2019 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.
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.
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.
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.
ROV ---------- Remotely Operated Vehicle.
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 **2019** Project Fisheries Annual Report for Bonneville Project summarizes activities occurring from **01 December 2018 through 30 November 2019** and is required by the Fish Passage Plan (FPP), per section 3.3.4.

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).

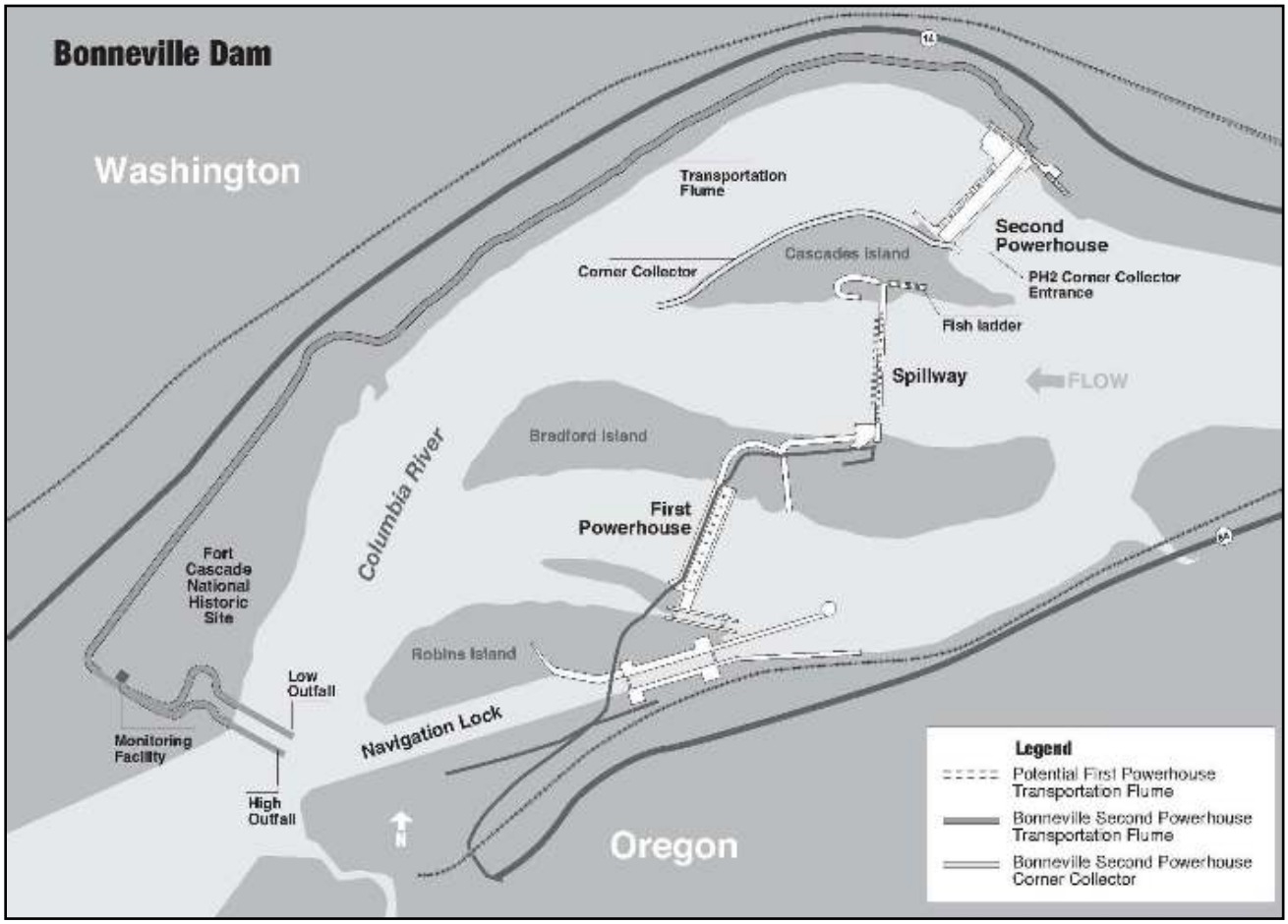

Figure 1. Bonneville Lock and Dam.

