Appendix A

Special Project Operations & Studies

Table of Contents

1. INTRODUCTION

1.1. Purpose

This Appendix to the annual *Fish Passage Plan* (FPP) describes special project operations and studies planned to occur during the current year that may affect fish passage at the four Lower Snake River and four Lower Columbia River projects. All special operations and studies will be coordinated with the project and appropriate regional agencies. The Corps RCC will issue a teletype to authorize all necessary operational changes and provide guidance to project operators.

1.2. Schedule

All dates shown for special operations and studies are approximate and could shift earlier or later due to a variety of factors, including river flow, contractor schedules, equipment failures, or other real-time conditions.

Some studies in this Appendix may not be implemented. Therefore, a final description of studies and outages/operations being conducted will be regionally coordinated prior to April 1 as part of the Corps' Anadromous Fish Evaluation Program (AFEP) via the Fish Facilities Design Review Workgroup (FFDRWG) and/or the Studies Review Workgroup (SRWG).

The Action Agencies will coordinate all significant operational requests and/or schedule changes with fish agencies and tribes through the appropriate regional forum to inform the final decision.

1.3. Spill for Juvenile Fish Passage

Spring and summer spill operations for juvenile fish passage will be implemented as defined in the *Fish Operations Plan* (FOP; included in the FPP as **Appendix E**), or as otherwise coordinated in-season through TMT. Spill for juvenile fish passage will begin April 3 at the Lower Snake River projects (IHR, LMN, LGS, LWG) and April 10 at the Lower Columbia River projects (BON, TDA, JDA, MCN), and continue through August 31. Alternative spill patterns to manage total dissolved gas (TDG) and/or fish passage conditions will be coordinated through the Fish Passage Operations & Maintenance (FPOM) workgroup. During periods of high river flow, the spill rate and forebay elevation at Lower Monumental and Lower Granite may need to be adjusted daily or every-other-day if necessary to provide safe conditions for the fish transport barge in the tailrace.

1.4. Navigation Lock Maintenance

Annual lock outages are scheduled for routine maintenance and inspections, as well as some non-routine work such as repairs of gate structures, concrete, and machinery. In 2019, locks will be closed at Lower Monumental, Little Goose, and Lower Granite for 3 weeks (March 2–24), and at McNary and Ice Harbor for 2 weeks (March 2–17). Additional information about Corps Walla Walla District navigation lock outages is available online at: www.nww.usace.army.mil/Missions/Navigation/

1.5. Doble Testing[1]

Transformers at the Lower Snake River projects are required to undergo Doble testing[1] every three years to ensure they are functioning correctly and identify any issues that need repair. The testing must be conducted during warm, dry conditions (July–August) and requires an outage of the transformer and associated units. Testing is performed during already scheduled outages to the extent possible and timed to avoid or minimize impacts to fish. The schedule for the current year is defined below in **Table A-1**. For more information, refer to the project-specific sections below and FPP Chapters 2-8.

Table A-1. Doble Testing Schedule in 2019.*

Project*	Dates	Outage (Transformer/Units)	Notes
MCN	Sep 9-13 Sep 23-27	T4 (Units 7-8) T5 (Units 9-10)	Both Units offline continuously until returned to service.
IHR	Jul 22-25	TW 1,2 (Units 1-2)	Units 1, 2 OOS daily from 0700-1700.
LMN	Jul 25 - Aug 3	T1 (Units 1-4)	All units OOS ≤ 4 hrs on first/last day for clearances. T2 (Units 5-6) RTS at night 1800-0600. Unit 5 will operate at speed-no-load during the day. Longer period scheduled to allow for installation of oil/water separator and overlapping T1 isophase bus inspection.
LGS	Aug 5-9	T2 (Units 5-6)	All units OOS on first/last day for clearances. T1 (Units 1-4) RTS nightly 1800-0530.
LWG	Aug 12-17	T1 (Units 1-4 and 6)	All units OOS 24 hours/day for clearances except Unit 5 will operate for station service power.

*BON, TDA, JDA have no specific outage for Doble tests (testing is done concurrent with outages for maintenance).

