



2018 Annual Fisheries Monitoring Report

Mystic Lake Hydroelectric Project FERC Project Number 2301

**March 2019
Public**



Submitted by:
NorthWestern Energy Corporation
Butte, Montana

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

New Wave Environmental Consulting, LLC
Missoula, Montana

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Acronyms

° C	degrees in Celsius
° F	degrees in Fahrenheit
APH	above Powerhouse
BPH	below Powerhouse
BWRL	below West Rosebud Lake
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
DEQ	Montana Department of Environmental Quality
EB	Brook trout
FERC	Federal Energy Regulatory Commission
FWP	Montana Fish, Wildlife and Parks
Licensee	NorthWestern Energy Corporation
LL	Brown trout
mm	millimeter
NorthWestern Project	NorthWestern Energy Corporation Mystic Lake Hydroelectric Project
RB	Rainbow trout
TAC	Technical Advisory Committee
USFS	U.S. Forest Service

Executive Summary

Mystic Lake Hydroelectric Project No. 2301 (Project) is operated and owned by NorthWestern Energy Corporation (NorthWestern or Licensee). Section 4(e) condition 16 requires the Licensee to prepare and implement a fisheries monitoring plan that must be approved by the Mystic Lake Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee (TAC), including agency representation from the U.S. Forest Service (USFS), Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP).

In consultation with the TAC, NorthWestern updated the 6-Year Fisheries Monitoring Plan (Plan) for implementation between 2016 and 2021. The Federal Energy Regulatory Commission (FERC or Commission) accepted the updated Plan in a letter dated June 17, 2016. The following outlines the schedule for continuation of fisheries monitoring activities between 2016 and 2021, as specified in the Plan.

Year	A	B	C	D	E	F
2016				X		X
2017		X	X		X	
2018	X					X
2019				X	X	
2020		X	X			
2021	X				X	

A = Mystic Lake monitoring

B = West Rosebud Creek between the dam and powerhouse

C = West Rosebud and Emerald lakes fish monitoring

D = West Rosebud Creek below Emerald Lake electrofishing

E = West Rosebud Creek fall redd counts

F = Water temperature monitoring

This report summarizes fisheries monitoring efforts completed by NorthWestern and TAC members in 2018, including Mystic Lake fisheries monitoring and stream temperature monitoring in West Rosebud Creek.

Mystic Lake Monitoring

The Mystic Lake fisheries survey occurred in August 2018. Sampling efforts included angling and gillnetting. Catch per unit effort, fish per hour was greater when angling (9.5 fish per hour) *versus* gillnetting (1.5 fish per hour), as was observed in past surveys.

Length-frequency histograms for rainbow trout showed similar trends in 2018 as in past years. Rainbow trout caught via angling were generally larger (in length) than fish collected in gillnets. Size distribution of rainbow trout in Mystic Lake in 2018 ranged from 135 to 419 mm (5.3-16.5 inches) and the data show there is recruitment of young fish into the population. Rainbow trout larger than 400 mm (15.7 inches) are not common.

Stream Temperature Monitoring

Stream temperatures were monitored at three designated locations in West Rosebud Creek from April 12 through September 30. Maximum stream temperatures did not exceed 16.0 °C (60.8 °F) in 2018. As in previous years of monitoring, peak temperatures in West Rosebud Creek remain within the preferred range for salmonids (less than 22 °C) in West Rosebud Creek and are not limiting for salmonid species present.

Redd Survey

In 2018, FWP completed two redd surveys in the autumn and identified a total of 35 redds; 31 brown trout redds and 4 brook trout redds. The total redd count in 2018 for brown trout was similar to past redd surveys between 2009 and 2013 and approximately double recent redd surveys in 2014 and 2015.

Reporting and Compliance

NorthWestern will continue to summarize and present the results of fisheries monitoring activities to the TAC annually, and every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary, for the term of the Project License.

In 2022, NorthWestern will prepare a 6-year comprehensive report summarizing fisheries activities completed between 2016 and 2021. The comprehensive report will be submitted to the TAC for review and approval prior to filing with the Commission (no later than December 31, 2022).

The annual reports, which are required by FERC and distributed to the TAC members for their project files, are posted to the Mystic Lake Project Coordination website, www.mysticlakeproject.com.

1. Introduction

Mystic Lake Hydroelectric Project No. 2301 (Project) is operated and owned by NorthWestern Energy Corporation (NorthWestern or Licensee). The Project is situated in south-central Montana, primarily located in Stillwater County with a very small portion within Carbon County. The Project is located in the Beartooth Mountain Range and surrounded on three sides by the Absaroka-Beartooth Wilderness Area. Mystic Lake is located at the head of a high mountain canyon, (El. 7,673.5 feet above mean sea level) in the upper reaches of West Rosebud Creek. Within West Rosebud Creek drainage (213.4 square miles), Mystic Lake is the fourth and largest lake in a chain of six hydraulically-connected lakes (listed in order going downstream: Star, Silver, Island, Mystic, West Rosebud, and Emerald). The Beartooth Ranger District of the Custer National Forest manages approximately 124.7 square miles of the West Rosebud Creek drainage while the remaining 88.7 square miles is privately-owned land.