2. OPERATIONS

2.1 Fish Facility Outages

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

FISH FACILITY	OOS DATE 2018	IN SERVICE DATE 2019	OOS DATE 2019	REASON FOR OUTAGE
BI LADDER	NA	NA	30-Nov	Winter Maintenance
A-BRANCH	NA	NA	30-Nov	Winter Maintenance
B-BRANCH	NA	NA	30-Nov	Winter Maintenance
CI LADDER	NA	NA	NA	Winter Maintenance
WA SHORE LADDER	1-Dec	28-Feb	NA	Winter Maintenance
UMT	1-Dec	28-Feb	NA	Winter Maintenance
BI LPS	31-Oct	18-Apr	31-Oct	Winter Maintenance
CI LPS	31-Oct	16-Apr	31-Oct	Winter Maintenance
WA AWS LPS	31-Oct	11-Apr	31-Oct	Winter Maintenance
NDE LFS/LPS	14-Sep	13-May	13-Sep	Low CPUE
AFF LAMPREY TRAP	14-Sep	13-May	13-Sep	Low CPUE
BI WETTED WALL	10-Sep	17-Apr	10-Oct	Winter Maintenance
B2CC	1-Sep	16-Jan	1-Sep	Early start due to PH1 ITS closure
DSM	19-Dec	23-Feb	19-Dec	Winter Maintenance
AFF	7-Nov	30-Apr	18-Oct	CRITFC concluded sampling efforts
SMF	31-Oct	2-Mar	31-Oct	Winter Maintenance

Table 1. Seasonal fish facility outages.

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.

UNIT	OOS DATE	RTS DATE	DURATION	REASON
1	12/3/18 7:07	3/12/19 12:07	99 days, 5 hrs	5-YR Overhaul
7	12/10/18 0:11	12/12/18 13:36	2 days, 13 hrs, 25 mins	Breaker Maintenance
8	12/10/18 0:12	12/12/18 13:37	2 days, 13 hrs, 25 mins	Breaker Maintenance
12	1/7/19 0:01	1/9/19 12:08	2 days, 12 hrs, 7 mins	Insulator Inspection/Repair
13	1/7/19 0:01	1/9/19 12:08	2 days, 12 hrs, 7 mins	Insulator Inspection/Repair
14	1/7/19 0:01	1/9/19 12:08	2 days, 12 hrs, 7 mins	Insulator Inspection/Repair
11	1/7/19 0:01	1/10/19 17:38	3 days, 17 hrs, 37 mins	Annual Maintenance & Insulator Inspection/Repair
10	1/28/19 0:01	1/31/19 16:11	3 days, 16 hrs, 10 mins	Annual Maintenance
18	1/28/19 0:01	2/1/19 7:49	4 days, 7 hrs, 48 mins	Annual Maintenance
17	2/11/19 0:01	2/14/19 16:28	3 days, 16 hrs, 27 mins	Annual Maintenance / QTC Inspection
15	2/16/19 7:00	2/18/19 13:38	2 days, 6 hrs, 38 mins	Forebay Dredging
16	2/16/19 7:00	2/18/19 13:39	2 days, 6 hrs, 39 mins	Forebay Dredging
17	2/16/19 7:00	2/18/19 13:52	2 days, 6 hrs, 52 mins	Forebay Dredging
18	2/16/19 7:00	2/18/19 13:52	2 days, 6 hrs, 52 mins	Forebay Dredging
16	3/4/19 0:01	3/7/19 11:41	3 days, 11 hrs, 40 mins	Annual Maintenance
16	3/7/19 20:08	3/11/19 16:41	3 days, 20 hrs, 33 mins	16B STS Failure
15	3/18/19 7:14	5/16/19 9:00	59 days, 1 hrs, 46 mins	4-YR Overhaul
12	4/15/19 0:05	4/18/19 15:29	3 days, 15 hrs, 24 mins	Annual Maintenance / QTC Inspection
14	6/3/19 0:04	6/13/19 13:31	10 days, 13 hrs, 27 mins	T11 Bi-Annual Maintenance / Annual Maintenance
13	6/3/19 0:05	6/13/19 13:31	10 days, 13 hrs, 26 mins	T11 Bi-Annual Maintenance
11	6/3/19 0:05	6/13/19 13:32	10 days, 13 hrs, 27 mins	T11 Bi-Annual Maintenance
12	6/3/19 0:05	6/13/19 13:36	10 days, 13 hrs, 31 mins	T11 Bi-Annual Maintenance
2	6/10/19 0:01	7/2/19 20:08	22 days, 20 hrs, 7 mins	Annual / Coolers / Gov Filters
9	6/17/19 0:01	6/26/19 19:18	9 days, 19 hrs, 17 mins	MU1 on Bank 9/10, Support of Bank 1/2
6	7/8/19 7:17	8/29/19 12:05	52 days, 4 hrs, 48 mins	5-YR Overhaul
4	7/15/19 0:01	7/18/19 16:52	3 days, 16 hrs, 51 mins	Annual Maintenance
5	7/22/19 0:01	7/25/19 17:20	3 days, 17 hrs, 19 mins	Annual Maintenance
7	7/29/19 0:04	8/1/19 9:54	3 days, 9 hrs, 50 mins	Annual Maintenance
8	8/5/19 0:01	8/8/19 18:56	3 days, 18 hrs, 55 mins	Annual Maintenance
11	8/6/19 5:56	8/7/19 16:17	1 day, 10 hrs, 21 mins	Replace Gantry 8 Breaker Cubicle
12	8/6/19 5:56	8/7/19 16:17	1 day, 10 hrs, 21 mins	Replace Gantry 8 Breaker Cubicle

