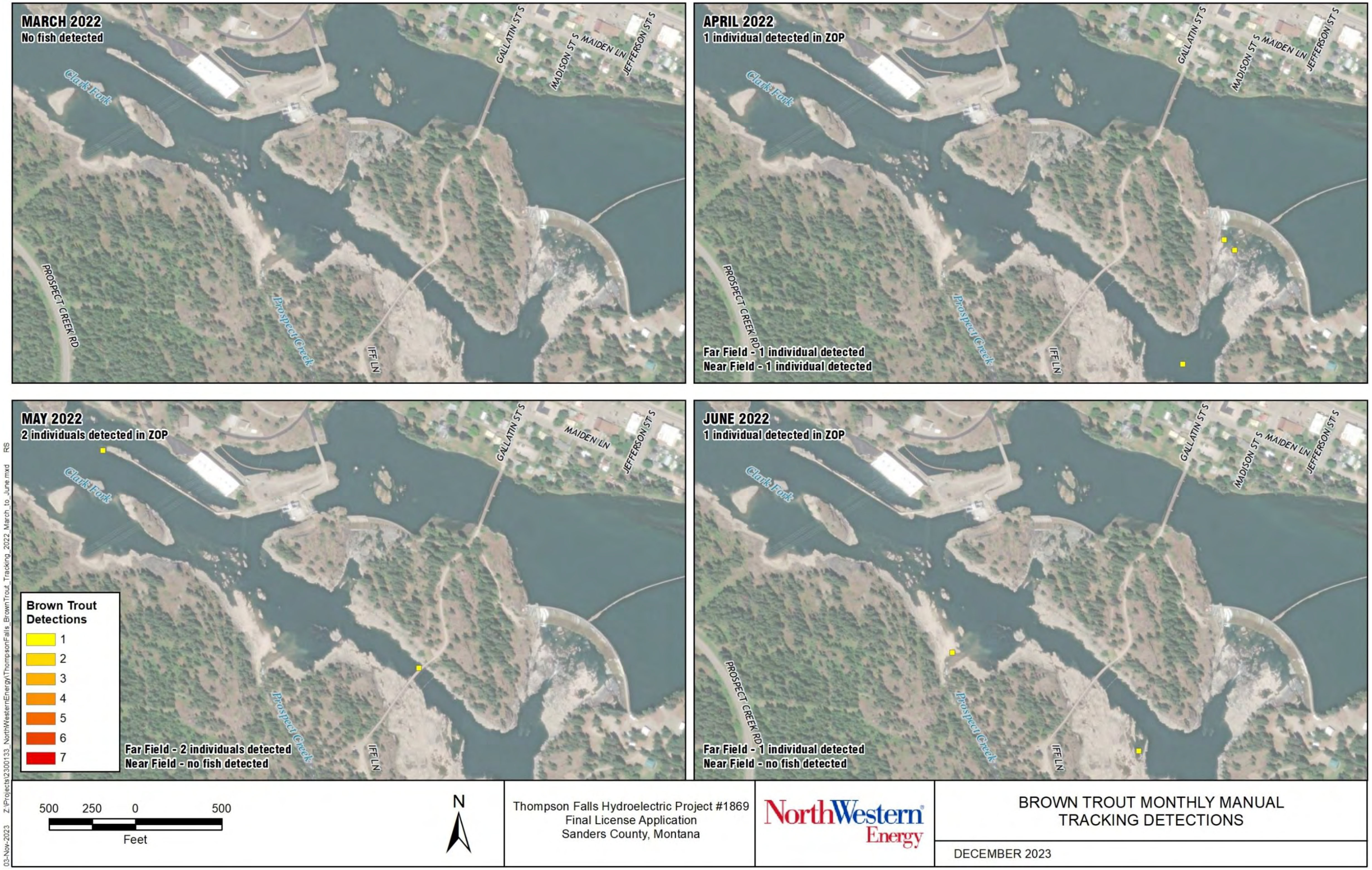
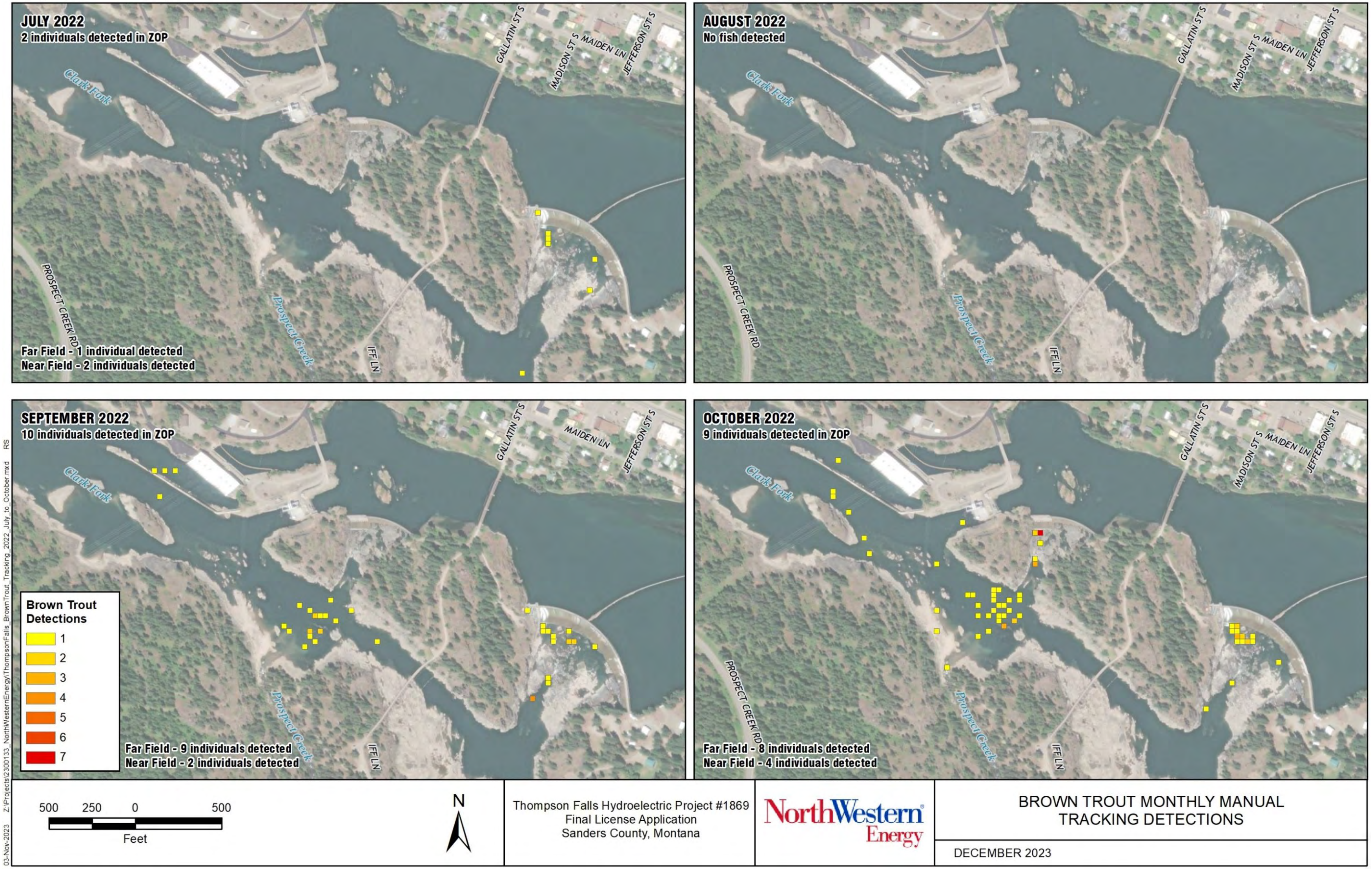


Figure 7-13: Monthly manual tracking of Brown Trout, July - October 2022. Number of individual fish detected in the ZOP each month provided.



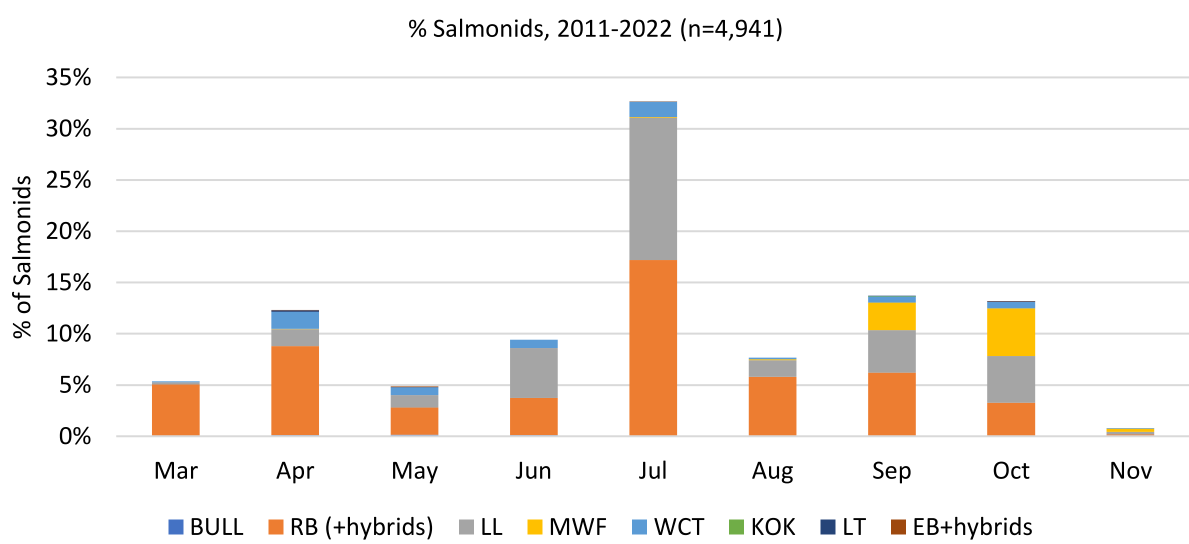
03-Nov-2023 Z:\Projects\2300133_NorthWesternEnergy\ThompsonFalls\ThompsonFalls_BrownTrout_Tracking_2022_July_to_October.mxd RS

The timing of fish entering the fish passage facility indicate many fish are not migrating upstream to immediately spawn. Rainbow Trout are spring spawning fish, but they ascend the fish passage facility in the spring, summer, and fall with minimal captures during the high flow periods of May and June and October-November (**Figure 7-14)** (Northwestern 2022a, 2022c, 2023a, 2023c, 2023e). These dips in movement (May-June; October-November) may be partially a result of high water velocity in the spring, fish passage facility closures in the spring, as well as less favorable river conditions in the fall. The passage of Rainbow Trout does not appear to be solely driven by a desire to migrate to spawning locations.

Brown Trout are fall spawning fish, but they also have passed through the fish passage facility at all seasons, with the peak season of passage during the descending limb of the hydrograph in June/July (**Error! Reference source not found.**14).

Mountain Whitefish have also been collected in the fish passage facility as early as April, but passage of this species outside of the September through October time period is rare (**Error! Reference source not found.**-14**)**. The largest number of Mountain Whitefish (73 individuals) recorded at the fish passage facility during a single fish passage facility check was the end of September 2014.

Figure 7-14: Percentage of salmonids, by month, recorded at the fish passage facility workstation, 2011-2022.

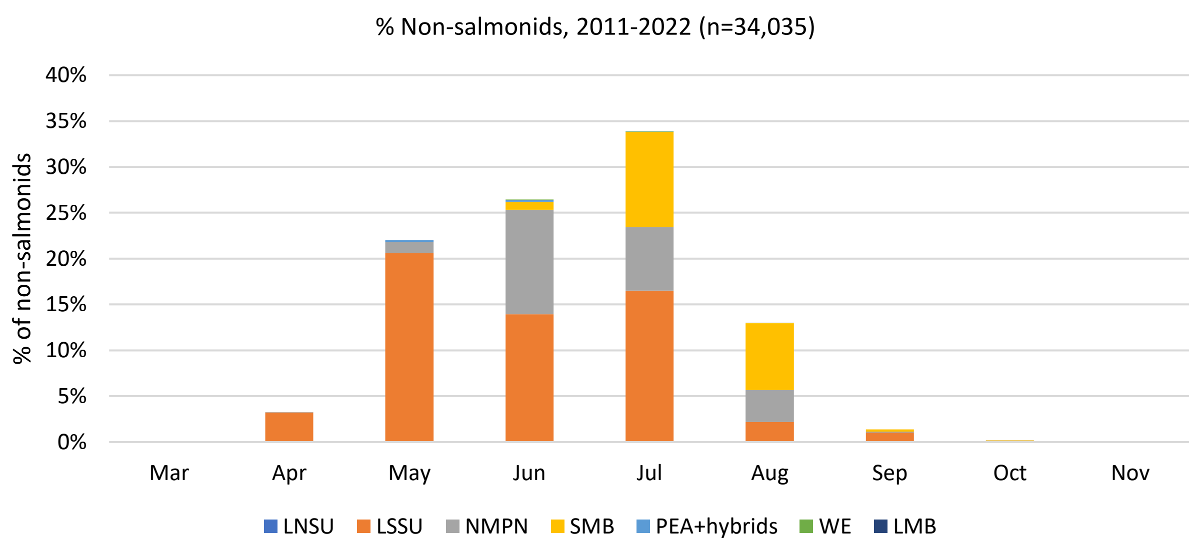


Several fish species displayed various patterns of returning to the fish passage facility, including annual, biennial, and triennial intervals. The timing of these fish returning to the fish passage facility on the exact date or within a week of the exact date 1, 2, and/or even 3 years later, supports the concept that fish movement is biological and a function of their circadian rhythm (Quinn 2005; Davie et al. 2009; O'Malley et al. 2010). In contrast, some fish have ascended the fish passage facility once and then remain upstream in the Thompson River for several years following their release upstream of the dam (e.g., unpublished data on Rainbow and Brown trout ascents in 2014 followed by Thompson River detections through 2023). The variability in movement patterns indicate inland fish utilization of the watershed is likely influenced by a multitude of factors related to the individual biological and physical needs for survival (Thurow 2016).

Tagged fish detections in the Thompson River add insight on fish behavior after passage. Some spring spawning fish migrate upstream in the summer/fall months and remain upstream of the dam through the winter and then spawn in the Thompson River in the spring. They may subsequently leave the Thompson River drainage, migrate downstream to Noxon Rapids Reservoir, then migrate back upstream to the fish passage facility, and repeat the process.

Non-salmonids are most common in warmer water months (May-August, depending on the year) and less common in the spring and fall months when water temperatures are cooler (Error! Reference source not found.**15**). Peak numbers for non-salmonids occur in July, after spring peak flows and prior to peak summer water temperatures. Smallmouth Bass have a higher tolerance for warmer temperatures and are more common during the peak summer temperatures (July-August).

Figure 7-15: Percentage of non-salmonids, by month, recorded at the fish passage facility workstation, 2011-2022.



Salmonids in general, and Bull Trout in particular, have been found to move upstream, downstream, and into multiple tributaries in the Clark Fork River drainage. The timing of these movements is not strictly tied to spawning seasons. Bull Trout ascend the fish passage facility most frequently in the spring, but the timing is variable, and they have ascended the fish passage facility as late in the season as September. An example of complex Bull Trout movement is a Bull Trout radio tagged in 2010 was found in both Fishtrap Creek (during spawning season) and then later in the Vermilion River (after spawning season). Adult Bull Trout have been found in multiple tributaries, including tributaries that are not their natal stream, even when the natal stream is accessible. The FWS (2015) states that the ability to migrate is important to the persistence of Bull Trout as it allows them to seasonally or temporally occupy habitat that may be advantageous on an intermittent basis. It appears that seasonal and temporal movements are a part of the behavior of Bull Trout, and other species in the Project area.

The fishway was designed to operate up to 48,000 cfs before being closed during flows that exceeded this total river discharge. Through experimentation it was found that the facility could be operated beyond the design capacity of 48,000 cfs and is commonly operating until flows exceed 60,000 cfs. Although fish movement in the river is limited at this time, 61 fish representing six species (25 Largescale Sucker, 21 Rainbow Trout, 5 Westslope Cutthroat Trout, 4 Northern Pikeminnow, 3 Bull Trout, 3 Brown Trout) have ascended the fish passage facility during periods of flow in excess of 48,000 cfs [NorthWestern unpublished]).

7.1.3.3 Upstream Passage Effectiveness

In 2021, 2022, and 2023 NorthWestern evaluated upstream fish movement *via* radio telemetry through the Project's zone of influence[18] which is defined by the 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 (**Figure 7-16)**. 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. The radio telemetry study focused on fish movement in a 0.75 mile section of the Clark Fork River -that is divided into the far field, near field, and fish passage facility entrance.

Results from 2021 are reported in detail in the *ISR – Fish Behavior Study* (NorthWestern 2022a); results from the 2022 season are included in the *USR – Fish Behavior Study 2021-2022* (NorthWestern 2023a); and the results from the 2023 season are included in the *FSR – Fish Behavior Study 2021-2023* (NorthWestern 2023e). Hydraulic conditions in the far field, near field, and fish passage facility entrance were modeled, with results reported in the *ISR – Hydraulic Conditions Study* and *USR- Hydraulic Conditions Study* (NorthWestern 2022b and 2023b).

The fish behavior studies focused on evaluating Rainbow and Brown trout movement from the Thompson Falls original powerhouse upstream to the fish passage facility entrance at the Main Channel Dam. Rainbow and Brown trout are important game fish in the study area and serve as surrogate species to better understand upstream fish passage efficacy for Bull Trout (Scientific Panel 2020). The study evaluated what proportion of 100-radio tagged fish (66 tagged Rainbow Trout, 34 tagged Brown Trout) enter the ZOP and find the fish passage facility entrance. The study measured the duration of time and pathway(s) of these movements during various flow conditions.

[18] Zone of Influence means an area within which there are positive or negative effects as a result of the Project.

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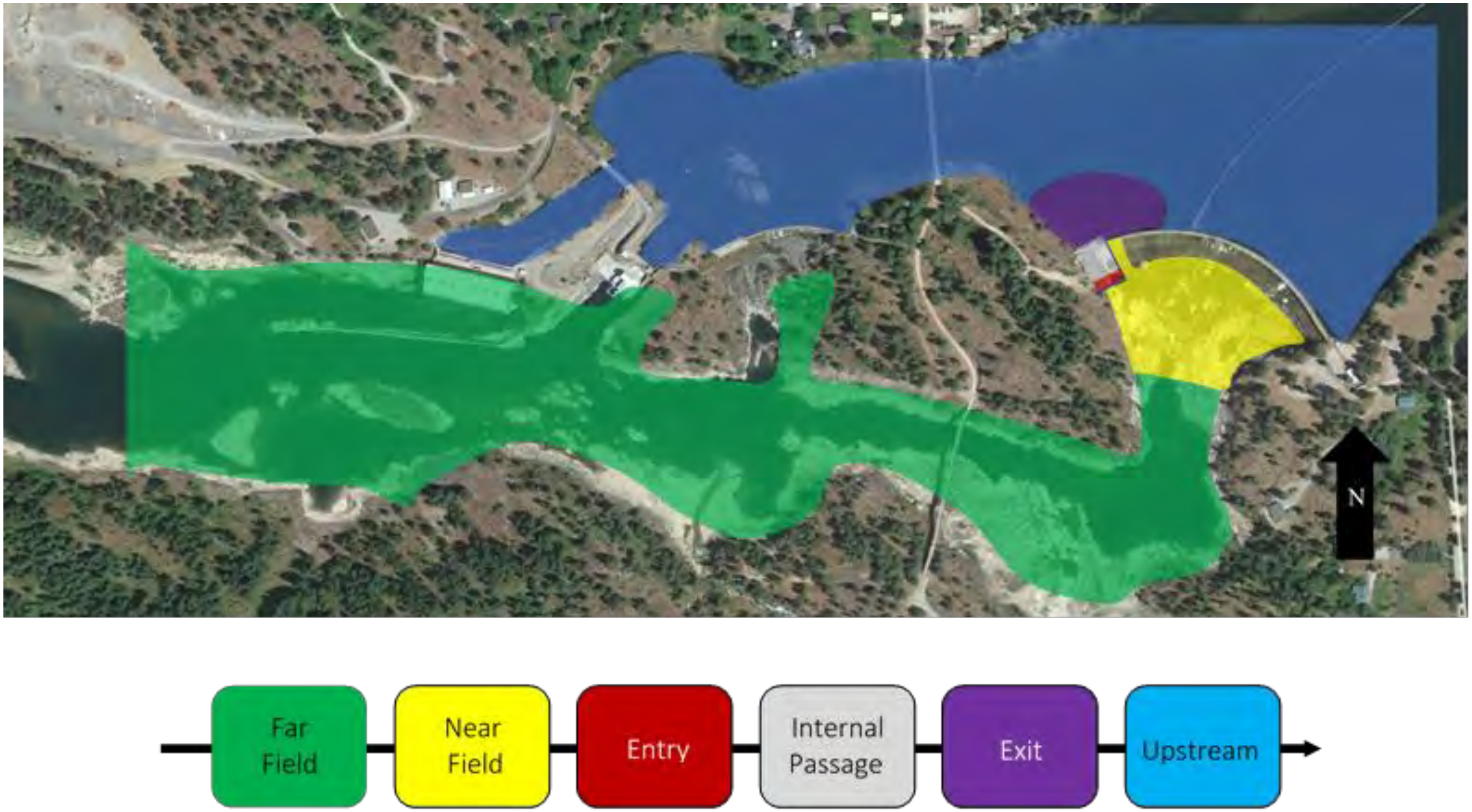
Figure 7-16: Study Areas as defined by the Zone of Passage concept.



Notes: Figure not to scale; Far Field = downstream of fish passage facility/dam where the 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.

Source: Scientific Panel 2020

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A summary of the 100-radio tagged fish studied in 2021, 2022 and 2023, including the month and year of tagging, species, total number radio tagged, percentage and number of radio-tagged fish detected in the far field, near field, and fish passage facility entrance, is provided in **Table 7-8**.

Table 7-8: Detections of radio tagged Rainbow and Brown Trout, 2021, 2022 and 2023.

Species	Collection Time	Total Tagged	% (#) in Far Field	% (#) in Near Field	% (#) Ladder Entrance	% (#) Ascend Ladder
Rainbow Trout	Jun ‘21	7	100% (7)	14% (1)	-	-
	Mar’ 22	29	100% (29)	86% (25)	48% (14)	45% (13)
	Mar/Apr ‘23	30	87% (26)	63% (19)	43% (13)	37% (11)
Total Rainbow Trout		**66**	**94% (62)**	**68% (45)**	**41% (27)**	**36% (24)**
Brown Trout	Jun ’21	6	100% (6)	50% (3)	33% (2)	17% (1)
Sept/Oct ‘21	Sep/Oct ‘21	3	100% (3)	33% (1)	33% (1)	33% (1)
	Mar ‘22	8	100% (8)	88% (7)	38% (3)	25% (2)
2021 Total	Sep ‘22	17	94% (16)	35% (6)	24% (4)	12% (2)
Total Brown Trout		**34**	**97% (33)**	**50% (17)**	**29% (10)**	**18% (6)**
Total (2021-2023) All Tagged Fish		**100**	**95%**	**62%**	**37%**	**30%**

Notes: % = percentage; # = number of fish detected.

The results of the 3-year fish behavior study indicate fish are motivated to move upstream and readily, unimpeded, and quickly access the ZOP following release. Rainbow Trout data represents three seasons (2021-2023), and Brown Trout data represents two seasons (2021-2022). Of the 66 radio-tagged Rainbow Trout, 62 (92%) were later detected in the far field. Of the 34 radio-tagged Brown Trout, 33 (97%) were later detected in the far field.

Not all fish detected in the far field proceeded to the near field. Of the 95 fish that were detected in the far field, 73 percent of the radio-tagged Rainbow Trout (45 fish) and 52 percent of radio-tagged Brown Trout (17 fish) made a foray to the near field. The proportion of radio-tagged Rainbow Trout continuing to make the foray to the near field was greater in 2022 (86%) than in 2023 (73%) and in 2021 (14%). The time of fish collection may have been a factor in the proportion of fish that moved upstream into the near field. In contrast to 2021, when Rainbow Trout were tagged and transported in June and only one (of 7 fish) was detected in the near field, 75 percent of the 59 Rainbow Trout radio-tagged in March/April in 2022 and 2023 were detected in the near field.

Of the 45 Rainbow Trout that were detected in the near field in 2021, 2022 and 2023, 27 (60%) were detected in the fish passage facility entrance. Brown Trout results from 2021 and 2022 recorded 59 percent of the fish detected in the near field entering the fish passage facility. Annually, the percentage of Rainbow Trout detected in the near field continuing into the fish passage entrance was 0 percent in 2021, 56 percent in 2022, 68 percent in 2023. Annually, the percentage of Brown Trout detected in the near field continuing into the fish passage entrance was 75 percent in 2021 and 54 percent in 2022.

In total, over the 3-year study, 27 (41%) of the 66 radio tagged Rainbow Trout and 10 (29%) of 34 radio-tagged Brown Trout were detected at the fish passage facility entrance. Detections of Rainbow Trout at the fish passage facility entrance were similar in 2022 and 2023 (when fish collection occurred in March/April), 48 and 43 percent, respectively compared to 2021 when no Rainbow Trout entered the fish passage facility entrance. Detections of Brown Trout at the fish passage facility entrance were similar in 2021 and 2022, 33 and 28 percent, respectively.

Fish showed the ability to move quickly after release upstream of the Flatiron FAS and enter the ZOP. Travel time from the far field to the near field varied between the two trout species. Rainbow Trout spent approximately 5 to 6 days between their first entry into the far field and their first detection in the near field. Behavior of Brown Trout tagged in spring was different than Brown Trout tagged in fall. The average travel time between the far and near field for Brown Trout tagged in 2022 was 28.4 days for spring-tagged fish compared to 14.4 days for fall-tagged fish.

Rainbow Trout movement from the near field to the fish passage facility entrance was consistent between 2022 and 2023 tagged fish. In 2022, Rainbow Trout spent an average of 8.2 days (0.03-37.8 days) from their first detection in the near field until entering the fish passage facility. In 2023, Rainbow Trout spent an average of 5.4 days (0.9-13.9 days) from their first detection in the near field until entering the fish passage facility. Rainbow Trout movement to the near field and fish passage facility was concentrated to the spring months, March, April, and early May.

The travel time for spring-tagged Brown Trout from the far field to the fish passage facility entrance averaged 136 days, whereas Brown Trout tagged in September 2022 made the journey in an average of 0.08 day. It appears most of the radio tagged Brown Trout enter the fish passage facility during the fall months regardless of the individual fish’s ability to navigate upstream to the near field earlier in the spring.

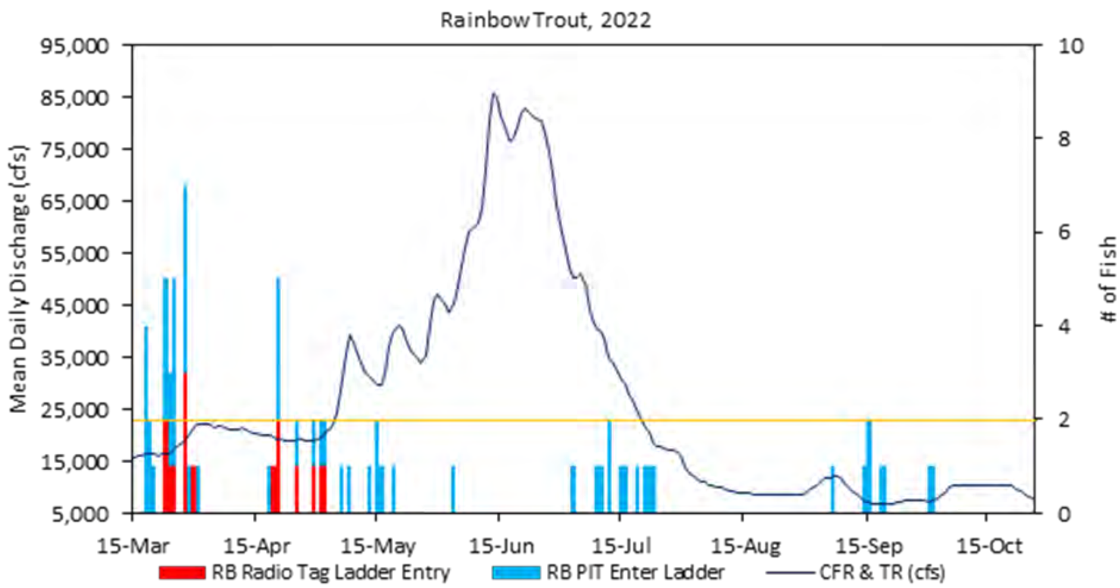
The majority of radio tagged fish entering the far field continued to the near field (60% of Brown Trout and 73% of Rainbow Trout). Once in the near field, about half of the Brown Trout and 60 percent of the Rainbow Trout continued to the fish passage facility entrance. Telemetry data (fixed station and manual tracking) indicate fish were most often recorded in the Main Dam right (MDR) zone. Rainbow Trout presence and use of the Main Dam left (MDL) zone appeared to vary from 2022 to 2023. There were more fixed station detections in the MDL zone in 2023 compared to MDR. However, manual tracking continued to indicate fish were more frequently located near the fish passage entrance in the MDR zone in both years. In 2023, the MDR fixed station receiver did not detect some fish prior to entering the fish passage facility. The reason for inconsistent detections from the MDR fixed station receiver in 2023 is unclear. The manual tracking and fish passage facility entrance PIT detections indicate fish that enter the near field are able to navigate to the fish passage facility. It remains unclear as to why some fish move in proximity to the passage entrance but do not enter or why some fish that enter the facility do not continue to ascend to the top.

Peak movement of Rainbow Trout occurred in the spring prior to spill (**Figures 7-17 and 7-18**). Peak movement of Brown Trout occurred in the fall (post-spill) and prior to the fish passage facility closing for the season (**Figure 7-19**). Both species observed in the ZOP prior to spill, appeared to leave the ZOP during spill.

The timing of fish detections at the fish passage facility was similar in 2022 and 2023. Entry to the fish passage facility by radio-tagged Rainbow Trout was limited to the spring in 2022 (Figure 7-17) and 2023 (Figure 7-18). Radio-tagged Rainbow Trout entered the fish passage facility in March and April, which coincided with pre-spill at the Main Channel Dam in both years. The spring movement of radio-tagged Rainbow Trout to the fish passage facility entrance coincided with other Rainbow Trout PIT tagged fish also recorded entering the fish passage facility in both years. Additional PIT-tagged Rainbow Trout were detected entering the fish passage facility during the descending limb of the hydrograph, as well as in the fall in 2022 and 2023. During peak spring flow in June 2022 and May 2023, no radio or PIT tagged Rainbow Trout were detected entering the fish passage facility. In 2023, there were two PIT-tagged Rainbow Trout detected when flows were declining (~40,000 cfs) approximately a week after the peak. In 2022, the fish passage facility was closed June 14 when spill exceeded 61,000 cfs and was then opened June 30 when spill was near 35,000 cfs. In 2023, the fish passage facility was open through the entire season.

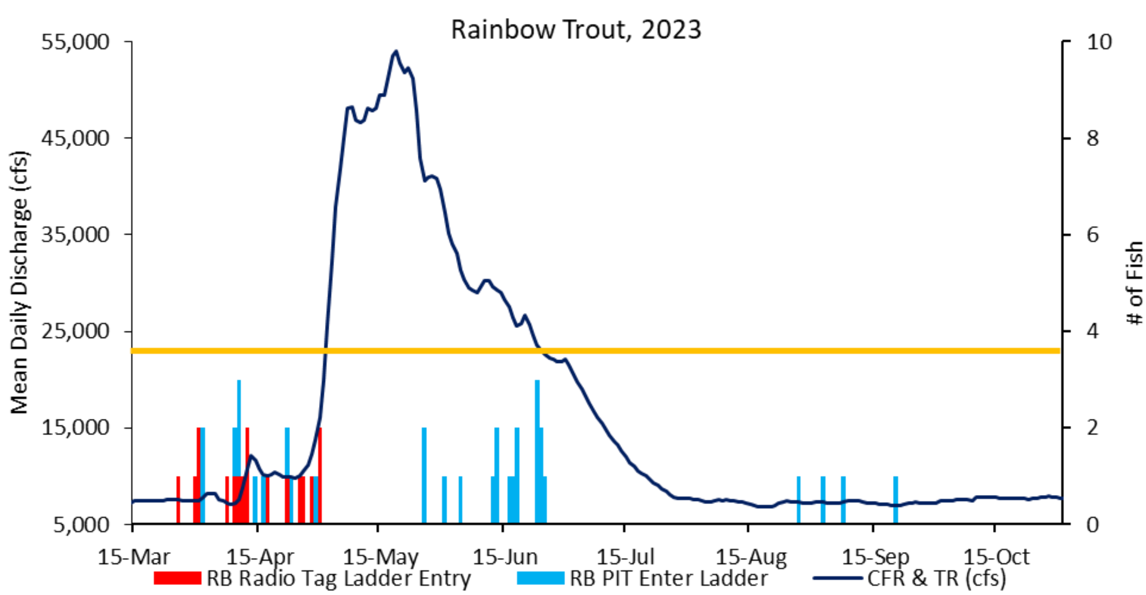
Radio-tagged Brown Trout entered the fish passage facility primarily during the fall months, September and October, with the exception of one Brown Trout entering the fish passage facility in July (in 2022). PIT-tagged Brown Trout recorded entering the fish passage facility were detected in May, July, once in August, and September and October. Brown Trout were detected entering the fish passage facility when spill occurred at the Main Channel Dam at the ascending and descending limb of the hygrograph, as well as during baseflows during the fall months (Figure 7-19)**.** As with Rainbow Trout, Brown Trout were not detected during peak flows.

Figure 7-17: Individual radio and PIT tagged Rainbow Trout detected entering the fish passage facility and mean daily streamflow (USGS gage stations #12389000 and #12389500), 2022.



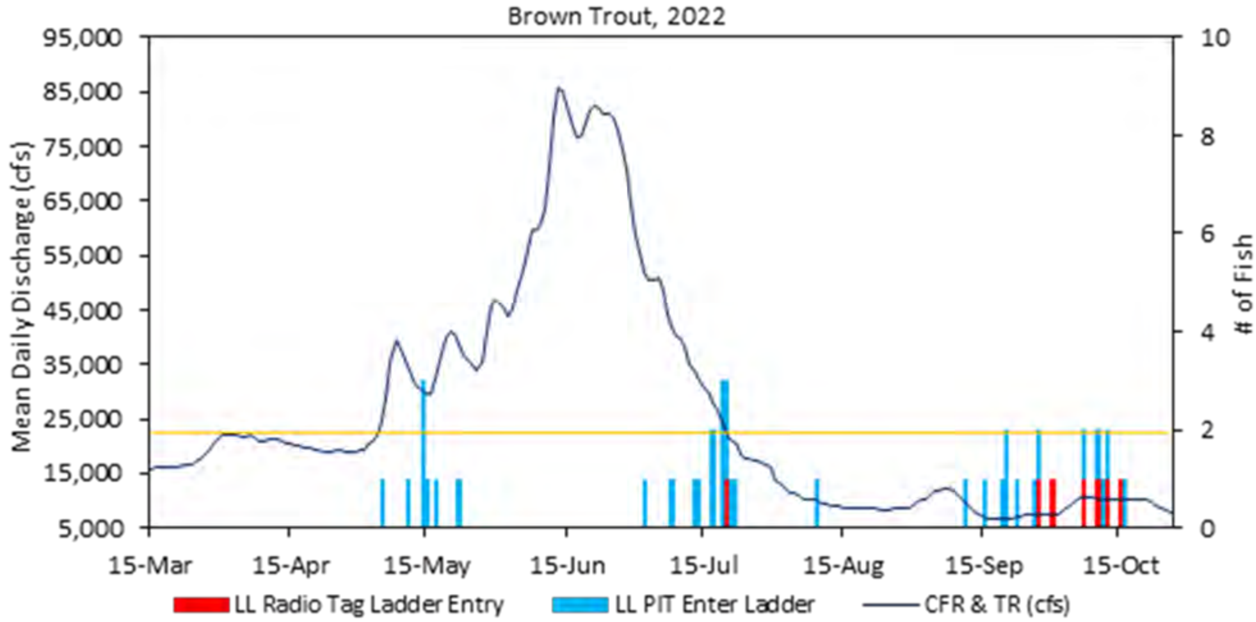
Notes: CFR = Clark Fork River; TR = Thompson River; yellow line = 23,000 cfs; spill occurs when flows exceed line.

Figure 7-18: Individual radio and PIT tagged Rainbow Trout detected entering the fish passage facility and mean daily streamflow (USGS gage stations #12389000 and #12389500), 2023.



Notes: CFR = Clark Fork River; TR = Thompson River; yellow line = 23,000 cfs; spill occurs when flows exceed line.

Figure 7-19: Individual radio and PIT tagged Brown Trout detected entering the fish passage facility and mean daily streamflow (USGS gage stations #12389000 and #12389500).



Notes: CFR = Clark Fork River; TR = Thompson River; cfs = cubic feet per square feet; yellow line = 23,000 cfs; spill occurs when flows exceed line.

7.1.3.4 Hydraulic Conditions Downstream of the Main Channel Dam

The 2021 and 2022 telemetry data, and the Hydraulic Conditions Study (computational fluid dynamics [CFD]) modeling data, provide insight into fish passage conditions at a range of flows. The goals of the Hydraulic Conditions Study were 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.

A CFD model was developed of the existing Thompson Falls Main Channel Dam and river downstream of the dam using FLOW-3D HYDRO software (FLOW 3D) (version 22.1.0.16). The hydraulic modeling involved two phases. Phase 1 used two-dimensional simulations to provide depth averaged velocities at four flow scenarios: 200, 2,000, 25,000, and 37,000 cfs. The modeling scenarios were developed to determine the flow behavior and resulting downstream flow conditions over the range of operating conditions for the upstream fish passage facility. During Phase 2, the full model domain was analyzed using 3D modeling to better evaluate the vertical velocity distributions of flow downstream of the Main Channel Dam. Additional evaluations during Phase 2 of the study evaluated flows of 37,000 and 2,000 cfs. These flow rates bracket the range of possible flow conditions that are likely to occur during operation of the Upstream Fish Passage Facility. This section provides a summary of the results, details can be found in the ISR and USR (NorthWestern 2022b and 2023b).

Based on the results of CFD modeling, flows immediately downstream of the Thompson Falls Main Channel Dam are very complex, dynamic, and highly turbulent. Due to the curved shape of the Main Channel Dam, the flow jets through the panel and gate openings collide downstream of the structure causing significant mixing, turbulence, and energy dissipation. As flows pass downstream through the rocky falls area, velocities generally increase but are quickly dissipated by the main channel. The relatively sharp bend in the river alignment further dissipates velocities. As flows proceed farther downstream to the High Bridge, approximately 2,200 feet downstream of the Main Channel Dam, flows are relatively calm and uniform. Velocities increase again as the river narrows and depths decrease at the downstream boundary of the model domain approximately 500 feet downstream of the High Bridge (NorthWestern 2022b).

At 37,000 cfs, the highest velocities are on the downstream face of the Main Channel Dam, which are reduced considerably immediately downstream of the Main Channel Dam due to energy dissipation from the highly turbulent flows. A plan view of water velocities within the model domain are shown in **Figure 7-20.** The local upstream fish passage facility velocities are relatively low (less than 5 feet per second [fps]) due to the submergence of the upstream fish passage facility. Within the natural falls area, water velocities increase to a maximum of approximately 21 fps. Within the main river channel downstream of the natural falls, velocities decrease to approximately 11 fps as the channel widens and turns right. As the channel narrows again and flows pass under the High Bridge near the downstream end of the model, velocities increase to approximately 20 fps. The margins of the downstream river channel generally exhibit velocities of approximately 3 fps. However, along the left bank of the main channel there are a number of small side channels which locally increase the velocities. These generally reenter the main river channel near or just downstream of the High Bridge. Overall, the depth-averaged velocities from the upstream fish passage facility, through the channel downstream of High Bridge range from about 3 to 20 fps, with the higher velocities in the main channel path and lower velocities along the edges of the channel banks.

At 25,000 cfs, the highest velocities are on the downstream face of the Main Channel Dam, which are reduced considerably immediately downstream of the Main Channel Dam due to energy dissipation from the highly turbulent flows. A plan view of flow velocities within the model domain is shown in Error! Reference source not found.**7-21**. The local upstream fish passage facility velocities are relatively low (less than 5 fps) due to the submergence of the upstream fish passage facility. Some impacts from the HVJ can be seen within the resulting velocity field. Within the falls area, velocities increase to a maximum of approximately 27 fps. These velocities are slightly higher than those modeled at 37,000 cfs due to less submergence and a larger drop across the falls. Within the main river channel downstream of the falls, flow velocities decrease to approximately 13 fps as the channel widens and turns right. As the channel narrows again and flows pass under the High Bridge near the end of the model, velocities increase to approximately 19 fps. The margins of the downstream river channel generally exhibit velocities of approximately 1 to 5 fps. Overall, the depth-averaged velocities from the upstream fish passage facility, through the channel downstream of High Bridge range from about 2 to 27 fps, with the high velocities in the main channel path and lower velocities along the edges of the channel banks.

At 2,000 cfs, the highest velocities are immediately downstream of the open radial gate. However, these velocities are quickly reduced due to energy dissipation from the turbulent flow in the pool downstream of the Main Channel Dam structure. A plan view of flow velocities within the model domain is shown in Error! Reference source not found.**7-22**. The velocities from the open radial gate generally carry flow directly towards the falls. The pools to the left and right of this main flow path generally have limited flow and are relatively calm. In the vicinity of the Upstream Fish Passage Facility, the local velocities are about 3 to 12 fps, which is noticeably higher than the previous two simulations due to the lower submergence. Additionally, the impacts of the HVJ and Upstream Fish Passage Facility entrance flows are much more evident. Within the falls area, the flow velocities increase to a maximum of approximately 23 fps. Within the main river channel downstream of the falls, peak flow velocities decrease to about 3 to 5 fps as the channel widens and turns right. As the channel narrows again and flows pass under the High Bridge near the end of the model, velocities increase to slightly greater than 2 fps. The margins of the downstream river channel generally exhibit velocities less than 1 fps. Overall, the depth-averaged velocities from the upstream fish passage facility, through the channel downstream of High Bridge range from about 3 to 23 fps, with the higher velocities in the main channel path and lower velocities along the edges of the channel banks.

At 200 cfs, the velocities downstream of the Main Channel Dam generally are less than 2 fps. Velocities are higher immediately downstream of bay 1. However, these velocities are quickly dissipated within the pool in front of the upstream fish passage facility entrance. A plan view of flow velocities within the model domain is shown in Error! Reference source not found.**7-23**. The local upstream fish passage facility velocities range from 3 to 8 fps. Higher velocities are most evident where shallow flows pass from the HVJ and Upstream Fish Passage Facility entrance into the neighboring pool. Within the natural falls, flow velocities increase to a maximum of approximately 17 fps. As flows exit the falls and enter the main river channel, the velocities are quickly dissipated to 3 fps or less. As the river channel widens flows pass through the righthand bend, velocities are less than 2 fps. The remainder of the modeled river channel also exhibits flow velocities less than 1 to 2 fps across the full cross section of the channel. Overall, the depth-averaged velocities from the upstream fish passage facility, through the channel downstream of High Bridge range from about 3 to 17 fps, with the higher velocities isolated to the falls area and downstream of the upstream fish passage facility.

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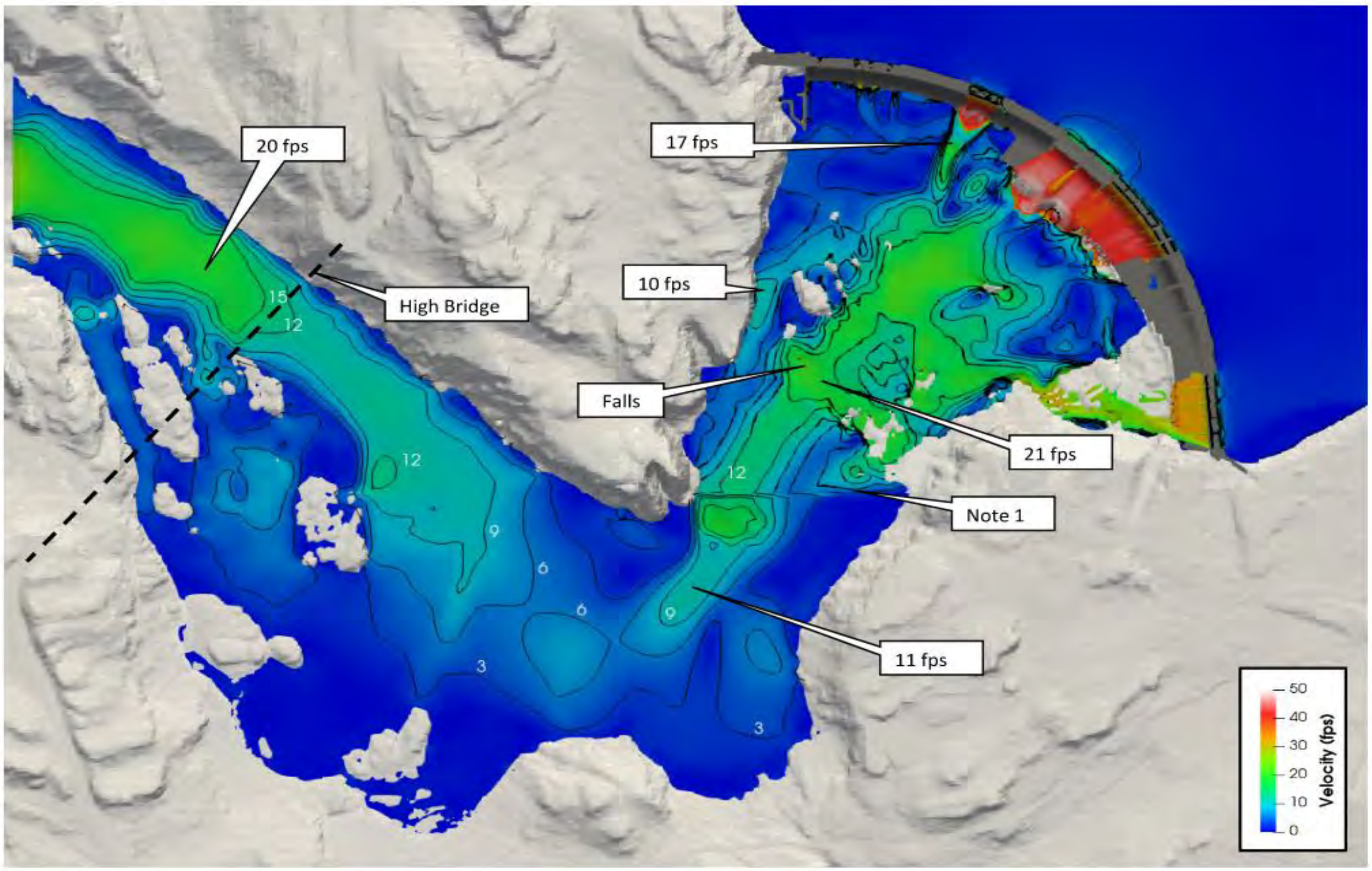
Figure 7-20: 37,000 cfs Plan View of Velocities.



Notes:
1. 2D/3D mesh block boundary.
2. Contour interval of 3 fps shown from 0-15 fps.

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NorthWestern Energy

RUN 1: 37,000 CFS
PLAN VIEW OF VELOCITIES

December 2023

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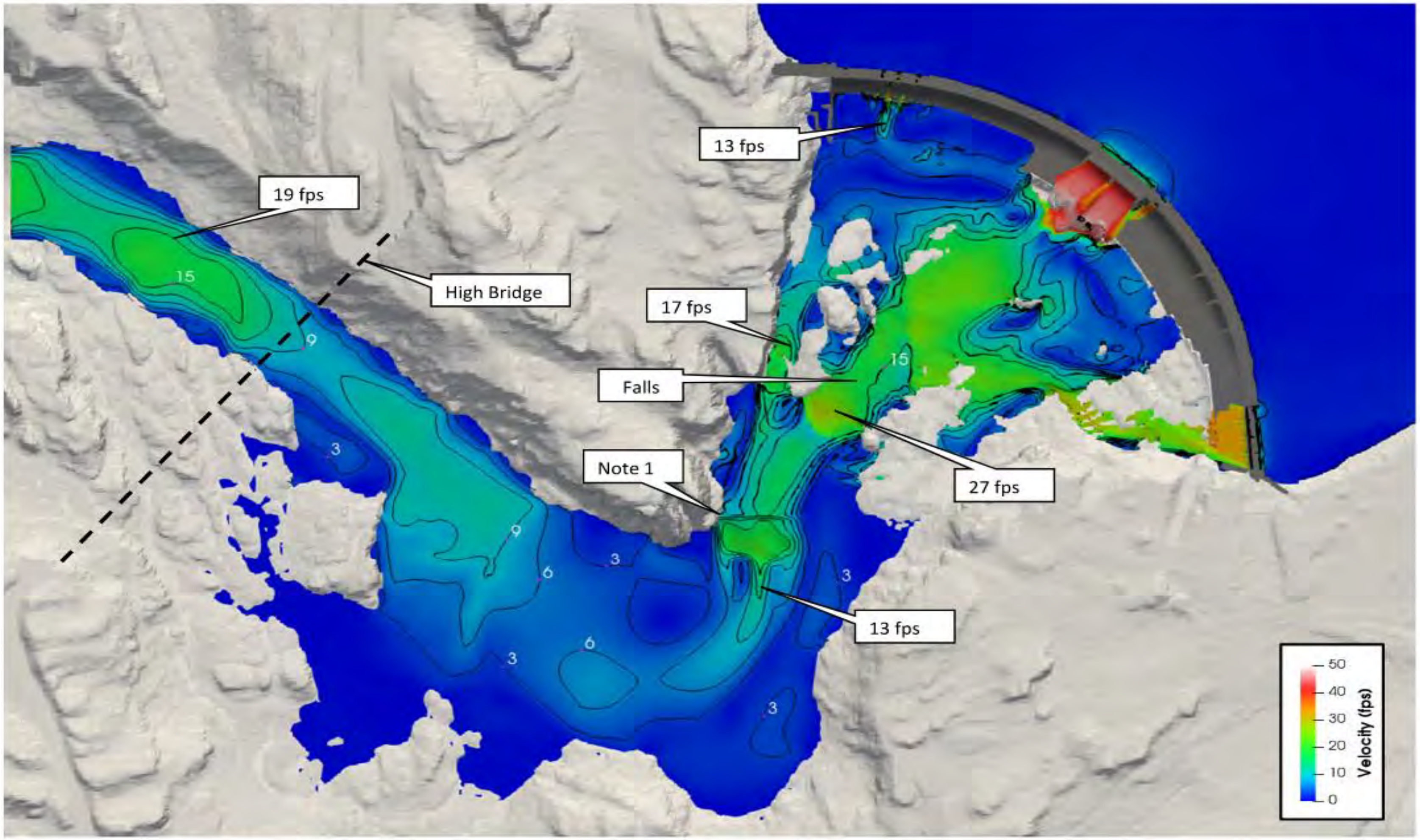
Figure 7-21: 25,000 cfs Plan View of Velocities.



Notes:
1. 2D/3D mesh block boundary.
2. Contour interval of 3 fps shown from 0-15 fps.

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Final License Application
Sanders County, Montana

NorthWestern Energy

RUN 2: 25,000 CFS
PLAN VIEW OF VELOCITIES

December 2023

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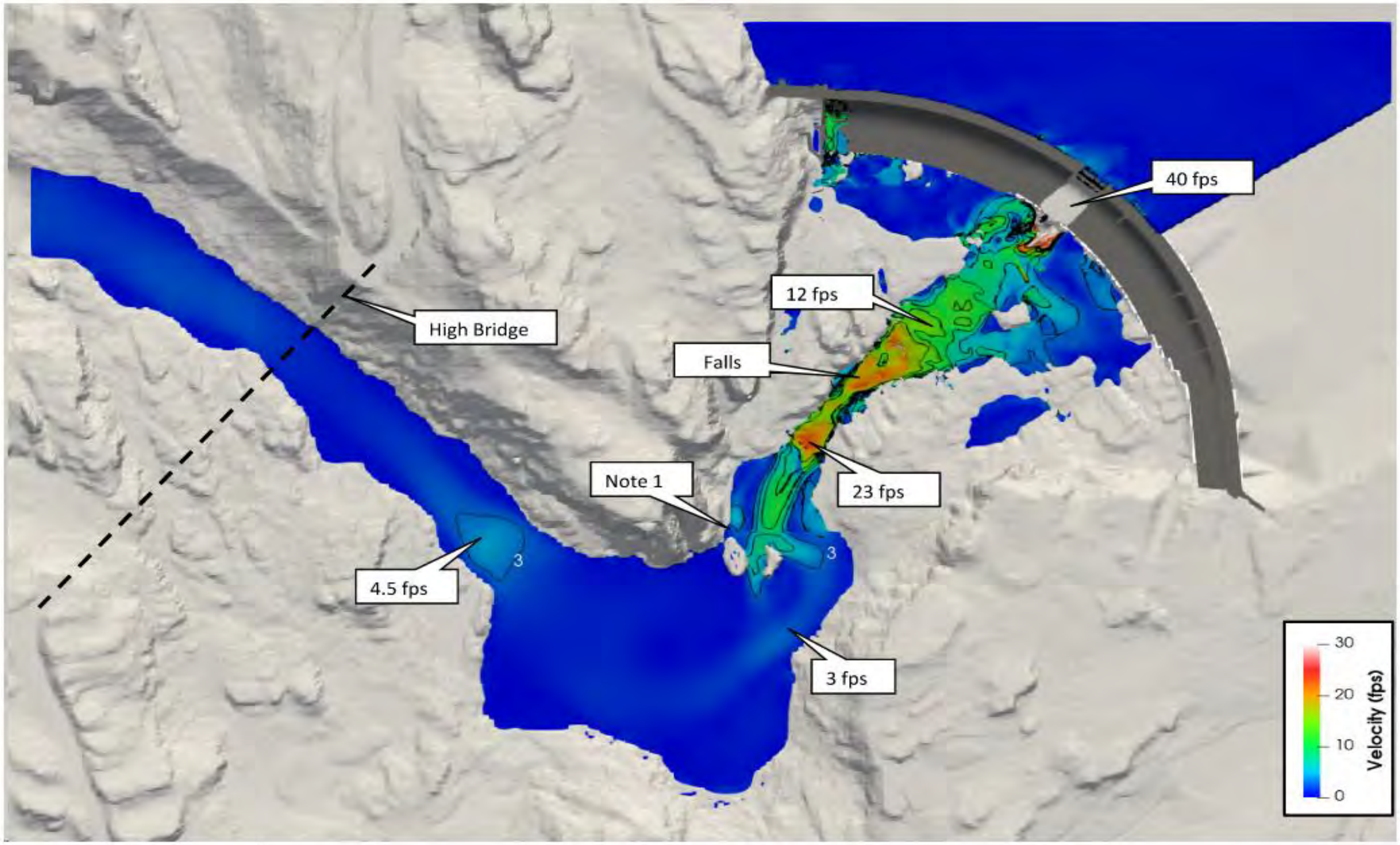
Figure 7-22: 2,000 cfs Plan View of Velocities.



Notes:
1. 2D/3D mesh block boundary.
2. Contour interval of 3 fps shown from 0-15 fps.

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NorthWestern Energy

RUN 3: 2,000 CFS
PLAN VIEW OF VELOCITIES

December 2023

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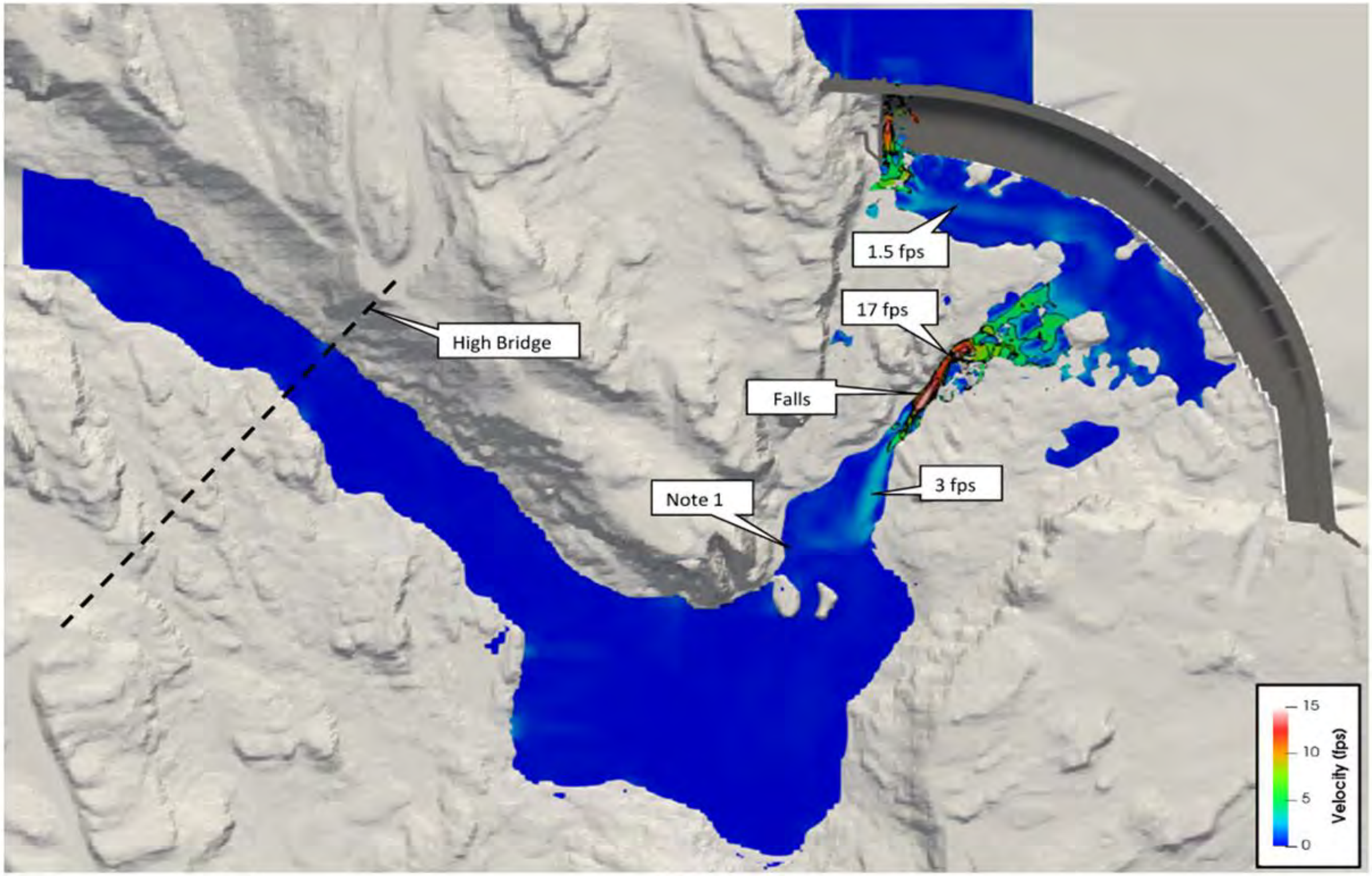
Figure 7-23: 200 cfs Plan View of Velocities.



Notes:
1. 2D/3D mesh block boundary.
2. Contour interval of 3 fps shown from 0-15 fps.

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Final License Application
Sanders County, Montana

NorthWestern Energy

RUN 4: 200 CFS
PLAN VIEW OF VELOCITIES

December 2023

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The natural falls, located approximately 600 feet downstream of the Main Channel Dam, has HVJ even at the lowest flow modeled (200 cfs) (**Table 7-9**). At the higher modeled flow ranges, a potential velocity barrier was also apparent further downstream near the High Bridge (Table 7-9). At 37,000 cfs, the depth averaged velocity in the High Bridge area was 21 fps (*refer to* Figure 7-20). At 25,000 cfs, the depth average velocity at the High Bridge was 19 fps (*refer to* Figure 7-21). At the lower modeled flows, no velocity barrier was apparent at the High Bridge (*refer to* Figures 7-22 and 7-23).

Table 7-9: Summary of Results of Thompson Falls Dam Phase 1 CFD Modeling

Run	Flow Rate (cfs)	Typical Flow Depth Below Dam* (feet)	Maximum Velocity Below Dam* (fps)	Typical Velocity Near Upstream Fish Passage Facility Entrance (fps)	Maximum Velocity Through Falls (fps)	Downstream Channel Margin Velocities (fps)	Maximum Velocity Near High Bridge (fps)
1	37,000	5-8	20	1-5	21	3	20
2	25,000	5-8	20	1-5	27	1-5	19
3	2,000	2-6	15	3-12	23	<1	2
4	200	1-5	10	3-8	14	<1	<1

Notes: * These columns *refer to* the area below the Main Channel Dam but above the falls; cfs = cubic feet per second; fps = feet per second

During Phase 2 of the study, the full model domain was analyzed using 3D modeling to evaluate the vertical velocity distributions of flow downstream of the Main Channel Dam. Additional evaluations during Phase 2 of the study evaluated flows of 37,000 and 2,000 cfs. These flow rates bracket the range of possible flow conditions that are likely to occur during operation of the upstream fish passage facility. The Phase 2 portion of the study identified three critical areas in the downstream reach on which to focus the modeling, including the area near the fish passage facility entrance, the falls area and the High Bridge area. The results were evaluated based on three categories related to the swimming ability of salmonids (Brown Trout, Bull Trout, Mountain Whitefish, Rainbow Trout, Westslope Cutthroat Trout) and native non-salmonids (Largescale Sucker and Northern Pikeminnow) as described in detail in Section 3.4 in the ISR Fish Behavior Study (NorthWestern 2022a) and Section 3.8 of the USR Fish Behavior Study (NorthWestern 2023a). The upper limits of adult fish swimming abilities for these species are shown in **Table 7-10**.

Table 7-10. Summary of Upper Limit of Adult Fish Swimming Abilities, Prolonged and Burst Speed.

Common Name	UL Prolonged Speed (fps)	UL Burst Speed (fps)
Brown Trout	7.7	13.2
Bull Trout	2.8	7.5
Mountain Whitefish	5.0	6.0
Rainbow Trout	4.0	13.5
Westslope Cutthroat Trout	6.4	13.5

Common Name	UL Prolonged Speed (fps)	UL Burst Speed (fps)
Largescale Sucker	1.9	6.0
Northern Pikeminnow	3.8	4.4

Source: NorthWestern 2022a

Based on the 3D modeling results, the percent of the cross-sectional area for each velocity category was determined for each of three identified critical areas. The percent of the cross-sectional area for each velocity category at the fish passage facility entrance, falls, and High Bridge areas are summarized in **Table 7-11**. The three velocity categories include a range that encompass most species upper prolonged speed swimming ability (7.0 fps or less), encompass most salmonid species and their upper burst speed swimming ability (7.1-14.0 fps or less), and exceed upper limit swimming abilities for all fish (greater than [>] 14.0 fps).

Table 7-11. Results of Thompson Falls Dam Phase 2 CFD Modeling

Location		Ladder Entrance		Falls Area		High Bridge	
Flow Rate (cfs)		37,000	2,000	37,000	2,000	37,000	2,000
Category Description	Velocity Range (fps)	Percent of Cross-Sectional Area (%)					
Maximum Prolonged Swim Speed	0-7.0	100	79	2	8	7	100
Intermediate Swim Speed Range	7.1-14.0	0	21	14	16	4	0
Exceeds Maximum Burst Speed	>14.0	0	0	84	76	89	0

Notes: > = greater than; cfs = cubic feet per second; fps = feet per second

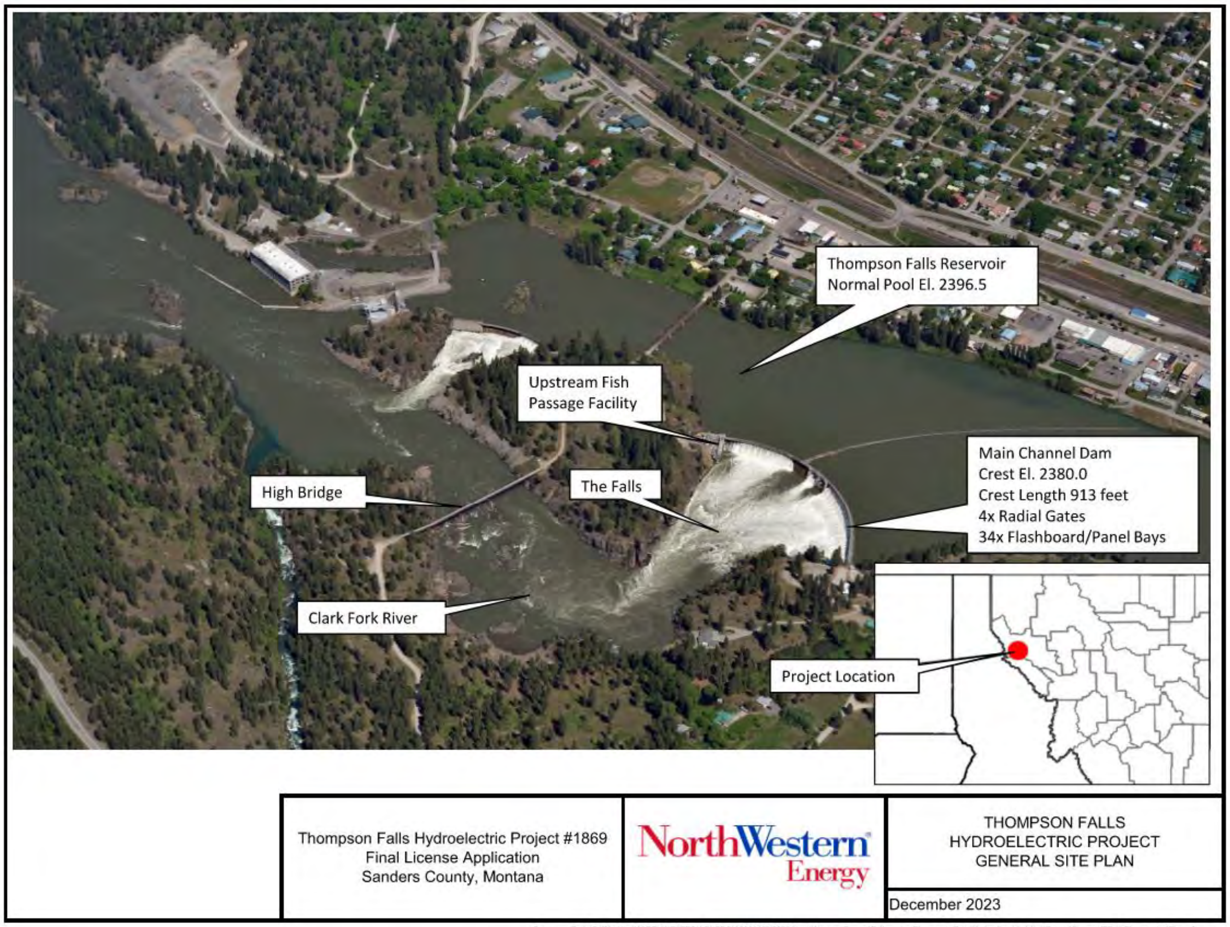
As shown in Table 7-10, for both flow rates evaluated, the fish passage facility entrance generally has large portions of the cross-section area that are below 7 fps, with negligible portions that exceed the maximum burst speed of 14 fps. These data indicate no impediments to fish passage in the area surrounding the upstream fish passage facility entrance.

Conversely, for both flow rates evaluated, the falls area has large portions of the cross-section area that exceed 14 fps, with limited portions that are below 7 fps.

At the High Bridge area, the results vary depending on the flow rate evaluated. At the higher flow, the velocity in the majority of the cross-section area exceeds 14 fps with limited portions that are below 7 fps. At the lower flow rate, the velocities within the High Bridge cross section area are all under 7 fps.

During spill at the Main Channel Dam, both the telemetry and CFD modeling results indicate velocity obstacles may exist in the ZOP, specifically at the natural falls where the channel is constricted by boulders and rock (**Figure 7-24).** The CFD model indicates the falls would be a particularly challenging area for slower swimming non-salmonids to navigate. Another area with high velocities, at and above 25,000 cfs, is immediately downstream of the High Bridge where the channel constricts again. Both constricted areas (at the falls and High Bridge) are natural features of the Clark Fork River. During spill, the area accessible for various fish species to move upstream declines and is limited to the margins of the wetted channel and near the bottom of the channel depending on the roughness and available topography.

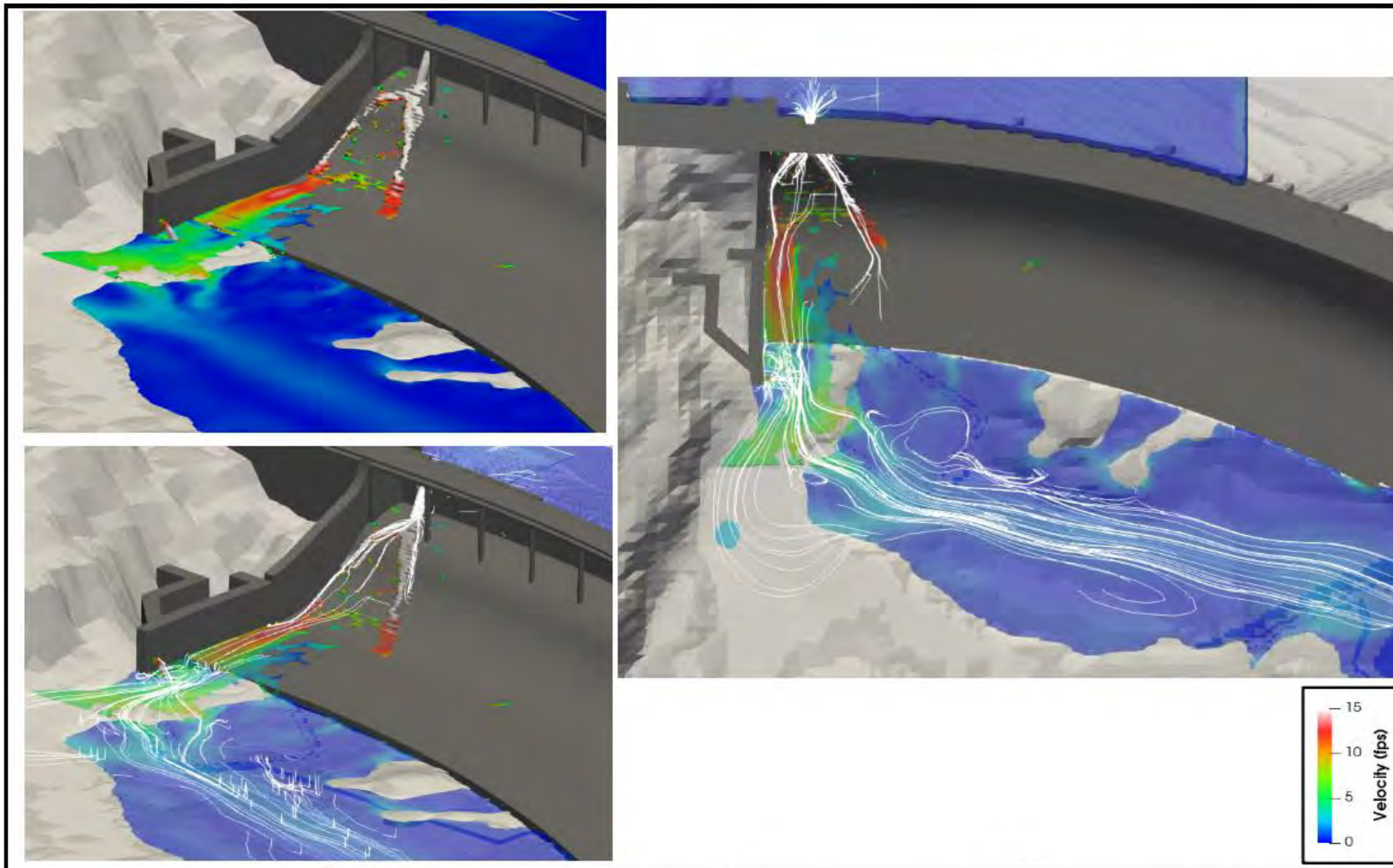
Figure 7-24: View of the Thompson Falls Project area and location of the falls in relation to the fish passage and High Bridge.



The CFD modeling indicates velocities near the fish passage facility entrance are within fish swimming abilities at all flow scenarios (*refer to* Table 7-11). There are no apparent velocity barriers near the fish passage facility entrance that would discourage fish from finding or entering the fish passage facility. The location of the fish passage facility appears to be on the optimal side for fish based on the manual tracking data and proportion of detections recorded within the MDR zone *versus* the MDL zone. The left side (MDL) is generally more turbulent and violent at various spill regimes at the Main Channel Dam. CFD modeling also illustrates the higher velocities along the left bank during spill that are less accessible/suitable for several species based on their swimming abilities.

When looking at flow path streamlines it appears that at modeled flows of 200 cfs there remains a distinguishable level of attraction flow near the fish passage facility entrance that flows downstream and through the falls (**Figure 7-25**). As flows increase to 2,000 cfs the flow path streamlines remain distinguishable near the fish passage facility entrance although as it reaches the falls area it begins mixing with the flow paths from spill at the radial gates. As total spill increases and reaches 25,000 and 37,000 cfs, flow path streamlines from the fish passage facility entrance area are not as distinct and appear to be overwhelmed from flows at the radial gates and flow over the Main Channel Dam (**Figure 7-26**). These data indicate when large flows occur at the Main Channel Dam, attractant flow from the fish passage facility efficacy may diminish.

Figure 7-25: 200 cfs Upstream Fish Passage Facility entrance details.



Notes
1. Legend shown without transparency.

Thompson Falls Hydroelectric Project #1869
Final License Application
Sanders County, Montana

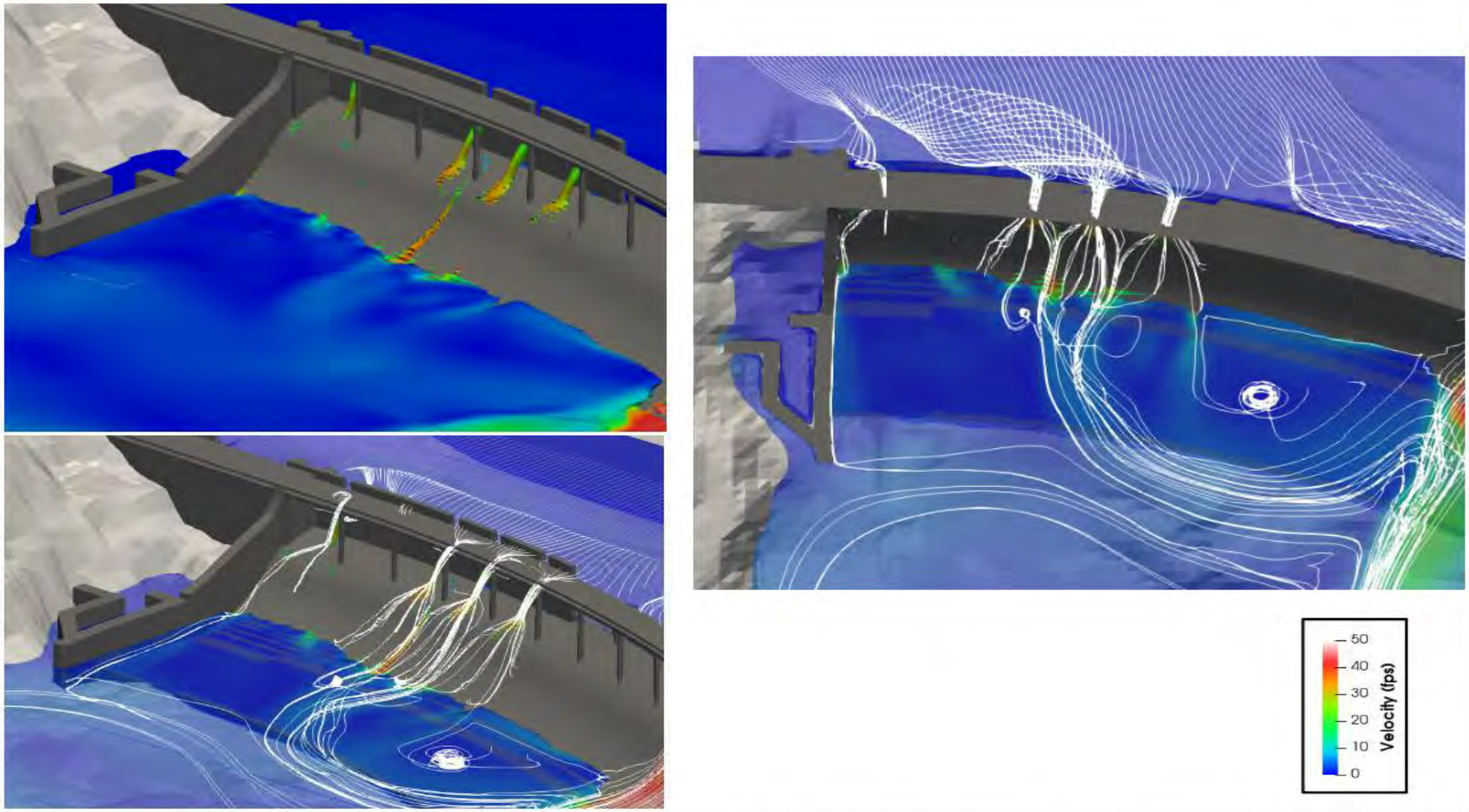
NorthWestern Energy

RUN 4: 200 CFS
UPSTREAM FISH PASSAGE FACILITY
ENTRANCE DETAILS

December 2023

Document Path: B:\Working\NORTHWESTERN ENERGY\2300133 2023 NorthWestern Energy\Relicensing Thompson Falls\Hydraulics Modeling\Report\Figures\[TFallsFigures.xlsx]Figure 30a

Figure 7-26: 37,000 cfs Upstream Fish Passage Facility entrance details.



Notes
1. Legend shown without transparency.

Thompson Falls Hydroelectric Project #1869
Final License Application
Sanders County, Montana

NorthWestern Energy

RUN 1: 37,000 CFS
UPSTREAM FISH PASSAGE FACILITY
ENTRANCE DETAILS

December 2023

Document Path: B:\Working\NORTHWESTERN ENERGY\2300133 2023 NorthWestern Energy\Relicensing Thompson Falls\Hydraulics Modeling\Report\Figures\[TFallsFigures.xlsx]Figure 12a

7.1.3.5 Internal Fish Passage Facility Efficiency

Based on the review of 65 articles from 1960 to 2011 that evaluated fish passage facilities, Noonan et al. (2012) found upstream passage efficiency for salmonids was close to 62 percent and non-salmonids was very poor (21%) in comparison. In addition, fish passage efficiency varied significantly among the various fishway types with the pool and weir, pool and slot, and natural fishways showing the highest efficiencies (Noonan et al. 2012).

Passage efficiency (internal) at Thompson Falls exceeds the values reported by Noonan et al. (2012) with approximately 70 to 75 percent of the salmonids and 23 to 27 percent of the non-salmonids (Largescale Sucker and Northern Pikeminnow) that enter the upstream fish passage facility ascend to the top (NorthWestern 2022c, 2023c). However, data on non-salmonids at the Thompson Falls fishway are limited as fewer of these species have been PIT-tagged. However, it is clear from the fish passage facility catch data that Largescale Sucker, Northern Pikeminnow, and Smallmouth Bass are capable of ascending the fish passage facility in large numbers.

Internal fish passage efficiency was best calculated in 2021 and 2022 after the installation of the PIT tag antennae in the entrance. Prior to 2021, all calculations required a PIT-tagged fish to enter the fish passage facility and move up to the lower pools 7/8. **Table 7-12** provides a summary of the 2021 and 2022 internal fish passage efficiency for salmonids and non-salmonids, as well as individual species.

The data collected in the fish passage facility from remote PIT tag arrays indicate there are more fish entering the fish passage facility and detected in the lower pools (7/8) than ascending to the top (holding pool) (NorthWestern 2022c, 2023c). Once salmonids reach the lower pool, it is estimated that around 91 percent of the salmonids and 71 percent of the non-salmonids continue to the top holding pool (Table 7-12**.** It is unclear what factors may be limiting fish that enter the fish passage facility from continuing to the lower pools and further up the fish passage facility to the top holding pool. It could be related to a lack of motivation to migrate upstream, or it could be related to hydraulic conditions in the fish passage facility.

Table 7-12. Number and percent of fish entering the fish passage facility recorded in the entrance, Pool 7/8, and top holding pool.

21/2022 PIT Tag Detections	# Fish @ Entrance	Fish in Pool 7/8 # (% of fish detected at entrance)	# Fish in Holding Pool (% of fish detected at entrance)	% of fish detected at Pool 7/8 reaching holding pool
Salmonids	166	131 (79%)	119 (72%)	91%
Non-salmonids	61	21 (34%)	15 (25%)	71%
Species				
BULL	4	3 (75%)	3 (75%)	75%
LL	66	46 (70%)	40 (61%)	87%
RB+ hybrids	92	80 (87%)	74 (80%)	93%
WCT	3	2 (67%)	2 (67%)	67%
MWF	1	0	0	0%
NPMN	35	17 (49%)	13 (37%)	76%
LSSU	22	2 (9%)	2 (9%)	9%
LNSU	3	0	0	0

Notes: BULL = Bull Trout; LL = Brown Trout; RB+ hybrids = Rainbow Trout and Rainbow x Cutthroat Trout; WCT = Westslope Cutthroat Trout; MWF = Mountain Whitefish; NPMN = Northern Pikeminnow; LSSU = Largescale Sucker; LNSU = Longnose Sucker

Once fish enter the fish passage facility, conditions within the facility are key to their successful ascent. Fish passage facility operations in orifice mode provide the largest opportunity for the most fish and fish species to ascend (NorthWestern 2019b). Based on the 2018 internal fish passage facility hydraulic study (NorthWestern 2018b), additional evaluation may identify added adjustments to further optimize fish passage facility hydraulics for upstream fish passage, specifically the lower pools between the entrance and pool 8. While the fish passage facility operates in orifice mode throughout the season (since 2019), the first eight pools are designed to be in notch mode.

7.1.3.6 Ascent Time in the Fish Passage Facility

Ascent information for PIT-tagged fish entering the fish passage facility and ascending the fish passage facility has been recorded since 2011. Prior to 2021, the ascent time was calculated based on the time between the last detection in the lower pools (7/8) and the holding pool. Since the PIT tag array was installed in the entrance of the fish passage facility in 2021, fish movement indicates travel duration between the entrance and lower pools can be within a few minutes. The time fish take to swim the distance between the entrance and lower pool PIT tag array is negligible. Therefore, ascent times are presented for all years.

Between 2011 and 2020, a total of 385 salmonids were recorded entering and ascending the ladder with a median salmonid ascent time of 2.2 hours in orifice mode and 1.3 hours in notch mode. In 2021 and 2022, the median ascent time for salmonids was 2.3 to 2.6 hours in orifice mode. Non-salmonid ascent times were longer, with a 2011 to 2020 median ascent time in orifice mode of

6.2 hours. Details of 575 ascent times for PIT-tagged fish that entered the fish passage facility 2011-2020, 2021 and 2022 are summarized in **Tables 7-13 and 7-14**.

Table 7-13. Summary of fish ascent times for fish moving through the fish passage facility while operating in orifice mode.

Orifice Mode / Fish Group	Year(s)	Number of Fish	Ascent Time (hours)			
			Min	Max	Median	Average
Salmonids	**2011-2020**	306	0.7	259	2.2	5.4
	2021	49	0.2	24.4	2.3	4.9
	2022	70	1	419.5	2.6	11.2
Non-Salmonids	**2011-2020**	53	1.3	31	6.2	7.8
	2021	9	2.3	6.6	3.3	3.7
	2022	6	1.4	13.4	3.2	4.5

Note: Data from 2011-2020 provides ascent times from lower pools to the holding pool, and data from 2021 and 2022 provide ascent times from last detection at the fish passage facility entrance to the holding pool.

Source: NorthWestern 2019a, 2019b, 2022c, 2023c

Notch mode results in higher velocities and reduction in areas of slack or calm water compared to orifice mode (NorthWestern 2018a). Therefore, faster ascent times do not necessarily translate into more fish or greater opportunity for upstream fish passage for all species. The faster ascent time may indicate limitations of access and potentially selection against some species to ascend the fish passage facility in notch *versus* orifice mode. In 2017 and 2018 testing was completed comparing notch with orifice mode where the passage facility was primarily operated in the notch configuration. This mode greatly reduced capture numbers of non-salmonid species and it was subsequently determined the gates should be operated in orifice mode.

Table 7-14. Summary of fish ascent times for fish moving through the fish passage facility while operating in notch mode.

Notch Mode / Fish Group	Year(s)	Number of Fish	Ascent Times (hours)			
			Min	Max	Median	Average
Salmonids	**2011-2018**	79	0.6	27.6	1.3	1.9
Non-Salmonids (Northern Pikeminnow)	**2018**	3	0.9	1.1	1.0	1.0

Notes: Data from 2011-2018 provides ascent times from lower pools to the holding pool. Fish passage facility operated full time in notch mode starting in 2019.

Based on the ascent time data, most salmonids ascend the ladder more quickly than non-salmonids. The maximum time any fish took to ascend the ladder was a Brown Trout that entered the fish passage facility September 22 and ascended 17 days later on October 10. The previous record was 10 days in June 2016 by a Brown Trout with a history of ascending the fish passage facility six times in 5 different years (2013, 2015, 2016, 2017, 2018). This Brown Trout had five ascent times recorded ranging from 58 minutes to 10 days and was detected in the lower pools in the ladder for extended periods prior to ascending in 2017 (21 days) and 2018 (4 days). It ascended the ladder in the spring and fall months, ascended more quickly in notch mode than orifice mode, and was detected in the Thompson River annually since 2015. The ascent time (0.97-10 days) did not appear to impede this Brown Trout's ability to continue migrating upstream and into the Thompson River after its release upstream of Thompson Falls Dam.

7.1.3.7 Upstream Fish Passage and Utilization of Upstream Habitat

Angler reports have provided insight into fish migration at a large scale, including the lower Flathead, middle Clark Fork, and Blackfoot rivers. Since 2017, salmonids recorded at the fish passage facility workstation receive a Floy tag that is visible to anglers, prior to being released upstream of the dam. FWP contact information is provided on the Floy tag.

Since 2017, anglers have reported catching 80 salmonids that previously ascended the fish passage facility (**Table 7-15**). The majority of the salmonids were captured upstream of Thompson Falls Dam with the greatest number of angler reports from the Thompson River. Other salmonids were captured downstream of Thompson Falls Dam, in the Noxon reach.

Table 7-15: Summary of Floy-tagged salmonids reported by anglers since 2017. Angler reports include fish caught upstream and downstream of Thompson Falls Dam.

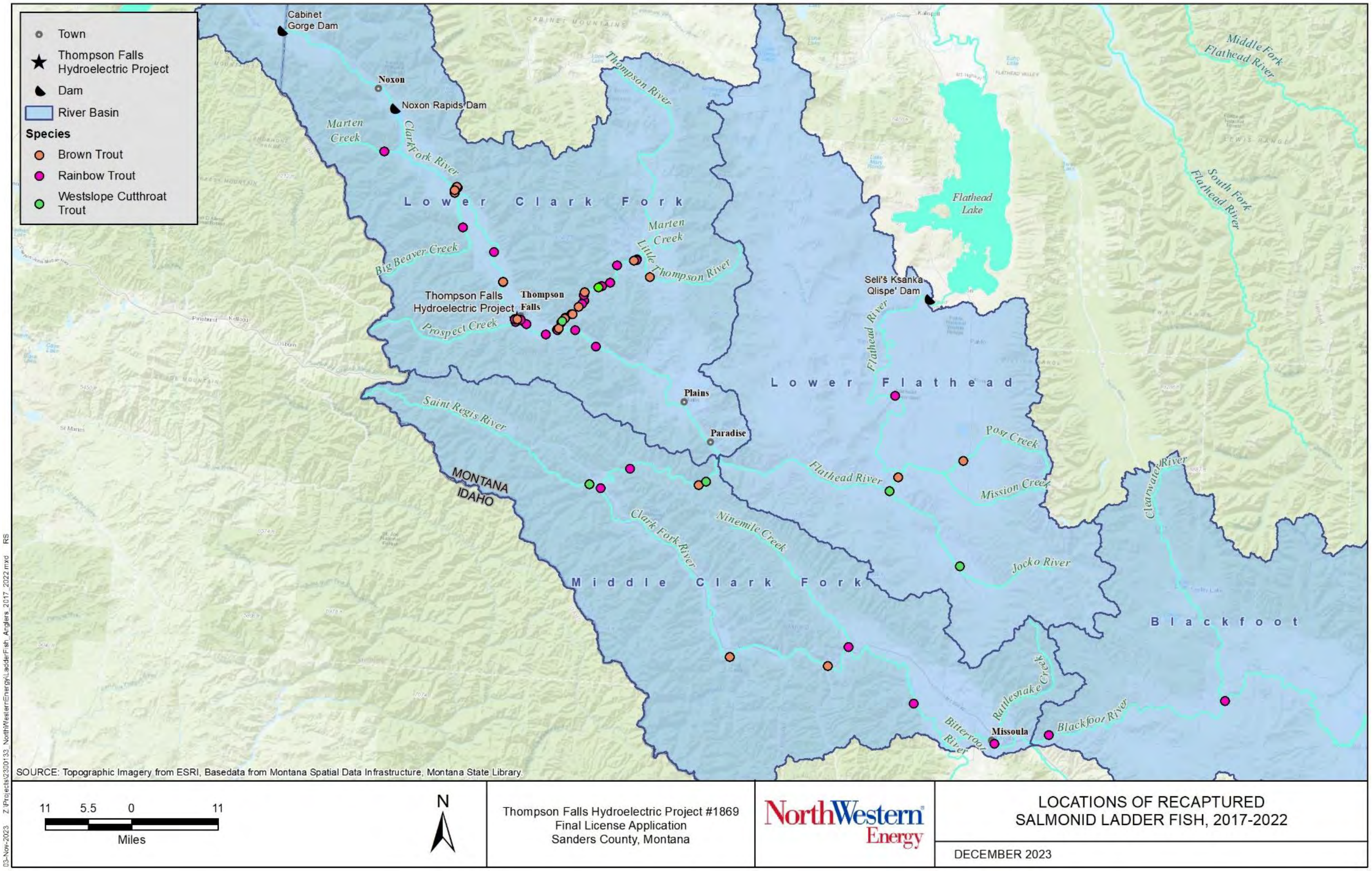
Species	2017	2018	2019	2020	2021	2022	Total
LL		1	3	6	5	7	22
RB	1		9	12	15	15	52
WCT		1	1	2	1	1	6
Total	**1**	**2**	**13**	**20**	**21**	**23**	**80**

Notes: LL = Brown Trout; RB = Rainbow Trout; WCT = Westslope Cutthroat Trout
Source: FWP unpublished

Angler report data continue to show the large geographical area fish are utilizing, both upstream and downstream of Thompson Falls Dam (**Figure 7-27**). In 2022, the longest distance report upstream was at the confluence of Nine Mile Creek with the Clark Fork River about 20 miles west of Missoula. Past reports include 190 miles upstream of the Project to the confluence of the Clearwater River and the Blackfoot River as well as other long forays to the Jocko River in the Lower Flathead River, and to the middle Clark Fork River near the towns of St. Regis, Alberton, and Missoula.

The majority of angler reports are from upstream of Thompson Falls Dam and near the Project area, in the mainstem Clark Fork River and Thompson River drainages (Figure 7-27). Downstream, fish have been captured at the mouth of Prospect Creek extending downstream in Noxon Reservoir to Vermilion Bay and White Pine Creek, as well as below Cabinet Gorge Dam.

Figure 7-27: Angler Reports of Recaptured Salmonid Ladder Fish, 2017-2022.



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7.1.4 Downstream Fish Passage

7.1.4.1 Downstream Survival

When water is spilling over or through the dams at the Thompson Falls Project, 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. In 2007, the previous Licensee (PPL Montana) prepared a *Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* (GEI 2007b) (2007 Literature Review) which included specific consideration of federally-listed Bull Trout and Westslope Cutthroat Trout, a Montana Species of Concern.

The 2007 Literature Review estimated that survival estimates at the Project are 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm was estimated to likely be 91 to 94 percent.

The BO (FWS 2008) issued by the FWS October 28, 2008, agreed with the downstream fish passage survival estimate in the 2007 Literature Review and 2008 Biological Assessment (GEI 2008).

In 2022, NorthWestern prepared an Updated Literature Review (NorthWestern 2022d) to provide updates, as available, to estimates of downstream passage survival of various size classes of fish, with respect to current Project configuration and operations. The 2022 Updated Literature Review supported the 2007 findings. The recent 2022 literature review found more recent work confirming the differences in survival between Kaplan and Francis-type turbines. Kaplan units are significantly safer for fish than Francis type units (Vikstrom et al. 2020; Algera et al. 2020). The range of survival through Kaplan turbines for juvenile Atlantic Salmon and Brown Trout is within the estimate previously reported with survival between 100 to 99 percent and Francis juvenile survival 88 to 91 percent (Vikstrom et al. 2020).

The literature reviews (2007 and 2022) concluded that combined survival estimates for passage through the Francis turbines, the Kaplan turbine and the spillway for trout measuring greater than 100 mm is likely 91 to 94 percent. Little research specific to the species at Thompson Falls has been completed since 2006. Thus, no additional literature was identified during the 2022 review that would measurably change the 2007 estimates of downstream survival at the Project.

The Licensee has documented downstream fish movement through the Project since the construction and operation of the Thompson Falls Upstream Fish Passage facility (fish passage facility) commenced in 2011. Salmonids, and some non-salmonids, which are 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 2019b). Additionally, about 6.5 percent of the 1,107 Floy-tagged Smallmouth Bass ascended the fish passage facility two or more times; two fish ascended three times; one fish ascended four times; and one fish ascended five times (NorthWestern 2018a).

On an annual basis, an average of 8 percent (range from 3-13.5%) of the salmonids PIT-tagged each 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 also been detected in tributaries both upstream and downstream of the Project (NorthWestern 2019a; 2019b), indicating that the fish 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 Channel 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.

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.

7.1.4.2 Fallback

Fallback is generally defined as a fish that successfully completes upstream passage of a fishway at a dam facility but later returns downstream of the dam (Rischel and Bjornn 2003; Naughton et al. 2006, McLaughlin et al. 2013; Silva et al. 2018). The time between successful passage and detection downstream of the facility is also an important component of fallback analysis, but there is no set standard for evaluating fallback.

The concerns with fallback include fish becoming disoriented when exiting the fishway and moving in the wrong direction and no longer motivated to swim upstream as a result of the fishway experience or fish are no longer physically capable of continuing the upstream migration due to the demands of the fishway (McLaughlin et al. 2013). Even if a fish returns to the fishway and re-ascends, there are concerns of unwanted delay and corresponding consequences such as reduction in fitness, increase susceptibility to injury/mortality, decrease in reproductive success (McLaughlin et al. 2013). Another concern in the Columbia River system regarding anadromous fish is the potential for bias estimates of fish passage and escapement calculations which could also impact estimates of adult salmon run sizes, which have management (ecological and economic) implications for the fish stocks (Boggs et al. 2004). Fallback is also commonly associated as an adverse impact post-tagging (Frank et al. 2009).

Between 2011 and 2022, approximately 3,495 salmonids (175-525 salmonids annually) were uniquely tagged at the fish passage facility and released upstream (**Table 7-16**). Fish were detected below Thompson Falls Dam *via* the PIT tag array in the fish passage facility, other tag arrays in downstream tributaries (e.g., Prospect Creek, Graves Creek), or other sampling efforts (e.g., Noxon Rapids Reservoir gillnetting and electrofishing). Most years there were a few salmonids detected downstream of Thompson Falls Dam within 30 days after ascending the fish passage facility and release upstream.

Table 7-16. Summary of the salmonids detected downstream of Thompson Falls Dam within 30 days of initial release upstream of the dam, 2011-2022.

Fish Species	Annual Salmonid Fallback within 30 days of release upstream of Thompson Falls Dam											
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
BULL	-	-	-	-	-	-	-	-	-	-	-	-
RB	8	-	-	1	1	3	-	1	1	1	2	1
RBxWCT	-	-	-	-	-	1	-	-	-	-	1	-
WCT	2	-	-	-	-	1	1	-	-	-	1	-
LL	-	-	-	2	1	4	-	-	-	1	1	4
Total	**10**	**-**	**-**	**3**	**2**	**9**	**1**	**1**	**1**	**2**	**5**	**5**
% of Tagged Salmonids	**4.6**	**-**	**-**	**1.2**	**0.4**	**1.7**	**0.4**	**0.6**	**0.9**	**0.7**	**2.5**	**2.7**

Notes: BULL = Bull Trout; LL = Brown Trout; RB = Rainbow Trout; RBxWCT = Rainbow x Westslope Cutthroat Trout hybrid; WCT = Westslope Cutthroat Trout

7.1.5 Freshwater Mollusks

There are two aquatic species of concern, the Western Pearlshell Mussel *Margaratifera falcata* (listed as Montana SOC, LNF SCC, and USFS Region 1 sensitive species), and the Shortface Lanx (*Fisherola nuttalli*), a Montana SOC with known historic range in the Project area. These species are discussed below, including a brief life history background, known distribution of the species in the Project area, threats and limiting factors for each species.

7.1.5.1 Western Pearlshell Mussel

The Western Pearlshell is a freshwater mussel identified as a SOC in Montana in 2008 and a USFS Region 1 sensitive species (2011), and LNF SCC (2023). The Western Pearlshell mussel is the only native freshwater mussel in western Montana (Cook 2022). The species is oblong shape and has a moderately thick outer shell. The outside shell is dark brown to black (visibly eroded at the umbo [hinge] as adults) and the interior shell has a purple to pink hue (Jepsen et al. 2012, Stagliano 2019). This species is mostly sedentary bottom dwellers and burrow about two-thirds of their shell into the streambed and/or between rock crevices. As filter feeders, they filter microscopic particles of plants or animals. Locomotion is achieved with a flexible and muscular foot; however, mobility is slow. The species is vulnerable to perturbations in the landscape that significantly alter physical stream habitat and/or water quality resulting in adverse impacts from, but not limited to nutrient loading, increased water temperature, sedimentation, debris flow, and scouring. The species dispersal capacity is limited to its host fish. Western Pearlshell are vulnerable to changes in host species distribution, presence, timing of migration and reproduction (Allard et al. 2015). The distribution of the species is often more geographically limited than the distribution of salmonid fish (Hovingh 2004). Common predators of Western Pearlshell mussel are mink, muskrat, river otter, wading birds, and game fish.

Reproductive maturity for adult Western Pearlshell is between 10 to 12 years of age, which coincides with 34 mm in length (Cook 2022). The cycle of life starts with the male releasing sperm into the water column. The sperm flow downstream until the female siphons the water, collects the sperm and fertilizes her eggs. The larvae (glochidia) develop inside the female after which are released. The brooding period for mussels in western Montana is approximately 24 to 39 days in May and June (Cook 2022). Mussels generally release millions of glochidia in conglutinate clusters into the water column (Rodgers et al. 2020; Haag 2012 cited in Scully-Engelmeyer et al. 2022). The timing of glochidial release into the water column has been documented between late March and July (Murphy 1942, Karna and Millemann 1978, Meyers and Millemann 1977) and attributed to seasonal changes in daily water temperature fluctuations, which may be related with presence/timing of host species (Allard et al. 2017). The newly released glochidia must find a salmonid host and attach themselves to the fish’s gills or fins within approximately 24 hours for survival. Glochidia, at initial release by an adult female mussel, measure about 0.6 to 0.7 mm and can increase in size more than 400 percent while attached to their host (Cook 2022). The glochidia attach to the fish gills and feed off their host for approximately 3 to 4 weeks (Cook 2022). The glochidia are obligatory parasites and after attaching to the host fish, the glochidia is encapsulated by epithelial cells on the hosts’ gills (Bauer 1987).

Cook found the larval infestation period generally occurred in June and July, lasting between 47 and 71 days (Cook 2022, Stagliano et al. 2021). Once the glochidia develop into juvenile mussels, they fall off their host fish, attach to the substrate or burrow into rock crevices, and begin to filter feed. The juvenile mussel requires clean sandy or gravelly substrate to settle and grow. Size and growth of the juvenile and later adult depends on environmental conditions such as hydrochemistry and water temperature. The life history strategy assumes host fish are moving upstream to spawn and thus further propagate mussel populations upstream. This life history strategy benefits mussels with upstream dispersal (Cook 2022).

Once they reach reproductive maturity, the cycle starts again. Adults can reach 6 to 7 inches in length and live more than 100 years. The average lifespan may vary depending on habitat conditions and health of the local host (salmonid) population.

Western Pearlshell mussel optimal habitat conditions are similar to their host fish, lotic systems that are oligotrophic with cooler temperatures, low turbidity, low levels of calcium carbonate, high levels of dissolved oxygen, and stable substrates (Bauer 1987, Bauer 1992, Jackson 1925, Roscoe and Redelings 1964, Toy 1998, Young and Williams 1984a, Stagliano 2010, MNHP 2018, MNHP 2023). Western Pearlshell mussel prefer cobble or gravel substrate interspersed with boulders, usually located in waterways with low velocities, low shear stress and stable substrate (Jepsen et al. 2012, Stagliano 2019, LNF 2023). Substrate composition is usually composed of sand, gravel, and cobbles that are "open" graded enough to allow for physical movement and water percolation. In steeper streams, larger boulders may provide small suitable sites immediately downstream of them. In larger streams, the streambank provides for flow disruption and energy dissipation which can result in the formation and maintenance of desired substrates.

The species is intolerant to sedimentation (Vannote and Minshall 1982, Stagliano 2019). Western Pearlshell mussel inhabit perennial rivers, streams, and creeks at depths of 1.5 to 5 feet and are most commonly observed congregated in areas with boulders and gravel substrate (Roscoe and Redelings 1964). The species has been documented at multiple elevations, including waterways above 5,000 feet (Jepsen et al. 2012). Stagliano et al. (2021) completed 188 population surveys in Montana streams evaluating habitat attributes for Western Pearlshell mussel populations. This effort documented and characterized the following habitat attributes for Montana mussel populations (Stagliano et al. 2021).

- 5.5-meter average stream size wetted width
- 1-3% average stream gradient
- C3, C4, E4 Rosgen channel classification
- 35 cm average depth of mussel bed (e.g. depth of species in substrate)
- 55% of populations present in riffles
- 37% of populations present in runs
- 8% of populations present in pools
- Gravel to cobble (<64 mm) primary benthic substrate

Western Pearlshell rely on a suitable host fish which is critical to their dispersal and survival (Jackson 1925; Roscoe and Redelings 1964; Young and Williams 1984b). Bauer (1994) concluded that the only suitable host for the glochidia, (larval stage), of *Margaritifera* spp. is the subfamily Salmoninae, restricting these freshwater mussels to trout streams. Specific host fish are often not known; however, studies have shown Brown, Brook, Rainbow, and Cutthroat trout are suitable hosts for Western Pearlshell glochidia (Murphy 1942; Toy 1998; Young and Williams 1984b). In

Montana, the native Westslope Cutthroat Trout was historically the host fish (MNHP and FWP 2023a; Stagliano 2019). Recent research conducted in western Montana streams by Cook (2022) and Stagliano et al. (2021) confirmed several suitable host fish for glochidia transformation (larval stage) including two native species Westslope Cutthroat Trout and Redband Trout, and three nonnative species, including Brook, Brown, and Rainbow trout. Species such as nonnative Rainbow Trout were also observed as host fish (Stagliano et al. 2021) but considered less optimal with lesser susceptibility for glochidia to latch on the gills of the fish (Cook 2022).

The Western Pearlshell is sensitive to water quality issues such as sedimentation and eutrophication (Stagliano 2019). The distribution of this species has also been threatened by impoundments and diversions (MNHP and FWP 2023a). Water quality issues and fragmentation of habitat as a result of water diversions or dam structures can adversely impact their host fish, which the freshwater mussel relies on for distribution and survival. This freshwater mussel is susceptible to adverse impacts to their environment due to its sedentary lifestyle after the larval stage, age of sexual maturity (10-12 years), and is generally intolerant of pollutants.

Historically, Western Pearlshell was present throughout the Clark Fork River drainage (Stagliano et al. 2007). Populations of the Western Pearlshell in larger rivers such as the Clark Fork River are believed to be extirpated or are at such low densities that long-term viability is unlikely because of habitat fragmentation of the mainstem (Stagliano et al. 2007).

Stagliano revisited stream reaches in the Clark Fork River where 20-year-old or older records of the Western Pearlshell were known and found no populations (Stagliano et al. 2007). The species is not known to inhabit reservoirs and has only been observed in river and stream habitats (Blevins et al. 2017; Howard and Cuffey 2006, Lynse and Krouse 2011; Mathias 2015; Oliver and Bosworth 1999; Stagliano 2010).

In 2014 Stagliano (2015) documented a few isolated populations in the upper Thompson River and upper Little Thompson River that received a fair to poor viability rating, indicating mussel densities less than 25 individuals or a few individuals, limited size-classes or older specimens, no juveniles present (Stagliano 2010). In 2022, Stagliano (2023) collected and analyzed environmental deoxyribonucleic acid (eDNA) and snorkeling surveys in the Thompson River with eDNA results detecting Western Pearlshell mussel in the lower Thompson River (mainstem) and observations of live mussels upstream of the confluence with the West Fork Thompson River (personal communication, D. Stagliano, February 3, 2023).

MNHP database (2023) indicated a single Western Pearlshell was collected in the Thompson Falls Reservoir just upstream of the Dry Chanel Dam along the shallows of the Island Park Shoreline (*see* **Figure 8-2**). The sample event occurred in July 2018 by FWP AIS survey crew (personal communication, S. Freeman, FWP, April 2023). Photos were taken of the specimen (**Photograph 7-3**). Although the specimen was found completely intact, it is unknown if the individual was still alive. The crew completing the survey in 2018 used kick nets, rock picking, and raking to examine plants.

The 2018 collection was the first documentation of a Western Pearlshell in Thompson Falls Reservoir. It is unclear if the shell was transported by another species (e.g., mink or river otter), or if it washed downstream from the closest documented population in the Thompson River. However, based on the specimen's roughness of the outer shell edges of the shell, it appears as if it has undergone scouring and tumbling along rocks. Typically, a mussel pulled from a streambed will have smooth edges and a substrate burial line that indicates it had been secured in the substrate feeding (**Photograph 7-4**) in contrast to the condition of the shell observed from the Thompson Falls sample (Photograph 7-3). Additionally, the condition of the specimen is not consistent with typical predation marks, such as predation bite and scratch marks on the anterior end of the shell (personal communication, D. Stagliano, November 2023).

Photograph 7-3: Western Pearlshell mussel individual sampled in Thompson Falls Reservoir, July 2018.

Photograph 7-4: Typical Western Pearlshell mussel sampled with red arrows pointing to the substrate burial lines (Stagliano, unpublished).

The Thompson Falls Reservoir does not provide suitable habitat to support a viable and reproducing population of mussels. Western Pearlshell mussel require sufficient flow of well-oxygenated water and food to provide daily metabolic resources for basic survival (Blevins et al. 2017). The species reproduction requirements require stream flow to deliver sperm from upstream adult male Western Pearlshell mussel to fertilize eggs of the downstream females (Cook 2022). The host fish, Westslope Cutthroat (or other salmonid species) utilize the reservoir as a migratory corridor and the abundance of host fish in the reservoir is low based on NorthWestern and FWP fish sampling surveys (e.g., fall gillnet data [2004-2023] and spring electrofishing [2009-2022]). Additionally, studies in Montana (Cook 20022, Stagliano et al. 2021) found Western Pearlshell glochidia were more successful at attaching to juvenile host fish (<100 mm) in early-June than adult host fish (>200 mm), which are more likely present in tributary streams than the reservoir. Abundance of suitable host fish is critical for successful mussel reproduction (Haag and Stoeckel 2015, Stagliano et al. 2021). The number of salmonids and potential host fish in the Thompson Falls Reservoir is low based on fish sampling surveys (NorthWestern 2019b, 2023c). Additionally, the lacustrine (lake-like) environment provides non-functional habitat attributes based on water depth, seasonal temperatures, and substrate.

7.1.5.2 Shortface Lanx

The Shortface Lanx is a native freshwater snail categorized as a Montana SOC. This snail was historically present throughout the Columbia River Basin (Nietzel and Frest 1989), but known occurrences are limited to parts of the Salmon and Snake rivers, Okanagan River drainage in British Columbia, and Deschutes River in Oregon (MNHP and FWP 2020). The species was presumed extirpated in Montana (Stagliano et al. 2007), likely due to historically suitable habitat been lost due to impoundments (MNHP and FWP 2020). Reports of the species in the Lower Clark Fork River basin have been isolated and few (MNHP and FWP 2020; MNHP 2023).

The Shortface Lanx is commonly referred to as a “limpet” although it is not a “true limpet”. This common name “limpet” is applied to this species based on the limpet-like appearance (having a simple shell which is conical in shape rather than being spirally coiled), which distinguishes it from all other freshwater snails living in the Columbia River drainage of Canada and the U.S. These snails are generally triangular-shaped and measure about 12 mm in length, 10 mm in width, and 6 mm in height (MNHP and FWP 2020).

The Shortface Lanx prefers cool, cold, clean waters that are well-oxygenated and consist of permanent flow and cobble-boulder substrate (Nietzel and Frest 1989). Stream habitat type includes large perennial rivers ranging from 98 to 300 feet wide. This species primarily feeds on algae and diatoms by scraping rock surfaces. It is not present in areas with a high abundance of macrophytes or epiphytic algae, in areas with a bedrock substrate, or in areas of heavy disturbance (Frest 1999). Distribution and movement are either from a slow snail-like crawl or stream current. These species are not active in the winter.

Shortface Lanx is a hermaphrodite (both sexes in same individual) and lays transparent, suboval gelatinous egg masses containing between one to 12 eggs. The life span of the species is about 1 year with adult mortality increasing rapidly after egg laying and when temperatures rise above 62.6°F (COSEWIC 2016b).

Specific threats to populations of Shortface Lanx have been identified as loss of habitat through impoundments, degraded water quality and siltation of cobbles, as well as nutrient enrichment (Nietzel and Frest 1989; Frest and Johannes 1995).

MNHP records show only three observations of the Shortface Lanx in Montana over the last 50 years (MNHP 2023). McGuire (2002) identified the snail in August 2000 and 2001 in the Lower Clark Fork River, upstream of Thompson Fall Reservoir at Station 27 with an average relative abundance of eight snails per Hess sample. This section of river is not influenced by the reservoir and is outside the Project vicinity. In July 2019, Stagliano (Montana Biological Survey/Stag Benthics 2019) identified one specimen of the snail from five samples identified at site CF3 located immediately downstream of Thompson Falls Dam and the FERC Project boundary (*see* **Figure 8-2**). No individuals were located in the upstream site, CF1. The current distribution or abundance of this species in the Lower Clark Fork River is not known.

7.1.6 Aquatic Invasive Species

Aquatic invasive species (AIS) can be in the form of aquatic plants, animals, and pathogens. AIS impact water bodies and wetlands, whose presence can cause severe damage to local ecosystems, industry and tourism. AIS can also be categorized as non-native species. Non-native species are defined as deliberately or accidentally introduced to areas outside of their native geographic range, which are able to reproduce and maintain sustainable populations in the areas.

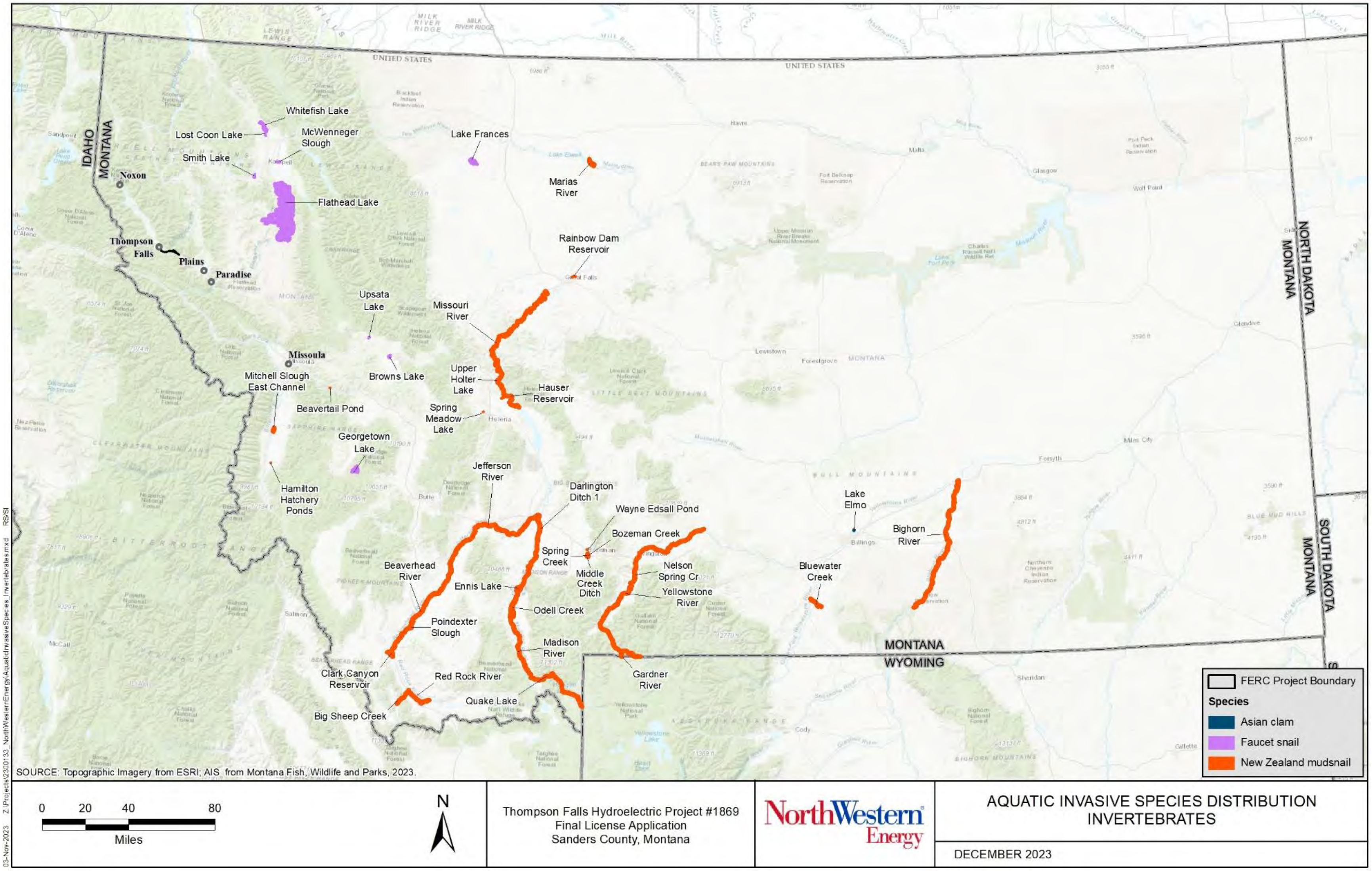
NorthWestern identified American bullfrog tadpoles (*Lithobates catesbeianus*) in the lower Thompson Falls Reservoir (large midchannel island area) during a sampling event in September 2021 (**Photograph 7-5**). This is the first known finding of this species in Thompson Falls Reservoir. Bullfrogs are non-native and invasive in the western U.S. where they have caused issues for other native amphibians through competition and chytrid fungus.

Another aquatic invasive and non-native species, Virile Crayfish *(Faxonius virilis)* was identified during the sample event in September 2021. This omnivorous species is native to eastern Montana but has been invading westward for the last 30 years. The Virile Crayfish was documented in the Thompson Chain of Lakes (Thompson River drainage) and was likely started with an illegal introduction *via* "bucket biology" (MNHP and FWP 2023b).

No populations of zebra (*Dreissena polymorpha*) or Quagga mussels (*Dreissena bugensis*) are known to currently exist in Montana. Known distribution of invasive aquatic mollusks in Montana as of 2020 (FWP 2020) are shown in **Figure 7-28**. Aquatic invasive plants are discussed in **Exhibit E - Section 8 – Wildlife and Botanical Resources.**

Photograph 7-5: American Bullfrog Located During September 2021 Sampling Event.
Source: NorthWestern 2022e Operations Study

Figure 7-28: Aquatic invasive invertebrates.



Source: FWP 2020

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7.2 Environmental Measures

7.2.1 Existing Environmental Measures

NorthWestern is implementing these ongoing environmental measures for the benefit of fisheries in the Project area:

- Operate and maintain the upstream fish passage facility from mid-March through mid-October per FERC order issued on February 12, 2009.
- Upstream fish passage monitoring and reporting per FERC order issued on February 12, 2009.
- Fisheries population monitoring and reporting (filed with FERC) within the reservoir and portions of the river.
- Downstream fish passage mitigation per FERC order issued on February 12, 2009.
- Develop and implement operational procedures to reduce TDG production during periods of spill per FERC order issued on February 12, 2009. Procedures are described in the TDG Control Plan, 2010.
- Maintain minimum instream flows downstream of the Project of 6,000 cfs or inflow, whichever is less per License Article 411.

7.2.2 Proposed Environmental Measures

NorthWestern is proposing to implement the PM&E measures described below:

- The Licensee will develop a Fisheries and Aquatic Resources PM&E Plan for purposes of reducing adverse effects on Bull Trout and other native fish species caused by the operation of the Project. The PM&E Plan will provide for the continuation of the adaptive management principles set forth in the January 15, 2008 MOU among the Licensee, FWS, FWP and the CSKT, including the Technical Advisory Committee (TAC). The PM&E Plan will add the USFS as a voting member of the TAC and will include, at a minimum, the following measures:
    - Improvements to upstream passage for native species, specifically:
        - Over the first 5 years of implementation, the Fisheries and Aquatic Resources PM&E Plan will involve deployment of up to 8 submersible PIT antenna within logistical and safe conditions below the Main Channel Dam to evaluate finer scale fish movements in the near field of the fish passage facility.
        - At the end of the first 5-year period, the Licensee will prepare a summary report discussing results of the 5-year study period. The summary report will be prepared in consultation with the TAC and filed with FERC.

        - The Licensee shall prepare an Upstream Passage Improvement Plan for the second 5-year period based on the results of the first 5-years. The Upstream Passage Improvement Plan will include further evaluations to improve capture efficiencies of the upstream fish passage facility, any proposed operational changes, and a plan and schedule to complete any facility modifications proposed by the Licensee in consultation with the TAC determined necessary to improve upstream passage efficiency. The Upstream Passage Improvement Plan will be prepared in consultation with the TAC and filed with FERC for approval.
    - Improvements to downstream passage of Bull Trout at the Project.

The Licensee shall prepare the Fisheries and Aquatic Resources PM&E Plan in consultation with the FWS, USFS, FWP, and CSKT, and will file the PM&E Plan for approval by the Commission within one year of the issuance of the new license.

- The Licensee shall continue to operate and maintain the upstream fish passage facility in accordance with TAC guidance. The following measures for operation will include:
    - Seasonally operate the fish passage facility from approximately March – October.
    - Spring closures when total river discharge is within 48,000 to 65,000 cfs, as approved by the TAC.
    - Adequate staff to operate and maintain the fish passage facility.
    - An engineered solution to provide adequate flow to the upstream fish passage facility at all water surface elevations down to 2.5 feet below full pool. This work will be completed prior to NorthWestern's implementation of flexible generation between 2.0 to 2.5 feet below full pool during periods when the fish passage facility is operating.
    - Compile data collected at the fish passage facility into NorthWestern's database following quality control and quality assurance review.
    - An annual report summarizing upstream passage activities and results to be provided to the TAC for review.
- For the first 5 years of the New License term, the Licensee shall implement fisheries population monitoring in the Thompson Falls Reservoir and Clark Fork River as specified below. These measures may be extended beyond the first 5 years of the New License term as agreed by the TAC.
    - Fall gillnetting annually in Thompson Falls Reservoir.
    - One spring electrofishing section in the lower reservoir from Wild Goose Landing upstream along HWY 200 to the pump house in even years (2026, 2028).
    - Fall electrofishing sections on even years (2026, 2028) immediately above islands and 1 downstream of Paradise.

- The Licensee will generally maintain minimum flow releases at the dam of 6,000 cfs or inflow whichever is less. These releases may be temporarily modified if required by operating emergencies beyond the Licensee's control and for short periods on mutual agreement between the Licensee, FWS, DEQ and FWP.

In addition, NorthWestern is proposing measures to benefit other resource areas which will also be of benefit to fisheries resources. Specifically:

- The Licensee shall implement the Thompson Falls Water Quality Monitoring Plan (Appendix C), which was developed in consultation with DEQ.
- Within 1 year of the issuance of the new License, the Licensee will update the 2010 TDG Control Plan in consultation with the DEQ to incorporate data that have been collected during the recently completed relicensing studies. At a minimum the updated TDG Control Plan shall include the following:
    - A requirement to monitor TDG at the project for 3 consecutive years to validate the updated TDG Control Plan.
    - A monitoring and reporting schedule in years where the most probable (50%) April 1 NRCS runoff forecast for the USGS Clark Fork River near Plains MT stream gage (12389000) is at or above 125%.

Following consultation with DEQ, the Licensee will submit the updated TDG Control Plan to FERC for approval. The Licensee will implement the updated TDG Control Plan upon FERC's approval.

- The Licensee will implement annual noxious weed control measures, as appropriate, in high-use areas on Project lands owned by the Licensee.
- Within 2 years of the new License, the Licensee, will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, SHPO and USFS.

7.3 Environmental Effects

7.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes. The following sections discuss the environmental effects on fisheries and aquatic resources under the no action alternative.

7.3.1.1 Upstream Fish Passage

Under the no action alternative, operation of the upstream fish passage facility would continue. A variety of species would continue to be captured during the seasonal March through October timeframe and capture efficiencies would remain the same. Floy and PIT tagging of salmonids captured in the fishway would proceed.

As reported in the ISR Operations Study, when the reservoir elevation was 2.3 feet down (2,394.2 feet) the fish passage facility began to have operating issues. The HVJ slowed down considerably and there was reduced water being fed to this feature. The fish sampling loop was inoperable due to the lack of water to fill the fish lift and anesthetizing tank. Pumps were shut off as they were drained, and the entire fish passage facility lacked sufficient flow and water to effectively capture fish. These impacts would reduce the amount of time the upstream fish passage facility would be operable during the season and therefore decrease total numbers of fish passed upstream at the facility.

7.3.1.2 Downstream Fish Passage

Downstream fish passage survival would continue as it has historically. Previous literature review efforts in 2007 (*Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* [GEI 2007b]) and the 2022 Updated Literature Review Study Report indicate relatively high survival estimates at the Project with 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm was estimated to likely be 91 to 94 percent. PIT tagging and floy tagging efforts have also documented downstream survival of adults through or over the facility (NorthWestern 2019b).

Downstream fish passage mitigation dollars ($100,000 annually) to improve Bull Trout survival would continue to be allocated focused on tributaries. Actions such as habitat restoration, streamside property acquisitions or easements would be sought after by NorthWestern Energy and agency and nonprofit partners. Although these actions are focused for Bull Trout improvements, other species such as Westslope Cutthroat Trout, which coexist in these same tributaries would also see benefits from these activities.

7.3.1.3 Reservoir Management

The no action alternative would periodically utilize the top 4 feet of water in the Thompson Falls Reservoir. During 2019, the reservoir was drafted 4 feet and widespread stranding was observed at this reservoir elevation. At the larger drawdowns, the quantity of dewatered habitats and fish stranding of primarily Black Bullhead was large in scope and scale. The large flat areas where juvenile fish rearing typically occurs were adversely impacted by dewatering at these low water levels and rapid rate of withdrawal. Areas in the lower Thompson Falls Reservoir and those near the islands upstream of Thompson River had the most stranded fish.

Under the no action alternative, NorthWestern may utilize the Project as needed to continue to meet NorthWestern's electric grid reliability demands using the capacity in the reservoir, up to the top 4 feet from full pool. NorthWestern may utilize the full authorized drawdown more frequently than in the past to meet the need for operational flexibility.

Increasing the frequency of using the full 4 feet of elevation in the no action alternative would have impacts to juvenile populations of non-native sportfish within Thompson Falls Reservoir. These affects would vary depending on the frequency and rate of elevation change, along with the time of year. A full 4-foot change during the spring or early summer could have a larger effect on species like Black Bullhead, Smallmouth and Largemouth bass if it occurred when they were spawning. Drying up redds, fry, and juvenile fish could have large negative effects on fish year classes within the reservoir. A 4-foot change in elevation during the early fall or late summer would primarily negatively impact juvenile or adult fish, while sparing egg mortality in redds.

As indicated in the Operations Study ISR (NorthWestern 2022e), access for salmonids into and out of Cherry Creek and Thompson River remains at all reservoir elevations. There are no flow or depth barriers to fish movement from the no action alternative.

Certain maintenance activities require the reservoir be lowered outside of the typical operating window. The first is an unplanned event that would occur when spring flows exceed the capacity of the combination of the spillway radial gates (less reserve for plant capacity restoration) and the spillway roller panels. Prior to the installation of the new radial gates in 2019, high flows and debris required tripping of stanchions and spill bays approximately every 7 to 10 years. With the installation of the new radial gates, it is estimated that the flow that will trigger stanchion tripping is approximately 112,000 cfs but is also dependent on the amount of debris accumulating at the dam that cannot be passed through the radial gates or spillway bays.

When flows near or exceed 112,000 cfs, NorthWestern may have to activate the trippable stanchions to allow the spillway to pass additional flows. It is anticipated this flow capacity without tripping stanchions to be more than the 10-year flood event of 110,335 cfs but less than the 25-year flood event of 122,947 cfs. When the stanchions are tripped, NorthWestern must draw the reservoir down to crest to execute repairs on the spillways. With the new radial gates, the frequency of deep drawdowns caused by the tripping of the stanchions will be far more rare.

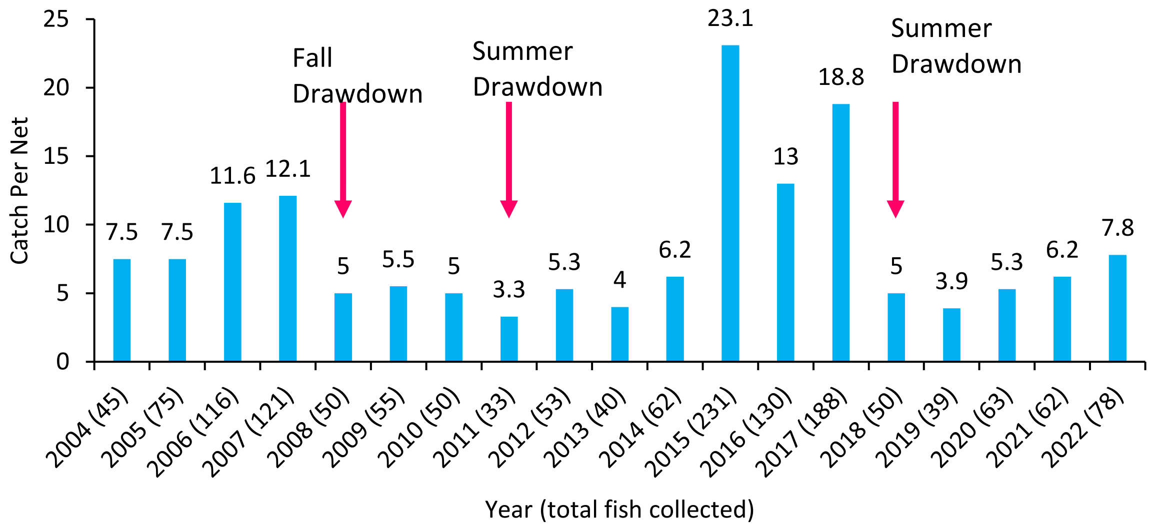
The duration of the drawdown would be dependent on the inflow values. The reservoir would not be able to be maintained at crest to facilitate the repairs until inflows approach the total powerhouse capacity of 23,320 cfs at which time the reservoir would be drafted approximately 16.5 feet. Once inflows reach a manageable level, dam stanchion and board replacement would take 1 to 3 weeks depending on the number of bays in which stanchions were tripped.

The other primary event triggering operations outside of the typical fluctuation window would be a planned event to replace the timber stop-log flashboards which have a 25 to 30-year service life. Both events require the reservoir to be lowered about 16.5 feet, to a level near or slightly lower than the Main Channel Dam spillway crest. The duration that the full depth of the drawdown must be maintained to complete a full flashboard replacement on the Main Channel Dam is approximately 3 weeks, the duration would be less to perform similar work on the Dry Channel Dam.

To reduce effects on the fish passage operations, the preferred timing of planned drawdowns to support maintenance activities is in the month of October. However, this timing is not achievable with emergency maintenance activities or when the drawdown is in response to high spring flow conditions that require tripping of the flashboard stanchions.

The abundance of some fish species in Thompson Falls Reservoir appears to be related to extended drawdowns, such as those that occurred in 2008, 2011 and 2018. The drawdown in fall (October) 2008 was a result of a planned maintenance activity while the 2011 and 2018 summer drawdowns were a result of very high flows tripping the stanchions on the spillways. Required maintenance work on the dam (due to stanchions tripping as a result of high flows) resulted in a reservoir drawdown during the summer of about 13 feet during 2011 and 16 feet in 2018. Annual gillnetting results since 2004 are shown in **Figure 7-29**. Total fish caught per net declined from the previous year in years following a deep drawdown, due to maintenance requirements, which was primarily related to the decline in Black Bullhead following each drawdown (NorthWestern 2019a).

Figure 7-29: Summary of the Thompson Falls Reservoir gillnetting efforts 2004-2022. Substantial drawdowns occurred in the fall of 2008 and summers of 2011 and 2018.



The impact of reservoir drawdowns on the population of Black Bullhead has been most apparent. Black Bullhead were the most abundant fish species caught in the years prior to the 2008 drawdown, before a precipitous decline for the years following the drawdown. Northern Pike catch rates also appear to have responded to these deep drawdowns in 2011 and 2018, with lower catch rates in the years following drawdowns. Other species did not have any immediate population response and overall catch rates per net remain low for Thompson Falls Reservoir, with Black Bullhead driving up overall catch rate numbers up in 2006, 2007, 2015, and 2017. Black Bullhead are an introduced species in Montana, with scattered populations statewide but primarily concentrated in small ponds and backwater sloughs of eastern Montana. They seldom exceed 1 pound in weight and thus are rarely a desirable game fish in Montana waters (FWP 2023).

7.3.1.4 Total Dissolved Gas and Gas Bubble Trauma

The no action alternative would have no change in TDG levels or associated GBT in fish located downstream of the facility. The current TDG control plan and gate sequencing would remain in operation. Previous investigations have found little GBT symptoms at any discharges in adult fish. Furthermore, fish captured at the upstream fish passage facility have not exhibited signs or symptoms of GBT during the 13 years of operation.

7.3.1.5 Minimum Flows

In general, a downstream minimum flow of the lesser or 6,000 cfs or inflow will be maintained downstream during normal operations. There are no known impacts to aquatic resources identified as related to minimum flows. The bypass channel provides a wetted channel sufficient for upstream fish passage. The upstream fish passage facility continues to operate seasonally (March–October). Prospect Creek confluence remains connected to the mainstem Clark Fork River and is accessible to fish.

7.3.1.6 AIS

Under the no action alternative NorthWestern operations and maintenance will not impact AIS status in the area.

7.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations.

The following sections discuss the status fisheries and aquatic resources as a result of proposed operations that is anticipated to continue under the action alternative.

7.3.2.1 Upstream Passage

Under the proposed action alternative, operation of the upstream fish passage facility would continue. A variety of species would continue to be captured during the seasonal March-October timeframe. Reservoir elevations more than 2.3 feet below full pool showed impacts to operation of the fish passage facility. To address this and potential other issues, under the proposed alternative Northwestern proposes to evaluate and assess opportunities to enhance the effectiveness of the existing upstream fish passage facility.

7.3.2.2 Downstream Passage

There are no proposed operational changes that would impact downstream fish passage survival. Previous literature review efforts in 2007 (*Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* [GEI 2007b]) and the 2022 Updated Literature Review Study Report indicate relatively high survival estimates at the Project with 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm was estimated to likely be 91 to 94 percent. PIT tagging and floy tagging efforts have also documented downstream survival of adults through or over the facility (NorthWestern 2019b).

7.3.2.3 Reservoir Management

The proposed Project operations would impact the water level fluctuation in the Thompson Falls Reservoir up to 2.5 feet The 2021 and 2022 Operations Study found some dewatering of shallow areas of the reservoir and side channels, including fish stranding when water levels are greater than 1.5 feet below full pool (NorthWestern 2022e, 2023d). Fish stranding was evaluated along 12 transects designated in a variety of locations, representing different shoreline aquatic habitat. The 2021 Operations Study evaluated water level fluctuations up to 2.5 feet below full pool and found fish stranding (**Table 7-17).** The 2022 Operations Study evaluated water fluctuations on August 24 and 31 with reservoir elevations at 2395.8 and 2395.7 feet, respectively. Transects were partially submerged and no fish stranding was observed. These data indicate stranding may occasionally occur as a result of reservoir fluctuations. However, the vast majority (78%) of the stranded fish observed were Black Bullhead. No salmonids were observed being stranded during either study.

Table 7-17. Total count of stranded fish for each survey event during Thompson Falls Reservoir Operations Study in 2021 and 2022.

Year Observed	Depth Below Full Pool (ft)	BBH	LMB	SMB	YP	NPMN	PUMP	Salmonids	Total
2021	0.5	-	-	-	-	-	-	**-**	-
2022	0.7	-	-	-	-	-	-	**-**	**-**
2022	0.8	-	-	-	-	-	-	**-**	**-**
2021	1.0	19	9	-	-	1	-	**-**	**29**
2021	1.5	3	1	-	-	-	-	**-**	**4**
2021	2.0	1	2	-	-	-	1	**-**	**4**
2021	2.5	89	9	2	4	1	-	**-**	**105**
	Total	**112**	**21**	**2**	**4**	**1**	**1**	**0**	**142**

Notes: BBH = Black Bullhead, LMB = Largemouth Bass, SMB = Smallmouth Bass,
YP = Yellow Perch, NPMN = Northern Pikeminnow, PUMP = Pumpkinseed Sunfish

Certain maintenance activities require the reservoir to be lowered outside of the typical operating window. These maintenance activities will happen under the no action alternative (*refer to* **Exhibit E - Section 7.3.1.3 – Reservoir Management**), and also under the proposed alternative. Proposed operations will not impact planned and unplanned drawdowns that result in tripping stanchions. When the stanchions are tripped, NorthWestern has to draw the reservoir down to crest to execute repairs on the spillways. NorthWestern plans to develop a drawdown plan to minimize and mitigate impacts to natural and recreation resources (e.g., minimize suspension of solids, minimize impacts to recreation access, minimize impacts to operations at the upstream fish passage facility). Planned maintenance resulting in a drawdown to or near crest at the Main Channel Dam is described in Exhibit E - Section 7.3.1.3.

Unplanned events resulting in stanchions tripping require flows to be near or exceed 112,000 cfs at the Main Channel Dam. This threshold increased to 112,000 cfs when the new radial gates were installed in 2019, which will reduce the frequency of unplanned deep drawdowns.

The impact of the proposed action is not anticipated to change the need for maintenance activities requiring deep drawdowns. The new radial gates will reduce the frequency of unplanned drawdowns that result in stanchions tripping at high spring flows. Planned maintenance activities will be implemented to mitigate impacts to natural resources (e.g., suspension of sediment) and other resources (e.g., recreation and upstream fish passage facility).

7.3.2.4 Total Dissolved Gas and Gas Bubble Trauma

TDG levels are not anticipated to change based on operations from the proposed action. However, within 1 year of the issuance of the new license, NorthWestern will update the 2010 TDG Control Plan in consultation with the DEQ to incorporate data that have been collected during the recently completed relicensing studies. Implementation of the TDG Control Plan will reduce, to the extent feasible, impacts to fish from GBT.

7.3.2.5 Minimum Flows

The proposed Project operations will have no impact on instream flows and subsequently no impact to fishery resources.

7.3.2.6 AIS

The proposed Project alternative is not anticipated to impact AIS.

7.3.2.7 Project Boundary Effects

Proposed modifications to the Project boundary incorporate the lands and water that are needed for Project purposes. The proposed Project boundary modification will have no impact on Fisheries or aquatic habitat.

7.4 Unavoidable Adverse Impacts

Based on the results of the Fish Behavior Study (NorthWestern 2023e) upstream fish passage is limited to fish that locate and ascend the fish passage facility. Similarly, continued operations will result in minimal fish passage mortality from passage through turbines and over the dam during spill.

Some stranding of fish (primarily Black Bullheads) is expected when reservoir is drawn down more than 1.5 feet. Stranding is more significant at deeper and faster drawdowns. Stranding of salmonids is not anticipated to occur.

Unplanned deep drawdowns resulting from stanchion tripping when flows near or exceed 112,000 cfs are likely to be infrequent but are known to impact fish community composition and abundance in the reservoir, primarily reducing numbers of Black Bullhead and other nonnative fish species to a lesser degree for a period of time.

These unavoidable adverse impacts are mitigated through implementation of PM&E’s.

8. Wildlife and Botanical Resources

This Section describes wildlife and botanical resources in the vicinity of the Project and considers potential effects of the Project. Threatened and endangered (T&E) species, as well as candidate species, are addressed in this **Exhibit E - Section 10 – Threatened, Endangered, Proposed, and Candidate Species**.

8.1 Affected Environment

This section provides a description of the wildlife and botanical resources within the Project boundary with the understanding that wildlife resources may move in and out of the Project boundary. Therefore, areas adjacent to or near the Project boundary (described as the Project vicinity) are included in the description of wildlife and botanical resources to provide an overall context of the larger geographic area used by wide-ranging wildlife species. Botanical resources are grouped according to vegetative communities or habitat types with some individual species analysis. Habitat types help determine actual and potential occurrence of wildlife species.

8.1.1 Wildlife Resources

A summary of known species in the Project vicinity, including big-game, small furbearers, other mammals, waterfowl, raptors, and other bird species, is provided in **Table 8-1.** Special status listed by the state of Montana or USFS are identified by an asterisk (*). Federally listed or candidate species are identified with ** and are described in more detail in this **Exhibit E - Section 10 – Threatened, Endangered, Proposed, and Candidate Species**.

Table 8-1. Summary of wildlife species known to occur in the Project vicinity.

Common Name	Scientific Name	Bird/ Mammal
Beaver	*Castor canadensis*	Mammal
Bighorn sheep*	*Ovis canadensis*	Mammal
Black bear	*Ursus americanus*	Mammal
Bobcat	*Lynx rufus*	Mammal
Elk	*Cervus canadensis*	Mammal
Fringed myotis*	*Myotis thysanodes*	Mammal
Grizzly bear**	*Ursus arctos horribilis*	Mammal
Mink	*Mustela vison*	Mammal
Moose	*Alces alces*	Mammal
Mountain lion	*Puma concolor*	Mammal
Mule deer	*Odocoileus hemionus*	Mammal
Muskrat	*Ondatra zibethicus*	Mammal
North American wolverine**	*Gulo gulo*	Mammal

Common Name	Scientific Name	Bird/ Mammal
Gray wolf	*Canis lupus*	Mammal
River otter	*Lontra canadensis*	Mammal
White-tailed deer	*Odocoileus virginianus*	Mammal
American avocet	*Recurvirostra americana*	Bird
American coot	*Fulica americana*	Bird
American crow	*Corvus brachyrhynchos*	Bird
American dipper	*Cinclus mexicanus*	Bird
American goldfinch	*Spinus tristis*	Bird
American kestrel	*Falco sparverius*	Bird
American pipit	*Anthus rubsescens*	Bird
American redstart	*Setophaga ruticilla*	Bird
American robin	*Turdus migratorius*	Bird
American tree sparrow	*Spizella arborea*	Bird
American white pelican*	*Pelecanus erythrorhynchos*	Bird
American wigeon	*Mareca americana*	Bird
Anna's hummingbird	*Anas americana*	Bird
Bald eagle*	*Haliaeetus leucocephalus*	Bird
Bank swallow	*Riparia riparia*	Bird
Barn swallow	*Hirundo rustica*	Bird
Barrow's goldeneye	*Bucephala islandica*	Bird
Belted kingfisher	*Megaceryle alcyon*	Bird
Black-billed magpie	*Pica hudsonia*	Bird
Black-chinned hummingbird	*Archilochus alexandri*	Bird
Black-capped chickadee	*Poecile atricapillus*	Bird
Black-headed grosbeak	*Pheucticus melanocephalus*	Bird
Black-throated green warbler	*Setophaga virens*	Bird
Blackpoll warbler	*Setophaga striata*	Bird
Black Swift*	*Cypseloides niger*	Bird
Blue jay	*Cyanocitta cristata*	Bird
Blue-winged teal	*Anas discors*	Bird
Bohemian waxwing	*Bombycilla garrulus*	Bird
Bonaparte's gull	*Chroicocephalus philadelphia*	Bird
Brewer's blackbird	*Euphagus cyanocephalus*	Bird
Brewer's sparrow*	*Spizella breweri*	Bird
Brown creeper*	*Certhia americana*	Bird
Brown-headed cowbird	*Molothrus ater*	Bird
Bullock's oriole	*Icterus bullockii*	Bird

Common Name	Scientific Name	Bird/ Mammal
Burrowing owl*	*Athene cunicularia*	Bird
California gull	*Larus californicus*	Bird
California scrub-jay	*Aphelocoma californica*	Bird
Calliope hummingbird	*Selasphorus calliope*	Bird
Canada goose	*Branta canadensis*	Bird
Canvasback	*Aythya valishineria*	Bird
Canyon wren	*Catherpes mexicanus*	Bird
Caspian tern*	*Hydropogne caspia*	Bird
Cassin’s finch*	*Haemorhous cassinii*	Bird
Cassin’s vireo	*Vireo cassinii*	Bird
Cedar waxwing	*Bombycilla cedrorum*	Bird
Chestnut-backed chickadee	*Poecile rufescens*	Brid
Chipping sparrow	*Spizella passerina*	Bird
Cinnamon teal	*Anas cyanoptera*	Bird
Clark’s grebe*	*Aechmophorus clarkii*	Bird
Clark’s nutcracker*	*Nucifraga columbiana*	Bird
Clay-colored sparrow	*Spizella pallida*	Bird
Common goldeneye	*Bucephala clangula*	Bird
Common grackle	*Quiscalus quiscula*	Bird
Common loon*	*Gavia immer*	Bird
Common merganser	*Mergus merganser*	Bird
Common nighthawk	*Chordeiles minor*	Bird
Common raven	*Corvus corax*	Bird
Common redpoll	*Acanthis flammea*	Bird
Common yellowthroat	*Geothlypis trichas*	Bird
Cooper’s hawk	*Accipiter cooperii*	Bird
Cordilleran flycatcher	*Empidonax occidentalis*	Bird
Dark-eyed junco	*Junco hyemalis*	Bird
Downy woodpecker	*Dryobates pubescens*	Bird
Dusky flycatcher	*Empidonax oberholseri*	Bird
Eastern kingbird	*Tyrannus tyrannus*	Bird
Eurasion collard-dove	*Streptopelia decaocto*	Bird
Eurasian wigeon	*Anas Penelope*	Bird
European starling	*Sturnus vulgaris*	Bird
Evening grosbeak*	*Coccothraustes vespertinus*	Bird
Flammulated owl*	*Psiloscops flammeolus*	Bird
Forster’s tern*	*Sterna forsteri*	Bird

Common Name	Scientific Name	Bird/ Mammal
Gadwall	*Anas strepera*	Bird
Golden eagle*	*Aquila chrysaetos*	Bird
Golden-crowned kinglet	*Regulus satrapa*	Bird
Gray catbird	*Dumetella carolinensis*	Bird
Gray jay	*Perisoreus canadensis*	Bird
Gray-crowned rosy-finch*	*Leucosticte tephrocotis*	Bird
Great blue heron*	*Ardea herodias*	Bird
Great horned owl	*Bubo virginanus*	Bird
Greater scaup	*Aythya marila*	Bird
Greater yellowlegs	*Tringa melanoleuca*	Bird
Green-winged teal	*Anas crecca*	Bird
Hairy Woodpecker	*Dryobates villosus*	Bird
Hammond’s flycatcher	*Empidonax hammondii*	Bird
Harlequin duck*	*Histrionicus histrionicus*	Bird
Harris’s sparrow	*Zonotrichia querula*	Bird
Hermit thrush	*Catharus guttatus*	Bird
Herring gull	*Larus argentatus*	Bird
Hooded merganser	*Lophodytes cucullatus*	Bird
Horned grebe	*Podiceps auratus*	Bird
Horned lark	*Eremophila alpestris*	Bird
House finch	*Haemorhous mexicanus*	Bird
House sparrow	*Passer domesticus*	Bird
House wren	*Troglodytes aedon*	Bird
Killdeer	*Charadrius vociferus*	Bird
Lazuli bunting	*Passerina amoena*	Bird
Least flycatcher	*Empidonax minimus*	Bird
Lesser scaup	*Aythya affinia*	Bird
Lewis’s woodpecker*	*Melanerpes lewis*	Bird
Lincoln’s sparrow	*Melospiza lincolnii*	Bird
Long-billed dowitcher	*Limnodromus scolopaceus*	Bird
MacGillivray’s warbler	*Geothlypis tolmiei*	Bird
Mallard	*Anas platyrhynchos*	Bird
Marsh wren	*Cistothorus palustris*	Bird
Merlin	*Falco columbarius*	Bird
Mountain bluebird	*Poecile gambeli*	Bird
Mountain chickadee	*Poecile gambeli*	Bird
Mourning dove	*Zenaida macroura*	Bird

Common Name	Scientific Name	Bird/ Mammal
Nashville warbler	*Oreothlypis ruficapilla*	Bird
Northern flicker	*Colaptes auratus*	Bird
Northern pintail	*Anas acuta*	Bird
Northern saw-whet owl	*Aegolius acadicus*	Bird
Northern rough-winged swallow	*Stelgidopteryx serripennis*	Bird
Northern shoveler	*Anas clypeata*	Bird
Northern shrike	*Lanius excubitor*	Bird
Northern waterthrush	*Parkesia noveboracensis*	Bird
Olive-sided flycatcher	*Contopus cooperi*	Bird
Orange-crowned warbler	*Oreothlypis celata*	Bird
Osprey	*Pandion haliaetus*	Bird
Pacific loon	*Gavia pacifica*	Bird
Pacific wren	*Troglodytes pacificus*	Bird
Pectoral sandpiper	*Calidris melanotos*	Bird
American peregrine falcon*	Falco peregrinus anatum	Bird
Pied-billed grebe	*Podilymbus podiceps*	Bird
Pileated woodpecker*	*Dryocopus pileatus*	Bird
Pine siskin	*Spinus pinus*	Bird
Purple finch	*Haemorhous purpureus*	Bird
Pygmy nuthatch	*Sitta pygmaea*	Bird
Red crossbill	*Loxia curvirostra*	Bird
Red-breasted merganser	*Mergus serrator*	Bird
Red-breasted nuthatch	*Sitta canadensis*	Bird
Red-eyed vireo	*Vireo olivaceus*	Bird
Red-naped sapsucker	*Sphyrapicus nuchalis*	Bird
Red-necked grebe	*Podiceps grisegena*	Bird
Red-shafted flicker	*Colaptes auratus cafer*	Bird
Red-tailed hawk	*Buteo jamaicensis*	Bird
Red-winged blackbird	*Agelaius phoeniceus*	Bird
Redhead	*Aythya americana*	Bird
Ring-billed gull	*Larus delawarensis*	Bird
Ringed-neck duck	*Aythya collaris*	Bird
Rough-legged hawk	*Buteo lagopus*	Bird
Rock pigeon	*Columba livia*	Bird
Ruby-crowned kinglet	*Regulus calendula*	Bird
Ruddy duck	*Oxyura jamaicensis*	Bird
Ruffed grouse	*Bonasa umbellus*	Bird

Common Name	Scientific Name	Bird/ Mammal
Rufous hummingbird	*Selasphorus rufus*	Bird
Sabine's gull	*Xema sabini*	Bird
Savannah sparrow	*Passerculus sandichensis*	Bird
Semipalmated plover	*Charadrius semipalmatus*	Bird
Sharp-shinned hawk	*Accipiter striatus*	Bird
Snow goose	*Chen caerulescens*	Bird
Solitary sandpiper	*Tringa solitaria*	Bird
Song sparrow	*Melospiza melodia*	Bird
Spotted sandpiper	*Actitis macularius*	Bird
Spotted towhee	*Pipilo maculatus*	Bird
Steller's jay	*Cyanocitta stelleri*	Bird
Surf scoter	*Melanitta perspicillata*	Bird
Swainson's thrush	*Catharus ustulatus*	Bird
Swamp sparrow	*Melospiza georgiana*	Bird
Tennessee warbler	*Oerothlypis peregrina*	Bird
Townsend's solitaire	*Myadestes townsendi*	Bird
Townsend's warbler	*Setophaga townsendi*	Bird
Tree swallow	*Tachycineta bicolor*	Bird
Trumpeter swan*	*Cygnus buccinator*	Bird
Tundra swan	*Cygnus columbianus*	Bird
Turkey vulture	*Cathartes aura*	Bird
Varied thrush*	*Ixoreus naevius*	Bird
Vaux's swift	*Chaetura vauxi*	Bird
Vesper sparrow	*Pooecetes gramineus*	Bird
Violet-green swallow	*Tachycineta thalassina*	Bird
Warbling vireo	*Vireo gilvus*	Bird
Western bluebird	*Bialia mexicana*	Bird
Western grebe	*Aechmophorus occidentalis*	Bird
Western meadowlark	*Sturnella neglecta*	Bird
Western sandpiper	*Calidris mauri*	Bird
Western tanager	*Piranga ludoviciana*	Bird
Western wood-pewee	*Contopus sordidulus*	Bird
White-breasted nuthatch	*Sitta carolinensis*	Bird
White-crowned sparrow	*Zonotrichia leucophrys*	Bird
White-throated sparrow	*Zonotrichia albicollis*	Bird
White-throated swift	*Aeronautes saxatalis*	Bird
White-winged crossbill	*Loxia leucoptera*	Bird

Common Name	Scientific Name	Bird/ Mammal
Wild turkey	*Meleagris gallopavo*	Bird
Willow flycatcher	*Empidonax traillii*	Bird
Wilson's phalarope	*Phalaropus tricolor*	Bird
Wilson's snipe	*Gallinago delicata*	Bird
Wilson's warbler	*Cardellina pusilla*	Bird
Wood duck	*Aix sponsa*	Bird
Yellow warbler	*Setophaga petechia*	Bird
Yellow-breasted chat	*Icteria virens*	Bird
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	Bird
Yellow-rumped warbler	*Setophaga coronata*	Bird

Notes: *= USFS sensitive species, USFS species of conservation concern, MT SOC, and Montana Special Status Species; **= federally listed, proposed, and candidate species are addressed in Exhibit E – Section 10 – Threatened and Endangered Species.

Sources: MPC 1982a, 1982b; Wood and Olsen 1984; D. Wrobleski, USFS, Wildlife Biologist, personal communication, April 5, 2018; B. Sterling, FWP, personal communication, April 5, 2018; MNHP 2018, 2023; Avian Knowledge Network 2019, 2023; LNF 2023

The bottomlands (low-lying lands along the Clark Fork River) provide important winter-feeding habitat for wildlife, especially during harsh winters for deer and other ungulates. Douglas-fir and larch stands with their needles and the understory shrub community represented by mountain berry, service berry, and lichen provide foraging opportunities for wildlife. Many big-game species utilize areas in the Project vicinity either seasonally or year-round.

The assemblage of islands in Thompson Falls Reservoir, located immediately upstream of the confluence with the Thompson River, provides habitat for elk, black bear, whitetail deer, bald eagle, other bird species as well as resident and migratory waterfowl. It is estimated that about 40 to 50 elk also use the islands for calving each spring (B. Sterling, FWP, personal communication, April 5, 2018).

Bighorn sheep are known to be present in the vicinity of the Project and are discussed in more detail in **Exhibit E - Section 8.1.1.1 – USFS Region 1 Sensitive Species**. Other wildlife species that may transit the Project vicinity, include moose, grizzly bear, and North American wolverine (wolverine). Grizzly bear and wolverine are discussed in more detail in **Exhibit E - Section 10 – Threatened and Endangered Species**.

The river corridor between the towns of Thompson Falls and Plains provides optimal nesting habitat for peregrine falcon and bald eagles. Peregrine falcon nesting sites were located about one every 5 miles in cliffs along the Clark Fork River where they can dive for prey such as ducks and other small birds (D. Wrobleski, USFS, Wildlife Biologist, personal communication, April 5, 2018). Bald eagle nests were located about one every 5 miles, including one located along the Thompson Falls Reservoir and one in the islands just upstream of the confluence with the

Thompson River (D. Wrobleski, USFS, Wildlife Biologist, personal communication, April 5, 2018).

8.1.1.1 USFS Region 1 Sensitive Species

The Project is within USFS Region 1 – Northern Region. Region 1 encompasses all of Montana, North Dakota, northern Idaho, and parts of northwest South Dakota. The USFS Region 1 list of sensitive species for the LNF and KNF, was last updated in 2011. On October 25, 2023, LNF identified SCC, replacing the 2011 USFS Region 1 sensitive species list (USFS 2011) for the LNF. However, the USFS Region 1 list continues to apply to KNF. The 2023 LNF SCC list was developed to meet criteria defined in the 2012 Planning Rule and for development of the revised Lolo National Forest's Revised Land Management Plan initiated in 2023. The 2023 LNF SCC list identifies six animal species. Two of the six animal species, Idaho Giant Salamander (*Dicamptodon aterrimus)* and mountain goat (*Oreamnos americanus*), were not included in the 2011 USFS Region 1 list (or the DLA) and are not likely to be present in the Project vicinity due to habitat requirements and known occurrence/distribution of the species (MNHP and FWP 2023a, 2023b). The following wildlife description and analysis remain unchanged following the review of the 2023 LNF SCC list.

LNF covers over 2 million acres with about 103.78 acres of federal lands within the FERC Project boundary. KNF borders LNF and is located downstream of the Project. KNF covers about 2.2 million acres of the northwestern section of Montana bordering Canada. There are no KNF lands in the Project boundary (**Figure 8-1**). Although the Project is outside of KNF and most of the Project is outside of the LNF, there is potential for some of these Region 1 sensitive species to the Project.

There are 21 USFS Region 1 sensitive species, including three amphibians, six birds, two fishes, one invertebrate, and nine mammals known or suspected to occur in the LNF and/or KNF (**Table 8-2**). The majority of the USFS sensitive species (18 of 21) are also recognized as Montana SOC or Montana Special Status Species (SSS) with the exception of American peregrine falcon (removed from the Montana SOC list in 2022), gray wolf, and bighorn sheep.

There are 18 USFS R1 sensitive species known to occur in both the LNF and KNF (Table 8-2). The presence designation (known or suspected) for two species, northern leopard frog and fringed-myotis, vary between the two forests (Table 8-2). The northern leopard frog is known to occur in KNF and suspected to occur in LNF. The fringed myotis is known to occur in KNF and has no designation for LNF. There are 10 species in Table 8-2 with an observation record with MNHP (2018, 2023). Where a species is designated with the "potential" to occur in Table 8-2, this indicates habitat exists in the Project vicinity, but no observation was identified through the 2018 or 2023 MNHP query. Species "unlikely" to be present indicate suitable habitat does not exist in the area for breeding, nesting, or denning purposes.

One USFS sensitive species in the vicinity of the Project that is closely monitored by FWP is bighorn sheep. FWP estimates the population of the Thompson Falls bighorn sheep herd is approximately 75 to 80 individuals (B. Sterling, FWP, personal communication, April 5, 2018). Bighorn sheep tend to congregate east and northeast of the Project boundary between October/November and April/May (MPC 1982b; B. Sterling, FWP, personal communication, April 5, 2018).

Figure 8-1. The Project location with respect to the Lolo and Kootenai National Forests.

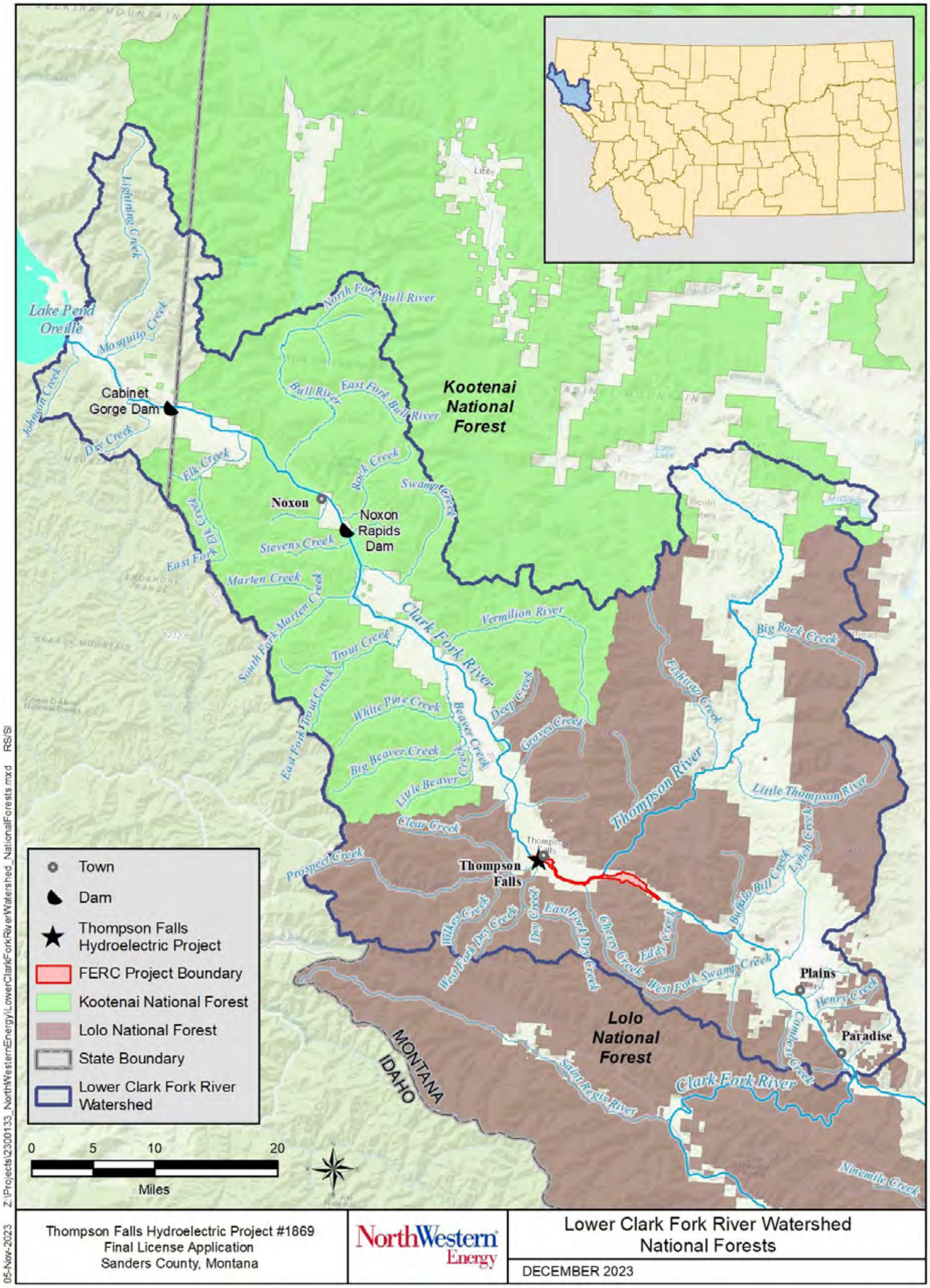


Table 8-2. Summary of USFS R1 sensitive species (2011) for aquatics, birds, mammals, and amphibians with known (K) or suspected (S) presence in LNF and/or KNF.

Taxon	Common Name	Scientific Name	Known (K) or Suspect (S) Presence in LNF/KNF	Habitat Type/ Requirement(s)	Additional Special Species Status	Likelihood of Occurrence in vicinity of Project
Amphibian	Northern leopard frog	*Rana pipiens*	K in KNF; S in LNF	Perennial wetlands and larger water bodies	MT SOC	Potential
Amphibian	Western toad	*Bufo boreas*	K	Wetlands and upland habitats	MT SOC	Observed
Amphibian	Coeur d'Alene salamander	*Plethodon idahoensis*	K	Streams, seeps, and springs	MT SOC	Potential
Bird	American peregrine falcon	*Falco peregrinus anatum*	K	Cliffs near water bodies	Removed from MT SOC in 2022	Observed
Bird	Bald eagle	*Haliaeetus leucoephalus*	K	Riparian forest	MT SSS	Observed
Bird	Black-backed woodpecker	*Picoides arcticus*	K	Forest affected by wildfire	MT SOC	Observed
Bird	Common Loon	*Gavia immer*	K	Fish-bearing lakes	MT SOC	Observed
Bird	Flammulated owl	*Otus flammeolus*	K	Forest	MT SOC	Observed
Bird	Harlequin Duck	*Histrionicus histrionicus*	K	Low gradient streams with little or no in-stream disturbance	MT SOC	Observed – no suitable breeding habitat is within the Project boundary
Fish	Columbia River Redband Trout	*Oncorhynchus mykiss gairdneri*	K in KNF	Cool, clean, low-gradient streams	MT SOC	Unlikely – no observations and no spawning or rearing habitat within the Project boundary
Fish	Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	K	Water bodies	MT SOC	Observed
Invertebrate	Western Pearlshell	*Margaritifera falcata*	K	Streams	MT SOC	Observed 1 shell in 2018 – suitable habitat (& presence of host fish) to support life history requirements, not present within Project boundary
Mammal	Bighorn sheep	*Ovis canadensis*	K	Open habitat and cliffs		Observed
Mammal	Fisher	*Martes pennant*	K	Mixed conifer forests	MT SOC	Unlikely

Taxon	Common Name	Scientific Name	Known (K) or Suspect (S) Presence in LNF/KNF	Habitat Type/ Requirement(s)	Additional Special Species Status	Likelihood of Occurrence in vicinity of Project
Mammal	Fringed-myotis	*Myotis thysanodes*	K in KNF	Desert shrublands, sagebrush-grassland, and woodland habitats (ponderosa pine, oak and pine, Douglas-Fir); caves, mines, rock crevices	MT SOC	Observed
Mammal	Gray wolf	*Canis lupus*	K in KNF	Generalists		Potential
Mammal	Long-eared myotis	*Myotis evotis*	K	Cluttered forest habits, including Douglas-fir and spruce-fir forests; hollow trees, under rocks on ground, under loose bark	MT SOC	Potential
Mammal	Long-legged myotis	*Myotis volans*	K	Forested mountain regions, river bottoms, high elevations; caves and mines	MT SOC	Potential
Mammal	North American wolverine	*Gulo gulo luscus*	K	Higher elevations with snow cover	MT SOC	Potential
Mammal	Northern bog lemming	*Synaptomys borealis*	K	Wet meadows, sphagnum bogs, and swamps	MT SOC	Potential
Mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	K	Caves in forested habitats (Douglas-fir and lodgepole pine forests, ponderosa pine woodlands, cottonwood bottomland, Utah juniper-sagebrush scrub)	MT SOC	Potential

Note 1: Habitat type requirements described, additional Montana special species designations noted (MT SSS or SOC), and likelihood of occurrence in the vicinity of the Project. (*Adapted from Sources:* USFS 2011; MNHP 2018, 2023; MNHP and FWP 2023d, NorthWestern File Data).