On December 17, 2007, the Federal Energy Regulatory Commission (FERC or Commission) issued a new License for the Project, effective January 1, 2010 (121 FERC ¶62, 198). The new License includes the U.S. Forest Services (USFS) Section 4(e) Terms and Conditions filed on May 3, 2007. Section 4(e) condition 16 requires the Licensee to prepare and implement a fisheries monitoring plan that must be approved by the Mystic Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee (TAC), represented by USFS, Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP).

NorthWestern revised the 6-year Fisheries Monitoring Plan (Plan), in consultation with the TAC, for implementation between 2016 and 2021. FERC accepted the revised Plan in a letter dated, June 17, 2016. The schedule for fisheries monitoring activities between 2016 and 2021 is outlined in Table 1-1; the sampling locations are identified in Figure 1-1.

Table 1-1. Mystic Lake Hydroelectric Project 6-Year (2016-2021) Fisheries Monitoring Schedule (NorthWestern, 2016a).

Year	A	B	C	D	E	F
2016				X		X
2017		X	X		X	
2018	X					X
2019				X	X	
2020		X	X			
2021	X				X	

A = Mystic Lake monitoring

B = West Rosebud Creek between the dam and powerhouse

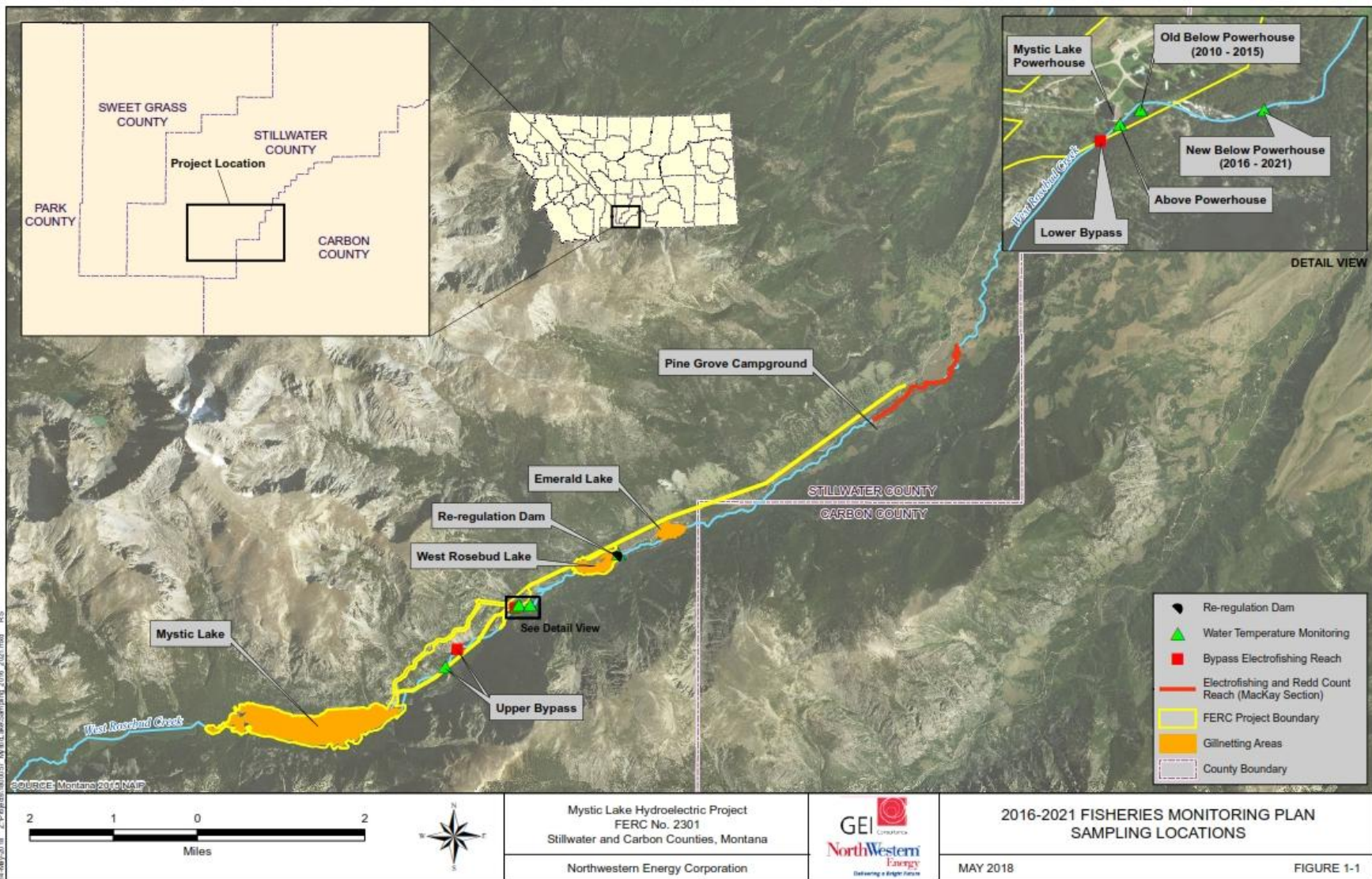
C = West Rosebud and Emerald lakes fish monitoring