13	8/6/19 5:56	8/7/19 16:17	1 day, 10 hrs, 21 mins	Replace Gantry 8 Breaker Cubicle
14	8/6/19 5:56	8/7/19 16:17	1 day, 10 hrs, 21 mins	Replace Gantry 8 Breaker Cubicle
15	8/6/19 5:56	8/7/19 16:17	1 day, 10 hrs, 21 mins	Replace Gantry 8 Breaker Cubicle
2	8/12/19 0:01	8/22/19 12:36	10 days, 12 hrs, 35 mins	In Support of Bank 9/10
9	8/12/19 0:01	8/29/19 11:11	17 days, 11 hrs, 10 mins	Annual Maintenance & Bank 9/10
15	9/3/19 0:02	9/4/19 14:42	1 day, 14 hrs, 40 mins	Thrust Collar Inspection
4	9/9/19 0:01	9/18/19 11:54	9 days, 11 hrs, 53 mins	Air Cooler Replacement
5	9/22/19 19:00	9/25/19 16:41	2 days, 21 hrs, 41 mins	Air Cooler Replacement
7	9/30/19 0:01	10/10/19 13:52	10 days, 13 hrs, 51 mins	Air Cooler Replacement
3	10/21/19 0:01	11/7/2019 14:17	17 days, 14 hrs, 16 mins	Annual Maint. / Air Cooler Replacement
9	10/21/19 6:16	10/22/19 17:00	1 day, 10 hrs, 44 mins	Fire Protection Work for Bank 1/2
2	10/21/19 6:16	10/28/19 20:56	7 days, 14 hrs, 40 mins	ZJ13 Inspection / Repair, Bank 1/2
1	10/22/19 17:00	10/28/19 20:56	6 days, 3 hrs, 56 mins	ZJ13 Inspection / Repair
4	10/23/19 6:16	10/24/19 11:58	1 day, 5 hrs, 42 mins	Fire Protection Work for Bank 3/4
5	10/28/19 6:00	10/29/19 11:39	1 day, 5 hrs, 39 mins	Fire Protection Work for Bank 5/6 & Bank 7/8
6	10/28/19 6:00	10/29/19 11:39	1 day, 5 hrs, 39 mins	Fire Protection Work for Bank 5/6 & Bank 7/8
7	10/28/19 6:00	10/29/19 11:39	1 day, 5 hrs, 39 mins	Fire Protection Work for Bank 5/6 & Bank 7/8
8	10/28/19 6:00	10/29/19 11:39	1 day, 5 hrs, 39 mins	Fire Protection Work for Bank 5/6 & Bank 7/8
2	10/29/19 8:20	11/4/2019 9:00	6 days, 40 mins	XJ2 Racking Mechanism Broken
3	11/18/2019 21:43	11/20/2019 13:08	1 day, 15 hrs, 25 mins	MU1 Loss of PT Signal
13	11/18/2019 0:01	11/21/2019 13:28	3 days, 13 hrs, 27 mins	Annual Maintenance
15	11/16/2019 5:26	11/18/2019 16:23	2 days, 10 hrs, 57 mins	Orifice 15A Failure

Table 2. Turbine outages lasting greater than 24 hours.

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 launch. The following 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.

DATE	LOCATION	FISH SALVAGED	RELEASE SITE
12/3	UMT	2 juvenile salmonids, 3 American Shad, ~200 Cyprinids, 4 adult Steelhead Trout, and 3 adult Chinook Salmon	Upstream of Nav Lock
12/3	WA Shore Exit to Tailwater	~150 American Shad, ~200 Cyprinids, 9 adult Steelhead Trout, ~20 juvenile salmonids, 6 adult Chinook Salmon, and 16 Pacific Lamprey	Upstream of Nav Lock
12/8	PH2CC / Junction Pool	1 adult Chinook Salmon	Upstream of Nav Lock
2/5	MU1 Tail-logs	5 juvenile salmonids, 1 juvenile lamprey, 15 sculpin, 2 crayfish and 1 Peamouth	Hamilton Island Boat Launch
5/9	MU15 Tail-logs	~20 sculpin, 1 Pikeminnow, and 1 catfish	Tailwater
7/9	MU6 Draft Tube	9 Pacific Lamprey	Upstream of Nav Lock
8/29	MU6 Tail-logs	4 Steelhead Trout, ~16 sculpins, 1 Carp, and 1 Centrarchid	Upstream of Nav Lock
9/7	Nav Lock 2	~24 adult Salmonids *25 salmonid mortalities	Upstream of Nav Lock
9/23	Nav Lock 2	1 adult Chinook Salmon and 2 adult Steelhead Trout	Upstream of Nav Lock
11/19	AFF	2 juvenile salmonids, 1 White Sturgeon, 4 Cyprinids, and ~300 American Shad	Upstream of Nav Lock

Table 3. Fish salvages at Bonneville December 2018 – November 2019.

