2013 Fish Passage Plan
Section 8 – Little Goose Dam
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Section 8 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 of extended length submersible bar screens (ESBSs) with flow vanes, vertical barrier screens (VBSs), 35 12" and 1 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, 2 emergency bypass systems, and 1 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. Juvenile passage timing at Little Goose Dam for the most recent 10-year period (2003-2012) is shown in **Table LGS-1.** During the period from 2006–2009, fish collection started later in the season, thus the passage timing dates shown may have been affected by the timing of data collection during these years. Passage timing dates in the table are based on juvenile fish collection numbers only. Salmon, steelhead, bull trout, lamprey, and other species are counted when they are observed in the juvenile monitoring facility. 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, 2003–2012. [1]

Yearling Chinook	10 %	50%	90 %	# of Days
2003	26-Apr	11-May	3-Jun	38
2004	24-Apr	5-May	18-May	24
2005	3-May	11-May	19-May	16
2006	23-Apr	6-May	20-May	27
2007	8-May	14-May	22-May	14
2008	5-May	15-May	28-May	23
2009	24-Apr	7-May	23-May	29
2010	2-May	15-May	29-May	27
2011	5-May	12-May	19-May	14
2012	30-Apr	7-May	21-May	21
MEDIAN	1-May	11-May	21-May	24
MIN	23-Apr	5-May	18-May	14
MAX	8-May	15-May	3-Jun	38

Subyearling Chinook	10 %	50%	90 %	# of Days
2003	4-Jun	22-Jun	24-Jul	50
2004	9-Jun	21-Jun	17-Jul	38
2005	12-May	6-Jun	20-Jun	39
2006	24-May	9-Jun	4-Jul	41
2007	7-Jun	15-Jun	6-Jul	29
2008	4-Jun	20-Jun	23-Jul	49
2009	29-May	7-Jun	30-Jun	32
2010	6-Jun	12-Jun	8-Jul	32
2011	4-Jun	17-Jun	20-Jul	46
2012	4-Jun	16-Jun	12-Jul	38
MEDIAN	4-Jun	15-Jun	10-Jul	39
MIN	12-May	6-Jun	20-Jun	29
MAX	9-Jun	22-Jun	24-Jul	50

Unclipped Steelhead	10 %	50%	90 %	# of Days
2003	28-Apr	24-May	30-May	32
2004	25-Apr	11-May	2-Jun	38
2005	6-May	12-May	24-May	18
2006	20-Apr	5-May	23-May	33
2007	11-May	15-May	30-May	19
2008	8-May	18-May	1-Jun	24
2009	24-Apr	4-May	29-May	35
2010	3-May	22-May	8-Jun	36
2011	7-May	16-May	6-Jun	30
2012	30-Apr	17-May	2-Jun	33
MEDIAN	1-May	20-May	31-May	33
MIN	20-Apr	4-May	23-May	18
MAX	11-May	24-May	8-Jun	38

Clipped Steelhead	10 %	50%	90 %	# of Days
2003	30-Apr	24-May	29-May	29
2004	27-Apr	10-May	1-Jun	35
2005	6-May	12-May	22-May	16
2006	21-Apr	4-May	20-May	29
2007	10-May	15-May	27-May	17
2008	1-May	12-May	23-May	22
2009	23-Apr	30-Apr	25-May	32
2010	2-May	20-May	7-Jun	36
2011	4-Apr	12-May	20-May	46
2012	25-Apr	9-May	26-May	31
MEDIAN	28-Apr	12-May	25-May	30
MIN	4-Apr	30-Apr	20-May	16
MAX	10-May	24-May	7-Jun	46

Coho	10 %	50%	90 %	# of Days
2003	23-May	28-May	5-Jun	13
2004	19-May	30-May	19-Jun	31
2005	11-May	15-May	24-May	13
2006	5-May	22-May	1-Jun	27
2007	14-May	17-May	5-Jun	22
2008	12-May	22-May	30-May	18
2009	16-May	24-May	21-Jun	36
2010	15-May	22-May	7-Jun	23
2011	7-May	16-May	22-May	15
2012	5-May	20-May	31-May	26
MEDIAN	13-May	22-May	3-Jun	23
MIN	5-May	15-May	22-May	13
MAX	23-May	30-May	21-Jun	36

Sockeye (Wild & Hatchery)	10 %	50%	90 %	# of Days
2003	22-May	1-Jun	6-Jun	15
2004	3-May	25-May	11-Jun	39
2005	12-May	24-May	5-Jun	24
2006	22-Apr	20-May	27-May	35
2007	13-May	19-May	30-May	17
2008	20-May	26-May	6-Jun	17
2009	28-Apr	22-May	30-May	32
2010	20-May	28-May	8-Jun	19
2011	14-Apr	13-May	15-Jun	62
2012	13-May	23-May	3-Jun	21
MEDIAN	12-May	23-May	5-Jun	23
MIN	14-Apr	13-May	27-May	15
MAX	22-May	1-Jun	15-Jun	62