D = West Rosebud Creek below Emerald Lake electrofishing

E = West Rosebud Creek fall redd counts
F = Water temperature monitoring

This report summarizes fisheries monitoring efforts completed by NorthWestern and TAC members in 2018 to comply with the fisheries monitoring plan and schedule (Table 1-1). Fisheries surveys completed in 2018 included Mystic Lake monitoring and stream temperature monitoring at four designated locations (upper bypass, above powerhouse, below powerhouse, and below West Rosebud Lake) in West Rosebud Creek. A fall redd count was also completed in West Rosebud Creek in 2018.

Figure 1-1: 2016-2021 Fisheries Monitoring Plan sampling locations.



2. Mystic Lake Monitoring

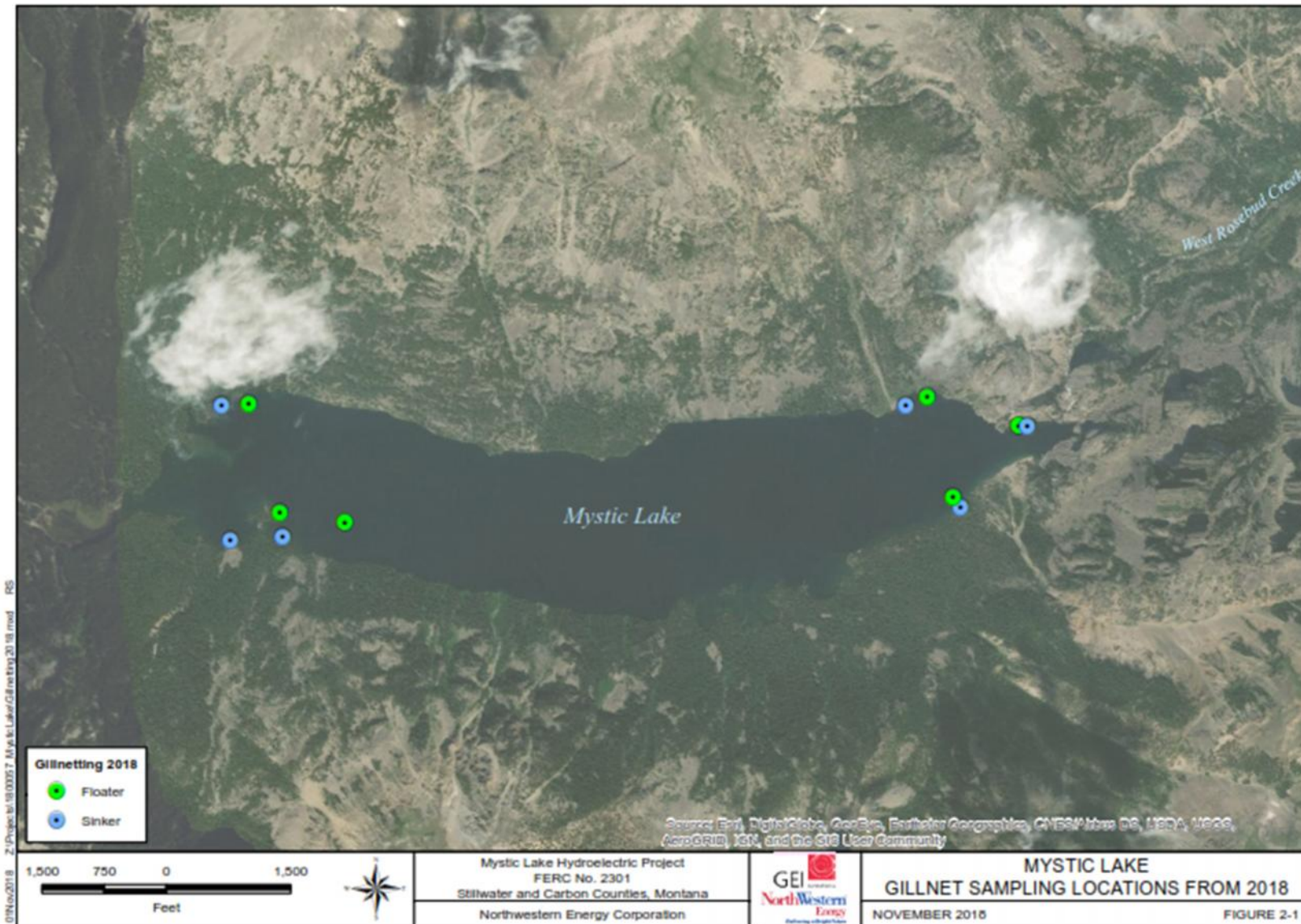
Mystic Lake monitoring occurs every third year (2018, 2021) to record resident fishery trends. The monitoring efforts will include:

- Summer netting with experimental floating and sinking gillnets in two standardized locations (upper and lower ends of the lake). Biological data collected include the number of fish caught by species and length and weight.
- Angling to capture fish in the upper and lower areas of Mystic Lake. Biological data collected include catch per unit effort (CPUE), length and weight, and physical characteristics.