Note 2: Observations and occurrence of a species are not necessarily indicative of the presence of suitable habitat or breeding/nesting/denning areas. Rather, an observation reflects the fact that the species has been seen, even if it was simply passing through the area.

Note 3: The 6 animals identified by the 2023 LNF SCC list with the potential to be present in the Project vicinity include Bighorn sheep, Fisher, Harlequin Duck, Idaho Giant Salamander, Mountain Goat, and Western Pearlshell.

8.1.1.2 Montana Special Status Species and Species of Concern

Montana maintains a list of SOC, and a separate list of SSS. Species listed as SSS are not Montana SOC, but need to be recognized in environmental review, permitting, or planning processes because they either have global conservation status ranks that include a G1 (Critically Imperiled[19]) or G2 (Imperiled[20]) or have some legal protections in place. The MNHP database was queried for SSS and SOC occurring within the FERC Project boundary and its vicinity (January 24, 2023).

The MNHP database results indicate 46 species with documented occurrence or observations in the Project vicinity, which extends beyond the FERC Project boundary (**Figure 8-2**). **Table 8-3** provides a summary of the species groups (amphibians, birds, bryophytes, fish, invertebrates, mammals, reptiles, and vascular plants), common and scientific name, habitat and distribution, and species status. Species status includes Montana state designation as SOC or SSS; federal protection by FWS under Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act of 1940 (BGEPA), Birds of Conservation Concern (BCC) Regions 10, 11 and 17 (BCC 110, BCC 11 or BCC 17), or designation under the ESA; and USFS sensitive species and known (K) or suspected (S) occurrence in KNF or LNF. The MNHP (2023) GIS files for Montana SSS and SOC occurrence/observations did not include all species listed in Table 8-3.

Observations and occurrence of a species are not necessarily indicative of the presence of suitable habitat or breeding/nesting/denning areas. Rather, an observation reflects the fact that the species has been seen, even if it was simply passing through the area.

[19] G1 = Critically Imperiled — At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
[20] G2 = Imperiled — At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

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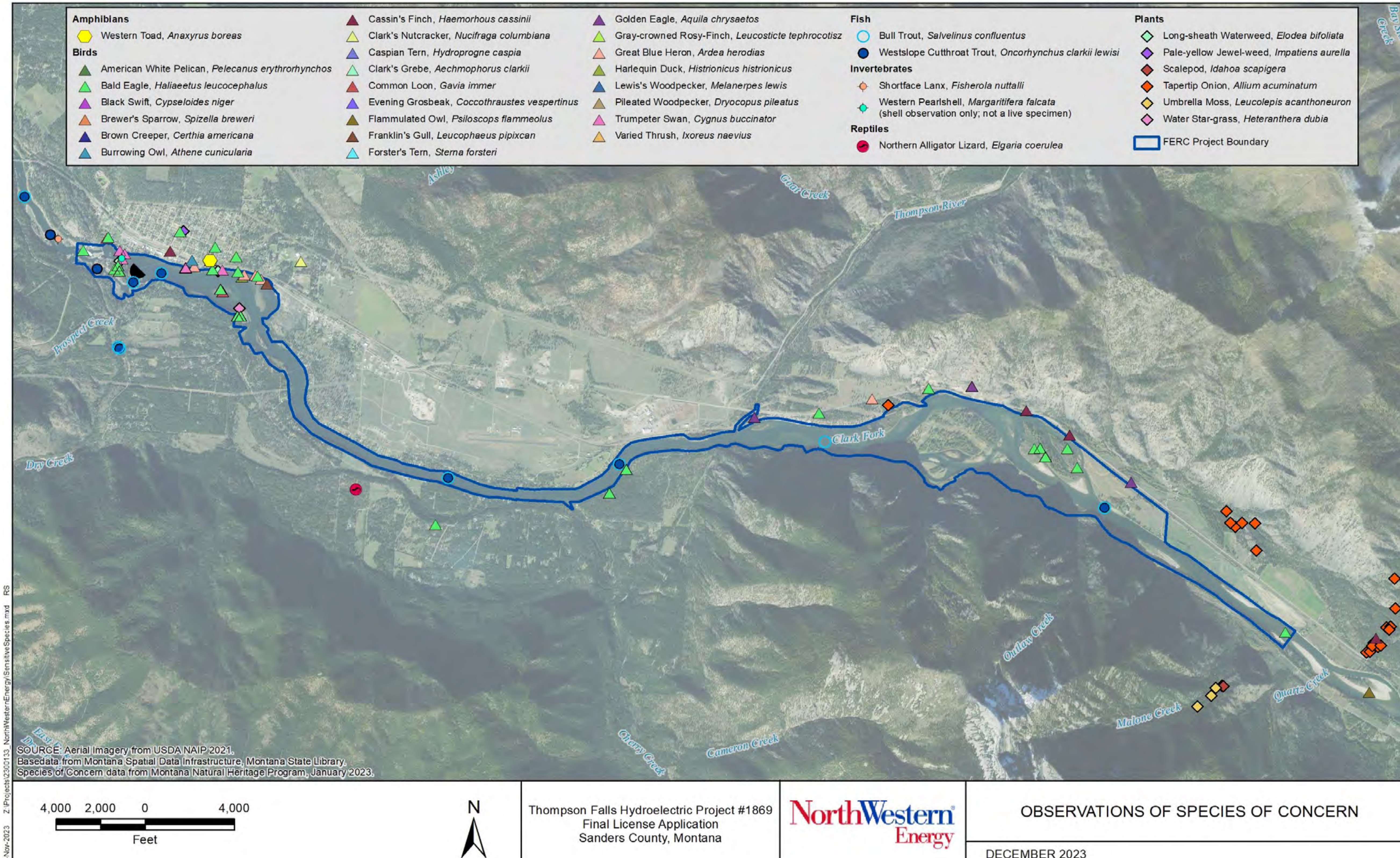
Table 8-3. Summary of the species groups, common and scientific name, habitat and distribution, and species status.

Species Group	Common Name	Scientific Name	Habitat Type	Distribution	MT	FWS	USFS	KNF	LNF
Amphibians	Western Toad	*Anaxyrus boreas*	Wetlands, floodplain pools	Resident Year Round	SOC		SENSITIVE	K	K
Birds	American White Pelican	*Pelecanus erythrorhynchos*	Lakes, ponds, reservoirs	Migratory Summer Breeder	SOC	MBTA			
Birds	Bald Eagle	*Haliaeetus leucocephalus*	Riparian forest	Resident Year Round	SSS	BGEPA; MBTA	SENSITIVE	K	K
Birds	Black Swift	*Cypseloides niger*	Waterfalls	Migratory Summer Breeder	SOC	MBTA; BCC10			
Birds	Brewer's Sparrow	*Spizella breweri*	Sagebrush	Migratory Summer Breeder	SOC	MBTA			
Birds	Brown Creeper	*Certhia americana*	Moist conifer forests	Resident Year Round	SOC	MBTA			
Birds	Burrowing Owl	*Athene cunicularia*	Grasslands	Migratory Summer Breeder	SOC	MBTA; BCC17	SENSITIVE		
Birds	Caspian Tern	*Hydroprogne caspia*	Large rivers, lakes	Migratory Summer Breeder	SOC	MBTA			
Birds	Cassin's Finch	*Haemorhous cassinii*	Drier conifer forest	Resident Year Round	SOC	MBTA; BCC10			
Birds	Clark's Grebe	*Aechmophorus clarkii*	Lakes, ponds, reservoirs	Migratory Summer Breeder	SOC	MBTA; BCC10; BCC11			
Birds	Clark's Nutcracker	*Nucifraga columbiana*	Conifer forest	Resident Year Round	SOC	MBTA			
Birds	Common Loon	*Gavia immer*	Mountain lakes w/ emergent veg	Migratory Summer Breeder	SOC	MBTA	SENSITIVE	K	K
Birds	Evening Grosbeak	*Coccothraustes vespertinus*	Conifer forest	Resident Year Round	SOC	MBTA; BCC10			
Birds	Flammulated Owl	*Psiloscops flammeolus*	Dry conifer forest	Migratory Summer Breeder	SOC	MBTA; BCC10	SENSITIVE	K	K
Birds	Forster's Tern	*Sterna forsteri*	Wetlands	Migratory Summer Breeder	SOC	MBTA			
Birds	Franklin's Gull	*Leucophaeus pipixcan*	Wetlands	Migratory Summer Breeder	SOC	MBTA; BCC10; BCC11; BCC17			
Birds	Golden Eagle	*Aquila chrysaetos*	Grasslands	Resident Year Round	SOC	BGEPA; MBTA			
Birds	Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	Alpine	Resident Year Round	SOC	MBTA			
Birds	Great Blue Heron	*Ardea herodias*	Riparian forest	Resident Year Round	SOC	MBTA			
Birds	Harlequin Duck	*Histrionicus histrionicus*	Mountain streams	Migratory Summer Breeder	SOC	MBTA	SENSITIVE SCC	K	K
Birds	Lewis's Woodpecker	*Melanerpes lewis*	Riparian forest	Migratory Summer Breeder	SOC	MBTA; BCC10; BCC17			
Birds	Northern Goshawk	*Accipiter gentilis*	Mixed conifer forests	Resident Year Round	SOC	MBTA			
Birds	Pileated Woodpecker	*Dryocopus pileatus*	Moist conifer forests	Resident Year Round	SOC	MBTA			
Birds	Trumpeter Swan	*Cygnus buccinator*	Lakes, ponds, reservoirs	Resident Year Round	SOC	MBTA	SENSITIVE		
Birds	Varied Thrush	*Ixoreus naevius*	Moist conifer forests	Migratory Summer Breeder	SOC	MBTA			
Bryophytes	Umbrella Moss	*Leucolepis acanthoneuron*	Talus slopes / rock outcrops	Present	SOC				
Fish	Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	Mountain streams, rivers, lakes	Resident Year Round	SOC		SENSITIVE	K	K
Fish	Bull Trout	*Salvelinus confluentus*	Mountain streams, rivers, lakes	Resident Year Round	SOC	Threatened; Critical Habitat			
Invertebrates	Humped Coin	*Polygyrella polygyrella*	Moist conifer forests	Resident Year Round	SOC				
Invertebrates	Shortface Lanx	*Fisherola nuttalli*	Large mountain rivers	Resident Year Round	SOC				
Invertebrates	Western Pearlshell	*Margaritifera falcata*	Mountain streams, rivers	Resident Year Round	SOC		SENSITIVE SCC	K	K
Mammals	Fisher	*Pekania pennanti*	Mixed conifer forests	Resident Year Round	SOC		SENSITIVE SCC	K	K
Mammals	Fringed Myotis	*Myotis thysanodes*	Riparian and dry mixed conifer forest	Resident Year Round	SOC				
Mammals	Hoary Bat	*Lasiurus cinereus*	Riparian and forest	Migratory Summer Breeder	SOC				
Mammals	Long-eared Myotis	*Myotis evotis*	Forest	Resident Year Round	SOC				
Mammals	Long-legged Myotis	*Myotis volans*	Conifer forest	Resident Year Round	SOC				
Mammals	Townsend's Big-eared Bat	*Corynorhinus townsendii*	Caves in forested habitats	Resident Year Round	SOC		SENSITIVE	K	K

Species Group	Common Name	Scientific Name	Habitat Type	Distribution	MT	FWS	USFS	KNF	LNF
Mammals	Western Pygmy Shrew	*Sorex eximius*	Open conifer forest, grasslands, and shrublands, often near water	Resident Year Round	SOC				
Mammals	Grizzly Bear	*Ursus arctos*	Conifer forest	Resident Year Round	SOC	Threatened			
Mammals	Wolverine	*Gulo gulo*	Boreal forest and Alpine habitats	Resident Year Round	SOC	Threatened	SENSITIVE	K	K
Reptiles	Northern Alligator Lizard	*Elgaria coerulea*	Talus slopes / rock outcrops	Resident Year Round	SOC				
Vascular Plants	Long-sheath Waterweed	*Elodea bifoliata*	Wetland/riparian (shallow water)	Present	SOC				
Vascular Plants	Pale-yellow Jewel-weed	*Impatiens aurella*	riparian	Present	SOC				
Vascular Plants	Scalepod	*Idahoa scapigera*	Vernally moist, rock ledges	Present	SOC		SENSITIVE SCC		S
Vascular Plants	Tapertip Onion	*Allium acuminatum*	Dry forest-grassland	Present	SOC		SENSITIVE		K
Vascular Plants	Water Star-grass	*Heteranthera dubia*	Aquatic	Present	SOC		SENSITIVE		

Notes: Species status includes Montana state designation as SOC or SSS; federal protection by FWS under Migratory Bird Treaty Act (MBTA), BGEPA 1940, Birds of Conservation Concern Regions 10, 11 and 17 (BCC110, BCC 11 or BCC 17), or designation under the ESA; and USFS sensitive species and known (K) or suspected (S) occurrence in KNF or LNF (MNHP 2023) or USFS SCC (LNF 2023).

Figure 8-2. Species occurrence or observations of Montana SOC and SSS species in the Project boundary and vicinity.



Source: data provided by MNHP 2023

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8.1.2 Botanical Resources

8.1.2.1 Habitat and Native Plant Assemblages

The general habitat types in the Project boundary include aquatic, gravel bars, grasslands/hay meadows, human developed areas, riparian tree-shrubs/shrub steppe, and mixed deciduous/conifer forest (Wood and Olsen 1984; MNHP 2018, 2023). Aquatic habitat includes all open water areas associated with rivers, streams, ponds, sloughs, and marshes (including emergent vegetation zones along the edge of open water). Gravel bars are typically represented by less stable areas associated with islands and streambanks that are generally covered during high streamflow and are sparsely vegetated. Grasslands are dominated by sedges and rushes and influenced by the presence of an elevated water table. Agricultural hay bottoms and grain fields are included in this habitat type. Occasionally trees and/or shrubs are present in grasslands, but they represent a small portion of the total coverage.

Where land development is absent, the benches and slopes above the Clark Fork River are dominated by forests of Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), western larch (*Larix occidentalis*), and ponderosa pine (*Pinus ponderosa*). Broadleaf trees and shrubs are confined to the river's edge. Riparian tree-shrub/shrub steppe is associated with the riverine systems and is primarily black cottonwood (*Populus trichocarpa*) with deciduous shrub understory such as serviceberry (*Amelachier*), Rocky Mountain maple (*Acer glabrum*), and snowberry (*Symphoricarpos*). The mixed deciduous/conifer forest occupies the floodplain between the riparian vegetation and dense conifer forests and represents a mosaic of conifer trees (Douglas-fir, Ponderosa pine, lodgepole pine) and deciduous trees (cottonwood and birch) and shrubs (Wood and Olsen 1984).

The two areas within the Project boundary where wildlife is most likely to be present include Island Park located between the Main Channel Dam and Dry Channel Dam and the group of islands in the Clark Fork River located upstream of the confluence with the Thompson River. Both areas provide a mix of conifer dominated forests and woodlands, grasslands, wet meadow/herbaceous marshes, and floodplain/riparian areas **Figure 8-3**.

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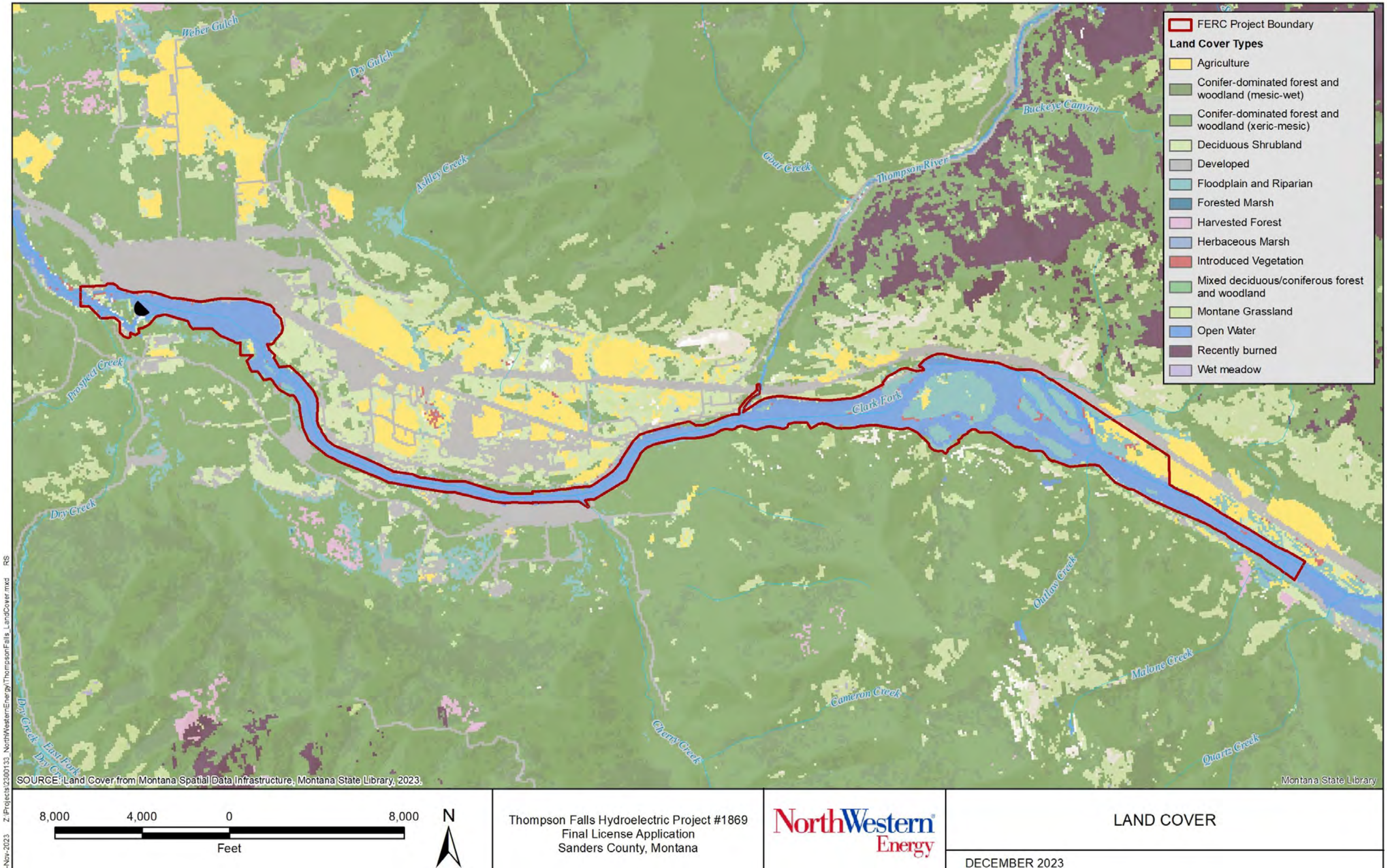
Figure 8-3. Thompson Falls Project and land cover types in Project boundary and Vicinity.



Source: MNHP 2016

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8.1.2.2 USFS R1 Sensitive Plant Species

The list of USFS R1 sensitive species known or suspected to occur in the LNF includes 35 species of plants (USFS 2011). KNF was not included in this review because the Project does not occupy any land or waters within KNF. Of the 35 plant species identified, 13 species are known to occur in Sanders County (MNHP 2018, 2023) and eight species were considered to have potential to occur in the Project boundary based on habitat requirements. A summary of the USFS sensitive plant species known or suspected to occur in the LNF, their habitat requirements, and likelihood of occurrence in the Project boundary is provided in **Table 8-4**. One of the sensitive plant species, tapertip onion, is also identified as a Montana SOC. Tapertip onion require dry, open forests and grassland habitat (MNHP and FWP 2023c).

On October 25, 2023, LNF identified SCC, replacing the 2011 USFS Region 1 sensitive species list for the LNF. The 2023 LNF SCC list was developed to meet criteria defined in the 2012 Planning Rule and for development of the revised Lolo National Forest's Revised Land Management Plan initiated in 2023. The 2023 LNF SCC list identified eight plant species. One plant species, Arctic sweet coltsfoot (*Petasites frigidus*), identified on the 2023 LNF SCC list was not included on the 2011 USFS Region 1 sensitive species list (or the DLA). This plant species is unlikely to be present in the Project vicinity due to habitat requirements and known occurrence outside of the Project vicinity (MNHP 2023). The following botanical description and analysis remain unchanged following the review of the 2023 LNF SCC list.

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Table 8-4. USFS, Region 1 sensitive plant species (2011) with known or suspected presence in Lolo National Forest and Sanders County.

Common Name	Scientific Name	Presence in LNF Known (K) or Suspect (S)	Known Occurrence in Sanders County	Habitat Type and Known Locations	Likelihood of Occurrence in the vicinity of the Project
Sapphire rockcress	*Arabis fecunda (syn. Boechera fecunda)*	S		Endemic to state. Present in southwest MT in Ravalli, Beaverhead, and Silver Bow counties.	Unlikely
Peculiar moonwort	*Botrychium paradoxum*	S		Mesic meadows and bunchgrass communities in western MT.	Unlikely
Giant helleborine	***Epipactis gigantea***	**K**	**X**	**Streambanks, lake margins, fens with springs, and seeps, often near thermal waters. Western and southwestern MT.**	**Potential**
Britton's Dry Rock Moss	***Grimmia brittoniae***	**K**	**X**	**Vertical faces of shaded, calcareous cliffs (1,640-2,300 feet above mean sea level). Endemic to northwestern MT and border with Idaho. Known presence in Flathead, Lincoln and Sanders counties.**	**Potential**
Howell's gumweed	*Grindelia howellii*	K		Roadsides and other similarly disturbed habitat. Regionally endemic Missoula and Powell counties in MT and Benewah County, Idaho.	Unlikely
Missoula phlox	*Phlox kelseyi*	S		Endemic to west-central MT. Range is Missoula to the Little Belt Mountains and the southern end of the Rocky Mountain Front south of Granite County.	Unlikely
Whitebark pine	*Pinus albicaulis*	K	X	Subalpine and krummholtz habitats in most mountain ranges in MT.	Unlikely
Idaho barren strawberry	*Waldsteinia idahoensis*	K		Endemic to north-central Idaho with one occurrence in MT. Open coniferous forest in the montane zone. One known site in MT in Missoula County.	Unlikely
Musk-root	*Adoxa moschatellina*	K		Sparsely distributed in Southwest MT in unimpacted areas by human disturbance or invasive weeds.	Unlikely
Tapertip Onion	***Allium acuminatum***	**K**	**X**	**Scattered sites in western MT, but rare. Known to occur in Ravalli and Sanders counties.**	**Potential**

Common Name	Scientific Name	Presence in LNF Known (K) or Suspect (S)	Known Occurrence in Sanders County	Habitat Type and Known Locations	Likelihood of Occurrence in the vicinity of the Project
Round-leaved Orchis	*Amerorchis rotundifolia*	S		Rocky Mountain Front, Bob Marshall Wilderness Complex, Swan Valley and northwest corner of MT. Spruce forest around seeps or along streams.	Unlikely
Sandweed	*Athysanus pusillus*	S		Limited to Bitterroot Mountains in MT. Vernal moist, shallow soil of steep slopes and cliffs in the lower montane zone.	Unlikely
Beck Water-marigold	*Bidens beckii*	K		Still or slow-moving water of lakes, rivers and sloughs in valleys, 0-10 feet. Western valleys of MT.	Unlikely
Watershield	*Brasenia schreberi*	K	X	Shallow waters in the valleys of northwest corner of MT.	Unlikely
Creeping Sedge	*Carex chordorrhiza*	S		Rare in MT. Fens and wet meadows in the northwest corner of MT.	Unlikely
Glaucus beaked sedge	*Carex rostrate*	K		Rare in MT. Wet, organic soils of fens in the montane zone, including floating peat mats.	Unlikely
Diamond clarkia	***Clarkia rhomboidea***	**K**	**X**	**Rare in MT, known in northwest corner of MT along lower Clark Fork River drainage and known in Sanders and Lincoln counties. Dry, open forest slopes with gravelly soils in the montane zone.**	**Potential**
Sand Springbeauty	***Claytonia arenicola***	**K**	**X**	**Rare in MT, one localized area in western MT in Sanders County. Mossy, forested, north-facing talus slopes in the lower montane zone.**	**Potential**
Cluster's Lady's-slipper	***Cypripedium fasciculatum***	**K**	**X**	**Northwest portion of MT in warm, dry mid-seral montane forest in the Douglas fir/ninebark and grand fir/ninebark habitat types.**	**Potential**
Small Yellow Lady's-slipper	*Cypripedium parviflorum*	K	X	Western half of MT. Fens, damp mossy woods, seepage areas, and moist forest-meadow ecotones in the valley to lower montane zones. Calcareous derived soils.	Unlikely

Common Name	Scientific Name	Presence in LNF Known (K) or Suspect (S)	Known Occurrence in Sanders County	Habitat Type and Known Locations	Likelihood of Occurrence in the vicinity of the Project
Sparrow's-egg Lady's slipper	*Cypripedium passerinum*	S		Mossy, moist, or seepy places in coniferous forests often on calcareous substrates. Occurrences are either in designated wilderness areas or Glacier National Park.	Unlikely
English sundew	*Drosera anglica*	K	X	Sphagnum moss in wet, organic soils of fens in the montane zone.	Unlikely
Crested Shieldfern	*Drypteris cristata*	K		Moist to wet, organic soils at the forest margins of fens and swamps in the montane zone. Known to occur in Flathead, Lake, Missoula, Ravalli and Beaverhead counties.	Unlikely
Western Joepey-weed	*Eupatorium occidentale*	S		Western part of MT in Mineral and Ravalli counties. Rocky outcrops and slopes in the montane and lower subalpine zones.	Unlikely
Hiker's gentian	*Gentianopsis simplex*	S		Rare in MT. Fens, meadows, and seeps usually in areas of crystalline parent material in montane and subalpine zones.	Unlikely
Western pearl-flower	***Heterocodon rariflorum***	**K**	**X**	**Northwest MT in vernally moist grassland slopes, mossy, ledges, and riparian swales in valley, foothills and montane zones.**	**Potential**
Scalepod	*Idahoa scapigera*	S		Rare and peripheral in MT. Known to be present in Bitterroot Mountains. Vernal moist, open soil on rock ledges in the lower montane zone.	Unlikely
Meesia Moss	*Meesia triquetra*	S		Wet soil and peat in fens and bogs, soil in wet woods. Known in Flathead County.	Unlikely
Oregon bluebells	*Mertensia bella*	K		Wet, seepy, open or partially shaded slopes in the montane and subalpine zones. Rare in MT and only known in parts of LNF in Missoula County.	Unlikely
North Idaho monkeyflower	***Mimulus clivicola***	**K**	**X**	**Known to occur in Sanders County in vernally moist soil of partially wooded slopes in the montane zone.**	**Potential**

Common Name	Scientific Name	Presence in LNF Known (K) or Suspect (S)	Known Occurrence in Sanders County	Habitat Type and Known Locations	Likelihood of Occurrence in the vicinity of the Project
Blunt-leaved Pondweed	*Potamogeton obtusifolius*	S		Shallow water of lakes, ponds, and sloughs in the valley, foothill, and montane zones. Known in northwest MT.	Unlikely
Pod Grass	*Scheuchzeria palustris*	K		Wet, organic soil of fens in the valley and montane zones, usually with Sphagnum moss. Known west of continental divide in MT.	Unlikely
Water Bulrush	*Schoenoplectus subterminalis*	K		Open water and boggy margins of ponds, lakes, and sloughs at 0.1-3 m depth in the valley, foothill, and montane zones. Known in western MT.	Unlikely
Red Clover	***Trifolium eriocephalum***	**S**	**X**	**Native to Europe and introduced for forage and hay in N. America. Meadows, fields, lawns, roadsides, riverbanks, plains, valleys, montane zone.**	**Potential**
Hollyleaf Clover	*Trifolium gymnocarpon*	K		Open woods and slopes, usually in dry soil of sagebrush steppe to ponderosa pine forest in the foothills to lower montane zone. Known within the West Fork Bitterroot River drainage, Rock Creek drainage.	Unlikely

<u>Notes</u>: K = unknown; MT = Montana; S = Suspect; X = known occurrence in Sanders County
Species with potential to occur in proximity of the Project are in bold.
The 8 plant species identified by the 2023 LNF SCC list include Arctic Sweet Coltsfoot, Hiker’s gentian, Hollyleaf clover, Howell’s gumweed, Idaho barren strawberry, Oregon bluebells, sandweed, and scalepod.
Sources: USFS 2011; MNHP 2018, 2023

8.1.2.3 Noxious Weeds

Nonnative plant species, specifically invasive or noxious weeds, can threaten the survival of native species and reduce the ecological integrity for aquatic and terrestrial systems, and thus adversely impact wildlife habitat. Invasive plant species such as noxious weeds are defined as, "any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities…" (Montana Code Annotated § 7-22-2101)

NorthWestern refers to the Montana Department of Agriculture (agr.mt.gov/Noxious-Weeds) for the latest state and county noxious weed list (MDA 2019) and guidance for prioritizing and targeting management efforts, if present in the area. Annually NorthWestern applies herbicides to control weeds on its property, including recreational trails, trailheads, and parking lots.

Table 8-5 summarizes the Montana noxious weed list plus three species specific to Sanders County (MDA 2019). Aquatic invasive plants such as Eurasian watermilfoil, curlyleaf pondweed, flowering rush, and yellow flag iris included on the Montana State noxious weed list are discussed in **Exhibit E - Section 9 – Wetland, Riparian, and Littoral Habitats**.

Table 8-5. Montana noxious weed list and Sanders County noxious weed list.

Classification	Common Name	Scientific Name
Priority 1A (non-established new invaders)	Yellow starthistle	*Centaurea solstitialis*
	Dyer's woad	*Isatis tinctoria*
	Common reed	*Phragmites australis ssp. australis*
	Medusahead	*Taeniatherum caput-medusae*
Priority 1B (established new invaders)	Knotweed complex	*Polygonum cuspidatum, P. sachalinense, P. × bohemicum, Fallopia japonica, F. sachalinensis, F. × bohemica, Reynoutria japonica, R. sachalinensis, and R.× bohemica*
	Purple loosestrife	*Lythrum salicaria*
	Rush skeletonweed	*Chondrilla juncea*
	Scotch broom	*Cytisus scoparius*
	Blueweed	*Echium vulgare*
Priority 2A (widespread weed infestations)	Tansy ragwort	*Senecio jacobaea, Jacobaea vulgaris*
	Meadow hawkweed complex	*Hieracium caespitosum, H. praealturm, H. floridundum, and Pilosella caespitosa*
	Orange hawkweed	*Hieracium aurantiacum, Pilosella aurantiaca*
	Tall buttercup	*Ranunculus acris*
	Perennial pepperweed	*Lepidium latifolium*
	Yellow flag iris	*Iris pseudacorus*
	Eurasian watermilfoil	*Myriophyllum spicatum, Myriophyllum spicatum x Myriophyllum sibiricum*
	Flowering rush	*Butomus umbellatus*

Classification	Common Name	Scientific Name
	Common buckthorn Ventenata	*Rhamnus cathartica L.* *Ventenata dubia*
Priority 2B (widespread weed infestations)	Canada thistle	*Cirsium arvense*
	Field bindweed	*Convolvulus arvensis*
	Leafy spurge	*Euphorbia esula*
	Whitetop	*Cardaria draba, Lepidium draba*
	Russian knapweed	*Acroptilon repens, Rhaponticum repens*
	Spotted knapweed	*Centaurea stoebe, C.maculosa*
	Diffuse knapweed	*Centaurea diffusa*
	Dalmatian toadflax	*Linaria dalmatica*
	St. Johnswort	*Hypericum perforatum*
	Sulfur cinquefoil	*Potentilla recta*
	Common tansy	*Tanacetum vulgare*
	Oxeye daisy	*Leucanthemum vulgare*
	Houndstongue	*Cynoglossum officinale*
	Yellow toadflax	*Linaria vulgaris*
	Saltcedar	*Tamarix spp.*
	Curlyleaf pondweed	*Potamogeton crispus*
	Hoary alyssum	*Berteroa incana*
Priority 3 (regulated plants)	Cheatgrass	*Bromus tectorum*
	Hydrilla	*Hydrilla verticillata*
	Russian olive	*Elaeagnus angustifolia*
	Brazilian waterweed	*Egeria densa*
	Parrot feather watermilfoil	*Myriophyllum aquaticum or M. brasiliense*
Sanders County	Baby's Breath	*Gypsophila paniculate*
	Common Mullein	*Verbascum thasus*

Source: MDA 2019

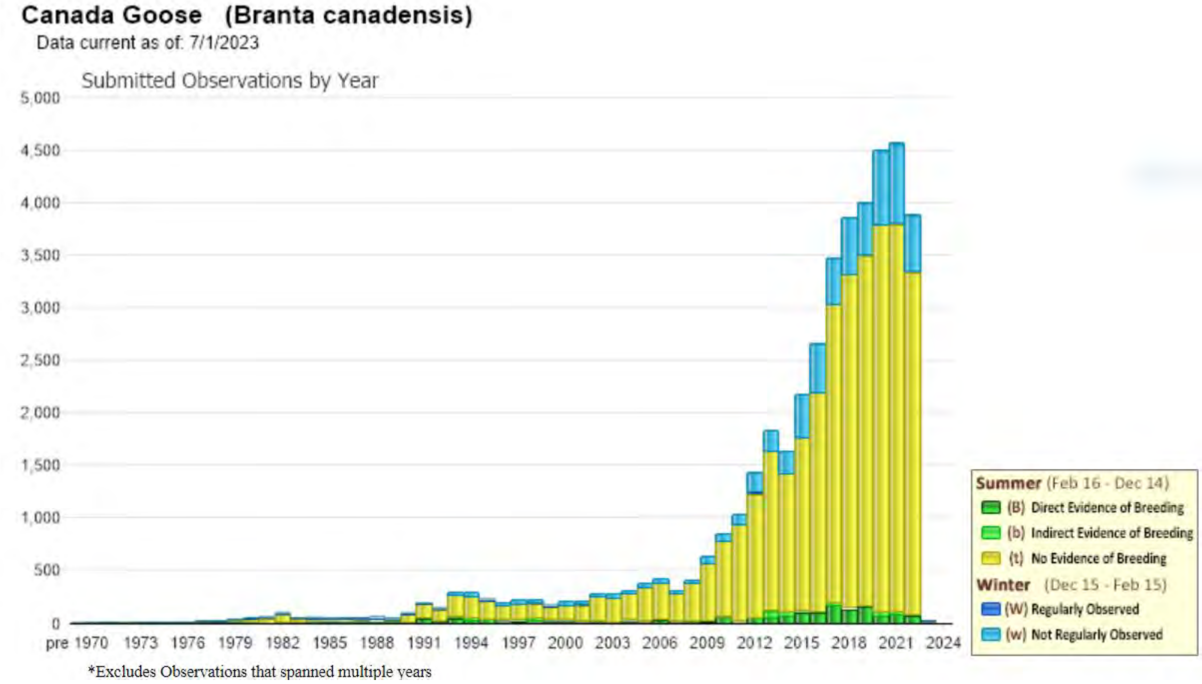
8.2 Environmental Measures

8.2.1 Existing Environmental Measures

8.2.1.1 Completed Environmental Measures

In 1983 USFWS and FWP recommended that the Licensee implement a Canada goose brood rearing enhancement plan. The Licensee implemented the plan by developing the Canada goose brood rearing habitat. New brood-rearing habitat was developed and on average 76 percent of goslings fledged successfully from 1983 to 1986 (O'Neil 1988). The Canada goose population in Montana has increased over the last 20 years, and they are currently abundant in the Project area, as is reflected by the increase in total observations each year in **Figure 8-4**.

Figure 8-4. Total Canada goose observations submitted to the Montana Natural Heritage Program Database, by year.



Source: MNHP and FWP 2023e.

Currently, NorthWestern implements control measures on its lands for noxious weeds in high use disturbed areas where weeds are more likely to occur (e.g., trailheads, parking lots, buildings) annually.

8.2.1.2 Ongoing Environmental Measures

Under the existing license the following environmental measures are ongoing.

- Implement annual noxious weed control measures in high-use areas on NorthWestern's lands.

8.2.2 Proposed Environmental Measures

NorthWestern is proposing to implement the PM&E measures described below:

- Implement annual noxious weed control measures in high-use areas on NorthWestern's lands.

8.3 Environmental Effects

This section discusses the potential effects of proposed Project operations on wildlife and botanical resources. The analysis of potential effects is limited to those effects associated with the proposed change in operations and Project boundary, as no new construction or development is proposed under the new license.

8.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E-Section 2.1.4.2 – Ongoing Environmental Measures,** including noxious weed control would continue. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations to only 2.5 feet. The terrestrial habitats would continue to function just as they do today.

The presence of disturbed land, vehicle traffic, and pedestrian traffic entering and exiting the Project provides a vector for introducing noxious weeds. Noxious weeds can impact wildlife by crowding out indigenous grasses and forbs that wildlife eat, reducing the amount of available forage. NorthWestern under the no action alternative would continue to engage in annual control measures for noxious weeds on NorthWestern-owned property.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's ability to manage lands and waters that are needed for Project purposes, under FERC's oversight.

8.3.2 Applicant's Proposed Alternative

NorthWestern does not propose additional construction or development of the Project, so there will be no construction-related impacts to wildlife resources under the Applicant's Proposed Alternative.

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations. Wildlife habitat at the Project is not expected to change as a result of reservoir fluctuation in the applicant's proposed alternative. Therefore, NorthWestern's proposed operational changes are not expected to affect wildlife species or habitat in the Project boundary.

NorthWestern's proposed alternative includes changes to the Project boundary which will modify the acreage of habitat types in the Project boundary (**Table 8-6**). The most notable change is the elimination of acres of agricultural land within the Project boundary. The proposed Project boundary encompasses fewer acres than the current Project boundary, so the acreage of other habitat types is also reduced. However no detrimental impacts to wildlife or botanical resources are anticipated as a result of the change in Project boundary.

Table 8-6. Acres of habitat types in current and proposed Project boundary

Cover Type	Acres in current Project boundary	Acres in proposed Project boundary
Agriculture	38	0
Conifer-dominated forest and woodland (mesic-wet)	31	16
Conifer-dominated forest and woodland (xeric-mesic)	37	26
Deciduous Shrubland	2	2
Developed	64	23
Floodplain and Riparian	190	151
Herbaceous Marsh	9	7
Insect-Killed Forest	8	8
Introduced Vegetation	2	0
Montane Grassland	136	81
Wet meadow	194	128

The Proposed Action alternative does not result in an increased risk of introduction of noxious weeds over the no action alternative. NorthWestern proposes to continue to engage in annual control measures for noxious weeds on NorthWestern-owned property.

There is no known direct or indirect effect identified from continuing to operate the Project under the Proposed Action alternative to wildlife and botanical resources. The terrestrial habitats would continue to function and provide existing benefits to wildlife and botanical resources.

8.4 Unavoidable Adverse Impacts

There is no unavoidable adverse impact identified for wildlife and botanical resources based on the no alternative or proposed alternative actions.

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9. Wetland, Riparian, and Littoral Habitats

This Section provides a description of the wetland, riparian, and littoral habitats within the Project boundary and analyzes potential effects of continued operations of the Project as proposed by NorthWestern on these resources.

9.1 Affected Environment

Aquatic and terrestrial animal species may use various habitats, including wetland, riparian, and littoral habitat(s) available within the Project vicinity. These species are identified and discussed in this **Exhibit E - Section 7 – Fisheries and Aquatic Resources**, **Section 8 – Wildlife and Botanical Resources**, and **Section 10 – Threatened, Endangered, Proposed, and Candidate Species**.

Riparian and wetland data were initially obtained from the Montana Spatial Data Infrastructure (MSDI 2020). A subsequent wetland delineation was also conducted. Wetland and riparian habitats within the Project boundary, as mapped in the MSDI, are limited and primarily occur at the upstream end of Thompson Falls Reservoir (**Figure 9-1**). This mapping includes wetlands supported by groundwater as well as wetlands with a direct connection to surface water. There is riverine riparian habitat along the shoreline and there are dispersed wetland areas and shallow channels around the islands near the confluence of the Thompson River (MSDI 2020). Some aquatic plant communities are native, while some species are invasive (Madsen and Cheshier 2009; Hansen Environmental 2016).

A summary of the illustrated wetland, and riparian habitat types shown in Figure 9-1 is provided in **Table 9-1** with the respective acreage within the current Project boundary.

Table 9-1. Wetland, riparian, and waterway habitat types identified in the current Project boundary.

Wetland and Riparian Habitat Type	Area in FERC boundary (acres)
Freshwater Emergent Wetland	131
Waterways (Lake/Riverine/Pond)	1372
Freshwater Forested/Shrub Wetland	171
Forested/Shrub Riparian	45
Total	**1,719**

Source: MSDI 2020

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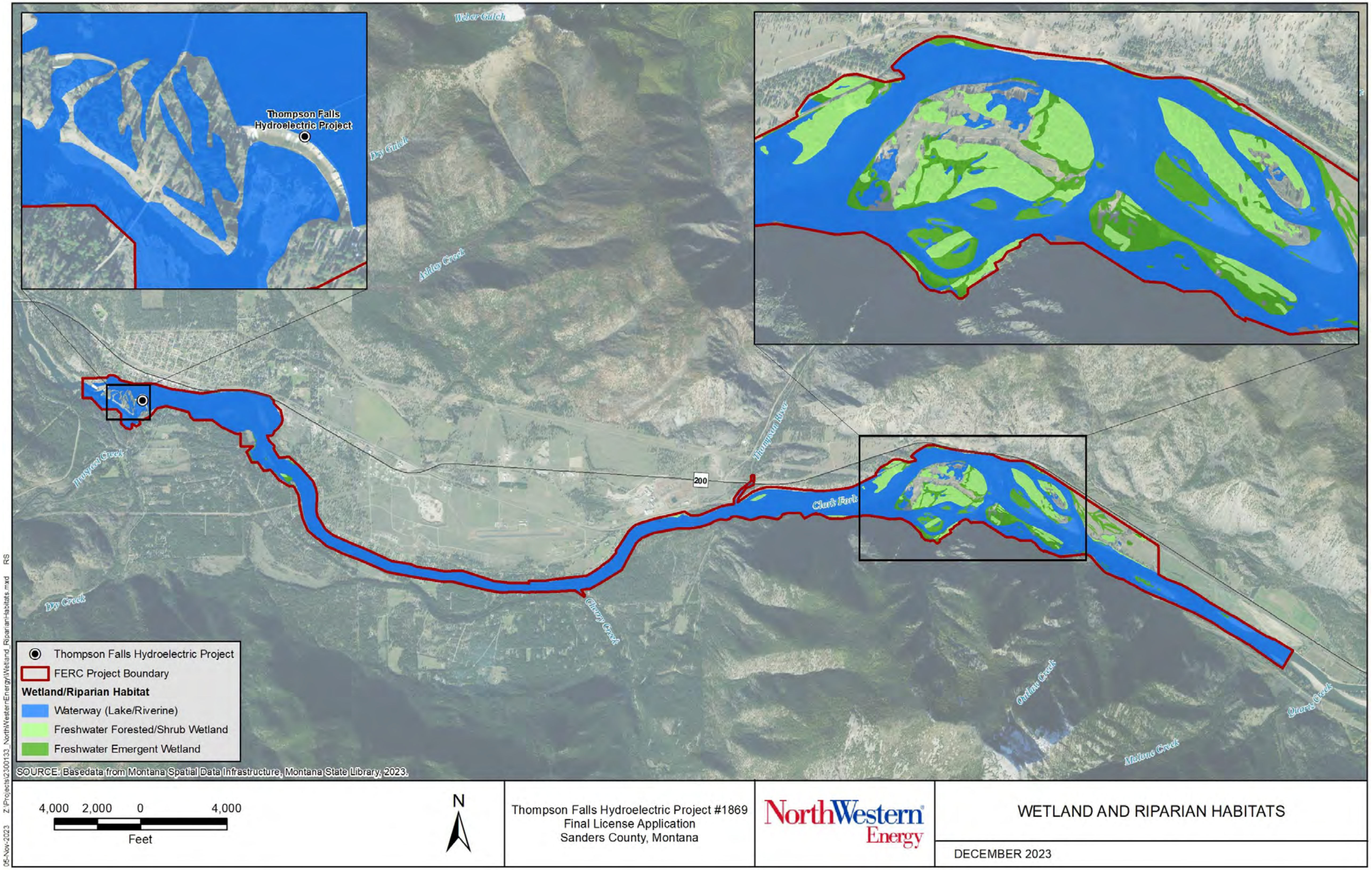
Figure 9-1. Montana wetland and riparian habitats within the current Project boundary.



Source: MSDI 2020

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9.1.1 Wetland Habitats

In 2023, a delineation and evaluation of wetlands with a direct hydrologic connection to the Project was completed (**Appendix B – Wetland Assessment Report**). Fourteen wetland areas were delineated along the water's edge of the reservoir. A total of 11.33 acres of palustrine emergent wetland habitat, of which 10.98 acres are within the current Project boundary, were delineated (**Figure 9-2)**.

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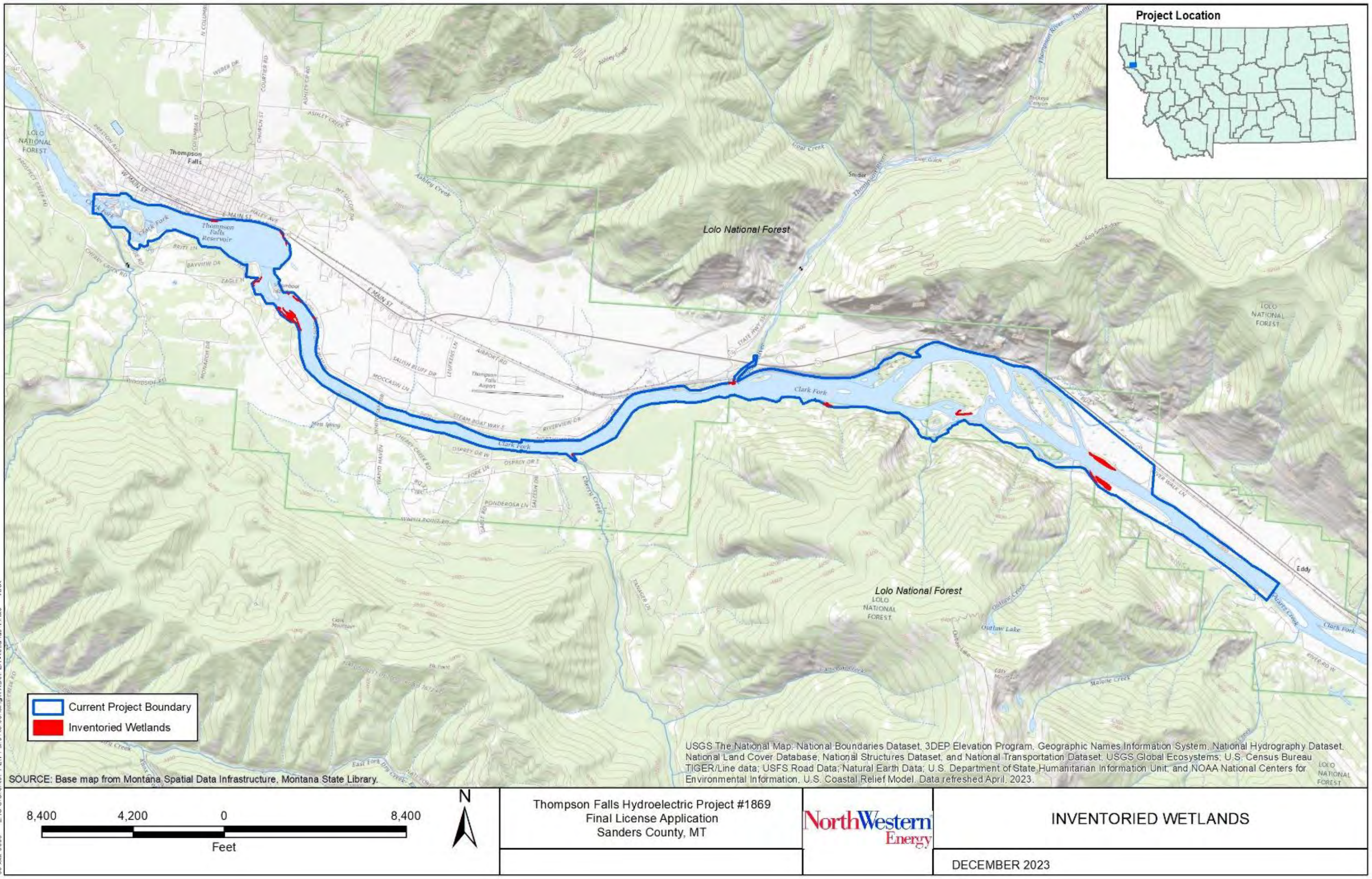
Figure 9-2. Inventoried wetlands within current Project boundary.



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In general, the inventoried wetland areas represent a narrow, vegetated fringe along the Ordinary High-Water Mark of the Thompson Falls Reservoir and are commonly found along the lower terraces and islands within the Project area. These wetland areas generally share common characteristics (**Table 9-2**) and have been grouped for the purpose of discussion based on the source for wetland hydrology. The two general categories for the 14 wetland areas include Group 1, with wetland hydrology solely provided by water elevations within the reservoir, and Group 2, which derive some level of hydrology for tributaries of the Clark Fork River. These two groups are discussed below.

Table 9-2. Inventoried Wetlands.

WETLAND/ WATERWAY ID	WETLAND TYPE[1]	WETLAND TYPE (HGM)[2]	SIZE (ACRES)	LOCATION (LAT/LONG)
Wetland 1 (WL-1)	PEM1A	Lacustrine	2.67	47.567594 -115.170191
Wetland 2 (WL-2)	PEM1A	Lacustrine/Riverine	0.30	47.568338 -115.172296
Wetland 3 (WL-3)	PEM1A	Lacustrine	3.41	47.570334 -115.170783
Wetland 4 (WL-4)	PEM1A	Lacustrine	0.61	47.575110 -115.197502
Wetland 5 (WL-5)	PEM1A	Lacustrine/Riverine	0.21	47.575009 -115.222833
Wetland 6 (WL-6)	PEM1A	Lacustrine	0.59	47.576939 -115.240836
Wetland 7 (WL-7)	PEM1A	Lacustrine/Riverine	0.05	47.566325 -115.269681
Wetland 8 (WL-8)	PEM1A	Lacustrine	0.04	47.581088 -115.319736
Wetland 9a/b (WL-9a/b)	PEM1A	Lacustrine	2.74	47.581326 -115.324284
Wetland 10 (WL-10)	PEM1A	Lacustrine	0.26	47.583343 -115.323203
Wetland 11 (WL-11)	PEM1A	Lacustrine	0.03	47.583935 -115.324840
Wetland 12 (WL-12)	PEM1A	Lacustrine	0.20	47.585195 -115.330850
Wetland 13a/b (WL-13a/b)	PEM1A	Lacustrine	0.10	47.590272 -115.325960
Wetland 14 (WL-4)	PEM1A	Lacustrine	0.12	47.592389 -115.339686
			Total	**11.33**

Notes: HGM = Hydrogeomorphic; PEM1A = Palustrine, Emergent, Persistent, Temporarily Flooded
Sources: [1]Cowardin et al. 1979; [2]Brinson 1993

9.1.1.1 Wetland Group 1 (WL-1, 3, 4, 6, 8-14)

Wetland Group 1 (WG-1) includes all wetland habitat that appears to be directly supported by water elevations impounded by the Thompson Falls Dam and consists of 11 wetland areas that total 10.78 acres of palustrine emergent wetland habitat. These wetland habitats typically occupy low benches and narrow fringes along the water's edge. The wetland hydrology indicators observed within WG-1 included surface water, high water table, saturation, sediment deposits, geomorphic position, and a positive FAC-neutral test. Hydrophytic vegetation observed within WG-1 primarily included reed canary grass (*Phalaris arundinacea*, facultative wetland [FACW]), with lesser amounts of Baltic rush (*Juncus balticus*, FACW), broad-leaf cattail (*Typha latifolia*, obligate wetland [OBL]), pale-yellow iris (*Iris pseudacorus*, OBL), Northwest Territory sedge (*Carex utriculata*, OBL), common spike rush (*Eleocharis palustris*, OBL), and hard-stem club-rush (*Schoenoplectus acutus*, OBL).

The hydrophytic vegetation indicators included a positive rapid test for hydrophytic vegetation, a positive dominance test, and prevalence index within the range indicating the presence of hydrophytic vegetation. Adjacent uplands were generally characterized by Rocky Mountain bee plant (*Cleome serrulate*, upland [UPL]), Canada goldenrod (*Solidago canadensis*, facultative upland [FACU]), slender wild rye (*Elymus trachycaulus*, FAC), blue wild rye (*Elymus glaucus*, FACU), smooth brome (*Bromus inermis*, UPL), common tansy (*Tanacetum vulgare*, FACU), Kentucky bluegrass (*Poa pratensis*, FAC), western meadow-rue (*Thalictrum occidentale*, FACU), great mullein (*Verbascum thapsus*, FACU), orchard grass (*Dactylis glomerata*, FACU), common yarrow (*Achillea millefolium*, FACU), and common dandelion (*Taraxacum officinale*, FACU). The hydric soil indicators observed within WG-1 included sandy redox and depleted matrix and commonly exhibited distinct redoximorphic concentrations starting within 8 inches of the soil surface. All wetland areas within WG-1 were preliminarily determined to be jurisdictional based on an observed hydrologic connection the Project.[21]

9.1.1.2 Wetland Group 2 (WL-2, 5, and 7)

Wetland Group 2 (WG-2) includes wetland habitat identified along the water's edge of the reservoir that receive supplemental wetland hydrology from surface water draining from adjacent slopes. WG-2 includes three areas of palustrine emergent habitat (~0.55 acre). Surface water observed draining from the steep mountain slopes through Wetland-2 (WL-2) was presumably determined to be Outlaw Creek, based on National Hydrography Dataset interpretation. Wetland hydrology for WL-5 appeared to be sustained by both impounded surface water and intermittent stream flow contributed from surface runoff of the mountainside above. WL-7 was identified as a very small wetland depression at the mouth of Cherry Creek. The wetland hydrology indicators for WG-2 included surface water, saturation, drainage patterns, geomorphic position, and a

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[21] Since the time of the preliminary determination, the United States Supreme Court decided *Sackett v. EPA,* 598 U.S. ___ (2023), establishing a new test for determining when a wetland is a water of the United States under the Clean Water Act. It is unclear whether the new test will affect the preliminary jurisdictional determination but given that the *Sackett* case narrowed the scope of jurisdictional waters, NorthWestern is conservatively relying on the preliminary jurisdictional determination to evaluate impacts of the Project.

positive FAC-neutral test. Dominant hydrophytic vegetation observed within WL-2 included pale-yellow iris and reed canary grass. The hydrophytic vegetation indicators included a positive rapid test for hydrophytic vegetation, a positive dominance test, and prevalence index within the range indicating the presence of hydrophytic vegetation. Adjacent uplands were generally characterized by blue wild rye, common tansy, western meadow-rue, and smooth brome. The hydric soil indicators observed within WL-2 included sandy redox and depleted matrix. All wetlands within WG-2 were preliminarily determined to be jurisdictional based on an observed hydrologic connection to the Project.

9.1.1.3 Functional Assessment

The two wetland groups were assessed on separate Montana Wetland Assessment Method (MWAM) forms (Berglund and McEldowney 2008) and include Assessment Areas (AA)-1 (WG-1) and AA-2 (WG-2). Completed forms are provided in **Appendix A** and a summary of wetland functions and value ratings is provided in **Table 9-3**. According to the functional assessments, both AAs were classified as Category III wetlands. According to the Montana Wetland Assessment Method, Category III wetlands are more common and generally less diverse than Category I and II wetlands. Category III wetlands can provide many functions and values but are not rated as high as Category I and II wetlands in the assessment. To be rated a Category III wetland, the AA must not qualify as a Category I, II, or IV site (Berglund and McEldowney 2008). Descriptions of each AA evaluation are provided below.

Table 9-3. MWAM Functional Assessment Summary

Function and Value Parameters from the 2008 MDT Wetland Assessment Method[1]	Assessment Area 1		Assessment Area 2	
	WL-1, 3, 4, 6, 8-14		WL-2, 5, 7	
	Rating	Points	Rating	Points
Listed/Proposed T&E Species Habitat	Low	0	Low	0
MNHP State Species of Concern Habitat	Low	0	Low	0
General Wildlife Habitat	Moderate	0.7	Moderate	0.7
General Fish/Aquatic Habitat	N/A	--	N/A	--
Flood Attenuation	Moderate	0.5	High	0.8
Short- and Long-Term Surface Water Storage	High	0.9	Moderate	0.4
Sediment/Nutrient/Toxicant Removal	High	1	High	1
Sediment/Shoreline Stabilization	High	1.0	High	1.0
Production Export/Food Chain Support	Moderate	0.5	Moderate	0.7
Groundwater Discharge/Recharge	Moderate	0.7	High	1.0
Uniqueness	Low	0.3	Low	0.3
Recreation/Education Potential	Moderate	0.1	Moderate	0.1
Actual Points/Possible Points	5.7/10.0		6.0/10.0	
% of Possible Score Achieved	57%		60%	
Overall Category	III		III	
Total Acreage of Assessed Wetlands	10.78		0.55	

Function and Value Parameters from the 2008 MDT Wetland Assessment Method[1]	Assessment Area 1		Assessment Area 2	
	WL-1, 3, 4, 6, 8-14		**WL-2, 5, 7**	
	Rating	Points	Rating	Points
Function Unit Total (actual points x estimate AA acreage)	61.5		3.3	
Total Projected Function Units on this Project	**64.8**			

Note: [1]*see* completed Montana Department of Transportation (MDT) functional assessment forms in **Appendix B – Wetland Assessment Report** for detailed ratings.

9.1.1.3.1 Functional Assessment of AA-1 (WG-1)

AA1 consists of the 11 wetland areas in WG-1 totaling 10.78 acres. According to the MWAM, AA-1 is a Category III wetland. AA-1 received low ratings for listed/proposed T&E species, MNHP state SOC habitat, and uniqueness. AA-1 received moderate ratings for general wildlife habitat, flood attenuation, production export/food chain support, groundwater discharge/recharge, and recreation/education potential and high ratings for short- and long-term surface water storage, sediment/nutrient/toxicant removal, and sediment/shoreline stabilization. AA-1 received 5.7 out of 10 possible points (57%) and a total of 61.5 functional units.

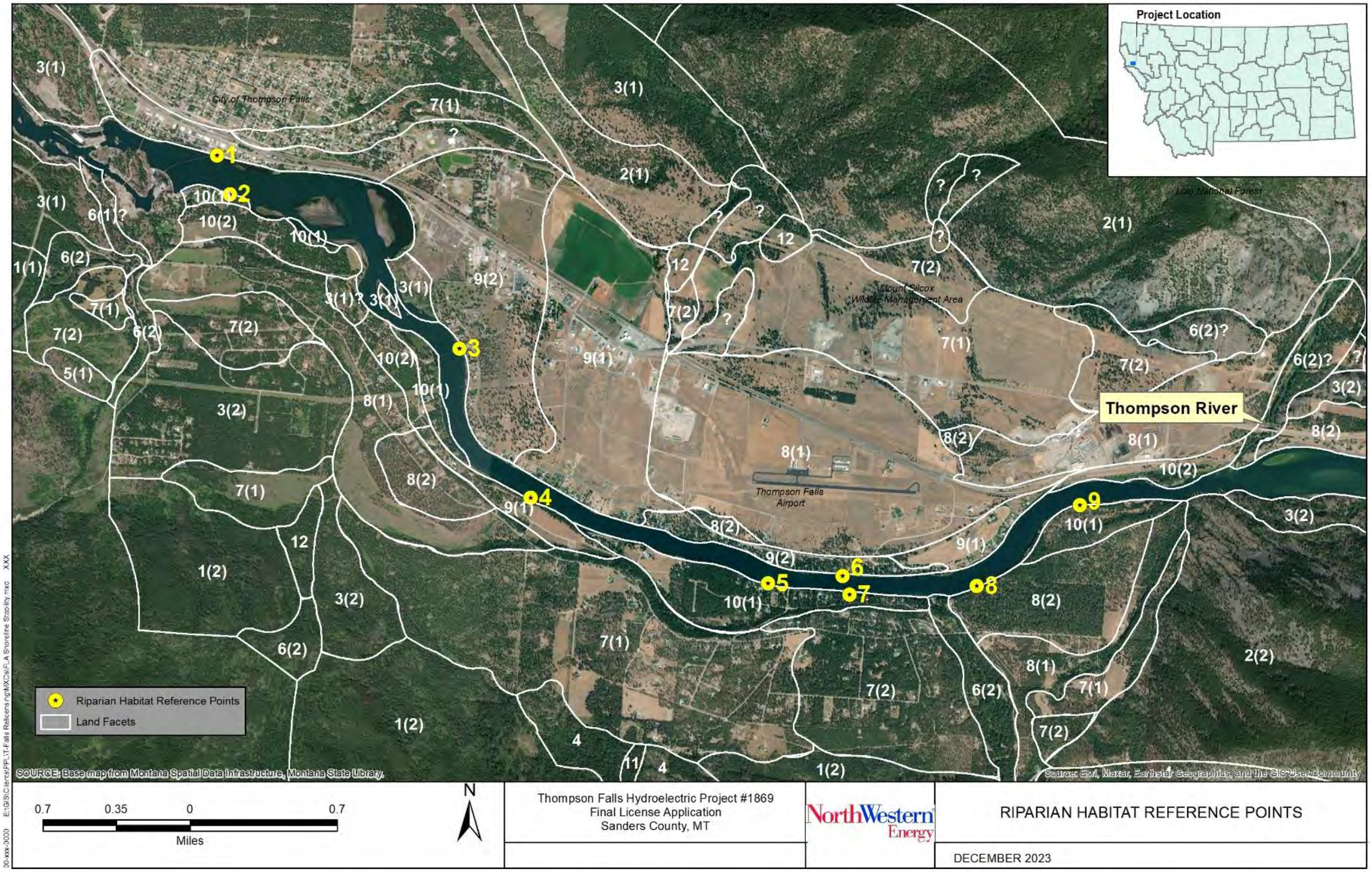
9.1.1.3.2 Functional Assessment of AA-2 (WG-2)

AA-2 consists of the three wetland areas in WG-2 totaling 0.55 acres. According to the MWAM, AA-2 is a Category III wetland. AA-2 received low ratings for listed/proposed T&E species, MNHP SOC habitat, and uniqueness. AA-2 received moderate ratings for general wildlife habitat, flood attenuation, production export/food chain support, and recreation/education potential and high ratings for short- and long-term surface water storage, sediment/nutrient/toxicant removal, sediment/shoreline stabilization, and groundwater discharge/recharge. AA-2 received 6.0 out of 10 possible points (60%) and a total of 3.3 functional units.

9.1.2 Riparian Habitats

In 2021, NorthWestern assessed riparian habitats as part of the Operations Study (NorthWestern 2022). Riparian habitat is considered the vegetation above the full pool, and aquatic vegetation is considered the vegetation below that elevation, with the aquatic vegetation being either emergent (protruding above the water surface) or submergent (not protruding above the water surface). In 2021 riparian habitats were observed at nine reference points (**Figure 9-3**). The nine reference points extend from the boat restraint (near the dam) upstream to the mouth of the Thompson River. In 2022, NorthWestern assessed shoreline stability and aquatic vegetation at the same nine reference points (NorthWestern 2023).

Figure 9-3. Location of riparian habitat reference points.



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Vegetation at the nine reference points varied significantly in both species' composition and density (**Table 9-4**).

Table 9-4. Riparian Vegetation at Reference Points.

Reference Point Number	Description
1	Dense stand of non-native forbs and grasses, which were mostly mowed to the water's edge as part of the landscaping for this recreation site
2	Dense stand of grasses with a few interspersed conifer trees.
3	Dense mixture of grass and shrub species such as chokecherry, black hawthorn and service berry, and a few interspersed conifer trees
4	Less dense riparian vegetation due to more active erosion and the species mix consisted of grasses, shrubs, and trees
5	Shoreline stabilization pilot project and dominated by a dense stand of grasses, with mixed survival of the shrub species that were planted for this pilot project
6	Low density stand of mostly grasses, with a few interspersed shrubs and conifer trees.
7	Dense stand of grasses, with a dense pocket of shrubs mixed in
8	Less dense riparian vegetation due to a boulder-type substrate not conducive to plant growth, and the plant species that do exist are mostly grasses
9	Less dense riparian vegetation due to more active erosion and a boulder-type substrate that is not conducive to plant growth, and the plant species that do exist are a mixture of grasses, shrubs, and conifer trees.

Source: NorthWestern 2022

Riparian habitats are present along the entire reservoir shoreline, other than where infrastructure is in place such as boat ramps, docks, and rock riprap. Similar to the nine reference points, the vegetative density and species composition vary significantly. The reservoir shoreline downstream of the islands, located upstream of the confluence with the Thompson River, tends to have taller and steeper shoreline slopes with rockier soils that create narrow riparian habitats consisting of low to high density stands of grasses, forbs, shrubs, and trees. The mouths of Cherry Creek and Thompson River are exceptions, each having a larger riparian habitat area as compared to the adjacent reservoir shoreline. The reservoir shoreline in the islands area, as well as the islands themselves, have less-steep slopes and finer soils creating large riparian habitat areas often densely vegetated including iconic riparian habitat species such as black cottonwood and willow species, which are much less common in the reservoir downstream of the islands. The reservoir shoreline upstream of the islands is more like the lower reservoir with narrower strips of riparian habitats with low to high density stands of vegetation.

Riparian habitat species have naturally adapted to fluctuating water levels in the reservoir, as well as even more dramatic fluctuations. Typical riparian habitats may be totally inundated at certain times of the year such as spring runoff or after a significant summer rainfall event, and at other times of the year such as the late summer and early fall when the water table may be below the root zone of the riparian plant species.

9.1.3 Littoral Zone

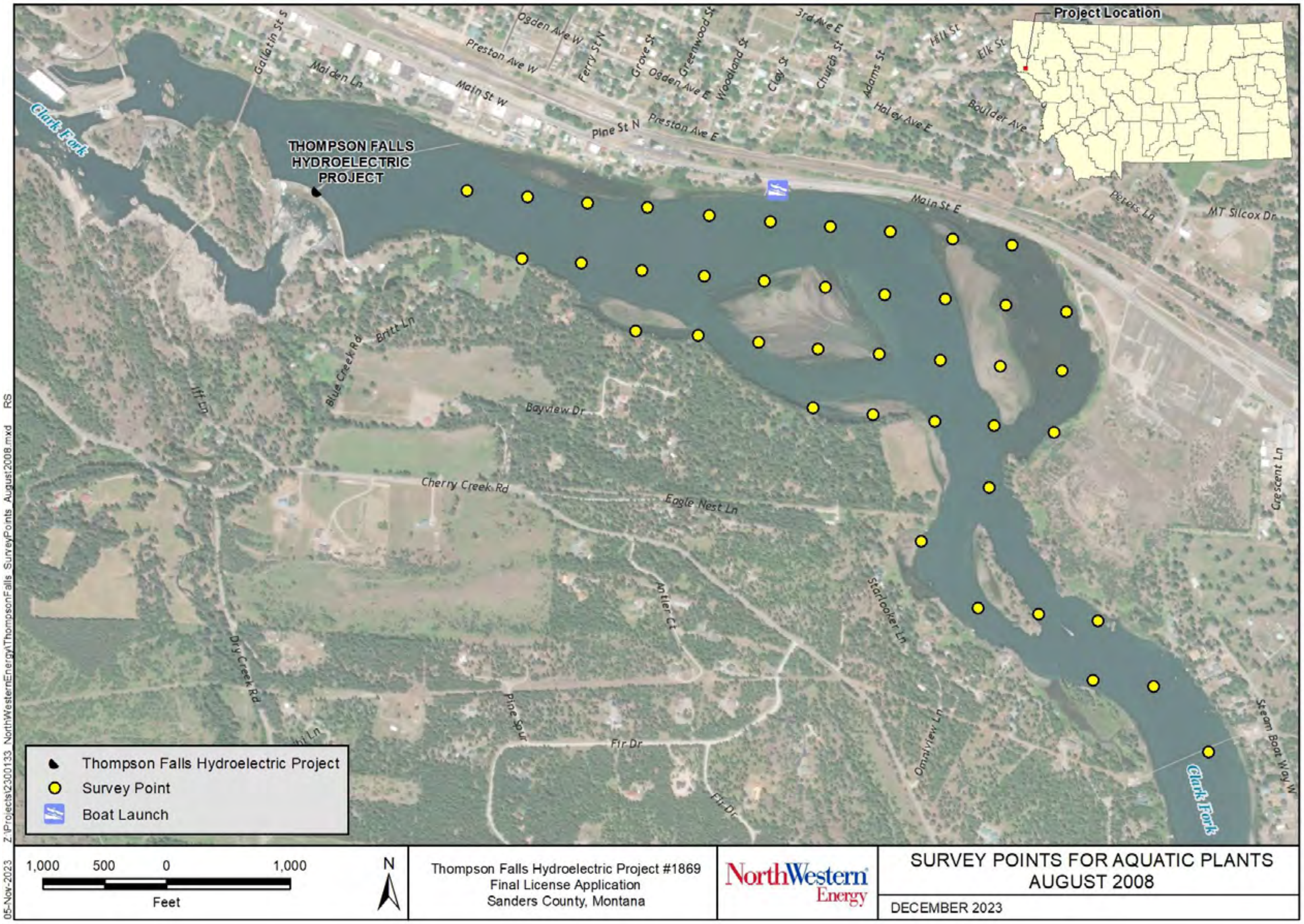
The littoral zone is defined as the nearshore area where sunlight can penetrate to the reservoir bottom, allowing for plant growth. In 2008, the littoral zone area in Thompson Falls Reservoir was defined by Madsen and Cheshier (2009) as extending to a depth of 25 feet, covering approximately 65 percent of the Thompson Falls Reservoir (Madsen and Cheshier 2009).

Aquatic vegetation surveys in Thompson Falls Reservoir and other reservoirs in the Lower Clark Fork River were conducted in 2008, **Figure 9-4** (Madsen and Cheshier 2009) and in 2016, **Figure 9-5** (Hansen Environmental 2016). These surveys were managed by the Sanders County Aquatic Invasive Plants Task Force. Surveys were completed in August in both years. Aquatic invasive plants documented or observed in the Thompson Falls Reservoir during these studies include curlyleaf pondweed, flowering rush, and yellow flag iris, all of which are on the Montana's noxious weed list (Montana State University Extension 2019) and known to occur in Montana (FWP 2020).

In 2008, Thompson Falls Reservoir was described as having good water clarity. However, depths between 12 and 25 feet were not suitable for plant colonization in most areas due to steep slopes. Aquatic plants were present in about 63 percent of the 40 sites surveyed in the Thompson Falls Reservoir (Figure 9-4). A total of nine species were recorded in the littoral zone. Aquatic plants were not present at depths greater than 11 feet. The aquatic plant community was dominated by native species Eloda (*Elodea Canadensis*), coontail (*Ceratophyllum demersum*), and northern watermilfoil (*Myriophyllum sibiricum*). Nonnative invasive species observed include curlyleaf pondweed (*Potamogeton cripus*) (~77 acres) and flowering rush (*Butomus umbellatus*) (~28 acres) (Madsen and Cheshier 2009).

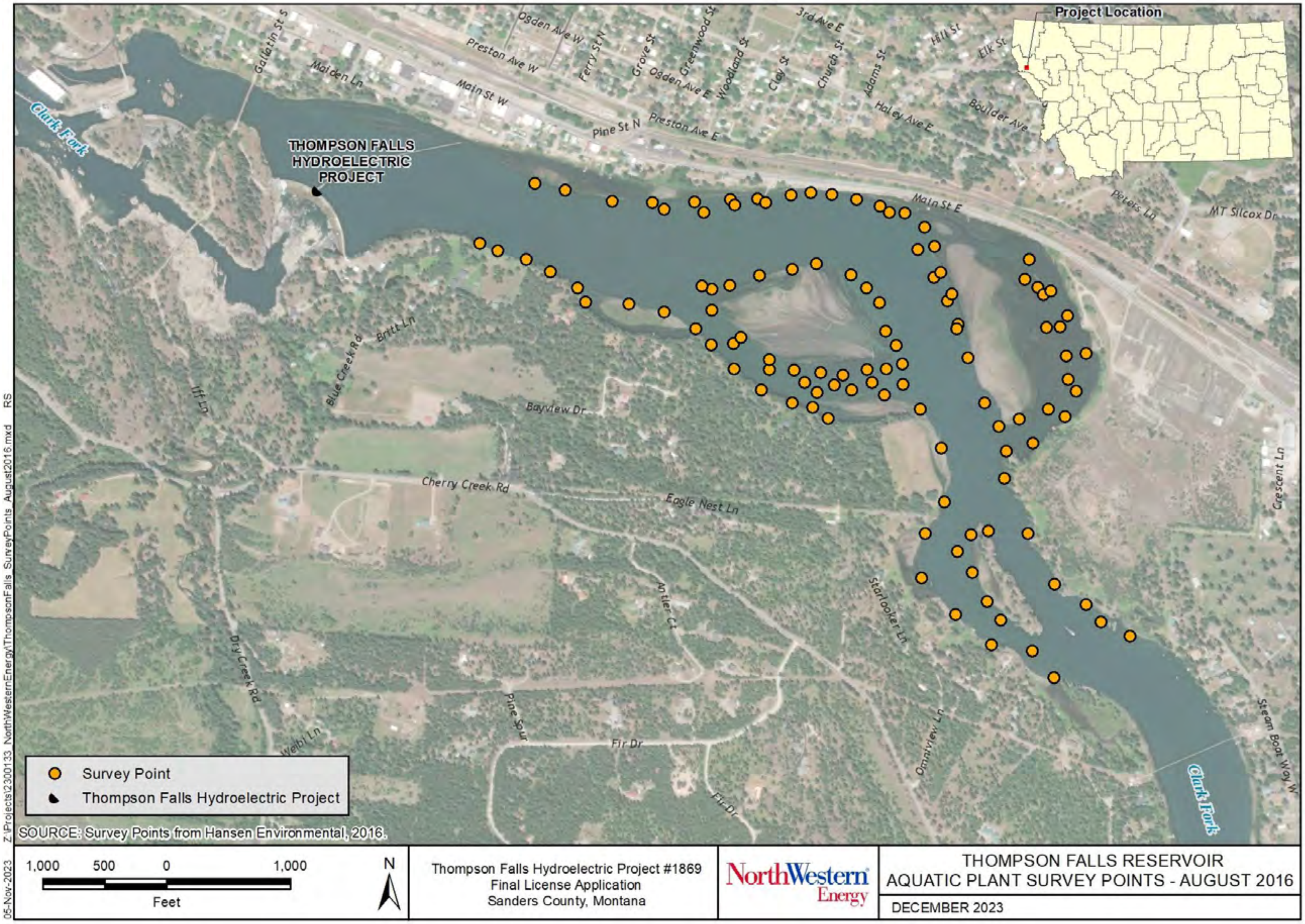
In 2016, Hansen Environmental surveyed 112 points in the Thompson Falls Reservoir at depths less than 15 feet (Figure 9-5). There were 11 species of aquatic plants identified and no aquatic plants were observed at depths greater than 13 feet. The aquatic plant community included primarily native species with the most dominant native plants represented by Eloda, coontail, and northern watermilfoil and other native plants including Chara (*Chara* spp.), water stargrass (*Heteranthera dubia*), white water buttercup (*Ranunclus aquatilis*), leafy pondweed (*P. foliosus*), sago pondweed (*P. pectinatus*), and Richardson's pondweed (*P. rishardonsii*). The two non-native species observed in the 2008 and 2016 surveys were flowering rush and curlyleaf pondweed (Madsen et al. 2009; Madsen and Cheshier 2009; Hansen Environmental 2016). Curlyleaf pondweed was observed at 19 percent of the sites, and flowering rush was observed at 13 percent of the sites (Hansen Environmental 2016). Although sampling methods differed between the 2008 and 2016 surveys, Hansen Environmental (2016) concluded the occurrence of these two-nonnative species appeared similar to 2008 results.

Figure 9-4. Thompson Falls Reservoir aquatic plant survey points, August 2008.



Source: Madsen and Cheshier 2009

Figure 9-5. Thompson Falls Reservoir aquatic plant survey points, August 2016.



Source: Hansen Environmental 2016

A qualitative review of aquatic vegetation and AIS along the reservoir shorelines was completed in 2021 and 2022 (NorthWestern 2022, 2023). Aquatic vegetation and AIS are common where the substrate is comprised of silt, sand, and other fine materials, and much less common where the substrate is comprised of gravels, cobbles, and other coarse materials. Upstream of the islands, aquatic vegetation and AIS are less prevalent since the shoreline tends to be comprised of coarse substrates, and/or the reservoir is more riverine in nature such that current flows and velocity reduce the ability for aquatic vegetation and AIS to become established. Flowering rush and yellow flag iris are AIS species that are fairly common in the reservoir. Flowering rush is particularly prevalent in the lower reservoir in areas of significant sediment deposition, close to the water's surface. Curlyleaf pondweed, an AIS with historic observations in the reservoir, is less prevalent than other species and was only observed at two wetland sites during recent evaluations (NorthWestern 2022, 2023). Eurasian watermilfoil, an invasive species common in the region and especially prevalent downstream of the Thompson Falls Project area, was not observed, though native northern watermilfoil is prevalent (NorthWestern 2022, 2023).

9.2 Environmental Measures

9.2.1 Existing Environmental Measures

9.2.1.1 Completed Environmental Measures

Under the existing license the following environmental measure was completed:

- In 2020 NorthWestern completed a pilot project utilizing a bioengineering approach to shoreline stabilization. The completed project involved revegetation of ~200 linear feet of eroding shoreline with native riparian plants.

9.2.1.2 Ongoing Environmental Measures

Under the existing license the following environmental measure is ongoing:

- Maintain and implement the *Standards for Design, Construction, Maintenance, and Operation of Shoreline Facilities.*

9.2.2 Proposed Environmental Measures

NorthWestern is proposing the following environmental measures to benefit terrestrial resources and geological resources. These measures will also benefit wetlands, riparian habitats and littoral zones:

- The Licensee will implement annual noxious weed control measures, as appropriate, in high-use areas on Project lands owned by the Licensee.
- The Licensee will manage the shoreline pursuant to FERC's Standard Land Use Articles, in coordination with the Green Mountain Conservation District in implementing Montana's Natural Streambed and Land Preservation Act.

- Within 2 years of the new License, the Licensee, will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The Plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, SHPO and USFS.

9.3 Environmental Effects

9.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Under the no action alternative, wetlands, riparian habitat, and littoral zone within the Project would continue to function as they have in the past. Current operations frequently utilize the top 1.5 feet of the reservoir, and the wetland, riparian and littoral plant communities have adapted to water level fluctuations within this range. Baseline conditions for these plant communities were observed and documented in the 2021 and 2022 Operations Studies (NorthWestern 2022 and 2023). Because the plant communities have adapted to 1.5-foot water level fluctuations, there are no anticipated impacts to wetland, riparian, and littoral plant communities by continuing to operate the reservoir in this manner. Under the current license, water fluctuations of up to 4 feet in the reservoir are allowed, which could potentially result in greater impacts to existing wetland and riparian vegetation than what was observed during the 2021 and 2022 study periods which looked at water fluctuations of up to 2.5 feet. Depending on the frequency and duration of the 4-foot fluctuations, both submergent and emergent vegetation could potentially be impacted due to dewatering of the root zone for extended periods of time, resulting in changes to the plant species composition in these areas.

AIS such as flowering rush and yellow flag iris appear to be resilient to fluctuations in the reservoir elevation. AIS are difficult to eradicate and can have adverse effects on native vegetation and species. AIS spread from upstream sources that are outside the Project area, such as recreation (e.g., boating, fishing, recreationists), and from species like birds that can move in and out of the Project area.

In the normal course of operations, planned drawdowns in excess of 2.5 feet may occur as a result of dam safety or maintenance requirements. These maintenance activities require the reservoir to be lowered up to about 16.5 feet, to a level near, or slightly lower than, the Main Channel Dam spillway crest. In addition, certain environmental and operational conditions outside of NorthWestern's control require the reservoir to be lowered outside of the typical operating window. These unplanned events occur when spring flows exceed the capacity of the combination of the spillway radial gates (less reserve for plant capacity restoration) and the spillway roller panels. With the installation of the new radial gates, it is estimated that the flow that will trigger stanchion tripping, and subsequent deeper drawdowns, is approximately 112,000 cfs. This is between a 10 and 25-year event but is also dependent on the amount of debris accumulating at the dam that cannot be passed through the radial gates or spillway bays.

During the deep drawdowns, some littoral habitat is dewatered, and wetlands may temporarily lose connectivity to the main river channel. However, these events are rare, resulting in temporary and infrequent impacts. Planned drawdowns will occur in the fall to the extent practical, which coincides with the dormancy of native plant communities, to minimize impacts to shoreline vegetation.

9.3.2 Applicant's Proposed Alternative

9.3.2.1 Impacts of Proposed Operational Changes

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations.

NorthWestern's Operations Study included an evaluation of impacts to wetlands at pool elevations down to 2.5 feet below full pool (NorthWestern 2022, 2023). Current operations support shallow areas with aquatic plant growth, backwater channels, and wetland areas in Thompson Falls Reservoir. The Operations Study in 2021 and 2022 indicate much of the existing wetland and riparian vegetation is resilient to water fluctuations of up to 2.5 feet in the reservoir, as no changes to emergent or woody vegetation were observed throughout the study period.

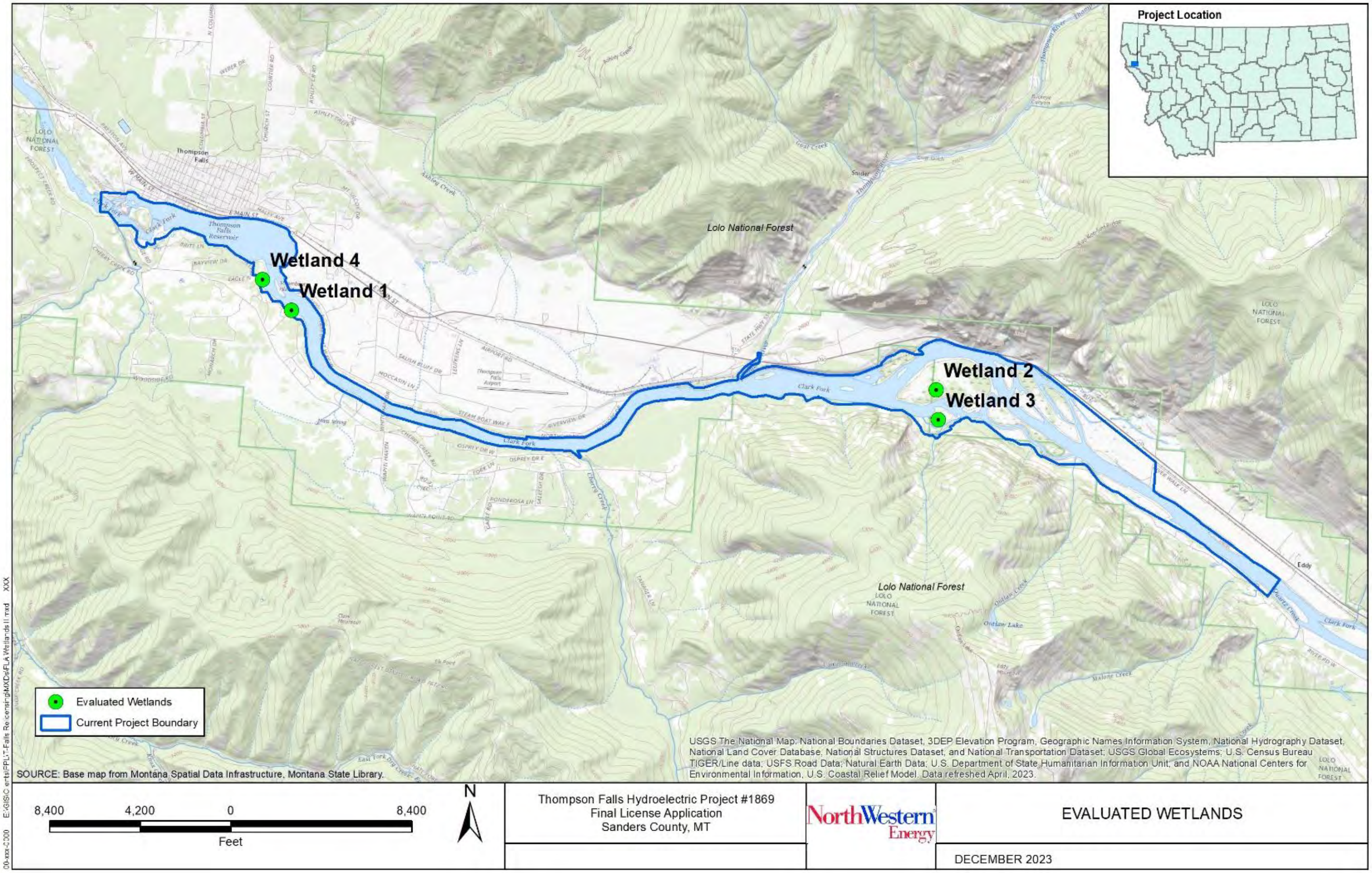
Wetland 1, located on a side channel of the reservoir near Steamboat Island, was selected as a representative site for conditions in the lower reservoir (**Figure 9-6**). This wetland contains features that are classified as palustrine with emergent vegetation, as well as riverine features that have an unconsolidated bottom (MNHP 2021). There is a visible surface water inlet and outlet to Wetland 1.

Wetland 2 is located in the upper reservoir on the large island in the middle of the island complex upstream of the Thompson River confluence (**Figure 9-6**). This wetland is classified as palustrine and contains both aquatic bed and forested wetland features (MNHP 2021).

Wetland 3 is located in the upper reservoir on a small island near river left in the island complex upstream of the Thompson River confluence (Figure 9-6). This wetland is classified as palustrine and contains both aquatic bed and emergent wetland features (MNHP 2021).

In 2022, NorthWestern evaluated Wetland 1 and a new location, Wetland 4. Wetland 4 has similar characteristics as Wetland 1 and contains features that are classified as palustrine with emergent vegetation (MNHP 2021). Wetland 4 is situated in a backwater area along the shoreline of the reservoir and is shallow and very small in size (Figure 9-6).

Figure 9-6. Location of Wetlands Evaluated During the Operations Study.



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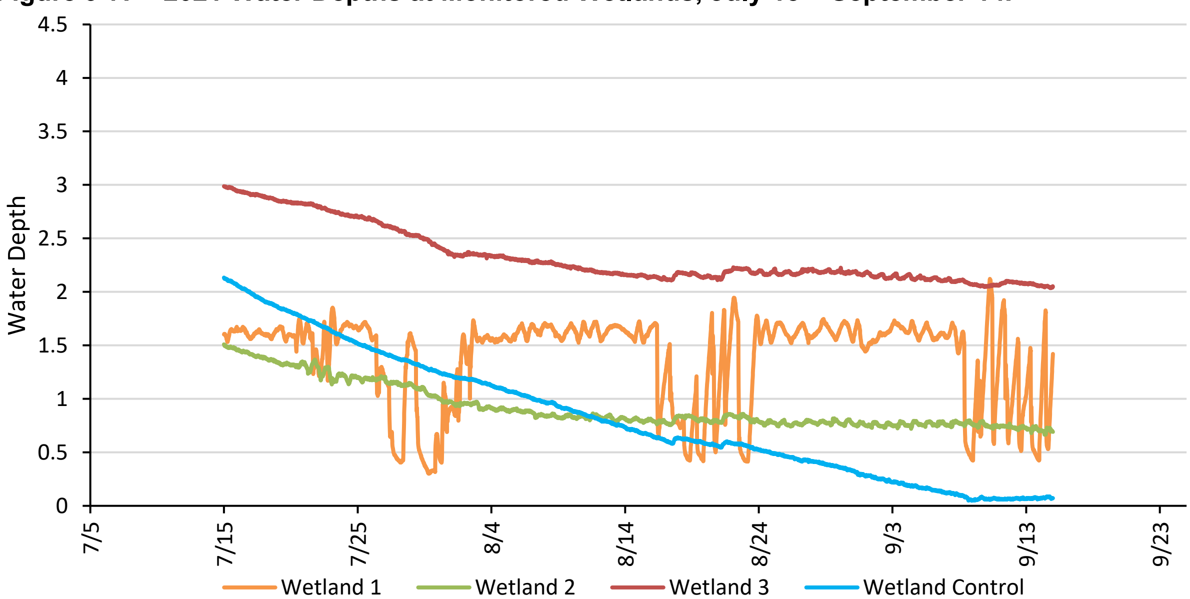
When the water surface elevation of the reservoir is approximately 1.5 feet below full pool, the side channel that feeds Wetland 1 becomes deactivated and the water volume in the wetland is significantly reduced. Conversely, when the water surface elevation of the reservoir goes above 2395.1 feet, the side channel re-activates and the volume of water in Wetland 1 increases (NorthWestern 2022). The current hydrology of Wetland 1 has evolved over time with reservoir operations typically using the top 1.5 feet of the reservoir. Under the proposed changes to operate the reservoir using the top 2.5 feet, wetlands such as Wetland 1 will establish a new baseline, and vegetation and hydrology will adapt to the new conditions due to their natural physiological resiliency to fluctuations in water from seasonality, flooding, and drought. Wetland 2 becomes flooded during spring runoff and at times when the stage is high in the Clark Fork River. This was evidenced by the large amount of driftwood debris around the wetland. As the stage in the Clark Fork River recedes, there is no longer an active surface water connection upstream or downstream of Wetland 2, and it appears that the wetland slowly discharges to groundwater throughout the rest of the year. Although this wetland has a close proximity to surface water in the reservoir, there is no visual surface water connection to the reservoir (NorthWestern 2022).

Although Wetland 3 is in close proximity to surface water in the reservoir, there is no observed surface water connection to the reservoir.

Wetland 4 is very shallow, has a surface water connection, and frequently goes dry throughout the summer months when the water surface elevation at the dam dips below approximately 2,395.7 feet.

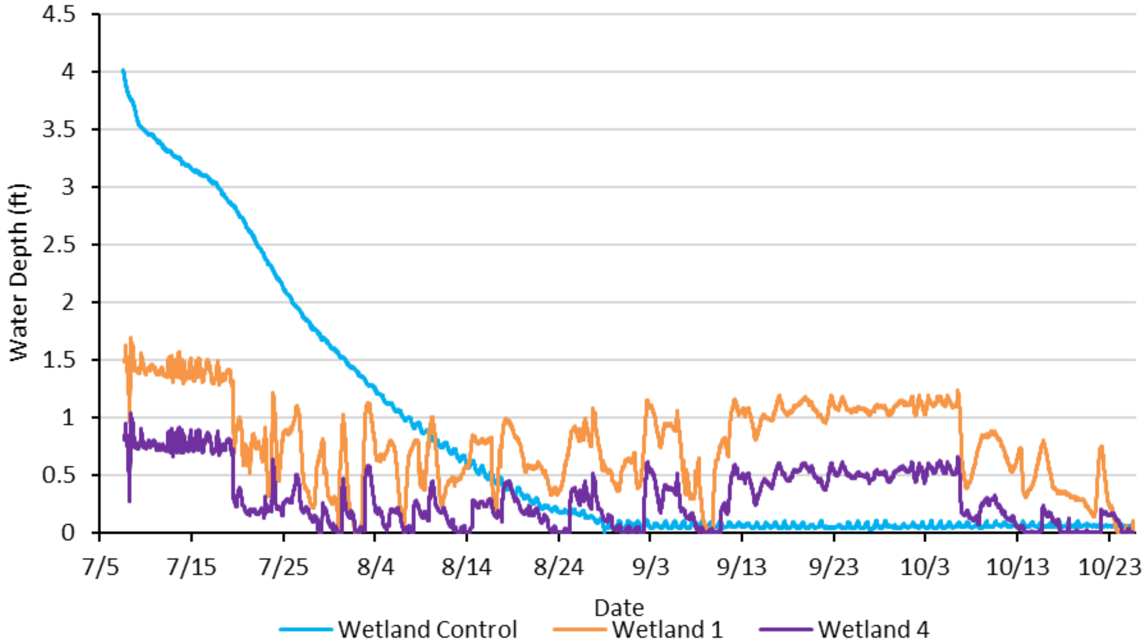
Results from the stage monitoring at the wetland sites are shown in **Figure 9-7** (2021 results) and **Figure 9-8** (2022 results). These figures graphically display the response or lack of response of each individual wetland site to changes in Project operations throughout each study season.

Figure 9-7. 2021 Water Depths at Monitored Wetlands, July 15 – September 14.



Source: NorthWestern 2022

Figure 9-8. 2022 Water Depths at Monitored Wetlands, July 7 – October 25.



Source: NorthWestern 2023

The results of the 2021 and 2022 Operations Study (NorthWestern 2022 and 2023) show that fluctuation of the reservoir at 2.5 feet has the potential to affect 11.33 acres (**Appendix B – Wetlands Assessment Report**) of wetlands with a direct surface water connection to the reservoir. Wetlands hydrologically connected to the reservoir *via* groundwater, do not appear to be affected by fluctuations in the water surface elevation of the reservoir (NorthWestern 2023). Therefore, proposed operations are not expected to have an effect on aquatic vegetation and AIS that inhabit these wetlands (~200.4 acres).

Wetlands with a surface water connection to the reservoir may be temporarily dewatered when the elevation of the reservoir is lowered but are restored when the reservoir is raised. Direct impacts to these types of wetlands are anticipated to be temporary in nature and may include loss of shallow aquatic habitat for fish, amphibians, birds, and other wildlife. This impact is anticipated to be short-term and intermittent and not result in any shift in aquatic or wildlife species use of the habitats.

Emergent vegetation at these sites is resilient and may not be affected as much as the submergent vegetation. Fluctuating water levels due to operations appear to change the submergent vegetation, eliminating some that historically existed in the 0- to 18-inch zone. (NorthWestern 2023).

Changes to riparian habitats were not observed as a result of fluctuating water levels during the Operations Study (NorthWestern 2022). Fluctuating water levels did not appear to impact riparian habitats, as riparian habitats have naturally adapted to fluctuating water levels. Long term changes to aquatic vegetation species composition and prevalence, including AIS, may occur under proposed operations, especially in areas that are frequently dewatered. Changes to aquatic vegetation species composition and prevalence may have a positive, negative, or neutral impact on other resource concerns and issues.

Under the proposed alternative, wetlands, and littoral zones would be impacted by 2.5-foot fluctuations in the reservoir. However, because these areas readily adapt to water level fluctuations, those impacts are similar to impacts of fluctuations of 1.5 feet, but both levels are less significant than reservoir fluctuations of 4 feet.

Deeper drawdowns under the proposed alternative will be required at the same frequency as under the no action alternative. As described in Exhibit E Section 9.3.1, during the deep drawdowns, some littoral habitat is dewatered, and wetlands may temporarily lose connectivity to the main river channel. However, these events are rare, resulting in temporary and infrequent impacts.

9.3.2.2 Impacts of Proposed Project Boundary Change

NorthWestern's proposed alternative includes changes to the Project boundary which will modify the acreage of wetlands in the Project boundary. The current Project boundary includes 10.98 acres of palustrine emergent wetland habitat. The proposed Project boundary contains 2.22 acres of palustrine emergent wetland habitat. The Project boundary modification will not change the form and function of these wetlands. The wetlands removed from the Project boundary will continue to be protected by applicable state and federal laws and regulations.

9.4 Unavoidable Adverse Impacts

Under the proposed alternative, dewatering impacts may occur at wetlands hydrologically similar to Wetlands 1 and 4. The extent of the impact will depend on the frequency and duration of flexible generation.

The impacts of deeper drawdowns will occur under the proposed alternative at the same frequency as under the no action alterative. During the deep drawdowns, some littoral habitat is dewatered, and wetlands may temporarily lose connectivity to the main river channel. However, these events are rare, resulting in temporary and infrequent impacts.

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10. Threatened, Endangered, Proposed, and Candidate Species

This Section provides an analysis of federally T&E species, and federally proposed and candidate (P&C) species, that are known to occur or have the potential to occur in the FERC Project area.

10.1 Affected Environment

10.1.1 Threatened and Endangered Species

A request was made on January 23, 2023, to FWS through the Environmental Conservation Online System (ECOS) – Information for Planning and Consultation (IPaC) system for a species list that identifies T&E and P&C species as well as proposed and final designated critical habitat. On January 17, 2023, the status of Whitebark pine (*Pinus albicaulis*) changed from candidate to threatened.[22] Effective January 2nd, 2024, the wolverine (*Gulo gulo*) will be listed as threatened.

The FWS T&E species list identified through ECOS-IPaC is provided in **Table 10-1**. A list of known biological opinions, status reports, or recovery plan(s) pertaining to the T&E species list is summarized in **Table 10-2**. The only designated critical habitat within the FERC Project boundary is for Bull Trout (*Salvelinus confluentus*).

Each T&E species is described briefly with focus on their potential presence, and the extent and location of any federally designated critical habitat, or other suitable habitat within the Project vicinity.

[22] https://ecos.fws.gov/ecp/species/R00E

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Table 10-1 List of T&E species identified by FWS ECOS-IPaC 2023.

Species	Fish, Plant, or Mammal	Scientific Name	FWS Status (Year)	Habitat	Occurrence Potential
Bull Trout	Fish	*Salvelinus confluentus*	Threatened (1998) Critical Habitat (2010)	Clear streams, rivers, and lakes west of the Continental Divide Cool, clear, connected, complex stream habitat.	Present
Grizzly Bear	Mammal	*Ursus arctos horribilis*	Threatened (1975)	Variable habitats including meadow, forest and riparian. Requires large tracts of wilderness.	Potential to occur as transients (no denning sites).
Canada Lynx	Mammal	*Lynx canadensis*	Threatened (2000)	Subalpine coniferous forests, with a deep winter snowpack, dense understory, and high density of snowshoe hares.	Unlikely
North American Wolverine	Mammal	*Gulo gulo luscus*	Threatened (2024)	Large tracts of essentially roadless /remote wilderness in high elevation alpine and subalpine terrain with strong association with persistent spring snow cover.	Unlikely
Yellow-billed Cuckoo	Bird	*Coccyzus americanus*	Threatened (2014)	Tall, dense, expansive cottonwood and willow riparian forest. Requires habitat patches at least 25 acres in size.	Unlikely
Spalding's Campion (Spalding's Catchfly)	Plant	*Silene spaldingii*	Threatened (2001)	Open, mesic grasslands in the valleys and foothills, in deep, loamy soils along northerly aspects.	Unlikely
Whitebark Pine	Plant	*Pinus albicaulis*	Threatened (2023)	Windy, cold, high-elevation or high-latitude environments. Subalpine and krummholz habitats (mostly mountain ranges).	Not Present

Source: FWS ECOS-IPaC 2023a, 2023b, 2023c, 2023d, 2023e, 2023f.

Table 10-2. List of the biological opinion, species status report(s), designation of critical habitat, or recovery plan(s) pertaining to each T&E species in Table 10-1.

Species	Document/Report Title	Type	Date
Bull Trout	Environmental Conservation Online System (ECOS) https://ecos.fws.gov/ecp/species/8212	Status Updates	Accessed January 2023
	FWS Bull Trout Recovery Planning https://www.fws.gov/species/bull-trout-salvelinus-confluentus	Status Updates	Accessed January 2023
	FWS. 2008. Biological Opinion for Thompson Falls Hydroelectric Project Bull Trout Consultation. FERC Docket No. 1869-048- Montana. https://northwesternenergy.com/docs/default-source/default-document-library/clean-energy/environmental-projects/thompson-falls/thompson_falls_biological_opinion_2008.pdf	Biological Opinion	2008
	FWS. 2015. Columbia Headwater Recovery Unit Implementation Plan for Bull Trout. FWS, Montana Ecological Services Office. https://ecos.fws.gov/docs/recovery_plan/Final_Columbia_Headwaters_RUIP_092915.pdf	Recovery Plan	2015
	Federal Register. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous U.S. Vol 75, No. 200, 63898-64070. https://www.govinfo.gov/content/pkg/FR-2010-10-18/pdf/2010-25028.pdf	Critical Habitat	2010
Grizzly Bear	ECOS https://ecos.fws.gov/ecp/species/7642	Status Updates	Accessed January 2023
	FWS. 2022. Species Status Assessment (SSA) for the Grizzly Bear (*Ursus arctos horribilis*) in the Lower-48 States. Version 1.2, January 22, 2022. Missoula, Montana. 369 pp. https://ecos.fws.gov/ServCat/DownloadFile/213247	Status Report	2022
	FWS. 2021.Grizzly Bear in the Lower-48 States (*Ursus arctos horribilis*) 5-year status review: summary and evaluation. March, 2021. Denver, Colorado. https://ecos.fws.gov/ServCat/DownloadFile/196991	Status Report	2021
Canada Lynx	ECOS https://ecos.fws.gov/ecp/species/3652	Status Updates	Accessed January 2023
	FWS. 2017. SSA for the Canada Lynx (*Lynx canadensis*) Contiguous U.S. Distinct Population Segment. Version 1.0, October, 2017. Lakewood, Colorado. https://ecos.fws.gov/ServCat/DownloadFile/213244	Status Report	2017
	U.S. 2000a. Recovery Outline Contiguous U.S. Distinct Population Sediment of the Canada Lynx. https://ecos.fws.gov/docs/recovery_plan/final%20draft%20Lynx%20Recovery%20Outline%209-05.pdf	Recovery Outline	2000
Yellow-billed Cuckoo	ECOS https://ecos.fws.gov/ecp/species/3911	Status Updates	Accessed January 2023

Species	Document/Report Title	Type	Date
	Federal Register. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo. Vol 86, No 75, 20798-21005. https://www.govinfo.gov/content/pkg/FR-2021-04-21/pdf/2021-07402.pdf#page=1	Critical Habitat	2021
Spalding's Catchfly	ECOS https://ecos.fws.gov/ecp/species/3681	Species Status	Accessed January 2023
	FWS. 2007. Recovery Plan for Silene spaldingii (Spalding's Catchfly). FWS, Portland, Oregon. xiii + 187 pages. https://ecos.fws.gov/docs/recovery_plan/071012.pdf	Recovery Plan	2007
Whitebark Pine	ECOS https://ecos.fws.gov/ecp/species/1748	Species Status	Accessed January 2023
	Federal Register. 2022a. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Whitebark Pine (*Pinus albicaulis*). Vol 87, 76882-76917. https://www.govinfo.gov/content/pkg/FR-2022-12-15/pdf/2022-27087.pdf#page=1	Species Status	2022
	FWS. 2021. SSA Report for the Whitebark Pine (*Pinus albicaulis*) version 1.3. 118 pp+appendices. Available: https://ecos.fws.gov/ServCat/DownloadFile/226045	Species Status	2021
American wolverine	FWS. 2023. North American wolverine receives federal protection (effective January 2, 2024) as a threatened species under the Endangered Species Act. The Service seeks public comment on an interim 4(d) Rule promoting measures tailored to the wolverine's conservation needs.	Status Update	2023
	FWS. 2023. SSA Addendum for North American Wolverine (*Gulo gulo luscus*). September 2023.	Species Status	2023
	ECOS https://ecos.fws.gov/ecp/species/5123	Status Updates	Accessed January 2023
	Federal Register. 2022b. Endangered and Threatened Wildlife and Plants; Request for New Information for the North American Wolverine SSA. Vol 87, No. 225, 71557-71559. https://www.govinfo.gov/content/pkg/FR-2022-11-23/pdf/2022-25433.pdf#page=1	Status Update	2022
	FWS. 2018. SSA report for the North American wolverine (*Gulo gulo luscus*). Version 1.2. March 2018. FWS, Mountain-Prairie Region, Lakewood, CO. https://ecos.fws.gov/ServCat/DownloadFile/187253]	Status Update	2018

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10.1.1.1 Bull Trout

10.1.1.1.1 Habitat and Distribution

In 1998, the Bull Trout was federally listed under the ESA as a threatened species (Federal Register 1998). Critical habitat was designated in 2005 and revised in 2010 (Federal Register 2005; 2010). In 2015, FWS developed a recovery plan for Bull Trout (FWS 2015). Bull Trout are present within the Clark Fork River drainage and are known to occur within the FERC Project boundary.

Critical habitat for Bull Trout has been defined as a habitat unit that can maintain and support viable Bull Trout core areas (Federal Register 2005). The designated critical habitat includes the Columbia Headwater Recovery Unit (CHRU). Within the CHRU there are 35 Bull Trout core areas that occur within four geographic regions including the Clark Fork River, Flathead Lake, Coeur d'Alene Lake, and Kootenai River (FWS 2015). The Lake Pend Oreille core area contains a total of 35 local Bull Trout populations.

Within the CHRU, FWS identified 32 Critical Habitat Units (CHUs), including the Clark Fork River Basin CHU. The Clark Fork River Basin CHU (Unit 31) includes 3,328 stream miles and 295,587 acres) of lakes and reservoirs as critical Bull Trout habitat (Federal Register 2010). The Clark Fork River Basin has 12 subunits including the Lower Clark Fork River Critical Habitat Subunit (CHSU) encompassing the Project, located in Sanders and Missoula counties covering 295 miles of stream and 9,719 acres of surface area as designated Bull Trout habitat (Federal Register 2010).

The Lower Clark Fork River CHSU (**Figure 10-1**) provides essential foraging, migration and overwintering habitat for several local Bull Trout populations and includes designated critical Bull Trout habitat (FWS 2009). The Project is located within this designated critical Bull Trout habitat. As part of the critical habitat designation, the Thompson Falls Reservoir is considered a stream reach and not a lake due to the lack of reservoir storage capacity (Federal Register 2010). Two tributaries near the Project including Prospect Creek, located immediately downstream of the Main Channel Dam, and the Thompson River, located about 6 miles upstream of the Main Channel Dam, are designated Bull Trout critical habitat. Designated critical habitat in the Lower Clark Fork River and Middle Clark Fork River, representing CHU Unit 31, is shown in Figure 10-1. **Table 10-3** identifies the Lower and Middle Clark Fork River reaches and respective local Bull Trout populations identified by FWS (2015).

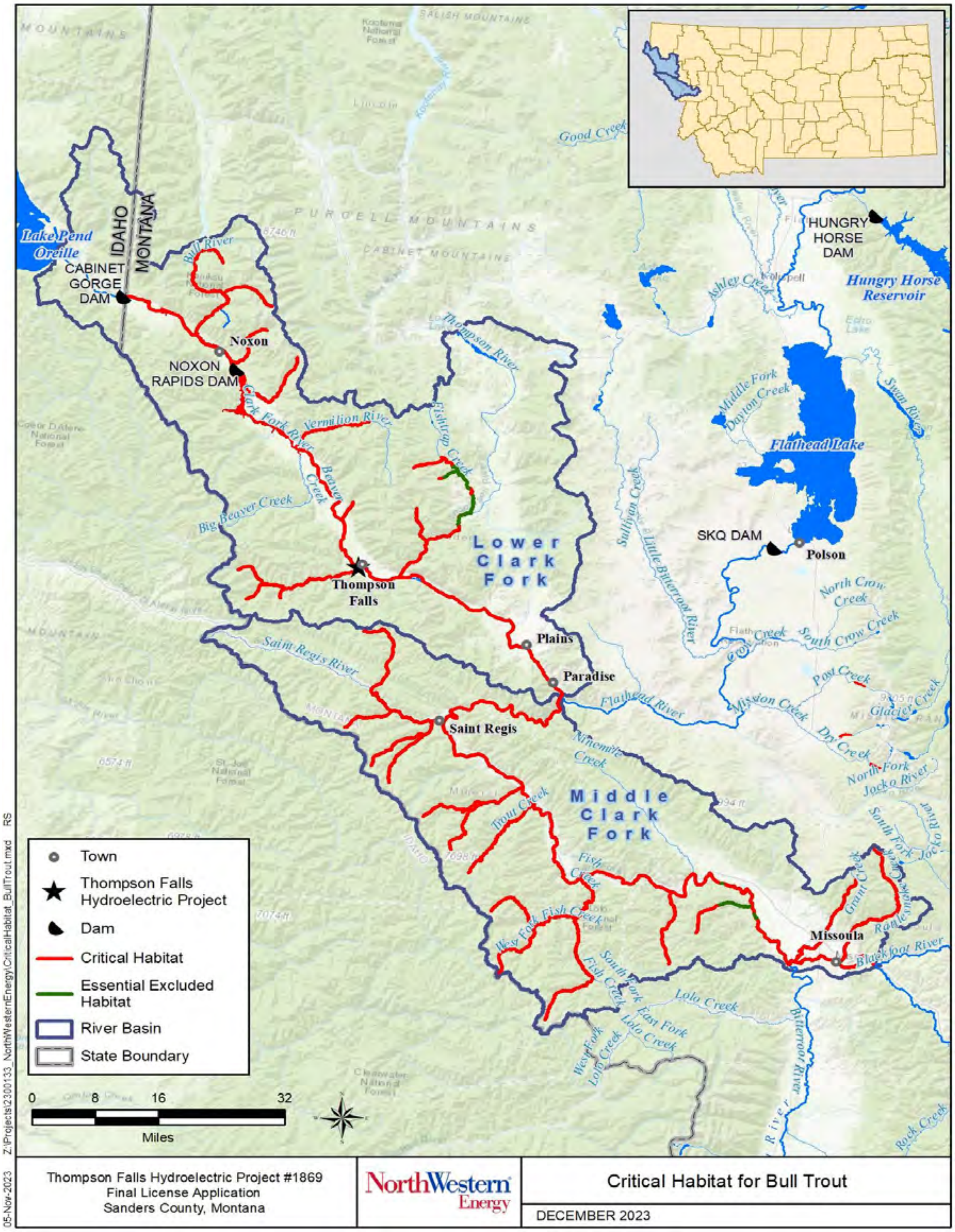
Since the upstream fish passage facility at the Project opened in 2011, between one and five Bull Trout have ascended the fish passage facility annually, except in 2018 when there were none (NorthWestern 2023a). During the 12 years of operation, 21 Bull Trout averaging 516 mm in length (range 320-620 mm) have ascended the fish passage facility. Approximately 70 percent of the Bull Trout ascending the fish passage facility were genetically assigned to the Thompson River drainage as their natal stream (specifically either Fishtrap Creek or West Fork Thompson River). Seven were subsequently detected in the Thompson River drainage via remote PIT tag array systems located in the mainstem and tributaries. These Bull Trout ascended the fish passage facility under various river conditions with flows ranging from 8,100 to 56,100 cfs (measured in the Clark Fork River upstream of the dam) and stream temperatures from 43.88 to 72.14°F.

Table 10-3. Bull Trout spawning and rearing tributaries to the Lower and Middle Clark Fork rivers and Lower Flathead River.

Upstream or Downstream of Project	River Reach Description	Bull Trout Spawning and Rearing Tributaries to the Clark Fork River/Flathead River (smaller tributaries)
Downstream	Noxon Rapids Dam upstream to Thompson Falls Dam	Swamp Creek, Vermilion River, Graves Creek, Prospect Creek
Upstream	Lower Clark Fork River – ends at the confluence with the lower Flathead River	Thompson River (West Fork Thompson River, Fishtrap Creek)
Upstream	Lower Flathead River	Jocko River (North Fork and South Fork), Mission Creek, Post Creek, Dry Creek
Upstream	Middle Clark Fork River – starts at the confluence with the lower Flathead River and ends at the confluence with the Blackfoot River	St. Regis River (Little Joe Creek, Ward Creek, Twelvemile Creek), Cedar Creek (Oregon Gulch), Fish Creek (North Fork, West Fork and South Fork, Cache Creek), Petty Creek, Albert Creek, Grant Creek, Rattlesnake Creek

Source: FWS 2015

Figure 10-1. Map of Bull Trout designated critical habitat (CHSU Unit 31) in the Lower Clark Fork River and Middle Clark Fork River in Montana[23].



Source: FWS 2010

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[23] Under section 4(b)(2) of the Endangered Species Act, Congress provided discretionary authority to the Secretary of the Interior to exclude any specific area from a critical habitat designation—Essential Excluded Habitat—if the benefits of such exclusion outweigh the benefits of designation, so long as the exclusion will not result in the extinction of the species.

10.1.1.1.2 Bull Trout Life History

Life history characteristics of Bull Trout have been reported by several authors (Pratt 1985 and 1996; Fraley and Shepard 1989; Brown 1992; Thomas 1992; McPhail and Baxter 1996; Nelson et al. 2002). In the Clark Fork River drainage, Bull Trout have three life history patterns: resident, fluvial, and adfluvial. Resident Bull Trout spend their entire lives in the same (or nearby) streams in which they were hatched. Resident Bull Trout adults and juveniles generally confine their migrations to their natal streams. In fluvial and adfluvial populations, the adults spawn in tributary streams where the young rear for 1 to 4 years (Fraley and Shepard 1989). The juvenile Bull Trout then migrate downstream to a larger body of water, either a lake (adfluvial fish) or a river (fluvial fish), where they grow to maturity.

It has been suggested that the ability for Bull Trout to express multiple life history forms is an adaptive mechanism to variable environmental conditions (Nelson et al. 2002). For example, adfluvial and fluvial migration movement to lakes and larger rivers may take advantage of more abundant food sources allowing for greater growth and fecundity (Gross 1987 cited in Nelson et al. 2002). The resident life history form may be an adaptation to the presence of migration barriers/restrictions or where growth opportunities in the headwaters are greater than the cost of migration (Nelson et al. 2002).

In the Lower Clark Fork River drainage, there appears to be a wide season, approximately between April and August, when adult Bull Trout leave Lake Pend Oreille to begin their upstream migrations to headwater streams to spawn (Normandeau Associates 2001). Bull trout records at the upstream fish passage facility indicate most Bull Trout are moving upstream between April and June with some additional Bull Trout detections in the fish passage facility between August and October (NorthWestern 2018). Mature adults spawn in headwater streams during the fall (September–October). However, the timing of movement into the tributaries may vary. Radio telemetry data indicate a relatively wide range of time during which Bull Trout move into spawning areas, between the middle of July and the middle of October (Lockard et al. 2002, 2003, 2004).

Adult Bull Trout leaving Lake Pend Oreille are captured downstream of Cabinet Gorge Dam and transported to their assumed natal waters (after being genetically tested and assigned to an upstream tributary) upstream of either Cabinet Gorge Dam (genetic assignment to Region 2), Noxon Rapids Dam (genetic assignment to Region 3), or to above Thompson Falls Dam (genetic assignment to Region 4).

Bull Trout have more specific habitat requirements compared to other salmonids, requiring clean, cold, complex, and connected habitat. Spawning grounds are generally low gradient (less than 2%) with a water depth range from 0.1 to 0.6 meter, stream velocity between 0.09 meter per second (m/s) and 0.61 m/s, comprised of gravel/cobble substrate with less than 35 to 40 percent of sediments smaller than 6.35 mm in diameter, and high gravel permeability (Montana Bull Trout Restoration Team (MBTRT) 2000). In the Lower Clark Fork River drainage spawning activity peaks in September (Katzman and Hintz 2003; Katzman 2003; Moran 2003) when stream temperatures are generally less than 46.4°F (McPhail and Baxter 1996; Pratt 1996). Sexually mature adult Bull Trout may spawn in multiple years, although they do not necessarily spawn in consecutive years (Downs et al. 2006).

Rearing habitat requirements for juvenile Bull Trout include cold summer water temperatures (less than 59°F) provided by sufficient surface and groundwater flows. Warmer temperatures are associated with lower Bull Trout densities and can increase the risk of invasion by other species that could displace, compete with, or prey on juvenile Bull Trout. Juvenile Bull Trout are generally benthic foragers, rarely stray from cover, and they prefer complex forms of cover. High sediment levels and embeddedness can result in decreased rearing densities. Unembedded cobble/rubble substrate is preferred for cover and feeding and provides invertebrate production. Highly variable streamflow, reduction in large woody debris, bedload movement, and other forms of channel instability can limit the distribution and abundance of juvenile Bull Trout. Habitat characteristics that are important for juvenile Bull Trout of migratory populations are also important for stream resident subadults and adults.

Both migratory and stream-resident Bull Trout move in response to developmental and seasonal habitat requirements. Migratory individuals can move great distances (up to 156 miles) among lakes, rivers, and tributary streams in response to spawning, rearing, and adult habitat needs (MBTRT 2000). Stream-resident Bull Trout migrate within tributary stream networks for spawning purposes, as well as in response to changes in seasonal habitat requirements and conditions. Open migratory corridors, both within and among tributary streams, larger rivers, and lake systems are critical for maintaining Bull Trout populations.

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 Dam, Noxon Rapids Dam, and Thompson Falls Dam. Today, Bull Trout passage in the Lower Clark Fork drainage is, in part, facilitated by Avista's trap and transport program and NorthWestern's upstream fish passage facility. There is no fish passage facility or trap system present at Noxon Rapids Dam.

As part of the Avista transport program, 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's downstream transport program does not include tributaries upstream of Thompson Falls Dam. Avista seasonally collects adult Bull Trout upstream of Lake Pend Oreille near the vicinity of Cabinet Gorge Dam[24]. 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. Fish transport upstream of Thompon Falls Dam, Region 4, began in 2007. Avista has transported an average 44 Bull Trout upstream of Cabinet

[24] Bull Trout have been collected for the transport program via trapping, electrofishing, and angling downstream of Cabinet Gorge Dam through 2022. A fish passage trap was built and commenced operation at Cabinet Gorge Dam in 2022.

Gorge Dam annually with about 16 percent (7 Bull Trout) transported to waterways upstream of Thompson Falls Dam. A portion of the adults captured at Cabinet Gorge Dam are fish that were previously transported downstream as juveniles. Avista's downstream transport program does not include tributaries upstream of Thompson Falls Dam.

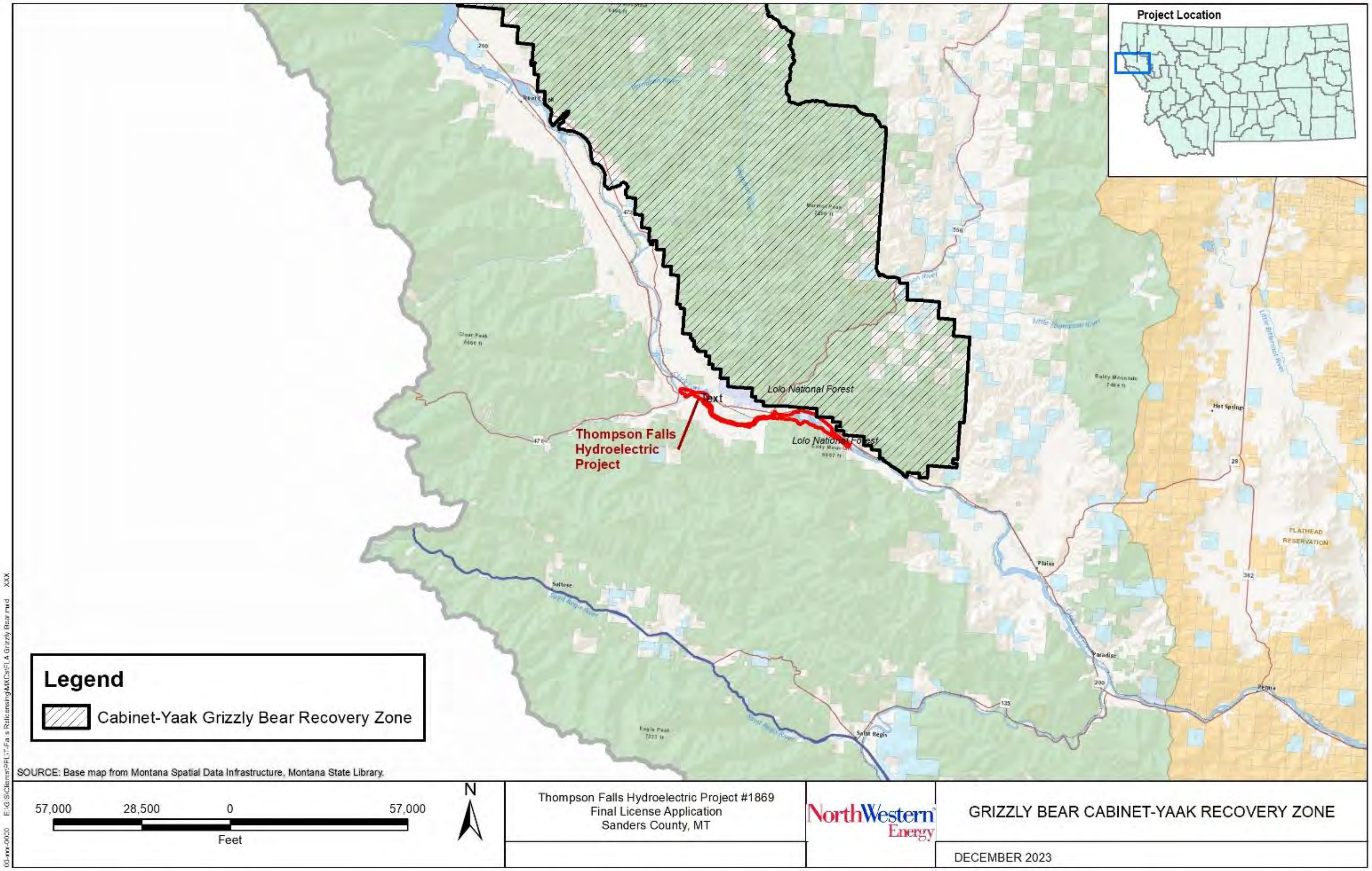
The Thompson River contains designated critical habitat for migratory (adfluvial/fluvial) and resident Bull Trout. Outmigrating juvenile Bull Trout from the Thompson River may pass downstream of Thompson Falls Dam and residualize in Noxon Rapids Reservoir. As adults, they can migrate upstream to their natal stream using the upstream 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 Rapids Dam, so Bull Trout that residualize in Cabinet Gorge Reservoir cannot return to tributaries upstream.

10.1.1.2 Grizzly Bear Habitat and Distribution

The grizzly bear was federally listed as a threatened species in 1975 in the conterminous 48 states, and the current distribution is limited to five areas in the western U.S. The Cabinet-Yaak Grizzly Bear recovery zone is about 6,800 square km of northwestern Montana and northern Idaho (**Figure 10-2**). The Project is nearby, but not within, the Cabinet-Yaak Grizzly Bear recovery zone. (Figure 10 2).

FWS estimated the 2016 grizzly population in the Cabinet-Yaak recovery zone to be approximately 55 individuals using mark-recapture techniques to estimate the population (Kasworm et al. 2017). Using all methods of detection (capture, rub tree deoxyribonucleic acid [DNA], corral DNA, photos), FWS identified a minimum of 35 individual grizzlies in the Cabinet-Yaak recovery zone in 2016. Thirteen of those bears were detected in the Cabinet Mountains (Kasworm et al. 2017). In 2020, the grizzly population in the Cabinet-Yak recovery zone was estimated to be 60 individuals (Kasworm et al. 2021). The recovery target population is 100 bears. The majority of sightings and habitat use appear to be more closed timber, timbered shrubfield areas in the Cabinet Mountains and less populated areas (Kasworm et al. 2007; 2017). Food habits for grizzlies in the Cabinet-Yaak recovery zone varies seasonally and includes, but is not limited to plants (grasses, shrubs, forbs), meat (deer, elk, moose), berries (huckleberry, whortleberry, serviceberry), and insects (Kasworm et al. 2017). Over the years, there have been confirmed grizzly bear sightings in the Thompson River drainage in 2014 (Kasworm et al. 2021), 2016 (B. Sterling, FWP, personal communication, April 5, 2018) and 2018 (Kasworm et al. 2021) and one in the Weeksville Creek drainage in 2018 (B. Sterling, FWP, personal communication, April 5, 2018). However, within the Project area no sightings have been documented in recent years.

Figure 10-2. Grizzly Bear Cabinet-Yaak Recovery Zone.



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10.1.1.3 Canada Lynx Habitat and Distribution

The contiguous U.S. distinct population segment of Canada lynx includes breeding populations in northwestern Montana/northern Idaho, north-central Washington, northeastern Minnesota, and Maine (FWS 2023b). The U.S. distinct population segment Canada lynx was federally listed as threatened species in 2000. Following the completion of the 5-year status review (FWS 2017), FWS announced on January 11, 2018, that Canada lynx may no longer warrant protection under the ESA and should be considered for delisting due to recovery (FWS 2018a).

Canada lynx are non-migratory, but movements of 27 to 137 miles have been recorded by lynx in northwestern Montana and northern Idaho (FWS 2017). Lynx occur in mesic coniferous forests that experience cold, snowy winters and provide a prey base of snowshoe hare (Ruediger et. al. 2000). Most of the lynx occurrences in the Northern Rocky Mountains are in the 4,920- to 6,560 -foot elevation range (FWS 2000a). The Project boundary does not contain elevations within that range.

Critical habitat was initially designated in 2006 with revisions in 2009 and 2014, generally covering the boreal forests of northwestern Montana and the area around the Greater Yellowstone Ecosystem (79 FR 35303). Designated Canada lynx critical habitat is located in Lincoln, Missoula, Flathead, Glacier, and Lewis and Clark counties, approximately 32 miles northeast of the Project (Federal Register 2014). No critical habitat was designated in Sanders County, where the Project is located.

Habitat types within the FERC Project boundary do not contain or represent suitable habitat for Canada lynx. Canada lynx are not anticipated to be present within the FERC Project boundary or proximity of the Project (B. Sterling, FWP, personal communication, April 5, 2018). Therefore, the Project will have no effect on Canada lynx.

10.1.1.4 North American Wolverine Habitat and Distribution

FWS announced its decision to list the distinct population segment of the North American Wolverine in the contiguous U.S. as threatened on November 29, 2023 (FWS 2023a), effective January 2, 2024. In September 2023, FWS updated the Species Status Assessment (SSA) for the species with an addendum that summarized new information collected and analyzed since the 2018 SSA (FWS 2023b). The 2023 SSA identified over 180 publications and hundreds of new wolverine observation records since the 2018 SSA. The 2023 SSA updated the risk assessment for wolverines in the western U.S. FWS has also issued an interim rule under the ESA section 4(d) regarding wolverine’s conservation needs available for comment until January 29, 2024 (FWS–R6–ES–2012–0107).

Wolverines require large territories in remote and/or inaccessible landscapes at elevations between 5,900 and 11,500 feet; access to a variety of food resources throughout the year as seasons vary; physical and/or structural features such as talus slopes, rugged terrain; and presence of persistent spring snow (FWS 2018b, 2023b). These requirements are strongly associated with reproductive behavior and survival (FWS 2023b). Wolverine habitat is isolated from human presence and development, associated with subalpine habitats with persistent spring snow cover (Aubrey et al. 2007; Copeland et al. 2007).

In the Northern Continental Divide Ecosystem, wolverine occupancy probability is highest in Montana, followed by Cascade Mountains of Washington and in Central Idaho (FWS 2018b). The highest predicted occupancy of wolverines in Montana in 2016-2017 were Glacier National Park and Bob Marshall Wilderness complex (Lukacs et al. 2020). However, the wolverine occupancy survey in Montana shows an overall decline in wolverine detections and spatial occupancy between 2016-2017 and 2021-2022 (FWS 2023b).

The wolverine is very territorial, and its home range may extend up to 500 square miles. Thus, the species lives in low densities at high elevations. It is estimated that populations are about 250 to 300 wolverines in the lower 48 states with the majority believed to inhabit Montana (FWS 2013, Castle 2023).

Wolverines depend on large wilderness areas of alpine tundra and boreal mountain forests, relying primarily on coniferous forests in the western mountains. Wolverines in northwestern Montana have been observed moving to higher, cooler elevations during the summer and selecting areas with steep terrain with tree cover, meadows, boulder, or talus fields. During the winter months, wolverines may move to lower elevations, but avoid low-elevation winter ranges occupied by predators or human activity (FWS 2018b). Individual dispersal movements can extend beyond 185 miles with seasonal habitat use. (MNHP and FWP 2019b). Denning habitat includes caves, rock crevices, crevices/opening under fallen trees, thickets, and or similar type of locations. Wolverines have been observed in the Thompson River drainage, and Weeksville Creek drainage, north of the Project area (B. Sterling, FWP, personal communication, April 5, 2018), but not within the Project area.

No suitable wolverine habitat is present in the Project area or close vicinity of the Project. If wolverines are present at all, they are, at most, rare and transient visitors to the Project area. Therefore, continued operation of the Project will have no effect on the North American wolverine.

10.1.1.5 Whitebark Pine Habitat and Distribution

Whitebark pine was federally listed as threatened on January 17, 2023 (FWS 2023f). Whitebark pine is located in the upper and subalpine ecosystems (5,900-9,300 feet). The Project is located below 3,000 feet and does not include upper or subalpine habitat. There is no suitable habitat for whitebark pine within the Project or immediate area and the species is not present. Therefore, the Project will have no effect on whitebark pine.

10.1.1.6 **Spalding's Campion (Spalding's Catchfly) Habitat and Distribution**

The Spalding's campion (also known as the Spalding's catchfly) was federally listed as threatened in 2001 (FWS 2001). The preferred habitat for this species is mesic (not extremely wet or dry)

Pacific bunchgrass prairie dominated by native perennial grasses such as Idaho and rough fescue at elevations between 1,500 to 5,100 feet (USDA 2011). The plant species is documented in Sanders County near the borders with Lake and Flathead counties. Based on MNHP's predicted suitable habitat model, the Project and general Lower Clark Fork River drainage is unlikely to provide suitable habitat for Spalding's campion (Burkholder 2017). Therefore, the Project will have no effect on Spalding's campion.

10.1.1.7 Yellow-billed Cuckoo Habitat and Distribution

The western distinct population segment of the yellow-billed cuckoo was federally listed as threatened west of the Continental Divide in Montana in 2014 (FWS 2014). In the west, yellow-billed cuckoo nest in tall cottonwood and willow riparian woodlands (MNHP and FWP 2019a). In Montana, the yellow-billed cuckoo is only known to occur in June and July (MNHP and FWP 2019a) and sightings are rare. The most recent sighting of the yellow-billed cuckoo bird in Montana was in the LNF near Missoula in 2012 (MNHP 2019). FWS proposed designated critical habitat for the yellow-billed cuckoo in 2014, but none is proposed within Montana (FWS 2014; Federal Register 2021). A review of available habitat in the Prospect Creek drainage, near the Project area, determined habitat of low suitability occurs along the lower end of Prospect Creek. However, based on a site visit conducted in June of 2018, there were no patches of dense riparian forest large enough to provide adequate breeding habitat (Nyquist 2018). There are no known nesting areas or sightings of the yellow-billed cuckoo near or within the FERC Project boundary and there is no known breeding identified in Montana (Federal Register 2021). Therefore, the Project will have no effect on yellow-billed cuckoo.

10.1.2 Proposed and Candidate Species

A request was made on January 23, 2023, to FWS through the ECOS – IPaC system for a species list that identifies P&C species. The FWS P&C species list identified through ECOS-IPaC is provided in **Table 10-4**. A list of known biological opinions, status reports, or recovery plan(s) pertaining to the P&C species list is summarized in **Table 10-5**.

Each P&C species is described briefly with focus on their potential presence, and the extent and location of any federally designated critical habitat, or other suitable habitat within the Project area.

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Table 10-4 List of P&C species identified by FWS ECOS-IPaC.

Species	Fish, Plant, or Mammal	Scientific Name	FWS Status (Year)	Habitat	Occurrence Potential
Monarch butterfly	Insect	*Danaus plexippus*	Candidate (2020)	Milkweed (primarily *Asclepias* spp.) for monarch butterflies (*Rhopalcera*) to lay their eggs and larval feeding. Diverse blooming nectar plants. Optimal temperatures 80.6-84.2°F	Unlikely

Source: FWS ECOS-IPaC 2023g, 2023h

Table 10-5. List of the biological opinion, species status report(s), designation of critical habitat, or recovery plan(s) pertaining to each P&C species in Table 10-4.

Species	Document/Report Title	Type	Date
Monarch Butterfly	ECOS https://ecos.fws.gov/ecp/species/9743	Status Updates	Accessed January 2023
	Federal Register. 2022c. 87 FR 26152 26178. 2022. Endangered and Threatened Wildlife and Plants; Review of Species That Are Candidates for Listing as Endangered or Threatened; Annual Notification of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. Vol. 87, No. 85, 26152-26178. Available: https://www.govinfo.gov/content/pkg/FR-2022-05-03/pdf/2022-09376.pdf#page=1	Status Update	2022
	U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form. 2021. Monarch butterly. *Danaus plexippus*. Available: https://ecos.fws.gov/docs/tess/publication/3726.pdf	Status Update	2021
	FWS. 2020a. Monarch (*Danaus plexippus*) SSA Report. V2.1 96 pp + appendices. Available https://ecos.fws.gov/ServCat/DownloadFile/191345	Status Update	2020
	FWS. 2020b. Biological Opinion and Conference Opinion on the U.S. Fish and Wildlife Service's approval of a Candidate Conservation Agreement with Assurances and Candidate Conservation Agreement and its issuance of an associated Endangered Species Act Section 10(a)(1)(A) Permit (TAILS No. 03E00000-2020-F-0001). Available: https://ecos.fws.gov/tails/pub/document/17795801	Biological Opinion	2020

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10.1.2.1 Monarch Butterfly Habitat and Distribution

The monarch butterfly is a candidate species (FWS ECOS 2023h) and is globally distributed throughout 90 countries, islands, and island groups representing 31 different populations (FWS 2020a). These butterflies are known for long-distance summer migration to the North American populations. There are two populations in North America, east and west of the Rocky Mountains (FWS 2020a). Western North America includes Canada, U.S. and Mexico and overwintering areas are primarily in groves of gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) along the coast of California and Baja California (FWS 2020a).

These butterflies migrate north between spring and fall and require blooming nectar plants for food during migration and breeding. The monarch butterfly requires milkweed plant species as a host plant for laying eggs and food source for the larvae. Monarch butterflies are also temperature sensitive with optimal temperature between 80.6° to 84.2°F and sublethal effects starting between 86° to 96.8°F (FWS 2020a). Temperatures exceeding 91.4°F are unsuitable for monarchs. Some of the key factors adversely impacting monarch butterflies in western North American include extreme widespread drought, disease, severe storm events, wildlife, widespread milkweed loss, and widespread insecticide spray events (FWS 2020a).

Historically, monarch butterflies have been documented in Sanders County (Kohler 1980). More recently, MNHP database for SOC indicate monarch butterfly occurrence has been verified only in Big Horn, Carbon, Carter, Custer, Missoula, Musselshell, Ravalli, and Rosebud counties in Montana (MNHP and FWP 2023a). Distribution of monarch butterflies and habitat type may occur in a variety of urban and rural habitat types that provide milkweed plants and other flowering forbs (FWS 2020a). Showy milkweed (*Asclepias speciosa*) is the primary milkweed species present west of the Rocky Mountains in Montana (MNHP and FWP 2023b). Showy milkweed is typically found in grasslands, meadows, fields, roadsides, marshes in plains and valleys (MNHP and FWP 2023b). MNHP records show observations of showy milkweed in the last 5 to 10 years in Sanders County, but density was low and the location east of the Project area (MNHP and FWP 2023b).

Based on available records, there are no known recent observations or sightings of monarch butterflies or host plant or breeding sites near or within the FERC Project boundary. Therefore, continued operation of the Project will have no effect on monarch butterfly.

10.2 Environmental Measures

10.2.1 Existing Environmental Measures

After Bull Trout were federally listed as a threatened species under the ESA in 1998, the Licensee prepared a 2003 Biological Evaluation that concluded the Project was likely adversely affecting Bull Trout. This determination led to a process to determine conservation measures to reduce "take." An interagency TAC was established and includes the Licensee, FWS, FWP, Avista, DEQ, USFS, and the CSKT.

From 2003 to 2008, the Licensee worked cooperatively with the TAC members to clarify regulatory issues and conduct significant scientific and engineering evaluations and in-situ testing. The objectives of the evaluations and testing were to determine factors affecting Bull Trout and other fish passage behavior, full height upstream fish passage design and construction, and subsequent upstream fish passage facility and Project operations.

On November 4, 2008, the FWS filed the BO with FERC, concluding that the Project adversely affects Bull Trout and that the Licensee's proposed conservation measures would reduce, but not eliminate, adverse impacts of the Project. The BO accepted the Licensee's proposal to construct a full-height pool and weir fish passage facility. On February 12, 2009, FERC approved construction and operation of the upstream fish passage facility. The Thompson Falls upstream fish passage facility was completed in 2010 and placed in operation in 2011. Priorities for upstream fish passage at Thompson Falls defined by the TAC are:

- Pass Bull Trout
- Pass native species
- Pass non-native salmonid sport fish, but not to the detriment to the first 2 objectives (e.g., if Brown Trout expansion extends into Bull Trout systems)
- Overarching goal is volitional passage

However, volitional passage through the upstream fish passage facility is not permitted by FWP and FWS due to the presence of Walleye downstream of Thompson Falls Dam and the absence of an established Walleye population upstream.

In 2008, a MOU (PPL Montana 2008) was established among the Licensee, the FWS, FWP, and CSKT (voting TAC members) which established the terms and conditions for collaborating on the implementation of Bull Trout conservation measures at the Project. The MOU also specifies how funding by the Licensee is allocated by the TAC annually for the purpose of downstream Bull Trout passage mitigation measures. The MOU, which was updated every 5 years, originally signed by each party in 2008 and renewed in 2013 and 2020, will expire on December 31, 2025.

Protection and mitigation measures implemented or funded by the Licensee in recent years related to the Bull Trout and its critical habitat are listed in **Table 10-6**. NorthWestern funded $1.6 M of TAC approved off-site mitigation and restoration between 2009 and 2022 (Table 10-6).

Table 10-6. Summary of Projects TAC approved for funding from the Licensee through the MOU that focuses on downstream Bull Trout passage mitigation measures, 2009-2023.

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
2009-2010	**Oregon Gulch Mine Restoration** – A tributary to Cedar Creek near Superior, MT flows into the Middle Clark Fork River. Fluvial Bull Trout documented to spawn in lower Oregon Gulch. Project objective is to restore about 2,000 feet of stream channel and 10 acres of adjacent floodplain and wetlands.	Trout Unlimited, FWP	$15,000 in 2009 $51,500 in 2010
2009 2010 2011 2012 2014 2016 2017 2018	**Bull Trout DNA Sampling, Clark Fork River** – Funds available for processing genetic samples taken of Bull Trout to improve genetic assignment database in the Lower Clark Fork River drainage.	Licensee	$5,000 in 2009 $5,000 in 2010 $5,000 in 2011 $5,000 in 2012 $10,000 in 2014 $10,000 in 2016 $16,500 in 2017 $10,000 in 2018
2009-2010	**Fish Creek Aquatic Passage Enhancement** – Fish Creek is a tributary to the Middle Clark Fork River and supports a fluvial Bull Trout population. Project objective is to restore unimpeded aquatic passage at 3 sites within the Fish Creek drainage.	Trout Unlimited, FWP, Nature Conservancy	$24,000 in 2009 $37,770 in 2010
2010	**Big Rock Creek Road Rehabilitation** – A tributary to the Thompson River which flows into the Lower Clark Fork River about 6 miles upstream of the Project and supports a resident population of Westslope Cutthroat Trout and Bull Trout. Project focused on providing stability and habitat to a meander bend that washed out a portion of the road, and to scarify and heavily revegetate the remnant road. Stabilizing the area will reduce sediment inputs and provide cover for fish and improve riparian area and channel form and function.	FWP	$6,000
2012	**Large Woody Debris (LWD) Placement in South and West Fork Fish Creek** – Project will place 21 structures of LWD in 5 reaches. DNRC donated trees and assistance.	Trout Unlimited	$20,000
2012	**Thompson River Drainage Evaluation Plan** – Produce a Bull Trout Recovery and Restoration Plan for the Thompson River drainage. Evaluate water temperatures in the drainage during the summer.	Licensee	$39,475
2012 2014	**Main Stem Fish Creek Land Acquisition** – Hulme Property – Funding used for the purchase of 2 private inholdings (80- and 148-acre parcels) along the lower main stem of Fish Creek to conserve vital Bull Trout habitat, provides a key migratory corridor and sub-adult rearing area for fluvial Bull Trout. FWP will own and include property in the Fish Creek Wildlife Management Area. Properties contain about 40 acres of riparian land and over 4,000 feet of Fish Creek channel.	Five Valleys Lands Trust and FWP	$115,300 in 2012 $120,000 in 2014

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
2013 2014 2015 2016	**Juvenile Bull Trout Outmigration of the Thompson River and into and through Thompson Falls Reservoir** (Montana State University Study) – Characterize movement of juvenile Bull Trout in the Thompson River and through Thompson Falls. The objective was to calculate travel time, describe travel rout, describe habitat use, and estimate survival. Glaid (2017) prepared a Master's Thesis summarizing results. A technical memo summarizing information is also available https://www.northwesternenergy.com/docs/default-source/default-document-library/clean-energy/environmental-projects/thompson-falls/thompson_falls_master_thesis_subadult_bull_trout_out-migration_072017.pdf	Montana State University, FWP	$37,932 in 2013 $50,405 in 2014 $50,966 in 2015 $24,669 in 2016
2013	**Update Jocko River Drainage Bull Trout Genetics** – Update the Jocko River drainage baseline for the Bull Trout genetics assignment database. Jocko River is a 4th order tributary to the Flathead River. Portions of the drainage are designated as critical habitat for Bull Trout, and collectively these areas comprise the Jocko River Core Area.	CSKT	$5,280
2014	**Thompson River Fish Surveys** – Survey streams in Thompson River for Bull Trout presence; fish surveys in Murr Creek, Mudd Creek, Alder Creek.	FWP	$29,933
2014	**Strategic Prioritization of Native Trout Restoration Actions in the Lower Clark Fork Using Spatially Explicit Decision Support Modeling** – Providing support for development of model.	FWS	$6,704
2014	**Bull Trout Sex Identification Marker** – Support funding for rapid response analysis. Abernathy Fish Technology Center has acquired the Bull Trout sex identification marker and is planning on incorporating this marker into their normal rapid response Bull Trout analysis.	Avista	$2,000
2014	**Prospect Creek Remote PIT Tag Reader** (Half Duplex [HDX] tags) – A tributary to the Lower Clark Fork River, located about 0.5 mile downstream of the Main Channel Dam at Thompson Falls. The goal is to install HDX PIT tag antenna arrays in the Prospect Creek drainage to monitor movements of PIT tagged adult and juvenile Bull Trout that migrate through the drainage. Avista installed a temporary HDX PIT Tag array in lower Prospect Creek. It was operational through mid-May (2014) when the upper and lower antenna broke. The array was reinstalled in August 27 and operational for the remainder of 2014 season.	Avista	$2,507
2015	**Update Little Joe Creek Bull Trout Genetics** – Update baseline data for Bull Trout in Little Joe Creek to accomplish routine updates to the lower Clark Fork genetic assignment database. The database is used to ensure correct assignment and transport of lower Clark Fork adult Bull Trout to their geographic basin of origin.	FWP	$3,000

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
2015	**West Fork Fish Creek Land Acquisition** – Rehbein Property – This parcel contains approximately 60 acres of riparian area and more than 10,000 feet of perennial stream channel (Bull Trout critical habitat), including West Fork Fish Creek, lower Bear Creek and lower Trail Creek (Middle Clark Fork River drainage). The West Fork Fish represents the migratory corridor for the 2 major Bull Trout spawning and rearing areas in Fish Creek (upper North and West Forks) and the 2 smaller tributaries that support viable Westslope Cutthroat Trout populations. The project would permanently protect a significant reach of the West Fork of Fish Creek and the lower portions of 2 tributaries from habitat degradation and facilitate enhancement activities along the stream corridor important to Bull Trout and Westslope Cutthroat Trout.	FWP	$40,000
2016	**Cedar Creek Road Relocation and LWD Enhancement Phase 2** – Cedar Creek flows northeast from the Idaho/Montana state line for approximately 20 miles before flowing into the Middle Clark Fork River. Cedar Creek is listed as a Priority Bull Trout Watershed by the USFS and was designated as core Bull Trout habitat by the Montana Bull Trout Scientific Group. Phase II includes rerouting a 0.18 section of road away from Cedar Creek and installing LWD in that section of stream to connect with work completed in 2015. This reroute section would be 1 of the largest within the Project area and further reduce sediment and provide for properly functioning channel and floodplain processes. Approximately 5-10 LWD structures would be augmented within this area to provide habitat, promote stream meandering and substrate sorting.	Trout Unlimited USFS	$30,000
2016	**Beartrap Fork Culvert Removal** (implemented in 2018) – Beartrap Fork is a large tributary to Radio Creek which flows into Fishtrap Creek in the Thompson River drainage. West Fork Fishtrap is an important for Bull Trout and Westslope Cutthroat providing spawning and rearing habitat. The cool water inputs from Beartrap Creek illustrate the importance to Fishtrap mainstem and the potential for Beartrap to at least provide thermal refuge to Bull Trout. The culvert on Beartrap Fork was identified as a partial fish barrier at higher flows, and possibly at low summer/fall flows. The project will remove the culvert and reconstruct the stream channel providing 5 miles of upstream access.	USFS	$11,000
2016	**Rattlesnake Creek Fish Screen Phase 1** – Rattlesnake Creek flows for 26 miles, beginning in the Rattlesnake Wilderness north of Missoula, Montana and ending at its confluence with the Middle Clark Fork River. Rattlesnake Creek is 1 of the major sources of trout recruitment for the middle Clark Fork River, a 100-mile reach of river located between Missoula and the Flathead River confluence. It supports a significant population of migratory Bull Trout and is 1 of only 6 major tributaries in the area known to support fluvial spawning. The creek also supports populations of native Westslope Cutthroat Trout, Mountain Whitefish and Sculpin, as well as Rainbow Trout, Brown Trout, and Brook Trout.	Trout Unlimited FWP	$13,125

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
	The project will include survey and design on the 4 irrigation diversions that do not currently have functional fish screens.		
2016, 2017, 2018, 2019	**Thompson River Coordinator** – Funding for the Thompson River watershed coordinator, whom works for the Lower Clark Fork Watershed Group a 501(c)(3) non-profit that works to facilitate collaborative restoration in the tributaries of the Lower Clark Fork River for the benefit of water quality, native fish and wildlife. The coordinator will work with partners in the Thompson River area to identify possible habitat improvement projects and opportunities through which NorthWestern could continue its efforts to recover native fish populations. Additionally, the Coordinator would work to secure grant funding sources and work with additional partners/landowners in the drainages in order to assist with large-scale projects.	FWP	$16,500 in 2016 $10,000 in 2017 $16,500 in 2018 $9,900 in 2019
2018	**Lower Fish Creek Property Acquisition** – Koch In-holding - Among FWP's purposes for purchasing the land (78 acres) is the objective to enhance fish and wildlife species and prevent this habitat from potentially being subdivided for development. More specifically, to "…protect some of the last and best remaining habitat for Bull Trout and Westslope Cutthroat Trout in the Clark Fork region by securing 1.2 miles of stream frontage and riparian habitat along Fish Creek."	FWP	$60,000
2018, 2019	**Crow Creek Design Phase 1 and Phase 2** – Crow Creek is a tributary to Prospect Creek which enters into the Lower Clark Fork River in the upper Noxon Reservoir (downstream of Thompson Falls Dam). Project is focused on design and implementation of channel restoration to improve channel pattern and profile, sinuosity, habitat diversity and complexity for native species such as Bull Trout, Westslope Cutthroat, and Cedar Sculpin.	FWP	$30,000 in 2018 $51,500 in 2019
2018, 2019	**Rattlesnake Dam Removal, Phase 1 and Rattlesnake Dam Removal** – Since that time the Dam has served no water storage or delivery purpose (and is no longer even viable as a back-up municipal system) but has continued to impact fish migrations and river processes (e.g., floodplain connections, sediment transport). The project will restore habitat for native fish (e.g., Bull Trout, Westslope Cutthroat Trout) and terrestrial wildlife, improving water quality in Rattlesnake Creek, improving riparian function and floodplain connectivity. Phase 1 – design. Phase 2 – project permitting, final design, and bid development.	Trout Unlimited	$20,000 in 2018 $50,000 in 2019
2018	**Prospect Remote PIT Tag Array System** – Installation of a remote PIT tag array near the mouth of Prospect to monitor PIT-tagged fish in the system. Array system will provide directionality and function year-round.	Avista, Licensee	$30,000

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
2018-2022	**Misc. Funding** – Funds available for processing genetic samples taken of Bull Trout to improve genetic assignment database in the Lower Clark Fork River drainage. Allows for immediate funding of equipment, stream restoration assessments or other conditions that may require urgent attention.	Licensee	$10,000 in 2018 $10,000 in 2019 $10,000 in 2020 $15,000 in 2021 $10,000 in 2022
2019	**West Fork Fishtrap Creek Road Realignment** – Fishtrap Creek and tributaries provide important Bull Trout habitat for spawning and rearing. The project has the following objectives: 1) Build new connector road between existing roads #7609 and #516 perpendicular to Fishtrap Creek. 2) Decommission approximately 600 feet of existing road #7609 parallel to mainstem Fishtrap Creek. 3) Reconstruct floodplain and stabilize newly constructed streambank and floodplain with large woody debris placement and woody vegetation.	USFS, Lower Clark Fork Watershed Group	$30,627
2020	**Fishtrap Creek Habitat Enhancement** – Through the implementation of the Fishtrap Creek Habitat Enhancement project in 2020, the amount of in-stream large wood was doubled throughout a 4,000-foot-long wood-limited reach upstream of 1 of the primary Bull Trout spawning reaches in the Thompson River drainage. Relatively low densities of Westslope Cutthroat Trout and Bull Trout have been documented in this project reach. Through habitat enhancement, increasing in-stream habitat complexity and diversity, this project aims to increase the carrying capacity of this reach for native trout. 30 log structures were built, consisting of over 100 pieces of large wood.	Trout Unlimited, Lower Clark Fork Watershed Group	$16,000
2020	**Thompson River Property Acquisition** – FWP acquired 40-acre property in September 2020 that is located on either side of the Thompson River. The property protects land from development near the confluence of the Thompson River. The property will become a designated parking area (Confluentus Corner) with walking access only to the river. FWP endeavors to maintain the rugged and undeveloped character of this area to limit traffic in the area and conserve the natural setting for aquatic and terrestrial resources.	FWP	$100,000
2021	**Big Rock Creek Barrier Design and Public Scoping** – Big Rock Creek is 1 of 3 drainages and the upper most tributary occupied by resident Bull Trout in the Thompson River watershed. The stream enters the Thompson River 32.6 river miles (RM) upstream of its confluence with the Clark Fork River, where Brown Trout represent over 95% of the trout community in this section of the mainstem. Sampling in the lower portions of Big Rock Creek at RM 1.3 in 2010 and 2013 (and in 2019 near RM 0.5) portray a fish community comprised of similar numbers of Westslope Cutthroat Trout and Brown Trout, with 1 Bull Trout encountered in 2010. Further upstream in the drainage the fish community is	FWP	$34,000

Year	Project Name - Project Description	Project Submitted By	Funding Approved by TAC
	dominated by Bull Trout and Westslope Cutthroat Trout, with an occasional Brown Trout occurring. Project funds feasibility assessment of developing a barrier, hydraulic and geologic investigations, design costs, fish survey and genetics, and Environmental Assessment.		
2022 2023	**Phase 1 – Thompson River Conservation Easement** **Phase 2 – Thompson River Conservation Easement** This project seeks to acquire a perpetual conservation easement on 48,032 acres of currently unprotected private timber company land owned by Green Diamond Resource Company in the Thompson River watershed in Sanders and Flathead counties. The proposed project would protect approximately 12,000 acres in Fishtrap Creek and Big Rock Creek drainages and 2 sections in the Deerhorn Creek drainage. The funds requested would serve as a portion of the non-federal match needed for the proposed Upper Thompson Connectivity project. The preliminary cost of this conservation easement is $16 million.	Trust for Public Land and FWP	$170,000 $100,000
2022	**Juvenile Bull Trout Downstream Study** – The intent of this project is to evaluate the feasibility of collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille. This project will 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. A long-term goal will be to evaluate adult returns from this work to help determine if this is a viable conservation action to increase populations in the drainage.	FWP, FWS, NorthWestern	$15,000
2023	**Thompson River Road Consolidation Coordination** – Funds to support staff to initiate a review of the issues and stakeholder concerns with consolidating the dual road system in the lower Thompson River drainage.	Trout Unlimited, Lower Clark Fork Watershed Group	$5,000

10.2.2 Proposed Environmental Measures

NorthWestern is proposing to implement the PM&E measures described below.

- The Licensee will develop a Fisheries and Aquatic Resources PM&E Plan for purposes of reducing adverse effects on Bull Trout and other native fish species caused by the operation of the Project. The Plan will provide for the continuation of the adaptive management principles set forth in the January 15, 2008 MOU among the Licensee, FWS, FWP and the CSKT, including the TAC. The Plan will add the USFS as a voting member of the TAC and will include, at a minimum, the following measures:
    - Improvements to upstream passage for native species, specifically:
        - Over the first 5 years of implementation, the Fisheries and Aquatic Resources PM&E Plan will involve deployment of up to 8 submersible PIT antenna within logistical and safe conditions below the Main Channel Dam to evaluate finer scale fish movements in the near field of the fish passage facility.
        - At the end of the first 5-year period, the Licensee will prepare a summary report discussing results of the 5-year study period. The summary report will be prepared in consultation with the TAC and filed with FERC.
        - The Licensee shall prepare an Upstream Passage Improvement Plan for the second 5-year period based on the results of the first 5-years. The Upstream Passage Improvement Plan will include further evaluations to improve capture efficiencies of the upstream fish passage facility, any proposed operational changes, and a plan and schedule to complete any facility modifications proposed by the Licensee in consultation with the TAC determined necessary to improve upstream passage efficiency. The Upstream Passage Improvement Plan will be prepared in consultation with the TAC and filed with FERC for approval.
    - Improvements to downstream passage of Bull Trout at the Project.

The Licensee shall prepare the Fisheries and Aquatic Resources PM&E Plan in consultation with the FWS, USFS, FWP, and CSKT, and will file the plan for approval by the Commission within 1 year of the issuance of the new License.

- The Licensee shall continue to operate and maintain the upstream fish passage facility in accordance with TAC guidance. The following measures for operation will include:
    - Seasonally operate the fish passage facility from ~March – October.
    - Spring closures when total river discharge is within 48,000-65,000 cfs, as approved by the TAC.
    - Adequate staff to operate and maintain the fish passage facility.

  - An engineered solution to provide adequate flow to the upstream fish passage facility at all water surface elevations down to 2.5 feet below full pool. This work will be completed prior to NorthWestern's implementation of flexible generation between 2.0 to 2.5 feet below full pool during periods when the fish passage facility is operating.
  - Compile data collected at the fish passage facility into NorthWestern's database following quality control and quality assurance review.
  - An annual report summarizing upstream passage activities and results to be provided to the TAC for review.
- For the first 5 years of the New License term, the Licensee shall implement fisheries population monitoring in the Thompson Falls Reservoir and Clark Fork River as specified below. These measures may be extended beyond the first 5 years of the New License term as agreed by the TAC.
  - Fall gillnetting annually in Thompson Falls Reservoir.
  - One spring electrofishing section in the lower reservoir from Wild Goose Landing upstream along HWY 200 to the pump house in even years (2026, 2028).
  - Fall electrofishing sections on even years (2026, 2028) immediately above islands and 1 downstream of Paradise.
- The Licensee will generally maintain minimum flow releases at the dam of 6,000 cfs or inflow whichever is less. These releases may be temporarily modified if required by operating emergencies beyond the Licensee's control and for short periods on mutual agreement between the Licensee, FWS, DEQ, and FWP.

In addition, NorthWestern is proposing measures to benefit other resource areas which will also be of benefit to Bull Trout. Specifically:

- The Licensee shall implement the Thompson Falls Water Quality Monitoring Plan (Appendix C), which was developed in consultation with DEQ.
- Within 1 year of the issuance of the new license, the Licensee will update the 2010 TDG Control Plan in consultation with the DEQ to incorporate data that have been collected during the recently completed relicensing studies. At a minimum the updated TDG Control Plan shall include the following:
  - A requirement to monitor TDG at the project for 3 consecutive years to validate the updated TDG Control Plan.
  - A monitoring and reporting schedule in years where the most probable (50 percent) April 1 NRCS runoff forecast for the USGS Clark Fork River near Plains MT stream gage (12389000) is at or above 125%.

Following consultation with DEQ, the Licensee will submit the updated TDG Control Plan to FERC for approval. The Licensee will implement the updated TDG Control Plan upon FERC's approval.

- The Licensee will implement annual noxious weed control measures, as appropriate, in high-use areas on Project lands owned by the Licensee.
- Within 2 years of the new License, the Licensee, will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The Plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, SHPO and USFS.

10.3 Environmental Effects

The analysis of potential effects is limited to operations, as no new construction or development is proposed under the new license.

10.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E – Section 2.2.4 – Proposed Environmental Measures** would not be implemented, including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes. A no effect determination has been made for the following species and are not addressed further: grizzly bear, Canada lynx, wolverine, whitebark pine, Spalding's campion, and yellow-billed cuckoo.

10.3.1.1 Bull Trout

Under the no action alternative, operation of the upstream fish passage facility would continue as it does presently. Bull Trout would continue to be captured during the seasonal March – October timeframe and capture efficiencies would remain the same.

Occasional use of the top 4 feet of the reservoir for flexible generation options, would have impacts to the upstream fish passage facility. As reported in the ISR, Operations Study when the reservoir elevation was 2.3 feet down (2,394.2 feet) the fish passage facility began to have operating issues. The HVJ slowed down as there was reduced water being fed to this feature. The fish sampling loop was inoperable due to the lack of water to fill the fish lift and anesthetizing tank. Pumps were shut off as they were drained, and the entire fish passage facility lacked sufficient flow and water to effectively capture fish. Without an engineered solution, these impacts would reduce the amount of time under the no action alternative in which the upstream fish passage facility would be operable during the season and could decrease total numbers of Bull Trout passed upstream at the facility.

For Bull Trout there would be little to no impacts from reservoir elevation changes. The Initial and Updated Study Report Operations Study showed that no stranding of Bull Trout or other salmonids occurred in the 2 years of operations studies. As indicated in the Operations Study ISR, access for Bull Trout into and out of Cherry Creek and Thompson River remains at all reservoir elevations. There are no flow or depth barriers to fish movement from the no action alternative.

Under the no action alternative downstream fish passage survival would remain unchanged. Previous literature review efforts in 2007 (*Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* [GEI 2007]) and the 2022 Updated Literature Review Study Report indicate relatively high survival estimates at the Project with 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm was estimated to likely be 91 to 94 percent. PIT tagging and floy tagging efforts have also documented downstream survival of adults through or over the facility (NorthWestern 2019).

In addition, downstream fish passage mitigation dollars ($100,000 annually) to improve Bull Trout survival would continue to be allocated focused on tributaries. Actions such as habitat restoration, streamside property acquisitions or easements would be sought after by NorthWestern Energy and agency and nonprofit partners. Although these actions are focused for Bull Trout improvements, other species such as Westslope Cutthroat Trout, which coexist in these same tributaries would also see benefits from these activities.

The no action alternative would have no effect on TDG levels or associated GBT in Bull Trout located downstream of the facility. The current TDG control plan and gate sequencing would remain in operation. Previous investigations have found little GBT symptoms at any discharges in adult fish. Furthermore, salmonids captured at the upstream fish passage facility have not exhibited signs or symptoms of GBT during the 13 years of operation.

In general, the Project would continue to release a minimum flow of 6,000 cfs, which is sufficient for Bull Trout passage into the Project area. There are no known impacts to Bull Trout identified as related to minimum flows. The bypass channel provides a wetted channel sufficient for upstream fish passage. Bull Trout would continue to have access to the fish passage facility. The Prospect

Creek confluence would remain connected to the mainstem Clark Fork River and accessible to Bull Trout.

10.3.2 Applicant's Proposed Alternative

10.3.2.1 Bull Trout

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations. NorthWestern does not propose additional construction or rehabilitation of the Project.

The applicant's proposed alternative includes a modification to Project operations that allow for reservoir fluctuations of 2.5 feet. The fish passage facility operates as designed until the reservoir is roughly 2.3 feet below normal operating level thus operation at 2.5 feet could impact the operation of the fish passage facility and passage of Bull Trout. Implementation of PM&E measures, however, will ensure continued operation of the fish passage facility, resulting in no additional impact to Bull Trout. Additionally, NorthWestern proposes to evaluate and assess opportunities to enhance the effectiveness of the existing upstream fish passage facility.

The applicant's proposed alternative includes a modification of the Project boundary which would have no impact on Bull Trout.

10.4 Unavoidable Adverse Impacts

Based on the results of the Fish Behavior Study (NorthWestern 2023b) upstream fish passage for Bull Trout is limited to those fish that locate and ascend the fish passage facility. Similarly, continued operations will result in minimal fish passage mortality from passage through turbines and over the dam during spill. Stranding of Bull Trout is not anticipated to occur under either alternative.

Unavoidable and adverse impacts are the same under both the no action and the applicants proposed alternative. Under the current license, these unavoidable adverse impacts are mitigated through implementation of the reasonable and prudent measures, and terms and conditions of the existing BO. Similarly, measures are anticipated to be developed and improved upon as part of this licensing process and ESA consultation to mitigate these impacts.

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11. Recreation

11.1 Affected Environment

The Project is located in western Montana, in a region with abundant outdoor recreation opportunities, including Glacier and Yellowstone National Parks. The LNF covers over 2 million acres of western Montana, with about 103.78 acres of federal lands within the current FERC Project boundary. The KNF borders the LNF and is located downstream of the Project. The KNF covers about 2.2 million acres of the northwestern section of Montana bordering Canada. There are no KNF lands in the FERC Project boundary. Other nationally important recreation areas in the region, within a 200-mile-radius, include the Cabinet Wilderness, Great Bear Wilderness, Bob Marshall Wilderness, Mission Mountain Wilderness, and the Scapegoat Wilderness. The National Bison Range is approximately 60 miles east of Thompson Falls.

This section provides an analysis of developed and dispersed recreation resources open to the public and opportunities within the Project Area, including areas within 0.5 mile of the FERC Project boundary. These sites support water-based activities such as fishing, motor boating, use of personal motorized watercraft, non-motorized canoes, kayaks, and similar vessels, along with floating and swimming. These sites also offer terrestrial-based activities including day hiking, running, and picnicking, as well as passive activities such as photography, wildlife viewing, and sight-seeing.

11.1.1 Existing Recreation Facilities Near the Project Area

The April 30, 1990, FERC order amending the license contains specific recreation-related direction to the Licensee. Article 404 approved a Licensee plan for recreation development of Island Park. Article 405 required the Licensee to construct a parking area, restrooms, garbage facilities, and interpretive signs on the south shore of the Clark Fork River. Article 406 required monitoring of recreational use of the Project area. Article 407 required the installation of a boat ramp and floating dock at Wild Goose Landing Park, improvements to the Flat Iron Ridge Fishing Access Site boat launch downstream of the Project, and installation of signs around Project shorelines warning visitors of potentially fluctuating water levels.

Article 404 was subsequently amended by FERC on May 21, 1993, to allow the Licensee to file a revised report on recreation resources detailing the Licensee's proposal for recreation development of Island Park. On March 24, 1994, the Licensee filed a revised report on recreation resources in compliance with the requirements of amended Article 404. On September 14, 1994, FERC approved the Licensee's revised recreation report.

