Section 8 Little Goose Dam

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Little Goose Dam

1. Fish Passage Information. Fish passage facilities at Little Goose Dam are shown in **Figure LGS-1**. Project operations for fish and special operations are in **Table LGS-2**.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The Little Goose juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains extended length submersible bar screens with flow vanes, vertical barrier screens, thirty five 12" and one 14" gatewell orifices, a bypass channel running the length of the powerhouse, a metal flume mounted on the face of the dam and the upper end of the fish ladder, a dewatering structure to eliminate excess water, two emergency bypass systems, and a corrugated metal flume to transport the fish to either the transportation facilities or to the river. The transportation facilities include a separator structure, raceways for holding fish, a distribution system for distributing the fish among the raceways, a sampling and marking building, truck and barge loading facilities, and PIT tag detection and diversion systems.

1.1.2 Juvenile Migration Timing. *Timing dates affected by later collection start dates in 2006- 2008.* **Table LGS-1** shows passage timing at Little Goose Dam. **Table LGS-1** dates are based on juvenile fish collection numbers only. Salmon, steelhead, bull trout, lamprey, and other species are counted. Maintenance of fish passage facilities that may impact juvenile passage or facility operation should be conducted during the winter maintenance season.

Table LGS-1. Juvenile migration timing at Little Goose Dam based on collections.

% Collection	2004	2005	2006	2007	2008
Clipped Yearling Chinook					
10%	4/25	5/5	4/26	5/8	5/6
90%	5/18	5/16	5/19	5/20	5/28
Unclipped Yearling Chinook					
10%	4/22	4/29	4/19	5/9	5/4
90%	5/25	5/27	5/23	5/23	5/30
Sub-yearling Chinook					
10%	6/9	5/12	5/24	6/7	6/4
90%	7/17	6/20	7/4	7/6	7/23
Clipped Steelhead					
10%	4/28	4/26	4/21	5/10	5/1
90%	6/1	5/16	5/20	5/27	5/23
Unclipped Steelhead					
10%	4/25	4/27	4/20	5/10	5/8
90%	6/2	5/20	5/20	5/30	6/1
Clipped Sockeye					
10%	5/20	5/21	5/16	5/16	5/21
90%	6/11	6/4	5/29	5/30	6/6
Unclipped Sockeye					
10%	5/1	4/28	4/21	5/7	5/18
90%	6/27	6/6	5/27	6/4	6/9

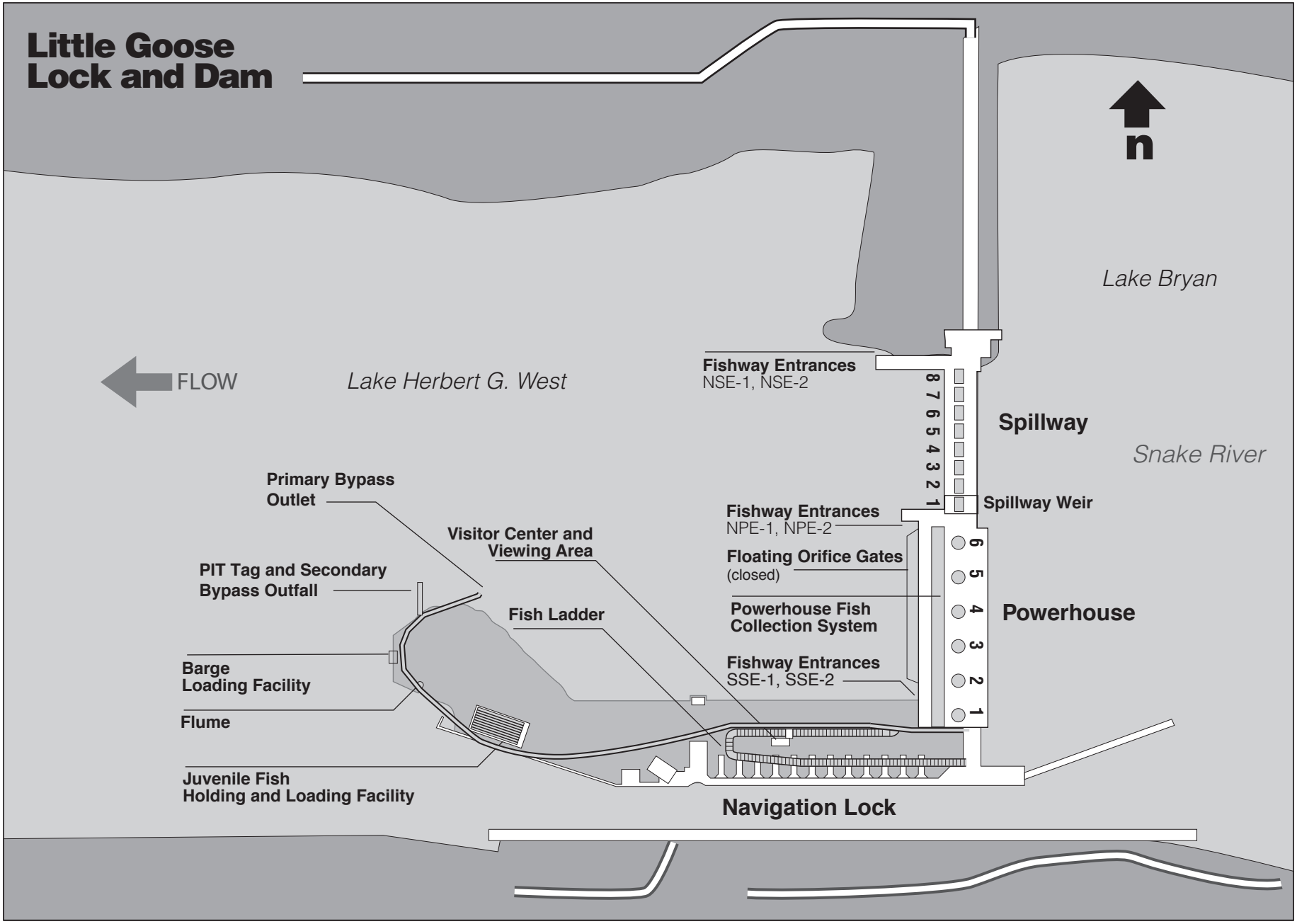
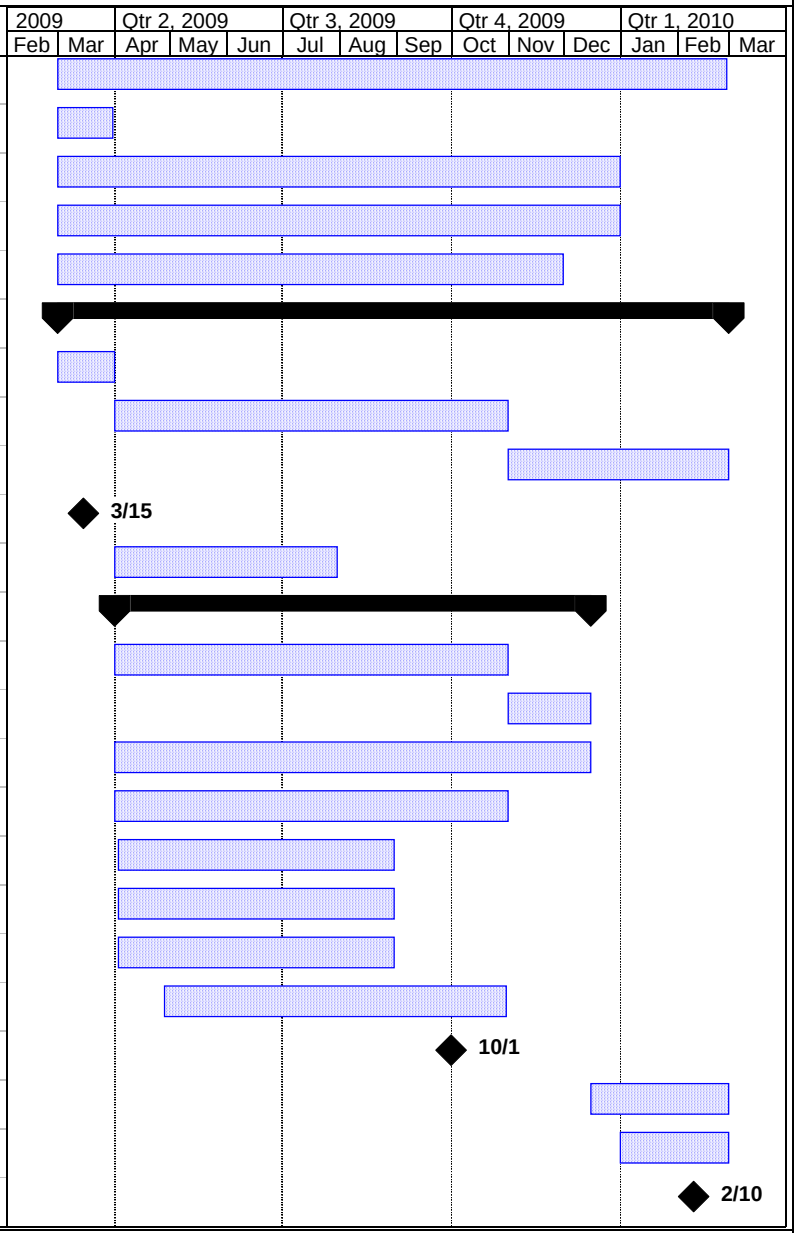


Figure 12 Little Goose Lock and Dam General Site Plan

Table LGS-1. Dates of project operations for fish purposes at Little Goose, 2009-10

