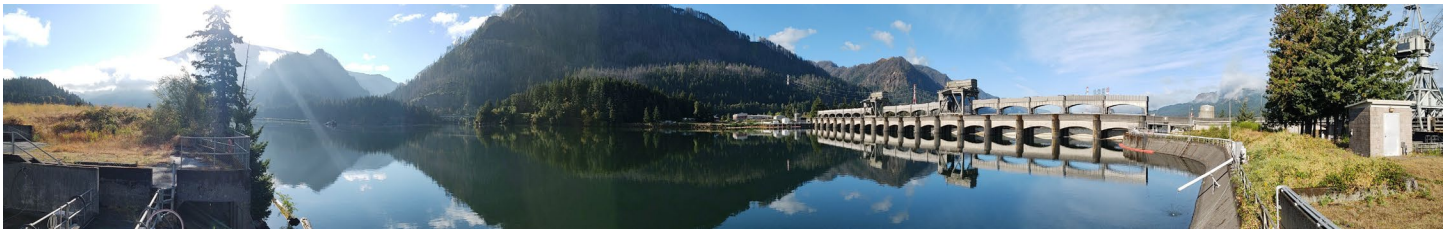
2020 Annual Fishway Status Report for Bonneville Project



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Glossary

AFF ----------Adult Fish Facility. Research lab associated with the Washington Shore ladder.
AWS ----------Auxiliary Water Supply.
B2CC----------Powerhouse Two Corner Collector. A surface bypass system located in the southern corner of the Bonneville Second Powerhouse forebay.
BI----------Bradford Island Fishway.
BIWW----------Bradford Island Wetted Wall.
BiOp----------Biological Opinion.
BPA ----------Bonneville Power Association.
CI----------Cascades Island Fishway.
CC----------Collection Channel - Part of the adult fishway spanning the length of the downstream side of each powerhouse.
CPUE ---------- Catch Per Unit Effort. Also known as catch rate.
DSM2 ----------Downstream Migrant transportation channel (PH2). Transport channel for juvenile fish from gatewell orifices to the juvenile transport pipe.
FDX----------Full-duplex Pit detection; smaller and faster tag that can receive and transmit simultaneously.
FG----------Fish diffusion gate.
FGE ----------Fish Guidance Efficiency.
FOG----------Floating Orifice Gate.
Forebay ----------That area of a reservoir immediately upstream of a dam.
FPOM----------Fish Passage Operations and Maintenance Coordination Team
FPP----------Fish Passage Plan.
FO ---------- Forced Outage, not planned or coordinated with the FPP.
FU----------Fish Unit. Provides auxiliary water to PH2 entrance diffusers.
FV----------Fish Valve.
HDX----------Half-duplex Pit detection; larger & slower tag that transmits then receives.
ITS ----------Ice and Trash Sluiceway.
IWW ----------In water work period (01-December through 28-February).
JBS----------Juvenile Bypass System.
JMF ----------Juvenile Monitoring Facility. Lab associated with the PH2 JBS.
LFS----------Lamprey Flume System.
MU ----------Main Unit. PH1 turbine units 1-10, PH2 units 11-18.
MUB ----------Main Unit Breaker
NDE---------- North Downstream Entrance. Overflow weir adult fishway entrances at PH2.
NUE----------North Upstream Entrance. See NDE.
NOAA----------National Oceanic and Atmospheric Administration.
OOS----------Out of Service.
OWS ---------- Oil Water Separator.
PH1----------Bonneville Powerhouse One.
PH2----------Bonneville Powerhouse Two.
PIT ---------- Passive Integrated Transponder. A tag inserted into juvenile and adult fish. Detectors are installed at all fish passage systems.
Project----------Bonneville Lock & Dam.
PO ---------- Planned Outage
ROV----------Remotely Operated Vehicle.
RS ----------Reserve Status; A unit in reserve status is available and running, but not currently generating power.
SDE ----------South Downstream Entrance. See NDE.
SLED----------Sea Lion Exclusion Device
SUE ----------South Upstream Entrance. See NDE.
STS----------Submersible Traveling Screen.
Tailrace----------The portion of a river immediately downstream of a dam or powerhouse.
TDG----------Total dissolved gas.

UMT---------- Upstream Migrant Transportation channel. This channel connects Cascades Island ladder to Washington Shore ladder through PH2.
VBS ----------Vertical Barrier Screen.
WDFW----------Washington Department of Fish & Wildlife.

1. INTRODUCTION

1.1 Introduction

This **2020** Project Fisheries Annual Report for Bonneville Project summarizes activities occurring from **01 December 2019 through 30 November 2020** and is required by the Fish Passage Plan (FPP), per section 2.5.2.3.

The Project includes two powerhouses, a spillway, and one operating navigation lock. There are four adult fish ladders, located at each powerhouse and the north and south ends of the spillway for upstream migration. There are three Juvenile Bypass Systems (JBS) for downstream migration: an Ice and Trash Sluiceway (ITS) at Powerhouse 1 (PH1), a downstream migration transportation channel (DSM) at Powerhouse Two (PH2), and the corner collector at PH2 (B2CC) (**Figure 1**).

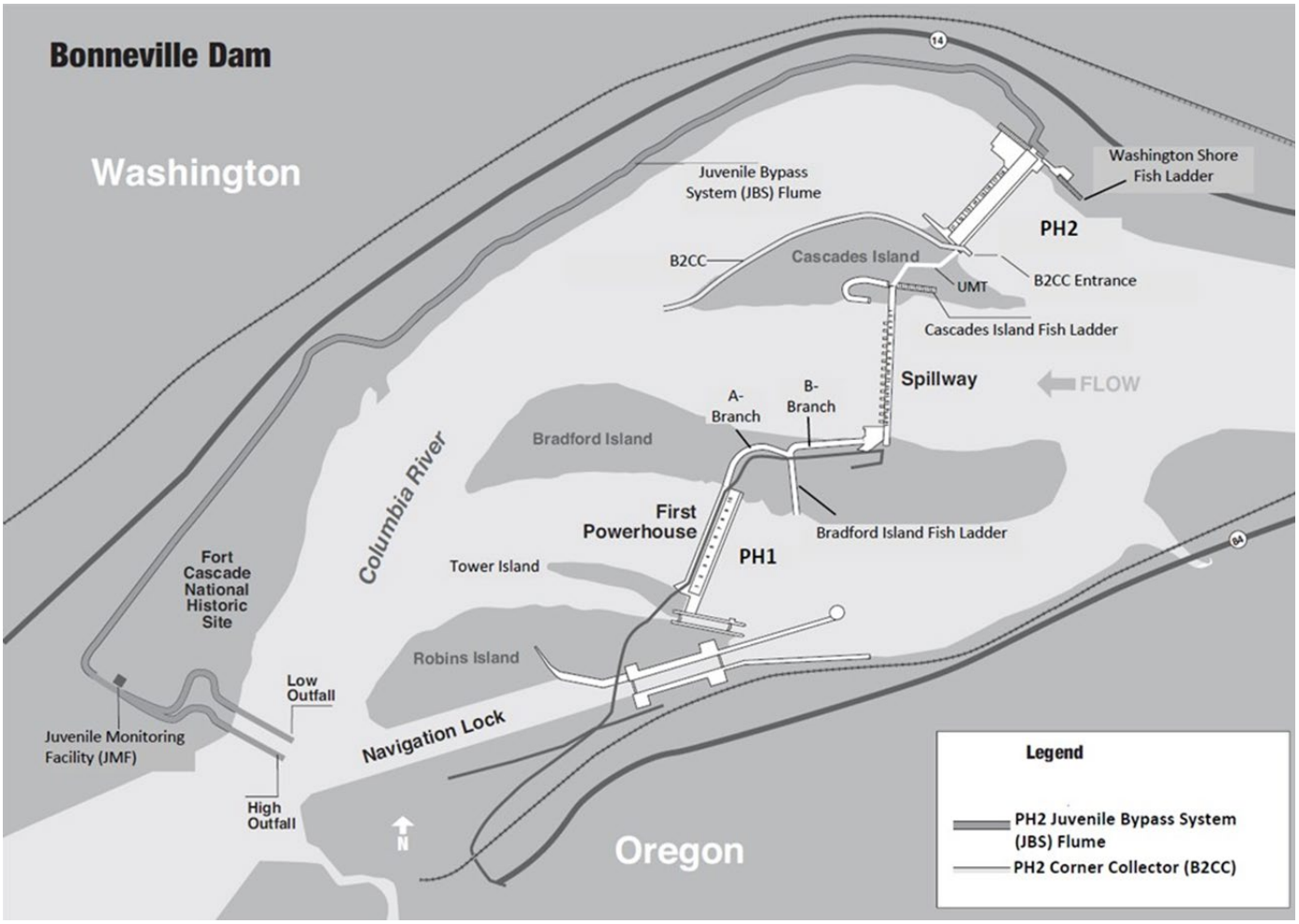

Figure 1. Bonneville Lock and Dam. Image obtained from FPP (2020).