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.

UNIT	OOS	RTS	DURATION	REASON
F1	12/2/2018 2:32	2/28/2019 10:53	88 days, 8 hrs, 21 mins	PO, 2-YR Overhaul
F2	12/2/2018 2:32	2/28/2019 10:49	88 days, 8 hrs, 17 mins	PO, Annual Maintenance
F2	3/2/2019 18:43	3/2/2019 20:19	1 hrs, 36 mins	RS, Float Trash
F2	3/12/2019 7:12	3/12/2019 13:20	6 hrs, 8 mins	PO, Vibration Monitoring
F2	3/12/2019 13:36	3/12/2019 16:05	2 hrs, 29 mins	PO, Vibration Monitoring
F2	3/13/2019 9:32	3/13/2019 9:59	27 mins	PO, Vibration Monitoring
F2	3/13/2019 13:46	3/13/2019 15:48	2 hrs, 2 mins	PO, Vibration Monitoring
F2	3/20/2019 16:10	3/20/2019 16:20	9 mins	FO, Model Validation Testing
F2	4/10/2019 8:32	4/10/2019 9:34	1 hrs, 2 mins	PO, Station Service Testing
F2	4/10/2019 10:24	4/10/2019 10:30	6 mins	PO, Station Service Testing
F2	4/10/2019 15:28	4/10/2019 15:47	19 mins	PO, Station Service Testing
F2	4/11/2019 18:23	4/11/2019 18:54	31 mins	RS, Float Trash
F1	4/11/2019 18:47	4/11/2019 19:34	46 mins	RS, Float Trash
F2	4/12/2019 18:37	4/12/2019 19:26	48 mins	RS, Float Trash
F2	4/14/2019 0:42	4/14/2019 2:41	1 hrs, 58 mins	RS, Float Trash
F1	4/14/2019 1:38	4/14/2019 2:45	1 hrs, 7 mins	RS, Float Trash
F1	4/19/2019 8:02	4/19/2019 9:13	1 hrs, 10 mins	FO, ERG Trip, T11 OOS
F2	6/1/2019 0:41	6/1/2019 4:35	3 hrs, 53 mins	RS, Nighttime Lamprey Ops
F1	6/1/2019 21:30	6/2/2019 4:30	6 hrs, 59 mins	RS, Nighttime Lamprey Ops
F2	6/2/2019 22:02	6/3/2019 4:30	6 hrs, 27 mins	RS, Nighttime Lamprey Ops

F2	6/3/2019 21:29	6/4/2019 4:30	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F1	6/4/2019 21:30	6/5/2019 4:31	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F2	6/5/2019 21:31	6/6/2019 4:25	6 hrs, 53 mins	RS, Nighttime Lamprey Ops
F1	6/6/2019 21:31	6/7/2019 4:32	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F2	6/7/2019 21:32	6/8/2019 4:36	7 hrs, 4 mins	RS, Nighttime Lamprey Ops
F1	6/8/2019 21:32	6/9/2019 4:31	6 hrs, 59 mins	RS, Nighttime Lamprey Ops
F2	6/9/2019 21:31	6/10/2019 4:33	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F1	6/10/2019 21:30	6/11/2019 4:31	7 hrs	RS, Nighttime Lamprey Ops
F2	6/11/2019 21:30	6/12/2019 4:30	6 hrs, 59 mins	RS, Nighttime Lamprey Ops
F1	6/12/2019 22:10	6/13/2019 4:28	6 hrs, 17 mins	RS, Nighttime Lamprey Ops
F2	6/13/2019 22:05	6/14/2019 4:47	6 hrs, 41 mins	RS, Nighttime Lamprey Ops
F2	6/14/2019 22:06	6/15/2019 4:48	6 hrs, 41 mins	RS, Nighttime Lamprey Ops
F2	6/15/2019 21:32	6/16/2019 4:35	7 hrs, 3 mins	RS, Nighttime Lamprey Ops
F1	6/16/2019 21:33	6/17/2019 4:31	6 hrs, 58 mins	RS, Nighttime Lamprey Ops
F1	6/17/2019 21:32	6/18/2019 4:26	6 hrs, 54 mins	RS, Nighttime Lamprey Ops
F2	6/18/2019 21:30	6/19/2019 4:43	7 hrs, 12 mins	RS, Nighttime Lamprey Ops
F1	6/19/2019 21:30	6/20/2019 4:22	6 hrs, 51 mins	RS, Nighttime Lamprey Ops
F2	6/20/2019 21:30	6/21/2019 4:30	7 hrs	RS, Nighttime Lamprey Ops
F1	6/21/2019 21:30	6/22/2019 4:32	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F2	6/22/2019 21:44	6/23/2019 4:30	6 hrs, 46 mins	RS, Nighttime Lamprey Ops
F1	6/23/2019 21:53	6/24/2019 4:35	6 hrs, 42 mins	RS, Nighttime Lamprey Ops
F2	6/24/2019 21:30	6/25/2019 4:31	7 hrs, 1 mins	RS, Nighttime Lamprey Ops
F1	6/25/2019 21:40	6/26/2019 5:01	7 hrs, 21 mins	RS, Nighttime Lamprey Ops
F2	6/26/2019 21:30	6/27/2019 4:33	7 hrs, 2 mins	RS, Nighttime Lamprey Ops
F1	6/27/2019 21:31	6/28/2019 4:30	6 hrs, 59 mins	RS, Nighttime Lamprey Ops
F2	6/28/2019 21:30	6/29/2019 4:30	7 hrs, 0 mins	RS, Nighttime Lamprey Ops
F1	6/29/2019 21:30	6/30/2019 4:29	6 hrs, 59 mins	RS, Nighttime Lamprey Ops
F2	6/30/2019 21:29	7/1/2019 4:31	7 hrs, 2 mins	RS, Nighttime Lamprey Ops