The FERC-approved recreation report called for developments on Island Park to emphasize the natural setting, with foot trails and bicycle paths on the island, and eliminate motorized travel. The recreation report also provided that the Licensee contribute $20,000 towards the rehabilitation of the Historic High Bridge, owned by Sanders County.

Following is a description of recreation sites that exist within or adjacent to the Project boundary, are on NorthWestern-owned property, or where maintenance of the site is funded by NorthWestern (**Table 11-1, Figure 11-1**).

Table 11-1: Recreation areas in the vicinity of the Project.

Recreation Area	Property Ownership and Managing Entity	Current Project or non-Project site?	Inside Current FERC Project Boundary?	Site Amenities
Power Park	Located on NorthWestern and City of Thompson Falls (City) property. Managed by NorthWestern.	Non-Project site	No	Community park with benches, tables, group use pavilion with running water, toilets, informational and interpretive signage, and parking.
Island Park	Located on NorthWestern property. Managed by NorthWestern.	Project site	Yes	Day use site between Main Channel Dam and Dry Channel Dam. Non-motorized access with adjacent parking areas, interpretation, picnic tables, benches, trails, fish passage viewing, garbage facilities, and vault toilets.
Wild Goose Landing Park	Located on NorthWestern and City property. Managed by City under management agreement with NorthWestern.	Project site	Partially	Community park with boat launch and dock, swimming dock, toilets, informational signs, parking, garbage facilities, and picnic facilities.
South Shore Dispersed Recreation Area	Located on NorthWestern property. Managed by NorthWestern.	Project site	Partially	Day use shoreline access area with dispersed parking and informational signs. Vault toilet and garbage facilities are nearby at the South Shore Parking Area.
Cherry Creek Boat Launch Site	Located on Sanders County property. Managed by Sanders County.	Non-Project site	Partially	Day use boat launch site with picnic facilities and vault toilet.
Powerhouse Loop Trail	Located on NorthWestern and other private property, and within Highway 200 right-of-way. Managed in cooperation with Thompson Falls Community Trails Group.	Non-Project site	Partially	Non-motorized trail with benches, vault toilet, and adjacent parking.
Sandy Beach (dispersed)	Dispersed beach area located on NorthWestern property adjacent to	Non-Project site	No	Undeveloped beach area along the Powerhouse Loop Trail below the tailrace.

Recreation Area	Property Ownership and Managing Entity	Current Project or non-Project site?	Inside Current FERC Project Boundary?	Site Amenities
	Powerhouse Loop Trail below the tailrace and generating facilities.			
North Shore Boat Restraint	Located on NorthWestern property. Managed by NorthWestern.	Non-Project site	Partially	Undeveloped shoreline above the Main Channel Dam with benches, picnic tables, a small dock, and parking.
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.	Non-Project site	Partially	Undeveloped shoreline area along the northeast shoreline of the main reservoir, popular for dispersed shoreline fishing.

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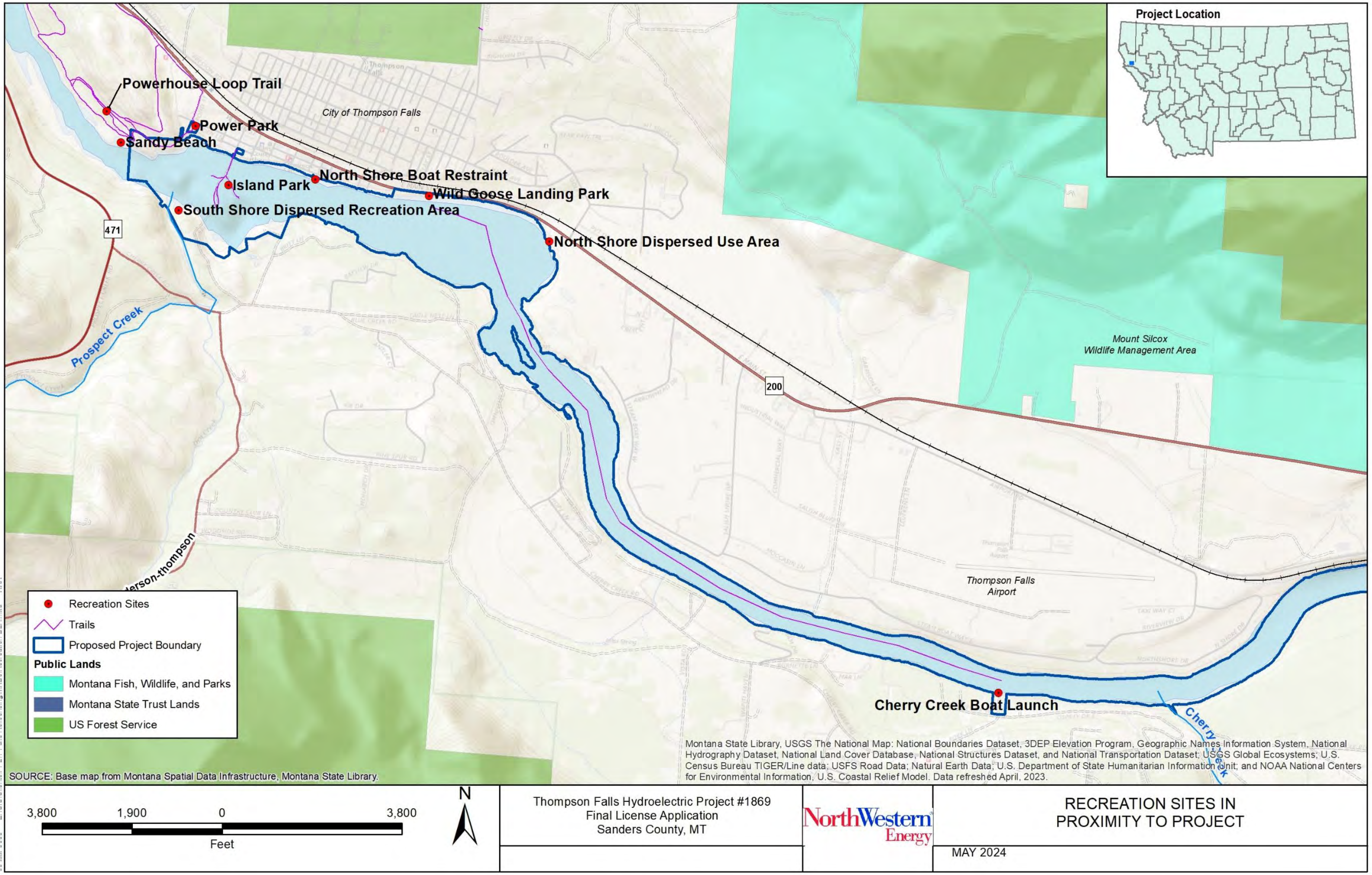
Figure 11-1: Map of recreation areas within or adjacent to the Project Area.



Note: Existing Project boundary extends 6 miles upstream from the upper edge of this map.

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11.1.1.1 Power Park

Power Park is a non-Project site which is located on property owned by NorthWestern and the City and operated and maintained by NorthWestern. Power Park is an ADA-accessible neighborhood park along the north shoreline just above the original powerhouse. Power Park offers multiple picnic tables, benches, mature shade trees, parking for 10 vehicles, an information sign related to the hydroelectric generating capacity of the Project, as well as views of Project facilities and an information kiosk which directs visitors to public recreation opportunities in and near the city of Thompson Falls (City). A long-standing group use pavilion was destroyed by fire in late 2021 and NorthWestern completed rebuilding that facility in summer 2023. The group-use pavilion offers a sheltered area with a plumbed sink with countertops and electrical plug-ins, a plumbed restroom facility, a drinking water station, trash service and a pet waste station. In addition, 13 new shade trees were planted at Power Park in the fall of 2022. The park serves as a parking area for visitors wishing to access the Powerhouse Loop Trail by following sidewalks within the park to trail segments linked by the Powerhouse access road. The park is a popular venue for numerous outdoor events each year (**Figure 11-2** and **Photographs 11-1**).

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Figure 11-2: Aerial Image of Power Park with Proposed Project Boundary.

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Photographs 11-1: Power Park information kiosk (top); bench overlooking Project facilities along sidewalk at edge of park (middle left); restroom and drinking fountain (middle right); and group-use pavilion (bottom).

11.1.1.2 Island Park

Island Park, a Project recreation site, is located largely on NorthWestern-owned property with a small portion owned by the City of Thompson Falls at the north shore abutment of the Gallatin Street Bridge (**Figure 11-3**). Island Park is operated and maintained by NorthWestern and offers trail-based recreation with views of the waterway and Project facilities. To better accommodate public access to the island from the north shoreline, the Licensee purchased three undeveloped City lots 100 feet from the Gallatin Street Bridge and developed them to provide a public parking area (the North Shore Parking Area). Designated ADA parking is available directly adjacent to the bridge, within the City's right-of-way for Gallatin Street. The North Shore Parking Area accommodates 17 vehicles, and the Gallatin Street Bridge provides walk-in access to the island.

Benches, picnic tables, and an ADA-accessible restroom are provided along trails on the island. The upstream fish passage facility public viewing platform, constructed in 2012 on the eastern edge of the island, offers views of the Main Channel Dam and the fish passage facility. Interpretive information regarding operation of the fish passage facility and fish species of interest is located at the viewing platform. Interpretation throughout Island Park includes historical information related to building of the Thompson Falls Project, the Prospect Plant, and other geographically and culturally significant topics.

The Historic High Bridge links Island Park to the south shore and completes the non-motorized throughway from homes along the south shore, across the island, and into the downtown area of Thompson Falls on the north shore. Originally constructed in 1911 to support construction of the Thompson Falls Project, the bridge was the primary route across the Clark Fork River at Thompson Falls until 1928, when a new bridge was built over the river at Birdland Bay. The Historic High Bridge linked the Cherry Creek area to Thompson Falls until the early 1970s when it was closed to vehicular use due to deterioration of the decking. It was then closed to all use beginning in 1979. Sanders County facilitated reconstruction of the Historic High Bridge and opened it for non-motorized use in 2010. The county owns, operates, and maintains the non-Project bridge. Designated parking for four vehicles, including one ADA parking spot, and an ADA-accessible restroom are provided on NorthWestern property at the South Shore Parking Area (adjacent to the south end of the Historic High Bridge) to provide walk-in access to Island Park from the south shoreline **(Figure 11-3**; **Photographs 11-2)**.

Figure 11-3: Aerial image of Island Park with Proposed Project Boundary.

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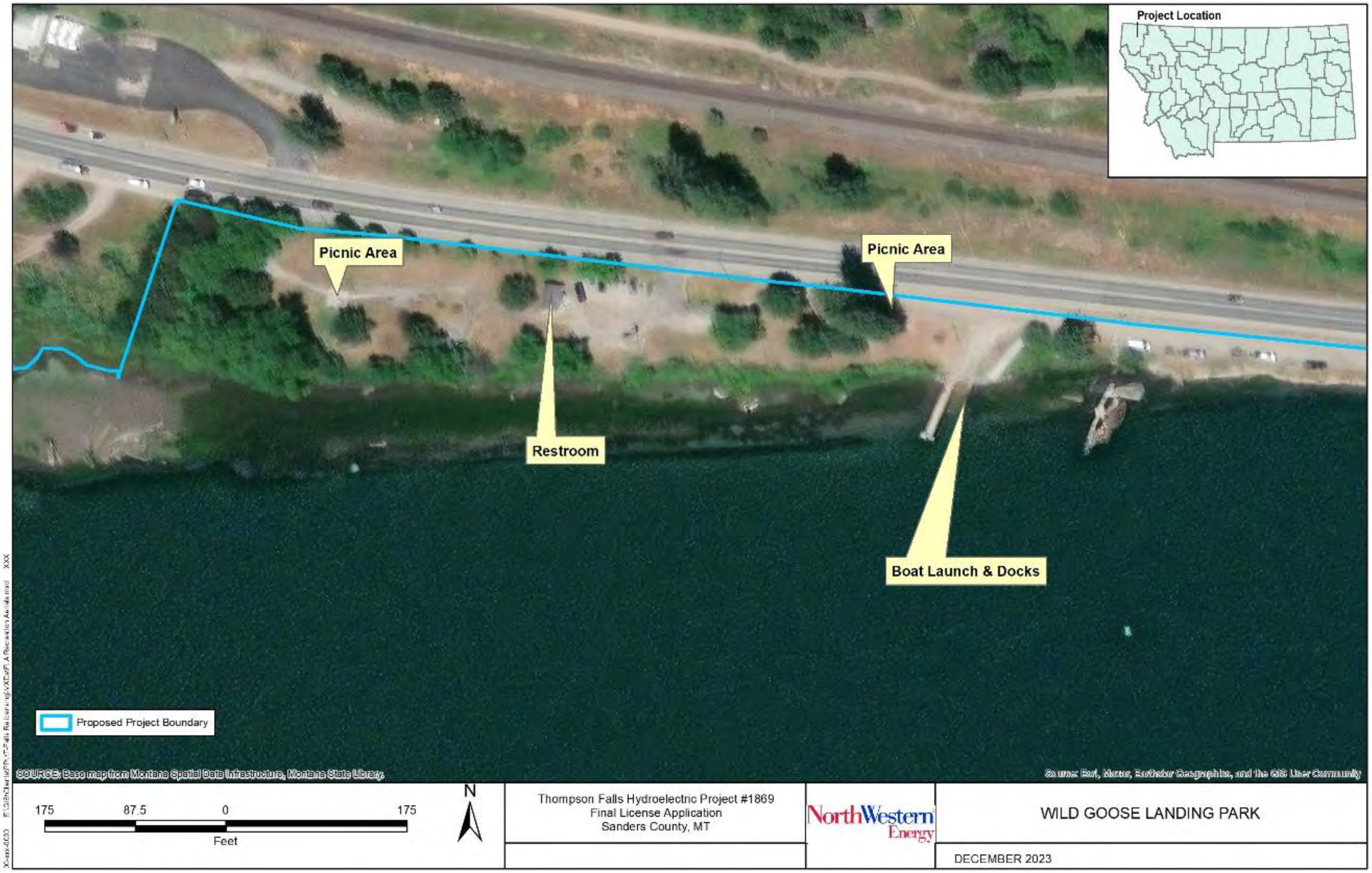
Photographs 11-2: **Internal trails at Island Park (top photos), visitors on the fish passage facility viewing platform (middle left); interpretive panels at overlook above Main Channel Dam (middle right), North Shore Parking Area (bottom left) and South Shore Parking Area (bottom right).**

11.1.1.3 Wild Goose Landing Park

Wild Goose Landing Park is a Project recreation site managed by the City of Thompson Falls with support from NorthWestern. The eastern portion of Wild Goose Landing Park is located on property owned by NorthWestern and the western portion is on property owned by the City. The park provides open space, picnic facilities, a plumbed restroom, a boat launch and stationary dock, a floating swim dock, and shoreline fishing. Designated parking adjacent to the restroom facility accommodates 10 vehicles, including one ADA-designated parking space, while about 10 more vehicles may park along the access road adjacent to the boat launch (**Figure 11-4** and **Photographs 11-3**).

NorthWestern partnered with the Sanders County Community Development Corporation in 2018 to improve the approach to the launch dock, add a boat bumper to the stationary dock, install fold-down cleats for boat mooring, and add an information kiosk and signage.

Figure 11-4: Aerial Image of Wild Goose Landing Park with Proposed Project Boundary.



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Photographs 11-3: Wild Goose Landing boat launch and dock (top left); picnic area near boat launch (top right); park picnic area (bottom left); restroom facility (bottom right).

11.1.1.4 South Shore Dispersed Recreation Area

The South Shore Dispersed Recreation Area, a Project recreation site, is located on NorthWestern-owned property and operated and maintained by NorthWestern. It encompasses the south shoreline of the river upstream and downstream of the Historic High Bridge. Large rock outcrops line the upstream shoreline, while the downstream shoreline offers wooded day use areas for picnicking or relaxing, as well as shoreline areas along the rocky banks and gravel bars near the mouth of Prospect Creek. The area is popular for fishing near the mouth of Prospect Creek and in the Clark Fork River. The area accommodates dispersed parking and has signage related to fluctuating water levels as required by Article 407 of the Project license. A vault latrine is located nearby at the South Shore Parking Area (**Figure 11-5** and **Photographs 11-4**).

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Figure 11-5: Aerial Image of the South Shore Dispersed Recreation Area with Proposed Project Boundary.

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Photographs 11-4: South Shore Dispersed Recreation Area (top left); fishing along the Clark Fork River shoreline (right); dispersed parking (bottom left).

11.1.1.5 Cherry Creek Boat Launch

About 4 miles upstream of the Main Channel Dam, the Cherry Creek Boat Launch Site is a non-Project recreation site located on property owned, operated, and maintained by Sanders County. The parcel is a designated public park related to the neighboring subdivision, and the site is primarily intended to serve the neighboring landowners. The site provides public access for launching small watercraft on the south shoreline. Picnic facilities, parking for about six vehicles, and a restroom are provided at the site (**Figure 11-6** and **Photographs 11-5**). Cherry Creek Boat Launch is also the beginning of a water trail with a take-out at Wild Goose Landing Park on the north shoreline.

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Figure 11-6: Aerial image of the Cherry Creek Boat Launch Site with Proposed Project Boundary.

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Photographs 11-5: Cherry Creek Boat Launch Site restroom and picnic areas (left); boat ramp and launch dock (right).

11.1.1.6 Powerhouse Loop Trail and Sandy Beach

The Powerhouse Loop Trail and Sandy Beach are non-Project recreation sites. The Powerhouse Loop Trail is managed by the Thompson Falls Community Trails Group (Trails Group) and is located primarily outside of the Project boundary. Portions of the trail are on NorthWestern property, as well as property owned by Avista and other public and private entities. A section of the trail is also within the Highway 200 right-of-way.

The 2.3-mile trail begins at Power Park and follows the powerhouse access road to a trailhead area near the powerhouse gate. From there, it continues to an area near privately-owned Rimrock Lodge adjacent to the Highway 200 bridge. The trail then loops up through Rimrock Lodge property, following Highway 200 east to Pond Street where it then links back to Power Park via Pond Street.

Connecting trail segments from the Powerhouse Loop Trail offer a low-water route along the shoreline of the upstream portion of the trail and a high-water route atop a tall embankment.

The Powerhouse Loop Trail links to the Thompson Falls State Park via the State Park Trail, a segment located mostly on Avista property along the shoreline of Avista's Noxon Rapids Reservoir.

Sandy Beach is a swimming hole that is accessed by the low-water route of the Powerhouse Loop Trail. The non-Project swimming hole is nestled behind a large rock outcrop and gravel bar, providing for a deep pool adjacent to a sandy shoreline. The small beach comfortably accommodates a few people, but typically not more than one or two recreation groups at a time. (**Figure 11-7** and **Photographs 11-6**).

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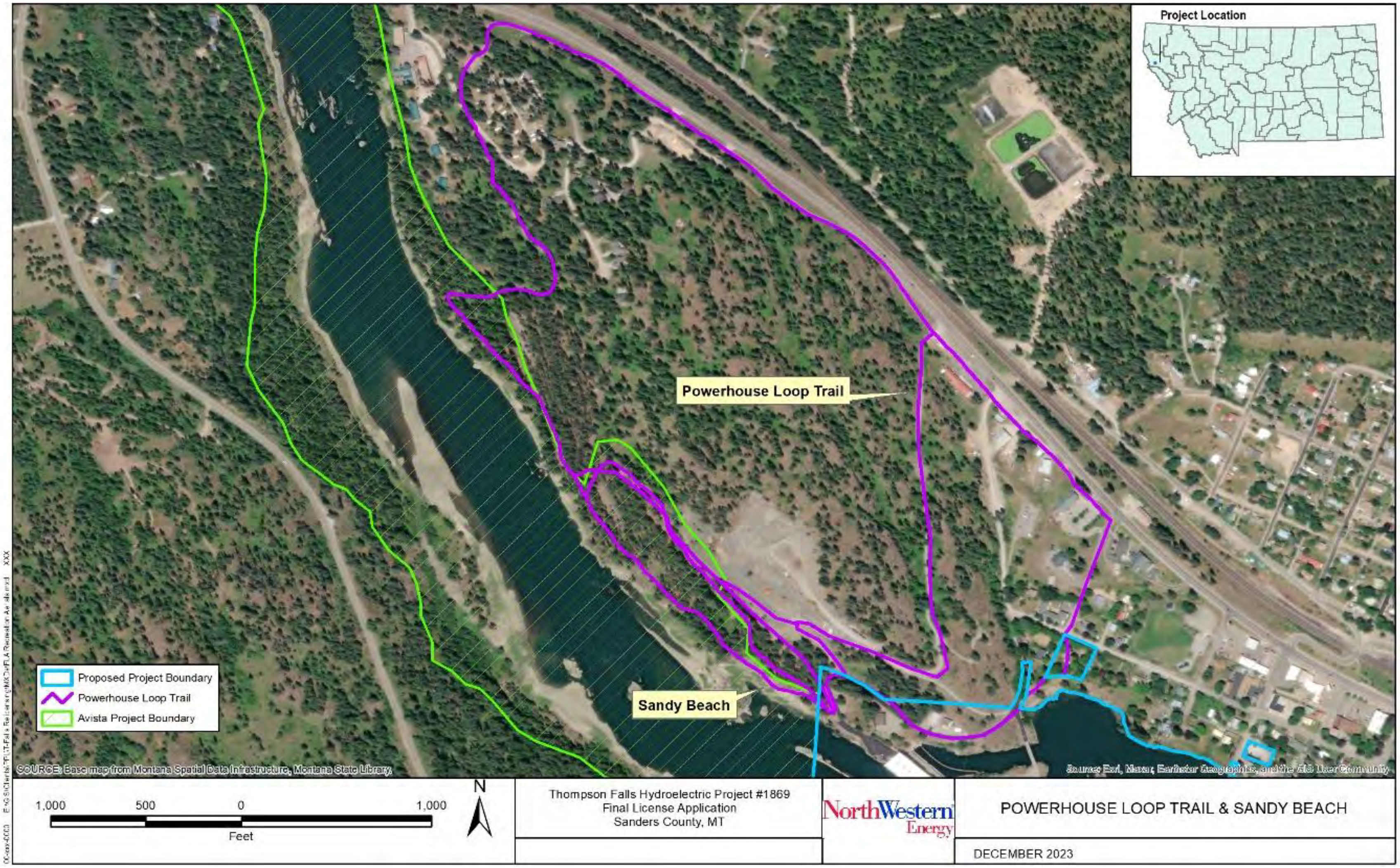
Figure 11-7: Aerial image of Powerhouse Loop Trail and Sandy Beach with the Proposed Project Boundary and Avista's Project Boundary.



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Photographs 11-6: Trailhead area (top left); restroom (top middle); bench at overlook (top right); junction of high water and low water trails (bottom left); Sandy Beach (bottom right).

11.1.1.7 North Shore Boat Restraint

The North Shore Boat Restraint site is a non-Project site located in part on lands owned by NorthWestern (near the boat restraint for the Project), and in part on lands owned by the City. The site is managed by NorthWestern and includes benches, picnic tables, an open grassy area for viewing the waterway and Project facilities, parking, and a small dock (**Figure 11-8** and **Photographs 11-7**).

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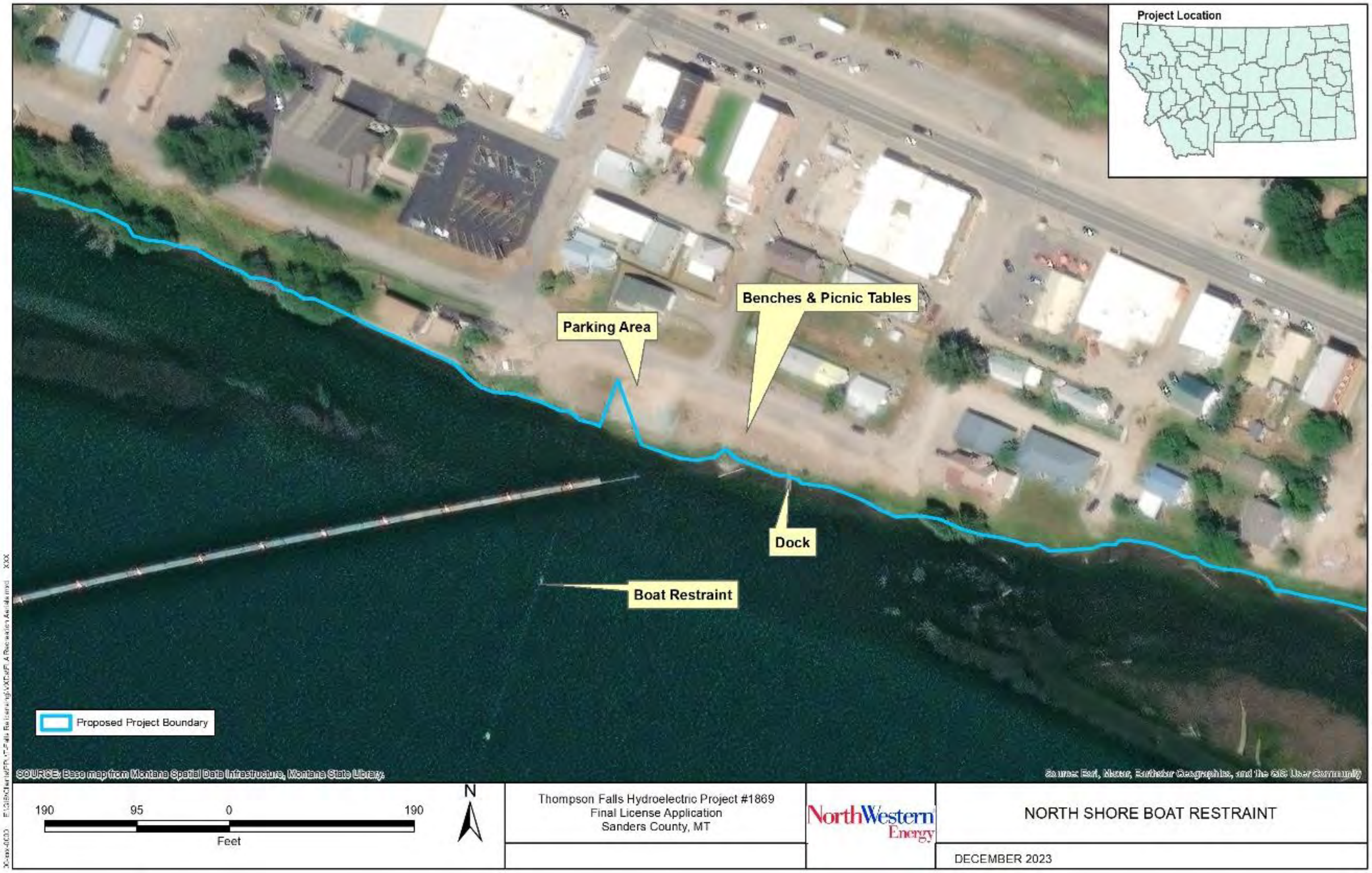
Figure 11-8: Aerial image of North Shore boat restraint with the Proposed Project Boundary.



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Photographs 11-7: Upstream view of boat restraint area.

11.1.1.8 North Shore Dispersed Use Area

The North Shore Dispersed Use Area is a non-Project recreation site. Dispersed fishing occurs on the north and northeast shorelines of the reservoir upstream of Wild Goose Landing Park and adjacent to Highway 200 and the former sawmill site. There are no facilities, improvements, or direct management of the area, which is a mix of ownership and easements by Montana Department of Transportation and private entities (NorthWestern, Burlington Northern and Santa Fe Railway [BNSF] Railway, and former sawmill operators) (**Figure 11-9** and **Photographs 11-8**). NorthWestern does not manage or maintain this area.

Figure 11-9: Aerial image of North Shore dispersed use area with the Proposed Project Boundary.

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Photographs 11-8: North shoreline along Highway 200 (top row); northeast shoreline adjacent to former sawmill site (bottom row).

11.1.2 Visitor Monitoring

Recreation visitor monitoring has been conducted for the Thompson Falls Project pursuant to Article 406 of the 1990 amendment. Following issuance of the amended license, the Licensee conducted peak-season (Memorial Day–Labor Day weekends) surveys of visitors to recreation sites in 1993, 2003, 2008, 2014, 2018, and most recently in 2021. The primary goal of the visitor survey is to understand use of recreation sites and identify any issues related to public recreation access. Specifically, the surveys examined visitor and trip characteristics related to previous site use, length of visit, group size, recreation activity participation, motivations to visit, opinions about the adequacy of recreation facilities, any problems encountered, and visitor demographics. Another dimension of visitor monitoring includes examination of the volume of visitor use at recreation sites using automated technologies that allow for monitoring vehicle access or pedestrian access to recreation sites. When coupled with visitor and trip characteristics gathered by the recreation visitor survey, this information provides a more complete picture of recreation site use. The 2021 Thompson Falls Recreation Visitor Survey concluded that visitors are highly satisfied with the facilities and opportunities available.

11.1.2.1 Recreation Visitor Survey Results and Site Use Monitoring

The 2021 Recreation Visitor Survey was conducted at both Project and non-Project recreation sites and public access sites within or adjacent to the Project boundary during the peak recreation season (Memorial Day–Labor Day weekends). More than three-fourths of all visitors to recreation sites were from Montana (78%) and more than one-third (36%) were from Thompson Falls (NorthWestern 2022). Visitors from Washington and Idaho comprised 16 percent of all visitors (10% and 6%, respectively). Most (60%) were repeat visitors, while 40 percent were first time visitors.

Overall, 85 percent of all visitors in 2021 indicated they were very or extremely satisfied with the site they were using. Additionally, feelings of crowdedness were low, with 96 percent indicating they felt not at all or not very crowded. Being outdoors and enjoying nature were primary motivations for visits, and visitors reported experiencing no problems of any kind during their visit.

Over time, while visitor and trip characteristics and visitor satisfaction have remained relatively consistent, visitors' desire for changes to recreation facilities or management declined from 43 percent in 2008 to 26 percent in 2014, 15 percent in 2018, and 1 percent in 2021. This decline is largely due to the numerous upgrades made to recreation sites and expansion of recreation opportunities in the Thompson Falls Project Area since 2008. Upgrades have largely consisted of additional amenities such as trails, benches, and picnic tables, as well as more toilet facilities and designated parking areas.

A few visitors suggested improvements during the 2021 recreation visitor survey. Generally, improvements pertained to a request for additional picnic tables, picnic facilities, and restrooms.

The volume of use at five recreation sites was monitored during the peak recreation season of 2021 using automatic traffic and trail counters. These sites were Island Park, Wild Goose Landing Park, and the South Shore Dispersed Use Area, all Project recreation sites, along with the Powerhouse Loop Trail and Cherry Creek Boat Launch, both non-Project sites. Counts for Sandy Beach are included with the Powerhouse Loop Trail since access to the beach originates on the trail. Estimating use with automatic counters at Power Park, the North Shore Boat Restraint, and the North Shore Dispersed Use Area is not possible due to the varied nature of access to these sites.

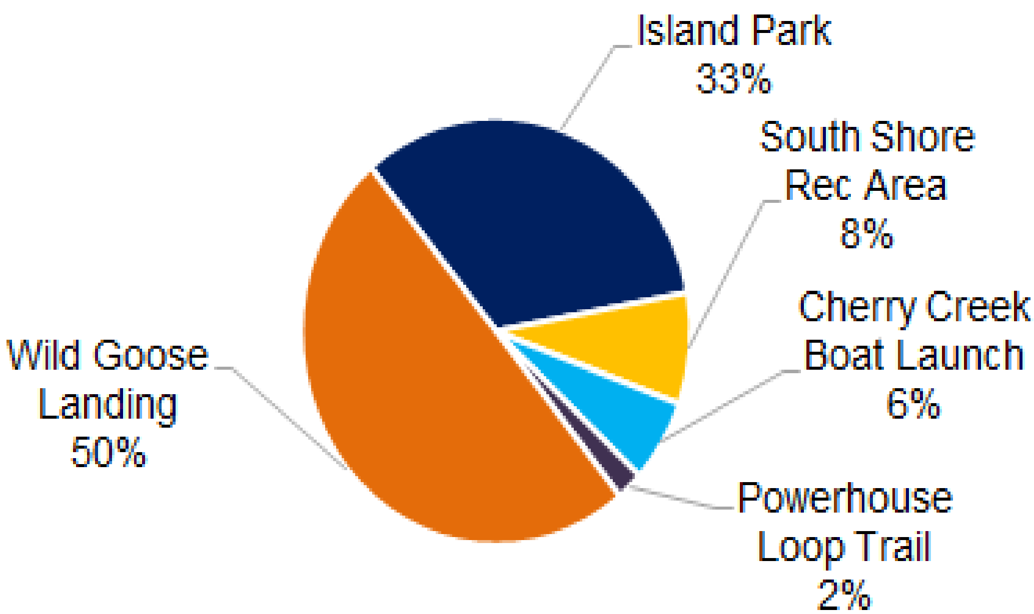
A total of 33,399 group visits were counted at the recreation sites monitored with automatic counters during the peak recreation season (May 28 – September 9) in 2021. Of that total, 16,649 group visits were recorded at Wild Goose Landing Park, accounting for half of the recorded visitation. One-third of recorded visitation occurred at Island Park (11,091 group visits), 8 percent (2,819 group visits) accessed the South Shore Dispersed Recreation Area, and 2,105 group visits

(6%) visited the Cherry Creek Boat Launch while the Powerhouse Loop Trail hosted 735 group visits (2% of total, including Sandy Beach). (**Table 11-2** and **Figure 11-10**).

Table 11-2: Visitation estimates of monitored recreation sites, peak season 2021.

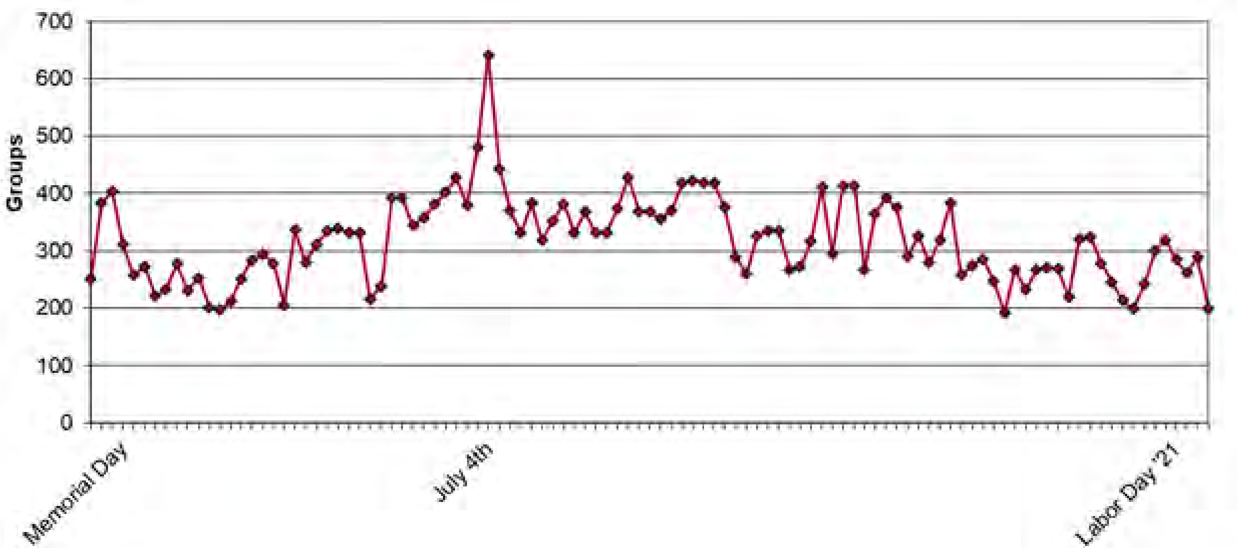
Recreation Area	2021 Peak Season Group Visits	Percent of Monitored Visitation
Wild Goose Landing Park	16,649	50%
Island Park	11,091	33%
South Shore Dispersed Recreation Area	2,819	8%
Cherry Creek Boat Launch	2,105	6%
Powerhouse Loop Trail (including Sandy Beach)	735	2%
Total	**33,399 Group Visits**	

Figure 11-10: Breakdown of recreation visitation by monitored site, peak season 2021.



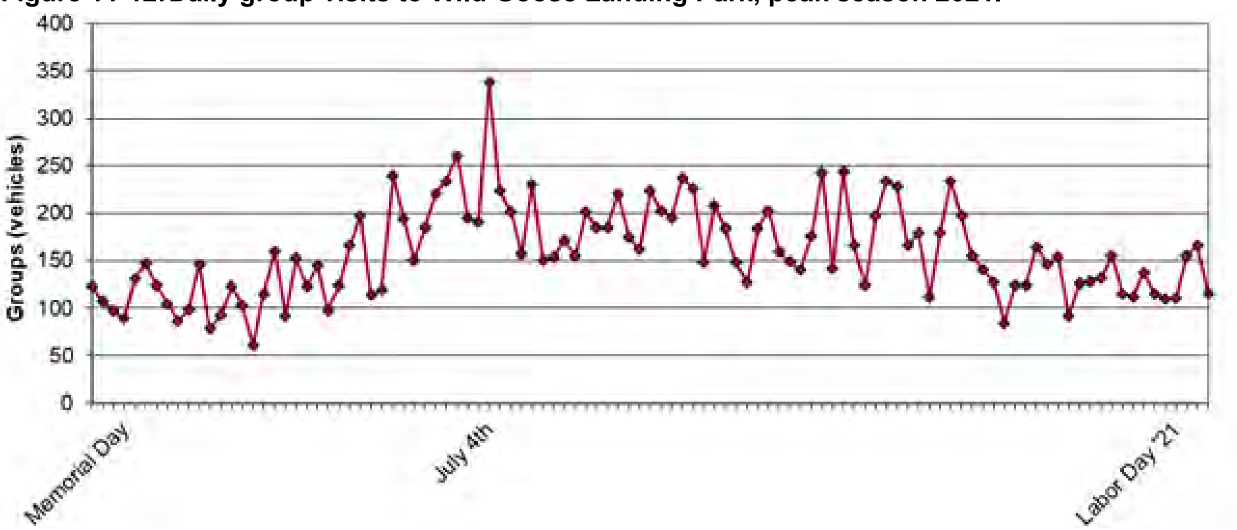
The highest visitation to all counted sites combined occurred on July 4, 2021, when 642 group visits were made to the monitored sites (**Figure 11-11**). Together, the monitored sites hosted an average of 318 group visits per day during the peak recreation season of 2021.

Figure 11-11: Daily group visits to monitored recreation sites, peak season 2021.



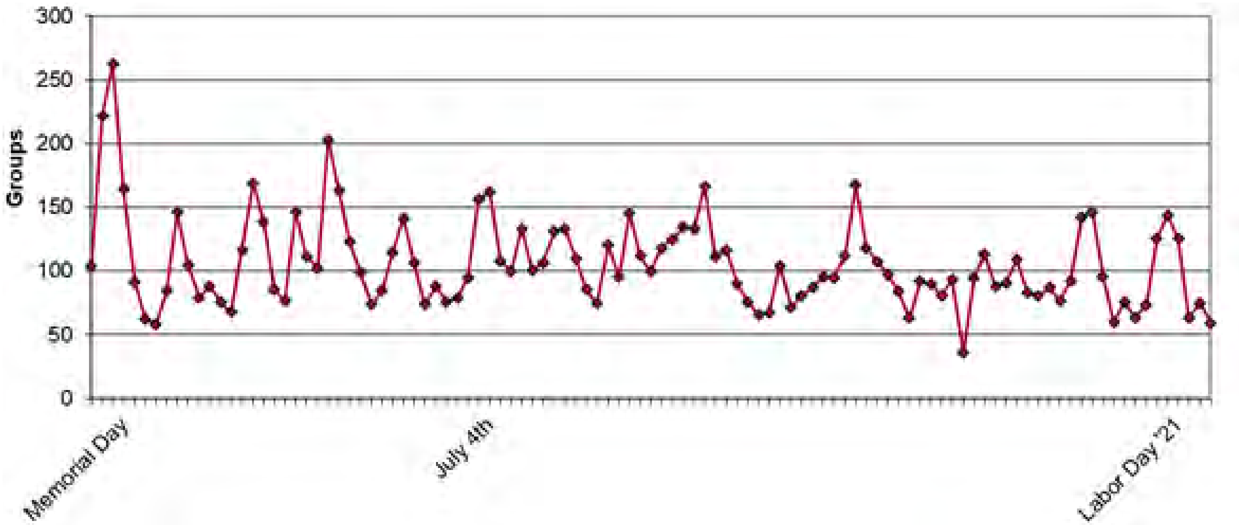
On average, Wild Goose Landing Park hosted 159 group visits per day, totaling more than 16,500 group visits during the peak use season. The highest level of use occurred on the July 4th holiday with 337 visits (**Figure 11-12**).

Figure 11-12: Daily group visits to Wild Goose Landing Park, peak season 2021.



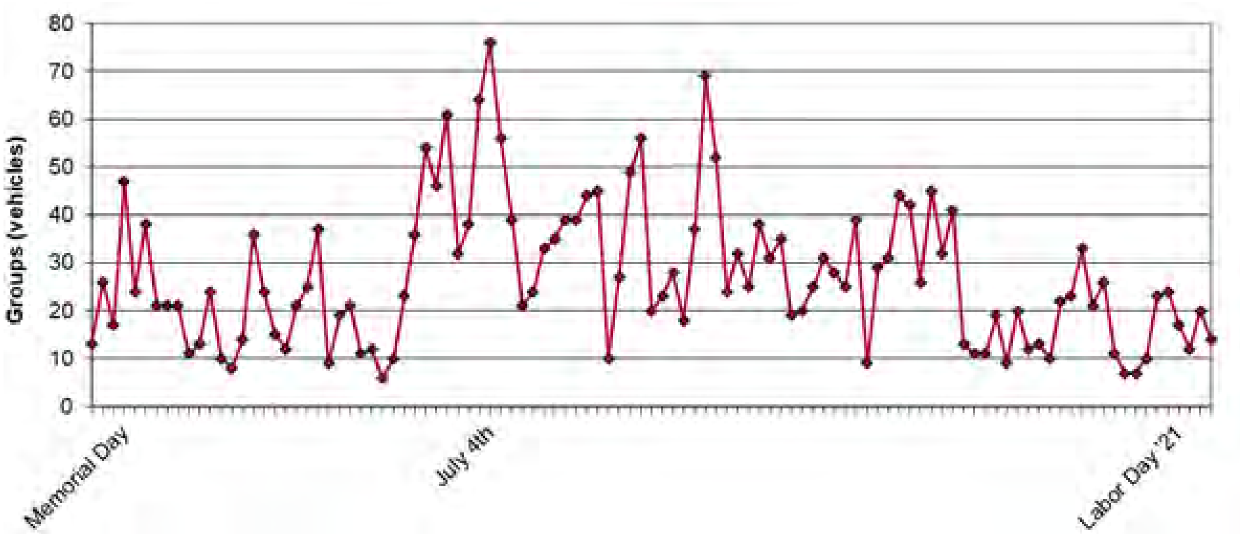
Between May 28 and September 9, 2021, Island Park hosted 11,091 group visits. The highest use of the site was recorded on May 30 (Sunday of Memorial Day weekend) with 263 group visits (**Figure 11-13**). On average Island Park hosted 106 group visits per day.

Figure 11-13: Daily group visits to Island Park, peak season 2021.



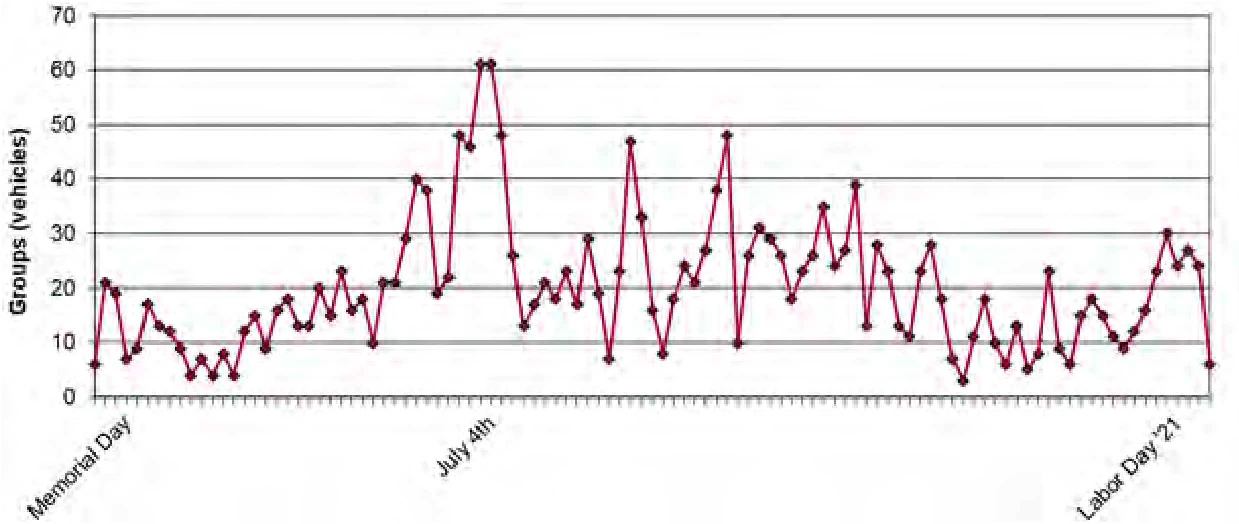
During the peak recreation season of 2021, the South Shore Dispersed Recreation Area hosted 2,819 group visits, an average of 27 group visits per day. Peak use occurred on July 4 with 76 group visits (**Figure 11-14**).

Figure 11-14: Daily group visits to South Shore Dispersed Recreation Area, peak season 2021.



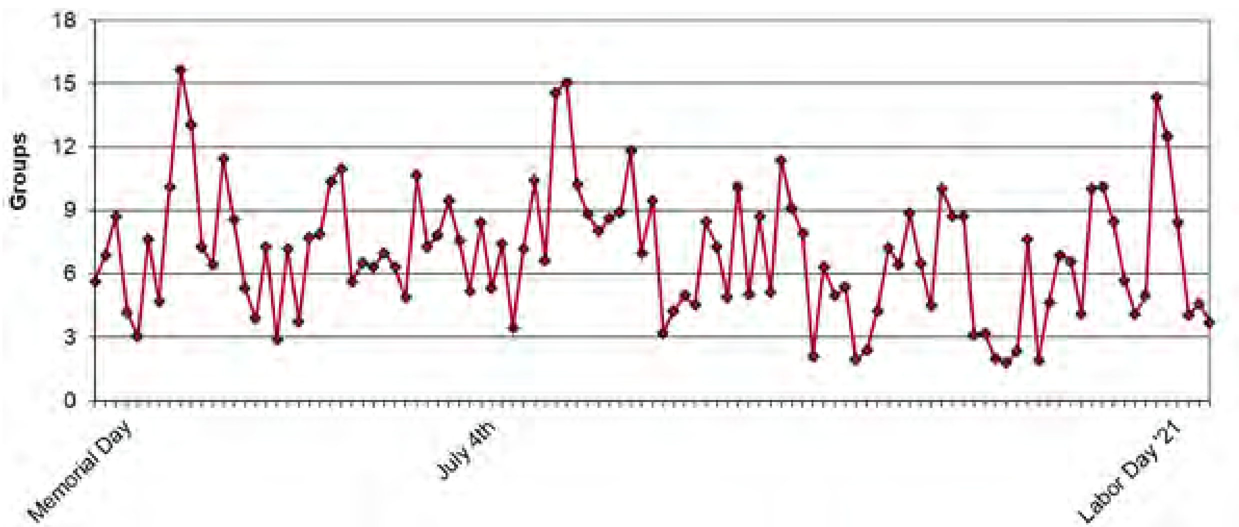
Cherry Creek Boat Launch hosted a total of 2,105 group visits during the peak recreation season of 2021. Highest use was recorded on July 3 and 4, when visitor groups accessed the site 61 times each day (**Figure 11-15**). The site hosted 20 group visits per day, on average, throughout the entire season.

Figure 11-15: Daily visitor groups to Cherry Creek Boat Launch Site, peak season 2021.



The Powerhouse Loop Trail (including Sandy Beach) hosted a total of 735 group visits during the peak recreation season of 2021. Peak use was recorded on June 25 with 16 groups (**Figure 11-16**).

Figure 11-16: Daily group visits to Powerhouse Loop Trail (including Sandy Beach), peak season 2021.

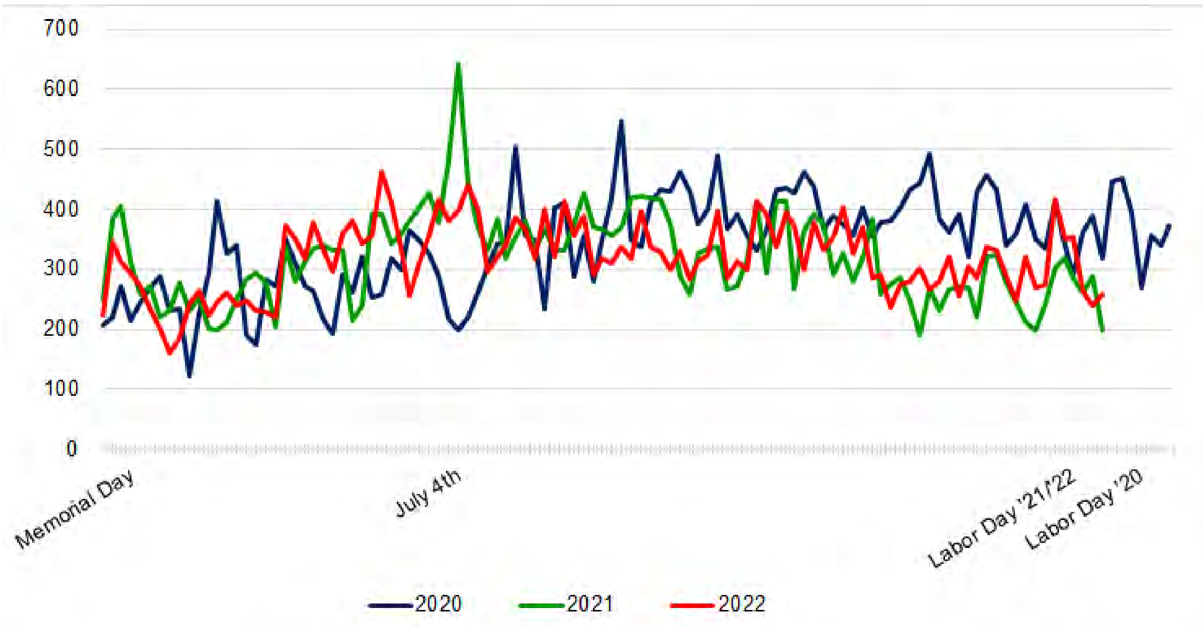


Change in the volume and timing of visitation to recreation sites over time is normal, and visitation is often dependent on factors such as weather (especially temperature and precipitation), water flows (duration and intensity of spring runoff or drought), local-area conditions (such as wildfire), economics (fuel prices, for example), and social conditions (such as a global pandemic). Total visitation to monitored recreation sites during the peak recreation season declined by 4 percent overall between 2020 and 2022 (**Table 11-3**). That fluctuation in visitation was largely due to the 2020 recreation season having an extra week compared to 2021 and 2022 since the Labor Day holiday fell on September 7, 2020. Patterns of use of recreation sites were largely similar during 2020, 2021, and 2022 (**Figure 11-17**).

Table 11-3: Visitation to monitored recreation sites, peak season 2020-2022.

Recreation Area	2020 Peak Season Group Visits	2021 Peak Season Group Visits	2022 Peak Season Group Visits
Island Park	11,186	11,091	12,086
Wild Goose Landing Park	15,198	16,649	16,131
South Shore Dispersed Recreation Area	2,217	2,819	2,556
Cherry Creek Boat Launch	4,603	2,105	1,860
Powerhouse Loop Trail (including Sandy Beach)	909	735	753
Total Visitor Groups	**34,793**	**33,399**	**33,386**

Figure 11-17: Daily group visits to monitored sites, peak season 2020-2022.



11.1.2.2 Angling Pressure

FWP conducts biennial statewide mail-in angling use surveys from a random sample of resident and nonresident licensed anglers. Data from 2021 showed Thompson Falls Reservoir had an estimated 3,902 angler days comprised of 2,529 resident anglers (65%) and 1,373 nonresident anglers (35%) (**Table 11-4**). Over the past 19 years, mean angler days per year was 2,516. Resident anglers represent, on average, 81 percent of the angler use, and non-resident anglers represented 19 percent. Out of 1,200 fisheries FWP monitors for angler use, Thompson Falls Reservoir's rank in 2021 was 148 and over the past 19 years was 272.

Table 11-4: Thompson Falls Reservoir angler use statistics 2005-2021.

	Total	Resident Angler Days	% Resident Angler Days	Non-resident Angler Days	% Non-resident Angler Days	State Rank
2021	3902	2529	65%	1373	35%	148
2020*	2607	2430	93%	177	7%	197
2019	3436	1629	47%	1807	53%	141
2017	3896	3895	100%	0	0%	131
2015	3565	2495	70%	1070	30%	144
2013	4621	4304	93%	316	7%	135
2011	146	52	36%	94	64%	774
2009	243	177	73%	66	27%	616
2007	1664	1664	100%	0	0%	177
2005	1080	1080	100%	0	0%	258
mean	**2516**	**2026**	**81%**	**490**	**19%**	**272**

Notes: *survey out of biennial sequence to evaluate increased public use during pandemic

Between 2013 and 2020, angling pressure in Thompson Falls Reservoir trended downward, to a 2020 low of 2,607 angler days. Angling pressure was higher in 2021 than in the preceding 6 years, though 1 year of increased pressure does not necessarily indicate a change in trend. By comparison, angler pressure in neighboring Noxon Reservoir trended upward from 2013 to a high of 41,171 angler days in 2020, with a slight decline in 2021 to 39,759 angler days. Nearby Flathead Lake (which also trended upward from 2013) supported a high of 50,699 angler days in 2020 followed by a slight decline to 50,490 angler days in 2021 (**Table 11-5**).

Table 11-5: Angler Days – Thompson Falls, Noxon, and Cabinet Gorge reservoirs.

	Total Pressure (angler days)					
Waterbody	**2013**	**2015**	**2017**	**2019**	**2020**	**2021**
Thompson Falls Reservoir	4,621	3,565	3,896	3,436	2,607	3,902
Noxon Reservoir	32,848	20,564	27,550	31,568	41,171	39,759
Flathead Lake	46,432	21,956	42,196	46,141	50,699	50,490

Source: League and Caball 2023, 2020; Selby and Skaar 2019; Selby et al. 2019; Selby et al. 2017, 2015

11.1.3 Other Recreation Sites and Facilities

The Thompson Falls area has an abundance of nearby recreation opportunities unrelated to the Project (**Table 11-6**).

Table 11-6: Property ownership and managing entity of nearby recreation areas unrelated to the Project.

Recreation Area	Property Ownership and Managing Entity
Ainsworth Park	Located on City property; managed by City.
Railway Park	Located on City property; managed by City.
Rose Garden Park and Fort Thompson Playground	Located on City property; managed by City.
Swimming Pool and Park	Located on City property; managed by City.
Community Center, Softball Field, and Dog Park	Located on City property; managed by City and volunteers.
Babe Ruth Baseball Field	Located on City property; managed by City.
Bighorn and Grizzly Parks	Located on City property; managed by City.
Thompson Falls State Park	Located on FWP and Avista property; managed by FWP under agreement with Avista.
State Park Trail	Located on Avista and other private property; managed by Avista, FWP, and Thompson Falls Community Trails Group.
River's Bend Golf Course	Located on Avista and private property; managed by private entity.
Flat Iron FAS	Jointly owned by Avista and FWP; managed by FWP under agreement with Avista.
US Forest Service Trails	Located on USFS property; managed by USFS.
Mount Silcox Wildlife Management Area	Located on FWP property; managed by FWP.

Note: City = city of Thompson Falls

Ainsworth Park lies northeast of Power Park. Historically, baseball games were hosted on the field, but deterioration of the covered grandstands and lack of room for expansion of the field resulted in re-design and renovation of the park. The space now includes a walking trail, irrigation, a monument to U.S. Armed Forces, a pavilion, restrooms, gravel parking area, and amphitheater.

Railway Park lies along Main Street of Thompson Falls, between the railroad and Highway 200, across from the west end of the downtown area. Benches, a Veterans of Foreign Wars monument, and landscaping offer a pleasant view for visitors and passersby.

The Rose Garden Park and Fort Thompson Playground are situated along Main Street, between the railroad and Highway 200, roughly 0.5 mile east of Railway Park. The park contains rose bushes and mature trees, along with picnic tables, a playground, and a seasonal portable restroom.

The swimming pool and adjacent park are located on City property next to the high school complex on Golf Street, about 0.5 mile north of Highway 200. The park provides a playground, picnic tables, pavilion, and swimming pool.

The softball field, Community Center, and dog park are on City property across from the high school complex on Golf Street, about 0.5 mile north of Highway 200. The softball field and dog park are managed by volunteers. The City rents the Community Center for social gatherings, community meetings, and other events or purposes.

The Babe Ruth Baseball Field was constructed in 2018 on City property behind the Search and Rescue building, about 0.25 mile off Highway 200 on Golf Street. The site hosts baseball games and is operated by volunteers.

Bighorn and Grizzly parks were dedicated to the City as part of the Ashley Creek subdivision. The park areas are undeveloped but offer open space for surrounding residents.

Thompson Falls State Park offers day use and overnight use. Managed by FWP under agreement with Avista, the site is located approximately 2 miles downstream of the Thompson Falls Powerhouse, adjacent to the Birdland Bay Bridge. In addition to overnight camping, the site contains day use picnic facilities, group use facilities, a boat launch, and fishing pond with an ADA-accessible fishing pier and pavilion. The site can be accessed by vehicle from Blue Slide Road or by non-motorized means from the State Park Trail. Compared to visitors to recreation sites within the Project Area, whom are typically day use recreationists from Thompson Falls or nearby Sanders County areas, visitors to Thompson Falls State Park are twice as likely to be from outside of Montana and are primarily visiting for two nights. The State Park is an important draw for the Thompson Falls area, but it serves a population of visitors that largely makes use of Noxon Rapids Reservoir and differs from those that frequent the Project area (REC Resources 2013).

The State Park Trail provides a non-motorized link between the Powerhouse Loop Trail and Thompson Falls State Park from a junction slightly upstream of the Rimrock Lodge property and Highway 200 bridge. The trail segment is aligned along shoreline property owned largely by Avista and terminates at the Thompson Falls State Park.

The River's Bend Golf Course and Birdland Bay RV Resort provide a privately managed golf course (the lower portion of which is owned by Avista and leased to the golf course) and RV resort just downstream of Thompson Falls State Park on the northeast shoreline of the Clark Fork River.

Across from River's Bend Golf Course, the Flat Iron Fishing Access Site on the west shoreline (~3 miles downstream from the Thompson Falls Powerhouses) is a day use boat launch site that also offers ADA-accessible fishing. The launch area provides parking for 14 vehicles with trailers including one ADA-designated spot. A picnic table and seasonal portable restroom are also provided in the launch area. Other areas of the site offer two fishing platforms (one of which is ADA-accessible), picnic tables, a vault toilet, and space to park about 20 vehicles along the access road. The site is jointly owned by Avista and FWP and managed by FWP under agreement with Avista.

In areas further removed from the Project, the USFS provides a network of fitness trails at the Mule Pasture 0.5 mile north of downtown Thompson Falls, 150 acres of open space at a former USFS plantation dubbed The Orchard (adjacent to the Mule Pasture), as well as trails that provide access to Weber Gulch, Sqaylth-kwum Creek, and Ashley Creek.

The Mount Silcox Wildlife Management Area (WMA), managed by FWP, is open to public access April 1 through November 30 and lies approximately 2 miles to the east of Thompson Falls. A parking area is provided just north of Highway 200. The WMA is more than 1,500 acres in size and provides winter and spring range for bighorn sheep, recreational access to adjacent public lands, and winter range for elk.

11.2 Environmental Measures

11.2.1 Existing Environmental Measures

Under the current FERC license, the Licensee developed recreation amenities and facilities at Island Park, Wild Goose Landing Park, and the South Shore Parking Area. Ongoing maintenance and weed control have continued at these sites. In addition, recreational use surveys have been completed as required. The most recent recreation survey found a high level of satisfaction among recreational users in the Project area. A complete list of completed and ongoing measures can be found in **Exhibit E - Section 2.1.4 – Existing Environmental Measures**.

11.2.2 Proposed Environmental Measures

- The Licensee shall implement the Recreation Management Plan (Exhibit E – Appendix D). This Recreation Management Plan includes the following elements:
    - Periodic visitor and site monitoring over the New License term.
    - Add Power Park as a Project recreation site, including maintenance of the group-use pavilion and plumbed restroom facility, drinking water station, picnic tables, and benches.
    - Add Cherry Creek Boat Launch as a Project recreation site, including improvements to the boat launch, and maintenance of the picnic facilities, vault toilet restroom, boat launch and dock.
    - Continue to operate and maintain Island Park and the North Shore and South Shore Parking Areas as Project recreation sites, including the parking areas, interpretive information and the upstream fish passage facility viewing platform, as well as benches, picnic tables, and vault latrines throughout Island Park and parking areas. This excludes the Historic High Bridge, which is owned and maintained by Sanders County.
    - Continue to operate and maintain Wild Goose Landing Park as a Project recreation site, including a new floating boat launch dock to accommodate reservoir fluctuations down to 2.5 feet and bathroom improvements. Annual maintenance of the boat ramp, swimming dock, picnic facilities, bathrooms, parking areas, garbage service, and general site and facility upkeep.

- Continue to operate and maintain the South Shore Dispersed Recreation Area as a Project recreation site with an expanded boundary, including dispersed parking and regulatory signage, to maintain the site as a primitive day use area.

11.3 Environmental Analysis

11.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2** – **Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

Under the current license, reservoir water level fluctuations to 4 feet below full pool could occur periodically, but more typically have been 1.5 feet. Impacts at the 1.5- and 4-foot level are described in detail in **Tables 11-7 and 11-8**. An operations test conducted in 2019 showed significant impacts to Wild Goose Landing Park, the only Project recreation site that offers developed access to the water, when the reservoir elevation was 4 feet below full pool. Other public and private docks and boat launching ramps also were impacted when the reservoir elevation was 4 feet below full pool. The Operations Study conducted in 2021 evaluated the impacts of operational fluctuations and showed minimal impacts to public and private docks and boat launches at reservoir elevations 1.5 feet below full pool.

In addition, the FERC Project boundary would not be adjusted under the no action alternative, which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes. Specifically, this would limit consistent oversight, management, and maintenance of sites such as Power Park, the South Shore Dispersed Recreation Area, the area that connects Island Park to the north shoreline, the picnic and restroom facilities at Wild Goose Landing Park, and the Cherry Creek Boat Launch Site.

11.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations.

The number and type of facilities that provide opportunities for public recreation in the Project Area are adequate and meet the needs of visitors. Monitored recreation sites near the Project host approximately 35,000 group visits each year during the peak recreation season (*refer to* **Table 11-3**), and ratings of crowdedness are only slightly higher than “Not at all Crowded” (NorthWestern 2022). Surveys of visitors also indicate that recreationists are highly satisfied with recreation opportunities and amenities that are available and have little desire for more. When visitors have requested more amenities, more picnic facilities are generally desired, but visitors make no mention of needs for additional sites. Therefore, NorthWestern is not proposing to construct any new recreation facilities. However, NorthWestern is proposing to expand the number of sites included in the Recreation Management Plan (Exhibit E – Appendix D) by adding the existing Power Park and Cherry Creek Boat Launch Site to the Recreation Management Plan to ensure the Project’s recreational values continue to be available to the public.

11.3.2.1 Impacts of Proposed Operational Changes

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations.

Recreational use of Project recreation sites Island Park, Power Park, the South Shore Dispersed Recreation Area, will not be impacted by the fluctuating water level proposed. Island Park and Power Park do not provide access to the waterway, so there are no impacts to access based on Project operations. The South Shore Dispersed Recreation Area is located on the shoreline of the Clark Fork River below the Main Channel Dam and Dry Channel Dam, and the elevation of the river below the dams does not fluctuate due to flexible generation operations.

Recreational access to the non-Project Powerhouse Loop Trail and Sandy Beach, below the dams and powerhouses, are not adversely affected by flexible generation operations. At Sandy Beach, the elevation and depth of the swimming hole changes as generation is increased or decreased, but flows are tempered by adjacent rock outcrops. The low water route of the Powerhouse Loop Trail may be flooded during spring runoff, but not as a result of flexible capacity operations.

The non-Project North Shore Boat Restraint and North Shore Dispersed Use Area offer shoreline views of the waterway and shoreline fishing. These sites do not offer good shoreline access to the waterway due to the vegetation along shallow shorelines at these sites, so reservoir fluctuations have minimal to no impact on recreational access at these locations. There may be greater difficulty in some areas for shoreline fishing due to the amount of the dewatered shoreline at lower reservoir elevations, but it is not uniform throughout the reservoir and many areas are available for shoreline fishing, even during low reservoir elevations.

Slight impacts are anticipated at the Cherry Creek Boat Launch due to fluctuating water levels. At 2.5 feet below full pool, the lowest proposed elevation, the boat launch remains functional though the floating dock becomes slightly pitched due to grounding of near-shore floats. However, the water depth at the end of the dock remains sufficient for boat mooring.

The stationary dock at Wild Goose Landing Park is designed for the water level at normal full pool. At lower water levels, including 1.5 feet and 2.5 feet below full, the dock is further above the water, which could potentially impact use of the dock, particularly getting in and out of boats from the dock. NorthWestern is proposing to address the impact of the proposed alternative by replacing the stationary dock with a new floating dock at Wild Goose Landing Park. A comparison of impacts to recreational use at the public access sites, Wild Goose Landing Park and Cherry Creek Boat Launch, when the reservoir is 1.5 feet, 2.5 feet and 4 feet below normal full reservoir is included in **Table 11-7.**

Table 11-7: Comparison of impacts to recreation use at public recreation sites.

Location	Recreation Access at 4 feet below full pool	Recreation Access at 2.5 feet below full pool	Recreation Access at 1.5 feet below full pool
Wild Goose Landing Park (Project Recreation Site)	Boat launch is functional. Stationary dock is not usable for boat mooring or swimming due to shallow water and vertical distance between dock and water surface. Floating dock is not usable for boat mooring or swimming due to shallow water.	Boat launch is functional. Stationary dock has sufficient water depth for boat mooring, but vertical distance makes getting into and out of moored boats and swimming from the dock challenging. The outer half of the floating dock remains watered, and the water depth is adequate for boat mooring. Swimming access from the floating dock is not ideal due to aquatic vegetation at the end of the dock.	Boat launch is functional. Access to moored boats and to waterway for swimming from the stationary dock is slightly impacted due to the increased vertical distance between the dock and water surface, but water depth remains adequate. Use of floating dock is not impacted and remains usable for swimming access and boat mooring.
Cherry Creek Boat Launch (Project Recreation Site)	Boat launch mostly out of the water and very challenging to use as the lower portion of the ramp, which remains watered, is steeper than the upper portion that is dewatered. Floating dock is steeply pitched and barely	Boat launch is usable. Use of floating dock for boat mooring and swimming is slightly impacted by grounding of near-shore floats and resultant pitching of dock, but water depth at end of the dock remains sufficient for boat mooring and swimming access.	Boat launch is usable. Floating dock is usable for swimming access and boat mooring.

	reaches the water so is not usable for boat mooring or swimming.		

Notes: Slight Impact = Access is minimally impacted in less than 25% of cases.
Moderate Impact = Access is impacted minimally or moderately in 50% or less of cases.
Significant Impact = Access is impacted moderately or significantly in more than 50% of cases.
Severe Impact = Access is prohibited in all or nearly all cases.

The private and non-Project community subdivision boat ramps at Salish Shores and North Shore Estates, which are available solely for use by subdivision property owners, remained usable at reservoir elevations down to 2.5 feet below full pool as both facilities had at least 2.5 feet of water at the end of the ramps at this elevation. Therefore, reservoir elevation fluctuations will not significantly affect the availability of private boat ramps under the proposed operations.

Effects of proposed operations on non-Project privately-owned docks varies with the amount of reservoir fluctuation, dock location, and specifications of each dock. About 20 percent of all docks on the reservoir are stationary docks, while the remaining 80 percent are floating docks. **Table 11-8** contains a comparison of impacts to private docks located in different areas of the reservoir.

NorthWestern is proposing, as an off-license measure, a program to address effects of reservoir fluctuations on privately owned docks that may occur should FERC approve NorthWestern's proposed alternative. The program provides a funding mechanism for owners of existing private docks to modify those structures to function adequately at reservoir elevation down to 2.5 feet below full pool. The program will only be offered if FERC approves the proposed alternative, which allows for 2.5 feet of reservoir fluctuations to support flexible capacity operations.

Table 11-8: Comparison of impacts to recreation use at private docks at various locations on the reservoir.

Location	Recreation Access at 4 feet below full pool	Recreation Access at 2.5 feet below full pool	Recreation Access at 1.5 feet below full pool
North and south shorelines between Main Channel Dam and north shoreline at former mill site	Private docks, whether stationary or floating, do not reach the water so are unusable for boat mooring or swimming access. Stationary docks remain accessible from the shoreline, but floating docks become pitched as they rest on sediment shelves along the shoreline.	Stationary docks remain accessible from the shore and reach the water, but boat mooring and swimming access is significantly impacted due to shallow water and the vertical distance between the dock and water surface. Floating docks also remain accessible from the shore but are grounded on sediment shelves along the shoreline and do not provide access for swimming or boat mooring.	Stationary docks remain accessible from shore, and access to moored boats and to the waterway for swimming from stationary docks is slightly impacted due to the increased vertical distance between the dock and water surface, but water depth remains adequate. Access to floating docks from shore is not impacted and floating docks remain usable for swimming access and boat mooring.
South side of Steamboat Island	No stationary docks exist in this segment. Floating docks do not reach the water so are unusable for boat mooring or swimming, and become pitched as they rest on sediment shelves along the shoreline.	No stationary docks exist in this segment. Floating docks remain accessible from the shore but most of the structures are grounded on sediment shelves and either become pitched or are entirely grounded. Access from floating docks for swimming or to moored boats is moderately to significantly impacted for half of floating docks and slightly impacted for the other half.	No stationary docks exist in this segment. Use of floating docks is not impacted and docks remain usable for swimming access and boat mooring.
Upstream end of Project area	Most private docks, whether stationary or floating, do not reach the water so are unusable for boat mooring or swimming access. Stationary docks that do reach the water's edge have very shallow water depth and the increased vertical distance between the dock and waterway makes access to moored	Stationary docks remain accessible from the shore and reach the water, but boat mooring and swimming access is significantly impacted due to shallow water and the vertical distance between the dock and water surface or boat. Floating docks also remain accessible from the shore but about half are either	Stationary docks remain accessible from the shore and reach the water, but access to moored boats and for swimming is slightly to moderately impacted due to the vertical distance between the dock and water surface or boat, depending on location. Floating docks also remain accessible from

Location	Recreation Access at 4 feet below full pool	Recreation Access at 2.5 feet below full pool	Recreation Access at 1.5 feet below full pool
	boats and for swimming from stationary dock structures severely challenging. Stationary dock structures remain accessible from the shoreline. Floating docks that reach the water's edge also have shallow water at the end of the dock that prevents boat mooring and swimming access, and floating docks or their associated gangways become steeply pitched as they rest on exposed sediment shelves.	entirely grounded or the near-shore floats are grounded on sediment shelves or the rocky shoreline, and slightly more than half are moderately impacted due to shallow water at the end of the dock that is not sufficient for boat mooring. Access to moored boats and for swimming from floating docks is significantly impacted for floating docks on the south shoreline and only moderately impacted on the north shoreline.	the shore and the near-shore floats of less than half are grounded, resulting in slight pitching of the dock. All floating docks have adequate water depth for boat mooring or swimming access, though north shore locations are generally deeper at the end of docks than south shore locations.

Notes: Slight Impact = Access is minimally impacted in less than 25% of cases.
Moderate Impact = Access is impacted minimally or moderately in 50% or less of cases.
Significant Impact = Access is impacted moderately or significantly in more than 50% of cases.
Severe Impact = Access is prohibited in all or nearly all cases.

11.3.2.2 Impacts of Proposed Project Boundary and Recreation Plan Changes

NorthWestern proposes a Project boundary adjustment that will include Project recreation sites and provide for FERC jurisdiction over those sites and facility resources to ensure public recreation needs are met.

Visitor studies demonstrate that the volume of visitation to public recreation sites near the Project is stable, ratings of crowdedness are very low, and the number and type of facilities that provide opportunities for public recreation in the Project Area are adequate and meet the needs of visitors (NorthWestern 2022). However, including Power Park and Cherry Creek Boat Launch Site in the Project boundary and Recreation Management Plan, and expanding Island Park, Wild Goose Landing Park, and the South Shore Dispersed Recreation Area will have a positive impact on recreational resources for the public. In addition, the Recreation Management Plan includes provisions for ongoing monitoring of public recreation conditions, visitation, and visitor satisfaction so that NorthWestern can respond as needs for public recreation change over the term of the new license.

Proposed Project recreation sites will consist of those depicted on **Figures 11-18, 11-19 and 11-20** and will include:

- Power Park as a Project recreation site.
- The North Shore Parking Area and South Shore Parking Area with vault latrine will be included with the Island Park recreation site. In addition, a small area at the north shore abutment of the Gallatin Street Bridge, which encompasses the automatic vehicle gate, ADA parking spot, and a trash can, will be added to the Island Park recreation site.
- An expanded Wild Goose Landing Park to add the picnic area and restroom facility.
- An expanded South Shore Dispersed Recreation Area and adjacent NorthWestern-owned shoreline lands.
- Cherry Creek Boat Launch Site as a Project recreation site

Figure 11-18: Aerial view of proposed Project boundary modification at Power Park, Island Park, and South Shore Dispersed. Recreation Area.

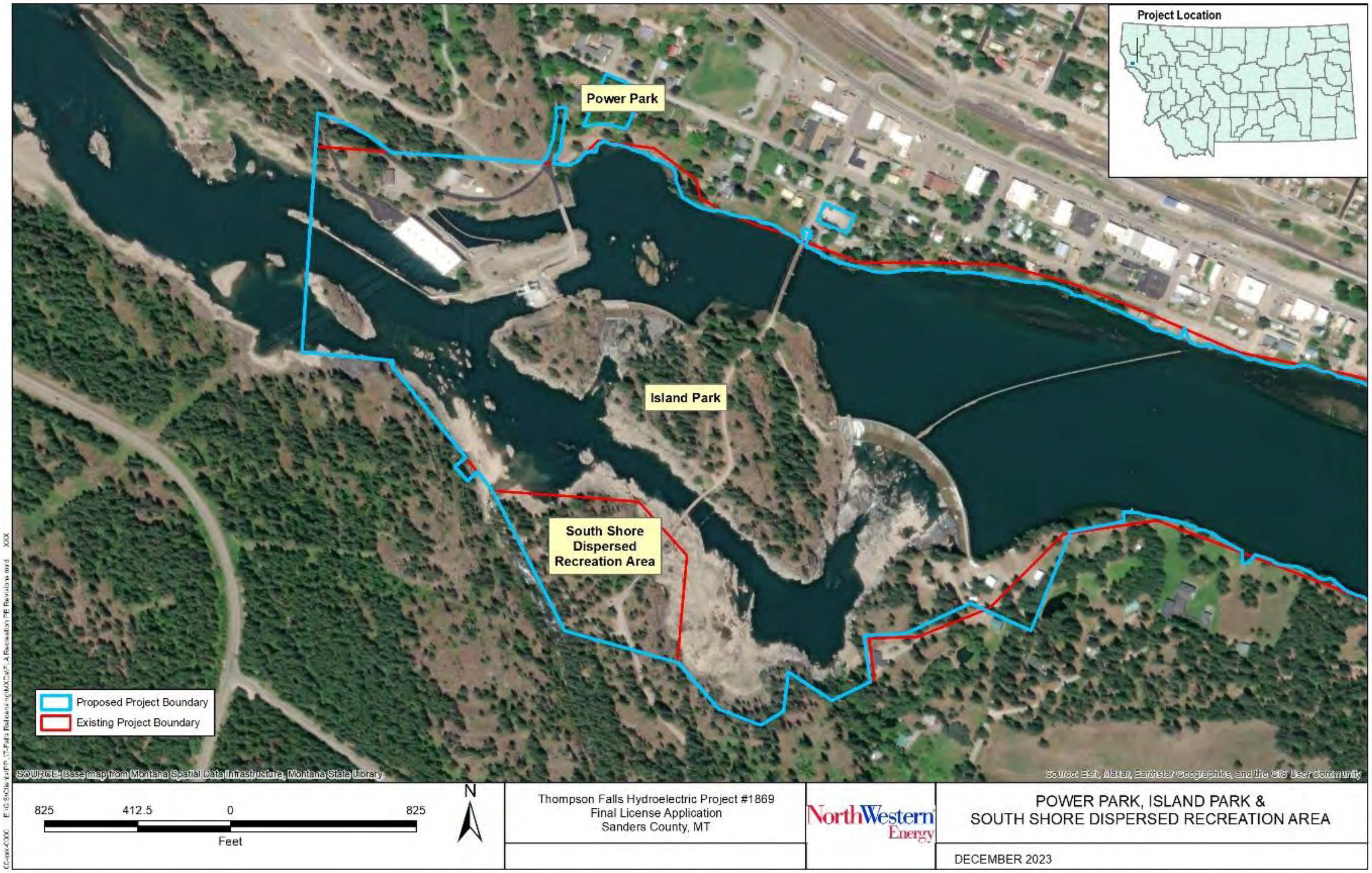


Figure 11-19: Aerial view of proposed Project boundary modification at Wild Goose Landing Park.

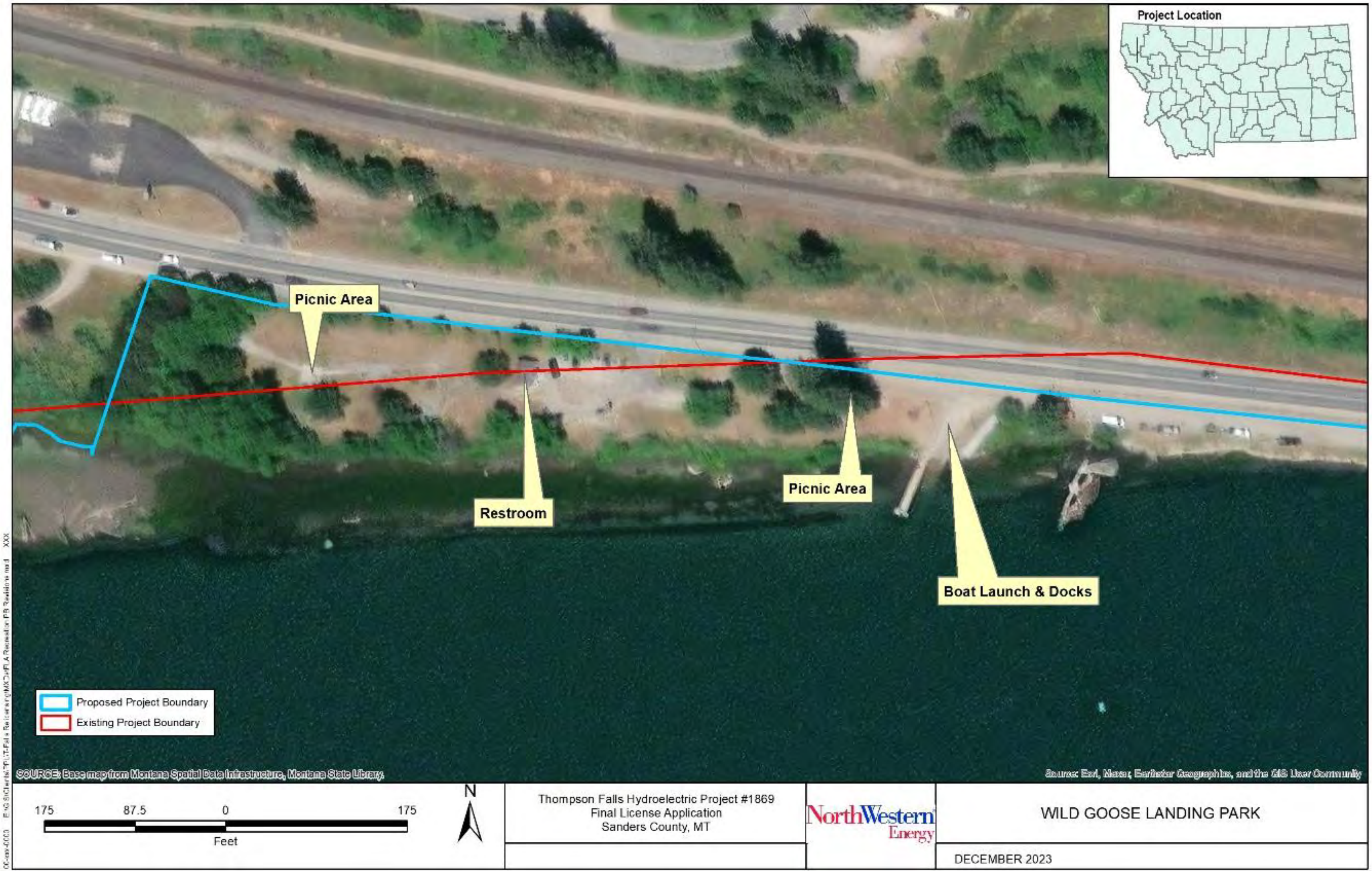


Figure 11-20: Aerial view of proposed Project boundary modification at Cherry Creek Boat Launch.

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Including these sites in the Project boundary will provide assurance that the sites continue to be operated and maintained through the new license term.

NorthWestern proposes to operate and maintain Power Park, Island Park, Wild Goose Landing Park, the South Shore Dispersed Recreation Area, and Cherry Creek Boat Launch Site to provide recreation access and amenities to the public. Including these sites in the Project boundary will provide assurance that the sites continue to be operated and maintained through the new license term. NorthWestern will implement the Recreation Management Plan in consultation with stakeholders to document roles and responsibilities for recreation site management over the term of the license, which is being filed with FERC for approval.

11.4 Unavoidable Adverse Impacts

Access to the water will be impacted, in varying degrees, by waterway fluctuations due to flexible capacity generation at Project and non-Project sites as sediment is exposed along shorelines at lower reservoir elevations. Non-Project private docks may be impacted as well as in various ways based on multiple factors. Some private docks appear to have been built to only provide access to the reservoir at or near full pool elevations, and not to withstand reservoir fluctuations as proposed or as allowed in the current license. These structures are generally stationary docks or floating docks that don’t extend very far from shore or have short gangways. Impacts to some private dock structures will be unavoidable. The off-license dock modification program proposed by NorthWestern aims to reduce these adverse effects in a meaningful way.

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12. Cultural Resources

12.1 Affected Environment

12.1.1 Cultural Resources Background Information

Cultural resources are evidence of past human use of an area. Management of cultural resources involves the long-term preservation of their historic values and consideration of the effect of a licensee's action on them. Cultural resources may include the Project facilities and other historic architectural and engineering properties, precontact and historic archaeological sites, and properties of traditional religious and cultural significance to Native American tribes (FERC 2002).

The lower Clark Fork River is located within a unique cultural and environmental region referred to as the Kootenai-Pend Oreille section of the Eastern Plateau culture area. Previous research has revealed extended and continuous human occupation of the region beginning possibly 12,000 years ago (Krigbaum 2016). Precontact hunter-gatherer land use resulted in numerous occupational sites, lithic scatters, rock cairns, burials, game drives/traps, and culturally modified trees. Comparatively large occupational sites are usually limited to major river drainages, but Native American peoples frequented higher elevation mountainous areas during the summer months as well. They developed travel routes traversing major stream drainages and saddle and ridge systems. These higher elevation areas provided hunter-gatherers with a wide range of resources from roots, seeds, and berries to deer, elk, and mountain sheep (Bacon 2013).

The Clark Fork River Valley surrounding Thompson Falls is at the core of traditional Kootenai, Salish, and Pend d'Oreille tribal territories (Schwab et al. 2001). For many millennia those tribes occupied a vast tract of the Northern Rockies, Plains, and Plateau of Western North America (CSKT 2020). The Clark Fork River served as those people's road, and it continues to be of central importance to tribal life in the region.

Thompson Falls was named after British explorer, geographer, and fur trader David Thompson who founded the North West Company fur trading post called Salish House in 1809. The community is located next to natural waterfalls on the Clark Fork River. The arrival of the railroad in 1881 brought the first real Euro-American activity to the area. Two years later, when the gold rush hit nearby Coeur d'Alene, Idaho the town grew to accommodate the men going over the Murray Trail to the mines. It is estimated that up to 5,000 men passed through the nearby settlement of Belknap, drinking in the saloons and sleeping in tents or one of the hotels. When the settlement of Thompson Falls forced the train to stop short of Belknap, another more popular trail developed up Prospect Creek over the route known now as Thompson Pass. The original townsite of Thompson Falls was surveyed in 1893, with the first substantial period of expansion and development occurring between 1905 and 1917. The Thompson Falls Dam, in operation since

1915, was constructed atop the original falls (SHPO 1986). Its electrical power supply was a major contributor to all manner of industrial, agricultural, and commercial improvements in the area during the early 20th century.

12.1.2 Previously Recorded Cultural Properties

In 2017 and 2022, NorthWestern requested the SHPO complete file searches of the 23 land sections encompassing the Thompson Falls Project. The resulting file searches (SHPO References 2017090701 and 2022120101) revealed that the SHPO holds records documenting nearly 40 cultural resource inventory and/or documentation projects that have been completed within those land sections. Additionally, review of the Library of Congress' records identified seven Historic American Building Survey/Historic American Engineering Record documentation projects conducted within those land sections. Finally, consultation with the Lolo National Forest provided information concerning four past or ongoing cultural resource investigations that extend within the sections.

NorthWestern reviewed all reports identified in the SHPO, Library of Congress, and Lolo National Forest file searches and determined that 25 inventory or documentation projects encompass lands within the Thompson Falls Project APE. **Table 12-1** below lists those projects.

Table 12-1: **Previous cultural resource inventory and documentation projects.**

Date	Author(s)	Title
1982	Bowers and Hanchette	An Evaluation of the Historic and Prehistoric Cultural Resources in the Thompson Falls, Ryan, and Hauser Dam Areas
1983	Greiser	Cultural Resource Inventory Thompson Falls Canada Goose Brood Rearing Project Area
1984	Murphy	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Dry Channel Bridge (MT-29)
1984	Murphy	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Main Channel Bridge (MT-28)
1986	Koop	National Register of Historic Places Inventory-Nomination Form: Thompson Falls Hydroelectric Dam Historic District
1991	Wyss and Axline	Cultural Resource Inventory and Assessment of F 6-1(48)52 Thompson Falls East
1993	Johnson	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Powerhouse Forman’s Bungalow (MT-90-A)
1993	Johnson	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Garage (MT-90-C)
1993	Johnson	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Chicken House (MT-90-B)
1995	Rossillon	Thompson Falls Island Thompson Falls Hydroelectric Project (FERC No. 1869) Cultural Resource Inventory and Evaluation
1997	Thompson, Schneid, & Hubber	Report of a Cultural Resources Inventory of the Eddy Flats Project Corridor
2000	Rossillon	Thompson River – East Highway Reconstruction and Bridge Replacement
2008	Dickerson	Thompson Falls Hydroelectric Development Proposed Fish Ladder Project
2008	Renewable Technologies, Inc.	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Main Channel Dam (MT-90-D)
2008	Renewable Technologies, Inc.	Historic American Engineering Record, Thompson Falls Hydroelectric Project, Warming Hut (MT-90-E)
2012	Bacon, Karuzas, & DeCleva	Lolo National Forest Heritage Program Inventory Report, Clark Fork Corridor Fuels Reduction
2014	Bacon	Lolo National Forest Heritage Program Inventory Report, Yellowstone Pipeline Abandonment on Lolo National Forest Lands
2016	Krigbaum	Class III Cultural Resource Investigations of Taft-Hot Springs No. 1 Access Roads
2016	Karuzas	Cultural Resource Report: Copper King Fire
2017	New, Sackman, and Harder	Cultural Resource Survey for the Hot Springs-Noxon Transmission Line Project within Lolo National Forest
2018	Karuzas	Northwestern Energy Thompson Falls to Burke A & B 115kV Transmission Line

Date	Author(s)	Title
2018	Dickerson	Thompson Falls-Kerr 115kV A-Line Structure Relocations, Sanders County, Montana
2019	Dickerson	Thompson Falls Shoreline Stabilization
2019	Dickerson	Thompson Falls Trail Addition
2022	Scheuring	Cultural Resources Report West Lolo Fire Complex and Thorne BAER

Notes: kV = kilovolts

The 25 previous cultural resource investigations resulted in documentation of 11 cultural properties that reportedly lay within, or appear to abut, the Project APE. Many of those were documented prior to the development or routine use of GPS technology and the recorders hand-drew the site boundaries on topographic maps. As a result, the exact locations and spatial extents of several previously recorded cultural properties are ill-defined. The 11 previously recorded cultural properties include nine historic sites and two that contain both precontact and historic components. Those are listed in **Table 12-2** below.

Table 12-2: Previously recorded cultural properties.

Site Number	Name	National Register Status	Ownership
24SA0130	Salish House	Undetermined	Private
24SA0131	Historic Resources of Thompson Falls (Multiple Properties)	Individual Properties National Register Listed	Private
24SA0165	Thompson Falls Hydroelectric Dam Historic District	National Register Listed	NorthWestern Energy
24SA0199	Northern Pacific Railroad	Eligible	Private
24SA0291	Precontact/Historic Artifact Scatter	Undetermined	Private
24SA0352	Plains-Thompson Falls pre-1924 Roadbed	Ineligible	Public and Private
24SA0593	Railroad Chinese Camp	Undetermined	Private
24SA0674	Yellowstone Pipeline	Ineligible	Public and Private
24SA0690	Livestock Corral and Storage Area	Undetermined	Private
24SA0719	Thompson Falls to Burke A & B 115kV Transmission Lines	Ineligible	Public and Private
24SA0756	Thompson Falls-Kerr A Transmission Line	Ineligible	Public and Private

Notes: kV = kilovolts

12.1.3 2021-2022 Cultural Resource Inventory

In 2021 NorthWestern updated the 1982 National Register listing of the only historic architectural and engineering property within the Project, namely the Thompson Falls Hydroelectric Dam Historic District. Because 34 years had passed since listing and several contributing elements to the district had been altered or demolished over time, the update served to clarify the current National Register status of each element. It resulted in an official amendment to the 1986 National Register listing accepted by the National Register in June 2022.

NorthWestern completed intensive cultural resources inventory of the Thompson Falls Project APE during the 2022 field season (**Figures 12-1** and **12-2**). It is important to note that the inventory included all areas where NorthWestern proposes changes to the Project boundary (**Figures 12-3** and **12-4**). The 2022 cultural resource inventory resulted in documentation of six cultural resources that lay within the Project APE, all of which had been previously recorded. Fieldwork revealed that five previously recorded cultural properties reported to be within or abutting the Project APE are, in fact, outside the Project APE. No new cultural properties were identified.

The six cultural properties within the Project APE are portions of the Thompson Falls Hydroelectric Dam Historic District (24SA0165), Northern Pacific Railroad (24SA0199), Plains-Thompson Falls pre-1924 Roadbed (24SA0352), Yellowstone Pipeline (24SA0674), Thompson Falls to Burke A & B Transmission Lines (24SA0719), and Thompson Falls-Kerr A Transmission Line (24SA0756). Two of those properties, the Thompson Falls Hydroelectric Dam Historic District and Northern Pacific Railroad are eligible for, or listed in, the NRHP. The remaining four (24SA0352, 24SA0674, 24SA0719, and 24SA0756) are ineligible for National Register listing.

The 2022 cultural resource inventory revealed that five previously recorded cultural properties reported to be within or abutting the Project APE are, in fact, outside the APE boundary. Those include 24SA0130 (Salish House), 24SA0131 (Historic Resources of Thompson Falls), 24SA0291 (precontact/historic artifact scatter), 24SA0593 (railroad Chinese camp), and 24SA0690 (livestock corral and storage area).

Figure 12-1: Thompson Falls 2021-2022 inventory area, west end.

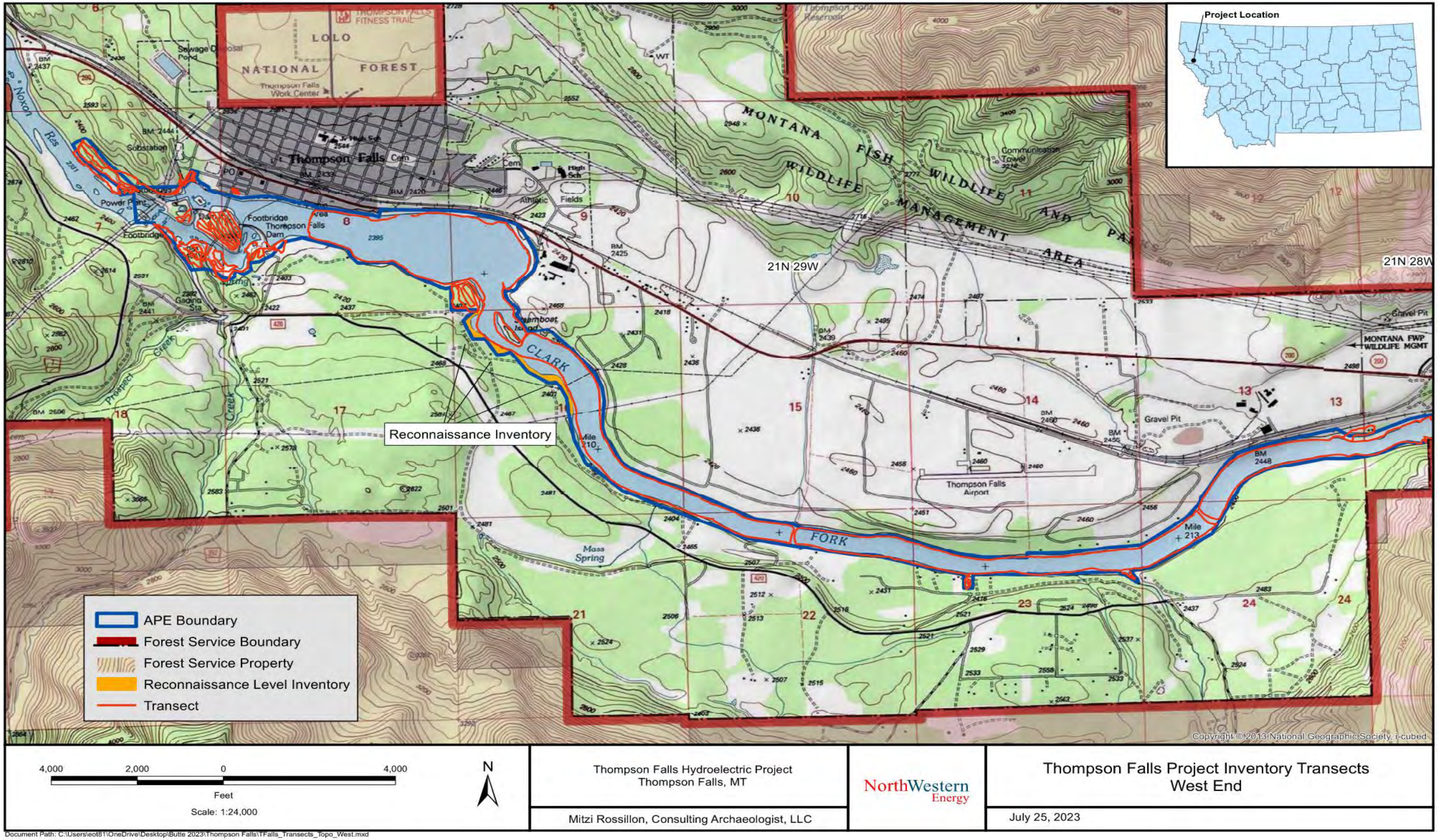
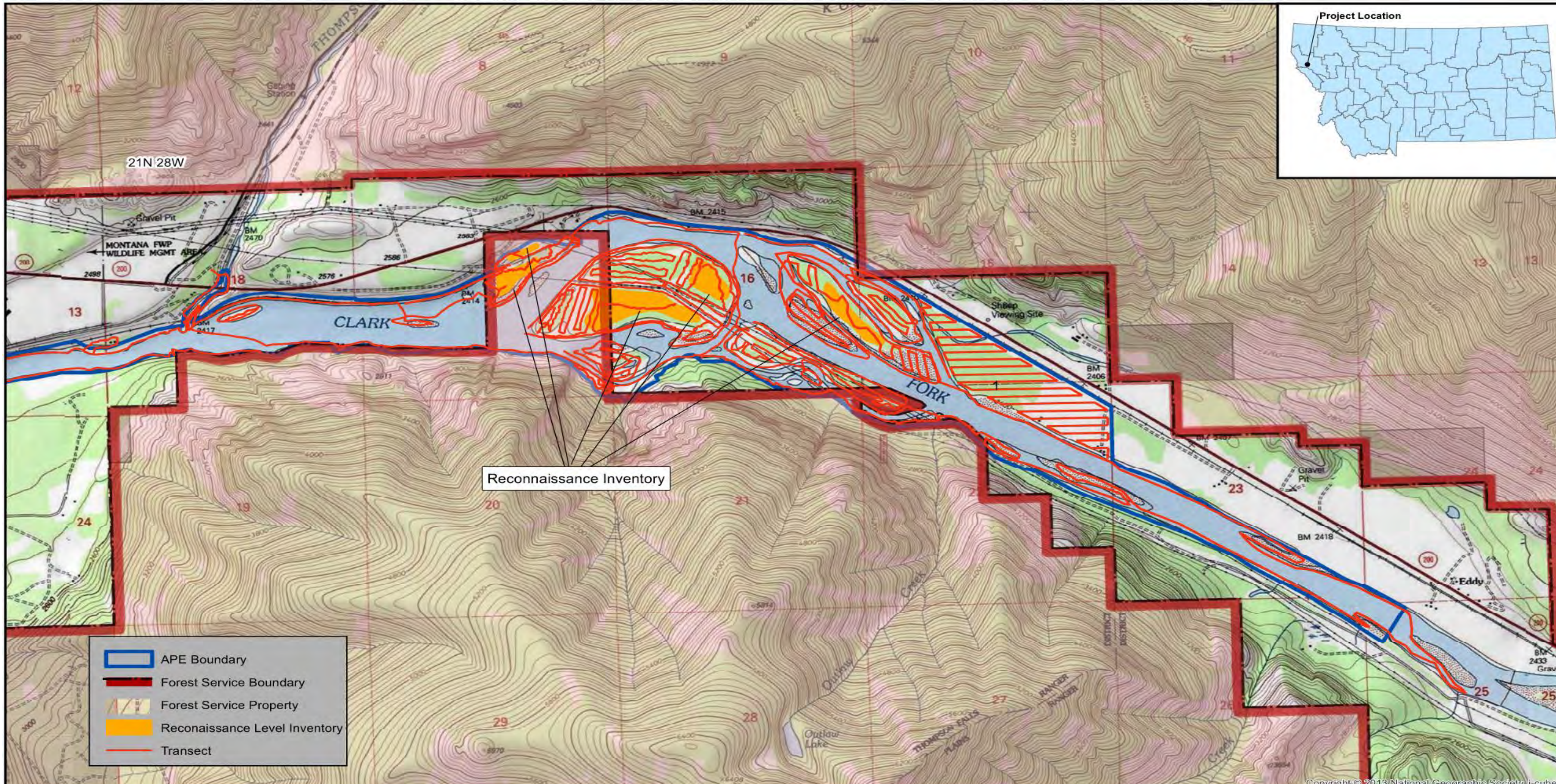


Figure 12-2. Thompson Falls 2021-2022 inventory area, east end.



4,000 2,000 0 4,000 Feet Scale: 1:24,000	Thompson Falls Hydroelectric Project Thompson Falls, MT	NorthWestern Energy	Thompson Falls Project Inventory Transects East End
	Mitzi Rossillon, Consulting Archaeologist, LLC		July 25, 2023

Document Path: C:\Users\eot81\OneDrive\Desktop\Butte 2022\ThompsonFalls Relicensing\TFalls_Transects_Topo_East.mxd

Figure 12-3. Thompson Falls proposed FERC license boundary, west end.

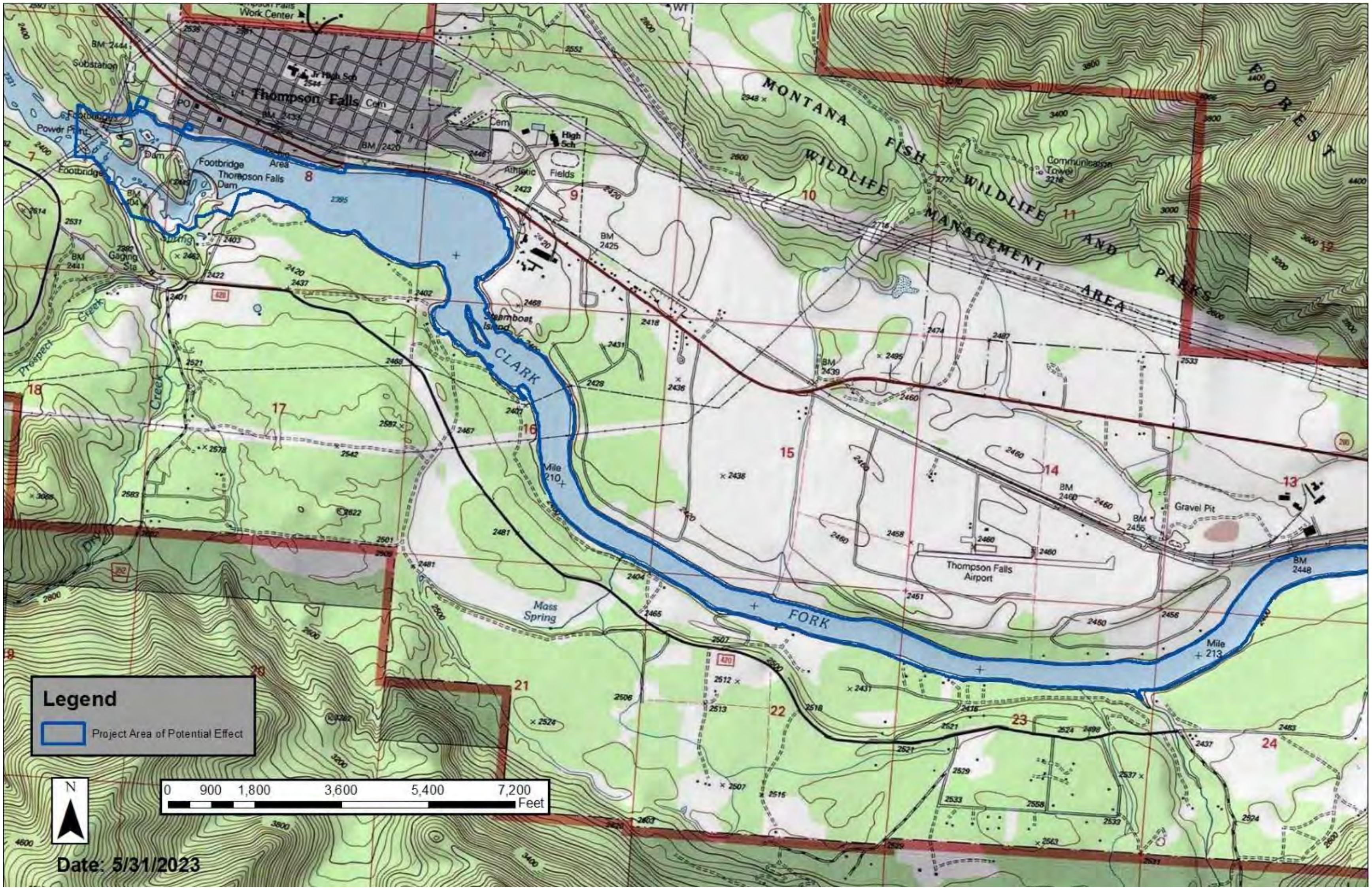
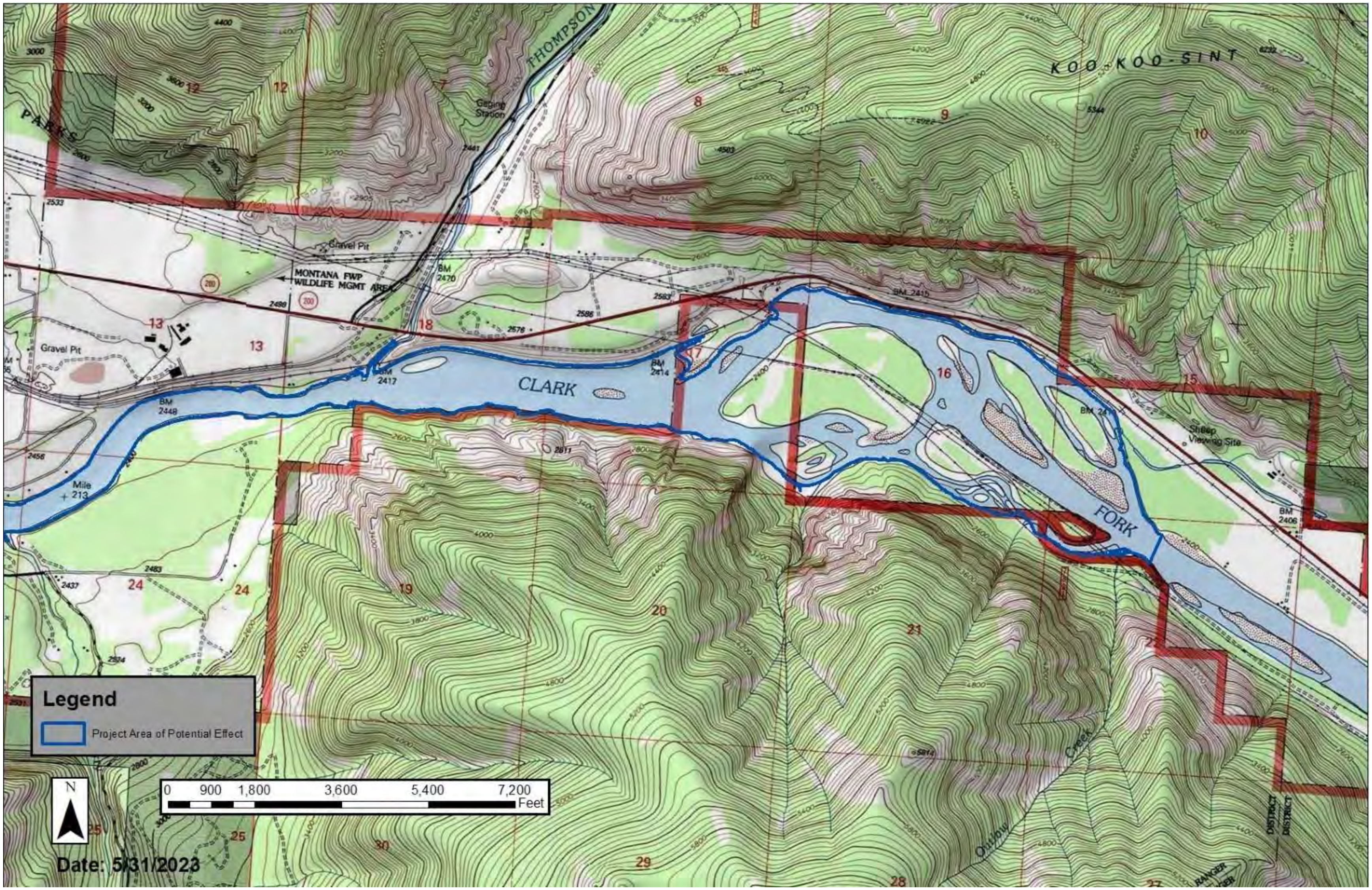


Figure 12-4. Thompson Falls proposed FERC license boundary, east end.



12.1.4 Existing Discovery Measures for Locating, Identifying, and Assessing the Significance of Resources

Discovery measures and assessments previously conducted are listed in Table 12-1. Further studies conducted throughout this relicensing are documented in the three Cultural Resources Study Reports (NorthWestern 2022a, 2022b, 2023).

12.2 Tribal Cultural and Economic Interests

NorthWestern knows of no Traditional and Religious Cultural Properties located within the APE or in the immediate vicinity of the Project.

NorthWestern contacted the Tribal Nations recommended by the SHPOs of Montana and Idaho as potentially interested in the relicensing. The Tribal Nations recommended by the SHPO in Montana were the Chippewa-Cree of the Rocky Boy's Indian Reservation, Blackfeet, and the Confederated Salish and Kootenai. The Tribal Nations recommended by the Idaho SHPO were the Kootenai, Kalispel, and Coeur d'Alene Tribes. Outreach soliciting Tribal input has continued, most recently regarding the HPMP.

12.3 Environmental Measures

12.3.1 Existing Environmental Measures

NorthWestern addresses cultural resources management per license Article 408. NorthWestern undertakes various measures to address potential effects to known cultural properties as a result of developments on the Project. Under consultation with the SHPO, where ground-disturbing actions are proposed, NorthWestern conducts cultural resource inventories and, when necessary, proposes measures to avoid or mitigate adverse effects to any properties listed in or eligible for listing in the NRHP.

12.3.2 Proposed Environmental Measures

The Licensee will implement the HPMP (Volume IV-Privileged), which was developed in consultation with the SHPO and Tribes.

12.4 Environmental Effects

12.4.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures**, of this Exhibit E would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures**, of this Exhibit E would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Under the terms and conditions of the current license, cultural resource inventories are required prior to any Project "construction or development" if the construction or development is not covered by a previous inventory. Effects analysis should consider if such actions would impact Historic Properties and develop impact mitigation measures in cases of an adverse effect.

12.4.2 Applicant's Proposed Alternative

No new construction is proposed as part of the Applicant's proposed alternative so construction would have no effect to cultural resources.

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. Based on the findings of the Operations Study (NorthWestern 2022c) no effects would occur to cultural resources as a result of the Applicant's proposed alternative to fluctuate the reservoir.

Additionally, under the proposed alternative, an HPMP would be implemented which will provide enhanced clarity and guidance for cultural resource management.

NorthWestern is also proposing modifications to the Project boundary, resulting in a proposed new FERC Project APE (*refer to* **Figures 12-3** and **12-4**). This proposal will also have no effect on cultural resources (*see* **Exhibit E - Sections 12.4.2.1 – Archaeological Properties** and **12.4.2.2 – Historic Architectural & Engineering Properties**).

12.4.2.1 Archaeological Properties

Modifying the Project boundary has no effect on National Register-listed or -eligible archaeological resources because none are known to exist on the lands being removed from the Project boundary. PM&E projects outside the Project APE for fisheries or recreation that may be proposed in the FLA could affect precontact and/or historic archaeological properties. Any such projects will be subject to the procedures proposed in the HPMP for inventory, National Register evaluation, finding of effect, and impact mitigation measures.

12.4.2.2 Historic Architectural & Engineering Properties

The proposed alternative does not propose any demolitions or other Project-related construction activities affecting historic architectural & engineering properties. In the event any such activity is proposed during the new license term, NorthWestern will follow the protocol established by the final HPMP specific to proposed alterations or modifications to architectural, engineering, and historic archaeological elements that contribute to the Thompson Falls Hydroelectric Dam Historic District's National Register listing. The HPMP will identify required impact mitigation measures should an alteration or modification constitute an adverse effect.

12.5 Unavoidable Adverse Impacts

No new construction is proposed but unavoidable adverse impacts to select elements of the Thompson Falls Hydroelectric Dam Historic District might be expected over the life of the new license. As Project equipment becomes obsolete, available replacements and their modes of operation may not include historically appropriate equivalents. In recognition of the need for continued efficient and safe future facility operation, standard mitigation measures will be employed under the terms of the HPMP in instances where adverse impacts cannot be avoided. These unavoidable adverse impacts would occur under either the no action alternative or the proposed alternative but would be more effectively mitigated under the proposed alternative by implementing the HPMP.

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13. Land Use

This Section describes the land use in the Project boundary, and within 0.5 mile of the Project. Lands used for recreation are addressed in more detail in **Exhibit E - Section 11 – Recreation**, of this Exhibit E

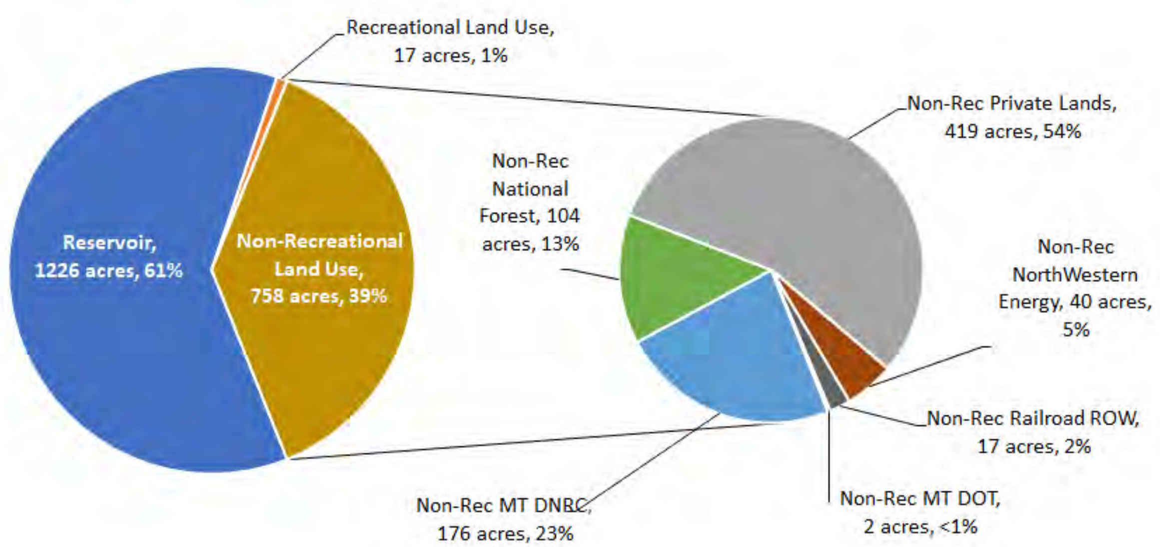
13.1 Affected Environment

Within the 2,001-acre current Project boundary there are 1,226 acres of river and reservoir (surface water) not including the islands, and 775 acres of non-reservoir. Of the 775 acres that are non-reservoir, about 17 acres are associated with recreational land uses, and the remaining 758 acres are associated with non-recreational land use.

13.1.1 Non-recreational Land Use and Management Within the Project

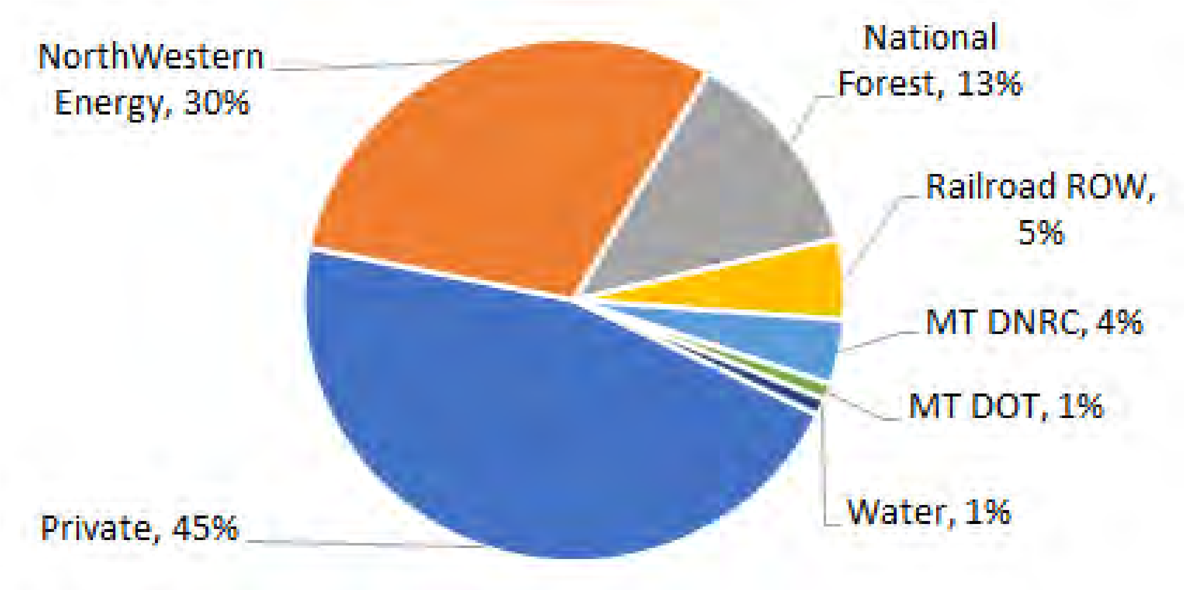
Of the 758 non-recreational acres in the current Project boundary, NorthWestern owns 40 acres, with the majority under and adjacent to the dams and powerhouses used for Project operations, as well as narrow slivers on the edge of the reservoir in various locations. Private lands consisting of a mix of large parcels, subdivision lots, and city lots comprise about 419 acres of non-recreational lands. Many private lands contain residential buildings. The Montana Department of Natural Resources and Conservation manages about 176 acres, which are largely open space. National Forest System Lands include 104 acres which are largely open space forest lands. Railroad right-of-way and state of Montana lands managed by the Montana Department of Transportation as Montana Highway 200 right-of-way comprise the approximate remaining 17 acres and 2 acres, respectively (**Figure 13-1**).

Figure 13-1: Use and ownership of lands within Project.



The Project has a perimeter length of 27 miles, comprised of a mix of public and private lands as shown in **Figure 13-2**.

Figure 13-2: Land use and ownership of Project perimeter.



13.1.2 Recreational and Non-Recreational Land Use and Management Adjacent to the Project

Lands within a 0.5 mile of the Project encompass an area of 8,589 acres. The largest land use category is privately-owned, large rural lots, comprising 3,728 acres (43%). Some of these lots have homes on them and others are vacant. LNF lands comprise the second largest land use category, accounting for 2,000 acres (23%). One specific LNF area – the Mule Pasture – is situated at the north edge of Thompson Falls and is specifically managed for trail-related recreation (walking, day hiking, exercising, etc.).

The third largest land use category is privately-owned, small rural lots, comprising 1,204 acres (14%). Many of these lots exist as reservoir-frontage and reservoir-view lots since much of the private shoreline on the Thompson Falls Reservoir has been subdivided and developed. The Cherry Creek Access Site, a public access site located amidst a shoreline subdivision on the south shoreline and managed by Sanders County, offers small watercraft launching and day use facilities.

The fourth largest land use category is a 474-acre mixed-use area to the east of the City limits. This mixed-use includes a grocery store, hardware store, commercial buildings, residences, and other uses on large lots. Areas along the north shoreline east of Wild Goose Landing Park (included in the "city" land use category) offer dispersed public access for shoreline fishing.

The fifth largest land use category is the City, consisting of 422 acres (6%). Thompson Falls, county seat of Sanders County, has a population of 1,336 (as of 2020) including restaurants, hotels/motels, municipal buildings, various stores, residences, and professional service offices. Developed recreation opportunities within this land use category include public parking for access to Island Park, day use of Power Park and the picnic pavilion facilities, as well as access to the Powerhouse Loop Trail near the original powerhouse, and the community's Rose Garden Park, which offers playground equipment, benches, and picnic facilities.

The sixth largest land use category is land owned by NorthWestern near the dams and powerhouses, as well as other non-Project utility facilities.

The seventh largest land use category includes Montana School Trust Lands managed by the Montana Department of Natural Resources and Conservation for open space and public access.

The eighth largest land use category contains lands managed by FWP, including the Mount Silcox WMA and a Rocky Mountain bighorn sheep wildlife viewing turnout along Highway 200.

The last three land use categories are an active sawmill comprising 105 acres, the Thompson Falls Airport consisting of 86 acres, and the Clark Fork River downstream of the Project, consisting of 35 acres.

While not broken out as separate acreages, there are other land uses within the 0.5-mile buffer. These include the BNSF Railway (railroad), State Highway 200, the Yellowstone Pipeline, and NorthWestern transmission lines.

13.2 Environmental Measures

13.2.1 Existing Environmental Measures

Shoreline management at the Project is guided by Article 40 of the current License which is commonly referred to by FERC as the "Standard Land Use Article" (SLUA) and NorthWestern's "*Shoreline Standards - Standards for the Design, Construction, Maintenance and Operation of Shoreline Facilities on NorthWestern Hydroelectric Projects*" (Shoreline Standards) which was adopted in January 2020 (NorthWestern 2020). The purpose of the Shoreline Standards is to provide standards such that shoreline facilities are designed, constructed, maintained, and operated in a safe and environmentally friendly manner that protects and/or enhances adjacent recreation, natural and aesthetic resources. NorthWestern's Shoreline Standards are implemented in coordination with the Green Mountain Conservation District, the entity with jurisdiction to administer Montana's Natural Streambed and Land Preservation Act (also known as the "310 Law").

13.2.2 Proposed Environmental Measures

NorthWestern proposes that the shoreline be managed pursuant to FERC's SLUAs in coordination with the Green Mountain Conservation District in implementing Montana's Natural Streambed and Land Preservation Act.

13.3 Environmental Effects

13.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Under the no action alternative, NorthWestern will continue to operate the Project under the terms of the current license and will continue to manage shoreline development using NorthWestern's existing *"Shoreline Standards - Standards for the Design, Construction, Maintenance and Operation of Shoreline Facilities on NorthWestern Hydroelectric Projects*" (NorthWestern 2020). The no action alternative will have no additional impact on land use in the Project area. The existing land use pattern within and adjacent to the Project has become well-established considering the Project has been present for more than a century. Any changes to land use would be caused by factors unrelated to the Project, such as subdivision and residential development.

13.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, minimum flow of the lesser or 6,000 cfs or inflow will be maintained downstream during normal operations.

No new development is proposed so there will be no impact to land use as a result of new construction. NorthWestern's proposed operations to fluctuate the reservoir will not impact land use other than that addressed in this **Exhibit E - Section 11 – Recreation**.

NorthWestern is proposing to modify the Project boundary. The proposed Project boundary would encompass 1,526 acres. The proposed Project boundary would extend 0.3 miles downstream from the two Thompson Falls dams, and 10 miles upstream. The Thompson River, a major tributary to the Clark Fork River, enters Thompson Falls Reservoir about 6.2 miles upstream of the dam, and the lower 0.2 mile of the Thompson River is included within the proposed Project boundary. The proposed Project boundary incorporates some uplands in the area around the dams and powerhouses, and all of the island between the dams (Island Park).

Modifying the Project boundary results in changes in the acreage of lands within the Project boundary, but no significant changes to the land use in or near the Project, as described below. As shown in **Table 13-1,** the total acreage in the proposed Project boundary is less than the current Project boundary, but the number of acres of recreational lands is greater. This is because the proposed Project boundary has been modified in several locations to encompass existing recreational areas.

The 465-acre reduction in the Project boundary, starting over 10 miles upstream of the Thompson Falls dam, is not needed for Project purposes. In addition, the acreage in the Project boundary decreased when the boundary was adjusted to a contour elevation rather than the current metes and bounds survey. Details about the specific changes proposed to the Project boundary are found in **Exhibit E - Section 2.2.3 – Proposed Project Boundary**.

Table 13-1: Acreage in the current Project boundary and the proposed Project boundary.

	Current Project Boundary (acres)	Proposed Project Boundary (acres)	Net Difference in acreage
Surface Water	1,226	1,094	-132
Recreational Lands	17	34	+17
Other Land Use	758	398	-360
Total Project Boundary	**2,001**	**1,526**	**-475**

The 475 acres being removed from the Project boundary are not needed for Project purposes and would have no impact on land use. The 17 acres being added will benefit recreation as described in **Exhibit E – Section 11 – Recreation**.

13.4 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts to land use.

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14. Aesthetic Resources

This Section provides a description of the aesthetics of the Thompson Falls Project, including views of the Project and views from the Project. Additionally, sounds and odors related to or surrounding the Project area are considered, as appropriate, as part of the Project's aesthetic quality.

14.1 Affected Environment

The Project lies in the Lower Clark Fork River valley between the Bitterroot and Cabinet Mountain ranges, adjacent to the City. Distant views are comprised of forested hillsides with occasional towering rock outcrops and grassy meadows. The Clark Fork River is not visible in distant views due to its meandering channel and forested banks.

Near ground views within the Project area include development related to the City, surrounding Thompson Falls Reservoir, and rural subdivision and residential development along Project shorelines. The main reservoir, which is the portion of the reservoir approximately 1.25 miles upstream of the dams, is visible from shorelines within the City as well as from a 1-mile segment of Montana Highway 200 where the highway flanks the northeast shoreline of the reservoir (**Photographs 14-1** and **14-2**). From the main reservoir upstream to the mouth of Thompson River, the Project reservoir becomes narrower and more riverine in nature, narrowing from roughly 600 yards wide to about 150 yards wide in the upstream area. The upstream area is not visible from the City area or Highway 200 but can be viewed from adjacent shorelines that are a mixture of privately owned and public land (**Photographs 14-3**). River crossings of the Yellowstone Pipeline and electric transmission lines can be seen.

The existing dams and powerhouses can be seen from shorelines in the immediate vicinity of the infrastructure but are otherwise screened from view by development. In addition, trees (predominately ponderosa pine and Douglas fir) and shrubs buffer views of Project facilities from the north and south shorelines as well as from Island Park, central to the existing generating facilities. Tree-lined edges at Island Park screen some views of north shore residential development for island visitors; only one privately-owned residence is visible on the south shoreline from Island Park. Waterway views from locations along the north shoreline of Island Park and the Gallatin Street Bridge include the reservoir upstream of the Main Channel and Dry Channel dams as well as the new powerhouse (**Photographs 14-4**). From other shorelines of Island Park spillways and tailraces in downstream river sections of both dams, as well as the original powerhouse, the upstream fish passage facility and south shoreline of the Project are visible (**Photographs 14-5** and **14-6**).

Views from the south shoreline of the reservoir can be seen from private residences and include the reservoir and City development on the north shoreline. Downstream of the Main Channel Dam views from the south shoreline and Historic High Bridge include the Main Channel Dam and Dry Channel Dam, the associated spillways and tailraces, as well as the original powerhouse (**Photographs 14-7**). Views from the north shoreline downstream of the Project facilities include the original powerhouse, tailrace, and timbered south shoreline (**Photographs 14-8**).

Middle ground views include hillside residences within a mile of the north shoreline, traffic along City streets and Montana Highway 200, and the BNSF Railway. Other middle ground areas have limited visibility from the Project area (or *vice versa*) due to the natural timber screening and topography of the valley floor.

Forested areas surround the Project and provide a backdrop for views. These areas are largely managed by the LNF with some private timber ownership and management. The LNF Plan (USDA 1986) defines Visual Quality Objectives (VQO) for each management unit on the LNF as part of the LNF's recreation plan and timber plan. VQO prescribe desired levels of scenic quality and diversity of natural features on National Forest System Lands. VQO classifications refer to the degree of acceptable alterations of the characteristic landscape but are not applicable to the immediate Project area.

Aesthetic conditions in the Project are affected by a variety of sounds from the surrounding area. Railroad traffic and loud horn blasts at railroad crossings adjacent to the downtown area can be heard from all points in the Project. Highway 200 traffic, including passenger vehicles, large semi-trucks, and emergency vehicles with sirens, can be heard from most places in the Project. The sound of rushing water masks these sounds to some degree near the spillways, and some areas are somewhat sheltered from the sounds of the area's activities, such as internal areas of Island Park. The audible alarm system associated with the Project, which sounds an alarm before certain gate movement can also be heard at areas directly adjacent to Project facilities, Island Park, and downstream of the powerhouse. At the upper end of the Project near the mouth of Thompson River, noise from the Thompson River Lumber sawmill plant is heard during hours of operation.

Olfactory characteristics vary among areas of the Project. Immediately adjacent to the Project waterway and facilities odors are typical of habitats that support fish and waterfowl. At Island Park, the South Shore Dispersed Recreation Area, and many other shoreline areas downstream of the dams, trees and shrubs offer additional smells of nature (pine trees, honeysuckle vines, snowberry shrubs, etc.) while developed shorelines in the City and residential areas may smell of human-based odors (train and vehicle exhaust, commercial kitchen exhaust, campfires, BBQ grills, etc.).

Photographs 14-1: View of reservoir from the North Shore Dispersed Use Area/former sawmill site (top left) and Wild Goose Landing Park (top right), and view of Highway 200 from Wild Goose Landing Park (bottom photos).

Photographs 14-2: View of reservoir and Project facilities from North Shore Boat Restraint (top left), near the Gallatin Street Bridge (top right), and upstream (bottom left) and downstream (bottom right) views from Power Park.

Photographs 14-3: Views of upstream reservoir area. View of south shoreline behind Steamboat Island (top left) and the reservoir (top right), and of the north shoreline with a train and sawmill buildings (bottom photos).

Photographs 14-4: **View of Project facilities upstream and downstream from Gallatin Street Bridge (top photos), the reservoir from Gallatin Street Bridge (bottom left) and north shoreline residential development from Island Park (bottom right).**

Photographs 14-5: **Upstream fish passage facility a from public viewing platform (top left), Channel Dam and reservoir with north shore City area (top right), Historic High Bridge from Island Park (bottom left), and downstream area and South Shore Dispersed Recreation Area from Island Park (bottom right).**

Photographs 14-6: Panorama view of Main Channel Dam from Island Park.

Photographs 14-7: View of downstream area with powerhouse from south end of Historic High Bridge (top left), from South Shore Recreation Area (top right), Dry Channel Dam across the river channel from South Shore Dispersed Recreation Area (bottom left), and upstream view of the Main Channel Dam tailrace from South Shore Dispersed Recreation Area (bottom right).

Photographs 14-8: View from north shoreline below Project facilities. Upstream view of original powerhouse (top left) and downstream of Sandy Beach and south shoreline (top right). View from high water route of Powerhouse Loop Trail, overlooking Sandy Beach and south shoreline (bottom left) and upstream of south shoreline and South Shore Dispersed Recreation Area (bottom right).

14.2 Environmental Measures

14.2.1 Existing Environmental Measures

Requirements of Article 403 of the 1990 license amendment (FERC 1990) stipulated conditions for construction of the new powerhouse to reduce contrast with the surrounding landscape. Specifically, these measures included constructing a low-profile structure with a flat-formed, gray concrete exterior as well as using nonreflective conductors, insulators, and supporting structures on the new transmission line. These requirements were fully implemented in construction of the new powerhouse and will continue to be implemented as any additional structures and improvements are planned for the Project; no new structures or improvements are planned at this time.

14.2.2 Proposed Environmental Measures

No new measures pertaining to aesthetics resources are proposed.

14.3 Environmental Effects

14.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented, including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Impacts to aesthetics were observed during the 2019 Operations Test, when the reservoir elevation was reduced to 4 feet below full pool. At 4-foot below full pool, shorelines consisted of many linear feet of exposed mud and rock (upwards of 50 feet in some cases), submerged mudflats became emergent, and in many cases submerged aquatic vegetation was also exposed. These newly exposed banks were unsightly (**Photographs 14-9**) and had strong odors associated with them. In addition, some areas of shallow benches of sediment that exist within the main reservoir body were also exposed, further degrading the viewshed and introducing odors of decaying organic matter.

At 1.5 feet below full pool elevation, aesthetic impacts are far less significant compared to 4 feet below full pool elevation. In general, only a few feet (typically less than 10 feet) of shoreline mud, rock and sediment was exposed at this elevation (**Photographs 14-10**) and submerged mud flats and vegetation remained submerged (NorthWestern 2022).

Since auditory characteristics associated with the Project are largely defined by nearby industry and transportation (trains, cars, emergency sirens, etc.) the impact of the Project has minimal effect on this aesthetic characteristic. One exception to this is the warning siren that is executed when gates are moved, opened, or additional water is spilled. This siren is clearly (and intended to be) heard in areas adjacent to, and downstream of, the Main Channel Dam and warns recreationists in and on the water that downstream flows will be changing.

Photographs 14-9: South shoreline at 4-feet below full pool (left) and 1.5-feet below full pool (right).

Photographs 14-10: North shoreline at 4 feet below full pool (left), and 1.5 feet below full pool (right).

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14.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. Generally, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations.

When reservoir elevation fluctuations occur as the Project is operated under flexible capacity generation, aesthetics are impacted to varying degrees as a result of rock and mud becoming exposed along the shoreline.

The amount and composition of substrate exposed during reservoir elevation reductions varies among shoreline areas. When aesthetic impacts were assessed with the reservoir drawn down to 2.5 feet below full pool, areas that had up to 10 horizontal feet of shoreline exposed had a faint or moderate odor of decaying organic matter (NorthWestern 2022). As exposed areas increased beyond 10 horizontal feet, odors of decaying organic material became stronger. These odors were most pungent in 2021 when the lower elevations were held for a longer period of time (compared to 2022).

At 2.5 feet below full pool, most areas of the reservoir had 5 to 20 horizontal feet of exposed mud and rock. This was true for areas near the north end of Gallatin Street Bridge, along the north shoreline of the main reservoir adjacent to the City, and along both shorelines upstream of Steamboat Island. In some areas, large mud flats became exposed when the reservoir elevation was reduced to 2.5 feet below full pool, including the north shoreline of Island Park and near Wild Goose Landing Park, where 20 to 60 horizontal feet of mud and rock were exposed, as well as the North Shore Dispersed Use Area, which had up to 100 horizontal feet of mud and rock exposed (**Photographs 14-11**). These mud flats can be unsightly and smell of decaying organic matter if exposed to summer heat for long periods of time. However, these impacts were less severe than those observed when the reservoir was 4 feet below full pool but slightly more than when the reservoir is 1.5 feet below full pool. Areas with shorter exposure timeframes also had odors that were less pungent than areas of longer exposure.

Since auditory characteristics associated with the Project are largely defined by nearby industry and transportation (trains, cars, emergency sirens, etc.) the impact of the Project has minimal effect on this aesthetic characteristic. One exception to this is the warning siren that is executed when gates will be moved, opened, or additional water is spilled. This siren is clearly (and intended to be) heard in areas adjacent to and downstream of the Main Channel Dam and warns recreationists in and on the water that downstream flows will be changing. On infrequent occasions, high flows that require additional spill, or flexible operations, may trigger a siren.

Proposed future operations have the potential to affect the aesthetics of the Project to varying degrees during flexible capacity operations that fluctuate the reservoir elevation. While the impacts to aesthetics are greater at a 2.5-foot fluctuation than a 1.5-foot fluctuation, they are significantly less than the impacts of fluctuating the reservoir 4 feet.

Proposed future operations are not likely to impact LNF VQO's near the Project since the VQO's are prescribed for Forest System Lands that serve primarily as a backdrop to near-ground areas.

Photographs 14-11: Shorelines at 2.5 feet below full pool reservoir elevation. North shoreline of Island Park (top left), Wild Goose Landing Park (top right), Cherry Creek Boat Launch (bottom left), and south shore upstream of Steamboat Island (bottom right).

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14.4 Unavoidable Adverse Impacts

Unavoidable adverse effects to aesthetic resources will be intermittent as they relate to changes in the visual, olfactory, and auditory qualities of the Project when reservoir elevations fluctuate. As generation increases and reservoir elevations recede, shoreline areas will become exposed and have the potential to smell of decaying organic matter. However, proposed operations stipulate fluctuations of 2.5 feet or less rather than 4 feet as currently allowed, and odors of decaying matter are less prominent when less shoreline mud is exposed.

Visual impacts may be greater in areas where shallow shorelines with sedimentation expose large mud flats at lowest reservoir elevations, but the majority of shoreline areas within the Project area will have exposures of less than 10 horizontal feet at the lowest reservoir elevation.

On infrequent occasions, flexible operations during high flows may require gate movements, some of which would trigger a siren. Signals warning recreationists of impending water flow and elevation changes are a necessary component of public safety.

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15. Socio-Economic Resources

15.1 Affected Environment

15.1.1 Socio-Economic Conditions in the Project Vicinity

Sanders County in northwestern Montana borders the state of Idaho to the west and is defined by the Bitterroot Mountain Range along the southwesterly side and the Cabinet Mountains on the northeasterly side. The Clark Fork River is joined by the Flathead River in the eastern portion of the county and the two rivers – along with Highway 200 and the railroad corridor – divide the county along a northwest-southeast axis. The river valley topography facilitates primary highway access (Highway 200), railroad, residential development, limited cultivated agriculture, and Clark Fork River reservoirs impounded by three dams, of which the Thompson Falls Project is the most upriver hydro facility. The western two-thirds of the 1,733,000-acre county is characterized by steep forested mountain slopes divided by tributaries of the river and are predominantly public lands managed by the USFS or corporate owned timberlands. The eastern third is more open prairie and cultivated agricultural land.

Sanders County is the 18th most populated of Montana's 56 counties with a 2020 population of 12,400 as compared with the 2010 population of 11,413 (U.S. Census Bureau 2020). The Flathead Indian Reservation encompasses approximately the eastern third of the county. The county has experienced stable, slow growth over the last 20 years, though most of that growth has occurred in outlying areas while populations within municipal boundaries have remained fairly stable. Rural residential development is distributed along the valley floor with concentrations at the county seat of Thompson Falls (1,336 residents), Plains (1,106 residents) and smaller communities such as Trout Creek (277 residents) and Noxon (255 residents) (U.S. Census Bureau 2020).

Thompson Falls, located on Highway 200, is approximately in the middle of the county, about 100 miles northwest of Missoula, Montana, and 125 miles east of Spokane, Washington. Sandpoint, Idaho, is about 80 miles to the west. Highway 200 and a major rail corridor divide the City. The downtown area of the City is located along Main Street/Highway 200 and borders the Project's reservoir. The residential development that is most closely related to the Project area is the City as well as those outside of the city limits but within the same zip code (**Figure 15-1**), totaling 3,416 people (U.S. Census Bureau 2020) and accounting for 28 percent of the county's population.

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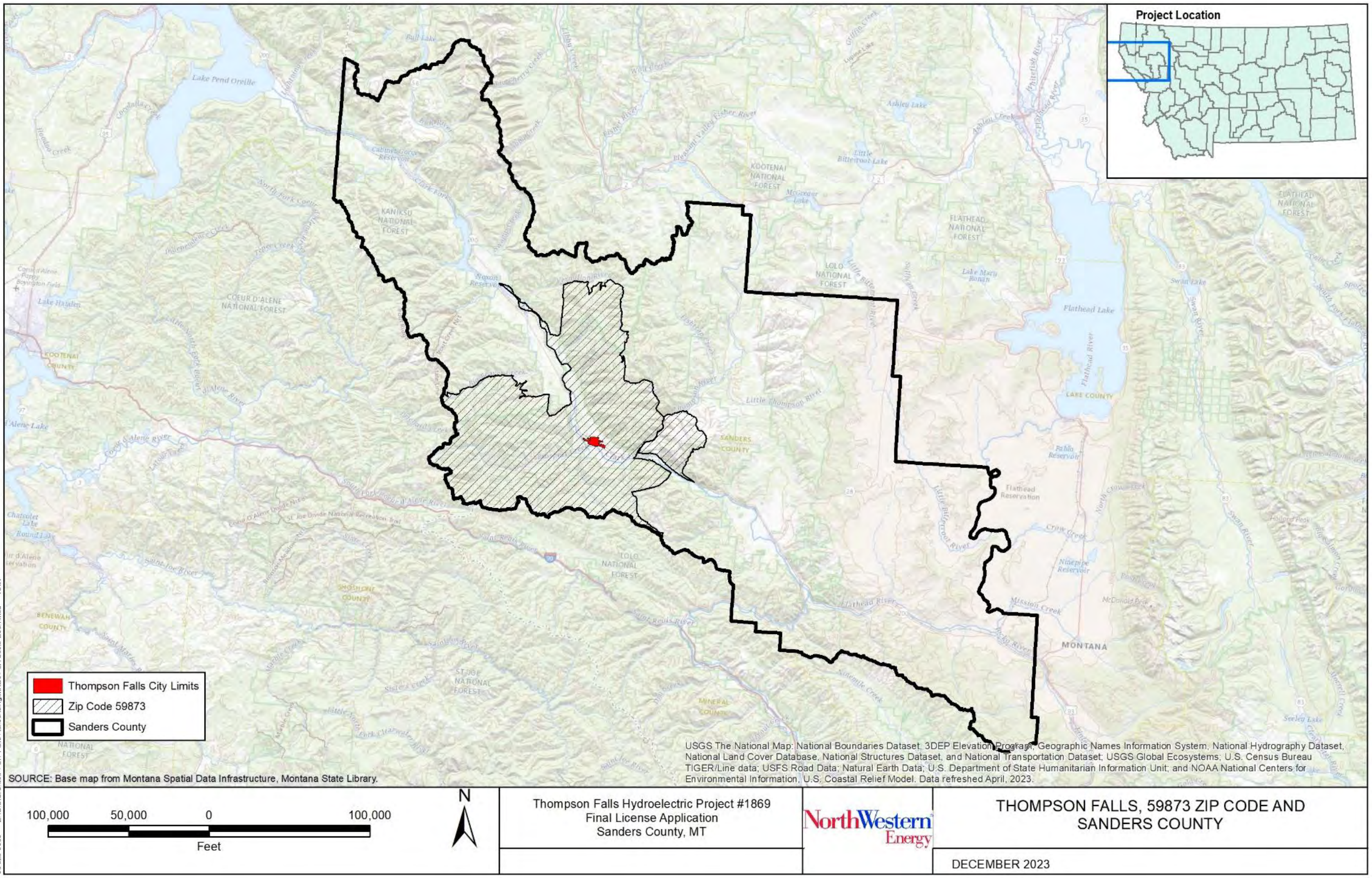
Figure 15-1: Boundaries of Thompson Falls, zip code 59873, and Sanders County, MT.



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The county economy has historically been based on timber harvest and processing. That industry has been in decline. Transition away from this industry amidst the recession of 2008 to 2010 was slow. The economic state that resulted is reflected in Sanders County's Distressed Communities Index[25] rating. The county ranked last in the state, accumulating 91 out of 100 possible points as averaged from 2007 to 2011 giving it a "distressed" ranking. However, that ranking improved for the timeframe 2012 to 2016, when the index fell 28.6 points to 62.4 putting it in the "at risk" ranking, reflecting improved economic conditions. As of June of 2023, there was further improvement with the index dropping to 52.5 points putting it in the "mid-tier" ranking (Economic Innovation Group 2023).

In Sanders County, average earnings per job increased 29.0 percent and per capita income increased 55.7 percent from 2000 to 2021. During this timeframe, the number of jobs in government decreased 3 percent, while jobs in non-service related and service related industries grew by 3 percent and 36 percent, respectively. Earnings increased in all three industries from 2001 to 2021, with a 58 percent increase in non-service industries, 78 percent increase in service industries, and a 19 percent increase in government jobs. The three industry sectors that added the most earnings from 2001 to 2021 were construction ($20.5 M), retail trade ($19.0M), and health care and social assistance ($33.0M). In 2021, the per capita income was $45,526 for Sanders County compared with $61,504 for Montana. Since 1990, the annual unemployment rate ranged from a low of 4.3 percent in 2022 to a high of 16.3 percent in 1985. In 2021, people living below the poverty rate in Sanders County was 16.8 percent as compared with 12.5 percent for Montana (Headwaters Economics 2023).

In 2020, the median property value in Sanders County, MT was $251,600, and the homeownership rate was 77.1 percent (Data USA 2023). However, property values have increased dramatically in western Montana since 2020, and Sanders County is no exception. The National Association of Realtors indicates a median home price of $374,165 as of the first quarter of 2023 (National Association of REALTORS® 2023). According to the City's most current Master Plan, there are close to 60 businesses in the City, most of which are locally owned. Primary employment classes are office and professional services (41%, including health care, social assistance, construction, retail trade, and utilities), restaurants (24%), financial (18%), medical (15%) and entertainment (3%) (Land Solutions 2015).

The local economy is based on a variety of sources including agriculture, fishing, hunting, forestry, and mining. Thompson Falls had been a logging community for many years, but reductions in timber harvest coupled with decreased lumber production have reduced logging projects (BBER 2019).

According to 2017 Census of Agriculture data, Sanders County encompasses 642,640 acres of farmland, accounting for 36.4 percent of land area in the county (USDA National Agricultural Statistics Service, 2019). These lands include nearly 400,000 acres of large-tract woodlands for timber production, while the remaining 240,000 acres (approximately) can be considered true

[25] The Distressed Communities Index (DCI) combines seven complementary economic indicators into a single measure of community well-being, ranging from 0 to 100. Scores over 80 are considered distressed.

farms (USDA National Agricultural Statistics Service, 2019). These smaller farm operations are typically not self-sustaining and use off-farm employment to support them.

The area is popular among Montana residents and nonresident visitors for fishing and hunting. In 2018, the Montana Office of Outdoor Recreation reported that outdoor recreation in Montana generated $7.1 billion in consumer spending in 2018 and supported 71,000 jobs in Montana. Similarly, residents of Montana spent $3.61 billion on outdoor recreation in Montana in 2018 (Montana Office of Outdoor Recreation 2018). Sanders County is no exception to these spending patterns and positive impacts. The FWP statewide angling pressure estimates in 2020 estimated 2,430 angler use days (of Montana residents) on Thompson Falls Reservoir (League and Ball 2020), a significant contribution to the local economy.

Travel-related spending in Sanders County in 2018 is estimated at $54M. Expenditures by out-of-state visitors are estimated at $17.9M (ITRR 2018), while Montana resident travel spending totaled $36.1M in the county (65% on day trips, 35% on overnight trips; Grau et al. 2018). Hunting, fishing, and outdoor recreation are large components of these spending behaviors. Big game hunters spent $12.7M in Sanders County in 2016; $6.2M by nonresidents and $6.5M by Montana residents. Elk hunters accounted for 52 percent of these expenditures, while deer hunters accounted for 48 percent (FWP 2017).

Thompson Falls has one public school system and multiple churches to serve most denominations common to the area.

There is a lighted and surfaced airport approximately 4 miles east of Thompson Falls with a 2,200-foot runway. Regional service centers with commercial air services are located in Missoula and Kalispell (101 and 107 miles, respectively, from Thompson Falls) and Spokane, Washington (125 miles from Thompson Falls). There is no public transportation available. Highway 200 is a secondary travel corridor to Glacier National Park, 141 miles to the northeast.

15.1.2 Economic Benefits of the Thompson Falls Project

Sanders County and the Thompson Falls area benefit directly and indirectly from the Project. Property taxes that support county budgets are paid annually by NorthWestern. The 2022 annual property taxes attributed to the Thompson Falls Project was $2,967,441.

Salaries for five permanent staff are paid and filter through the local economy, as well as out-of-area staff, contractors, and supporting positions such as fisheries biologists with FWP that work at the Thompson Falls Project periodically and provide an economic benefit through their travel and accommodation expenses.

The Project's reservoir draws landowners who desire water frontage more so than inland properties, a feature that increases property values and property taxes paid by private owners.

Finally, providing high-quality, well-managed recreation sites to the public free of charge allows personal disposable income to support recreation trips (food, drinks, boat gas, fishing supplies, etc.) rather than site use fees.

15.2 Environmental Measures

Because NorthWestern has identified no adverse impacts to socioeconomic resources related to operation or maintenance of the Thompson Falls Project, no protection and mitigation measures are currently being implemented or proposed.

15.3 Environmental Effects

15.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E – S**ection **2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E – Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

NorthWestern has identified no adverse impacts to socioeconomic resources related to operation or maintenance of the Thompson Falls Project under the existing license. Continuing operation of the Project will provide continued economic benefit to the Project area.

15.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations.

NorthWestern has identified no adverse impacts to socioeconomic resources related to operation or maintenance of the Thompson Falls Project under NorthWestern's proposed alternative. Future operation of the Project will continue to provide economic benefits to the Project area.

15.4 Unavoidable Adverse Impacts

No unavoidable or adverse impacts to socioeconomic resources are anticipated due to the proposed operations.

16. Environmental Justice

16.1 Affected Environment

In May of 2023, NorthWestern completed an Environmental Justice Study (EJ Study) of the Project (NorthWestern 2023a) in accordance with Schedule A of FERC's July 5, 2022, letter with additional staff study requests. The EJ Study followed the methodology of the EPA's *Promising Practices for EJ Methodologies in NEPA Reviews* (EPA 2016) in addition to the guidance outlined in Schedule A.

16.1.1 EJ Study Objectives

The goals and objectives of the EJ Study were to determine if any EJCs exist in or near the Project, and if so, the potential effects of the Project on those communities.

The EJ Study had five objectives:

1. To identify the presence of EJCs in the vicinity of the Thompson Falls Project and identify outreach strategies to engage the identified EJC in the relicensing process, if present.
2. To identify the presence of non-English-speaking populations that may be affected by the Project and identify outreach strategies to engage non-English-speaking populations in the relicensing process, if present.
3. To discuss effects of relicensing the Project on any identified EJC and identify any effects that are disproportionately high and adverse.
4. To identify mitigation measures to avoid or minimize adverse Project effects, if any, on EJCs.
5. To identify sensitive receptor locations within the Project area and identify potential effects and measures taken to avoid or minimize any adverse effects to such locations, if they are present.

Based on the results reported in the *Environmental Justice – FSR* (NorthWestern 2023a), NorthWestern initiated additional outreach locally, including a tour of the Project and a public meeting in Thompson Falls, both on May 25, 2023. Additional meetings were held in Thompson Falls on October 22, 2023, with an emphasis on recreation and docks. Feedback from these meetings has been considered in developing this FLA, as described below.

16.1.2 Study Area and Methods

The study area is the area within 1 mile of the current Project boundary consistent with FERC methodology for collecting environmental justice data for hydroelectric projects and as specified in FERC's study request (FERC 2022).

The methodology for identifying the presence of EJ communities in the vicinity of the Project is the methodology FERC adopted for collecting environmental justice data for hydroelectric projects, and is summarized in FERC's July 5, 2022, request for the EJ Study. FERC's study request (FERC 2022) indicates that this methodology has been successfully employed at a number of projects during the licensing process and is consistent with guidance from the EPA (2016). The methodology involves using statistics from the U.S. Census Bureau's 2021 American Community Survey (Census 2022) 5-year estimates for racial, ethnic, and poverty populations for each state, county, and census block group within the study area. The *Environmental Justice – FSR* (NorthWestern 2023a) used data from the 2020 American Community Survey (Census 2021). At FERC's request, the data used in this Section is updated to include the most recently collected data from the 2021 American Community Survey (Census 2022). Those statistics were then analyzed to determine if an EJC exists within the study area by applying the methods included in the guidance from the EPA (2016).

16.1.2.1 Minority Populations

For minority populations, the 2021 American Community Survey (Census 2022) 5-year estimates from Table B03002 were used for race and ethnicity data. That data was then analyzed to determine if an EJC exists based on the presence of minority populations by the following methods:

i. 50% Analysis Method: Determine whether the total percent minority population of any block group in the affected area exceeds 50%.

ii. Meaningfully Greater Analysis Method: Determine whether the minority population in the effected census block group is 10% greater than the percentage of the minority population in Sanders County.

16.1.2.2 Low-Income Populations

For low-income populations, the 2021 American Community Survey (Census 2022) 5-year estimates from Table B17017 were used for income information. That data was then analyzed to determine if an EJC exists based on the "Low-income Threshold Criteria Method." An EJC exists if the percent of the population below the poverty level in the identified block group is equal to or greater than the percent of the population below the poverty level in Sanders County.

16.1.2.3 Non-English-Speaking Groups

The EPA's "EJScreen: Environmental Justice Screening and Mapping Tool" (EPA 2022) was used to determine non-English-speaking groups in the study area.

16.1.2.4 New Construction-Sensitive Receptor Location

New construction is not proposed so the identification of sensitive receptor locations (e.g., schools, day care centers, hospitals, etc.) within the study area is not required.

16.1.3 Results

There are five census block groups within the study area. The statistics from these five census block groups were compared to the reference population of Sanders County to determine if any EJCs exist. **Figure 16-1** shows the general location and size of the five census block groups in the Project area, and **Figure 16-2** shows the location of the census block groups and two EJCs within the study area.

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Figure 16-1: Size (in acres) and location of Census blocks groups in the Project area.

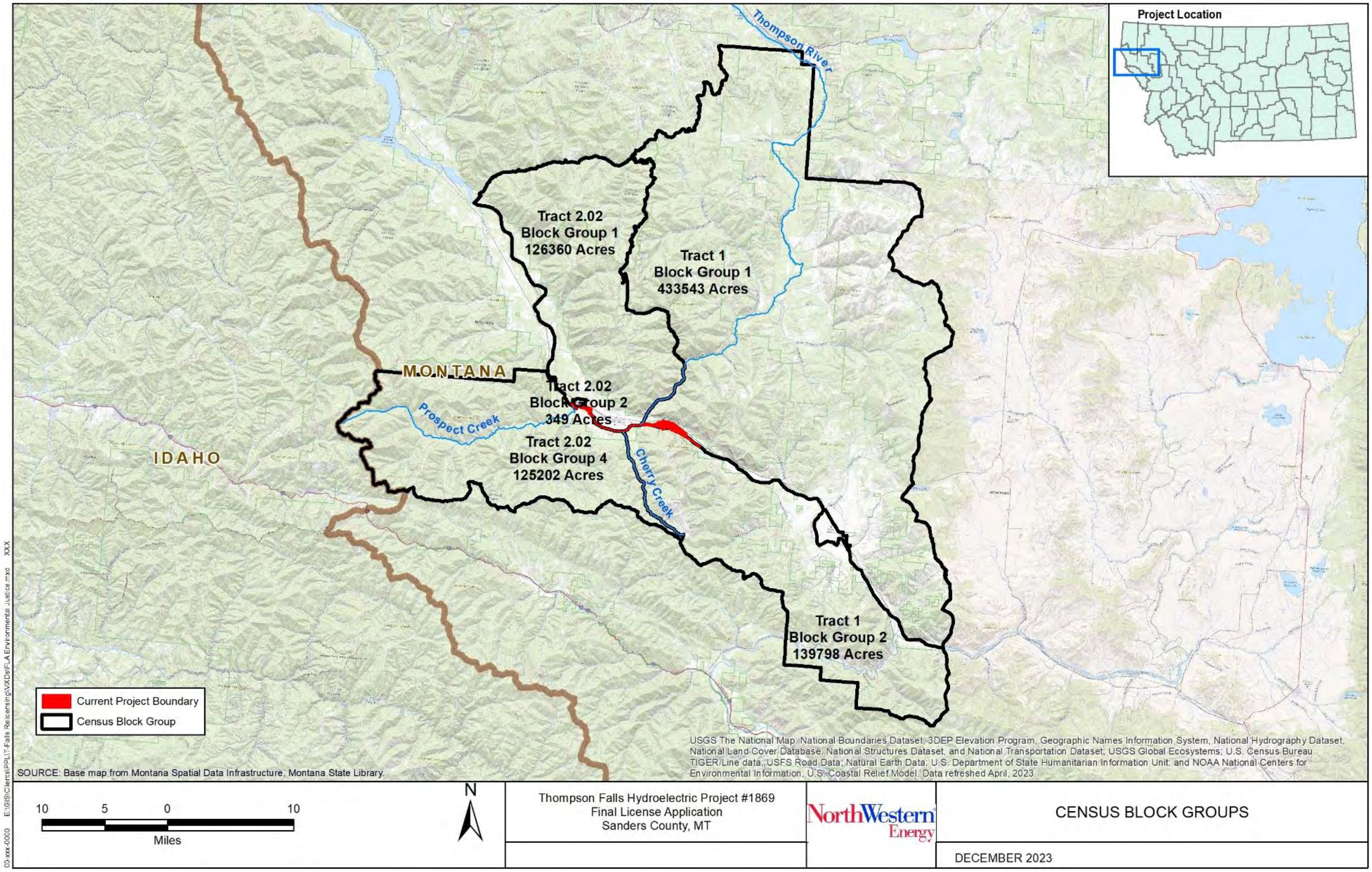
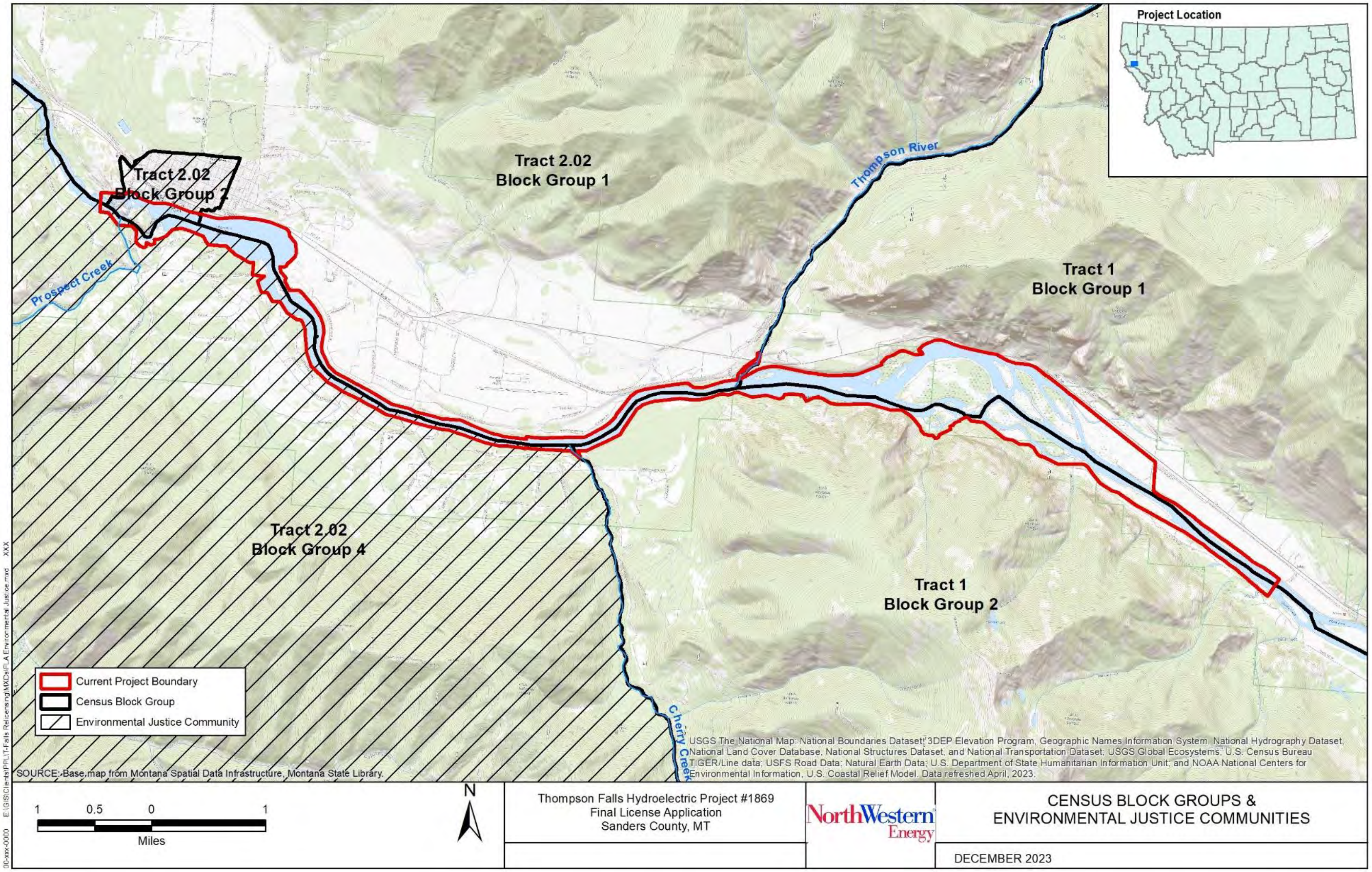


Figure 16-2: Census blocks groups and Environmental Justice Communities in the Project area.



State, county, and census block group statistics from the 2021 American Community Survey 5-year estimates for minority and low-income populations (Census 2022) are shown in **Table 16-1**.

16.1.3.1 Minority Populations

The 50-Percent Analysis Method and the Meaningfully Greater Analysis Method were applied to the statistics shown in Table 16-1 to determine if an EJC exists for the Project based on minority populations:

i. 50% Analysis Method – None of the minority populations exceed 50% of the total population. Thus, an EJC does not exist using this method.

ii. Meaningfully Greater Analysis Method – This method determines if the minority population in the affected census block group is 10% greater than the overall minority population in Sanders County. Sanders County has a minority population of 10.5%. Thus, the threshold to qualify as an EJC using this method would be a minority population in the census block group of 11.6%. None of the 5 census block groups have a minority population that is above 11.6%. Thus, an EJC does not exist using this method.

16.1.3.2 Low-Income Populations

As described in the study methods, the "Low-income Threshold Criteria Method" was applied to the statistics shown in Table 16-1 to determine if an EJC exists. In Sanders County, 16.2 percent of the population is below the poverty level. The percent below the poverty level in two of the five census block groups exceeds 16.2 percent, making these two census block groups EJCs.

In census block group #2 (GEOID #2022) (EJC-1), 19.2 percent of the population is below the poverty level. This census block group is located in the approximate western two-thirds of the City (*refer to* Figure 16-2). It is 349 acres in size and is entirely within the EJ Study area. EJC-1 includes the Project's powerhouses and much of the dam infrastructure. It includes many City businesses such as restaurants, stores, banks, and gas stations. It also includes the City's mayoral office and other City administrative offices, and the Sanders County administrative offices (Thompson Falls is the county seat for Sanders County). More information regarding the socio-economic conditions of the City can be found in **Exhibit E – Section 15 – Socio-Economic Resources**.

In census block group #4 (GEOID #2024) (EJC-2), 23.5 percent of the population is below the poverty level. This census block group is 125,202 acres in size, extending south of the Project area to the Idaho border (*refer to* Figure 16-1). A small portion of this large census block group is located on the south shore of Thompson Falls Reservoir and the Clark Fork River from Cherry Creek on the upstream end to a point 1 mile downstream of the Project (*refer to* Figure 16-2).

16.1.3.3 Non-English-Speaking Groups

The EPA's "EJScreen: Environmental Justice Screening and Mapping Tool" indicated 0 percent non-English-speaking groups in the study area (EPA 2022).

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Table 16-1: 2021 American Community Survey Data, Census Tract/Block Groups – race, ethnicity, and low-income data.

Geography GEOID (last 4 digits)	RACE AND ETHNICITY DATA										LOW INCOME DATA
	Total Population Count	White Alone Not Hispanic (count)	African American (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Hispanic or Latino (count)	Total Minority (%)	Below Poverty Level (%)
Montana	1,077,978	938,223	6,236	65,452	8,972	581	10,155	48,359	43,877	14.9	12.3
Sanders County	12,298	11,006	37	432	23	10	6	381	403	10.5	16.2
Tract 1 Block Group 1	1,658	1,469	0	33	0	0	0	121	35	11.4	12.4
Tract 1 Block Group 2	1,837	1,713	8	30	3	0	0	35	48	6.8	14.5
Tract 2.02 Block Group 1	1,267	1,147	0	11	3	0	0	51	55	9.5	0.9
Tract 2.02 Block Group 2	1,016	907	0	14	0	0	0	0	95	10.7	19.2
Tract 2.02 Block Group 4	431	431	0	0	0	0	0	0	0	0	23.5

Source: Census 2022

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Socio-Economic conditions in Sanders County are summarized below, with more detail available in **Exhibit E – Section 15- Socio-Economic Resources.** In general, the local economy is based on agriculture, fishing, hunting, forestry, and mining. Thompson Falls had been a logging community for many years, but reductions in timber harvest coupled with decreased lumber production have reduced logging projects (BBER 2019).