Task Name	Start	Finish	FPP Reference
TDG Monitoring	3/1/09	2/28/10	App D Table 4
Winter Maintenance Period Juvenile	3/1/09	3/31/09	Lgs 2.3.1.1.
Adult Fish Passage Period	3/1/09	12/31/09	Lgs 2.3.2.2
Weekly Reports	3/1/09	12/31/09	Lgs 2.3.3.1
Operate Turbines for Fish Passage	3/1/09	11/30/09	Lgs 4.1
1% limitations	**3/1/09**	**2/28/10**	**Lgs 4.1**
1% Soft	3/1/09	3/31/09	Lgs 4.1.1
1% Hard	4/1/09	10/31/09	Lgs 4.1.1
1% Soft	11/1/09	2/28/10	Lgs 4.1.1
Final Report	3/15/09	3/15/09	Lgs 2.3.3.4
Back flush orifices once per shift	4/1/09	7/31/09	Lgs 2.3.1.2.c.6
Operate juvenile facilities	**4/1/09**	**12/15/09**	**Lgs 2.3.1**
Operate for Juvenile Fish Passage	4/1/09	10/31/09	Lgs 2.3.1
Operate for Adult Fallback	11/1/09	12/15/09	Lgs 2.3.1
Juvenile Passage Period	4/1/09	12/15/09	Lgs 2.3.1.2
Adult Fish Counting (Visual 0400 - 2000)	4/1/09	10/31/09	Lgs 1.2.2
Spill for Fish	4/3/09	8/31/09	App E
Adult Passage - Varying Spill Conditions	4/3/09	8/31/09	App A. Lgs 2.1
Bull Trout Pit Tag Study	4/3/09	8/31/09	App A. Lgs 2.2
Juvenile Fish Transportation	4/28/09	10/31/09	App B 3
1/2 ESBSs May Be Pulled	10/1/09	10/1/09	Lgs 2.3.1.2 b 5
Winter Maintenance Period Juvenile	12/16/09	2/28/10	Lgs 2.3.1.1.
Maintenance of Adult Facilities	1/1/10	2/28/10	Lgs 1.2.2
Draft Final Report	2/10/10	2/10/10	Lgs 2.3.3.4



1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Little Goose are comprised of one fish ladder on the south shore, two south shore entrances, a powerhouse collection system, north shore entrances with a transportation channel underneath the spillway to the powerhouse collection system, and auxiliary water supply system. The powerhouse collection system is comprised of two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. The north shore entrances are made up of two downstream facing entrances and a side entrance into the spillway basin with the two downstream entrances operated. The auxiliary water is supplied by three turbine-driven pumps that pump water from the tailrace into the distribution system for the diffusers. Additional water is supplied to the auxiliary water supply system from the juvenile fish facilities primary dewatering structure.

1.2.2. Adult Migration Timing. Upstream migrants are present at Little Goose Dam throughout the year and adult passage facilities are operated year round. Maintenance of adult fish facilities is scheduled for January and February to minimize impacts on upstream migrants. Adult salmon, steelhead, shad, and lamprey are counted as per **Table LGS-3;** these data appear daily on the Corps adult count website. Salmon migration timing data appear in **Table LGS-4**. Sturgeon and bull trout are also counted and recorded on the WDFW fish counters' daily summary sheet comments section; and these data are summarized in the Annual Fish Passage Report, but do not appear on the Corps daily website total due to relative infrequency of passage.

Table LGS-3. Adult fish counting schedule at Little Goose Dam.

Period	Counting Method
April 1 – October 31	Visual count 0400 - 2000 PST

Table LGS-4. Adult migration timing from 1970-2008 based on fish counts at Little Goose Dam.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
Spring Chinook	4/1 - 6/15	4/20	6/1
Summer Chinook	6/16 - 8/15	6/14	7/12
Fall Chinook	8/16 - 10/31	9/5	9/30
Steelhead	4/1 - 10/31	9/15	10/14
Sockeye	6/15 - 10/31	6/24	7/25

2. Project Operation.

2.1. Spill Management. See the 2009 Fish Operations Plan (**Appendix E**) for more information.

2.1.1. Involuntary spill at Little Goose is the result of river flow exceeding powerhouse

capacity, insufficient generation loads to pass the river flow, turbine unit outages (forced or scheduled), or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Little Goose shall be distributed in accordance with the spill pattern included at the end of this section, Table LGS-9, pending development of a "high gate" spill pattern. Special spills for juvenile fish passage will be provided as detailed in **Appendices A and E**.

2.1.2. During years when fish passage spill is provided at Little Goose, and project biologists or researchers at Little Goose notice an extraordinary congregation of juvenile fish delaying in the forebay, they will notify NOAA Fisheries and CENWW to request a fish flush spill (FFS) that evening. The FFS request will be for up to three hours, 8 pm to 11 pm, and be up to 50% of river flow during those hours, using a uniform spill pattern to lessen dissolved gas entrainment.

2.2. Total Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at LGS are monitored in accordance with the Dissolved Gas Monitoring Program, **Appendix D**.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish bypass, collection, and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate according to the criteria listed below and in **Appendix B** (Corps' Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids. The transportation program may be revised in accordance with the ESA Section 10 permit and the NOAA Fisheries biological opinion.

2.3.1.1. Winter Maintenance Period (December 16 through March 31). Check and perform maintenance as required on the items listed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trashracks just prior to the operating season.

3. Measure drawdown in gatewell slots after cleaning trashracks and with ESBSs in place.

4. Inspect and repair gatewell dip net as needed.

b. Extended-Length Submersible Bar Screens, Flow Vanes, and Vertical Barrier Screens.

1. Maintenance completed on all screens.

2. Inspect ESBSs prior to installation and operate debris cleaner (dogged off on deck) to ensure proper operation.

3. Log results of trial run.

4. Inspect VBSs with an underwater video camera at least once per year. Repair as needed.

5. Inspect flow vanes to make sure they are in good condition and all surfaces smooth. Repair as needed.

c. Collection Channel.

1. Water-up valve capable of operating when needed.

2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

4. Orifice cycling and air backflush system works correctly.

d. Dewatering Structure and Flume.

1. Inclined screen clean and in good condition with no gaps between screen panels or damaged panels.

2. Cleaning brush and air burst systems maintained and operating correctly.

3. Overflow weirs should be maintained, tested and operating correctly.

4. All valves should be operating correctly.

5. Baffle boards under inclined screen in good condition.

6. Flume interior should be smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate maintained and in good operating condition.

2. Flume interior smooth with no rough edges.

3. Perforated plate smooth with no rough edges.

4. Wet separator and fish distribution system maintained and ready for operation as designed.

5. Brushes and screens on crowders in good condition with no holes in screens or rough edges.

6. Crowders maintained, tested, and operating correctly.

7. All valves, slide gates, and switch gates maintained and in good operating condition.

8. Retainer screens in place with no holes in screens or sharp wires protruding.

9. Barge and truck loading pipes free of debris, cracks, or blockages and barge loading boom maintained and tested.

10. All sampling equipment should be maintained and in good operating condition prior to watering up the facilities.

11. Maintain juvenile PIT tag system as required (see "Columbia Basin PIT Tag Information System, General Gate Maintenance and Inspection, Walla Walla District", February 2003). Coordinate with PSMFC.

12. Mini- and midi-tanks maintained and in good operating condition.

f. Avian Predation Areas (Forebay and Tailrace). Inspect bird wires, water cannon, and other deterrent devices and repair or replace as needed. Where possible, install additional bird wires or other deterrent devices to cover areas of known avian predation activity. Prepare avian abatement contract as needed.

g. Maintenance Records. Record all maintenance and inspections.

2.3.1.2. Fish Passage Period (April 1 through December 15).

a. Forebay Area and Intakes.

1. Remove debris from forebay. All floating debris will be removed whenever two acres of debris accumulates in the spring and one acre in the summer and fall.

2. Log drawdown differentials in bulkhead slots at least once a week.

3. Remove debris from forebay and trashracks as required to maintain less than 1' of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river or when fish condition requires it.

4. Inspect gatewell slots daily (preferably early in day shift) for debris, fish

buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice, or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be closed and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

5. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot be removed within 24 hours, the gatewell orifices shall be closed immediately and the turbine unit shut down within one hour until the material has been removed and any problems corrected. A preferred method for removing oil from the water surface is to install absorbent (not adsorbent) socks, booms, or pads capable of encapsulating the material, tied off with a rope for later disposal. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

6. Coordinate cleaning efforts with personnel operating juvenile collection facilities.

7. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for dewatering a bulkhead slot.

b. Extended-Length Submersible Bar Screens, Vertical Barrier Screens, and Operating Gates.

1. Operate ESBSs with flow vanes attached to screen.

2. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency as required to maintain clean screens and good fish condition. Change cleaning frequency as needed.

3. Inspect each ESBS once per month by means of underwater video in April, May, and June. Conduct similar inspections in August and October, focusing on at least three turbine units as the judgment of project personnel dictates. Spot check VBSs at the same time.

4. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs (see **section 3.1.2.1**). In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, except as noted.

5. One-half of the ESBSs may be pulled after October 1 for maintenance as long as unscreened turbine units are not operated.

6. Make formal determination at end of season as to adequacy of ESBS bar screen panels and debris cleaner brushes and replace components as necessary.

7. Measure head differentials across VBSs at least once per week from April 1 through June 30 (more frequently if required) and biweekly for the remainder of the operating season. Clean VBS when head differentials reach 1.5'. When a head differential of 1.5' is reached, the respective turbine unit should be operated at a reduced loading, not more than 110 MW, to minimize loading on the VBS and potential fish impingement until the VBS can be cleaned. Clean VBSs as soon as possible after a 1.5' head differential is reached.