[1] Common term referring to a power factor test of transformers to measure performance of electrical insulation. *Doble* is a manufacturer of the test equipment.

2. BONNEVILLE DAM

2.1. BON Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

2.2. BON Studies

2.2.1. PH2 Fish Guidance Efficiency (FGE) Program – Unit 15 Construction and Gatewell Hydraulic Measurements.

a) Dates: Spring and summer 2019.

b) Description: Steel plates were installed in all A and B gatewells of Units 11-18 in 2015-2016. They functioned well from a hydraulic standpoint; limiting flow through the gatewell slots and reducing guided fish mortality. Unfortunately the plates were found to be structurally inadequate, thereby necessitating an alternative design to be formulated that would provide hydraulic equivalency to the steel plate design but also be structurally sound. A concrete corbel will be placed in the same location as the steel plates (downstream of the VBS on the gatewell beam at el. +31) and will occlude approximately the same amount of the gatewell return flow area as the steel plates, located near the head gate. The concrete will be rigid enough to not vibrate, which is what is believed to have been the failure mechanism of the steel plates. Thus the feature will be structurally sound.

Unit 15 will need to be dewatered and out of service during construction for approximately six weeks. Following the construction period and Unit 15 water-up, the A, B, and C gatewells will have hydraulic measurement equipment installed sequentially and tested for a duration of approximately two weeks total.

Hydraulic testing: a daily schedule will be provided for test operations at Unit 15. Hydraulic measurements in gatewell slots 15A, 15B, and 15C are scheduled to occur in the upper 1% range (18.0-18.5 kcfs) if possible, or the highest unit flow if not able to achieve the target flow range. Additionally, flow conditions representative of middle 1% will also be measured. Adjacent units 14 and 16 operations in the 1% range are requested during the test periods to provide stable operations to minimize hydraulic changes in the gatewell.

VBS screens in test gatewells will be raised, seals inspected, and cleaned at least once per week prior to testing, or as coordinated with the project to account for environmental conditions.

If the prototype testing results fall within the range of acceptable flow rates as determined by the USACE and in coordination with FFDRWG/FPOM, the construction contractor may proceed with full powerhouse implementation based on schedule coordination with the USACE. At this time USACE will also provide guidance for the reduction or termination of flow limits for Unit 15.

Study methods, schedule, and test unit operations coordinated in FFDRWG. Hydraulic test strategy coordinated at FFDRWG Dec. 6, 2018.

c) Impacts to FPP Criteria: Unit outages and test operations may result in PH2 units being operated out of FPP priority order.

2.2.2. Evaluation of Lower Columbia River Dam Fish Ladder Modifications to Improve Pacific Lamprey Passage.

a) Dates: Data collection is ongoing; lamprey tagging May through August 2019

b) Description: Radio telemetry (RT) and passive integrated transponder (PIT) tag detections will be used to evaluate passage success of adult Pacific Lamprey through the lower Columbia River and opportunistically in the Mid-Columbia and Snake Rivers. This study requires surgical implantation of adult Pacific Lamprey with radio transmitters and half-duplex PIT tags which occurs at the BON Adult Fish Facility (AFF). Adult lamprey are collected from a trap in the AFF ladder and the BON WA Shore Lamprey Flume. In addition this study will require researcher access to RT receivers located around the Project to download data and maintain systems. Some maintenance will require access to the fishways and will occur during the winter maintenance period when adult fishways are dewatered.

c) Impacts to FPP Criteria: None.

2.2.3. Evaluation of an Experimental Wetted Wall at the BON Bradford Island Fishway.

a) Dates: April through September 2019.

b) Description: Lamprey-specific fishways have been employed to allow lamprey to bypass obstacles in traditional fishways. An experimental wetted wall was installed in the BON Bradford Island (BI) Fishway upstream of the count station window. This structure will pass lamprey from the top of the BI Fishway, where lamprey experience poor passage success, into the adjacent MUWS channel, which is outfitted with a lamprey passage structure (LPS). Monitoring of the wetted wall is needed to assess its efficacy in passing adult lamprey, to adjust lamprey escapement estimates at Bonneville Dam, and to ensure minimal risk to migrating adult salmonids.

c) Impacts to FPP Criteria: None.