The Sanders County Distressed Communities Index[26] rating has been improving over time. The county ranked last in the state from 2007-2011, however, that ranking is improving. As of June of 2023, the county had moved from last in the state to a "mid-tier" ranking (Economic Innovation Group 2023).

In Sanders County, average earnings per job increased 29.0 percent and per capita income increased 55.7 percent from 2000 to 2021. In 2021, the per capita income was $45,526 for Sanders County compared with $61,504 for Montana. Since 1990, the annual unemployment rate ranged from a low of 4.3 percent in 2022 to a high of 16.3 percent in 2009. In 2022, people living below the poverty rate in Sanders County was 16.2 percent as compared with 12.3 percent for Montana (Headwaters Economics 2023).

The National Association of REALTORS® indicates a median home price of $374,165 in Sanders County as of the first quarter of 2023 (National Association of REALTORS®, 2023). According to the City's most current Master Plan, there are close to 60 businesses in the City, most of which are locally owned. Primary employment classes are office and professional services (41%, including health care, social assistance, construction, retail trade, and utilities), restaurants (24%), financial (18%), medical (15%) and entertainment (3%) (Land Solutions 2015).

The EJ Study results indicate the following:

- There are no EJCs within the Project area associated with minority populations.
- Two of the 5 census blocks within the Project area are EJCs associated with low-income populations.
- There are no non-English speaking groups in the Project area.
- Since the Project did not involve new construction, sensitive receptor locations were not identified nor further analyzed.

16.1.3.4 Outreach to EJCs in the Project Area (Meaningful Involvement)

Before filing a FLA with FERC, applicants are required to conduct a rigorous pre-license application filing process that consists of 1) presenting the Project to Relicensing Participants; 2) consulting with those Relicensing Participants; 3) identifying issues; 4) gathering available information; 5) preparing study results and obtaining review of those results from Relicensing

[26] The Distressed Communities Index (DCI) combines 7 complementary economic indicators into a single measure of community well-being, ranging from 0 to 100. Scores over 80 are considered distressed.

Participants; and 6) preparing a DLA and providing an opportunity for Relicensing Participants to review and comment on the DLA.

NorthWestern maintains a website with information about the Thompson Falls Project, including relicensing information, meeting notices and presentations, reports, and other documents.

NorthWestern proactively initiated relicensing outreach discussions with Relicensing Participants in 2018. The first activity was a training program, "FERC 101," was held in Missoula, Montana on September 12, 2018. This program included FERC staff who presented information on the procedures used to relicense hydropower projects under the FERC's jurisdiction. NorthWestern also presented information on the Thompson Falls Project. The goal of the meeting was to inform Relicensing Participants of the relicensing process and schedule for the Thompson Falls Project. Presentations from this meeting, and all other Thompson Falls relicensing meetings, are posted on NorthWestern's website.

Next, prior to the commencement of the formal FERC relicensing process, NorthWestern voluntarily prepared a BED which was a compilation of existing resource information. This document was released for public comment on November 1, 2018, and is available on the website. On December 4, 2018, a workshop was held in Missoula to discuss the BED and identify any data gaps and resource issues. The presentations from that meeting are available on the website.

On October 15, 2019, from 6 to 8 p.m., NorthWestern voluntarily hosted a public meeting in Thompson Falls at the Thompson Falls Community Center. The meeting was held in the evening to avoid conflict with normal work hours with the goal of receiving input from the local community in which the Project infrastructure is located. Notice of the meeting was provided through an advertisement in the local newspaper (the Sanders County Ledger), sending notice of the meeting via email to people who had signed up to be on the email list, and by sending post cards to people who had signed up to be on the mailing list.

The material presented at the meeting included a general description of the relicensing process and the purpose of the recently completed operations test. Forty-four people attended the meeting. Attendees had many comments and questions, with most of them pertaining to the operations test that NorthWestern completed from October 8 to 10, 2019, and the impacts caused by the 4-foot fluctuation in water levels during the test. Further, during the meeting, a recommendation was made that NorthWestern expand its outreach regarding relicensing developments to include seasonal residents. Based on the comments from the October 2019 public meeting, NorthWestern expanded email and mailings to include all landowners adjacent to the Project boundary.

On March 11, 2020, from 6 to 8 p.m., NorthWestern voluntarily hosted a second public meeting at the Thompson Falls Community Center. Once again, the meeting was held in the evening to avoid conflict with normal work hours to maximize attendance. Notice of the meeting was provided through an advertisement in the local newspaper, sending notice of the meeting by email to people who had signed up to be on the email list, and by sending post cards to people who had signed up to be on the mailing list and to landowners adjacent to the Project boundary. Twentytwo people attended the meeting. Based on the comments from the October 2019 public meeting, NorthWestern added all landowners along the reservoir to the mailing list to make sure all landowners were also provided notice of the meeting. The material presented at the meeting included a general description of the relicensing process, the results of the October 2019 operations test including the observed impacts to resources from the 4-foot fluctuation, and of NorthWestern's intention to propose a maximum 2.5-foot fluctuation in water levels under the new license. Attendees had many comments and questions, with most of them pertaining to the operations test that NorthWestern completed from October 8 to 10, 2019, and the impacts caused by the 4-foot fluctuation in water levels during the test.

NorthWestern completed a recreation visitor survey in 2021 (NorthWestern 2022a). Three of the survey sites were in EJC-1 and two of the survey sites were in EJC-2. Of the visitor survey responses, 78 percent came from within the two EJCs, indicating both significant outreach and feedback from respondents that were recreating within the two EJCs.

It is also important to note that elected officials in the City and Sanders County, who represent people in the two EJCs, have been actively involved in NorthWestern's consultation process. Further, consultation with tribes is described in **Exhibit E - Section 12.2 – Tribal Cultural and Economic Interests** and **Exhibit E - Section 19 – Consultation Documentation**.

On April 28, 2023, NorthWestern staff and consultants met with the three Sanders County Commissioners, the Mayor of the City, a City Council Member who also happens to be the Sanders County Planner, and the Recreation and Outreach Coordinator for the Kaniksu Land Trust. One of the purposes of the April 28, 2023, meeting was to receive input specific to the two local EJCs.

On May 24, 2023, NorthWestern held a daytime meeting to review the Updated Study Reports. This meeting was attended by tribes, agencies, and local residents. Additionally, NorthWestern held a site tour and a public meeting on the evening of May 25, 2023, at the Sanders County Courthouse, which is located within EJC-1. The presentation included a summary of the Updated Study Reports, including the EJ Study. Approximately ten members of the public attended the meeting. This provided another opportunity for residents of the two EJC's to provide comment on the Project prior to the filing of the DLA.

On October 22, 2023, NorthWestern held additional meetings at Thompson Falls with an emphasis on docks and recreation. These meetings were attended by approximately 40 individuals (in person and virtual) comprised of a combination of local citizens, recreation groups, local government officials and NorthWestern.

16.2 Environmental Measures

16.2.1 Existing Environmental Measures

Under the current license, and as described in more detail below, NorthWestern provides a diverse network of public recreation resources. NorthWestern operates and maintains these facilities, with no admission or other user cost, for use by members of the surrounding community, including the two EJCs. Based on surveys of users of the recreational resources, these are of tremendous value to the surrounding communities, including the EJCs.

NorthWestern provides opportunities for members of the surrounding communities, including the two EJCs, to provide feedback and input regarding the recreational resources and the operation of the Project itself. NorthWestern maintains a website that provides details regarding the Project and its operation. The website includes contact information for NorthWestern staff. NorthWestern also regularly surveys the users of the recreational resources for feedback.

Additionally, hydropower is a renewable energy source that produces reliable, low-cost energy (DOE 2023; NHA 2023). Given the fact that the two identified EJCs are EJCs because they meet the low-income criteria, low energy costs are an important benefit.

16.2.2 Proposed Environmental Measures

NorthWestern is not proposing additional PM&E measures specific to environmental justice communities. However, PM&E measures for other resource areas will also benefit EJCs, such as:

- The Licensee shall implement the Recreation Management Plan (Exhibit E-Appendix D). This Recreation Management Plan includes the following elements:
    - Periodic visitor and site monitoring over the New License term.
    - Add Power Park as a Project recreation site, including maintenance of the group-use pavilion and plumbed restroom facility, drinking water station, picnic tables, and benches.
    - Continue to operate and maintain Island Park and the North Shore and South Shore Parking Areas as Project recreation sites, including the parking areas, interpretive information and the upstream fish passage facility viewing platform, as well as benches, picnic tables, and vault latrines throughout Island Park and parking areas. This excludes the Historic High Bridge which is owned and maintained by Sanders County.
    - Continue to operate and maintain Wild Goose Landing Park as a Project recreation site, including a new floating boat launch dock to accommodate reservoir fluctuations down to 2.5 feet, boat ramp, swimming dock, picnic facilities, bathrooms, parking areas, garbage service, and general site and facility upkeep.
    - Continue to operate and maintain the South Shore Dispersed Recreation Area as a Project recreation site with an expanded boundary, including dispersed parking, regulatory signage and vault latrine so as to maintain the site as a primitive day use area.
    - Add Cherry Creek Boat Launch Site as a Project recreation site, including operation and maintenance of the picnic facilities, vault toilet restroom, boat launch and dock.

16.3 Environmental Effects

16.3.1 No Action Alternative

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

The Project primarily has positive environmental, economic, recreation, and community effects on EJC-1 and EJC-2. Hydropower is a renewable energy source that produces reliable, low-cost energy (DOE 2023; NHA 2023). Hydropower plays a key role in addressing climate change and provides benefits beyond electricity generation such as flood control, irrigation support, and recreational resources (DOE 2023; NHA 2023).

There are no greenhouse gas emissions or other air emission-related impacts associated with electrical generation from hydropower. This stands in contrast to other energy sources, particularly those involving production of energy from fossil fuels. Because renewable energy projects have minor, if any, greenhouse gas emissions, a detailed analysis of such impacts is not necessary or appropriate (Council on Environmental Quality 2023).

The Project employs five full-time and one seasonal employee with a combined annual income/benefit value of about $650,000. NorthWestern also contracts with companies that provide services to NorthWestern at the Project, and average contract payments over the last 5 years total approximately $1,300,000 per year. It is presumed that these employees and contractors spend some of that money in the local area, and since many of the businesses (e.g., gas stations, restaurants, lodging, hardware store, etc.) within the City are located within EJC-1, it is reasonable to conclude a positive economic impact is provided by the Project in EJC-1.

NorthWestern provides important recreation facilities that serve both EJCs, free-of-charge. Island Park and Power Park are both located in EJC-1.

Island Park is located on NorthWestern-owned property and is operated and maintained by NorthWestern. The site offers trail-based recreation with views of the waterway and Project facilities. To better accommodate public access to the island from the north shoreline, the Licensee purchased three undeveloped City lots 100 feet from the Gallatin Street Bridge and developed them to provide a public parking area. Designated ADA parking is available directly adjacent to the bridge. The parking area accommodates 17 vehicles, and the Gallatin Street Bridge provides walk-in / ADA access to the island.

Benches, picnic tables, and an ADA-accessible restroom are provided along trails on the island. The upstream fish passage facility public viewing platform, constructed in 2012 on the eastern edge of the island, offers views of the Main Channel Dam and the fish passage facility. Interpretive information regarding operation of the fish passage facility and fish species of interest was placed at the viewing platform as well. Interpretation throughout Island Park includes historical information related to building of the Thompson Falls Project and other geographically and culturally significant topics. The island is linked to the south shore by the Historic High Bridge.

Power Park is located on NorthWestern-owned property and is operated and maintained by NorthWestern. Power Park is ADA-accessible and is located along the north shoreline, just above the original powerhouse with parking available for 10 vehicles. Until 2021, Power Park offered a group use pavilion with power, running water, and plumbed restrooms, as well as multiple picnic tables, and benches. The pavilion was destroyed in an arson fire in 2021. NorthWestern voluntarily reconstructed and upgraded facilities at Power Park beginning in 2022. Currently, the park contains an information sign related to the hydroelectric generating capacity of the Project, as well as an information kiosk which directs visitors to public recreation opportunities in and near Thompson Falls. The park also serves as a parking area for visitors that seek to access the Powerhouse Loop Trail by following sidewalks within the park to trail segments linked by the Powerhouse access road. The park is a popular venue for numerous outdoor events each year.

Wild Goose Landing Park is not located within EJC-1, but is less than 1,000 feet away, within easy walking distance. Wild Goose Landing Park provides open space, picnic facilities, plumbed restrooms, a boat launch and dock, a separate swimming dock, and shoreline fishing. Designated parking adjacent to the restroom facility accommodates 10 vehicles, including one ADA-designated parking space, while about 10 more vehicles may park in dispersed areas along the access road adjacent to the boat launch.

There are also non-Project recreation amenities within these two EJCs. The Cherry Creek Boat Launch is located in EJC-2, as well as a parking area that provides access to Island Park from the south shoreline. The Historic High Bridge, restored in 2010 to 2011, is within both EJC-1 and EJC-2, and provides a non-motorized transportation corridor that links EJC-1 to EJC-2. The Powerhouse Loop Trail is not located within EJC-1, but is less than 1,000 feet away, within easy walking distance. All of these Project recreation sites, and non-Project public recreation amenities are open to the public free of charge and maintained for public use by NorthWestern and other partners.

As discussed in **Exhibit E – Section 11 – Recreation**, visitor surveys have shown that Project recreation sites and the other recreational amenities are repeatedly enjoyed by local residents, including residents of the two EJCs. Survey results indicate that local residents are satisfied with the opportunities and amenities available, and they feel uncrowded as they participate in recreation activities to maintain a healthy mind and body. Power Park also provides opportunities for get-togethers such as family picnics and community events such as the Trick-or-Treat Move Your Feet fun run and the annual Chicken Jamboree. The recreation facilities are also enjoyed by people that live outside the area, and presumably those people are having a positive economic impact to EJC-1 by spending money at businesses within EJC-1.

In addition, NorthWestern supports local groups and events, such as decorating in the City at Christmas time, sponsoring ads in the local paper for local high school teams and booster club sponsorship, accommodating tours of the hydro facilities for local school groups, being a member of the Chamber of Commerce, donating to the local foodbank, etc.

Under the no action alternative, potential negative Project impacts to public boat launches and docks may result from intermittent use of the top 4 feet of the reservoir to accommodate flexible capacity generation. However, these impacts are not disproportionately high or adverse to EJC-1 or EJC-2.

16.3.2 Applicant's Proposed Alternative

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations.

Impacts to EJCs under NorthWestern's proposed alternative will not be disproportionate and would be the same as the no action alternative, with the exception that the proposed change in the Project boundary will result in additional recreation lands being incorporated into the Project, a benefit to EJCs.

Members of the public have raised concerns about the reservoir fluctuations. Potential negative Project impacts may result from intermittent use of the top 2.5 feet of the reservoir to accommodate flexible capacity generation. However, this is less than the drawdowns under the no action alternative, which could be as much as 4 feet, at least occasionally. Additionally, in **Exhibit E – Section 11.3 – Environmental Analysis - Recreation**, impacts to public recreation associated with the 2.5-foot fluctuation are described. Based on results from the Operations Studies (NorthWestern 2022b, 2023b), flexible generation could adversely affect some private boat docks and some private boat launches that were not constructed to account for fluctuating water levels. To address these concerns, NorthWestern is working with private dock owners on an off-license mitigation measure. With respect to public recreation facilities, the impacts of the 2.5-foot fluctuations are minor and not disproportionately high or adverse to EJC-1 or EJC-2 because they are experienced throughout the Project reservoir area. Additionally, the proposed alternative enables NorthWestern to continue to provide low cost, reliable, and carbon free power.

16.4 Unavoidable Adverse Impacts

Based on the results of the EJ Study, there are no unavoidable adverse impacts to EJCs.

17. Developmental Analysis

This section analyzes the cost of continued operation and maintenance of the Thompson Falls Project under the no action alternative and NorthWestern's proposed alternative. Costs are associated with the operation and maintenance of the Project's facilities, as well as the cost of providing proposed PM&E measures.

17.1 Power and Economic Benefits of the Project

The Thompson Falls Project is currently operated to maximize production from available baseflows while providing flexible capacity with available reservoir volume.

The Project has a maximum hydraulic capacity of 23,320 cfs for a maximum production of 94 MW of actual electric production. The Thompson Falls Project has averaged 475,379 MWh of net energy production annually for the 5-year period of 2018-2022. Through that time the plant attained a capacity factor of 57.2 percent and an Equivalent Availability Factor of 84.36 percent, showing good availability and reliability.

River flows not passing through the plant are passed through the spillgates or over the spillway of the dam. The Project has a minimum flow requirement of 6,000 cfs downstream of the facility that must be maintained at all times, unless inflows drop below 6,000 cfs. The Project's current FERC license allows for use of the top 4 feet of the reservoir for flexible capacity operation, although historically has operated within the top 1.5 feet of the reservoir.

The Project currently provides flexible capacity by increasing or decreasing generation through the plant while maintaining normal operating elevations of the reservoir. Availability of flexible capacity is dynamic and based on Project baseflows, available unit(s), current production, and reservoir elevation.

The normal maximum reservoir level of El. 2,396.5 results in active storage of approximately 15,000 acre-feet between El. 2,396 and 2,380. The Project is generally operated to provide both baseload generation and flexible capacity (as unit availability, river flow, and reservoir conditions are appropriate). Unit availability to provide flexible capacity either through an increase or decrease in generation changes as the baseflows of the river change through the seasons.

Absent the Thompson Falls Project, NorthWestern would be required to build another generation project or purchase energy on the open market to serve customer load. The Project has provided an average $21M annually in avoided cost value and is projected to provide $30 M annually going forward based on future market rates for electricity at the Mid-Columbia hub. Flexible capacity provides value above and beyond baseload energy production. The value of flexible capacity was estimated using comparable alternatives of battery projects. The current estimated value of flexible capacity using the top 4 feet of reservoir (per the current license) is $4.1M annually.

17.2 Comparison of Alternatives

The only operational difference between the alternatives is the change in reservoir storage.

Under the no action alternative, the Project would continue to operate as it has in the past. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

The proposed alternative limits the flexible reservoir storage to the top 2.5 feet. Baseload annual generation, Project capacity, and production cost remain the same for all alternatives (**Table 17-1**). The quantity of flexible storage is increased to 100 MWh due to the increased flexible storage in the reservoir.

Table 17-1: Comparison of alternatives.

Alternatives	Generation*	Capacity	Production Cost**	Flexible Storage
	(MWh)	(MW)	($/yr)	(MWh)
No Action Alternative (4 feet)	475000	92.6	$29,456,671	160
No Action Alternative (1.5 feet)	475000	92.6	$29,456,671	60
Proposed Action (2.5 feet)	475000	92.6	$29,456,671	100

Notes: * estimate from past production; ** annual revenue requirement; $/yr = cost per year, in dollars; MW = megawatt; MWh =megawatt-hours

The basic formula for determining a revenue requirement is:

$$R = B \bullet r + E + d + T$$

where:

R = revenue requirement,
B = ratebase, which is the amount of capital or assets the utility dedicates to providing its regulated services
r = allowed rate of return, which is the cost the utility incurs to finance its rate base, including both debt and equity,
E = operating expenses, which are the costs of items such as supplies, labor (not used for plant construction), and items for resale that are consumed by the business in a short period of time (less than 1 year),
d = annual depreciation expense, which is the annual accounting charge for wear, tear, and obsolescence of plant, and
T = all taxes not counted as operating expenses and not directly charged to customers.

17.2.1 *No Action Alternative*

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented including limiting reservoir level fluctuations by only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the No Action Alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes.

Under the no action alternative, the annual production of baseload generation (475,000 MWh) would not change and has an avoided cost value of approximately $30M per year based on the Mid-Columbia hub index. Flexible capacity under the current license provides for 160 MW-hrs of storage. For more information *see* **Exhibit D- Section 9 – Power Generation from Changes in Operations**.

17.2.2 *Proposed Action*

Under the Proposed Alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations.

Under the proposed alternative, the annual production of baseload generation (475,000 MWh) would not change and has an avoided cost value of approximately $30M per year on the Mid-Columbia hub index. Flexible capacity under the proposed action provides 100 MWh of flexible storage. For more information *see* **Exhibit D – Section 9 – Power Generation from Changes in Operations**.

17.3 Cost of Environmental Measures

Estimated costs for proposed PM&E environmental measures are in **Table 17-2.** Costs were estimated to implement the proposed PM&E measures on a recurring annual basis and for one-time capital costs. The capital costs were annualized over a 30-year period and added with the annual costs of implementation resulting in a total annualized costs for the Project PM&E as proposed, rounded to the nearest $1,000.

Table 17-2: Estimated cost of PM&E environmental measures.

One-timePM&E Measure	Capital Cost	Annual Cost	Annualized Cost[27]
Fisheries			
Implement Fisheries and Aquatic Resources PM&E Plan (mitigation and continued operation of the TAC)		$200,000	$200,000
Annual staffing for upstream fish passage facility		$100,000	$100,000
Operate and maintain the upstream fish passage facility	$1,500,000[28]	$100,000	$150,000
Fisheries monitoring staffing (annual population monitoring, PIT arrays, telemetry)		$150,000	$150,000
Submersible PIT tag arrays - equipment	$100,000		$3,000
Minimum instream flows		$5,000	$5,000
Water Quality			
Implement Thompson Falls Water Quality Monitoring Plan		$40,000	$40,000
Implement the TDG Control Plan		$13,100	$13,000
Terrestrial Resources			
Implement annual noxious weed control measures		$35,000	$35,000
Manage the shoreline pursuant to FERC's Standard Land Use Articles		$25,000	$25,000
Geology			
Develop and implement a Drawdown Management Plan	$12,000	$1,600	$2,000
Recreation			
Implement Recreation Management Plan - Project Management		$66,000	$66,000
Power Park Operation and Maintenance		$26,900	$27,000
Island Park - Operation and Maintenance		$33,200	$33,000
South Shore Dispersed Area - Operation and Maintenance		$17,600	$18,000
Wild Goose Landing Park - Operation and Maintenance		$44,900	$45,000
Cherry Creek Boat Launch - Operation and Maintenance		$23,750	$24,000
Wild Goose Landing Park - Bathroom and dock improvements	$200,000		$7,000
Cherry Creek Boat Launch Site - boat launch improvements	$125,000		$4,000
Cultural Resources			
Implement HPMP		$55,000	$55,000
Total	$1,937,000	$ $937,050	$1,002,000

17.4 Air Quality

No new construction is proposed for the Project. As such, an effects analysis of air quality is not required.

[27] Rounded to nearest $1,000

[28] NorthWestern has included the high cost estimate for modifications to the fish passage facility, but intends to work to reduce costs as possible.

18. Conclusions and Recommendations

18.1 Comparison of Alternatives

Under the no action alternative, the Project would continue to operate as it has in the past. The Project would continue to operate as authorized under the existing license. The license allows for baseload and flexible generation including peaking such that when electrical demand is high, the Project would be operated at or near full load; when electrical demand is low, generation would be reduced. NorthWestern would have the option of using the top 4 feet of the reservoir from full pool for these purposes. In practice, NorthWestern has rarely used the full 4 feet, typically operating in the top 1.5 feet.

Also under the no action alternative, the ongoing environmental measures described in **Exhibit E - Section 2.1.4.2 – Ongoing Environmental Measures** would continue to be implemented. However, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would not be implemented and as such, the resulting public benefits and resources would not be realized, including limiting reservoir level fluctuations to only 2.5 feet.

In addition, the FERC Project boundary would not be adjusted under the no action alternative which would limit NorthWestern's and FERC's ability to manage lands and waters that are needed for Project purposes. Specifically, this would limit consistent oversight, management, and maintenance of sites such as Power Park, the South Shore Dispersed Recreation Area, the area that connects Island Park to the north shoreline, the picnic and restroom facilities at Wild Goose Landing Park, and the Cherry Creek Boat Launch Site. Under the proposed alternative, NorthWestern is proposing to expand the number of sites included in the Recreation Management Plan (Exhibit E - Appendix D) by adding the existing Power Park and Cherry Creek Boat Launch Site to the Recreation Management Plan to ensure the Project's recreational values continue to be available to the public.

Under the no action alternative, NorthWestern's plans to conduct water quality monitoring to develop long-term trends in accordance with the Water Quality Monitoring Plan (Appendix C), would not be implemented. The Water Quality Monitoring Plan includes provisions for routine monitoring for nutrients and TDG. In addition, sediment quality monitoring would not occur prior to permitted sediment disturbance or removal of reservoir bed sediments.

While the existing PM&E measures for fisheries would continue to be implemented, the proposed additional fisheries PM&E would not be implemented under the no action alternative.

Under the proposed alternative, the Project will continue to be operated to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. In general, a minimum flow of 6,000 cfs or inflow whichever is less will be maintained downstream during normal operations.

Under the no action alternative, reservoir water level fluctuations to 4 feet below full pool could occur periodically. Reservoir fluctuations at this level have been shown to have adverse effects on shoreline erosion, recreation, aesthetics, and fisheries.

Under the proposed alternative, the proposed new environmental measures described in **Exhibit E - Section 2.2.4 – Proposed Environmental Measures** would be implemented as well as the off-license Dock Mitigation Plan.

18.2 Unavoidable Adverse Effects

No unavoidable adverse impacts to wildlife, botanical resources, land use, socio-economic resources, or EJ are anticipated. Unavoidable adverse impacts to other resources are described in the following sections of Exhibit E:

- Section 5.6 – Geology, Topography, and Soil Resources - unavoidable adverse impacts
- Section 6.10 – Water Quality and Quantity - unavoidable adverse impacts
- Section 7.4 – Fisheries and Aquatic Resources - unavoidable adverse impacts
- Section 9.4 – Wetland, riparian, and littoral habitats - unavoidable adverse impacts
- Section 10.4 – Threatened and endangered species - unavoidable adverse impacts
- Section 12.5 – Cultural resources - unavoidable adverse impacts
- Section 11.4 – Recreation - unavoidable adverse impacts
- Section 14.4 – Aesthetics - unavoidable adverse impacts

18.3 Consistency with Comprehensive Plans

18 CFR Section 5.18(b)(5)(ii)(F) requires that license applications "identify relevant comprehensive plans and explain how and why the proposed Project would, would not, or should not comply with such plans, and a description of any relevant resource agency or Indian tribe determination regarding the consistency of the Project with any such comprehensive plan." On April 27, 1988, FERC issued Order No. 481-A, revising Order No. 481, issued October 26, 1987, establishing that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any federal or state plan that: 1) is a comprehensive study of one or more of the beneficial uses of a waterway or waterways; 2) specifies the standards, the data, and the methodology used; and 3) is filed with the Secretary of the Commission. FERC publishes a list of filed documents which satisfy their criteria as a comprehensive plan (FERC 2023).

NorthWestern reviewed the List of Comprehensive Plans (FERC 2023) in Montana, published September 2023, to identify and review relevant comprehensive plans to determine if the Project would comply with these plans.

The plans that were found to be relevant to Project are listed in **Table 18-1**. In some cases, the comprehensive plans on the FERC list have been revised since their original publication. In that case, NorthWestern reviewed the updated plan. The Project's continued operation and the associated environmental protection, mitigation or enhancement measures proposed and analyzed herein would ensure continued consistency with the uses outlined in the plans listed in **Table 18-1**.

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Table 18-1. Consistency with FERC-approved comprehensive plans

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
USFS. 1986. Lolo National Forest Plan. Department of Agriculture, Missoula, Montana. February 1986.	Plan revisions will be initiated in 2023 and are expected to take several years. NorthWestern reviewed the 1986 plan. https://www.fs.usda.gov/main/lolo/landmanagement/planning	1. Provide a sustained yield of timber and other outputs at a level that will help support the economic structure of local communities and provide for regional and national needs. 2. Provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big-game animals. 3. Provide for a broad spectrum of dispersed recreation involving sufficient acreage to maintain a low user density compatible with public expectations. 4. Provide a pleasing and healthy environment, including clear air, clean water, and diverse ecosystems. 5. Emphasize conservation of energy resources. 6. Encourage a "Good Host" concept when dealing with the public. 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 nonthreatened status. 8. Meet or exceed state water quality standards.	Project will have no detrimental effect on timber harvest or wildlife habitat. The Project will continue to provide a broad spectrum of dispersed recreation opportunities and a pleasing and healthy environment. The Project generates clean, renewable energy. Goal #6 is specific to the USFS. There will be no effect on threatened and endangered species with the exception of Bull Trout. Conservation measures are proposed to contribute to the recovery of Bull Trout. The Project is managed to meet or exceed state water quality standards, as they pertain to dams in place July 1, 1971. Therefore, the Project is consistent with the comprehensive plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
Montana Department of Environmental Quality. 2004. Montana water quality integrated report for Montana (305(b)/303(d)). Helena, Montana. November 24, 2004.	Montana Department of Environmental Quality. 2021. Montana Final 2020 Water Quality Integrated Report https://deq.mt.gov/files/Water/WQPB/CWAIC/Reports/IRs/2020/MT_2020_IR_Final.pdf	Report prepared to comply with Sections 305(b), 303(d), and 314 of the Federal Water Pollution Control Act, also known as the Clean Water Act (CWA). The Report provides an analysis of the condition and trends of Montana's streams and lakes, contaminants found in groundwater, and the safety of drinking water and the degree to which waters support their designated uses.	The Project is managed to meet or exceed state water quality standards, as they pertain to dams in place July 1, 1971 (ARM 17.30.602). Therefore, the Project is consistent with the comprehensive plan.
Montana Department of Environmental Quality. 2001. Montana non-point source management plan. Helena, Montana. November 19, 2001.	Watershed Protection Section. 2017. Montana Nonpoint Source Management Plan. Helena, MT: Montana Dept. of Environmental Quality. https://deq.mt.gov/files/Water/WPB/Nonpoint/Publications/Annual%20Reports/2017NPSManagementPlanFinal.pdf	The goal of Montana's Non-Point Source Management Program is to protect and restore water quality from the harmful effects of nonpoint source pollution.	The Project is managed to meet or exceed state water quality standards, as they pertain to dams in place July 1, 1971 (ARM 17.30.602). Therefore, the Project is consistent with the comprehensive plan.
Montana Department of Environmental Quality. Montana's state water plan: 1987-1999. Part I: Background and Evaluation. Part II: Plan Sections - Agricultural Water Use Efficiency; Instream Flow Protection; Federal	Montana Department of Environmental Quality. 2015. Montana's State Water Plan. A Watershed Approach to the 2015 Montana State Water Plan, December 5, 2014. https://leg.mt.gov/content/Committees/Interim/2019-2020/Water-Policy/Committee-	The State Water Plan provides a high-level overview of the state's water resources and lays out a path for managing those resources over the next 20 years.	The Project is a non-consumptive water use, managed to meet or exceed state water quality standards, as they pertain to dams in place July 1, 1971 (ARM 17.30.602). Therefore, the Project is consistent with the comprehensive plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
Hydropower Licensing and State Water Rights; Water Information System; Water Storage; Drought Management; Integrated Water Quality and Quantity Management; Clark Fork Basin Watershed Management Plan; Upper Clark Fork River Basin Water Management Plan; and Montana Groundwater Plan. Helena, Montana	Topics/2015_mt_water_plan.pdf		
Montana Department of Fish, Wildlife, and Parks. Montana Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2003-2007. Helena, Montana. March 2003.	Montana Department of Fish, Wildlife, and Parks. Montana SCORP: 2020-2024. Helena, Montana. https://leg.mt.gov/content/Committees/Interim/2019-2020/EQC/Meetings/Jan-2020/scorp-2020-2024.pdf	Goal 1: Promote Outdoor Recreation Opportunities for All Montanans. Goal 2: Enhance Public Access to Outdoor Recreation Resources and Facilities. Goal 3: Support Economic Vitality of Communities and State. Goal 4: Improve Quality of Life Through Outdoor Recreation Experiences Goal 5: Adapt Outdoor Recreation for a Changing Environment. Goal 6: Honor Montana's Outdoor Legacy.	The Project will continue to provide outdoor recreation opportunities and recreational access to Thompson Falls Reservoir. The Project supports economic vitality and the community of Thompson Falls. Therefore, the Project is consistent with the comprehensive plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
Montana Department of Fish, Wildlife and Parks. 1993. Water rights filings under S.B.76. Helena, Montana. February 8, 1993.	Water Rights in Montana https://leg.mt.gov/content/Publications/Environmental/2018-water-rights-handbook-final.pdf	*Water Rights in Montana* is a compilation of two previous citizen guides discussing Montana water rights—the Montana Department of Natural Resources and Conservation's Water Rights in Montana and the Environmental Quality Council's and Montana University System Water Center's Wading into Montana Water Rights.	NorthWestern holds 8 water right claims from the Clark Fork River for power generation, totaling 30,967 cfs. Additionally, NorthWestern holds one water right claim for domestic use at the Project. Therefore, the Project is consistent with the comprehensive plan.
Montana Department of Fish, Wildlife and Parks. 1997. Montana warm water fisheries management. Helena, Montana. March 1997. Available: https://archive.org/details/montanawarmwater1997mont/page/n33	FWP has updated fisheries management plans since the 1997 document focused specifically on warm water fisheries. The current management plan focus on statewide management for warm and cold water species and are posted on FWP's website. The current plan is: 2023-2026 Montana Statewide Fisheries Management Program and Guide, Montana Fish Wildlife and Parks. Available: https://fwp.mt.gov/conservation/fisheries-management/statewide-fisheries-management	The mission of FWP is to steward the fish, wildlife, parks, and recreational resources for the public, now and into the future. The FWP Fisheries Division preserves, maintains, and enhances aquatic species and their ecosystems to meet the public's demand for recreational opportunities and stewardship of aquatic wildlife. Specific management goals for Thompson Falls Reservoir: Trout and native non-game species - Maintain current angling and harvest opportunity (except bull trout and westslope cutthroat trout). Continue to work with NorthWestern Energy to pass these species above Thompson Falls Dam. Smallmouth Bass- Provide liberal harvest opportunity to decrease predation by this unauthorized introduction on native and recreational fisheries. Do not pass over Thompson Falls Dam. Northern Pike - Provide liberal harvest opportunities to decrease predation on native and recreational fisheries. Maintain current angling opportunity and harvest level. Do not pass them	NorthWestern's proposed environmental measures for the new license term include operating and maintaining the upstream fish passage facility from mid-March through mid-October, evaluate and assess opportunities to enhance the effectiveness of the existing upstream fish passage facility, and continuing to engage with TAC partners on PM&E. These measures will facilitate the fisheries management goals specified in the Statewide Fisheries Management Plan. Therefore, the Project is consistent with the comprehensive plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
		over Thompson Falls Dam. All other species- Continue to monitor population trends. *See* drainage wide species management at top of table.	
Montana State Legislature. 1997. House Bill Number 546. Total Maximum Daily Load. Helena, Montana. https://leg.mt.gov/bills/1997/Bills/HOUSE/HB0546_02.htm	This 1997 legislation (HB 546) was codified, as Mont. Code Ann. §§ 75-5-103, 75-5-702, 75-5-703, 75-5-704 and 75-5-705. These sections each have been amended by the Montana Legislature several times since 1997, with the exceptions of Mont. Code Ann §§ 75-5-704 and 75-5-705.	The legislation states that it is an "Act amending the water quality laws to further direct the department of environmental quality to monitor state waters to assess their quality and to develop total maximum daily loads for those waters identified as threatened or impaired".	The Montana list of threatened or impaired waters (303(d) list) does not include the Clark Fork River in the Project area (Thompson Falls Reservoir and Clark Fork River downstream to Noxon Rapids Reservoir). Therefore, the Project is consistent with the comprehensive plan.
National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993. Source: https://www.nps.gov/subjects/rivers/montana.htm	No updates found.	The Nationwide Rivers Inventory (NRI) is a listing of more than 3,200 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be at least regionally significant. NRI river segments are potential candidates for inclusion in the National Wild and Scenic River System. Under the Wild and Scenic Rivers Act section 5(d)(1) and related guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect NRI river segments.	The Clark Fork River in the Project area (Thompson Falls Reservoir and Clark Fork River downstream to Noxon Rapids Reservoir) is not on the NRI list. Therefore, the Project is consistent with the comprehensive plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
Northwest Power and Conservation Council. 2014. Columbia River Basin Fish and Wildlife Program. Portland, Oregon. Council Document 2014-12. October 2014. https://www.nwcouncil.org/media/7148624/2014-12.pdf	No updates found.	The Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act) of 1980 directs the Northwest Power and Conservation Council to develop a program to "protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries … affected by the development, operation, and management of [hydroelectric projects] while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply." The Northwest Power Act also directs the Council to ensure widespread public involvement in the formulation of regional power and fish and wildlife policies. The Northwest Power and Conservation Council's Fish and Wildlife program aims to rebuild healthy, naturally producing fish and wildlife populations adversely affected by the construction and operation of hydroelectric dams in the Columbia River Basin. It accomplishes this by protecting, mitigating, and enhancing habitats and biological systems.	NorthWestern's proposed environmental measures for the new license term include measures intended to rebuild healthy, naturally producing fish and wildlife populations affected by the Project. These measures are intended to protect, mitigate, and enhance habitats and biological systems. For the following reasons, NorthWestern believes that its relicensing proposal is consistent with Appendix F of the Program: • The Project is an existing hydroelectric facility, licensed by the Commission, and which is not located within a protected area. • NorthWestern consulted with state and federal fish and wildlife agencies and tribes in development of the licensing proposal as documented Volume II Exhibit E Section 19 in the Application. • NorthWestern's relicensing proposal does not increase the area of inundated lands, maintains existing minimum instream flows downstream of the Project of 6,000 cfs or inflow, whichever is less, and does not propose any new development or infrastructure in the new license term. • Pursuant to a 1988 Mitigation Agreement with Montana Fish, Wildlife and Parks (FWP), NorthWestern paid $250,000 to FWP to provide full and complete mitigation as required under section 903(e)(6) of the Council's Program for impacts caused by the construction and maintenance of the Project. FWP uses these funds to annually purchase 10,000 acre-feet of water from Painted Rocks Reservoir to enhance summer and fall flows for resident fish in the

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
			Bitterroot River as well as to implement other mitigation measures. • In 1990 NorthWestern incorporated into its license a wildlife management plan, prepared by FWP, which required NorthWestern to fund $123,000 for implementation of the plan. • In 2009, the Commission issued a license amendment approving construction and operation of fish passage facilities for Bull Trout, which are federally listed under the Endangered Species Act as threatened. NorthWestern has complied with the fish passage requirements of the U.S. Fish and Wildlife Service (USFWS) and FERC. NorthWestern currently operates the upstream fish passage facility from mid-March through mid-October. NorthWestern also has a fisheries population and monitoring program within the reservoir and portions of the Clark Fork River. • Pursuant to a Memorandum of Understanding to collaboratively implement measures for Bull Trout with USFWS, FERC, the CSKT, and FWP, NorthWestern provides $100,000 in annual funding to conduct offsite habitat restoration or acquisition in important upstream Bull Trout spawning and rearing tributaries to boost recruitment of juveniles. The funding mitigates incidental take of Bull Trout caused by downstream passage through the turbines and spillways. • In 2020, NorthWestern completed a shoreline stabilization pilot project to revegetate the vertical bank to a slope less than or equal to 3:1 and utilize native willow and dogwood cuttings

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
			to develop deep-binding root mass to stabilize the newly constructed bank. • NorthWestern implements annual noxious weed control measures in high-use areas. • NorthWestern is proposing to implement several environmental measures upon relicensing, including improvements to upstream passage for native species, and preparing a Fisheries and Aquatic Resources Protection, Mitigation, and Enhancement Plan in consultation with USFWS, U.S. Forest Service, FWP, and CSKT. NorthWestern submitted a request to the Council on April 8, 2024, requesting its review and comment on the Final License Application. The Council responded by letter dated April 25, 2024. The Council's comment letter confirmed that the Project is not located in a protected area, and states that, "From the Council's perspective, NorthWestern is working appropriately to address the development standards in the Council's fish and wildlife program."
Northwest Power and Conservation Council 2020. 2020 Addendum to the 2014 Columbia River Basin Fish and Wildlife Program. Portland, Oregon. Council Document 2020-9. October 2020. https://www.nwcouncil.org/media/filer_public/2e/0b/2e0b888c-	No updates found.	The Northwest Power and Conservation Council (Council) updated their Fish and Wildlife Program document in 2020. The goals, objectives, and indicators and the description of adaptive management were reorganized, reformulated, and supplemented to enable the Council and others to evaluate program performance in an effective way. The program goal for "All Other Native Aquatic Focal Species" (that is, non-anadromous species) is to protect, mitigate and	The Project is located upstream of the historic range of anadromous species, therefore the Council's goals for All Other Native Aquatic Focal Species (non-anadromous species), pertain to the Project. NorthWestern's proposed environmental measures for the new license term include measures intended to rebuild healthy, naturally producing fish and wildlife populations affected by the Project. These measures are intended to protect, mitigate, and enhance habitats and biological systems. The Project is consistent with the comprehensive plan, for the reasons outlined above.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
[8854-4495-ba0d-fa19e5667676/2020-9.pdf]		enhance these other native focal aquatic species adversely affected by the development and operation of the Columbia River hydroelectric power system, including related spawning grounds and habitat. By protecting, mitigating and enhancing other native focal species, the Program is intended to contribute to reversing the decline in populations and making progress toward restoring and then maintaining stable healthy populations that support sustainable fisheries and allow for desired expressions of traditional cultural values and practices. Populations that are healthy and support sustainable fisheries are defined as abundant, productive, genetically diverse, and spatially distributed in areas of the historic range within the Columbia River Basin, and provide ample opportunities for subsistence, ceremonial, recreational and (where appropriate) commercial fisheries that are of tribal trust, treaty, and non-treaty origin.	NorthWestern submitted a request to the Council on April 8, 2024, requesting their review and comment on the Final License Application. The Council responded by letter dated April 25, 2024. The Council's comment letter confirmed that the Project is not located in a protected area, and states that, "From the Council's perspective, NorthWestern is working appropriately to address the development standards in the Council's fish and wildlife program."
Northwest Power and Conservation Council. 2022. The 2021 Northwest Power Plan. Portland, Oregon. Council Document 2022-03. February 2022. https://www.nwcouncil.org/media/filer_pu	No updates found.	The Northwest Power Act directed the Council to, among other things, prepare and review a "regional conservation and electric power plan" not less than once every 5 years. The 2021 Power Plan recognizes states that have requirements and policies pursuing emission reductions that support cleaner electricity generation. Influenced by these policies, the 2021 Power Plan includes significantly	The Project generates electricity without producing emissions and is a renewable energy source. Proposed Project flexible generation will facilitate the energy transformation that the Council envisions in the Power Plan.

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
blic/4b/68/4b681860-f663-4728-987e-7f02cd09ef9c/2021powerplan_2022-3.pdf		more renewable generation than previous power plans. The plan's forecast through 2041 indicates the region can expect a more substantial transformation in the fleet of regional resources used to generate electricity. Through this transformation into the future, hydropower and energy efficiency will continue to be a fundamental part of the region's power system.	
Northwest Power and Conservation Council. 1988. Protected areas amendments and response to comments. Portland, Oregon. Council Document 88-22. September 14, 1988. https://www.nwcouncil.org/media/63794/88_22.pdf	The Northwest Power and Conservation Council amended the protected areas in 1990 and1992, however, no changes from the 1988 list were made to the protected areas in Montana. Protected areas designations basically apply to new hydroelectric projects only. Dams in existence or licensed as of August 10, 1988, are not covered by the protected areas rule.	On August 10,1988, the Council adopted a proposal to designate some 44,000 miles of Northwest streams as "protected areas" because of their importance as critical fish and wildlife habitat.	The Project was constructed prior to August 10, 1988, therefore the Project is not covered by the protected areas rule.
U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife	Executive Order 12962 was issued June 7, 1995 Recreational Fisheries	This Presidential Executive Order was issued in order to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide.	NorthWestern's proposed environmental measures for the new license term include measures intended to rebuild healthy, naturally producing fish and wildlife populations affected by the Project. In addition, NorthWestern is proposing to maintain recreation sites, providing access to Project waters for recreational

Document Name	Updates, if any	Goals of the Plan	Project Consistency with Comprehensive Plan
Service. Washington, D.C. 1989: https://www.govinfo.gov/content/pkg/FR-1995-06-09/pdf/95-14407.pdf			fishing. Therefore, the Project is consistent with the comprehensive plan.
U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American Waterfowl Management Plan. Department of the Interior. Environment Canada. May 1986. https://nawmp.org/sites/default/files/2018-01/1986%20Original NAWMP.pdf	Department of the Interior. Environment Canada. Environment and Natural Resources Mexico. 2018. North American Waterfowl Management Plan. Connecting People, Waterfowl, and Wetlands. https://nawmp.org/sites/default/files/2018-12/6056%202018%20NAWMP%20Update_EN16.pdf	The North American waterfowl management plan is an international plan which fosters public and private waterfowl conservation and management partnerships working toward habitat protection, restoration, and enhancement. This continental system of partnerships fosters important conservation actions and research.	The Project will continue to support a variety of waterfowl species in the new license. In addition, NorthWestern will continue to provide recreation sites providing access to Project waters for waterfowl hunting and observing. Therefore, the Project is consistent with the comprehensive plan.

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Some of the plans on the FERC list (FERC 2023) do not apply to the Thompson Falls Project as they address geographic areas, species, or habitats, not found in or near the Thompson Falls Project area. These not relevant plans are listed in **Table 18-2**.

Table 18-2. FERC approved comprehensive plans not relevant to the Thompson Falls Hydroelectric Project

Document Name	Reason for Exclusion from Detailed Review
Bureau of Land Management. 1983. Billings resource area management plan. Department of the Interior, Miles City, Montana. November 1983.	Outside geographic scope of Thompson Falls Project area
Bureau of Land Management. 1984. Powder River resource area management plan. Department of the Interior, Miles City, Montana. December 1984.	Outside geographic scope of Thompson Falls Project area
Bureau of Land Management. 2015. Record of Decision and Approved Resource Management Plan for the Great Basin Region, Including the Greater Sage- Grouse Sub-Regions of Idaho and Southwestern Montana, Nevada and Northeastern California, Oregon, and Utah. Washington, D.C. September 2015.	Outside geographic scope of Thompson Falls Project area
USFS. 1985. Flathead National Forest land and resource management plan. Department of Agriculture, Kalispell, Montana. December 1985.	Outside geographic scope of Thompson Falls Project area
USFS. 2009. Beaverhead-Deerlodge National Forest land and resource management plan. Department of Agriculture, Missoula, Montana. January 2009.	Outside geographic scope of Thompson Falls Project area
USFS. 1986. Lewis and Clark National Forest plan. Department of Agriculture, Great Falls, Montana. June 4, 1986.	Outside geographic scope of Thompson Falls Project area
USFS. 1986. Custer National Forest and National Grasslands land and resource management plan. Department of Agriculture, Billings, Montana. October 1986.	Outside geographic scope of Thompson Falls Project area
USFS. 1986. Helena National Forest land and resource management plan. Department of Agriculture, Helena, Montana. April 1986.	Outside geographic scope of Thompson Falls Project area
USFS. 1987. Gallatin National Forest plan. Department of Agriculture, Bozeman, Montana. September 23, 1987.	Outside geographic scope of Thompson Falls Project area
USFS. 1987. Kootenai National Forest plan. Department of Agriculture, Libby, Montana. September 1987.	Outside geographic scope of Thompson Falls Project area
USFS. 1987. Bitterroot National Forest plan. Department of Agriculture, Hamilton, Montana. September 1987.	Outside geographic scope of Thompson Falls Project area
Montana Department of Fish, Wildlife and Parks. 1989. Hauser Reservoir fisheries management plan, September 1989-1994. Helena, Montana. September 1989.	Outside geographic scope of Thompson Falls Project area
Montana Department of Fish, Wildlife and Parks. 1990. Missouri River management plan: Holter Dam to Great Falls, 1990-1994. Helena, Montana. May 1990.	Outside geographic scope of Thompson Falls Project area
Montana Department of Fish, Wildlife and Parks. 1992. Canyon Ferry Reservoir fisheries management plan, 1992-1997. Helena, Montana. July 1992.	Outside geographic scope of Thompson Falls Project area
Montana Department of Natural Resources and Conservation. 1977. Yellowstone River Basin final environmental impact statement for water reservation applications. Helena, Montana. February 1977. 194 pp and draft addendum, dated June 1977.	Outside geographic scope of Thompson Falls Project area

Document Name	Reason for Exclusion from Detailed Review
U.S. Fish and Wildlife Service. 1985. Final environmental impact statement for the management of Charles M. Russell National Wildlife Refuge. Department of the Interior, Denver, Colorado. August 1985.	Outside geographic scope of Thompson Falls Project area
U.S. Fish and Wildlife Service. 1980. Protecting instream flows in Montana: Yellowstone River reservation case study. Cooperative Instream Flow Service Group. Fort Collins, Colorado. FWS/OBS-79-36. September 1980.	Outside geographic scope of Thompson Falls Project area
U.S. Fish and Wildlife Service. 1995. U.S. Prairie Pothole joint venture implementation plan - update. Department of the Interior, Denver, Colorado. January 1995.	Outside geographic scope of Thompson Falls Project area
U.S. Fish and Wildlife Service. 1986. Whooping Crane Recovery Plan. Department of the Interior, Albuquerque, New Mexico. December 23, 1986.	Species not present in Thompson Falls Project area
U.S. Fish and Wildlife Service. 1988. Great Lake and Northern Great Plains Piping Plover Recovery Plan. Department of the Interior, Twin Cities, Minnesota. May 12, 1988.	Species not present in Thompson Falls Project area
Montana Board of Natural Resources and Conservation. 1992. Final order establishing water reservations above Fort Peck Dam. Helena, Montana. July 1992.	Outside geographic scope of Thompson Falls Project area
Montana Board of Natural Resources and Conservation. n.d. Order of the Board of Natural Resources establishing water reservations. Helena, Montana. https://www.arlis.org/docs/vol1/Susitna/41/APA4172.pdf	Outside geographic scope of Thompson Falls Project area
U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. Denver, Colorado. February 2013.	Species not present in Thompson Falls Project area
National Park Service. 2012. Foundation Document: Lewis and Clark National Historic Trail (IL, MO, KS, NE, IA, SD, ND, MT, ID, WA, OR). September 2012.	Outside geographic scope of Thompson Falls Project area. The Lewis and Clark National Historic Trail does not pass through the Thompson Falls Project area
National Park Service. 1982. Lewis and Clark Trail National Historic Trail: Comprehensive Plan for Management and Use. January 1982.	Outside geographic scope of Thompson Falls Project area. The Lewis and Clark National Historic Trail does not pass through the Thompson Falls Project area

19. Consultation Documentation

A list containing the name and address of federal and state resource agencies, Tribes, local authorities, or members of the public with which the applicant consulted in preparation of the Environmental Exhibit is included in the Distribution List attached to the cover letter for this FLA.

19.1 Voluntary Pre-Relicensing Efforts

Before filing a FLA with FERC, applicants are required to conduct a pre-license application filing process that consists of 1) presenting the Project to Relicensing Participants[29]; 2) consulting with those Relicensing Participants; 3) identifying issues; and 4) gathering available information.

NorthWestern maintains a website with information about the Thompson Falls Project[30]. Relicensing information, including meeting notices and presentations, reports, and other documents are available on this website.

NorthWestern proactively initiated relicensing outreach discussions with Relicensing Participants in 2018 (**Table 19-1**). The first activity was a training program, "FERC 101," which was held in Missoula, Montana on September 12, 2018. This program included FERC staff who presented information on the procedures used to relicense hydropower projects under the Commission's jurisdiction. NorthWestern also presented information on the Thompson Falls Project. The goal of the meeting was to inform Relicensing Participants of the relicensing process and schedule for the Thompson Falls Project. Representatives from DEQ, DNRC, USFS, Coeur d'Alene Tribe, FWP, the City, Sanders County, Sanders County Development Corporation, Avista, FWP, CSKT, and Bureau of Land Management (BLM) were in attendance. Presentations from this meeting, and all other Thompson Falls relicensing meetings, are posted on NorthWestern's Project website.

Next, NorthWestern voluntarily prepared the BED which was a compilation of existing resource information. This document was released for public comment on November 1, 2018, and is available on the Project website. A workshop was held in Missoula to discuss the BED and identify any data gaps and resource issues on December 4, 2018 (**Table 201**). The presentations from that meeting are available on the Project website. NorthWestern received written comments on the BED from FWP and DEQ.

The Project is operated to provide baseload and flexible generation within the reservoir elevation and minimum flow requirements of the license. During flexible generation operations[31], the Licensee may use the top 4 feet of the reservoir from full pool while maintaining minimum flows.

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29 Local, state, and federal governmental agencies, Native American Indian Tribes, local landowners, non-governmental organizations, and other interested parties.

30 http://www.northwesternenergy.com/environment/thompson-falls-project

31 Flexible generation supports grid reliability by providing spinning reserve and load balancing as river and reservoir conditions allow, by lowering the reservoir to increase generation and raising the reservoir to reduce generation.

For several reasons, the full 4 feet typically have not been regularly used in recent years. To assess the effects using the Project's full operational flexibility, an operational test was conducted in October 2019. Details of the operational test and observations made during the test are described in Section 14 of the PAD.

In October 2019, NorthWestern hosted a public meeting in Thompson Falls to further inform Relicensing Participants about the relicensing process and provide an update on an operational test and resource studies NorthWestern had conducted.

In March 2020, NorthWestern hosted a second public meeting in Thompson Falls to inform the Relicensing Participants of observations made during the October 2019 operational test, and to describe proposed NorthWestern Project operations. The meeting also included further information on the relicensing process.

All of these activities, summarized in **Table 19-1**, were done voluntarily by NorthWestern to engage the Relicensing Participants in advance of initiating the ILP. The goals of these extra efforts were to learn about potential concerns or gaps in data and to establish a common understanding among interested parties as to what is involved with relicensing a hydroelectric project.

Table 19-1: Thompson Falls voluntary outreach and other pre-ILP activities.

Thompson Falls Relicensing Outreach and Other Activities	Comment	Date
FERC 101 Relicensing Outreach Training, Missoula. Public invited.	FERC training on the procedures used to relicense hydropower projects.	Sept 12, 2018
Notified Relicensing Participants of availability of BED.	The BED described the Project and available fish, wildlife, water quality, cultural and recreation, operational and other Project specific information.	Nov 1, 2018
Workshop to discuss the relicensing (ILP) process and BED and identify data gaps and resource issues.	Workshop included small group breakout sessions to discuss fisheries, water resources and recreation/cultural issues.	Dec 4, 2018
Pre-relicensing data collection.	Included operations, water quality, fisheries, and recreation use data.	2018-2020
Public meeting in Thompson Falls for Relicensing Participants.	Included updates on studies and the relicensing process.	Oct. 15, 2019
Public meeting in Thompson Falls for Relicensing Participants.	Included observations made during the operational test and information on data collection for the PAD.	March 11, 2020

In addition to the outreach efforts, NorthWestern accelerated the schedule to conduct certain resource studies so the information would be available to inform relicensing. Specifically, NorthWestern prepared a water quality monitoring plan which was implemented in 2019 to address data gaps that were noted during the preparation of the BED. The results of that study were submitted in the PAD, filed with FERC on July 1, 2020, and available on the Project website.

A Recreation Visitor Survey was conducted during the 2018 peak recreation season (Memorial Day weekend – Labor Day). In addition, the volume of use at five local area recreation sites was monitored during the 2019 peak recreation season using automatic traffic and trail counters. The results of that study were submitted in the PAD, filed with FERC on July 1, 2020, and available on the Project website.

19.2 Implementation of the Biological Opinion

The 2008 BO issued by the FWS for the Project included a requirement for the Licensee to conduct Phase 2 fish passage evaluation studies from 2010 to 2020. At the end of the Phase 2 evaluation period, the Licensee was required to prepare a comprehensive 10-year report for filing with the Commission.

The BO specified that the comprehensive report be completed by December 31, 2020. NorthWestern reviewed the relicensing schedule and found that some adjustments in the compliance reporting schedule could better align the compliance schedule with the relicensing schedule. Specifically, NorthWestern requested, and FWS concurred, that the comprehensive report described in the BO would be submitted a year early. The Comprehensive Phase 2 Fish Passage Report was prepared with guidance from the TAC and filed with FERC on December 20, 2019. The Comprehensive Phase 2 Fish Passage Report summarizes the results of fish passage studies at the Project, conducted in compliance with the BO.

The BO also required that the Licensee conduct a scientific review to determine if the Thompson Falls Project upstream fish passage facility was functioning as intended, and whether operational or structural modifications were needed. The review was to also include a set of recommendations to be submitted to the FWS. The scientific review convened in January 2020, with the formation of the Scientific Panel. The Scientific Panel included representatives from the FWS, FWP, and Water & Environmental Technologies, an environmental and engineering consulting firm. On March 27, 2020, the Scientific Panel issued a memo summarizing its evaluation of the upstream fish passage facility and providing recommendations on how to better evaluate the facility in the future. On April 16, 2020, NorthWestern received written confirmation from the FWS that the requirement for a scientific review, as expressed in TC1-h in the BO, had been met with the submittal of the memo summarizing the Scientific Panel’s findings. The recommendations from the scientific review were considered in the development of NorthWestern’s list of preliminary issues and studies, found in Section 14 of the PAD.

19.3 Preparation of the Pre-Application Document

Under FERC regulations, NorthWestern was 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. The PAD is a document that describes the Project proposal and existing, relevant information that can be used to assess potential Project effects on natural, cultural, recreational, and Tribal resources. The PAD was prepared by NorthWestern, taking into consideration information in the BED, additional information collected through post-BED Relicensing Participant outreach

(**Table 19-1**), review of federal and state comprehensive plans filed with FERC and listed on FERC's website (Appendix A of the PAD), and additional data gathering.

An applicant is not required to conduct studies to generate information for the PAD but is expected to exercise due diligence to gather existing information. This includes consulting Relicensing Participants for information relevant to the Project, the local area environment, and potential Project effects. NorthWestern significantly exceeded these requirements with its voluntary development and distribution of the BED and subsequent Relicensing Participant outreach, as described above.

19.4 Scoping

FERC initiated the scoping process with the issuance of SD1 on August 28, 2020. FERC solicited comments and suggestions on the preliminary list of issues and alternatives to be addressed in the Environmental Assessment which will be prepared by FERC. Due to the proclamation declaring a National Emergency concerning COVID-19, issued by the President on March 13, 2020, FERC waived section 5.8(b)(viii) of the Commission's regulations and did not conduct a public scoping meeting and site visit in this case. Instead, they solicited written comments, recommendations, and information, on the SD1. Comments on SD1 were submitted by FWP, FWS, the U.S. Bureau of Reclamation, EPA, USFS, and NorthWestern.

Based on the submission of written comments, FERC updated SD1 to reflect their current view of issues and alternatives to be considered in the NEPA document on December 9, 2020.

19.5 Preparation of Study Plan and Study Plan Determination

In the PAD, NorthWestern identified preliminary issues and potential studies based on existing and relevant information, baseline conditions, and current and proposed future operations. NorthWestern identified eight potential studies in the PAD.

In response to requests for studies submitted by the USFS and FWP, NorthWestern's PSP (filed with FERC December 11, 2020) proposed one additional study to the eight proposed in the PAD, a study of Westslope Cutthroat Trout Genetics.

In accordance with 18 CFR § 5.11, NorthWestern held a study plan meeting on January 6, 2021, which was open to any interested party. At the meeting, NorthWestern presented its proposed studies and provided opportunities for participants to provide input and ask questions. The meetings were attended by representatives of FERC, FWS, FWP, USFS, SHPO, CSKT, DEQ, GMCD, Sanders County Commissioners, Montana Trout Unlimited, EPA, the City, and local residents.

Subsequent to the Study Plan Meeting, requests for studies were submitted by USFS and FWP. During the public comment period, NorthWestern met, sometimes multiple times, with representatives of FWP, FWS, USFS, and 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. The comments from FWP and USFS, and NorthWestern's responses, were included in the RSP, filed with FERC April 12, 2021. In response to requests for studies submitted by FWP, NorthWestern added 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.

On May 10, 2021, FERC issued a Study Plan Determination on studies to be conducted. The FERC Study Plan Determination directed NorthWestern to conduct seven of the studies proposed in the RSP. The Study Plan Determination did not require NorthWestern to conduct the Water Quality Study, Downstream Transport of Bull Trout Study, Westslope Cutthroat Genetics Study, study of Distribution and Status of Westslope Cutthroat Trout, or the study of Heavy Metals and Organic Compounds in Thompson Falls Reservoir.

19.6 Conduct of Studies

The seven studies included in the May 2021 FERC Study Plan Determination 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. TDG: A study of TDG in the Project reservoir, below the Main Channel Dam, and at the Birdland Bay Bridge.
3. 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).
4. 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.
5. Visitor Use Survey: A study surveying recreationists at 10 recreation sites on or near the reservoir and the Clark Fork River below the dams.
6. Cultural Resources: A study to update the inventory of the 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 APE[32].

[32] The Interim Study Report 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 was filed with FERC on January 26, 2022. The updated inventory of the H-A&E is included in this Initial Study Report.

7. Updated Literature Review of Downstream Fish Passage: A literature review of information in the scientific literature published since 2007, regarding downstream passage survival of various size classes of fish, with respect to current Project configuration and operations.

Study reports on each of the seven studies were filed with FERC in an ISR on April 28, 2022. The reports are also available on the Project website and through the FERC eLibrary. The Visitor Use Survey and the Updated Literature Review of Downstream Fish Passage studies were 1-year studies, and thus the ISR contained the final reports for those two studies. The remainder of the studies were multi-year studies, so the ISR contained the results of the data collected in the first year.

NorthWestern held its ISR Meeting on May 5, 2022; and filed its ISR Meeting Summary on June 9, 2022. Attendees at the ISR Meeting included representatives of FERC, USFS, FWP, SHPO, FWS, DEQ, EPA, CSKT, Kaniksu Land Trust, Avista, the City, BLM, Sanders County Commission, Trout Unlimited, and Montana State University Extension. Section 5.15(c)(4) of the Commission's regulations, 18 CFR § 5.15(c)(4), provides that any participant or Commission staff may file disagreements concerning the applicant's study report meeting summary, modifications to ongoing studies, or propose new studies within 30 days of the study report meeting summary being filed (i.e., by July 9, 2022). NorthWestern received comments from FERC staff, the USFS, FWS, FWP, and the CSKT, including proposed modifications to ongoing studies and proposed new studies.

On August 8, 2022, NorthWestern filed a response to the comments received on the ISR, proposing to conduct one additional study and modify one study. NorthWestern proposed to conduct an Environmental Justice Study to provide information that FERC staff stated they needed to assess Project effects. In addition, NorthWestern proposed to modify the Fish Behavior Study to extend the study into a third study season.

On September 1, 2022, FERC issued its determination on requests for study modifications. Modifications to Study 4 (Hydraulic Conditions), which were requested by agencies, were not approved. FERC notified NorthWestern that they approved the proposed Environmental Justice study and the proposed modifications to the Fish Behavior Study.

On May 5, 2023, pursuant to 18 CFR § 5.15(f), NorthWestern filed the USR for the relicensing of the Project. In accordance with Commission staff's September 1, 2022, *Determination on Requests for Study Modifications*,[33] the USR reported on the following:

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.

[33] Letter from John Wood, FERC, to Mary Gail Sullivan, NorthWestern, Project No. 1869-060, Accession No. 20220901-3052 (issued Sept. 1, 2022).

2. TDG: A study of TDG in the Project reservoir, below the Main Channel Dam, and at the Birdland Bay Bridge.
3. Hydraulic Conditions: A 3D hydraulics study to characterize water velocities and water depths between the Main Channel Dam and the High Bridge (below the Main Channel Dam).
4. 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.
5. Cultural Resources: Results of a field inventory of cultural resources in the Project's APE.
6. Environmental Justice: An evaluation to determine the presence of impacts of environmental justice communities in the surrounding community, and an assessment of whether those impacts would be disproportionately high and adverse for minority and low-income populations.

The USR included an Executive Summary, described the six studies approved in the Commission staff's September 1, 2022, *Determination on Requests for Study Modifications*, identified minor variances from the approved Study Plan Determination, and presented results of the second season of studies (2022). With the filing of the USR, the studies required by the Commission-approved study plan for the relicensing of the Project is complete—except for the Fish Behavior Study, which is continuing in 2023.[34] Except for the remaining work on the Fish Behavior Study, the USR contains a complete reporting of all studies and study plan modifications required by the Commission in this relicensing effort, including in its original May 10, 2021 Study Plan Determination,[35] as well as its September 1, 2022, *Determination on Requests for Study Modifications* referenced above.

Relicensing participants were notified of the filing and provided a link and the address for the Project website where the USR is posted as well as instructions for accessing the reports through FERC's eLibrary. In addition, the notification invited Relicensing Participants to a USR meeting, as required under FERC's ILP regulations (18 C.F.R. §§ 5.15(f), (c)(2)). NorthWestern hosted two USR meetings, one on Wednesday, May 24, 2023, at NorthWestern's Missoula, MT office, from 9:00 AM until 2:00 PM Mountain Time and another on May 25, 2023, from 6:00 PM to 8:00 PM (Mountain Time), at the Sanders County Courthouse. Both meetings were accessible remotely via Zoom. The daytime meeting was attended by representatives of FERC, USFS, FWP, SHPO, FWS, DEQ, EPA, CSKT, BIA as well as two local residents. The evening meeting was attended by representatives of FERC, the Kaniksu Land Trust, the Trails Group, the Sanders County Ledger (newspaper), Avista, a member of the state legislature, and six local residents.

[34] Final results of the Fish Behavior Study will be included in the Final License Application for the Project, which will be filed with the Commission no later than December 31, 2023.

[35] Letter from Terry L. Turpin, FERC, to Mary Gail Sullivan, NorthWestern, Project No. 1869-060, Accession No. 20210510-3034 (issued May 10, 2021).

NorthWestern also sent separate notifications to Relicensing Participants inviting them to participate in a voluntarily provided Project tour on the afternoon of May 25, 2023. Although attendance was not recorded, approximately 20 people attended the tour including resource agencies representatives, Commission staff, and local residents.

As required under FERC's ILP regulations (18 C.F.R. §§ 5.15(f), (c)(3)) and the Commission's Process Plan and Schedule, NorthWestern filed a summary of the USR meeting on June 8, 2023. The meeting summary included the meeting agendas, attendee lists, and copies of the presentations given at the USR meetings. At FERC Staff's request, on June 28, 2023, NorthWestern filed an Updated Study Report Meeting Summary Supplement which included additional information on the USR meeting. Comments on the USR were due by July 9, 2023 (18 C.F.R. § 5.15(c)(4)). NorthWestern received comments from 25 local landowners and residents, BIA, CSKT, FWP, FWS, GMCD, and SHPO.

NorthWestern filed the response to comments on August 8, 2023. Commission staff issued a Determination on August 24, 2023 (18 C.F.R. § 5.15(c)(6)) (*refer to* **Exhibit E – Section 1.4.3 - Integrated Licensing Process Environmental Studies**). The Determination noted that most of the comments submitted on the USR did not specifically request modifications to the RSP or additional studies. The Determination only addressed specific recommendations to modify the approved study plan or conduct new studies. In the Determination, FERC did not recommend that NorthWestern conduct additional studies, specifically a sediment analysis requested by one commentor.

19.7 Preparation of License Application

The DLA was filed with FERC on August 3, 2023. The public comment period on the DLA closed on November 1, 2023. NorthWestern received written comments from the FERC, Avista, the U.S. Army Corps of Engineers and 16 private citizens. On November 29, 2023, NorthWestern received an email from DEQ stating that their satisfaction with the most up-to-date copy of the proposed Water Quality Monitoring Plan being incorporated into the FERC license.

The comments received, and NorthWestern's response to the comments, are summarized in **Table 19-2** and in the text below.

Table 19-2: NorthWestern's response to comments on the DLA.

Agency	Comment Number	Comment and NorthWestern Response
FERC	Intro	On August 3, 2023, NorthWestern Energy filed a draft license application with the Federal Energy Regulatory Commission for the Thompson Falls Hydroelectric Project No. 1896. Our comments are in the attached Appendix A. Please provide the requested information in the final license application. If you have any questions regarding this letter or the contents of the final license application, please contact Michael Tust at (202) 502-6522, or via email at Michael.tust@ferc.gov.
		NorthWestern response: The requested information has been included in the Final License Application.
FERC	1	Exhibit A: In your final license application, please confirm that the roof of the original powerhouse is where the primary project transmission lines for both powerhouses connect to the regional grid and be sure to clearly label all primary project transmission lines on your Exhibit F and G drawings.
		NorthWestern response: The hydro generation point of receipt is the 115kv buss on the ceiling of the original powerhouse. All four original transmission lines pass through the roof and then each are connected to a breaker on the third floor. Generating Units 1-3 and 4-6 are connected to two generator step-up transformers that are connected to circuit switchers by two lead lines that are approximately 50 ft. long. A 300 ft. long generator lead line for Generator Unit 7 also passes through the roof of the Units' 1-6 (original) powerhouse then down to its own breaker. Units 1-3 and 4-6 get connected to a circuit switcher. All 5 breakers and both circuit switchers are then connected to the 115kv buss. Project generation is interconnected to NorthWestern's transmission system by the 115 kV buss on the ceiling of the Units' 1-6 (original) powerhouse. Four 115 kV transmission lines on the roof of the Units' 1-6 (original) powerhouse, the Burke A and B and the Kerr A and B lines, pass through the roof and each are connected to a breaker on the third floor. This is where the project interconnects to the grid. In summary, the Project includes three generator lead lines that are considered to be "primary transmission lines" under FERC's regulations, consisting of: (1) the 300 ft long lead line from Unit 7; and (2) the two 50 ft. long generator lead lines from the original powerhouse. This information has been added to Exhibit A and the drawings in Exhibits F and G.
FERC	2	Exhibit B: Section 4.51(c)(2)(i) of the Commission's regulations requires that the Exhibit B contain monthly flow duration curves. Section 2.1 of Exhibit B of the draft license application contains one graph showing the combined annual flow duration curve based on monthly mean flow. In your final license application, please include flow duration curves for each individual month.
		NorthWestern response: The requested information has been added to Section 2.1 of Exhibit B.

Agency	Comment Number	Comment and NorthWestern Response
FERC	3	In conducting our analysis, Commission staff assess environmental effects of the proposed action and action alternatives when compared to current conditions (i.e., baseline). Throughout your draft license application, you describe existing conditions as providing baseload and flexible generation within the reservoir elevation and minimum flow requirements of the existing license, including utilizing the top 4 feet of the reservoir for these purposes. However, you have previously stated that you have rarely utilized the full 4-foot daily fluctuation authorized by the license but instead have typically only utilized the top 1.0 to 1.5 feet of the reservoir. This is consistent with the results of your operations study which found that the reservoir level was maintained within the top 1-foot (i.e., between 2396.5 feet and 2395.5) for 87 percent of time during the March 15 to October 31 2022 study period, with a minimum elevation of 2394.7 feet (i.e., 1.8 feet below full pool) occurring for only a brief time in September.2 Based on this, staff will likely consider baseline conditions as utilizing the top 1.5 feet with only occasional brief periods when the reservoir is lowered below that point. Therefore, Exhibit E should be revised to describe environmental effects of utilizing the top 2.5 feet on a more routine basis compared to the 1.5 feet that has been typically utilized under existing conditions. Additionally, table 9-1 of Exhibit D should contain a value of the flexible capacity of utilizing only the top 1.5 feet of the reservoir in addition to the already calculated values for utilizing the top 4 feet and top 2.5 feet.
		NorthWestern response: Additional information has been added throughout Exhibit E to describe the effects of reflect the environmental effects managing the reservoir within 1.5 feet of full pool, with only occasional deeper drawdowns to 4 feet. In addition, Table 9-1 of Exhibit D has been revised to include value of flexible capacity of utilizing only the top 1.5 feet of the reservoir.
FERC	4	Project Boundary Modifications: Section 2.2.3 of Exhibit E describes your proposed changes to the project boundary, including specific parcels/acres of land and water you propose to add and remove from the current project boundary and the reasons why. However, so that staff can better visualize the differences, please include a figure showing the proposed project boundary overlaid on top of the current project boundary.
		NorthWestern response: New figures have been added to Section 2.2.3 of Exhibit E to illustrate the location of the existing and proposed Project boundary.
FERC	5	Aquatic Resources: Section 6.2.1 of Exhibit E contains a summary of minimum, maximum, and mean daily streamflow in the Clark Fork River entering the project. We note that estimates of median flows can also be an indicator of how often flows remain within the operating capacity of the project. Therefore, please add median flow values to Figure 6-1 and Table 6-1 of Exhibit E. Additionally, please add a separate table to Exhibit E showing the minimum, maximum, mean, and median streamflow values for each individual month in addition to the yearly flow data shown in Table 6-1.
		NorthWestern response: The requested information has been added to Section 6.2.1 of Exhibit E.
FERC	6	Staff will need to understand the timing, frequency, or duration of maintenance drawdowns of the reservoir (such as for repairs to the intake facilities or upstream passage facility) to understand effects of maintenance on water quality, fish

Agency	Comment Number	Comment and NorthWestern Response
		resources, and aquatic and shoreline habitat at the project. Therefore, please include in Exhibit E of your final license application a description of: (1) the types of maintenance activities that would result in maintenance drawdowns of the reservoir below the typical operating level; (2) the specific elevation (or range of elevations) that the reservoir is typically drawn down to for maintenance purposes; (3) the frequency and duration of typical maintenance drawdowns; (4) any seasonal limitations or preferences for the maintenance drawdowns if they exist; and (5) associated effects of planned maintenance drawdowns on aquatic resources and shoreline habitat.
		NorthWestern response: The requested information for items numbered 1 - 4 is included in Section 2.1.3.2 of Exhibit E. The requested information about effects of deep drawdowns is included in Exhibit E Section 6.9.1 (water quality), Section 9.3 (shoreline habitat), Section 7.3 (aquatic resources), and Section 5.5 (shoreline stability). These types of occasional drawdowns are also identified in Exhibit B.
FERC	7	Section 7.1.5.1 of Exhibit E states that one Western Pearlshell mussel (a state designated species of concern in Montana) was found during a survey conducted by Montana Department of Fish, Wildlife, and Parks just upstream of the Dry Channel Dam along the shallows along the Island Park shoreline. You state this was the first time this species was documented in Thompson Falls Reservoir but that the reservoir "does not provide optimal habitat to support a viable and reproducing population of mussels." In your license application, please provide a basis for this conclusion and provide more information on the biology of the species, including depths that adult and juvenile life stages are found along with details concerning its life history (i.e., seasonal spawning periods and times when sensitive life stages are typically present).
		NorthWestern response: Additional information about the life history traits and habitat requirements for the Western Pearlshell mussel is included in Exhibit E - Section 7.1.5. As described in Exhibit E – Section 7.1.5, Thompson Falls Reservoir does not provide suitable habitat to sustain a population of Western Pearlshell mussels. This conclusion is based on the lack of suitable lotic habitat for rearing and reproduction of lotic mussels and the low abundance of host fish (Westslope Cutthroat Trout or other salmonid species).
FERC	8	Some of your proposed aquatic protection, mitigation, and enhancement measures listed in section 7.2.2 of Exhibit E are too vague to evaluate. These include the following: • "Evaluate and assess opportunities to enhance the effectiveness of the existing upstream fish passage facility." • "Continue to engage with TAC partners on PM&E." • "NorthWestern is in discussions with other Relicensing Participants concerning other potential environmental PM&E measures." In your final license application, please only indicate specific actionable measures you propose to take for minimizing effects to environmental resources and be sure to describe their benefits and associated costs. For example, what specific actions do you plan to take to assess the effectiveness of the existing passage facility? What methods and metrics will you use to determine passage effectiveness? Please include this level of detail for each environmental measure you propose.
		NorthWestern response: Additional detail about proposed PM&E measures are included throughout the relevant sections of Exhibit E and compiled in Exhibit E Section 2.2.4 "Proposed Environmental Measures".

Agency	Comment Number	Comment and NorthWestern Response
FERC	9	Recreation Resources: In Table 11-1, Figure 11-1, and in section 11.1.1, Existing Recreation Facilities Near the Project Area, you describe recreation-related sites; however, it is not clear whether these sites are project recreation sites or non-project recreation sites. In the final license application, please classify the sites and update the table and figure accordingly.
		NorthWestern response: The distinction between Project and non-Project recreation sites included in Exhibit E - Section 11 and in the Recreation Management Plan was enhanced to address this comment.
FERC	10	Additionally, it appears that the non-project recreation site, Cherry Creek Boat Launch, is included in table 11-1, but not in figure 11-1. Please update the map to include all project and non-project recreation sites.
		NorthWestern response: Figure 11-1 has been revised to include the location of the non-Project Cherry Creek Boat Launch.
FERC	11	Cultural Resources: In section 2.4 of the draft Historic Properties Management Plan (filed August 3, 2023), the Area of Potential Effect (APE) is defined as "lands within the project boundary as delineated in the new FERC license." However, the APE should be determined in consultation with the SHPO. While this generally conforms to the project boundary, it could include additional lands outside the project within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. Please provide documentation of SHPO concurrence on the APE.
		NorthWestern response: NorthWestern's consultation with NT SHPO is described in the HPMP, and also in Exhibit E-19.7.2. NorthWestern requested SHPO concurrence with the APE on December 1, 2023. The SHPO replied on December 20, 2023 in a letter stating, "We concur with the proposed APE boundaries as it is described in Appendix A of the HPMP." A copy of correspondence with the SHPO is included in the HPMP.
FERC	12	Comprehensive Plans: Section 16.8(f)(6) of the Commission's regulations requires licensees to explain how and why the project would, would not, or should not, comply with any relevant comprehensive plan and a description of any relevant resource agency or Indian tribe determinations regarding the consistency of the project with any such comprehensive plan. In the draft license application, you list several comprehensive plans that you identify as relevant to the project; however, you do not explain how or why the proposed project is consistent with the plans. In the final license application, please provide this explanation for each relevant comprehensive plan. Be sure to use the most current list of comprehensive plans approved for Montana. This list is available on the Commission' webpage at: https://cms.ferc.gov/media/comprehensive-plans.
		NorthWestern response: The list of comprehensive plans has been updated to the most recent version and the requested information on how the Project is consistent with the comprehensive plans is included in Exhibit E - Section 18.5.

Agency	Comment Number	Comment and NorthWestern Response
FERC	13	Section 4.51(h) of the Commission's regulations requires an Exhibit G that conforms to section 4.41(h). Section 4.41(h) of the Commission's regulations requires that Exhibit G include: (1) project boundary data in a geo-referenced electronic format (i.e., ArcView shapefile or similar format), (2) electronic boundary data that is positionally accurate to ±40 feet, and (3) a text file describing the map projection used for the Exhibit G data. Be sure to include this information with your final license application in accordance with section 4.41(h). NorthWestern response: The requested information has been added to Exhibit G. The electronic Project boundary files are being submitted with this filing.
FERC	14	Section 5.18(c)(1)(F)(3) of the Commission's regulations requires that the Exhibit H include a detailed single-line electrical diagram. In your draft application, the single line electrical diagram was filed as Critical Electric Energy Infrastructure (CEII). The single-line diagram is not considered CEII and should be filed as public information as part of Exhibit H of your final license application. NorthWestern response: NorthWestern reached out to FERC staff for clarification on this comment and received guidance that the single line diagram may be filed as CEII. Therefore, we are filing Exhibit H with the single line diagram filed separately as CEII.
USACE	1	Can you tell me where you are in terms of 404 permitting? Do you have proposed designs that will result in the discharge of dredged or fill material? Sorry for the broad question, but as you know, there is a TON of documentation associated with this effort. Thanks! NorthWestern response: No new construction is being proposed, so there will be no discharge of dredged or fill material and no 404 permit will be needed.
Avista	1	Section 6. Water Quality. Pg. 538/539: There was no temperature data for Prospect Creek or CF3 despite collecting nutrients and metals data from these locations. Temperature was collected for the other four sites (i.e., CF1, CF3, CF4, and TR). Avista suggests including any temperature data or adding an explanation of why temperature data is absent from these two sites. On Pg. 183 there is the statement: "Prospect Creek provides a cold-water refuge for salmonids during the warm summer months." However, Avista did not see any data that supported this statement and suggests adding available data. Avista has cost-shared a PIT-monitoring station with NorthWestern, and further information on temperature or cold-water refuges for Bull Trout would be helpful.

Agency	Comment Number	Comment and NorthWestern Response
		NorthWestern response: There were no continuous water temperature data collected at Prospect Creek as a part of the 2019 and 2021 monitoring effort. Some temperature data were collected at site CF3 in conjunction with the operations testing, and those data are summarized in Table 69 and Figure 631 in Section 6.7.3 of the FLA. The purpose of the water temperature data collection effort in 2019 and 2021 was to determine what effect, if any, the Project has on water temperature. The study design included measuring water temperature upstream of the Project (Site CF1), the mouth of the Thompson River which is the main tributary to Thompson Falls Reservoir (TR1), the downstream end of Thompson Falls Reservoir near the fish passage facility (CF2), and downstream of the Project (CF4). Site CF4 was chosen over Site CF3 for this study because site CF4 captures the influences of both powerhouses as well as any spillway water from the dams, which makes it a more representative site to evaluate water temperatures leaving the Project. Site CF3 only captures water leaving the old powerhouse and does not provide a representative picture of water quality leaving the Project, however some temperature data were collected in conjunction with stage monitoring data as a part of the operations study. Prospect Creek was not monitored because it enters the Clark Fork River downstream of Thompson Falls Reservoir and therefore does not have any influence on water temperatures in the reservoir. In the ISR and USR for the Fisheries Behavior Study (NorthWestern 2022 and 2023), NorthWestern reported on temperature profiles collected in the Clark Fork River below the Main Channel Dam in the Dollar Hole (below the natural falls), High Bridge (upstream of Prospect Creek confluence and at the High Bridge), and Prospect Hole (outlet of Prospect and confluence with the Clark Fork River) during the 2021 and 2022 study seasons with focus on summer temperatures (see ISR Fish Behavior Study Section 3.3.5 (NorthWestern 2022) and USR Fish Behavior Study Section 3.6 (NorthWestern 2023). Prospect Hole provided cooler water temperatures (at shallower depths) during the summer months compared to other locations and radio-tagged fish are observed holding in this area during warm summer months (refer to ISR Fish Behavior Study Figure 3-11). Prospect Creek is also known to provide suitable cold water habitat conditions for Westslope Cutthroat Trout and Bull Trout. Data collected by USFS NorWeST (USFS 2023; Isaak et al. 2015) indicate the mean August temperature from 1993-2011 was 13.35° C. Furthermore, Avista (2018) reported mean August temperature in lower Prospect Creek during 2017 as 13.3°C. This is a considerably cooler water input to the mainstem Clark Fork River that often reaches over 20°C in the summer months. Text in Exhibit E Section 7.1.1.2 has been updated to support the statement that "Prospect Creek provides cold-water refuge for salmonids."
Avista	2	Section 6. Water Quality. Pg. 163: Based on Table 6-12 it is unclear whether more than two spill gates were tested at a time. Avista suggests adding the results of all tests to the document to clarify what operational methods have been used to reduce TDG. If it has not already been done, Avista suggests testing the TDG produced by all potential spillgate combinations. As a downstream facility, Avista reacts to all incoming TDG levels from upstream.

Agency	Comment Number	Comment and NorthWestern Response
		NorthWestern response: During the spill gate testing, NorthWestern only tested combinations of two radial gates at any one given time because the test was designed to capture TDG data from actual normal operating conditions. NorthWestern plans to operate two radial gates under normal spill operations and reserve the other two radial gates for downstream flow restoration purposes in situations when there is a plant trip. Because of the need to have two radial spill gates available for this purpose, NorthWestern will not be using more than two gates at a time for normal spill operations, and therefore did not need to test scenarios outside of those normal operations. All spill gate test results have been reported.
Avista	3	Section 6. Water Quality. Pg. 175: "However, no significant adverse impacts to fish have been found as a result of the TDG levels at the Project." This statement is made without providing evidence to support it in the preceding Total Dissolved Gas section. If studies have been conducted to support this conclusion Avista suggests including them in the preceding section.
		NorthWestern response: Gas bubble trauma (GBT) is the primary concern to fish as a result of elevated TDG levels. Information and monitoring efforts on the potential impact elevated TDG levels on fish downstream of Thompson Falls Dam is presented in more detail in Exhibit E Section 7.1.1.2. Text in Exhibit E Section 6.9 has been modified to refer to Section 7.1.1.2 for study details and supporting evidence. Several fish collection efforts occurred between 2008 and 2014 with minimal signs of GBT observed and documented among the 2,080 fish sampled during higher flows (>57,000 cfs).
Avista	4	Section 7. Fisheries and Aquatic Resources. Pg. 182: "Tailrace elevations immediately downstream of the Project are related to the total volume of water passing through the Project." "In addition, Noxon Rapids Reservoir operations have an influence on Clark Fork River flows all the way upstream to the tailrace of the Project." It is Avista's understanding that the Noxon pool does not impact the tailrace of Thompson Falls Dam according to our project boundary maps in the Clark Fork Project License (No. 2058).
		NorthWestern response: The Thompson Falls tailrace is located directly below both powerhouses at the Thompson Falls Project. The upstream end of Avista's Clark Fork Project No. 2058 boundary extends upstream and abuts to the downstream end of the Thompson Falls Project boundary, and includes the most downstream portion of the tailrace below the Original Powerhouse (refer to Exhibit E – Figure 11-8). Project boundaries are intended to designate the geographic extent in which the licensee must own or have control for operation of the project. The project boundary must include lands necessary for operation and maintenance of the project and for other project purposes such as recreation or protection of environmental resources. The downstream extent of the Thompson Falls project boundary as defined meets these purposes, but that does not preclude the possibility of there being a hydrologic influence from the Noxon Rapids Dam impoundment downstream. A more detailed explanation of the effect of operations of Noxon Rapids Dam on water surface elevations (WSE) at the Project tailrace has been added to Exhibit E - Section 7.1.1.2. The 2021 Operations Study that NorthWestern conducted and reported on in the Operations Study - ISR (NorthWestern 2022) found that changes in WSE at Birdland Bay Bridge, which is downstream of the Thompson Falls outflow, closely mirror WSE changes at the Noxon Rapids forebay. Birdland Bay Bridge is within the Clark Fork Project No. 2058 boundary and is generally regarded as the upstream extent of the area impounded

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Agency	Comment Number	Comment and NorthWestern Response
		by Noxon Rapids Dam. Therefore, the resulting changes in WSE and their close association with Noxon Rapids forebay elevations is to be expected. In addition, Noxon Rapids Reservoir operations have an influence on Clark Fork River flows all the way upstream to the tailrace of the Project, refer to Exhibit E - Figure 7-2 for an illustration of WSE at the Noxon Rapids Forebay, Birdland Bay Bridge, and the Project tailrace. The magnitude of the observed influence of Noxon Rapids Dam operations on WSE at the Project tailrace is reduced compared to the influence at Birdland Bay Bridge but is still apparent.
Avista	5	Section 7. Fisheries and Aquatic Resources. Pg. 183: "TDG has never exceeded 120% at the Birdland Bay Bridge Site." Avista suggests that this sentence be changed to say "…rarely exceeded…" as Table 6-11 (Pg. 161) indicates that TDG greater than 120% saturation was detected at the Birdland Bay Bridge in 2011. In addition, Avista has data from 1997, 2011, and 2014 indicating that TDG in the Noxon Rapids Dam forebay was greater than 120% saturation. Avista is not aware of any known sources of TDG between Thompson Falls Dam and the Noxon Rapids Dam forebay.
		NorthWestern response: The text has been updated in Exhibit E Section 7.1.1.2. to clarify. Under normal spill operations, TDG does not exceed 120% at Birdland Bay Bridge, but in rare circumstances which lead to the tripping of stanchions on the Main Channel Dam and Dry Channel Dams for dam safety reasons, TDG may exceed 120% at Birdland Bay Bridge due to the uncontrolled spill that occurs once the dam stanchions are tripped. As described in Exhibit E Section 2.1.3.2, prior to the installation of the new radial gates in 2019, high flows and debris required tripping of stanchions and spill bays approximately every 7 to 10 years. With the installation of the new radial gates it is estimated that the flow that will trigger stanchion tripping is approximately 112,000 cfs (a 10-25-year event). Therefore, the frequency of stanchion trips causing high TDG will be less frequent than in the past.
Avista	6	Section 7. Fisheries and Aquatic Resources. Pg. 183: "…no observed impact on fish has been detected." This statement is followed up with information about gas bubble trauma (GBT) that has been observed during sampling (i.e., an effect of elevated TDG on fish). Avista suggests that information be added to clarify what is viewed as "no impact" as there is no evidence provided regarding potential effects on fish abundance or growth.
		NorthWestern response: Exhibit E Section 7.1.1.2 - The baseline conditions are described in this section and the intent of this statement is to indicate when TDG levels at the Project exceed 110 percent TDG standard set by MDEQ, NorthWestern has not observed any significant visible sign of GBT symptoms in fish during various fish collection and survey efforts. Additionally, fish collection efforts and observations of 2,080 fish over 6 years (2008-2014) during high flows (>57,000 cfs) representing a minimum of 16 species, indicated a low level of visible GBT symptoms in fish. Additional text has been inserted to clarify the statement.

<table>
<tr><th>Agency</th><th>Comment Number</th><th>Comment and NorthWestern Response</th></tr>
<tr><td rowspan="2">Avista</td><td rowspan="2">7</td><td>Section 7. Fisheries and Aquatic Resources. Pg. 231–234: It is unclear what “local fish species” were used in the modeling to determine swim speeds (although Pg. 217 suggests Rainbow and Brown trout). It is difficult to gage the results of the model without knowing this information. Avista suggests explicitly stating the species used in this section. In addition, Tables 7-10 and 7-11 appear to show the same information.</td></tr>
<tr><td>NorthWestern response: The term “local fish species” refers to the swimming abilities detailed in the ISR- Fish Behavior Study Section 3.4 (NorthWestern 2022) and the USR- Fish Behavior Study Section 3.8 (NorthWestern 2023). The species include salmonids (Brown Trout, Bull Trout Mountain Whitefish, Rainbow Trout, Westslope Cutthroat Trout) and native non-salmonids (Largescale Sucker and Northern Pikeminnow). The text of Exhibit E Section 7.1.3 has been updated to detail the species representing “local fish” and connect the swimming abilities to the velocity categories utilized in the modeling analysis.

<table>
<tr><th>Common Name</th><th>UL Prolonged Speed (fps)</th><th>UL Burst Speed (fps)</th></tr>
<tr><td>Brown Trout</td><td>7.7</td><td>13.2</td></tr>
<tr><td>Bull Trout</td><td>2.8</td><td>7.5</td></tr>
<tr><td>Mountain Whitefish</td><td>5.0</td><td>6.0</td></tr>
<tr><td>Rainbow Trout</td><td>4.0</td><td>13.5</td></tr>
<tr><td>Westslope Cutthroat Trout</td><td>6.4</td><td>13.5</td></tr>
<tr><td>Largescale Sucker</td><td>1.9</td><td>6.0</td></tr>
<tr><td>Northern Pikeminnow</td><td>3.8</td><td>4.4</td></tr>
</table></td></tr>
<tr><td rowspan="2">Avista</td><td rowspan="2">8</td><td>Section 7. Fisheries and Aquatic Resources. Pg. 203: We feel the license application would be strengthened by providing additional information and context regarding Bull Trout life history expression in the Thompson River drainage. As suggested in the application, we are also surprised at the low juvenile outmigration rates reported for the Thompson River. However, we believe context is missing that would allow meaningful interpretation of the empirical data, and that there is a much stronger adfluvial component than would be inferred through reading the application. See letter for supporting text.</td></tr>
<tr><td>NorthWestern response:

Most of the tagged juvenile Bull Trout (754) in Fishtrap Creek and West Fork Thompson River were initially PIT-tagged in 2014 and 2015 during a study of juvenile out-migration (Glaid 2017). Since then, FWP has continued to PIT-tag juveniles in subsequent years, but on a much-reduced scale. Additional text has been added to Exhibit E Section 7.1.2.6.2 regarding Glaid’s (2017) study and interpretation of the study results. FWP and NorthWestern continued PIT tagging and monitoring PIT tag arrays in the Thompson River and tributaries after Glaid’s study was complete. There were minimal PIT tag detections of juvenile Bull Trout by the mainstem Thompson River, indicating low out-migration.

Fisheries surveys indicate the tributaries of the Thompson River; Fishtrap Creek, West Fork Thompson River, and Big Rock Creek, support all three Bull Trout life history forms - resident, fluvial, and adfluvial. However, evidence indicates the numbers of adfluvial Bull Trout are low. The Avista adult transport program averages five Bull Trout transported from Lake</td></tr>
</table>

Agency	Comment Number	Comment and NorthWestern Response
		Pend Oreille to Thompson River drainage (Region 4) annually (2009-2023) and the Thompson Falls fish passage facility generally passes 1-3 adult Bull Trout from Region 3 upstream of Thompson Falls Dam annually (2011-2023). These low numbers of adult adfluvial Bull Trout support the conclusion that the adfluvial life history remains in the Thompson River drainage, but the stability and strength of this life history form is currently low. Low juvenile outmigration survival through all three reservoirs likely plays a significant factor in suppressing the adfluvial life history which is a key component to a healthy Bull Trout population in the Thompson River.
Avista	9	Section 7. Fisheries and Aquatic Resources. Page 243: We feel the license application would be strengthened by including more information in Section 7.1.4.1 (Downstream Survival). Presently, the application provides little information specific to the survival of outmigrating juvenile Bull Trout through the project. While the application lacks empirical information specific to dam passage survival at Thompson Falls dam, the two literature reviews provide reasonable background information pertaining to dam passage survival (it is not likely feasible to directly estimate these metrics for juvenile Bull Trout through Thompson Falls Dam). However, no information is provided regarding Thompson Falls Reservoir survival or the likelihood that outmigrating juvenile Bull Trout will pass Thompson Falls Dam. We believe the greatest risk to outmigrating juvenile Bull Trout is reservoir survival as opposed to dam passage survival. This risk is more pronounced than ever due to abundances of piscivorous fishes in the reservoir.
		NorthWestern response: Exhibit E Section 7.1.4.1 provides a summary of available data and literature regarding downstream survival. NorthWestern agrees there is potential for predation of outmigrating juvenile/subadult Bull Trout when migrating through Thompson Falls Reservoir. However, there are little available data to ascertain the relative risks of predation or dam passage. The relative abundance of Northern Pike, a primary nonnative predator species present in Thompson Falls Reservoir, has remained consistent since fall gillnetting began in 2004 with an average 2.7 fish caught per net and maximum of about 5 fish per net. Additionally, a multi-year study in 2014-2015 on out-migration of juvenile Bull Trout out of the Thompson River drainage and into the Thompson Reservoir did not identify non-native fish predation as a critical limiting factor (Glaid 2017).
Avista	10	Section 7. Fisheries and Aquatic Resources. Page 256: We are concerned with the Applicant's Proposed Alternative for Downstream Passage outlined in Section 7.3.2.2. We do not believe the Proposed Alternative provides adequate protection, mitigation, or enhancement for outmigrating juvenile Bull Trout. In particular, we are concerned for the Thompson River drainage local populations of Bull Trout. Through the Clark Fork Settlement Agreement and FERC License 2058, Avista has made substantial investments in Thompson River habitat in the interest of protecting and enhancing native salmonid populations. As such, it is our hope that efforts will be made to transport juvenile Bull Trout directly from the Thompson River to the superior foraging, migration, and overwintering habitat in Lake Pend Oreille. The model has been extremely effective at recovering the Graves Creek local population.

Agency	Comment Number	Comment and NorthWestern Response
		NorthWestern response: The DLA provided a conceptual outline of proposed PM&E measures. Since the filing of the DLA, NorthWestern has engaged federal and state resource agencies to refine and specify these concepts. As of the filing of the FLA, these discussions are ongoing.
Avista	11	Section 7. Fisheries and Aquatic Resources. Pg. 331: “There is no fish passage facility or trap system present at Noxon Rapids Dam.” Although this statement is correct, fish passage is implemented at Noxon Rapids, as adult Bull Trout captured below Cabinet Gorge Dam that are genetically assigned to upstream regions (including above Noxon Rapids Dam) are transported and released at appropriate locations defined in established protocols as agreed to by the state of Montana, the USFWS, and others, and approved by FERC. Downstream passage around Noxon Rapids Dam is facilitated by capturing putative outmigrating juvenile Bull Trout in tributaries (i.e., Graves Creek and Vermillion River) and transporting them downstream around both Noxon Rapids and Cabinet Gorge Dams.
		NorthWestern response: Thank you for the additional information. Per the scope of NorthWestern’s Project, the text remains the same to accurately describe presence or absence of fish passage facilities at the three dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) on the lower Clark Fork River.
Avista	12	Section 11. Recreation. Table 11-6: Avista suggests adding mention of Avista ownership/management of the Thompson Falls golf course.
		NorthWestern response: Table 11-6 has been revised to acknowledge Avista’s ownership and management of the Thompson Falls golf course.
Avista	13	Section 11. Recreation. Section 11-1: There are several instances in Section 11 regarding property ownership of recreation sites where Avista ownership and/or management responsibility is not identified (see table in letter). Avista suggests delineating ownership and management for clarification purposes.
		NorthWestern response: Exhibit E Section 11-1 has been revised as suggested regarding Avista ownership and management responsibilities.
Avista	14	Section 12. Cultural Resources and Lands. There are multiple instances of inconsistency between information in Volume I and Volume II of the draft license application, particularly pertaining to identification of cultural sites. In addition, there were a couple of instances when it was unclear who was consulted or what feedback NorthWestern received during consultation with Tribal or State Historic Preservation entities.

Agency	Comment Number	Comment and NorthWestern Response
		NorthWestern response: The introductory text of Exhibit G has been changed to clarify that the proposed boundary "encompass[es] Project facilities, recreation sites and all elements of the Thompson Falls Hydroelectric Dam Historic District. The previous language mentioned simply "a cultural resource site." That site (the Prospect Creek Powerhouse) is a new district element that was identified during update of the National Register nomination and that now will be included within the proposed project boundary. To clarify Exhibit E Section 2.2.3.3, the text has been changed to read: "Lands ...being proposed for removal ... were inventoried for cultural resources and no National Register-eligible or -listed properties were identified." Regarding previously recorded cultural resources identified in Exhibit E - Section 12.1.2, we note that Section 12.1.3 paragraph 2 correctly identified the numbers of sites that actually lay within the proposed project boundary. Regarding a possible conflict with Exhibit E - Section 12.4.2.1, we have revised the text to delete reference to exclusion of 24SA756, a transmission line, because, as a resource that is not National Register-eligible, it should not have been referenced in that section. Finally, Exhibit E - Section 19.8 (Additional Tribal Consultation) includes detailed information on tribal contacts made and responses received.
Kalispel Tribe	1	I'm closing an open loop in our communications regarding Thompson Falls relicensing. I received the information below and I'm still digesting it in terms of management needs. Accessibility to lands seems to have been an issue, of the various drafts of the project's HPMPs that are a float, I'd recommend a more robust accounting and oversight of 4E conditions and their compliance with NHPA (USFS has a habit of building campgrounds on other people's dime). Albeit 106 "needs" from FERC perspective might have been scratched, there is a growing interest domestically and amongst sister sovereigns to put some 110 product out on the street. By product, placename interpretive panels and the like that are robust and well maintained. An approach along these lines supports local economies and has stake holder buy in. Thank you again for your call this morning, as mentioned Mr Cullooyah and I shall discuss your client's needs and PA signatory recommendations to leadership
		NorthWestern Response: Regarding oversight of section 4e conditions and compliance with the National Historic Preservation Act, the HPMP is clear that, for any non-exempt Project-related action within the proposed FERC boundary (including one initiated by other parties that NorthWestern would support financially or otherwise), NorthWestern must comply with the requirements set out in Section 4.2. Specifically, if project impacts constitute an adverse effect, procedures for avoiding, minimizing, or mitigating those impacts are set out. These procedures specify NorthWestern consultation with SHPO and/or other consulting parties (Subsections 4.2.2 and 4.2.3.4). Additionally, Section 4.3 of the HPMP covers project actions outside the project APE (proposed FERC boundary). That section specifies a sequence of procedures that must be followed when NorthWestern initiates a project or intends to participate in funding another entity's project that involves ground-disturbing activities. Those procedures are essentially those of standard Section 106 and afford SHPO and other

Agency	Comment Number	Comment and NorthWestern Response
		consulting parties (including tribal consulting parties) the opportunity to review and comment on project-related actions outside the project APE. Regarding applicability of Section 110 of the National Historic Preservation Act, while Section 110 technically applies to all federal agencies, only land managing agencies can carry out the provisions. NorthWestern notes, however, that the HPMP includes provisions for public interpretation as impact mitigation in the event of an adverse effect (Section 4.2.3.4). That subsection refers to the previous subsection (4.2.3.3), which aims to place interpretive panels in local community-based venues, where wear may be minimized and the signs protected as much as possible from other damage.
DEQ	1	Thank you for updating the plan to include the comments from our meeting a couple weeks ago. We're satisfied with this most up-to-date WQ monitoring plan being incorporated into the license. We have no further comments.
		NorthWestern response: The Water Quality Monitoring Plan that was developed in consultation with DEQ is being filed with this FLA, *see* Exhibit E – Appendix C.

Notes: > = greater than; Avista = Avista Corporation; DEQ = Montana Department of Environmental Quality; FERC = Federal Energy Regulatory Commission; USACE = U.S. Army Corps of Engineers; WQ = Water Quality Monitoring Plan

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19.7.1 Response to Comments on the DLA from members of the public

Comments received from members of the public on the DLA had a number of recurring themes: operations effects on fisheries and aquatic habitat, wildlife habitat, aquatic invasive species, shoreline erosion, public safety, length of license term, impacts of deeper maintenance drawdowns, and recreation.

Community Comment 1. Comments related to impacts of reservoir operations on fish populations.

Community Comment 1 Response. The Exhibit E Section 7.3.2 summarizes fish stranding observed during the 2021 and 2022 Operations Study. Most (74 percent) of the stranded fish were observed when the reservoir was 2.5 feet below full pool, the lowest level NorthWestern is proposing to utilize routinely in the new license term. No stranded fish were observed when the reservoir was within 1 foot of full pool, with low numbers of stranded fish observed between 1 and 2 feet of full pool.

Most (79 percent) of the stranded fish were Black Bullhead. Black Bullhead are an introduced species in Montana, with scattered populations statewide but primarily concentrated in small ponds and backwater sloughs of eastern Montana. They seldom exceed 1 pound in weight and thus are rarely a desirable game fish in Montana waters (FWP 2023). Other species noted were Largemouth Bass, Smallmouth Bass, Yellow Perch, Northern Pikeminnow, and Pumpkinseed. All of these species are non-native to Montana, except for Northern Pikeminnow, a non-game species. No salmonids were observed in the stranding transects.

The results of the 2021 and 2022 operations study concluded fish stranding was limited to juvenile fish of only non-salmonid species. Fish stranding potential appeared to increase with the rate of elevation change, particularly in areas where topography sloped back into higher elevation areas, or within confined depressions.

Table 1. Total Count of Stranded Fish for Each Survey Event during Thompson Falls Reservoir Operations Study in 2021 and 2022

Year Observed	Distance Below Full Pool (ft)	BBH	LMB	SMB	YP	NPMN	PUMP	Salmonids	Total
2021	0.5	-	-	-	-	-	-	-	-
2022	0.7	-	-	-	-	-	-	-	-
2022	0.8	-	-	-	-	-	-	-	-
2021	1.0	19	9	-	-	1	-	-	**29**
2021	1.5	3	1	-	-	-	-	-	**4**
2021	2.0	1	2	-	-	-	1	-	**4**
2021	2.5	89	9	2	4	1	-	-	**105**
Total		**112**	**21**	**2**	**4**	**1**	**1**	**0**	**142**

Notes: BBH = Black Bullhead, LMB = Largemouth Bass, SMB = Smallmouth Bass, YP = Yellow Perch, NPMN = Northern Pikeminnow, PUMP = Pumpkinseed Sunfish

Some commenters expressed concern about other impacts to fish beyond the stranding risk. There is no evidence that fluctuating the reservoir 2.5 feet has other impacts to fish. Water level fluctuations will not result in warmer water temperatures in Thompson Falls Reservoir. NorthWestern's studies have found that Thompson Falls Reservoir does not stratify and water temperature is the same entering the Project area as it is leaving the Project area.

Community Comment 2. Comments related to impacts to invertebrate communities.

Community Comment 2 Response: Reservoir operations are not anticipated to have any significant adverse impacts on invertebrate communities in the Project. Reservoir fluctuations may lead to temporary displacement of invertebrates from the habitats that they occupy. Overall, habitat in the fluctuation zone is not currently optimal for invertebrates. However, where habitat exists that may be suitable, it is expected that displaced invertebrates would recolonize in habitats that remain watered.

Community Comment 3. Comments related to operation limitations and reduced functionality of the fish ladder.

Community Comment 3 Response. The operation of the fish passage facility was evaluated during the Operations Study. NorthWestern documented that fluctuations of the reservoir. more than 2.3 feet below full pool showed impacts to operation of the fish passage facility per the existing configuration. However, NorthWestern believes there is a relatively straightforward engineering solution to address this but wishes to evaluate it further when it assesses fish passage efficiency, as described in the proposed PM&E measures in Exhibit E - Section 2.2.4 - Proposed Environmental Measures.

Community Comment 4. Comments related to impacts to wildlife habitat including migratory waterfowl, mammals, and amphibians.

Community Comment 4 Response: Reservoir operations are not anticipated to have any significant adverse impacts to wildlife habitat in the Project, *see* FLA - Exhibit E - Section 9.3.2. Reservoir fluctuations will be temporary in nature and therefore any changes to existing wildlife habitat will also be temporary. There are no anticipated long-term impacts to emergent or riparian vegetation, which are generally made up of resilient species that are naturally adapted to changing hydrologic conditions due to their robust root structure. There is the potential for changes to the density of aquatic vegetation, which was observed in the 2022 study season. Specifically, the density of submergent vegetation was reduced in the 0 to 18-inch depth range in certain areas of the reservoir (Operations Study – USR). However, there are no anticipated long-term impacts to emergent or riparian vegetation, which are generally made up of resilient species that are naturally adapted to changing hydrologic conditions due to their robust root structure.

Community Comment 5. Comments related to increased production of aquatic invasive species (flowering rush, Eurasian watermilfoil) and algae.

Community Comment 5 Response: The Operations Study – ISR noted that flowering rush and yellow flag iris, AIS species, are fairly common in the reservoir and were observed at six of the nine reference points. The prevalence of these species varied depending on time of year.

The Operations Study Reports – ISR – Section 3.3.1 and USR – Section 3.3 documented a reduction in submergent aquatic vegetation in the 0 to 18-inch depth range. Fluctuating water levels under flexible operations may be a factor in this reduction. NorthWestern did not observe an increase in flowering rush in either study season, but did observe an overall reduction of aquatic plant density in the near shore area less than 18-inch depth.

Eurasian watermilfoil is also an aquatic invasive species, prevalent downstream of Thompson Falls Reservoir (Operations Study – ISR – Section 3.3.1). However, it was not observed in Thompson Falls Reservoir by NorthWestern during 2021 or 2022, nor has it been observed during any other monitoring conducted by NorthWestern.

NorthWestern did not observe an increase in algae in either 2021 or 2022.

Community Comment 6. Comments related to erosion to the riverbanks and displacement of rocks and trees.

Community Comment 6 Response: As stated in the Operations Study Reports – ISR – Section 3.2 and USR – Section 3.2, NorthWestern did not observe any erosion that appeared to be caused by flexible operations. NorthWestern did observe erosion, but concluded the causes to be high flows associated with spring runoff, boat wakes, wave action from wind, overland flow of water due to rainfall or snowmelt events and wildlife or human paths. NorthWestern evaluated nine reference points along the reservoir between the boat restraint and the Thompson River. This area captures the majority of developed lands potentially affected by flexible operations. 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. Based on this methodology, any widespread erosion due to flexible operations would have been detected.

During the Operations Study, visual observations made by boat noted that historical reservoir sediment infill and some limited areas of fine-grained alluvium that is less compact experienced some surficial slumping. However, the fluctuating water levels due to Project operations did not appear to appreciably change the amount, type, or cause of erosion.

NorthWestern's assessment is that drafting the reservoir multiple times in 24 hours, or only once in 24 hours, or other frequency would not change the effects to shoreline erosion. Instead, factors unrelated to Project operations, such as spring runoff, boat wakes, wave action from wind, overland flow of water due to rainfall or snowmelt events and wildlife or human paths are the principal causes of erosion.

Community Comment 7. Comment stating that NorthWestern does not enforce boating regulations.

Community Comment 7 Response: NorthWestern does not have the authority to enforce boating regulations. Enforcement of boating regulations is under the jurisdiction of the state of Montana.

Community Comment 8. Comment suggesting limiting reservoir fluctuation to no more than 1 foot, as is the case on some other reservoirs.

Community Comment 8 Response: Limiting the allowable reservoir fluctuations to less than 2.5 feet would adversely impact NorthWestern's ability to regulate the grid and to respond to increased energy demands. Specifically, it would significantly limit the duration NorthWestern could provide flexible generation and the associated value to its customers. Additionally, NorthWestern's proposed operations modification from fluctuations of up to 4 feet to fluctuations of up to 2.5 feet is a reduction of nearly 40 percent of the volume allowed under the current license. NorthWestern believes a 2.5-foot fluctuation is a reasonable compromise that balances the resource needs with energy production needs. Additionally, NorthWestern is proposing an off-license program to mitigate impacts to private docks due to reservoir fluctuations, if granted the ability to fluctuate 2.5 feet.

The amount of fluctuation that is allowed at other hydroelectric projects is highly variable. Larger daily fluctuations are not uncommon. For example, immediately downstream of Thompson Falls are Noxon Rapids and Cabinet Gorge reservoirs which fluctuate up to 4 and 7 feet respectively on a daily basis.

Community Comment 9. Comments related to concerns that reservoir fluctuations may impact public safety.

Community Comment 9 Response: The impact to public safety due to in-water hazards were monitored during 2021 related to changing reservoir elevations. Two hazards became more visible at lower water elevations during the 2021 study, resulting in a decreased risk of contact. Two other rock outcrops became shallower as the reservoir elevation was reduced, bringing them within the depth for potential contact with watercraft, but were not visible above the water line until water elevations were reduced to near 2.5 feet below full pool. The contact risk with these two hazards increased as the water elevation decreased.

Shoals and inundated islands in the main reservoir body are generally visible and easily identifiable. Lower water elevations will make these obstacles more prominent, but the associated contact risk due to Project Operations is unchanged or possibly reduced due to increased visibility. (Operations Study – ISR - Section 4.6)

Community Comment 10. Comments related to access to the reservoir at Wild Goose Landing Park and Cherry Creek Boat Launch.

Community Comment 10 Response: Based on the Operations Study, the boat dock and boat launches at the public access sites, Cherry Creek, and Wild Goose Landing Park, remained usable when the reservoir was drawn down 2.5 feet (Operations Study – USR - Section 3.5). At Wild Goose Landing Park, at 2.5 feet below full pool, the distance from the stationary dock to boats moored at the dock made access to and from boats more challenging, but the floating dock remained watered and provided access. NorthWestern proposes to replace the stationary dock with a new floating dock to resolve impacts related to the use of the boat launch dock from fluctuations if granted the ability to fluctuate 2.5 feet. The public floating dock at Cherry Creek boat launch became pitched due to grounding of near-shore floats, but was still usable at 2.5 feet below full pool. Public docks are typically only used to access boats during launching or loading. Boats are not typically moored except for relatively brief periods of time, so impacts to moored boats due to flexible generation would be minimal.

Community Comment 11. Comments related to steep docks, access ramps, and stationary docks becoming unsafe for users and the need to be rebuild these structures for safe use during flexible operations. Concerns regarding personal property damage (docks and boats) and comments related to the inaccessibility to utilize boats or docks during the flexible operations.

Community Comment 11 Response: Refer to the Operations Study Report- USR for a more complete description of impacts observed to docks when the reservoir elevation was lowered for flexible generation. There were no observations of stationary dock structure damage due to reservoir fluctuations during either study season, nor was access to the stationary docks from shore impacted. At some locations, access from the dock to the water became more difficult at lower water levels.

Floating docks provide better recreational access to the water compared to stationary docks because the dock adjusts to pool elevation changes. While the majority of floating docks remained watered at all elevations, floating docks that were aligned perpendicular to the shoreline provided better access to deeper water at lower pool elevations than docks aligned parallel to the shoreline. Floating docks with shorter gangways often had the near-shore floats of the dock grounded, though the outer edge remained watered. Floating docks also became pitched or angled if they became partly or entirely grounded at lower reservoir elevations. (Operations Study Report – USR - Section 4.5).

However, these situations can be alleviated, in most cases, through modifications to the structures. NorthWestern is proposing a program to fund dock repairs to address impacts to privately owned docks in order to mitigate for impacts related to reservoir fluctuations, if granted the ability to fluctuate 2.5 feet.

Community Comment 12. Comments related to personal shoreline property damage due to erosion.

Community Comment 12 Response: During both years of the Operations Study, there was no erosion observed related to fluctuating reservoir levels. The causes of the documented erosion were concluded to be high flows associated with spring runoff, boat wakes, wave action from wind, overland flow of water due to rainfall or snowmelt events, and wildlife or human paths. While there is a fair amount of erosion above the full-pool water's edge in the form of bank sloughing and undercutting, the reservoir bed that would be exposed by flexible Project operations would be armored by rock, cobble, gravel, woody material, and aquatic vegetation (Operations Study Report – USR - Section 4.2.)

Community Comment 13. A 40-year license agreement period is too long.

Community Comment 13 Response: Section 6 of the Federal Power Act (FPA) provides that hydropower licenses shall be issued for a term not to exceed 50 years. Section 15(e) FPA provides that any "new licenses" shall be for a term FERC determines to be in the public interest, but not less than 30 years or more than 50 years. On October 26, 2017, FERC issued a policy statement (82FR49501) adopting a 40-year default license term for new license for hydropower projects located at nonfederal dams. The policy was established to ease the economic impact of new costs, promote balanced and comprehensive development of renewable power generating resources, and encourage licensees to be good environmental stewards.

Community Comment 14. The maintenance drawdown in 2023 caused shoreline slumping.

Community Comment 14 Response: Certain maintenance activities require the reservoir be lowered further than normal operating levels. The drawdown in October 2023 was a planned event to replace the timber stop-log flashboards. These flashboards have a 25–30-year service life, so a drawdown of this type is not expected to be needed again for several decades.

Shoreline slumping was observed associated with the October 2023 drawdown. Most slumping occurred below the high water line, but in a few areas the slumping extended above the high water line.

NorthWestern will develop a Drawdown Plan for future planned maintenance drawdowns which will specify the rate of drawdown, and include a shoreline monitoring program.

The other circumstance when deep drawdowns are needed is unplanned. It occurs when spring flows exceed the capacity of the combination of the spillway radial gates (less reserve for plant capacity restoration) and the spillway roller panels. When flows near or exceed approximately 112,000 cfs, NorthWestern may have to activate the trippable stanchions to allow the spillway to pass additional flows. When the stanchions are tripped, NorthWestern has to draw the reservoir down to crest to execute repairs on the spillways. With the new radial gates (installed 2019), deep drawdowns caused by the tripping of the stanchions will be relatively rare. It is anticipated this flow capacity is more than the 10-year flood event of 110,335 cfs but less than the 25-year flood event of 122,947 cfs.

Community comment 15: Local children need safe places to access the reservoir for swimming.

Community Comment 15 Response: NorthWestern is proposing to partner with the City to maintain the Wild Goose Landing recreation site, which includes swimming access, available at no cost.

Community Comment 16: there has not been enough public outreach, the comment period on the Draft License Application should be extended.

Community Comment 16: Since 2018, NorthWestern has had many public meetings, public comment periods, and meetings with local community groups and leaders. Please *see* Exhibit E Section 1.4 and Exhibit E Section 19 for a detailed review of the public review and consultation process used to develop the FLA.

The length of the comment period for the Draft License Application is set by the Code of Federal Regulations and is not within NorthWestern's authority to modify.

Beyond the regulatory consultations described above, during the 5-year pre-filing stage of the relicensing process, NorthWestern engaged with the entities listed in **Table 19-3**.

Table 19-3: Additional agency consultation meetings

Agency[36]	Meeting Subject	Date
FWP	Initial relicensing discussion FWP headquarters	11/25/2019
	Study plan proposals	1/15/2021, 1/29/2021, 2/19/2021, 2/26/2021
	Fish telemetry options (FWS, FWP, USFS)	2/25/2021
	Relicensing update	5/31/2022
	Relicensing updates	10/14/2022
	Settlement discussions	1/13/2023, 3/10/2023, 6/23/2023, 8/4/2023, 8/18/2023, 8/31/2023, 9/15/2023, 9/28/2023,10/11/2023,10/24/2023, 10/25/2023,11/7/2023, 11/20/2023, 12/14/2023, 12/15/2023, 1/11/2024
CSKT	Settlement discussions	8/4/2023, 8/18/2023, 8/31/2023, 9/15/2023, 9/28/2023,10/11/2023,10/24/2023, 10/25/2023,11/7/2023, 11/20/2023, 12/14/2023, 12/15/2023, 1/11/2024
FWS	Virtual relicensing introduction	2/04/2019

[36] Joint agency (FWS, FWP, USFS, CSKT) settlement meetings were held on 8/4/2023, 8/18/2023, 8/31/2023, 9/15/2023, 9/28/2023,10/11/2023,10/24/2023, 10/25/2023,11/7/2023, 11/20/2023, 12/14/2023, 12/15/2023, 1/11/2024.

Agency[36]	Meeting Subject	Date
	Started relicensing monthly conference calls	Started 3/19/2019, ongoing
	Discuss Proposed Study Plans	2/19/2021
	Fish telemetry options (FWS, FWP, USFS)	2/25/2021
	Discuss study plans	5/13/2021
	Settlement discussions	7/21/2022, 02/13/2023, 06/22/2023, 8/4/2023, 8/18/2023, 8/27/2023, 8/31/2023, 9/15/2023, 9/28/2023,10/11/2023,10/24/2023, 10/25/2023, 10/31/2023, 11/7/2023, 11/20/2023, 12/14/2023, 12/15/2023, 1/11/2024
DEQ	Relicensing introduction meeting	8/17/2018
	Water Quality monitoring	1/8/2019
	Relicensing updates	3/11/2021
	Water quality updates	3/16/2022
	Settlement discussion	5/31/2023
	Discussion about the Major Facility Siting Act	11/6/2023
	Discussion of water quality monitoring plan	11/14/2023
	Received comments on the TDG Control Plan	May 6, 2024
Sanders County Commissioner and officials	Relicensing updates	4/28/2023
	Recreation Plan meeting	10/24/2023
	County Park Board meeting	11/07/2023
	Cherry Creek Boat Launch easement meeting	11/16/2023
	Call with County Attorney regarding draft easement for Cherry Creek Boat Launch	11/21/2023
	Cherry Creek Boat Launch easement meeting	2/1/2024

Agency[36]	Meeting Subject	Date
City of Thompson Falls	Relicensing updates	4/28/2023
	City Council meeting regarding easements for recreation sites	9/11/2023, 12/11/2023
	Recreation Plan meeting	10/24/2023
	Recreation site easements meeting with Mayor and City Attorney	11/21/2023, 11/28/2023
USFS	Relicensing introduction meeting at USFS office	7/16/2019
	Virtual meeting	12/04/2020
	Study Plan meeting	2/22/2021, 2/25/2021
	Settlement discussions	3/03/2023, 8/4/2023, 8/18/2023, 8/31/2023, 9/15/2023, 9/28/2023, 10/11/2023, 10/24/2023, 10/25/2023, 11/03/2023, 11/7/2023, 11/20/2023, 12/14/2023, 12/15/2023, 1/11/2024
	Recreation Plan meeting	10/24/2023
Shoreline property owners	Proposed dock modification program meeting related to proposed 2.5-foot fluctuation	10/24/2023
Avista	DLA comments discussion	11/30/2023
SHPO	Discuss the SHPO comments on the HPMP and additional comments SHPO had not previously provided.	August 31, 2023
	Revised HPMP sent out for comment	October 6, 2023.
	SHPO provided comments on the revised HPMP	November 3, 2023.
	NorthWestern responded to additional	December 1, 2023

Agency[36]	Meeting Subject	Date
	comments from SHPO and submitted request for concurrence with the APE	
	SHPO provided concurrence with the eligibility determinations for the previously recorded cultural sites	December 15, 2023
	SHPO provided concurrence with the APE boundaries as described in Appendix A of the HPMP	December 20, 2023
	SHPO concurred with revised APE, including the Cherry Creek Boat Launch Site	May 1, 2024

19.7.2 Consultation with DEQ

During the preparation of the FLA, NorthWestern consulted with DEQ on NorthWestern's proposed Water Quality Monitoring Plan. NorthWestern revised the Water Quality Monitoring Plan in response to DEQ's comments, and on November 29, 2023, DEQ notified NorthWestern that they are satisfied with the most up-to-date version of the Water Quality Monitoring Plan being incorporated into the license. The finalized Water Quality Monitoring Plan is included in Appendix C.

On November 6, 2023, NorthWestern met with staff from DEQ to discuss NorthWestern's compliance with the Major Facilities Siting Act, Montana Code Annotated Section 75-20-204 (2). DEQ provided NorthWestern direction to send DEQ a cover letter and access to the FLA at the time the FLA is filed with FERC. NorthWestern is sending a cover letter with links to the FLA to DEQ, simultaneously with this filing.

On April 5, 2024, NorthWestern submitted a TDG Control Plan to DEQ for their review and comment. DEQ submitted comments on the TDG Control Plan on May 6, 2024 and NorthWestern revised the TDG Control Plan in response to DEQ's comments. The TDG Control Plan is attached as Appendix G.

19.7.3 National Historic Preservation Act Section 106 Consultation

NorthWestern prepared a draft HPMP that proposes a protocol for addressing impacts to National Register-listed or -eligible Historic Properties that result from Project operations. The draft HPMP was submitted to SHPO, Tribal entities, and select state and federal agencies on June 8, 2023, with a request for review and comment by July 10, 2023.

SHPO submitted written comments on the draft HPMP on July 6, 2023. NorthWestern met with SHPO on July 31, 2023, to discuss the comments. The revised draft HPMP addressed the written comments from the SHPO, as well as comments discussed during the meeting.

On June 9, 2023, the Montana Department of Natural Resources responded that they do not have any cultural resource concerns.

On July 27, 2023, the Kalispel Tribe replied that they planned to submit written comments. On December 6, 2023, the Kalispel Tribe submitted written comments on the Cultural Resources Inventory Report – FSR and revised HPMP. NorthWestern responded to those comments in the HPMP.

No other cultural resources consulting entities submitted comments on the draft HPMP. NorthWestern prepared a response to the comments received and revised the draft HPMP to respond to the comments. The revised draft HPMP with transmittal memo was distributed to an expanded list of cultural resources consulting entities and potential consulting entities on October 6, 2023. On November 3, 2023, the SHPO submitted written comments on the revised draft. No other cultural resources consulting entities submitted comments on the revised draft HPMP.

NorthWestern responded to the SHPO comments by revising the revised draft HPMP.

On December 1, 2023, NorthWestern submitted a request to the SHPO for its concurrence on the APE. On December 20, 2023, the SHPO concurred with the boundaries of the APE as presented in Appendix A of the HPMP.

On December 6, 2023, NorthWestern submitted a request to the SHPO for its concurrence on the eligibility determinations for the previously recorded cultural sites. On December 15, 2023, SHPO concurred with the previous determinations of eligibility.

In 2024, NorthWestern proposed to update the Project Boundary to include an additional recreation site, the Cherry Creek Boat Launch, on the south side of Thompson Falls Reservoir. The addition of this recreation site resulted in a slight change to the Project's APE.

On April 3, 2024, NorthWestern submitted a request for SHPO concurrence with the updated Project APE, which included updated maps to replace the maps of the Project APE in Appendix A of the HPMP.

On May 1, 2024, SHPO responded that they concur with the expansion of the APE to include the Cherry Creek Boat Launch Site.

19.7.4 Consultation with the Northwest Power and Conservation Council

NorthWestern submitted a request to the Council on April 8, 2024, requesting its review and comment on the Final License Application.

On April 25, 2024, the Council responded, confirming that the Project is not located in a protected area, and stating that, "From the Council's perspective, NorthWestern is working appropriately to address the development standards in the Council's fish and wildlife program." The Council asked, "that FERC itself, in its consideration of the license application, take an independent look at the information provided by NorthWestern and make sure that these protection standards are adequately addressed. And in doing so, we ask that FERC consider carefully the comments of especially the fish and wildlife agencies and tribes in the docket on these details."

19.8 Additional Tribal Consultation

When NorthWestern began relicensing efforts in 2018, NorthWestern contacted the Tribal Nations recommended by the SHPO of Montana and Idaho as potentially interested in the relicensing. The Tribal Nations recommended by the SHPO in Montana were the Chippewa-Cree of the Rocky Boy's Indian Reservation, Blackfeet, and the Confederated Salish and Kootenai. The Tribal Nations recommended by the Idaho SHPO were the Kootenai, Kalispel, and Coeur d'Alene Tribes. These Tribes were contacted by NorthWestern in April 2018 to make them aware of the relicensing, inquiring if they wanted to be added to the list of interested Tribal Nations for "Nation-to-Nation" consultation to be sent to FERC, and inviting them to share information important to protecting Tribal resources.

The CSKT have been actively engaged in fish passage planning and implementation at the Project for approximately 20 years. The CSKT is a signatory of the MOU for the fish passage Project and is a voting member of the TAC. The CSKT have been active participants in ongoing discussions with NorthWestern and federal and state resource agencies related to potential PM&E measures under the new license.

On July 17, 2020, FERC sent a letter to the above listed Tribes and invited them to participate in the Project relicensing and offered to meet with them individually. On August 12, 2020, the CSKT replied that they were interested in meeting with FERC to discuss the Tribes interest in the relicensing.

NorthWestern has included the Tribes on the mailing list for all the meeting announcements and comments periods described in **Exhibit E - Sections 19.1 through 19.7**. As mentioned above, the CSKT has been a regular participant in the relicensing proceedings, attending meetings and commenting on study plans and reports.

In addition, the Tribes were also invited to comment on the draft Interim Cultural Resources Report and Predictive Model. The CSKT submitted comments on the Interim Cultural Resources Report, which were adopted in the finalization of that report. In the CSKT comments, they noted that they had information from oral histories and the CSKT Site Registry database that would help to inform the relicensing proceeding. On December 21, 2021, NorthWestern responded to CSKT requesting that they share relevant information.

On June 9, 2023, NorthWestern distributed the Draft HPMP to the cultural resources consulting entities with a request for their review and comment. The cultural resources consulting entities included the SHPO, the Lolo National Forest, the Montana Department of Natural Resources and Conservation, the Bureau of Indian Affairs, the Kalispel- Tribe of Indians, the Blackfeet Nation, the Coeur d'Alene Tribe of Idaho, Chippewa-Cree Tribe of Rocky Boy's Indian Reservation, the Confederated Salish and Kootenai Tribes, and the Kootenai Tribe of Idaho. The SHPO submitted comments on the Draft HPMP.

The Draft HPMP was revised in response to the comments from the SHPO and sent to the cultural resources consulting parties on October 6, 2023, for a second comment period. The Tribal consulting parties were contacted by telephone as well as email.

In a telephone call on October 5, 2023, the Kalispel Tribe requested additional information, which was provided by NorthWestern on October 6, 2023. On July 27, 2023, the Kalispel Tribe replied that they planned to submit written comments. On December 6, 2023, the Kalispel Tribe submitted written comments on the Cultural Resources Inventory Report – FSR and revised HPMP. NorthWestern responded to those comments in the HPMP.

No other comments from Tribes were received during the comment period. The SHPO submitted comments on the Revised Draft HPMP which were addressed in the HPMP, being submitted with this FLA.

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Appendix A – Water Quality Monitoring Report 2019-2021

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Thompson Falls Project No. 1869
Water Quality Monitoring Report

2019-2021

Final Version – July 2022

NorthWestern Energy

Delivering a Bright Future

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Abbreviations and Acronyms

<	less than
BED	Baseline Environmental Document
DO	dissolved oxygen
EPT species	*Ephemeroptera*, *Plecoptera*, and *Tricoptera*
FERC	Federal Energy Regulatory Commission
mg/L	milligrams per liter
Montana DEQ	Montana Department of Environmental Quality
Montana FWP	Montana Fish Wildlife and Parks
ng/kg	nanograms per kilogram
NO_3+NO_2	Nitrate+Nitrite
NorthWestern Energy	NorthWestern Corporation, a Delaware corporation, d/b/a NorthWestern Energy
NTU	nephelometric turbidity unit
PCB	Polychlorinated Biphenyl
Project	Thompson Falls Hydroelectric Project
QA/QC	quality assurance and quality control
SKQ	Seli'š Ksanka Qlispe'
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	total equivalence
Thompson Falls Project	Thompson Falls Hydroelectric Project
TN	Total Nitrogen
TP	Total Phosphorus
U.S.	United States
USGS	U.S. Geological Survey

Section 1.0 – 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) 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. The current FERC License is scheduled to expire December 31, 2025.

In preparation for renewal of the FERC License for the Project, NorthWestern developed a plan to collect baseline water quality data on the Project (NorthWestern, 2019, 2020, 2021). This resulting data will serve as a water quality baseline for the new FERC license period and enable NorthWestern to track water quality trends over time. 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 Seli'š Ksanka Qlispe' (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 regard to its hydrograph. The Clark Fork River downstream of Thompson Falls Dam runs for approximately 3.2 miles (5.1 km) 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, cultural and public recreation resources (NorthWestern, 2018). Water quality data gaps were identified in the BED, and subsequent water quality data collected in 2019, 2020, and 2021 to fill data gaps and provide an overall picture of existing water quality conditions.

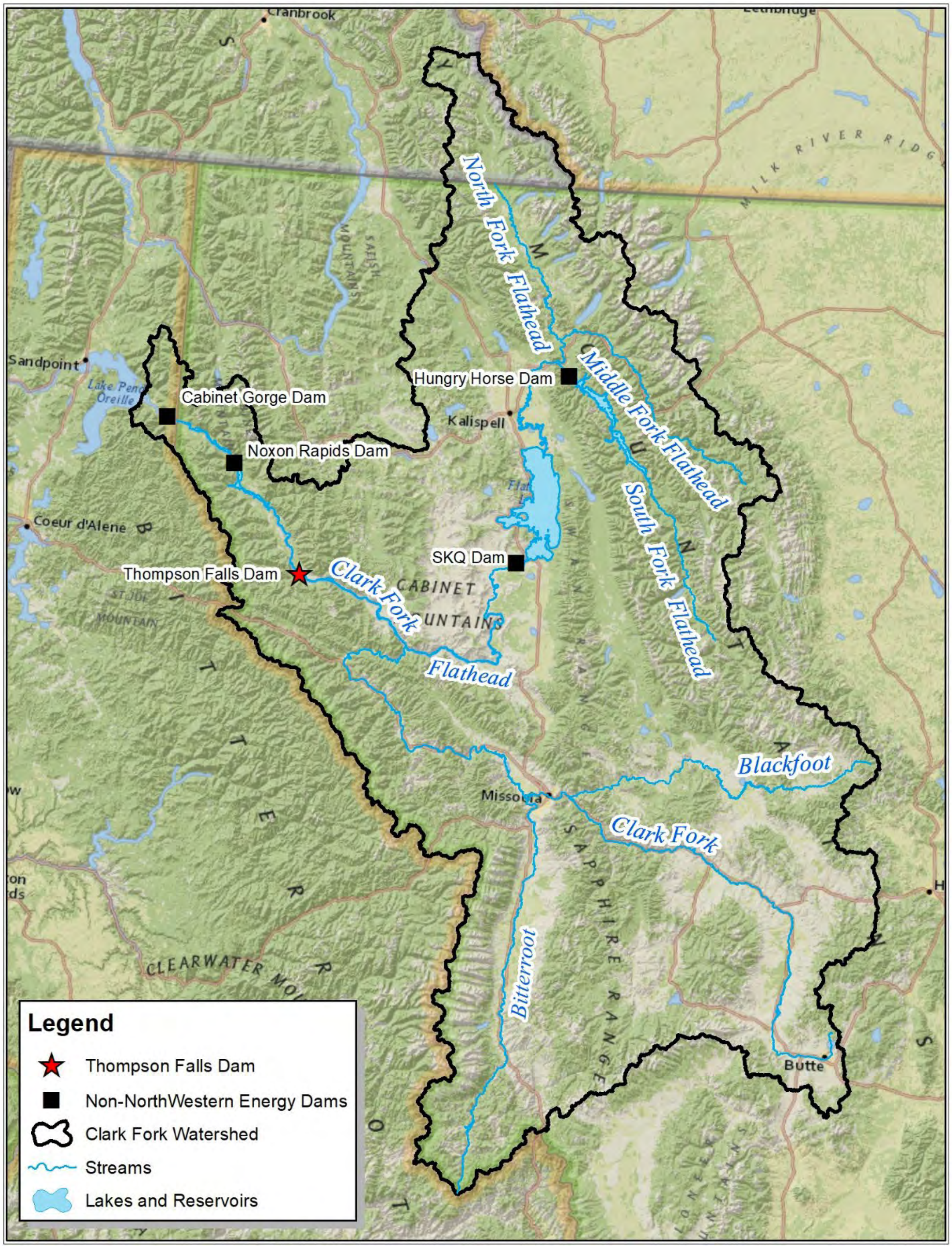

Figure 1-1. Map showing the location of Thompson Falls Dam in the Clark Fork River watershed.

Thompson Falls Reservoir is approximately 12 miles (19.3 km) long with a maximum width of about 1,800 feet. The shoreline length of the reservoir is approximately 25 miles (40.2 km). Active storage capacity of Thompson Falls Reservoir is approximately 15,000 acre-feet between crest El. 2,380 feet and normal full pool El. 2,396 feet, 1 foot below the Project boundary El. of 2397 feet. At the normal full pool reservoir El. 2,396 feet, the reservoir surface area is approximately 1,446 acres. Thompson Falls Reservoir has a maximum depth in excess of 45 feet (Montana Power Company, 1982). At full powerhouse flow (23,000 cfs) the available storage (15,000 acre-feet) can be discharged in about 8 hours.

The monthly fluctuation of average residence time (flushing rate) for Thompson Falls Reservoir is displayed in **Figure 1-2**. The results indicate that water residence time in Thompson Falls Reservoir is very short, particularly in the spring when residence time is, on average, less than 4 hours. The residence time ranges from less than 4 hours (June) to approximately 17 hours (September). It is not uncommon for residence times in lakes to range from months to years.

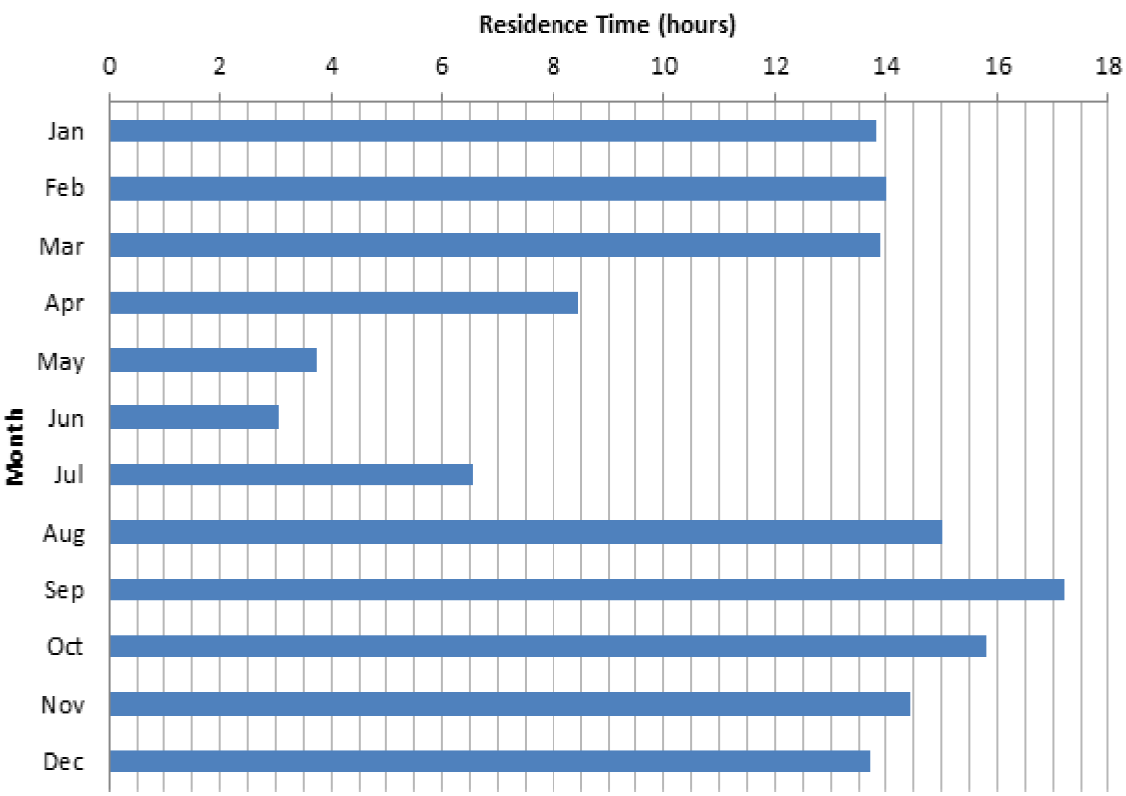

Figure 1-2. Estimated average monthly residence time in Thompson Falls Reservoir.

Flows in the Clark Fork River are gaged near Plains, MT, which is approximately 30 miles (48 km) upstream of the Thompson Falls Project. There is only one tributary with significant flow between the Plains gage station and the Project, the Thompson River. The Thompson River joins the Clark Fork River approximately 6 miles (9.7 km) upstream of the dams and contributes on average 2.0 percent of the flow in the Clark Fork River with a range of 0.7 percent up to 5.4 percent. The U.S. Geological Survey (USGS) also maintains a gage on the Thompson River. Therefore, the most accurate available flow statistics were derived by combining USGS gages on Clark Fork River at Plains, Montana (USGS gage 12389000) with the Thompson River near Thompson Falls (USGS gage 12389500), to calculate streamflow in Clark Fork River at the Project (**Figure 1-3**).

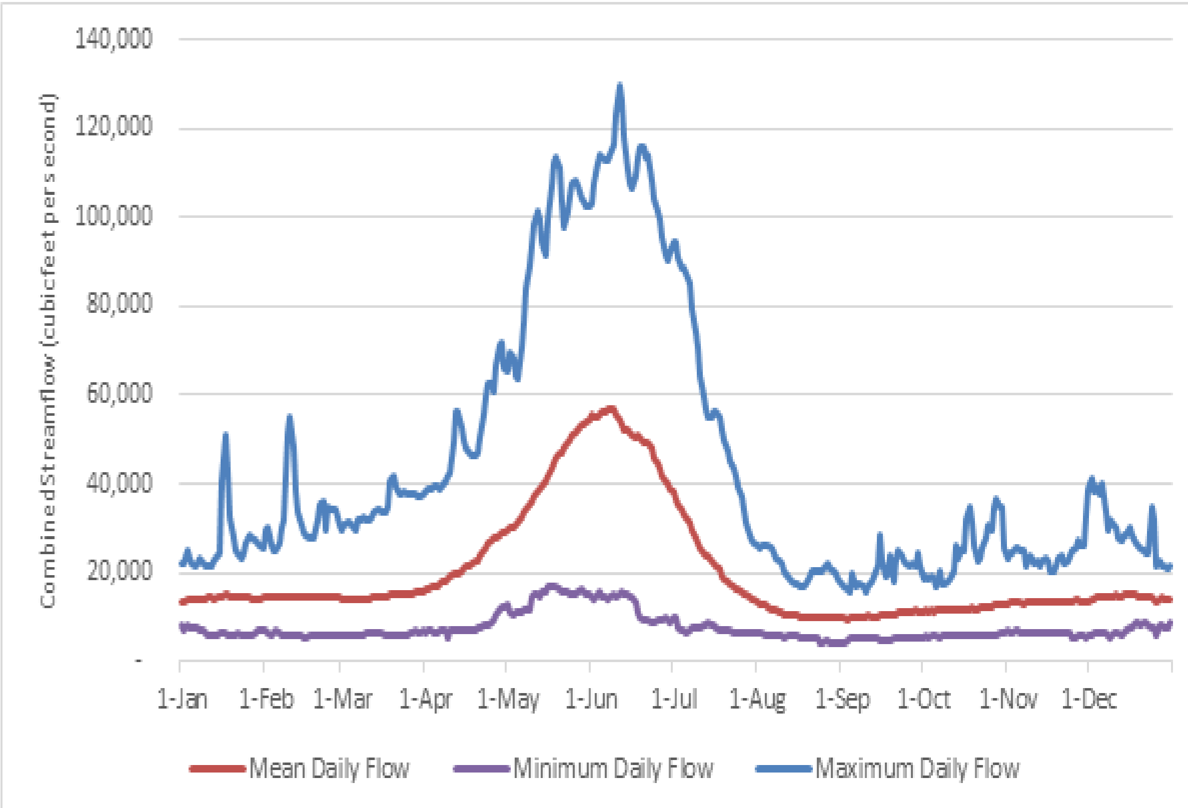

Figure 1-3. Daily minimum, maximum, and mean streamflow at Thompson Falls Project from April 1, 1956 to present.

Mean daily streamflow data were recorded at the USGS gage on the Clark Fork River at Plains from October 1, 1910 to present. The Thompson River near Thompson Falls flow data were recorded from March 1 to September 29, 1911 and from April 1, 1956 to present. To ensure that the hydrograph is representative of current conditions, **Figure 1-3** represents the minimum, maximum, and mean daily flows from April 1, 1956 to present. This period of record allows complete datasets for both USGS gages (Clark Fork River at Plains and Thompson River near Thompson Falls) to be analyzed and, also, provides representative data of upstream flows since the construction of upstream dams on the Flathead River. The ascending limb of the hydrograph begins between mid- and late March, peaks between late May and mid-June, and descends to base flow levels around mid-August (**Figure 1-3**).

Section 2.0 – Water Quality Monitoring

Water quality monitoring was conducted at the Thompson Falls Project in 2019, 2020, and 2021. Data collected provide a characterization of existing water quality conditions at the Project, and include water chemistry and field parameters, sediment chemistry, and biological data. **Figure 2-1** is a map showing the location of the water quality monitoring sites and **Table 2-1** provides a description of each monitoring site.

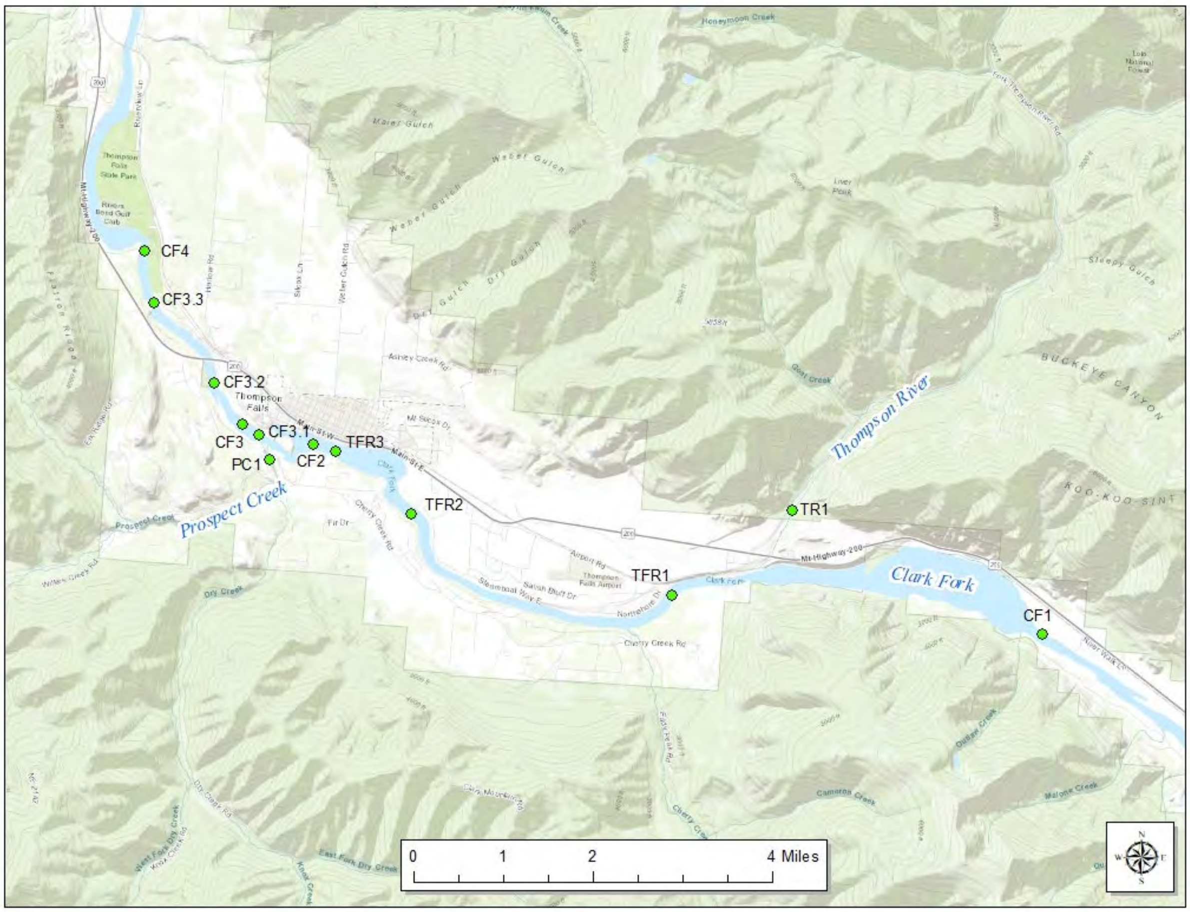

Figure 2-1. Map showing the location of the 2019-2021 Thompson Falls water quality monitoring sites.

Each monitoring site was chosen to provide spatial representation throughout the Project, bracket powerhouse infrastructure, and provide information on significant tributaries. Data collected at the monitoring sites listed in **Table 2-1** and shown in **Figure 2-1** differed from site to site depending on the purpose a particular site was selected.

Table 2-1. Descriptions and locations of biological and water quality monitoring sites.

Site Name	Site Description	Latitude	Longitude
CF1	Clark Fork River upstream of Thompson Falls Reservoir	47.569187	-115.167518
CF1*	*Biological sampling location for CF1	47.569904	-115.175776
CF2	Clark Fork River upstream of dam in Thompson Falls Reservoir	47.593502	-115.353699
CF3	Clark Fork River downstream of old powerhouse	47.594303	-115.362777
CF3*	*Biological sampling location for CF3	47.594984	-115.365869
CF3.1	Clark Fork River downstream of new powerhouse	47.592967	-115.358745
CF3.2	Clark Fork River near HWY 200 Bridge	47.601154	-115.372673
CF3.3	Clark Fork River near Thompson Falls State Park	47.612526	-115.388294
CF4	Clark Fork River at Birdland Bay Bridge	47.621436	-115.391592
TR1	Thompson River near mouth	47.587434	-115.232969
PC1	Prospect Creek near mouth	47.590124	-115.358559
TFR1	Thompson Falls Reservoir, upper	47.572973	-115.259564
TFR2	Thompson Falls Reservoir, mid-reservoir	47.578977	-115.320398
TFR3	Thompson Falls Reservoir, lower	47.591410	-115.344833

Note:
*Biological sampling sites were not in the same, exact location as the correlating water quality monitoring sites.

Section 2.1 – Water Chemistry and Field Parameters

Water chemistry was sampled at multiple monitoring sites around the Project to characterize the incoming water quality from the Clark Fork River and the outgoing water quality downstream of the Project. Parameter groups analyzed included nutrients, metals, inorganics, and physical properties. Field parameters collected in-situ were also measured.

Section 2.1.1 – Monitoring Sites and Methods

Water chemistry was monitored at nine sites in and around the Project from 2019 through 2021 (**Table 2-2**). These nine sites included four recurring monitoring sites on the Clark Fork River, three additional sites downstream of Project infrastructure for source assessment purposes, and two tributary sites. The tributary monitoring sites were located on the Thompson River, which enters Thompson Falls Reservoir near the upstream end of the Project, and Prospect Creek, which enters the Clark Fork River downstream of Project infrastructure.

The water quality sampling consisted of the collection of either single point depth integrated samples, or depth integrated equal width increment composites at each monitoring location. Grab samples were collected from the bank in a well-mixed portion of the river, or from a bridge at equal width increments and composited in a Teflon churn splitter. The sampling methodology described above conforms to current standard operating procedures used by the Montana Department of Environmental Quality (Montana DEQ) (Makarowski, 2019). A list of analytes monitored are shown in **Table A-1** in **Appendix A**.

Chlorophyll-*a* samples were collected in 2019 using the whole-rock method. Six replicate transects were conducted at each chlorophyll-*a* monitoring site, with each transect containing five to six rocks per sample. The rocks were then placed in a cooler on ice and transported to the laboratory for chlorophyll-*a* analysis of the sample.

Field parameters were collected at each sampling site using a laboratory calibrated Hydrolab HL7 sonde. A list of field parameters monitored in this study can be found in **Table A-2** in **Appendix A**. Continuous water temperature monitoring also occurred at various locations across the Project in 2019 and 2021.

Table 2-2. Description of purpose, methods, and parameters measured at water chemistry monitoring sites.

Site Name	Site Purpose	Sampling Method	Analyte Groups
CF1	Incoming water quality to the Project	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature, Chlorophyll-*a*
CF2	Water quality leaving the reservoir, upstream of the powerhouses	Equal width increment composite sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
CF3	Water quality downstream of the old powerhouse	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature, Chlorophyll-*a*
CF3.1	Water quality downstream of the new powerhouse (Metals source assessment)	Single point grab sample	Metals
CF3.2	Water quality near the HWY 200 bridge (Metals source assessment)	Single point grab sample	Metals
CF3.3	Water quality near Thompson Falls State Park (Metals source assessment)	Single point grab sample	Metals
CF4	Water quality leaving the Project	Equal width increment composite sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field

Site Name	Site Purpose	Sampling Method	Analyte Groups
			Parameters, Temperature
TR1	Water quality of the Thompson River	Single point grab sample, Hydrolab HL7 Sonde, Onset Thermograph	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters, Temperature
PC1	Water quality of Prospect Creek	Single point grab sample, Hydrolab HL7 Sonde	Nutrients, Metals, Physical Properties, Inorganics, Field Parameters

Data quality assurance and quality control (QA/QC) were accomplished 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 (also known as RPDs) 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 were also employed for any statistical analyses. These measures included:

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.

Section 2.1.2 - Water Chemistry and Field Parameter Results

Section 2.1.2.1 - Nutrients

Nutrients within the Thompson Falls Project are generally low in concentration, which is reflected in both the water chemistry data as well as the biological data. Water chemistry samples were collected throughout the year, so nutrient concentrations may reflect conditions outside of the summertime window of July 1 through September 1 when most of the biological growth is occurring in the waterbody. Outside of this summertime window, nutrient concentrations in the water column are typically higher because they are not being consumed by biological growth as readily.

Total Nitrogen

Total nitrogen (TN) concentrations remained consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), but were lower at the two tributary monitoring sites (PC1 and TR1) (**Figure 2-2**). There are relatively few nitrogen inputs between the upstream end of the Project boundary (CF1) and the upstream end of Noxon Reservoir (CF4), which is reflected in the data.

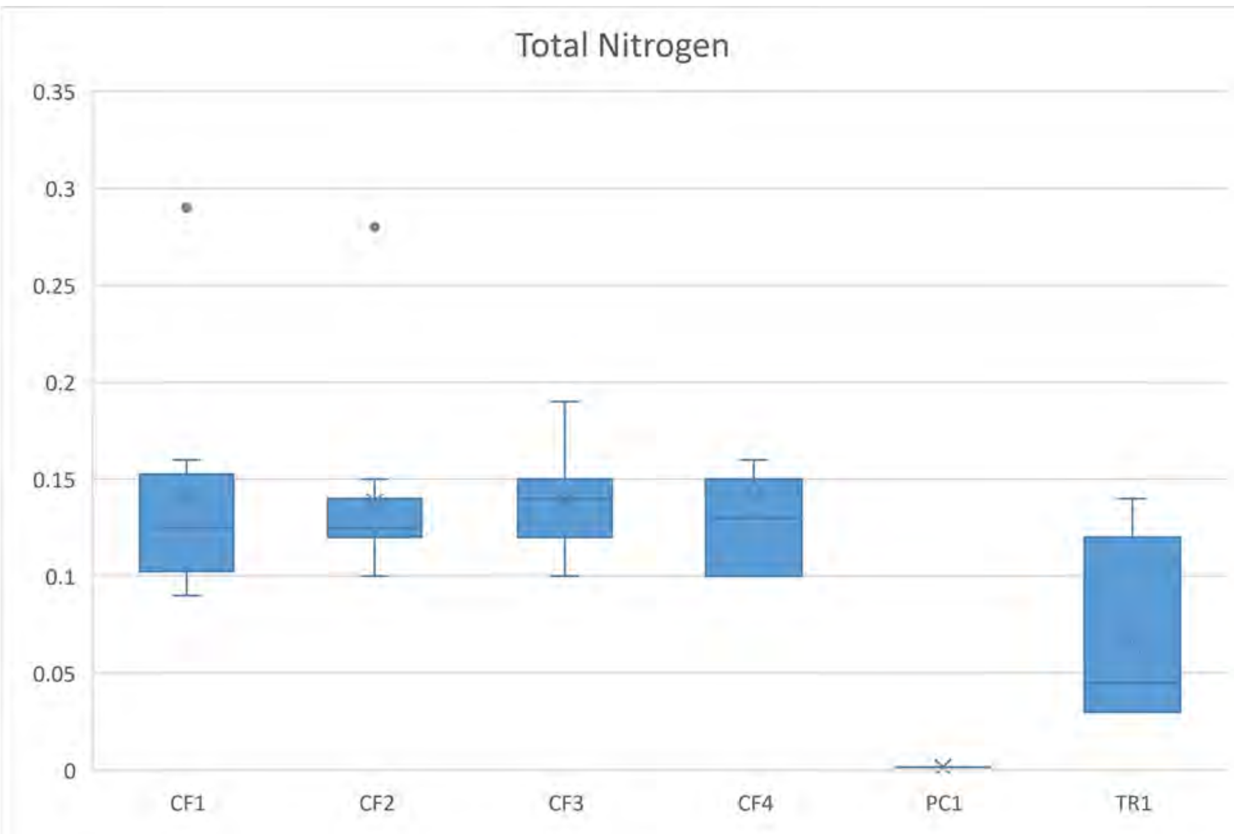

Figure 2-2. Total nitrogen concentrations across all water quality monitoring sites (**in mg/L**).

Nitrate+Nitrite

Nitrate+Nitrite (NO_3+NO_2) concentrations show a similar pattern to TN concentrations, with little to no change across the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4). As with TN, the tributary sites (PC1 and TR1) also showed lower concentrations of NO_3+NO_2. **Figure 2-3** below shows the NO_3+NO_2 concentrations across all monitoring sites.

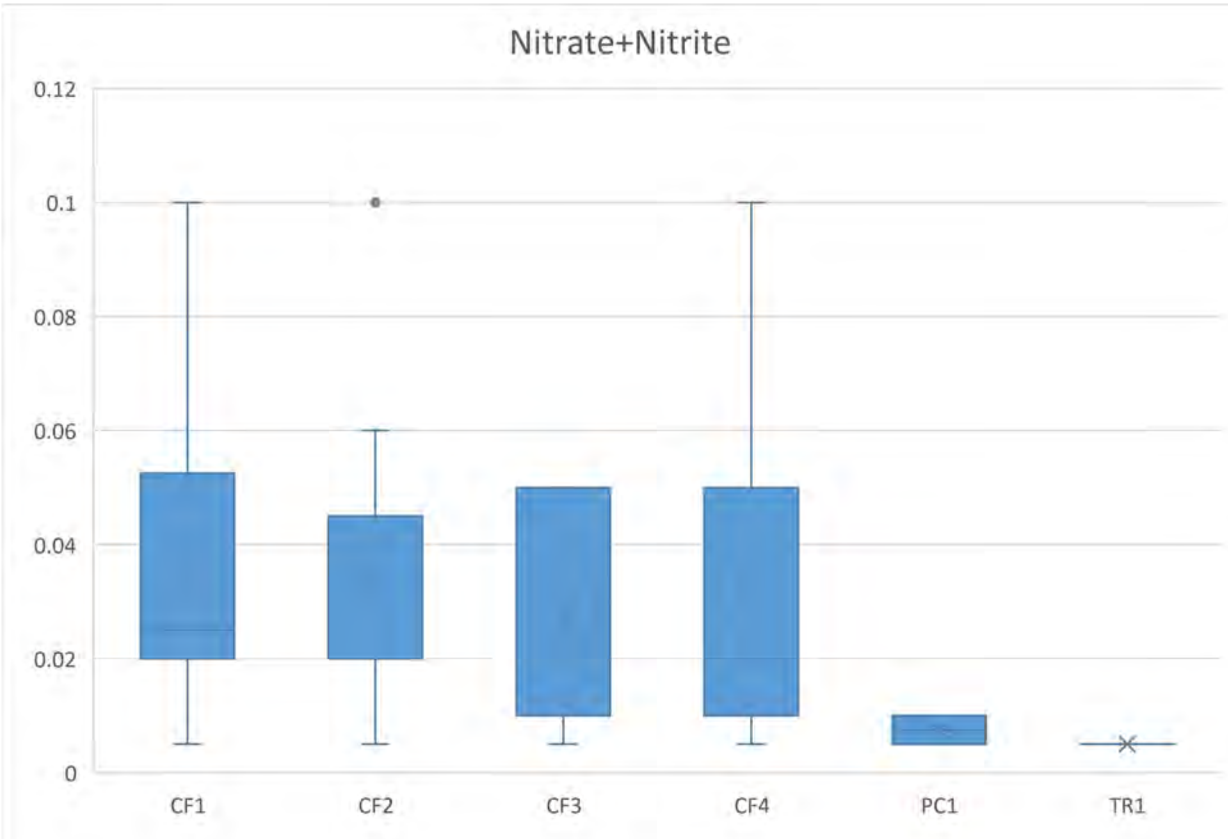

Figure 2-3. Nitrate+Nitrite concentrations across all water quality monitoring sites (in mg/L).

Total Phosphorus

Total phosphorus (TP) concentrations follow a similar pattern to TN and NO_3+NO_2 concentrations across the Project. The lowest TP concentrations on the Clark Fork sites (CF1, CF2, CF3, and CF4) were found at sites CF2 and CF3, which are located just upstream and downstream of the dams and powerhouses respectively (**Figure 2-4**). Phosphorus has a tendency to bind tightly to soil particles, many of which settle out in the reservoir and are consumed by biological growth in the reservoir, which would explain the slightly lower TP concentrations found at sites CF2 and CF3 as compared to site CF1, which is located at the upstream end of the reservoir. As with TN and NO_3+NO_2, the concentrations of TP were found to be lower at the tributary sites (PC1 and TR1) than at the Clark Fork sites.

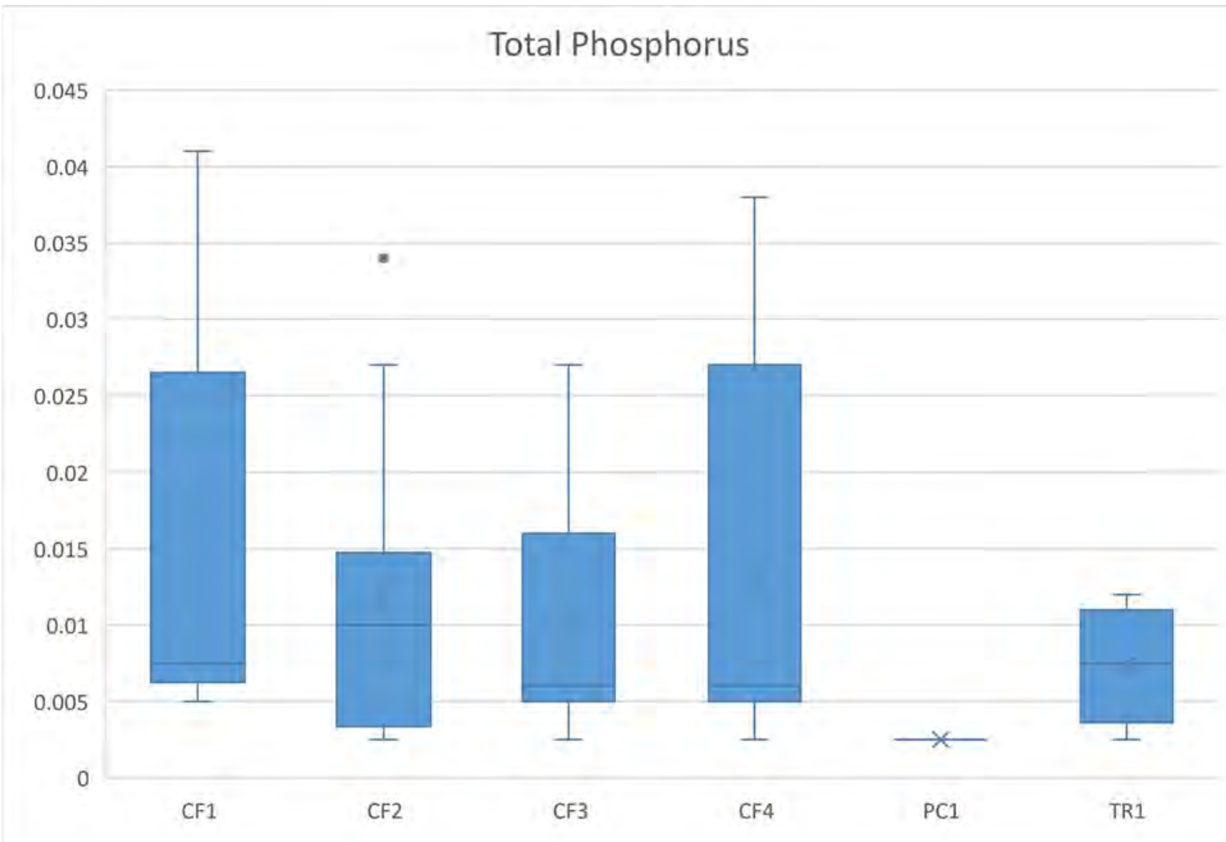

Figure 2-4. Total phosphorus concentrations across all water quality monitoring sites (**in mg/L**).

Chlorophyll-a

Chlorophyll-*a* samples were collected at two locations in 2019; site CF1 to represent conditions upstream of Thompson Falls Reservoir and site CF3 to represent conditions downstream of Thompson Falls Reservoir. Upstream chlorophyll-*a* concentrations were found to be higher at site CF1 versus the downstream chlorophyll-*a* concentrations at site CF3 (**Figure 2-5**). This likely indicates that some nutrient uptake and attenuation is occurring in Thompson Falls Reservoir, and therefore less nutrients are available downstream to be consumed by phytoplankton.