8. Inspect at least 2 VBSs in 2 different turbine units between the spring and summer migration periods. Both turbine units should have been operated frequently during the spring. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

9. Turbine units are to be operated with raised operating gates to improve fish guidance efficiency when ESBSs are installed (April 1 through December 15), except as provided for in **Section 4.3.,** Turbine Unit Maintenance.

c. Collection Channel.

1. Orifices clean and operating. Operate at least one orifice per gatewell slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain a full collection channel. If orifices must be closed to repair any part of the facility, do not close orifices in operating turbine units with ESBSs in place for longer than 5 hours. If possible, keep to less than 3 hours. Reduce turbine unit loading to the lower end of the 1% efficiency range if deemed necessary by the project biologist. Monitor fish conditions in gatewells hourly or more frequently during orifice closure periods.

2. Orifice lights operational and operating on open orifices. Orifice lights and area lights may be turned off the evening before the channel is dewatered at the end of the season (dewatering occurs on December 16 or later) to encourage fish to exit the channel volitionally. Area lights can be turned on briefly for personnel access if necessary.

3. Replace all burned out orifice lights within 24 hours of notification. Orifice lights shall remain lighted 24 hours/day.

4. Orifice jets hitting no closer than 3' from back wall, collection channel full.

5. Orifice valves are either fully open or closed.

6. Backflush orifices at least once per day and more frequently if required. During periods of high fish and debris passage, April 1 through July 31, orifices should be inspected and backflushed once per 8-hour shift or more frequently as determined by the project biologist, to keep orifices clean. If debris is causing continual orifice plugging problems in a particular turbine unit gatewell, the respective turbine unit generation may be restricted to the lower end of the 1% turbine efficiency range to minimize orifice plugging problems.

7. If utilizing the automatic orifice backflush system, inspect as determined by the project biologist (but at least once per 8-hour shift unless coordinated differently) to ensure that the orifices are opening and closing correctly and are clear of debris. The project biologist will determine the frequency of automatic orifice cycling and backflushing to maintain clear orifices.

8. Water-up valve capable of operating when needed.

d. Dewatering Structure.

1. Trash sweep and air burst systems operating correctly. The frequency of screen cleaning should be set as necessary to maintain a clean screen.

2. Hand clean trapezoidal section as often as required to maintain in clean condition, with a minimum of once per day.

3. Check overflow weirs to make sure they are operating correctly, perform maintenance as required.

4. There should be no gaps between screen panels or damaged panels in the inclined screen. Screen panels in place and tightly secured.

5. Lights at the dewatering structure should be turned off at night, unless needed for personnel access, to encourage fish to move downstream volitionally.

e. Transportation Facilities.

1. Operate wet separator and fish distribution system as designed.

2. Crowder screen brushes should be maintained in good operating condition, with no holes or sharp edges on crowder screens. Crowders should be in good operating condition.

3. Inspect raceway and tank retainer screens to make sure they are clean with no holes or protruding wires.

4. Barge and truck loading pipes and related equipment free of debris, cracks, or blockages and in good condition. Barge loading boom in good operating condition

5. Inform PSMFC, in advance if possible, of situations that cause the PIT tag system to become inoperable (e.g. power outages) or that could result in confounding the interpretation of PIT tag data (e.g. bypassing fish from raceways to the river, operating in primary bypass mode without an operational full-flow detector, emergency dewaterings).

f. Avian Predation Areas (Forebay and Tailrace).

1. Bird wires and other avian deterrent devices should be monitored to assure they are in good condition. Any broken wires or devices should be replaced as soon as possible.

2. Harassment program in place to deter avian predation in areas actively used by birds and not covered by bird wires or other devices.

3. Project biologists shall routinely monitor project areas to determine areas of active avian predation and, if possible, adjust harassment program to cover these areas or install bird wires or other deterrent devices to discourage avian predation activities.

g. Spillway Weir.

1. The season is started with the low crest in place. The trigger to change to the high crest for the summer season is based on the following:

a. when discharge falls below 70 kcfs for more than three days in a row and the forecast indicate continuing lower discharges;

b. a review of juvenile fish counts from Little Goose monitoring to prevent changes during the middle of peak outmigration.

h. Inspection and Record Keeping.

1. Inspect fish facilities at least once every 8 hours. Inspect all facilities

according to fish facilities monitoring program.

2. Record all maintenance and inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the following criteria.

2.3.2.1. Winter Maintenance Period (January 1 through February 28).

a. Inspect all staff gages and water level indicators. Repair and/or clean where necessary.

b. Dewater the ladder and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. The fish ladder exit trashrack must have smooth surfaces where fish pass, and must have downstream edges that are adequately rounded or padded. A spare trashrack should be on hand for use as necessary. Inspect all diffuser gratings and chambers, and the fallout fence, annually by dewatering or by using divers or video inspection techniques. All diffuser gratings and chambers are to be dewatered and physically inspected at least every 3 years. Repair deficiencies.

c. Inspect for and clean debris from the fish ladder exit. The trashrack and picketed leads must be clean and installed correctly.

d. Calibrate all water level measuring devices, as necessary, for proper facility operations.

e. Inspect all spill gates and ensure that they are operable.

f. Fish pumps maintained and ready for operation.

g. Inspect ladder netting and repair prior to fish passage season.

2.3.2.2. Fish Passage Period (March 1 through December 31). Note: Lower Monumental pool may be operated at minimum operating pool (MOP), between elevations 537' and 538' msl, as part of the Corps' efforts to improve migration conditions for juvenile salmonids. This may result in some of the adult fishway entrances at Little Goose bottoming out on their sills prior to reaching criteria depths. Continuous operation at MOP may also result in increased pumping head on the auxiliary water supply pumps, decreasing the amount of water supplied by the pumps.

a. Fishway Ladder. Water depth over weirs: 1' to 1.3'.

b. Counting Window. The minimum counting slot width should be 18". All equipment should be maintained and in good condition. The counting window and backboard should be cleaned as needed to maintain good visibility.

c. Head on all Fishway Entrances. Head range: 1' to 2'.

d. North Shore Entrances (NSE 1 & 2). Elev. at top of gates when on sill = 529'.

1. Operate both downstream gates.

2. Weir depth: 6' or greater below tailwater.

e. North Powerhouse Entrances (NPE 1 & 2). Elev. at top of gates when on sill = 532'.

1. Operate both downstream gates.

2. Weir Depth: 7' or greater below tailwater, tailwater permitting. At tailwater below elevation 539', entrance weirs should be on sill.

f. Floating Orifice Gates. No floating orifice gates will be operated. Inspect fish fallout fence for debris buildup, holes, etc.

g. South Shore Entrances (SSE 1 & 2). Elev. of top of gates when on sill = 529'.

1. Operate both gates.

2. Weir depth: 8' or greater below tailwater.

h. Channel Velocity. 1.5' to 4' per second.

1. Adult collection channel water velocities must flow between 1.5’ and 4’ per second. This velocity is optimum criteria for returning adult salmon and steelhead to migrate upstream though the fishway. Velocity readings will be included in required fishway inspections and reported in the weekly and annual reports.

2. Surface water velocities will be measured in the open access area near the south shore weir / fish Entrance. The surface velocity will be measured using a piece of woody debris (stick, bark) or water bubble timed over a marked fixed distance. The measurement of the water velocity at this location typifies the velocity conditions throughout the length of the channel.

3. Subsurface water velocity will be collected from a permanently installed flowmeter located near the south shore weir / fish entrance. The flowmeter generally measures a slower velocity than the manual measurement of the surface velocities due to “averaged calibration”. The location of the sending unit typifies the subsurface velocity conditions throughout the length of the channel. The flowmeter is positioned in the channel to avoid the non-

characteristic high readings that would occur near a restricted entrance or the non-characteristic low flows induced by turbulence from pump discharge auxiliary water supply. The flowmeter is calibrated every three years using measurements from near the bottom, mid-depth, and near the surface averaged for accuracy.

i. Tunnel Lights. Lights in the tunnel section under the spillway shall be on during fish passage period.

j. Head on Trashracks.

1. Maximum head of 0.5' on ladder exit.

2. Maximum head on picketed leads shall be 0.3'.

3. Trashrack and picketed leads installed correctly.

k. Staff Gages and Water Level Indicators. All staff gages should be readable at all water levels encountered during the fish passage period. Repair or clean as necessary.

l. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day shift and check computer monitor information at least once during each back shift.

2. Project biologists shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Picketed leads shall be checked during all inspections to ensure they are clean and in the correct position (all the way down and vanes in line with flow).

4. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration. This may be done as part of routine fishway inspections.

5. Inspect fishways daily for foreign substances (particularly oil). If substances are found, corrective actions should be undertaken immediately.

6. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections.

2.3.3.1. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions.

2.3.3.2. The reports shall include:

a. Any out-of-criteria situations observed and subsequent corrective actions taken;

b. Any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities;

c. Adult fishway control calibrations;

d. ESBS and VBS inspections;

e. Any unusual activities which occurred at the project which may affect fish passage.

2.3.3.3. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENWW-OD-T by noon the following Monday via electronic mail.

2.3.3.4. Project biologists shall prepare a draft annual report by February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. The annual report shall also include a description of all actions taken to discourage avian predation at the project, with an overview of the effectiveness of the activities in discouraging avian predation.

2.3.3.5. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra and Quagga mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing mussel inspections.