A summary of Mystic Lake monitoring between 2003 and 2015 is summarized in *the 6-Year (2010-2015) Fisheries Monitoring Report* (NorthWestern, 2016). Sampling locations in 2018 (Figure 2-1) were similar to previous years and methods for data collection remained the same. A summary of the gillnetting and angling efforts from 2018 are summarized in this report.

The Licensee completed gillnetting and angling efforts in August 2018. The data refer to the hybrid swarm rainbow trout population (referred to as rainbow trout in this report) observed in Mystic Lake and have been summarized by CPUE (measured in fish per hour) and using length-frequency histograms.

Figure 2-1: Mystic Lake gillnet sample locations from 2018.



2.1 Gillnet and Angling Results

A summary of the total number of rainbow trout captured, total duration of effort (hours), and CPUE via gillnetting and angling in Mystic Lake in 2018 compared to previous sample years is presented in Table 2-1.

Table 2-1: Summary of the total fish, total hours of effort, and total CPUE (fish per hour) for angling and gillnetting efforts completed in Mystic Lake in 2003, 2009, 2012, 2015, and 2018.

Year	Sampling Method	Total Fish Caught	Total Hours	CPUE (Fish / Hour)
2003	Angling	733	93.3	7.9
2009	Angling	124	16.5	7.5
2012	Angling	52	13.0	4.0
2015	Angling	86	18.8	4.6
2018	Angling	101	10.6	9.5
2003	Gillnet	86	176.2	0.5
2009	Gillnet	254	160.1	1.6
2012	Gillnet	141	148.4	1.0
2015	Gillnet	221	180.4	1.2
2018	Gillnet	264	176.8	1.5

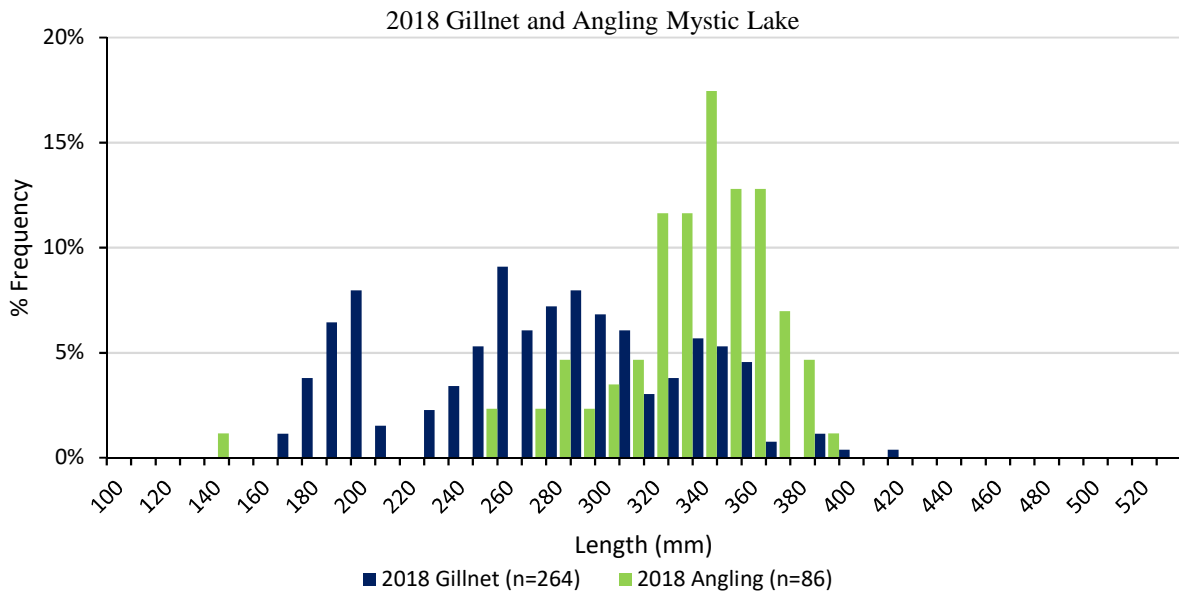
Between 2003 and 2018, CPUE when angling, ranged from 4.0 fish per hour to 9.5 fish per hour while CPUE when gillnetting ranged from 0.5 fish per hour to 1.6 fish per hour. CPUE yielded higher rates while angling than gillnetting during each year of sampling. Angling CPUE rates were greatest in 2018 (9.5 fish per hour), approximately double the angling CPUE rates of 2015 and 2012 efforts. Gillnetting CPUE rates remained low and relatively constant since 2003 ranging between 0.5 fish per hour and 1.6 fish per hour.