2. OPERATIONS

2.1 Fish Facility Outages

Table 1 shows the outage dates for Bonneville fishways, fish facilities, and lamprey passage structures.

Table 1. Seasonal Fish Facility Outages.

FISH FACILITY	OOS DATE 2019	IN SERVICE DATE 2020	OOS DATE 2020	REASON FOR OUTAGE
BI LADDER	28-Nov	27-Feb	---	Winter Maintenance
A-BRANCH	NA	27-Feb	---	Winter Maintenance
B-BRANCH	NA	27-Feb	---	Winter Maintenance
CI LADDER	NA	NA	---	Winter Maintenance
WA SHORE LADDER	NA	NA	---	Winter Maintenance
UMT	09-Dec	11 Dec (2019)	---	Winter Maintenance
BI LPS	31-Oct	16-Apr	02-Nov	Winter Maintenance
CI LPS	31-Oct	01-Apr	02-Nov	Winter Maintenance
WA AWS LPS	31-Oct	01-Apr	02-Nov	Winter Maintenance
NDE LFS/LPS	14-Sep	NA	NA	Low CPUE
AFF LAMPREY TRAP	14-Sep	15 June	03-Sept	Low CPUE
CI LAMPREY TRAP	---	3 June	16-Sept	Low CPUE
BI WETTED WALL	10-Sep	NA	NA	Winter Maintenance
B2CC	1-Sep	20- March	1-Sept	Winter Maintenance
DSM	19-Dec	13-Feb		Winter Maintenance
AFF	7-Nov	14-Apr	25 Nov	Winter Maint./CRITFC concluded sampling
SMF	31-Oct	02-March	31-Oct	Winter Maintenance

2.2 Turbine Outages

Table 2 shows turbine outages that lasted 24 hours or longer. Note that turbine outages lasting less than 24 hours did occur but are not included for the sake of brevity.

Table 2. Turbine Outages Lasting Greater Than 24 Hours.

UNIT	OOS DATE	RTS DATE	DURATION	REASON
18	0001 on 12/09/19	1647 on 12/11/19	2 days, 16 hours, 16 mins	P.O., Annual & OWS Mods
1	0001 on 01/06/20	2214 on 01/23/20	17 days, 22 hours, 13 mins	P.O., Bus Inspection
2	0001 on 01/06/20	2214 on 01/23/20	17 days, 22 hours, 13 mins	P.O., Bus Inspection
11	0004 on 01/27/20	2009 on 01/27/20	3 days, 20 hours, 5 mins	P.O., Annual + Cooler Replacement
10	0001 on 02/03/20	1727 on 02/19/20	16 days, 17 hours, 26 mins	P.O. Annual
16	0003 on 02/03/20	1437 on 02/06/20	3 days, 14 hours, 34 mins	P.O. Annual
14	0740 on 02/24/20	1150 on 04/21/20	57 days, 4 hours, 10 min	P.O., 4-year Overhaul
1	0720 on 04/06/20	1208 on 04/07/20	1 day, 4 hours, 48 mins	P.O., Relay Testing
2	0715 on 04/06/20	1325 on 06/04/20	59 days, 6 hours, 10 min	P.O., 5-year Overhaul
12	0753 on 04/20/20	1510 on 06/24/20	65 days, 7 hours, 17 mins	P.O., 4-year Overhaul
17	0004 on 04/27/20	1357 on 04/29/20	2 days, 13 hours, 53 min	P.O., Annual Overhaul
9	0006 on 06/01/20	1303 on 06/04/20	3 days, 12 hours, 57 mins	P.O., Annual Overhaul
15	0003 on 06/01/20	1550 on 06/04/20	3 days, 15 hours, 47 mins	P.O., Annual Overhaul/QTCI
8	0700 on 06/15/20	1513 on 08/06/20	52 days, 8 hours, 13 mins	P.O., 5-year Overhaul
6	2000 on 07/12/20	1438 on 07/30/20	17 days, 18 hours, 38 mins	P.O., Annual
13	0723 on 07/13/20	1528 on 07/30/20	17 days, 8 hours, 5 mins	P.O., Headcover Pump Replacement
18	0800 on 07/13/20	1723 on 07/28/20	15 days, 9 hours, and 23 mins	F.O., Thrust Bearing Leak
7	0045 on 08/03/20	1653 on 08/06/20	3 days, 16 hours, 8 mins	P.O., Annual Overhaul
3	1924 on 08/09/20	1658 on 08/27/20	17 days, 21 hours, 34 mins	P.O., Annual Overhaul
4	1924 on 08/09/20	1658 on 08/28/20	17 days, 21 hours, 34 mins	P.O., Annual Overhaul
13	0758 on 09/08/20	1350 on 09/23/20	15 days, 5 hours, 54 mins	F.O., Th. Bearing Cooler Leak

5	0612 on 09/14/20	1246 on 09/30/20	16 days, 6 hours, 34 mins	P.O., Annual Maintenance
11	0755 on 10/19/20	1712 on 10/28/20	9 days, 9 hours, 22 mins	P.O., Electrical Protection System Work
12	0716 on 10/19/20	1110 on 11/10/20	22 days, 3 hours, 54 mins	P.O., 5 Year Overhaul/Shaft Sleeve
13	0752 on 10/19/20	1714 on 10/28/20	9 days, 9 hours, 22 mins	P.O., Electrical Protection System Work
14	0747 on 10/19/20	1715 on 10/28/20	9 days, 9 hours, 28 mins	P.O., Electrical Protection System Work
15	0732 on 10/19/20	1133 on 11/04/20	16 days, 4 hours, 1 min	P.O., Electrical Protection System Work
16	0755 on 10/19/20	1133 on 11/04/20	16 days, 3 hours, 38 mins	P.O., Electrical Protection System Work
17	0737 on 10/19/20	1134 on 11/04/20	16 days, 3 hours, 57 mins	P.O., Electrical Protection System Work
18	0737 on 10/19/20	1134 on 11/04/20	16 days, 3 hours, 57 mins	P.O., Electrical Protection System Work
3	0003 on 11/09/20	1035 on 11/25/20	16 days, 10 hours, 32 mins	Station Service Work
4	0003 on 11/09/20	1035 on 11/25/20	16 days, 10 hours, 32 mins	Station Service Work
5	0003 on 11/09/20	1035 on 11/25/20	16 days, 10 hours, 32 mins	Station Service Work
6	0003 on 11/09/20	1035 on 11/25/20	16 days, 10 hours, 32 mins	Station Service Work
7	0149 on 11/10/20	1710 on 11/14/20	4 days, 15 hours, 21 mins	F.O., Exciter Failed
13	0005 on 11/16/20	1239 on 11/19/20	3 days, 12 hours, 34 mins	P.O., Annual QTCI
14	0749 on 11/20/20	1503 on 11/23/20	3 days, 7 hours, 14 mins	F.O., Ground in STS Motor
1	0700 on 11/30/20	---	---	Station Service Work
2	0700 on 11/30/20	---	---	Station Service Work
18	1250 on 11/30/20	---	---	4 Year Overhaul

Definitions: Planned Outage (P.O.) and Forced Outage (F.O.)