1. Dates are derived from daily and yearly facility collection numbers.

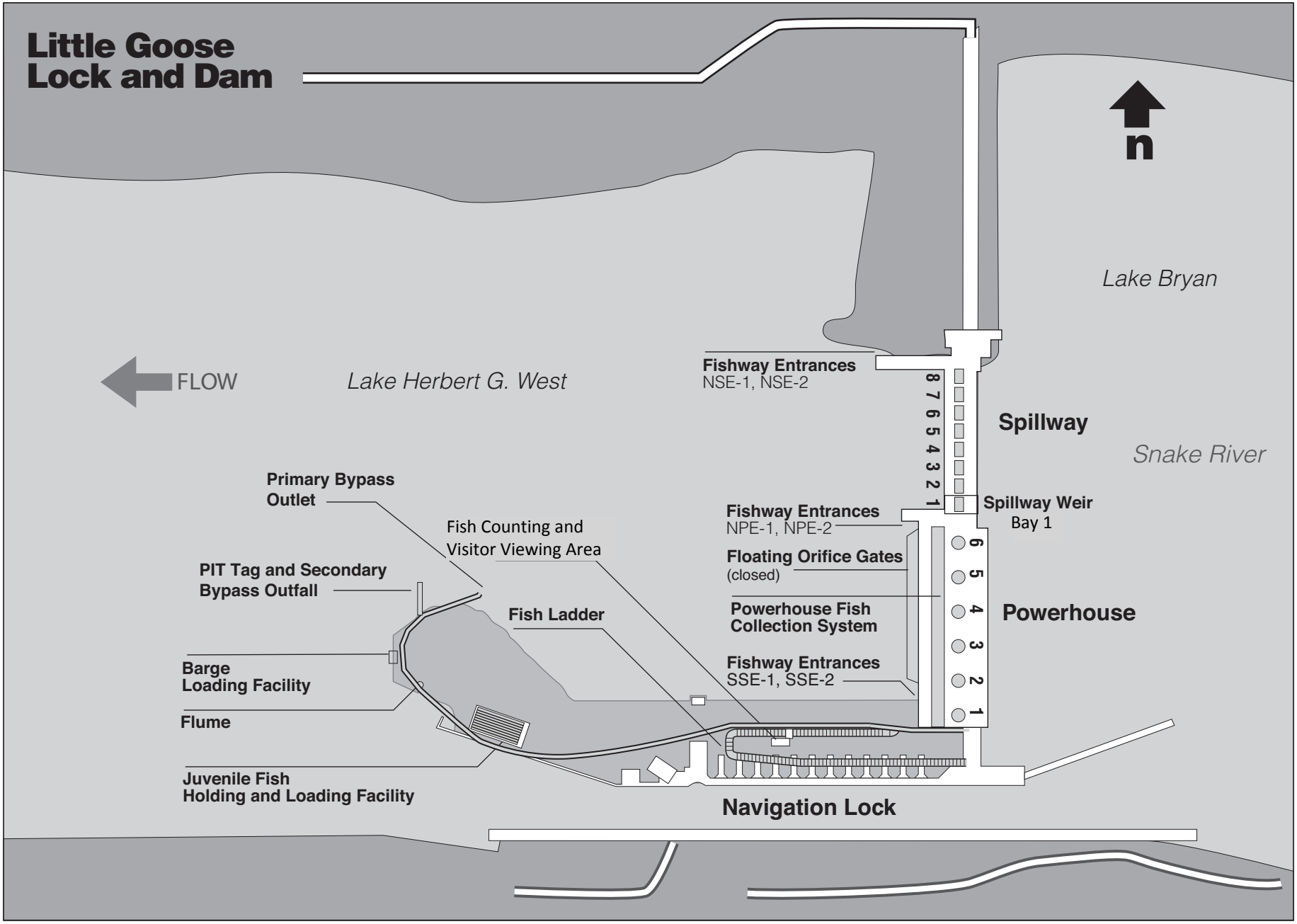
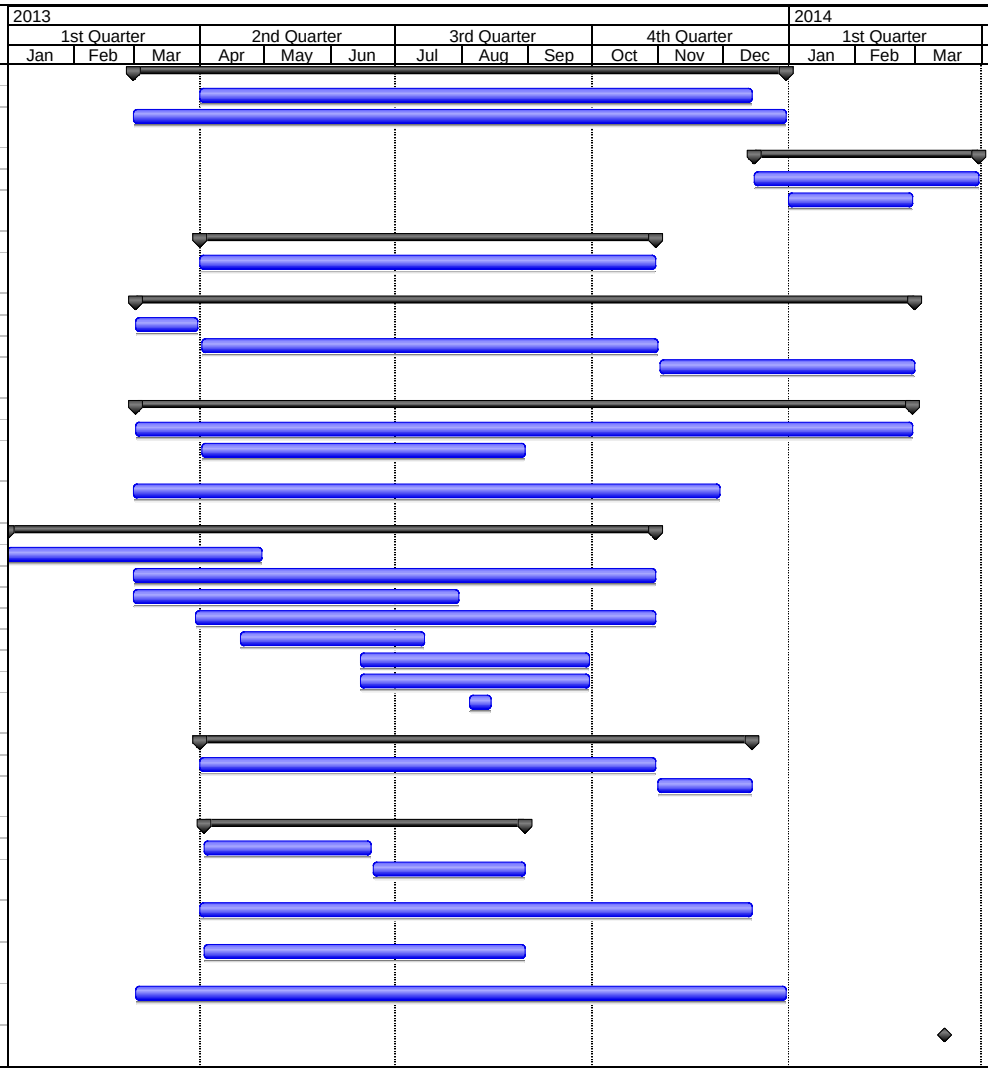