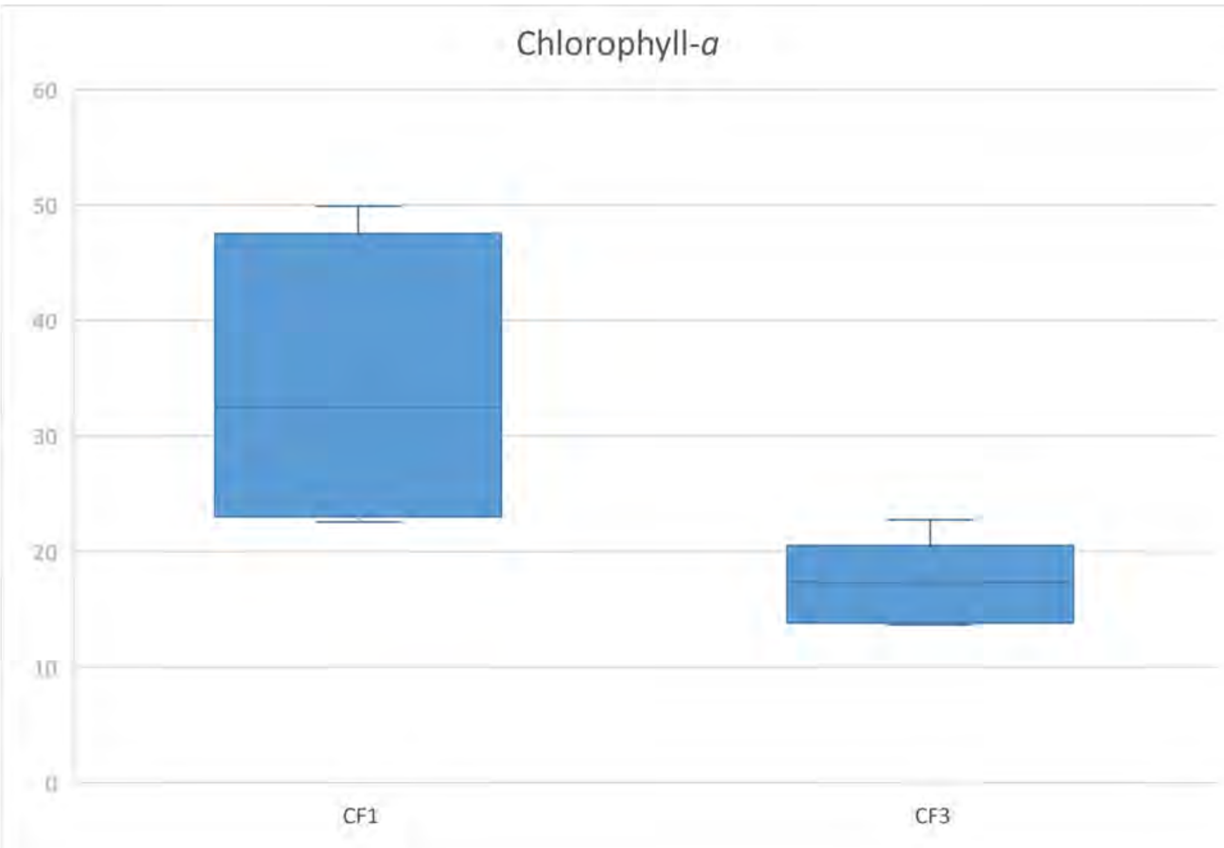

Figure 2-5. Chlorophyll-*a* concentrations upstream and downstream of Thompson Falls Reservoir (in mg/m^2).

Section 2.1.2.2 - Metals

Generally, aqueous metal concentrations within the Project are meeting water quality standards at all sites with the exception of three samples from Birdland Bay Bridge (site CF4) which showed lead levels exceeding the water quality standard for chronic aquatic life. Site CF4 is located downstream of the Project and is used to characterize the water quality as it enters Noxon Reservoir. These three samples were collected during both high and low flow periods, and the source of the lead is unknown because all other sites had low or non-detectable concentrations of lead. Additional source assessment sampling for lead was conducted in the fall of 2020 and detailed in this section below. All other metals analyzed were found to be at concentrations below water quality standards.

Arsenic

Arsenic concentrations at all sites were below water quality standards and remain fairly consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), with a greater variation in sample concentrations found at sites CF1 and CF4 (**Figure 2-6**). Tributary site (PC1 and TR1) arsenic concentrations were found to be at non-detectable levels.

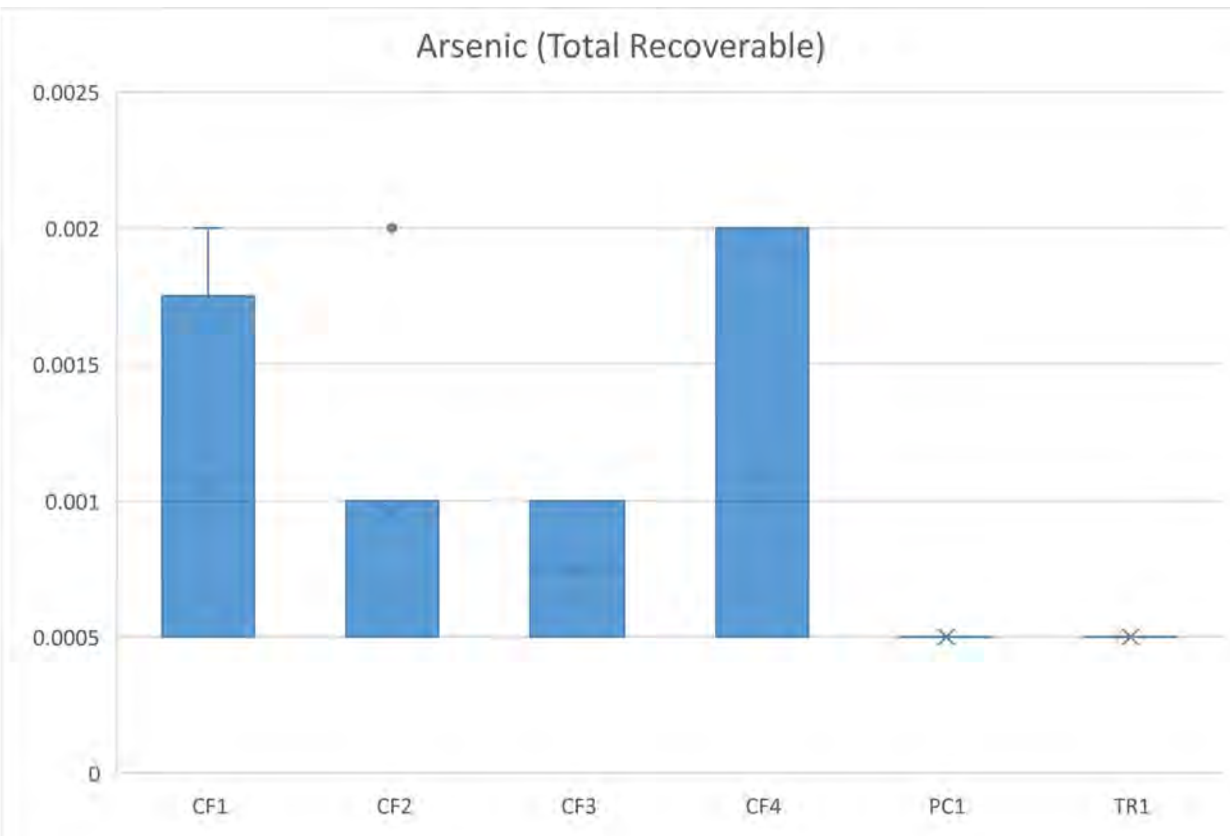

Figure 2-6. Arsenic concentrations across all water quality monitoring sites (in mg/L).

Cadmium

Cadmium concentrations at all Clark Fork sites (CF1, CF2, CF3, and CF4) were below water quality standards and remain fairly consistent throughout the Clark Fork monitoring sites. All of the Clark Fork samples, with the exception of two samples at site CF2, were found to be at non-detectable concentrations of cadmium (**Figure 2-7**). Cadmium toxicity is dependent on water hardness, and when the hardness of the Clark Fork River is factored in, the two cadmium detections at site CF2 were below water quality standards for aquatic life.

Cadmium concentrations in the Thompson River were non-detectable, but cadmium concentrations in Prospect Creek exceeded the water quality standard for chronic aquatic life when the water hardness of Prospect Creek is factored in. Prospect Creek has a history of mining in the watershed, so mining activity is a potential source of cadmium in Prospect Creek. Prospect Creek enters the Clark Fork River downstream of the Main Channel Dam, and therefore has no influence on the water quality of Thompson Falls Reservoir.

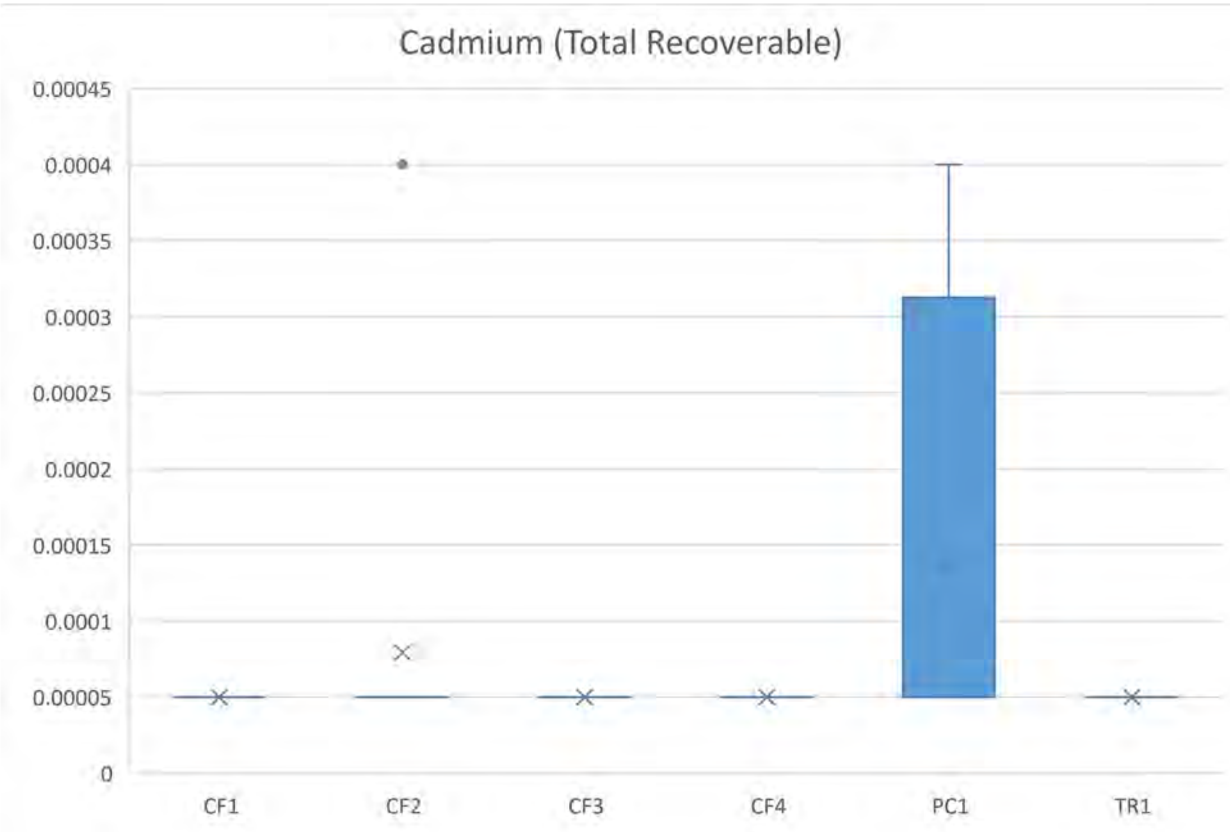

Figure 2-7. Cadmium concentrations across all water quality monitoring sites (in mg/L).

Copper

Copper concentrations remain fairly consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4), with the lowest concentrations found at site CF3, downstream of the old powerhouse (**Figure 2-8**). Copper toxicity is dependent on water hardness, and when the hardness is factored in, the copper concentrations at all sites were below water quality standards for aquatic life. Tributary site (PC1 and TR1) copper concentrations were found to be at non-detectable levels.

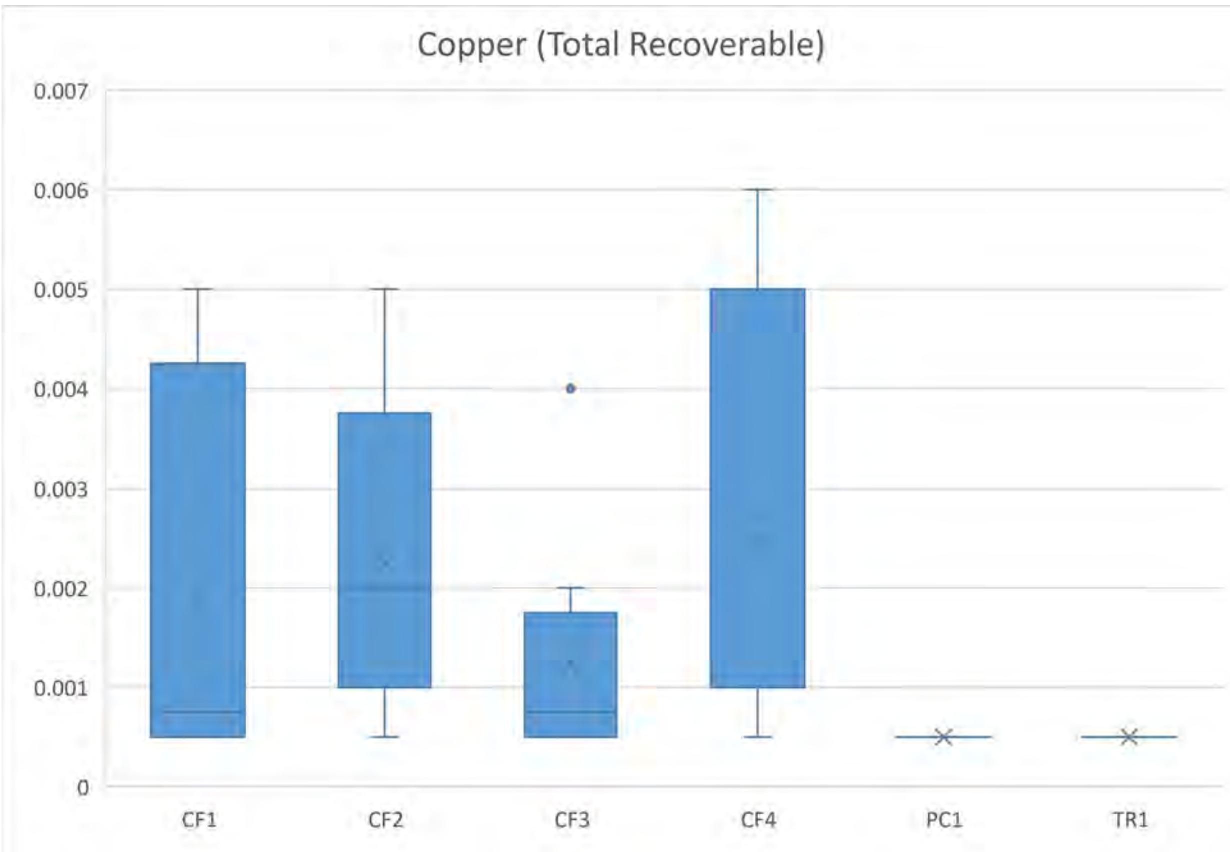

Figure 2-8. Copper concentrations across all water quality monitoring sites (in mg/L).

Iron

Iron concentrations at all sites were below water quality standards and remain fairly consistent throughout the Clark Fork monitoring sites (CF1, CF2, CF3, and CF4) (**Figure 2-9**). Tributary site (PC1 and TR1) iron concentrations were also found to be at low levels, with the Thompson River having slightly higher concentrations of iron than Prospect Creek.

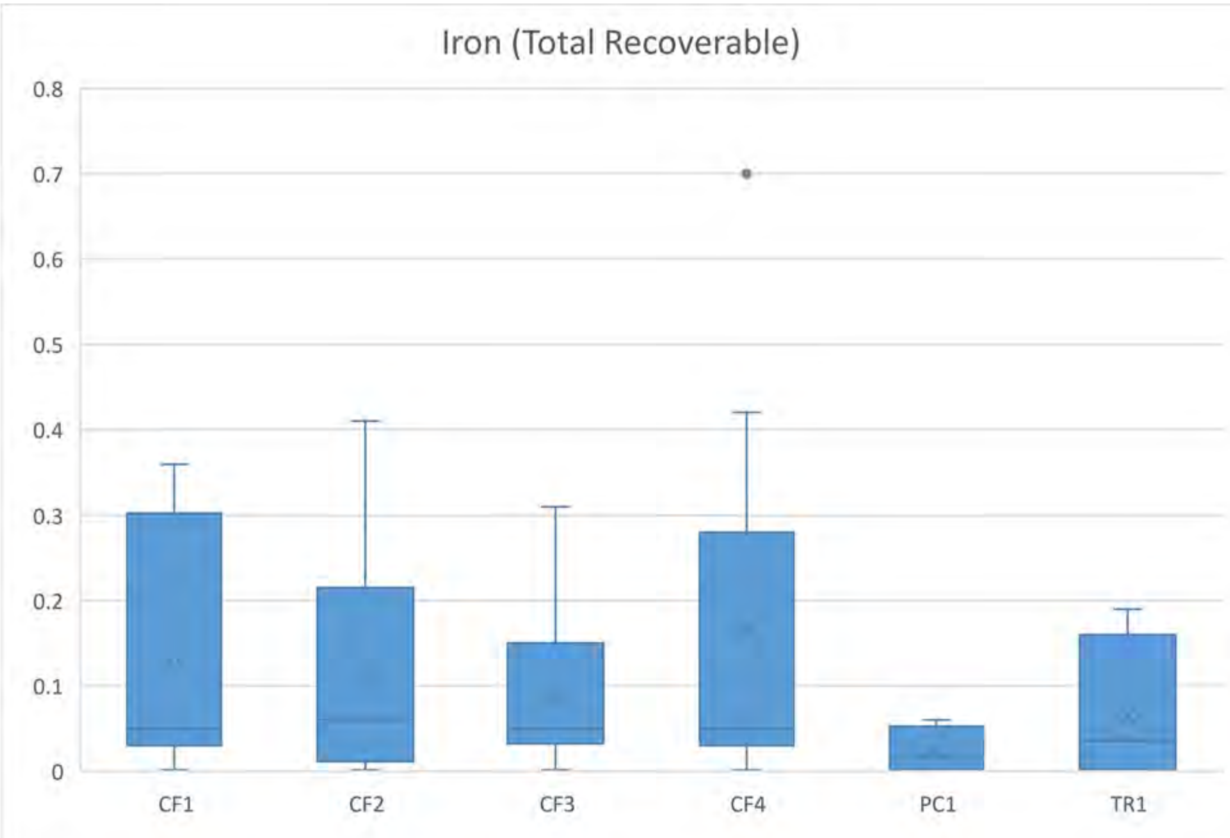

Figure 2-9. Iron concentrations across all water quality monitoring sites (in mg/L).

Lead

Lead concentrations were at low to non-detectable levels at all sites except site CF4 (**Figure 2-10**). Lead toxicity is dependent on water hardness, and when the hardness of the Clark Fork River is factored in, three lead samples at site CF4 were above water quality standards for chronic aquatic life. Site CF4 is downstream of the Project.

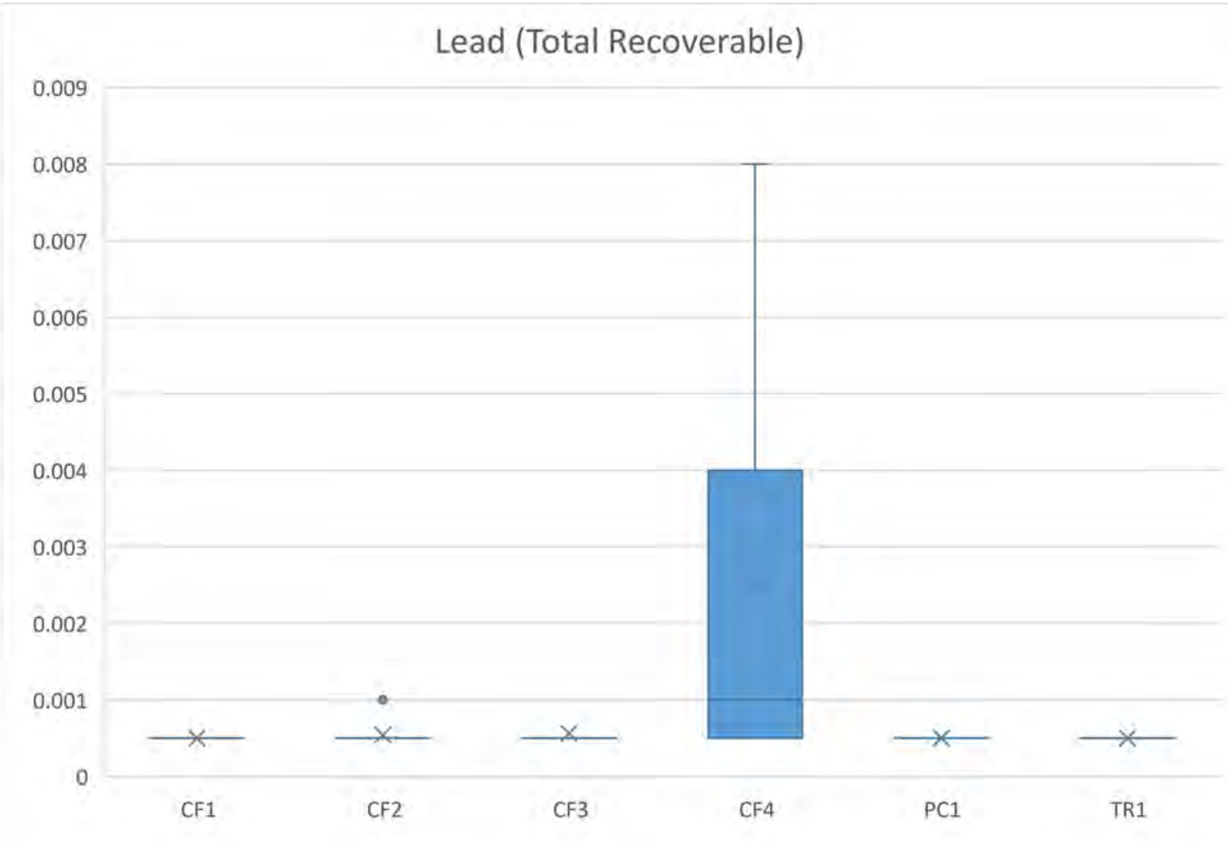

Figure 2-10. Lead concentrations across all water quality monitoring sites (in mg/L).

In response to the initial lead detection in 2019, additional monitoring sites were added at Prospect Creek (PC1) and downstream of the old powerhouse (CF3) for the 2020 monitoring season. With continued lead detections at site CF4 in 2020, and no clarity on potential lead sources, a synoptic monitoring event was conducted in October 2020 to provide information for a more detailed source assessment. This monitoring event included samples at site CF2 (above the dam), site PC1 (Prospect Creek), site CF3 (below the old powerhouse), site CF3.1 (below the new powerhouse), site C3.2 (near the Highway 200 bridge), site CF3.3 (near Thompson Falls State Park), and site CF4 (Birdland Bay Bridge). The results of this monitoring event showed that lead was found at non-detectable concentrations at all sites except site CF4 (**Figure 2-11**). The potential source of lead at site CF4 still remains unknown but has been isolated to the area between Birdland Bay Bridge and upstream 0.65 mile. This source area is located outside of the Project, and the source of lead at site CF4 is not related to the Project or Project operations.

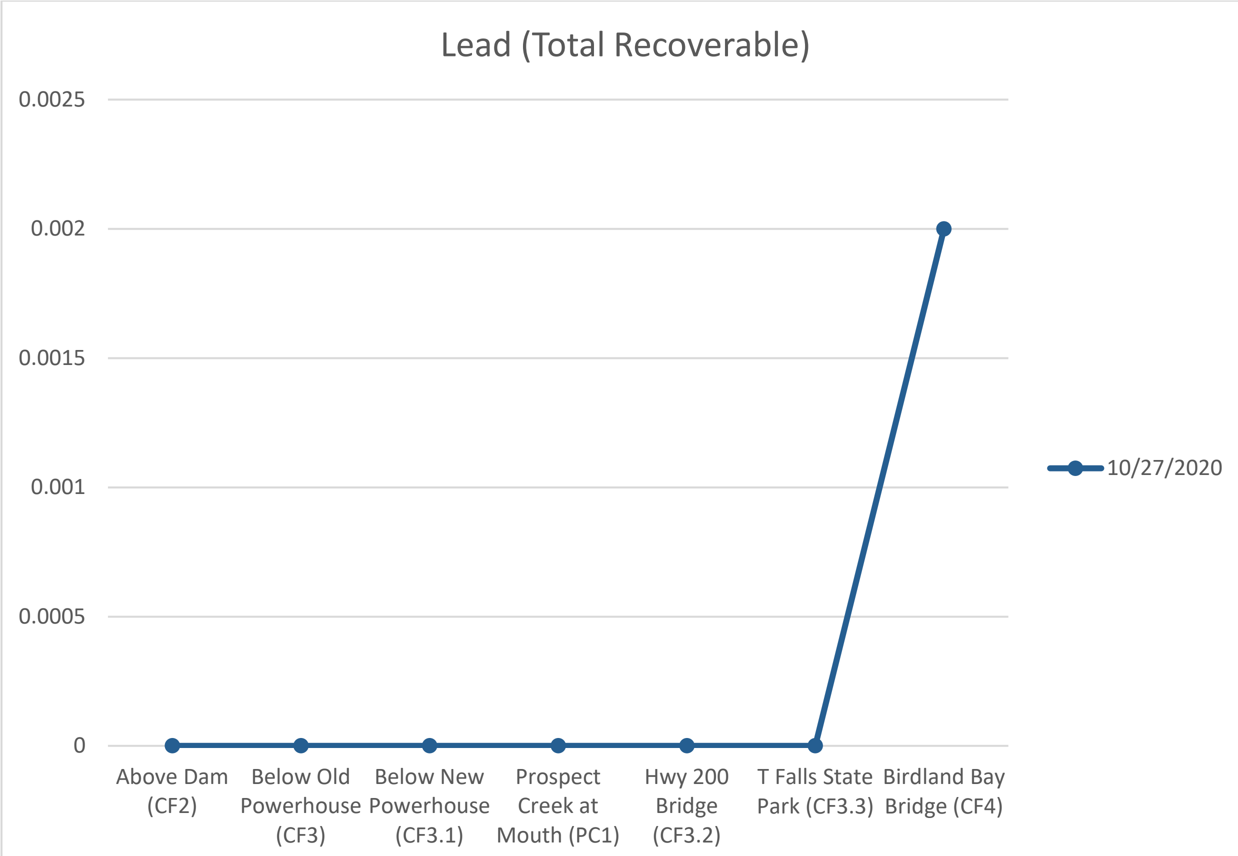

Figure 2-11. Lead concentrations from an upstream to downstream orientation for the synoptic monitoring event on October 27, 2020 (in mg/L).

Zinc

Zinc concentrations in the Project were at low to non-detectable levels at all monitoring sites (**Figure 2-12**). Zinc toxicity is dependent on water hardness, and when the hardness is factored in, all samples containing detectable concentrations of zinc were below water quality standards for aquatic life.

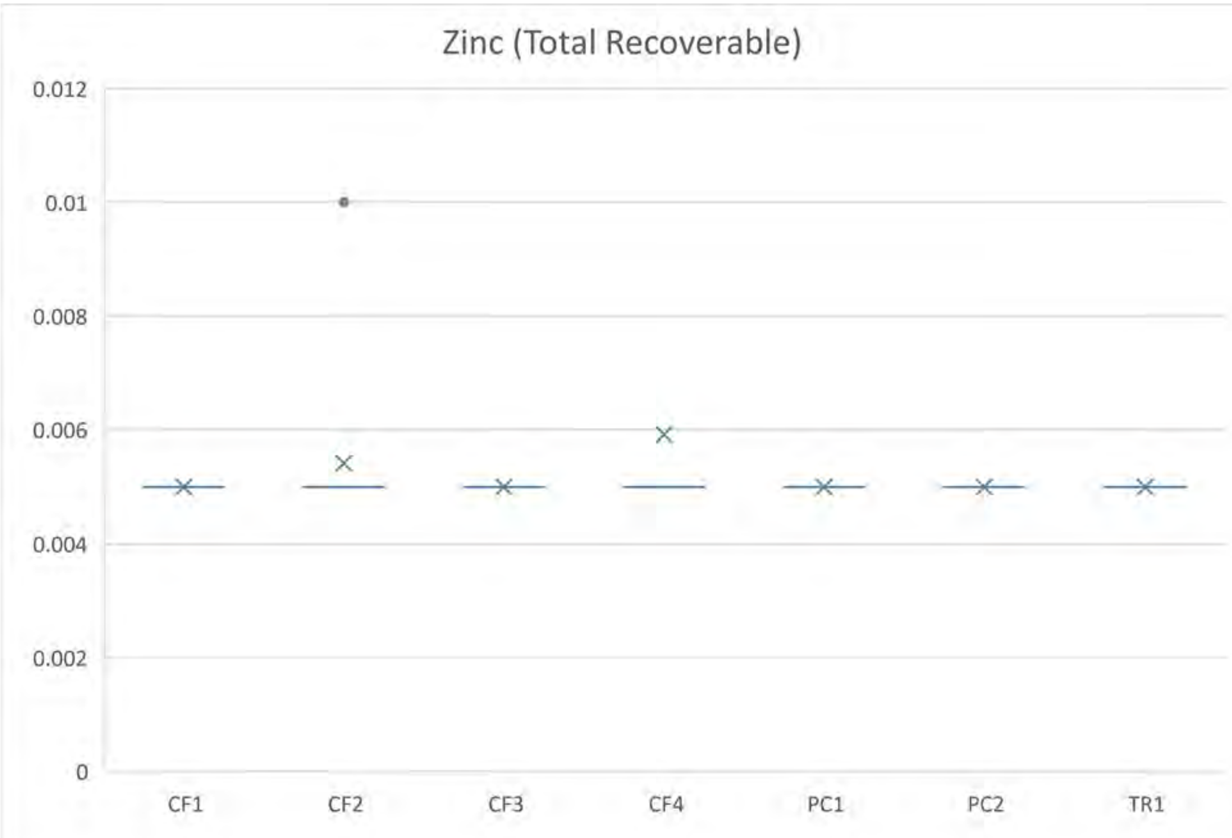

Figure 2-12. Zinc concentrations across all water quality monitoring sites (in mg/L).

Section 2.1.2.3 – Field Parameters

Field parameters were collected during each water chemistry monitoring event using a Hydrolab HL7 sonde as a part of the overall site characterization. Parameters measured included depth, water temperature, specific conductivity, pH, turbidity, and dissolved oxygen. The Hydrolab sonde was laboratory calibrated prior to each monitoring event to ensure instrument accuracy. Total dissolved gas (TDG) monitoring was also conducted in 2021 as a separate FERC approved study. The results of the 2021 TDG study can be found in the Initial Study Report, Total Dissolved Gas Study that was submitted to FERC in April 2022 (NorthWestern, 2022).

Specific Conductivity

Specific conductivity changed very little across the Clark Fork sites (CF1, CF2, CF3, and CF4) (**Figure 2-13**), but was significantly lower at the tributary sites (PC1 and TR1). Prospect Creek had the lowest conductivity values of all sites, and the conductivity of the Thompson River was slightly lower than the Clark Fork sites.

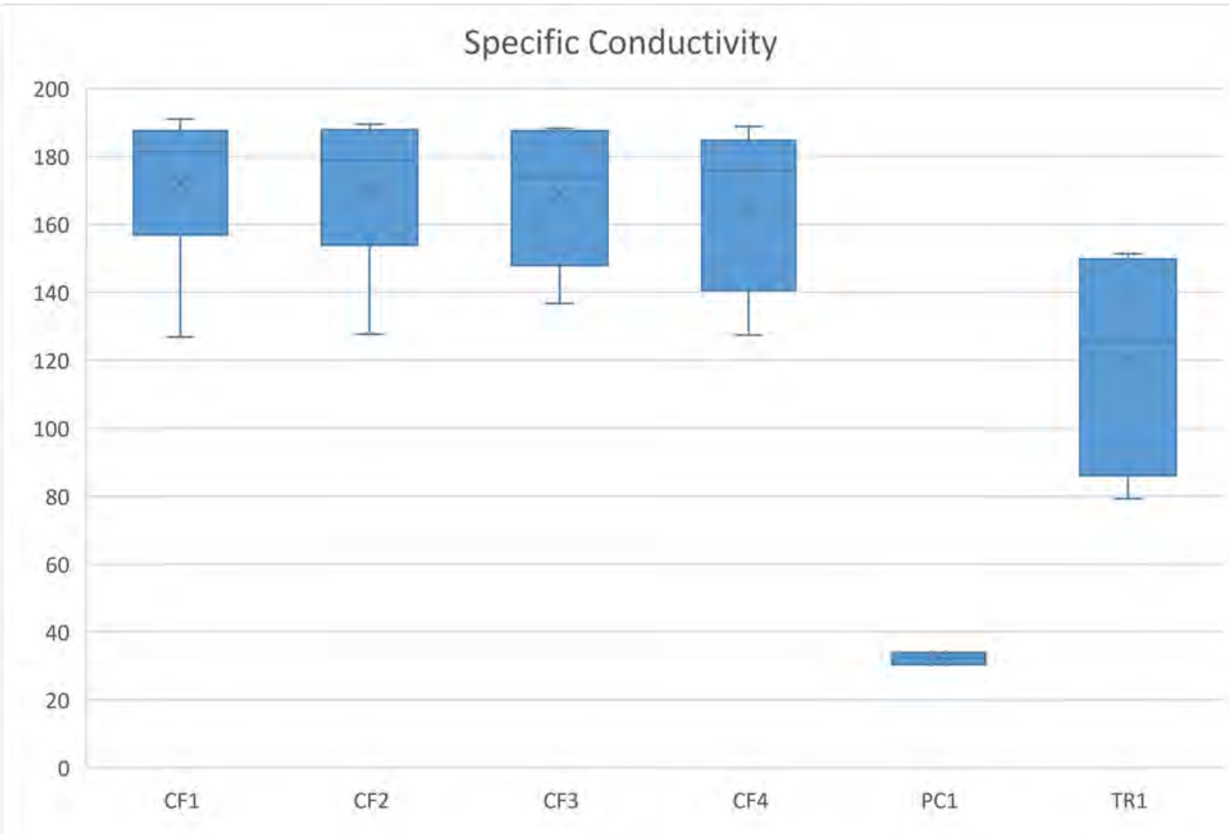

Figure 2-13. Specific conductivity across all water quality monitoring sites (**in μS/cm**).

pH

The measurement of pH at the Clark Fork sites (CF1, CF2, CF3, and CF4) showed relatively little change in pH from site to site, but the pH of Prospect Creek was significantly lower than the Clark Fork sites, and the pH of the Thompson River was more similar to the pH of the Clark Fork sites (**Figure 2-14**). The pH of Prospect Creek is closer to a neutral pH of 7, whereas all other sites have a high pH generally falling in the 8-8.5 range.

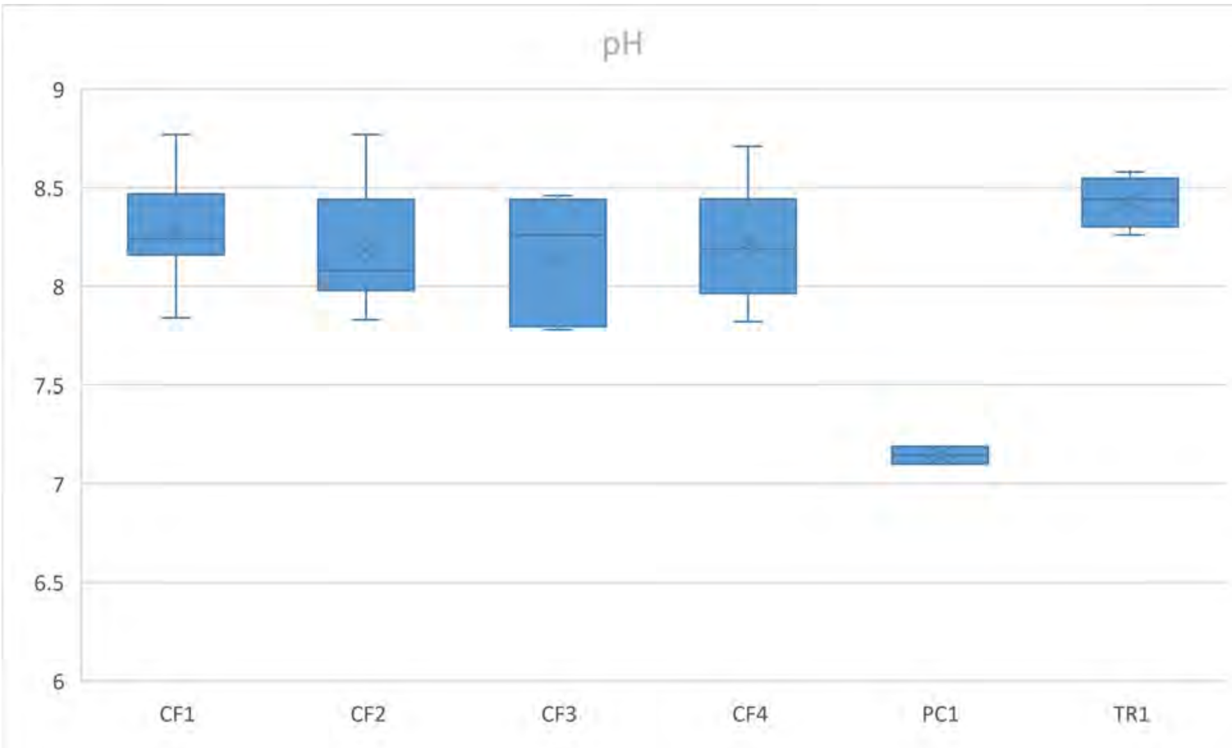

Figure 2-14. pH measurement across all water quality monitoring sites (in units).

Turbidity

Turbidity, or the measure of relative clarity in water, remained fairly consistent throughout the Clark Fork sites (CF1, CF2, CF3, and CF4) with elevated turbidity (~20 nephelometric turbidity unit [NTU]) occurring during the spring runoff period, and low to no turbidity (<1 NTU) occurring throughout the rest of the year (**Figure 2-15**). Turbidity measurements in Prospect Creek and the Thompson River remained low (<5 NTU) throughout the entire monitoring period.

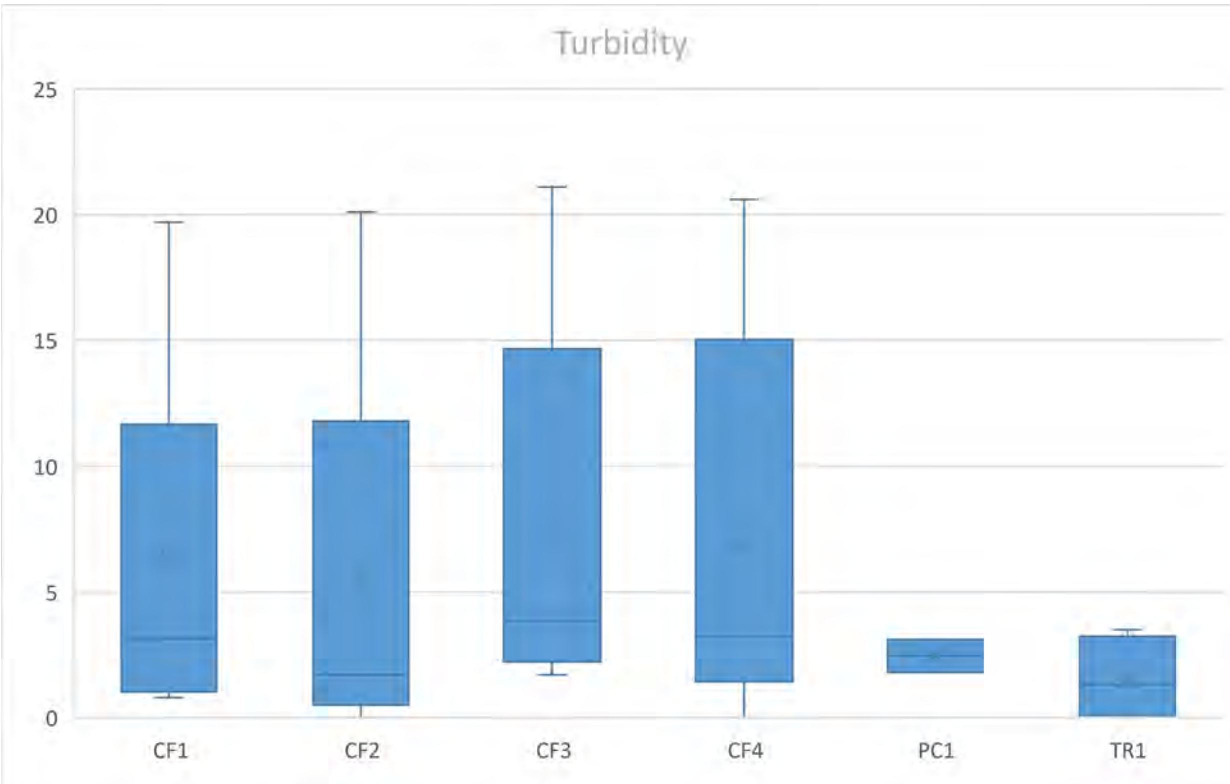

Figure 2-15. Turbidity measurement across all water quality monitoring sites (**in NTU**).

Dissolved Oxygen

Dissolved oxygen (DO) is measurement of the amount of oxygen that is present in water and can be represented as a concentration (in milligrams per liter [mg/L]) or as a saturation percentage. Concentrations of DO showed little change across the Clark Fork sites (CF1, CF2, CF3, and CF4), while DO concentrations in the Thompson River were slightly higher than the other sites, and Prospect Creek DO concentrations were similar to those of the Clark Fork sites (**Figure 2-16**). DO percent saturation values showed a similar pattern to the measured DO concentrations except the range of DO percent saturation at site CF4 was much greater than the other sites (**Figure 2-17**). This is likely due to the influence of spillway water during periods of high flow.

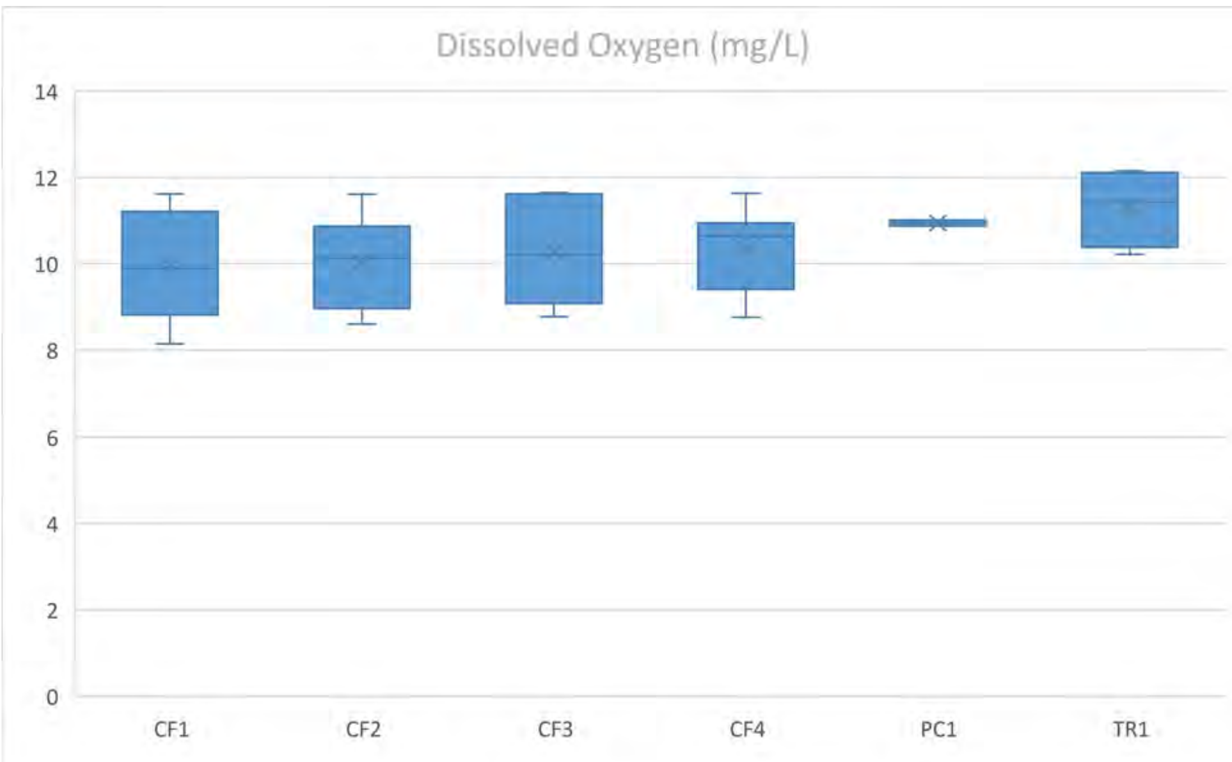

Figure 2-16. Dissolved oxygen concentration across all water quality monitoring sites (**in mg/L**).

NorthWestern Energy

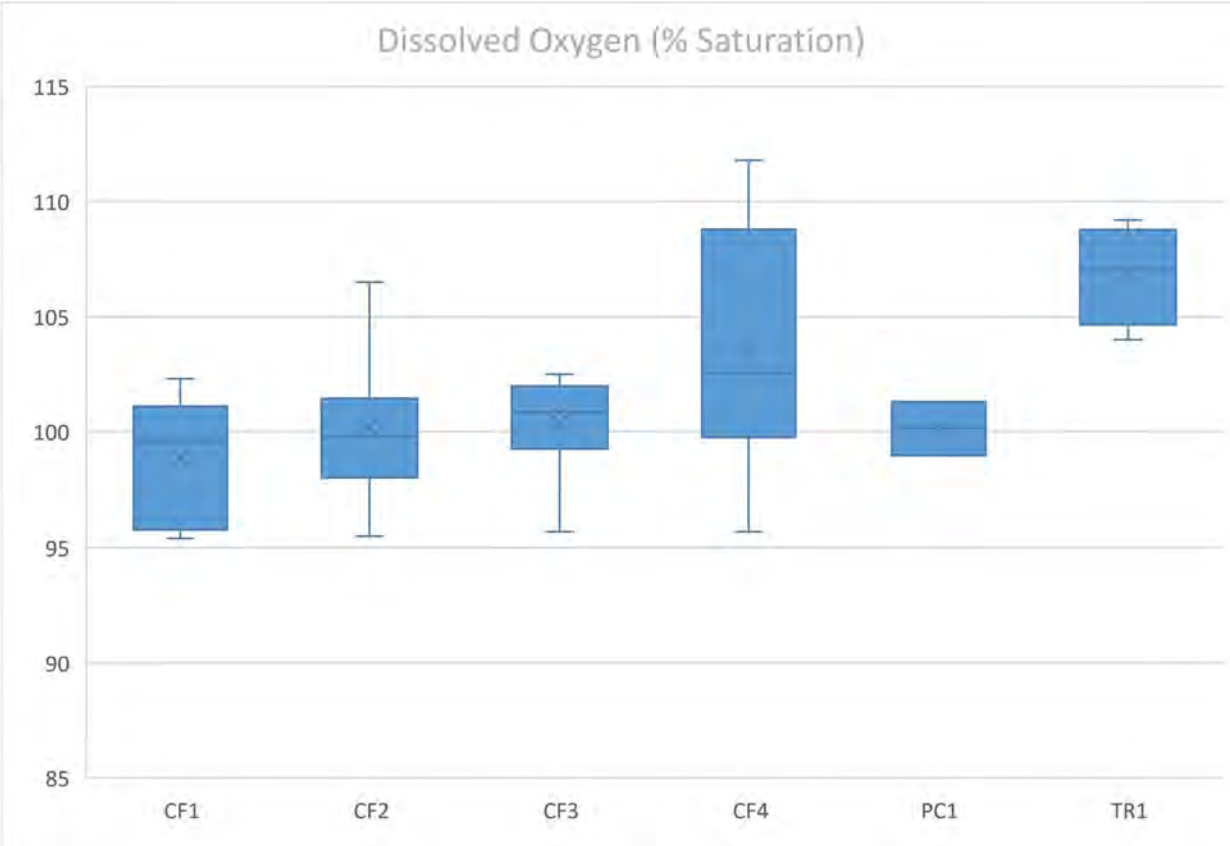

Figure 2-17. Dissolved oxygen percent saturation across all water quality monitoring sites (in %).

Section 2.1.2.4 – Water Temperature

In 2019 and 2021, water temperature data were collected at multiple locations throughout the Project to characterize the existing thermal regime of the reservoir, its inputs and outputs. After high river flows receded, thermographs were placed at four locations in 2019 (**Table 2-3**) and seven locations in 2021 (**Table 2-4**) across the Project and monitored water temperature at 15-minute intervals throughout the summer months. Instantaneous maximum water temperatures were reported as the warmest instantaneous measurement for the dataset. 7-Day maximum water temperatures were calculated and reported as an average of the daily maximum temperatures for the seven warmest consecutive days.

The instantaneous and 7-day maximum water temperatures in the Clark Fork River upstream of Thompson Falls Reservoir were just slightly higher than the comparable measurements collected downstream of the Project at the Birdland Bay Bridge (**Table 2-3, Figures 2-18 and 2-19**). Water temperature in the Thompson River is cooler than water temperature in the Clark Fork River, with the 7-day maximum water temperature being significantly lower than the comparable measurement in the Clark Fork River (**Table 2-3**). This pattern was consistent throughout the summer of 2019, with the Thompson River being cooler than the Clark Fork River from late June until early October (**Figure 2-18**). In addition, the three measurement sites on the Clark Fork River all had very similar water temperature from late June until early October

(**Figure 2-18**). These data support the conclusion that water temperature is consistent from upstream to downstream of the Project.

Monitoring in 2021 included the same sites as 2019, but data were also collected at additional sites as a part of the FERC approved Thompson Falls Relicensing Operations Study. The additional monitoring sites included a site at the furthest upstream extent of the Project boundary, a site located in the island complex downstream of site CF1, and site CF3, which is located directly downstream of the old powerhouse (**Table 2-4**). Similar to 2019, water temperatures remained relatively stable throughout the Clark Fork monitoring sites and the Thompson River was significantly cooler than the Clark Fork River (**Table 2-4, Figures 2-20 and 2-21**).

Table 2-3. Summary of 2019 water temperature data.

Site Name	Site Description	Date of Sample	Variable	Temperature (°F)	Temperature (°C)
CF1	Clark Fork River upstream of Thompson Falls Reservoir	8/8/19	Instantaneous Maximum Temperature	74.79	23.77
		8/3/19-8/9/19	7-Day Maximum	73.93	23.29
CF2	Clark Fork River upstream of dam in Thompson Falls Reservoir	8/9/19	Instantaneous Maximum Temperature	73.75	23.19
		8/3/19-8/9/19	7-Day Maximum	73.33	22.96
CF4	Clark Fork River at Birdland Bay Bridge	8/7/19	Instantaneous Maximum Temperature	73.47	23.04
		8/3/19-8/9/19	7-Day Maximum	73.15	22.86
TR1	Thompson River at mouth	8/3/19	Instantaneous Maximum Temperature	65.85	18.81
		8/1/19-8/7/19	7-Day Maximum	65.00	18.33

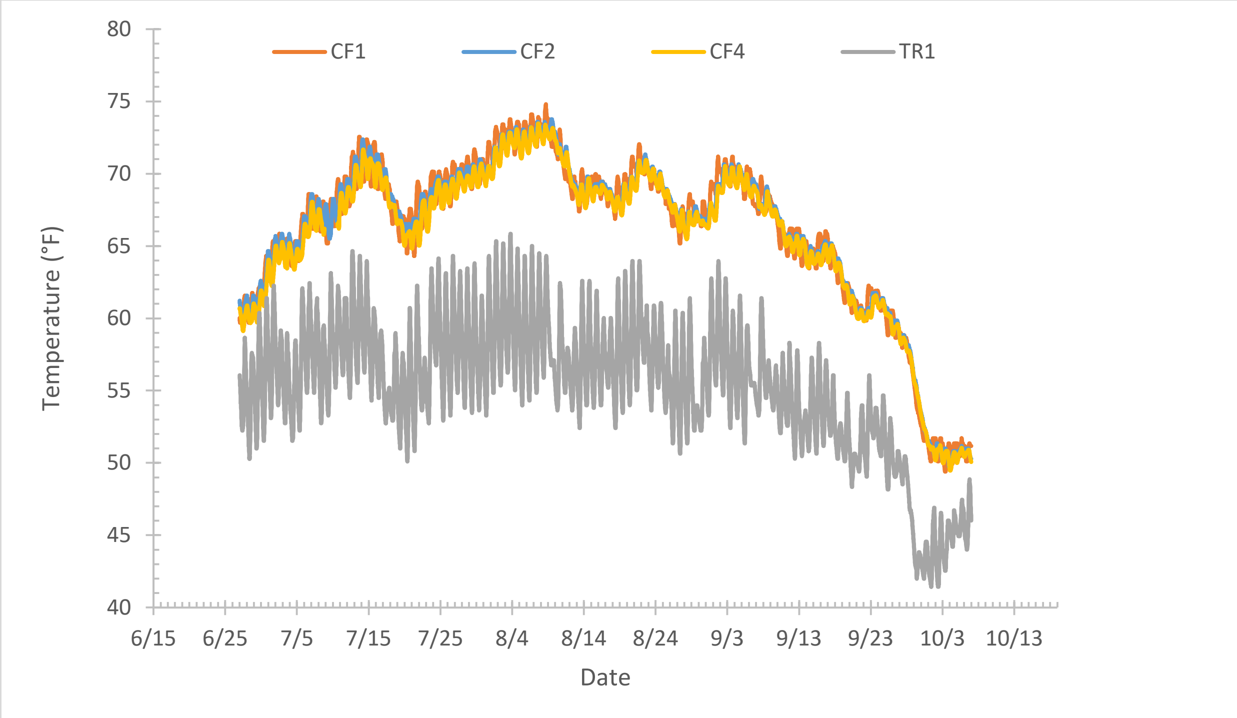

Figure 2-18. Thompson Falls Project water temperatures from June 27 through October 6, 2019.

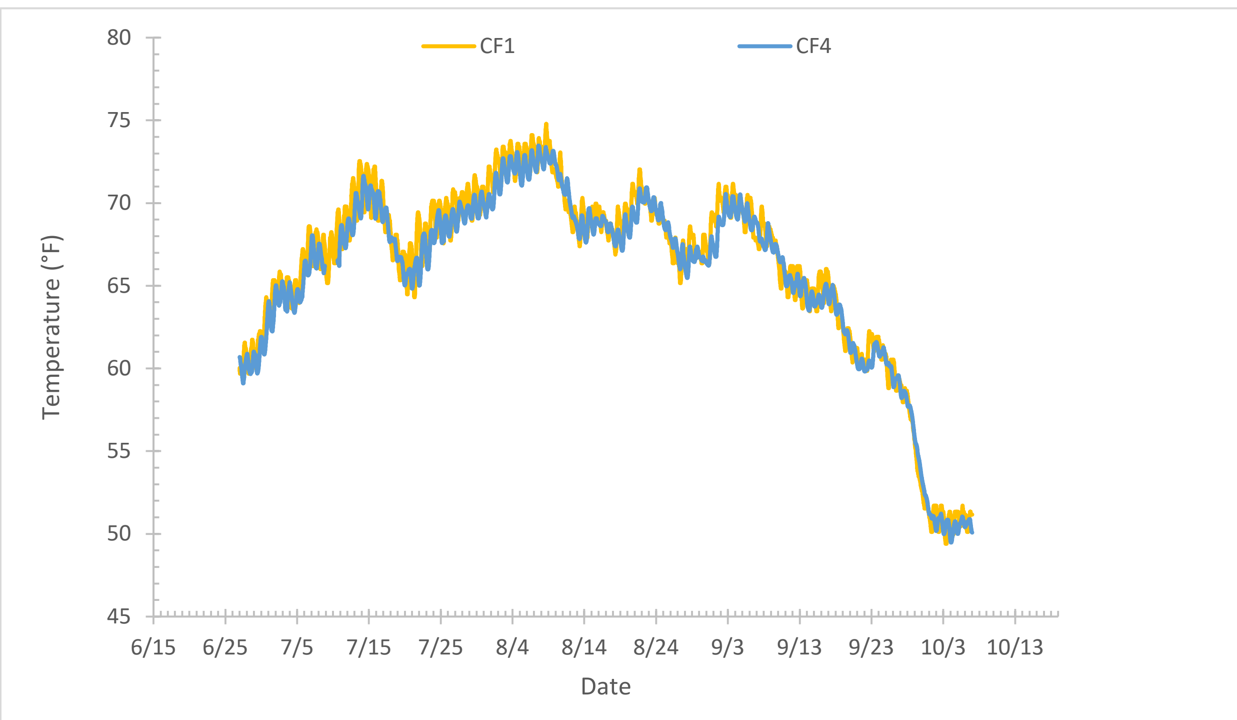

Figure 2-19. Upstream and downstream water temperature comparison from June 27 through October 6, 2019.

Table 2-4. Summary of 2021 water temperature data.

Site Name	Site Description	Date of Sample	Variable	Temperature (°F)	Temperature (°C)
Upstream Project Boundary	Clark Fork River at the edge of the upstream Project boundary	7/31/21	Instantaneous Maximum Temperature	77.28	25.16
		7/29/21-8/4/21	7-Day Maximum	76.53	24.74
CF1	Clark Fork River upstream of Thompson Falls Reservoir	7/31/21	Instantaneous Maximum Temperature	77.28	25.16
		7/29/21-8/4/21	7-Day Maximum	76.28	24.60
Island Complex	Clark Fork River in the Island complex downstream of CF1	7/31/21	Instantaneous Maximum Temperature	77.10	25.06
		7/29/21-8/4/21	7-Day Maximum	76.20	24.56
CF2	Clark Fork River upstream of dam in Thompson Falls Reservoir	8/1/21	Instantaneous Maximum Temperature	76.88	24.93
		7/30/21-8/5/21	7-Day Maximum	75.93	24.41
CF3	Clark Fork River downstream of old powerhouse	7/31/21	Instantaneous Maximum Temperature	77.28	25.16
		7/29/21-8/4/21	7-Day Maximum	76.28	24.60
CF4	Clark Fork River at Birdland Bay Bridge	8/1/21	Instantaneous Maximum Temperature	76.40	24.67
		7/30/21-8/5/21	7-Day Maximum	75.51	24.17
TR1	Thompson River at mouth	7/29/21	Instantaneous Maximum Temperature	65.55	18.64
		7/29/21-8/4/21	7-Day Maximum	63.78	17.66

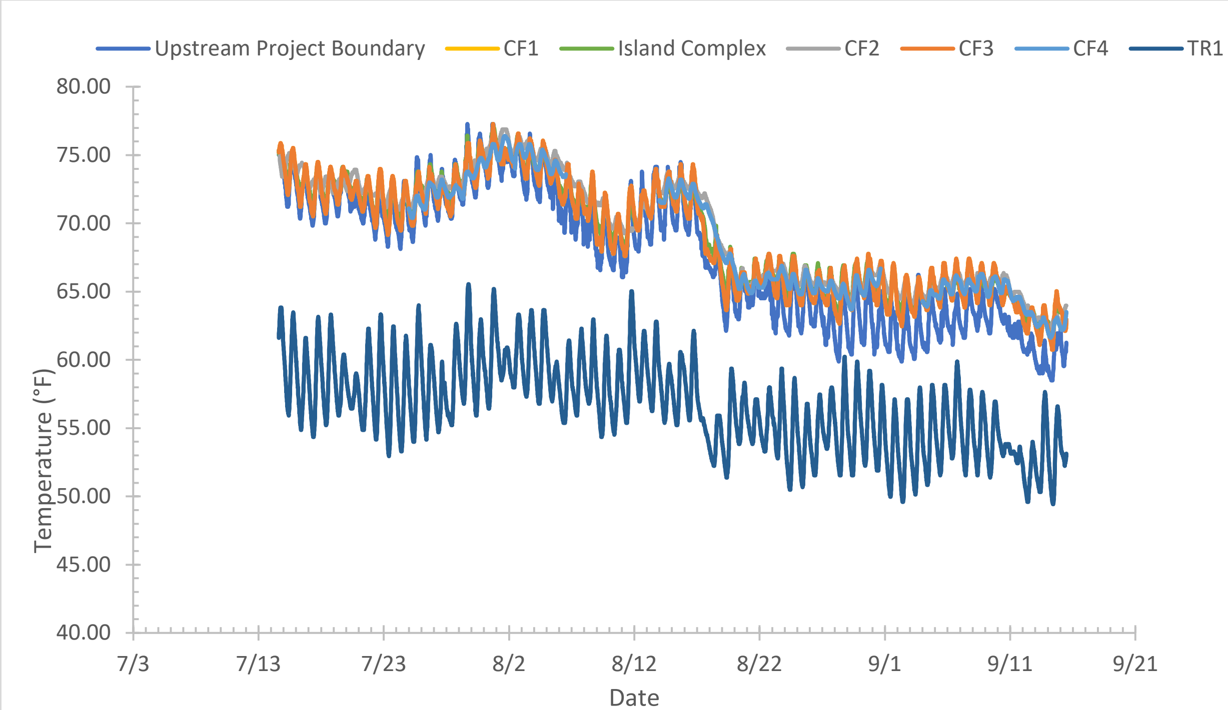

Figure 2-20. Thompson Falls Project water temperatures from July 15 through September 15, 2021.

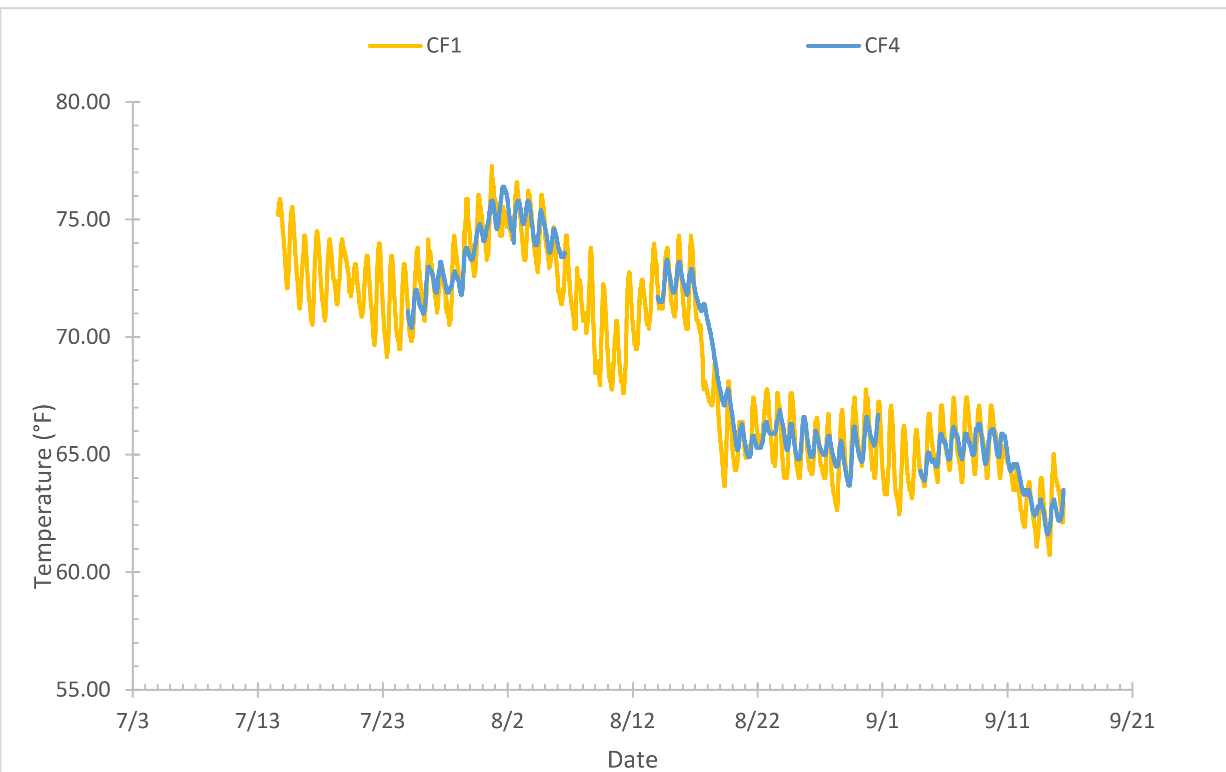

Figure 2-21. Upstream and downstream water temperature comparison from July 15 through September 15, 2021.

Section 2.2 – Sediment Chemistry

Four sediment bars were sampled in the lower portion of Thompson Falls Reservoir on July 13, 2020, using a core sampler to characterize the sediment in the lower reservoir. The reservoir was drafted 12 inches down that day to assist in accessing the sediment deposits via boat, and an attempt was made to sample the 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, PCBs, and Dioxins.

Table 2-5 provides 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. This information is useful in determining the pond elevation in which that substrate becomes exposed.

Table 2-5. Locations and characteristics of Thompson Falls Reservoir sediment cores collected on 7/13/20.

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	47.59230	-115.34370
2	1	1.0	1.0	47.58980	-115.34135
2	2	1.0	1.1	47.58969	-115.34044
2	3	1.5	0.0	47.58952	-115.33917
3	1	2.0	1.0	47.58947	-115.33701
3	2	1.3	0.5	47.59066	-115.33594
3	3	1.0	1.8	47.58933	-115.33310
4	1	2.0	1.0	47.59074	-115.33001
4	2	3.0	0.0	47.58842	-115.32886
4	3	1.5	1.4	47.58995	-115.32819

Figure 2-22 is a map showing the locations of each core sample from the lower reservoir in relation to the Town of Thompson Falls. The aerial imagery in **Figure 2-22** is from 2018 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; under normal full-pool reservoir elevations, the locations of these sample sites are underwater.

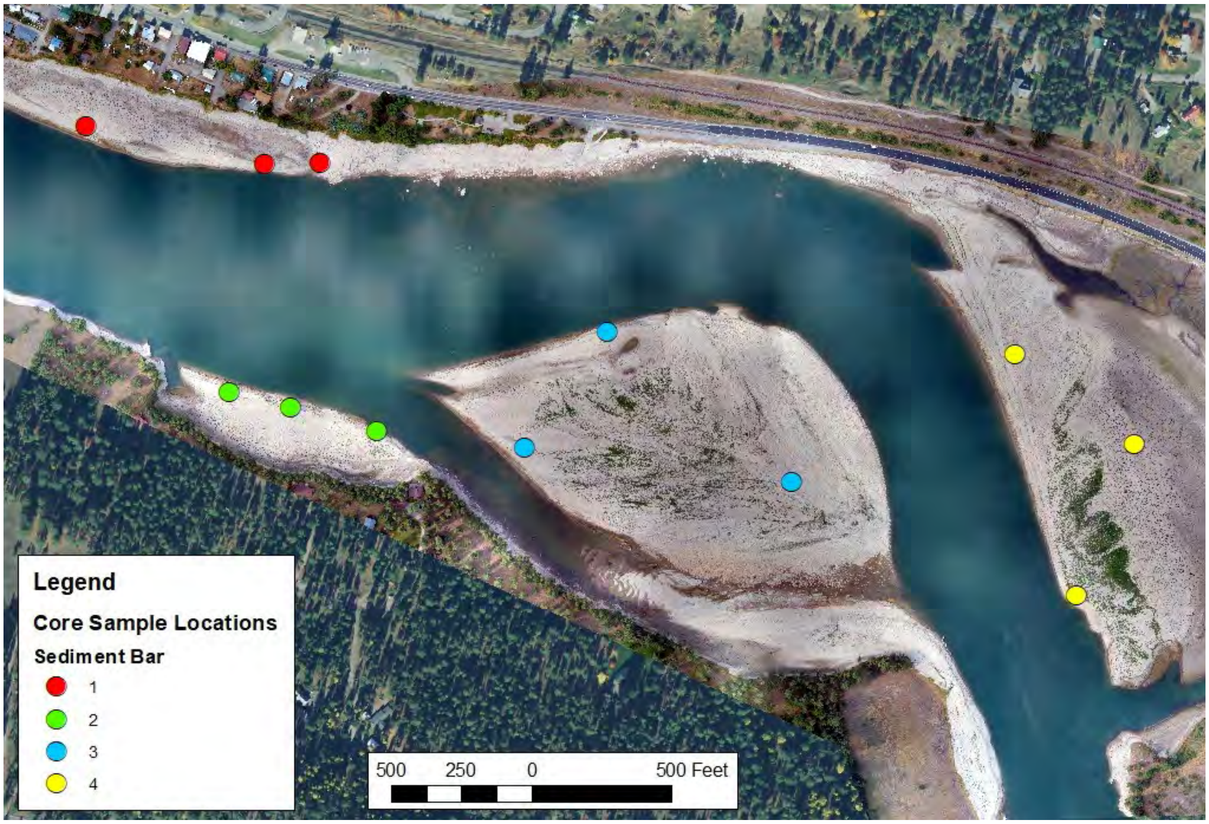

Figure 2-22. Sediment core sample locations in Thompson Falls Reservoir on 7/13/20.

Analytical results from the sediment core samples are shown in **Table 2-6 through Table 2-8**, below. **Table 2-6** 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 2-6. TCLP metals analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20.

Metals TCLP Extractable (mg/L)								
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

Note:
ND = that the sample result was not found at a detectable concentration

Table 2-7 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 2-7. PCB analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20

Polychlorinated Biphenyls (PCBs) (mg/kg-Dry)									
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

Note:
ND = 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-HxCDD and 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 2-8**) 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 nanograms 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 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 2-8**. TEQ results for each composite sediment sample were well below the TEQ screening level of 22 ng/kg.

Table 2-8. Dioxin analysis results from Thompson Falls Reservoir sediment cores collected on 7/13/20.

Dioxin Screening (ng/kg)			
Sediment Bar Sample	**1,2,3,7,8,9-HxCDD**	**2,3,7,8-TCDD**	**TEQ**
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

Notes:
ND = the sample result was not found at a detectable concentration
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 on July 13, 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.

Section 2.3 – Biological Monitoring

Biological indicators are an important part of monitoring the overall ecological health of a waterbody. These biological indicators typically respond to changes in water quality and can be studied to see a response to changing water quality conditions.

Aquatic macroinvertebrates and periphyton, the assemblage of aquatic organisms that attach to substrate, are strong bioindicators of stream health. Healthy streams support diverse macroinvertebrate communities of mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), caddisflies (*Trichoptera*), true flies (*Diptera*), beetles (*Coleoptera*), and many others. Macroinvertebrate and periphyton assemblages reflect cumulative impacts of all pollutants, such as toxic substances, organic pollution, or excessive sediment loading.

Zooplankton found in a lake or reservoir can be an important food source for fish and other aquatic organisms. Their presence and species composition can be used as an indicator of biological community health of a lake or reservoir.

Fish species can accumulate environmental contaminants in their muscle tissue over time through bioaccumulation. Typically, top trophic level predator species have the highest concentrations of contaminants, while lower trophic level prey species have the lowest concentrations of contaminants. Monitoring and tracking the concentrations in fish tissue contaminants over time can be used as an indicator of the environmental health of a waterbody.

Section 2.3.1 – Monitoring Sites and Methods

Biological monitoring occurred at two sites for macroinvertebrate and periphyton collection, three sites for zooplankton collection, and a reservoir-wide sampling effort for fish tissue biocontaminants. (**Table 2-9**).

In 2019, macroinvertebrate and periphyton samples were collected at sites CF1 and CF3 to determine if there were any changes in the biological community upstream and downstream of the reservoir (refer to **Figure 2-1**). Macroinvertebrate sampling methods used were consistent with NorthWestern's large river macroinvertebrate sampling methodologies. Sites CF1 and CF3 were chosen because the riffle habitat at these sites was the only appropriate habitat available in the Project area that meets the large river sampling criteria.

In addition to the macroinvertebrate and periphyton samples collected upstream and downstream of the reservoir, zooplankton samples were also collected at three sites on the reservoir, TFR1, TFR2, and TFR3 to determine the existing species composition and densities (refer to **Figure 2-1**). These sites were chosen to be representative of the upper, middle, and lower areas of Thompson Falls Reservoir. Vertical plankton tows were collected using an 80 µm (micron, or micrometer) mesh Wisconsin plankton net, and tow lengths were from the reservoir bed to the water surface.

Fish tissue samples were collected in the fall of 2019 as a part of NorthWestern's Thompson Falls Reservoir fisheries surveys. Gillnets were placed at multiple locations in the reservoir to capture representative fish populations throughout the reservoir. An attempt was made to analyze tissue from multiple species including both predator species and bottom-dwelling prey species. Multiple fish were collected of each species and each predator fish (Rainbow Trout and Northern Pike) was filleted and the fillets were composited by species to run as one representative composite sample per species. Bottom-dwelling prey species (Largescale Sucker) were processed whole and composited for one representative sample for that species.

Table 2-9. Description of methods and parameters measured at water chemistry monitoring sites.

Site Name	Site Purpose	Sampling Method	Samples Collected
CF1	Biological communities upstream of the reservoir	Kicknet, Scrape method	Macroinvertebrates, Periphyton
CF3	Biological communities downstream of the reservoir	Kicknet, Scrape method	Macroinvertebrates, Periphyton
TFR1	Upper reservoir sampling site	Wisconsin plankton net	Zooplankton
TFR2	Middle reservoir sampling site	Wisconsin plankton net	Zooplankton
TFR3	Lower reservoir sampling site	Wisconsin plankton net	Zooplankton
Thompson Falls Reservoir	Representative fish community sample	Gillnet	Fish tissue

Section 2.3.2 – Biological Monitoring Results

Section 2.3.2.1 - Aquatic Macroinvertebrates

Macroinvertebrate data were collected upstream (site CF1) and downstream (site CF3) of Thompson Falls Reservoir in 2019 to compare the biological communities and look at any effects on those communities from the Project. **Table 2-10** shows a comparison of the macroinvertebrate data collected at monitoring sites CF1 and CF3. The 2019 biological monitoring found that the Clark Fork River upstream (CF1) and downstream of Thompson Falls (CF3) support very similar macroinvertebrate benthic densities. Late-July density estimates at

CF3 reported 5,560 (±563) benthic macroinvertebrates per square meter (1,390 per sample), while upstream (CF1) densities averaged 5,115 (±950) per m^2.

In years of higher-than-normal discharge, macroinvertebrate densities are typically lower due to the flushing effect of high flows. Higher flows can reduce benthic macroinvertebrate densities by directly removing less velocity tolerant organisms (scuds, snails) or by removing silt in the gravels that favor midges and aquatic worms. Although higher than normal flows were observed in 2018 and 2019, midges (Diptera family: Chironomidae) still dominated the samples at both sites (Montana Biological Survey/Stag Benthics, 2019).

Table 2-10. Mean macroinvertebrate values for 8 metrics used in the bioassessment scores for 2019 samples.

Metric	CF1	CF3
Taxa Richness	37	38.4
EPT Richness	16.4	19.6
Shannon Diversity (log2)	3.6	3.4
Biotic Index	5.3	5.0
% EPT	36%	44%
% Chironomidae	40%	48%
% Filterers	49%	67%
EPT/EPTC	47%	48%
Mean Densities (per m^2)	5,115 (± 956)	5,568 (± 563)
Metals Tolerance Index	2.5	2.9

Note:
An average of 37 benthic macroinvertebrate taxa, including 16 EPT (*Ephemeroptera*, *Plecoptera*, and *Tricoptera*) species were collected per sample upstream of Thompson Falls, while 38 total taxa and 20 EPT taxa were collected downstream in 2019**.**

Macroinvertebrate community composition was also fairly similar upstream and downstream of Thompson Falls Dam except for a higher relative abundance of non-insect taxa reported at the CF1 site (**Figure 2-23**). The large non-insect taxa component at CF1 was largely comprised of *Lymnaeidae* and *Physidae* snails in the genera *Fossaria* and *Physella*, respectively. Dipterans accounted for 40 and 52 percent of the benthic community composition for CF1 and CF3 in 2019, respectively; this was largely composed of the midges, *Chironomidae*. Riffle beetles (*Coleoptera*: family *Elmidae*) made up a small, but not insignificant, component of the benthic community at each Clark Fork River site (Montana Biological Survey/Stag Benthics, 2019).

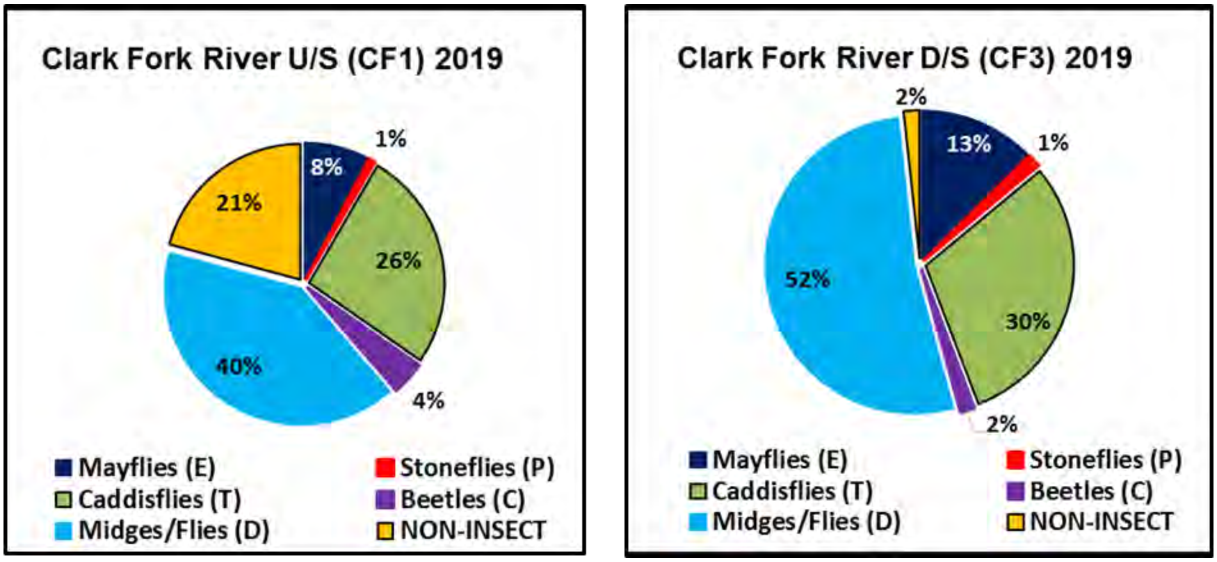

Figure 2-23. Macroinvertebrate community composition for sites CF1 and CF3.

Mayflies and caddisflies are important components of the Clark Fork River benthic community and to the bioassessment metrics, while Stoneflies represent a relatively small component (~1%) (**Figure 2-23**). Caddisflies were the most abundant of the EPT taxa in the Clark Fork River samples collected in 2019, representing 26 and 30 percent of the upstream (CF1) and downstream (CF3) communities, respectively. Of the 11 species of caddisflies collected at these sites, populations of three net-spinning caddisflies (*Cheumatopsyche, Hydropsyche occidentalis* and *H. morosa gr.*) were most abundant below the dam at site CF3, while the net-spinner, *Cheumatopsyche* and the long-horned caddisflies, *Ceraclea* and *Oecetis* were most abundant upstream of the reservoir at site CF1 (Montana Biological Survey/Stag Benthics, 2019).

Mayflies were the third most abundant invertebrate group at the downstream site (CF3) in 2019, while upstream (CF1) they were the fourth most abundant group (**Figure 2-23**). Of the 13 species of mayflies reported at site CF3, the most common were Tricos (mayflies in the genera *Tricorythodes*), *Tricorythodes minutus,* Blue-winged Olives *Acentrella and Baetis tricaudatus* and *Macaffertium* in the family *Heptageniidae*. A few *Attenella margarita* have been collected at this site. Site CF1 reported 8 species of mayflies with the dominant being Tricos, two *Heptageniidae* species, *Macaffertium* and *Heptagenia* and *Attenella margarita* (Montana Biological Survey/Stag Benthics, 2019).

Section 2.3.2.2 – Periphyton

In the periphyton assemblage, there were two predominant taxa found upstream and downstream of the reservoir, *Achnanthidium minutissimum* and *Achnanthidium subatomus*. These two species comprised of 57.17 percent of the upstream sample and 55.97 percent of the downstream sample. There was little change between the upstream and downstream metric scores, which ranged from good to excellent (**Table 2-11**).

Table 2-11. 2019 Clark Fork periphyton metric scores upstream and downstream of Thompson Falls Reservoir.

Site Name	Site Description	Date of Sample	Metric	Value	Rating
CF1	Clark Fork River upstream of Thompson Falls Reservoir	7/31/19	Shannon H	3.394	Excellent
			Species Richness	44	Excellent
			Dominant Taxon Percent	40.82%	Good
			Siltation Taxa Percent (Sediment)	11.24%	Excellent
			Pollution Index (Nutrients)	2.792	Excellent
			Disturbance Taxa Percent (Metals)	40.82%	Good
			Abnormal Cells Percent (Metals)	0.00%	Excellent
			Bioindex (Montana DEQ Mountains)	N/A	Good
CF3	Clark Fork River downstream of Old Powerhouse	7/31/19	Shannon H	3.670	Excellent
			Species Richness	52	Excellent
			Dominant Taxon Percent	30.22%	Good
			Siltation Taxa Percent (Sediment)	9.83%	Excellent
			Pollution Index (Nutrients)	2.729	Excellent
			Disturbance Taxa Percent (Metals)	30.22%	Good
			Abnormal Cells Percent (Metals)	0.00%	Excellent
			Bioindex (Montana DEQ Mountains)	N/A	Good

Section 2.3.2.3 - Zooplankton

Zooplankton were collected at three sites in Thompson Falls Reservoir in July 2019, using a vertical plankton tow. Results of the zooplankton tows are displayed in **Table 2-12**. Zooplankton concentrations in the reservoir were quite low, which is not surprising given the short residence time of water in the reservoir. Reservoir residence times of greater than 18 days are generally required to support a sustainable zooplankton population (Brook and Woodward, 1956). This time is needed for the zooplankton to successfully reproduce before being flushed downstream. Typical residence times of water in Thompson Falls Reservoir range from less than 4 hours in June to approximately 17 hours in September (refer to **Figure 1-2**).

Table 2-12. Zooplankton data collected from Thompson Falls Reservoir in 2019.

Taxon		Site TFR1 (Upstream end of TF Reservoir) 2019		Site TFR2 (Mid TF Reservoir) 2019		Site TFR3 (Downstream end of TF Reservoir) 2019	
		Count	Cells / ml	Count	Cells / ml	Count	Cells / ml
Cladocera	Chydoridae	0	0	0	0	1	0.00000161
Copepoda	Cyclopoida	1	0.00000189	4	0.00000821	5	0.00000804
Copepoda	Harpacticoida	0	0	1	0.00000205	0	0
Rotifera	Conochilus	0	0	2	0.00000411	0	0
Rotifera	Euchlanis	3	0.00000568	9	0.00001848	6	0.00000965
Rotifera	*Filinia longiseta*	2	0.00000378	0	0	0	0
Rotifera	*Filinia terminalis*	0	0	4	0.00000821	7	0.00001126
Rotifera	*Gastropus hyptopus*	1	0.00000189	0	0	1	0.00000161
Rotifera	*Kellicottia longispina*	9	0.00001703	3	0.00000616	4	0.00000643
Rotifera	*Keratella cochlearis*	5	0.00000946	1	0.00000205	4	0.00000643
Rotifera	*Keratella testudo*	9	0.00001703	0	0	7	0.00001126
Rotifera	Lecane	0	0	0	0	2	0.00000322
Rotifera	Monostyla lunaris	0	0	0	0	1	0.00000161
Rotifera	Pompholyx	0	0	2	0.00000411	3	0.00000483
Rotifera	Rotifera	4	0.00000757	6	0.00001232	8	0.00001287
Rotifera	Synchaeta	1	0.00000189	0	0	0	0
Rotifera	*Trichotria tetractis*	1	0.00000189	0	0	0	0

Section 2.3.2.4 - Fish Tissue Biocontaminants

In the fall of 2019, fish tissue samples were collected in Thompson Falls Reservoir for the purpose of quantifying concentrations of biocontaminants in fish. Eleven fish in total were collected as a part of this effort. Lengths and weights were recorded for each fish, and the fish from each species were composited into a single representative sample for the species (**Table 2-13**). Two predator species were represented in this sampling, Northern Pike and Rainbow Trout, and one bottom-dwelling prey species was represented, Largescale Sucker for a total of three representative composite samples.

Table 2-13. Individual fish length and weight data for composited fish tissue samples collected in 2019.

Fish Species	Length (mm)	Weight (g)
Largescale Sucker	230	140
Largescale Sucker	265	222
Largescale Sucker	260	218
Largescale Sucker	250	196
Northern Pike	720	3238
Northern Pike	640	2592
Northern Pike	625	2138
Northern Pike	530	908
Northern Pike	495	723
Rainbow Trout	420	1098
Rainbow Trout	460	1080

Results of the fish tissue analysis are shown below in **Table 2-14**. These data were provided to Montana Fish Wildlife and Parks (Montana FWP) to supplement their fish consumption advisory dataset. Montana FWP samples Thompson Falls Reservoir once every 5 years to maintain and update any fish consumption advisories that may be in place. Currently, there are fish consumption advisories for Northern Pike, Rainbow Trout, Smallmouth Bass, and Yellow Perch from Thompson Falls Reservoir due to the presence of Mercury (Montana FWP, 2021).

Table 2-14. 2019 Fish tissue biocontaminant analysis results by species.

Analyte	Rainbow Trout	Northern Pike	Largescale Sucker
Strontium	ND	0.8	26.2
Copper	1	1	4
Manganese	ND	2	36
Nickel	ND	ND	ND
Zinc	17	18	61
Arsenic	ND	ND	0.4
Cadmium	ND	ND	ND
Chromium	ND	ND	0.4

Analyte	Rainbow Trout	Northern Pike	Largescale Sucker
Selenium	0.9	0.6	0.7
Mercury	0.32	0.57	ND
Aluminum	ND	ND	47
Iron	30	17	115
Lead	ND	ND	ND

Notes:
ND = that the sample result was not found at a detectable concentration
All results are presented in mg-kg dry

Section 3.0 – Summary and Discussion

The Thompson Falls Project is the first impoundment in a series of three dams in the lower Clark Fork River and is the furthest upstream dam on the Clark Fork River (refer to **Figure 1-1**). NorthWestern collected a wide array of water quality data to characterize the current water quality conditions of the Project. Data were collected in 2019, 2020, and 2021 as a part of this effort, and included water chemistry and field parameters, water temperature, sediment chemistry, and biological data.

Water chemistry changes very little across the Project from upstream to downstream. This is mostly due to the very short residence time of the reservoir (3-17 hours) (refer to **Figure 1-2**). Nutrient concentrations remain low throughout the Clark Fork sites (CF1, CF2, CF3, and CF4) as well as the tributary sites on the Thompson River and Prospect Creek. Metals concentrations were generally low throughout the Clark Fork sites with the exception of lead concentrations at site CF4, which is downstream of the Project at Birdland Bay Bridge. Synoptic source assessment monitoring conducted in October 2020 was able to determine that the source of lead was occurring somewhere between Thompson Falls State Park (Site CF3.3) and Birdland Bay Bridge (site CF4). This lead source occurs outside of the Project, and the actual source remains unknown at this point. Prospect Creek, a tributary that enters the Clark Fork River downstream of Thompson Falls Dam, was found to contain high concentrations of cadmium, but it appears to be diluted by the time the water reaches site CF4 on the Clark Fork River.

Specific conductivity, pH, and turbidity remain relatively consistent throughout the Clark Fork sites, and dissolved oxygen saturation increases slightly downstream of the Project at site CF4 during the high flow season when the spillway is in use. Water temperatures show a slight decrease moving downstream through the Project, and the water temperature of the Thompson River is significantly cooler than that of the Clark Fork River.

Sediment chemistry samples collected in the lower portion of Thompson Falls Reservoir showed TCLP metals and PCBs were all at non-detectable concentrations. Dioxin analysis results for both 1,2,3,7,8,9-HxCDD and 2,3,7,8-TCDD were at non-detectable levels for all samples, and the calculated TEQs for all samples were found to be well below the screening level.

Macroinvertebrate taxa richness, EPT taxa richness, percent EPT taxa, and mean densities were higher downstream of Thompson Falls Reservoir than they were upstream of the reservoir, but percent *Chironomidae* were also higher downstream and were the dominant taxa at both monitoring sites. Periphyton metric scores were similar at both the upstream and downstream sites and had ratings of “good” or “excellent” for all metrics. Zooplankton were collected at three sites in Thompson Falls Reservoir, but due to the low residence time of the water in the reservoir, the reservoir does not support much of a zooplankton community. Fish consumption advisories have historically been in place for Thompson Falls Reservoir due to mercury, and 2019 fish tissue analysis confirmed the presence of mercury in both the Rainbow Trout and Northern Pike specimens that were sampled, but not in bottom-dwelling fish like Largescale Suckers.

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Appendix A

Table A-1. List of water chemistry analyses performed for 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 collected.

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

Appendix B – Wetland Assessment Report

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July 20, 2023

NORTHWESTERN ENERGY

Thompson Falls Reservoir

Wetland Assessment Report

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0239852_0000

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Wetland Assessment Report

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ACRONYMS AND ABBREVIATIONS

AA	Assessment Areas
APT	Antecedent Precipitation Tool
CWA	Clean Water Act
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
FEMA	Federal Emergency Management Agency
HGM	Hydrogeomorphic
MNHP	Montana Natural Heritage Program
MWAM	Montana Wetland Assessment Method
NAIP	National Agriculture Imagery Program
NHD	National Hydrography Dataset
NRCS	Natural Resources Conservation Service
NWE	NorthWestern Energy
NWI	National Wetland Inventory
OBL	Obligate Wetland
OHWM	Ordinary High Water Mark
POWER	POWER Engineers, Inc.
PWS	Professional Wetland Scientist
SP	Sampling Point
SOC	Species of Concern (Montana Natural Heritage Program)
T&E	Threatened and Endangered
UPL	Upland
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WOTUS	Waters of the United States

1.0 INTRODUCTION

POWER Engineers, Inc. (POWER) was retained by NorthWestern Energy (NWE) to complete a delineation and evaluation of potentially regulated wetlands (i.e., identifying boundaries of aquatic resources potentially regulated by the federal government along the Thompson Falls Reservoir that may be influenced by changes in water surface elevation due to reservoir operations (Assessment Area). The legal description of the Project includes portions of Sections 8, 9, 13, 16, and 23, Township 21 North, Range 29 West, and portions of Sections 15, 16, 17, 18, and 22, Township 21 North, Range 28 West, Sanders County, Montana.

This report presents the professional opinion of POWER regarding the presence/absence/assessment of potentially regulated wetlands above the approximated ordinary high water mark (OHWM) of the Thompson Falls Reservoir. The final determination of the limits, jurisdictional status, and assessment of on-site wetlands is under the purview of the United States Army Corps of Engineers (USACE) and may require an on-site inspection with the USACE. Of note, this review did not include the delineation or assessment of waterways draining into the Assessment Area, as these features will not be affected by changes in water surface elevation of the reservoir.

1.1 Site Description

The Assessment Area considered wetland areas along the water's edge of Thompson Falls Reservoir, from the dam at Thompson Falls on the west to approximately 10 miles upstream of the dam along the Clark Fork River on the east, between approximate river miles 208 and 218. This investigation focused on riparian wetlands apparently affected by water impounded behind the dam. The Clark Fork River forms the boundary between the Cabinet Mountains to the northeast and the Coeur d'Alene Mountains to the southwest. The Assessment Area is situated within the Natural Resources Conservation Service (NRCS) Northern Rocky Mountain Valleys Major Land Resource Area (NRCS 2022a). Surrounding hillslopes are generally covered by a mature mixed conifer forest. Habitat types within the Assessment Area include open channel/water, alpine-montane wet meadow, emergent marsh, mesic montane mixed conifer forest, ponderosa pine woodland and savanna, lower montane grassland, and lower montane riparian woodland and shrubland (MTNHP 2017). Land uses surrounding the Assessment Area include low intensity residential, commercial/industrial, railroad, undeveloped vacant, and forestland. Topography across the Assessment Area includes stream terraces, flood plains, alluvial fans, side and mid-channel gravel bars, and valley bottoms. Elevations within the Assessment Area range from approximately 2,398 to 2,415 feet above mean sea level. A topographic map of the Assessment Area is provided as Figure 1 and aerial maps as Figure 2 (National Agriculture Imagery Program [NAIP] 2021).

1.2 Jurisdictional Authority

The USACE has primacy over the regulation of federal jurisdictional waters under Sections 9 and 10 of the Rivers and Harbors Act of 1899 and federal jurisdictional waters under Section 404 of the Clean Water Act (CWA). Federal jurisdictional waters include navigable waters and all other waters that are regulated by the USACE, which together are referred to as "WOTUS." Impacts to WOTUS are regulated by the USACE through Section 404 of the CWA (33 United States Code [U.S.C.] § 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 403). In addition, prior to federal authorization for impacts to waters or wetlands, a water quality certification must first be obtained from the applicable state as defined in Section 401 of the CWA (33 U.S.C. § 1341).

The USACE administers the Clean Water Act (CWA) Section 404 permitting program, and issues permits pursuant to Sections 9 and 10 of the Rivers and Harbors Act of 1899. 33 U.S.C. § 1344; 33 U.S.C. § 403. These permitting programs address impacts to Federally jurisdictional waters, or waters of the United

States (WOTUS). Pursuant to Section 401 of the CWA, Montana must issue or waive a water quality certification prior to USACE issuing a permit. 33 U.S.C. § 1341.

The definition of WOTUS is in the process of being revised. On January 18, 2023, the United States Environmental Protection Agency (USEPA) and the USACE published the final "Revised Definition of Waters of the United States" rule, which took effect on March 20, 2023. 88 Fed. Reg. 3004 (Jan. 18, 2023). However, on May 25, 2023, the United States Supreme Court issued a ruling rejecting the "significant nexus" standard that supported key components of the March 20, 2023 rule. *Sackett v. USEPA,* (U.S. EPA 2023). On June 26, 2023, USEPA announced that it will interpret WOTUS consistent with the *Sackett* decision and issue a new rule defining WOTUS by September 1, 2023.

For purposes of this report, Power followed USACE guidance that it will not assert jurisdiction over swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow), ditches (including roadside ditches) excavated wholly in and draining only uplands that do not carry a relatively permanent flow of water, prior converted cropland, waste treatment systems, artificially irrigated areas, artificial lakes or ponds, artificial reflecting pools or swimming pools, or waterfilled depressions created in dry land until the construction operation is abandoned and the resulting body of water meets the definition of WOTUS. Although uncertainty remains about the scope of federal jurisdiction, the *Sackett* decision holds that only relatively permanent waters with a continuous-surface water connection to traditional navigable bodies of water will warrant a WOTUS designation and thus be subject to federal permitting requirements.

2.0 METHODS

2.1 Analysis of Existing Data

Prior to the commencement of the on-site field investigation, POWER reviewed available technical documents, databases, and maps to determine the potential extent of wetlands and waterways within the Assessment Area. These data included:

- United States Geological Survey (USGS) 7.5-minute Topographic Quadrangle Maps: Thompson Falls, Montana (USGS 1992); Eddy Mountain, Montana (USGS 1964)
- United States Department of Agriculture NAIP 2021 imagery (NAIP 2021)
- Google Earth Aerial Imagery (1985-2021)
- United States Department of Agriculture NRCS' Soil Survey Geographic database for Sanders County, and Parts Lincoln and Flathead Counties, Montana (NRCS 2022b) and partial database for Lolo National Forest Area, Montana (NRCS 2022c)
- United States. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Wetlands Mapper (USFWS 2023)
- USGS National Hydrography Dataset (NHD) mapper (USGS 2023)
- Federal Emergency Management Agency (FEMA) 100-year Floodplain maps (FEMA 2023)

2.2 Field Investigation

This review focused on determining the presence of wetlands within the limits of the Assessment Area. Field surveys were conducted in accordance with the "Routine Onsite Determination Method" described in the USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0) (USACE 2010).

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated conditions. Under normal circumstances, three parameters must be present for an area to be considered a wetland: hydrophytic vegetation, wetland hydrology, and hydric soils.

The approximated OHWM of the Thompson Falls Reservoir generated by desktop analysis was used to define the extent of the Assessment Area and also to define the wetland boundary along the water's edge. A combination of the NWI data and on-the-ground knowledge of the Assessment Area by a Hydro Compliance Professional with NWE was used as a starting point for the field Assessment. Based on the desktop analysis, 46 investigation areas were identified for field surveys. The Assessment Area was navigated via motorboat, stopping periodically to evaluate vegetation, soils, and hydrology at all 46 potential wetland areas preidentified during the desktop analysis. A few areas were sampled that were not identified during the desktop analysis, due to obvious indicators observed in the field. The survey determined the presence of wetland indicators for each parameter (hydric soils, hydrophytic vegetation, and hydrology), according to methodologies outlined in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0) (USACE 2010). The boundaries of wetland areas determined to meet the three criteria were surveyed using a Trimble GeoXH global positioning system (GPS) unit with sub-meter accuracy. The specific methods for characterizing and evaluating vegetation, hydrology, and soils for determining the presence of wetland areas are identified below.

2.2.1 Soils

At the center of each data plot, the wetland scientist conducted borings with a hand-held auger to depths necessary to accurately determine a soil's hydric status (typically 18 to 24 inches below ground surface). The information collected for each soil profile included soil horizons, depth, texture, color, and hydric soil characteristics including organic content, accumulation of sulfides, gley formation, redoximorphic concentrations and depletions, and the visually detectable depletion of minerals such as iron and manganese. Colors of the soil matrix and concentrations/depletions were identified using Munsell Soil Color Charts (Munsell 2000). Hydric soil determinations were based on criteria established in the 1987 USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987), along with *Field Indicators of Hydric Soils in the United States* (NRCS 2010), and the Regional Supplement (USACE 2010).

2.2.2 Vegetation

Species abundance in both upland and wetland communities were visually estimated. Dominant trees and shrubs/saplings were recorded within a 30-foot and 15-foot radius, respectively, from the center of each sampling point. Woody vines were recorded within a 30-foot radius of the plot. Dominant herbaceous vegetation was recorded within a 5-foot radius of the plot. The indicator status of each species was identified using the *National Wetland Plant List for the Western Mountains, Valleys, and Coast Region* (USACE 2020). The presence of hydrophytic vegetation within a representative plant community was positively identified if more than 50% of the dominant species within the community had an indicator status of Obligate Wetland (OBL), Facultative Wetland (FACW), or Facultative (FAC). This determination method is referred to as the dominance test. Dominant plant species are determined using the "50/20 rule" defined in the 1987 *Wetlands Delineation Manual* (Environmental Laboratory 1987). If the plant community failed the dominance test, but indicators for hydric soils or wetland hydrology were present, the plant community was examined for additional hydrophytic vegetation indicators. These hydrophytic vegetation indicators are identified in the Regional Supplement and include the prevalence index, evidence of morphological adaptations for growth in a wetland, and problematic hydrophytic vegetation (USACE 2010).

2.2.3 Hydrology

Site hydrology was evaluated during the field survey by initially observing whether the soil at the surface was inundated or saturated. If the ground surface was dry, the depth to freestanding groundwater or saturated soil was measured, and the presence or absence of other indicators of wetland hydrology (e.g., drift lines, water stained leaves) was noted. The wetland hydrology criterion was met if one or more primary or two or more secondary field indicators were present (Environmental Laboratory 1987). However, during the survey, those wetlands which lacked any hydrology indicators due to temporarily dry conditions, disturbance, or other factors and did not meet the 1987 USACE manual criteria were evaluated using criteria from the Regional Supplement (USACE 2010).

2.2.4 Wetland Classification

In the field, wetlands and waterways were classified according to the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). The Cowardin classification is a taxonomic system that divides wetlands and deepwater habitats into five systems based on hydrologic factors: Marine, Estuarine, Riverine, Lacustrine, and Palustrine.

Additionally, wetlands were classified based on hydrogeomorphic (HGM) system (Brinson 1993). This approach considers wetland function and places an emphasis on geomorphic and hydrologic attributes, rather than using a system that is limited to biotic characteristics. This system recognizes water inputs and outputs which drive wetlands systems. This classification system includes seven major HGM classes (riverine, depressional, slope, mineral soil flats, organic soil flats, estuarine fringe, and lacustrine fringe wetlands).

2.2.5 Antecedent Precipitation

The Antecedent Precipitation Tool (APT) is a desktop tool developed by the USACE that is commonly used by the USACE and USEPA to support decisions as to whether field data collection and other site-specific observations occurred under normal climatic conditions. This tool streamlines the review of climatic data, which supports decision-making related to wetland delineations. The APT facilitates the comparison of antecedent or recent rainfall conditions for a given location to the range of normal rainfall conditions that occurred during the preceding 30 years. In addition to providing a standardized methodology to evaluate normal precipitation conditions (“precipitation normalcy”), the APT can also be used to assess the presence of drought conditions, as well as the approximate dates of the wet and dry seasons for a given location.

2.2.6 Functional Assessment

The 2008 MDT Montana Wetland Assessment Method (MWAM) (Berglund and McEldowney 2008) was used to evaluate functions and values of wetland areas identified during the field investigation. This method provides an objective means of assessing mitigation success based on wetland functions. Functions are self-sustaining properties of a wetland ecosystem that exist in the absence of society and relate to ecological significance without regard to subjective human values (Berglund and McEldowney

2008). Field data for this assessment were collected during the site visit. A Wetland Assessment Form was completed for two Wetland Groups (WG).

3.0 RESULTS

3.1 Desktop Analysis

The desktop analysis completed by POWER included soils, waterways, topographic, wetlands, and floodplain data to determine the potential presence of wetland/waterway features. The results of the desktop analysis are provided in the following sections. A topographic map (Figure 1), aerial map (Figure 2), NRCS soils map (Figure 3), and NWI/NHD water resources map (Figure 4) were all reviewed as part of the desktop analysis and have been included in this report. Additionally, FEMA floodplain data were evaluated to identify potential wetlands and waterways.

3.1.1 Topographic Map

According to the USGS topographic map (Figure 1), the wetland Assessment Area is situated directly adjacent to the lower Clark Fork River along an approximate 10-mile reach and affected by the Thompson Falls Reservoir water impoundment. Through the Assessment reach, five unnamed intermittent channels, one unnamed perennial channel, and four named perennial drainages discharge into the Clark Fork River. Named perennial tributaries include Outlaw Creek, Cherry Creek, Moss Spring, and the Thompson River. As noted above, waterways were not delineated during this investigation. The topographic map shows multiple islands, lower terraces, and steep hillslopes along the assessed river corridor. A review of the topographic map indicated wetlands are likely present throughout the Assessment Area.

3.1.2 Aerial Map

The 2021 NAIP (Figure 2), the 2019 NAIP, and historic aerial photographs show variable bank conditions (exposed/inundated) with varying water levels. A slightly lower water level shown on the 2019 NAIP as compared to the 2021 NAIP displayed a slight increase in shoreline and island size, exposing areas of fine-textured sediment. Relatively stable water levels were observed on the Google Earth historic aerials between 1995 and 2020. Water levels impounded by the Thompson Falls Dam appear to support a relatively narrow shoreline, intermittently exposed gravel bars, and partially vegetated mid-channel and point bars. Based on a review of the aerial imagery from 1985 to current, river morphology has remained relatively constant throughout the Assessment Area. Vegetated bars, low-lying shoreline, and dark green vegetation signatures were evident in select areas along the reservoir's shoreline within the aerial imagery and indicate the presence of wetland resources within the Assessment Area.

3.1.3 Soils

Eight NRCS soil units and two other areas have been mapped within the Assessment Area in areas determined to be wetland during a field investigation conducted during May 2023. The two non-soil map units included "Water" and "Denied Access" where NRCS soil mapping were not available due to property access. The NRCS mapped units are listed in Table 1 and illustrated in Figure 3. Soils within these areas are generally formed in alluvium along floodplains, stream terraces, mountains, and valleys. One of the soil map units is rated as hydric by NRCS and occupies approximately 52% of the identified wetland areas.

TABLE 1 ON-SITE SOIL MAP UNITS

SOIL MAP UNIT NAME	SOIL MAP UNIT CODE	LANDFORM	DRAINAGE CLASS	HYDRIC RATING	PERCENT OF WETLAND AREAS
Riverwash	200	Floodplains	--	Yes (2 percent of map unit hydric)	52.5
Rock outcrop-Specie, extremely stony-Wilde, extremely stony, families, complex, stream breaklands	26UA	--	--	No	1.6
Bigarm gravelly loam, alluvial, 30 to 50 percent slopes	350F	Hills	Somewhat excessively drained	No	0.1
Oldtrail-Glaciercreek-Larchpoint complex, 0 to 8 percent slopes	41B	Floodplains, mountains	Moderately well drained	No	0.4
Selon fine sandy loam, moist, 0 to 4 percent slopes	421B	Mountains, stream terraces	Well drained	No	3.7
Elkrock gravelly ashy silt loam, moist, 0 to 4 percent slopes	472B	Stream terraces, valleys	Somewhat excessively drained	No	0.8
Elkrock-Selon complex, 4 to 15 percent slopes	473D	Stream terraces	Somewhat excessively drained	No	1.3
Horseplains fine sandy loam, 0 to 2 percent slopes	93A	Floodplains, mountains	Somewhat excessively drained	No	4.3
Denied access	DA	--	--	--	25.1
Water	W	--	--	--	10.2

3.1.4 Wetlands

The NWI data for the Assessment Area in the vicinity of the identified wetlands is provided in Figure 4. Ten types of NWI wetland were mapped within the identified wetlands within the Assessment Area and include one type of lacustrine, six types of palustrine, and three types of riverine systems specifically classified as:

- Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (L1UBHh)
- Palustrine, Emergent, Persistent, Temporarily Flooded (PEM1A)
- Palustrine, Emergent, Persistent, Temporarily Flooded, Diked/Impounded (PEM1Ah)
- Palustrine, Emergent, Persistent, Seasonally Flooded (PEM1C)
- Palustrine, Emergent, Persistent, Semipermanently Flooded (PEM1F)
- Palustrine, Forested, Broad-Leaved Deciduous, Temporary Flooded (PFO1A)
- Palustrine, Scrub-Shrub, Temporarily Flooded (PSSA)
- Riverine, Upper Perennial, Unconsolidated Shore, Seasonally Flooded (R3USC)
- Riverine, Upper Perennial, Unconsolidated Shore, Temporary Flooded (R3USA)

- Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded (R3UBH)

NWI data are typically based on aerial photography interpretation and are not always ground-truthed.

Mapped wetlands are identified throughout the length of the Assessment Area. Open water within the Clark Fork River is generally mapped as R3UBH. Open water within one mile upstream of the dam has been mapped as lacustrine (L1UBHh) and is strongly influenced by the dam impoundment. Wetland fringe areas around R3UBH are mapped along some of the island areas and in low-lying areas of shoreline as a mix of palustrine emergent, scrub-shrub, and forested wetland habitats. In most cases along the islands and shorelines, areas mapped as palustrine forest consist of cottonwoods (*Populus spp*.), firs (*Abies* spp.), spruce (*Picea* spp.) and pines (*Pinus* spp.) growing in upland habitat. Similarly, areas mapped as scrub-shrub commonly consisted of alders (*Alnus* spp.), dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana*), rose (*Rosa* spp.), snowberry (*Symphoricarpos* spp.), Rocky Mountain juniper (*Juniperus scopulaorum*), and other upland woody shrubs. These areas commonly consisted of steeply-sloped banks with no apparent wetland hydrology.

As noted in the methods above, the NWI data was used to provide a foundation for field efforts and areas identified as NWI wetlands within the Assessment Area were targeted during the field investigation. Several areas mapped as wetland habitat by NWI were determined to be upland habitat during the field investigation.

3.1.5 Waterways

Although waterways were not surveyed as part of this wetland assessment, USGS topographical mapping and NHD data were evaluated to identify potential waterway features within the Assessment Area (Figure 1 and Figure 4, respectively). Waterway features within the Assessment Area are briefly discussed in Section 3.1.1.

3.1.6 Floodplains

FEMA floodplain data were evaluated to identify potential wetlands and waterways. The Assessment Area is located on FIRM Panels 30089C1375D and 30089C1400D (FEMA 2012). The majority of the site is mapped as flood hazard zone A. Zone A sites have a one percent annual chance of flooding. Based on the field survey and proximity of the wetland areas to the existing water surface, many of these areas appear to experience periodic flooding/inundation.

3.1.7 Antecedent Precipitation

Results of the APT analysis for the latitude and longitude of the Assessment Area are provided in Appendix A. Based on this analysis, “Drier than Normal” conditions were present at the time of the field survey. The drought index indicated that moderate drought conditions were present during this field survey, conducted during the wet season.

3.2 Field Investigation

A Professional Wetland Scientist (PWS) with POWER completed an on-site field investigation on May 2, 2023, to identify wetlands associated with the Assessment Area. The average reservoir elevation from 7am to 7pm on May 2 was 2,396.3 feet above mean seas level with a range from 2,395.9 to 2,396.6 The results of the investigation are discussed below.

Photographs and associated field observations of the vegetation, hydrology, and delineated wetland features identified within the Assessment Area are included as Appendix B. The location of wetland determination sampling points and the extent of the wetland boundaries that were identified in the field are depicted on Figure 5 at the end of this report. Completed USACE wetland determination data forms, for both wetland and adjacent upland areas, are provided in Appendix C.

3.2.1 Wetland Findings

Table 2 provides a summary for the wetland areas delineated within the Assessment Area. Details regarding observed wetland criteria are provided on the USACE wetland determination forms. Fourteen wetlands were delineated within the Assessment Area, totaling 11.33 acres of wetland habitat. In general, these wetland areas represent a narrow, vegetated fringe along the OHWM of the Thompson Falls Reservoir and are commonly found along the lower terraces and islands within the Assessment Area. These wetland areas generally share common characteristics and have been grouped for the purpose of discussion based on the source for wetland hydrology. The two general categories for the 14 wetland areas include Group 1 with wetland hydrology solely provided by water elevations within the reservoir and Group 2 which derive some level of hydrology for tributaries of the Clark Fork River. These two groups are discussed below.

TABLE 2 SUMMARY DATA FOR WETLANDS

WETLAND/ WATERWAY ID	WETLAND TYPE[1]	WETLAND TYPE (HGM)[2]	SIZE (ACRES)	LOCATION (LAT/LONG)
Wetland 1 (WL-1)	PEM1A	Lacustrine	2.67	47.567594 -115.170191
Wetland 2 (WL-2)	PEM1A	Lacustrine/Riverine	0.30	47.568338 -115.172296
Wetland 3 (WL-3)	PEM1A	Lacustrine	3.41	47.570334 -115.170783
Wetland 4 (WL-4)	PEM1A	Lacustrine	0.61	47.575110 -115.197502
Wetland 5 (WL-5)	PEM1A	Lacustrine/Riverine	0.21	47.575009 -115.222833
Wetland 6 (WL-6)	PEM1A	Lacustrine	0.59	47.576939 -115.240836
Wetland 7 (WL-7)	PEM1A	Lacustrine/Riverine	0.05	47.566325 -115.269681
Wetland 8 (WL-8)	PEM1A	Lacustrine	0.04	47.581088 -115.319736
Wetland 9a/b (WL-9a/b)	PEM1A	Lacustrine	2.74	47.581326 -115.324284
Wetland 10 (WL-10)	PEM1A	Lacustrine	0.26	47.583343 -115.323203
Wetland 11 (WL-11)	PEM1A	Lacustrine	0.03	47.583935 -115.324840
Wetland 12 (WL-12)	PEM1A	Lacustrine	0.20	47.585195 -115.330850
Wetland 13a/b (WL-13a/b)	PEM1A	Lacustrine	0.10	47.590272 -115.325960
Wetland 14 (WL-4)	PEM1A	Lacustrine	0.12	47.592389 -115.339686
--			11.33	--

Note: PEM1A = Palustrine, Emergent, Persistent, Temporarily Flooded.
1 Cowardin et al. 1979
2 Brinson 1993

Wetland Group 1 (WL-1, 3, 4, 6, 8-14)

Wetland Group 1 (WG-1) includes all wetland habitat that appears to be directly supported by water elevations impounded by the Thompson Falls Dam and consists of eleven wetland areas that total 10.78 acres of palustrine emergent wetland habitat. These wetland habitats typically occupy low benches and narrow fringes along the water's edge. The wetland hydrology indicators observed within WG-1 included surface water, high water table, saturation, sediment deposits, geomorphic position, and a positive FAC-neutral test. Hydrophytic vegetation observed within WG-1 primarily included reed canary grass (*Phalaris arundinacea*, FACW) with lesser amounts of Baltic rush (*Juncus balticus*, FACW), broad-leaf cat-tail (*Typha latifolia*, OBL), pale-yellow iris (*Iris pseudacorus*, OBL), Northwest Territory sedge (*Carex utriculata*, OBL), common spike rush (*Eleocharis palustris*, OBL), and hard-stem club-rush (*Schoenoplectus acutus*, OBL).

The hydrophytic vegetation indicators included a positive rapid test for hydrophytic vegetation, a positive dominance test, and prevalence index within the range indicating the presence of hydrophytic vegetation. Adjacent uplands were generally characterized by Rocky Mountain bee plant (*Cleome serrulate*, UPL), Canada goldenrod (*Solidago canadensis*, FACU), slender wild rye (*Elymus trachycaulus*, FAC), blue wild rye (*Elymus glaucus*, FACU), smooth brome (*Bromus inermis*, UPL), common tansy (*Tanacetum vulgare*, FACU), Kentucky bluegrass (*Poa pratensis*, FAC), western meadow-rue (*Thalictrum occidentale*, FACU), great mullein (*Verbascum thapsus*, FACU), orchard grass (*Dactylis glomerata*, FACU), common yarrow (*Achillea millefolium*, FACU), and common dandelion (*Taraxacum officinale*, FACU). The hydric soil indicators observed within WG-1 included sandy redox and depleted matrix and commonly exhibited distinct redoximorphic concentrations starting within eight inches of the soil surface. All wetland areas within WG-1 were observed to be hydrologically connected to the Thompson Falls Reservoir and the Clark Fork River.

Wetland Group 2 (WL-2, 5, and 7)

Wetland Group 2 (WG-2) includes wetland habitat identified along the water's edge of the reservoir that receive supplemental wetland hydrology from surface water draining from adjacent slopes into the Clark Fork River. WG-2 includes three areas of palustrine emergent habitat (approximately 0.55 acre). Surface water observed draining from the steep mountain slopes through WL-2 was presumably determined to be Outlaw Creek, based on NHD interpretation. Wetland hydrology for WL-5 appeared to be sustained by both impounded surface water and intermittent stream flow contributed from surface runoff of the mountainside above. WL-7 was identified as a very small wetland depression at the mouth of Cherry Creek. The wetland hydrology indicators for WG-2 included surface water, saturation, drainage patterns, geomorphic position, and a positive FAC-neutral test. Dominant hydrophytic vegetation observed within WL-2 included pale-yellow iris and reed canary grass. The hydrophytic vegetation indicators included a positive rapid test for hydrophytic vegetation, a positive dominance test, and prevalence index within the range indicating the presence of hydrophytic vegetation. Adjacent uplands were generally characterized by blue wild rye, common tansy, western meadow-rue, and smooth brome. The hydric soil indicators observed within WL-2 included sandy redox and depleted matrix. All wetlands within WG-2 were observed to be hydrologically connected to the Thompson Falls Reservoir and the Clark Fork River.

3.2.2 Functional Assessment

The two wetland groups were assessed on separate MWAM forms and include WG-1 and WG-2. Completed forms are provided in Appendix D and a summary of wetland functions and value ratings is provided in Table 3. According to the functional assessments, both WGs were classified as Category III wetlands. Descriptions of each WG evaluation are provided below.

TABLE 3 MWAM FUNCTIONAL ASSESSMENT SUMMARY

Function and Value Parameters from the 2008 MDT Wetland Assessment Method[1]	Wetland Group 1		Wetland Group 2	
	WL-1, 3, 4, 6, 8-14		WL-2, 5, 7	
	Rating	Points	Rating	Points
Listed/Proposed T&E Species Habitat	Low	0	Low	0
MNHP State Species of Concern Habitat	Low	0	Low	0
General Wildlife Habitat	Moderate	0.7	Moderate	0.7
General Fish/Aquatic Habitat	N/A	--	N/A	--
Flood Attenuation	Moderate	0.5	High	0.8
Short and Long Term Surface Water Storage	High	0.9	Moderate	0.4
Sediment/Nutrient/Toxicant Removal	High	1	High	1
Sediment/Shoreline Stabilization	High	1.0	High	1.0
Production Export/Food Chain Support	Moderate	0.5	Moderate	0.7
Groundwater Discharge/Recharge	Moderate	0.7	High	1.0
Uniqueness	Low	0.3	Low	0.3
Recreation/Education Potential	Moderate	0.1	Moderate	0.1
Actual Points/Possible Points	5.7/10.0		6.0/10.0	
% of Possible Score Achieved	57%		60%	
Overall Category	III		III	
Total Acreage of Assessed Wetlands	10.78		0.55	
Function Unit Total (actual points x estimate AA acreage)	61.5		3.3	
Total Projected Function Units on this Project	64.8			

[1]See completed MDT functional assessment forms in Appendix D for detailed ratings.

WG-1

Wetland Group 1 consists of 11 wetland areas totaling 10.78 acres. According to the MWAM, WG-1 is a Category III wetland. WG-1 received low ratings for listed/proposed threatened and endangered (T&E) species, Montana Natural Heritage Program (MNHP) state species of concern (SOC) habitat, and uniqueness. Of note, the area assessed in WG-1 did not include habitat below the OHWM of the reservoir and therefore did not include bull trout or aquatic SOC habitat. WG-1 received moderate ratings for general wildlife habitat, flood attenuation, production export/food chain support, groundwater discharge/recharge, and recreation/education potential and high ratings for short and long term surface water storage, sediment/nutrient/toxicant removal, and sediment/shoreline stabilization. WG-1 received 5.7 out of 10 possible points (57%) and a total of 61.5 functional units.

WG-2

WG-2 consists of three wetland areas totaling 0.55 acres. According to the MWAM, WG-2 is a Category III wetland. WG-2 received low ratings for listed/proposed threatened and endangered (T&E) species, MNHP SOC habitat, and uniqueness. WG-2 received moderate ratings for general wildlife habitat, flood attenuation, production export/food chain support, and recreation/education potential and high ratings for short and long term surface water storage, sediment/nutrient/toxicant removal, sediment/shoreline stabilization, and groundwater discharge/recharge. WG-2 received 6.0 out of 10 possible points (60%) and a total of 3.3 functional units.

4.0 SUMMARY

POWER completed an assessment of wetland areas along an approximate 10-mile stretch of the Clark Fork River impounded by the Thompson Falls Dam within Sanders County, Montana. This assessment included wetland areas potentially affected by a water elevation change within the reservoir. Based on the NWI database and NWE personnel experience, 46 Assessment Areas were evaluated via motorboat on May 2, 2023. Based on the field investigation, several of these areas did not support wetland habitat.

A total of 14 wetland areas were delineated along the water's edge of the reservoir and included a few areas not within the initial investigation areas. Only wetland boundaries above the OHWM of the Thompson Falls Reservoir were surveyed. A total of 11.33 acres of palustrine emergent wetland habitat were delineated as part of this assessment. Wetland areas surveyed within the Assessment Area shared similar habitats, vegetation communities, and general functions and were evaluated based on similarities in wetland hydrology. WG-1 included areas where wetland hydrology was supported solely by water levels within the reservoir; WG-2 included areas that also received wetland hydrology from adjacent tributaries. Based on an assessment of functions and values of these two wetland groups, wetlands identified along the Assessment Area are classified as Category III based on the MWAM.

All wetlands identified within the Assessment Area were were observed to be hydrologically connected to the Thompson Falls Reservoir and the Clark Fork River. The preliminary wetland boundaries identified within the Assessment Area, and their assessments, are based on POWER's professional opinion. Any impacts to jurisdictional waters within the Assessment Area may require authorization under Sections 404 and 401 of the CWA. Current regulations may require authorization of any impacts to these features from the USACE and the Montana Department of Environmental Quality.

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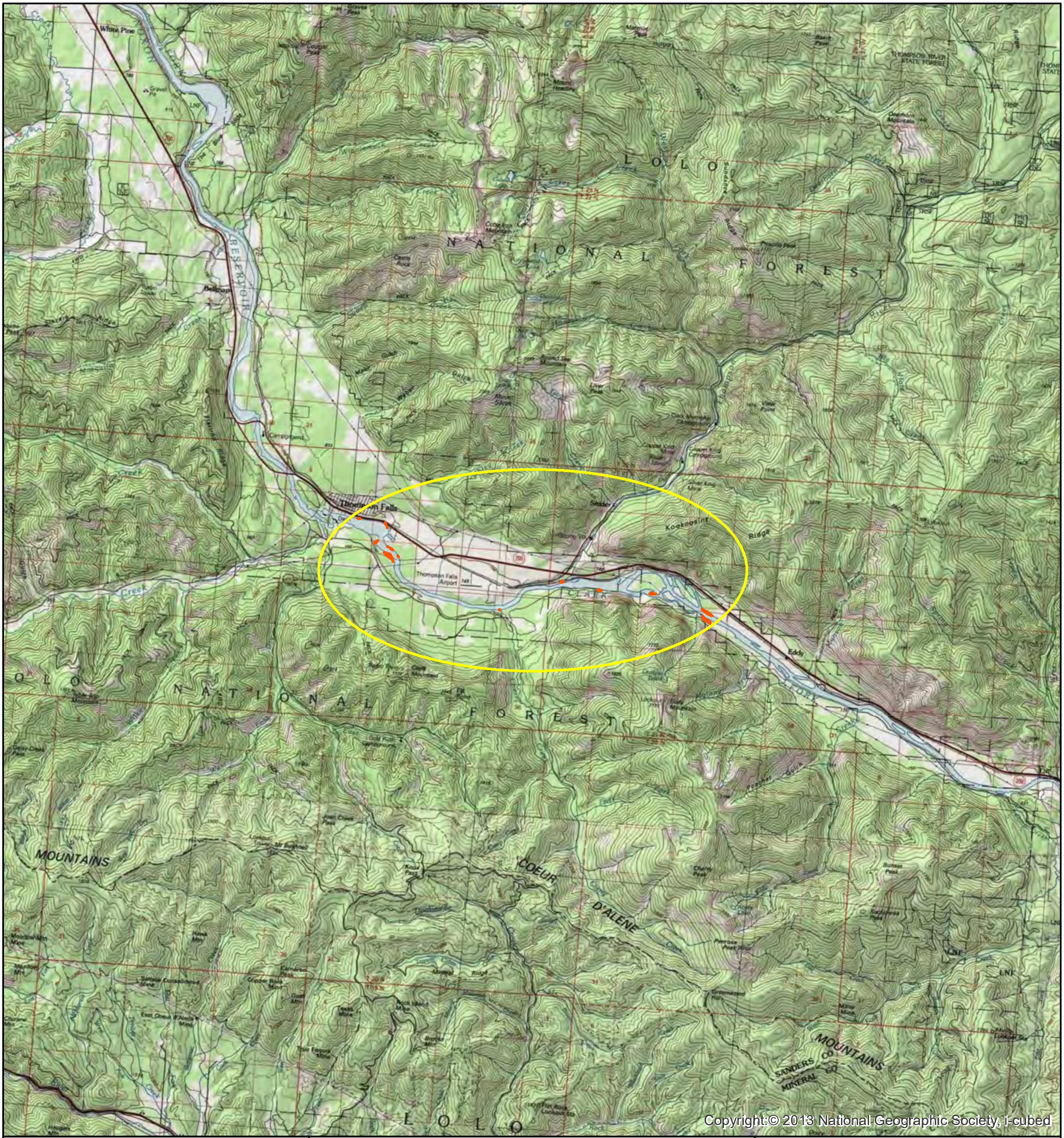
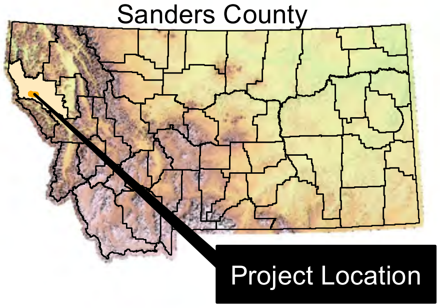




Legend

Approximate Investigation Area

Thompson Falls Reservoir Wetland Areas

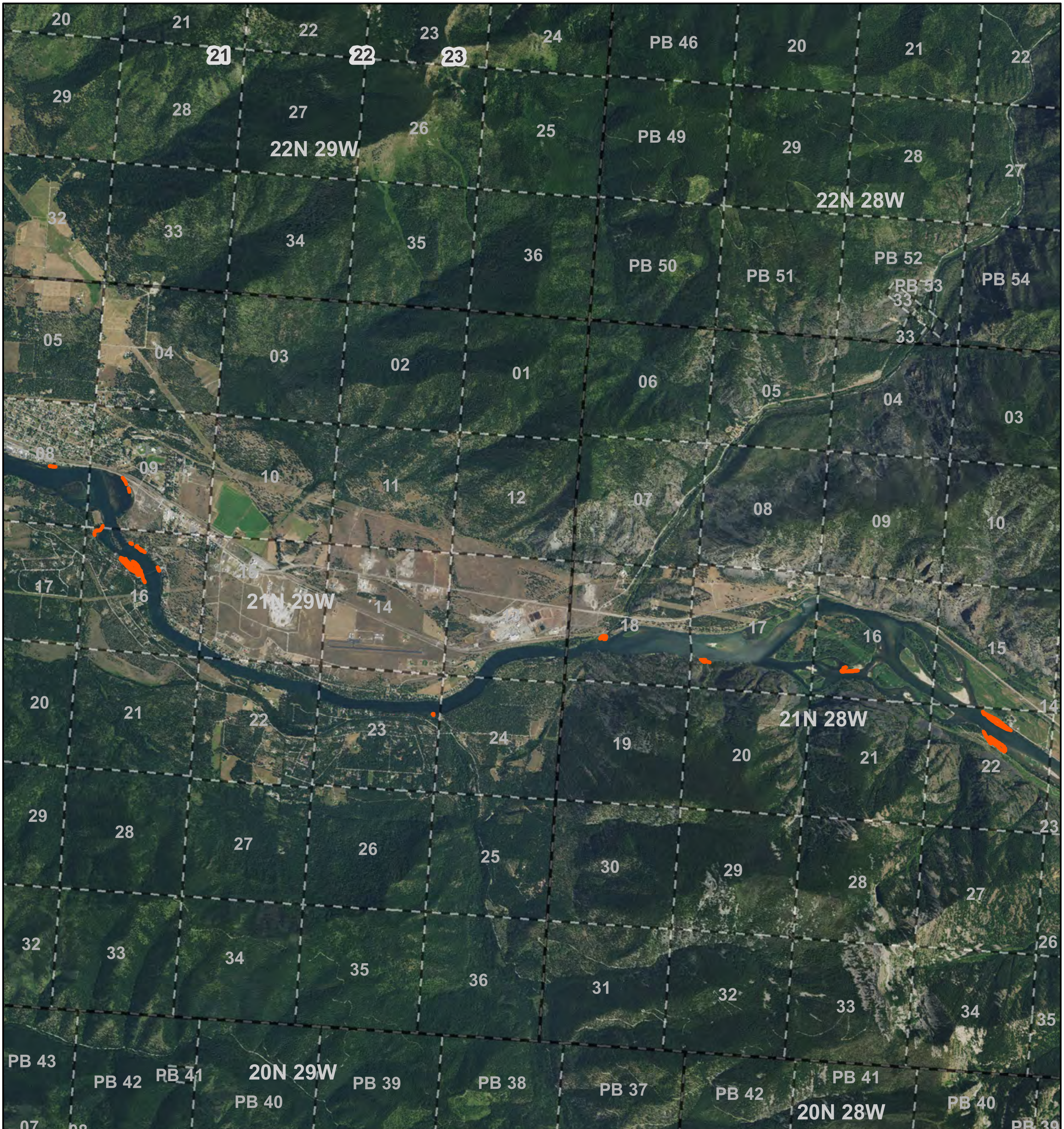
Thompson Falls

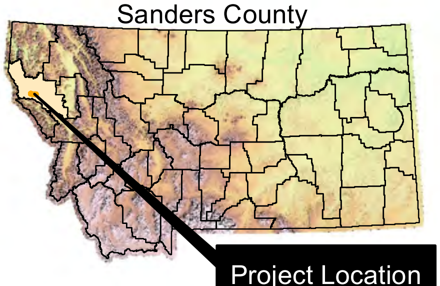
Figure 1:
Topographic/Vicinity Map

0 1.25 2.5 5
Miles

N

POWER ENGINEERS





Legend

- Thompson Falls Reservoir Wetland Areas
- PLSS Township
- PLSS Section

Thompson Falls

Figure 2:
2019 NAIP Map

0 0.5 1 2
Miles

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

200 - Riverwash

421B - Selon fine sandy loam, moist, 0 to 4 percent slopes

W - Water

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 1 of 8

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

200 - Riverwash

W - Water

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 2 of 8

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

26UA - Rock outcrop-Specie, extremely stony-Wilde, extremely stony, families, complex, stream break*

W - Water

MAP 3 of 8

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

350F - Bigarm gravelly loam, alluvial, 30 to 50 percent slopes

93A - Horseplains fine sandy loam, 0 to 2 percent slopes

W - Water

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

41B - Oldtrail-Glaciercreek-Larchpoint complex, 0 to 8 percent slopes

MAP 5 of 8

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

421B - Selon fine sandy loam, moist, 0 to 4 percent slopes

472B - Elkrock gravelly ashy silt loam, moist, 0 to 4 percent slopes

DA - Denied access

W - Water

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

472B - Elkrock gravelly ashy silt loam, moist, 0 to 4 percent slopes

473D - Elkrock-Selon complex, 4 to 15 percent slopes

DA - Denied access

W - Water

Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 7 of 8

Legend

Thompson Falls Reservoir Wetland Areas

NRCS Soils

473D - Elkrock-Selon complex, 4 to 15 percent slopes

W - Water

MAP 8 of 8

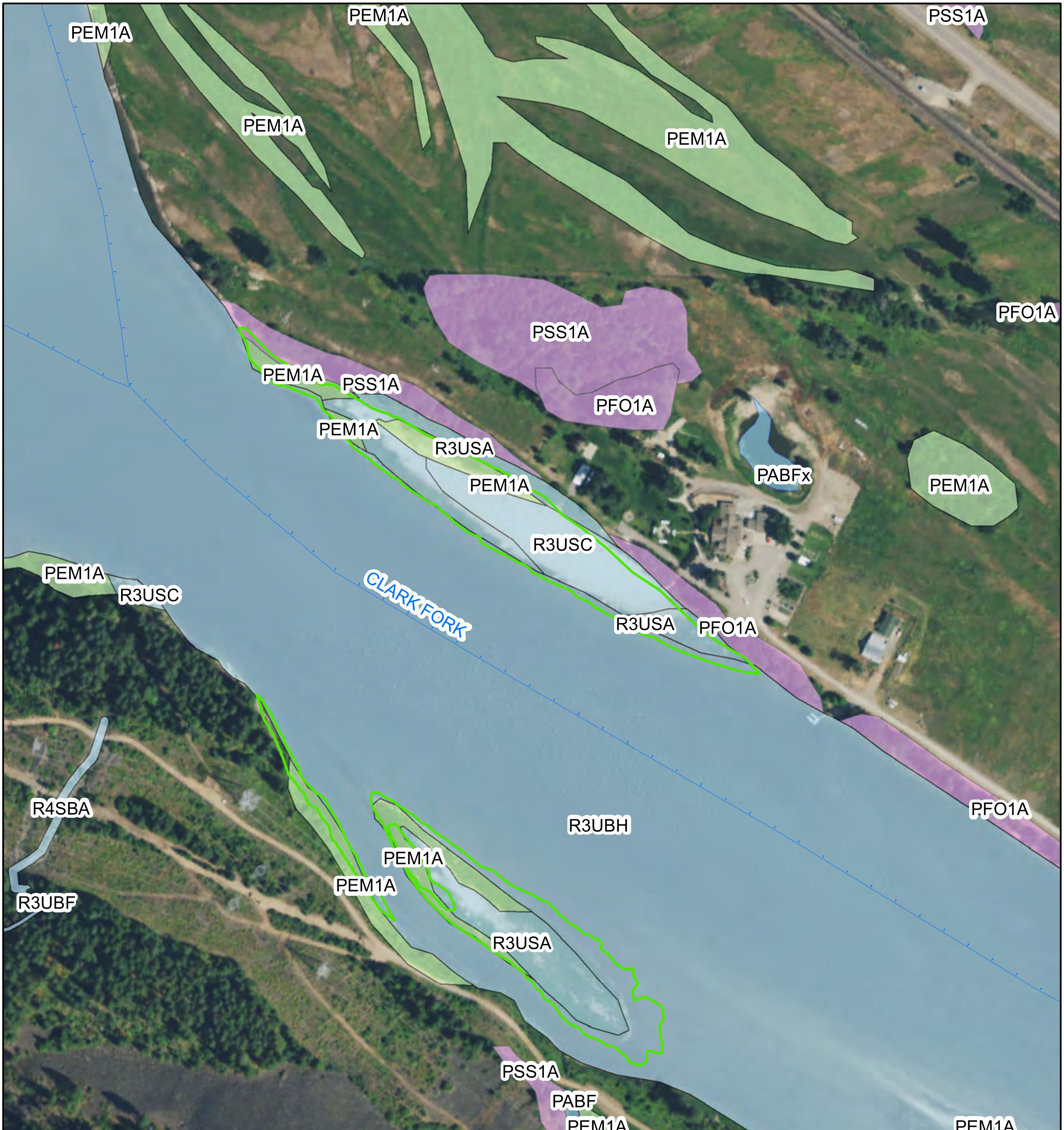
Thompson Falls

Figure 3:
NRCS Soils Map

0 125 250 500
Feet

N

POWER ENGINEERS



Legend

Thompson Falls Reservoir Wetland Areas

Artificial Path

NWI Wetland Type

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

Freshwater Pond

Riverine

MAP 1 of 8

Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

- Thompson Falls Reservoir Wetland Areas
- Perennial Stream/River
- Artificial Path

NWI Wetland Type

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

MAP 2 of 8

Thompson Falls

Figure 4:
NWI/NHD Map

POWER ENGINEERS

Legend

- Thompson Falls Reservoir Wetland Areas
- Intermittent Stream/River
- Artificial Path

NWI Wetland Type

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Riverine

MAP 3 of 8

Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

Artificial Path

NWI Wetland Type

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

Riverine

MAP 4 of 8

Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

- Thompson Falls Reservoir Wetland Areas
- Intermittent Stream/River
- Perennial Stream/River
- Artificial Path

NWI Wetland Type

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Riverine

MAP 5 of 8

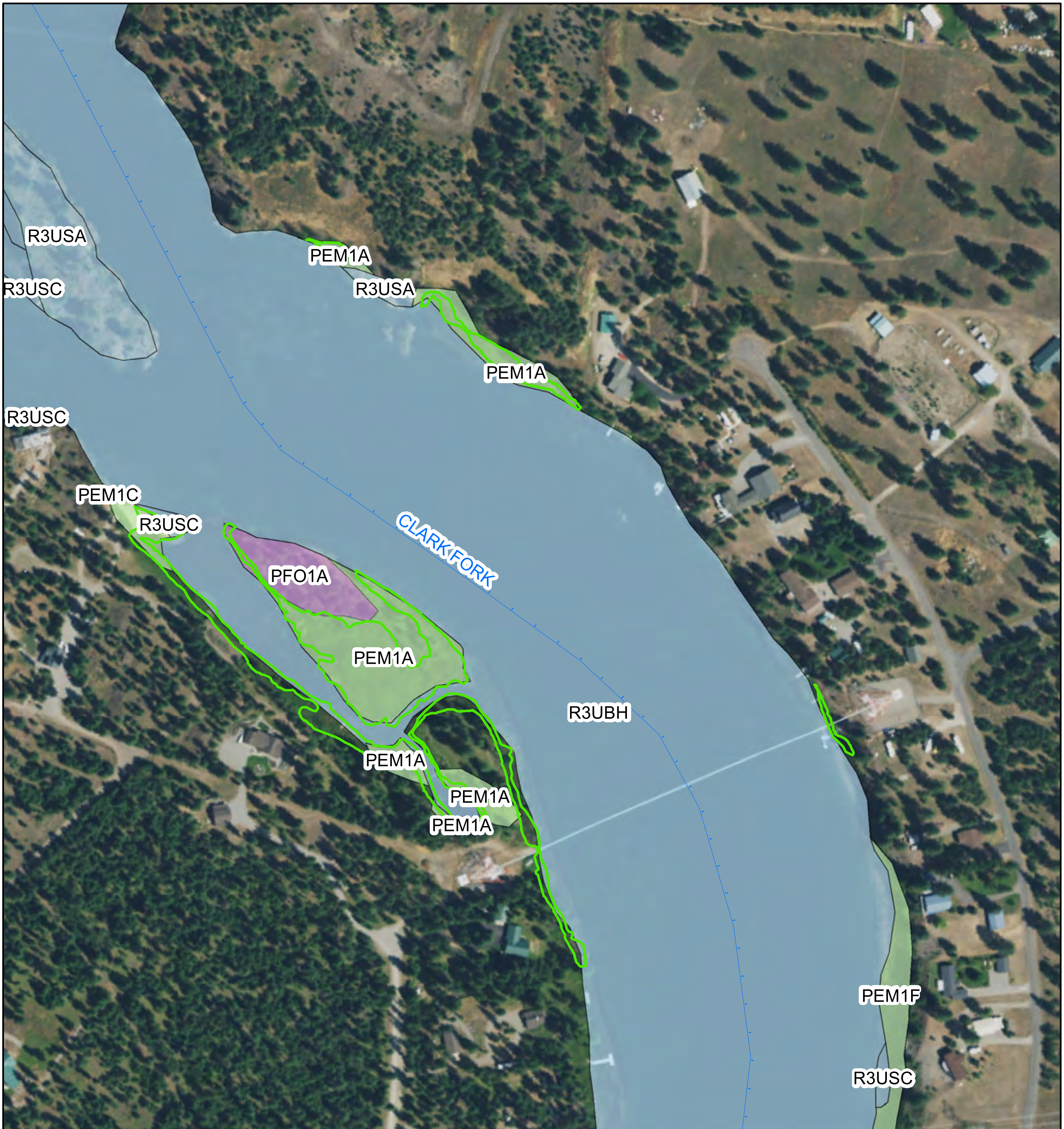
Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS



Legend

Thompson Falls Reservoir Wetland Areas

Artificial Path

NWI Wetland Type

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

Riverine

Thompson Falls

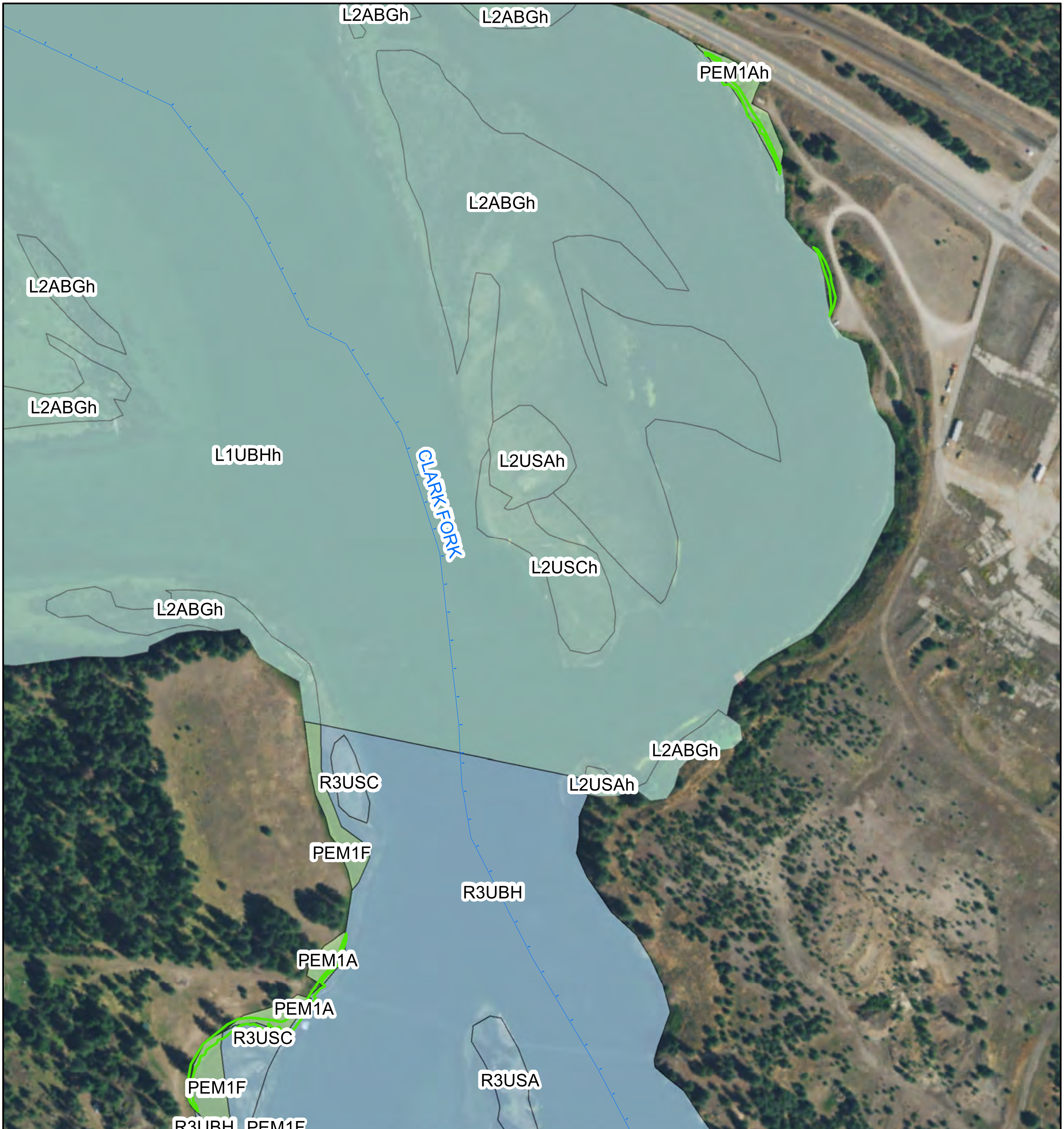
Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 6 of 8



Legend

Thompson Falls Reservoir Wetland Areas

Artificial Path

NWI Wetland Type

Freshwater Emergent Wetland

Lake

Riverine

Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500

Feet

N

POWER ENGINEERS

MAP 7 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Artificial Path

NWI Wetland Type

Freshwater Emergent Wetland

Lake

MAP 8 of 8

Thompson Falls

Figure 4:
NWI/NHD Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

MAP 1 of 8

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 2 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 3 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 4 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 5 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

MAP 6 of 8

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

0 125 250 500
Feet

N

POWER ENGINEERS

Legend

Thompson Falls Reservoir Wetland Areas

Thompson Falls

Figure 5:
Surveyed Wetlands Map

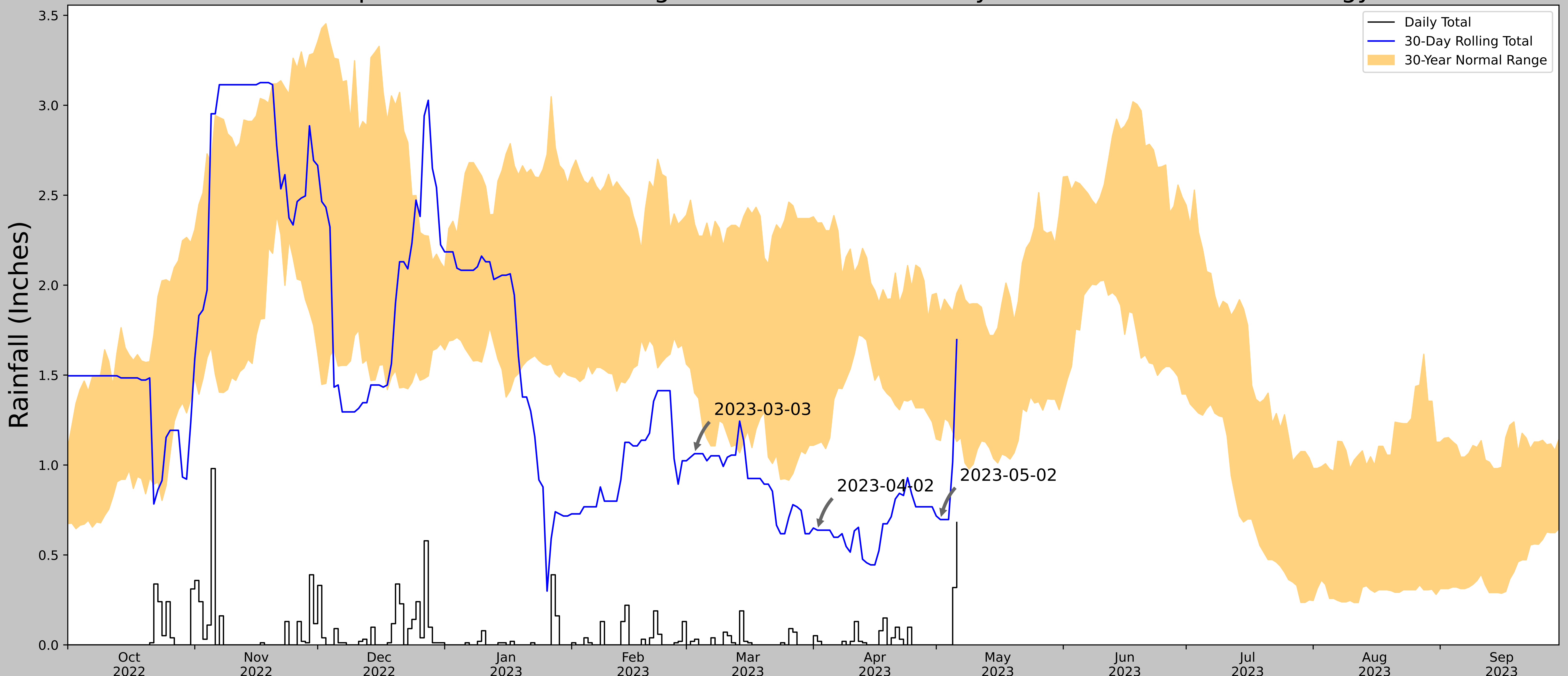
0 125 250 500
Feet

N

POWER ENGINEERS

APPENDIX A ANTECEDENT PRECIPITATION TOOL RESULTS

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	47.568362, -115.171635
Observation Date	2023-05-02
Elevation (ft)	2402.827
Drought Index (PDSI)	Moderate drought (2023-04)
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-05-02	1.136614	1.844488	0.69685	Dry	1	3	3
2023-04-02	1.119291	2.345276	0.637795	Dry	1	2	2
2023-03-03	1.401181	2.338583	1.062992	Dry	1	1	1
Result							Drier than Normal - 6

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
THOMPSON FALLS PH	47.5933, -115.3594	2379.921	8.919	22.906	4.218	11091	89
THOMPSON FALLS 9.3 NW	47.6939, -115.4767	2595.144	8.839	215.223	5.88	185	1
TROUT CREEK RS	47.8664, -115.6272	2410.105	22.604	30.184	10.854	70	0
HAUGAN 1 W	47.3889, -115.4225	3160.105	14.427	780.184	17.748	6	0
PLAINS 5.2 N	47.536, -114.8893	2894.029	22.271	514.108	21.472	1	0

APPENDIX B PHOTOGRAPHS

Photo 1: View northwest at SP1, wetland data point within WL-1.

Photo 2: View southeast at SP2, upland data point.

Photo 3: View south at SP3, wetland data point within WL-2.

Photo 4: View north at SP4, upland data point.

Photo 5: View southeast at SP5,wetland data point within WL-3.

Photo 6: View southwest at SP6, upland data point.

Photo 7: View east at SP7, wetland data point within WL-4.

Photo 8: View east at SP8, upland data point.

Photo 9: View west at SP9, wetland data point within WL-5.

Photo 10: View south at SP10, upland data point.

Photo 11: View west at SP11, wetland data point within WL-6.

Photo 12: View south at SP12, upland data point.

Photo 13: View northwest at SP13, wetland data point within WL-7.

Photo 14: View west at SP14, upland data point.

Photo 15: View southwest at SP15, wetland data point WL-8.

Photo 16: View west at SP16, upland data point.

Photo 17: View west at SP17, wetland data point within WL-9a.

Photo 18: View east at SP18, upland data point.


Photo 19: View west at SP19, wetland data point within WL-10.


Photo 20: View southwest at SP20, upland data point.


Photo 21: View south at SP21, wetland data point within WL-11.


Photo 22: View south at SP22, upland data point.


Photo 23: View southeast at WL-1.


Photo 24: View south at WL-2.

Photo 25: View northwest at WL-3.

Photo 26: View west at WL-5.

Photo 27: View north at WL-8.

Photo 28: View northwest at WL-9a.

Photo 29 View north at WL-9b.

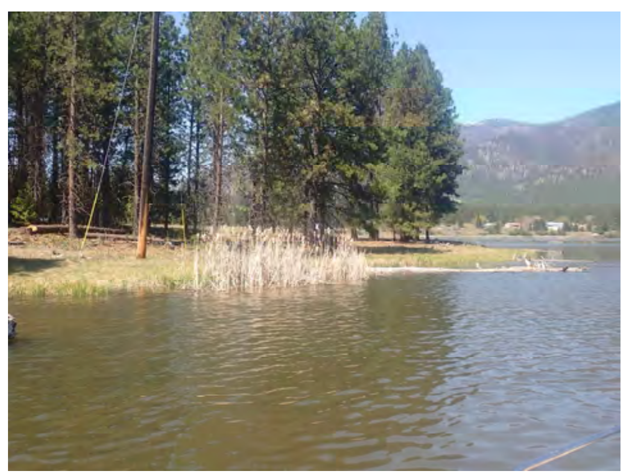


Photo 30: View west at WL-12.

Photo 31: View north at WL-13a.

Photo 32: View north at WL-13b.

Photo 33: View east at WL-14.

APPENDIX C USACE WETLAND DETERMINATION DATA SHEETS

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP1
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Bank/water's edge | Local relief (concave, convex, none): Convex | Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.568362 | Long: -115.171635 | Datum: WGS84
Soil Map Unit Name: 200-Riverwash | NWI classification: PEM1A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	
Is the Sampled Area within a Wetland?	**X**	

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	80	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	20		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)

Total Number of Dominant Species Across All Strata: **1** (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**80**	x 2 = **160**
FAC species	**0**	x 3 = **0**
FACU species	**0**	x 4 = **0**
UPL species	**0**	x 5 = **0**
Column Totals:	**80** (A)	**160** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

- X 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

SOIL

Sampling Point: SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/2	100	None		—	—	Sand	
6-12	10YR 7/2	95	10YR 4/6	5	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:
A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
X Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
____ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
A positive indication of wetland hydrology was observed (at least one primary indicator).
A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP2
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Island Local relief (concave, convex, none): Convex Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.568219 Long: -115.171553 Datum: WGS84
Soil Map Unit Name: 200-Riverwash NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	15	Yes	FACU
2.			
3.			
4.			
5.			
= Total Cover	15		
Herb Stratum (Plot size: 5 ft.)			
1. *Cleome serrulata*	40	Yes	UPL
2. *Solidago canadensis*	20	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	60		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 40			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**0**	x 2 = **0**
FAC species	**0**	x 3 = **0**
FACU species	**35**	x 4 = **140**
UPL species	**40**	x 5 = **200**
Column Totals:	**75** (A)	**340** (B)
Prevalence Index = B/A =	**4.53**	

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 5/3	100	None		—	—	Sand	
5-16	10YR 7/3	100	None	—	—	—	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth(inches): ____________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP3
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Linear Slope Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.568306 Long: -115.172285 Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam, moist, 0 to 4% slopes NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Iris pseudacorus*	20	Yes	OBL
2. *Phalaris arundinacea*	80	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.00%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	100 (A)	180 (B)

Prevalence Index = B/A = 1.80

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP3

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100	None		—	—	Loamy Sand	
6-16	10YR 5/2	95	10YR 4/6	5	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___
Depth(inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

X Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) **(LRR A)**
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
X Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) **(LRR A)**
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): **0.5**
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? Yes X No ___ Depth (inches): **0**
(includes capillary fringe)

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP4
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Upper terrace Local relief (concave, convex, none): Convex Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.568252 Long: -115.172252 Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam, moist, 0 to 4% slopes NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ____
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No **X**
Hydric Soil Present?	Yes ____	No **X**
Wetland Hydrology Present?	Yes ____	No **X**

Is the Sampled Area within a Wetland? **Yes** ____ **No** **X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	20	Yes	FACU
2.			
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size: 5 ft.)			
1. *Tanacetum vulgare*	20	Yes	FACU
2. *Elymus glaucus*	50	Yes	FACU
3. *Thalictrum occidentale*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	**0**	x 1 =	**0**
FACW species	**0**	x 2 =	**0**
FAC species	**0**	x 3 =	**0**
FACU species	**100**	x 4 =	**400**
UPL species	**0**	x 5 =	**0**
Column Totals:	**100** (A)		**400** (B)

Prevalence Index = B/A = **4.00**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** **X**

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/2	100	None		—	—	Loamy Sand	
4-8	10YR 5/2	100	None	—	—	—	Sandy Loam	
8-18	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? Yes ____ No X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment   City/County: Sanders Co.   Sampling Date: 05/02/2023
Applicant/Owner: NWE   State: MT   Sampling Point: SP5
Investigator(s): Brian Sandefur, PWS   Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Lower terrace   Local relief (concave, convex, none): Concave   Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62   Lat: 47.571263   Long: -115.173182   Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam, moist, 0 to 4% slopes   NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed?   Are "Normal Circumstances" present? Yes X No ____
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No
Hydric Soil Present?	Yes X	No
Wetland Hydrology Present?	Yes X	No

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	80	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	**0**	x 1 =	**0**
FACW species	**80**	x 2 =	**160**
FAC species	**0**	x 3 =	**0**
FACU species	**0**	x 4 =	**0**
UPL species	**0**	x 5 =	**0**
Column Totals:	**80** (A)		**160** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

SOIL

Sampling Point: SP5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	100	None		—	—	Loamy Sand	
6-16	10YR 5/2	95	10YR 6/6	5	C	M	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:
A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
X Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
____ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
A positive indication of wetland hydrology was observed (at least one primary indicator).
A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP6
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 22, T21N, R28W
Landform (hillslope, terrace, etc.): Upper terrace | Local relief (concave, convex, none): Linear Slope | Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.571289 | Long: -115.173074 | Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam, moist, 0 to 4% slopes | NWI classification: PSS1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		**X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	20	Yes	FACU
2. *Symphoricarpos albus*	30	Yes	FACU
3.			
4.			
5.			
= Total Cover	50		
Herb Stratum (Plot size: 5 ft.)			
1. *Cleome serrulata*	40	Yes	UPL
2. *Elymus trachycaulus*	25	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	65		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 35			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **4** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **25.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	25	x 3 = 75
FACU species	50	x 4 = 200
UPL species	40	x 5 = 200
Column Totals:	115 (A)	475 (B)

Prevalence Index = B/A = **4.13**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

Sampling Point: SP6

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/2	100	None		—	—	Sandy Loam	
8-16	10YR 5/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________
Depth(inches): ________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP7
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R28W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Convex Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.575020 Long: -115.198447 Datum: WGS84
Soil Map Unit Name: 200-Riverwash NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes **X**	No ___
Hydric Soil Present?	Yes **X**	No ___
Wetland Hydrology Present?	Yes **X**	No ___

Is the Sampled Area within a Wetland? **Yes X** **No** ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	80	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **1** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**80**	x 2 = **160**
FAC species	**0**	x 3 = **0**
FACU species	**0**	x 4 = **0**
UPL species	**0**	x 5 = **0**
Column Totals:	**80** (A)	**160** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X** **No** ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP7

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/2	100	None		—	—	Loamy Sand	
4-16	10YR 5/2	95	10YR 4/6	5	C	M	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth(inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP8
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R28W
Landform (hillslope, terrace, etc.): Upper terrace Local relief (concave, convex, none): Convex Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.575076 Long: -115.198442 Datum: WGS84
Soil Map Unit Name: 200-Riverwash NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Cleome serrulata*	20	Yes	UPL
2. *Elymus glaucus*	40	Yes	FACU
3. *Phalaris arundinacea*	20	Yes	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	33.33%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	20	x 2 = 40
FAC species	0	x 3 = 0
FACU species	40	x 4 = 160
UPL species	20	x 5 = 100
Column Totals:	80 (A)	300 (B)
Prevalence Index = B/A =	3.75	

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

Sampling Point: SP8

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/2	100	None		—	—	Loamy Sand	
8-16	10YR 6/3	100	None	—	—	—	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP9
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 17, T21N, R28W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Linear Slope Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.575116 Long: -115.223190 Datum: WGS84
Soil Map Unit Name: 26UA-Rock outcrop NWI classification: PSS1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	80	Yes	FACW
2. *Iris pseudacorus*	10	No	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	90		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	10		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.00% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	10	x 1 = 10
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	90 (A)	170 (B)

Prevalence Index = B/A = 1.89

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP9

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	100	None		—	—	Loamy Sand	
6-12	10YR 5/2	95	10YR 4/6	5	C	M	Loamy Sand	
12-16	10YR 7/2	90	10YR 4/6	10	C	M	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth(inches): ______

Hydric Soil Present? **Yes** X **No** ______

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches):
Surface Water Present?		X	
Water Table Present?		X	
Saturation Present? (includes capillary fringe)	X		8

Wetland Hydrology Present? **Yes** X **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP10
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 17, T21N, R28W
Landform (hillslope, terrace, etc.): Upper terrace Local relief (concave, convex, none): Convex Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.575070 Long: -115.223101 Datum: WGS84
Soil Map Unit Name: 26UA-Rock outcrop NWI classification: PSS1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Cornus alba*	40	Yes	FACW
2.			
3.			
4.			
5.			
= Total Cover	40		
Herb Stratum (Plot size: 5 ft.)			
1. *Elymus glaucus*	60	Yes	FACU
2. *Phalaris arundinacea*	20	Yes	FACW
3. *Bromus inermis*	20	Yes	UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **2** (A)
Total Number of Dominant Species Across All Strata: **4** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **50.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	60	x 2 =	120
FAC species	0	x 3 =	0
FACU species	60	x 4 =	240
UPL species	20	x 5 =	100
Column Totals:	140 (A)		460 (B)

Prevalence Index = B/A = **3.29**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/3	100	None		—	—	Sandy Loam	
6-16	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ____ 2 cm Muck (A10)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres along Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) **(LRR A)**
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)
- ____ Raised Ant Mounds (D6) **(LRR A)**
- ____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP11
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 18, T21N, R28W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Linear Slope Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.576957 Long: -115.240738 Datum: WGS84
Soil Map Unit Name: W-Water NWI classification: R3USC
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	70	Yes	FACW
2. *Juncus balticus*	10	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	20		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **1** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	**0**	x 1 =	**0**
FACW species	**80**	x 2 =	**160**
FAC species	**0**	x 3 =	**0**
FACU species	**0**	x 4 =	**0**
UPL species	**0**	x 5 =	**0**
Column Totals:	**80** (A)		**160** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

- X 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP11

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100	None		—	—	Sand	
4-12	10YR 4/2	95	10YR 4/6	5	C	M	Loamy Sand	
12-16	10YR 6/2	90	10YR 4/6	10	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth(inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	X		**0.5**
Water Table Present?	X		**0**
Saturation Present? (includes capillary fringe)	X		**0**

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment   City/County: Sanders Co.   Sampling Date: 05/02/2023
Applicant/Owner: NWE   State: MT   Sampling Point: SP12
Investigator(s): Brian Sandefur, PWS   Section, Township, Range: Sec. 18, T21N, R28W
Landform (hillslope, terrace, etc.): Island   Local relief (concave, convex, none): Convex   Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62   Lat: 47.576982   Long: -115.240658   Datum: WGS84
Soil Map Unit Name: 93A-Horseplains fine sandy loam, 0 to 2% slopes   NWI classification: PSS1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed?   Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		**X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Alnus incana*	15	Yes	FACW
2. *Cornus alba*	10	Yes	FACW
3.			
4.			
5.			
= Total Cover	25		
Herb Stratum (Plot size: 5 ft.)			
1. *Elymus glaucus*	30	Yes	FACU
2. *Achillea millefolium*	10	No	FACU
3. *Bromus inermis*	30	Yes	UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	70		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 30			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **2** (A)
Total Number of Dominant Species Across All Strata: **4** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **50.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**25**	x 2 = **50**
FAC species	**0**	x 3 = **0**
FACU species	**40**	x 4 = **160**
UPL species	**30**	x 5 = **150**
Column Totals:	**95** (A)	**360** (B)

Prevalence Index = B/A = **3.79**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** **X**

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-8	10YR 4/3	100	None		—	—	Loamy Sand	
8-16	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________
Depth(inches): ________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	
Water Table Present?		X	
Saturation Present? (includes capillary fringe)		X	

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP13
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 23, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Concave Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.566326 Long: -115.269690 Datum: WGS84
Soil Map Unit Name: 41B-Oldtrail-Glaciercreek-Larchpoint complex NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___	**Is the Sampled Area within a Wetland?** **Yes X No ___**
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes X	No ___	

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Phalaris arundinacea*	80	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**80**	x 2 = **160**
FAC species	**0**	x 3 = **0**
FACU species	**0**	x 4 = **0**
UPL species	**0**	x 5 = **0**
Column Totals:	**80** (A)	**160** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ___**

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

SOIL

Sampling Point: SP13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100	None		—	—	Sandy Loam	
5-15	10YR 5/2	95	10YR 4/6	5	C	M	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______
Depth(inches): ______

Hydric Soil Present? **Yes** _X_ **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) **(LRR A)**
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
_X_ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
_X_ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) **(LRR A)**
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No _X_ Depth (inches): ___
Water Table Present? Yes ___ No _X_ Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes ___ No _X_ Depth (inches): ___

Wetland Hydrology Present? **Yes** _X_ **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP14
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 23, T21N, R29W
Landform (hillslope, terrace, etc.): Slope | Local relief (concave, convex, none): Linear Slope | Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.566295 | Long: -115.269758 | Datum: WGS84
Soil Map Unit Name: 41B-Oldtrail-Glaciercreek-Larchpoint complex | NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Tanacetum vulgare*	20	Yes	FACU
2. *Bromus inermis*	60	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	20		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	20	x 4 = 80
UPL species	60	x 5 = 300
Column Totals:	80 (A)	380 (B)

Prevalence Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

Sampling Point: SP14

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/2	100	None		—	—	Loamy Sand	
8-16	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:
No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP15
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace | Local relief (concave, convex, none): Concave | Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.581226 | Long: -115.319855 | Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam | NWI classification: Non-Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Typha latifolia*	80	Yes	OBL
2. *Iris pseudacorus*	10	No	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	90		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	10		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.00% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	90	x 1 = 90
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	90 (A)	90 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

SOIL

Sampling Point: SP15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100	None		—	—	Loamy Sand	
6-12	10YR 5/2	95	10YR 4/6	5	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth(inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No	X	Depth (inches):	___
Water Table Present?	Yes X	No	___	Depth (inches):	8
Saturation Present? (includes capillary fringe)	Yes X	No	___	Depth (inches):	4

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP16
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Upper terrace Local relief (concave, convex, none): Linear Slope Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.581176 Long: -115.319776 Datum: WGS84
Soil Map Unit Name: 421B-Selon fine sandy loam NWI classification: Non-Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	5	Yes	FACU
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: 5 ft.)			
1. *Bromus inermis*	50	Yes	UPL
2. *Elymus glaucus*	20	Yes	FACU
3. *Tanacetum vulgare*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **0** (A)
Total Number of Dominant Species Across All Strata: **3** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **0.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	35	x 4 = 140
UPL species	50	x 5 = 250
Column Totals:	85 (A)	390 (B)

Prevalence Index = B/A = **4.59**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/3	100	None		—	—	Loamy Sand	
6-16	10YR 6/3	100	None	—	—	—	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:
No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP17
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Lowland Local relief (concave, convex, none): None Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.581388 Long: -115.324240 Datum: WGS84
Soil Map Unit Name: DA-Denied Access NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Carex utriculata*	40	Yes	OBL
2. *Typha latifolia*	40	Yes	OBL
3. *Eleocharis palustris*	5	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 15			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **2** (A)
Total Number of Dominant Species Across All Strata: **2** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	85	x 1 = 85
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	85 (A)	85 (B)

Prevalence Index = B/A = **1.00**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP17

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	95	10YR 4/6	5	C	M	Sandy Loam	
6-12	10YR 5/2	95	10YR 4/6	5	C	M	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___
Depth(inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) **(LRR A)**
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) **(LRR A)**
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	
Water Table Present?	Yes X	No ___	Depth (inches):	10
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	8

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP18
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Valley bottom | Local relief (concave, convex, none): None | Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.581536 | Long: -115.323915 | Datum: WGS84
Soil Map Unit Name: DA-Denied Access | NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: 30 ft.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus ponderosa*	40	Yes	FACU
2.			
3.			
4.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	5	Yes	FACU
2. *Ribes aureum*	10	Yes	FAC
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Elymus glaucus*	20	Yes	FACU
2. *Elymus trachycaulus*	20	Yes	FAC
3. *Poa pratensis*	20	Yes	FAC
4. *Thalictrum occidentale*	10	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 30			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **3** (A)
Total Number of Dominant Species Across All Strata: **6** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **50.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	50	x 3 = 150
FACU species	75	x 4 = 300
UPL species	0	x 5 = 0
Column Totals:	125 (A)	450 (B)

Prevalence Index = B/A = **3.60**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3	100	None		—	—	Loamy Sand	
4-10	10YR 4/2	100	None	—	—	—	Loamy Sand	
10-16	10YR 5/2	95	10YR 4/6	5	C	M	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ____ 2 cm Muck (A10)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres along Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) **(LRR A)**
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)
- ____ Raised Ant Mounds (D6) **(LRR A)**
- ____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP19
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Concave Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.583343 Long: -115.323194 Datum: WGS84
Soil Map Unit Name: 41B-Oldtrail-Glaciercreek-Larchpoint complex NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Typha latifolia*	80	Yes	OBL
2. *Carex utriculata*	20	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.00% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP19

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100	None		—	—	Loamy Sand	
4-12	10YR 4/2	95	10YR 4/6	5	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___
Depth(inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) **(LRR A)**
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) **(LRR A)**
___ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	
Water Table Present?	X		12
Saturation Present? (includes capillary fringe)	X		8

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
A positive indication of wetland hydrology was observed (at least one primary indicator).
A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP20
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Linear Slope Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.583383 Long: -115.323155 Datum: WGS84
Soil Map Unit Name: 41B-Oldtrail-Glaciercreek-Larchpoint complex NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		**X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Symphoricarpos albus*	5	Yes	FACU
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: 5 ft.)			
1. *Bromus inermis*	60	Yes	UPL
2. *Poa pratensis*	20	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**33.33%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**0**	x 2 = **0**
FAC species	**20**	x 3 = **60**
FACU species	**5**	x 4 = **20**
UPL species	**60**	x 5 = **300**
Column Totals:	**85** (A)	**380** (B)
Prevalence Index = B/A =	**4.47**	

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No **X**

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

Sampling Point: SP20

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100	None		—	—	Sandy Loam	
6-12	10YR 4/3	100	None	—	—	—	Loamy Sand	
12-16	10YR 6/3	100	None	—	—	—	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP21
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): None Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.583949 Long: -115.324894 Datum: WGS84
Soil Map Unit Name: 472B-Elkrock gravelly ashy silt loam NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No **X** (If no, explain in Remarks.)
Are Vegetation **No** ,Soil **No** ,or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ____
Are Vegetation **No** ,Soil **No** ,or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes **X**	No	Is the Sampled Area within a Wetland? Yes **X** No
Hydric Soil Present?	Yes **X**	No	
Wetland Hydrology Present?	Yes **X**	No	

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Typha latifolia*	40	Yes	OBL
2. *Eleocharis palustris*	10	No	OBL
3. *Juncus balticus*	10	No	FACW
4. *Carex utriculata*	30	Yes	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	90		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	10		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **2** (A)
Total Number of Dominant Species Across All Strata: **2** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	80	x 1 = 80
FACW species	10	x 2 = 20
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	90 (A)	100 (B)

Prevalence Index = B/A = **1.11**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes **X** No ____

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP21

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/1	100	None		—	—	Silt Loam	
4-10	10YR 4/2	95	10YR 4/6	5	C	M	Sandy Loam	
10-15	10YR 6/2	95	10YR 6/6	5	C	M	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth(inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 10

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment　City/County: Sanders Co.　Sampling Date: 05/02/2023
Applicant/Owner: NWE　State: MT　Sampling Point: SP22
Investigator(s): Brian Sandefur, PWS　Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Upper terrace　Local relief (concave, convex, none): Linear Slope　Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62　Lat: 47.583999　Long: -115.324936　Datum: WGS84
Soil Map Unit Name: 472B-Elkrock gravelly ashy silt loam　NWI classification: Non-Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed?　Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic?　(If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: 30 ft.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus ponderosa*	5	Yes	FACU
2.			
3.			
4.			
	5 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *Rosa acicularis*	15	Yes	FACU
2.			
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Verbascum thapsus*	10	No	FACU
2. *Equisetum arvense*	5	No	FAC
3. *Elymus glaucus*	30	Yes	FACU
4. *Poa pratensis*	40	Yes	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 15			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 25.00% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	45	x 3 = 135
FACU species	60	x 4 = 240
UPL species	0	x 5 = 0
Column Totals:	105 (A)	375 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

Sampling Point: SP22

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100	None		—	—	Loam	
6-10	10YR 4/3	100	None	—	—	—	Sandy Loam	
10-15	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________
Depth(inches): ____________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No **X** Depth (inches): ____
Water Table Present? Yes ____ No **X** Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No **X** Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP23
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Bank/water's edge | Local relief (concave, convex, none): Linear Slope | Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.585260 | Long: -115.330587 | Datum: WGS84
Soil Map Unit Name: DA-Denied Access | NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation No ,Soil No ,or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation No ,Soil No ,or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___
Is the Sampled Area within a Wetland?	**Yes X**	**No ___**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Typha latifolia*	80	Yes	OBL
2. *Carex utriculata*	20	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.00%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP23

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	95	10YR 4/6	5	C	M	Loamy Sand	
8-16	10YR 4/2	95	10YR 4/6	5	C	M	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:

A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
____ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ____	No **X**	Depth (inches): ____
Water Table Present?	Yes **X**	No ____	Depth (inches): **10**
Saturation Present? (includes capillary fringe)	Yes **X**	No ____	Depth (inches): **8**

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A positive indication of wetland hydrology was observed (at least one primary indicator).