2.3 Fish Removal

Fish passage facilities and turbine units are taken out of service and dewatered to allow for inspection, preventative maintenance, repairs, and modifications. As facilities and turbine units are dewatered, project biologists follow procedures outlined in the FPP and detailed in the Fish Salvage Plan to minimize impacts on fish. Adult salmonids and adult lamprey are generally released into the forebay above the new navigation lock. Juvenile salmonids, juvenile lamprey, and sturgeon are generally released below the dam at the Hamilton Island boat ramp. **Table 3** is a summary of the number of fish that were removed during facility and turbine unit dewaterings. All fish were recovered in good condition unless otherwise noted.

Table 3. Fish Salvages at Bonneville December 2019 – November 2020.

DATE	LOCATION	FISH SALVAGED	RELEASE SITE
12/03/19	BI Serpentine, AWS, Ladder to Junction Pool	~10 juvenile salmonids, 6 Steelhead Trout, ~200 Pacific Lamprey, 6 Three-Spine Stickleback, 3 Ictalurids ~30 Cyprinids, ~20 American Shad, 1 Smallmouth Bass	Upstream of Nav Lock
12/03/19	BI Junction Pool	16 White Sturgeon, ~5 juvenile salmonids, 2 Steelhead Trout, 1 Smallmouth Bass	Upstream of Nav Lock
12/03/19	A-Branch to TW	18 juvenile salmonids, 2 Steelhead Trout, 1 Chinook Jack, 1 Chum Salmon, 9 White Sturgeon, ~10 Cyprinids, ~30 American Shad	Upstream of Nav Lock
12/04/19	B-Branch ladder	75 White Sturgeon, 3 Steelhead Trout	Tailwater (Sturgeon), Nav Lock (Trout)
12/05/19	B-Branch Entrance	42 White Sturgeon, 2 Pacific Lamprey	Tailwater (Sturgeon), Nav Lock (Lamprey)
12/09/19	A-Branch diffuser pools to tailwater	2 Chinook Salmon, 1 Steelhead Trout	Upstream of Nav Lock
12/10/19	UMT	6 Steelhead Trout, 2 Chinook Salmon, ~15 juvenile salmonids, ~10 resident fish (Cyprinids and Centrarchids)	Upstream of Nav Lock
12/10/19	Cascades Island ladder to FG6-5	1 Steelhead Trout, 1 Chinook Salmon, 2 juvenile salmonids	Upstream of Nav Lock
12/10/19	Cascades Island AWS	2 Smallmouth Bass, 18 juvenile salmonids, 4 Cyprinids, 1 Steelhead Trout	Upstream of Nav Lock
12/30/19	FG3-9 Diffuser Pit	~20 Pacific Lamprey, 20 Salmonids, 3 Sculpin, 2 Bass and 1 Bullhead	Forebay
02/10/20	Upper section of Cascades Island Fishway	2 juvenile salmonids, 1 juvenile lamprey, 2 juvenile smallmouth bass	Tailwater
02/24/20	U14 Draft Tube	1 Pacific Lamprey	Forebay
03/09/20	Navlock 2 Sill	5 juvenile salmonids, 1 sculpin	Tailwater
04/08/20	U2 Scroll Case	1 juvenile salmonid, 1 juvenile smallmouth bass, 1 juvenile cyprinid	Tailwater
04/08/20	U2 Draft Tube	2 juvenile salmonid, 1 juvenile catfish, 1 stickleback, 1 juvenile smallmouth bass	Tailwater
04/09/20	U14 Tail Logs	3 sculpin	Tailwater
04/22/20	U12 Draft Tube	7 juvenile salmonids	Tailwater
06/03/20	U2 Tail Logs	3 juvenile steelhead	Tailwater
06/17/20	U8 Scroll Case	~300 juvenile salmonids up to 14", ~5 juvenile bass and carp, 1 catfish	Upstream and Tailwater

06/17/20	U8 Draft Tube	~35 juvenile salmonids up to 14", 1 sturgeon (5'), ~5 juvenile bass and carp, 1 catfish	Upstream and Tailwater
06/23/20	U12 Tail Logs	1 Pacific lamprey, 1 juvenile lamprey, 1 bullhead, ~ 25 sculpin	Tailwater
07/14/20	U13 Scroll Case	1 juvenile shad	Tailwater
07/14/20	U13 Draft Tube	8 lamprey, 2 salmonids	Tailwater
07/30/20	U13 Tail Logs	3 smallmouth bass, 2 shad and 5 sculpin	Upstream
10/20/20	U12 Draft Tube	9 Pacific Lamprey, 2 sculpin	Upstream
11/02/20	BI, CI, WA Shore LPS	No Fish Recovered	---
11/10/20	U12 Tail Logs	60 sculpin	Tailwater
11/25/20	AFF	2 adult salmonids, 6 juvenile salmonids, 2 carp, ~100 shad, ~30 suckers, and 2 smallmouth bass	Upstream of the Nav Lock

2.4 Fish Unit Outages

A list identifying every closure for Fish Unit 1 and Fish Unit 2 is shown in **Table 4**. Throughout the year, the fish units are cleaned using a crane-operated trash rake during working hours. On weekends when personnel are unavailable to operate the trash rake, debris accumulation may occur to the point of causing excessive drawdowns, requiring the units to be "floated" to prevent potential trash rack or unit damage. During high debris loading, this may also occur overnight between daytime trash raking. When floating, the units may be placed in standby between the hours of 2200 and 0400 to minimize impact on adult fish passage. An adjacent unit is then operated to pull trash away from the fish unit trashracks. Lamprey Operations June 1–August 31: Reduce fish unit output to operate all north (NUE, NDE) and south (SUE, SDE) entrances at 0.5' of entrance head. To ensure proper function of fish units, B2 fish unit output can be further reduced or placed on standby to float debris as necessary from 2200-0400 hours.

Table 4. List of Fish Unit Outages.

UNIT	OOS	RTS	DURATION	REASON
F1	1749 on 12/01/19	0001 on 12/02/19	6 hours, 20 mins	R.S., Float Trash
F1	0001 on 12/02/19	1732 on 12/09/19	7 days, 17 hours, 31 minutes	P.O., Annual Maintenance
F2	1049 on 12/09/19	1053 on 12/09/19	4 mins	R.S.
F2	1057 on 12/09/19	1706 on 12/09/19	6 hours, 9 minutes	R.S.
F2	0621 on 12/10/19	1606 on 12/10/19	9 hours, 45 minutes	R.S.
F1	1024 on 12/10/19	1032 on 12/10/19	8 minutes	R.S.
F2	1608 on 12/10/19	1508 on 12/11/19	23 hours	R.S.
F1	1511 on 12/11/19	1143 on 12/12/19	20 hours, 32 minutes	R.S.
F1	1105 on 12/14/19	1126 on 12/14/19	21 minutes	R.S.
F2	0010 on 12/15/19	0724 on 02/26/20	73 days, 7 hours, 14 mins	P.O., 2-YR Overhaul
F1	1901 on 02/06/20	0324 on 02/07/20	8 hours, 23 mins	R.S., Float Trash
F1	2106 on 03/15/20	2101 on 03/16/20	23 hours, 55 mins	F2 Headgate Oil Leak
F2	2106 on 03/15/20	0744 on 03/27/20	11 days, 10 hours, 38 mins	F2 Headgate Oil Leak
F1	0747 on 03/27/20	1357 on 03/29/20	2 days, 6 hours, 10 mins	Headgate Inspection
F2	2228 on 06/01/20	0533 on 06/02/20	7 hours, 5 mins	R.S., Nighttime Lamprey Ops.
F1	2327 on 06/03/20	0234 on 06/04/20	3 hours, 7 mins	R.S., Nighttime Lamprey Ops.
F2	0233 on 06/04/20	0631 on 06/04/20	3 hours, 58 mins	R.S., Nighttime Lamprey Ops./Float Trash