3. THE DALLES DAM

3.1. TDA Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

3.2. TDA Studies

3.2.1. Evaluation of Lower Columbia River Dam Fish Ladder Modifications to Improve Pacific Lamprey Passage.

a) Dates: Data collection is ongoing; lamprey tagging May through August 2019

b) Description: Radio telemetry (RT) and passive integrated transponder (PIT) tag detections will be used to evaluate passage success of adult Pacific Lamprey through the lower Columbia River and opportunistically in the Mid-Columbia and Snake Rivers. This study requires surgical implantation of adult Pacific Lamprey with radio transmitters and half-duplex PIT tags which occurs at the BON Adult Fish Facility (AFF). Adult lamprey are collected from a trap in the AFF ladder and the BON WA Shore Lamprey Flume. In addition this study will require researcher access to RT receivers located around TDA to download data and maintain systems. Some maintenance will require access to the fishways and will occur during the winter maintenance period when adult fishways are dewatered.

c) Impacts to FPP Criteria: None

4. JOHN DAY DAM

4.1. JDA Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

4.2. JDA Studies

4.2.1. Evaluation of Lower Columbia River Dam Fish Ladder Modifications to Improve Pacific Lamprey Passage.

a) Dates: Data collection is ongoing; lamprey tagging May through August 2019

b) Description: Radio telemetry (RT) and passive integrated transponder (PIT) tag detections will be used to evaluate passage success of adult Pacific Lamprey through the lower Columbia River and opportunistically in the Mid-Columbia and Snake Rivers. This study requires surgical implantation of adult Pacific Lamprey with radio transmitters and half-duplex PIT tags which occurs at the BON Adult Fish Facility (AFF). Adult lamprey are collected from a trap in the AFF ladder and the BON WA Shore Lamprey Flume. In addition this study will require researcher access to RT receivers located around TDA to download data and maintain systems. Some maintenance will require access to the fishways and will occur during the winter maintenance period when adult fishways are dewatered.

c) Impacts to FPP Criteria: None

5. McNARY DAM

5.1. MCN Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

5.1.1. Fish Ladder Exit, Entrance, Regulating/Tilting Weir Maintenance.

a) Dates: Winter Maintenance Period (Long-Term).

b) Description: The *Oil Accountability Program* PMs maintenance efforts require the project to operate all equipment monthly and semi-annually to assess oil/grease requirements and to ensure seals do not dry out or stick to shafts. The motors for each weir can be operated during the winter outage to exercise seals.

c) Impacts to FPP Criteria: None planned. Any modification or deviation from FPP criteria will be coordinated through FPOM.

5.1.2. Fish Attraction Pumps.

a) Dates: March 1 through May 7, 2019.

b) Description: Following the return to service of the Oregon fish ladder (ORFL) on February 28, fish pump (FP) 1 will remain out of service for maintenance (intake logs will be installed in February with the assistance of a diver) which will commence on March 18, 2019, after the navigation lock outage. Critical maintenance is scheduled for FP1 in 2019 due to extended operation for 7-9 years without relief from FP2. FP1 has not been dewatered and inspected since 2006. Maintenance will include all below-water inspections and repairs that project staff can do in a timely manner. Dive scheduling and/or unforeseen maintenance issues may extend the outage dates. This maintenance will improve reliability of attraction water for adult salmonids utilizing the Oregon fish ladder system.

c) Impacts to FPP Criteria: None planned. Any modification or deviation from FPP criteria will be coordinated through FPOM. Minimal impact due to other two FPs being available.

5.1.3. Waterfowl Nesting.

a) Dates: April through July (annually).

b) Description: Annually since 1982, McNary pool is operated for waterfowl nesting on Lake Wallula late April through early July. During this operation, the McNary pool may be restricted to an operating range of 337'–340' elevation. Pool elevations are also operated in the range of 338.5'–339.5' for 4-6 hours during daylight hours at least once every 4 days.

c) Impacts to FPP Criteria: None. Provided for informational purposes only.