A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP24
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 16, T21N, R29W
Landform (hillslope, terrace, etc.): Fan Local relief (concave, convex, none): Linear Slope Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.585301 Long: -115.330707 Datum: WGS84
Soil Map Unit Name: 473D-Elkrock-Selon complex NWI classification: PEM1A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No **X**
Hydric Soil Present?	Yes ___	No **X**
Wetland Hydrology Present?	Yes ___	No **X**

Is the Sampled Area within a Wetland? **Yes** ___ **No** **X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Poa pratensis*	80	Yes	FAC
2. *Dactylis glomerata*	20	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **2** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **50.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**0**	x 2 = **0**
FAC species	**80**	x 3 = **240**
FACU species	**20**	x 4 = **80**
UPL species	**0**	x 5 = **0**
Column Totals:	**100** (A)	**320** (B)

Prevalence Index = B/A = **3.20**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** **X**

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/3	100	None		—	—	Silt Loam	
6-16	10YR 6/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________
Depth(inches): ____________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP25
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 9, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace Local relief (concave, convex, none): Concave Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 Lat: 47.590165 Long: -115.325904 Datum: WGS84
Soil Map Unit Name: W-Water NWI classification: Non-Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No** ,Soil **No** ,or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No** ,Soil **No** ,or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes **X**	No ___
Hydric Soil Present?	Yes **X**	No ___
Wetland Hydrology Present?	Yes **X**	No ___

Is the Sampled Area within a Wetland? **Yes X No** ___

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Schoenoplectus acutus*	90	Yes	OBL
2. *Iris pseudacorus*	10	No	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **1** (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**100**	x 1 = **100**
FACW species	**0**	x 2 = **0**
FAC species	**0**	x 3 = **0**
FACU species	**0**	x 4 = **0**
UPL species	**0**	x 5 = **0**
Column Totals:	**100** (A)	**100** (B)

Prevalence Index = B/A = **1.00**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No** ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP25

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	100	None		—	—	Silt Loam	
8-14	10YR 4/2	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:
A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
____ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches):
Surface Water Present?		X	
Water Table Present?	X		0
Saturation Present? (includes capillary fringe)	X		0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
A positive indication of wetland hydrology was observed (at least one primary indicator).
A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment — City/County: Sanders Co. — Sampling Date: 05/02/2023

Applicant/Owner: NWE — State: MT — Sampling Point: SP26

Investigator(s): Brian Sandefur, PWS — Section, Township, Range: Sec. 9, T21N, R29W

Landform (hillslope, terrace, etc.): Slope — Local relief (concave, convex, none): Linear Slope — Slope (%): 2-5

Subregion (LRR): LRR E, MLRA 62 — Lat: 47.590172 — Long: -115.325861 — Datum: WGS84

Soil Map Unit Name: 472B-Elkrock gravelly ashy silt loam — NWI classification: Non-Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of hydric soils and wetland hydrology.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Poa pratensis*	60	Yes	FAC
2. *Achillea millefolium*	5	No	FACU
3. *Taraxacum officinale*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	70		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum	30		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: **1** (A)

Total Number of Dominant Species Across All Strata: **1** (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **100.00%** (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	60	x 3 = 180
FACU species	10	x 4 = 40
UPL species	0	x 5 = 0
Column Totals:	70 (A)	220 (B)

Prevalence Index = B/A = **3.14**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).

SOIL

Sampling Point: SP26

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/3	100	None		—	—	Silt Loam	
6-12	10YR 5/3	100	None	—	—	—	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth(inches): ____________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment | City/County: Sanders Co. | Sampling Date: 05/02/2023
Applicant/Owner: NWE | State: MT | Sampling Point: SP27
Investigator(s): Brian Sandefur, PWS | Section, Township, Range: Sec. 8, T21N, R29W
Landform (hillslope, terrace, etc.): Lower terrace | Local relief (concave, convex, none): Concave | Slope (%): 0-1
Subregion (LRR): LRR E, MLRA 62 | Lat: 47.592383 | Long: -115.339571 | Datum: WGS84
Soil Map Unit Name: 473D-Elkrock-Selon complex | NWI classification: PEM1A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	
Is the Sampled Area within a Wetland?	**X**	

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined to be within a wetland due to the presence of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Juncus balticus*	20	Yes	FACW
2. *Eleocharis palustris*	10	No	OBL
3. *Iris pseudacorus*	10	No	OBL
4. *Carex utriculata*	40	Yes	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 20			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**60**	x 1 = **60**
FACW species	**20**	x 2 = **40**
FAC species	**0**	x 3 = **0**
FACU species	**0**	x 4 = **0**
UPL species	**0**	x 5 = **0**
Column Totals:	**80** (A)	**100** (B)

Prevalence Index = B/A = **1.25**

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes **X** No ___

Remarks:
A positive indication of hydrophytic vegetation was observed (Rapid Test for Hydrophytic Vegetation).
A positive indication of hydrophytic vegetation was observed (>50% of dominant species indexed as OBL, FACW, or FAC).
A positive indication of hydrophytic vegetation was observed (Prevalence Index is ≤ 3.0).

Sampling Point: SP27

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100	None		—	—	Loamy Sand	
5-15	10YR 5/2	95	10YR 4/6	5	C	M	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:
A positive indication of hydric soil was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
X Geomorphic Position (D2)
____ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	
Water Table Present?	X		0
Saturation Present? (includes capillary fringe)	X		0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
A positive indication of wetland hydrology was observed (at least one primary indicator).
A positive indication of wetland hydrology was observed (at least two secondary indicators).

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Thompson Falls Wetland Assessment City/County: Sanders Co. Sampling Date: 05/02/2023
Applicant/Owner: NWE State: MT Sampling Point: SP28
Investigator(s): Brian Sandefur, PWS Section, Township, Range: Sec. 8, T21N, R29W
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Linear Slope Slope (%): 2-5
Subregion (LRR): LRR E, MLRA 62 Lat: 47.592456 Long: -115.339543 Datum: WGS84
Soil Map Unit Name: 473D-Elkrock-Selon complex NWI classification: Non-Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No **X** (If no, explain in Remarks.)
Are Vegetation **No**, Soil **No**, or Hydrology **No** significantly disturbed? Are "Normal Circumstances" present? Yes **X** No ___
Are Vegetation **No**, Soil **No**, or Hydrology **No** naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No **X**
Hydric Soil Present?	Yes ___	No **X**
Wetland Hydrology Present?	Yes ___	No **X**
Is the Sampled Area within a Wetland?	**Yes** ___	**No X**

Remarks: The NWPL 2020 wetland ratings were used.
This point was determined not to be within a wetland due to the lack of all three wetland criteria.
Based on APT results, site was "drier than normal' during the May 2023 field survey.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1. *None Observed*			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5 ft.)			
1. *Bromus inermis*	80	Yes	UPL
2. *Poa pratensis*	20	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	100		
Woody Vine Stratum (Plot size: 30 ft.)			
1. *None Observed*			
2.			
= Total Cover			
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**50.00%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	**0**	x 1 = **0**
FACW species	**0**	x 2 = **0**
FAC species	**20**	x 3 = **60**
FACU species	**0**	x 4 = **0**
UPL species	**80**	x 5 = **400**
Column Totals:	**100** (A)	**460** (B)

Prevalence Index = B/A = **4.60**

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No X**

Remarks:
No positive indication of hydrophytic vegetation was observed (≥50% of dominant species indexed as FACU or drier).

SOIL

Sampling Point: SP28

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-8	10YR 3/3	100	None		—	—	Loamy Sand	
8-16	10YR 5/3	100	None	—	—	—	Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1) **(except MLRA 1)**
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

____ 2 cm Muck (A10)
____ Red Parent Material (TF2)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____
Depth(inches): ____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

No positive indication of hydric soils was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) **(LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water-Stained Leaves (B9) **(MLRA 1, 2 4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)
____ Raised Ant Mounds (D6) **(LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No positive indication of wetland hydrology was observed.

APPENDIX D MONTANA WETLAND ASSESSMENT METHOD FORMS

MDT Montana Wetland Assessment Form (revised March 2008)

1. Project Name: Thompson Falls WG1 **2. MDT Project #:** NA **Control #:**

3. Evaluation Date: 05/11/2023 **4. Evaluator(s):** Brian Sandefur, PWS **5. Wetlands/Site #(s):** WG1: WL-1, 3, 4 6, 8-14

6. Wetland Location(s): i. Legal: T21N,R28W,16, 18, 22 ;T21N,R29W,8, 9, 16

Latitude/Longitude:
47.567594, -115.170191 : WL-1
47.570334, -115.170783 : WL-3
47.57511, -115.197502 : WL-4
47.576939, -115.240836 : WL-6
47.581088, -115.319736 : WL-8
47.581326, -115.324163 : WL-9
47.590272, -115.32596 : WL-13
47.583343, -115.323203 : WL-10
47.583935, -115.32484 : WL-11
47.585195, -115.33085 : WL-12
47.592389, -115.339686 : WL-14

ii. Approx. Stationing or Mileposts: NA

iii. Watershed: HUC12 170102130514

Watershed Name, County: Lower Clark Fork, Sanders

7. a. Evaluating Agency: POWER Engineers

b. Purpose of Evaluation:

1. __ Wetlands potentially affected by MDT project
2. __ Mitigation wetlands; pre-construction
3. __ Mitigation wetlands; post-construction
4. X Other: Wetland areas potentially impacted by change in water surface elevation of reservoir

8. Wetland size: 10.780 acres (measured)

9. Assessment area (AA): 10.780 acres (measured)

10. Classification of Wetland and Aquatic Habitats in AA

HGM Class (Brinson)	Class (Cowardin)	Modifier (Cowardin)	Water Regime	% of AA
R	EM	I	SI	100.00

Abbreviations: *(see manual for definitions)*

HGM Classes: Riverine (**R**), Depressional (**D**), Slope (**S**), Mineral Soil Flats (**MSF**), Organic Soil Flats (**OSF**), Lacustrine Fringe (**LF**);

Cowardin Classes: Rock Bottom (**RB**), Unconsolidated bottom (**UB**), Aquatic Bed (**AB**), Unconsolidated Shore (**US**), Moss-lichen Wetland (**ML**), Emergent Wetland (**EM**), Scrub-Shrub Wetland (**SS**), Forested Wetland (**FO**)

Modifiers: Excavated (**E**), Impounded (**I**), Diked (**D**), Partly Drained (**PD**), Farmed (**F**), Artificial (**A**)

Water Regimes: Permanent / Perennial (**PP**), Seasonal / Intermittent (**SI**), Temporary / Ephemeral (**TE**)

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)

COMMON

12. General condition of AA:

i. Disturbance: (use matrix below to determine [circle] appropriate response – see instructions for Montana-listed noxious weed and aquatic nuisance vegetation species (**ANVS**) list)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings; and noxious weed or ANVS cover is >=15%.	Land not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings; noxious weed or ANVS cover is <= 30%.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is > 30%.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings; and noxious weed or ANVS cover is <= 15%.	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings; noxious weed or ANVS cover is <=	moderate disturbance	**moderate disturbance**	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is > 30%.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): AA1 includes wetland areas around Thompson Falls reservoir that are directly supported by water elevations maintained by the reservoir. These areas appear to experience hydrological alterations based on water elevation fluctuations.

ii. Prominent noxious, aquatic nuisance, & other exotic vegetation species: Canadian thistle (Cirsium arvense), yellowflag iris (Iris psuedacorus), flowering rush (Butomus umbellatus).

iii. Provide brief descriptive summary of AA and surrounding land use/habitat: Landuse surrounding WG1 includes undeveloped forest, low-intensity residential, railroad, and highway.

13. Structural Diversity: (based on number of "Cowardin" ***vegetated*** classes present [do not include unvegetated classes], see #10 above)

Existing # of "Cowardin" Vegetated Classes in AA	Initial Rating	Is current management preventing (passive) existence of additional vegetated classes?		Modified Rating
>= 3 (or 2 if 1 is forested) classes	H	NA	NA	NA
2 (or 1 if forested) classes	M	NA	NA	NA
1 class, but not a monoculture	**M**	<-- NO	YES -->	L
1 class, monoculture (1 species comprises >= 90% of total cover)	L	NA	NA	NA

Comments: WG1 includes PEM1A wetland habitat.

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

i. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions): No usable habitat

Primary or critical habitat (list species) **Secondary habitat (list species)** **Incidental habitat (list species)**

ii. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating)

Highest Habitat Level	*doc/primary*	*sus/primary*	*doc/secondary*	*sus/secondary*	*doc/incidental*	*sus/incidental*	*None*
Functional Points and Rating	1H	.9H	.8M	.7M	.3L	.1L	**0L**

Sources for documented use (e.g. observations, records, etc): USFWS IPaC, field survey

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

i. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions): No usable habitat

Primary or critical habitat (list species) **Secondary habitat (list species)** **Incidental habitat (list species)**

ii. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating)

Highest Habitat Level	*doc/primary*	*sus/primary*	*doc/secondary*	*sus/secondary*	*doc/incidental*	*sus/incidental*	*None*
***S1 Species:** Functional Points and Rating*	1H	.8H	.7M	.6M	.2L	.1L	0L
***S2 and S3 Species:** Functional Points and Rating*	.9H	.7M	.6M	.5M	.2L	.1L	**0L**

Sources for documented use (e.g. observations, records, etc): MTNHP database, field survey

14C. General Wildlife Habitat Rating:

i. Evidence of overall wildlife use in the AA (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):

__ observations of abundant wildlife #s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Minimal (based on any of the following [check]):

__ few or no wildlife observations during peak use periods
__ little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):

__ observations of scattered wildlife groups or individuals or relatively few species during peak periods
X common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. Wildlife habitat features (Working from top to bottom, circle appropriate AA attributes in matrix to arrive at rating. Structural diversity is from #13. For class cover to be considered evenly distributed, the most and least prevalent vegetated classes must be within 20% of each other interms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms])

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in >=10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	**H**	M	M	H	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

iii. Rating (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Moderate
Substantial	1E	.9H	.8H	.7M
Moderate	.9H	**.7M**	.5M	.3L
Minimal	.6M	.4M	.2L	.1L

Comments: Common waterfowl sightings

14D. General Fish Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not used by fish, fish use is not restorable due to habitat constraints, or is not desired from a management perspective [such as fish entrapped in a canal], then mark X **NA** and proceed to 14E.)

Type of Fishery: Cold Water **(CW)** ___ Warm Water **(WW)** ___ **Use the CW or WW guidelines in the user manual to complete the matrix**

i. Habitat Quality and Known / Suspected Fish Species in AA (use matrix to arrive at [circle] the functional points and rating)

Duration of surface water in AA	Permanent / Perennial						Seasonal / Intermittent						Temporary / Ephemeral					
Aquatic hiding / resting / escape cover	Optimal		Adequate		Poor		Optimal		Adequate		Poor		Optimal		Adequate		Poor	
Thermal cover optimal / suboptimal	O	S	O	S	O	S	O	S	O	S	O	S	O	S	O	S	O	S
FWP Tier I fish species	1E	.9H	.8H	.7M	.6M	.5M	.9H	.8H	.7M	.6M	.5M	.4M	.7M	.6M	.5M	.4M	.3L	.2L
FWP Tier II or Native Game fish species	.9H	.8H	.7M	.6M	.5M	.5M	.8H	.7M	.6M	.5M	.4M	.4M	.6M	.5M	.4M	.3L	.2L	.2L
FWP Tier III or Introduced Game fish	.8H	.7M	.6M	.5M	.5M	.4M	.7M	.6M	.5M	.4M	.4M	.3L	.5M	.4M	.3L	.2L	.2L	.1L
FWP Non-Game Tier IV or No fish species	.5M	.5M	.5M	.4M	.4M	.3L	.4M	.4M	.4M	.3L	.3L	.2L	.2L	.2L	.2L	.1L	.1L	.1L

Sources used for identifying fish sp. potentially found in AA:

ii. Modified Rating (NOTE: Modified score cannot exceed 1 or be less than 0.1)

a) Is fish use of the AA significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the current final MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support, or do aquatic nuisance plant or animal species (see Appendix E) occur in fish habitat? ___ If yes, reduce score in i above by 0.1.

*b) Does the AA contain a documented spawning area or other critical habitat feature (i.e., sanctuary pool, upwelling area, etc.- specify in comments) for native fish or introduced game fish? ___ If yes, add 0.1 to the adjusted score in **i** or **iia.***

iii. Final Score and Rating: NA **Comments:** AA1 does not include any areas below the OHWM

14E. Flood Attenuation: (Applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, mark ___ **NA** and proceed to 14F.)

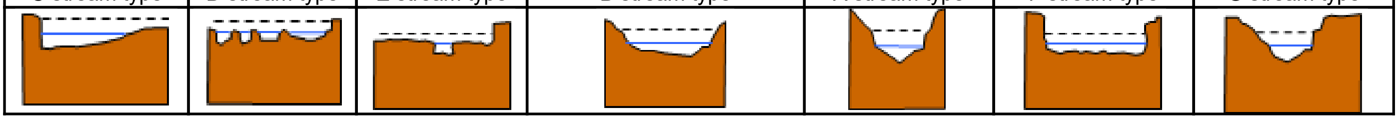
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

Estimated or Calculated Entrenchment (Rosgen 1994, 1996)	Slightly entrenched - C, D, E stream types			Moderately entrenched – B stream type			Entrenched-A, F, G stream types		
% of flooded wetland classified as forested and/or scrub/shrub	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	1H	.9H	.6M	.8H	.7M	**.5M**	.4M	.3L	.2L
AA contains **unrestricted outlet**	.9H	.8H	.5M	.7M	.6M	.4M	.3L	.2L	.1L

Entrenchment ratio (ER) estimation – see User's Manual for additional guidance. Entrenchment ratio = (flood-prone width)/(bankfull width) Flood-prone width = estimated horizontal projection of where 2 x maximum bankfull depth elevation intersects the floodplain on each side of the stream.

950 /	650 =	**1.46**
Flood-prone width	*Bankfull width*	*Entrenchment ratio (ER)*

Slightly Entrenched ER = >2.2			**Moderately Entrenched ER = 1.41 – 2.2**	**Entrenched ER = 1.0 – 1.4**		
C stream type	D stream type	E stream type	B stream type	A stream type	F stream type	G stream type



ii. Are ≥10 acres of wetland in the AA subject to flooding **AND** are man-made features which may be significantly damaged by floods located within 0.5 mile downstream of the AA (circle)? ___ **Comments:** Wetland hydrology within AA1 supported by restricted outlet (Thompson Falls Reservoir Dam).

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, mark ___**NA** and proceed to 14G.)

i. Rating (Working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			1.1 to 5 acre feet			<=1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **>= 5 out of 10 years**	1H	**.9H**	.8H	.8H	.6M	.5M	.4M	.3L	.2L
Wetlands in AA flood or pond **< 5 out of 10 years**	.9H	.8H	.7M	.7M	.5M	.4M	.3L	.2L	.1L

Comments: Surface water storage during high water periods.

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, mark ___**NA** and proceed to 14H.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H=high, M=moderate, or L=low])

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver levels of sediments, nutrients, or compounds at levels such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	>= 70%		< 70%		>= 70%		< 70%	
Evidence of flooding / ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains **no or restricted outlet**	**1H**	.8H	.7M	.5M	.5M	.4M	.3L	.2L
AA contains **unrestricted outlet**	.9H	.7M	.6M	.4M	.4M	.3L	.2L	.1L

Comments: Potential to receive sediment/nutrients

14H Sediment/Shoreline Stabilization: (Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If 14H does not apply, mark___**NA** and proceed to 14I.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

*% Cover of **wetland** streambank or shoreline by species with stability ratings of >=6 (see **Appendix F**).*	*Duration of surface water adjacent to rooted vegetation*		
	Permanent / Perennial	Seasonal / Intermittent	Temporary / Ephemeral
>= 65%	**1H**	.9H	.7M
35-64%	.7M	.6M	.5M
35%	.3L	.2L	.1L

Comments: AA1 primarily includes hydrophytic species with stability rating of =6.

14I. Production Export/Food Chain Support:

i. Level of Biological Activity (synthesis of wildlife and fish habitat ratings [circle])

General Fish Habitat Rating (14D.iii.)	**General Wildlife Habitat Rating (14C.iii.)**		
	E/H	M	L
E/H	H	H	M
M	H	M	M
L	M	M	L
N/A	H	**M**	L

ii. Rating (Working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating. Factor A = acreage of vegetated wetland component in the AA; Factor B = level of biological activity rating from above (14I.i.); Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P, S/I, and T/E are as previously defined, and A = "absent" [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component < 1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.7M	.8H	.5M	.6M	.4M	.9H	.6M	.7M	.4M	.5M	.3L	.8H	.6M	.6M	.4M	.3L	.2L
S/I	.9H	.6M	.7M	**.4M**	.5M	.3L	.8H	.5M	.6M	.3L	.4M	.2L	.7M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.5M	.6M	.3L	.4M	.2L	.7M	.4M	.5M	.2L	.3L	.1L	.6M	.4M	.4M	.2L	.2L	.1L

iii. Modified Rating (NOTE: Modified score cannot exceed 1 or be less than 0.1.) **Vegetated Upland Buffer (VUB):** Area with >= 30% plant cover, = 15% noxious weed or ANVS cover, and that is not subjected to periodic mechanical mowing or clearing (unless for weed control).

a) Is there an average >= 50 foot-wide vegetated upland buffer around >= 75% of the AA circumference? **X** *If yes, add 0.1 to the score in ii above.*

iv. Final Score and Rating: 0.50M **Comments:** AA1 generally surrounded by =50 foot-wide buffer on boundary not adjacent to water's edge.

14J. Groundwater Discharge/Recharge: (check the appropriate indicators in i & ii below)

i. Discharge Indicators

_______ The AA is a slope wetland
_______ Springs or seeps are known or observed
_______ Vegetation growing during dormant season/drought
_______ Wetland occurs at the toe of a natural slope
_______ AA permanently flooded during drought periods
_______ Wetland contains an outlet, but no inlet
_______ Shallow water table and the site is saturated to the surface
_______ Other:

ii. Recharge Indicators

X Permeable substrate present without underlying impeding layer
_______ Wetland contains inlet but no outlet
_______ Stream is a known 'losing' stream; discharge volume decreases
_______ Other:

iii. Rating (use the information from i and ii above and the table below to arrive at [circle] the functional points and rating)

	Duration of saturation at AA Wetlands *FROM GROUNDWATER DISCHARGE OR WITH WATER THAT IS RECHARGING THE GROUNDWATER SYSTEM*			
Criteria	P/P	S/I	T	None
Groundwater Discharge or Recharge	1H	**.7M**	.4M	.1L
Insufficient Data/Information	N/A			

Comments: Soils within AA1 typically sandy, sandy loam.

14K. Uniqueness:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland **or** plant association listed as "S1" by the MTNHP			AA does not contain previously cited rare types **and** structural diversity (#13) is high **or** contains plant association listed as "S2" by the MTNHP			AA does not contain previously cited rare types or associations **and** structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1H	.9H	.8H	.8H	.6M	.5M	.5M	.4M	.3L
Moderate disturbance at AA (#12i)	.9H	.8H	.7M	.7M	.5M	.4M	.4M	**.3L**	.2L
High disturbance at AA (#12i)	.8H	.7M	.6M	.6M	.4M	.3L	.3L	.2L	.1L

Comments: No uncommon vegetation communities identified within AA1

14L. Recreation/Education Potential: (affords "bonus" points if AA provides recreation or education opportunity)

i. Is the AA a known or potential rec./ed. site: (circle) X (if 'Yes' continue with the evaluation; if 'No' then mark ___ **NA** and proceed to the overall summary and rating page)

ii. Check categories that apply to the AA: ___Educational/scientific study; ___Consumptive rec.; X Non-consumptive rec.; ___Other :

iii. Rating:

Known or Potential Recreation or Education Area	Known	Potential
Public ownership or public easement with general public access (no permission required)	.2H	.15H
Private ownership with general public access (no permission required)	.15H	**.1M**
Private or public ownership without general public access, or requiring permission for public access	.1M	.05L

Comments: General access to WG1 via open water.

General Site Notes
Wetlands within WG1 range in size from 0.03 to 3.41 acres in size,

FUNCTION & VALUE SUMMARY & OVERALL RATING FOR WETLAND/SITE #(S): WG1: WL-1, 3, 4 6, 8-14

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units: (Actual Points x Wetland Acreage)	Indicate the four most prominent functions with an asterisk (*)
A. Listed/Proposed T&E Species Habitat	L	0.00	1	0.00	
B. MT Natural Heritage Program Species Habitat	L	0.00	1	0.00	
C. General Wildlife Habitat	M	0.70	1	7.55	
D. General Fish Habitat	NA				
E. Flood Attenuation	M	0.50	1	5.39	
F. Short and Long Term Surface Water Storage	H	0.90	1	9.70	*
G. Sediment/Nutrient/Toxicant Removal	H	1.00	1	10.78	*
H. Sediment/Shoreline Stabilization	H	1.00	1	10.78	*
I. Production Export/Food Chain Support	M	0.50	1	5.39	
J. Groundwater Discharge/Recharge	M	0.70	1	7.55	*
K. Uniqueness	L	0.30	1	3.23	
L. Recreation/Education Potential (bonus points)	M	0.10	1	1.08	
Totals:		5.70	10.00	61.45	
Percent of Possible Score			57%		

Category I Wetland: (must satisfy one of the following criteria; otherwise go to Category II)
____ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
____ Score of 1 functional point for Uniqueness; **or**
____ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; **or**
____ Percent of possible score > 80% (round to nearest whole #).

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; otherwise go to Category IV)
____ Score of 1 functional point for MT Natural Heritage Program Species Habitat; **or**
____ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
____ Score of .9 or 1 functional point for General Fish Habitat; **or**
____ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish/Aquatic Habitat; **or**
____ Score of .9 functional point for Uniqueness; **or**
____ Percent of possible score > 65% (round to nearest whole #).

Category III Wetland: (Criteria for Categories I, II, or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; otherwise go to Category III)
__X__ "Low" rating for Uniqueness; **and**
____ Vegetated wetland component 1 acre (do not include upland vegetated buffer); **and**
____ Percent of possible score 35% (round to nearest whole #).

OVERALL ANALYSIS AREA RATING: III

Summary Comments: AA1 includes 11 separate wetland areas along the reservoir potentially affected by water level elevation controlled by dam.

MDT Montana Wetland Assessment Form (revised March 2008)

1. Project Name: Thompson Falls WG2 **2. MDT Project #:** NA **Control #:**

3. Evaluation Date: 05/11/2023 **4. Evaluator(s):** Brian Sandefur, PWS **5. Wetlands/Site #(s):** WG 2:

6. Wetland Location(s): i. Legal: T21N,R28W,17 & 22 ;T21N,R29W,23 **Latitude/Longitude:** 47.568338, -115.172296 : WL-2; 47.575009, -115.222833 : WL-5; 47.566325, -115.269681 : WL-7

ii. Approx. Stationing or Mileposts: NA

iii. Watershed: HUC12 170102130512

Watershed Name, County: Lower Clark Fork, Sanders

7. a. Evaluating Agency: POWER Engineers

b. Purpose of Evaluation:

1. __ Wetlands potentially affected by MDT project
2. __ Mitigation wetlands; pre-construction
3. __ Mitigation wetlands; post-construction
4. X Other: Wetland areas potentially impacted by change in water surface elevation of reservoir

8. Wetland size: 0.550 acres (measured)

9. Assessment area (AA): 0.550 acres (measured)

10. Classification of Wetland and Aquatic Habitats in AA

HGM Class (Brinson)	Class (Cowardin)	Modifier (Cowardin)	Water Regime	% of AA
R	EM	I	PP	100.00

Abbreviations: *(see manual for definitions)*

HGM Classes: Riverine (**R**), Depressional (**D**), Slope (**S**), Mineral Soil Flats (**MSF**), Organic Soil Flats (**OSF**), Lacustrine Fringe (**LF**);
Cowardin Classes: Rock Bottom (**RB**), Unconsolidated bottom (**UB**), Aquatic Bed (**AB**), Unconsolidated Shore (**US**), Moss-lichen Wetland (**ML**), Emergent Wetland (**EM**), Scrub-Shrub Wetland (**SS**), Forested Wetland (**FO**)
Modifiers: Excavated (**E**), Impounded (**I**), Diked (**D**), Partly Drained (**PD**), Farmed (**F**), Artificial (**A**)

Water Regimes: Permanent / Perennial (**PP**), Seasonal / Intermittent (**SI**), Temporary / Ephemeral (**TE**)

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
COMMON

12. General condition of AA:

i. Disturbance: (use matrix below to determine [circle] appropriate response – see instructions for Montana-listed noxious weed and aquatic nuisance vegetation species (**ANVS**) list)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*: Managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings; and noxious weed or ANVS cover is >=15%.	Land not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings; noxious weed or ANVS cover is <= 30%.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is > 30%.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings; and noxious weed or ANVS cover is <= 15%.	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings; noxious weed or ANVS cover is <=	moderate disturbance	**moderate disturbance**	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is > 30%.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): AA2 includes wetland areas directly adjacent to Thompson Falls Reservoir that receive supplemental hydrology from Clark Fork River tributaries.

ii. Prominent noxious, aquatic nuisance, & other exotic vegetation species: Yellowflag iris (Iris psuedacorus)

iii. Provide brief descriptive summary of AA and surrounding land use/habitat: Landuse surrounding AA2 include undeveloped forest, utility corridor, and low-intensity residential.

13. Structural Diversity: (based on number of "Cowardin" ***vegetated*** classes present [do not include unvegetated classes], see #10 above)

Existing # of "Cowardin" Vegetated Classes in AA	Initial Rating	Is current management preventing (passive) existence of additional vegetated classes?		Modified Rating
>= 3 (or 2 if 1 is forested) classes	H	NA	NA	NA
2 (or 1 if forested) classes	M	NA	NA	NA
1 class, but not a monoculture	**M**	<-- NO	YES -->	L
1 class, monoculture (1 species comprises >= 90% of total cover)	L	NA	NA	NA

Comments: Primarily PEM1A wetland habitat.

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:
i. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions): No usable habitat
Primary or critical habitat (list species) **Secondary habitat (list species)** **Incidental habitat (list species)**

ii. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating)

Highest Habitat Level	*doc/primary*	*sus/primary*	*doc/secondary*	*sus/secondary*	*doc/incidental*	*sus/incidental*	*None*
Functional Points and Rating	1H	.9H	.8M	.7M	.3L	.1L	**0L**

Sources for documented use (e.g. observations, records, etc): USFWS IPaC, field survey.

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)
i. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions): No usable habitat
Primary or critical habitat (list species) **Secondary habitat (list species)** **Incidental habitat (list species)**

ii. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating)

Highest Habitat Level	*doc/primary*	*sus/primary*	*doc/secondary*	*sus/secondary*	*doc/incidental*	*sus/incidental*	*None*
***S1 Species:** Functional Points and Rating*	1H	.8H	.7M	.6M	.2L	.1L	0L
***S2 and S3 Species:** Functional Points and Rating*	.9H	.7M	.6M	.5M	.2L	.1L	**0L**

Sources for documented use (e.g. observations, records, etc): MTNHP database, field survey.

14C. General Wildlife Habitat Rating:
i. Evidence of overall wildlife use in the AA (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
__ observations of abundant wildlife #s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Minimal (based on any of the following [check]):
__ few or no wildlife observations during peak use periods
__ little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
__ observations of scattered wildlife groups or individuals or relatively few species during peak periods
X common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. Wildlife habitat features (Working from top to bottom, circle appropriate AA attributes in matrix to arrive at rating. Structural diversity is from #13. For class cover to be considered evenly distributed, the most and least prevalent vegetated classes must be within 20% of each other interms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms])

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in >=10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	**H**	M	M	H	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

iii. Rating (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Moderate
Substantial	1E	.9H	.8H	.7M
Moderate	.9H	**.7M**	.5M	.3L
Minimal	.6M	.4M	.2L	.1L

Comments: Observed waterfowl usage.

14D. General Fish Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not used by fish, fish use is not restorable due to habitat constraints, or is not desired from a management perspective [such as fish entrapped in a canal], then mark **X** **NA** and proceed to 14E.)

Type of Fishery: Cold Water **(CW)**___ Warm Water **(WW)**___ **Use the CW or WW guidelines in the user manual to complete the matrix**

i. Habitat Quality and Known / Suspected Fish Species in AA (use matrix to arrive at [circle] the functional points and rating)

Duration of surface water in AA	Permanent / Perennial						Seasonal / Intermittent						Temporary / Ephemeral					
Aquatic hiding / resting / escape cover	Optimal		Adequate		Poor		Optimal		Adequate		Poor		Optimal		Adequate		Poor	
Thermal cover optimal / suboptimal	O	S	O	S	O	S	O	S	O	S	O	S	O	S	O	S	O	S
FWP Tier I fish species	1E	.9H	.8H	.7M	.6M	.5M	.9H	.8H	.7M	.6M	.5M	.4M	.7M	.6M	.5M	.4M	.3L	.2L
FWP Tier II or Native Game fish species	.9H	.8H	.7M	.6M	.5M	.5M	.8H	.7M	.6M	.5M	.4M	.4M	.6M	.5M	.4M	.3L	.2L	.2L
FWP Tier III or Introduced Game fish	.8H	.7M	.6M	.5M	.5M	.4M	.7M	.6M	.5M	.4M	.4M	.3L	.5M	.4M	.3L	.2L	.2L	.1L
FWP Non-Game Tier IV or No fish species	.5M	.5M	.5M	.4M	.4M	.3L	.4M	.4M	.4M	.3L	.3L	.2L	.2L	.2L	.2L	.1L	.1L	.1L

Sources used for identifying fish sp. potentially found in AA:

ii. Modified Rating (NOTE: Modified score cannot exceed 1 or be less than 0.1)

a) Is fish use of the AA significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the current final MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support, or do aquatic nuisance plant or animal species (see Appendix E) occur in fish habitat? ___ If yes, reduce score in i above by 0.1.

*b) Does the AA contain a documented spawning area or other critical habitat feature (i.e., sanctuary pool, upwelling area, etc.- specify in comments) for native fish or introduced game fish?___ If yes, add 0.1 to the adjusted score in **i** or **iia.***

iii. Final Score and Rating: NA **Comments:** AA2 does not include any area below the OHWM.

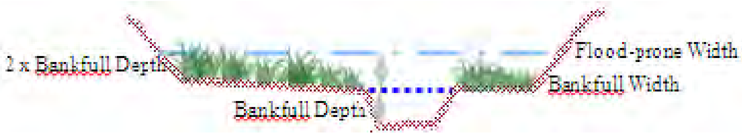
14E. Flood Attenuation: (Applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, mark___ **NA** and proceed to 14F.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

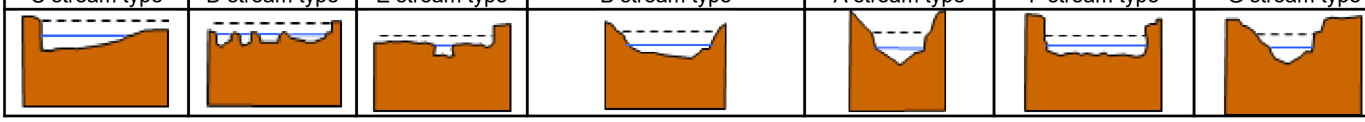
Estimated or Calculated Entrenchment (Rosgen 1994, 1996)	Slightly entrenched - C, D, E stream types			Moderately entrenched – B stream type			Entrenched-A, F, G stream types		
% of flooded wetland classified as forested and/or scrub/shrub	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	1H	.9H	.6M	.8H	.7M	.5M	.4M	.3L	.2L
AA contains **unrestricted outlet**	.9H	.8H	.5M	.7M	.6M	.4M	.3L	.2L	.1L

Entrenchment ratio (ER) estimation – see User's Manual for additional guidance. Entrenchment ratio = (flood-prone width)/(bankfull width) Flood-prone width = estimated horizontal projection of where 2 x maximum bankfull depth elevation intersects the floodplain on each side of the stream.

8 /	5 =	**1.60**
Flood-prone width	*Bankfull width*	*Entrenchment ratio (ER)*



Slightly Entrenched ER = >2.2			**Moderately Entrenched ER = 1.41 – 2.2**	**Entrenched ER = 1.0 – 1.4**		
C stream type	D stream type	E stream type	B stream type	A stream type	F stream type	G stream type



ii. Are ≥10 acres of wetland in the AA subject to flooding **AND** are man-made features which may be significantly damaged by floods located within 0.5 mile downstream of the AA (circle)? ___ **Comments:** AA2 includes wetland areas supported by tributaries with unrestricted outlet draining into reservoir with restricted outlet.

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, mark ___**NA** and proceed to 14G.)

i. Rating (Working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			1.1 to 5 acre feet			<=1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **>= 5 out of 10 years**	1H	.9H	.8H	.8H	.6M	.5M	**.4M**	.3L	.2L
Wetlands in AA flood or pond **< 5 out of 10 years**	.9H	.8H	.7M	.7M	.5M	.4M	.3L	.2L	.1L

Comments: Hydrology within AA2 supplementally supported by water flowing from tributaries.

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, mark ___**NA** and proceed to 14H.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H=high, M=moderate, or L=low])

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver levels of sediments, nutrients, or compounds at levels such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	>= 70%		< 70%		>= 70%		< 70%	
Evidence of flooding / ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains **no or restricted outlet**	**1H**	.8H	.7M	.5M	.5M	.4M	.3L	.2L
AA contains **unrestricted outlet**	.9H	.7M	.6M	.4M	.4M	.3L	.2L	.1L

Comments: Wetland hydrology supported by high water elevations/seasonal runoff.

14H Sediment/Shoreline Stabilization: (Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If 14H does not apply, mark ___**NA** and proceed to 14I.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

*% Cover of **wetland** streambank or shoreline by species with stability ratings of >=6 (see **Appendix F**).*	*Duration of surface water adjacent to rooted vegetation*		
	Permanent / Perennial	Seasonal / Intermittent	Temporary / Ephemeral
>= 65%	**1H**	.9H	.7M
35-64%	.7M	.6M	.5M
35%	.3L	.2L	.1L

Comments: AA2 directly adjacent to open-water channels and impounded reservoir.

14I. Production Export/Food Chain Support:

i. Level of Biological Activity (synthesis of wildlife and fish habitat ratings [circle])

General Fish Habitat Rating (14D.iii.)	**General Wildlife Habitat Rating (14C.iii.)**		
	E/H	M	L
E/H	H	H	M
M	H	M	M
L	M	M	L
N/A	H	**M**	L

ii. Rating (Working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating. Factor A = acreage of vegetated wetland component in the AA; Factor B = level of biological activity rating from above (14I.i.); Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P, S/I, and T/E are as previously defined, and A = "absent" [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component < 1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.7M	.8H	.5M	.6M	.4M	.9H	.6M	.7M	.4M	.5M	.3L	.8H	.6M	**.6M**	.4M	.3L	.2L
S/I	.9H	.6M	.7M	.4M	.5M	.3L	.8H	.5M	.6M	.3L	.4M	.2L	.7M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.5M	.6M	.3L	.4M	.2L	.7M	.4M	.5M	.2L	.3L	.1L	.6M	.4M	.4M	.2L	.2L	.1L

iii. Modified Rating (NOTE: Modified score cannot exceed 1 or be less than 0.1.) **Vegetated Upland Buffer (VUB):** Area with >= 30% plant cover, = 15% noxious weed or ANVS cover, and that is not subjected to periodic mechanical mowing or clearing (unless for weed control).

a) Is there an average >= 50 foot-wide vegetated upland buffer around >= 75% of the AA circumference? **X** *If yes, add 0.1 to the score in ii above.*

iv. Final Score and Rating: 0.70M **Comments:** Vegetated buffer around areas of AA2 not directly adjacent to reservoir.

14J. Groundwater Discharge/Recharge: (check the appropriate indicators in i & ii below)

i. Discharge Indicators

_______ The AA is a slope wetland
_______ Springs or seeps are known or observed
_______ Vegetation growing during dormant season/drought
_______ Wetland occurs at the toe of a natural slope
_______ AA permanently flooded during drought periods
_______ Wetland contains an outlet, but no inlet
_______ Shallow water table and the site is saturated to the surface
_______ Other:

ii. Recharge Indicators

X Permeable substrate present without underlying impeding layer
_______ Wetland contains inlet but no outlet
_______ Stream is a known 'losing' stream; discharge volume decreases
_______ Other:

iii. Rating (use the information from i and ii above and the table below to arrive at [circle] the functional points and rating)

	Duration of saturation at AA Wetlands *FROM GROUNDWATER DISCHARGE OR WITH WATER THAT IS RECHARGING THE GROUNDWATER SYSTEM*			
Criteria	P/P	S/I	T	None
Groundwater Discharge or Recharge	**1H**	.7M	.4M	.1L
Insufficient Data/Information	N/A			

Comments: Groundwater recharge potential based on coarse soil texture with high hydraulic conductivity.

14K. Uniqueness:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating)

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland **or** plant association listed as "S1" by the MTNHP			AA does not contain previously cited rare types **and** structural diversity (#13) is high **or** contains plant association listed as "S2" by the MTNHP			AA does not contain previously cited rare types or associations **and** structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1H	.9H	.8H	.8H	.6M	.5M	.5M	.4M	.3L
Moderate disturbance at AA (#12i)	.9H	.8H	.7M	.7M	.5M	.4M	.4M	**.3L**	.2L
High disturbance at AA (#12i)	.8H	.7M	.6M	.6M	.4M	.3L	.3L	.2L	.1L

Comments: No unique vegetation communities identified within AA2.

14L. Recreation/Education Potential: (affords "bonus" points if AA provides recreation or education opportunity)

i. Is the AA a known or potential rec./ed. site: (circle) X (if 'Yes' continue with the evaluation; if 'No' then mark ___ **NA** and proceed to the overall summary and rating page)

ii. Check categories that apply to the AA: ___Educational/scientific study; X Consumptive rec.; ___Non-consumptive rec.; ___Other :

iii. Rating:

Known or Potential Recreation or Education Area	Known	Potential
Public ownership or public easement with general public access (no permission required)	.2H	.15H
Private ownership with general public access (no permission required)	.15H	**.1M**
Private or public ownership without general public access, or requiring permission for public access	.1M	.05L

Comments: Access to shoreline provided by open water travel

General Site Notes
Wetlands within AA2 range in size from 0.04 to 0.30 acre.

FUNCTION & VALUE SUMMARY & OVERALL RATING FOR WETLAND/SITE #(S): WG2:

Function & Value Variables	**Rating**	**Actual Functional Points**	**Possible Functional Points**	**Functional Units:** (Actual Points x Wetland Acreage)	**Indicate the four most prominent functions with an asterisk (*)**
A. Listed/Proposed T&E Species Habitat	L	0.00	1	0.00	
B. MT Natural Heritage Program Species Habitat	L	0.00	1	0.00	
C. General Wildlife Habitat	M	0.70	1	0.39	
D. General Fish Habitat	NA				
E. Flood Attenuation	H	0.80	1	0.44	*
F. Short and Long Term Surface Water Storage	M	0.40	1	0.22	
G. Sediment/Nutrient/Toxicant Removal	H	1.00	1	0.55	*
H. Sediment/Shoreline Stabilization	H	1.00	1	0.55	*
I. Production Export/Food Chain Support	M	0.70	1	0.39	
J. Groundwater Discharge/Recharge	H	1.00	1	0.55	*
K. Uniqueness	L	0.30	1	0.17	
L. Recreation/Education Potential (bonus points)	M	0.10	1	0.06	
Totals:		6.00	10.00	3.32	
Percent of Possible Score			60%		

Category I Wetland: (must satisfy one of the following criteria; otherwise go to Category II)

____ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
____ Score of 1 functional point for Uniqueness; **or**
____ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; **or**
____ Percent of possible score > 80% (round to nearest whole #).

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; otherwise go to Category IV)

____ Score of 1 functional point for MT Natural Heritage Program Species Habitat; **or**
____ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
____ Score of .9 or 1 functional point for General Fish Habitat; **or**
____ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish/Aquatic Habitat; **or**
____ Score of .9 functional point for Uniqueness; **or**
____ Percent of possible score > 65% (round to nearest whole #).

Category III Wetland: (Criteria for Categories I, II, or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; otherwise go to Category III)

X "Low" rating for Uniqueness; **and**
X Vegetated wetland component 1 acre (do not include upland vegetated buffer); **and**
____ Percent of possible score 35% (round to nearest whole #).

OVERALL ANALYSIS AREA RATING: III

Summary Comments: AA2 includes three separate wetland areas supported by stream flow from tributaries draining into the reservoir.

Appendix C – Water Quality Monitoring Plan

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Thompson Falls Project No. 1869
Water Quality Monitoring Plan

NorthWestern Energy

Delivering a Bright Future

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NorthWestern Energy

Abbreviations and Acronyms List

CFR	Clark Fork River
DEQ	Montana Department of Environmental Quality
FERC	Federal Energy Regulatory Commission
licensee	NorthWestern Corporation
NorthWestern	NorthWestern Corporation
NRCS	Natural Resources Conservation Service
PCBs	polychlorinated biphenyls
Plan	Water Quality Monitoring Plan
previous licensee	PPL Montana
Project	Thompson Falls Hydroelectric Project (FERC Project No. 1869)
TAC	Technical Advisory Committee
TDG	total dissolved gas
QA/QC	quality assurance and quality control
USFWS	United States Fish and Wildlife Service

Section 1.0 – Introduction

NorthWestern Corporation (NorthWestern) is the owner and operator of the Thompson Falls Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 1869) (Project), located on the Clark Fork River near Thompson Falls, Montana. The Project is located in the downstream portion of the Clark Fork River watershed (**Figure 1-1**). There are 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.

This Water Quality Monitoring Plan (Monitoring Plan) was developed in consultation with Montana Department of Environmental Quality (DEQ) (Appendix B). The Monitoring Plan outlines the water quality monitoring that NorthWestern will conduct to fulfill licensing requirements for the Project during the new license term. The monitoring, as described in this Monitoring Plan, includes nutrient monitoring, sediment quality sampling, and total dissolved gas (TDG) monitoring.

The nutrient monitoring is intended to provide data for the long-term nutrient dataset for the Clark Fork River, which was started in 1998 as the Clark Fork Water Quality Monitoring Program. Data collected through the Clark Fork Water Quality Monitoring Program is used as part of an ongoing basin-wide effort to track nutrient trends in the Clark Fork River.

In addition to the nutrient monitoring as a part of the Clark Fork Water Quality Monitoring Program, NorthWestern will monitor water chemistry and field parameters and conduct sediment quality sampling in Thompson Falls Reservoir prior to any permitted sediment disturbance or removal actions that have the potential to re-suspend reservoir sediments.

NorthWestern will also continue to implement the 2010 TDG Control Plan (PPL Montana, 2010; **Appendix A**) and associated monitoring. Under the new FERC Project No. 1869 license, NorthWestern will update the 2010 TDG Control Plan within one year of the issuance of the new FERC license to incorporate data that have been collected during the recently completed relicensing studies.

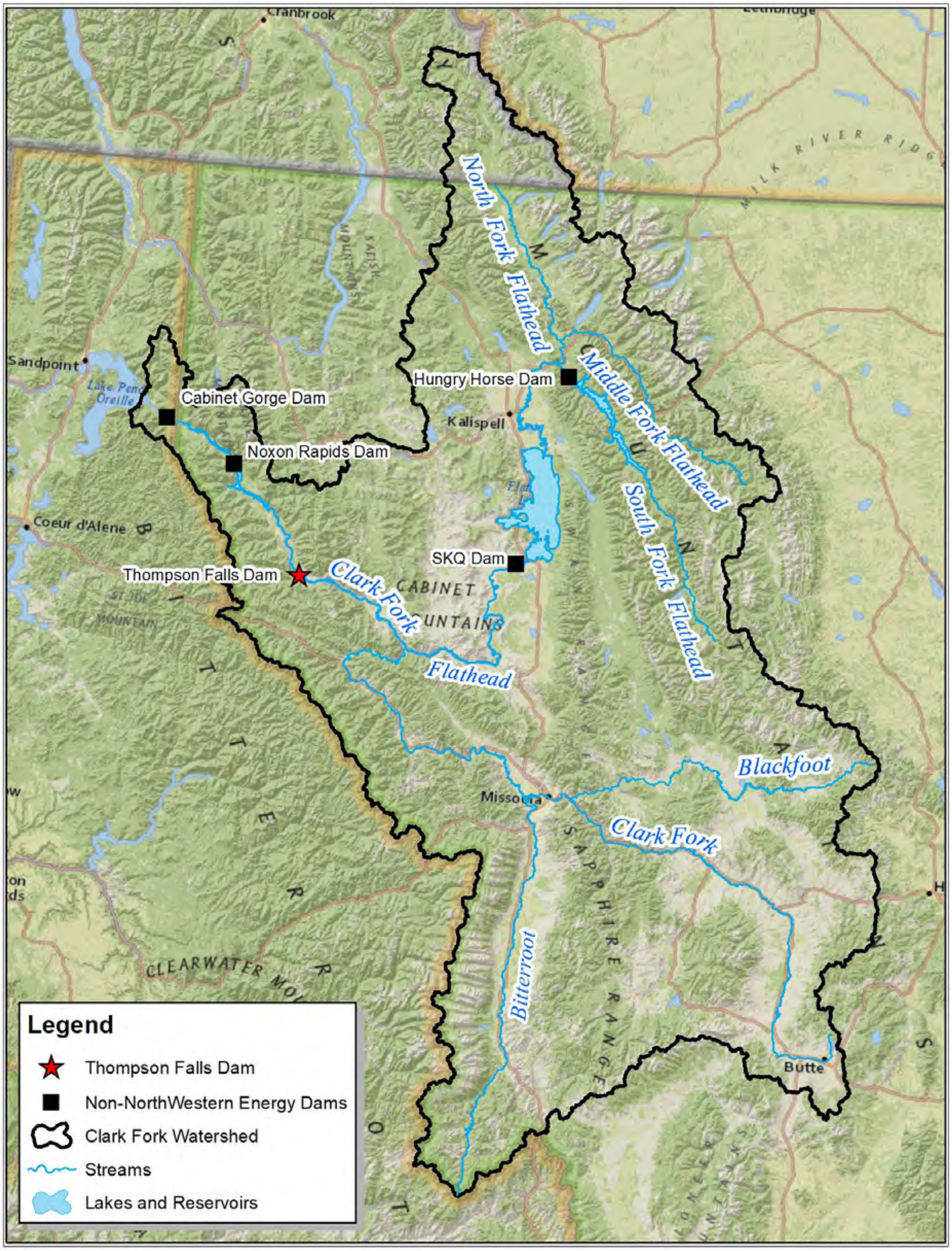

Figure 1-1. Map showing the location of Thompson Falls Dam in the Clark Fork River watershed.

Section 2.0 – Nutrient Monitoring

Nutrient monitoring outlined in this document will include water chemistry sampling and field parameters measured in-situ. **Figure 2-1** is a map showing the location of all proposed nutrient monitoring sites for the Project covered under this Monitoring Plan.

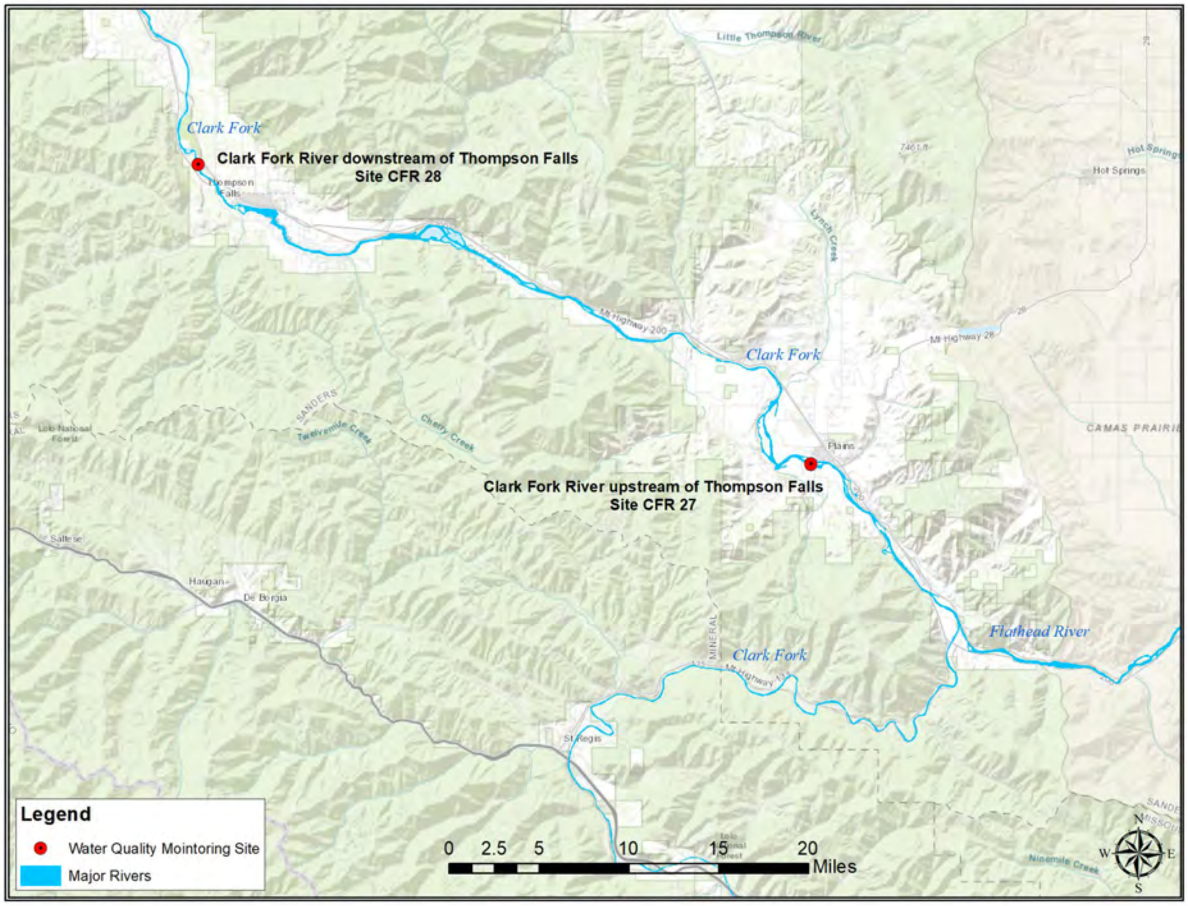

Figure 2-1. Map showing nutrient monitoring sites.

Nutrient sampling will consist of monitoring sites upstream and downstream of the Project to characterize the incoming water quality from the Clark Fork River and the outgoing water quality downstream of Thompson Falls Dam. The sampling will also provide spatial water quality data to supplement the monitoring data collected by other entities as part of the Clark Fork Water Quality Monitoring Program.

Section 2.1 – Monitoring Sites

Two nutrient monitoring sites have been identified in this Monitoring Plan, and the names and locations of these sites can be found in **Table 2-1**. Site CFR Station 28 is an established long-term monitoring site which is currently being used for the Clark Fork Water Quality Monitoring Program. Site CFR Station 27 is located approximately 9.5 river miles upstream of a previously used and subsequently abandoned CFR Station 27 from prior Clark Fork Water Quality Monitoring Program efforts due to access and safety concerns at the abandoned site. Prior to initiating monitoring at the new CFR Station 27, NorthWestern will verify that the new monitoring site is in a well-mixed portion of the Clark Fork River to provide assurances that the data collected will be representative of the water quality conditions at that location.

Each site will be sampled on an annual basis, once monthly from July through September, to capture data that falls within the time of year where the State of Montana's numeric nutrient criteria apply (DEQ, 2014). Parameter groups to be analyzed include nutrients, inorganics, and physical properties.

Table 2-1. Descriptions and locations of nutrient monitoring sites.

Site Name	Site Description	Latitude	Longitude
CFR Station 27	Clark Fork River upstream of Thompson Falls Reservoir, at Plains	47.453303	-114.896351
CFR Station 28	Clark Fork River downstream of Thompson Falls Reservoir, at Thompson Falls State Park	47.615943	-115.389710

Table 2-2 contains the list of analyses to be performed for the water chemistry samples, as well as the laboratory methods and quantification limits for each analyte. Field parameters collected in-situ will also be measured as a part of this sampling effort and the list of field parameters to be measured is found in **Table 2-3**.

Table 2-2. List of water chemistry analyses performed for water samples.

Analyte Group	Analyte	Method	Required Quantification 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	2 µg/L
Nutrients	Nitrogen, Total Persulfate	A4500 N-C	40 µg/L
Nutrients	Ammonia-Nitrogen, Dissolved	E350.1	10 µg/L
Nutrients	Phosphorus, Total	E365.1	2 µg/L
Nutrients	Phosphorus, Soluble Reactive (SRP)	E365.1	2 µg/L

Table 2-3. List of water chemistry field parameters to be collected.

Analyte Group	Analyte	Method
Field Parameters	pH	Water Quality Sonde
Field Parameters	Turbidity	Water Quality Sonde
Field Parameters	Dissolved Oxygen	Water Quality Sonde
Field Parameters	Temperature	Water Quality Sonde
Field Parameters	Specific Conductance	Water Quality Sonde
Field Parameters	Depth	Water Quality Sonde

Section 2.2 – Monitoring Timeframe and Method

Monitoring sites CFR 27 and CFR 28 will be monitored once monthly for the months of July through September on an annual basis, and each monitoring event will consist of collecting a grab sample and measuring field parameters in-situ at each site. **Table 2-4** describes the sampling time frames and parameter groups collected for each sampling event.

Table 2-4. Description of timeframe, methods, and parameters measured at water chemistry monitoring sites.

Site Name	July	August	September	Sampling Method	Analyte Groups
CFR 27	X	X	X	Single point grab sample	Nutrients, Physical Properties, Inorganics, Field Parameters
CFR 28	X	X	X	Single point grab sample	Nutrients, Physical Properties, Inorganics, Field Parameters

The nutrient sampling will consist of the collection of a single point depth integrated grab sample at each monitoring location. Grab samples will be collected from the bank in a well-mixed portion of the river. 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.

Filtration with a 0.45 micron filter for dissolved parameters will be done at the time of sample collection. All sample bottles will be virgin polyethylene bottles supplied by the receiving analytical laboratory.

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 degrees Celsius for transport to the laboratory. The sampling methodology described above conforms to current standard operating procedures used by the DEQ (2019).

Field parameters will be collected at each sampling site using a laboratory calibrated sonde. After one 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.

Section 2.3 – Data Quality Assurance/Quality Control

Data quality assurance and quality control (QA/QC) will be accomplished under this Monitoring Plan using methods described in the standard operating procedures used by the DEQ (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 five times the method detection limit.
3. **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.

Individual data which fails to achieve QA/QC objectives will be flagged with appropriate qualifiers in the database. 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.

QA/QC 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.

Section 2.4 – Data Reporting

Nutrient and water chemistry data collected as described in this section will be transmitted to the DEQ through the Montana EQuIS Water Quality Exchange database, and in an annual report submitted to the DEQ. The DEQ, through the Clark Fork Water Quality Monitoring Program, plans to utilize this data, in addition to data collected by other entities, for status and trends reporting which occurs once every 5 years. The nutrient and water chemistry data will also be presented to the Thompson Falls Technical Advisory Committee (TAC) at the annual TAC meeting.

Section 3.0 – Sediment Quality Sampling

Throughout the duration of the FERC-issued license for the Project, the need may arise for Project related construction and maintenance activities. When these activities include the disturbance or removal of reservoir sediments and require a Clean Water Act permit, there is a potential for the resuspension of reservoir sediments while the activity is being conducted.

To ensure water quality is maintained, sediment quality sampling will be conducted prior to any permitted sediment disturbance or removal. Collecting sediment data will help to characterize the quality of the sediment being removed as well as any sediment that may be re-suspended in the reservoir or downstream of the Project.

Section 3.1 – Monitoring Sites

Sediment quality sampling sites will be dependent on the location of the proposed maintenance activity. A representative sample or samples of the sediment to be disturbed or removed, will be collected prior to any permitted removal activity.

Analytes to be monitored in the collected sediment samples will include metals, polychlorinated biphenyls (PCBs), and dioxins. A complete table of analytes as well as the analysis methodologies can be found in **Table 3-1**.

Table 3-1. List of analyses to be performed for sediment samples.

Analyte Group	Analyte	Method
Dioxin	2,3,7,8-TCDF-13C	8290
Dioxin	2,3,7,8-TCDD-13C	8290
Dioxin	1,2,3,7,8-PeCDF-13C	8290
Dioxin	2,3,4,7,8-PeCDF-13C	8290
Dioxin	1,2,3,7,8-PeCDD-13C	8290
Dioxin	1,2,3,4,7,8-HxCDF-13C	8290
Dioxin	1,2,3,6,7,8-HxCDF-13C	8290
Dioxin	2,3,4,6,7,8-HxCDF-13C	8290
Dioxin	1,2,3,7,8,9-HxCDF-13C	8290
Dioxin	1,2,3,4,7,8-HxCDD-13C	8290
Dioxin	1,2,3,6,7,8-HxCDD-13C	8290
Dioxin	1,2,3,4,6,7,8-HpCDF-13C	8290
Dioxin	1,2,3,4,7,8,9-HpCDF-13C	8290
Dioxin	1,2,3,4,6,7,8-HpCDD-13C	8290
Dioxin	OCDD-13C	8290
Dioxin	2,3,7,8-TCDF	8290
Dioxin	2,3,7,8-TCDD	8290
Dioxin	1,2,3,7,8-PeCDF	8290
Dioxin	2,3,4,7,8-PeCDF	8290
Dioxin	1,2,3,7,8-PeCDD	8290
Dioxin	1,2,3,4,7,8-HxCDF	8290
Dioxin	1,2,3,6,7,8-HxCDF	8290
Dioxin	2,3,4,6,7,8-HxCDF	8290
Dioxin	1,2,3,7,8,9-HxCDF	8290
Dioxin	1,2,3,4,7,8-HxCDD	8290

Analyte Group	Analyte	Method
Dioxin	1,2,3,6,7,8-HxCDD	8290
Dioxin	1,2,3,7,8,9-HxCDD	8290
Dioxin	1,2,3,4,6,7,8-HpCDF	8290
Dioxin	1,2,3,4,7,8,9-HpCDF	8290
Dioxin	1,2,3,4,6,7,8-HpCDD	8290
Dioxin	OCDF	8290
Dioxin	OCDD	8290
Metals	Mercury	SW7471B/SW7470A
Metals	Arsenic	SW6020/SW6010B
Metals	Barium	SW6020/SW6010B
Metals	Cadmium	SW6020/SW6010B
Metals	Chromium	SW6020/SW6010B
Metals	Lead	SW6020/SW6010B
Metals	Selenium	SW6020/SW6010B
Metals	Silver	SW6020/SW6010B
PCBs	Arochlor 1016	SW8082A
PCBs	Arochlor 1221	SW8082A
PCBs	Arochlor 1232	SW8082A
PCBs	Arochlor 1242	SW8082A
PCBs	Arochlor 1248	SW8082A
PCBs	Arochlor 1254	SW8082A
PCBs	Arochlor 1260	SW8082A
PCBs	Arochlor 1262	SW8082A
PCBs	Arochlor 1268	SW8082A

Section 3.2 – Monitoring Timeframe and Method

Sediment quality sampling will occur on an as-needed basis and sampling design and methodology will be dependent on the type of proposed activity and the location of the sediment to be sampled.

For shallow water samples or in areas with limited bedrock outcroppings, a stainless steel sediment core sampler may be used to collect a representative sample or samples. In areas where a deep-water sediment sample is to be collected, a benthic grab sampler may be used to collect the sample.

The number of samples collected will be unique to each sampling event and dependent on the volume and level of heterogeneity of the sediment to be removed. Samples will be collected using the DEQ's sediment sampling methodology (DEQ, 2019).

Section 3.3 – Data Reporting

Sediment chemistry data collected as described in this section will be transmitted to the DEQ through the Montana EQuIS Water Quality Exchange database and will be presented to the Thompson Falls TAC at the annual TAC meeting.

Section 4.0 – Total Dissolved Gas Monitoring

Total dissolved gas (TDG) data have been collected at the Project since 2003 to aid in the development of a TDG Control Plan. In 2010, the previous licensee filed a TDG Control Plan (PPL Montana, 2010) with the DEQ, and NorthWestern, the current licensee, is implementing that plan to guide operations and TDG monitoring efforts (**Appendix A**). In 2018, NorthWestern installed two new radial gates on the Main Channel Dam, which replaced some of the dam's wooden panels. Prior to the filing of the FERC Project No. 1869 Final License Application in 2023, NorthWestern conducted studies to monitor TDG at the Project and the effects that the operation of the new radial gates had on TDG entrainment downstream (NorthWestern, 2022 and 2023). Within one year of the issuance of the new FERC Project No. 1869 License, NorthWestern plans to update the TDG Control Plan (PPL Montana, 2010) in consultation with the DEQ to incorporate data that have been collected during the recently completed relicensing studies. Upon completion and approval of the TDG Control Plan update, NorthWestern will provide the updated TDG Control Plan to the United States (U.S.) Fish and Wildlife Service (USFWS) and will continue to monitor TDG at the Project for three consecutive years to validate the updated TDG Control Plan.

Section 4.1 – Monitoring Sites

Monitoring for TDG at the Project will be conducted at three sites to capture TDG concentrations: above the Main Channel Dam, below the Main Channel Dam at the High Bridge, and downstream of the Project at Birdland Bay Bridge. **Table 4-1** provides the locations of each of these monitoring sites.

Table 4-1. Descriptions and locations of TDG monitoring sites.

Site Name	Site Description	Latitude	Longitude
Site AD	Above Dam – Upstream of the Main Channel Dam	47.591912	-115.352619
Site HB	High Bridge – Downstream of the Main Channel Dam	47.590720	-115.354920
Site BBB	Birdland Bay Bridge – Clark Fork River downstream of Project at Birdland Bay Bridge	47.621619	-115.392088

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. **Figures 4-1** and **4-2** show the location of the TDG monitoring sites in relation to Project infrastructure.

Section 4.2 – Monitoring Timeframe and Method

TDG monitoring at the Project will be conducted in years where the most probable (50%) April 1 Natural Resources Conservation Service (NRCS) runoff forecast for the U.S. Geological Survey (USGS) Clark Fork River near Plains MT stream gage (12389000) is at or above 125 percent. This trigger value was agreed upon in 2013 by NorthWestern, DEQ, USFWS, and the Thompson Falls Fisheries TAC. In years where the April 1 trigger value has been met, NorthWestern will monitor TDG throughout the spring runoff season (April-July) at the three established monitoring sites identified in **Section 4.1**. Upon completion and approval of the TDG

Control Plan updates, NorthWestern will monitor TDG at the Project for 3 consecutive years to validate the updated TDG Control Plan.

Each TDG monitoring site consists of a stilling well which houses a water quality sonde that collects in-situ measurements at pre-programmed intervals. The data collected helps to generate a continuous dataset for the entire monitoring season, which can be cross-referenced to streamflow values and operational changes at the Project. The sondes are calibrated once every 2 to 3 weeks to ensure that the sensors are operating correctly.

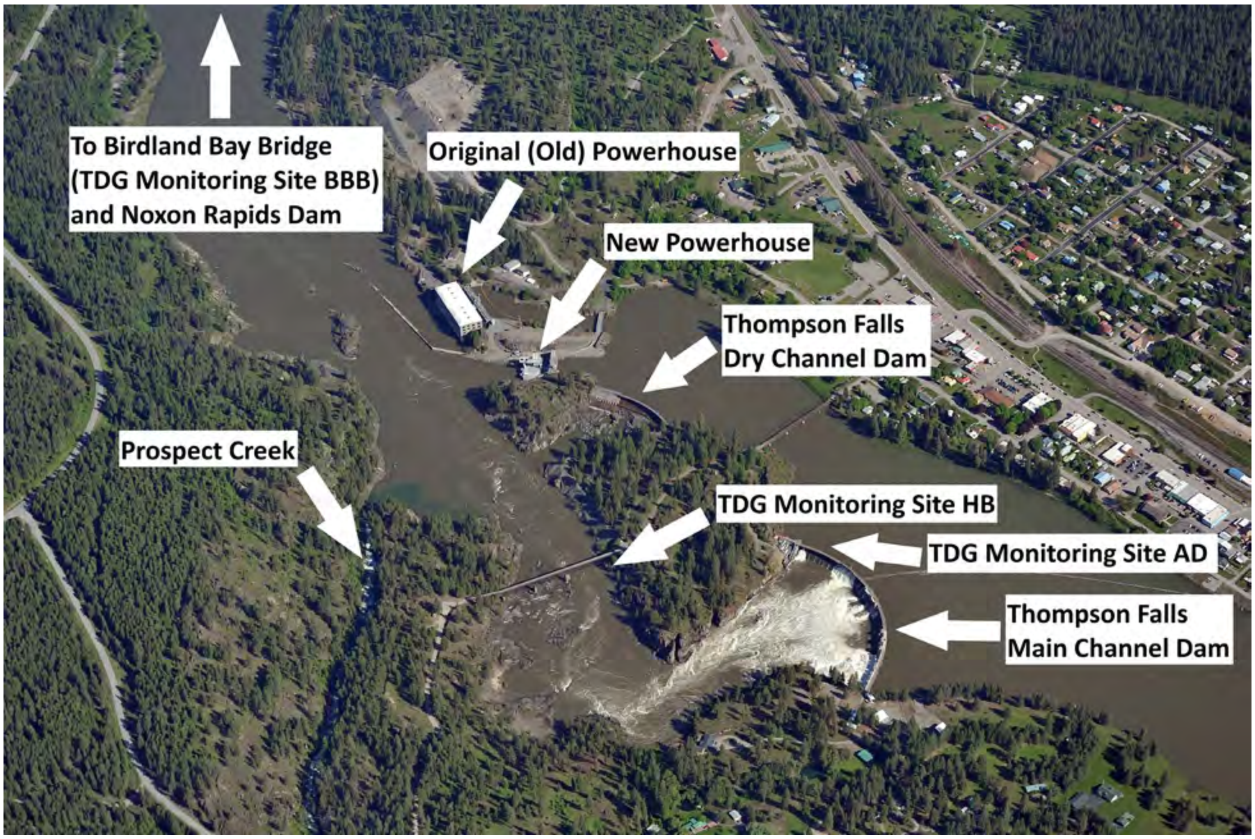

Figure 4-1. TDG monitoring locations at the Project.

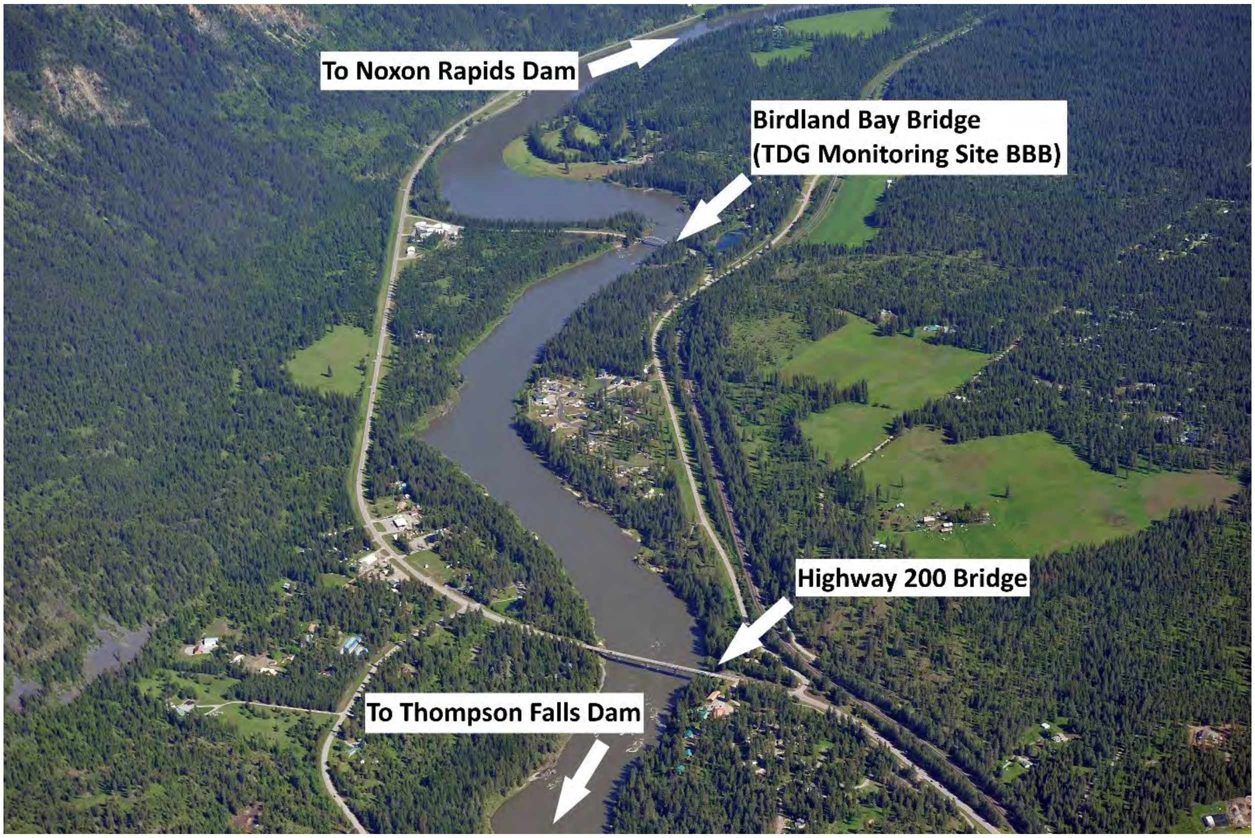

Figure 4-2. TDG monitoring locations downstream of the Project.

Section 4.3 – Data Reporting

TDG data as described in this section will be submitted in an annual report to the DEQ. Additionally, data will be presented to the Thompson Falls TAC at the annual TAC meeting.

Section 5.0 – References

Montana Department of Environmental Quality (DEQ). 2014. Department Circular 12-A, Montana Base Numeric Nutrient Standards. Montana Department of Environmental Quality, Helena, MT.

Montana Department of Environmental Quality (DEQ). 2019. Standard Operating Procedure, Sample Collection for Chemistry Analysis: Water, Sediment, and Biological Tissue. Montana Department of Environmental Quality, Helena, MT.

NorthWestern Energy. 2022. Thompson Falls Hydroelectric Project, FERC Project No. 1869, Initial Study Report – Total Dissolved Gas Study. NorthWestern Energy, Butte, MT.

NorthWestern Energy. 2023. Thompson Falls Hydroelectric Project, FERC Project No. 1869, Total Dissolved Gas Study – Final Study Report. NorthWestern Energy, Butte, MT.

PPL Montana. 2010. Total Dissolved Gas Control Plan – Thompson Falls Hydroelectric Project, FERC Project Number 1869. PPL Montana, Butte, MT.

Appendix A – 2010 Total Dissolved Gas Control Plan

Total Dissolved Gas Control Plan

Thompson Falls Hydroelectric Project
FERC Project Number 1869

Submitted to:
Montana Department of Environmental Quality
1520 E. Sixth Avenue
P.O. Box 200901
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October 2010

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1.0 Introduction

1.1 Background

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

Montana Water Quality Standards (Montana Department of Environmental Quality [MDEQ], Circular DEQ-7, 2008) sets a standard of 110% of saturation for Total Dissolved Gas (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. TDG levels in excess of 110% can occur for a few months each year during the spring freshet downstream of hydroelectric project spillways.

On February 12, 2009 the FERC issued an Order Approving Construction and Operation of Fish Passage Facilities for the Thompson Falls Hydroelectric Project. The FERC Order required PPL Montana to:

a. For the remainder of the license (through 2025), in consultation with the Thompson Falls Technical Advisory Committee (TAC) and subject to U.S. Fish and Wildlife Service approval, PPL Montana will develop and implement operational procedures to reduce or minimize the TDG production at Thompson Falls Dams during periods of spill. Future modifications to prescribed operations may be determined from ongoing evaluations, as necessary, and determined appropriate by MDEQ.

b. For the remainder of the license (through 2025), in consultation with the TAC and subject to U.S. Fish and Wildlife Service approval, PPL Montana will continue to collaborate with MDEQ, Avista, MFWP, and other entities toward reducing the overall systemic gas supersaturation levels in the Clark Fork River, occurring from a point downstream of Thompson Falls Dam to below Albeni Falls Dam.

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

The MDEQ has requested that PPL Montana prepare a TDG Control Plan and an Annual Report of PPL Montana's activities to measure and control TDG in the Clark Fork River at the Thompson Falls Hydroelectric Project. This report is intended to comply with this request, and the terms of the FERC Order.

1.2 Cause of TDG Supersaturation and Related Information

Gas bubble trauma (GBT) is a condition that affects many aquatic organisms residing in fresh or marine waters which are supersaturated with atmospheric gases. Both natural and human-induced processes are known to create supersaturated waters. When water plunges into a pool, air becomes entrained regardless of whether the plunge is a natural waterfall or a dam spillway (Weitkamp and Katz, 1980). Supersaturation at hydroelectric projects is primarily caused by water containing gas that was dissolved under a higher than atmospheric pressure.

At many dams, water passing over the dam (known as spill) plunges into a deep armored stilling basin. (Stilling basins are designed to confine energy dissipation in the armored zone, so that erosion does not scour and undermine the spillway.) As spill plunges, a turbulent energy dissipation zone is created, characterized by unsteady flow and high shear forces. Vertical circulation cells often take turbulence aeration to depth, where hydrostatic pressure collapses bubbles, forcing gas into solution and elevating TDG levels (gas absorption).

At the Thompson Falls Hydroelectric Project, the spillway is built on bedrock therefore scour is not a concern. For this reason, there is no formal spillway stilling basin and no plunge pool to create excessive TDG. Nonetheless, TDG downstream of the Thompson Falls Project often exceeds the Montana Water Quality Standard of 110% saturation during the spring freshet. The Thompson Falls Project was built on a natural river falls (Thompson Falls, Figures 1-1 and 1-2). No data on TDG during the pre-Project time period are available. However, the natural waterfalls likely elevated TDG in the Clark Fork River.

TDG carrying capacity depends on temperature and ambient pressure. TDG supersaturation is an unstable condition, and if the river channel downstream of a spillway is sufficiently wide and shallow, and with an appreciable enough hydraulic gradient, channel boundary roughness will force flow to "tumble" in a manner where there is increased water surface exposure of ambient air conditions. Where this kind of open-channel flow conditions occur, TDG levels rapidly drop back to near the stable, 100% saturation level in less than a mile (distance varies from site to site).

However, if there is a reservoir backed up to near the powerhouse tailrace, as is the case at Thompson Falls, the normal river gradient is reduced and the flow regime becomes more stable. Lower reservoir velocities result in less turbulence, and elevated TDG levels are locked in after entering the impoundment. If there are elevated wind levels, enough shear can be created to induce the vertical circulation necessary to reduce TDG levels in the reservoir. Otherwise, the elevated reservoir TDG levels wane slowly, and on the basis of delayed replenishment by lower level TDG inflows.

Figure 1-1. View of Thompson Falls, Montana

View of Thompson Falls, Montana (in background) and the Clark Fork River (in foreground), at the site of the Main Dam of the Thompson Falls Hydroelectric Project. Circa 1908. Woodworth Photo. Photo courtesy of the University of Montana, K. Ross Toole Archives.

Figure 1-2. View of Thompson Falls, Montana

View of Thompson Falls, Montana (in background) and the Clark Fork River (in foreground), circa 1908. Woodworth Photo. Photo courtesy of the University of Montana, K. Ross Toole Archives.

1.3 Goals and Objectives of the Total Dissolved Gas Plan

PPL Montana developed this plan to summarize the TDG data collected from 2002 to 2010 in the Thompson Falls Hydroelectric Project area, and to propose operational procedures to reduce or minimize the TDG production at Thompson Falls Dams during periods of spill in 2011.

PPL Montana will continue to collaborate with MDEQ, Avista, MFWP, and other entities with a long term goal of reducing the overall systemic gas supersaturation levels in the Clark Fork River, occurring from a point downstream of Thompson Falls Dam to below Albeni Falls Dam. In the short term, PPL Montana proposes to continue experimentation with the spillway operating schedule with a goal of finding a feasible spillway operating plan which minimizes TDG without impeding fish passage.

Future modifications to operational procedures will be developed through ongoing monitoring and experimentation as determined through consultation with the TAC and approval by MDEQ.

The February 2009 FERC Order for the Thompson Falls Hydroelectric Project specifies that:

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

It is PPL Montana’s intention to include a summary of the results of the previous year’s TDG monitoring in the annual report, as well as a proposal for the next year’s monitoring and spillway operation plan.

2.0 Methods

2.1 Measurement of TDG

All field work was performed by PPLM personnel. PPLM uses Hydrolab Series 4 and 5 DataSondes fitted with TDG sensors to collect TDG data. DataSonde TDG sensors are calibrated by the manufacturer, Hydrolab, every two- three years. At the beginning of the year, TDG sensors are compared to each other for accuracy and brought to within 1 mmHg of each other if necessary. Sensor membranes are pressure tested by PPLM to approximately 1000 mmHg at the beginning of the spill season. Each membrane is used once during the spill season.

Deployment periods for the DataSonde units were three - four weeks. Biological and sediment fowling is not a problem at the water temperatures found at the project site over this length of time. All parameters including pH, specific conductivity, DO and turbidity are calibrated at the beginning of each 4 week deployment period. During calibrations, sensors are cleaned and batteries replaced. Time and date are checked. A calibration check sheet is used (Appendix B). The stated accuracy of the TDG sensor is +/- 1.5 mm Hg over a range of 400 - 1400 mmHg.

Barometric pressure (BP) has been measured by an Onset Computer Corp HOBO Microstation Barometric Pressure Smart Sensor with a stated error of +/- 1.5 mbar = 1.1 mmHg at 25^{o}C and a maximum error of +/- 2.5 mbar = .9 mm Hg over the temperature range -10^{o}C to +60^{o}C. The barometer is mounted approximately 6 feet above the floor of the Control Room in the old powerhouse. The elevation of the barometer is approximately 2381.2 msl.

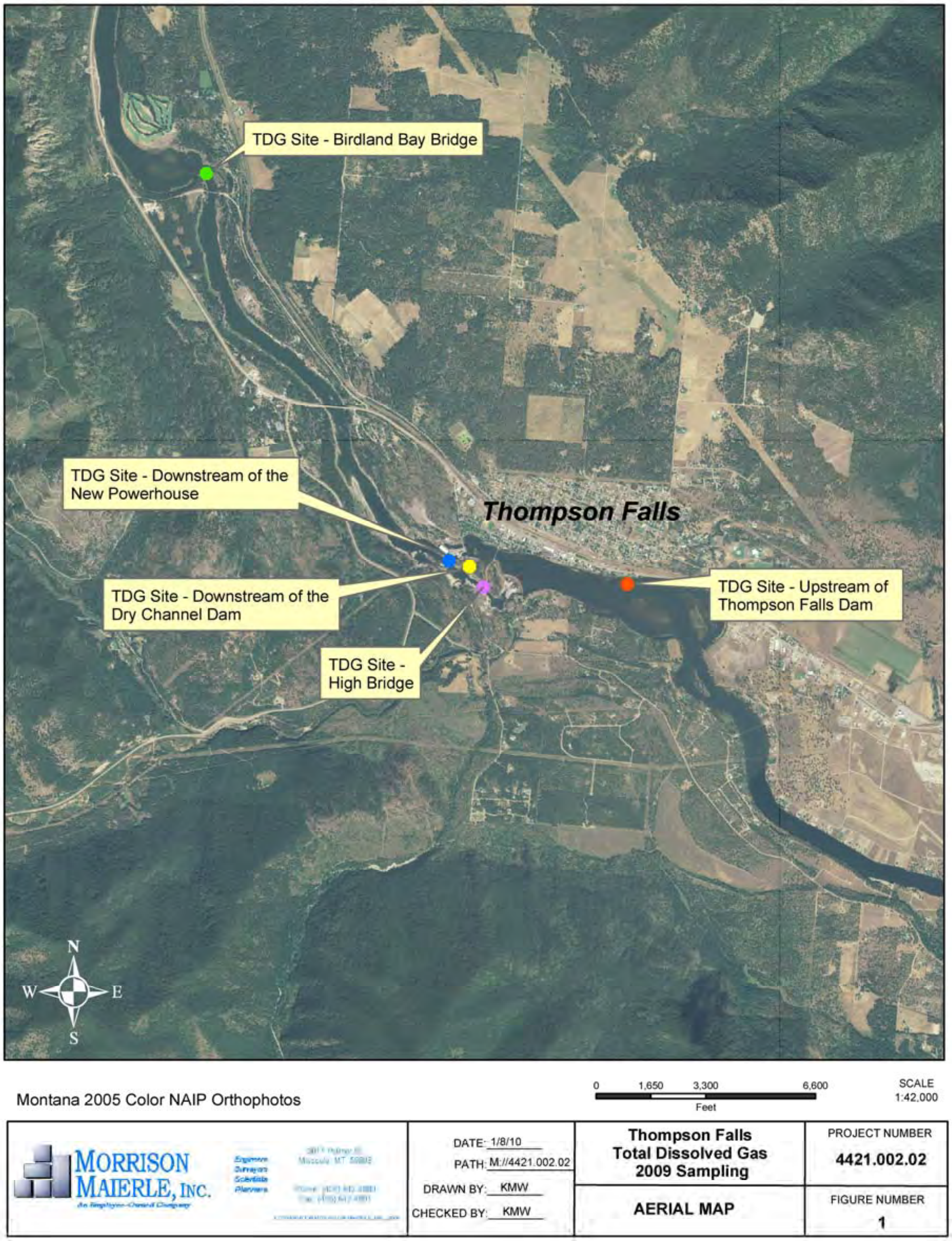
TDG has been monitored in the Thompson Falls Hydroelectric Project area since 2003. Sites that have been monitored include 1) above dam, 2) immediately below the Main Dam, 3) below the Dry Channel Dam, 4) High Bridge, 5) Birdland Bay Bridge, and 6) below the powerhouse (Figure 2-1). Not all sites were monitored in all years. The High Bridge monitoring site captures information on TDG at a location that is downstream of the Main Dam spillway and the falls, but is upstream where the Dry Channel Dam spill enters the river. The Birdland Bay Bridge monitoring site captures information on the level of TDG entering Noxon Rapids Reservoir.

In 2008, TDG was monitored at two locations immediately downstream of the Main Dam spillway. This is a difficult location for monitoring of TDG because of the high level of turbulence that occurs at this site. One sensor was washed downstream during high flows.

In 2009, TDG monitoring was conducted at the above dam site, High Bridge, and Birdland Bay Bridge.

In 2010, monitoring was conducted above the dam, at the High Bridge, below the Dry Channel Dam, and at Birdland Bay Bridge.

Figure 2-1. Map of TDG Monitoring Locations



2.2 Evaluation of Impact of Operational Procedures on TDG

In 2006, 2007, and 2008, a spillway operational procedure was implemented for the purpose of attracting upstream migrating adult salmonids to the right bank of the Main Dam spillway. This operational procedure was a part of a series of studies undertaken to determine the optimal method of providing upstream adult fish passage at the Project. Ultimately, the TAC made a unanimous decision that the preferred approach to fish passage was to construct a full height ladder on the right bank of the Main Dam spillway. With the fish ladder on the right bank, it will be desirable to operate the spillway in such a way as to attract fish to the right bank to the degree possible. However, concerns have been raised that the “fish passage” spillway operational plan may increase TDG.

Therefore, in 2009, the spillway operational procedure was revised to reflect the operations used during the pre-2006 time period to assess if the operation of the spillway has an impact on TDG.

During spring and summer 2010, the fish ladder was under construction at the Main Dam. The spillway was operated to minimize spill at the Main Dam to protect the construction site from large flows. For this reason, the Dry Channel spillway was used as soon as discharge exceeded powerhouse capacity. Spill was not released through the panels on the Main Dam spillway until June 5, when total river discharge exceeded 46,000 cfs. This was an unusual spillway operating procedure, and was unique to this one year during the ladder construction. A TDG monitor was installed below the Dry Channel spillway, but washed out during the high flow and has not been recovered to date. TDG data was successfully recorded at the above dam, High Bridge, and Birdland Bay Bridge sites in 2010.

2.3 Evaluation of Potential Biological Impacts

Electrofishing downstream of Thompson Falls Dam between the Main Dam and the Highway 200 Bridge was conducted during high flow time periods in both 2008 and 2009. This area was chosen for crew safety and because fish in this reach of river have the highest possibilities of showing symptoms of the GBT. Sampling occurred when flows were higher than 50,000 cfs, which is the discharge at which TDG begins to approach 115% of saturation at Birdland Bay Bridge.

Electrofishing was conducted with an 18.5 foot, aluminum hull Wooldridge boat with a gasoline generator and a Smith-Root VVP 15A rectifier using 120-160 volts with 4-6 amps. The waveform setting varied and was dependent on conductivity in the river system, which varies seasonally. Two booms were attached to the hull extending 4 feet past the bow with four dangling electrodes per boom. Shocking crews consisted of the boat driver and two netters. Captured fish were put in a 100 gallon holding tank before being measured (total length). All electrofishing was done during daylight hours. Most fish sampled were within 1 meter of the surface, where potential effects from TDG are greatest.

Examination of fishes (all species) included gills, lateral line, and fins. Fish were examined for bubbles, which can be very fine, or off coloring or fraying or unhealthy changes from normal morphology. Procedures were consistent from year to year, although no written Standard Operating Procedures (SOP) have been developed. If written SOP are needed for future efforts, they will be included in the annual monitoring plan which is prepared by PPL Montana and approved by the TAC.

3.0 Results

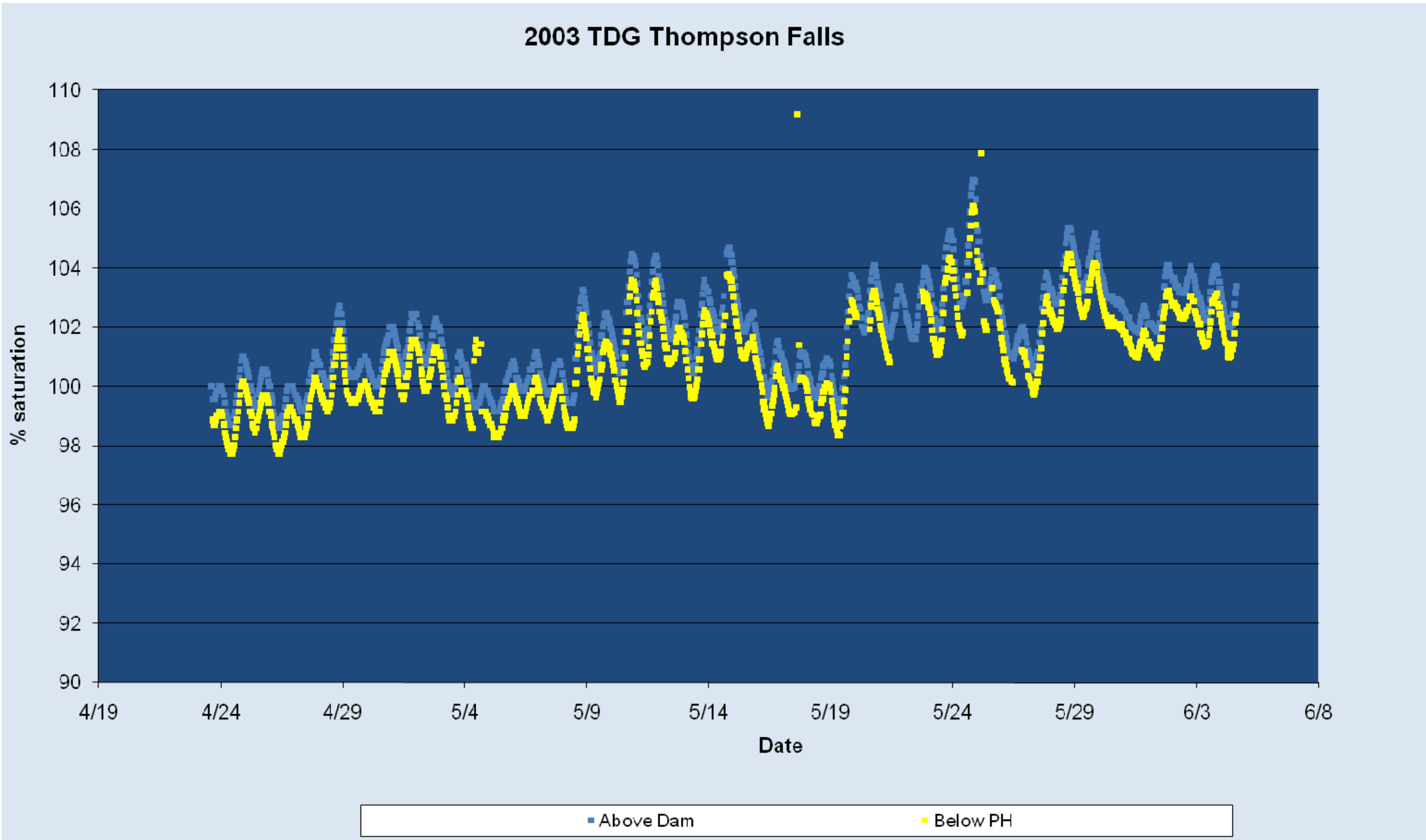
3.1 General Pattern of TDG Levels in the Thompson Falls Project Area

3.1.1 Non-Spill Time Periods

TDG upstream of the Thompson Falls Project, measured in the forebay, is generally between 100-105% of saturation regardless of river flow.

Downstream of the Project, TDG varies with discharge. During non-spill time periods, when total river flow is < 23,000 cfs, all river flow passes through the powerhouse. River flow passing through turbines is stripped of TDG to a slight degree. TDG measurements collected above the Project and below the powerhouse have found that TDG in the powerhouse tailrace is generally 1-2% lower than TDG in the forebay (Figure 3-1)

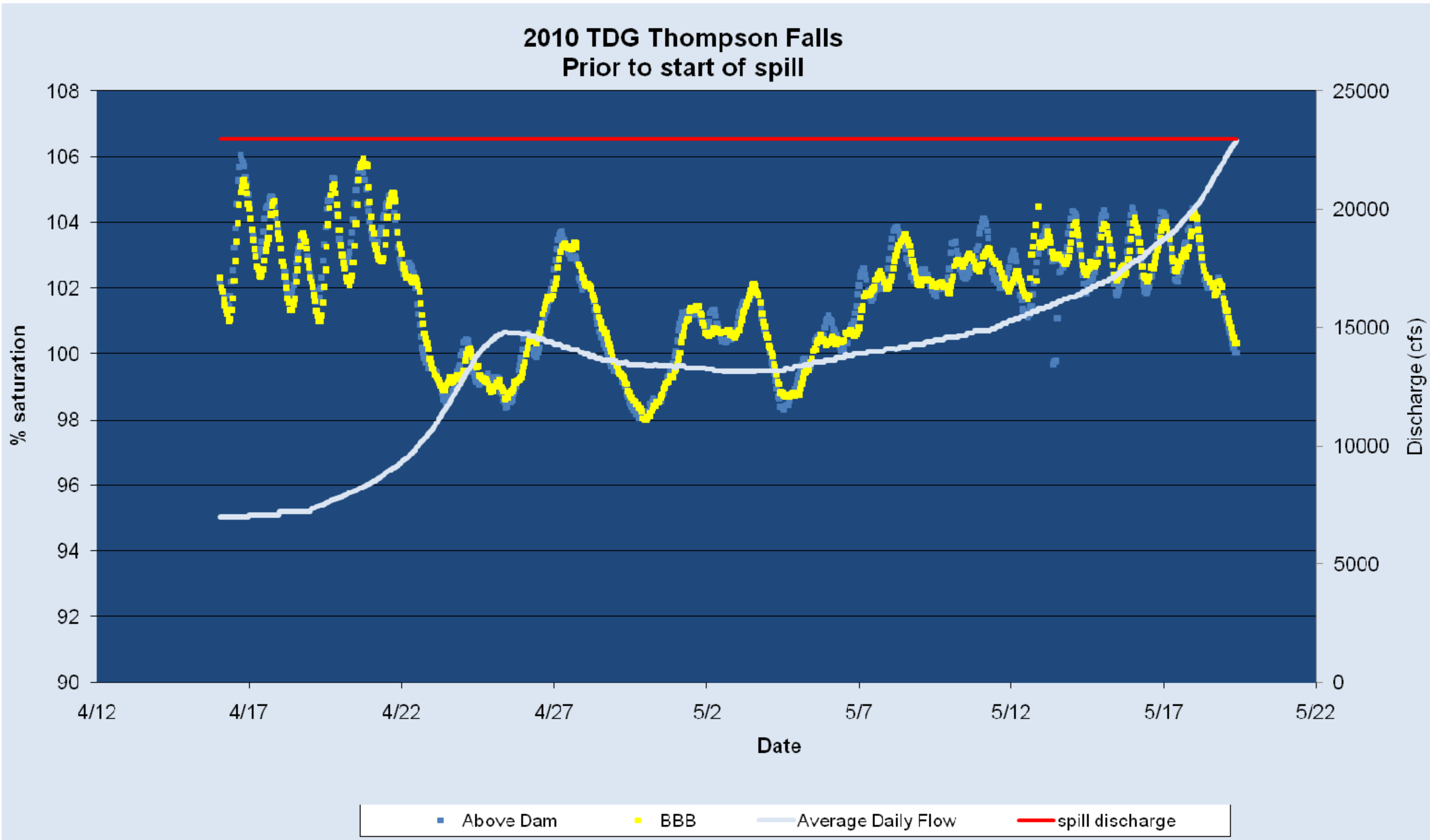
Figure 3-1.



TDG as percent saturation measured upstream of the Thompson Falls Hydroelectric Project (above Dam) and downstream of the Thompson Falls Hydroelectric Project powerhouse (below PH) in 2003.

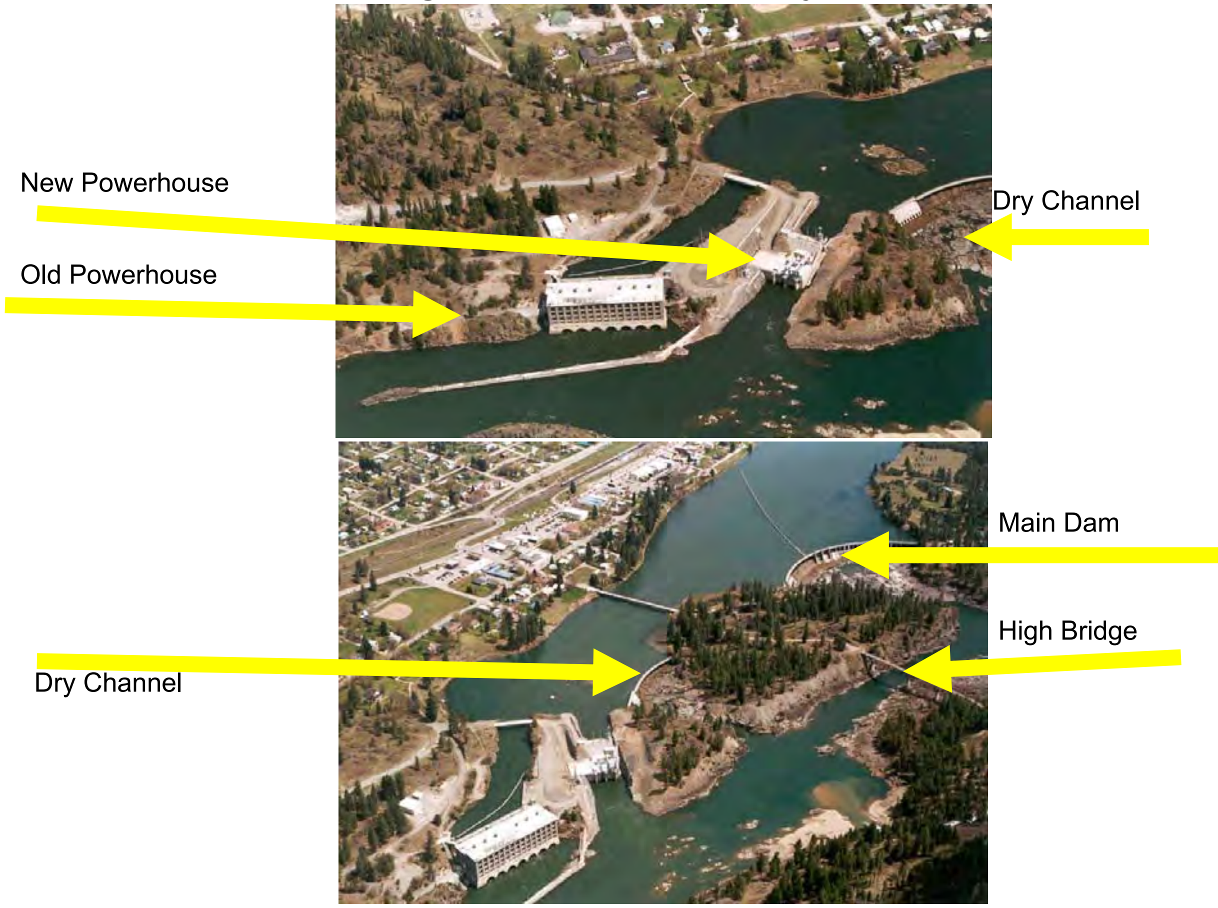
During the non-spill time period, when total river discharge is less than or equal to 23,000 cfs, TDG as measured at the Birdland Bay Bridge is generally equal to or slightly less than the TDG measured in the forebay (above Project site) (Figure 3-2). The Birdland Bay Bridge site is the downstream-most measurement site in the Project area. River water at this site is a mixture of water that has passed through the Thompson Falls Project powerhouses mixed with water coming from upstream. This upstream water has passed through or over the Project spillways and over the falls. Prospect Creek also enters the Clark Fork River downstream of the Main Dam spillway and upstream of Birdland Bay Bridge. Even during non-spill time periods, there is always some water in the channel that flows over the falls, largely as a result of seepage and leakage at the Main Dam (Figure 3-3). As Figure 3-2 shows, during the non-spill time period, the TDG of water leaving the Thompson Falls Project site is essentially the same or slightly less than the TDG of water entering the Thompson Falls Project site.

Figure 3-2.



TDG measured upstream of the Thompson Falls Hydroelectric Project and at the Birdland Bay Bridge (BBB) in early spring 2010, when total river discharge was less than powerhouse capacity.

Figure 3-3. Overview of Project Site.



Note that there is water in the channel downstream of the Main Dam even though no spill is occurring.

3.1.2 Spill Period

When river discharge exceeds powerhouse capacity, flow passes over the spillways, then passes over the natural falls, adding TDG at both points. The levels of TDG in the Clark Fork River at the Project site vary from year to year, depending on the discharge and configuration of spillway panels. Higher flows create higher levels of TDG, up to a point, however, relationship between flow and TDG is non-linear. At the highest levels of discharge, TDG at sites downstream of the Project levels off and remains relatively constant (Figures 3-4 and 3-5).

During peak discharge time periods, TDG exceeds 115% in the Clark Fork River, as measured at the High Bridge (Table 1), which is downstream of the Main Dam but upstream of the powerhouses (Figure 3-5).

TDG dissipates downstream of the High Bridge. In addition, low TDG water from the powerhouses mixes with higher TDG water that has passed over the spillways and falls.

Therefore, TDG is lower at the Birdland Bay Bridge than it is at the High Bridge (Table 1). Water entering Noxon Rapids Reservoir has an average peak TDG of approximately 110-116%, depending on discharge (Figure 3-4). However, there is considerable variability in TDG at higher discharge (Figure 3-5). The range of TDG entering Noxon Rapids Reservoir at discharge in excess of 60,000 is approximately 112-118% (Figure 3-5).

Table 1.

	2003	2004	2005	2006	2007	2008	2009
High Bridge							
Percent of year (in hours) TDG > 110%	N/A	5.1	11.8	17.2	7.9	N/A	11
Percent of year (in hours) > TDG 115%	N/A	0.2	4.6	10.5	2.4	N/A	6
Percent of year (in hours)> TDG 120%	N/A	0.0	0.0	4.4	0.0	N/A	0
BBB							
Percent of year (in hours)> TDG 110%	2.6	0.0	4.1	9.8	0.7	14	5
Percent of year (in hours)> TDG 115%	0	0.0	0.0	3.5	0.0	8	0
Percent of year (in hours) > TDG 120%	0	0.0	0.0	0.0	0.0	0	0
Percent of year discharge > 23,000 cfs (spill)	11.7*	17.9	16.1	23.2	22.0	20.4	20.9
Percent of year discharge > 45,000 cfs	0.3	0	3.6	7.7	2.2	14.2	5.6

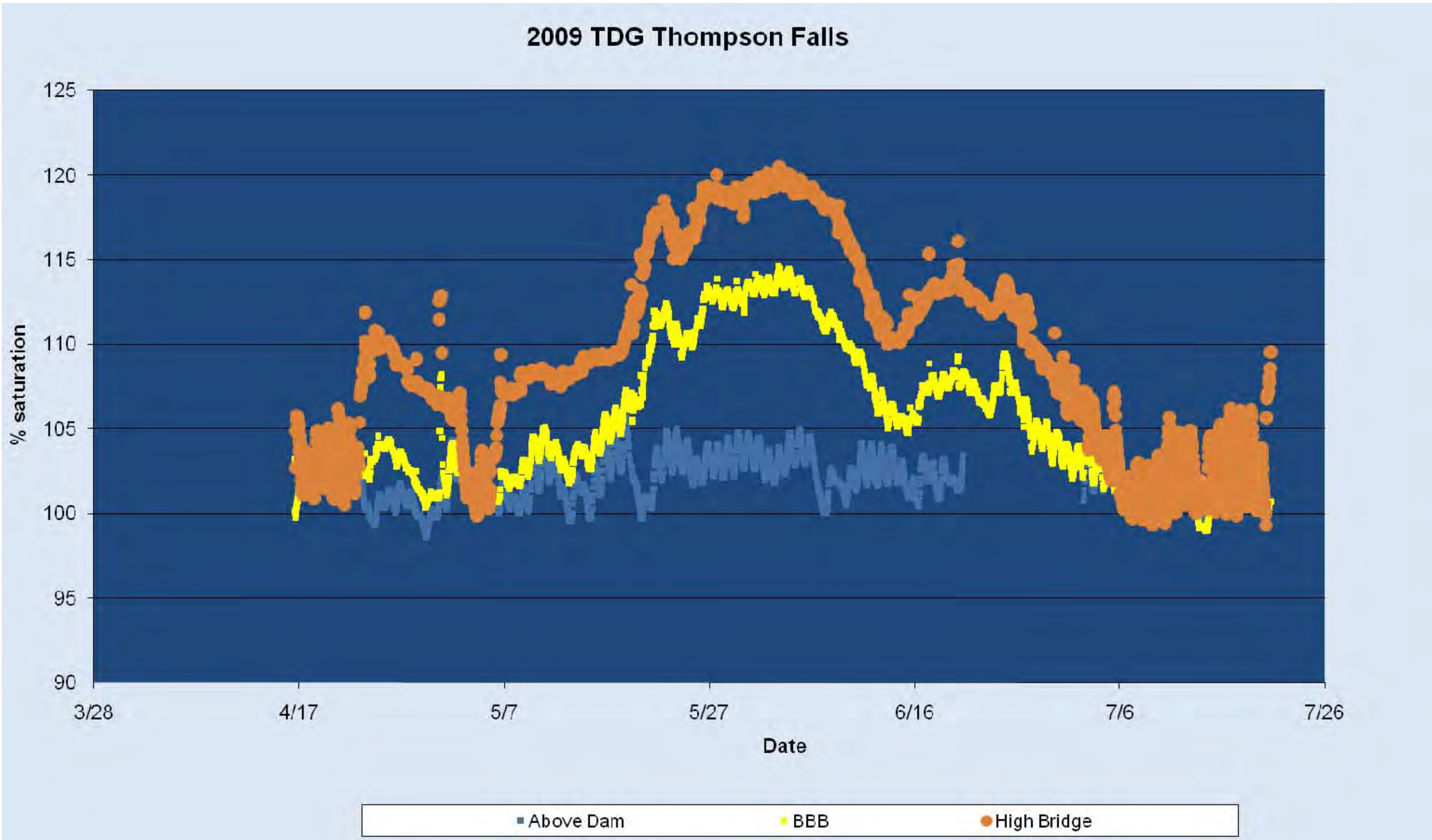
*Incomplete data set (data stopped recording June 4)

Percentage of time when TDG exceeds 110%, 115%, and 120% at the two downstream measuring sites in the Thompson Falls Project tailrace. Percent of time when discharge is greater than 23,000 cfs, the level when spill occurs and the percent of time when discharge > 45,000 cfs.

TDG increases with increasing discharge, up to a point. At the highest levels of discharge, TDG tends to remain constant. Figure 3-5 shows TDG as measured at the Birdland Bay Bridge in 2008, which is the year with the highest peak discharge since the study began. In this year, TDG increased with increases in discharge in a linear pattern until approximately 60,000 cfs. Above that level of discharge, TDG did not continue to increase linearly, but averaged approximately 116%.

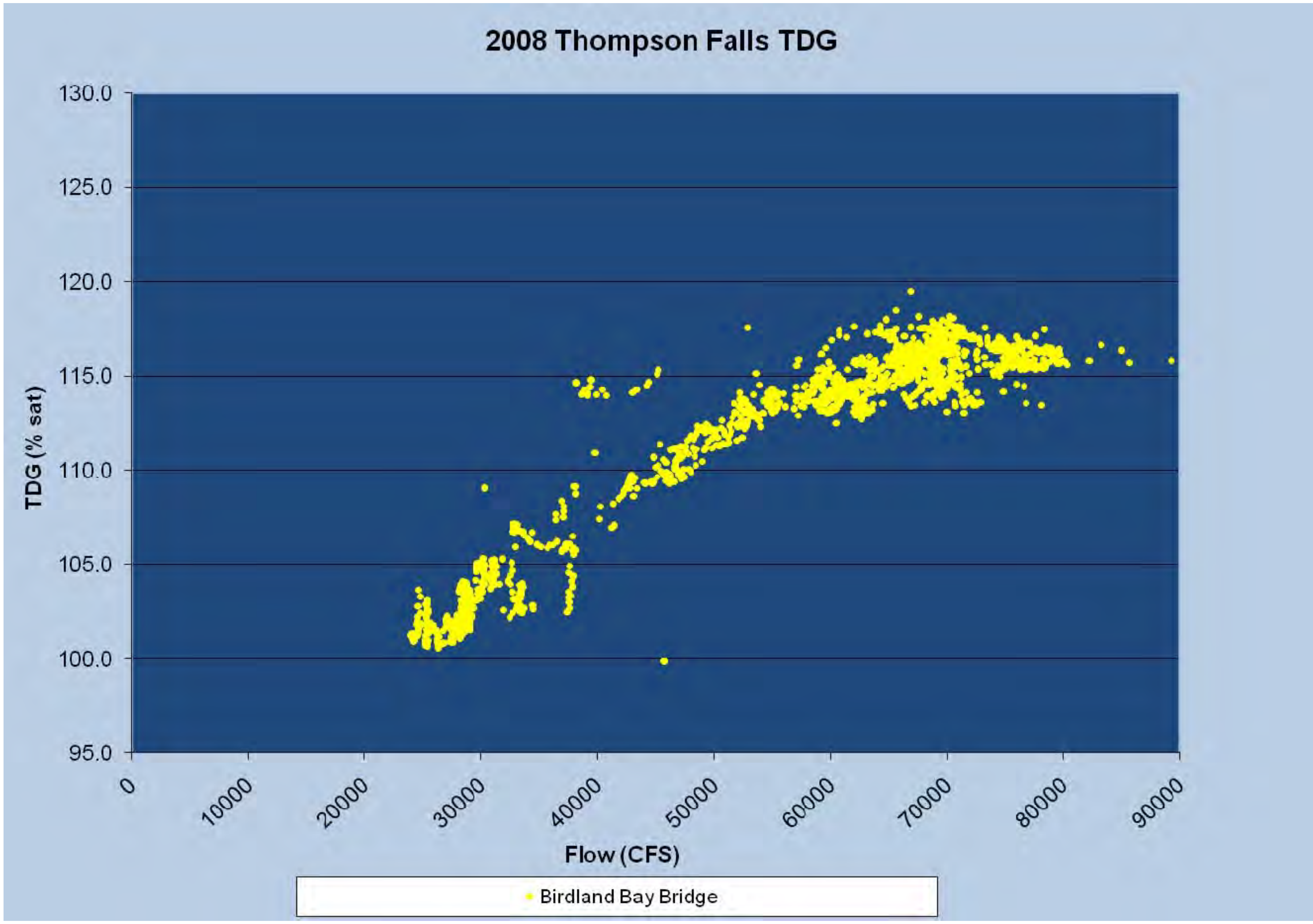
It is apparent that TDG increased with increasing discharge up to about 65,000 cfs. Above that discharge, increasing discharge had little effect on TDG at Birdland Bay Bridge. In 2008, TDG exceeded the 110% water quality standard when total river discharge exceeded 45,000 cfs (Figure 3-5).

Figure 3-4.



TDG measured at the Thompson Falls Hydroelectric Project site upstream of the Project (Above Dam), at the Birdland Bay Bridge, and at the High Bridge in 2009

Figure 3-5.



TDG measured at the Birdland Bay Bridge in 2008, plotted with total discharge in cfs in the Clark Fork River.

A Technical Memorandum prepared by GEI Consultants, Inc. in 2007 (Appendix A) summarized the results of the TDG studies conducted from 2003 to 2007. This memorandum drew the following conclusions:

- For discharge up to 23,000 cfs, all river flow passes through the powerhouses. At this discharge, little or no flow passes over the spillway and falls. Therefore, TDG below the Project is lower at this level of discharge than would have been the case in the pre-Project condition, when all river discharge passed the falls and deep pool immediately downstream.

- For higher river discharges (above 80,000 cfs), spill discharge is high enough that the TDG benefit of passing the first 23,000 cfs through turbines is overridden, and the normal operating conditions will yield higher TDG levels than the pre-Project condition. However, this occurs less than approximately 1% of the time.

- For total river discharges of 23,000-80,000 cfs, there is a *cross-over discharge* below which TDG levels are lower than the pre-Project condition, and above which TDG levels are higher than the pre-Project condition. If that change-over level is 50,000 cfs total river discharge, the TDG levels are lower now than during the pre-Project condition 96% of the time. If that cross-over discharge is 70,000 cfs, normal operating conditions would reduce TDG relative to the pre-Project condition 98% of the time. However, further monitoring will not resolve the magnitude of the cross-over total river discharge, since pre-Project TDG data are not available.

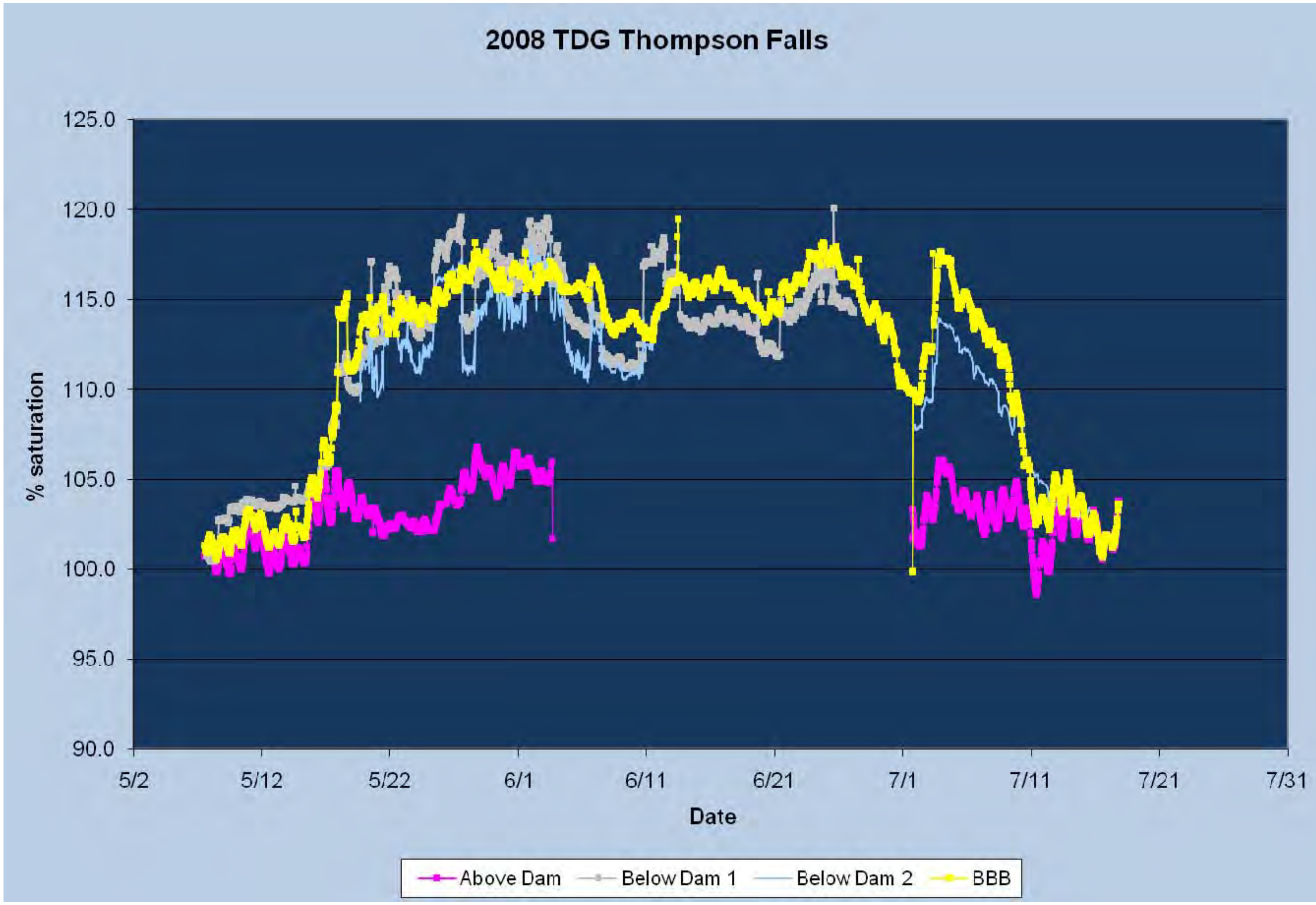
- Gas abatement measures at Thompson Falls, if required by the state or federal government, would not be successful if employed at the spillway structure. Since the TDG uptake zone is the deep pool immediately downstream of the falls, that is where direct structural measures would be required. The primary means of reducing TDG uptake at this location would be to add turbine capacity (probably not economically viable) or fill and cap deep zones in the bypass reach to keep turbulence from going to depth. This would be costly, entail a considerable length of the bypass reach channel, and would transfer energy further downstream.

Additional monitoring has been conducted since 2007. Results of monitoring conducted in 2008-2010 are detailed in the following sections.

3.2 2008 Total Dissolved Gas Monitoring

In 2008 there were two Hydrolabs installed below the dam: below dam 1 (BD1) and below dam 2 (BD2). Both were installed in the same location on the log sluice (right bank), but one was installed earlier in the spring at a lower elevation. BD2 was installed later, about 5-6 feet higher on the wall. There was no High Bridge Hydrolab this year (2008) but the above dam and Birdland Bay Bridge sites were monitored as in previous years. Both the above dam sensor and the BD2 sensor suffered failures during part of the year; hence there are some missing data points (Figure 3-6). Measurements of TDG at the Main Dam site are problematic as a result of the amount of turbulence at this location. The water is "frothy" and full of bubbles, making accurate measurements of TDG difficult. This is apparent in the scatter in the data points for the two below dam monitors (Figure 3-6). For this reason, the results from these monitors should be considered rough approximations, rather than precise measurements of TDG.

Figure 3-6.

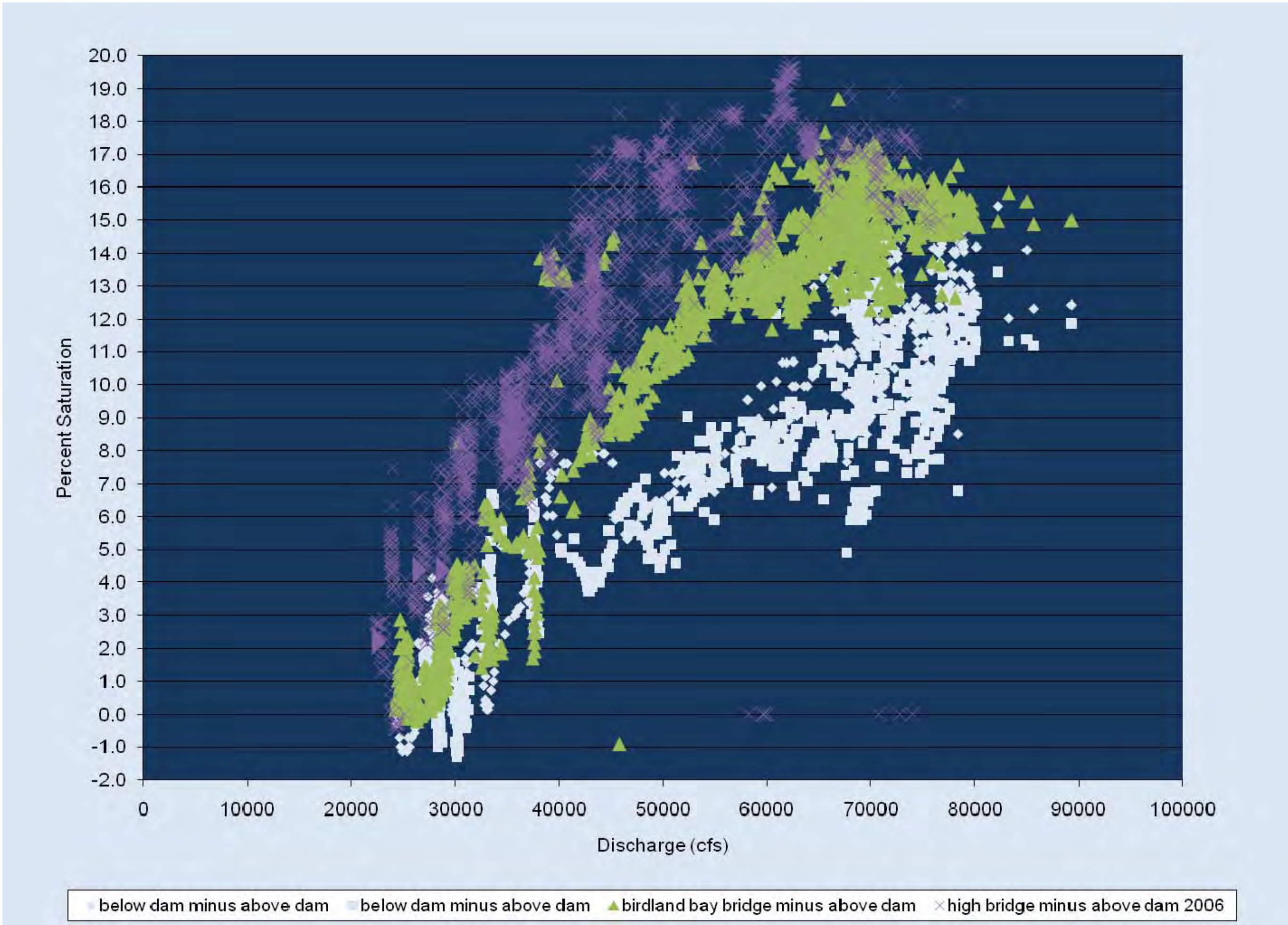


TDG measured above the Thompson Falls Hydroelectric Project (Above Dam), at two sites at the Main Dam log sluice (Below Dam 1 and Below Dam 2), and at Birdland Bay Bridge in 2008.

During 2008, the below dam TDG was about 6-10% higher than the above dam TDG during the spill season (Figure 3-6). This is approximately how much TDG is added to the water as a result of spill over Thompson Falls Dam.

For much of the 2008 runoff season, the Birdland Bay Bridge site had higher TDG than the below dam sites (Figure 3-6). This means that the river must increase in TDG after it passes over the Main Dam. These results lend credence to the theory that TDG is added at the falls below the dam. The amount of TDG added at the falls can be estimated by using data collected at the High Bridge in other years. The runoff in 2006 was similar in magnitude to the runoff in 2008, so 2006 data were selected for use in this analysis. Using 2006 High Bridge TDG data plotted against total discharge, it is apparent that both the Main Dam and the falls add TDG to the Clark Fork River (Figure 3-7).

Figure 3-7.



TDG measured below the dam and at Birdland Bay Bridge in 2008, subtracted from the above dam measurement taken at the same date and time, plotted against total discharge in cfs. High Bridge TDG measured in 2006 is also subtracted from above dam measurements collected at the same date and time.

On Figure 3-7, the difference between TDG measured above the dam and TDG measured at various locations below the dam was determined by subtracting TDG measurements taken below the dam from those taken above the dam at the same date and time. A difference of zero indicates that the below dam measurement and the above dam measurement were the same. A positive number indicates that the below dam measurement was higher than the above dam measurement.

Table 2 presents the mean TDG at differing ranges of total river discharge at the above dam, below dam, High Bridge, and Birdland Bay Bridge locations. Table 3 shows how TDG changes in a downstream direction. A positive number indicates that TDG increased by this amount in comparison to the measurement station located upstream. A negative number indicates that TDG decreased in comparison to the measurement station upstream.

Table 2.

Total Discharge (cfs)	AD Mean	AD Range	BD Mean	BD Range	HB* Mean	HB* Range	BBB Mean	BBB Range
23,000 - 30,000	101.52	99.74-104.77	103.25	100.41-104.80	106.51	101.75- 111.71	102.18	100.57-105.08
30,000 - 40,000	102.74	98.62-105.74	105.56	103.15-111.35	111.69	107.47- 117.01	105.65	102.20-114.80
40,000 - 50,000	103.32	101.24-104.87	108.98	107.23-111.95	116.41	112.38- 121.81	110.63	99.86-115.31
50,000 - 60,000	103.30	101.95-105.10	111.11	108.70-117.12	120.25	116.37- 122.19	113.59	111.30-117.56
60,000 - 70,000	103.58	101.86-106.46	113.74	109.56-120.05	121.62	119.37- 123.58	115.32	112.48-119.49
70,000 - 80,000	104.76	101.71-106.82	115.39	110.43-119.52	120.58	118.67- 121.97	115.99	113.06-118.17
80,000 - 90,000	104.99	103.63-105.75	117.26	114.58-119.06	N/A		115.90	115.59-116.64

Mean TDG at differing range of total river discharge. Data for High Bridge was collected in 2006. Data for other sites collected in 2008. AD = Above Dam, BD = Below Dam and is the mean for BD1 and BD2, HB = High Bridge, BBB = Birdland Bay Bridge.

Table 3.

Discharge (cfs)	BD - AD	HB* - BD	BBB - HB
23,000 - 30,000	1.73	3.26	-4.33
30,000 - 40,000	2.82	6.13	-6.05
40,000 - 50,000	5.66	7.43	-5.77
50,000 - 60,000	7.81	9.14	-6.66
60,000 - 70,000	10.15	7.88	-6.29
70,000 - 80,000	10.63	5.19	-4.59
80,000 - 90,000	12.26	N/A	N/A

Mean TDG as it changes in a downstream direction at varying levels of total river discharge. BD-AD = Below Dam TDG minus Above Dam TDG, HB-BD = High Bridge TDG minus Below Dam TDG, BBB-HB = Birdland Bay Bridge TDG minus High Bridge TDG.

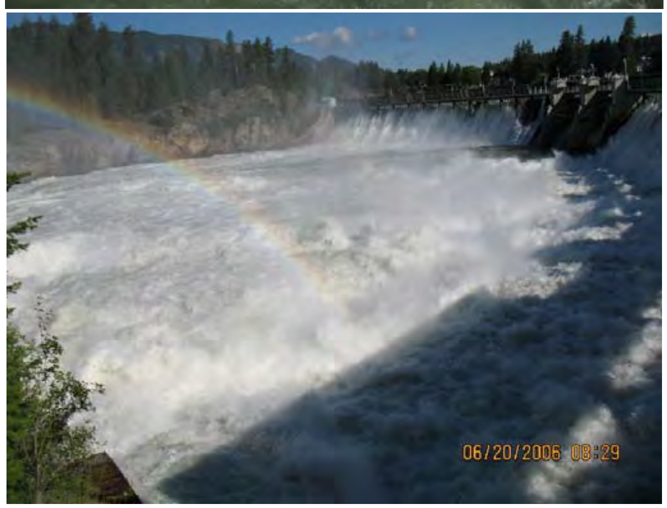
At low levels of spill (23,000 cfs to approximately 30,000 cfs) there is considerable scatter in the estimates of TDG added at the Main Dam (Figure 3-7). However, water passing over the Main Dam at this level of discharge increases in TDG 1.73% on average, with a range of from -1% to +4% in comparison to the above dam TDG. Increasing total discharge results in increasing amounts of TDG added to the water at the Main Dam. At total discharge above 65,000 cfs there is a wide range in scatter in the results (Figure 3-7). At this level of spill, turbulence in the tailrace is extreme and TDG measurements are not necessarily reflecting a stable condition in the water (Figure 3-8). However, based on the data available, at total river discharge in excess of 60,000 cfs the water passing over the Main Dam increases in TDG by approximately 10%.

Downstream of the Main Dam, water passes over the falls where it picks up additional TDG. On Figure 3-7, the difference between the light blue squares and the purple crosses reflect the TDG added by the falls. The amount of TDG added by the falls varies with discharge, with an average of 3.3% added at low levels of discharge (between 23,000 cfs and 30,000 cfs), increasing to approximately 9% at higher levels of discharge (between 50,000 and 60,000 cfs). At the highest discharges measured, the contribution of the falls to total TDG declines. At discharge in excess of 60,000 cfs, the falls are backwatered, and therefore there is less of a plunge and less TDG added to the water (Figure 3-8).

These results support the hypothesis that both the Main Dam and the falls contribute TDG to the Clark Fork River, and that the relative contributions of these two features varies with discharge. At the flows less than 60,000 cfs, the falls appear to contribute more TDG than the Main Dam. However, at the highest levels of flow, the Main Dam contributes more TDG than the falls.

The green triangles on Figure 3-7 depict the TDG at Birdland Bay Bridge in comparison to the above dam level of TDG. As described above, TDG at Birdland Bay Bridge is less than at the High Bridge because of dilution from the water passing through the powerhouses and dissipation of TDG as the river flows downstream.

Figure 3-8. Thompson Falls Main Dam Tailrace.



Photographs of the Thompson Falls Main Dam tailrace, taken June 20, 2006. At this time the estimated total discharge in the Clark Fork River at the Project site was 60,000 cfs. Note the high level of turbulence below the Main Dam in the lower photo. The upper photo shows the falls below the Main Dam backwatered at this level of river flow.

3.3 2009 Total Dissolved Gas Monitoring

3.3.1 Measurements of TDG in the Project Area

Similar to past years, TDG in 2009 was lowest above the Project, highest at the first measurement site below the Project (at the High Bridge), and intermediate at the most downstream site at the Birdland Bay Bridge (Figure 3-2). TDG levels declined downstream of the High Bridge as a result of mixing with river flow coming through the powerhouse and, potentially, some degassing as the river moves downstream.

3.3.2 Spillway Panel Operations

In 2006, PPL Montana implemented a specialized spillway operation schedule in an effort to determine if fish can be attracted to the right bank of the Main Dam. This “fish” spillway schedule, depicted in Figure 3-9, was implemented during spill operations in 2006, 2007, and 2008. Data collected on TDG during this period indicated that TDG levels may be have been slightly higher during the years when the “fish” spill schedule was implemented than during previous years when the “non-fish” schedule, depicted in Figure 3-10, was in place.

In order to test this theory, operations of the spillway were returned to the “non-fish” schedule during 2009.

Photos 1 and 2 show the Main Dam spillway, with the spill bays numbered. Each spill bay contains 6 spill panels. When opened, the panels release 235 cfs at full pool. Figures 3-9 and 3-10 display the “fish” and the “non-fish” schedule spillway opening schedule.

A visual comparison of the “fish” *vs.* the “non-fish” operating schedule indicates that TDG levels are higher by approximately 2-3% under the “fish” operating schedule, when total flow is in excess of approximately 45,000 cfs (Figures 3-11 and 3-12).

Photo 1. The right and center of the Main Dam, with bays numbered.

Photo 2. The left bank of the Main Dam at the Thompson Falls Project, with the spillway bays numbered.

Figure 3-9. Operational Plan for the Main Dam Spillway.

Thompson Falls Main Dam Spillway -"Fish" Spill Schedule

BAY NUMBER																																				Lift Gates	Total Flow (cfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
		1	1	1																																3	23,705
		1	1	1																												6	6	6	6	27	29,345
		1	1	1													6	6	6	6												6	6	6	6	51	34,985
		1	1	1					6	6							6	6	6	6												6	6	6	6	63	37,805
		1	1	1					6	6							6	6	6	6	6	6										6	6	6	6	75	40,625
		1	1	1					6	6							6	6	6	6	6	6								6	6	6	6	6	6	87	43,445
		1	1	1			6	6	6	6							6	6	6	6	6	6								6	6	6	6	6	6	99	46,265
		1	1	1			6	6	6	6							6	6	6	6	6	6					6	6	6	6	6	6	6	6	6	117	50,495
		1	1	1	6	6	6	6	6	6							6	6	6	6	6	6					6	6	6	6	6	6	6	6	6	129	53,315
		1	1	1	6	6	6	6	6	6							6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	153	58,955
		6	6	6	6	6	6	6	6	6							6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	168	62,480
6	6	6	6	6	6	6	6	6	6	6	6						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	186	66,710
DRY CHANNEL SPILLWAY (12 Bays)																																					
6	6	6	6	6	6	6	6	6	6	6	6																									72	83,630
Radial Gates (Bays 16 and 17)																																					
													Both - Full-Open - 11,000 cfs per bay																								105,630

Operational plan for the Main Dam spillway when the “fish” spill schedule is in place. Each lift bay contains 6 panels. Opening a panel releases ~235 cfs. As river flow increases, panels are opened to attract fish to the right bank and detract fish from going to the left bank.

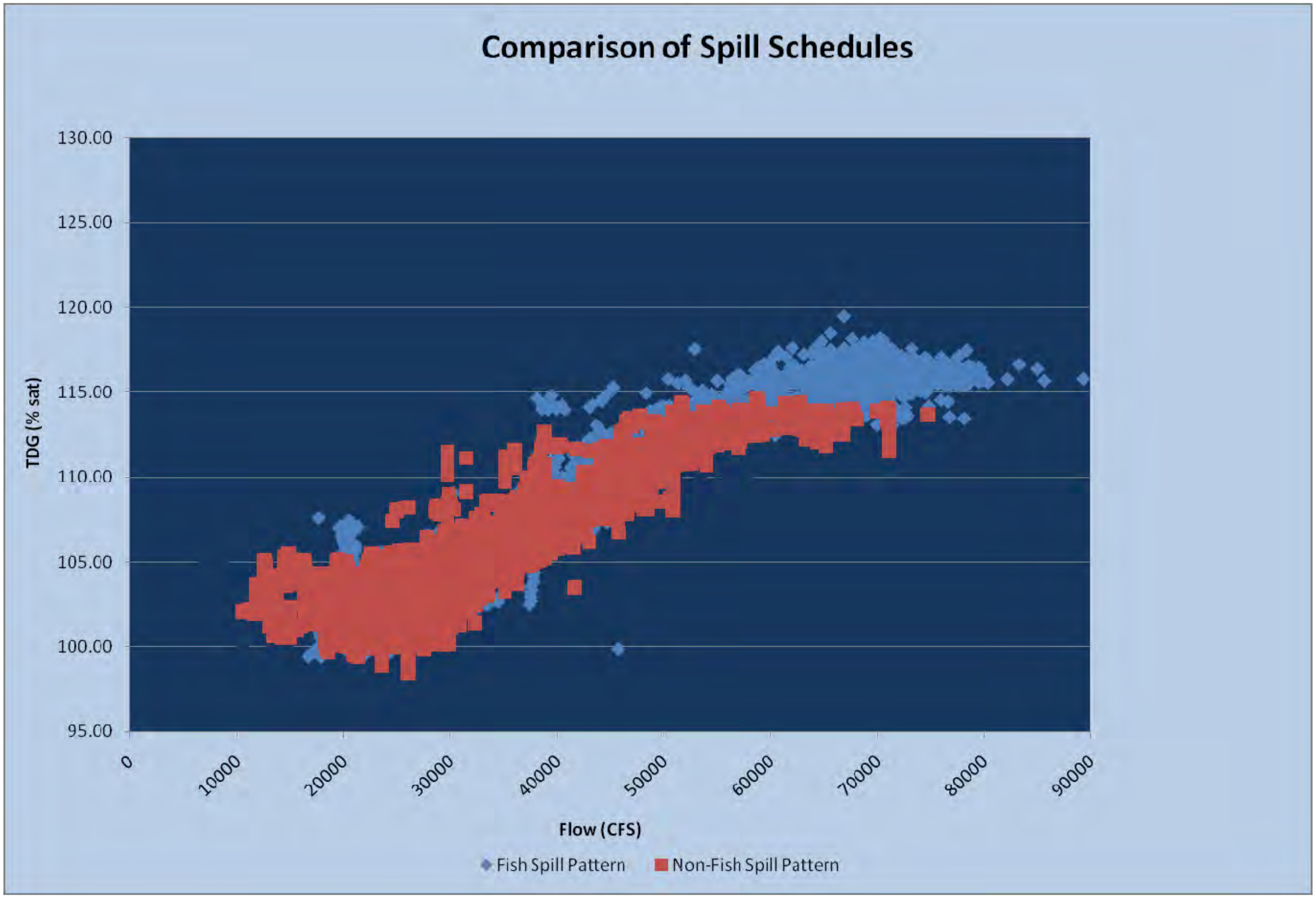
Figure 3-10. Operational Plan for the Main Dam Spillway.

Thompson Falls Main Dam Spillway - Baseline (non-fish) Spill Schedule

BAY NUMBER																																				**Lift Gates**	**Total Flow (cfs)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
																												6	6	6	6	6	6	6	6	48	34,280
										6	6																	6	6	6	6	6	6	6	6	60	37,100
										6	6														6	6	6	6	6	6	6	6	6	6	6	78	41,330
							6	6	6	6	6														6	6	6	6	6	6	6	6	6	6	6	96	45,560
							6	6	6	6	6											6	6	6	6	6	6	6	6	6	6	6	6	6	6	114	49,790
				6	6	6	6	6	6	6	6											6	6	6	6	6	6	6	6	6	6	6	6	6	6	132	54,020
				6	6	6	6	6	6	6	6								6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	150	58,250
6	6	6	6	6	6	6	6	6	6	6	6								6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	174	63,890
6	6	6	6	6	6	6	6	6	6	6	6						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	186	66,710
DRY CHANNEL SPILLWAY (12 Bays)																																					
6	6	6	6	6	6	6	6	6	6	6	6																									72	83,630
Radial Gates (Bays 16 and 17)																																					
													Both - Full-Open - 11,000 cfs per bay																								105,630

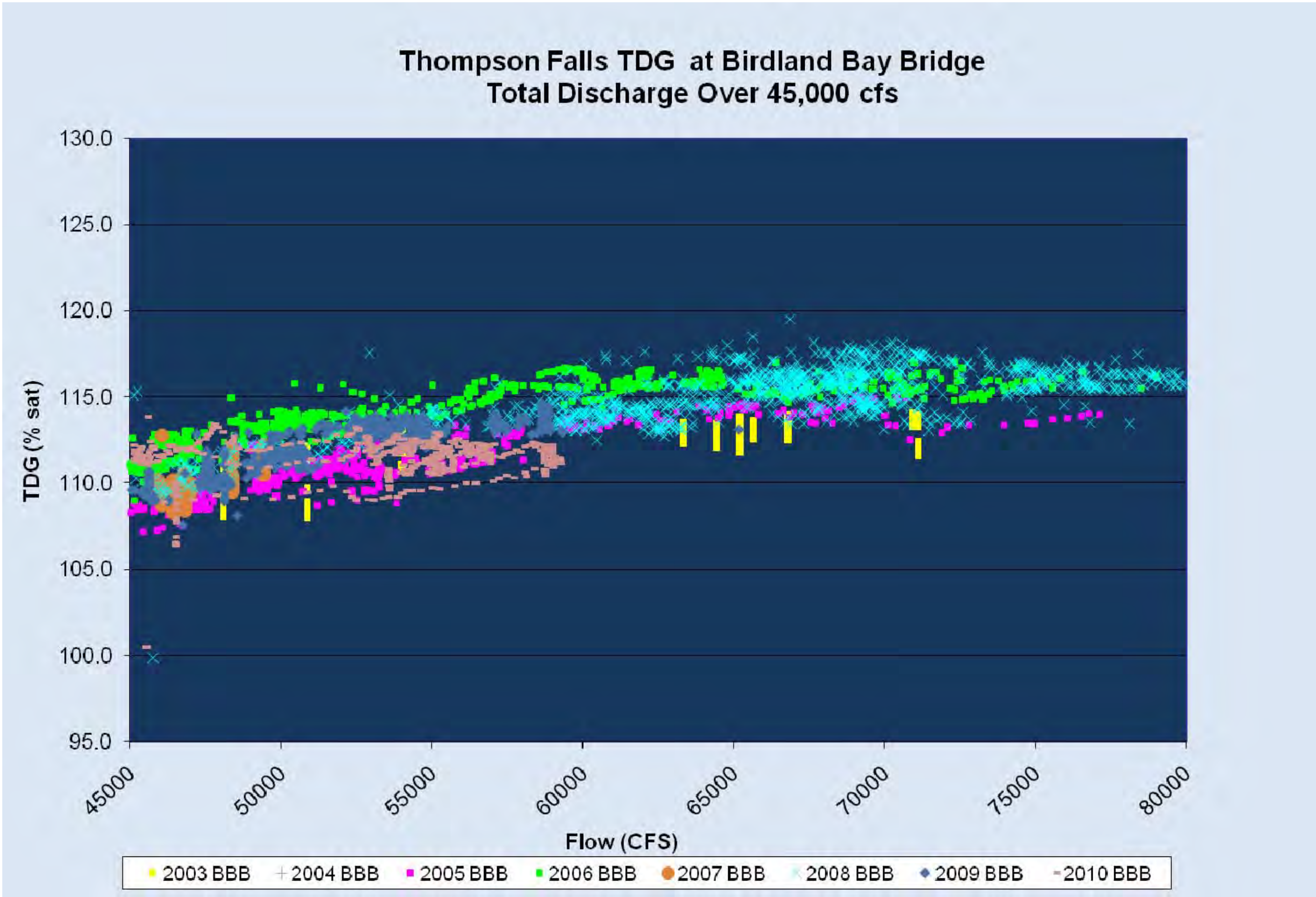
Operational plan for the Main Dam spillway when the "non-fish" spill schedule is in place. Each lift bay contains 6 panels. Opening a panel releases ~235 cfs. As river flow increases, panels are opened balance flow between the right and left bank.

Figure 3-11.



TDG in percent saturation at discharge (cfs) in 2003, 2004, 2005, 2009, in red, the "non-fish" spill schedule. Blue is TDG at discharge in 2006, 2007, and 2008, the "fish" spill schedule. TDG measured at the Birdland Bay Bridge.

Figure 3-12.



TDG as measured at the Birdland Bay Bridge, in all years. Showing discharge between 45,000 cfs and 80,000 cfs. "Fish" spill schedule was used during 2006, 2007, and 2008. The "Non-fish" schedule was used during 2003, 2004, 2005, and 2009. 2010 was unique because of the constraints of construction of the fish ladder and the Dry Channel spillway was used first.

In order to more thoroughly investigate the issue, PPL Montana compared the percentage TDG at various levels of total flow (Table 4). These data seem to confirm that TDG levels are higher than average during the years when the “fish” spillway schedule was implemented when total flow exceeds 40,000 cfs, but not at lower levels of flow. However, it is difficult to draw firm conclusions because data are limited. In some years (2004 and 2007), peak discharge did not exceed 50,000 cfs. Therefore, there are only 2 years when the “fish” spill schedule was implemented and peak flow exceeded 70,000 cfs. It should also be noted that 2006 and 2008 were years with high peak flow. The apparent higher levels of TDG during the “fish” operating years may actually be a result of the higher runoff.

Table 4.

Total Flow	2003	2004	2005	2006	2007	2008	2009	2010	Average
<23,000	N/A	102.75	103.69	99.45	103.11	N/A	101.58	101.64	102.31
>23,000, <30,000	102.14	103.55	103.57	103.56	102.46	102.22	102.59	101.98	102.81
>30,000, <40,000	104.75	105.05	107.06	106.71	105.22	105.65	105.15	106.58	105.73
>40,000, <50,000	109.46	107.49	110.41	110.62	109.05	110.63	109.16	110.93	109.94
>50,000, <60,000	111.01	N/A	112.68	114.34	N/A	114.92	112.98	111.61	113.62
>60,000, <70,000	112.92	N/A	114.15	115.74	N/A	115.99	113.11	N/A	115.21
>70,000, <80,000	113.17	N/A	113.99	115.68	N/A	115.90	N/A	N/A	114.77

Mean TDG, measured at the Birdland Bay Bridge, at various levels of total flow, by year. The “Fish” spillway operating procedures were implemented in 2006, 2007, and 2008 (blue). The non-fish spillway operations were implemented in 2003, 2004, 2005, and 2009 (green). Spillway operations in 2010 were dictated by the needs of the fish ladder construction, and the Dry Channel Dam spillway was used more extensively than in any other year.

3.3.3 Radial Gate Operation

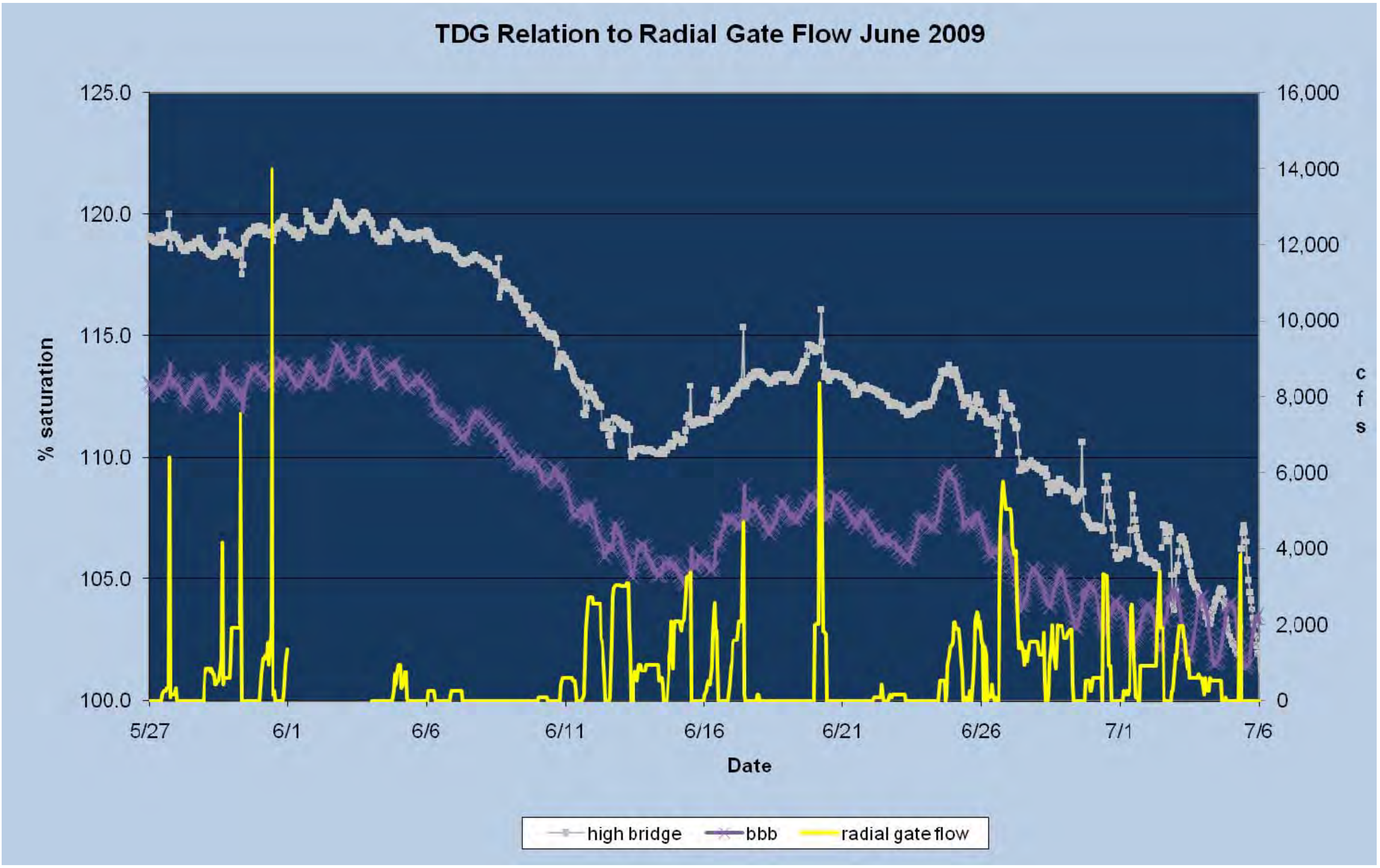
Main Dam spillway gates 16 and 17 are radial gates which are controlled by computer to open at a full reservoir elevation set point. The set point is approximately elevation 2,396 feet during the spring runoff.

Radial gate operation is necessary for dam structural integrity and reservoir level control. Radial gate automation allows water to be spilled safely when flow exceeds the dam spill capacity. Dam spill capacity changes with the number of panels removed from the top of the dam. As flow changes during the spring freshet, spill panels are removed and inserted to maintain spill capacity approximately equal to inflow. The radial gates fine-tune the dam spill capacity for short-term changes in flow. All spill changes are made to maintain a stable reservoir level.

When the radial gates open, a surge of water is released. As shown on Figure 3-13, this seems to create a momentary increase in TDG downstream, most noticeable at the High

Bridge station. Small openings of the radial gates do not appear to affect TDG downstream. When spikes in TDG occur simultaneously with radial gate opening, the spike is generally about 1-2%, and is generally detected for 15 to 30 minutes before declining to previous levels.

Figure 3-13.

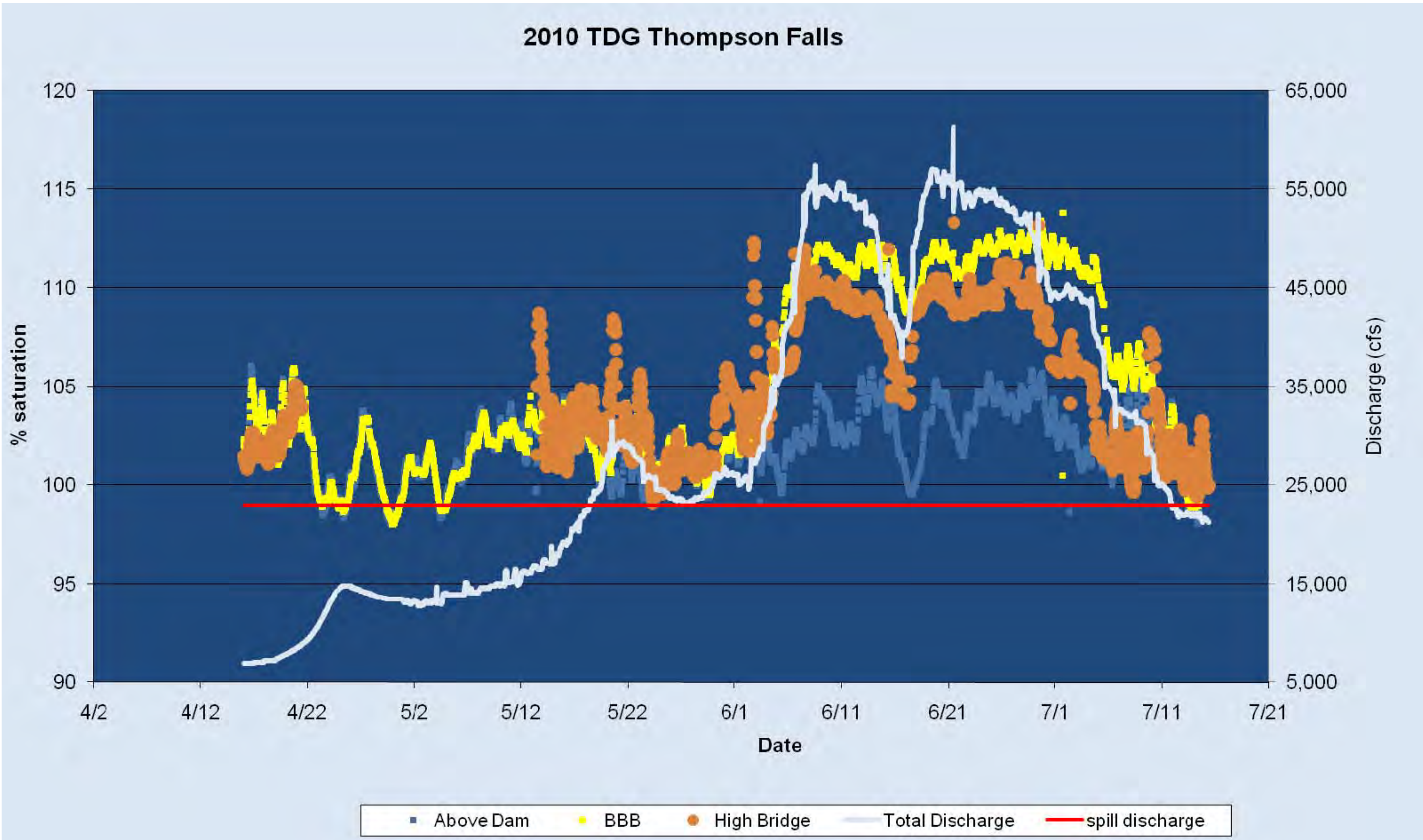


Discharge (cfs) from the Main Dam radial gates in June 2009. TDG is also shown, as measured at the High Bridge and also at the Birdland Bay Bridge at the same date and time.

3.4 2010 Total Dissolved Gas Monitoring

In 2010, the fish ladder at the Main Dam was under construction during the spring runoff period. Because there was construction equipment on site at the Main Dam, it was a priority to minimize spill at the Main Dam. For this reason, the Dry Channel spillway was used first to handle total river discharge in excess of powerhouse capacity. Normally, the Dry Channel spillway is only used in high flow years, after the Main Dam spillway has been fully opened. TDG monitoring was conducted upstream of the Project, in the Dry Channel, at the High Bridge, and at the Birdland Bay Bridge. The Dry Channel sensor washed downstream in the high flows and has not yet been recovered.