F1	2258 on 06/04/20	0422 on 06/05/20	4 hours, 24 mins	R.S., Nighttime Lamprey Ops.
F2	2231 on 06/05/20	0512 on 06/06/20	6 hours, 41 mins	R.S., Nighttime Lamprey Ops.
F2	2232 on 06/06/20	0514 on 06/07/20	6 hours, 42 mins	R.S., Nighttime Lamprey Ops.
F2	2232 on 06/07/20	0512 on 06/08/20	6 hours, 40 mins	R.S., Nighttime Lamprey Ops.
F1	2243 on 06/08/20	0517 on 06/09/20	6 hours, 34 mins	R.S., Nighttime Lamprey Ops.
F2	2236 on 06/09/20	0515 on 06/10/20	6 hours, 39 mins	R.S., Nighttime Lamprey Ops.
F2	2230 on 06/10/20	0602 on 06/11/20	7 hours, 32 mins	R.S., Nighttime Lamprey Ops.
F1	2229 on 06/11/20	0526 on 06/12/20	6 hours, 57 mins	R.S., Nighttime Lamprey Ops.
F2	2229 on 06/12/20	0534 on 06/13/20	7 hours, 5 mins	R.S., Nighttime Lamprey Ops.
F1	2230 on 06/13/20	0530 on 06/14/20	7 hours, 0 mins	R.S., Nighttime Lamprey Ops.
F1	2230 on 06/14/20	0529 on 06/15/20	6 hours, 59 mins	R.S., Nighttime Lamprey Ops.
F2	2230 on 06/15/20	0532 on 06/16/20	7 hours, 2 mins	R.S., Nighttime Lamprey Ops.
F1	2231 on 06/16/20	0530 on 06/17/20	6 hours, 59 mins	R.S., Nighttime Lamprey Ops.
F2	2230 on 06/17/20	0536 on 06/18/20	7 hours, 6 mins	R.S., Nighttime Lamprey Ops.
F1	2229 on 06/18/20	0533 on 06/19/20	7 hours, 4 mins	R.S., Nighttime Lamprey Ops.
F2	2231 on 06/19/20	0536 on 06/20/20	7 hours, 5 mins	R.S., Nighttime Lamprey Ops.
F1	2233 on 06/20/20	0530 on 06/21/20	6 hours, 57 mins	R.S., Nighttime Lamprey Ops.
F2	2231 on 06/21/20	0239 on 06/22/20	4 hours, 8 mins	R.S., Nighttime Lamprey Ops.
F1	0241 on 06/22/20	1143 on 06/22/20	9 hours, 2 mins	F.O. Water in Turbine Bearings
F2	2230 on 06/22/20	0531 on 06/23/20	7 hours, 1 min	R.S., Nighttime Lamprey Ops.
F2	2229 on 06/23/20	0532 on 06/24/20	7 hours, 3 mins	R.S., Nighttime Lamprey Ops.
F2	2232 on 06/24/20	0512 on 06/25/20	6 hours, 40 mins	R.S., Nighttime Lamprey Ops.
F1	2231 on 06/25/20	0504 on 06/26/20	6 hours, 33 mins	R.S., Nighttime Lamprey Ops.
F2	2233 on 06/26/20	0512 on 06/27/20	6 hours, 39 mins	R.S., Nighttime Lamprey Ops.
F1	2235 on 06/27/20	0517 on 06/28/20	6 hours, 42 mins	R.S., Nighttime Lamprey Ops.

F2	2230 on 06/28/20	0532 on 06/29/20	7 hours, 2 mins	R.S., Nighttime Lamprey Ops.
F1	2231 on 06/29/20	0535 on 06/30/20	7 hours, 4 mins	R.S., Nighttime Lamprey Ops.
F2	2230 on 06/30/20	0535 on 07/01/20	7 hours, 5 mins	R.S., Nighttime Lamprey Ops.
F1	2230 on 07/01/20	0532 on 07/02/20	7 hours, 2 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/02/20	No Record	Unknown	R.S., Nighttime Lamprey Ops.
F2	2300 on 07/03/20	0531 on 07/04/20	6 hours, 31 mins	R.S., Nighttime Lamprey Ops.
F1	2301 on 07/04/20	0510 on 07/05/20	6 hours, 9 mins	R.S., Nighttime Lamprey Ops.
F2	2259 on 07/05/20	0508 on 07/06/20	6 hours, 9 mins	R.S., Nighttime Lamprey Ops.
F1	2245 on 07/06/20	0510 on 07/07/20	6 hours, 16 mins	R.S., Nighttime Lamprey Ops.
F2	2254 on 07/07/20	0511 on 07/08/20	6 hours, 17 mins	R.S., Nighttime Lamprey Ops.
F1	0356 on 07/08/20	0444 on 07/08/20	48 mins	R.S., Float Trash
F2	2301 on 07/08/20	0515 on 07/09/20	6 hours, 14 mins	R.S., Nighttime Lamprey Ops.
F1	0828 on 07/09/20	1422 on 07/09/20	5 hours, 54 mins	P.O., ROV Inspection
F2	0829 on 07/09/20	1420 on 07/09/20	5 hours, 51 mins	P.O., ROV Inspection
F2	2300 on 07/09/20	0543 on 07/10/20	6 hours, 43 mins	R.S., Nighttime Lamprey Ops.
F2	2300 on 07/10/20	0528 on 07/11/20	6 hours, 28 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/11/20	0534 on 07/12/20	6 hours, 34 mins	R.S., Nighttime Lamprey Ops.
F2	2300 on 07/12/20	0525 on 07/13/20	6 hours 25 mins	R.S., Nighttime Lamprey Ops.
F2	2248 on 07/13/20	0514 on 07/14/20	6 hours, 26 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/14/20	0529 on 07/15/20	6 hours, 29 mins	R.S., Nighttime Lamprey Ops.
F2	2259 on 07/15/20	0528 on 07/16/20	6 hours, 29 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/16/20	0530 on 07/17/20	6 hours, 30 mins	R.S., Nighttime Lamprey Ops.
F2	2305 on 07/16/20	0533 on 07/18/20	6 hours, 28 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/18/20	0534 on 07/19/20	6 hours, 34 mins	R.S., Nighttime Lamprey Ops.
F2	2312 on 07/19/20	0528 on 07/20/20	6 hours, 16 mins	R.S., Nighttime Lamprey Ops.