5.1.4. Doble Testing.

a) Dates: See schedule in **Table A-1** above.

b) Description: See **section 1.5** above.

c) Impacts to FPP Criteria: None. Since McNary Dam has multiple transformer banks and transmission lines and redundant switching capability, most turbine units will be available for operation during testing and operated pursuant to FPP priority order within ±1% of peak efficiency (1% range).

5.2. MCN Studies

5.2.1. Study of Adult Steelhead Fallback (Overshoots) through the Spillway Weir.

a) Dates: Fall 2019.

b) Description: The objectives of this study are to:

- Estimate the seasonal duration of winter spill for steelhead overshoots;
- Estimate weekly timing and duration of winter spill for steelhead overshoots;
- Determine if winter spill at McNary Dam has unintended consequences for overwintering upstream stocks of steelhead.

c) Impacts to FPP Criteria: To be determined. Any modification to or deviation from FPP criteria will be coordinated through FPOM.

6. ICE HARBOR DAM

6.1. IHR Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

6.1.1. Unit 3 Turbine Runner Replacement.

a) Dates: 2019 through early 2020.

b) Description: Unit 3 will be out of service in 2019 to replace the turbine runner. The unit is currently scheduled to return to service in early 2020. Commissioning of Unit 3 will require full load rejection testing, which needs to be completed without STSs installed. It is very possible that Unit 3 will not return to service until after March 2020, which would result in running the unit for the time required to complete commissioning (10 days) without STS screens installed.

c) Impacts to FPP Criteria: None, unless the unit is returned to service after March 2020 and requires commission testing without STSs during juvenile fish passage season (April 1–December 15). While Unit 3 is out of service and unavailable for operation, the project will operate the next available unit in the FPP priority order. Commissioning of Unit 3 without STSs installed would violate FPP criteria if it occurs during juvenile fish passage season (April 1 through December 15).

6.1.2. Units 4, 5 and 6 Turbine Oil Replacement.

a) Dates: Spring/Summer 2019.

b) Description: Each unit will be out of service for approximately 3 weeks to replace all the turbine oil in each unit. Projected outage order is dependent on when the work is scheduled to possibly align with other scheduled outages such as a unit annual.

c) Impacts to FPP Criteria: None. When a unit is out of service for oil replacement, the next unit in the FPP priority order will be operated. Impacts will be minimal if the oil replacement occurs during the normal annual maintenance window for each unit.

6.1.3. North Shore Fish Ladder Entry Weir Electric Repairs.

a) Dates: Summer 2019.

b) Description: Both North Shore fish ladder entrance weirs have embedded electrical conduit that has failed, resulting in failure of the primary wiring to operate the weirs. Currently they are operational on the last set of spare conductors in the embedded conduits. The project is going to install temporary wiring that is above-deck to the weirs in Feb 2019. The permanent repair will be to run above-deck conduit and relocate the control boxes to

prevent water intrusion from spill from bay 10. In order to install the conduit, the spill pattern will need to be modified to stop spill from bay 10 from 0700 to 1700, Monday–Friday, for the length of the repairs. The project needs to minimize the time of operating on the temporary fix so must begin work in the summer before spill stops on September 1.

c) Impacts to FPP Criteria: FPP spill patterns will need to be altered by shifting spill (1 or 2 gate stops, approx. 1.7 to 3.5 kcfs, respectively) from bay 10 to other bays.

6.1.4. Doble Testing.

a) Dates: See schedule in **Table A-1** above.

b) Description: See **section 1.5** above.

c) Impacts to FPP Criteria: None. Doble testing is conducted in conjunction with scheduled unit maintenance. Since Ice Harbor has multiple transformer banks and transmission lines and redundant switching capability, remaining units will be available and operated pursuant to FPP priority order within ±1% of peak efficiency (1% range).