2.1.1 Length-Frequency Distribution

Length-frequency histograms for rainbow trout captured in Mystic Lake via angling and gillnetting in 2018 are shown in Figure 2-2. Length-frequency histograms for rainbow trout captured gillnetting in the upper and lower sections in Mystic Lake are shown in Figure 2-3.

Angling efforts appear to capture larger size classes of rainbow trout than gillnetting (Figure 2-2). Rainbow trout collected while angling ranged in size from 135 to 389 mm (5.3-15.3 inches) with an average length of 327 mm (12.9 inches) and a median length of 330 mm (13 inches). The majority of rainbow trout collected angling were between 320 and 370 mm (12.6-14.6 inches) in length.

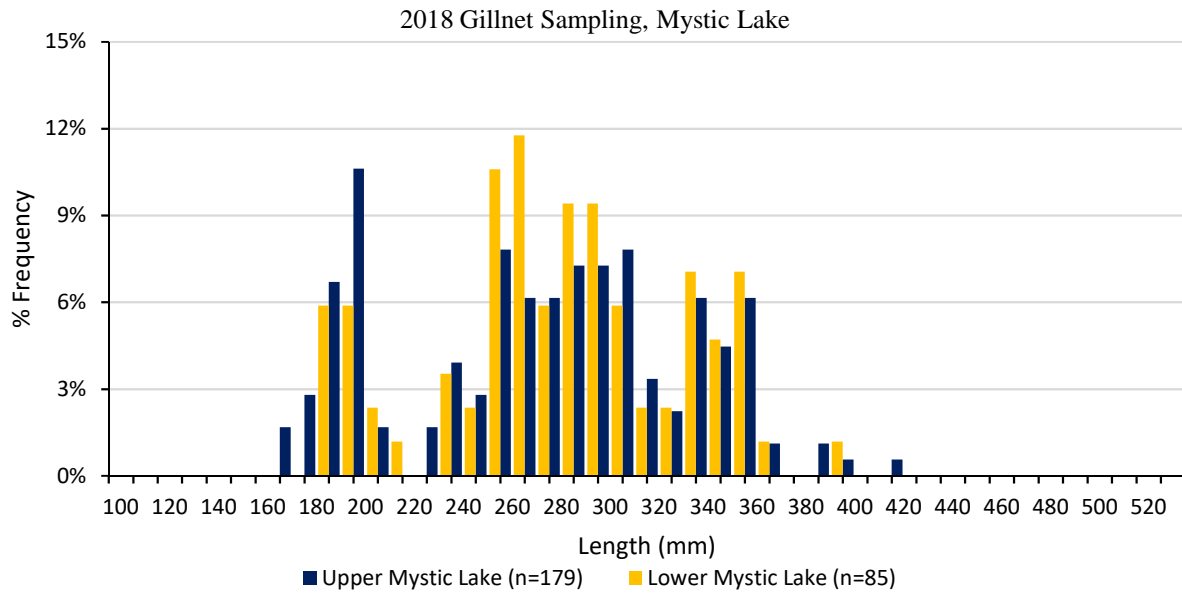
Figure 2-2: Length-frequency for rainbow trout sampled via gillnetting and angling in Mystic Lake in 2018.



The size-classes of fish captured gillnetting in the upper and lower ends of Mystic Lake show similar size distributions (Figure 2-3). The length of fish captured gillnetting ranged from 163 to 419 mm (6.4-16.5 inches) with an average length of 271 mm (10.7 inches) and a median length of 274 mm (10.8 inches). The length-frequency distribution results from gillnetting showed a bimodal length distribution in 2018, which was also observed in previous sampling years (NorthWestern, 2016a). Overall, gillnetting appears to capture a wider size range of rainbow trout than what is captured by angling.

Overall, the length-frequency histograms showed recruitment of young fish into the population. Rainbow trout larger than 400 mm (15.7 inches) are not common.

Figure 2-3: Length-frequency for rainbow trout sampled via gillnetting in Mystic Lake in 2018.



3. West Rosebud Creek Stream Temperature

Since 2010, West Rosebud Creek temperature monitoring has been conducted every other year. A summary of the 2010, 2012, and 2014 data is provided in the *6-Year (2010-2015) Fisheries Monitoring Report* (NorthWestern, 2016a) and a summary of the 2016 data is provided in the 2016 Annual Fisheries Monitoring Report (NorthWestern, 2017). This section provides a summary of the stream temperature data collected in 2018. There are no future stream monitoring events scheduled under the revised *6-Year (2016-2022) Fisheries Monitoring Plan* (NorthWestern, 2016). Any future stream monitoring efforts will be reported under NorthWestern's water quality monitoring program scheduled to be updated by the end of 2019.