3. Project Maintenance. Project biologists should be present to provide technical guidance at all project activities that may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering and fish handling plans. **When river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T.** Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modifications of facilities that

require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 through March 31. During the fish passage season parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation that prevents the facilities from operating according to criteria or that will impact fish passage or survival. Maintenance of facilities such as ESBSs, which sometimes break down during the fish passage season, will be carried out as described below. In these cases, repairs will be made as prescribed and CENWW-OD-T notified for further coordination. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with NOAA Fisheries and other FPOM participants on a case-by-case basis by CENWW-OD-T. CENWW-OD-T will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Operations Manager has the authority to initiate work prior to notifying CENWW-OD-T when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWW-OD-T includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage and proposed measures to mitigate them.

3.1.2.1. Extended-length Submersible Bar Screens. The ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found damaged or malfunctions at any time it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated during the juvenile bypass season with a missing, known damaged or non-operating ESBS (except as detailed below). If an ESBS fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another fully screened unit. If all screened turbine units are in service, water may be spilled until the effected ESBS can be removed and repaired or replaced.

3.1.2.1.1. During the spring runoff when river flows are at the level where taking a unit out of service and spilling will exceed the TDG limits allowed by state standards, project personnel may operate a turbine unit at <u>110 MWs or less</u> with a failed screen cleaner if there is evidence that the ESBS will not plug with debris. Evidence of this is a lack of debris accumulation in the gatewell and along the face of the powerhouse. This will only happen if an ESBS screen cleaner fails after 1400 hours on a regular workday or any time on a weekend. Project personnel will pull and replace the screen the next morning, weekday or weekend inclusive. If the screen cannot be pulled and repaired first thing the next morning, the turbine unit will be removed from service until the screen can be repaired. If there is

evidence that fish are being injured under this operation, by either observing injured fish in the gatewells or injured fish appearing on the separator, the turbine unit will be removed from service immediately. This operation will not take place when daily average river flows are less than total powerhouse capacity and the turbine unit will not be operated during power peaking operations where turbine units are being turned on and off.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12" orifices (gatewell slot 1A has one 14" test orifice) with air operated valves to allow fish to exit the gatewell. Under normal operation, at least one orifice per gatewell is operated. To minimize blockage from debris, orifices should be backflushed every day. If an air valve fails, the valve should be closed and the alternate orifice and air valve for that gatewell operated until repairs can be made. If both orifices are blocked with debris, damaged, or must be kept closed, the turbine unit will be taken out of service until repairs can be made. If repairs are to take longer than 48 hours, juvenile fish will be dipped from the gatewell with a gatewell dip basket.

3.1.2.3. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the corrugated metal flume. An inclined screen allows excess water to be bled off, with all fish and remaining water transitioning into the corrugated metal flume. The excess water can be either discharged into the river or added to the adult passage facilities auxiliary water supply system, and is also used as the water supply for the transportation facilities. The dewatering structure contains a trash sweep for cleaning the inclined screen of impinged debris. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen is damaged, an emergency bypass system at the upstream end of the dewatering structure can be used, if required, to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be dewatered and stoplogs inserted at the upstream end of the inclined screen. During this setup process, turbine units may be operated at the lower end of the 1% efficiency range. The emergency bypass is then opened and the bypass system operated with six gatewell orifices open. Orifices will then need to be routinely rotated, at a minimum of every 2 hours, to allow juveniles to emigrate from all of the gatewells. During any orifice closure, gatewells shall be monitored hourly by project personnel for signs of fish problems or mortality. Orifices shall not be closed for longer than 5 hours in an operating turbine unit with ESBSs in place. During periods of high fish passage, orifice closure times may need to be less than 5 hours depending on fish numbers and condition. If orifices are closed, gatewells shall be monitored hourly. Spill may be used as an alternative avenue for fish passage during a collection channel outage.

3.1.2.4. Bypass Flume. The corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project. If there is a problem with the flume that interferes with its operation, an emergency bypass system at the upper end of the flume can be opened and all of the fish in the bypass system diverted to the river below the project through a 30" pipe while repairs are made.

3.1.2.5. Transportation Facilities. The transportation facilities can be operated either to collect and hold juveniles for the transportation program or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish

around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility that must be dewatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will have no effect on fish passage may be conducted at any time. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal criteria unless otherwise coordinated with NOAA Fisheries and other FPOM participants.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with NOAA Fisheries and other FPOM participants. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities (see section 3.1.2.). If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladder and Counting Station. The fish ladder contains fixed weirs, a counting station with picket leads, and a fish exit with trashrack. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct the problem without dewatering the ladder. Trashracks, picket leads, and counting stations can sometimes be repaired or maintained without dewatering the ladder. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after coordination with the fish agencies and tribes.

3.2.2.2. Auxiliary Water Supply System. Three turbine-driven pumps on the south shore supply the auxiliary water for the fish ladder and the powerhouse collection system. All three pumps are required for normal operation. Approximately 150 to 180 cfs of excess water from the juvenile fish passage facilities is also added to the auxiliary water supply system. If one, two, or all three pumps fail, the fishway will be adjusted in the following manner to get the best fish passage conditions possible until repairs can be made: first, increase the speed of the operable pump(s). As necessary, then close NSE 2 and NPE 2 and operate NPE 1 to provide the required 1' to 2' head differential. If the desired head differential cannot be maintained at a depth of 5' or greater, then NSE 1 should be raised until a depth of 5' below tailwater is reached. If the head differential cannot be maintained at this point, SSE 1 and 2 should be raised at 1' increments until 6' below tailwater is reached. If the head differential still cannot be maintained, the transportation channel to the north shore should be bulkheaded off at the end of the powerhouse collection channel. Next, NPE 1 should be closed and the powerhouse collection channel bulkheaded off at the junction pool.

SSE 1 and 2 should then be operated as deep as possible to maintain the head, but not shallower than 6' regardless of the head.

3.2.2.3. Fishway Entrances. The fishway entrances consist of main entrance weirs with hoists and automatic controls. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually, the weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made.

3.2.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done either by dewatering and physically inspecting the diffuser gratings, or by using underwater video cameras, divers, or other methods. Diffuser gratings may come loose during the fish passage season due to a variety of reasons. Daily inspections of fish ladders and collection systems should include looking for any flow changes that may indicate problems with diffuser gratings. If a diffuser grating is known or suspected to have moved, creating an opening into a diffuser chamber, efforts must immediately be taken to correct the situation and minimize impacts on adult fish in the fishway. Coordination of the problems should begin immediately through the established unscheduled maintenance coordination procedure (see section 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. Turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During this time period turbine units will be operated in the priority order shown in **Table LGS-5**. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. Turbine unit operating priority shall be turbine unit 1, then turbine units 2 through 6 (**Table LGS-5**). If more than one turbine unit is operating, maximize discharge (i.e.: operated at the upper 1% limit) through the southernmost turbine units to the extent possible without exceeding 1% guidelines, starting with turbine unit 1. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Table LGS-5. Turbine unit operating priority for Little Goose Dam.

Season	Time of Day	Unit Priority
March 1 – November 30	24 hours	1, 2, 3, 4, 5, 6 *Maximize discharge through lowest numbered turbine units*)
December 1 – February 28	24 hours	Any Order

4.1.1. Turbine units will be operated within 1% of best efficiency from April 1 through October 31 (as specified in BPA's load shaping guidelines, **Appendix C**) unless operation outside of that range is necessary to:

1) Meet the load requirements of the BPA Administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (**Appendix C**);

2) If the turbine unit draft tube is to be dewatered, operate unit with full load for a minimum of 15 minutes prior to installing tail logs. If not possible to load, run unit at speed-no-load for minimum of 15 minutes. This is to reduce the number of fish in the scrollcase prior to installing stop logs;

3) Operating a turbine unit solely to provide station service; or

4) Comply with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between November 1 and March 31, turbine units will continue to be operated within the 1% efficiency range except when BPA load requests require the units to be operated outside the 1% range. Guidelines for operation of the turbines within the 1% efficiency range at various heads are shown in **Tables LGS-7 through LGS-10.**

4.1.2. During fish passage season, Unit 1 lower operating limits shall follow **Table LGS-6**. Historic operation within the GDACS program tended to balance flows out of any units in operation. This year's operation will, at times, result in an unbalanced operation where more flow is passing through Unit 1 than other operating units. A heavier flow out of Unit 1 has been shown, in the Little Goose physical model, to be very important in disrupting the eddy that forms along the south shore downstream of the powerhouse. Disrupting the eddy optimizes the tailrace conditions for both adult passage and juvenile egress with the TSW operating in spillway bay 1.

Table LGS-6. Little Goose Unit 1 2009 Spill Season Operating Limits

Lower Limit	Upper Limit	Condition
1% Lower Generation Limit (Varies w/Head)	1%Upper Generation Limit (Varies w/Head)	With ESBSs installed. Powerhouse Discharge ≤ 16 kcfs
115 MW (16 kcfs)*	1%Upper Generation Limit (Varies w/Head)	With ESBSs installed. Powerhouse Discharge > 16 kcfs
1% Lower Generation Limit (Varies w/Head)	1%Upper Generation Limit (Varies w/Head)	Without ESBSs installed. Powerhouse Discharge ≤ 17.5 kcfs
125 MW (17.5 kcfs)*	1%Upper Generation Limit (Varies w/Head)	Without ESBSs installed. Powerhouse Discharge > 17.5 kcfs

See tables LGS-7 and LGS-8 for the 1% Generation Limits at specific heads. * Discharges are approximate.