Figure LGS-1 Little Goose Lock and Dam General Site Plan

Table LGS-2. Little Goose Dam Dates of Fish-Related Operations for 2013 Fish Passage Season and 2013/14 Winter Maintenance Period.

Task Name	Start	Finish	Reference
2013 FISH PASSAGE SEASON	**3/1/13**	**12/31/13**	**LGS 2.3**
Juvenile Fish Passage Season	4/1/13	12/15/13	LGS 2.3.1.2
Adult Fish Passage Season	3/1/13	12/31/13	LGS 2.3.2.2
2013-2014 WINTER MAINTENANCE PERIOD	**12/16/13**	**3/31/14**	**LGS 2.3**
Juvenile Fish Facilities Winter Maintenance	12/16/13	3/31/14	LGS 2.3.1.1
Adult Fish Facilities Winter Maintenance	1/1/14	2/28/14	LGS 2.3.2.1
ADULT FISH COUNTING	**4/1/13**	**10/31/13**	**Table LGS-3**
Visual 0400-2000 PST	4/1/13	10/31/13	
1% CONSTRAINTS (YEAR-ROUND)	**3/1/13**	**2/28/14**	**LGS 4.1.1**
1% soft constraint	3/1/13	3/31/13	
1% hard constraint	4/1/13	10/31/13	
1% soft constraint	11/1/13	2/28/14	
TDG MONITORING	**3/1/13**	**2/28/14**	**LGS 2.2**
TDG Monitoring - Tailrace (year-round)	3/1/13	2/28/14	LGSW
TDG Monitoring - Forebay	4/1/13	8/31/13	LGSA
Operate Turbine Priority for Fish Passage	**3/1/13**	**11/30/13**	**LGS 4.1; Table LGS-5**
SPECIAL OPERATIONS & STUDIES	**1/1/13**	**10/31/13**	**Appendix A**
Exciter Replacement	1/1/13	4/30/13	App A LGS 1.5
Lamprey Passage Evaluations	3/1/13	10/31/13	App A LGS 2.4
Intake Gantry Crane Replacement	3/1/13	7/31/13	App A LGS 1.7
Adult Salmon Studies	3/30/13	10/31/13	App A LGS 2.3
BiOp Performance Standard Compliance Test	4/20/13	7/15/13	App A LGS 2.1
Video Monitoring of Fish Ladder Modifications for Lamprey	6/15/13	9/30/13	App A LGS 2.5
BiOp Kelt Passage & Survival Monitoring	6/15/13	9/30/13	App A LGS 2.2
Doble Testing	8/5/13	8/15/13	App A LGS 1.6
OPERATION OF JUVENILE FISH PASSAGE SYSTEM	**4/1/13**	**12/15/13**	**LGS 2.3.1**
Juvenile Fish Bypass, Collection and Transportation	4/1/13	10/31/13	
Adult Fish Fallback Bypass	11/1/13	12/15/13	
SPILL FOR FISH PASSAGE	**4/3/13**	**8/31/13**	**Appendix E**
Spring Spill	4/3/13	6/20/13	end date approximate
Summer Spill	6/21/13	8/31/13	start date approximate
Avian Abatement Measures	**4/1/13**	**12/15/13**	**LGS 2.3.1.2.f**
Spillway Weir in service (removed from service no later than August 31)	**4/3/13**	**8/31/13**	**LGS 2.3.1.2.g**
Weekly Reports	**3/1/13**	**12/31/13**	**LGS 2.3.3.1**
Annual Report (for Dec 1, 2012 - Nov 30, 2013)	**3/15/14**	**3/15/14**	**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 facing entrances into the spillway basin on the north end of the powerhouse, and a common transportation channel. The north shore entrances are comprised of two downstream facing entrances into the spillway basin. 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–February to minimize impacts on upstream migrants. Adult salmon, steelhead, shad, and lamprey are counted as per **Table LGS-3**, and count data are posted daily on the Corps adult fish count website at: http://www.nwp.usace.army.mil/Missions/Environment/Fishdata.aspx. Salmon migration timing data appear in **Table LGS-4**. Sturgeon and bull trout are counted and recorded on the daily summary sheet comments section but are not posted in the daily reports on the Corps website due to relatively infrequent passage. These data are posted periodically during the passage season in the Miscellaneous Fish Counts report on the Corps' website, and summarized in the Annual Fish Passage Report.