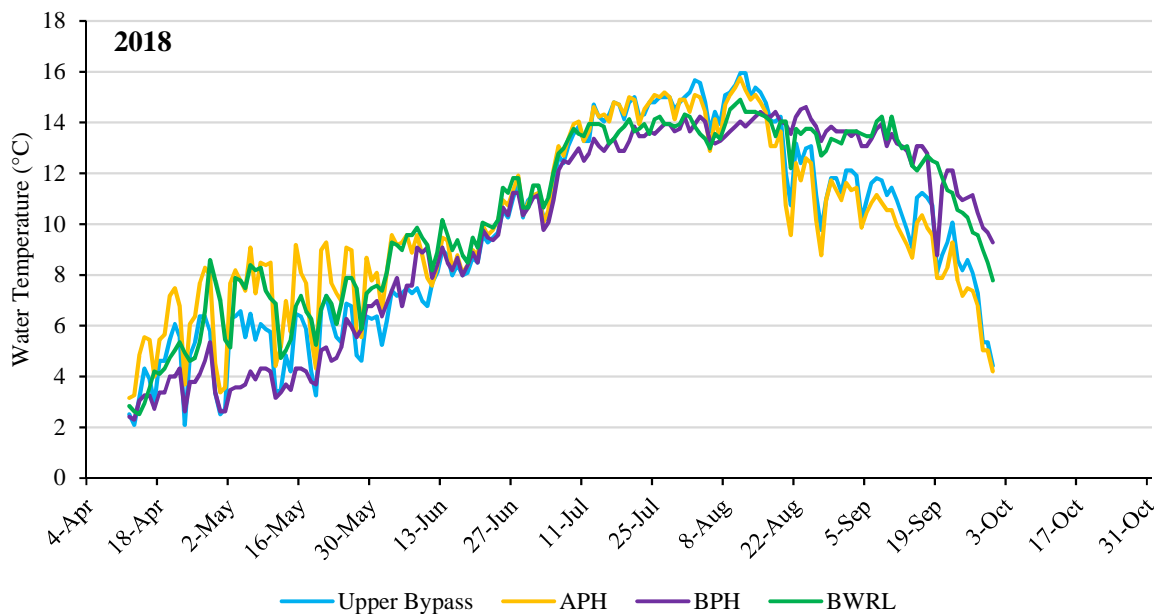
3.1 Data Collection

In 2018, continuous stream temperature data in West Rosebud Creek were collected via HOBO Pendant Temperature Logger (15-minute increments) in three designated locations (Upper Bypass, APH, BPH, and BWRL) from April 12 through September 30. The BPH site in 2018 represents the new site selected in 2016 (NorthWestern, 2017). A detailed summary of the 2018 results compared to previous years' data are provided in the *10-year (2010-2019) Water Quality Monitoring Report* (NorthWestern, *in progress*).

3.2 Results

Stream temperatures in West Rosebud Creek did not exceed 16.0 °C (60.8 °F) in 2018. In the summer months, maximum temperatures occurred in August at all sites in West Rosebud Creek. The peak stream temperature, 16.0 °C (60.8 °F), in West Rosebud Creek was recorded in the upper bypass on August 11. The maximum stream temperatures at the other three sites were less than 16.0 °C (60.8 °F). The peak stream temperatures at APH and BPH also occurred on August 11 and were 15.8 °C (60.4 °F) and 14.4 °C (57.9 °F), respectively. The peak stream temperature at BWRL occurred on August 24 and was 13.8 C (56.8 °F). Daily maximum stream temperatures for 2018 are shown in Figure 3-1.

Figure 3-1: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2018. BPH = New Site selected in 2016.



Stream temperatures are important for cold-water fishery. Salmonids are cold-water fish with specific temperature requirements. Although some populations of salmonids have adapted to warmer temperatures, in general salmonids are not present if summer water temperatures consistently exceed 22 °C (71.6 °F) (Griffith, 1999). Brown trout can survive in warmer waters, 18 to 24 °C (64.4-75.2°F), compared to other species of trout (Wydoski and Whitney, 2003). Optimal growth for brown trout has been reported at temperatures ranging between 14 and 17 °C (57.2-62.6 °F) (Forseth and Jonsson, 1994). Rainbow trout generally prefer temperatures less than 21 °C (69.8 °F) (Wydoski and Whitney, 2003) and achieve optimal growth around 13.1 °C (55.6 °F) (Bear, 2005; Bear et al. 2007).

In 2018 and in previous years of monitoring stream temperatures in West Rosebud Creek remained well below thermal limits of rainbow and brown trout (NorthWestern, *in progress*). During the warmest portion of the summer, stream temperatures in West Rosebud Creek were often within the optimum range (14-17 °C; 57.2-62.6 °F) for brown trout while sometimes exceeding the optimum growth temperature for rainbow trout (13.1 °C; 55.6 °F).

In conclusion, stream temperatures in 2018 (as in previous years) appear to be within the preferred range for salmonids in West Rosebud Creek.