F1	2300 on 07/20/20	0532 on 07/21/20	6 hours, 32 mins	R.S., Nighttime Lamprey Ops.
F2	2309 on 07/21/20	0528 on 07/22/20	6 hours, 19 mins	R.S., Nighttime Lamprey Ops.
F1	2304 on 07/22/20	0531 on 07/23/20	6 hours, 27 mins	R.S., Nighttime Lamprey Ops.
F2	2259 on 07/23/20	0529 on 07/24/20	6 hours, 30 mins	R.S., Nighttime Lamprey Ops.
F2	2251 on 07/24/20	0514 on 07/25/20	6 hours, 23 mins	R.S., Nighttime Lamprey Ops.
F1	2259 on 07/25/20	0530 on 07/26/20	6 hours, 31 mins	R.S., Nighttime Lamprey Ops.
F2	2300 on 07/26/20	0527 on 07/27/20	6 hours, 27 mins	R.S., Nighttime Lamprey Ops.
F2	2316 on 07/27/20	0530 on 07/28/20	6 hours, 14 mins	R.S., Nighttime Lamprey Ops.
F1	2301 on 07/28/20	0527 on 07/29/20	6 hours, 26 mins	R.S., Nighttime Lamprey Ops.
F2	2300 on 07/29/20	0533 on 07/30/20	6 hours, 33 mins	R.S., Nighttime Lamprey Ops.
F1	2300 on 07/30/20	0528 on 07/31/20	6 hours, 28 mins	R.S., Nighttime Lamprey Ops.
F2	2259 on 07/31/20	0556 on 08/01/20	6 hours, 57 mins	R.S., Nighttime Lamprey Ops.
F1	2239 on 08/01/20	0556 on 08/02/20	7 hours, 17 mins	R.S., Nighttime Lamprey Ops.
F2	2242 on 08/02/20	0558 on 08/03/20	7 hours, 16 mins	R.S., Nighttime Lamprey Ops.
F2	2241 on 08/03/20	0559 on 08/04/20	7 hours, 18 mins	R.S., Nighttime Lamprey Ops.
F1	2229 on 08/04/20	0559 on 08/05/20	7 hours, 30 mins	R.S., Nighttime Lamprey Ops.
F2	2243 on 08/05/20	0600 on 08/06/20	7 hours, 17 mins	R.S., Nighttime Lamprey Ops.
F1	2245 on 08/06/20	0610 on 08/07/20	7 hours, 25 mins	R.S., Nighttime Lamprey Ops.
F2	2245 on 08/07/20	0600 on 08/08/20	7 hours, 15 mins	R.S., Nighttime Lamprey Ops.
F1	2245 on 08/08/20	0558 on 08/09/20	7 hours, 14 mins	R.S., Nighttime Lamprey Ops.
F2	2244 on 08/09/20	0643 on 08/10/20	7 hours, 59 mins	R.S., Nighttime Lamprey Ops.
F1	2244 on 08/10/20	0600 on 08/11/20	7 hours, 16 mins	R.S., Nighttime Lamprey Ops.
F2	1041 on 08/11/20	1042 on 08/11/20	1 min	Testing
F2	1051 on 08/11/20	1056 on 08/11/20	5 mins	Testing
F2	2244 on 08/11/20	0607 on 08/12/20	7 hours, 23 mins	R.S., Nighttime Lamprey Ops.

F1	2244 on 08/12/20	0559 on 08/13/20	7 hours, 15 mins	R.S., Nighttime Lamprey Ops.
F2	2144 on 08/13/20	0609 on 08/14/20	8 hours, 25 mins	R.S., Nighttime Lamprey Ops.
F2	2244 on 08/14/20	0610 on 08/15/20	7 hours, 26 mins	R.S., Nighttime Lamprey Ops.
F1	2245 on 08/15/20	0559 on 08/16/20	7 hours, 14 mins	R.S., Nighttime Lamprey Ops.
F2	2249 on 08/16/20	0610 on 08/17/20	7 hours, 12 mins	R.S., Nighttime Lamprey Ops.
F1	2230 on 08/17/20	0603 on 08/18/20	7 hours, 33 mins	R.S., Nighttime Lamprey Ops.
F2	2129 on 08/18/20	0559 on 08/19/20	8 hours, 30 mins	R.S., Nighttime Lamprey Ops.
F1	2129 on 08/19/20	0600 on 08/20/20	8 hours, 31 mins	R.S., Nighttime Lamprey Ops.
F2	2127 on 08/20/20	0601 on 08/21/20	8 hours, 34 mins	R.S., Nighttime Lamprey Ops.
F1	2128 on 08/21/20	0600 on 08/22/20	8 hours, 32 mins	R.S., Nighttime Lamprey Ops.
F2	2130 on 08/22/20	0558 on 08/23/20	8 hours, 28 mins	R.S., Nighttime Lamprey Ops.
F1	2130 on 08/23/20	0601 on 08/24/20	8 hours, 31 mins	R.S., Nighttime Lamprey Ops.
F2	2131 on 08/24/20	0556 on 08/25/20	8 hours, 25 mins	R.S., Nighttime Lamprey Ops.
F1	2143 on 08/25/20	0556 on 08/26/20	8 hours, 13 mins	R.S., Nighttime Lamprey Ops.
F2	2130 on 08/26/20	0557 on 08/27/20	8 hours, 27 mins	R.S., Nighttime Lamprey Ops.
F1	2132 on 08/27/20	0559 on 08/28/20	8 hours, 27 mins	R.S., Nighttime Lamprey Ops.
F2	2129 on 08/28/20	0603 on 08/29/20	8 hours, 34 mins	R.S., Nighttime Lamprey Ops.
F1	2129 on 08/29/20	0601 on 08/30/20	8 hours, 32 mins	R.S., Nighttime Lamprey Ops.
F2	2129 on 08/30/20	0559 on 08/31/20	8 hours, 30 mins	R.S., Nighttime Lamprey Ops.
F2	2129 on 08/31/20	0052 on 09/01/20	3 hours, 23 mins	R.S., Nighttime Lamprey Ops.
F1	2025 on 09/08/20	2159 on 09/08/20	1 hour, 34 mins	R.S., Float Trash
F2	2150 on 09/08/20	2340 on 09/08/20	1 hour, 50 mins	R.S., Float Trash
F1	0023 on 09/15/20	1010 on 09/15/20	9 hours, 15 mins	P.O., Replace Slip Ring Brushes
F2	0002 on 09/18/20	0317 on 09/18/20	3 hours, 15 mins	R.S., Float Trash
F1	0724 on 10/19/20	1559 on 10/28/20	9 days, 8 hours, 35 mins	P.O., Electrical Protection System Work

F2	0609 on 10/19/20	1651 on 10/28/20	9 days, 10 hours, 42 mins	P.O., Electrical Protection System Work
F1	1054 on 10/29/20	1059 on 10/29/20	5 mins	R.S., Troubleshoot Breaker Indication
F2	1112 on 10/29/20	1131 on 10/29/20	19 mins	R.S., Troubleshoot Breaker Indication
F2	0826 on 11/03/20	0953 on 11/03/20	1 hour, 27 mins	R.S., Troubleshoot Breaker Indication

Definitions: Reserve Status (R.S.) and Planned Outage (P.O.).

3. FISH PASSAGE PLAN COMPLIANCE

3.1 Fish Passage Plan Violations

Project Fisheries and the control room operators conduct inspections each day during fish passage season, and at least 3 days per week during winter maintenance. Project Biologists conducted 99% (309 / 313) of the required daily fishway inspections. Listed below are the FPP violations and the percentage of days the item was in criteria based on Project Biologist's inspections only (**Table 5**). Items in criteria 100% of the time are not listed. Explanations for items that were in criteria less than 90% of the reporting year, or having unusual circumstances, are given below.

Table 5. Fish Passage Plan Violations and Percent in Criteria.

Violation	Occurrences	In Criteria (%)
PH1 Forced into Being Priority	4	98.7%
Calibrations Missed	7	86.8%
PH1		
Collection Channel Differential	76	75.4%
B-Branch Entrance Differential	36	88.3%
FG3-26 (B-Branch)	72	76.7%
FG3-27 (B-Branch)	61	80.3%
FG3-28 (B-Branch)	6	98.1%
FG3-29 (B-Branch)	5	98.4%
BI Exit	1	99.7%
A-Branch Weir Differential	128	58.6%
B-Branch Weir Differential	3	99.0%
Ice & Trash Sluiceway	309	0.0%
PH2		
FG6-11 (Cascade Island)	309	0.0%
FG6-12 (Cascades Island)	70	77.3%
FG6-18 (Cascades Island)	183	40.8%
FG6-19 (Cascades Island)	104	66.3%
CI Entrance Differential	49	84.1%
Weir 37 Differential	9	97.1%
Weir 38 Differential	3	99.0%
Weir 67 Differential	1	99.7%
UMT Weir Differential	1	99.7%

3.1.1. PH1 Forced into Being Priority: Powerhouse 1 was forced into being the priority powerhouse from 15 to 18 March due to a headgate oil leak on F2 at Powerhouse 2.

3.1.2. Calibrations: Calibrations did not occur on several days during the 2020 reporting year due to being short staffed and hazardous smoke conditions several days during wildland fire season in the Columbia River Gorge Area.

3.1.3. Collection Channel Differentials: PH1 south (typically WG-2) and north (typically WG-64) entrances are controlled by different sources. With the aging Symax PLC system and sensors maintaining 1.0-2.0' differential is often difficult. Funding remains an issue with upgrading the PLC at PH1.