Table LGS-3. Adult Fish Counting Schedule at Little Goose Dam.

Count Period	Counting Method and Hours [1]
April 01 – October 31	Visual 0400–2000 hours (PST)

1. All count hours are shown in Pacific Standard Time (PST). Note that during daylight saving time (DST) from March 10–November 3, 2013, count hours will be adjusted forward one hour (DST = PST+1).

Table LGS-4. Adult Count Periods and Peak Migration Timing at Little Goose Dam Based on Fish Count Data from 1970-2012.

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 – 6/15	4/20	6/1
Summer Chinook	6/16 – 8/15	6/16	7/12
Fall Chinook	8/16 – 10/31	9/3	9/30
Steelhead	4/1 – 10/31	9/6	10/14
Sockeye	6/15 – 10/31	6/24	7/25
Lamprey	4/1 – 10/31	7/6	8/20

2. PROJECT OPERATION

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

2.1.2. 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, Tables LGS-9 through LGS-12. Special spills for juvenile fish passage will be provided as detailed in **Appendices A and E**.

2.1.3. 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.

2.1.4. Change from 30% Spill to a Constant Spill Rate. When forecast daily average inflows at Little Goose Dam (LGS) are 33 kcfs or less for 3 consecutive days, and forecasts indicate a continued decline, change the 30% spill operation to a constant rate of spill of approximately 11.2, 9.3, or 7.5 kcfs. The rate selected should be the rate that will result in the daily spill average closest to 30%. These consistent spill levels are approximate and may vary depending on changing inflow, forebay and tailwater elevations, and other operational demands.

It is difficult for LGS to achieve 30% spill when inflows are less than 38 kcfs because it requires switching frequently between one and two unit operations. Spilling 30% at these low flows is incompatible with the more constant discharge upstream at Lower Granite Dam (18 kcfs - 2013 FOP Spill Operation) and downstream at Lower Monumental Dam (17 kcfs – 2013 FOP). This causes both spillway and turbine discharge to vary considerably to maintain 30% spill within the forebay minimum operating pool (MOP) 1-foot range, as total discharge must either be approximately 25 or 38 kcfs to meet 30% spill. It is also difficult to achieve the FOP-prescribed spill rate downstream at Lower Monumental Dam and maintain the MOP operation at LGS.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at all projects are monitored in accordance with the TDG Monitoring Plan, included in the Water Management Plan as Appendix 4, and available online at: http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2013/.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1–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 with ESBSs in place.

4. Inspect and repair gatewell dip net as needed.

b. Extended-Length Submersible Bar Screens(ESBSs), Flow Vanes, and Vertical Barrier Screens (VBSs).

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. Juvenile Fish Passage Period (April 1–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 (ESBSs), Vertical Barrier Screens (VBSs), 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 passage condition. Change cleaning frequency as needed.

3. Monitor ESBS operating status regularly throughout work shifts via the ESBS operating computer display located in the control room.

4. Inspect ESBS, cleaning brush control panels located in the orifice gallery for cleaning brush failures (trouble lights) at least once per day throughout the entire fish passage season.

5. Manually operate ESBS cleaning brush monthly during the fish passage season April through December 15 (more frequently if required) to verify proper and complete up-and-down brush travel and to monitor and record amperage draws.

6. Inspect ESBS by underwater video during turbine unit annual maintenance (more frequently if required). Thoroughly inspect VBSs at the same time.

7. Inspect at least 2 VBSs in 2 different turbine units by means of underwater video 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.

8. 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.

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

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

11. 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.

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

13. 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.

14. When cold weather is forecasted for an extended period of time between Thanksgiving and December 15, ESBSs and STSs may be removed. The project will first request special permission from CENWW-OD-T. CENWW-OD-T will inform NOAA Fisheries and other FPOM participants. "Cold weather" is defined as: forecasted daily high temperature below 32°F or daily low temperatures below 20°F as forecasted for the Little Goose Dam area by NOAA's National Weather Service (http://www.weather.gov).

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 channel is dewatered at end of 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. .