6.2. IHR Studies

6.2.1. Adult Lamprey Studies.

a) Dates: July through October 2019.

b) Description: Installation of an adult lamprey passage structure at the South Shore Fish Ladder (SFE2) is expected to be completed in February 2019. This passage structure will provide a lower velocity passage route into adult fish ladder during a prescribed lamprey passage season. DIDSON acoustic cameras will be used to evaluate passage behavior of Pacific lamprey at the entrance and exit of the passage structure, as well as monitor the entrance area for adult salmonid interactions. The monitoring equipment will be installed during the in-water work window while the South fish ladder is dewatered, and will involve installation of I-beams on the fishway walls to position the acoustic cameras. Operation of monitoring equipment will occur throughout the adult lamprey passage season (early July–October), and removed during the next in-water work window. The design of the lamprey passage structure allows for the quick removal of the entrance component from the bulkhead slot in the event that SFE2 is needed as the primary fish ladder entrance or if adult salmonid attraction and interaction is deemed harmful in coordination with NOAA Fisheries.

c) Impacts to FPP Criteria: When the passage structure is in operation in SFE2, no change to FPP criteria is required as the entrance is in standby mode and thus not used for salmonid passage. In the event that SFE2 is required as the primary entrance, i.e., SFE1 is non-operational, then the lamprey passage structure will be taken out of service by lowering the bottom leaf of the telescoping weir, which blocks the lamprey passage structure entrance. This will allow the fish ladder entrance to remain in FPP criteria.

6.2.2. IHR Unit 2 Direct Injury and Sensor Fish Characterization.

a) Dates: September through October 2019

b) Description: Juvenile spring Chinook salmon and Sensor Fish will be directly released into turbine unit 2 to evaluate the new fixed-blade runner. The study is expected to require approximately four weeks of total study time. Direct release pipes will be installed in all three intakes of Unit 2 for direct fish and Sensor Fish releases. Release pipes will be installed on the STS frames. Three specific turbine operations will be tested. Project support will be provided for equipment install, removal, and turbine operations. A one-day Unit 2 outage is expected for release pipe install and removal. Another consideration will be river flow and unit priority during the study period. Specific dates for Project support, outages, and operations will be scheduled appropriately with the Project and through FPOM closer to study implementation.

c) Impacts to FPP Criteria: Any modification to unit priority order or other FPP criteria will be coordinated through FPOM.

7. LOWER MONUMENTAL DAM

7.1. LMN Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

7.1.1. Lower Monumental Head Gate Rehab.

a) Dates: Ongoing through 2019.

b) Description: Under the BPA Large Cap Program, parts and materials have been acquired to rehabilitate the head gates at Lower Monumental Dam. The work started in December 2012. To facilitate the process, units will be scheduled out of service to remove or replace head gates. The head gates will be serviced in the repair pit and then placed back into service.

c) Impacts to FPP Criteria: Deviation from unit priority will be necessary to swap head gates from the unit to the pit. The duration of the outage is expected to be one day.

7.1.2. Model Validation Testing.

a) Dates: September through March (annually).

b) Description: Western Electricity Coordinating Council (WECC) requires steady state model validation testing periodically to ensure generating equipment will meet real and reactive power ratings. All units are tested on a 1–2 year cycle. Tests are also required when equipment is replaced or upgraded. Tests will require running the unit out of FPP priority and outside the 1% range. Testing can occur any time from September 1–March 31 and will not occur during peak juvenile fish passage season (April 1–August 31). Tests will preferably be conducted just after annual maintenance, but may happen at other times. Test durations will be minimized to the extent possible and will only be run for the purpose of completing required model validation testing.

c) Impacts to FPP Criteria: None. During validation testing, units will be out of service and the project will operate the next available unit in the FPP priority order.

7.1.3. Doble Testing.

a) Dates: See schedule in **Table A-1** above.

b) Description: See **section 1.5** above.

c) Impacts to FPP Criteria: On the first and last day of testing, clearance procedures will require a total powerhouse outage for up to 4 hours and all project outflow will be spilled except approximately 5 kcfs for station service. During testing, available units will be operated pursuant to FPP priority order within ±1% of peak efficiency (1% range).

7.1.4. Digital Governor Installation & Commissioning.

a) Dates: Mid to Late 2019.

b) Description: Digital Governors have been installed on Units 2–6. Unit 2 was commissioned with fixed blades and is scheduled to be commissioned as a Kaplan Unit in 2019 after liner work is completed. The digital governor installation on Unit 1 is scheduled to occur May–July 2019.

c) Impacts to FPP Criteria: None. During work, the unit will be out of service and the project will operate the next available unit in the FPP priority order.