Figure 3-14. TDG at the Thompson Falls Hydropower Project in 2010.
BBB = Birdland Bay Bridge

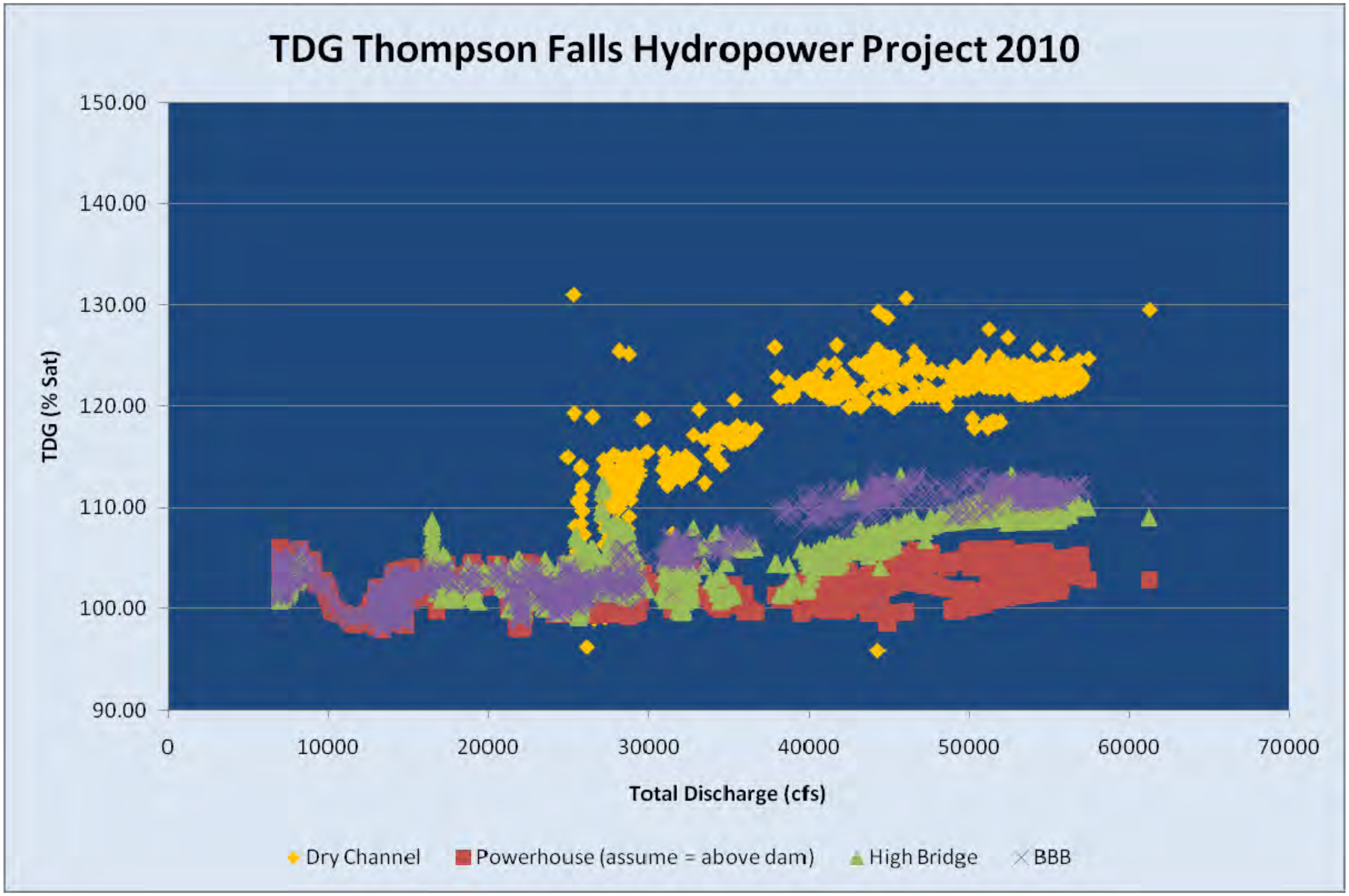


The High Bridge monitoring site collects data on TDG in the Clark Fork River below the Main Dam, but is upstream of the confluence with the Dry Channel. As a result, TDG monitored at the High Bridge was lower in 2010 than in previous years, because flow over the Main Dam was lower in 2010 than in previous years. This is the only year when TDG levels at the High Bridge were lower than at the Birdland Bay Bridge. In order for TDG to be higher at the Birdland Bay Bridge than at the High Bridge, the Dry Channel must be the source of the additional TDG.

The quantity of TDG added to the river at the Dry Channel cannot be directly assessed until the Dry Channel sensor is recovered. However, it possible to calculate the quantity of TDG added at the Dry Channel Dam using a mass balance approach because the discharge and TDG level is known at the other flow pathways (High Bridge, Above Dam, and Birdland Bay Bridge). In making these calculations it was assumed that the TDG in water passing through the powerhouse was equal to the TDG entering the project site as measured at the above dam location. Total river discharge and discharge through the powerhouse were measured by PPL Montana on an hourly basis. Discharge over the Main Dam and Dry Channel Dam was calculated based on records kept by PPL Montana project operators of the number of bays and panels that were opened on the spillways. The Main Dam spillway was assumed to pass 235 cfs for each panel that was opened.

The results of these calculations of Dry Channel TDG are depicted in Figure 3-15, along with TDG levels at the Birdland Bay Bridge, High Bridge, and powerhouse.

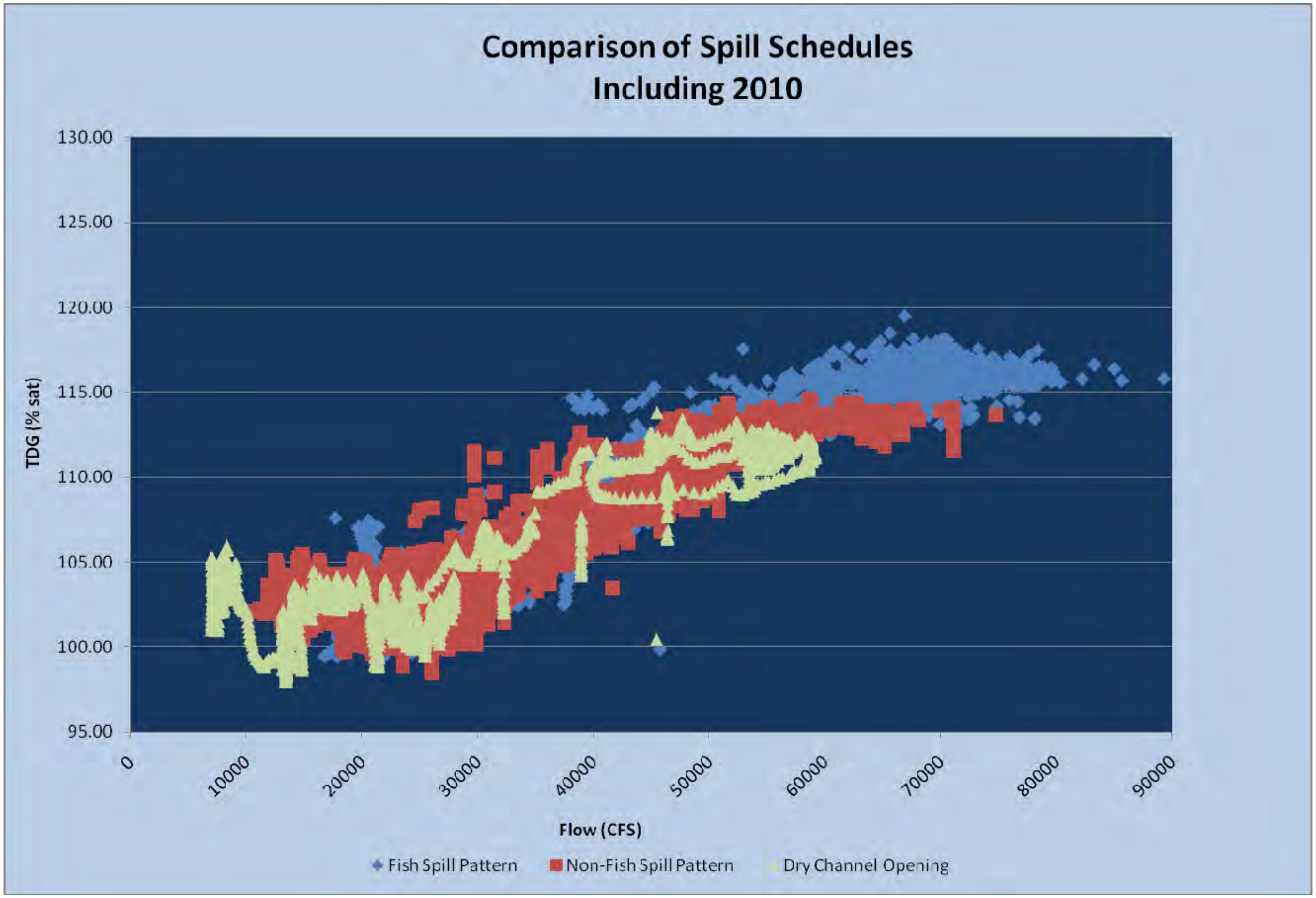
Figure 3-15. TDG at Thompson Falls Hydroelectric Project in 2010. TDG at the Dry Channel Spillway and powerhouse were estimated based on calculations described in the text.



It is clear that TDG was added by passing water over the Dry Channel spillway. Calculated TDG levels at the Dry Channel ranged from approximately 115% when total river discharge was about 27,000 cfs to approximately 123% when total river discharge was in excess of 40,000 cfs.

In order to assess the implications of this spillway operating scheme on TDG at the Birdland Bay Bridge, a comparison was made of TDG at Birdland Bay Bridge over the years of study (Figure 3-16). Opening the Dry Channel spillway first resulted in TDG levels at the Birdland Bay Bridge site that were comparable to previous years (Table 4). Runoff in 2010 was relatively low, so there are no data for flows in excess of 60,000 cfs total discharge, and relatively few data points for flows between 50,000 cfs and 60,000 cfs. This one year's experience provides a limited data set to evaluate the potential impacts of using the Dry Channel Spillway early in the spill season.

Figure 3-16



TDG in percent saturation at discharge (cfs) in 2003, 2004, 2005, 2009, in red, the "non-fish" spill schedule. Blue is TDG at discharge in 2006, 2007, and 2008, the "fish" spill schedule. Green is TDG during 2010, when the Dry Channel spillway was opened first. TDG measured at the Birdland Bay Bridge.

Changing the spillway operating plan to use the Dry Channel Spillway first does not appear to have had a significant impact on the amount of TDG measured downstream of the project site at the Birdland Bay Bridge, at least over the range of flows experienced during 2010. See also Table 4 for a calculation of the mean TDG at varying levels of total river discharge over the study period for a comparison of 2010 TDG levels with the long term average.

However, the Dry Channel Spillway is further downstream than the Main Dam Spillway. Therefore, using the Dry Channel Spillway reduces TDG in the reach of river between the Main Dam Spillway and the Dry Channel Spillway, a distance of approximately 700 m. Water passing over the Dry Channel Spillway mixes with water passing through the new powerhouse approximately 200 m downstream. Therefore, only 200 m of river is exposed to the undiluted levels of TDG passed over the Dry Channel Dam when the Dry Channel Dam is used to pass spill.

The impact of using the Dry Channel Spillway as the initial route to pass spill on fish passage at the newly constructed fish ladder at the Main Dam is not known at this time. Some questions to be examined are: would migrating fish be distracted by high flows from the Dry Channel Dam? Would this detrimentally affect their ability to locate the fish ladder at the Main Dam? In addition, when high flows are passed over the Dry Channel Dam, high velocity water crosses the Clark Fork River, potentially creating a velocity barrier to migratory fish (Figure 3-17).

Therefore, the relatively minor benefits of passing spill at the Dry Channel should be weighed against the potential detrimental impact on fish passage. This is an area that could be studied in future years.

Figure 3-17. Three photos taken during 2010, with water passing through the Dry Channel. Photos were taken July 2, 2010 when all 12 bays were pulled out on the Dry Channel Dam and total flow was about 45,000 cfs. The second photo shows the current from the Dry Channel Dam shooting across the main river channel to hit the far bank near where Prospect Creek empties into the Clark Fork.

3.5 Evaluation of Gas Bubble Trauma in Fish

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

Fish were sampled via electrofishing and evaluated for GBT six times between May 19 and June 23, 2008 and twice in 2009 (on May 28 and June 4). Electrofishing was conducted via boat using methods described in the 2009 Annual Report for the Fish Passage Project. Fish were sampled downstream of Thompson Falls Dam and upstream of the Highway 200 Bridge. River flows during fish sampling in 2008 varied from 55,197 cfs to 76,889 cfs. . River flows during fish sampling in 2009 varied from 54,880 cfs on May 28 to 57,154 cfs on June 4. Fish were captured and visually inspected for signs of GBT before being released. The gills, lateral line, dorsal fin, and caudal fin were visually examined for blistering, bubbling, boils, or discoloration of the gills.

In 2008 a total of 220 fish representing 16 species were collected between May and June 2008. Fish collected included one bull trout (*Salvelinus confluentus*), four westslope cutthroat trout (*Oncorhynchus clarki lewisi*), 13 brown trout (*Salmo trutta*), 52 rainbow trout (*Oncorhynchus mykiss*), one introgressed westslope cutthroat - rainbow trout, 29 mountain whitefish (*Prosopium williamsoni*), nine northern pikeminnow (*Ptychocheilus oregonensis*), 35 peamouth (*Mylocheilus caurinus*), one kokanee (*Oncorhynchus nerka*), two largemouth bass (*Micropterus salmoides*), 16 smallmouth bass (*Micropterus dolomieu*), two yellow perch (*Perca flavescens*), three northern pike (*Esox lucius*), 13 lake whitefish (*Coregonus clupeaformis*), 36 largescale suckers (*Catostomus macrocheilus)*, and three longnose suckers (*Catostomus catostomus*).

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

In 2009 a total of 276 fish representing 14 species were examined for visual signs of GBT. The gills, lateral line, dorsal fin, and caudal fin were visually examined for blistering, bubbling, boils, or discoloration of the gills. After visual examination of all 276 fish, there were no visual indications of any fish exhibiting GBT symptoms. Species totals were: 146 largescale sucker, 17 rainbow trout, four lake trout, six lake whitefish, three brown trout, 10 mountain whitefish, 49 smallmouth bass, six longnose sucker, 13 northern pikeminnow, 15 peamouth, four westslope cutthroat trout, one northern pike, one westslope cutthroat X rainbow trout hybrid, one sculpin (*Cottus* sp.).

In the Thompson Falls Project tailrace TDG exceeds 110% in most, but not all, years as measured at the Birdland Bay Bridge site. TDG is rarely in excess of 115% at the Birdland Bay Bridge site. This only occurred in 2006 and 2008. During the six years of data collection, the percentage of time when TDG exceeded 120% was very low, only during 2006 and only at the High Bridge Site. TDG has never exceeded 120% at the Birdland Bay Bridge site. Although the Clark Fork River exceeds the water quality standard of 110% saturation at the High Bridge and Birdland Bay Bridge sites during peak flow seasons in most years, no apparent impact on fishes in the Thompson Falls tailrace has been detected.

The risk to aquatic life from elevated levels of TDG increases with dosage and exposure (Weitkamp and Katz 1980). In addition, the level of TDG that salmonids can tolerate varies depending on species, body size, general physical condition, swimming depth and water temperature (Johnson et al 2005). In their 1980 review of dissolved gas supersaturation literature, Weitkamp and Katz concluded that a dramatic change occurs in both the number of deaths and the time to death at approximately 120% to 125% TDG in shallow water (1 m or less). At gas pressures below this general level, a low incidence of gas bubble disease will be found in juvenile salmonids, and deaths will occur at a low rate. Above 120 - 125% TDG, mortality due to GBD increases dramatically. More recent studies confirm these conclusions in natural waters. Weitkamp et al. 2003 evaluated the incidence of GBT below Cabinet Gorge Dam on the Clark Fork River and found that continuous supersaturation exceeding about 125–130% of saturation for prolonged periods produced GBT in at least some fish in the lower Clark Fork River. However, intermittent exposure to 120–130% TDG produced

GBT signs in a very small number of largescale suckers and yellow bullhead. Backman and Evans (2002) examined 4,667 adult chinook salmon *Oncorhynchus tshawytscha*, 1,878 sockeye salmon *O. nerka*, and 1,431 steelhead *O. mykiss* at Bonneville Dam for incidences of GBT at Bonneville Dam on the Columbia River. They found GBT symptoms were uncommon (<0.5%) among all species when TDG remained below 125%. The severity of GBT increased as TDG increased, but most symptoms were minor. Severe symptoms were observed only when TDG exceeded 126%

Fish depth plays a crucial role in the expression of GBT because hydrostatic pressure has a strong influence on the TDG exposure to individual fish. Each meter of depth exerts pressure that increases the solubility of dissolved gas to compensate for 10% of saturation. That is, a fish at 1 meter depth is exposed to 10% lower TDG than it would be exposed to if swimming at the surface. This may explain why so few fish are found with GBT when TDG is less than 120% saturation. Johnson et al (2005) found that adult spring and summer Chinook salmon spent a majority of the time at depths that would have provided adequate hydrostatic compensation for average conditions in the Columbia River. Weitkamp et al. 2003 also found salmonids in the Clark Fork River spent enough time at depth to reduce the incidence of GBT.

4.0 Recommendations

PPL Montana's plan, pending operational practicalities, will be to work toward a dual mode of spill control starting in 2011. Between 23,000 cfs and 45,000 cfs, the priority will be fish attraction to ladder. The "fish" spill schedule will be implemented and refined for the fish ladder. A new mode - TDG abatement will be implemented at discharge in excess of 45,000 cfs. The best possible TDG abatement scheme will be determined through experimentation. However, initially PPL Montana will use the "non-fish" spillway operating plan.

Specifically, the spillway panels will be opened in this order:

1. Remove three slide panels for fish attractant. Panels: 4, 8, and 12
2. Pull out eight bays of slide panels, Bays: 29-36, on the far side of the Main Dam
3. Pull out two bays of slide panels, Bays: 10 and 11
4. Pull out two bays of slide panels, Bays: 27 and 28
5. Pull out two bays of slide panels, Bays: 8 and 9
6. Pull out two bays of slide panels, Bays: 25 and 26
7. Pull out two bays of slide panels, Bays: 6 and 7
8. Pull out two bays of slide panels, Bays: 23 and 24
9. Pull out two bays of slide panels, Bays: 4 and 5
10. Pull out three bays of slide panels, Bays: 20, 21, and 22
11. Pull out two bays of slide panels, Bays: 2 and 3
12. Pull out two bays of slide panels, Bays: 18 and 19
13. Pull out the last remaining bay of slide panels, Bay: 1

Next, start to pull the Dry Channel Dam.

As changing conditions like weather, runoff and operational/maintenance demands pose different concerns, changes in this schedule may occur.

This schedule is illustrated in Figure 3-16. This schedule is tentative, pending review by the TAC and Thompson Falls Project operators. It is based on the assumption that once a panel is opened, it will not be closed again unless discharge is declining.

The operational mode will switch back to fish attraction when flows recede to allow fish to use ladder.

During radio telemetry studies of fish behavior at the Main Dam, fish left the Main Dam tailrace when discharge exceeded 40,000 cfs (Figure 3-16). Therefore, PPL Montana does not anticipate that making TDG abatement a priority during the spring freshet, when discharge exceeds 45,000 cfs, will have a significant impact on the efficiency of the fish ladder. However, experiments will continue in coming years to confirm this.

Figure 3-18. Example spill schedule that is initially designed for fish attraction (light blue rows), then to TDG abatement (green rows).

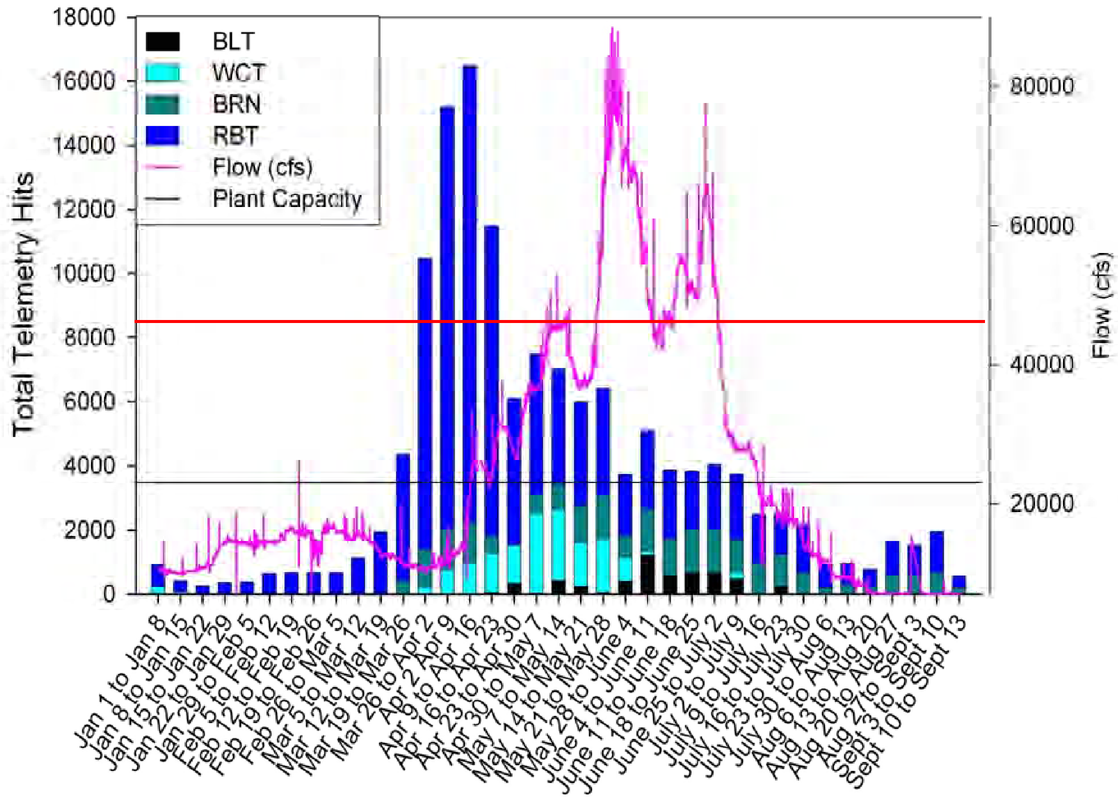
Thompson Falls Main Dam Spillway -"Dual Mode" Spill Schedule

BAY NUMBER																																				Lift Gates	Total Flow (cfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
			1				1				1																									3	23,705
			1				1				1																	6	6	6	6	6	6	6	6	51	34,985
			1				1		6	6	1																	6	6	6	6	6	6	6	6	63	37,805
			1				1		6	6	1															6	6	6	6	6	6	6	6	6	6	75	40,625
			1				6	6	6	6	1															6	6	6	6	6	6	6	6	6	6	86	43,210
			1				6	6	6	6	1													6	6	6	6	6	6	6	6	6	6	6	6	98	46,030
			1		6	6	6	6	6	6	1													6	6	6	6	6	6	6	6	6	6	6	6	110	48,850
			1		6	6	6	6	6	6	1											6	6	6	6	6	6	6	6	6	6	6	6	6	6	122	51,670
			6	6	6	6	6	6	6	6	1											6	6	6	6	6	6	6	6	6	6	6	6	6	6	133	54,255
			6	6	6	6	6	6	6	6	1								6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	151	58,485
	6	6	6	6	6	6	6	6	6	6	1								6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	163	61,305
	6	6	6	6	6	6	6	6	6	6	1						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	175	64,125
6	6	6	6	6	6	6	6	6	6	6	1						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	181	65,535
DRY CHANNEL SPILLWAY (12 Bays)																																					
6	6	6	6	6	6	6	6	6	6	6	6																									72	82,455
Radial Gates (Bays 16 and 17)																																					
													Both - Full-Open - 11,000 cfs per bay																								104,455

Notes:

1. Numbers under each bay represent the six lift gates in each spill bay
2. Each bay should have all six lift gates opened, before opening lift gates from another bay
3. Closing sequence is opposite of the opening sequence
4. Bays 13 through 15 should never be opened
5. Bays 16 and 17 are radial gates, to be operated in a pre-set manner by operations for forebay elevation control, and load rejection purposes
6. This is a living document, and can be changed as necessary to depict past, non-fish Project spill operations

Figure 3-19.



Total number of “hits” of fish in the Thompson Falls Project tailrace, by date, during 2006. The red horizontal line shows the level when discharge is 45,000 cfs total flow.

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Appendix A

Technical Memorandum on TDG at Thompson Falls, Prepared by Steve Rainey, GEI Consultants, Inc. May 14, 2007.

Geotechnical
Environmental &
Water Resources
Engineers

Technical Memo

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To: Thompson Falls Interagency Technical Team

From: Steve Rainey, GEI Consultants, Inc.

Date: 5/14//2007

Re: Total Dissolved Gas (TDG) at Thompson Falls

The purpose of this memorandum is to give a short description of the total dissolved gas (TDG) issue at many Pacific Northwest hydro projects, then to briefly summarize apparent implications on TDG dynamics at Thompson Falls Hydroelectric Project (Thompson Falls), in order to initiate dialogue about how this project actually reduces TDG levels at all except the highest river discharges, relative to historic dissolved gas levels below the falls. *The implication is that the project may not need to mitigate for elevated TDG levels, either structurally or operationally*.

Background

Current Thompson Falls Hydroelectric Project Total Dissolved Gas Data Monitoring Program

The US Fish and Wildlife Service asked PPL Montana (PPLM) to monitor total dissolved gas at Thompson Falls, during development of the Biological Evaluation, as part of the Endangered Species Act consultation process. Since hydro projects often impound water, and spill is common during the spring freshet, elevated TDG levels downstream of spillways occur for a few months each year. An important issue is whether the data reflects TDG levels greater than the maximum allowable (110 percent) level referenced in the Clean Water Act (CWA). When spillway gas levels increase above the CWA TDG cap, there may be an effort by the state or federal government to induce implementation of TDG abatement measures. This memorandum addresses that potential occurrence.

(Note: this memorandum also addresses the manner in which TDG uptake is thought to occur below the Main Dam spillway and falls. In 2004, TDG measurements were taken from a monitoring station in the immediate Main Dam spillway tailrace. A discussion of why the measurements at this monitoring station may be misleading, and how that influences the issue of whether TDG abatement mitigation measures are required at Thompson Falls, is presented at the end of this memorandum.)

General Description of Typical Hydro Project Operations with Elevated Total Dissolved Gas Levels

Spill at hydroelectric dams usually increases downstream TDG levels, and occurs when river discharge exceeds turbine hydraulic capacity. Since no additional flow can pass the project's turbines, it must pass over the spillway. Since the height of dam typically provides much of the energy head for generation of power, spillway flow transfers much of that potential energy to the spillway tailrace, where turbulence dissipates that excess energy. During spill, total dissolved gas supersaturation occurs, and often exceeds the 110 percent saturation limit stipulated in the CWA. The CWA is intended to protect fish from lethal levels of TDG, which can create gas bubble trauma symptoms. It has been shown that TDG levels on the order of 140 percent result in embolisms and the appearance of tiny gas bubbles in fish tissues, resulting in elevated mortality rates. Conversely, it has been shown that Columbia and Snake River juvenile salmon and steelhead have no gas bubble trauma symptoms at levels of $\leq$120 percent TDG in spillway tailraces. Gas bubble trauma studies downstream of Cabinet Gorge, where TDG levels reach 135%, showed little sign of adverse impacts to non-anadromous species in 2000 (need citation).

Cause of Total Dissolve Gas Supersaturation and Related Information

As spill discharge passes into the spillway tailrace, it typically plunges into a deep armored stilling basin, designed with enough volume to dissipate energy for the maximum design flood discharge. The intent is to confine energy dissipation in the armored zone, so that erosion does not scour and undermine the spillway or other dam features – thereby leading to potential structural failure.
As spill plunges into a deep spillway stilling basin, a turbulent energy dissipation zone is created, characterized by unsteady flow and high shear forces. Vertical circulation cells often take turbulence aeration to depth, where hydrostatic pressure collapses bubbles, *forcing them into solution* and elevating TDG levels (gas absorption).

TDG carrying capacity depends on temperature and ambient pressure, consistent with Gauss's Law. (The same amount of total dissolved gas content that constitutes 100 percent saturation at one water temperature, will be supersaturated if the water temperature is higher, and ambient pressure is the same. This memorandum is not intended to address gas absorption in that degree of detail.

TDG supersaturation is an unstable condition, and if the river channel downstream of a spillway is sufficiently wide and shallow, and with an appreciable enough hydraulic gradient, channel boundary roughness will force flow to "tumble" in a manner where there is increased water surface exposure of ambient air conditions. Where this kind of open-channel flow conditions occur, TDG levels rapidly drop back to near the stable, 100 percent saturation level in less than a mile (distance varies from site to site).

However, if there is a reservoir backed up to near the powerhouse tailrace, as at Thompson Falls, the normal river gradient is reduced and the flow regime becomes more stable. Lower reservoir velocities result in less turbulence, and elevated TDG levels are locked in after entering the impoundment. If there are elevated wind levels, enough shear can be created to induce the vertical circulation necessary to reduce TDG levels in the reservoir. Otherwise, the elevated reservoir TDG levels wane slowly, and on the basis of delayed replenishment by lower level TDG inflows.

Other relevant information

- Spillway stilling basins have their own signature, and induce an outflow TDG level that is higher than the forebay TDG level. As spillway flow passes into a deep spillway stilling basin, memory of forebay TDG levels is erased. TDG level downstream of a spillway is a direct result of the spillway signature (stilling pool configuration and inflow hydraulic conditions), air and water temperatures, and atmospheric pressure.

- For that component of flow passing through turbines, there is very little TDG uptake. Turbine energy is extracted at a high rate (through generation of power), and little energy remains as flow discharges from turbine draft tubes. (In 2003, PPLM had TDG monitors stationed downstream of the new powerhouse. This monitor showed that under normal operating conditions, flow passing through the powerhouse did not have elevated TDG levels.) While there is a turbine boil in the powerhouse tailrace, aeration from turbulence is at a lower level, resulting in a powerhouse tailrace TDG level nearly the same as the forebay. Therefore, *passing flow through a turbine is a way to minimize TDG uptake*.

- Tailrace Mixing and the Gas Balance Equation: *(Turbine Flow x PH Tailrace TDG)* + *(Spillway Flow x Spillway Tailrace TDG) divided by Total River Discharge = Composite* *(mixed) TDG downstream of the project*. This assumes a reservoir backwater just downstream of the powerhouse (as at Thompson Falls). Therefore, *passing a larger percentage of total river discharge through the powerhouse reduces downstream composite TDG during spill periods*.

Previous Total Dissolved Gas Abatement Efforts

The U.S. Army Corps of Engineers (USACE) initiated a comprehensive five-year study of total dissolved gas supersaturation and abatement at their Lower Snake and Columbia River hydroelectric projects in the mid-1990's, titled the Dissolved Gas Abatement Study (DGAS). This effort was based on the perceived need (by the fisheries agencies and tribes) to increase survival of juvenile salmon outmigrants, by passing as many as possible over the spillway rather than through turbines or intake screen and bypass systems. However, the number of fish that could be passed in spill discharge was limited by CWA TDG limits (110 percent). The conundrum was that water quality standards for TDG were designed to protect aquatic species, but these regulations were forcing more fish to pass through lethal turbines. The study included a gas bubble trauma monitoring program, which concluded that a TDG level of 120 percent below spillways could be sustained without detectable damage to salmon and steelhead, and an annual waiver was granted so that higher spill levels could route more fish over spillways. (Note: the effects of 120 percent TDG were not studied in the context of non-migratory fishes, so the regulatory agencies were not willing to grant annual waivers indefinitely.)

Meanwhile, an entire array of gas abatement measures at spillways was investigated. The common denominator for these design approaches was to keep turbulence downstream of spillways from going to depth, thereby limiting gas absorption. The principles of the approaches studied can be considered at other hydro projects where gas abatement may be required (including Thompson Falls). (Note: one option was to increase turbine capacity at hydro projects, thereby reducing spill levels by the added turbine discharge capacity.)

Site-Specific Subjective Assessment of Total Dissolve Gas Dynamics at Thompson Falls

Generally, TDG levels downstream of the spillway increase as spill discharge increases. In Figure 1 the blue data points and regression curve (Blue Curve) from 2006 TDG field data show this is true at Thompson Falls. These data were collected at the high bridge (HB), several hundred yards downstream of the spillway and falls. However, there are unusual and mitigating circumstances at this location, relative to other hydro power projects. Figure 2 is an aerial view of the Main Dam spillway tailrace. Note that there is no formal spillway stilling basin. There doesn't need to be, as the spillway is built on bedrock and erosion/scour is not a concern. Further, the depth on the bedrock shelf immediately downstream of the spillway apron appears *not* to be deep enough (though there are a few deeper pools) for appreciable gas absorption to occur on the basis of required hydrostatic pressure. The rock shelf extends downstream to the falls, and to a deeper downstream pool where there *is* enough depth for appreciable TDG uptake. (Therefore, TDG measurements collected at the base of the spillway, and above the falls, may not be accurate. See the last section of this memorandum for additional discussion of this issue.)

Three Configurations and Operating Conditions

Three configuration and operating conditions relating to the Main Dam spillway and falls (and TDG readings at the HB, TDG monitoring site) are referenced below, and in the subsequent discussion of the central issue – whether Thompson Falls increases TDG levels.

1. The true baseline is the **Pre-Dam condition**, where all total river discharge passed over the falls and increased TDG at the HB location. TDG readings for the Pre-Dam condition

can be never attain since the spillway structure is in place and influences readings downstream of the falls. However, as river discharge increased, can assume that river plunge into the deep natural pool below the falls would have increased TDG levels at the HB site.

2. For the current **Normal Dam Operating condition**, spill discharge passing the Main Dam spillway entails gas uptake from the composite of flow passing over the spillway and falls, and into the deep natural pool below the falls. This is based on TDG measurements at HB. However, the first 23,000 cfs of river discharge is normally passed through the powerhouses (when operating at full turbine capacity). That amount of total river discharge passing the powerhouse (as depicted from 2003 TDG data collection below the new powerhouse), does not have higher TDG reading than forebay, and may actually be slightly lower. Only the flow above turbine capacity passes over the spillway and falls (as represented by the Blue Curve).

3. On occasion, the **Turbine Load-Rejection condition** will occur. This happens when electrical generation cannot be delivered onto the regional power grid, due to an unexpected emergency. Powerhouse turbines go off-line, and all flow passes the spillways. This happens intermittently for brief periods of time. In 2003, PPLM had TDG monitors stationed downstream of the new powerhouse (Figure 2). These showed that under normal operating conditions, flow passing through the powerhouse did not have elevated TDG levels. However, during load rejection, when the powerhouse was off-line, discharge passing this gage was exclusively from the Main Dam spillway and TDG levels abruptly increased until turbines were back on line. (Note: total river discharge was approximately 30,000 cfs during the dates shown in Figure 2, and there were not enough data points to develop a regression curve.) These 2003 data points represent TDG levels close to the Pre-Dam Operation.

The Figure 1 Blue Curve depicts 2006 HB TDG readings as a function of total river discharge for the Normal Dam Operating condition, (2) above. Note that conditions (1) and (3) would also have their own HB TDG data points and regression curve, if that data were available. Further, if the respective curves were to the left of the Blue Curve, HB TDG levels would be higher for a given total river discharge than for the Blue Curve. (Conversely, if the curves were to the right of the Blue Curve, HB TDG levels would be lower than for the Blue Curve.) Paraphrased, higher TDG levels would be generated at the HB, with the same total river discharge and all flow passing over the falls. The implication is that the Normal Dam Operating condition results in lower TDG at HB than the Turbine Load-Rejection condition, at all river discharges. The only uncertainty is whether the same is true for the Pre-Dam condition.

Total River Discharge Ranges

It is useful to discuss three levels of total river discharge, when assessing whether Thompson Falls increases TDG uptake at the location with the highest total dissolved gas readings – the HB monitoring location.

Low River Discharge Level (total river discharge $\leq$ 23,000 cfs) – This range of river discharge occurs 85 percent of the time (Figure 5). There is no spill during Normal Dam Operations and HB TDG readings are less than if total river discharge were passing the falls with either the Pre-Dam or Turbine Load-Rejection conditions.

High River Discharge Level (total river discharge > 80,000 cfs) – This high river discharge occurs less than one (1) percent of the time, and has not occurred since before 2003. It was stated earlier that HB TDG levels below the falls generally increase as spillway discharge increases for each condition described above. However, when total river discharge is very high, the tailwater elevation downstream of the spillway and falls rises enough to backwater the falls, and there is a reduced plunging action into the deep pool below the falls. It is unknown whether the rate of increase in HB

TDG at very high total river discharges tapers off, or even drops to a lower level, during river discharges in this range. The Normal Dam Operating and Turbine Load-Rejection conditions could be expected to have higher HB TDG readings than the Pre-Dam condition during very high river discharges, since the spillway adds approximately 35-40 feet of energy during this condition. The positive TDG abatement influence of passing 23,000 cfs through the powerhouse turbines (at lower river discharges) no doubt has a very small influence over HB TDG levels for very high river total discharges.

Middle River Discharge Level (23,000 – 80,000 cfs total river discharge) – At the lower end of this total river discharge range, spill discharge is at a lower level (e.g., < 20,000 cfs spill) for the Normal Dam Operating condition, and HB TDG readings are relatively low (< 115 percent). Examples of different river discharges and HB TDG levels are discussed below and describe the positive influence on HB TDG of routing a large percentage of flow through turbines. At the higher end of the middle river discharge range, a bigger percentage of river discharge passes over the spillway for Normal Dam Operating condition, and it is suspected that HB TDG levels for the Normal Dam Operating and Turbine Load-Rejection conditions exceed levels for the Pre-Dam condition. At some intermediate total river discharge, I suspect there is a *cross-over river discharge,* above which the HB TDG would be higher for both the Normal Dam Operating and Turbine Load-Rejection conditions than for the Pre-Dam condition. Although the cross-over discharge magnitude is unknown (as there is no Pre-Dam HB TDG regression curve), it is expected that the percentage of time river discharge is at, or above, this level is less than five (5) percent as depicted on Figure 4.

Premise

Normal Dam Operating Condition Total Dissolve Gas Levels at High Bridge are nearly always lower than for the Pre-Dam Condition

Reason

The primary TDG uptake is in the deep pool immediately downstream of the Main Dam and falls, as measured at the HB site. Prior to the dam, the total river discharge passed the deep pool below the falls, and created progressively higher TDG levels at higher river discharges. The current Normal Dam Operating condition routes up to 23,000 cfs through the two powerhouses (where TDG does not increase for this component of total river discharge). With up to 23,000 cfs less river flow passing the pool below the falls, HB TDG readings are proportionately lower for the Normal Dam Operating condition than for the Turbine Load-Rejection and Pre-Dam conditions (if the Pre-Dam conditions data were available).

Discussion

The Blue Curve in Figure 1 represents the 2006 TDG levels at HB for the Normal Dam Operating condition, relative to total river discharge. The red data points and regression curve (Red Curve) in Figure 1 are meant to represent the condition where the total river discharge is the same, but turbines are not operating and the entire river discharge is passing over the spillway and falls. As noted, TDG data for the Pre-Dam condition does not exist, and only a few 2003 data points for the Load Rejection condition (Figure 2). Therefore, for illustration, we have developed the Red Curve as a surrogate for the Load Rejection Curve, and subtracted 23,000 cfs from the total river discharge for each data point on the Blue Curve. (For example, 40,000 cfs river discharge in 2006 gave Blue Curve HB TDG levels of 112-113 percent, which included 23,000 cfs through the turbines and 17,000 cfs over the spillway. To attain the related Red Curve data points, it was assumed that the total river discharge of 17,000 cfs, and zero turbine discharge, created the same 112-113 percent TDG levels. This supposes that 17,000 cfs spill creates the same HB TDG level, whether the turbines pass zero or 23,000 cfs. Concurrently, if the assumption is made that the entire 40,000 cfs were passing the spillway, with no turbines operating, HB TDG levels increase to 122 percent. Again, this assumes that 40,000 cfs spill creates the same HB TDG whether turbines are operating or not.)

The Red Curve, as described above, could represent either the Pre-Dam condition, or the Turbine Load Rejection condition. The primary difference in the two conditions is believed to be the additional energy that enters the falls tailrace with the spillway structure in place (the Turbine Load-Rejection condition). The Turbine Load-Rejection condition results in higher energy flow (due to passage over the 50- foot high spillway, at a lower river stage), which increases turbulence in the pool below the falls, and takes more aeration to depth. This means the Turbine Load-Rejection condition results in incrementally higher TDG uptake below the falls, relative to the Pre-Dam Condition.

The 2003 data showed that HB TDG levels of 114-116 percent occurred during Load Rejection conditions for river discharges of approximately 30,000 cfs, compared to the Red Curve TDG HB readings of 118 percent and Blue Curve TDG HB readings of approximately 108 percent.

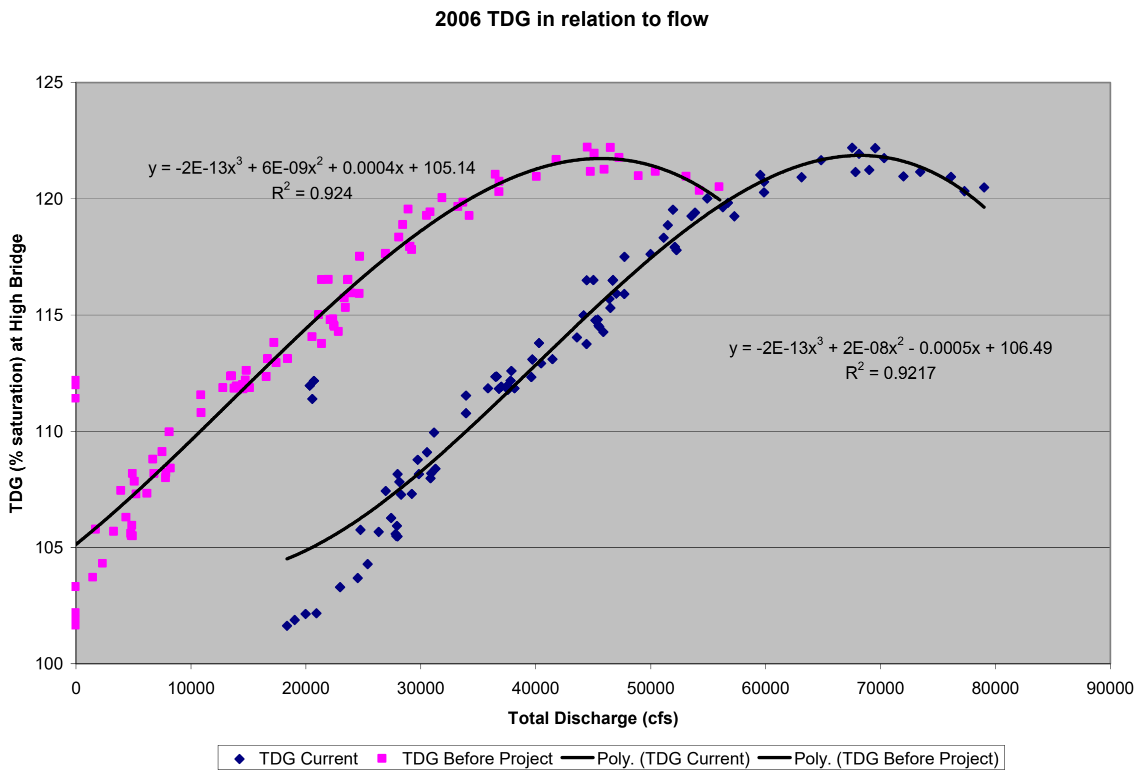

Figure 1 – Total Dissolved Gas Levels at the Thompson Falls High Bridge Monitoring Station, before and after hydro development (see above explanation).

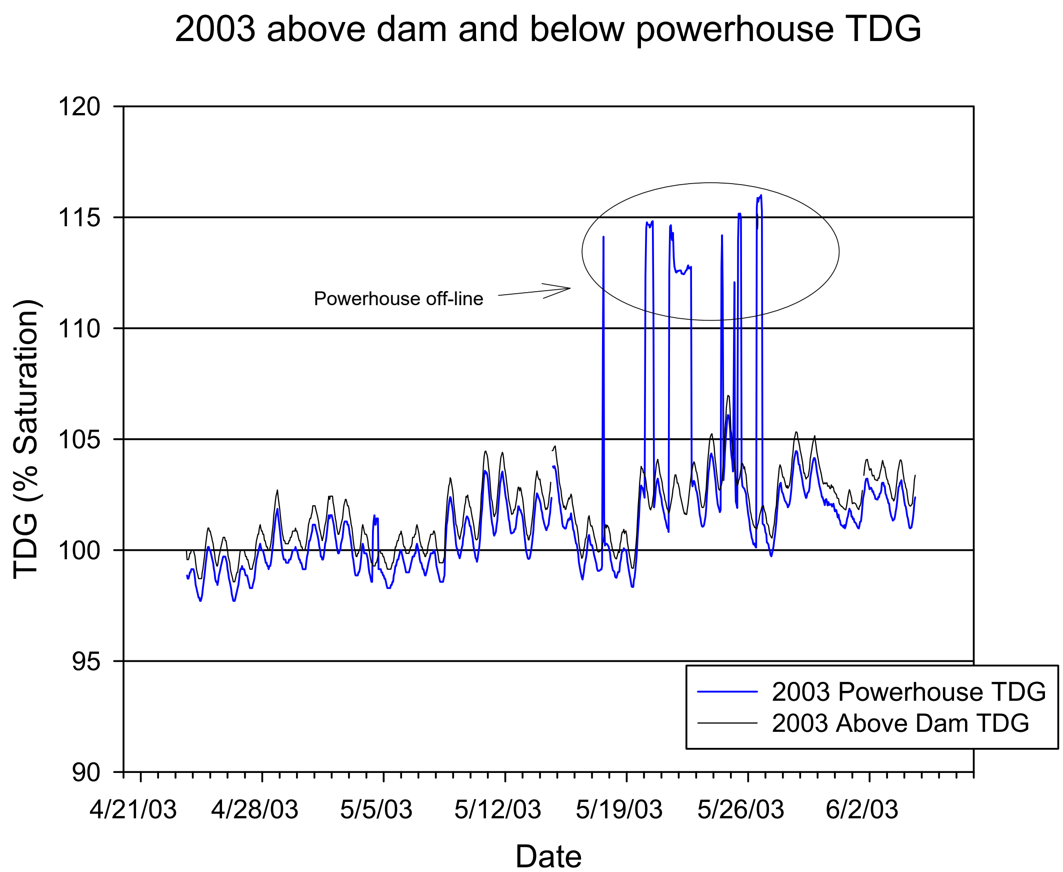

Figure 2 – TDG as measured above the dam and below the new powerhouse in 2003.

Figure 3 – Aerial photo of Main Dam Spillway.

Total Dissolve Gas Levels at the High Bridge Monitoring Station for Different Total River Discharge Levels

As examples of TDG abatement benefits of passing the first 23,000 cfs of river discharge through turbines, different levels of spill are considered below. In each case, the Blue Curve (Normal Dam Operating condition) HB TDG levels are compared with the Red Curve (which approximate the Turbine Load-Rejection and Pre-Dam conditions).

Low Normal Dam Operation Spill Levels (33,000 cfs total river discharge and 10,000 cfs spill):

Normal Dam Operation (Blue Curve) - Figure 4 shows the roughness of the channel downstream of the spillway apron, and upstream of the deep pool below the falls. At low levels of spill, there is a hydraulic jump near the downstream end of the spillway apron that dissipates some of the energy from spill. Additional energy is lost as spill flow passes over the rough channel in Figure 4, before plunging into the deep pool below the falls. Whereas the forebay TDG level was approximately 102–104 percent, a spill discharge of 10,000 cfs (assuming a river discharge of 33,000 cfs and powerhouse discharge of 23,000 cfs from Figure 1) increases TDG at the high bridge to 110 percent. Mixing downstream of the two powerhouses reduces the total river discharge TDG to below 110 percent (the gas balance formula can be used to get approximate Birdland Bay TDG readings).

Turbine Load-Rejection and Pre-Dam Conditions (Red Curve, Figure 1) – At low levels of spill with the Normal Dam Operation (river discharge = 33,000 cfs and spill discharge = 10,000 cfs), TDG levels are lower at the high bridge than the Pre-Dam condition, where the entire river (33,000 cfs) would be passing over the falls and plunging into the deep pool immediately downstream of the falls. Figure 1 shows that the TDG levels would be approximately 119 percent at HB if spill is 33,000 cfs (the entire river discharge). *Therefore, the hydro project development reduces TDG levels approximately nine (9) percent during the low spill scenario, by passing 23,000 cfs through turbines.*

Further, 119 percent TDG occurred in 2006 at a river discharge of 56,000 cfs spill (Normal Dam Operations – 33,000 cfs spill and 23,000 cfs powerhouse discharge).

Figure 4 – Steep center thalweg and "falls" roughness.

Mid-Level Spill (25,000 cfs)

Normal Dam Operations - For 25,000 cfs spill, the river discharge in Figure 1 is 48,000 cfs (23,000 cfs powerhouse and 25,000 cfs spill). The Blue Curve shows TDG at approximately 116 percent.

Load Rejection and Pre-Dam Conditions (Red Curve, Figure 1) – For the same river discharge of 48,000 cfs, the Pre-Dam condition entailed the total river discharge of 48,000 cfs over the falls. From Figure 1, this would yield a TDG level of approximately 121 percent. Further, to get a 121 percent TDG with current configuration, and 23,000 cfs through the powerhouse, a river discharge of 70,000 cfs (48,000 cfs spill and 23,000 cfs powerhouse) would be required. *Therefore, the hydro project development reduces TDG levels approximately five (5) percent during the referenced mid-level spill scenario, by passing 23,000 cfs through turbines.*

High Level Spill Discharges

As total river discharge increased from 33,000 cfs to 48,000 cfs, the influence of passing 23,000 cfs through the powerhouse turbines diminished from a nine (9) percent TDG reduction to a five (5) percent TDG reduction. As discussed, under the "Total River Discharge Ranges" section (page 4), the positive gas abatement influence of passing 23,000 cfs through turbines diminishes as total river discharge increases, until a *cross-over discharge* is reached. Above that unknown river discharge, it is suspected that both the Normal Dam Operating and Turbine Load-Rejection conditions increase TDG levels, relative to the Pre-Dam condition. One explanation for the lower Pre-Dam TDG levels at higher river discharges is the considerably higher tailrace elevation below the falls, which increases 10 feet at the two powerhouses between 10,000 and 50,000 cfs total river discharge. This backwaters and reduces the plunge of spilled discharge at the falls, which may decrease the rate of HB TDG increase, relative to total discharge. However, there is still appreciable turbulence from the high spill discharge creating vertical circulation in the deep pool, taking aeration to depth and increasing TDG uptake, just not to the same degree as at lower levels of spill.

Whether an asymptote is reached for the Normal Dam Operating condition (where TDG does not increase above a limiting TDG level) is not known, since data collection in the last few years has not measured TDG at a total river discharge above 79,000 cfs (in 2006). Figure 5 shows that total river discharge does not exceed 80,000 cfs over one (1) percent of the time, and the high river discharge of 79,000 cfs (2006) was the greatest discharge during TDG data collection that commenced in 2003.

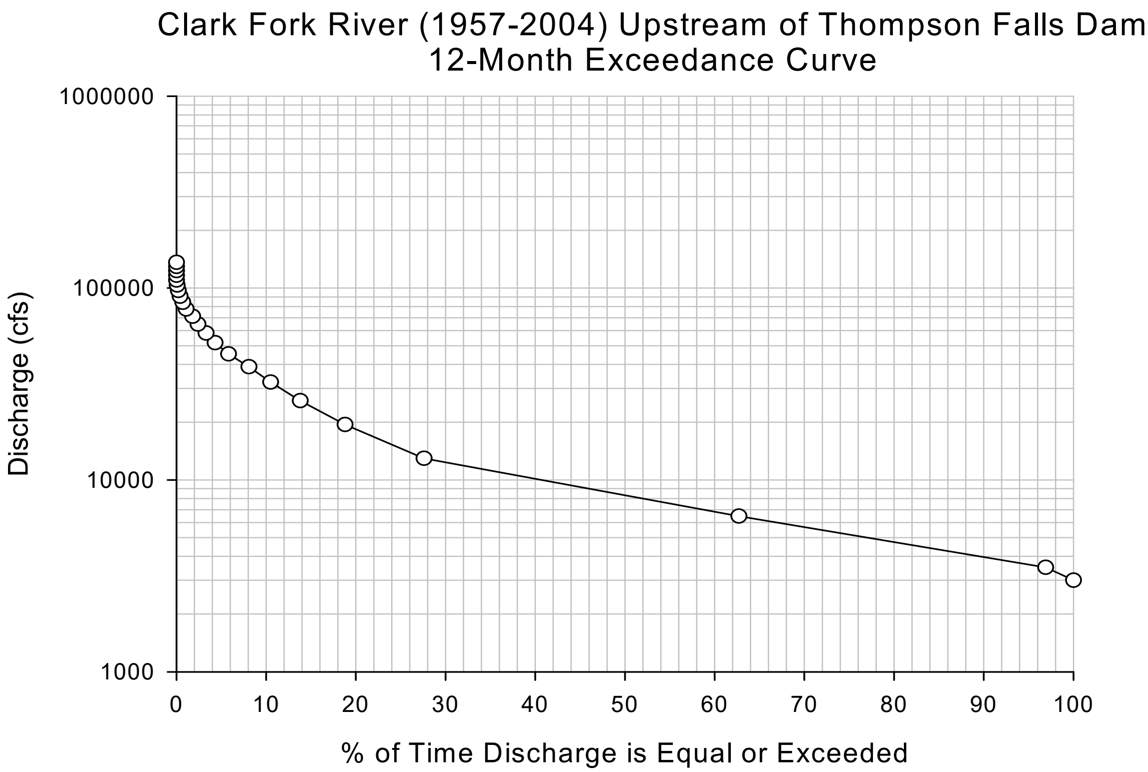

Figure 5 – River Discharge Exceedence Curve.

Reduced Downstream Total Dissolve Gas Levels Due to Mixing of Spill and Powerhouse Discharges

Figure 6 shows that mixing of lower TDG powerhouse discharge and higher TDG spillway discharge results in intermediate gas levels downstream of the Thompson Falls project than at the High Bridge monitoring station. The gas balance formula (page 3) gives a close indication of the Birdland Bay TDG readings. Note that this monitor is less than two miles downstream of where the powerhouses discharge into the Clark Fork River. The highest river discharge and TDG levels for 2003-2006 were 79,000 cfs and 117 percent. This shows how mixing influences the highest High Bridge monitoring station readings (123 percent). It also shows that the High Bridge TDG readings of 123% were confined to a several hundred yard reach of river between the deep gas uptake pool below the spillway/falls and the two powerhouses. At this location, mixing and dilution of higher TDG spillway discharge with lower TDG (the same as the forebay TDG level) occurred.

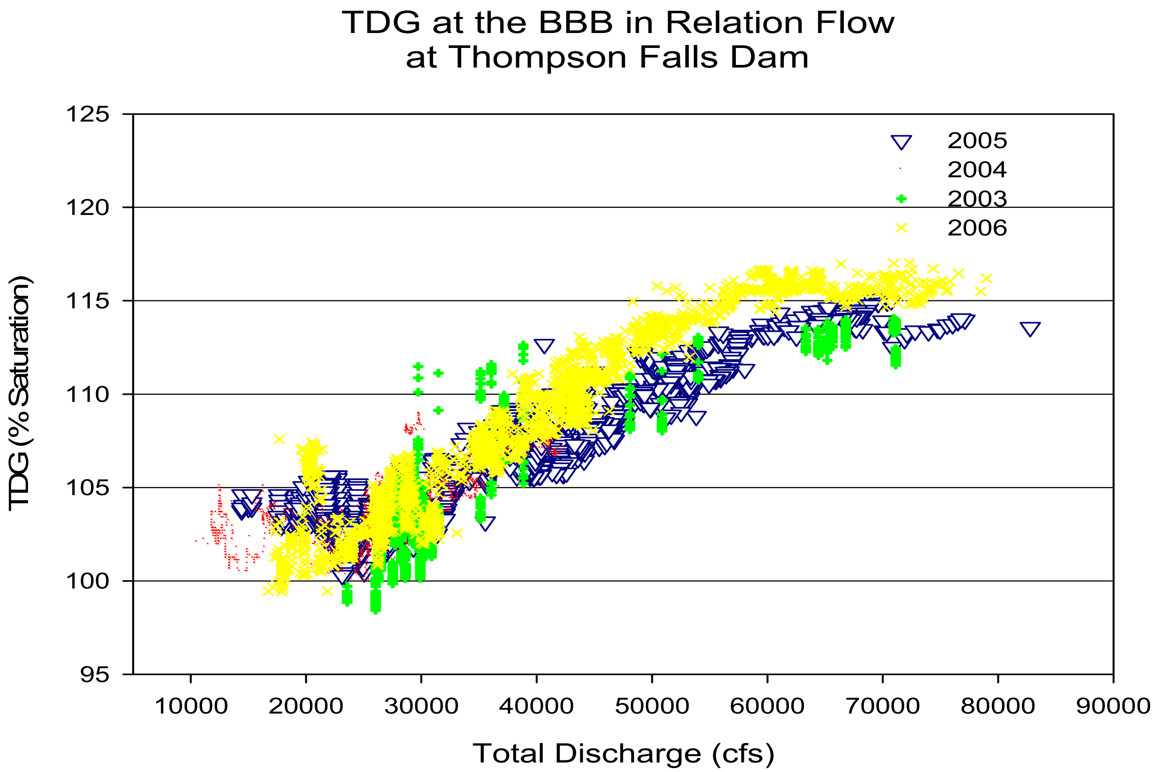

Figure 6 – TDG at the Birdland Bay Monitoring Station, 2003 - 2006

Conclusions: Thompson Falls Gas Abatement

1. The primary question addressed in this memorandum is whether the Normal Dam Operation results in higher TDG levels. The baseline is presumed to be the Pre-Dam condition.

2. The location of greatest total dissolved gas uptake is believed to be, on the basis of accumulated data at different PPLM monitoring stations, the HB location.

3. TDG levels at Thompson Falls did not exceed 123 percent during the 2003-06 TDG monitoring period, at a maximum total river discharge of 79,000 cfs. This is far lower than locations such as Cabinet Gorge, where spillway tailrace TDG levels reach 140 percent.

4. TDG levels two miles downstream of Thompson Falls, at the Birdland Bay monitoring station, did not exceed 117 percent during the 2003-06 TDG monitoring period.

5. It was shown in the Columbia and Snake Rivers, though extensive research, that TDG levels of ≤120 percent did not result in detectable gas bubble trauma symptoms. It is unknown, however, whether non-anadromous fish species would be adversely impacted from relatively short exposure to 123 percent TDG levels at Thompson Falls. However, it is questionable whether the 123 percent TDG level at Thompson Falls has any adverse impact on indigenous fish populations.

6. The Normal Dam Operating condition abates TDG, relative to the Pre-Dam condition, by routing up to 23,000 cfs around the primary TDG uptake zone (below the spillway and falls), and through turbines.

7. The Normal Dam Operating condition abates TDG, relative to the Turbine Load-Rejection condition, by routing up to 23,000 cfs around the TDG uptake zone, and through turbines.

8. I believe the Pre-Dam condition did not increase TDG uptake below the spillway and falls as much as the Turbine Load-Rejection condition, because of the additional 30-50 feet of energy added by the presence of the spillway in the Turbine Load-Rejection condition (which increased turbulence and conditions increasing TDG uptake below the falls).

9. The Red Curve in Figure 1 is probably most representative of the Turbine Load-Rejection condition, although it predicts TDG HB readings slightly higher than the 2003 Turbine Load-Rejection data for the approximately 30,000 cfs river discharges during those dates.

10. Both the Red Curve, and limited 2003 Turbine Load-Rejection data suggest that the Normal Dam Operating condition TDG HB levels are always lower than the Turbine Load-Rejection condition levels, for any total river discharge.

11. For the first 23,000 cfs of total river discharge (lower river discharge levels), the Normal Dam Operating condition entails less flow passing into the deep pool below the falls, and thus entails lower TDG HB levels than the Pre Dam condition (where all river discharge passed the falls and deep pool immediately downstream.)

12. For higher river discharges (above 80,000 cfs), Normal Dam Operating condition spill discharge is high enough that the TDG benefit of passing the first 23,000 cfs through turbines is overridden, and I believe the Normal Dam Operating condition will yield higher HB TDG levels than the Pre-Dam condition. However, this occurs less than approximately one (1) percent of the time.

13. For total river discharges of 23,000 – 80,000 cfs, there is a *cross-over discharge* below which HB TDG levels are lower than the Pre-Dam condition, and above which HB TDG levels are higher than the Pre-Dam condition. If that change-over level is 50,000 cfs total river discharge, Figure 5 suggests that the Normal Dam Operating condition would have lower HB TDG levels 96 percent of the time. If that cross-over discharge is 70,000 cfs, the Normal Dam Operating condition would reduce HB TDG relative to the Pre-Dam condition 98 percent of the time. However, further monitoring will not resolve the magnitude of the cross-over total river discharge, since Pre-Dam HB TDG data is not available.

14. Therefore, the question of whether it is appropriate to continue to monitor TDG levels, or investigate structural measures to abate TDG, is raised. In theory, additional TDG monitoring should lead to additional information that will aid in resolving outstanding questions and/or issues. TDG data collection from 2003 -2006 has given a reasonable scope of understanding of TDG dynamics at Thompson Falls. It appears timing is appropriate to address what additional measures are necessary, if any.

15. Gas abatement measures at Thompson Falls, if required by the state or federal government, would not be successful if employed at the spillway structure. Since the TDG uptake zone is the deep pool immediately downstream of the falls, that is where direct structural measures would be required. The primary means of reducing TDG uptake at this location would be to add turbine capacity (probably not economically viable) or fill and cap deep zones in the bypass reach to keep turbulence from going to depth. This would be costly, entail a considerable length of the bypass reach channel, and would transfer energy further downstream.

This analysis suggests that TDG levels below the spillway and falls rarely exceed 123 percent, which is a low level compared to hydro projects such as Cabinet Gorge (TDG reaches 140 percent). There is no research that suggests 123 percent TDG exposure for short periods may induce adverse impacts to non-anadromous fish. Routing 23,000 cfs through project turbines also routes flow around the primary gas uptake area at the falls below the spillway. The Pre-Dam passage of total river discharge at the falls increased TDG levels, especially at low – medium stages. These observations beg the question of whether enough TDA monitoring at Thompson Falls has occurred, and whether there is a need for additional studies and monitoring. In short, it is reasonable for PPLM to request that the resource agencies provide a sound rationale and appropriate next steps, for committing additional resources to TDG monitoring and/or gas abatement studies.

Appendix

Total Dissolve Gas Data Collection Immediately Below the Spillway

In 2004, TDG readings were taken at the base of the Main Dam spillway, and at the HB location. Figure 7 shows the difference in TDG readings at the two sites. The first impression is that the falls is not contributing an appreciable amount to TDG uptake. However, I believe that there is insufficient depth for much TDG uptake in the shallow bedrock channel between the spillway and

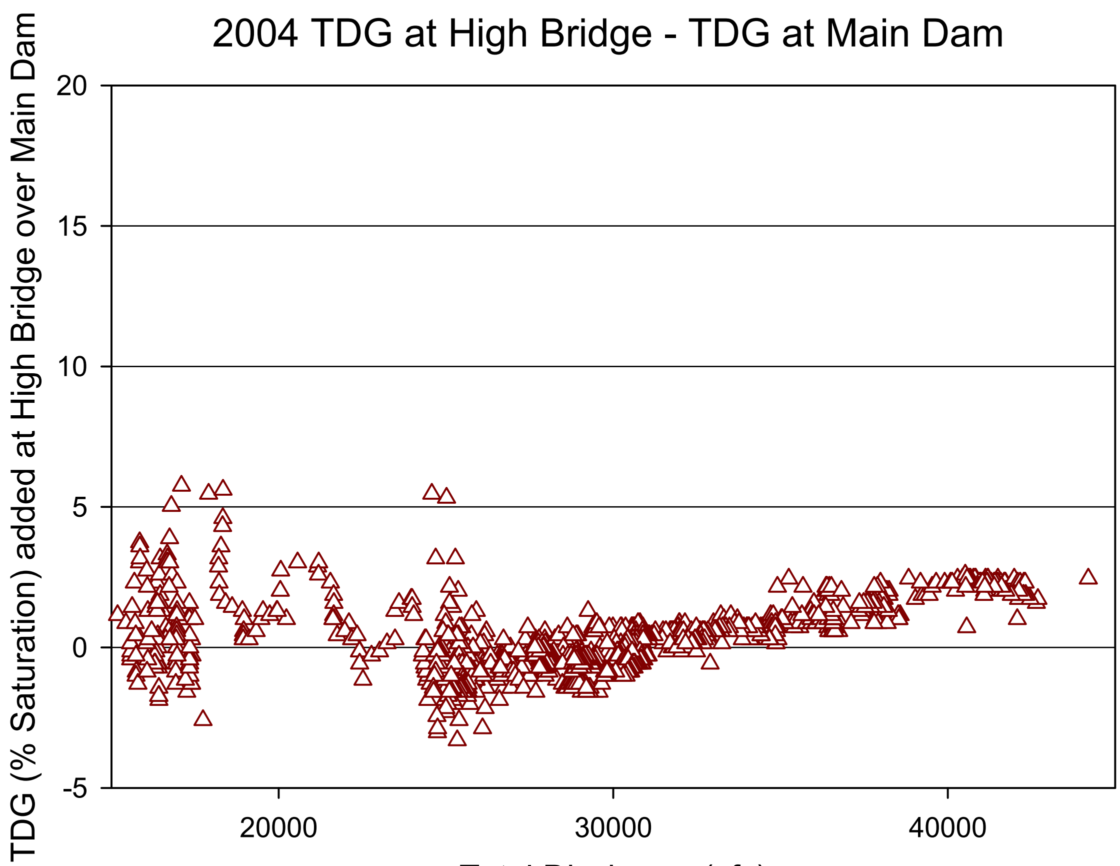

Figure 7 – Apparent TDG component of the 2004 HB TDG reading contributed by the falls.

falls. Rather, appreciable spill energy is being transferred to the deep pool below the falls, where turbulence is dissipated. This deep pool is where most of the TDG uptake is occurring. The following is an excerpt from the USACE's report on the Dissolved Gas Abatement Study, which pertains to this issue:

(ES1.08. SUMMARY OF INVESTIGATIONS)

a. Field Investigations.

Much experience and knowledge has been gained through the data collection efforts and the near-field investigations conducted below the Corps projects. Initially, measurements of TDG were made by boat at a distance of 2,500 feet or more downstream of the spillway stilling basins where TDG levels were expected to be the highest near the end of the aerated spillway plume. With advances in instrumentation and on-board data logging, the Corps was able to develop methods for deploying instruments directly below the spillway. Peak TDG levels much higher than previously measured or expected were observed. TDG levels as high as 170 percent were measured near the spillway's endsill of the non-deflected Ice Harbor spillway. The TDG levels dropped off very rapidly to less than 130 percent within the first 2,500 feet downstream of the stilling basin and then began to stabilize at levels less than 125 percent as the flow continued to move downstream. Similar trends have been observed at other projects both with and without spillway flow deflectors. The near-field tests have shown that a significant and rapid decrease in TDG occurs within the aerated plume exiting the spillway's stilling basin. Because flows from the spillway flow deflectors tend to force higher energy flow out into the tailrace channel, they not only prevent the flow from plunging deep into the spillway stilling basin (reducing the initial uptake in TDG), they also promote a rapid decrease in TDG by extending the boundaries of a more turbulent aerated plume.

The following is surmised, relative to where TDG uptake is occurring at Thompson Falls

- If TDG measurements are in a highly turbulent zone (such as immediately below a spillway), readings will be artificially high relative to a downstream location such as the HB, because the TDG levels drop in intervening zones of waning turbulence. This is due to residual "tumbling" of water that releases unstable TDG in solution to the atmosphere.

- Since there are few areas of depth in the immediate spillway tailrace, but appreciable turbulence and aeration, little absorption of TDG should be occurring in this zone during spill. Therefore, there is uncertainty whether elevated 2004 TDG readings below the spillway were artificially influenced by a high density of aeration bubbles in this turbulent zone.

- At low spill levels, some of the energy is dissipated between the spillway and falls, due to surface roughness and the hydraulic jump at the base of the spillway apron. But residual energy combines with the vertical drop at the falls to transfer composite energy to the deep pool below the falls. I believe this is where the primary TDG uptake occurs during spill.

- Since the primary energy dissipation appears to occur in the deep falls tailrace pool, the TDG levels upstream (in the immediate spillway tailrace) are erased when they pass into the deeper pool below the falls. That is where the presence of (1) pool volume and (2) pool depth combine to create the vertical circulation necessary to take aeration to depth, and expose it to the hydraulic pressures required for TDG uptake.

- Therefore, TDG readings at the base of the spillway appear to be misleading, and the HB reading (at a location far enough downstream to reflect a more stable TDG level) appears to be the most useful for measuring the *composite* TDG uptake for the spillway and falls.

- It is inappropriate to try to segment TDG uptake downstream of the Main Dam spillway at Thompson Falls, since the spillway and falls are a composite system.

Appendix B – Calibration Checklist

Checklist for Thompson Falls Hydrolab Logging Run Maintenance

Site ___________ Date __________ Time __________ Tech __________
DS# __________

1. Remove DataSonde ………………………………………………… Time __________
2. Clean DataSonde exterior and probes ……………………………… __________
3. Connect to PC or Surveyor
4. Remove and Replace TDG Sensor …………………………………. __________
   Check TDG Sensor holds pressure …………………………………. __________
5. Check/Calibrate Specific Conductance from _________ to __________
6. Check/Calibrate pH 7 from __________ to __________ temp __________
   pH 10 from __________ to __________ temp __________
7. Check/Calbrt DO % sat from __________ to __________ temp________
   mg/l from ___________ to __________
8. Check/Calibrate Turbidity from ___________ to __________
9. Download Logging file to C drive or SUV ………………………… ___________
   Name of file and computer _____________________________________
   Reprogram Logging file if necessary ……………………………… ____________
10. Check/Cal Depth and Barometric Pressure ……………………… ___________
11. Remove/Replace C Batteries …………………………………………… ___________
12. Check Internal Voltage (at or above 12 volts) ………………….. ___________
13. Check Date and Time ……………………………………………………. ___________

14. Read/record water temperature …………………………………… ____________

15. Reinsert DataSonde Time …………………………………………… ____________

16. Photos ____

Appendix B – Consultation with Montana Department of Environmental Quality

From: Storrar, Keenan <Keenan.Storrar@mt.gov>
Sent: Wednesday, November 29, 2023 8:54 AM
To: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>; Kron, Darrin <dkron@mt.gov>
Cc: Welch, Andrew <Andrew.Welch@northwestern.com>; Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>; Metzner, Gabrielle <Gabrielle.Metzner@mt.gov>
Subject: [EXTERNAL] RE: Updated Thompson Falls WQ Monitoring Plan Draft

CAUTION: This Email is from an EXTERNAL source outside of NorthWestern Energy.
The Original Sender of this email is Keenan.Storrar@mt.gov.
Are you expecting the message? Is this different from the message sender displayed above?
Do not click on links or open attachments unless you are sure you recognize the sender and you know the contents are safe.
If you believe the email to be malicious and/or phishing email, please use the **Report Phish** button.

Jordan,

Thank you for updating the plan to include the comments from our meeting a couple weeks ago. We're satisfied with this most up-to-date WQ monitoring plan being incorporated into the license. We have no further comments.

Thanks again,
Keenan Storrar | *401/318 coordinator*
Water Protection Bureau
Montana Department of Environmental Quality
Office: 406-444-2734

DEQ Montana Department of Environmental Quality

How did we do? »

1

From: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>
Sent: Thursday, November 16, 2023 12:22 PM
To: Kron, Darrin <dkron@mt.gov>; Storrar, Keenan <Keenan.Storrar@mt.gov>
Cc: andrew.welch@northwestern.com; Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>
Subject: [EXTERNAL] Updated Thompson Falls WQ Monitoring Plan Draft

Keenan and Darrin,

Thank you for taking the time to meet with us this week regarding the Thompson Falls Water Quality Monitoring Plan. Attached is an updated version of the plan based on your comments from this week's meeting.

Changes to note:

1. I added in a subsection titled "Data Reporting" under each monitoring section, which discusses how the monitoring data collected for that portion of the plan will be reported.
2. I added in language in Section 2.1 describing that Site 28 is an established long-term monitoring site, and how the new Site 27 is upstream of a previously established Site 27 and our reasoning for moving that site. I also mentioned that we will provide assurances that the new Site 27 is representative and in a well-mixed portion of the river.
3. I added in language in Section 4.0 that we will update the TDG control plan within one year of the issuance of the new FERC license and upon DEQ approval of the plan, will provide that plan to the USFWS.

Based on my notes, I believe that should have addressed everything from our discussions on Tuesday. Please let me know if you have any further comments as we will be including this plan in with our Final License Application to FERC.

Jordan

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Appendix D – Recreation Management Plan

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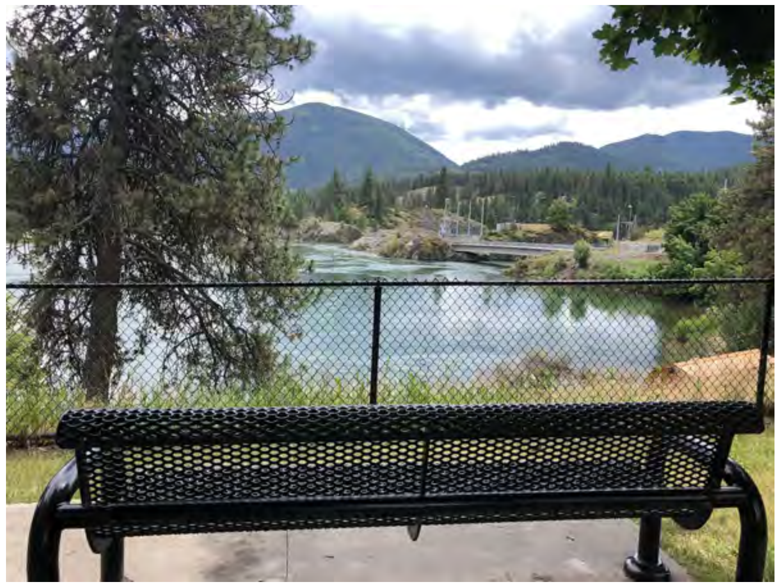
Thompson Falls Hydroelectric Project
FERC Project No. 1869

Recreation Management Plan



Prepared by:
NorthWestern Energy
Butte, MT 59701

With Support From
Pinnacle Research
Plains, MT 59859

May 2024

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Executive Summary

NorthWestern Energy (NorthWestern) is the owner and operator of the Thompson Falls Hydroelectric Project (FERC Project No. 1869) (Project), located on the Clark Fork River near Thompson Falls, Montana. A wide variety of recreation opportunities exist within the region of the Project and within the vicinity of the Project near the City of Thompson Falls, Montana.

Recent surveys of visitors to sites in proximity to the Project indicate that recreationists do not feel crowded and are highly satisfied with the opportunities and amenities offered. The majority of visitors that use these recreation sites are local-area residents. The volume of site visitation is quite stable, and patterns of use have been consistent over time.

Five recreation sites, Power Park, Island Park, Wild Goose Landing Park, the South Shore Dispersed Recreation Area, and the Cherry Creek Boat Launch Site are included as Project recreation sites in this Recreation Management Plan. NorthWestern will operate and maintain these five sites as Project recreation sites under its Federal Energy Regulatory Commission (FERC) license for the Project.

Power Park and Wild Goose Landing Park are located adjacent to Thompson Falls Reservoir, above the Project's two dams (Main Channel Dam and Dry Channel Dam) and two powerhouses (original and new). Island Park is located between the two dams, adjacent to the fish passage facility on the right abutment of the Main Channel Dam. The South Shore Dispersed Recreation Area is located along the banks of the Clark Fork River, downstream of the Project's dams. Cherry Creek Boat Launch Site is located on the south shoreline approximately 4 miles upstream of the dams.

NorthWestern will manage and maintain:

- Power Park, as a neighborhood park with a group use pavilion, picnic facilities, and restrooms
- Island Park, as a pedestrian-access park in a natural setting with vault toilet restrooms, trails, and an overlook to the Project's fish passage facility
- Wild Goose Landing Park, as a water-access site with boat launching facilities, shoreline access for swimming, a restroom, and picnic facilities
- South Shore Dispersed Recreation Area, as dispersed Clark Fork River shoreline access
- Cherry Creek Boat Launch Site as a water-access site with boat launching facilities, a restroom, and picnic facilities.

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1.0 Introduction

The Thompson Falls Hydroelectric Project (Project) is located on the Clark Fork River in Sanders County, Montana, adjacent to the city of Thompson Falls (City). 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. The Project is licensed by FERC as Project No. 1869.

1.1 Purpose of Plan

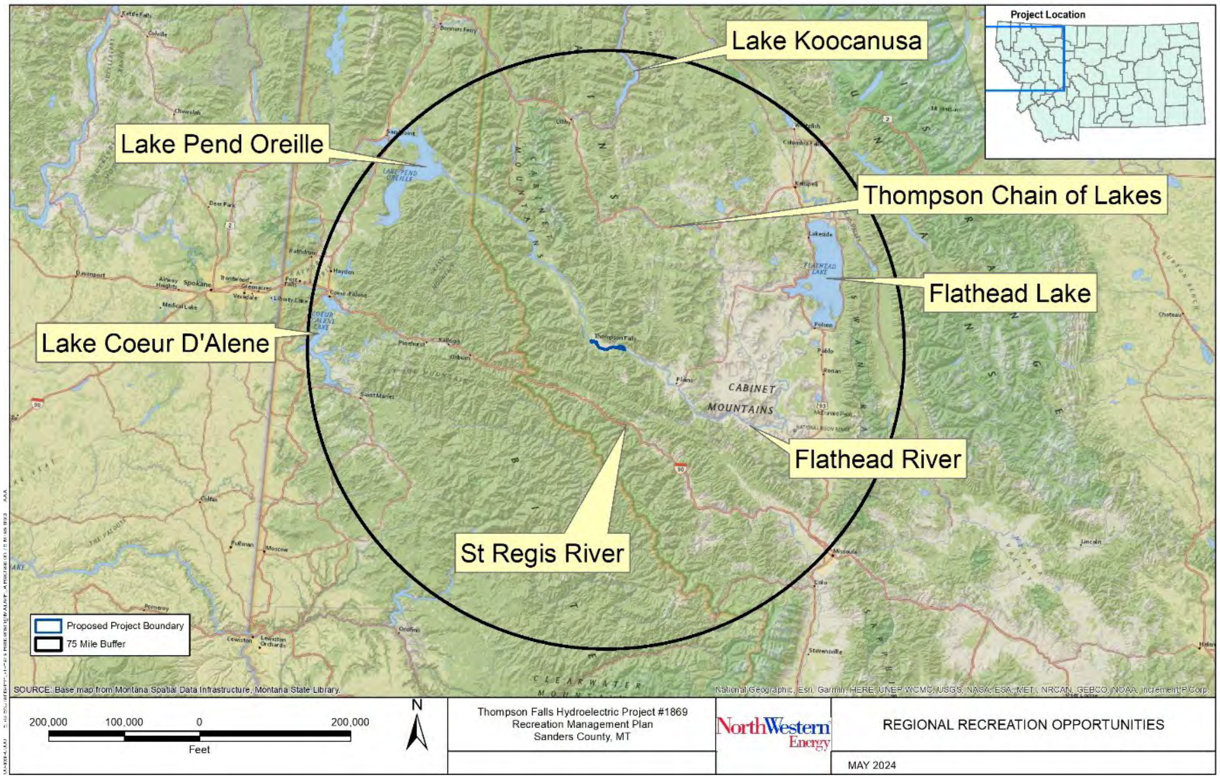
The purpose of this Thompson Falls Hydroelectric Project Recreation Management Plan (Plan) is to address management of Project recreation sites over the term of the new License. The Plan identifies and describes the sites, amenities, and measures that will be implemented to manage the recreation sites associated with the FERC-licensed Project. Amenities exist at Power Park, Island Park, Wild Goose Landing Park, and the Cherry Creek Boat Launch Site that enhance access or support desired recreation opportunities and experiences, while the South Shore Dispersed Use Area is managed as a primitive site in natural settings with no improved facilities.

This Plan describes measures for managing the recreation sites and provides for on-going consultation with stakeholders to ensure sites meet the needs of the recreating public, as identified through visitor and site condition monitoring, in the Project area over the term of the license.

1.2 Regional Recreation in the Project Vicinity

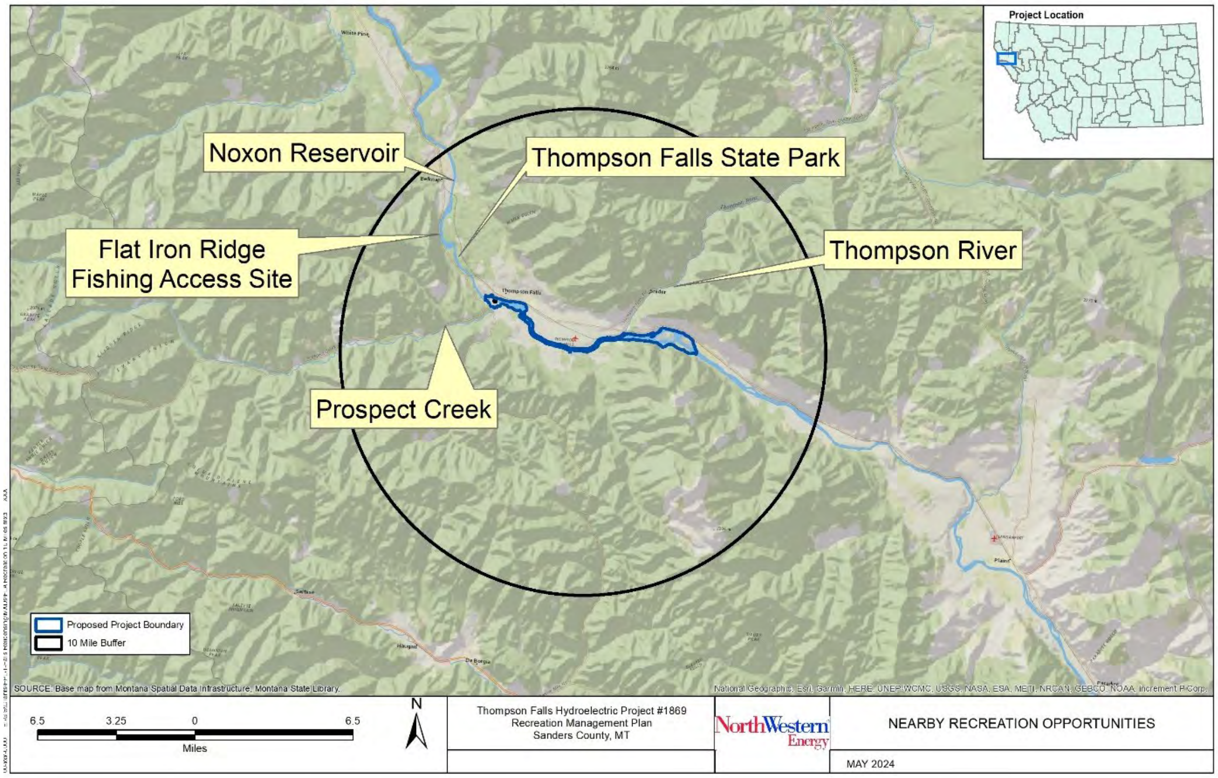
A wide variety of recreation opportunities exist within a 75-mile-radius of Thompson Falls, including hiking trails, camping areas, Forest Service lookouts, lakes, rivers, forest roads, and others. Sites and settings for recreation are managed by a mix of federal, state, tribal, and local agencies, as well as private entities. Some notable areas within the 75-mile-perimeter include Flathead Lake, Lake Koocanusa and the Thompson Chain of Lakes in Montana, Lake Pend Oreille and Lake Coeur d'Alene in Idaho, and the Flathead and St. Regis rivers in Montana (**Figure 1-1**).

Figure 1-1: Recreation areas within a 75-mile-radius of Thompson Falls.



Nearer the Project, within a 10-mile-radius, are recreational trails, campgrounds, fishing access sites, and water-based recreation opportunities. Notable areas include Thompson River, Noxon Reservoir, Flat Iron Ridge Fishing Access Site, Thompson Falls State Park, and Prospect Creek (**Figure 1-2**).

Figure 1-2: Recreation areas within a 10-mile-radius of Thompson Falls.



In the immediate vicinity of the Project, nine developed and dispersed recreation sites offer trail-based recreation, shoreline access to the Thompson Falls Reservoir and the Clark Fork River, boat launching facilities, picnic facilities, and user conveniences such as a group use pavilion and toilet and trash facilities. Eight of the nine recreation sites are situated in the area roughly 1 mile above and 1 mile below the Main Channel Dam, while the ninth site, Cherry Creek Boat Launch Site, is located about 4 miles upstream (**Figure 1-3**).

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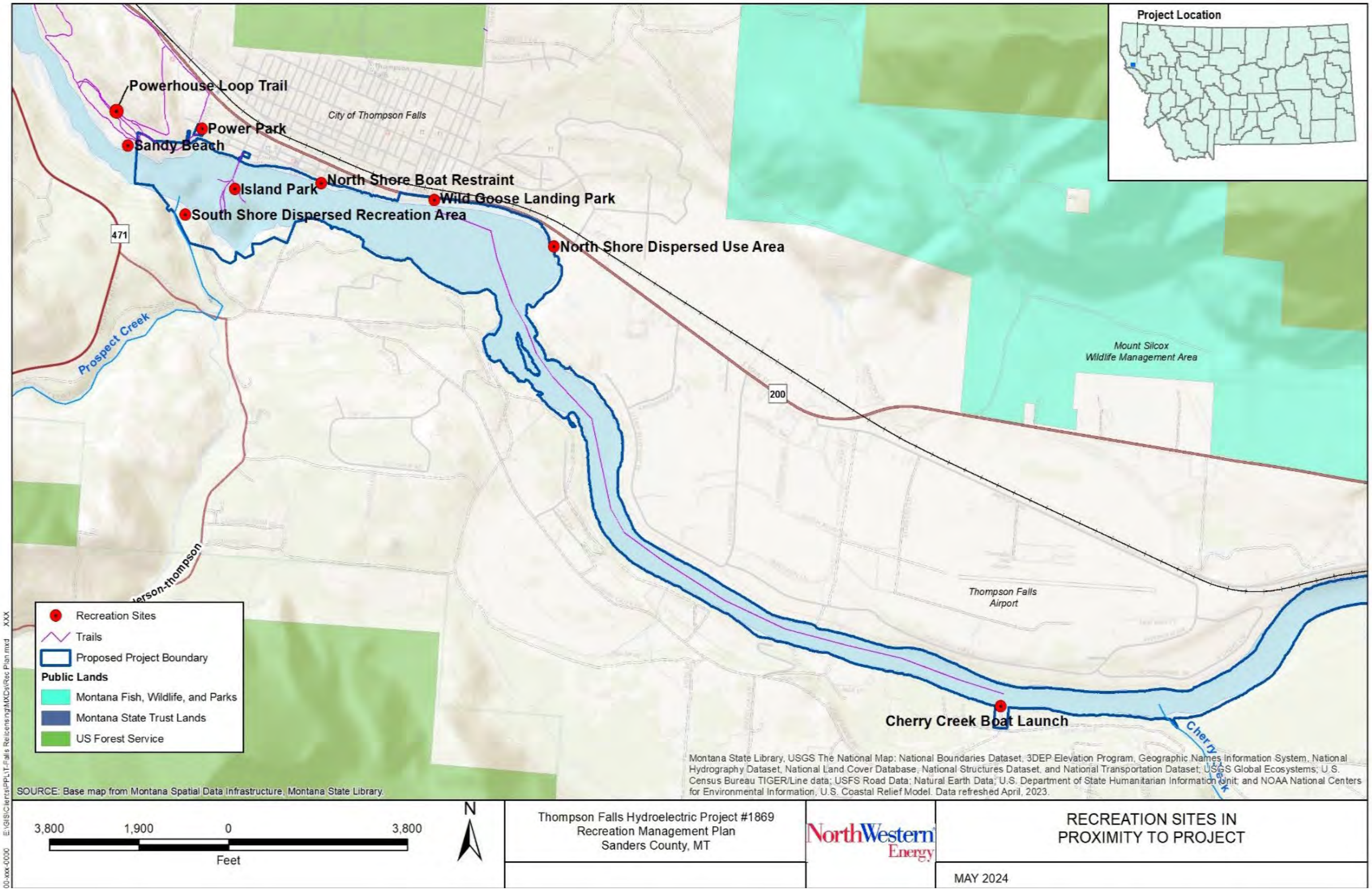
Figure 1-3: Recreation sites in proximity to the Thompson Falls Project.



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2.0 Project Recreation Sites

Pursuant to this Plan, NorthWestern will operate and maintain five Project recreation sites: Power Park, Island Park, Wild Goose Landing Park, the South Shore Dispersed Recreation Area, and Cherry Creek Boat Launch Site (**Figure 2-1**). The following section describes these Project recreation sites and summarizes Project amenities at each site.

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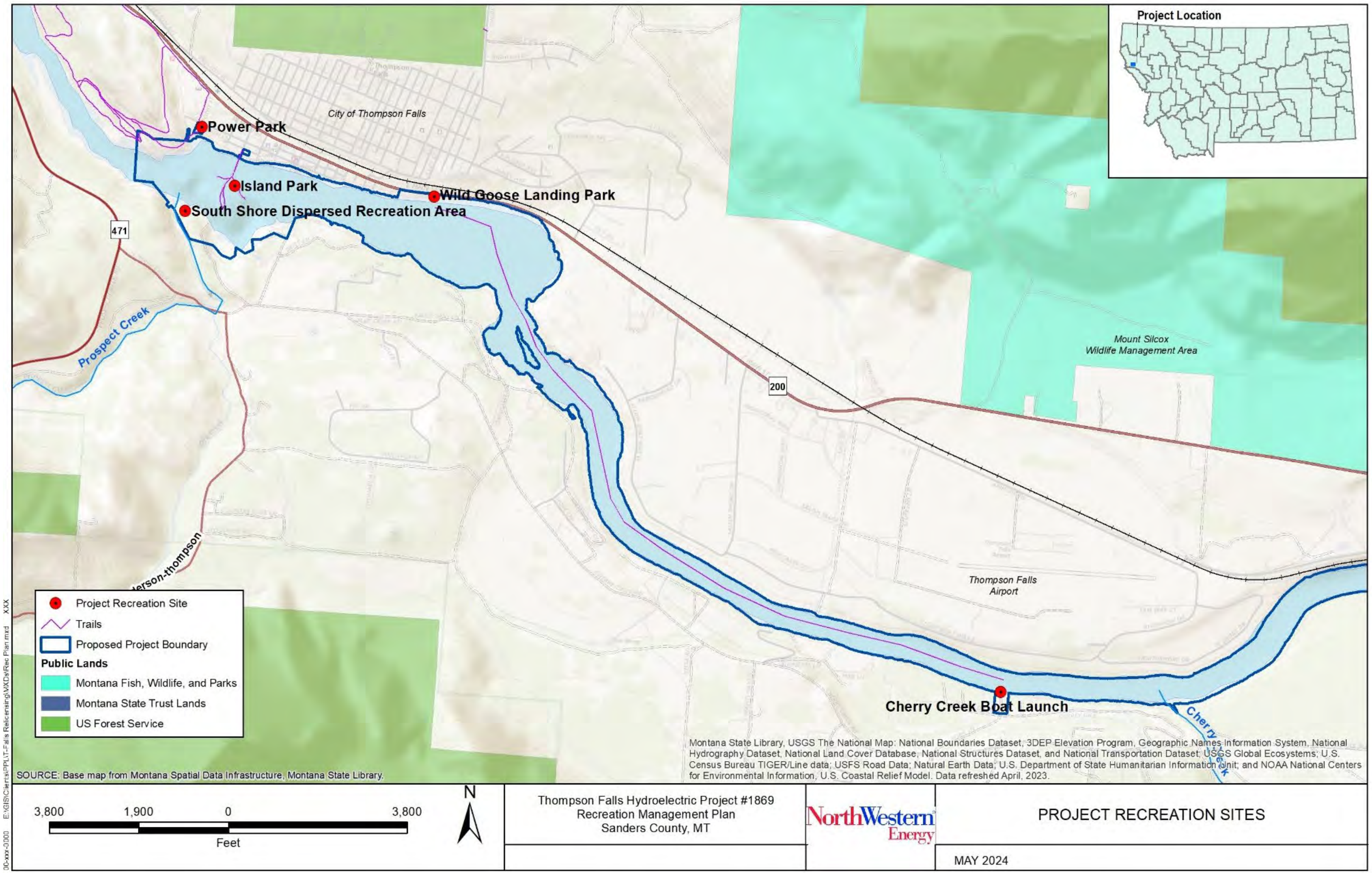
Figure 2-1: Map of Project Recreation Sites.



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2.1 Power Park

Power Park is a neighborhood park within the proposed FERC Project boundary (**Figure 2-2**). NorthWestern owns approximately 75 percent of the park property with the remaining 25 percent owned by the City, over which NorthWestern holds an easement allowing it to use the City-owned portion as a recreation site. Project amenities at the site include a group-use pavilion with running water, electrical plug-ins and countertops, an ADA-accessible restroom facility, concrete sidewalks linking site facilities, drinking water station, trash cans and collection service, benches, numerous picnic tables, a site welcome sign and a large hydroelectric information sign (FERC Part 8 sign) (**Photographs 2-1**). Use of the site is offered free of charge for year-round public day use from dawn to dusk. Plumbed facilities (pavilion sink, drinking fountain, and plumbed restrooms) are offered free of charge during the peak recreation season (Memorial Day – Labor Day), and will be winterized and unavailable during non-peak seasons. Site management responsibilities include mowing, irrigation, weed management, hazardous tree monitoring, trimming, and removal, trash collection and litter pick-up, cleaning and stocking restrooms during the peak recreation season, and winterizing water lines during cold months to prevent breakage.

Figure 2-2: Power Park Project Recreation Site and Facilities.

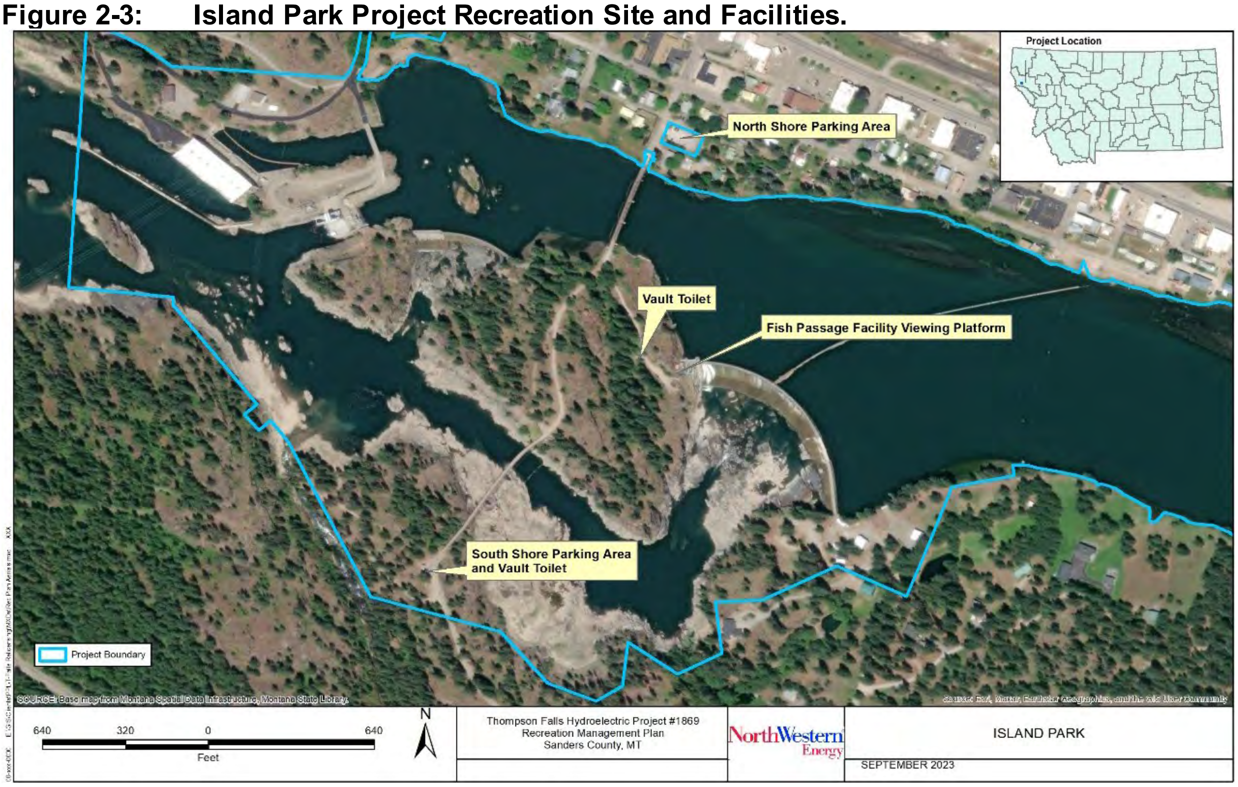
© NorthWestern Energy

Photographs 2-1: Photos of Power Park

2.2 Island Park

Island Park is located between the Main Channel Dam and Dry Channel Dam (**Figure 2-3**). The 22-acre park is almost entirely on NorthWestern property, with a small portion (less than 0.5 acre) at the north shore abutment under City ownership over which NorthWestern holds an easement allowing it to use the City-owned portion for ADA parking and access control. Parking areas on the north and south shorelines allow for visitor walk-in access to the site via the Gallatin Street Bridge on the north and the Historic High Bridge on the south. The bridges are owned, operated, and managed by Sanders County and are non-Project amenities. Project amenities associated with Island Park include the North and South Shore Parking Areas (each with 1 ADA-accessible parking spot), vault toilets (on the island and at the South Shore Parking Area), benches and picnic tables throughout the park, a viewing platform overlooking the Main Channel Dam and fish passage facility, a pedestrian trail connecting the county bridges to the viewing platform, site welcome signs, and numerous interpretive panels (**Photographs 2-2**). The park and the North and South Shore Parking Areas (including the vault toilet at the South Shore Parking Area) are included in the proposed Project boundary and managed by NorthWestern. The site and Project amenities are available free of charge for year-round public day use (dawn-dusk). Site management responsibilities include weed management, hazardous tree monitoring, trimming, and removal, trash collection and litter pick-up, and cleaning and stocking vault toilets during the peak recreation season (Memorial Day – Labor Day).

Figure 2-3: Island Park Project Recreation Site and Facilities.



Photographs 2-2: Photos of Island Park.

2.3 Wild Goose Landing Park

Wild Goose Landing Park is a developed recreation site within the proposed Project boundary (**Figure 2-4**). About half the site is located on NorthWestern-owned property and half on City-owned property over which NorthWestern holds an easement allowing it to use the City-owned portion as a recreation site. Project amenities include a boat launch, courtesy launch dock and swimming dock, an access road, parking, plumbed restroom facility, picnic facilities, and a site sign (**Photographs 2-3)**. The park is available free of charge for year-round public day use (dawn to dusk). Plumbed restroom facilities are offered free of charge during the peak recreation season

(Memorial Day – Labor Day) and will be winterized and unavailable during non-peak seasons. Site management responsibilities include mowing, irrigation, weed management, hazardous tree monitoring, trimming, and removal, trash collection and litter pick-up, and cleaning and stocking restrooms during the peak recreation season.

Figure 2-4: Wild Goose Landing Park Project Recreation Site and Facilities.

Photographs 2-3: Photos of Wild Goose Landing Park.

2.4 South Shore Dispersed Recreation Area

The South Shore Dispersed Recreation Area (South Shore) is a primitive shoreline access area on the south shoreline of the Clark Fork River, adjacent to the mouth of Prospect Creek, below the dams (**Figure 2-5**). The site is included in the proposed Project boundary. Project facilities include the access road, dispersed parking area, and dispersed shoreline areas, all of which are located on NorthWestern property and managed by NorthWestern as primitive areas (**Photographs 2-4**). The site is available free of charge for year-round public day use (dawn to dusk). Dispersed parking is available at the site during the peak recreation season (Memorial Day – Labor Day), and during the winter months at the nearby South Shore Parking Area (which is managed as a component of Island Park), where a vault toilet is also available during the peak recreation season. Site management responsibilities include weed management, hazardous tree monitoring, trimming, and removal, and litter pick-up.

Figure 2-5: South Shore Dispersed Recreation Area Project Recreation Site and Facilities.

Photographs 2-4: Photos of South Shore Dispersed Recreation Area.

2.5 Cherry Creek Boat Launch Site

The Cherry Creek Boat Launch Site is a day use site approximately four miles upstream of the Main Channel Dam (**Figure 2-6**). The site is located on Sanders County property over which NorthWestern holds an easement allowing it to operate and maintain the recreation site. Project amenities include a small boat launch and floating courtesy dock, a day use area with picnic facilities, and a vault toilet (**Photographs 2-5**). Site management responsibilities include weed management, hazardous tree monitoring, trimming, and removal, litter pick-up, and operation and maintenance of the picnic facilities, vault toilet restroom, boat launch and dock.

Figure 2-6: Cherry Creek Boat Launch Site Project Recreation Site and Facilities.

Photographs 2-5: Photos of Cherry Creek Boat Launch Site.

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3.0 Recreation Monitoring

Recreation visitor monitoring has been conducted at the Thompson Falls Project since the early 1990s pursuant to Article 406 of the 1990 FERC license amendment (FERC 1990). Visitors were surveyed during the peak season (Memorial Day weekend – Labor Day weekend) in 6 different years since 1990, most recently during the peak recreation season in 2021. Visitor surveys documented visitor and trip characteristics, including previous site use, length of visit, group size, recreation activity participation, motivations to visit, opinions about the adequacy of recreation facilities, any problems encountered, and visitor demographics.

Over time, while visitor and trip characteristics have remained fairly consistent and visitor satisfaction has remained high, visitors' desire for changes to recreation facilities or management have declined. This decline in visitors' perceived needs for additional facilities is assumed to be largely due to the numerous upgrades made to recreation sites and expansion of recreation opportunities in the Project area since 2008. Upgrades have largely consisted of additional amenities such as trails, benches, and picnic tables, as well as more toilet facilities and designated parking areas.

The 2021 Thompson Falls Recreation Visitor Survey (NorthWestern 2022) revealed that more than three-fourths of all visitors were from Montana (78%) and more than one-third (36%) were from Thompson Falls. Visitors from Washington and Idaho comprised 16 percent of all visitors (10 and 6%, respectively). Most (60%) were repeat visitors, while 40 percent were making their first visit.

Overall, 85 percent of all visitors in 2021 indicated they were very or extremely satisfied with the site they were using. Additionally, feelings of crowdedness were low, with 96 percent indicating they felt not at all or not very crowded. Being outdoors and enjoying nature were primary motivations for visits, and visitors reported experiencing no problems of any kind during their visit.

Examination of the volume of visitor use at recreation sites has also been conducted during the peak recreation season in recent years using automated technologies that allow for monitoring vehicle or pedestrian access to recreation sites. When coupled with visitor and trip characteristics gathered by the recreation visitor survey, this information provides a more complete picture of recreation site use.

Peak-season use monitoring of Project recreation sites revealed roughly 33,000 group visits were made to Project recreation sites[1] during the peak recreation seasons of 2020, 2021, and 2022. Of the total use at these sites, 45 to 51 percent occurred at Wild Goose Landing Park, 34 to 37 percent

[1] Estimating the use of Power Park with automatic counters is not possible due to the varied nature of access to the site.

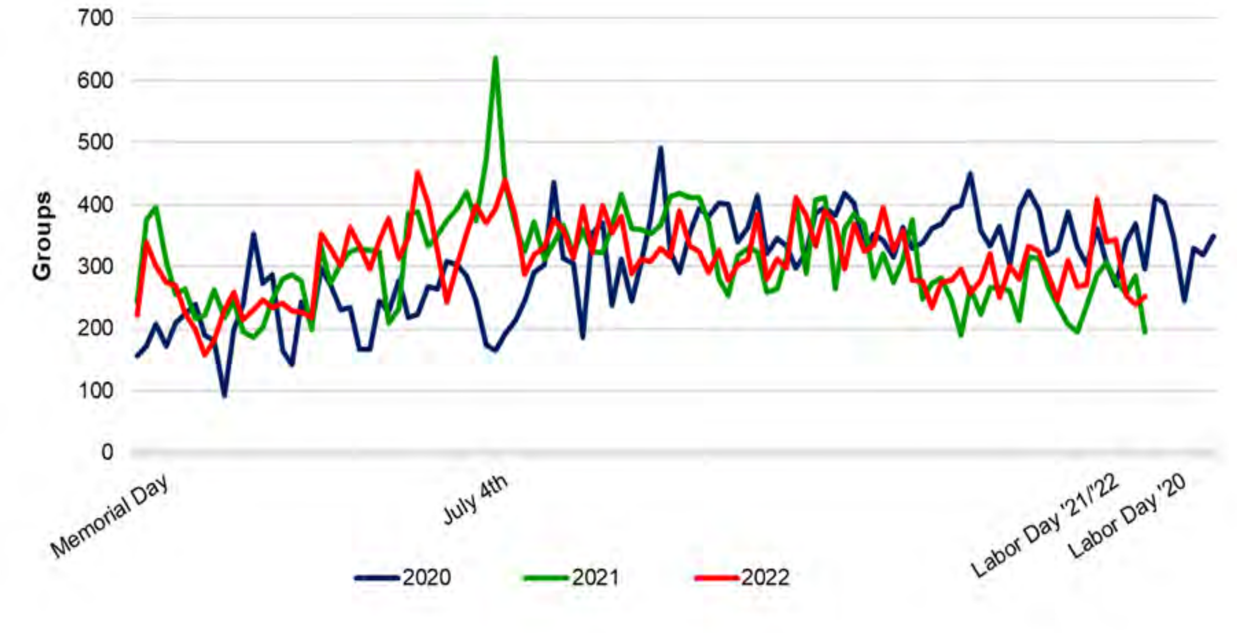
occurred at Island Park, 7 to 9 percent occurred at South Shore Dispersed Recreation Area, and 6 to 13 percent occurred at the Cherry Creek Boat Launch Site over the 3-year timeframe (**Table 3-1**).

Table 3-1: Peak season visitation estimates to Project recreation sites.

Recreation Area	2020 Peak Season: # Group Visits (% of total)	2021 Peak Season: # Group Visits (% of total)	2022 Peak Season: # Group Visits (% of total)
Wild Goose Landing Park	15,198 (45%)	16,649 (51%)	16,131 (49%)
Island Park	11,866 (35%)	11,091 (34%)	12,086 (37%)
South Shore Dispersed Recreation Area	2,217 (7%)	2,819 (9%)	2,556 (8%)
Cherry Creek Boat Launch Site	4,603 (13%)	2,105 (6%)	1,860 (6%)
Total Visitation to All Monitored Sites	**33,884**	**32,664**	**32,633**

In general, combined visitation to these monitored sites is fairly consistent over the course of the peak recreation season (**Figure 3-1**). Visitor use of Wild Goose Landing Park, the South Shore Dispersed Recreation Area, and Cherry Creek Boat Launch Site peaks during the middle part of the season (generally on or around the July 4th holiday) since these sites are primarily used for waterway access. Use of Island Park is typically highest in the early season, when runoff is high and views of water passing through the Main Channel Dam and the natural falls below are spectacular.

Figure 3-1: Peak season daily visitor groups to monitored Project recreation sites, 2020-2022.



Recreation visitor surveys will be conducted every 12 years in the Project area beginning in 2036, to include input from visitors to Project and non-Project recreation sites. Project site and facility condition assessments will also be conducted every 12 years beginning in 2036, and visitation data to Project sites will be collected using automated counters, as feasible[2], on an annual basis.

A Recreation Report will be produced every 12 years that summarizes monitoring information, and will include assessment of visitor satisfaction and opinions, recreation activities engaged in, motivations for engaging in recreation visits and site selection, visitor demographics, recreation site visitation estimates, and site and facility conditions.

The Recreation Report will identify significant issues, concerns, or needs for improvements to meet recreational demand at Project recreation sites. NorthWestern will provide a 30-day comment period for the City of Thompson Falls and Sanders County. Comments received will be considered and addressed in the final Recreation Report, along with NorthWestern's determination of any necessary measures to ensure Project recreation resources adequately meet public needs. The Recreation Report will be filed with FERC on September 15 in the year following the visitor survey. Significant modifications to Project recreation sites and amenities will be subject to review and approval by FERC.

Visitor monitoring under the current license was conducted at intervals that coincided with FERC's Form 80 reporting requirement, which had been adjusted periodically over time and was on a 6-year interval near the end of the current license term. The Form 80 filing requirement was

[2] Visitor volume data at some sites, such as Power Park, cannot be captured with automatic counters due to the varied nature of access to the site.

removed in 2018[3]. Visitor surveys over the term of the current license reveal that the Thompson Falls recreation visitor base is stable and has not changed significantly over time. Therefore, it is reasonable to extend the visitor monitoring interval from the former 6-year interval to a 12-year under the new license. A 12-year monitoring interval will accommodate four monitoring events during a 50-year license, and the final monitoring event will occur 3 years before the 50-year license expires.

[3] 165 FERC 165 FERC ¶ 61,256 Elimination of Form 80 and Revision of Regulations on Recreational Opportunities and Development at Licensed Hydropower Projects

4.0 Summary

NorthWestern will operate and maintain Power Park, Island Park, Wild Goose Landing Park, the South Shore Dispersed Recreation Area, and the Cherry Creek Boat Launch Site as Project recreation sites. High levels of visitor satisfaction and low ratings of crowdedness have been documented through visitor surveys, along with visitor support for leaving sites as they are. The volume of visitation to recreation sites is quite stable and patterns of use have been consistent over time.

Ongoing management of Project recreation sites will offer a diverse set of opportunities to the recreating public, including picnic facilities and a large group-use area at Power Park, a natural setting to view fish passage, dam facilities, and natural falls at Island Park, reservoir access and boat launching facilities at Wild Goose Landing Park and the Cherry Creek Boat Launch Site, and shoreline access on the Clark Fork River below the dams for fishing and dispersed recreation at the South Shore Dispersed Recreation Area. These opportunities and facilities that support visitor use will be provided free of charge to the recreating public.

Visitor use and satisfaction, as well as site facility conditions, will be monitored at regular intervals to ensure that Project recreation amenities meet the needs of the recreating public.

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5.0 Citations

Federal Energy Regulatory Commission (FERC) 1990. Thompson Falls Hydroelectric Project (P-1869). Order Amending License (Major). April 30, 1990.

NorthWestern Energy (NorthWestern). 2022. Thompson Falls Hydroelectric Project P-1869. Final Study Report - Visitor Use Survey. April 2022. https://www.northwesternenergy.com/docs/default-source/default-document-library/clean-energy/environmental-projects/thompson-falls/thompson-falls-relicensing/p1869-isr-visitor-use-survey.pdf

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Appendix E – Biological Assessment

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Thompson Falls Hydroelectric Project
FERC Project No. 1869

Biological Assessment

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December 2023

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Appendix A: FWS ECOS-IPAC

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List of Abbreviations and Acronyms

~	about or approximately
ºC	degrees Celsius
ºF	degrees Fahrenheit
>	greater than
<	less than
≥	greater than or equal to
≤	less than or equal to
Avista	Avista Corporation
BA	Biological Assessment
BNSF	Burlington Northern Santa Fe
CFD	computational fluid dynamics
cfs	cubic feet per second
CHRU	Columbia Headwater Recovery Unit
CHSU	Critical Habitat Subunit
CHU	Critical Habitat Unit
CSKT	Confederated Salish and Kootenai Tribes
D	Degrade
DEQ	Montana Department of Environmental Quality
ECOS	Environmental Conservation Online System
El.	Elevation
ESA	Endangered Species Act
FA	Functioning Appropriately
FAR	Functioning at Risk
FERC	Federal Energy Regulatory Commission
FMO	foraging, migration, and overwintering
FUR	Functioning at Unacceptable Risk
FWP	Montana Fish, Wildlife and Parks
FWS	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
High Bridge	bridge below the Main Channel Dam

HWY	Montana State Highway
IPaC	Information for Planning and Consultation
Licensee	NorthWestern Energy
LL	Brown Trout
M	Maintain
m	meter
m/s	meters per second
mm	millimeter
WM	megawatt
MDL	Main Dam Left
MDR	Main Dam Right
MNHP	Montana Natural Heritage Program
MPC	Montana Power Company
MRL	Montana Rail Link
MW	megawatts
n=	number equals
NMFS	National Marine Fisheries Service
NorthWestern	NorthWestern Energy
PCEs	primary constituent elements
PIT	passive integrated transponder
Project	Thompson Falls Hydroelectric Project
R	Restore
SKQ	Seli'š Ksanka Qlispe'
TAC	Technical Advisory Committee
TDG	total dissolved gas
TDG Control Plan	Total Dissolved Gas Control Plan
Thompson Falls Project	Thompson Falls Hydroelectric Project
U.S.	United States
USFS	United States Forest Service
USGS	United States Geological Survey
ZOP	Zone of Passage

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1.0 Introduction

1.1 Project Background

The Thompson Falls Hydropower Project P-1869 (Thompson Falls Project or Project) is located on the Clark Fork River in Sanders County, Montana. Preliminary development of the 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. By May 1917, an additional generation unit was placed in service bringing the total to six generating units. Montana Power Company (MPC) acquired the Project in 1929. An order amending the License was issued by the Federal Energy Regulatory Commission (Commission or FERC) to MPC in 1990 allowing for construction of an additional powerhouse and generating unit, subsequently completed in 1995, giving the Project a total generating capacity of 92.6 megawatts (MW).

Non-federal hydropower projects in the United States (U.S.) are regulated by FERC under the authority of the Federal Power Act. The original license for the Project was issued effective January 1, 1938, and expired on December 31, 1975. The current FERC License was issued December 28, 1979. A major license amendment was issued April 30, 1990, approving the construction of a new powerhouse and extending the license term to 50 years. The Project was purchased by PPL Montana in 1999 and later purchased by NorthWestern Energy (Northwestern, Licensee) in 2014. With each purchase, the Project's FERC License was transferred to the new owner. FERC approved a Project License amendment necessitated by a U.S. Fish and Wildlife Service (FWS) Biological Opinion (BO) requiring construction and operation of an upstream fish passage facility on February 12, 2009.

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.

Federal agencies are required by Section 7(a)(2) of the Endangered Species Act (ESA) to ensure that any action authorized, funded, or carried out by the agency would not jeopardize a federally listed threatened or endangered species or species proposed for listing, or result in the destruction or adverse modification of designated critical habitat. As the lead federal agency responsible for consultation with FWS[1] under Section 7 of the ESA, the FERC is responsible for determining the proposed action's potential effects on protected species or critical habitat(s).

FERC designated NorthWestern as its non-federal representative for ESA consultation for the Project on August 28, 2020 (FERC 2020). NorthWestern prepared this Biological Assessment (BA) to support FERC's ESA consultation.

1 There are no species regulated by the National Marine Fisheries Service impacted by the Project.

1.2 Methods for Species Analysis

This BA reviews information for each listed species identified by FWS as potentially occurring in the project vicinity. As part of this assessment, site-specific information regarding the action area was compared to the identified species' habitat and range. If their habitat and range were not present in the action area, the species were eliminated from detailed analysis in this BA. In addition, the location of designated or proposed critical habitat was reviewed for each species. The standardized criteria used to determine the potential for occurrence of individual species is outlined in **Section 5.0 – ESA Listed Species and Critical Habitat in Action Area**.

2.0 Project Description

The Thompson Falls Project is located at approximately (~) River Mile 65 on the Clark Fork River in Sanders County, Montana. The Clark Fork River is the largest river in the state of Montana based on flow. The Clark Fork River is ~ 320 miles long with headwaters in southwestern Montana and the terminus at Lake Pend Oreille, Idaho. The Lower Clark Fork River subbasin consists of 180 miles of perennial stream. In general, the ascending limb of the hydrograph in the Lower Clark Fork River begins between mid- and late-March, peaks between late May and mid-June, and descends to base flow levels around mid-August. The Clark Fork River drainage is shown in **Figure 2-1.**

Upstream of the Thompson Falls Project is the Seli'š Ksanka Qlispe' (SKQ) Project (formerly known as Kerr Dam, FERC Project P-5), located on the Flathead River, ~ 100 miles upstream (Figure 2-1). The Flathead River is a tributary to the Clark Fork River. The Confederated Salish and Kootenai Tribes (CSKT) are owners and its wholly owned, federally chartered corporation, Energy Keepers, Inc. is operator of the FERC licensed SKQ Project. The only other major dam in the watershed upstream of the Thompson Falls Project is Hungry Horse Dam on the South Fork of the Flathead River, managed by the U.S. Bureau of Reclamation.

Downstream of the Thompson Falls Project is Avista Corporation's (Avista) Clark Fork River Project (FERC Project P-2058) consisting of Noxon Rapids Dam, located ~ 33 miles downstream of Thompson Falls Project in Montana, and Cabinet Gorge Dam, located ~ 19 miles downstream of Noxon Rapids Dam in Idaho (Figure 2-1).

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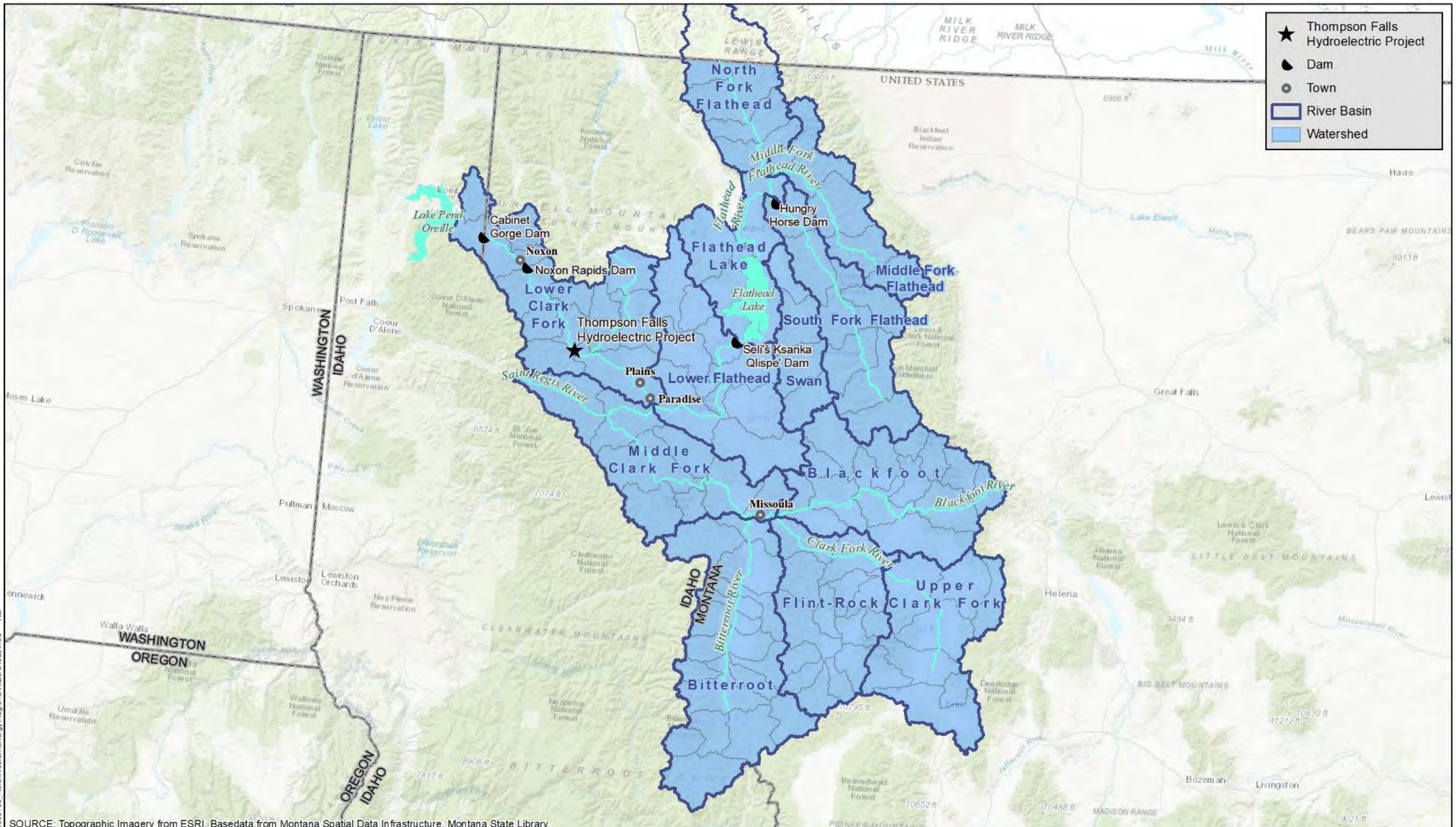
Figure 2-1: Regional Watersheds in the Clark Fork River drainage, and existing dams.



Thompson Falls Hydroelectric Project #1869
Biological Assessment
Sanders County, Montana

NorthWestern Energy

REGIONAL WATERSHEDS

DECEMBER 2023

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The existing Thompson Falls Project boundary as defined in the current FERC License is ~ 0.3 mile downstream and 12 miles upstream of the Project (**Figure 2-2**). Thompson Falls Reservoir covers 1,446 acres at a normal pool elevation of 2,396.5 feet. The Project has a perimeter length of about 27 miles.

The primary tributaries of the Clark Fork River within the Project area are the Thompson River and Cherry, Dry, Ashley and Prospect creeks. Prospect Creek flows into the Clark Fork River downstream of the Main Channel Dam and flows eastward into the Clark Fork River from the mountain range separating Idaho and Montana (Figure 2-2). The Thompson River flows into the Clark Fork River ~ 6 miles upstream of the dam. Cherry Creek flows northward and enters Thompson Falls Reservoir ~ 4 miles upstream of the dam. Other streams in the Project area are ephemeral drainages which flow subsurface when they reach the valley alluvium.

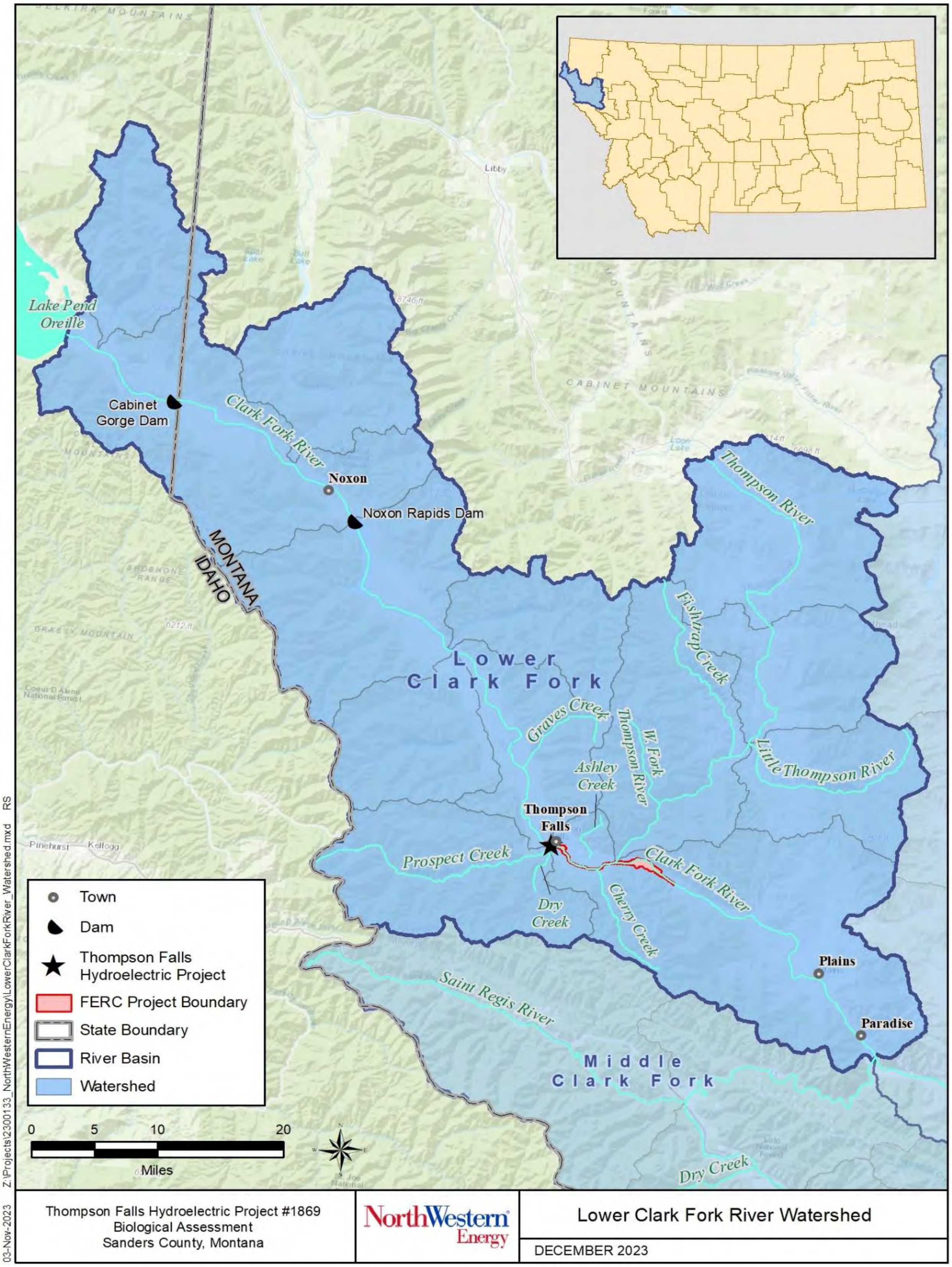
The topography in the Project area consists of a U-shaped river valley at ~ 2,400 feet that is bounded by steep mountainous terrain that exceeds 5,900 feet. The Cabinet Mountains border the north and the Coeur d'Alene Mountains, part of the northernmost extent of the Bitterroot Range, border the south side of the Clark Fork River. The Clark Fork River flows northwest terminating into Lake Pend Oreille.

The Project area can be described as a cold temperate climate with freezing, snowy and mostly cloudy winters and short, clear, warm and dry summers. Average monthly temperatures in the city of Thompson Falls vary from 23°F during the winter to 84°F during the summer, and it is rarely below 6°F or above 92°F (Weather Spark 2022). On average Thompson Falls receives about 23 inches of rain per year and 42 inches of snow per year. The warm season lasts about 2.6 months, June 22 to September 10 while the cold season extends from November 12 to March 1 (Weather Spark 2022).

The 2,001-acre existing Project boundary consists of 1,446 acres of reservoir, and 555 acres of non-reservoir. Lands in the area include about 17 acres of recreation land uses and 538 acres associated with non-recreational land use.

NorthWestern owns ~ 40 acres of the 538 non-recreational acres. The majority of the 40 acres is utilized for Project operations supporting the dams and powerhouse. Private lands represent about 208 acres of non-recreational lands and consist of a mix of large parcels, subdivision lots, and city lots. Many private lands contain residential buildings. The state of Montana's Department of Natural Resources and Conservation manages about 176 acres, which are largely open space. National Forest System lands include about 104 acres, which are largely open space forest lands. Railroad right-of-way and state of Montana lands managed by the Montana Department of Transportation as Montana State Highway (HWY) 200 right-of-way comprise the remaining areas of ~ 17 acres and 2 acres, respectively.

Figure 2-2: Location of Thompson Falls Hydroelectric Project (No. 1869) near the town of Thompson Falls, Montana and the Lower Clark Fork River drainage.



2.1 Project Structures

The existing Project structures consist of two curved concrete gravity dams (Dry Channel Dam and Main Channel Dam) with overflow spillways and two powerhouses (original powerhouse and new powerhouse) (**Photograph 2-1**).

The original powerhouse consists of a mass concrete substructure, a masonry rock wall, concrete and structural steel superstructure, concrete floor, and roof slabs supported on steel framing. The total installed capacity of the six turbine-generator units is ~ 40 MWs at a normal water head of 55 feet.

The Unit No. 7 powerhouse (new powerhouse), completed in 1995, is a cast-in-place reinforced concrete gravity structure founded on rock and includes an integral intake and headworks. A substantial portion of the new powerhouse is located below grade.

The turbine is a vertical shaft, double-regulated Kaplan type rated 52.6 MW at 54.5 feet net head and 94.7 revolutions per minute. The range of net head is 40 to 65 feet.

The Main Channel Dam is a curved gravity ogee spillway section, 913 feet long and an average height of 18 feet above the riverbed (Photograph 2-1). The Main Channel Dam has 30 bays divided by concrete piers or permanent steel frames on 24-foot-wide centers, which support flashboards and removable fixed wheel panels. The Main Channel Dam spillway crest is at elevation (El.) 2,380 feet and the top of the fixed wheel panels establish the normal full pool El. 2,396.5 feet. A concrete apron extends 30 to 50 feet downstream of the entire spillway section.

Two 41-foot-wide by 18-foot-high radial gates are located in Panels 16 and 17. In 2019, NorthWestern completed construction of two new radial gates near the left abutment on the Main Channel Dam. The new radial gates are similar in dimension and configuration to the older radial gates but located in bays 25 through 29. Each radial gate passes ~ 10,000 cubic feet per second (cfs), for a total spillway capacity through the radial gates of 40,000 cfs.

The fixed wheel panels are installed and removed by a crane, which travels along tracks on a 10-foot-wide bridge over the full length of the spillway. In a high flow event, the flashboards can be released by tripping or by torch cutting the bolt that secures the tripping latch and releasing the entire assembly free of the flashboard support structures.

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Photograph 2-1: Aerial photo of the Thompson Falls Project, taken June 2, 2014, with streamflow ~ 78,330 cfs (USGS gage #12389000 Clark Fork River near Plains and Thompson River).

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The Dry Channel Dam is located on a former channel of the river separated from the Main Channel Dam by an island. It is a curved concrete gravity dam and consists of two distinct structures. A non-overflow sluiceway section, 122 feet long and 38 feet high is located at the right side of the dam. It contains 10, 5- by 6.5-foot sluiceways that were originally controlled by slide gates operated from the crest of the dam. The slide gates were permanently closed about 1942 and in 1990 bulkheads were constructed within each sluiceway. The second part of the dam is an overflow spillway with an ogee crest. It has an overall length of 289 feet and an average height of 17 feet above the riverbed. The overflow spillway contains 12 bays, each with six panels and steel flashboard supports on 24-foot centers. The Dry Channel spillway crest is at El. 2,384 feet, but storage is increased by 4-foot flashboards and 8-foot fixed wheel panels similar to those on the Main Channel Dam, which brings the normal reservoir level to El. 2,396.5 feet.

As with the Main Channel Dam, the flashboards of the Dry Channel Dam can be released by tripping or by torch cutting the bolt that secures the tripping latch and releasing the entire assembly from the flashboard support structures.

2.2 Upstream Fish Passage Facility

The Thompson Falls Upstream Fish Passage Facility was constructed, in coordination with FWS, between 2009 and 2010 to help restore habitat connectivity for adult Bull Trout (*Salvelinus confluentus*) along the Clark Fork River above and below the Project. Bull Trout were listed as a threatened species under the ESA in 1998. The fish passage facility was constructed on the right side (facing downstream) of the Main Channel Dam, adjacent to the non-overflow gravity dam section (*refer to* Photograph 2-1). The Main Channel Dam is the furthest upstream impoundment structure of the Project. The fish passage facility was designed in general accordance with the National Oceanic and Atmospheric Administration Fisheries Criteria (NMFS 2008), which was used by FWS in the design of upstream passage facilities. The location and design of the fish passage facility were collaboratively developed and agreed to between the Licensee at the time and FWS, Montana Fish, Wildlife and Parks (FWP), and CSKT over the course of multiple years. FERC (2009) approved the final design and construction of the fish passage facility.

The fish passage facility was constructed with a sloping concrete floor, with 48 individual pools created by internal weir plates constructed across the concrete "U" section. Hydraulically, the ladder was designed to induce a 1-foot drop in the hydraulic grade line for each of the 48 pools to allow passage of a diverse population of fish over the Main Channel Dam. Additional details regarding the design of the upstream fish passage facility are found in the **Final License Application Exhibit E Section 2.1.1** (NorthWestern 2023c).

2.3 Thompson Falls Reservoir

Thompson Falls Reservoir formed by the impounded water is about 10 miles long with a maximum width of about 1,800 feet and maximum depth of 90 feet. Active storage capacity of the Thompson

Falls Reservoir is ~ 15,000 acre-feet between crest El. 2,380 feet and normal full pool El. 2,396.5 feet. At the normal full pool reservoir El. 2,396.5 feet, the reservoir surface area is ~ 1,092 acres.

2.4 Project and Passage Operations

When flow exceeds total powerhouse capacity (23,000 cfs), the radial gates are used along with the spillway panels to pass additional flow. As runoff increases, the 4- by 8- foot spillway panels on the Main Channel Dam are removed for additional spill capacity. As flows increase, more panels are removed to balance flows across the length of the Main Channel Spillway. In most years, when the peak flood discharge is less than 70,000 cfs, spill is restricted to the Main Channel Dam section. If flows exceed 70,000 cfs, there are 72 Dry Channel Dam spill panels (each 4 x 8 foot) available to increase spill capacity. Operation of the Dry Channel Spillway has been used in 5 of the past 10 years.

The Thompson Falls upstream fish passage facility operates annually (since 2011), typically from mid-March to mid-October depending on weather. The operational season ends when a fall freeze is imminent, or maintenance/project is necessary. Temporary closures may occur during the season due to high spring streamflows and associated debris and sediment accumulation in the lower pools of the ladder. The work station (3 cfs) and fish ladder (6 cfs pool-to-pool), including attractant flows (high velocity jet and auxiliary water system), may utilize between 9 and 83 cfs.

The elevation of Thompson Falls Reservoir has been near full pool (2,396.5 feet) during fish ladder operations, providing 9 cfs (6 cfs down the ladder; 3 cfs through the fish working station) for fish ladder functionality. An optional 20 cfs from the high velocity jet and/or 54 cfs from the auxiliary water system can be used to provide fish attractant flows that exit at the bottom of the fish ladder. In addition to these flows through the ladder and at the entrance of the ladder, NorthWestern may partially open one dam spill gate near the fish ladder to provide an additional fish attractant flow. The ladder remains functional until the reservoir elevation is 2.3 feet below full pool.

3.0 Description of Proposed Action

3.1 Project Facilities

NorthWestern does not propose additional construction or redevelopment of Project facilities.

3.2 Proposed Operations

NorthWestern proposes the Project will continue to provide baseflow generation and flexible capacity needs in the new license term. Baseflow generation uses the river inflow by matching reservoir inflows to generate electricity while maintaining a stable reservoir elevation. Flexible capacity increases or decreases generation from the baseflow, raising or lowering the reservoir elevation as the flow through the units is changed to support flexible capacity needs. Under normal operations, NorthWestern will maintain the reservoir between El. 2396.5 and 2394 feet (2.5 feet below normal full operating level). In the spring during periods of spill, the reservoir may be operated above El. 2396.5 but is maintained below El. 2397.0. The units may increase or decrease generation during normal operations within the above defined reservoir elevations. Spill gates may be used to maintain reservoir elevation if needed in times of decreased generation. In general, a minimum flow of the lesser of 6,000 cfs or inflow will be maintained downstream during normal operations which is the same as previous operations.

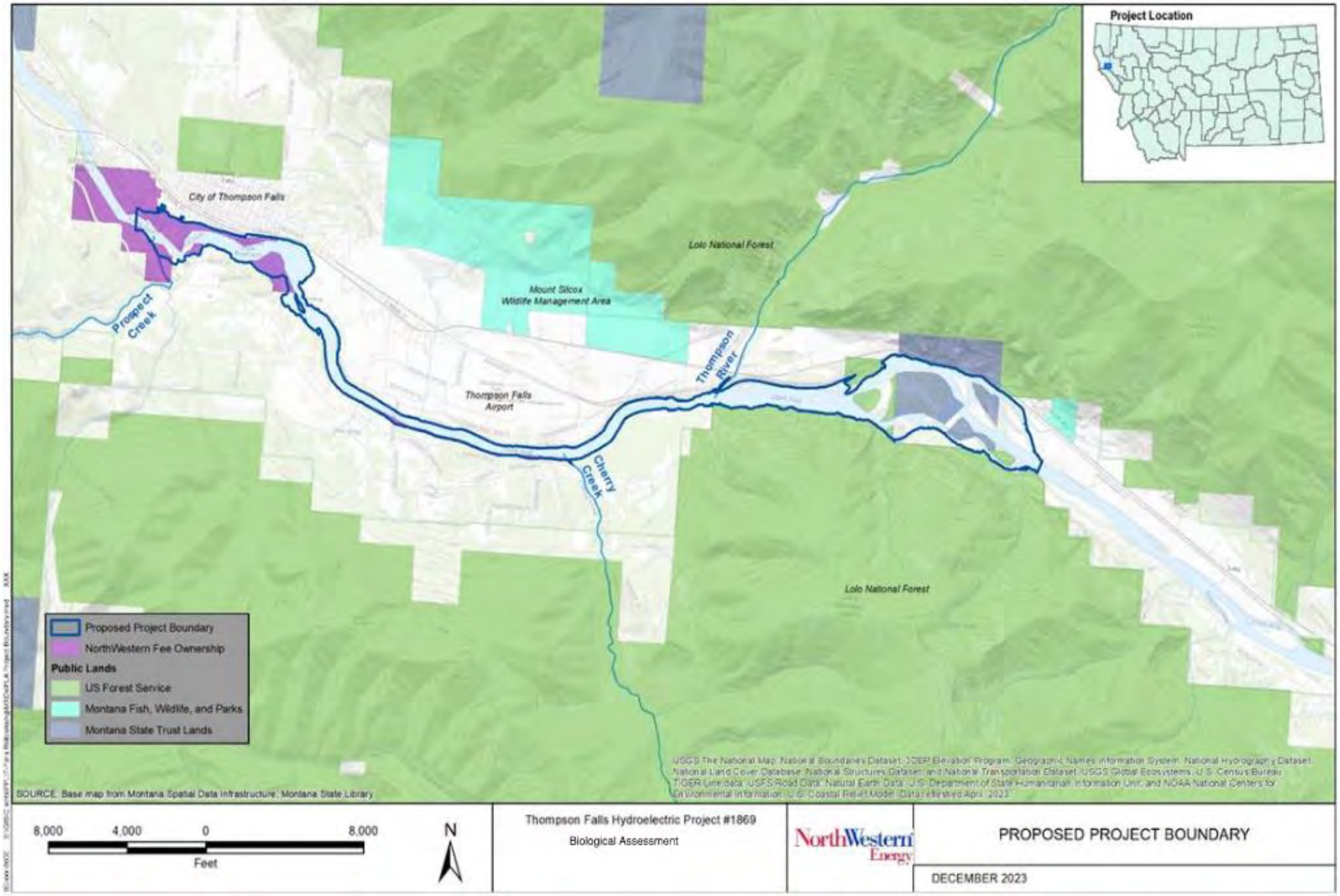
3.3 Proposed Project Boundary

The proposed Project Boundary extends ~ 0.3 mile downstream and 10 miles upstream of the Project's dams (**Figure 3-1)**. The proposed Project Boundary encompasses a total of 1,536 acres, consisting of 1,092 acres of reservoir and 444 acres of non-reservoir. Federal land managed by the U.S. Forest Service (USFS) (National Forest System Lands) includes 66.9 acres, which are largely open space forest lands (**Table 3-1**). The Thompson River, a major tributary to the Clark Fork River, enters the reservoir about 6.2 miles upstream of the dam. Its lower 0.2 mile is included within the proposed Project Boundary. The proposed Project Boundary is a combination of a contour elevation of 2397 feet elevation at the dam (elevation of contour increase proceeding upstream) for most of the reservoir and a metes and bounds description that incorporates areas above the contour elevation to encompass Project facilities, recreation sites and a cultural resource site.

Table 3-1: Thompson Falls Project – Federal Lands Within Proposed Project Boundary.

Township	Range	Section	Subdivision	Acres	Agency
21N	28W	15	Government Lot 1	0.3	USFS
21N	28W	17	Government Lots 5-11	49.7	USFS
21N	28W	18	Government Lots 8-10	4.4	USFS
21N	28W	21	Government Lot 1	1.5	USFS
21N	28W	22	Government Lots 3-4	11.3	USFS
			Total	**67.2**	

Figure 3-1: Proposed Project Boundary.



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4.0 Action Areas

The action areas include the areas affected directly or indirectly by the proposed action. This BA is focused on the action area in which aquatic and terrestrial threatened and endangered species may be present. The following defines an aquatic action area and terrestrial action area.

4.1 Aquatic Resources Action Area

For aquatic species, the action area includes the proposed FERC Project boundary, including the project structures, such as the dams, powerhouse, upstream fish passage facility, and developed infrastructure supporting operations.

Effects of the Project include modifications of streamflow and water elevation in the Clark Fork River downstream of the Project to Noxon Rapids Reservoir. The Project also impounds and fluctuates water elevations upstream of the Project's dams for 10 miles.

The aquatic analysis will focus on the Lower Clark Fork River and Thompson Falls Reservoir. However, it is understood Bull Trout occur throughout the Clark Fork River watershed and drainage and their tributaries and utilize different habitat areas to complete various life history stages.

4.2 Terrestrial Resources Action Area

For terrestrial species, the action area includes the entire area within the proposed FERC Project boundary. The Project impacts are limited to the waterbody within the FERC Project boundary. Listed upland and terrestrial species or designated critical habitat within the proposed FERC Project boundary or vicinity are not anticipated to be affected by Project operations.

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5.0 ESA Listed Species and Critical Habitat in Action Area

5.1 Listed Species in Action Area

Background material and information on aquatic and terrestrial resources was gathered from NorthWestern, Avista, FWP, Montana Natural Heritage Program (MNHP), CSKT, Montana Department of Environmental Quality (DEQ), FWS, and USFS reports and databases. In addition, an internet search was completed for other reports and data available on ESA species status and distribution in Montana.

A request was made on September 8, 2023, to FWS through the Environmental Conservation Online System (ECOS) – Information for Planning and Consultation (IPaC) system for a species list that identifies threatened, endangered, and proposed species as well as proposed and final designated critical habitat. On January 17, 2023, the status of Whitebark Pine (*Pinus albicaulis*) changed from candidate to threatened.

The status of the North American Wolverine (*Gulo gulo luscus*) will change from proposed to threatened effective January 2, 2024. The FWS species list identified through ECOS-IPaC and most recent FWS (2023a) news release is provided in **Table 5-1**. The only designated critical habitat within the FERC Project boundary and action area is for Bull Trout.

Four occurrence categories were applied to each species as reflected in Table 5-1 and defined below:

- <u>Known to occur</u> – The species is documented to occur in the action area or vicinity.
- <u>May occur</u> – The action area is within the species' currently known range or distribution, and vegetation communities, habitat, soils, or other biotic and abiotic indicators resemble those known to support the lifecycle requirements of the species.
- <u>Unlikely to occur</u> – The action area is within the species' currently known range or distribution. However, vegetation communities, soils, and other biotic and abiotic indicators do not resemble those known to support the lifecycle requirements of the species.
- <u>Does not occur</u> – The action area is not within the known range or distribution, and other biotic and abiotic indicators do not resemble those known to support the lifecycle requirements of the species.

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Table 5-1: Summary of ESA listed species identified by FWS ECOS-IPaC (2023) and FWS (2023a).

Species	Scientific Name	FWS Status (Year)	Habitat	Potential to Occur	Habitat Availability in Action Area
Bull Trout	*Salvelinus confluentus*	Threatened (1998) Critical Habitat (2010)	Clear streams, rivers, and lakes west of the Continental Divide Cool, clear, connected, complex stream habitat.	**Known to Occur**	Bull Trout are documented downstream and upstream of Thompson Falls Dam, documented utilizing the Upstream Fish Passage Facility, documented moving downstream through Thompson Falls turbines/spillway. The action area is within designated Bull Trout critical habitat (Federal Register 2010).
Grizzly Bear	*Ursus arctos horribilis*	Threatened (1975)	Variable habitats including meadow, forest and riparian. Requires large tracts of wilderness.	**Unlikely to Occur**	There is no habitat to support the required lifecycle requirements of the species within the action area. There is no denning site within the action area. Forest and riparian areas near and around the FERC Project boundary provide habitat for Grizzly Bear and individuals have been documented in the valley of the Lower Clark Fork River drainage. Potential for transient use of action area. Action area is outside the boundary for the Cabinet Yaak Grizzly Bear Recovery Zone.
Canada Lynx	*Lynx canadensis*	Threatened (2000)	Subalpine coniferous forests, with a deep winter snowpack, dense understory, and high density of snowshoe hares.	**Unlikely to Occur**	Action area is below typical elevation and does not provide suitable habitat and does not include Canada Lynx critical habitat.
Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened (2014)	Tall, dense, expansive cottonwood and willow riparian forest. Requires habitat patches at least 25 acres (10 ha) in size.	**Unlikely to Occur**	Habitat in the action area does not provide suitable nesting or foraging habitat.
Spalding's Campion (Spalding's Catchfly)	*Silene spaldingii*	Threatened (2001)	Open, mesic grasslands in the valleys and foothills, in deep, loamy soils along northerly aspects.	**Unlikely to Occur**	Action area is unlikely to provide suitable habitat for species.
Whitebark Pine	*Pinus albicaulis*	Threatened (2023)	Windy, cold, high-elevation or high-latitude environments. Subalpine and krummholz habitats (mostly mountain ranges).	**Does not Occur**	Action area does not provide subalpine habitat and is below 3,000 feet above sea level.

Species	Scientific Name	FWS Status (Year)	Habitat	Potential to Occur	Habitat Availability in Action Area
Wolverine	*Gulo gulo luscus*	Threatened (2023)	Large tracts of essentially roadless wilderness in high elevation alpine and subalpine terrain. Denning habitat includes caves, rock crevices, crevices/opening under fallen trees, thickets, and or similar type of locations	**Unlikely to Occur**	There is no habitat within the action area. There is no denning site within the action area. Canada lynx protected zone overlap much of the wolverine's habitat in Montana (FWS 2023b). The distribution and presence of Wolverine is strongly related to persistent spring snow (FWS 2023b), restricting the species to high-elevations in the region.

Based on the potential occurrence (i.e., ***unlikely to occur*** and ***does not occur***), lack of habitat availability within the action area, and lack of Project effects, all species listed in Table 5-1, except for Bull Trout, were excluded from analysis in this BA. Bull Trout and Bull Trout designated critical habitat were classified as ***known to occur*** within the action area. There is no critical habitat located within the action area for Grizzly Bear, Canada Lynx, Yellow-Billed Cuckoo, Spalding's Campion, Whitebark Pine or Wolverine and the other species were unlikely to occur in the action area. Therefore, the proposed action would have ***No Effect*** on Grizzly Bear, Canada Lynx, Yellow-Billed Cuckoo, Spalding's Campion, Whitebark Pine, or Wolverine. Bull Trout and Bull Trout designated critical habitat are the only species and critical habitat analyzed in this BA.

5.2 Bull Trout Life History

In 1998, the Bull Trout was listed under the federal ESA as a threatened species (Federal Register 1998). Critical habitat was designated in 2005 and revised in 2010 (Federal Register 2005; 2010). In 2015, FWS developed a recovery plan for Bull Trout (FWS 2015). Bull Trout are present within the Clark Fork River drainage and are known to occur within the FERC Project boundary.

Life history characteristics of Bull Trout have been reported by several authors (Pratt 1985 and 1996; Fraley and Shepard 1989; Brown 1992; Thomas 1992; McPhail and Baxter 1996; Nelson et al. 2002). In the Clark Fork River drainage, Bull Trout have three life history patterns: resident, fluvial, and adfluvial. Resident Bull Trout spend their entire lives in the same (or nearby) streams in which they were hatched. Resident Bull Trout adults and juveniles generally confine their migrations to their natal streams. In fluvial and adfluvial populations, the adults spawn in tributary streams where the young rear for 1 to 4 years (Fraley and Shepard 1989). The juvenile Bull Trout then migrate downstream to a larger body of water, either a lake (adfluvial fish) or a river (fluvial fish), where they grow to maturity.

It has been suggested that the ability for Bull Trout to express multiple life history forms is an adaptive mechanism to variable environmental conditions (Nelson et al. 2002). For example, adfluvial and fluvial migration movement to lakes and larger rivers may enable Bull Trout to take advantage of more abundant food sources allowing for greater growth and fecundity (Gross 1987 cited in Nelson et al. 2002). The resident life history form may be an adaptation to the presence of migration barriers/restrictions or where growth opportunities in the headwaters are greater than the cost of migration (Nelson et al. 2002).

In the Lower Clark Fork River drainage, there appears to be a wide season, ~ between April and August, when adult Bull Trout leave Lake Pend Oreille to begin their upstream migrations to headwater streams to spawn (Normandeau Associates 2001). Bull Trout records at the upstream fish passage facility indicate most Bull Trout are moving upstream between April and June with some additional Bull Trout detections in the fish passage facility between August and October (NorthWestern 2019b). Mature adults spawn in headwater streams during the fall (September–October). However, the timing of movement into the tributaries may vary. Radio telemetry data indicate a relatively wide range of time during which Bull Trout move into spawning areas, between the middle of July and the middle of October (Lockard et al. 2002; 2003; 2004).

Bull Trout have more specific habitat requirements compared to other salmonids, requiring clean, cold, complex, and connected habitat. Spawning areas are generally low gradient (< 2%) with a water depth range from 0.1 to 0.6 meters, stream velocity between 0.09 meters per second (m/s) and 0.61 m/s, comprised of gravel/cobble substrate with less than 35 to 40 percent of sediments smaller than 6.35 millimeters (mm) in diameter, and high gravel permeability (MTBRT 2000). In the Lower Clark Fork River drainage spawning activity peaks in September (Katzman and Hintz 2003; Katzman 2003; Moran 2003) when stream temperatures are generally less than 8°C (McPhail and Baxter 1996; Pratt 1996). Sexually mature adult Bull Trout may spawn in multiple years, although they do not necessarily spawn in consecutive years (Downs et al. 2006).

Rearing habitat requirements for juvenile Bull Trout include cold summer water temperatures (< 15°C) provided by sufficient surface and groundwater flows. Warmer temperatures are associated with lower Bull Trout densities and can increase the risk of invasion by other species that could displace, compete with, or prey on juvenile Bull Trout. Juvenile Bull Trout are generally benthic foragers, rarely stray from cover, and they prefer complex forms of habitat. High sediment levels and substrate embeddedness can result in decreased rearing densities. Unembedded cobble/rubble substrate is preferred for cover and feeding and provides invertebrate production. Highly variable streamflow, reduction in large woody debris, bedload movement, and other forms of channel instability can limit the distribution and abundance of juvenile Bull Trout.

Both migratory and stream-resident Bull Trout move in response to developmental and seasonal habitat requirements. Migratory individuals can move great distances (up to 156 miles) among lakes, rivers, and tributary streams in response to spawning, rearing, and adult habitat needs (MTBRT 2000). Stream-resident Bull Trout migrate within tributary stream networks for spawning purposes, as well as in response to changes in seasonal habitat requirements and conditions. Open migratory corridors, both within and among tributary streams, larger rivers, and lake systems are critical for maintaining Bull Trout populations.

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 Dam, Noxon Rapids Dam, and Thompson Falls Dam. Today, Bull Trout passage in the Lower Clark Fork drainage is, in part, facilitated by Avista's trap and transport program and NorthWestern's upstream fish passage facility. There is no fish passage facility or trap system present at Noxon Rapids Dam (*see* **Section 6.1 – Current Bull Trout Management**).

5.3 Bull Trout Critical Habitat

Critical habitat for Bull Trout has been defined as a habitat unit that can maintain and support viable Bull Trout core areas (Federal Register 2005). The Project is within the Columbia Headwater Recovery Unit (CHRU). Within the CHRU there are 35 Bull Trout core areas that occur within four geographic regions including the Clark Fork River, Flathead Lake, Coeur d'Alene Lake, and Kootenai River (FWS 2015). The Project is within the Lake Pend Oreille core area that includes the former Lower Clark Fork River and Flathead River core areas (2002 designation), representing 35 local Bull Trout populations.

Within the CHRU, FWS identified 32 Critical Habitat Units (CHUs), including the Clark Fork River Basin CHU. The Clark Fork River Basin CHU (Unit 31) includes 3,328 stream miles and 295,587 acres of lakes and reservoirs as critical Bull Trout habitat (Federal Register 2010). The Clark Fork River Basin has 12 subunits including the Lower Clark Fork River Critical Habitat Subunit (CHSU) encompassing the Project, located in Sanders and Missoula counties covering 295 miles of stream and 9,719 acres of surface area as designated Bull Trout habitat (Federal Register 2010).

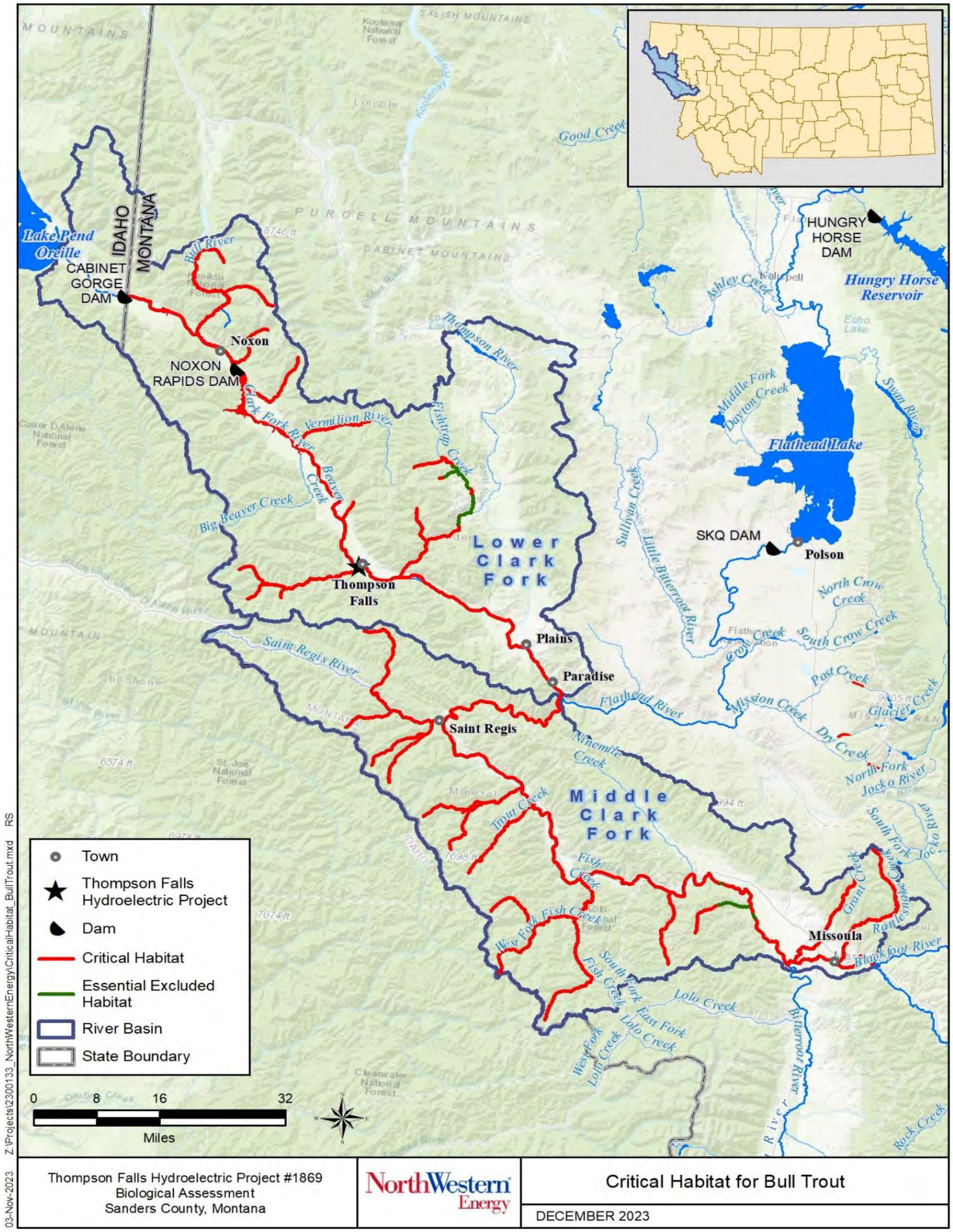
The Lower Clark Fork River CHSU (**Figure 5-1**) provides essential foraging, migration, and overwintering (FMO) habitat for Bull Trout from potentially several local Bull Trout populations and includes designated critical Bull Trout habitat (FWS 2010a). The Project is located within designated critical Bull Trout habitat for the Lower Clark Fork River CHSU. As part of the critical habitat designation, the Thompson Falls Reservoir is considered a stream reach and not a lake due to the lack of reservoir storage capacity (Federal Register 2010). Two tributaries near the Project including Prospect Creek, located immediately downstream of the Main Channel Dam, and the Thompson River, located about 6 miles upstream of the Main Channel Dam, are designated Bull Trout critical habitat. Designated critical habitat in the Lower Clark Fork River and Middle Clark Fork River, representing CHU Unit 31, is shown in **Figure 5-1. Table 5-2** identifies the Lower and Middle Clark Fork River reaches and respective local Bull Trout populations identified by FWS (2015).

Table 5-2: Bull Trout spawning and rearing tributaries to the Lower and Middle Clark Fork rivers and Lower Flathead River.

Upstream or Downstream of Thompson Falls Project	River Reach Description	Bull Trout Spawning and Rearing Tributaries to the Clark Fork River/Flathead River (smaller tributaries)
Downstream	Noxon Rapids Dam upstream to Thompson Falls Dam	Swamp Creek, Vermilion River, Graves Creek, Prospect Creek
Upstream	Lower Clark Fork River - ends at the confluence with the lower Flathead River	Thompson River (West Fork Thompson River, Fishtrap Creek)
Upstream	Lower Flathead River	Jocko River (North Fork and South Fork), Mission Creek, Post Creek, Dry Creek
Upstream	Middle Clark Fork River - starts at the confluence with the lower Flathead River and ends at the confluence with the Blackfoot River	St. Regis River (Little Joe Creek, Ward Creek), Twelvemile Creek, Cedar Creek (Oregon Gulch), Fish Creek (North Fork, West Fork and South Fork, Cache Creek), Petty Creek, Albert Creek, Grant Creek, Rattlesnake Creek

Source: FWS 2015

Figure 5-1: Map of Bull Trout designated critical habitat (CHSU Unit 31) in the Lower Clark Fork River and Middle Clark Fork River in Montana.



Source: FWS 2010b

In determining which areas to designate as critical habitat for a species, FWS considers those physical and biological attributes that are essential to species conservation (i.e., primary constituent elements [PCEs]). The FWS (Federal Register 2010) has listed nine PCEs including physical and biological features essential to Bull Trout conservation (*see* **Table 7-2):**

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
- Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks, and substrates, to provide a variety of depths, gradients, velocities, and structure.
- Water temperatures ranging from 2-15°C, with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on Bull Trout life history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; stream flow; and local groundwater influence.
- In spawning and rearing areas, substrates of sufficient amount, size, and composition to ensure the success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrate, is characteristic of these conditions. The size and amounts of fine sediment suitable to Bull Trout will likely vary from system to system.
- A natural hydrograph, including peak, high, low, and base flows within historical and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
- Sufficiently-low levels of occurrence of nonnative predatory (e.g., Lake Trout [*Salvelinus namaycush*], Walleye [*Sander vitreus*], Northern Pike [*Esox lucius*], Smallmouth Bass [*Micropterus dolomieu]*; interbreeding [e.g., Brook Trout, *Salvelinus fontinalis*]; or competitive [e.g., Brown Trout, *Salmo trutta*] species) that, if present, are adequately, temporally, and spatially isolated from Bull Trout.

6.0 Environmental Baseline and Review

As part of the Lake Pend Oreille core area, the Lower Clark Fork River drainage provides an important portion of the spawning and rearing habitat for Lake Pend Oreille, as well as an essential migratory corridor for Bull Trout from Lake Pend Oreille to be able to access productive watersheds upstream (FWS 2010b).

For over 70 years, three hydroelectric dams have been in operation on the Lower Clark Fork River affecting migratory fish movement extending over 65 river miles near the inlet to Lake Pend Oreille upstream to Thompson Falls, Montana. In addition to the Thompson Falls Project, there are two hydroelectric facilities owned and operated by Avista, Cabinet Gorge Dam (built in 1952) located just downstream of the Idaho and Montana state line and Noxon Rapids Dam (built in 1959) located ~ 28 river miles east of the state line. Upstream fish passage at these facilities has been limited to an adult Bull Trout fish passage program (capture and haul) managed by Avista at Cabinet Gorge Dam since 2001, and the seasonal upstream fish passage facility operated and managed by NorthWestern at Thompson Falls Dam since 2011. The history of the development of the upstream fish passage facility and consultation with agencies is provided in Comprehensive Phase 2 Final Fish Passage Report (NorthWestern 2019b). Construction of a fishway at Cabinet Gorge Dam commenced in 2019 and seasonal operations began in spring 2022. No fishway/passage facility is present at Noxon Rapids Dam.

6.1 Current Bull Trout Management

Juvenile adfluvial Bull Trout that outmigrate from natal tributaries upstream of the Project, can move downstream through the Project and rear in one of the three downstream large water bodies; Noxon Rapids Reservoir, Cabinet Gorge Reservoir, or Lake Pend Oreille. Juvenile Bull Trout that rear in Noxon Rapids Reservoir may migrate upstream as adults to return to their natal streams for spawning using the upstream fish passage facility at the Project. Bull Trout that rear in Cabinet Gorge Reservoir do not have a means to return to their natal stream upstream of the Project.

Therefore, the numbers of Bull Trout available to pass upstream of the Project utilizing the upstream fish passage facility are limited to just those individuals that rear in Noxon Rapids Reservoir. This is only a subset of the total number of adfluvial Bull Trout that pass downstream through the Project. Water temperatures, non-native predators, and habitats within Noxon Rapids Reservoir are not ideal for Bull Trout survival. These poor conditions, and assumed low survival rates, further limit the number of Bull Trout that may be present at the Project. As a result, an average of less than two Bull Trout per year are captured by the upstream fish passage facility at the Project.

Lake Pend Oreille provides preferred conditions for adfluvial Bull Trout survival and growth. Accordingly, Avista has established an upstream Bull Trout fish passage program. Bull Trout that rear in Lake Pend Oreille may be collected by Avista as part of their upstream Bull Trout fish passage program. Once adult Bull Trout begin upstream migrations from Lake Pend Oreille a portion are captured at Avista's Cabinet Gorge Dam by way of electrofishing efforts, a trap at the dam, or a capture facility at a nearby cold water source.

Through a rapid genetic assignment process, captured individuals are then assigned to their natal tributary. Those Bull Trout with natal tributaries to Lake Pend Oreille (Region 1) are not transported upstream. Bull Trout with natal tributaries upstream of either Cabinet Gorge Dam (genetic assignment to Region 2), upstream of Noxon Rapids Dam (genetic assignment to Region 3), or upstream of the Thompson Falls Project (genetic assignment to Region 4) are transported by truck above the appropriate dam. On average, ~ 44 Bull Trout have been transported above Cabinet Gorge Dam per year (2009-2023), and 15 percent (n=7) of these Bull Trout were transported upstream of the Project from Lake Pend Oreille. Through this program, adult Bull Trout bypass the Project, and are returned directly to the area of their natal stream. Avista has operated the adult Bull Trout transport program since 2001. Fish transport upstream of the Project (Region 4) began in 2007.

Occasionally a Bull Trout caught below Cabinet Gorge Dam is genetically assigned to Region 4, but the decision is made to transport the fish to Region 3 because it was previously captured and transported downstream as a juvenile from a Region 3 tributary. Although the genetic assignment tool is very accurate (90% +), it is not 100 percent accurate all the time.

In addition to the upstream transport program, Avista also has a downstream transport program. Avista captures a portion of juvenile Bull Trout within their natal streams, implants them with passive integrated transponder (PIT) tags, and transports them to Lake Pend Oreille. Avista's downstream transport program does not include tributaries upstream of the Project.