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 ensure they are in good condition, and any broken wires or devices 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. Temporary Spillway Weir (TSW).[1]

1. Spring fish passage season will start with the TSW deployed in the high crest (SW-HI) position [elevation 622 msl]. It will be operated in this position the entire spill season unless the conditions described in paragraph #2 below are met.

2. Change to TSW Low Crest (SW-LO) position three normal working days prior to the date on which the most recent stream flow forecast (STP) projects daily average flows above 85 kcfs for at least seven consecutive days or if actual flows indicate that 85 kcfs will be exceeded before the next STP forecast is issued, as determined by NWW Water Management staff. The position change will take place within three normal working days after RCC has issued the operating project a teletype. During the period when the change is occurring, the uniform spill pattern will be used, with the exception that spillbay 2 will not be used for safety reasons. The trigger to change to the SW-LO position is further based on the following:

a. review of the juvenile fish passage at Lower Granite and Little Goose dams to prevent changes during a peak in outmigration;

b. coordination with regional fish managers.

3. After the spring freshet has passed, change to the SW-HI position after river discharge falls below 85 kcfs and streamflow forecasts indicate river discharges to remain below 85 kcfs for at least seven consecutive days. The TSW will not be operated in the SW-LO position for the rest of the season, even if river discharges subsequently increase above 85 kcfs. The position change will take place within three normal working days after RCC has issued the operating project a teletype. During the period when the change is occurring, the uniform spill pattern will be used, with the exception that spillbay 2 will not be used for safety reasons. The trigger to change to the SW-HI position is further based on the following:

a. a review of the juvenile fish passage at Lower Granite and Little Goose dams to prevent changes during a peak in outmigration;

b. coordination with regional fish managers.

[1] Temporary spillway weirs (TSWs) are installed at Little Goose, McNary and John Day dams. TSWs are differentiated from Removable Spillway Weirs (RSWs, installed at Lower Granite, Lower Monumental and Ice Harbor dams) by the ability to install, uninstall and move TSWs between spillbays using the project's gantry crane.

4. When daily average discharge drops below 35 kcfs in the summer while the SW-HI is installed and forecasts predict flows to remain below 35 kcfs for at least three days, the TSW will be closed for the remainder of the spill season. The TSW will be closed within three normal working days and coordinated through CENWW-OD-T.

5. Special turbine unit 1 operations will change from the upper 25% of the 1% of peak efficiency range to the full 1% of peak efficiency range when project discharge is below 38 kcfs and above 31 kcfs.

6. The uniform spill pattern with no TSW operating will be used as an alternate pattern when the TSW must be closed for any reason, such as when switching the crest elevation or when the TSW is removed from service due to low river flows.

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–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. Adult Fish Passage Period (March 1–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 counting window slot at Little Goose Dam is fixed at a width of no less than 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 measured and reported once per month using an underwater flowmeter. The average velocity will be calculated using several measurements taken at various depths across the width of the channel that best represents the average subsurface flow. The measurements will be taken at a location in the channel that represents the overall flow characteristic.

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 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°F or greater, all adult fish handling will be coordinated through CENWW-OD-T.* Dewatering and fish handling plans were reviewed and revised in 2011 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.

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. Transportation facilities can be operated either to collect and hold juveniles for the transportation program or to bypass fish back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass fish around the damaged area. If this is not possible, fish will be bypassed around the transportation facility.

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 <u>significant effect</u> 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 providing 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 ensure 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 otherwise coordinated.

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. [1]

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

* 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 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 (Qr<38 kcfs), with only 1 unit operating, Unit 1 may operate at less than 16 kcfs.

4.1.1. Turbine units will be operated within 1% of peak efficiency from April 1–October 31, as specified in BPA's Load Shaping Guidelines (**Appendix C**) unless operation outside of that range is necessary to:

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

b. 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;

c. Operating a turbine unit solely to provide station service; or

d. 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 and LGS-8.**

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 Spill Season Operating Limits.

ESBSs Installed	Powerhouse Discharge (kcfs)	Lower Limit	Upper Limit
YES	≤ 16 kcfs	1% Lower Generation Limit (Varies w/Head)	1% Upper Generation Limit (Varies w/Head)
YES	> 16 kcfs	115 MW (16 kcfs)*	1% Upper Generation Limit (Varies w/Head)
NO	≤ 17.5 kcfs	1% Lower Generation Limit (Varies w/Head)	1% Upper Generation Limit (Varies w/Head)
NO	> 17.5 kcfs	125 MW (17.5 kcfs)*	1% Upper Generation Limit (Varies w/Head)

* 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 11.3 – 13.1 kcfs for

turbine units 1 – 3 and 13.5 – 14.5 kcfs for turbine units 4-6. Actual attainable minimum generation levels may vary depending on project conditions.