F2	7/1/2019 22:03	7/2/2019 4:33	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	7/2/2019 22:01	7/3/2019 4:29	6 hrs, 27 mins	RS, Nighttime Lamprey Ops
F2	7/3/2019 22:01	7/4/2019 4:30	6 hrs, 28 mins	RS, Nighttime Lamprey Ops
F1	7/4/2019 22:00	7/5/2019 4:32	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F2	7/5/2019 22:01	7/6/2019 4:30	6 hrs, 28 mins	RS, Nighttime Lamprey Ops
F1	7/6/2019 21:59	7/7/2019 4:30	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	7/7/2019 22:00	7/8/2019 4:30	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F1	7/8/2019 22:00	7/9/2019 4:38	6 hrs, 37 mins	RS, Nighttime Lamprey Ops
F2	7/9/2019 22:00	7/10/2019 4:31	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	7/10/2019 22:05	7/11/2019 4:29	6 hrs, 23 mins	RS, Nighttime Lamprey Ops
F2	7/11/2019 21:57	7/12/2019 4:41	6 hrs, 43 mins	RS, Nighttime Lamprey Ops
F1	7/12/2019 21:57	7/13/2019 4:27	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	7/13/2019 22:01	7/14/2019 4:30	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	7/14/2019 21:59	7/15/2019 4:31	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F2	7/15/2019 22:02	7/16/2019 4:31	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	7/16/2019 21:59	7/17/2019 4:31	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F1	7/17/2019 22:00	7/18/2019 4:30	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	7/18/2019 22:00	7/19/2019 4:29	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	7/19/2019 22:00	7/20/2019 4:30	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	7/20/2019 22:02	7/21/2019 4:35	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F1	7/21/2019 21:59	7/22/2019 4:34	6 hrs, 34 mins	RS, Nighttime Lamprey Ops
F2	7/22/2019 22:00	7/23/2019 4:30	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F1	7/23/2019 8:20	7/23/2019 8:47	26 mins	RS, Troubleshoot & Repair Brakes
F1	7/23/2019 13:08	7/23/2019 14:20	1 hrs, 11 mins	RS, Troubleshoot & Repair Brakes
F1	7/23/2019 14:24	7/23/2019 14:33	9 mins	RS, Troubleshoot & Repair Brakes
F2	7/23/2019 14:36	7/23/2019 14:50	14 mins	RS, Troubleshoot & Repair Brakes
F1	7/23/2019 14:56	7/23/2019 15:10	14 mins	RS, Troubleshoot & Repair Brakes
F2	7/23/2019 22:04	7/24/2019 4:31	6 hrs, 27 mins	RS, Nighttime Lamprey Ops
F2	7/24/2019 8:31	7/24/2019 8:39	8 mins	RS, Shifting 125 DC Panels