4.1.3. All of the lower Snake River powerhouses may be required to keep one generating turbine unit on line at all times to maintain power system reliability. During low flows, there may not be enough river flow to meet this generation requirement and required minimum spill. Under these circumstances the power generation requirement will take precedence over the minimum spill requirement. At Little Goose Dam, minimum generation requirements are 11 - 12 kcfs for turbine units 1 – 3 and 17 - 19 kcfs for turbine units 4-6.

4.2. Turbine Unit Outages During High River Flow Periods. During high spring flows, turbine unit outages for inspecting fish screens, repairing research equipment such as hydroacoustic or radio telemetry equipment, and other fish items may cause increased spill at a project in order to maintain reservoir levels within operating levels. This may result in TDG levels exceeding standards. It is important that this work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data are collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Little Goose, this special operation shall take place when river flows are above 120 kcfs or when increasing spill levels will result in TDG levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the TMT whenever possible.

4.2.1. For scheduled inspection or repair of research equipment, reservoirs shall be drafted to MOP and allowed to fill to 1' above the 1' MOP operating range as the work is accomplished. After the work, reservoirs will be drafted back to the MOP operating range. When inspection or repair work can be scheduled ahead of time, the following process will be followed:

a. Project personnel shall schedule turbine unit outages through the approved turbine outage scheduling procedure by noon of the Tuesday of the week prior to the outage.

b. Project personnel shall also contact CENWW-OD-T and RCC by the same time period and inform them of the intended work.

c. The RCC will coordinate the work activities through the TMT.

d. After coordination with the TMT, RCC shall issue a teletype through the CBTT issuing instructions to project and BPA personnel for the scheduled work.

e. Spill will be increased by one spillbay stop setting (about 1.7 kcfs) above passing inflow to slowly lower the level of Little Goose pool to MOP prior to the scheduled work taking place.

f. When the work takes place, additional spill will not be provided and the reservoir will be allowed to refill until the reservoir is 1' above the normal MOP range (a 2' pondage from where the pool was when the work started). At this point, screen inspections shall stop. (At Snake River projects, this should allow about one normal workday for the scheduled work.)

g. At the conclusion of the work, the reservoir shall be drafted back down to the MOP range utilizing a one spillbay stop increase in spill above passing inflow.

h. If work, such as screen inspections, is not finished, project personnel shall schedule another turbine unit outage for a date where it can be implemented again.

4.2.2. If the work that needs to be done is of an emergency nature that does not normally require the turbine unit to be taken out of service (such as a failed hydroacoustic transducer versus a failed fish screen), and can not wait for the above process to be implemented, project personnel shall notify CENWW-OD-T and RCC to get approval to do the work. If approval to do the work is given, the turbine unit shall be taken out of service and the reservoir level allowed to increase until it reaches 1' above the MOP operating range. At this point, the turbine unit must be returned to service and the reservoir will be drafted back to the MOP range using one spillbay stop setting above passing inflows.

Table LGS-7. The 1% turbine operating range at Little Goose Dam for units 1-3 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	**69.6**	**11,396**	**111.5**	**18,269**
86	70.3	11,381	113.7	18,402
87	71.1	11,366	115.9	18,531
88	71.9	11,351	118.1	18,657
89	72.6	11,336	120.3	18,779
90	**73.4**	**11,322**	**122.5**	**18,898**
91	74.3	11,313	122.9	18,717
92	75.1	11,304	123.2	18,540
93	76.0	11,295	123.6	18,367
94	76.9	11,285	123.9	18,197
95	**77.7**	**11,276**	**124.3**	**18,031**
96	78.8	11,294	124.4	17,841
97	79.8	11,312	124.6	17,654
98	80.9	11,329	124.7	17,472
99	81.9	11,346	124.8	17,293
100	**82.9**	**11,361**	**125.0**	**17,117**
101	83.8	11,363	126.6	17,163
102	84.7	11,364	128.3	17,207
103	85.6	11,365	129.9	17,250
104	86.5	11,367	131.6	17,293
105	**87.4**	**11,367**	**133.2**	**17,334**

Note: This table is based on the 2003 index test of U3 and the 1962 turbine model test.

Table LGS-8. The 1% turbine operating range at Little Goose Dam for units 1-3 without extended-length submersible bar screens.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	**70.5**	**11,320**	**124.5**	**20,006**
86	71.3	11,305	127.0	20,152
87	72.0	11,290	129.5	20,293
88	72.8	11,276	131.9	20,431
89	73.6	11,262	134.4	20,566
90	**74.4**	**11,247**	**136.9**	**20,696**
91	75.3	11,239	137.3	20,499
92	76.1	11,230	137.7	20,306
93	77.0	11,221	138.0	20,116
94	77.9	11,212	138.4	19,931
95	**78.7**	**11,203**	**138.8**	**19,750**
96	79.8	11,222	139.0	19,541
97	80.9	11,240	139.1	19,338
98	81.9	11,257	139.3	19,138
99	83.0	11,274	139.4	18,942
100	**84.0**	**11,290**	**139.6**	**18,751**
101	84.9	11,291	141.4	18,801
102	85.8	11,293	143.3	18,850
103	86.7	11,294	145.1	18,897
104	87.6	11,295	147.0	18,944
105	**88.5**	**11,296**	**148.8**	**18,989**

Note: This table is based on the 2003 index test of U3 and the 1962 turbine model test.

Table LGS-9. The 1% turbine operating range at Little Goose Dam for units 4-6 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	**87.1**	**13,880**	**119.6**	**19,076**
86	88.2	13,890	121.3	19,102
87	89.3	13,899	122.9	19,127
88	90.5	13,908	124.6	19,151
89	91.6	13,916	126.3	19,174
90	**92.8**	**13,924**	**127.9**	**19,196**
91	93.9	13,925	129.4	19,193
92	95.0	13,925	130.9	19,190
93	96.1	13,926	132.4	19,186
94	97.2	13,926	133.9	19,183
95	**98.3**	**13,926**	**135.3**	**19,179**
96	99.2	13,898	135.8	19,038
97	100.0	13,871	136.3	18,900
98	100.9	13,844	136.8	18,765
99	101.8	13,818	137.3	18,633
100	**102.7**	**13,791**	**137.8**	**18,503**
101	103.9	13,821	139.1	18,503
102	105.2	13,849	140.5	18,503
103	106.4	13,878	141.9	18,503
104	107.7	13,905	143.3	18,503
105	**108.9**	**13,932**	**144.6**	**18,503**

Note: This table is based on the 2003 index test of U4 and the 1975 turbine model test.

Table LGS-10. The 1% turbine operating range at Little Goose Dam for units 4-6 without extended-length submersible bar screens.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	**86.4**	**13,479**	**122.2**	**19,052**
86	87.6	13,488	123.9	19,078
87	88.7	13,497	125.6	19,104
88	89.8	13,506	127.2	19,128
89	91.0	13,514	128.9	19,151
90	**92.1**	**13,522**	**130.6**	**19,174**
91	93.2	13,523	132.1	19,171
92	94.3	13,524	133.7	19,168
93	95.4	13,524	135.2	19,165
94	96.5	13,525	136.7	19,162
95	**97.6**	**13,525**	**138.2**	**19,158**
96	98.4	13,498	138.7	19,018
97	99.3	13,472	139.2	18,880
98	100.2	13,446	139.7	18,745
99	101.1	13,420	140.2	18,613
100	**101.9**	**13,395**	**140.7**	**18,484**
101	103.2	13,423	142.1	18,484
102	104.4	13,451	143.5	18,484
103	105.7	13,478	144.9	18,484
104	106.9	13,505	146.3	18,484
105	**108.1**	**13,532**	**147.7**	**18,484**

Note: This table is based on the 2003 index test of U4 and the 1975 turbine model test.

4.3. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance that may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent best efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (**Appendix C**) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 workdays. To conduct the testing, the transmission lines have to be disconnected from the transformers and normal generation stopped. One turbine unit will operate in a speed-no-load condition to provide project power and operation of fish passage facilities. Spill may be provided to meet minimum required project discharges during the testing hours. The Doble tests are normally

scheduled for the August or early September time period to minimize impacts on adult and juvenile fish passage.

4.3.1. Turbine units are to be operated with raised operating gates to improve fish passage conditions when ESBSs are installed, except as provided below. To facilitate annual maintenance, operating gates are used to dewater the turbine units. To minimize turbine outage periods to the actual time required for maintenance (during the July 1 through December 15 time period), operating gates in one turbine unit may be lowered to the standard operating position and connected to hydraulic cylinders on the afternoon of the last regular workday (normally Thursday) prior to the start of the maintenance. With the operating gates in the standard operating position, the turbine unit may be operated until 0700 hours of the next regular workday (normally Monday) with generation loads restricted to 100 MWs or less. On the completion of maintenance, the turbine unit can be operated with the operating gates in the standard operating position at 100 MWs or less until 0700 hours of the first regular workday after the maintenance is completed. The project biologist will be notified when the operating gates are set in the standard operating position. The gatewells will be monitored 2 times per day to observe fish condition while the operating gates are in the standard operating position. If turbine maintenance or the raising of the operating gates to the raised operating position is delayed after the time periods stated above, the turbine unit shall be immediately taken out of service until the work can be accomplished. Operation of turbine units with operating gates in the standard operating position shall be restricted to the July 1 through December 15 time period, and shall not occur unless at least 4 other turbine units are available for service. No more than 1 turbine unit at a time shall be operated with operating gates in the standard operating position and the turbine unit will be operated on last on, first off operating priority.