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. Turbine Unit Operating Range Within 1% of Peak Efficiency at Little Goose Dam Units 1-3 With and Without Extended-Length Submersible Bar Screens (ESBSs) Installed.*

Head (feet)	TURBINE UNITS 1, 2 and 3							
	With ESBS				Without ESBS			
	1% Lower Limit		1% Upper Limit		1% Lower Limit		1% Upper Limit	
	(MW)	(cfs)	(MW)	(cfs)	(MW)	(cfs)	(MW)	(cfs)
85	**69.6**	**11,396**	**111.5**	**18,269**	**70.5**	**11,320**	**124.5**	**20,006**
86	70.3	11,381	113.7	18,402	71.3	11,305	127.0	20,152
87	71.1	11,366	115.9	18,531	72.0	11,290	129.5	20,293
88	71.9	11,351	118.1	18,657	72.8	11,276	131.9	20,431
89	72.6	11,336	120.3	18,779	73.6	11,262	134.4	20,566
90	**73.4**	**11,322**	**122.5**	**18,898**	**74.4**	**11,247**	**136.9**	**20,696**
91	74.3	11,313	122.9	18,717	75.3	11,239	137.3	20,499
92	75.1	11,304	123.2	18,540	76.1	11,230	137.7	20,306
93	76.0	11,295	123.6	18,367	77.0	11,221	138.0	20,116
94	76.9	11,285	123.9	18,197	77.9	11,212	138.4	19,931
95	**77.7**	**11,276**	**124.3**	**18,031**	**78.7**	**11,203**	**138.8**	**19,750**
96	78.8	11,294	124.4	17,841	79.8	11,222	139.0	19,541
97	79.8	11,312	124.6	17,654	80.9	11,240	139.1	19,338
98	80.9	11,329	124.7	17,472	81.9	11,257	139.3	19,138
99	81.9	11,346	124.8	17,293	83.0	11,274	139.4	18,942
100	**82.9**	**11,361**	**125.0**	**17,117**	**84.0**	**11,290**	**139.6**	**18,751**
101	83.8	11,363	126.6	17,163	84.9	11,291	141.4	18,801
102	84.7	11,364	128.3	17,207	85.8	11,293	143.3	18,850
103	85.6	11,365	129.9	17,250	86.7	11,294	145.1	18,897
104	86.5	11,367	131.6	17,293	87.6	11,295	147.0	18,944
105	**87.4**	**11,367**	**133.2**	**17,334**	**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-8. Turbine Unit Operating Range Within 1% of Peak Efficiency at Little Goose Dam Units 4-6 With and Without Extended-Length Submersible Bar Screens (ESBSs) Installed.*

Head (feet)	TURBINE UNITS 4, 5 and 6							
	With ESBS				Without ESBS			
	1% Lower Limit		1% Upper Limit		1% Lower Limit		1% Upper Limit	
	(MW)	(cfs)	(MW)	(cfs)	(MW)	(cfs)	(MW)	(cfs)
85	**87.1**	**13,880**	**119.6**	**19,076**	**86.4**	**13,479**	**122.2**	**19,052**
86	88.2	13,890	121.3	19,102	87.6	13,488	123.9	19,078
87	89.3	13,899	122.9	19,127	88.7	13,497	125.6	19,104
88	90.5	13,908	124.6	19,151	89.8	13,506	127.2	19,128
89	91.6	13,916	126.3	19,174	91.0	13,514	128.9	19,151
90	**92.8**	**13,924**	**127.9**	**19,196**	**92.1**	**13,522**	**130.6**	**19,174**
91	93.9	13,925	129.4	19,193	93.2	13,523	132.1	19,171
92	95.0	13,925	130.9	19,190	94.3	13,524	133.7	19,168
93	96.1	13,926	132.4	19,186	95.4	13,524	135.2	19,165
94	97.2	13,926	133.9	19,183	96.5	13,525	136.7	19,162
95	**98.3**	**13,926**	**135.3**	**19,179**	**97.6**	**13,525**	**138.2**	**19,158**
96	99.2	13,898	135.8	19,038	98.4	13,498	138.7	19,018
97	100.0	13,871	136.3	18,900	99.3	13,472	139.2	18,880
98	100.9	13,844	136.8	18,765	100.2	13,446	139.7	18,745
99	101.8	13,818	137.3	18,633	101.1	13,420	140.2	18,613
100	**102.7**	**13,791**	**137.8**	**18,503**	**101.9**	**13,395**	**140.7**	**18,484**
101	103.9	13,821	139.1	18,503	103.2	13,423	142.1	18,484
102	105.2	13,849	140.5	18,503	104.4	13,451	143.5	18,484
103	106.4	13,878	141.9	18,503	105.7	13,478	144.9	18,484
104	107.7	13,905	143.3	18,503	106.9	13,505	146.3	18,484
105	**108.9**	**13,932**	**144.6**	**18,503**	**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 three 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 November or December, but can be conducted in mid-August. Impacts to migrating adults should be minimized. 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 peak 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. If Doble testing impacts priority units for adult fish passage, adult passage timing should be considered. Impacts to migrating adults should be minimized.

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. <u>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.</u> 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.

4.3.3. Units may be operationally tested for up to 30 minutes before going into maintenance status by running the unit at speed no load and various loads within the 1% criteria to allow pre-maintenance measurements and testing AND TO ALLOW ALL FISH TO MOVE THROUGH THE UNIT. Units may be operationally tested after maintenance or repair while remaining in maintenance or forced outage status. Operational testing may consist of running the unit for up

to a cumulative time of 30 minutes (within 1% criteria) before it is returned to operational status. Operational testing OF UNIT UNDER MAINTENANCE is in addition to a unit in run status (E.G. MINIMUM GENERATION) required for power plant reliability. Operational testing may deviate from fish priority units and may require water that would otherwise be used for spill if the running unit for reliability is at its 1% minimum load. Water will be used from the powerhouse allocation if possible, and water diverted from spill for operational testing will be minimized to that necessary to maintain and assure generation system reliability.