F2	7/24/2019 22:00	7/25/2019 4:32	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F2	7/25/2019 13:27	7/25/2019 13:34	7 mins	RS, Shifting 125 DC Panels
F2	7/25/2019 22:00	7/26/2019 4:30	6 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	7/26/2019 22:00	7/27/2019 4:32	6 hrs, 32 mins	RS, Nighttime Lamprey Ops
F1	7/27/2019 22:00	7/28/2019 4:41	6 hrs, 41 mins	RS, Nighttime Lamprey Ops
F2	7/28/2019 22:28	7/29/2019 4:34	6 hrs, 6 mins	RS, Nighttime Lamprey Ops
F1	7/29/2019 21:59	7/30/2019 10:44	12 hrs, 44 mins	RS, Nighttime Lamprey Ops, Failed Limit Switch
F2	7/30/2019 22:00	7/31/2019 4:31	6 hrs, 30 mins	RS, Nighttime Lamprey Ops
F1	7/31/2019 7:08	7/31/2019 16:20	9 hrs, 11 mins	RS, PH2 ROV Inspection
F2	7/31/2019 7:09	7/31/2019 16:38	9 hrs, 28 mins	RS, PH2 ROV Inspection
F1	7/31/2019 22:01	8/1/2019 5:00	6 hrs, 58 mins	RS, Nighttime Lamprey Ops
F1	8/1/2019 21:45	8/2/2019 5:01	7 hrs, 15 mins	RS, Nighttime Lamprey Ops
F1	8/2/2019 21:48	8/3/2019 4:59	7 hrs, 10 mins	RS, Nighttime Lamprey Ops
F2	8/3/2019 21:45	8/4/2019 5:01	7 hrs, 15 mins	RS, Nighttime Lamprey Ops
F1	8/4/2019 21:45	8/5/2019 5:01	7 hrs, 15 mins	RS, Nighttime Lamprey Ops
F2	8/5/2019 21:45	8/6/2019 5:00	7 hrs, 14 mins	RS, Nighttime Lamprey Ops
F1	8/6/2019 7:54	8/6/2019 11:13	3 hrs, 19 mins	FO, T11 Trip
F2	8/6/2019 21:47	8/7/2019 4:59	7 hrs, 12 mins	RS, Nighttime Lamprey Ops
F1	8/7/2019 21:45	8/8/2019 4:59	7 hrs, 14 mins	RS, Nighttime Lamprey Ops
F2	8/8/2019 21:46	8/9/2019 5:03	7 hrs, 17 mins	RS, Nighttime Lamprey Ops
F2	8/9/2019 21:44	8/10/2019 4:59	7 hrs, 15 mins	RS, Nighttime Lamprey Ops
F2	8/10/2019 21:44	8/11/2019 5:02	7 hrs, 17 mins	RS, Nighttime Lamprey Ops
F2	8/11/2019 21:44	8/12/2019 5:01	7 hrs, 17 mins	RS, Nighttime Lamprey Ops
F2	8/12/2019 21:46	8/13/2019 5:02	7 hrs, 15 mins	RS, Nighttime Lamprey Ops
F1	8/13/2019 21:45	8/14/2019 5:01	7 hrs, 16 mins	RS, Nighttime Lamprey Ops
F2	8/14/2019 21:46	8/15/2019 4:59	7 hrs, 13 mins	RS, Nighttime Lamprey Ops
F2	8/15/2019 21:45	8/16/2019 5:00	7 hrs, 14 mins	RS, Nighttime Lamprey Ops
F1	8/16/2019 21:45	8/17/2019 4:59	7 hrs, 13 mins	RS, Nighttime Lamprey Ops

F2	8/17/2019 20:36	8/18/2019 4:57	8 hrs, 21 mins	RS, Nighttime Lamprey Ops
F2	8/18/2019 20:29	8/19/2019 5:02	8 hrs, 33 mins	RS, Nighttime Lamprey Ops
F2	8/19/2019 20:29	8/20/2019 4:52	8 hrs, 22 mins	RS, Nighttime Lamprey Ops
F2	8/20/2019 20:27	8/21/2019 4:51	8 hrs, 24 mins	RS, Nighttime Lamprey Ops
F1	8/21/2019 3:21	8/21/2019 3:56	35 mins	RS, Float Trash
F1	8/21/2019 20:30	8/22/2019 6:30	9 hrs, 59 mins	RS, Nighttime Lamprey Ops
F1	8/22/2019 6:30	8/22/2019 13:45	7 hrs, 15 mins	PO, Replace Trash Racks & AWS Inspection
F2	8/22/2019 6:30	8/22/2019 13:45	7 hrs, 15 mins	Replace Trash Racks
F2	8/22/2019 20:30	8/23/2019 5:01	8 hrs, 31 mins	RS, Nighttime Lamprey Ops
F1	8/23/2019 20:30	8/24/2019 4:59	8 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	8/24/2019 20:30	8/25/2019 4:59	8 hrs, 29 mins	RS, Nighttime Lamprey Ops
F1	8/25/2019 20:29	8/26/2019 4:58	8 hrs, 29 mins	RS, Nighttime Lamprey Ops
F2	8/26/2019 20:30	8/27/2019 4:59	8 hrs, 28 mins	RS, Nighttime Lamprey Ops
F1	8/27/2019 20:29	8/28/2019 0:33	4 hrs, 3 mins	RS, Nighttime Lamprey Ops
F2	8/28/2019 0:34	8/28/2019 5:01	4 hrs, 27 mins	RS, Nighttime Lamprey Ops
F2	8/28/2019 20:31	8/29/2019 4:59	8 hrs, 27 mins	RS, Nighttime Lamprey Ops
F1	8/29/2019 20:31	8/30/2019 5:02	8 hrs, 30 mins	RS, Nighttime Lamprey Ops
F2	8/30/2019 20:31	8/31/2019 5:00	8 hrs, 29 mins	RS, Nighttime Lamprey Ops
F1	8/31/2019 20:31	9/1/2019 5:56	9 hrs, 25 mins	RS, Nighttime Lamprey Ops
F2	9/1/2019 23:34	9/2/2019 2:18	2 hrs, 43 mins	RS, Float Trash
F2	9/8/2019 6:45	9/8/2019 6:53	8 mins	Trip During Gov. Changeover
F2	9/13/2019 18:15	9/13/2019 19:56	1 hrs, 41 mins	RS, Float Trash
F2	10/1/2019 9:22	10/1/2019 9:42	20 mins	RS, Shifting 125 DC Panels
F2	10/2/2019 16:10	10/2/2019 16:22	12 mins	RS, Shifting 125 DC Panels
F1	10/30/2019 16:24	11/4/2019 19:07	5 days, 2 hrs, 43 mins	FO, Lower Guide Bearing Oil Leak
F2	10/30/2019 19:13	10/31/2019 1:29	6 hrs, 15 mins	RS, Float Trash