7.2. LMN Studies

7.2.1. LMN FGE Gate Closure Study.

a) Dates: February through July 2019.

b) Description: This study is to estimate and compare fish guidance efficiency (FGE) at two adjacent units with head gates in the raised (control) and stored (treatment) operating positions, and to estimate impacts (if any) to FGE and juvenile fish passage performance when units are operated with head gates stored. Results will aid in determining the appropriate path forward for restoring the 10-minute emergency head gate closure criterion.

Hydroacoustic transducers will be installed on the trash rack and STS frames in units 2 and 3. During the study, Unit 2 will be fixed at the mid-range of the 1% operating range (25°) and Unit 3 will operate at the same mid-range of the 1% range for as much of the day as possible during the study period.

Installation is expected to occur during the in-water work window in February 2019. A dive to install transducers on the trash racks will require a three-unit outage. Project personnel will assist with alternating unit 2 and unit 3 head gate orientation between raised and stored operating positions once per week on a random block design for the duration of the study beginning approximately 20 April 2019 through approximately 12 July 2019. During the study, unit operating priority will switch to unit 2 being first priority and unit three being second priority. If low flow conditions occur where two turbine units cannot operate, operating gates will remain in either the raised or lowered position in units 2 and 3 and operation will alternate on the random block design rather than changing head gate position.

Adult fish passage will not be affected as all in-water work will be conducted during the work window. No specific turbine unit operating points (MW) are requested for this study. The dive to remove transducers will occur during the in-water work window in FY20.

c) Impacts to FPP Criteria: Any modification to unit priority order or other FPP criteria will be coordinated through FPOM.

8. LITTLE GOOSE DAM

8.1. LGS Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

8.1.1. Doble Testing.

a) Dates: See schedule in **Table A-1** above.

b) Description: See **section 1.5** above.

c) Impacts to FPP Criteria: None. Doble testing is conducted in conjunction with scheduled unit maintenance. Available units will be operated pursuant to FPP priority order within ±1% of peak efficiency (1% range).

8.2. LGS Studies

No studies are planned at Little Goose Dam in 2019.

9. LOWER GRANITE DAM

9.1. LWG Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 (Overview)**. See **section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

9.1.1. Head Gate Repair.

a) Dates: Bi-Monthly (long-term).

b) Description: This is a long-term program to return head gates to a safe operating condition by adding new roller chain, seals, anodes, and other miscellaneous components. The plan will require brief unit outages throughout the year while transporting rebuilt gates from the turbine units to the repair pit and back. Each swap will take 4–6 hours to complete and occur approximately every 2 months.

c) Impacts to FPP Criteria: None anticipated. Head gate movements are expected to take place concurrently with other outages. As the program progresses and fewer head gates need repair, it may require an occasional outage on a priority unit. Available units will be operated pursuant to FPP priority order within ±1% of peak turbine efficiency.

9.1.2. ESBS Repair.

a) Dates: Bi-Monthly (long-term).

b) Description: This is a long-term program to return ESBSs to a safe operating condition by tearing down, repainting and rebuilding the screens. The plan will require brief unit outages throughout the year while transporting rebuilt ESBSs from the turbine units to the repair pit and back. Each swap will take 4–6 hours to complete and occur approximately every 2 months.

c) Impacts to FPP Criteria: None anticipated. ESBS movements are expected to take place concurrently with other outages. As the program progresses and fewer screens need repair, it may require an occasional outage on a priority unit. Available units will be operated pursuant to FPP priority order within ±1% of peak turbine efficiency.