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. Normally, the project shall contact CENWW-OD-T at least two workdays prior to the day the special operation is required. Using information provided by the project, CENWW-OD-T will notify FPOM and RCC will issue a teletype detailing the special operations.

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.

5.1.1. Emergency spills may be implemented if necessary to pass woody debris that are accumulating in front of the spillbay weir(s), compromising the safe, unobstructed passage of fish. The operating project will immediately spill the woody debris to remove the obstructions to fish passage. The operating project will notify CENWW-OD-T of the emergency spill as soon as possible to provide notification to RCC, NOAA Fisheries, and other FPOM participants.

Table LGS-9 (pg 1 of 2). Little Goose Dam Spill Pattern for Spillway Weir in Low Crest (SW-Lo) Configuration (Crest Elev = 618 ft).

Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 & 3] 1 (Note 4)	2	3	4	5	6	Spillway Flow (stops) [Note 3] 1	2	3	4	5	6	7	8	Total Stops TS	Notes
37.3	26.1	11.2	30.0%	633.5	14.8	11.3					SW-LO								0	Lowest Qr w/ SW-LO
38.5	27.3	11.2	29.1%	633.5	16.0	11.3					SW-LO								0	Lowest Qr for U1 special operation (Note 4)
43.2	30.2	13.0	30.0%	633.5	16.0	14.2					SW-LO							1	1	
49.0	34.3	14.7	30.0%	633.5	17.2	17.1					SW-LO	1						1	2	
49.7	35.0	14.7	29.6%	633.5	17.5	17.5					SW-LO	1						1	2	Max. Qr w/ 2 units, 2 stops, Qs ~30%
53.3	38.6	14.7	27.6%	633.5	16.0	11.3	11.3				SW-LO	1						1	2	Min. Qr w/ 3 units, 2 stops, Qs ~28%
55.4	38.8	16.6	30.0%	633.5	16.0	11.4	11.4				SW-LO	1						2	3	
61.3	42.9	18.4	30.0%	633.5	16.0	13.5	13.4				SW-LO	1		1				2	4	
67.1	47.0	20.1	30.0%	633.5	16.0	15.5	15.5				SW-LO	1		1		1		2	5	
73.0	51.1	21.9	30.0%	633.5	17.1	17.0	17.0				SW-LO	1	1	1		1		2	6	
74.4	52.5	21.9	29.4%	633.5	17.5	17.5	17.5				SW-LO	1	1	1		1		2	6	Max. Qr w/ 3 units, 6 stops, Qs ~29%
74.4	52.5	21.9	29.4%	633.5	16.0	11.3	11.3	13.9			SW-LO	1	1	1		1		2	6	Min. Qr w/ 4 units, 6 stops, Qs ~29%
78.9	55.2	23.7	30.0%	633.5	16.0	12.7	12.6	13.9			SW-LO	1	1	1		1	1	2	7	
84.7	59.3	25.4	30.0%	633.5	16.0	14.5	14.4	14.4			SW-LO	1	1	1	1	1	1	2	8	Trigger Qr to change SW crest elev. (Note 5)
91.0	63.7	27.3	30.0%	633.5	16.0	15.9	15.9	15.9			SW-LO	2	1	1	1	1	1	2	9	
97.4	68.2	29.2	30.0%	633.5	17.1	17.1	17.0	17.0			SW-LO	2	1	2	1	1	1	2	10	
100.6	71.4	29.2	29.0%	633.5	17.5	17.5	17.5	18.9			SW-LO	2	1	2	1	1	1	2	10	Max. Qr w/ 4 units, 10 stops, Qs ~29%
100.6	71.4	29.2	29.0%	633.5	16.0	13.9	13.8	13.8	13.9		SW-LO	2	1	2	1	1	1	2	10	5 units, 10 stops, Qs~29%
103.7	72.6	31.1	30.0%	633.5	16.0	14.2	14.2	14.1	14.1		SW-LO	2	1	2	1	2	1	2	11	
110.0	77.0	33.0	30.0%	633.5	16.0	15.3	15.3	15.2	15.2		SW-LO	2	2	2	1	2	1	2	12	
116.4	81.5	34.9	30.0%	633.5	16.3	16.3	16.3	16.3	16.3		SW-LO	2	2	2	2	2	1	2	13	
122.7	85.9	36.8	30.0%	633.5	17.2	17.2	17.2	17.2	17.1		SW-LO	2	2	2	2	2	2	2	14	
129.4	90.6	38.8	30.0%	633.5	16.0	15.0	14.9	14.9	14.9	14.9	SW-LO	3	2	2	2	2	2	2	15	
136.0	95.2	40.8	30.0%	633.5	16.0	15.9	15.9	15.8	15.8	15.8	SW-LO	3	3	2	2	2	2	2	16	
142.7	99.9	42.8	30.0%	633.5	16.7	16.7	16.7	16.6	16.6	16.6	SW-LO	3	3	3	2	2	2	2	17	
149.3	104.5	44.8	30.0%	633.5	17.5	17.4	17.4	17.4	17.4	17.4	SW-LO	3	3	3	3	2	2	2	18	
156.0	109.2	46.8	30.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	3	3	3	3	3	2	2	19	Max. PH capacity w/ Qs=30% (Note 6)
158.0	109.2	48.8	30.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	3	3	3	3	3	3	2	20	
160.0	109.2	50.8	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	
162.0	109.2	52.8	32.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	3	3	3	3	3	3	22	
163.9	109.2	54.7	33.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	3	3	3	3	3	23	
165.9	109.2	56.7	34.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	3	3	3	3	24	
167.9	109.2	58.7	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	
169.8	109.2	60.6	35.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	4	3	3	26	
171.8	109.2	62.6	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	
173.8	109.2	64.6	37.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	4	4	4	4	4	4	4	28	
175.7	109.2	66.5	37.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	4	4	4	4	4	4	29	
177.7	109.2	68.5	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	
179.7	109.2	70.5	39.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	4	4	4	4	31	
181.6	109.2	72.4	39.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	4	4	4	32	
183.6	109.2	74.4	40.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	4	4	33	
185.6	109.2	76.4	41.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	5	4	34	
187.5	109.2	78.3	41.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	5	5	5	5	5	5	5	35	
189.5	109.2	80.3	42.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	5	5	5	5	5	5	36	
191.5	109.2	82.3	43.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	5	5	5	5	5	37	
193.4	109.2	84.2	43.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	5	5	5	5	38	
195.4	109.2	86.2	44.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	5	5	5	39	