3.1.4. B-Branch Entrance Differential: The B-Branch fishway entrance gate is supposed to maintain a 1.0'-2.0' differential. Occasionally the differential was greater than 2.0' or less than 1.0'. At these times, the control room was notified, and modifications were made with FV 4-4 or the gates themselves.

3.1.5. FG3-26: For much of March FG3-26 was mechanically bound closed and eventually repaired. Starting in August, FG3-26 was found mechanically bound open when it should have been closed. Repairs were made again.

3.1.5. FG3-27: FG3-27 was found to be mechanically bound open in August. Repairs could not occur with the fishway watered up.

3.1.6. A-Branch Weir Differential: Leakage from the FV3-7 conduit along A-Branch is believed to be the cause for slightly above average differentials. Often the differential is +0.1' above criteria during the year.

3.1.7. PH1 ITS: The PH1 Ice and Trash Sluiceway lower gate failed on 30 December 2018. Auto-chain gates 3B, 6C, and 10B are operational; fixed-gates 1A and 1B are closed for safety reasons.

3.1.10. FG6-11: FG6-11 was found broken partially open on 01 May 2018. Due to the subsidence issues at Cascades Island repairs cannot occur until crane support is allowed in the vicinity and the fishway is out of service. Repairs are scheduled for the 2020/21 IWW period.

3.1.8. FG6-12: FG6-12 was found to be mechanically bound on 18 August 2018. Due to the subsidence issues at Cascades Island repairs cannot occur until crane support is allowed in the vicinity and the fishway is out of service. Repairs are scheduled for the 2020/21 IWW period.

3.1.9. FG6-18: FG6-18 was found to be mechanically bound on 27 March. Due to the subsidence issues at Cascades Island repairs cannot occur until crane support is allowed in the vicinity and the fishway is out of service. Repairs are scheduled for the 2020/21 IWW period

3.1.10. FG6-19: On the week of 31 May 2020, FG6-19 (Cascades Island) is mechanically bound in the closed position. The diffuser should be open with tailwaters > 15.0'. Due to the subsidence issues at Cascades Island, repairs cannot occur until crane support is allowed in the vicinity. Repairs are scheduled for the 2020/21 IWW period.

3.1.11. Cascades Island Entrance Differential: Cascades Island entrance differential is supposed to remain between 1.0' and 2.0' to attract fish to the CI fishway. Occasionally the differential was less than 1.0' due to several diffusers being mechanically bound closed.

3.2 STS / VBS Inspections

Submersible traveling screens (STS) and vertical barrier screens (VBS) are typically inspected once a month (**Table 6**). Each STS has a timer that automatically shows elapsed time of operation, with one month of continuous operation equaling 720 hours. Bonneville uses an underwater video camera to inspect STSs and VBSs, allowing inspection of the screens while they are installed and while the unit is running. PH2 STSs are generally installed in operational units from the end of February until mid-December for juvenile fish passage and for adult fallbacks. PH1 screens have been permanently removed.

Table 6. 2020 STS / VBS Inspections.

Unit	Install Dates & Run Hours Upon Installation	MAR	APR/MAY	JUN	JUL	AUG	SEPT	NOV	DEC	Removal Dates & Run Hours at Removal
11	20-Feb-20 49614	745	1075	1435	556	641	832	642	1006	16-Dec-20 56546
12	20-Feb-20 38372	767	464	285	557	552	834	479	859	16-Dec-20 43169
13	20-Feb-20 07447	---	285	1423	164	336	363	643	903	15-Dec-20 04117
14	20-Feb-20 10132	115	248	1426	548	294	548	533	903	15-Dec-20 14747
15	20-Feb-20 19578	729	656	1352	478	178	415	253	754	15-Dec-20 24383
16	20-Feb-20 32459	746	609	1414	366	81	251	139	666	14-Dec-20 36731
17	20-Feb-20 27636	780	693	1436	495	487	799	485	961	14-Dec-20 03227
18	20-Feb-20 68092	702	---	---	141	643	833	483	620	14-Dec-20 03051

3.3 Avian Abatement Measures

USDA Wildlife Service's avian hazing occurred from 01 March through July 31, 2020. This was done from the tailrace side of the powerhouses, the spillway, and the shoreline.

3.4 Fish Counts

The Corps of Engineers contracted with Four Peaks Environmental for fish counting during the 2020 fish passage season. The fish count season is year-round with visual counts from March until December and video counts during the rest of the year. All fish count numbers may be found at the Fish Passage Center (http://www.fpc.org/).

4. WATER QUALITY MONITORING

4.1 Zebra/Quagga Mussels

Through monthly inspections of the monitoring station at PH1 and of all dewatered fishways, no indication of zebra or quagga mussel colonization was found. The Project stays involved in regional preparation for zebra/quagga mussel arrival by sending project personnel to trainings and seminars to stay abreast of the latest information concerning these invasive species. Monitoring will continue with hopes that control programs can be initiated at the first indication of the mussel's arrival in the Pacific Northwest.

4.2 Fishway Temperature Monitoring

Project biologists monitor fishway temperatures throughout the fish passage season, from 01 March through 07 November (**Figure 2**). Temperature probes are installed at the following locations: A-Branch entrance, B-Branch entrance, Bradford Island exit, Washington Shore Entrance (NDE), Washington Shore Exit (near FV6-9), AFF, SMF, BI LPS, CI LPS, WA LPS, and the LFS. Additionally, the Technical Management Team (TMT) tracks BON forebay temperature on their website. The TMT temperature is publicly accessible in real-time, and is the standard utilized per the FPP to determine when high-temperature fish sampling restrictions are operative in BON facilities. In 2020, these temperatures were available from 12 March - 24 September. Detailed daily temperatures can be found in the weekly reports and are available upon request.