4. West Rosebud Creek Redd Count

Redd surveys in West Rosebud Creek have occurred annually since 2008 (NorthWestern, 2016a). The survey reach is a 1.5-mile-long reach of West Rosebud Creek between the Pine Grove Campground and the bridge on the Mackay property, referred to as the Mackay Flat section (*refer to* Figure 1-1). The Mackay Flat section serves as an important spawning area for both resident West Rosebud Creek fish and migratory rainbow and brown trout from the Stillwater and Yellowstone rivers. Details of previous spring and fall redd counts completed between 2008 and 2015 are provided in the respective annual reports (PPL Montana, 2011; 2012; 2013; 2014 and NorthWestern, 2015; 2016b).

The *2016-2021 Fisheries Monitoring Plan* (NorthWestern, 2016a) includes fall redd surveys, focused on brown trout, in West Rosebud Creek scheduled to occur every other year, starting in 2017. Spring redd surveys were discontinued in the revised 6-year fisheries monitoring plan due to the challenges associated with spring surveys and high streamflows.

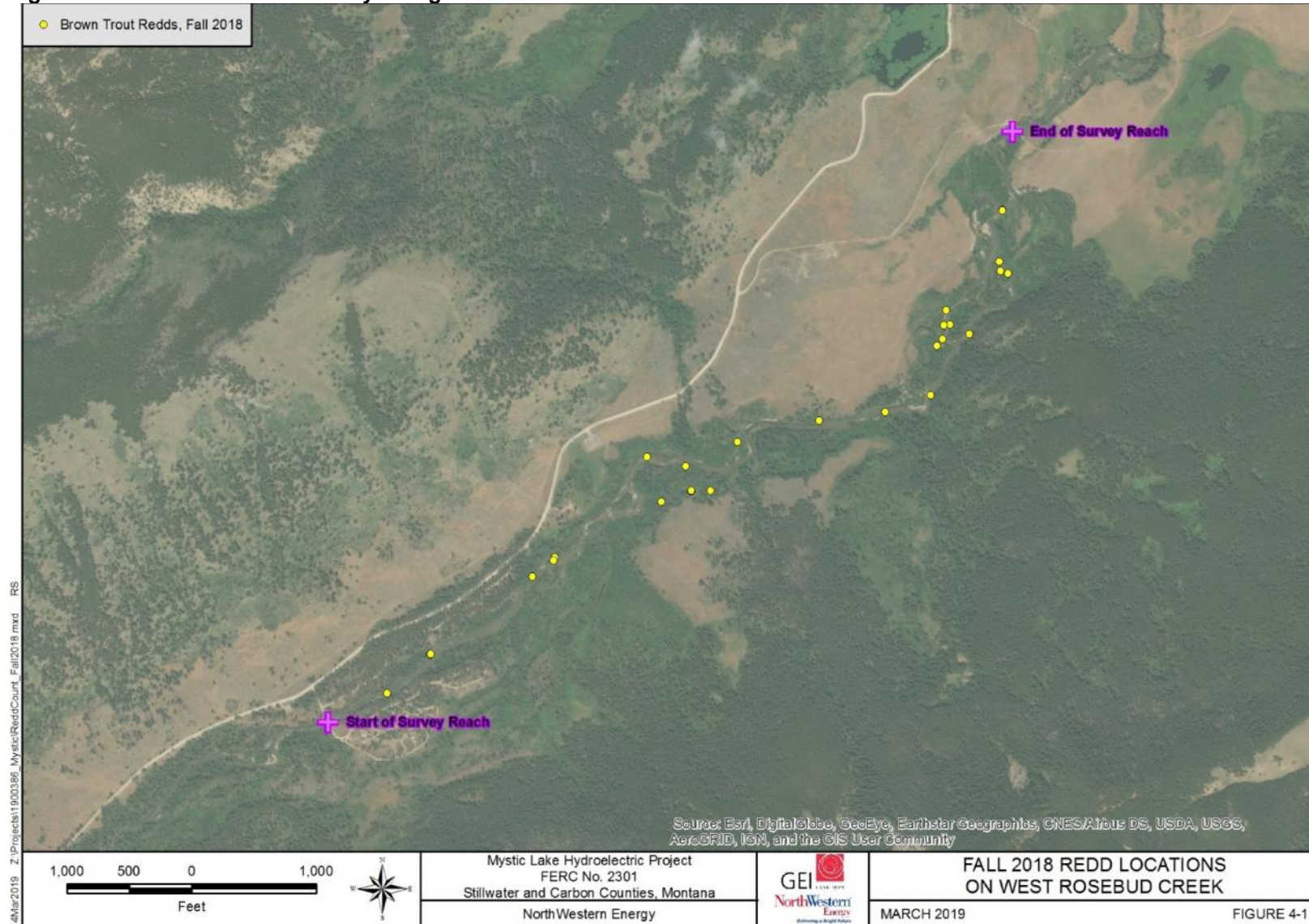
Fall redd surveys typically occur between mid-October and mid-November (Table 4-1). By mid- to late-November, the stream reach surveyed is often iced over. In 2016, FWP completed a fall redd survey instead of in 2017 (due to a scheduling error) and recorded 16 brown trout redds on November 22, 2016. In 2018, FWP completed two redd surveys, one on October 30 and a second on November 12. A summary of survey dates for each year is shown in Table 4-1.