4.3.2. Unwatering turbine units should be accomplished in accordance with project dewatering plans. If the turbine unit draft tube is to be dewatered, operate unit with full load for a minimum of 15 minutes prior to installing tail logs. If not possible to load, run unit at speed-no-load for minimum of 15 minutes. This is to reduce the number of fish in the scrollcase prior to installing stop logs. If a turbine unit is out of service for maintenance for an extended period of time without tailrace stoplogs in place, efforts should be made to not open the wicket gates if the scroll case must be dewatered at a later date without the unit being spun beforehand.

5. Forebay Debris Removal. Debris at projects can impact fish passage conditions. Debris can plug or block trashracks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. Debris can be removed from the forebay by: physically encircling the debris with log booms and pulling it to shore with boats where it can be removed with a crane, removing the debris from the top of the dam using a crane and scoop, or passing the debris through the spillway with special powerhouse operations and spill. The preferred option is to remove debris at each project when possible to avoid passing debris on to the next project downstream. This is not always possible at each project as some

projects do not have forebay debris removal capability. In this case, the only viable alternative is to spill to pass the debris.

5.1. All special spills (other than normal spill patterns for ongoing spill operations) and project operations for passing debris will be coordinated prior to the operations taking place. Each project shall contact CENWW-OD-T at least two workdays prior to the day they want the special project operations for spilling to pass debris. CENWW-OD-T shall coordinate the special operations with RCC, NOAA Fisheries, and other FPOM participants. Project personnel shall provide CENWW-OD-T the reason for the debris spill request including an explanation of project facilities being impacted by the debris, the date and time of the requested spill, and any special powerhouse or other operations required to move the debris to the spillway. When a debris spill is coordinated and approved, RCC shall issue a teletype detailing the specifics of the special operations.

Updated spill tables have been approved by FPOM. These tables are provided directly to the project.

Table LGS-10. Little Goose Dam spill pattern for low crest (Crest Elev. = 618 ft) Spillway Weir.

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]								Total Stops TS	Notes
					1 (Nt. 3)	2	3	4	5	6	1	2	3	4	5	6	7	8		
27.3	12.3	39.6	31.1%	634.5	16.0	11.3					SW-LO								0	Lowest Qr possible w/ SW-LO (Note 5)
31.7	12.3	44.0	28.0%	634.5	16.0	15.7					SW-LO								0	
30.0	14.1	44.1	31.9%	634.5	16.0	14.0					SW-LO	1							1	
34.9	14.1	49.0	28.7%	634.5	17.5	17.4					SW-LO	1							1	Max. Qr for MOP+1 rules to apply (Note 2)
34.3	14.7	49.0	30.0%	633.5	17.2	17.1					SW-LO	1	1						2	Min. Qr for MOP rules to apply (Note 2)
38.6	16.5	55.1	29.9%	633.5	16.0	11.3	11.3				SW-LO	1	1	1					3	
42.5	18.2	60.7	30.0%	633.5	16.0	13.3	13.2				SW-LO	1	1	1	1				4	
46.6	20.0	66.6	30.0%	633.5	16.0	15.3	15.3				SW-LO	1	1	1	1	1			5	
50.6	21.7	72.3	30.0%	633.5	16.9	16.9	16.8				SW-LO	1	1	1	1	1	1		6	
54.7	23.5	78.2	30.0%	633.5	16.0	12.4	12.4	13.9			SW-LO	1	1	1	1	1	1	1	7	Likely lowest Qr w/ SW-LO (Note 6)
59.1	25.3	84.4	30.0%	633.5	16.0	14.4	14.4	14.3			SW-LO	2	1	1	1	1	1	1	8	
63.5	27.2	90.7	30.0%	633.5	16.0	15.9	15.8	15.8			SW-LO	2	1	2	1	1	1	1	9	
67.9	29.1	97.0	30.0%	633.5	17.0	17.0	17.0	16.9			SW-LO	2	1	2	1	2	1	1	10	
72.4	31.0	103.4	30.0%	633.5	16.0	14.1	14.1	14.1	14.1		SW-LO	2	1	2	1	2	1	2	11	
76.8	32.9	109.7	30.0%	633.5	16.0	15.2	15.2	15.2	15.2		SW-LO	2	2	2	1	2	1	2	12	
81.2	34.8	116.0	30.0%	633.5	16.3	16.3	16.2	16.2	16.2		SW-LO	2	2	2	2	2	1	2	13	
85.6	36.7	122.3	30.0%	633.5	17.2	17.1	17.1	17.1	17.1		SW-LO	2	2	2	2	2	2	2	14	
90.2	38.7	128.9	30.0%	633.5	16.0	14.9	14.9	14.8	14.8	14.8	SW-LO	3	2	2	2	2	2	2	15	
94.9	40.7	135.6	30.0%	633.5	16.0	15.8	15.8	15.8	15.8	15.7	SW-LO	3	3	2	2	2	2	2	16	
99.5	42.7	142.2	30.0%	633.5	16.6	16.6	16.6	16.6	16.6	16.5	SW-LO	3	3	3	2	2	2	2	17	
104.2	44.6	148.8	30.0%	633.5	17.4	17.4	17.4	17.4	17.3	17.3	SW-LO	3	3	3	3	2	2	2	18	
108.8	46.6	155.4	30.0%	633.5	17.5	17.5	17.5	18.8	18.8	18.7	SW-LO	3	3	3	3	3	2	2	19	Max. PH capacity w/ Qs=30% (Note 7)
109.2	48.6	157.8	30.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	3	3	3	3	3	3	2	20	
109.2	50.6	159.8	31.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	3	3	3	3	3	3	3	21	
109.2	52.6	161.8	32.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	3	3	3	3	3	3	22	
109.2	54.5	163.7	33.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	3	3	3	3	3	23	
109.2	56.5	165.7	34.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	3	3	3	3	24	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt. 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
109.2	58.5	167.7	34.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	3	3	3	25	
109.2	60.4	169.6	35.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	4	3	3	26	
109.2	62.4	171.6	36.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	4	4	3	27	
109.2	64.3	173.5	37.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	4	4	4	28	
109.2	66.3	175.5	37.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	4	4	4	4	4	4	29	
109.2	68.2	177.4	38.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	4	4	4	4	4	30	
109.2	70.2	179.4	39.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	4	4	4	4	31	
109.2	72.1	181.3	39.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	4	4	4	32	
109.2	74.1	183.3	40.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	4	4	33	
109.2	76.0	185.2	41.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	5	4	34	
109.2	78.0	187.2	41.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	5	5	35	
109.2	79.9	189.1	42.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	5	5	5	5	5	5	36	
109.2	81.9	191.1	42.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	5	5	5	5	5	37	
109.2	83.8	193.0	43.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	5	5	5	5	38	
109.2	85.8	195.0	44.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	5	5	5	39	
109.2	87.7	196.9	44.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	5	5	40	
109.2	89.7	198.9	45.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	6	5	41	
109.2	91.6	200.8	45.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	6	6	42	
109.2	93.6	202.8	46.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	6	6	6	6	6	6	43	
109.2	95.5	204.7	46.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	6	6	6	6	6	44	
109.2	97.5	206.7	47.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	6	6	6	6	45	
109.2	99.4	208.6	47.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	6	6	6	46	
109.2	101.3	210.5	48.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	6	6	47	
109.2	103.3	212.5	48.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	7	6	48	
109.2	105.2	214.4	49.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	7	7	49	
109.2	107.2	216.4	49.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	7	7	7	7	7	7	50	
109.2	109.1	218.3	50.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	7	7	7	7	7	51	
109.2	111.1	220.3	50.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	7	7	7	7	52	
109.2	113.0	222.2	50.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	7	7	7	53	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt. 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
109.2	115.0	224.2	51.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	7	7	54	
109.2	116.9	226.1	51.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	8	7	55	
109.2	118.9	228.1	52.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	8	8	56	
109.2	120.8	230.0	52.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	8	8	8	8	8	8	57	
109.2	122.7	231.9	52.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	8	8	8	8	8	58	
109.2	124.6	233.8	53.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	8	8	8	8	59	
109.2	126.5	235.7	53.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	8	8	8	60	
109.2	128.5	237.7	54.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	8	8	61	
109.2	130.4	239.6	54.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	9	8	62	
109.2	132.3	241.5	54.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	9	9	63	
109.2	134.3	243.5	55.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	9	9	9	9	9	9	64	
109.2	136.3	245.5	55.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	9	9	9	9	9	65	
109.2	138.3	247.5	55.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	9	9	9	9	66	
109.2	140.3	249.5	56.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	9	9	9	67	
109.2	142.3	251.5	56.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	10	9	9	68	
109.2	144.3	253.5	56.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	10	10	9	69	
109.2	146.3	255.5	57.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	10	10	10	70	

Note 1: Powerhouse unit priority should be Unit 1 ==> 6. Unit 1 operation is especially important to maintain good tailrace conditions for juvenile fish egress and adult fish attraction.

Note 2: Assume Minimum Operating Pool (MOP) rules apply (i.e. forebay elevation between 633.0 - 634.0 feet) for river discharges (Qr) greater than about 50 kcfs. For Qr less than 50 kcfs, assume MOP+1 rules. apply (i.e. forebay elevation between 634.0 - 635.0 feet).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (634.5 ft for Qr ≤ 50 kcfs or 633.5 ft for Qr ≥ 50 kcfs), and are approximate. Particularly the powerhouse discharges are shown as an indication of how the Unit 1 operating restriction will work, not as a precise requirement. Actual operation will change with changing inflow, forebay and tailwater elevations, and other operating constraints and demands.