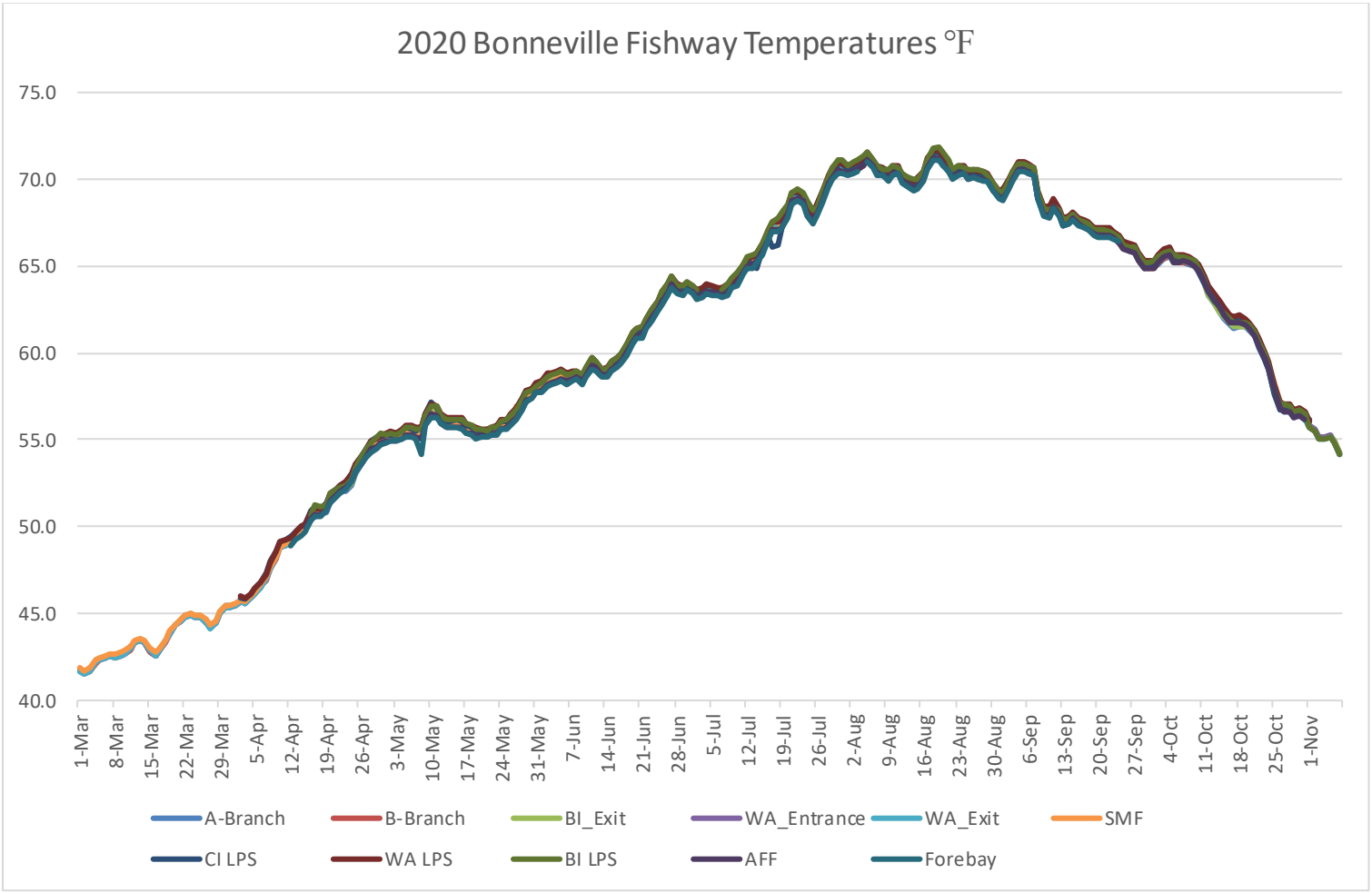

Figure 2. 2020 Temperatures at Bonneville.

5. FISHWAY MODIFICATIONS (1996 - present)

POWERHOUSE ONE ADULT

2018. Installed HOBO temperature monitors.
2012. Replaced PIT tag antenna in Bradford Island serpentine section.
2012. Dredged along the exit channel for the Bradford Island fish ladder.
2011. Repaired erosion cavities under the B-branch ladder of Bradford Island.
2006-present. Sea lion exclusion devices (SLEDs) are installed at the fishway entrances to prevent sea lion access to the fish ladder.
2005/06. Bulkheads were installed in the orifice gate and telescoping gate slots. Gates were removed along with the associated electronic and mechanical equipment.
2005/06. Passive Integrated Transponder (PIT) tag detectors installed in four serpentine weirs in the Bradford Island fishway.
2004-present. Utilize ROVs for fishway inspections instead of divers.
2003/04. Installed new electronic velocity meter at the north end of the PH1CC. No longer used.
2002/03. PH1CC orifice gates and telescoping gates are closed and disabled. Studies indicated more fish exited these gates than entered. Weir gates were left in service.
2001/02. Extra orifices in the overflow weirs were filled with concrete.
2000/01. PIT tag detectors installed in four orifice weirs in A-branch and four orifice weirs in B-branch.
1998/99. FG3-10 through 17 disabled and filled with concrete. FG3-14 (at the junction pool) covered with metal plates instead of concrete.

POWERHOUSE ONE JUVENILE

2019. Broken ITS end gate removed.
2013/14. ITS gate removed for repairs, gate slot plated for fish passage during removal.
2012/13. Spillway erosion hole and ogee repair.
2010/11. Welded elevation indicators on chain gates 3B, 6C, and 10B.
2010. PH1 JBS outfall pipe removed.
2009/10. Removal of the wall separating the Powerhouse 1 downstream migrant channel (DSM1) from the ITS completed to improve surface passage at PH1. The floor was raised and sloped.
2009. All remaining PH1 screens scrapped.
2008/09. ITS automated chaingates installed in 3B, 6C, and 10B.
2004-2007. The Powerhouse 1 downstream migrant channel (DSM1) is disabled as a juvenile bypass route. Screens are not installed during fish passage season except from 15 September until 15 December for adult fallback. DSM1 runs south during this time.
2001-2003. Unit 8 extended submerged bar screens were deemed undesirable and replaced with standard STSs.
2001-present. The 2000 Biological Opinion (BiOp) required the removal of impediments to fish passage from the turbine environments. Removal and replacement of excess metal, with fish friendly alternatives, occurs as units go out of service for rehab.
2000-2010. Turbine rehab involves installing minimum gap runners on all PH1 main units.

POWERHOUSE ONE LAMPREY

2020. Lamprey rest boxes were moved to their permanent locations in the BI flow control section.
2019. Bradford Island LPS exit ramp had grooves deepened and lid installed to dissuade algae growth and avian predation.
2018/19. Tested reduced nighttime entrance velocities at PH1 and B-branch entrances.
2018/19. Field tested the Bradford Is. Wetted Wall (BIWW).
2018. Installed HOBO temperature monitors.
2017/18. Modified the Bradford Is. LPS exit. Objective was to allow for adjustable slope and to release lamprey further from the adult ladder exit thus reducing fallback.
2017/18. Orifice slots drilled in lower serpentine weir walls (weirs 1, 3, and 5); trial rest boxes installed.
2015/16. Modified Bradford crowder station to reduce lamprey mortality due to crowder run-over and those dying in area behind crowder. Perf plate in count slot, skirt in bottom of crowder, plating on sides of crowder.
2013/14. Lamprey passage structure pumps relocated from forebay location to within the AWS to minimize debris buildup. Fry criteria screens placed on lamprey pumps.
2012. Picket lead modifications to insure one inch spacing between leads and sill plate and prevent lead bending. Spacers installed.
2011. Lamprey count improvements including video verification network at exit flume.
2011. Picket lead spacers for lamprey passage removed on 29 June.
2011. One inch picket lead spacers installed on 24 May to allow lamprey passage under leads.
2005/06. PIT tag detection and expanded lamprey ramp installed in the Bradford Island FV3-9 AWS channel.
2003/04. Lamprey ramp installed in the Bradford Island FV3-9 AWS channel.

CASCADES ISLAND FISHWAY/ UMT

2004-present. Utilize ROVs for fishway inspections instead of divers.
2004/05. UMT fish count window crowder and window cleaner removed.
2001/02. New diffuser covers built and installed.
2000/01. More PIT tag detectors installed in four orifice weirs.
1999/00. FG6-1 through 4 filled in with concrete.
1998/99. PIT tag detectors installed in four orifice weirs.
1996-2000. The UMT drain is blind flanged and no longer used.

CASCADES ISLAND LAMPREY

2020. Cascade Island lamprey trap was constructed and placed into service 3 June.
2017/18. FDX PIT systems installed.
2016. Gaps in picket leads fixed with addition of new pickets to reduce lamprey incursion into AWS.
2014/15. Picket lead spacing reduced and side gaps amended to block lamprey access to the AWS and ladder exit area above the lower pickets.
2012/13. Lamprey passage system extension into the forebay and conversion to volitional passage system.
2008/09. Lamprey ramp and bollards installed in CI entrance pool. Variable width entrance weir installed in May.
2005/06. HDX PIT tag detectors were installed along the picket leads to track lamprey.