Table 4-1: Survey dates for redds in West Rosebud Creek, Fall 2009-2018.

Year	Fall Survey Date(s)
2018	Oct 30, Nov 12
2017	No Survey
2016	Nov 22
2015	Oct 27, Nov 5
2014	Oct 29
2013	Oct 12, Nov 7
2012	Oct 31; Nov 14, 15
2011	Oct 31; Nov 1, 15
2010	Oct 5 (iced over, no survey)
2009	Nov 11

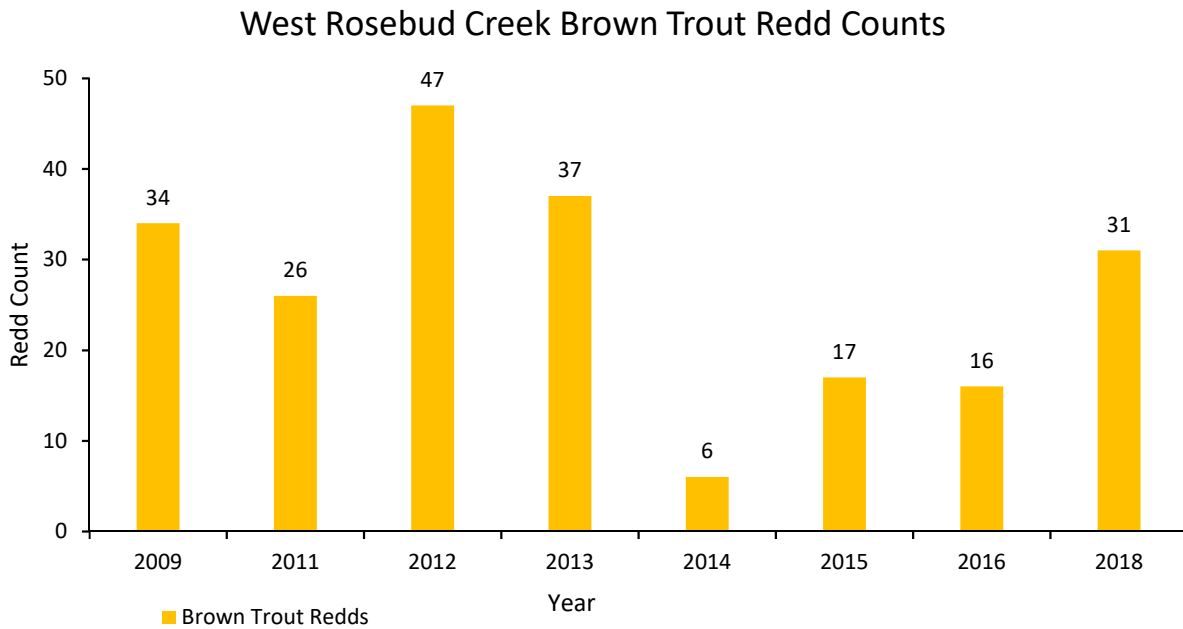
The location of the fall redds observed in 2018 are shown in Figure 4-1. Due to the scale of the map, the location of the redds often represent a cluster of redds and not just an individual redd.

Figure 4-1: Fall 2018 Redd Survey Along West Rosebud Creek.



A summary of the total number of brown trout redds observed annually since 2009 is shown in Figure 4-2. Annual brown trout redd counts have varied from a low of 6 redds in 2014 to a high of 47 redds in 2012 (NorthWestern, 2017). In 2018, FWP identified a total of 35 redds. Based on location and size, it was assumed that four redds were brook trout redds and 31 redds were brown trout redds. FWP counted 28 brown trout redds during the first survey and three additional brown trout redds in during the second survey (in 2018). The 2018 count was approximately double the count from 2015 and 2016 and representative of numbers observed in 2009, 2011-2013.

Figure 4-2: Summary of brown trout redd surveys along West Rosebud Creek, 2009 – 2018. No survey was done in 2010 or 2017.



5. Fisheries Monitoring Schedule for 2019

In 2019, fisheries monitoring efforts in the Project area will focus on fish surveys in West Rosebud Creek between the dam and powerhouse and fish surveys in West Rosebud and Emerald lakes (*refer to* Table 1-1).

NorthWestern will continue to prepare and submit annual reports summarizing the previous year's monitoring activities to the TAC and posting the reports on the Mystic Lake Project Coordination website (www.mysticlakeproject.com). Every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary for the term of the Project License (40 years).

A comprehensive 6-year (2016-2021) fisheries monitoring report with an updated 6-year (2022-2027) fisheries monitoring plan will be prepared in 2022 and submitted to the TAC for review and approval prior to filing with the Commission. These two reports will be filed with the Commission no later than December 31, 2022. The final reports will also be posted on the Mystic Lake Project Coordination website.

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