F2	11/3/2019 20:31	11/3/2019 21:18	0 hrs, 47 mins	RS, Float Trash
F2	11/7/2019 17:50	11/7/2019 20:00	2 hrs, 9 mins	RS, Float Trash
F1	11/7/2019 17:52	11/7/2019 19:56	2 hrs, 3 mins	RS, Float Trash

Table 4. List of fish unit outages.

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 97% (305 / 314) 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 4). 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.

Violation	Occurrences	In Criteria (%)
Avian Arrays	116	68.2%
Calibration Occurred	22	58.5%
PH1		
Collection Channel Differential	47	84.5%
FG3-5 (A-Branch)	71	76.7%
FG3-27 (B-Branch)	73	76.1%
A-Branch Differential	137	51.1%
Ice & Trash Sluiceway	336	7.9%
PH2		
FG6-12 (Cascades Island)	71	76.7%
FG6-18 (Cascades Island)	113	63.0%
FG6-11 (Cascades Island)	153	49.8%

Table 5. Fish Passage Plan violations and percent in criteria.

3.1.1. Avian Arrays: Bonneville had the majority of its avian lines broken due to ice storms during the 2016/17 winter. PH2 arrays were installed the week of 17 March.

3.1.2. Calibrations: Calibrations did not occur during the IWW period. Regrettably due to equipment issues in 2019 a number of additional spillway calibrations did not occur.

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. FG3-5: FG3-5 was found to be mechanically bound on 04 April 2019. Repairs could not occur with the fishway watered up. Repairs are scheduled to occur during the 2019/20 IWW period.

3.1.5. FG3-27: FG3-27 was found to be mechanically unsound on 23 August. The diffuser was set to manual and remained in the open position to prevent further damage. Repairs could not occur with the fishway watered up. Repairs are scheduled to occur during the 2019/20 IWW period.

3.1.6. A-Branch 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.

3.1.8. 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.

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.

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.

3.2 STS / VBS Inspections

Submersible traveling screens (STS) and vertical barrier screens (VBS) are typically inspected once a month. 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 December 15 for juvenile fish passage and for adult fallbacks. PH1 screens have been permanently removed.

Run Hours Between Inspections											
Unit	**Install Dates & Run Hours Upon Installation**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**Removal Dates & Run Hours**
11	23-Feb-19 42789	43694	44361	45164	45934	46438	47081	47724	48561	49614	18-Dec-19 6825
12	23-Feb-19 32701	33610	34190	34996	35494	35697	35840	36484	37324	38372	18-Dec-19 5671
13	23-Feb-19 2345	3240	3910	4716	5018	5033	5093	5722	6563	7447	18-Dec-19 5102
14	22-Feb-19 5453	6342	7007	7814	8013	8030	8094	8498	9103	10132	17-Dec-19 4679
15	22-Feb-19 16798	17292	- - -	17724	18051	18067	18100	18305	18669	19578	17-Dec-19 2780
16	22-Feb-19 28758	29378	30030	30810	31084	31104	31144	31244	31435	32459	17-Dec-19 3701
17	22-Feb-19 22090	22880	23531	24349	24946	25038	25166	25812	26633	27636	16-Dec-19 5546
18	21-Feb-19 61210	62000	62670	63485	64488	65004	65674	66319	67156	68092	16-Dec-19 6882
*MU15 was OOS from 18-Mar until 16-May for its 4-YR Overhaul.											