Note 4: Unit 1 operation is manually restricted to operate between 115 - 125 MW, which is approximately 16.0 - 17.5 kcfs. Assume Unit 1 will be at the lower end of this range if other units are operating at discharges lower than 16.0 kcfs. Assume other operating units will be operated approximately uniformly, within constraints of normal 1% operation (Units 4-6 are different than Units 1-3). When average unit discharge is higher than 16.0 kcfs, assume all units will operate uniformly, again given different 1% range for Units 4-6. For low river discharges, with only one unit operating, Unit 1 may operate at less than 16 kcfs.

Note 5: For river discharges less than this value, the SW will be closed, and the remaining spill bays will be used, following the uniform spill pattern (see separate table).

Note 6: Spring fish passage season will start with SW-LO in place, even if river discharges are less than 75 kcfs. After the spring freshet has passed, river discharge falls below 75 kcfs for three days in a row and forecasts indicate continuing lower river discharges, the SW-HI will be installed for the remainder of the summer fish passage season, even if river discharges subsequently increase above 75 kcfs, unless coordinated differently with regional fish managers.

Note 7: Above this river discharge, involuntary spill will force a spill ratio higher than 30%

Table LGS-11. Little Goose Dam spill pattern for high crest (Crest Elev. = 622 ft) Spillway Weir.

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]								Total Stops TS	Notes
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8		
17.5	8.1	25.6	31.6%	634.5	17.5						SW-HI								0	Lowest Qr possible w/ SW-HI (Note 5)
17.5	9.9	27.4	36.1%	634.5	17.5						SW-HI	1							1	1 unit, 1 stop, Qs~36%
27.3	8.1	35.4	22.9%	634.5	16.0	11.3					SW-HI								0	2 units, 0 stop, Qs~23%
27.3	9.9	37.2	26.6%	634.5	16.0	11.3					SW-HI	1							1	2 units, 1 stop, Qs~27%
27.3	11.6	38.9	29.9%	634.5	16.0	11.3					SW-HI	1	1						2	
31.3	13.4	44.7	30.0%	634.5	16.0	15.3					SW-HI	1	1	1					3	
35.0	15.2	50.2	30.3%	634.5	17.5	17.5					SW-HI	1	1	1	1				4	Max. Qr for MOP+1 rules to apply (Note 2)
35.0	15.9	50.9	31.2%	633.5	17.5	17.5					SW-HI	1	1	1	1	1			5	2 units, 5 stops, Qs~31%; Min. Qr for MOP rules to apply (Note 2)
38.6	15.9	54.5	29.2%	633.5	16.0	11.3	11.3				SW-HI	1	1	1	1	1			5	3 units, 5 stops, Qs~29%
41.2	17.7	58.9	30.0%	633.5	16.0	12.6	12.6				SW-HI	1	1	1	1	1	1		6	
45.3	19.4	64.7	30.0%	633.5	16.0	14.7	14.6				SW-HI	1	1	1	1	1	1	1	7	
49.7	21.3	71.0	30.0%	633.5	16.6	16.6	16.5				SW-HI	2	1	1	1	1	1	1	8	
54.1	23.2	77.3	30.0%	633.5	16.0	12.1	12.1	13.9			SW-HI	2	1	2	1	1	1	1	9	Likely highest Qr w/ SW-HI (Note 6)
58.5	25.1	83.6	30.0%	633.5	16.0	14.2	14.2	14.1			SW-HI	2	1	2	1	2	1	1	10	
62.9	27.0	89.9	30.0%	633.5	16.0	15.7	15.6	15.6			SW-HI	2	1	2	1	2	1	2	11	
67.3	28.9	96.2	30.0%	633.5	16.9	16.8	16.8	16.8			SW-HI	2	2	2	1	2	1	2	12	
71.7	30.7	102.4	30.0%	633.5	16.0	14.0	13.9	13.9	13.9		SW-HI	2	2	2	2	2	1	2	13	
76.1	32.6	108.7	30.0%	633.5	16.0	15.1	15.0	15.0	15.0		SW-HI	2	2	2	2	2	2	2	14	
80.8	34.6	115.4	30.0%	633.5	16.2	16.2	16.2	16.1	16.1		SW-HI	3	2	2	2	2	2	2	15	
85.4	36.6	122.0	30.0%	633.5	17.1	17.1	17.1	17.1	17.0		SW-HI	3	3	2	2	2	2	2	16	
90.1	38.6	128.7	30.0%	633.5	16.0	14.9	14.8	14.8	14.8	14.8	SW-HI	3	3	3	2	2	2	2	17	
94.7	40.6	135.3	30.0%	633.5	16.0	15.8	15.8	15.7	15.7	15.7	SW-HI	3	3	3	3	2	2	2	18	
99.4	42.6	142.0	30.0%	633.5	16.6	16.6	16.6	16.6	16.5	16.5	SW-HI	3	3	3	3	3	2	2	19	
104.0	44.6	148.6	30.0%	633.5	17.4	17.4	17.3	17.3	17.3	17.3	SW-HI	3	3	3	3	3	3	2	20	
108.6	46.6	155.2	30.0%	633.5	17.5	17.5	17.5	18.7	18.7	18.7	SW-HI	3	3	3	3	3	3	3	21	Max. PH capacity w/ Qs=30% (Note 7)
109.2	48.5	157.7	30.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	3	3	3	3	3	3	22	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
109.2	50.5	159.7	31.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	3	3	3	3	3	23	
109.2	52.4	161.6	32.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	3	3	3	3	24	
109.2	54.4	163.6	33.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	3	3	3	25	
109.2	56.4	165.6	34.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	3	3	26	
109.2	58.3	167.5	34.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	4	3	27	
109.2	60.3	169.5	35.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	4	4	28	
109.2	62.2	171.4	36.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	4	4	4	4	4	4	29	
109.2	64.2	173.4	37.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	4	4	4	4	4	30	
109.2	66.1	175.3	37.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	4	4	4	4	31	
109.2	68.1	177.3	38.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	4	4	4	32	
109.2	70.0	179.2	39.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	4	4	33	
109.2	72.0	181.2	39.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	5	4	34	
109.2	73.9	183.1	40.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	5	5	35	
109.2	75.9	185.1	41.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	5	5	5	5	5	5	36	
109.2	77.8	187.0	41.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	5	5	5	5	5	37	
109.2	79.8	189.0	42.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	5	5	5	5	38	
109.2	81.7	190.9	42.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	5	5	5	39	
109.2	83.7	192.9	43.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	5	5	40	
109.2	85.6	194.8	44.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	6	5	41	
109.2	87.6	196.8	44.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	6	6	42	
109.2	89.5	198.7	45.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	6	6	6	6	6	6	43	
109.2	91.5	200.7	45.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	6	6	6	6	6	44	
109.2	93.4	202.6	46.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	6	6	6	6	45	
109.2	95.3	204.5	46.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	6	6	6	46	
109.2	97.3	206.5	47.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	6	6	47	
109.2	99.2	208.4	47.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	7	6	48	
109.2	101.2	210.4	48.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	7	7	49	
109.2	103.1	212.3	48.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	7	7	7	7	7	7	50	
109.2	105.1	214.3	49.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	7	7	7	7	7	51	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
109.2	107.0	216.2	49.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	7	7	7	7	52	
109.2	109.0	218.2	49.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	7	7	7	53	
109.2	110.9	220.1	50.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	7	7	54	
109.2	112.9	222.1	50.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	8	7	55	
109.2	114.8	224.0	51.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	8	8	56	
109.2	116.7	225.9	51.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	8	8	8	8	8	8	57	
109.2	118.7	227.9	52.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	8	8	8	8	8	58	
109.2	120.6	229.8	52.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	8	8	8	8	59	
109.2	122.5	231.7	52.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	8	8	8	60	
109.2	124.4	233.6	53.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	8	8	61	
109.2	126.3	235.5	53.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	9	8	62	
109.2	128.3	237.5	54.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	9	9	63	
109.2	130.3	239.5	54.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	9	9	9	9	9	9	64	
109.2	132.3	241.5	54.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	9	9	9	9	9	65	
109.2	134.3	243.5	55.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	9	9	9	9	66	
109.2	136.3	245.5	55.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	9	9	9	67	
109.2	138.3	247.5	55.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	10	9	9	68	
109.2	140.3	249.5	56.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	10	10	9	69	
109.2	142.3	251.5	56.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	10	10	10	70	

Note 1: Powerhouse unit priority should be Unit 1 ==> 6. Unit 1 operation is especially important to maintain good tailrace conditions for juvenile fish egress and adult fish attraction.

Note 2: Assume Minimum Operating Pool (MOP) rules apply (i.e. forebay elevation between 633.0 - 634.0 feet) for river discharges (Qr) greater than about 50 kcfs. For Qr less than 50 kcfs, assume MOP+1 rules apply (i.e. forebay elevation between 634.0 - 635.0 feet).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (634.5 ft for Qr ≤ 50 kcfs or 633.5 ft for Qr ≥ 50 kcfs), and are approximate. Particularly the powerhouse discharges are shown as an indication of how the Unit 1 operating restriction will work, not as a precise requirement. Actual operation will change with changing inflow, forebay and tailwater elevations, and other operating constraints and demands.

Note 4: Unit 1 operation is manually restricted to operate between 115 - 125 MW, which is approximately 16.0 - 17.5 kcfs. Assume Unit 1 will be at the lower end of this range if other units are operating at discharges lower than 16.0 kcfs. Assume other operating units will be operated approximately uniformly, within constraints of normal 1% operation (Units 4-6 are different than Units 1-3). When average unit discharge is higher than 16.0 kcfs, assume all units will operate uniformly, again given different 1% range for Units 4-6. For low river discharges, with only one unit operating, Unit 1 may operate at less than 16 kcfs.