POWERHOUSE TWO ADULT

2017. Removal of Collection Channel velocity meter.
2017. Permanent SLEDs (Sea Lion Exclusion Devices) were fabricated and installed on top of FOGs to prevent Sea Lions from entering the fishway.
2017. Four floating orifice gates (FOGs) were removed and replaced with bulkheads to minimize locations for potential sea lion entry. This reduced the number of FOGs from 12 to 8.
2017. An opening in the wall separating the crowder area of the main ladder from the AWS was covered with screen to prevent possible Sockeye incursion into the AWS.
2017. Installed ID plates at bases of "C" diffusers in the collection channel for ROV inspections.
2017. The base of the AWS picket leads was modified to reduce possible Sockeye incursion into the AWS.
2013-2015. Modifications to the AFF to improve water velocity and sampling conditions.
2013. Replaced PIT antenna in WA Shore ladder serpentine section.
2013. Forebay dredging in front of the Fish Unit intakes.
2012/13. Repairs to the gates and guides on B-valves 3 and 4.
2012. Debris removal from the AWS and accompanying diffusers.
2011. SA-24 board replaced with new PH2 Collection Channel Fishway PLC.
2011. Reattached blown off diffuser grating in ladder at North Monolith and debris removal from AWS and accompanying diffusers.
2010/11. AFF sample flume modified to accommodate an auxiliary sample tank used by WDFW. CRITFC obtained and installed a new, larger sample tank complete with a PIT tag detector at the entrance to the tank.
2008/09. Picket leads installed perpendicular to existing AFF picket leads. Not used after 2009 sample season.
2007/08. Manufactured new FOG SLEDs.
2006/07. Installed new staff gauges in the monoliths.
2006/07. AFF lamprey orifice gate removed due to pulley failure resulting in salmon passage blockage and dewatering difficulties.
2005-present. SLEDs installed at fishway entrances to prevent sea lion access to the fish ladders.
2005/06. AFF count window crowder removed due to structural failure.
2004-present. Utilize ROVs for fishway inspections instead of divers.
2004/05. Repaired the AWS conduit.
2004/05. Installed new velocity meter at South Upstream Entrance (SUE).
2004/05. PIT tag detectors installed in four serpentine weirs.
2004/05. AFF brail pool modifications made. The brail pool is now the primary recovery pool.
2003/04. AFF electrical upgrades complete.
2003/04. Picket leads for the triangle section were removed.
2002/03. Removed old metal staff gauge frames from monolith entrances.
2001/02. PIT tag detectors installed in eight orifice weirs, four upstream and four downstream of the AFF.
1999/00. AFF exit ladder equipped with orifice PIT tag detectors.

POWERHOUSE TWO JUVENILE

2018. Removal of FGE flow control plates from all units.
2018. Installed HOBO temperature monitors.
2018. Major electrical upgrades to the SMF PLC.
2016/17. LED lighting improvements to DSM.
2016/17. Flow control plates installed in 'A' & 'B' gatewells of all PH2 units, plating on upper sections of VBSs.
2014. Testing of a flow control plate in Unit 15 "A" slot.
2013. Gantry 7 rehabilitation.
2013. Turbulence Reduction Device (TRD) testing in Unit 14 "A" slot.
2013. Alarm installed on the 2-way rotating gate at the SMF.
2012. B2CC bulkhead converted to permanent hoist with automatic control.
2012. B2CC joint repair to fix spalling and decrease channel roughness.
2008/09. Release pipe attached to JMF outfall pipe for juveniles trucked from Walla Walla District.
2007/08. Behavioral Guidance Structure (BGS) installed in PH2 forebay. Removed in December 2010.
2007/08. PH2 Downstream Migrant transportation channel (DSM2) LED lights returned to halogen lights due to the unknown effects of LEDs.
2007/08. Units 14 and 18 are modified for new VBSs and improved FGE.
2006/07. New LED lights replace the halogen lights. The LED lights are cooler and will last years longer than the halogens. These lights were salvaged from DSM1.
2006/07. Units 11, 15, 16 are modified for new VBSs and improved FGE.
2005/06. B2CC PIT tag antenna installed.
2005/06. SMF full flow PIT tag antenna installed.
2005/06. Units 12 and 13 modified for new VBSs and improved Fish Guidance Efficiency (FGE).
2004/05. VBS modifications for Unit 17 result in screen failure. The design for the new VBSs is re-examined and redrawn.
2004/05. SMF Outfall hydro-cannon piping is replaced.
2004/05. B2CC complete and online.
2003/04. Unit 17 VBSs and gatewells are modified to improve FGE. Modifications include gap closure devices on the STSs and modified VBSs.
2002/03. NOAA Fisheries fyke net frame is removed from the tailrace.
2002/03. Unit 15 gatewells are partially modified to improve FGE. Modifications include gap closure devices on the STSs.
2002/03. Biologists noticed places of ovality while inspecting the two mile pipe. The pipe has been monitored regularly to document potential changes.
2002-present. The 2000 BiOp required the removal of impediments to fish passage from the turbine environments. Removal and replacement of excess metal, with fish friendly alternatives, occurs as units come out of service for maintenance.
2001/02. Raised the DSM2 walkway grating to prevent fish from impacting it.
2001/02. Modified the DSM2 add-in screen to vertical bars to allow juveniles to move out of the add-in water and into the channel. The bars didn't reach the walkway so a perforated plate was added later in the season to prevent adults from jumping into the add-in section.
2001/02. Flume covers were added over the switch gates. This was to encourage fish to stay in the main channel and not seek shade by swimming under the switch gates.
2000/01. Saltwater rearing moved into the SMF.
2000/01. Modifications were made to the primary dewatering structure drain pipe to divert more water into the wetlands. This reduced the flow fluctuations and air bubbles under the perforated plate in the primary dewatering structure.
1998-2000. SMF construction completed. The facility goes online.

POWERHOUSE TWO LAMPREY

2020. Repair of the blown LFS inspection hatch by District Dive Safety.
2019. Orifice slots in weir 1 closed permanently. Six additional slots drilled in odd numbered weirs to exit (7, 9, 11, 13, 15, &17).
2019. Lamprey weir caps installed on NDE and NUE.
2018. Replaced the two winch-deployed AFF lamprey traps for a permanently installed single ramp trap.
2018. Installed HOBO temperature monitors.
2018. WA AWS LPS exit "plunge box" installed.
2017. Blackout blinds were installed over visitor center viewing windows in order to reduce in-ladder nighttime light pollution.
2017. The count station crowder was modified with perf plating and a rubber "skirt" to reduce incidences of lamprey being run over. Grating was installed on the downstream side of the crowder to reduce fish incursion into the area behind the crowder.
2016/17. Lamprey weir caps installed on SDE and SUE.
2016/17. Orifice slots drilled in lower serpentine weir walls (weirs 1, 3, and 5); trial rest boxes installed.
2016/17. FLS velocity barrier plate installed to reduce areas of high velocity.
2016/17. Removed lamprey plating in N entrance area, replaced with orifice plates. AWS LPS extensions and new pump system.
2016. LFS repairs. Divers replaced missing hatch, hydraulic air entrainment 'dampener' installed.
2013. Lamprey refuge boxes installed in the WA Shore ladder, near the UMT confluence.
2012/13. Construction of Lamprey Flume System and associated LPS at NDE on the north monolith.
2012/13. Picket lead modifications to insure 1 ½ inch spacing between leads and sill plate and prevent lead bending. Spacers installed.
2011. Picket lead spacers for lamprey passage removed on 29 June.
2010/11. NOAA installed a picket lead sill ramp to ease the transition from the ladder into the AWS. NOAA also installed ¾ inch crowder picket leads at the count station.
2010. One inch picket lead spacers installed on 25 May for lamprey passage under leads.
2007/08. Lamprey ramp installed in the Washington Shore FV6-9 AWS channel.
2004/05. Lamprey ramp installed at North Downstream Entrance (NDE).
2000/01. Lamprey plates are installed over the Washington Shore diffuser grates.

BASS LAKE

2006. The leaking drain is repaired. The lake holds water and Coho are seen spawning in the outlet (Moffett Creek) of Bass Lake. The salvaged logs create log jams over the sink hole.
2004. Salvaged logs are placed in Bass Lake to provide habitat.

REFERENCES

2019-2020. Weekly reports and daily inspections for Bonneville Dam. U.S. Army Corps of Engineers, Portland District. Bonneville Lock and Dam.

2020. Fish Passage Plan for Corps of Engineers Projects. U. S. Army Corps of Engineers, Northwestern Division, Portland, Oregon.

2018-2019. Daily fishway inspections for Bonneville Dam.

2018-2019. Weekly reports for Bonneville Dam. U.S. Army Corps of Engineers, Portland District. Bonneville Lock and Dam.