Table 6. 2019 STS / VBS inspections.

3.3 Avian Abatement Measures

USDA Wildlife Service's avian hazing occurred from March through July 2019. 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 2019 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 training 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 30 November. 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 publically accessible real-time, and is the standard utilized per the FPP to determine when high-temperature fish sampling restrictions are operative in BON facilities. In 2019, these temperatures were available from 15 March - 17 September. Detailed daily temperatures can be found in the weekly reports and are available upon request.

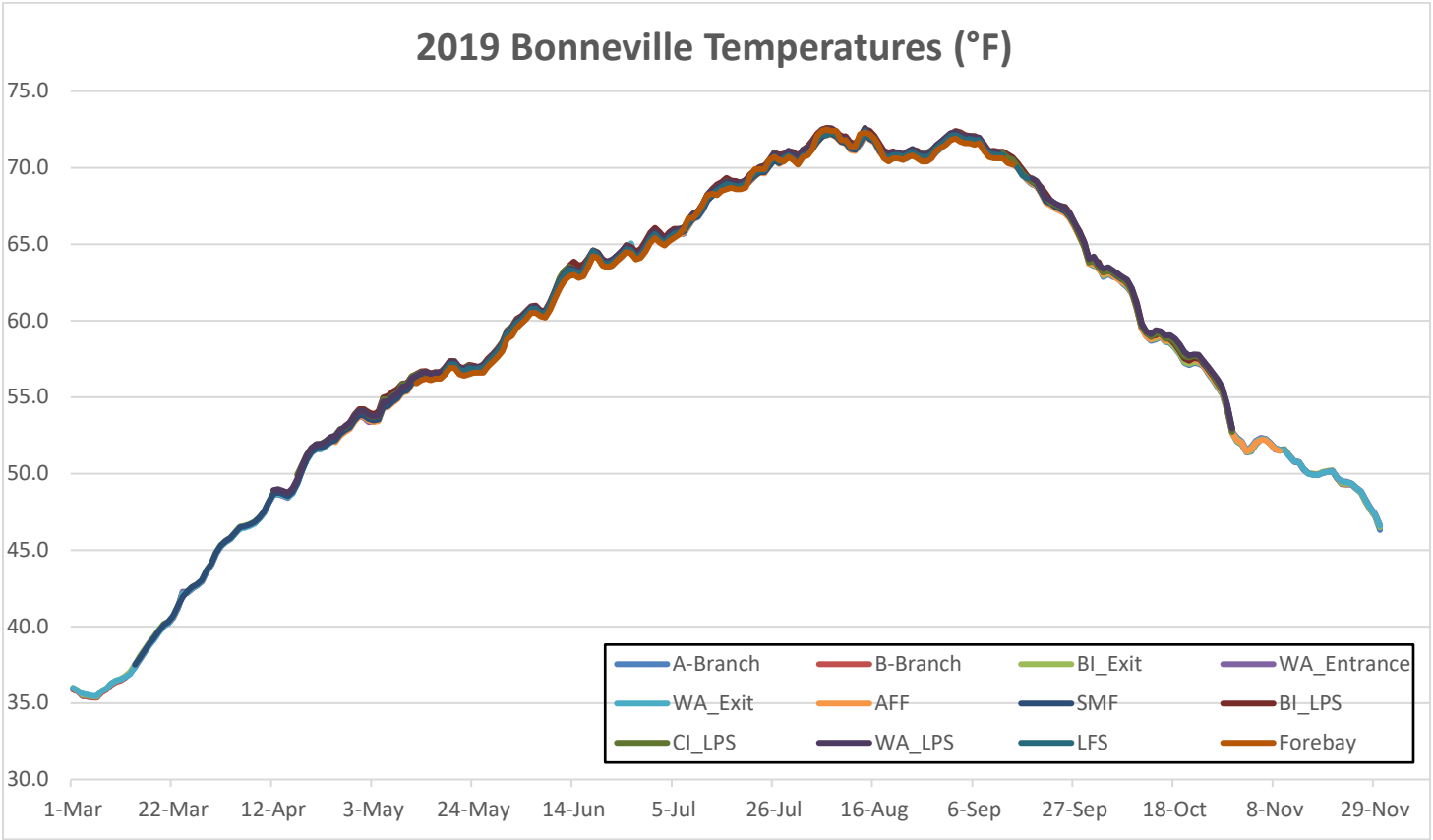

Figure 2. 2019 Bonneville temperatures.

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

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

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

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 SLIBs (Sea Lion Incursion 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

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.

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