6.2 Bull Trout Abundance and Distribution

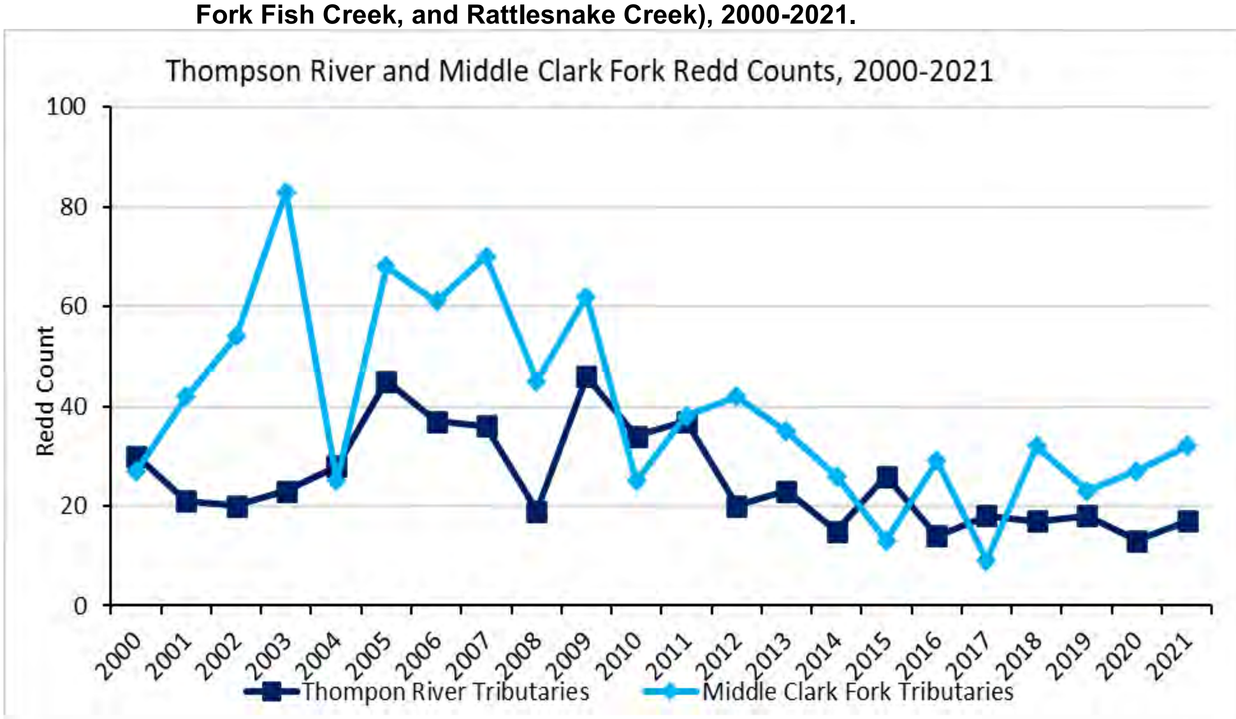
6.2.1 Bull Trout Populations in the Lower and Middle Clark Fork River

Acquiring an accurate population estimate for Bull Trout in the Clark Fork River upstream or directly downstream of the Project, is difficult, primarily because numbers are too low to allow for an accurate count. Within the mainstem Clark Fork River above the facility, electrofishing has estimated ~ one to two Bull Trout per mile (L. Knotek, FWP, personal communication 2023). Large river systems are challenging to effectively sample and likely underestimate total numbers of Bull Trout.

Another Bull Trout population index is based on redd counts. FWP has monitored Bull Trout redds in spawning and rearing tributaries in the Thompson River and tributaries in the Middle Clark Fork River (Cedar Creek, Fish Creek, St. Regis River, Rattlesnake Creek) between 2000 and 2023 (FWP, unpublished data). Not all tributaries were surveyed annually. Some tributaries present a mix of resident and fluvial/adfluvial Bull Trout populations, complicating the interpretation of redd count index data for fluvial/adfluvial Bull Trout populations. However, these are the best available data for known Bull Trout populations that are most likely to be affected by the proposed action at the Project.

Annual Bull Trout redd counts in the Thompson River (Fishtrap Creek and West Fork Thompson River) and in the Middle Clark Fork River (Fish Creek and Rattlesnake Creek) provide the most consistent annual redd count data available since 2000 (**Figure 6-1**). Fishtrap Creek consistently shows the highest number of redds per survey year (peak of 46 redds in 2009) while West Fork Thompson River and Rattlesnake show the lowest number of redds per survey year (≤ 15 redds per a given survey year). Collectively, Thompson River drainage has recorded 13 to 46 redds annually between 2000 and 2021 (FWP, unpublished). Fish Creek drainage (Middle Clark Fork tributary) is represented by West Fork and North Fork Fish creeks combined. Redd counts collectively in Fish Creek have oscillated between 6 and 33 redds per survey year. The redd count data in more recent years show a declining trend in the Thompson River and Middle Clark Fork River drainages (Figure 6-1). Regardless of the precision the redd count data provide, these data indicate that the number of fluvial/adfluvial juvenile Bull Trout outmigrating from upstream tributaries into the lower and Middle Clark Fork River is low.

Figure 6-1:6 Bull Trout redd counts in the Thompson River (Fishtrap Creek and West Fork Thompson River) and Middle Clark Fork River tributaries (North Fork and West Fork Fish Creek, and Rattlesnake Creek), 2000-2021.



Source: FWP, unpublished data.

Bull Trout were historically widely distributed throughout the Lower Clark Fork River drainage via connected habitats that included large lakes such as Lake Pend Oreille and Flathead Lake, and numerous tributaries (MTBRT 2000). Historically abundant fluvial and adfluvial populations of migratory Bull Trout have generally been reduced to resident fish because of mainstem dam construction that blocked upstream migrations and fragmented habitat. The FWS (2002) stated that the likelihood of extinction of a given stock of Bull Trout within the Lower Clark Fork River subbasin increased with the shift from larger, more migratory adfluvial populations present historically to smaller, more isolated resident populations of Bull Trout that are found in this reach of the Clark Fork today (FWS 2002).

After 13 years (2011-2023) of upstream fish ladder operations at the Project, Bull Trout ladder ascents varied from zero to five Bull Trout per year, averaging just under two Bull Trout per year. The annual number of Bull Trout recorded at the ladder, while very low, appears to be reflective of the very low numbers of Bull Trout present between Noxon Rapids Dam and Thompson Falls Dam.

Evidence for this conclusion comes from sampling conducted over a long period in the Project area. For example, the numbers of Bull Trout captured downstream of the Project via multiple sampling methods (angling, electrofishing, and fish trapping) over a 7-year period (1999-2006) resulted in one to seven Bull Trout captured per year (an average of 3.3 Bull Trout per year). Additional seasonal sampling via a small scale Denil fish ladder in the Project Main Channel Dam tailrace in 2001 and 2004 also found few Bull Trout in the area. In 2001 (March 21 – September 28), three Bull Trout out of 4,259 fish were collected in the Denil trap. In 2004 (March 16 – May 10), three Bull Trout out of 195 fish were collected at this trap.

Electrofishing downstream of the Project in the spring of 2011, 2012, and 2014 collectively sampled seven individual Bull Trout out of 2,222 fish handled. Bull Trout represented a small fraction of the fish community sampled each year with three Bull Trout sampled out of 1,109 fish in 2011, one Bull Trout out of 737 fish in 2012, and three Bull Trout out of 376 fish in 2014.

Upstream of the Project, 11 Bull Trout were collected during NorthWestern sampling efforts, 2009 to 2022. Spring electrofishing in Thompson Falls Reservoir captured six Bull Trout, one in the lower section and five in the upper section. Fall electrofishing in the Clark Fork River upstream of the confluence of the Thompson River in the above islands complex and Plains-to-Paradise reach captured five Bull Trout. Annual fall gillnetting in Thompson Falls Reservoir (starting in 2004) has never caught a Bull Trout.

Avista collects Bull Trout upstream of Lake Pend Oreille and downstream of Cabinet Gorge Dam. 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. In some instances, Bull Trout captured as juveniles in their natal stream are returned to that stream, even if the genetic analysis does not concur. Avista has implemented the adult Bull Trout transport program since 2001. Transport of Bull Trout to Region 4, upstream of Thompson Falls Dam began in 2007. For the last 15 years (2009-2023), Avista has transported an average 44 Bull Trout upstream of Cabinet Gorge Dam annually with an average of about 15 percent (7 Bull Trout) genetically assigned and transported to Region 4 (upstream of Thompson Falls Dam) each year.

Based on the numbers of Bull Trout collected below Cabinet Gorge Dam that are estimated to have outmigrated from Clark Fork River tributaries, it appears that the portion of the adfluvial population of Bull Trout originating from the Clark Fork drainage is relatively small. Other factors such as warm water temperatures, predators, and poor habitat conditions likely contribute to these low numbers of adult adfluvial fish below Thompson Falls Dam.

6.2.2 Bull Trout Collection at the Upstream Fish Passage Facility

Since the upstream fish passage facility at the Project opened in 2011, between one and five Bull Trout ascended the passage facility annually, except in 2018 when there were none (NorthWestern 2023). During the 13 years of operation (2011-2023), 23 Bull Trout, representing 21 unique individuals, averaging 501 mm in length (range 285-620 mm) have ascended the fish passage facility, an average of 1.8 Bull Trout per year.

Genetic testing of Bull Trout collected at the fish passage facility found that the natal streams for these fish were most likely tributaries upstream of Thompson Falls Dam (Region 4). Approximately 67 percent of the Bull Trout ascending the fish passage facility were genetically assigned to tributaries in the Thompson River drainage, 29 percent assigned to Fish Creek or its tributaries, and one fish assigned to a tributary to the Bitterroot River as their natal stream (**Table 6-1**).

Table 6-1: Summary of genetic assignments of Bull Trout ascending the Thompson Falls fish passage facility, 2011-2023.

Drainage	Most Like Genetic Assignment	Number of Bull Trout Ascend Fish Passage Facility	Year(s) Bull Trout Recorded Ascending Fish Passage Facility
Thompson River	Fishtrap Creek	9	Same fish in 2011 & 2012, 4 in 2013, 2 in 2015, 2016, same fish in 2021 & 2022
	West Fork Thompson River	5	2011, 2017, 2020, 2022, 2023
Fish Creek	Fish Creek	2	2013, 2014
	North Fork Fish Creek	3	2 in 2016, 2023
	West Fork Fish Creek	1	2015
Bitterroot River	Meadow Creek	1	2012

Prior to ascending the fish passage facility, three Bull Trout collected in the fish passage facility were captured and transported by Avista from downstream of Cabinet Gorge Dam upstream to Region 4, as follows:

- 1 Bull Trout was captured below Cabinet Gorge Dam twice (August 2015 & July 2017) and transported upstream to St. Regis (Middle Clark Fork River), before entering and ascending the fish passage facility in June 2019.

- 1 Bull Trout was transported by Avista from below Cabinet Gorge Dam in April 2020 to the Thompson River drainage, and subsequently entered and ascended the fish passage facility twice, in May 2021 & April 2022.
- 1 Bull Trout was captured and transported from downstream of Cabinet Gorge Dam by Avista in May 2021 to the Thompson River, and subsequently entered and ascended the fish passage facility in June 2022.

None of the other Bull Trout collected at the fish passage facility had a history of being transported from Lake Pend Oreille, but instead migrated from the Clark Fork River, upstream of Noxon Rapids Dam.

A remote PIT tag antenna array system was installed in the mainstem Thompson River in late September 2014 as well as in the tributaries, West Fork Thompson River in 2014 and Fishtrap Creek in 2015 (NorthWestern 2023). Since the installation of the Thompson River and tributary PIT tag antenna array system, 13 Bull Trout were released upstream of Thompson Falls Dam after ascending the ladder (2015-2023) and eight (62%) were subsequently detected in the Thompson River drainage.

Between 2011 and 2023, 10 Bull Trout were detected entering the ladder and did not ascend to the top holding pool. Six of these fish were genetically assigned to natal tributaries in Region 4, Thompson River drainage (n=5) and South Fork Jocko River (n=1). The other four fish were genetically assigned to natal tributaries in Region 3 (upstream of Noxon Rapids Dam and downstream of Thompson Falls Dam).

Seven Bull Trout that did not ascend the fish passage facility were previously captured downstream of Cabinet Gorge Dam by Avista, and transported to their respective stream assignment and Region, four tributaries in Region 3 (Graves and Prospect creeks) and Region 4 (Thompson River and South Fork Jocko River). A summary of these fish is provided in **Table 6-2.**

Table 6-2: Bull Trout detected entering Thompson Falls fish passage facility 2011-2023 but did not ascend.

2011-2023	Bull Trout enter fish passage facility, not ascend	Count	Genetic Assignment	Year and Location of Transport from Below Cabinet Gorge Dam	Comment
2015	May	2	Thompson River (R4)	None	
		1	Thompson River (R4)	2013, Thompson River	
	June	1	Graves Creek (R3)	2015, Graves Creek	
		1	Rock Creek (R2) - but juvenile captured in Prospect Creek (R3)	2013, Prospect Creek	
2016	May & June	1	West Fork Thompson River (R4)	2014, Thompson River	
	September	1	Graves Creek (R3)	2013 and 2014, Graves Creek	
	October	1	Fishtrap Creek (R4)	None	**Ascended Ladder in April 2016,** returned downstream and entered ladder in October of the same year
2021	June	1	Graves Creek (R3)	2021, Graves Creek	
2023	June & September	1	South Fork Jocko River (R4)	2021, South Fork Jocko River	Detected in Prospect Creek July – Sep/Oct 2022 and 2023.

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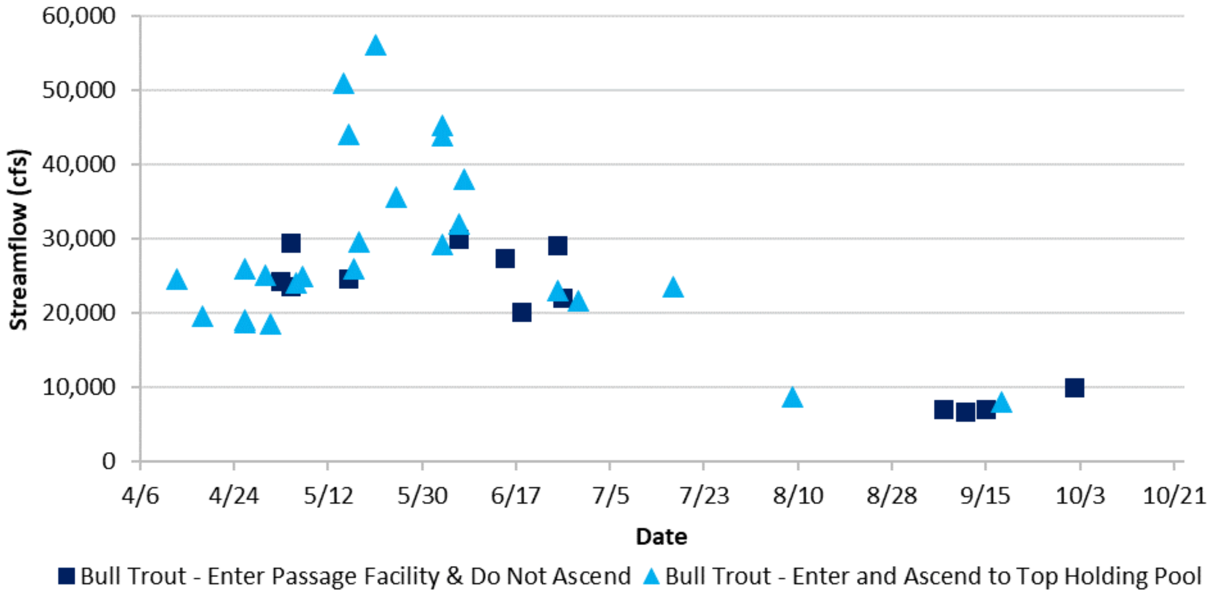
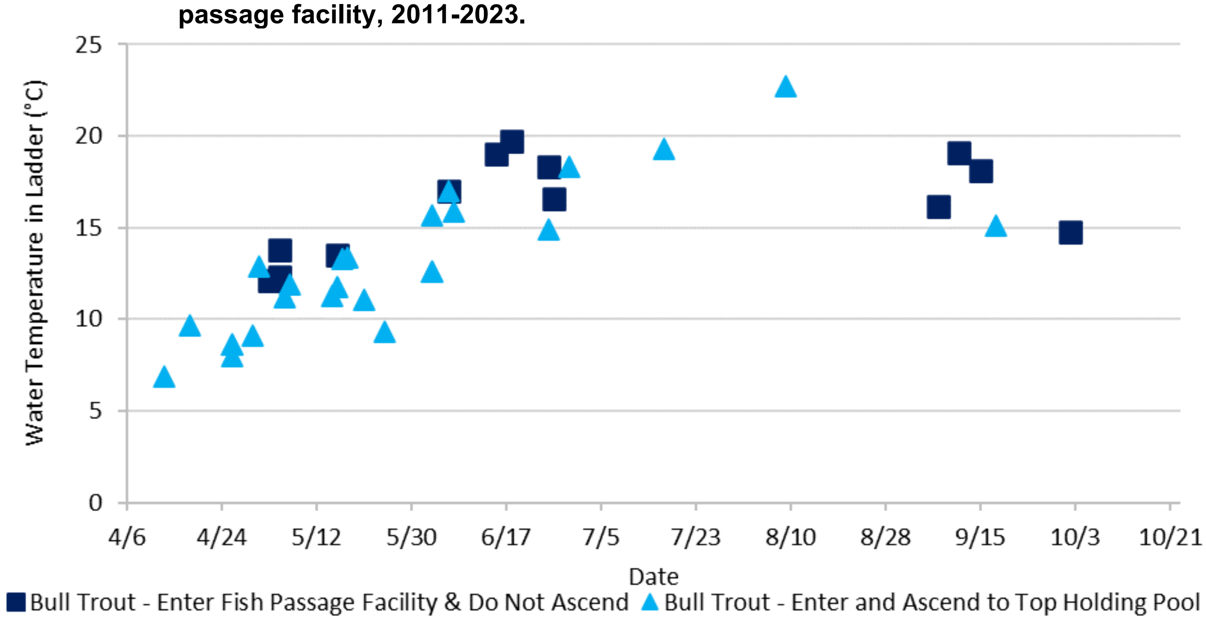
Since 2011, Bull Trout were documented entering the fish passage facility with river discharge ranging from 6,600 to 56,100 cfs and water temperatures ranging from ~ 6.9 to 22.7ºC. **Figure 6-2** and **Figure 6-3** show streamflow and water temperature data corresponding to when Bull Trout ascended to ladder and reached the holding pool (triangles) and when Bull Trout only entered the fish passage facility (detected in the lower pools or entrance) and did not ascend to the top. Note that some Bull Trout entered the ladder on multiple dates, thus the symbols in Figures 6-2 and 6-3 do not represent unique fish.

Figure 6-2: Mean daily Clark Fork River streamflow (USGS gage #12389000) corresponding to when Bull Trout were detected in the fish passage facility, 2011-2023.



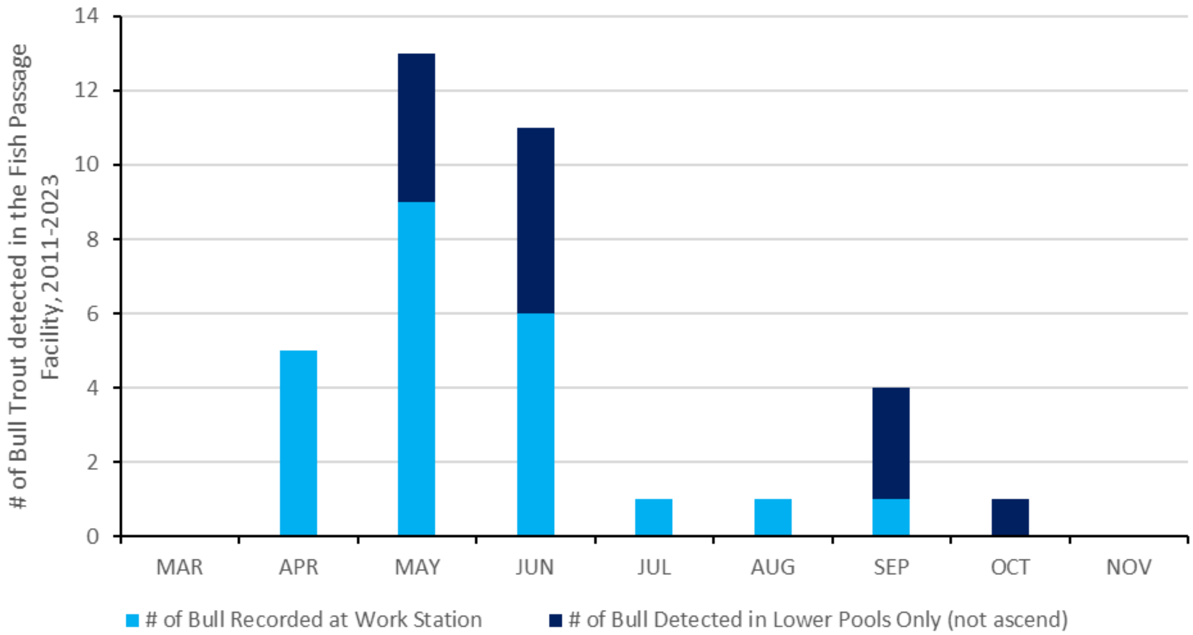
Note: USGS = U.S. Geological Survey

Figure 6-3: Water temperature in the ladder on dates when Bull Trout were detected in the fish passage facility, 2011-2023.



Based on data collected at the fish passage facility, the peak use by Bull Trout occurred between April and June (20 of 23 ascents). Streamflows were between 18,600 and 56,100 cfs, and water temperature ranged from 6.9 to 18.3°C. The majority of Bull Trout (17) ascended the fish passage facility during spill at the Main Channel Dam (streamflow > 23,000 cfs). Bull Trout were also recorded entering and ascending the fish passage facility once in July, August, and September. **Figure 6-4** summarizes the number of Bull Trout (with PIT tags) detected in the fish passage facility, 2011-2023.

Figure 6-4: Number of Bull Trout detected in the Thompson Falls ladder by month, 2011-2023.



6.3 Reservoir Habitat

Water temperature data collected in Thompson Falls Reservoir indicate that the reservoir does not stratify and is generally thermally homogeneous (NorthWestern 2019b). The cool water influence of the Thompson River only extends downstream in Thompson Falls Reservoir a short distance, ~ 100 meters (m) downstream of the Thompson River confluence and 15.2 m from the right bank. Additional water temperature data indicate there may also be some cool water potentially from groundwater inflow, near Cherry Creek, ~ 3.2 kilometers downstream from the Thompson River. However, these small areas of cool water do not extend throughout the reservoir but appear to be highly localized. It does not appear that there are large cool water zones in Thompson Falls Reservoir that could be used by Bull Trout as a migratory corridor through the reservoir upstream to Thompson River (NorthWestern 2019b). Discrete locations at the mouths of Cherry Creek and Thompson River have been identified as small areas where these cold-water inputs likely provide refuge as Bull Trout move throughout the reservoir. However, these appear to be small areas that do not have much influence on overall temperatures within the reservoir.

The data also indicate that Thompson Falls Reservoir has a short retention time (~8 hours) (PPL Montana 2011). This is consistent with the finding that the reservoir does not stratify. The habitat in the reservoir is intermediate between lentic and lotic habitat type.

Fall gillnetting sampling collected annually since 2004 have recorded 16 species in the Thompson Falls Reservoir (NorthWestern 2023). The number of salmonids found in Thompson Falls Reservoir in general is quite low. Rainbow Trout have been found more commonly than Brown or Westslope Cutthroat Trout, but Rainbow Trout were still very uncommon, averaging 0.1 fish per net (NorthWestern 2023, 2019b). On average the most common species in Thompson Falls Reservoir (2004-2022) are Black Bullhead (average 3.1 fish per net) and Northern Pike (average 2.7 fish per net) (NorthWestern 2023). The reservoir is primarily habitat for native non-game species and non-native species.

Bull Trout appear to use Thompson Falls Reservoir as a migratory corridor, but no specific migratory pathway has been defined due to the lack of data and few fish. No Bull Trout were sampled during fall gillnetting, but one Bull Trout was sampled during a spring sampling event in 2009 during a Northern Pike study (PPL Montana 2010). A juvenile Bull Trout was found in a Northern Pike (captured in the Island Complex area) stomach during a 2009 food habits study indicating that there is some risk of non-native species predation on juvenile Bull Trout (PPL Montana 2010). However, a multi-year study in 2014-2015 on out-migration of juvenile Bull Trout out of the Thompson River drainage and into the Thompson Reservoir did not identify non-native predation as a critical limiting factor (Glaid 2017). Therefore, NorthWestern and the Technical Advisory Committee (TAC) agencies did not identify, develop, or recommend a non-native species suppression program be instituted in Thompson Falls Reservoir because the efficacy of such a program for the purpose of Bull Trout restoration seems unlikely.

6.4 Bull Trout Downstream Migration

Out migration of subadult Bull Trout from tributary streams has been commonly reported to have a bimodal (spring and fall) pattern (Lacy et al. 2016; Downs et al. 2006; Muhlfeld and Marotz, 2005). Avista (Lacy et al. 2016) documented juvenile Bull Trout downstream movement out of Graves Creek occurring primarily in the fall (September – November) with a second smaller movement recorded in early May. Downs et al. (2006) studied juvenile Bull Trout movement in Trestle Creek, Idaho and found that emigration of juveniles occurred in two pulses, one in spring that was associated with snowmelt runoff and increasing water temperatures and a second in fall as stream temperatures dropped and fall rains began. This trend was also documented in the Upper Flathead River system by Muhlfeld and Marotz (2005).

In the Thompson River drainage, juvenile Bull Trout were found to outmigrate in the fall (Glaid 2017). In the Thompson River, weir traps placed in Fishtrap Creek, tributary of the Thompson River, found peak catch of downstream moving Bull Trout (≤ 300 mm) occurred during October. In the West Fork Thompson River, peak catch of downstream moving Bull Trout (≤ 300 mm) in weir traps also occurred primarily during October (Kreiner and Terrazas 2018). However, weir traps are difficult to maintain in high flow conditions, and weir trapping efforts were limited during spring runoff (Liermann 2003; Liermann et al., 2003).

Glaid (2017) found few subadult Bull Trout emigrated from the tributaries into the mainstem Thompson River or from the tributaries to Thompson Falls Reservoir. Glaid (2017) tracked 14 radio-tagged Bull Trout for 78 days between September 24 and December 22, 2015. None of the radio-tagged fish were documented leaving the Thompson River drainage and only one was recorded at the remote array station on the mainstem Thompson River near the confluence with the Clark Fork River. Radio-tagged Bull Trout from Fishtrap Creek and West Fork Thompson River did not intermix and four of the radio-tagged fish were casualties of mink predation.

The majority of Bull Trout emigration from the tributaries occurred at night between 9:00 PM and 8:00 AM (Glaid 2017). Bull Trout movement out of the tributaries peaked in October and out-migration of the Thompson River peaked in December. Size of Bull Trout tagged in the tributaries were not a strong predictor of out-migration and abiotic factors were weakly associated with out-migration.

Glaid's (2017) study found sub-adult Bull Trout spend prolonged periods in the mainstem Thompson River and shows the importance of the mainstem Thompson River for overwintering habitat and potentially prolonged residency (Glaid 2017). The study also identified mink predation as a potential risk to Bull Trout. Monitoring data show there was the lack of intermixing between Fishtrap Creek and West Fork Thompson River sub-adult Bull Trout in the mainstem Thompson River and Glaid (2017) questioned if potential "habitat bottlenecks" are associated with predation and/or human-instigated habitat degradation.

Of the 746 subadult Bull Trout that have been tagged in tributaries to the Thompson River between 2014 and 2018, 51 (6.8%) have been detected at the mainstem Thompson River PIT tag array. A higher percentage of West Fork Thompson River subadult Bull Trout have been detected at the Thompson River PIT tag array (11.3 %) than Fishtrap Creek subadult Bull Trout (4.7%).

The 2008 FWS BO for the Thompson Falls Project estimated that at least 10 percent and perhaps as much as 25 percent of juvenile Bull Trout in the Thompson River drainage outmigrate to the Thompson Falls Reservoir and pass downstream of the project. Based on this estimated percentage of outmigration, the 2008 BO estimated that between 234 and 585 juvenile Bull Trout from the Thompson River migrate downstream through Thompson Falls Dam. Recent data collection from 2014 through June 2019 (Glaid 2017; Kreiner and Terrazas 2018) indicate that the adfluvial life history form is currently less abundant than expected. To date, based on recent tagging studies, the percentage of juvenile Bull Trout found to outmigrate from the Thompson River drainage is less than 7 percent (NorthWestern 2019b).

Kreiner and Terrazas (2018) noted in their report that,

> The proportions of Bull Trout detected leaving the tributaries and the mainstem indicates that conservation actions intended to benefit reservoir-utilizing Bull Trout (e.g., Northern Pike suppression, trap and transport) would only benefit a small

percentage of Bull Trout in the Thompson River. Instead, conservation actions intended to benefit Thompson River Bull Trout should focus first on perceived problems within the Thompson River basin, before actions downstream are considered. An adfluvial form of Bull Trout was perhaps more common prior to dam construction, as migratory life histories can be suppressed due to man-made barrier construction (Nelson et al. 2002, Schmetterling 2003). However, given the current physical habitat limitations in the Clark Fork River, focus should be placed on conserving populations and improving conditions within vital tributary networks such as the Thompson River.

6.5 Downstream Survival

6.5.1 Non-native Species Predation

Bull Trout appear to use Thompson Falls Reservoir as a migratory corridor, but no specific migratory pathway has been defined due to the lack of data on these rare fish. The number of salmonids found in Thompson Falls Reservoir in general is quite low (NorthWestern 2023). The Reservoir is primarily habitat for native non-game species and non-native species including Black Bullhead and Northern Pike.

A juvenile Bull Trout was found in a Northern Pike (captured in the Island Complex area) stomach during a 2009 food habits study indicating that there is some risk of non-native species predation on juvenile Bull Trout (PPL Montana 2010). However, a multi-year study (2014-2015) on out-migration of juvenile Bull Trout out of the Thompson River drainage and into the Thompson Reservoir did not identify non-native predation as a critical limiting factor (Glaid 2017). Therefore, NorthWestern and the participating TAC agencies, comprised of resource managers from FWP, FWS, USFS, DEQ, CSKT, Avista, NorthWestern, Trout Unlimited did not identify, develop, or recommend a non-native species suppression program be instituted in Thompson Falls Reservoir because the efficacy of such a program for the purpose of Bull Trout restoration seems unlikely.

6.5.2 Fallback

There is little consistency with fallback reporting in literature (Frank et al. 2009). The type of movement associated with fallback, the temporal time frame when fallback occurs, and species evaluated vary greatly in the literature. The concerns and causations of fallback also vary and can range from adverse effects to fish movement and behavior related to the fishway experience, post-tagging issues, location of a fishway exit, etc. (Frank et al. 2009; Boggs et al. 2004; Reischel and Bjornn 2003).

At the Project's fish passage facility, there was concern that Bull Trout (and other species) would get disoriented after their passage upstream, or potentially get swept back downstream over the spillway, precluding them from reaching their spawning tributary. The data available for Bull Trout do not indicate fish are disoriented after ascending the fish passage facility.

Data for Bull Trout following release upstream of the dam is limited to PIT tag array detections. The ability to determine fallback of Bull Trout is limited to whether a Bull Trout is recaptured (e.g., angling, array detection) downstream. Available data indicate concerns about Bull Trout being swept downstream or disoriented after released upstream is not common. Following the installation of the Thompson River PIT Tag array system (late-September 2014), 13 Bull Trout were recorded ascending the ladder and released upstream (2015-2023). Over half (8 fish) were later detected in the Thompson River with six fish genetically assigned to the Thompson River and the other two assigned to North Fork Fish Creek, located about 100 river miles upstream of Thompson Falls Dam.

Movements following release upstream from the dam indicate Bull Trout are able to make deliberate upstream and downstream migrations and fallback has not been identified as an issue or common occurrence. For example, two Bull Trout were detected entering the Thompson River drainage and tributary Fishtrap Creek in 2 consecutive years. One Bull Trout remained upstream of Thompson Falls Dam for the 2 years (2017-2018) and the second Bull Trout ascended the ladder 2 consecutive years (2021-2022) (NorthWestern 2019b, 2023). Another example was a Bull Trout that ascended the ladder in May 2016 (genetically assigned to North Fork Fish Creek) and was later detected the same year in the Thompson River in September. This individual was detected 1-year later (in September 2017) ~ 8 miles downstream of Thompson Falls Dam in Graves Creek.

At this time, fallback evaluated over a 30-day period does not appear to be an issue at Thompson Falls Dam (NorthWestern 2019b). Bull Trout (or other species) are not immediately swept downstream (from disorientation or energy use) after their release upstream. There is no evidence that fallback is impeding the successful passage of Bull Trout. Concerns regarding disorientation after fish ascend the ladder and are released upstream of Thompson Falls Dam does not appear to be an issue.

6.6 Limiting Factors for Bull Trout

The primary limiting factors for Bull Trout are disconnected habitat (e.g., large dams, diversion structures), elevated stream temperatures, impaired and channelized stream channels (reduced habitat complexity and stability), and competition and negative interactions with nonnative species (FWS 2015). The adfluvial migratory Bull Trout life history in the Clark Fork River basin was significantly affected with the development of the three dams on the Lower Clark Fork River. Connected habitat from Lake Pend Oreille, Idaho upstream to the Clark Fork River drainage and lower Flathead River was disconnected for migratory Bull Trout with the construction of Thompson Falls Dam in 1915, Cabinet Gorge Dam in 1952 and Noxon Rapids Dam in 1959. Upstream fish passage at these dams has been limited until recent times.

Avista Corporation (Avista) owns and operates Cabinet Gorge and Noxon Rapids dams and facilitates an adult Bull Trout transport program at Cabinet Gorge Dam (started in the early 2000s). Avista finished construction of a new fish trap facility below Cabinet Gorge Dam in 2022 that is designed to operate from the first of April through mid-October and at Lower Clark Fork River flows of 52,000 cfs or less (Bernall and Cabinet Gorge Dam Fish Passage Facility Subgroup 2021).

The goal of the fish trap facility is to attract and capture Bull Trout and Westslope Cutthroat Trout that meet upstream transport criteria (Bernall and Cabinet Gorge Dam Fish Passage Facility Subgroup 2021). However, no fish passage occurs at Noxon Rapids Dam. NorthWestern's Thompson Falls upstream fish passage facility began annual seasonal (March – October) operation in 2011.

Summer stream temperatures in the mainstem Lower Clark Fork River exceed 15°C, creating suboptimal conditions for Bull Trout. FWS (2015) indicates the high summer water temperatures in the Lower Clark Fork River is due in part to the discharge of warm water into the lower Flathead River below SKQ Dam. However, the Middle Clark Fork River water temperatures also exceed preferred temperatures annually during July and August for Bull Trout (CH2M Hill and The Clark Fork and Blackfoot, LLC 2004). During periods of high-water temperatures, Bull Trout are found in the Middle Clark Fork River in thermal plumes of cold-water tributaries or groundwater inflow areas (Swanberg 1997, Peters 1983).

Fragmented habitat, elevated stream temperatures during the summer months, and introduction of nonnative species adversely affect Bull Trout in much of the Clark Fork River basin. Many nonnative species present in the Lower Clark Fork River (e.g., Smallmouth Bass, Largemouth Bass [*Micropterus salmoides*], Northern Pike, and Brown Trout) are piscivorous and likely prey upon juvenile Bull Trout (FWS 2015). Other nonnative species such as Brown Trout and Brook Trout (*Salvelinus fontinalis*) compete with Bull Trout for resources and space, adversely affecting Bull Trout fitness and reproductivity. Brook Trout specifically threaten Bull Trout through hybridization (FWS 2015).

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7.0 Effects of the Proposed Action

7.1 Bull Trout Direct and Indirect Effects

Anticipated direct and indirect effects to Bull Trout from proposed changes to operations are analyzed in the following text.

7.1.1 Proposed Project Operations

Thompson Falls Reservoir Habitat

Thompson Falls Reservoir serves as a migratory corridor for adult Bull Trout moving upstream to spawning and rearing tributaries and for juvenile/subadult and adult Bull Trout outmigrating downstream to rearing habitats. Data from the PIT tag arrays show fish generally move upstream and out of the reservoir within about 1 day following release upstream of the dam (after ascending the ladder). Fish surveys indicate salmonids and Bull Trout do not spend much time in the reservoir. The proposed action will not modify habitat conditions in Thompson Falls Reservoir for upstream or downstream migrating Bull Trout.

Water Temperature

In 2019 and 2021, NorthWestern measured water temperature throughout the Project area to characterize the existing thermal regime of the reservoir, its inputs and outputs (*refer to* Exhibit E Section 6.7.3 for more details, NorthWestern 2023c). The temperature evaluation found water temperature is consistent from upstream to downstream of the Project (NorthWestern 2022c). The evaluation also found that while the Clark Fork River temperatures remained relatively stable among upstream and downstream sites, the Thompson River was significantly cooler than the Clark Fork River. The cool water influence of the Thompson River extends downstream in Thompson Falls Reservoir a short distance, ~ 328 feet downstream of the Thompson River confluence and 50 feet from the right bank. The salmonid fishery in Thompson Falls Reservoir appears to be concentrated at the mouths of the Thompson River and Cherry Creek, as reported by anglers (Terrazas and Kreiner 2017). These confluence areas have cooler water temperatures from the inflow of the cool tributaries and are thus more conducive to summer use by salmonids.

Summer water temperature in the Clark Fork River often exceeds the optimal threshold of 15°C for Bull Trout (Fraley and Shepard 1989). The habitat in the reservoir is more conducive to nonnative species tolerant of warmer water temperatures and slower moving water. The proposed operations allowing for the Thompson Falls Reservoir to fluctuate 2.5 feet below full pool is not anticipated to modify water temperatures in the Project area, nor alter cool water refugia provided at the confluence of Thompson River or Cherry Creek.

Stranding

The proposed action is to operate the Project to provide baseload and flexible generation, limited to the top 2.5 feet of the reservoir from full pool, under normal operations. An Operations Study conducted in 2021 and 2022 to evaluate the potential effect of flexible generation did not observe any adverse effects to Bull Trout or Bull Trout critical habitat. Some fish stranding in the reservoir of Black Bullhead, Largemouth Bass, Smallmouth Bass, Yellow Perch, Northern Pikeminnow, and Pumpkinseed was observed during the 2021 study when reservoir elevations were 2,395.0 feet or less (NorthWestern 2022b). No fish stranding was observed during the Operations Study in 2022, when reservoir elevations were 2,395.7 to 2,395.8 feet. No salmonids were observed stranded at any of the elevations tested during the Operations Study (NorthWestern 2023b).

Tributary Access

The Thompson River, a key Bull Trout spawning and rearing tributary, remains connected and accessible to fish during all proposed operation reservoir levels (NorthWestern 2022b, 2023b). Prospect Creek, a Bull Trout spawning and rearing tributary located immediately downstream of Main Channel Dam remains accessible during all proposed operation levels.

Total Dissolved Gas

Total Dissolved Gas (TDG) upstream of the Thompson Falls Project, measured in the forebay, is generally between 100 and 108 percent of saturation regardless of river flow (NorthWestern 2019a and NorthWestern 2023). During the time periods when the spillways are not in use, TDG as measured at the Birdland Bay Bridge is generally equal to or slightly less than the TDG measured above the dams (PPL Montana 2010).

When river discharge exceeds the capacity of the powerhouses, flow passes over the spillways, then passes over the natural falls, adding TDG at both points. During peak discharge time periods, when spill over the Project's dams exceed 60,000 cfs, TDG exceeds 120 percent at the High Bridge, which is downstream of the Main Channel Dam but upstream of the powerhouses' tailrace channels.

TDG dissipates downstream of the High Bridge. In addition, low TDG water from the powerhouses mixes with higher TDG water that has passed over the spillways and falls. Therefore, TDG is lower at the Birdland Bay Bridge than it is at the High Bridge.

Previous investigations in 2008, 2009, 2011, 2012, and 2014 sampled 2,080 fish and identified Gas Bubble Trauma (GBT) in 0.4 to 9 percent of fish sampled per year. Results found little GBT symptoms at any discharges in adult fish. Furthermore, fish captured at the upstream fish passage facility have not exhibited signs or symptoms of GBT during the 13 years of operation.

The proposed action would have no impact on TDG levels and GBT on fish, including Bull Trout, downstream of the dams or powerhouse. TDG levels are not anticipated to change based on operations from the proposed action.

7.1.2 Upstream Migration

Since 2011, the Thompson Falls Upstream Fish Passage Facility provides seasonal fish passage between March and October. During high flows (exceeding ~ 56,000 cfs), the ladder is temporarily shut down until flows decline, debris can be removed, and the ladder is safe to operate again. Bull Trout entering and ascending the passage facility most often are detected during the spring and during higher flows when the facility is operating at its upper limits or closed due to flows/debris. During spring flows, the facility has not consistently operated thus potentially preventing access for upstream migrating Bull Trout.

The 9-year Comprehensive Phase 2 Report (NorthWestern 2019b) did not find evidence indicating adult migrating fish are delayed in their migration in the Thompson Fall Reservoir. Approximately 25 percent of 638 PIT-tagged fish between 2014 and 2018 (635 salmonids, 3 non-salmonids) released upstream from Thompson Falls Dam (after ascending the passage facility) migrated upstream and were detected in the Thompson River within 24 hours, 62 percent took less than 10 days to make the journey.

Upstream fish passage averages 1.8 Bull Trout per year at the Thompson Falls Project (2011-2023) and is likely not attracting all potential Bull Trout in the Zone of Passage (ZOP). Assuming NorthWestern’s 2021-2023 radio telemetry study using Rainbow and Brown trout as a surrogate species for Bull Trout represent the efficiency to attract Bull Trout to the fish passage facility entrance, an estimated 29 to 41 percent of the potential four to six individual Bull Trout in the ZOP enter the facility.

Access for Bull Trout to the fish passage facility is not likely to be impacted by proposed operations of the reservoir. NorthWestern plans to engineer a solution to mitigate any potential operational limitations of the facility when reservoir levels are less than 2,394.2 feet (≥ 2.3 feet from full pool).

7.1.3 Effectiveness of the Fish Passage Facility

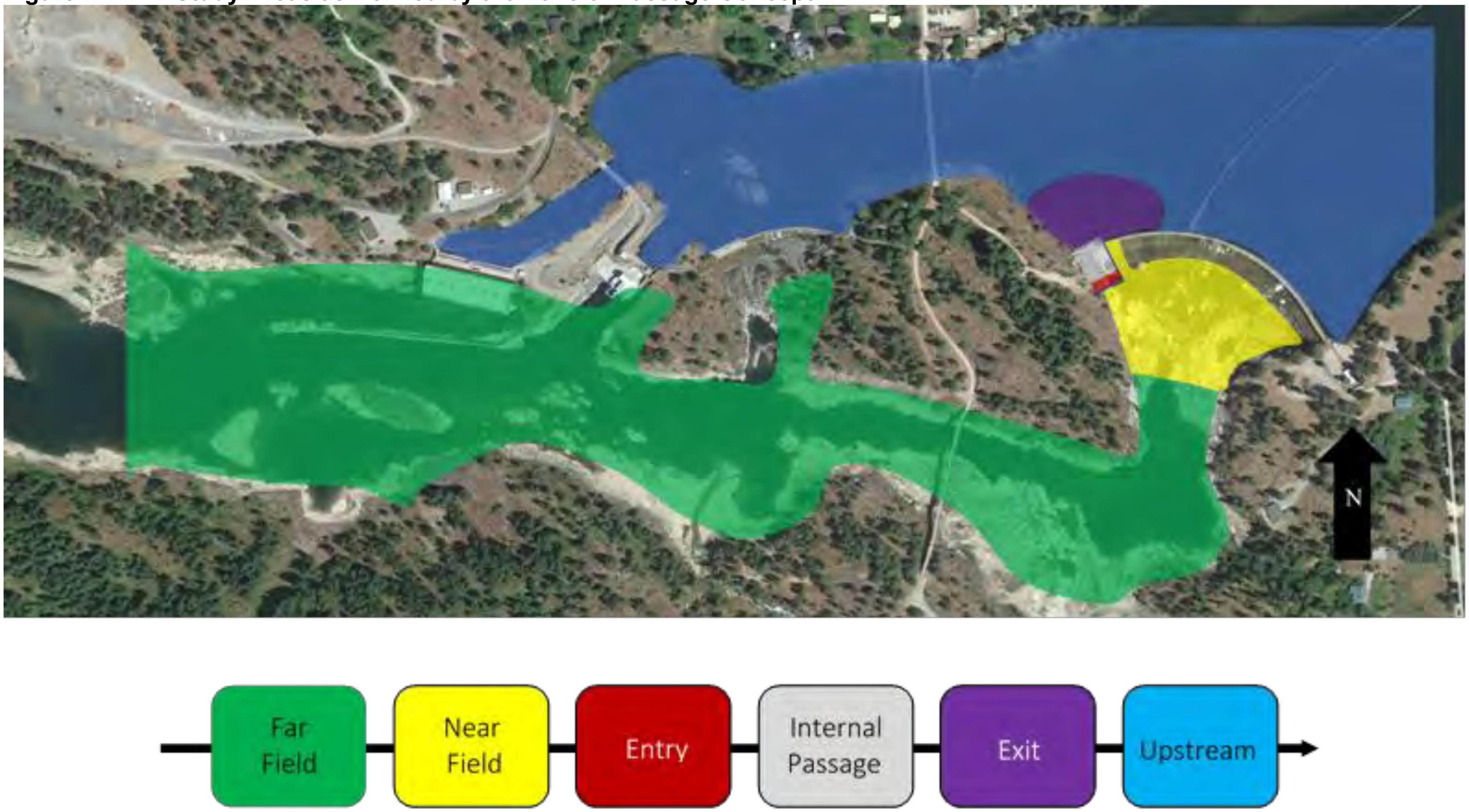
A radio telemetry study using Rainbow (*Onchorhynchus mykiss*) and Brown trout as surrogates for Bull Trout was completed in 2021, 2022, and 2023 (NorthWestern 2022a, 2023a, 2023d). Rainbow Trout are spring spawners migrating upstream during the spring months, which overlaps the same period when Bull Trout have been observed entering fish passage facility or known to start moving upstream to spawning tributaries. Brown Trout are fall spawners migrating upstream during the fall months, another period when Bull Trout have been observed moving upstream. Rainbow Trout provide insight to movement during spring conditions compared to movement and fish behavior of Brown Trout during fall conditions. The two trout species are available for sampling and provide a method to better understand upstream fish passage efficacy as a surrogate for movement timing related to Bull Trout.

The 3-year study focused on the movement of radio-tagged fish from the Thompson Falls original powerhouse upstream to the fish passage facility entrance at the Main Channel Dam, a 0.75-mile section of the Clark Fork River. The study evaluated upstream fish movement *via* radio telemetry[2] through the Project's Zone of Influence[3] which is defined by the 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 (**Figure 7-1**).

[2] Radio telemetry uses individually coded tags which transmit radio waves which can be detected with receivers mounted on shore.

[3] Zone of Influence means an area within which there are positive or negative effects as a result of the Project.

Figure 7-1. Study Areas as Defined by the Zone of Passage Concept.



Notes:
Figure not to scale.
Far Field = Downstream of fish passage facility/dam where the 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.
Source: Scientific Panel 2020.

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A total of 100 trout (Rainbow and Brown) were tagged over the 3 years of study. In 2021, 16 trout were tagged: seven Rainbow Trout and six Brown Trout in June, and three Brown Trout in late September and early October. In 2022, 54 trout were tagged: 29 Rainbow Trout and eight Brown Trout in March, and 17 Brown Trout in September. In 2023, 30 Rainbow Trout were tagged in March and April, and their movements were monitored through July 31, 2023.

Over the 3 years of study, 95 percent of fish collected, tagged, and transported downstream for release at Flatiron FAS were later detected in the far field. This includes fish collected and tagged in March, June, September, and October; fish of both species (Rainbow and Brown trout); and fish collected by electrofishing and at the fish passage facility. These data indicate that handling or tagging mortality was low or none during the study. The data also support the assumption that tagged fish were motivated, at some level, to move upstream. The study methodology was effective in generating information on fish movement in the study area.

A summary of the fish studied in 2021, 2022, and 2023, including the month and year of tagging, species, total number radio tagged, percentage and number of radio-tagged fish detected in the far field, near field, and fish passage facility entrance, is provided in **Table 7-1**.

Table 7-1: Summary of the Rainbow and Brown Trout Detected in 2021, 2022, and 2023.

Collection Time	Spp.	Total Tagged	% (#) in Far Field	% (#) in Near Field	% (#) Ladder Entrance	% (#) Ladder Ascent
Jun '21	RB	7	100 (7)	14 (1)	-	-
	LL	6	100 (6)	50 (3)	33 (2)	17 (1)
Sep/Oct '21	LL	3	100 (3)	33 (1)	33 (1)	33 (1)
2021 Total RB & LL		**16**	**100 (16)**	**31 (5)**	**19 (3)**	**13 (2)**
Mar '22	RB	29	100 (29)	86 (25)	48 (14)	45 (13)
	LL	8	100 (8)	88 (7)	38 (3)	25 (2)
Sep '22	LL	17	94 (16)	35 (6)	24 (4)	12 (2)
2022 Total RB & LL		**54**	**98 (53)**	**70 (38)**	**39 (21)**	**31 (17)**
Mar & Apr '23	RB	30	87 (26)	63 (19)	43 (13)	37 (11)
2021-2023	**RB**	**66**	**94 (62)**	**68 (45)**	**41 (27)**	**36 (24)**
2021-2022	**LL**	**34**	**97 (33)**	**50 (17)**	**29 (10)**	**18 (6)**
Total ALL Years RB & LL		**100**	**95 (95)**	**62 (62)**	**37 (37)**	**30 (30)**

Notes: % = percentage; # = number of fish detected; LL = Brown Trout; RB = Rainbow Trout.

The results of the study indicate fish are motivated to move upstream and readily, unimpeded, and quickly access the ZOP following release. Rainbow Trout data represents three seasons (2021-2023), and Brown Trout data represents two seasons (2021-2022). Of the 66 radio tagged Rainbow Trout, 62 (94%) were later detected in the far field. Of the 34-radio tagged Brown Trout, 33 (97%) were later detected in the far field.

However, not all fish detected in the far field proceeded to the near field. Of the 95 fish that were detected in the far field, 73 percent of the radio-tagged Rainbow Trout (45 fish) and 52 percent of radio-tagged Brown Trout (17 fish) made a foray to the near field. The proportion of radio-tagged Rainbow Trout continuing to make the foray to the near field was greater in 2022 (86%) than in 2023 (73%) and in 2021 (14%). The time of fish collection may have been a factor in the proportion of fish that moved upstream into the near field. In contrast to 2021, when Rainbow Trout were tagged and transported in June and only one (of 7 fish) was detected in the near field, 75 percent of the 59 Rainbow Trout radio-tagged in March/April in 2022 and 2023 were detected in the near field.

Of the 45 Rainbow Trout that were detected in the near field in 2021, 2022 and 2023, 27 (60%) were detected in the fish passage facility entrance. Brown Trout results from 2021 and 2022 recorded 59 percent of the fish detected in the near field entering the fish passage facility. Annually, the percentage of Rainbow Trout detected in the near field continuing into the fish passage entrance was 0 percent in 2021, 56 percent in 2022, 68 percent in 2023. Annually, the percentage of Brown Trout detected in the near field continuing into the fish passage entrance was 75 percent in 2021 and 54 percent in 2022.

In total, over the 3-year study, 27 (41%) of the 66 radio tagged Rainbow Trout and 10 (29%) of 34 radio-tagged Brown Trout were detected at the fish passage facility entrance. Detections of Rainbow Trout at the fish passage facility entrance were similar in 2022 and 2023 (when fish collection occurred in March/April), 48 and 43 percent, respectively compared to 2021 when no Rainbow Trout entered the fish passage facility entrance. Detections of Brown Trout at the fish passage facility entrance were similar in 2021 and 2022, 33 and 28 percent, respectively.

The two areas where Brown and Rainbow trout congregated the most were near the mouth of Prospect Creek and along the right side of the Main Channel Dam, near the upstream fish passage facility. Most fish moved up the main section of the channel and did not concentrate near the Original Powerhouse or the New Powerhouse, although some fish were detected for short periods of time in these locations before moving further upstream.

Rainbow Trout were observed utilizing many locations in the ZOP, however in the near field, Rainbow Trout concentrated within the Main Channel Dam Right (MDR) zone near the fish passage facility entrance during March and April. Rainbow Trout utilization of the Main Channel Dam area showed three Rainbow Trout in the Main Channel Dam Left (MDL) zone prior to moving to the MDR zone and greater use of the MDL zone prior to spill in 2023 than in 2022. Rainbow Trout presence in the ZOP was greatest during the spring months in both the far and near field before tapering off rapidly when runoff occurred in May and June and then with few detections into the summer and fall months.

There was no consistent holding area observed for Brown Trout in the ZOP during the spring and summer months. Peak activity in the ZOP and upstream movement into the fish passage facility occurred in the fall.

The telemetry data, and the computational fluid dynamics (CFD) modeling data, provide insight into fish passage conditions at flows at or exceeding the high design streamflow (48,000 cfs) for the fish passage facility. The data indicate that, during spill at the Main Channel Dam, the detection of fish in the ZOP was limited to a few individuals. Rainbow Trout were very active in the ZOP from March through May, prior to the start of high flow. Fixed station receivers, both in the far and near field areas had over 2 million detections (post-processing) as Rainbow Trout moved upstream into the ZOP and between sites. Of the 59-tagged Rainbow Trout in 2022 and 2023, 75 percent of the Rainbow Trout moved upstream into the near field in the spring and about half entered the upstream fish passage facility. However, no Rainbow Trout were detected in the near field after mid-May. Rainbow Trout were essentially absent from the ZOP once spill started at the Main Channel Dam, and for the remainder of the season. Brown Trout present in the ZOP during the spring, appeared to leave the ZOP during spill, and then returned in the fall.

As records and data collected from fish ascending the fish passage facility, manual fish tracking, and 3D model results support, velocities in much of the river often exceed swimming ability (>14 feet per second) for most fish during spring flows and likely limit access upstream for fish in the ZOP and to the near field. The CFD model confirms that there is limited available area with suitable velocities at higher spill quantities for fish to navigate through the High Bridge and falls locations.

While the past (early 2000s) and more recent (2021-2023) telemetry data indicate that many fish leave the study area during high flow, a few fish remain and manage to find the fish passage facility. Fish are known to ascend the fish passage facility when spill is exceeding design capacity (>25,000 cfs spill). Records at the fish passage facility indicate 61 fish recorded at the fish passage facility at flows exceeding the design capacity from 2011 through 2022 (NorthWestern, unpublished data). The fish include 32 salmonids (21 Rainbow Trout, 5 Bull Trout, 3 Brown Trout, 3 Westslope Cutthroat Trout [*Onchorhynchus clarkii lewisi*]) and 29 non-salmonids (25 Largescale Sucker [*Catostomus macrocheilus*], 4 Northern Pikeminnow [*Ptychocheilus oregonensis*]).

Peak Rainbow Trout counts at the fish passage facility occurs prior to, and after spill. Peak Rainbow Trout counts at the ladder occur in, descending order July, April, September, August, and then March. Peak Brown Trout counts occur at the fish passage facility post spill in July and fall months. In contrast to Rainbow and Brown trout, 78 percent of Bull Trout ascending the fish passage facility were documented between the onset of spill to ~ 33,000 cfs spill.

During spill at the Main Channel Dam, the telemetry and CFD modeling results indicate velocity obstacles may exist in the ZOP, specifically at the falls where the channel is constricted by boulders and rock. The CFD model indicates the falls would be a particularly challenging area for slower swimming non-salmonids to navigate. Another area with high velocities, at and above 25,000 cfs spill, is immediately downstream of the High Bridge where the channel constricts again. Both constricted areas (at the falls and High Bridge) are natural features of the Clark Fork River. During spill, the area accessible for various fish species to move upstream declines and is limited to the margins of the wetted channel and near the bottom of the channel depending on the roughness and available topography.

The CFD modeling indicates velocities near the fish passage entrance are within fish swimming abilities at all flow scenarios. There are no apparent velocity barriers near the fish passage facility entrance that would discourage fish from finding or entering the fish passage facility.

When looking at flow path streamlines it appears that at modeled spill flows of 200 cfs there remains a distinguishable level of attraction flow near the fish passage facility entrance that flows downstream and through the falls. As flows increase to 2,000 cfs spill, the flow path streamlines remain distinguishable near the fish passage facility entrance although as it reaches the falls area it begins mixing with the flow paths from spill at the radial gates. As total spill increases and reaches 25,000 and 37,000 cfs, flow path streamlines from the fish passage facility entrance area are not as distinct and appear to be overwhelmed from flows at the radial gates and flow over the Main Channel Dam. These data may indicate that attraction flow may be insufficient at some flows to provide the velocity clues that upstream migrating fish require to readily find the fish passage facility entrance.

Internal Ladder Efficiency and Ascent Times

Internal ladder efficiency is calculated as the proportion of the fish that enter the ladder and ascend the ladder (detected in holding pool). The ladder has a PIT tag antenna system that provides detection date and time. The system has antennas set up in the lower pools 7 and 8 and at the holding pool. The ascent time is calculated by the duration between detections in the lower pool and holding pool.

In 2021, antennas were set up in the entrances (upper and lower). This allowed for additional analysis of how many fish that enter the ladder continue to the lower pools and holding pool (top of ladder). It also allowed for ascent time to be calculated from the ladder entrance.

In 2013, the maximum number of Bull Trout recorded at the top of the ladder was five. The maximum number of Bull Trout detected either entering the lower pools or ascending to the top in a given year was seven (in 2015). These are minimum values because all fish detections require the fish to either ascend to the top and be handled at the work station, or for the fish to already have a PIT-tag prior to entering the upstream fish passage facility

Since 2011, an estimated 70 percent (21 of 30) of Bull Trout ascended the ladder after entering the ladder (**Table 7-2**). The majority of Bull Trout (15 individuals) ascending the ladder were not previously PIT-tagged. Ascent data for Bull Trout are limited to six fish that entered the ladder with a PIT tag. All Bull Trout were recorded ascending the ladder in orifice mode.

Table 7-2. Number of Bull Trout entering Pools 7/8, and the number ascending to the holding pool, 2011-2022.

Year	Known Number of Bull Trout Detected in the Ladder, 2011-2022	
	Enter Ladder	Ascend to Top of Ladder
2011	2	2
2012	2	2
2013	5	5
2014	1	1
2015	7	2
2016	6	3
2017	1	1
2018	-	-
2019	1	1
2020	1	1
2021	2	1
2022	2	2
Total	**30**	**21**

Ascent time information for salmonids entering the ladder and ascending the ladder has been recorded since 2011. Prior to 2021, the ascent time was calculated based on the time between the last detection in the lower pools (7/8) and the holding pool. In 2021, a PIT tag array was installed in the entrance of the ladder. Fish movement indicates travel duration between the entrance and lower pools can be within a few minutes. Bull Trout ascent times were between 2.0 to 3.3 hours with the exception of one fish taking 7.0 hours in 2019. This is comparable to the ascent times for other salmonid species (NorthWestern 2023).

Internal fish passage efficiency and ascent times are presented in each Thompson Falls Project, Fish Passage Annual Report. In general salmonids appear to be more capable of ascending the ladder than non-salmonids. Over the years, internal fish passage efficiency for salmonids has been around 70 to 75 percent. These data have been primarily based on PIT tag detections from the lower pools 7 and 8 *versus* the entrance. Detections in the entrance started in 2021. Internal fish passage efficiency for salmonids was 75 percent in 2021 compared to 69 percent of 101 fish in 2022.

7.1.4 Downstream Migration

When water is spilling over or through the dams at the Thompson Falls Project, 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. In 2007, the previous Licensee

(PPL Montana) prepared a *Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* (GEI 2007) which included specific consideration of federally listed Bull Trout and Westslope Cutthroat Trout, a sensitive species, and Montana Species of Special Concern (GEI 2007).

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.

The 2007 Literature Review estimated that survival estimates at the Project are 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm were estimated to likely be 91 to 94 percent. The Biological Opinion (FWS 2008) issued by the FWS October 28, 2008, concurred with the survival estimate in the 2007 Literature Review.

In 2022, NorthWestern prepared an Updated Literature Review (NorthWestern 2022d). The 2022 literature review provided updates, as available, to estimates of downstream passage survival of various size classes of fish, with respect to current Project configuration and operations. The 2022 literature review results were consistent with the 2007 literature review. No additional scientific literature was identified that would measurably change these existing estimates of downstream survival at the Project.

The Licensee has documented downstream fish movement through the Project since the construction and operation of the Thompson Falls Upstream Fish Passage facility (fish passage facility) commenced in 2011. Salmonids, and some non-salmonids, which are 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 as many as six times. 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 (*Prosopium williamsoni*), three Northern Pikeminnow, and one Largescale Sucker (NorthWestern 2019b).

On an annual basis, an average of 8 percent (3-13.5%) of the salmonids PIT-tagged each year return to the fish passage facility the following year.

PIT tagged adult and juvenile Bull Trout have been detected in tributaries both upstream and downstream of the Project (NorthWestern 2019a; 2019b), indicating that the fish 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 ~ 23,000 cfs. When river inflows exceed this capacity, spill is initiated at the Main Channel 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 12 years of fish passage facility operations indicate Bull Trout, and a host of other species, all successfully migrated downstream of Thompson Falls Dam, either through the turbines or over the spillway.

The available data demonstrate that fish are successfully passing both upstream and downstream of the Project, and that some fish make the trip multiple times over the years.

Operations will continue to pass the river flows through turbines at the Project or over the dam either through spill gates or flashboard panels. Bull Trout will use these same pathways to travel downstream over the Project as they have in the past. There will be continued mortality due to downstream factors including entrainment mortality.

Downstream fish passage survival would continue as it has historically. Previous literature review efforts in 2007 (*Literature Review of Downstream Fish Passage Issues at Thompson Falls Hydroelectric Project* [GEI 2007]) and the 2022 Updated Literature Review Study Report indicate relatively high survival estimates at the Project with 94 percent through the new powerhouse (Kaplan turbine), 85 percent through the original powerhouse (Francis turbines), and 98 percent through the spillway. Combined survival estimates for trout measuring greater than 100 mm were estimated to likely be 91 to 94 percent. PIT tagging and floy tagging efforts have also documented downstream survival of adults through or over the facility (NorthWestern 2019b).

7.1.5 Matrix of Pathway Indicators

The action area focuses on the Clark Fork River, which serves as a migratory corridor for Bull Trout. Spawning and rearing habitat are located in tributaries to the Clark Fork River. The matrix of pathway indicators is typically used to assess habitat indicators in spawning and rearing habitats, thus applying it to the mainstem Clark Fork River was not the intent of the analysis. With that said, NorthWestern believes the matrix analysis provides a useful tool to provide a general context of habitat indicators in the action area.

In the matrix analysis, each of the 19 habitat indicators were designated as Functioning Appropriately (FA), Functioning at Risk (FAR), or Functioning at Unacceptable Risk (FUR). There were no indicators designated as FA, thus this category is not shown in **Table 7-3.** For each habitat indicator, major and minor effects were analyzed (USDI 1998). Major effects are defined as an action that results in a change in one level of baseline conditions (e.g., FA to FAR or FUR to FAR). Minor effects are defined as actions that may result in an incremental or cumulative effect, but they do not result in a functional change to the system. For each indicator the major and minor effects are identified as M (Maintain), R (Restore) or D (Degrade). The matrix of pathway indicators provides an analysis of the existing baseline condition and potential effects to Bull Trout and their critical habitat (Table 7-3).

Table 7-3: Matrix of Pathway Indicators.

Thompson Falls Relicensing Project – Biological Assessment	Environmental Baseline		Proposed Action		Comments
Pathways: Indicators	**FAR**	**FUR**	**Major Effects**	**Minor Effects**	
Characteristics Subpopulations					
Subpopulation Size		FUR	M	M	Bull Trout are rare in the Lower Clark Fork River. The Lower Clark Fork River provides Bull Trout critical habitat for foraging, migration, and overwintering (FWS 2010a, 2010b). Most of the Bull Trout recorded at the fish passage facility are genetically assigned to the Thompson River drainage. The closest migratory Bull Trout populations to the Project are found in the Thompson River drainage, West Fork Thompson River and Fishtrap Creek. These Bull Tout subpopulations remain at high risk. The Project will not affect spawning or rearing habitat. Upstream fish passage provides Bull Trout opportunities to reach spawning grounds upstream of Thompson Falls Dam. The number of Bull Trout recorded annually at the fish passage facility remains low, 1 to 5 per year. The fish passage facility helps facilitate the migratory life history, but the occurrence of Bull Trout at the fish passage facility and in Region 3 is currently very low. Improving upstream passage with current numbers will likely have minimal effect to population size in upstream tributaries (e.g., Thompson River drainage, Jocko River drainage, Fish Creek drainage, Rattlesnake drainage).
Growth & Survival		FUR	M	M	
Life History Diversity & Isolation		FUR	M	R	
Persistence and Genetic Integrity		FUR	M	R	
Water Quality					
Temperature		FUR	M	M	River temperatures entering the Project area often exceed 15°C during the summer months (July and August) creating unsuitable habitat for Bull Trout (PPL Montana 2008, 2014; NorthWestern 2022c). Thompson Falls Reservoir does not stratify, water temperature leaving the Project area are unchanged as a result of the Project. The Project is not anticipated to change stream temperatures. Water temperature remained stable throughout changes in reservoir water levels during the operations study in 2022 and showed no relationship to fluctuations in reservoir operations (NorthWestern 2023b).

Thompson Falls Relicensing Project – Biological Assessment	Environmental Baseline		Proposed Action		Comments
Pathways: Indicators	**FAR**	**FUR**	**Major Effects**	**Minor Effects**	
Characteristics Subpopulations					
Sediment/Turbidity	FAR		M	M	Bull Trout use this area as a migratory corridor (FWS 2002). This section of the river is not suitable spawning habitat, so sediment in the Project area is not a limiting factor. Turbidity downstream of the Project was evaluated during the Operations Study and there was no relationship observed between fluctuations in reservoir level and turbidity downstream.
Chemical Contamination/Nutrients	FAR		M	M	No change anticipated to watershed inputs in area. NorthWestern's (2022c) water quality report from data collected in 2019-2021 indicates conditions are good in the Project area. Water chemistry changes very little across the Project from upstream to downstream. This is mostly due to the very short residence time of the reservoir (3-17 hours). Nutrient concentrations remain low. Metals concentrations were generally low. Specific conductivity, pH, and turbidity remain relatively consistent. Sediment chemistry samples collected in the lower portion of Thompson Falls Reservoir showed TCLP metals and PCBs were all at non-detectable concentrations. The proposed action is not anticipated to have any effects to chemical contamination/nutrients.
Habitat Access					
Physical Barriers	FAR		R	R	Thompson Falls Dam is a physical barrier that provides seasonal upstream fish passage annually, March – October. Further evaluation and improvements to upstream passage for Bull Trout will help improve connectivity in the Lower Clark Fork River.
Habitat Elements					
Substrate Embeddedness	FAR		M	M	The action area is designated foraging, migrating, and overwintering and not suitable for spawning or rearing. The project will not affect substrate embeddedness.

Thompson Falls Relicensing Project – Biological Assessment	Environmental Baseline		Proposed Action		Comments
Pathways: Indicators	**FAR**	**FUR**	**Major Effects**	**Minor Effects**	
Characteristics Subpopulations					
Large Woody Debris		FUR	M	M	The mainstem Clark Fork River has very little LWD. LWD that accumulates in the spring along the Thompson Falls Dam will continue to be passed downstream. The project will not affect LWD.
Pool Frequency	FAR		M	M	The project will not affect in-channel features.
Pool Quality	FAR		M	M	
Off-Channel Habitat		FUR	M	M	
Refugia		FUR	M	M	
Channel Condition and Dynamics					
Width/Depth Ratio		FUR	M	M	With few exceptions, the shoreline monitoring (for the reservoir) data from the 2022 Operations Study indicates no changes in the amount, type, or cause of erosion related to reservoir fluctuations (NorthWestern 2023b). When changes did occur, the most common causes are use-based impacts such as human or wildlife footpaths, or natural events such as spring runoff, runoff in response to rain events, or wind-toppled trees. This is similar to the conclusions of the first study season (NorthWestern 2022b). There are no anticipated changes to streambank erosion.
Streambank Condition	FAR		M	M	
Floodplain Connectivity		FUR	M	M	Operations at Thompson Falls Project will maintain the existing floodplain. Many portions of the mainstem Clark Fork River and reservoir are confined in places by HWY 200 and Montana Rail Link rail line that often constrict the channel in places and reduce connectivity to historic riparian areas. The project will not affect floodplain connectivity.

Flow/Hydrology

Thompson Falls Relicensing Project – Biological Assessment	Environmental Baseline		Proposed Action		Comments
Pathways: Indicators	**FAR**	**FUR**	**Major Effects**	**Minor Effects**	
Characteristics Subpopulations					
Peak/Base Flows	FAR		M	M	Thompson Falls Dam is a run-of-the-river facility, the dam changes the natural hydrograph during occasional peaking operations or drawdown. Dams upstream in the Flathead Drainage (Hungry Horse, SKQ) provide flood control and have some hydrologic influence on the lower Flathead River and the Lower Clark Fork River. The project will maintain minimum flows and not affect river hydrology.
Drainage Network Increase	FAR		M	M	The project will not change the drainage network.
Watershed Conditions					
Road Density & Location		FUR	M	M	HWY 200 and Montana Rail Link are parallel to the Clark Fork River and are constructed on a floodplain terrace (Dames and Moore 1997). Powerlines and the Yellowstone Pipeline corridor are also located along the river and over the river channel. There is residential development also adjacent to the river channel. The project will not change road density in the area.
Disturbance History		FUR	M	M	The analysis area is not a pristine environment and as a result of dam construction, road construction, rail line construction, power line construction, pipeline construction, and development in the area. The proposed project does not include any additional disturbance or major construction activities.
Riparian Conservation Areas	FAR		M	M	There are no riparian habitat conservation areas within the project area.
Disturbance Regime		FUR	M	M	As a result of road construction, rail line construction, power line construction, pipeline construction, and development, resiliency of habitat to recover from environmental disturbances is moderate.

Thompson Falls Relicensing Project – Biological Assessment	Environmental Baseline		Proposed Action		Comments
Pathways: Indicators	**FAR**	**FUR**	**Major Effects**	**Minor Effects**	
Characteristics Subpopulations					
Integration of Species and & Habitat Condition		**FUR**	M	M	The action area is designated critical habitat for Bull Trout providing FMO habitat (Federal Register 2010). However, the presence of Bull Trout in the analysis area is rare. NorthWestern has recorded 23 Bull Trout at the upstream fish passage facility 2011-2023, 1 to 5 fish a year. Bull Trout abundance and occurrence at the upstream fish passage facility and area remain low, but likely is higher than what is currently captured and passed upstream. The Project provides upstream fish passage opportunity for Bull Trout during their migration period but limits upstream passage when the facility is closed during the winter months. The Project provides downstream passage through the spillway or through the turbines. Although literature review for downstream passage and data collected at the site indicate survival is good, it is likely not 100%.

Notes: °C = degrees Celsius; D = Degrade; FAR= Functioning at Risk; FUR= Functioning at Unacceptable Risk; M = Maintain; R = Restore TCLP = Toxicity Characteristic Leaching Procedure; LWD = large woody debris

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7.2 Effects on Bull Trout Critical Habitat

The Lower Clark Fork River is designated critical habitat for FMO between Thompson Falls Dam and Flathead River (FWS 2010a, 2010b). FMO habitat is typically downstream from spawning and rearing habitat and contains all the physical elements to meet critical overwintering, spawning migration, and subadult and adult rearing needs (FWS 2010a, 2010b). Although use of FMO habitat by Bull Trout may be seasonal or very brief (as in some migratory corridors), it is a critical habitat component.

The action area includes designated critical FMO habitat for Bull Trout. The action area defined for this report provides a migratory corridor for Bull Trout to access the middle and/or upper Clark Fork River. Upstream of the dam, the closest spawning and rearing tributary is ~ 6 miles upstream of the dam, the Thompson River drainage.

The presence of Thompson Falls Dam affects upstream and downstream fish passage. Downstream fish passage includes migration over the spillway when streamflow exceeds 23,000 cfs or migration through the turbines. Upstream fish passage is available seasonally between March and October, weather and river conditions permitting. Bull Trout upstream migration has been documented throughout the spring months, including times during spill. Not all fish that enter the fish passage facility ascend the ladder.

As reported in the Initial Study Report's Operations Study, when the reservoir elevation was 2.3 feet down (2,394.2 feet) the fish passage facility began to have operating issues. The high velocity jet slowed down considerably and there was reduced water being fed to this feature. The fish sampling loop was inoperable due to the lack of water to fill the fish lift and anesthetizing tank. Pumps were shut off as they were drained, and the entire fish passage facility lacked sufficient flow and water to effectively capture fish. The proposed action would reduce the amount of time the upstream fish passage facility would be operable during the season and therefore decrease total numbers of fish passed upstream at the facility.

The proposed action would continue to provide upstream passage for migratory Bull Trout, from Noxon reach, and other species. The proposed action would maintain existing habitat features conditions of the reservoir and tailrace (**Table 7-4**).

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Table 7-4: **Summary of PCE descriptions, associated habitat indicators, baseline conditions, and effects of the proposed action.**

#	PCE Description (October 18, 2010, Final Rule)	Associated Habitat Indicators	Baseline FA/FAR/ FUR	Effects of Action R/M/D	Comments
1	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.	Chemical Contaminants & Nutrients; Physical Barriers; Substrate Embeddedness; Streambank Condition, Floodplain Connectivity; Flow/Hydrology; Road Density and Location; Riparian Conservation Areas	FAR	M	Cool water enters the Clark Fork River at the confluence with Prospect Creek and Thompson River. However, the Clark Fork River temperature often exceeds 15°C during the summer months (PPL Montana 2010, NorthWestern 2022c). The proposed action will have no effect on subsurface water connectivity, water quality or quantity, or the presence of thermal refugia.
2	Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.	Water Quality; Physical Barriers; Refugia; Wetted Width/Maximum Depth Ratio; Changes in Peak/Base Flow	FUR	r	The proposed action will improve passage at Thompson Falls Dam, but this will be minor and other barriers will still exist.
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Water Quality; Physical Barriers; Substrate Embeddedness; Pool Frequency and Quality; Floodplain Connectivity; Riparian Conservation Areas	FAR	M	The proposed action will not change baseline conditions of the reservoir.
4	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and process that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.	Large Woody Debris; Pool Frequency and Quality; Large Pools; Off-Channel Habitat; Channel Conditions and Dynamics; Disturbance History; Riparian Conservation Areas; Disturbance Regime	FAR	M	This section of stream serves as a migratory corridor and does not provide a clean, cold, complex system typical of spawning and rearing habitats. The proposed action will not change conditions of the reservoir or function as a migratory corridor.

#	PCE Description (October 18, 2010, Final Rule)	Associated Habitat Indicators	Baseline FA/FAR/ FUR	Effects of Action R/M/D	Comments
5	Water temperatures ranging from 2-15°C with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will vary depending on Bull Trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; streamflow; and local groundwater influence.	Temperature; Large Pools; Refugia; Channel Conditions and Dynamics; Change in Peak/Base Flows; Road Density and Location; Riparian Conservation Areas	FUR	M	Temperatures in the summer often exceed 15°C for an extended period of time during the summer months (PPL Montana 2014, NorthWestern 2022c). High summer temperatures are not an effect of the Project. The proposed action will have no effect on the temperature regime in the action area.
6	In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, is characteristic of these conditions. The size and amounts of fine sediment suitable to Bull Trout will likely vary from system to system.	Sediment; Substrate Embeddedness; Large Woody Debris; Pool Frequency and Quality; Streambank Condition	FUR	M	Not applicable – the analysis area does not provide spawning or rearing habitat. Area serves as a migratory corridor (FWS 2002, 2010b).
7	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.	Floodplain Connectivity; Flow/Hydrology; Watershed Condition	FUR	M	The current hydrograph will remain unchanged with baseline flows near 10,000 cfs and peak flows following spring runoff average 60,000 cfs (USGS Gage near Plain).
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Water Quality; Floodplain Connectivity; Flow/Hydrology; Watershed Conditions	FAR	M	Water quality is unimpaired in this section of stream (DEQ 2014). Recent water quality monitoring support finding by DEQ (NorthWestern 2022c).

#	PCE Description (October 18, 2010, Final Rule)	Associated Habitat Indicators	Baseline FA/FAR/ FUR	Effects of Action R/M/D	Comments
9	Sufficiently low levels of occurrence of nonnative predatory (e.g., Lake Trout, Walleye, Northern Pike, Smallmouth Bass); interbreeding (e.g., Brook Trout); or competing (e.g., Brown Trout) species that, if present, are adequately temporally and spatially isolated from Bull Trout.	Physical Barriers; Refugia; Disturbance History	FUR	M	Nonnative predatory species (e.g., Northern Pike, Smallmouth Bass, Walleye are present downstream of Thompson Falls Dam in Noxon Reservoir. Proposed action will not modify the abundance of these species.

Notes: cfs = cubic feet per second; D = Degrade; FAR= Functioning at Risk; FUR= Functioning at Unacceptable Risk; M = Maintain; R = Restore; USGS = U.S. Geological Survey

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8.0 Cumulative Effects

Cumulative effects include impacts on the environment which result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

Federal actions unrelated to this Project are not considered in this analysis because they require separate analysis and consultation pursuant to Section 7 of the ESA. Agricultural input sources have not been quantified but may impact water and soil chemistry within the river and riparian areas resulting in potential effects to suitable habitat for ESA listed species and the species themselves. The construction of the Montana Rail Link/Burlington Northern Santa Fe railway and HWY 200 have fragmented habitats (e.g., side channel habitat), and added impervious surfaces with stormwater impacting the adjacent river and wetlands.

8.1 Past, Present Foreseeable Future Actions

Bull Trout utilize a multitude of habitats to complete specific life history stages, from headwater streams (e.g., Thompson River, Prospect Creek) to large river system (e.g., Clark Fork River) or lakes such as Lake Pend Oreille. The interruption of habitat connectivity and modification of riverine habitats to lentic habitats has cumulatively affected Bull Trout and aquatic resources.

Past activities in the lower Clark Fork River basin, including development of the three Clark Fork River dams, mining activities, timber harvest and road systems, and historic forest fires all contributed to the current condition of the existing landscape and historic impacts to fisheries and aquatic resources. Physical changes to the landscape from these activities have cumulatively impacted various life history stages of Bull Trout, suitable habitat availability, access and quality of river channel migratory corridors, and access to tributary spawning habitat.

The three hydropower projects in the lower Clark Fork River have converted ~ 65 miles of the lower Clark Fork River from lotic to lentic habitat. The change in habitat type has created beneficial habitats for some species but has been detrimental for others. Introductions of nonnative fish species in the lower Clark Fork River system has altered fish species composition, often to the detriment of Bull Trout. Twenty-four fish species plus three hybrids have been recorded in recent years in the Project area, including 11 natives and 16 nonnatives. Several non-native species such as Walleye, Largemouth, and Smallmouth bass, are well suited to reservoir habitats. These species have the potential to impact populations of Bull Trout in the region.

Current operations and maintenance of the three hydroelectric projects on the lower Clark Fork River continue to have a cumulative impact on fisheries and aquatic resources through impacts to habitat and fish passage.

Bull Trout moving downstream face increased potential for injury and mortality when traveling through turbines or over the spillways at all three hydroelectric projects. Bull Trout moving downstream (from upstream of Thompson Falls Dam) with the goal of reaching Lake Pend Orielle will either pass over the spillway during high flow or through the turbine at the three hydroelectric facilities. Data collected from tagging studies and angler reports in the Project area demonstrate that fish, including Bull Trout, can survive passage over or through the three hydropower projects. As described in the Downstream Fish Passage Literature Review Final Study Report (NorthWestern 2022d), downstream survival is estimated to be 94 percent through the new Powerhouse (Kaplan turbine), 85 percent survival through the original Powerhouse (Francis turbine), and 98 percent over the spillway. Bull Trout must repeat this process through two additional facilities, with uncertain survival rates, before reaching Lake Pend Oreille.

Currently, upstream fish passage is limited in the lower Clark Fork River. Avista operates a trap and haul facility seasonally at Cabinet Gorge Dam, providing upstream fish passage to Bull Trout and Westslope Cutthroat Trout. Other fish species are not transported upstream of Cabinet Gorge Dam. Bull Trout collected downstream of Cabinet Gorge Dam are genetically tested and assigned to spawning tributaries of most likely origin. These fish are then directly transported to the respective region and their natal tributary. Bull Trout genetically assigned upstream of Thompson Falls are transported upstream of Thompson Falls and do not utilize the fish passage facility at Thompson Falls Dam.

There is no upstream fish passage facility at Noxon Rapids Dam. Fish located within Cabinet Gorge Reservoir have no upstream fish passage option at Noxon Rapids Dam

There is an upstream fish passage facility at Thompson Falls Dam which is designed to provide seasonal volitional passage. However, the presence of undesirable fish species downstream of Thompson Falls Dam prevents the opening of the fish passage facility to volitional passage. All fish which ascend the fish passage facility are manually sorted, and Walleye, Brook Trout, Brook x Bull Trout hybrid, Lake Trout, and Smallmouth Bass are not passed upstream. The Thompson Falls upstream fish passage facility is only available for Bull Trout present in the 25-mile-long Noxon Reservoir and connected tributaries.

Water quality studies have found the Project operations do not contribute to cumulative impacts of water quality downstream. Water quality changes very little across the Project from upstream to downstream. This is mostly due to the very short residence time of the reservoir (3-17 hours) and lack of thermal stratification in Thompson Falls Reservoir.

No additional future foreseeable actions in the lower Clark Fork River drainage were identified that may cumulatively impact Bull Trout.

9.0 Determination of Effects

The following effects determinations have been made for the ESA listed species and critical habitat analyzed in this BA:

- Canada Lynx [Threatened]: ***No Effect***
- Spalding's Catchfly/Campion [Threatened]: ***No Effect***
- Whitebark Pine [Threatened]: ***No Effect***
- Grizzly Bear [Threatened]: ***No Effect***
- Yellow-billed Cuckoo [Threatened]: ***No Effect***
- North American Wolverine [Threatened]: ***No Effect***
- Bull Trout [Threatened]: ***May Affect, Likely to Adversely Affect***
- Bull Trout Critical Habitat: ***May Affect, Likely to Adversely Affect***

The proposed action will continue to impact upstream and downstream passage for Bull Trout and support lacustrine habitat in the reservoir, which is less than optimal for Bull Trout. The proposed action is not anticipated to result in additional impacts to the population or existing condition of habitat in the action area. The seasonal operations of the Thompson Falls Upstream Fish Passage Facility continue to provide upstream passage opportunity for Bull Trout. Literature review indicates survival for fish moving downstream through the turbine is ~ 85 to 94 percent and 98 percent over the spillway *(refer to* **Section 7.1.4 - Downstream Migration**). Records of Bull Trout and other fish species (salmonids and non-salmonids) returning downstream after release upstream of Thompson Falls Dam indicate survival through the turbine or over the spillway is occurring with some level of success. The presence of the Project and other downstream dams limits fish movement in the Clark Fork River and fragments critical Bull Trout habitat. The downstream dams and upstream truck and transport programs minimize the number of adult Bull Trout in the Thompson Falls Project area.

This BA has been prepared for NorthWestern to comply with Section 7 of the ESA for the relicensing of the Thompson Falls Project. As described in the BA, the proposed Project ***may affect, is likely to adversely affect*****,** Bull Trout and critical habitat for Bull Trout.

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10.0 Conservation, Avoidance, and Mitigation Measures

NorthWestern is proposing to implement the conservation, avoidance, and mitigation measures described below.

- The Licensee will develop a Fisheries and Aquatic Resources PM&E Plan for purposes of reducing adverse effects on Bull Trout and other native fish species caused by the operation of the Project. The Plan will provide for the continuation of the adaptive management principles set forth in the January 15, 2008 Memorandum of Understanding among the Licensee, FWS, FWP and the CSKT, including the TAC. The Plan will add the USFS as a voting member of the TAC and will include, at a minimum, the following measures:
    - Improvements to upstream passage for native species, specifically:
        - Over the first 5 years of implementation, the Fisheries and Aquatic Resources P, M & E Plan will involve deployment of up to eight submersible PIT antenna within logistical and safe conditions below the Main Channel Dam to evaluate finer scale fish movements in the near field of the fish passage facility.
        - At the end of the first 5-year period, the Licensee will prepare a summary report discussing results of the 5-year study period. The summary report will be prepared in consultation with the TAC and filed with FERC.
        - The Licensee shall prepare an Upstream Passage Improvement Plan for the second 5-year period based on the results of the first 5 years. The Upstream Passage Improvement Plan will include further evaluations to improve capture efficiencies of the upstream fish passage facility, any proposed operational changes, and a plan and schedule to complete any facility modifications proposed by the Licensee in consultation with the TAC determined necessary to improve upstream passage efficiency. The Upstream Passage Improvement Plan will be prepared in consultation with the TAC and filed with FERC for approval.
    - Improvements to downstream passage of Bull Trout at the Project.

The Licensee shall prepare the Fisheries and Aquatic Resources P, M & E Plan in consultation with the FWS, USFS, FWP, and CSKT, and will file the plan for approval by the Commission within 1 year of the issuance of the new License.

- The Licensee shall continue to operate and maintain the upstream fish passage facility in accordance with TAC guidance. The following measures for operation will include:
    - Seasonally operate the fish passage facility from approximately March – October.
    - Spring closures when total river discharge is within 48,000 to 65,000 CFS, as approved by the TAC.

- Adequate staff to operate and maintain the fish passage facility.
    - An engineered solution to provide adequate flow to the upstream fish passage facility at all water surface elevations down to 2.5 feet below full pool. This work will be completed prior to NorthWestern’s implementation of flexible generation 2.0-2.5 feet below full pool during periods when the fish passage facility is operating.
    - Compile data collected at the fish passage facility into NorthWestern's database following quality control and quality assurance review.
    - An annual report summarizing upstream passage activities and results to be provided to the TAC for review.
- For the first 5 years of the New License term, the Licensee shall implement fisheries population monitoring in the Thompson Falls Reservoir and Clark Fork River as specified below. These measures may be extended beyond the first 5 years of the New License term as agreed by the TAC.
    - Fall gillnetting annually in Thompson Falls Reservoir.
    - 1 spring electrofishing section in the lower reservoir from Wild Goose Landing upstream along HWY 200 to the pump house in even years (2026, 2028).
    - Fall electrofishing sections on even years (2026, 2028) immediately above islands and 1 downstream of Paradise.
- The Licensee will generally maintain minimum flow releases at the dam of 6,000 cfs or inflow whichever is less. These releases may be temporarily modified if required by operating emergencies beyond the Licensee’s control and for short periods on mutual agreement between the Licensee, FWS, DEQ and FWP.

In addition, NorthWestern is proposing measures to benefit other resource areas which will also be of benefit to Bull Trout. Specifically:

- The Licensee shall implement the Thompson Falls Water Quality Monitoring Plan (Appendix C), which was developed in consultation with DEQ.
- Within 1 year of the issuance of the new license, the Licensee will update the 2010 Total Dissolved Gas Control Plan (TDG Control Plan) in consultation with the DEQ to incorporate data that have been collected during the recently completed relicensing studies. At a minimum the updated TDG Control Plan shall include the following:
    - A requirement to monitor TDG at the project for 3 consecutive years to validate the updated TDG Control Plan.
    - A monitoring and reporting schedule in years where the most probable (50%) April 1 NRCS runoff forecast for the USGS Clark Fork River near Plains, MT stream gage (12389000) is at or above 125%.

Following consultation with DEQ, the Licensee will submit the updated TDG Control Plan to FERC for approval. The Licensee will implement the updated TDG Control Plan upon FERC’s approval.

- The Licensee will implement annual noxious weed control measures, as appropriate, in high-use areas on Project lands owned by the Licensee.
- Within 2 years of the new License, the Licensee will develop and implement a Drawdown Management Plan prior to planned deep drawdowns, needed for maintenance or repairs on the Project. The Plan will be submitted to FERC for approval, following consultation with DEQ, FWS, FWP, Montana State Historic Preservation Office, and USFS.

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Appendix A: FWS ECOS-IPAC

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Montana Ecological Services Field Office
585 Shephard Way, Suite 1
Helena, MT 59601-6287
Phone: (406) 449-5225 Fax: (406) 449-5339

In Reply Refer To: September 08, 2023
Project Code: 2023-0036560
Project Name: Thompson Falls Hydroelectric Project - Environmental Resource Review

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Montana Ecological Services Field Office
585 Shephard Way, Suite 1
Helena, MT 59601-6287
(406) 449-5225

PROJECT SUMMARY

Project Code:	2023-0036560
Project Name:	Thompson Falls Hydroelectric Project - Environmental Resource Review
Project Type:	Power Gen - Hydropower - FERC
Project Description:	Providing a summary of existing environmental conditions of the Thompson Falls Hydroelectric Project area as related to natural resources (aquatic and terrestrial). The Project area extends downstream of the dam about 0.25 miles and upstream of the dam approximately 12 miles . The Project boundary primarily follows the shoreline of the reservoir and river channel (or the full pool elevation). The FERC license for this Project expires at the end of 2025.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@47.590535981429355,-115.34402199423614,14z

Counties: Sanders County, Montana

ENDANGERED SPECIES ACT SPECIES

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Canada Lynx *Lynx canadensis* Population: Wherever Found in Contiguous U.S. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3652	Threatened
Grizzly Bear *Ursus arctos horribilis* Population: U.S.A., conterminous (lower 48) States, except where listed as an experimental population There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/7642	Threatened
North American Wolverine *Gulo gulo luscus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5123	Proposed Threatened

FISHES

NAME	STATUS
Bull Trout *Salvelinus confluentus* Population: U.S.A., conterminous, lower 48 states There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Spalding's Catchfly *Silene spaldingii* There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/3681	Threatened

CONIFERS AND CYCADS

NAME	STATUS
Whitebark Pine *Pinus albicaulis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1748	Threatened

CRITICAL HABITATS

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Bull Trout *Salvelinus confluentus* https://ecos.fws.gov/ecp/species/8212#crithab	Final

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
Cassin's Finch *Carpodacus cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10

NAME	BREEDING SEASON
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lewis's Woodpecker *Melanerpes lewis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Rufous Hummingbird *selasphorus rufus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

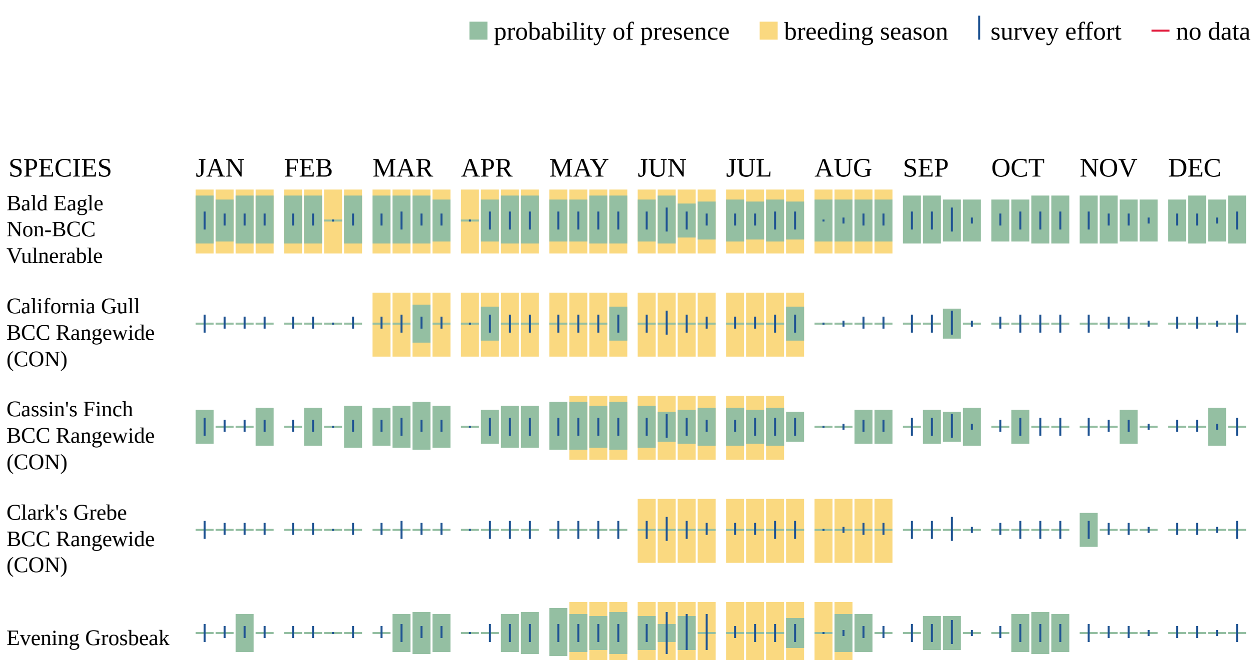
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

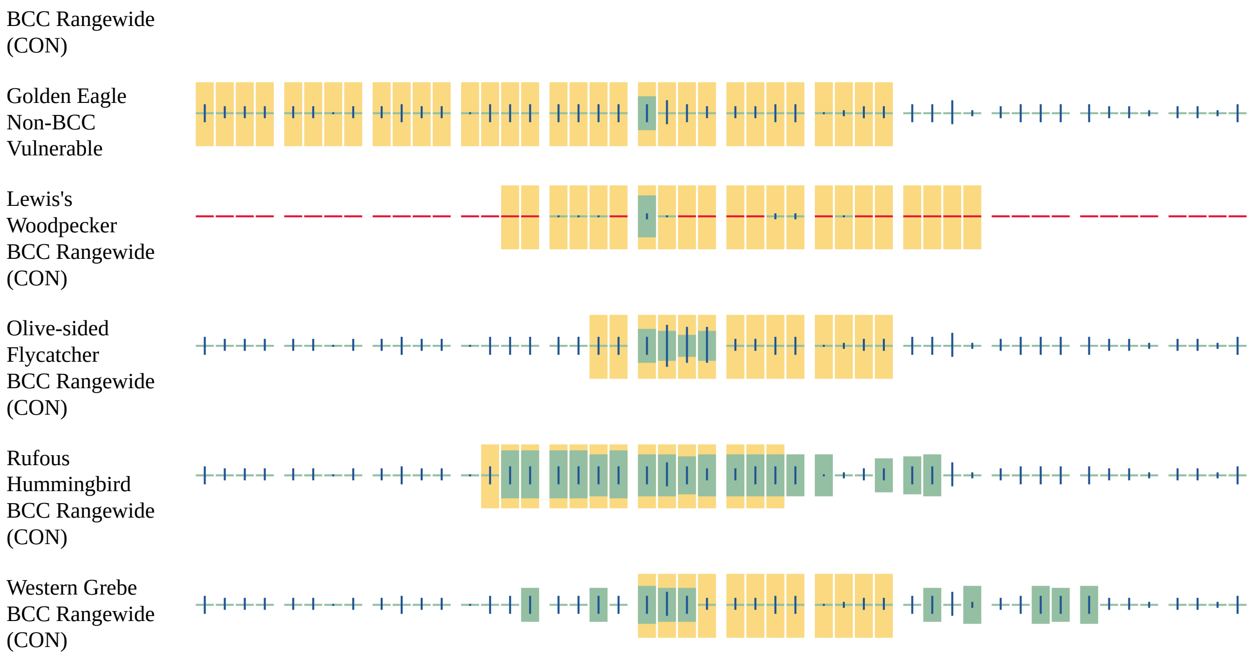
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R3UBH
- R3USA
- R5UBH
- R3UBF
- R4SBA
- R4SBC
- R3USC

FRESHWATER EMERGENT WETLAND

- PEM1F
- PEM1C
- PEM1Ah
- PEM1A

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1Ah
- PSS1A
- PFO1A

LAKE

- L1UBHh
- L2USAh
- L2ABGh
- L2USCh

FRESHWATER POND

- PABF
- PUSCh
- PABFx

IPAC USER CONTACT INFORMATION

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LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Energy Regulatory Commission

Appendix F – Historic Properties Management Plan – Filed in Volume IV (Privileged)

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Appendix G - Total Dissolved Gas Control Plan

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Thompson Falls Hydroelectric Project P-1869

Total Dissolved Gas Control Plan

Final Version - 5/20/2024

NorthWestern Energy

Delivering a Bright Future

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List of Acronyms

AD – Above Dam

ARM – Administrative Rules of Montana

BBB – Birdland Bay Bridge

CFS – Cubic Feet per Second

DEQ – Department of Environmental Quality

FERC – Federal Energy Regulatory Commission

GBT – Gas Bubble Trauma

HB – High Bridge

N/A – Not Applicable

NRCS – Natural Resources Conservation Service

TAC – Technical Advisory Committee

TDG – Total Dissolved Gas

U.S. – United States

USFWS – US Fish and Wildlife Service

USGS – US Geological Survey

Section 1.0 – Introduction and Background

NorthWestern Corporation, a Delaware corporation, d/b/a NorthWestern Energy (NorthWestern or Licensee) prepared this updated Total Dissolved Gas Control Plan (TDG Control Plan) as part of the relicensing of the Thompson Falls Hydroelectric Project, P-1869 (Project). Non-federal hydropower projects in the United States (U.S.) are regulated by Federal Energy Regulatory Commission (FERC) under the authority of the Federal Power Act. A relicensing application was filed with FERC on December 28, 2023, and the current FERC license for the Project expires December 31, 2025.

The Project is located on the Clark Fork River in Sanders County, Montana. Preliminary development of the Thompson Falls Project began in June 1912, and the Project has been operating continuously since 1915.

Total dissolved gas, or TDG, is a measurement of the total concentration of atmospheric gas saturation in water. This can occur naturally from hydraulic features in a waterbody or from human actions on the environment. When water plunges into a pool, air becomes entrained regardless of whether the plunge is a natural waterfall or a dam spillway (Weitkamp and Katz 1980). Supersaturation (TDG in excess of 115 percent of saturation) at hydroelectric projects is primarily caused by water containing gas that was dissolved under a higher than atmospheric pressure.

TDG carrying capacity depends on temperature and ambient pressure. TDG supersaturation is an unstable condition, and if the river channel downstream of a spillway is sufficiently wide and shallow, and with an appreciable enough hydraulic gradient, channel boundary roughness will force flow to “tumble” in a manner where there is increased water surface exposure of ambient air conditions. Where these kinds of open-channel flow conditions occur, TDG levels rapidly drop back to near the stable, 100 percent saturation level. The distance that is required for this to happen varies from site to site. However, if there is a downstream reservoir impounded near the powerhouse tailrace, as is the case at the Project, the normal river gradient is reduced, and the flow regime becomes more stable. Lower reservoir velocities result in less turbulence, and elevated TDG levels often persist above saturation after entering the impoundment. If there are elevated wind levels, enough shear can be created to induce the vertical circulation necessary to reduce TDG levels. Otherwise, the elevated reservoir TDG levels wane slowly by delayed replenishment from lower level TDG inflows.

In Montana, the Montana Department of Environmental Quality (DEQ) has set the water quality standard for TDG at 110 percent of saturation (DEQ 2019). The 110 percent of saturation water quality standard was developed to protect fish from high levels of TDG, which may cause gas bubble trauma (GBT), a condition that affects many aquatic organisms residing in fresh or marine waters which are supersaturated with atmospheric gases. GBT can cause injury and, in severe cases, death to fish. Montana’s Surface Water Quality Standards and Procedures include 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."

The Project was constructed in 1915 and built on a natural river falls. Due to the age of the Project, no data on TDG during the pre-Project time period are available. However, the natural waterfalls likely elevated TDG in the Clark Fork River prior to the construction of the Project. NorthWestern and the prior Licensee monitored TDG in the Clark Fork River most years from 2003 to 2023. These data have helped to inform the optimal operations scenario to minimize TDG concentrations. The prior Licensee developed a TDG Control Plan in 2010 in consultation with the DEQ (PPL Montana 2010). The TDG Control Plan outlines operational practices used during the annual spring runoff period to minimize TDG concentrations in the Clark Fork River downstream of the Project. Since 2010, the TDG Control 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. Because these new radial gates are a change from the spill panels that were previously in use, NorthWestern proposed additional TDG monitoring to assess the effect on TDG from the new radial gates. Data collection occurred in 2019 through 2023, and these data have resulted in a better understanding of TDG concentrations at a wide range of discharge levels.

This updated TDG Control Plan incorporates the data collected from 2019-2023, and outlines the plan of spill operations to be used under the new License, when issued by FERC. The TDG Control Plan was developed in consultation with the Montana DEQ, and satisfies ARM 17.30.636 (1), which provides 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."

Section 2.0 – Existing Data

This section outlines available data related to the management of TDG at the Project.

Section 2.1 – Hydrology Data

Streamflow in the Clark Fork River is measured by the US Geological Survey (USGS) at a stream gaging station near Plains, MT, approximately 30 miles upstream of the Project. There is only one tributary with appreciable flow between the Plains stream gaging station and the Project, the Thompson River. The USGS also maintains a stream gaging station on the Thompson River near the mouth. The Thompson River contributes, on average, 2.0 percent of the flow in the Clark Fork River with a range of 0.7 percent up to 5.4 percent (USGS 2023). Flow statistics were derived by combining the USGS gage on the Clark Fork River at Plains, Montana (USGS gage 12389000) with the USGS gage on the Thompson River near Thompson Falls, Montana (USGS gage 12389500), to calculate streamflow in the Clark Fork River at the Project (**Figure 2-1**) (USGS 2023).

Mean daily streamflow data were recorded at the USGS stream gage on the Clark Fork River at Plains from October 1, 1910, to present. The Thompson River near Thompson Falls flow data were recorded from March 1 to September 29, 1911, and from April 1, 1956, to present. To ensure that the hydrograph is representative of current conditions, **Figure 2-1** represents the minimum, maximum, median, and mean daily flows from April 1, 1956 to 2022. This period of record allows complete datasets for both USGS gages (Clark Fork River at Plains and Thompson River near Thompson Falls) to be analyzed and provides representative data of upstream flows since the construction of upstream dams on the Flathead River. The ascending limb of the hydrograph begins between mid- and late March, peaks between late May and mid-June, and descends to base flow levels around mid-August (**Figure 2-1**).

A summary of the minimum, maximum, and mean daily streamflow from the Clark Fork River at Plains and Thompson River near Thompson Falls gages combined for the most recent 5-year period (2018-2022) appears in **Table 2-1**. Minimum daily streamflow showed little variation, while both mean and maximum daily streamflow showed substantial variation. Mean daily flows were greater in 2018 and 2022 compared to the long-term average. Mean daily streamflow in recent years ranged from 16,481 cfs (2021) to 25,467 cfs (2018) and maximum daily streamflow ranged from 59,229 cfs (2021) to 104,475 cfs (2018).

Figure 2-1. Thompson Falls Project daily minimum, maximum, median, and mean streamflow, 1956-2022. USGS stream gage stations 12389000 and 12389500

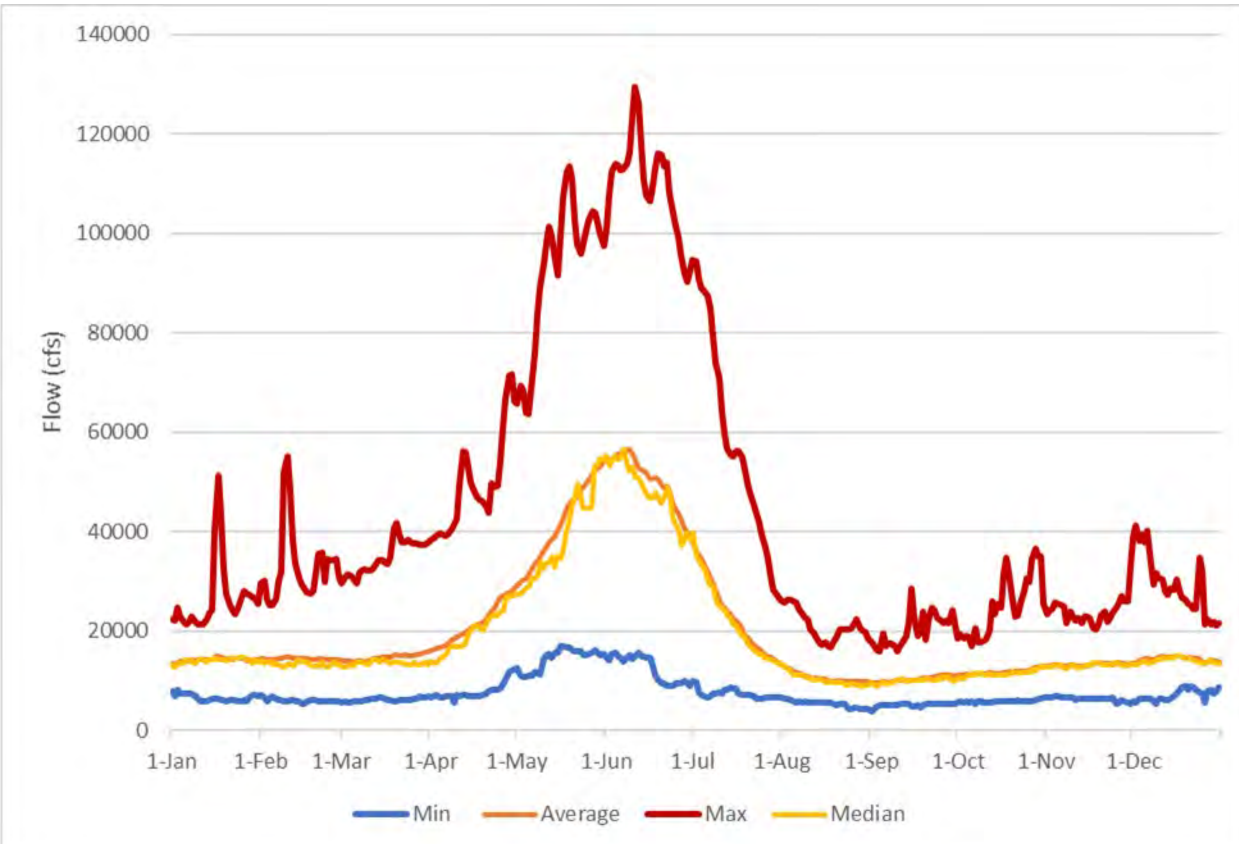


Table 2-1. Summary of Thompson Falls Project daily minimum, maximum, median, and mean streamflow for the water years 2018-2022 and the historic record, 1956-2022. USGS stream gage stations 12389000 and 12389500

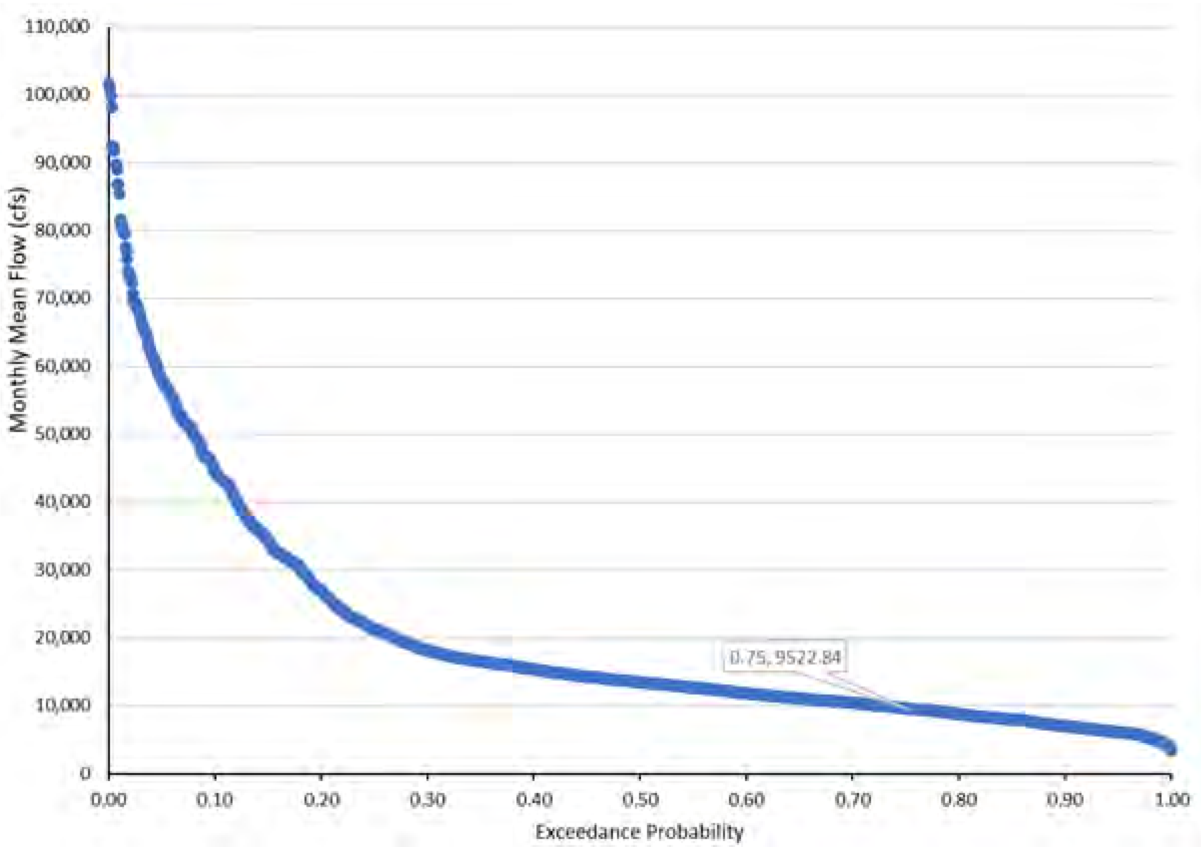
Water Year	Minimum Daily Streamflow (cfs)	Mean Daily Streamflow (cfs)	Median Daily Streamflow	Maximum Daily Streamflow (cfs)
2018	7,895	25,467	16,182	104,475
2019	6,925	16,910	12,088	69,169
2020	7,577	19,712	12,039	79,778
2021	7,164	16,481	12,785	59,229
2022	6,685	20,880	15,662	84,312
1956-2022	**3,806** (1958)	**20,067**	**14,426**	**129,510** (1964)

The maximum daily streamflow for the period of record was 129,510 cfs on June 11, 1964, and the minimum daily streamflow for the period of record was 3,806 cfs on September 1, 1958 (USGS 2023). The average daily streamflow from 1956 to present was calculated from the combined streamflow data of the two recorded USGS gage data to be 20,067 cfs. September has the lowest mean and median daily flows, and June has the highest (**Table 2-2**). The monthly flow duration curve data, shown in **Figure 2-2**, is from the USGS stream gages on Clark Fork River at Plains, Montana (USGS gage 12389000) and Thompson River near Thompson Falls (USGS gage 12389500) combined (USGS 2023).

Table 2-2. Summary of Thompson Falls Project daily minimum, maximum, median, and mean streamflow by month, 1956-2022. USGS stream gage stations 12389000 and 12389500

Month	Minimum Daily Streamflow (cfs)	Median Daily Streamflow (cfs)	Mean Daily Streamflow (cfs)	Maximum Daily Streamflow (cfs)
January	5,688	14,108	14,154	51,130
February	5,216	13,285	14,328	55,170
March	5,607	13,515	14,599	41,780
April	5,435	19,595	21,605	71,650
May	10,632	37,010	41,996	113,450
June	8,771	47,838	50,633	129,510
July	6,257	19,643	23,118	94,590
August	4,141	10,112	10,592	26,301
September	3,806	9,859	10,276	28,534
October	5,179	11,386	11,735	36,439
November	5,295	13,083	13,222	32,980
December	5,295	14,001	14,379	41,140
1956-2022	**3,806** (1958)	**14,427**	**20,067**	**129,510** (1964)

Figure 2-2. Monthly flow duration curve of the Clark Fork River at the Thompson Falls Project from 1911-2023. USGS stream gage stations 12389000 and 12389500



Section 2.2 – Project Operations Data

The Project contains two powerhouses and two dams, which work in conjunction to regulate downstream flow to the Clark Fork River. The total flow capacity of the two powerhouses at Thompson Falls is approximately 23,320 cfs. River flow in excess of this amount is routed over the spillways of the Main Channel and Dry Channel Dams. Each dam is comprised of multiple spill bays, with each bay containing six dam board panels. On the Main Channel Dam, there are 30 spill bays and four radial gates (**Figure 2-3**). The Dry Channel Dam contains 12 spill bays (**Figure 2-4**). Spill is routed through the spill bays by either manually removing dam board panels or opening the radial gates. Each spill panel can pass approximately 235 cfs, and each radial gate can pass approximately 11,000 cfs.

Typically, spill begins in late April, peaks in early June, and ends in mid-July. Additional flow is passed downstream of the Main Channel Dam Spillway during the fish passage season (March – October) to enhance operation of the upstream fish passage facility and to provide fish attraction flow. The minimum flow downstream of the Project is 6,000 cfs or inflows to the reservoir, whichever is less. This value was established under the current FERC license for the Project.

Figure 2-3. Spill bays and radial gates of the Main Channel Dam

Figure 2-4. Spill bays of the Dry Channel Dam

Section 2.3 – Total Dissolved Gas (TDG) Data

NorthWestern and the prior licensee monitored TDG in the Clark Fork River most years from 2003 to 2023. These data have helped to inform the optimal operational configurations to minimize TDG concentrations downstream. The prior Licensee developed a TDG Control Plan in 2010 in consultation with the DEQ (PPL Montana 2010). 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 Project. Since 2010, the TDG Control 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. Because these new radial gates are a change from the spill panels that were previously in use, NorthWestern proposed additional TDG monitoring to assess the effect on TDG from the new radial gates. Data collection occurred from 2019-2023, and these data have resulted in a better understanding of TDG concentrations at a wider range of discharge levels.

TDG monitoring at the Project is normally conducted in years where the most probable (50 percent) April 1 Natural Resources Conservation Service (NRCS) runoff forecast for the U.S. Geological Survey (USGS) Clark Fork River near Plains, Montana stream gage (12389000) is at or above 125 percent. This trigger value was agreed upon in 2013 by NorthWestern, DEQ, the US Fish and Wildlife Service (USFWS), and the Thompson Falls Fisheries Technical Advisory Committee (TAC). In years where the April 1 trigger value has been met, NorthWestern monitors TDG throughout the spring runoff season (April-July) at the three established monitoring sites identified in **Section 2.3.1**.

Section 2.3.1 – TDG Monitoring Sites

Water quality sondes are deployed at three locations to monitor TDG concentrations: above the dams, below the Main Channel Dam at the High Bridge, and downstream of the Project at Birdland Bay Bridge. **Table 2-3** provides the details and locations of each of these monitoring sites.

Table 2-3. Location and description of TDG monitoring sites

Site Name	Site Description	Latitude	Longitude
Site AD	Above Dam – Upstream of the Main Channel Dam	47.591912	-115.352619
Site HB	High Bridge – Downstream of the Main Channel Dam	47.590720	-115.354920
Site BBB	Birdland Bay Bridge – Clark Fork River downstream of Project at Birdland Bay Bridge	47.621619	-115.392088

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. **Figures 2-5 and 2-6** show the location of the TDG monitoring sites in relation to Project infrastructure.

Each TDG monitoring site consists of a stilling well which houses a water quality sonde that collects in-situ measurements at pre-programmed intervals. The data collected helps to generate a continuous dataset for the entire monitoring season, which can be cross-referenced to streamflow values and operational changes at the Project. The sondes are calibrated once every two to three weeks to ensure that the sensors are operating correctly.

Figure 2-5. TDG monitoring locations around the Project infrastructure

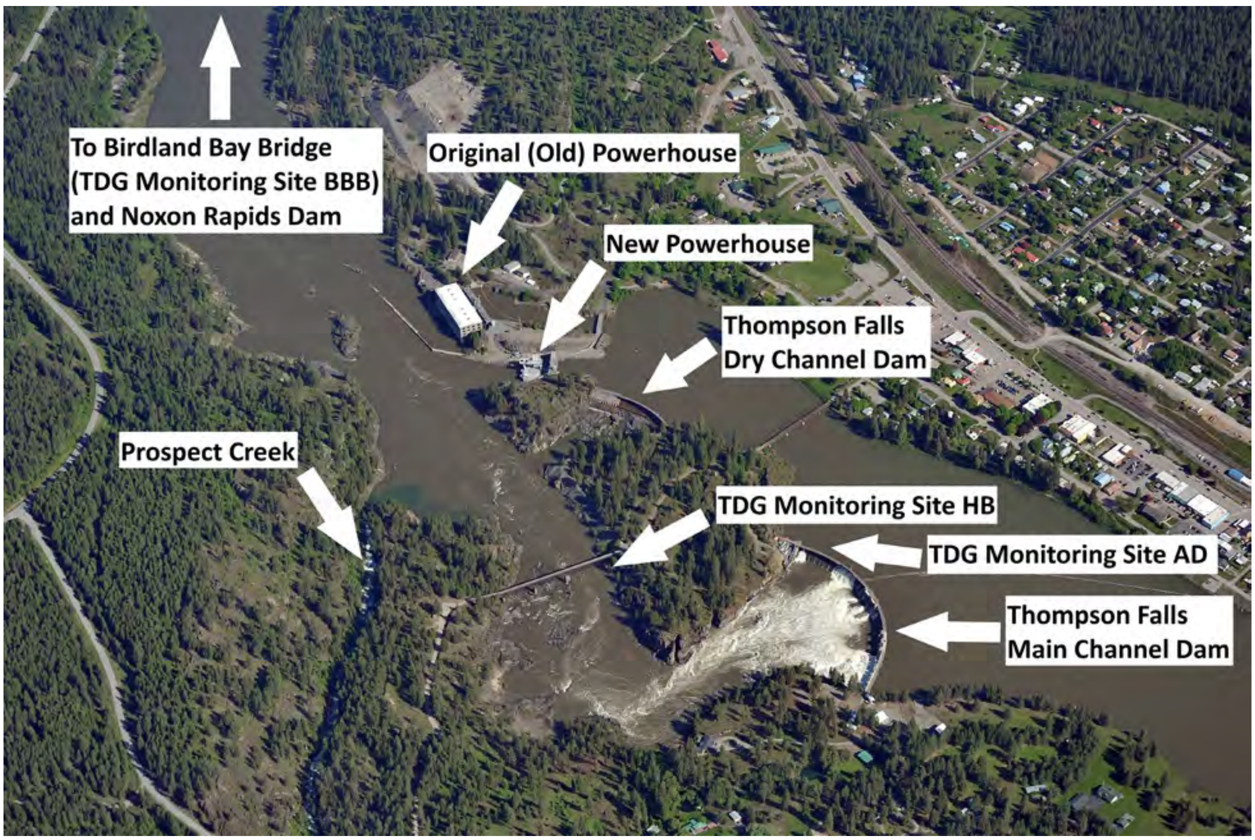
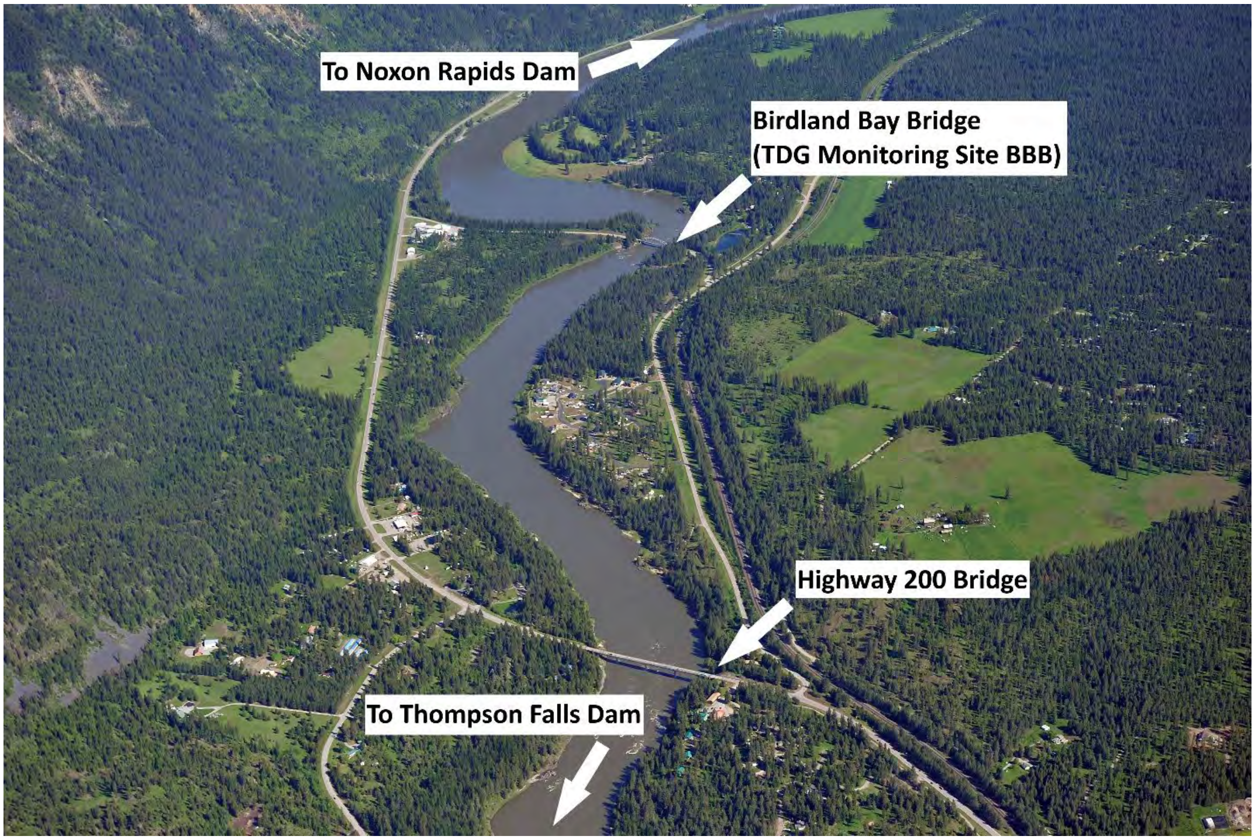


Figure 2-6. TDG Monitoring locations downstream of the Project



Section 2.3.2 – TDG Monitoring Results

Annual TDG Data

For the five years in which all four radial gates were in operation (2019-2023), TDG data were collected annually to help characterize the range of conditions throughout the spill season. **Figures 2-7, 2-8, and 2-9** show the TDG values that were measured at the Above Dam, High Bridge, and Birdland Bay Bridge monitoring sites respectively for the 2019-2023 monitoring periods.

TDG concentrations are lowest at the Above Dam site (**Figure 2-7**), and increase below the Main Channel Dam at the High Bridge site during the spill season (**Figure 2-8**). Water that passes through the two powerhouses contains lower concentrations of TDG, and mixes with the higher TDG water from the Main and Dry Channel dam spillways to lower the TDG concentrations being passed downstream. The furthest downstream monitoring site, Birdland Bay Bridge, effectively characterizes the TDG concentrations downstream of the Project (**Figure 2-9**). **Table 2-4** contains the mean percent TDG measured at the Birdland Bay Bridge site for all years in the monitoring record (2003-2023) for a given streamflow.

Figure 2-7. TDG measurements at the Above Dam monitoring site, 2019-2023

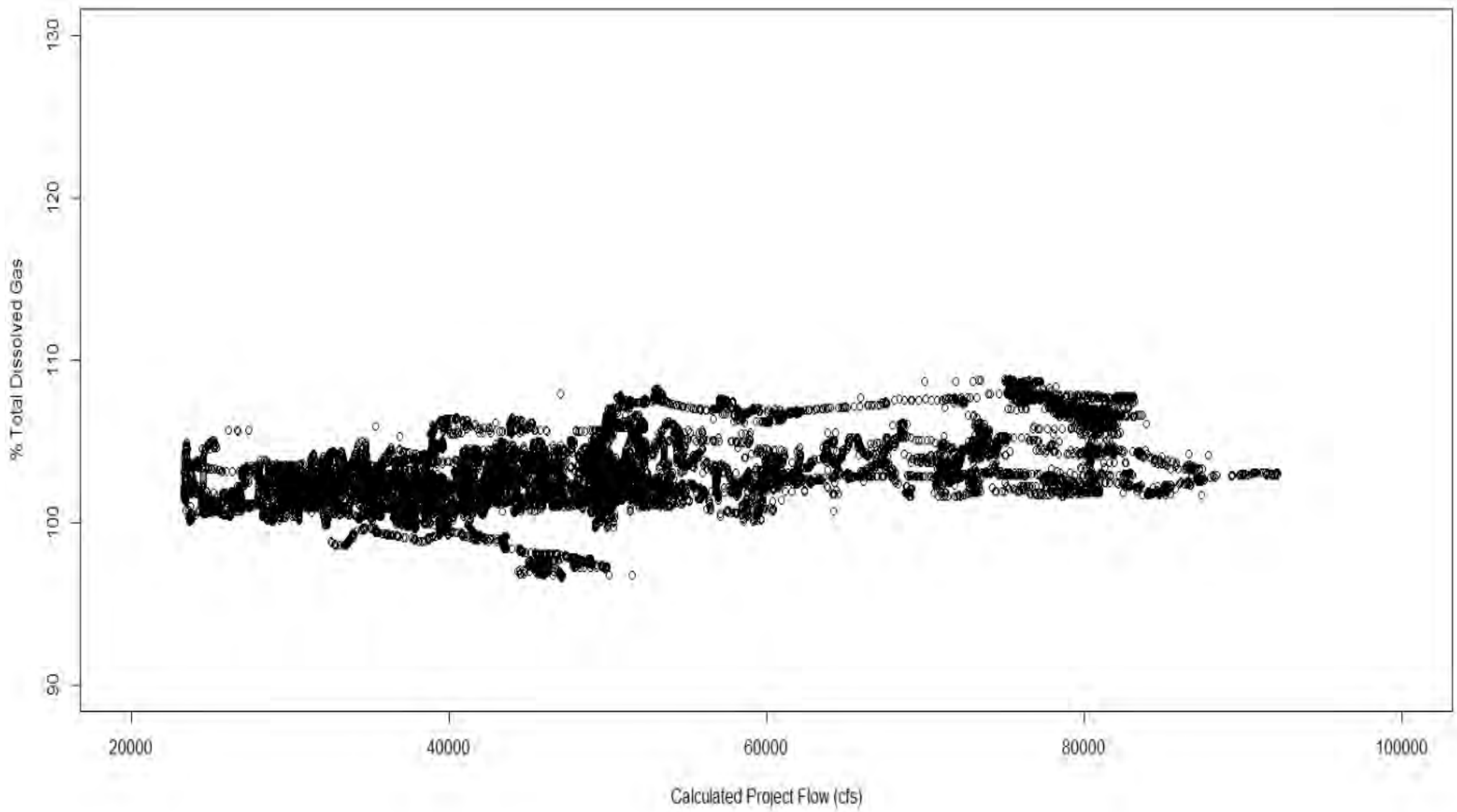


Figure 2-8. TDG measurements at the High Bridge monitoring site, 2019-2023

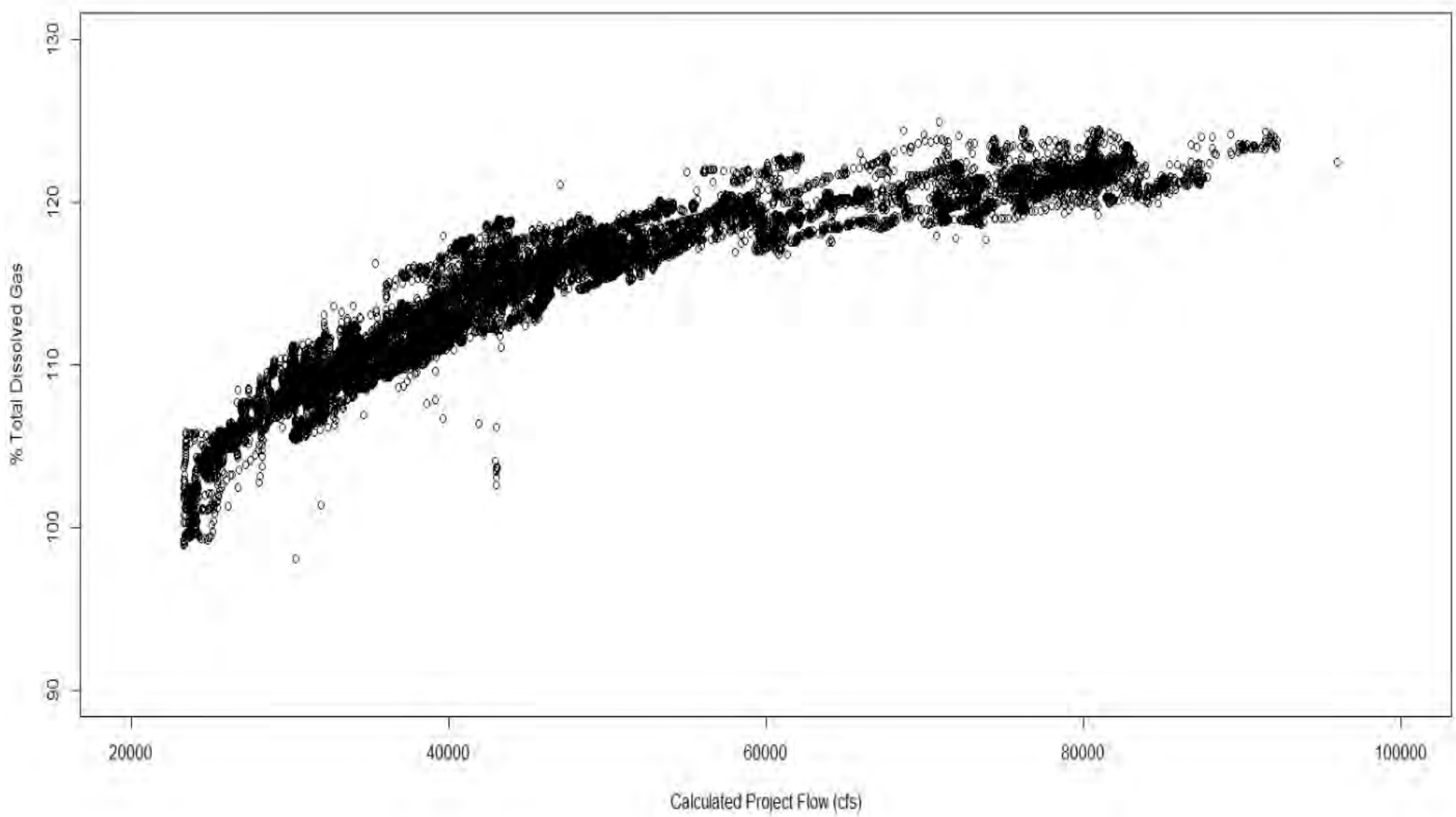
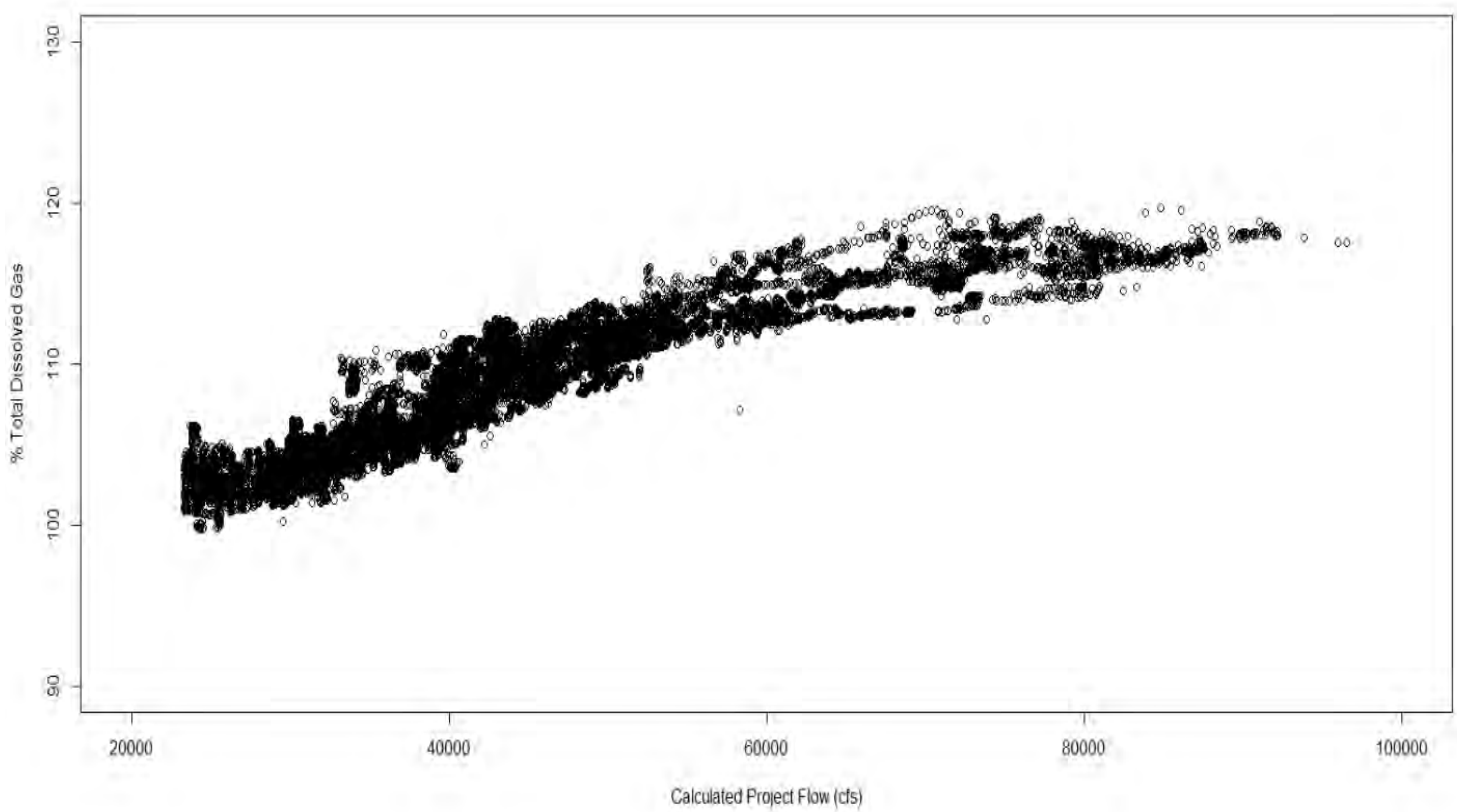


Figure 2-9. TDG measurements at the Birdland Bay Bridge monitoring site, 2019-2023



TDG upstream of the Thompson Falls Project at the Above Dam site, is generally between 100 and 108 percent of saturation regardless of river flow (**Figure 2-7**). TDG measurements collected above the Project and below the powerhouses in 2003 found that TDG in the powerhouse tailrace was generally 1 to 2 percent lower than TDG upstream of the powerhouse (PPL Montana 2010). Therefore, passing flow through the powerhouses results in slight de-gassing of the flow. For this reason, during the time periods when the spillways are not in use, TDG as measured at the Birdland Bay Bridge is generally equal to or slightly less than the TDG measured above the dams (PPL Montana 2010). While the levels of TDG at a particular streamflow varies from year to year, as shown in **Table 2-4**, there does not appear to be a pattern of changing TDG over time.

During peak discharge time periods, when total river flow exceeds 60,000 cfs, TDG exceeds 120 percent at the High Bridge monitoring site, which is downstream of the Main Channel Dam but upstream of the powerhouses' tailrace channels. Higher flows create higher levels of TDG, up to a point, though the relationship between flow and TDG is non-linear. At the highest levels of discharge, TDG at sites downstream of the Project still increases with increasing discharge, but at a much slower rate (**Figures 2-8 and 2-9**). At very high levels of discharge, the tailwater elevation downstream of the Main Channel Dam spillway and natural falls rises enough to create a backwater area near the falls, causing a reduced plunging action into the deep pool below the falls. This reduced plunging action slows the rate at which TDG is entrained downstream.

Table 2-4: Mean TDG (%) recorded over a range of discharge at the Birdland Bay Bridge on the Clark Fork River, 2003-2023

	Total Flow (in thousand cfs)									
Year	**>23, <30**	**>30, <40**	**>40, <50**	**>50, <60**	**>60, <70**	**>70, <80**	**>80, <90**	**>90, <10**	**>100, <110**	**>110, <120**
	Mean Percent Total Dissolved Gas									
2003	102.1	104.7	109.5	111.0	112.9	113.2	N/A	N/A	N/A	N/A
2004	103.5	105.0	107.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2005	103.6	107.1	110.4	112.7	114.1	114.0	N/A	N/A	N/A	N/A
2006	103.6	106.7	110.6	114.3	115.7	115.7	N/A	N/A	N/A	N/A
2007	102.5	105.2	109.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2008	102.2	105.6	110.6	114.9	116.0	115.9	N/A	N/A	N/A	N/A
2009	102.6	105.2	109.2	113.0	113.1	N/A	N/A	N/A	N/A	N/A
2010	102.0	106.6	110.9	111.6	N/A	N/A	N/A	N/A	N/A	N/A
2011	102.9	105.8	108.1	111.0	113.5	116.0	116.8	119.7	120.6	119.9
2012	102.3	104.4	108.8	111.2	113.0	112.7	112.5	N/A	N/A	N/A
2014	102.7	104.7	108.6	111.5	114.8	115.4	116.2	N/A	N/A	N/A
2017	103.0	105.2	108.7	113.9	115.2	115.6	116.6	N/A	N/A	N/A
2018	104.0	106.8	110.1	113.3	112.5	115.0	115.7	N/A	N/A	N/A
2019	102.5	104.6	110.5	112.9	113.2	N/A	N/A	N/A	N/A	N/A
2020	102.5	105.5	109.1	112.0	114.3	115.8	116.1	N/A	N/A	N/A
2021	102.9	105.1	108.7	111.8	N/A	N/A	N/A	N/A	N/A	N/A
2022	102.6	105.1	108.9	113.0	115.5	117.5	117.0	118.1	N/A	N/A

Total Flow (in thousand cfs)										
Year	**>23, <30**	**>30, <40**	**>40, <50**	**>50, <60**	**>60, <70**	**>70, <80**	**>80, <90**	**>90, <10**	**>100, <110**	**>110, <120**
Mean Percent Total Dissolved Gas										
2023	103.2	105.6	110.5	112.7	N/A	N/A	N/A	N/A	N/A	N/A
Mean % TDG 2003-2023	**102.9**	**105.5**	**109.4**	**112.6**	**114.1**	**115.2**	**115.8**	**118.9**	**120.6**	**119.9**

Notes: N/A = data not available at that flow range

Radial Gate Study and Results

NorthWestern initiated a study of various configurations of spill over the Main Channel Dam in 2019 using different combinations of two of the four radial gates to measure changes in downstream TDG. Continued investigations were formalized in a FERC-approved TDG study during relicensing of the Project in the 2021 and 2022 spill seasons (NorthWestern 2022, 2023). Two gates were tested at a time to represent potential future operating conditions. Under normal spill operation, two radial gates remain closed and held "in reserve" for the purposes of flow restoration below the dam in the event of a plant trip at the powerhouses, or if needed for reservoir elevation control. The other two remaining radial gates are used for spill operations. During the study, each radial gate spill configuration was held for approximately 4 hours to allow the downstream TDG levels to stabilize. TDG was measured below the Main Channel Dam at the High Bridge monitoring site to track changes in TDG concentrations as radial gate configurations were tested. **Table 2-5** shows a summary of the results of this testing as well as data from previous testing on the radial gates, which was conducted in 2019 and 2020. The full results of this testing can be found in **Table A-1** in **Appendix A.**

Table 2-5. Maximum and minimum TDG by total Project flow at the High Bridge (HB) monitoring site, 2019-2022

Total Project Flow Range (cfs)	Max TDG at HB (% saturation)	Gate Setting at Max TDG	Min TDG at HB (% saturation)	Gate Settings Min TDG
30,000-35,000	112.5	1 full open, 2 4' open	107.5	4-partially open
40,000-45,000	114.4	1 and 2 open	111.7	1 and 4 open
45,000-50,000	118.8	1 and 4 open	116.2	2 and 4 open
55,000-60,000[1]	121.6	3 and 4 open	119.6	1 and 2 open
55,000-60,000[2]	122.2	1 and 2 open	119.9	2 and 4 open
65,000-70,000	122.7	3 and 4 open	119.8	1 and 3 open
75,000-80,000	123.1	1 and 2 open	121.2	2 and 3 open
80,000-85,000	124.1	3 and 4 open	120.6	1 and 3 open

[1] Partial testing was conducted in 2019
[2] Full testing was conducted in 2022

Overall, the study found that while the radial gate operational scenario that entrained the least amount of TDG differed at various river flows, utilizing non-adjacent radial gates generally entrains less TDG downstream than utilizing adjacent radial gates (i.e. Radial Gates 1 and 2 used together or Radial Gates 3 and 4 used together). Opening non-adjacent radial gates during spill operations will most likely minimize the amount of TDG entrained downstream, however operation in this manner may not be practical at all times due to the need to flush large woody debris from the trash boom to prevent the debris from building up on the upstream face of the Main Channel and Dry Channel dams.

The buildup of large woody debris on the upstream faces of the Main Channel and Dry Channel dams can lead to situations where the metal stanchions on the dams need to be removed to ensure adequate flow passage and to maintain the structural integrity of the dams. The stanchions hold the dam panels in place, which control reservoir elevation. When the stanchions are removed, NorthWestern loses the ability to control reservoir elevation as well as the ability to operate the fish ladder until spring runoff recedes and the dams have been repaired.

In previous instances where the removal of the stanchions has occurred, there was a large increase in the percent of TDG entrained downstream due to uncontrolled releases of water over the dam. In 2018, which was the last time the stanchions were removed, there was a 5 percent increase in TDG at the High Bridge site following the stanchion removal (NorthWestern 2018). The drastic increase in TDG entrainment from stanchion removal is far more significant than the differences in TDG entrainment from operating adjacent radial gates vs non-adjacent radial gates, therefore radial gate operations should be conducted in a way to facilitate passage of debris and minimize the need for emergency stanchion removal.

Section 3.0 – Proposed Project Operations and TDG Monitoring Schedule

Section 3.1 – Spill Operations Sequence

Using the TDG data collected from 2019-2023, NorthWestern has developed a spill operations sequence to be implemented upon FERC approval of the new license. The updated spill operations sequence mimics the operations and intent of the 2010 TDG Control Plan, but incorporates the infrastructure of the four radial gates and their contribution to downstream TDG (**Appendix B**).

At lower total Project flows, when the fish passage facility is operating, the spill operations sequence will be designed to optimize upstream fish passage efficiency. This may include removing one panel or a combination of panels to attract fish to the fish ladder. Similar to the 2010 TDG Control Plan, spill panels will then be removed from the side of the dam opposite of the fish ladder to maintain reduced river velocities near the fish ladder. Only one radial gate, Radial Gate #1 (**Figure 2-3**), is planned to be used in the open position at this point in the sequence so that lower river velocities through the natural falls area can be maintained. Because the trash boom is connected to Radial Gate #1, that gate will be the primary means of passing debris downstream to prevent it from building up on the upstream face of the Main Channel Dam. Bays 13 through 15 on the Main Channel Dam, which abut Radial Gate #1, should remain closed throughout most of the spill sequence to avoid pulling debris under the trash boom resulting in debris buildup on those stanchions. Because utilizing non-adjacent radial gates together produces less downstream TDG than adjacent radial gates (**Table 2-5**), Radial Gate #3 will be used periodically for reservoir elevation control as dam panels are being removed, so that the water surface elevation of the reservoir can be maintained.

The maximum operational capacity at the fish ladder is 48,500 cfs, so when total Project flow exceeds this value, spill operations will then be designed to minimize TDG concentrations downstream. To minimize TDG concentrations downstream, the removal of the remaining spill panels on the Main Channel Dam will be done prior to utilizing Radial Gate #3 fully, which would occur at approximately 72,391 cfs. The radial gate study showed that operating Radial Gates #1 and #3 together at total Project flows above 65,000 cfs entrained the least amount of TDG downstream.

The complete sequence of spill operations is as follows with the approximate total river flow for each sequence shown in parentheses:

1. Removal of one or more panels from Bays 1 through 10 on the Main Channel Dam to be used as fish attractant flow (< 23,555 cfs).
2. Remove panels from Bays 34 through 26, sequentially, starting at Bay 34 on the Main Channel Dam (23,555–36,245 cfs).
3. Open Radial Gate #1 (36,246–47,245 cfs).
4. Remove panels from Bays 12, 23, 11, 22, 10, 21, 9, 20, 8, 19, 7, and 18, sequentially starting at Bay 12, to spread out the flow across the face of the Main Channel Dam (47,246–64,165 cfs).
5. Remove panels from Bays 6 through 1, sequentially starting at Bay 6, on the Main Channel Dam (64,166–72,390 cfs).
6. Open Radial Gate #3 on the Main Channel Dam (72,391–83,390 cfs).
7. Remove panels from Bays 12 through 1, sequentially starting at Bay 12, on the Dry Channel Dam (83,391–100,310 cfs).
8. Remove panels from Bays 13 through 15, sequentially starting at Bay 13, on the Main Channel Dam (100,311–104,540 cfs).
9. Open Radial Gate #2 on the Main Channel Dam (104,541–115,540 cfs).
10. Open Radial Gate #4 on the Main Channel Dam (115,541–126,540 cfs).

Section 3.2 – TDG Monitoring Schedule

TDG monitoring under this updated TDG Control Plan will occur annually for the first three years to validate the effectiveness of the plan. After the three-year validation period, the normal TDG monitoring schedule will continue in high water years where the most probable (50 percent) April 1 Natural Resources Conservation Service (NRCS) runoff forecast for the U.S. Geological Survey (USGS) Clark Fork River near Plains, Montana stream gage (12389000) is at or above 125 percent. This trigger value is an accurate predictor of years in which elevated concentrations of TDG are likely to be found. Monitoring will occur throughout the spring runoff season (April-July) at the same three established monitoring sites identified in **Section 2.3.1**.

In years where TDG is monitored at the Project, NorthWestern will submit collected TDG data to the DEQ and report the results of that monitoring effort to the Thompson Falls Fisheries TAC at the annual TAC meeting.

Section 4.0 – Discussion

The previously developed 2010 Total Dissolved Gas Control Plan for the Thompson Falls Project was designed to manage Project operations to minimize the entrainment of downstream TDG. Since late 2018, upgrades to infrastructure at the Main Channel Dam have changed how river flow is passed over the dam during the spill season. This updated plan addresses the changes to the project infrastructure, the new radial gates' effect on downstream TDG, and provides a sequence of operations for managing water during the spill season to both optimize upstream fish passage efficiencies and minimize downstream TDG concentrations.

Radial Gate #1 will be the first radial gate used during spill operations due to its location on the Main Channel Dam in relation to the trash boom. As debris builds up on the Main Channel Dam, Radial Gate #1 is used to flush that debris downstream to help maintain the structural integrity of the dam. The 2019-2022 radial gate testing concluded that operating non-adjacent radial gates in conjunction with one another generally entrained less downstream TDG than operating adjacent radial gates in that fashion. Because of this, Radial Gate #3 will be the next radial gate to be used for spill operations (**Table B-1** in **Appendix B**). Radial Gate #3 may also be periodically used for reservoir elevation control as dam panels are being either removed or installed throughout the spill operations sequence.

At total Project flows of 48,500 cfs or less, spill over the Main Channel Dam will be managed to optimize upstream fish passage efficiency. When total Project flow exceeds 48,500 cfs, the operational capacity of the fish ladder, spill will be managed to minimize the downstream concentrations of TDG. Coincidentally, this level of Project flow is where TDG concentrations have historically started to exceed 110 percent TDG at the Birdland Bay Bridge site and 120 percent TDG at the High Bridge site below the Main Channel Dam, necessitating the need for minimizing downstream TDG at this point in the spill operations sequence. **Section 3.1** and **Table B-1** in **Appendix B** outline the spill operations sequence to be used to accomplish this management strategy.

Since routing Project flows through the powerhouses results in lower downstream TDG than routing Project flows through the spillways, NorthWestern will prioritize using the powerhouses to pass Project flows over using the spillways in most circumstances. There are circumstances where this is not possible or feasible from an operations standpoint due to outages, negative market pricing, and grid reliability, which may necessitate the need to use the spillways instead of the powerhouses to pass Project flow. To minimize the impacts resulting from this, planned maintenance activities requiring the re-routing of flow from the powerhouses to the spillways will be scheduled outside of the spill season, whenever possible, to minimize Project TDG contributions downstream. There may be some unavoidable instances however where maintenance or construction timelines require units in the powerhouses to be offline during the spill season.

If future significant changes to Project infrastructure or management alter the way that water is routed through the Project, resulting in changes to the contribution of downstream TDG, NorthWestern will consult with DEQ to update the TDG Control Plan, if necessary, and submit the updated plan to FERC.

Section 5.0 – References

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Appendix A – Thompson Falls Radial Gate Testing Results

Table A-1. Results of radial gate testing at the Main Channel Dam and associated TDG monitoring at the High Bridge site conducted at the Project from 2019-2022

Date of Test	Gate 1 Status	Gate 2 Status	Gate 3 Status	Gate 4 Status	Approximate Total River Flow (cfs)	Average % TDG During Testing Phase (HB Site)
6/20/2021	Full Open	4' Open			30,000-35,000	112.5
6/20/2021		Full Open	4' Open		30,000-35,000	111.9
6/20/2021			Full Open	4' Open	30,000-35,000	111.0
6/21/2021	3' Open			Full Open	30,000-35,000	109.4
6/21/2021		3' Open		Full Open	30,000-35,000	109.6
6/21/2021			3' Open	Full Open	30,000-35,000	110.3
6/25/2021	8.3'-8.4' Open				30,000-35,000	107.8
6/25/2021		8.4'-8.0' Open			30,000-35,000	108.5
6/25/2021			8.0'-7.7' Open		30,000-35,000	108.1
6/25/2021				7.7'-8.2' Open	30,000-35,000	107.5
6/16/2021	Open	Open			40,000-45,000	114.4
6/16/2021	Open		Open		40,000-45,000	113.2
6/16/2021	Open			Open	40,000-45,000	111.7
6/17/2021		Open		Open	40,000-45,000	112.5
6/17/2021		Open	Open		40,000-45,000	113.4
6/17/2021			Open	Open	40,000-45,000	113.5
5/23/2019	Open	Open			45,000-50,000	118.0
5/23/2019	Open		Open		45,000-50,000	118.3

Date of Test	Gate 1 Status	Gate 2 Status	Gate 3 Status	Gate 4 Status	Approximate Total River Flow (cfs)	Average % TDG During Testing Phase (HB Site)
5/23/2019	Open			Open	45,000-50,000	118.8
5/23/2019	Open	Open			45,000-50,000	118.7
5/24/2019	Open	Open			45,000-50,000	117.4
5/24/2019		Open	Open		45,000-50,000	116.7
5/24/2019		Open		Open	45,000-50,000	116.2
5/24/2019	Open	Open			45,000-50,000	117.1
5/21/2019	Open	Open			55,000-60,000	119.6
5/21/2019			Open	Open	55,000-60,000	121.6
5/21/2019	Open	Open			55,000-60,000	120.9
6/30/2022	Open	Open			55,000-60,000	122.2
6/30/2022	Open		Open		55,000-60,000	121.7
6/30/2022	Open			Open	55,000-60,000	121.3
6/30/2022		Open	Open		55,000-60,000	120.6
7/1/2022		Open		Open	55,000-60,000	119.9
7/1/2022			Open	Open	55,000-60,000	120.3
5/30/2020	Open	Open			65,000-70,000	120.5
5/30/2020	Open		Open		65,000-70,000	119.8
5/30/2020	Open			Open	65,000-70,000	120.1
5/30/2020		Open		Open	65,000-70,000	120.7
5/30/2020		Open	Open		65,000-70,000	120.1
5/31/2020			Open	Open	65,000-70,000	122.7
6/3/2020	Open	Open			75,000-80,000	123.5

Date of Test	Gate 1 Status	Gate 2 Status	Gate 3 Status	Gate 4 Status	Approximate Total River Flow (cfs)	Average % TDG During Testing Phase (HB Site)
6/3/2020	Open		Open		75,000-80,000	121.5
6/3/2020	Open			Open	75,000-80,000	121.6
6/3/2020		Open		Open	75,000-80,000	123.0
6/3/2020		Open	Open		75,000-80,000	121.2
6/4/2020			Open	Open	75,000-80,000	123.1
6/15/2022	Open	Open			80,000-85,000	121.0
6/15/2022	Open		Open		80,000-85,000	120.6
6/15/2022	Open			Open	80,000-85,000	121.0
6/16/2022		Open	Open		80,000-85,000	121.5
6/16/2022		Open		Open	80,000-85,000	121.6
6/21/2022			Open	Open	80,000-85,000	124.1

Appendix B – Thompson Falls Spill Operations Sequence

Table B-1. Spill operations sequence when total Project flow exceeds powerhouse capacity

Thompson Falls Spill Operations Sequence																																						
Main Channel Dam Bay/Gate Number and Number of Panels to be Removed																																						
Sequence Step	Bay Numbers															Gate Numbers		Bay Numbers						Gate Numbers		Bay Numbers									Total Panels	Number of Spill Gates Open	Total Flow	Upstream Fish Passage
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Gate 1	Gate 2	18	19	20	21	22	23	Gate 3	Gate 4	26	27	28	29	30	31	32	33	34				
1	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed										1	0	23,555	Yes
2	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed									6	7	0	24,965	Yes
3	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed								6	6	13	0	26,375	Yes
4	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed							6	6	6	19	0	27,785	Yes
5	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed						6	6	6	6	25	0	29,195	Yes
6	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed					6	6	6	6	6	31	0	30,605	Yes
7	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed				6	6	6	6	6	6	37	0	32,015	Yes
8	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed			6	6	6	6	6	6	6	43	0	33,425	Yes
9	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed		6	6	6	6	6	6	6	6	49	0	34,835	Yes
10	1	*	*	*	*	*	*	*	*	*						Closed	Closed							Closed	Closed	6	6	6	6	6	6	6	6	6	55	0	36,245	Yes
11	1	*	*	*	*	*	*	*	*	*						Open	Closed							Closed	Closed	6	6	6	6	6	6	6	6	6	55	1	47,245	Yes
12	1	*	*	*	*	*	*	*	*	*		6				Open	Closed							Closed	Closed	6	6	6	6	6	6	6	6	6	61	1	48,655	No
13	1	*	*	*	*	*	*	*	*	*		6				Open	Closed						6	Closed	Closed	6	6	6	6	6	6	6	6	6	67	1	50,065	No
14	1	*	*	*	*	*	*	*	*	*	6	6				Open	Closed						6	Closed	Closed	6	6	6	6	6	6	6	6	6	73	1	51,475	No
15	1	*	*	*	*	*	*	*	*	*	6	6				Open	Closed					6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	79	1	52,885	No
16	1	*	*	*	*	*	*	*	*	6	6	6				Open	Closed					6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	85	1	54,295	No
17	1	*	*	*	*	*	*	*	*	6	6	6				Open	Closed				6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	91	1	55,705	No
18	1	*	*	*	*	*	*	*	6	6	6	6				Open	Closed				6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	97	1	57,115	No
19	1	*	*	*	*	*	*	*	6	6	6	6				Open	Closed			6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	103	1	58,525	No
20	1	*	*	*	*	*	*	6	6	6	6	6				Open	Closed			6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	109	1	59,935	No
21	1	*	*	*	*	*	*	6	6	6	6	6				Open	Closed		6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	115	1	61,345	No
22	1	*	*	*	*	*	6	6	6	6	6	6				Open	Closed		6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	121	1	62,755	No
23	1	*	*	*	*	*	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	127	1	64,165	No
24	1	*	*	*	*	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	133	1	65,575	No
25	1	*	*	*	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	139	1	66,985	No
26	1	*	*	6	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	145	1	68,395	No
27	1	*	6	6	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	151	1	69,805	No
28	1	6	6	6	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	157	1	71,215	No
29	6	6	6	6	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Closed	Closed	6	6	6	6	6	6	6	6	6	162	1	72,390	No
30	6	6	6	6	6	6	6	6	6	6	6	6				Open	Closed	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	6	6	6	162	2	83,390	No

*At total Project flows below 48,500 cfs, one panel or a combination of panels may be removed from the Main Channel Dam, Bays 1-10, and used for attraction flow to the upstream fish passage facility. This panel may be moved periodically as needed to optimize fish passage efficiency.

NorthWestern Energy

Thompson Falls Spill Operations Sequence

Dry Channel Dam Bay Number and Number of Panels to be Removed

Sequence Step	Bay Numbers												Main Dam Flow	Total Panels	Number of Spill Gates Open	Total Flow	Upstream Fish Passage
	1	2	3	4	5	6	7	8	9	10	11	12					
31												6	83,390	168	2	84,800	No
32											6	6	83,390	174	2	86,210	No
33										6	6	6	83,390	180	2	87,620	No
34									6	6	6	6	83,390	186	2	89,030	No
35								6	6	6	6	6	83,390	192	2	90,440	No
36							6	6	6	6	6	6	83,390	198	2	91,850	No
37						6	6	6	6	6	6	6	83,390	204	2	93,260	No
38					6	6	6	6	6	6	6	6	83,390	210	2	94,670	No
39				6	6	6	6	6	6	6	6	6	83,390	216	2	96,080	No
40			6	6	6	6	6	6	6	6	6	6	83,390	222	2	97,490	No
41		6	6	6	6	6	6	6	6	6	6	6	83,390	228	2	98,900	No
42	6	6	6	6	6	6	6	6	6	6	6	6	83,390	234	2	100,310	No

Thompson Falls Spill Operations Sequence

Main Channel Dam Bay/Gate Number and Number of Panels to be Removed

Sequence Step	Bay Numbers															Gate Numbers		Bay Numbers						Gate Numbers		Bay Numbers									Total Panels	Number of Spill Gates Open	Total Flow	Upstream Fish Passage
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Gate 1	Gate 2	18	19	20	21	22	23	Gate 3	Gate 4	26	27	28	29	30	31	32	33	34				
43	6	6	6	6	6	6	6	6	6	6	6	6	6			Open	Closed	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	6	6	6	240	2	101,720	No
44	6	6	6	6	6	6	6	6	6	6	6	6	6	6		Open	Closed	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	6	6	6	246	2	103,130	No
45	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	6	6	6	252	2	104,540	No
46	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	Open	Open	6	6	6	6	6	6	Open	Closed	6	6	6	6	6	6	6	6	6	252	3	115,540	No
47	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	Open	Open	6	6	6	6	6	6	Open	Open	6	6	6	6	6	6	6	6	6	252	4	126,540	No

Appendix C - Documentation of Consultation

From: Tollefson, Jordan
To: Metzner, Gabrielle; Bushnell, Ella; Kron, Darrin; Keenan Storrar; "Erik.Englebert@mt.gov"
Cc: "Welch, Andrew"; "Babcock, Sarah (Sady)"; ggillin@geiconsultants.com
Subject: Thompson Falls Total Dissolved Gas Control Plan - Final Version
Date: Monday, May 20, 2024 5:32:00 PM
Attachments: 2024 Thompson Falls TDG Control Plan 5.20.24 Final Version.pdf

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Thank you all for taking the time to review and provide comments on the Thompson Falls TDG Control Plan. NorthWestern has incorporated your suggestions by providing the following updates to the document:

- Language has been added to Section 3.1 and Section 4.0 to further clarify how Radial Gates #1 and #3 will be used to minimize the downstream concentrations of TDG to the best extent practicable.
- Language has been added to Section 3.2 discussing TDG data submittal to DEQ in years when TDG data are collected.
- Language has been added to Section 4.0 to address powerhouse utilization to reduce downstream TDG and the scheduling of future planned maintenance and construction activities outside of the spring runoff period whenever possible.

Attached is the final version of the TDG Control Plan for your records. We will be submitting the plan to FERC this week to satisfy the Additional Information Request for our License application.

Jordan Tollefson
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NorthWestern Energy
Delivering a Bright Future
Connect With Us:

From: Storrar, Keenan
To: Tollefson, Jordan; Metzner, Gabrielle; Bushnell, Ella; Kron, Darrin
Cc: Welch, Andrew; ggillin@geiconsultants.com; Babcock, Sarah (Sady); Englebert, Erik
Subject: [EXTERNAL] RE: Thompson Falls TDG Control Plan Draft for Agency Review
Date: Monday, May 6, 2024 9:31:20 AM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.png
image007.png

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Jordan,

DEQ has reviewed the Thompson Falls TDG Control Plan proposal and is providing these comments:

1. Data submission: The plan includes a trigger for when TDG data will be collected. Please submit instantaneous TDG data via EQuIS EDD format to MT DEQ. An alternative format is acceptable if the data is continuously collected by an insitu sonde.
2. Utilize Powerhouses to the Maximum Extent Practicable In Lieu of Spilling: "TDG measurements collected above the Project and below the powerhouses in 2003 found that TDG in the powerhouse tailrace was generally 1 to 2 percent lower than TDG upstream of the powerhouse" (TDG Control Plan). The Powerhouse can pass a maximum of ~23,300 cfs. The plan should include a narrative that the powerhouse capacity will be fully utilized to the maximum extent practicable to prevent spilling and the powerhouse turbines should be scheduled to be taken off line for maintenance or repair outside of the spring runoff/peak flow season to minimize TDG concentrations in the Clark Fork River downstream of the Project.
3. Incorporate Radial Gate Study Results into Spill Operations Sequence: "NorthWestern initiated a study of various configurations of spill over the Main Channel Dam in 2019-2022 using different combinations of two of the four radial gates to measure changes in downstream TDG. Two gates were tested at a time to represent potential future operating conditions" (TDG Control Plan). The 'Appendix A – Thompson Falls Radial Gate Testing Results' shows the most advantageous radial gate opening sequences minimizing TDG levels at the High Bridge Site for flows ranging from 30,000 cfs up to 85,000 cfs. It does not appear the Thompson Falls Spill Operations Sequence in Appendix B utilizes these data in the best practicable manner to minimize TDG concentrations in the Clark Fork River downstream of the Project. The Spill Operations Sequence proposes to open Gate 1 when spill reaches 47,245 cfs and proposes to open Gate 2 when spill reaches 83,390 cfs. The Spill Operations Sequence in Appendix B should consider incorporating the Radial Gate Study spill sequencing

results to minimize TDG concentrations in the Clark Fork River downstream of the Project.

Let me know if you have any questions.

Thank you,
Keenan Storrar | 401/318 coordinator
Water Protection Bureau
Montana Department of Environmental Quality
Office: 406-444-2734

DEQ Montana Department of Environmental Quality

How did we do? »

From: Tollefson, Jordan <Jordan.Tollefson@northwestern.com>
Sent: Friday, April 5, 2024 4:02 PM
To: Storrar, Keenan <Keenan.Storrar@mt.gov>; Metzner, Gabrielle <Gabrielle.Metzner@mt.gov>; Bushnell, Ella <Ella.Bushnell@mt.gov>; Kron, Darrin <dkron@mt.gov>
Cc: Andy Welch <andrew.welch@northwestern.com>; ggillin@geiconsultants.com; Babcock, Sarah (Sady) <Sady.Babcock@northwestern.com>
Subject: [EXTERNAL] Thompson Falls TDG Control Plan Draft for Agency Review

Hello,

NorthWestern has developed an updated Total Dissolved Gas (TDG) Control Plan for the Thompson Falls Project, and is submitting this draft to DEQ for a 30-day agency review prior to our submittal to FERC. Please see the attached draft of the plan and provide any comments that you may have on the plan by Tuesday, May 7th. If you have any questions, please don't hesitate to reach out to me about this. I hope you all have a wonderful weekend!

Jordan

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