9.1.3. Juvenile Fish Bypass System Upgrade.

a) Dates: Ongoing through March 2019, with refinements through March 2020.

b) Description: Construction activities associated with the Lower Granite Dam juvenile bypass system (JBS) upgrade began in 2014 and components directly impacting fish passage are expected to be substantially complete by March 2019. Final project commissioning activities are expected to be completed by March 2019 prior to the 2019 fish passage season (FPOM MOC 18 LWG 05). However, some limited construction, testing, and operational refinement activities may continue throughout 2019 in order to improve JBS operations and complete site restoration efforts. All fish salvage operations, if necessary, will follow

standard dewatering procedures and will be coordinated through Lower Granite's fisheries staff in accordance with standard operational procedures.

c) Impacts to FPP Criteria: Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.1.4. Digital Governor and OPTO 22 Upgrade.

a) Dates: July 2018 through March 2019.

b) Description: Outages for replacement of Digital Governor began July 2, 2018, and are scheduled to continue through March 29, 2019. Replacement outages will be one unit at a time and require about six weeks to complete work and commissioning. The current plan is to schedule replacement of priority units outside the fish passage season. Commissioning will require starts, stops, and load rejections to verify proper governor operation and may require operating units out of FPP priority order. OPTO 22 upgrades will be completed while units are out of service for Digital Governor replacement, as coordinated in MOC 18 LWG 10.

c) Impacts to FPP Criteria: Commissioning may require operating units out of FPP priority order. Activities that may impact FPP compliance will be coordinated with FPOM via MOC.

9.1.5. Doble Testing.

a) Dates: See schedule in **Table A-1** above.

b) Description: See **section 1.5** above.

c) Impacts to FPP Criteria: On the first and last day of testing, clearance procedures will require a total powerhouse outage for up to 4 hours and all project outflow will be spilled except approximately 5 kcfs for station service. During testing, available units will be operated pursuant to FPP priority order within ±1% of peak efficiency (1% range).

9.1.6. Lower Granite Spillbay 1 PIT-Tag Detector Installation.

a) Dates: Jan-Feb 2019 and fall 2019 through March 2020.

b) Description: Construction activities associated with PIT-tag detection system installation at Lower Granite Dam are now planned for two construction windows. The first will take place Jan-Feb 2019 and will include replacement of the spillbay 1 gate side seal, core drilling through the south pier wall, and installing electrical conduit through the core drills and along the wall above the water surface in the fishway passage gallery. The second construction window will begin in fall 2019 and is expected to continue through winter 2020, with project completion expected in March 2020. Construction activities will primarily be in, or near, spillbay 1 and will include reshaping of the ogee, installation of a new spillway flow deflector, and installation of a PIT-tag detection system. To facilitate these construction activities, including concrete removal and installation of new equipment, the Corps anticipates needing to request an extended in-water work window of September 9, 2019, to February 28, 2020. The type of work and level of effort is expected to be similar to what was needed for the reshaping of the ogee and new flow deflector for the Ice Harbor spillbay 2 during the winter of 2015/16. An MOC will be distributed to FPOM once sufficient project details are available. Immediately following winter 2020 construction, the Corps expects to

coordinate through the SRWG process to conduct a study to determine the efficiency of the spillbay 1 PIT-tag array. Study parameters and timing of the study TBD.

c) Impacts to FPP Criteria: Activities that require special project operations, FPP deviations, or outages will be coordinated with FPOM via MOC.

9.1.7. Lower Granite- XJ0 Station Service Breaker Replacement.

a) Dates: First outage February 11-15 2019. Second Outage: July 2019.

b) Description: Lower Granite will be replacing the Station Service Breakers in 2019. The Breakers are original equipment and are at the end of their usable life. Due to the critical nature of the circuit breakers, the indication of degradation leading to end of life conditions or decreased reliability is sufficient cause to consider replacement. A long-term failure of a station service circuit breaker will cause an elevation of risk and increase the potential for flooding of the dam. There will be two outages for replacement, one to measure and "as-built" the existing components, and the second to install the fabricated breakers. The first outage is scheduled February 11, 2019 through February 15, 2019. The second outage will be in mid-July to bypass the electrical system for a safe installation of the new breaker.

c) Impacts to FPP Criteria: Commissioning may require operating units out of FPP priority order. Activities that may impact FPP compliance will be coordinated with FPOM via MOC.

9.2. LWG Studies

No studies are planned at Lower Granite Dam in 2019.