Note 5: For river discharges less than this value, the SW will be closed, and the remaining spill bays will be used, following the uniform spill pattern (see separate table).

Note 6: The SW-HI will be installed after river discharge falls below 75 kcfs for three days in a row, and forecasts indicate continuing lower river discharges, or as coordinated with regional fish managers, and will remainin place for the rest of the season, even if river discharges subsequently increase above 75 kcfs.

Note 7: Above this river discharge, involuntary spill will force a spill ratio higher than 30%.

Table LGS-12. Little Goose Dam spill pattern for Uniform Spill, no Spillway Weir.

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
11.3	0.0	11.3	0.0%	634.5	11.3						No SW								0	No spill
11.3	1.8	13.1	13.5%	634.5	11.3						No SW	1							1	
11.3	3.5	14.8	23.9%	634.5	11.3						No SW	1	1						2	
12.3	5.3	17.6	30.2%	634.5	12.3						No SW	1	1	1					3	Lowest Qr possible w/ 30% spill and no SW (Note 5)
16.3	7.1	23.4	30.3%	634.5	16.3						No SW	1	1	1	1				4	
17.5	8.9	26.4	33.6%	634.5	17.5						No SW	1	1	1	1	1			5	1 unit, 5 stops, Qs~33%
27.3	8.9	36.2	24.5%	634.5	16.0	11.3					No SW	1	1	1	1	1			5	2 units, 5 stops, Qs~24%
27.3	10.6	37.9	28.0%	634.5	16.0	11.3					No SW	1	1	1	1	1	1		6	
28.9	12.4	41.3	30.0%	634.5	16.0	12.9					No SW	1	1	1	1	1	1	1	7	
33.4	14.3	47.7	30.0%	634.5	16.7	16.7					No SW	2	1	1	1	1	1	1	8	Max. Qr for MOP+1 rules to apply (Note 2)
35.0	16.0	51.0	31.4%	633.5	17.5	17.5					No SW	2	1	2	1	1	1	1	9	2 units, 9 stops, Qs~31%; Min. Qr for MOP rules to apply (Note 2)
38.6	16.0	54.6	29.3%	633.5	16.0	11.3	11.3				No SW	2	1	2	1	1	1	1	9	3 units, 9 stops, Qs~29%
41.8	17.9	59.7	30.0%	633.5	16.0	12.9	12.9				No SW	2	1	2	1	2	1	1	10	
46.2	19.8	66.0	30.0%	633.5	16.0	15.1	15.1				No SW	2	1	2	1	2	1	2	11	
50.6	21.7	72.3	30.0%	633.5	16.9	16.9	16.8				No SW	2	2	2	1	2	1	2	12	
55.0	23.6	78.6	30.0%	633.5	16.0	12.6	12.5	13.9			No SW	2	2	2	2	2	1	2	13	
59.5	25.5	85.0	30.0%	633.5	16.0	14.5	14.5	14.5			No SW	2	2	2	2	2	2	2	14	
64.1	27.5	91.6	30.0%	633.5	16.1	16.0	16.0	16.0			No SW	3	2	2	2	2	2	2	15	
68.7	29.5	98.2	30.0%	633.5	17.2	17.2	17.2	17.1			No SW	3	3	2	2	2	2	2	16	
73.4	31.5	104.9	30.0%	633.5	16.0	14.4	14.4	14.3	14.3		No SW	3	3	3	2	2	2	2	17	
78.0	33.4	111.4	30.0%	633.5	16.0	15.5	15.5	15.5	15.5		No SW	3	3	3	3	2	2	2	18	
82.7	35.4	118.1	30.0%	633.5	16.6	16.6	16.5	16.5	16.5		No SW	3	3	3	3	3	2	2	19	
87.3	37.4	124.7	30.0%	633.5	17.5	17.5	17.5	17.4	17.4		No SW	3	3	3	3	3	3	2	20	
92.0	39.4	131.4	30.0%	633.5	16.0	15.2	15.2	15.2	15.2	15.2	No SW	3	3	3	3	3	3	3	21	
96.5	41.4	137.9	30.0%	633.5	16.1	16.1	16.1	16.1	16.1	16.0	No SW	4	3	3	3	3	3	3	22	
101.1	43.3	144.4	30.0%	633.5	16.9	16.9	16.9	16.8	16.8	16.8	No SW	4	4	3	3	3	3	3	23	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
105.7	45.3	151.0	30.0%	633.5	17.5	17.5	17.5	17.8	17.7	17.7	No SW	4	4	4	3	3	3	3	24	
109.2	47.3	156.5	30.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	3	3	3	25	Max. PH capacity w/ Qs=30% (Note 6)
109.2	49.2	158.4	31.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	3	3	26	
109.2	51.2	160.4	31.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	4	3	27	
109.2	53.1	162.3	32.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	4	4	28	
109.2	55.1	164.3	33.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	4	4	4	4	4	4	29	
109.2	57.0	166.2	34.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	4	4	4	4	4	30	
109.2	59.0	168.2	35.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	4	4	4	4	31	
109.2	60.9	170.1	35.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	4	4	4	32	
109.2	62.9	172.1	36.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	4	4	33	
109.2	64.8	174.0	37.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	5	4	34	
109.2	66.8	176.0	37.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	5	5	35	
109.2	68.7	177.9	38.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	5	5	5	5	5	5	36	
109.2	70.7	179.9	39.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	5	5	5	5	5	37	
109.2	72.6	181.8	39.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	5	5	5	5	38	
109.2	74.6	183.8	40.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	5	5	5	39	
109.2	76.5	185.7	41.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	5	5	40	
109.2	78.5	187.7	41.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	6	5	41	
109.2	80.4	189.6	42.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	6	6	42	
109.2	82.4	191.6	43.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	6	6	6	6	6	6	43	
109.2	84.3	193.5	43.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	6	6	6	6	6	44	
109.2	86.3	195.5	44.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	6	6	6	6	45	
109.2	88.2	197.4	44.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	6	6	6	46	
109.2	90.1	199.3	45.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	6	6	47	
109.2	92.1	201.3	45.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	7	6	48	
109.2	94.0	203.2	46.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	7	7	49	
109.2	96.0	205.2	46.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	7	7	7	7	7	7	50	
109.2	97.9	207.1	47.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	7	7	7	7	7	51	
109.2	99.9	209.1	47.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	7	7	7	7	52	

PH (kcfs)	Spill (kcfs)	Calc River (kcfs)	Per-cent Spill	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 and 2]						Spillway Flow (stops) [Note 2]									
					1 (Nt 3)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
109.2	101.8	211.0	48.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	7	7	7	53	
109.2	103.8	213.0	48.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	7	7	54	
109.2	105.7	214.9	49.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	8	7	55	
109.2	107.7	216.9	49.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	8	8	56	
109.2	109.6	218.8	50.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	8	8	8	8	8	8	57	
109.2	111.5	220.7	50.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	8	8	8	8	8	58	
109.2	113.4	222.6	50.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	8	8	8	8	59	
109.2	115.3	224.5	51.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	8	8	8	60	
109.2	117.3	226.5	51.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	8	8	61	
109.2	119.2	228.4	52.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	9	8	62	
109.2	121.1	230.3	52.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	9	9	63	
109.2	123.1	232.3	53.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	9	9	9	9	9	9	64	
109.2	125.1	234.3	53.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	9	9	9	9	9	65	
109.2	127.1	236.3	53.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	9	9	9	9	66	
109.2	129.1	238.3	54.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	9	9	9	67	
109.2	131.1	240.3	54.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	10	9	9	68	
109.2	133.1	242.3	54.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	10	10	9	69	
109.2	135.1	244.3	55.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	10	10	10	70	

Note 1: Powerhouse unit priority should be Unit 1 ==> 6. Unit 1 operation is especially important to maintain good tailrace conditions for juvenile fish egress and adult fish attraction.

Note 2: Assume Minimum Operating Pool (MOP) rules apply (i.e. forebay elevation between 633.0 - 634.0 feet) for river discharges (Qr) greater than about 50 kcfs. For Qr less than 50 kcfs, assume MOP+1 rules apply (i.e. forebay elevation between 634.0 - 635.0 feet).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (634.5 ft for Qr ≤ 50 kcfs or 633.5 ft for Qr ≥ 50 kcfs), and are approximate. Particularly the powerhouse discharges are shown as an indication of how the Unit 1 operating restriction will work, not as a precise requirement. Actual operation will change with changing inflow, forebay and tailwater elevations, and other operating constraints and demands.

Note 4: Unit 1 operation is manually restricted to operate between 115 - 125 MW, which is approximately 16.0 - 17.5 kcfs. Assume Unit 1 will be at the lower end of this range if other units are operating at discharges lower than 16.0 kcfs. Assume other operating units will be operated approximately uniformly, within constraints of normal 1% operation (Units 4-6 are different than Units 1-3). When average unit discharge is higher than 16.0 kcfs, assume all units will operate uniformly, again given different 1% range for Units 4-6. For low river discharges, with only one unit operating, Unit 1 may operate at less than 16 kcfs.

Note 5: For river discharges less than this value, additional spill bays will be closed, Unit 1 will operate at the lower end of the 1% efficiency range, and the spill ratio will be less than 30%.

Note 6: Above this river discharge, involuntary spill will force a spill ratio higher than 30%.

Note 7: This uniform spill pattern, with no SW operating, will be used when river discharges are too low to maintain a 30% spill ratio with a SW operating, or as an alternate pattern when the SW must be closed for any reason, such as when switching from SW-LO to SW-HI.