Table LGS-9 (pg 2 of 2). Little Goose Dam Spill Pattern for Spillway Weir in Low Crest (SW-Lo) Configuration (Crest Elev = 618 ft).

Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	1 (Note 4)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
197.3	109.2	88.1	44.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	5	5	40	
199.3	109.2	90.1	45.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	6	5	41	
201.3	109.2	92.1	45.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	6	6	6	6	6	6	6	42	
203.2	109.2	94.0	46.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	6	6	6	6	6	6	43	
205.1	109.2	95.9	46.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	6	6	6	6	6	44	
207.1	109.2	97.9	47.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	6	6	6	6	45	
209.0	109.2	99.8	47.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	6	6	6	46	
211.0	109.2	101.8	48.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	6	6	47	
212.9	109.2	103.7	48.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	7	6	48	
214.9	109.2	105.7	49.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	7	7	7	7	7	7	7	49	
216.8	109.2	107.6	49.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	7	7	7	7	7	7	50	
218.8	109.2	109.6	50.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	7	7	7	7	7	51	
220.8	109.2	111.6	50.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	7	7	7	7	52	
222.7	109.2	113.5	51.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	7	7	7	53	
224.7	109.2	115.5	51.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	7	7	54	
226.7	109.2	117.5	51.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	8	7	55	
228.6	109.2	119.4	52.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	8	8	8	8	8	8	8	56	
230.6	109.2	121.4	52.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	8	8	8	8	8	8	57	
232.5	109.2	123.3	53.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	8	8	8	8	8	58	
234.4	109.2	125.2	53.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	8	8	8	8	59	
236.3	109.2	127.1	53.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	8	8	8	60	
238.3	109.2	129.1	54.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	8	8	61	
240.2	109.2	131.0	54.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	9	8	62	
242.1	109.2	132.9	54.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	9	9	9	9	9	9	9	63	
244.1	109.2	134.9	55.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	9	9	9	9	9	9	64	
246.2	109.2	137.0	55.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	9	9	9	9	9	65	
248.2	109.2	139.0	56.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	9	9	9	9	66	
250.2	109.2	141.0	56.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	9	9	9	67	
252.2	109.2	143.0	56.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	10	9	9	68	
254.2	109.2	145.0	57.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-LO	10	10	10	10	10	10	9	69	
256.2	109.2	147.0	57.4%	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).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (633.5 ft for MOP rules), 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 (Qr<38 kcfs), with only one unit operating, Unit 1 may operate at less than 16 kcfs.

Note 5: 85 kcfs is the river discharge trigger to switch from the SW-HI to SW-LO on the rising limb of the spring hydrograph, or from SW-LO to SW-HI on the receding limb, as detailed in the Fish Passage Plan. In other words, 85 kcfs is the lowest river discharge at which the SW-LO should be operated.

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

Table LGS-10 (pg 1 of 2). Little Goose Dam Spill Pattern for Spillway Weir in High Crest (SW-Hi) Configuration (Crest Elev = 622 ft).

					Powerhouse Flow (kcfs) [Notes 1 & 3]						Spillway Flow (stops) [Note 3]									
Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	1 (Note 4)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
23.9	16.7	7.2	30.0%	633.5	16.7						SW-HI								0	Lowest Qr possible w/ SW-HI
26.4	17.5	8.9	33.7%	633.5	17.5						SW-HI							1	1	1 unit, 1 stop, Qs~34%
31.5	22.6	8.9	28.3%	633.5	11.3	11.3					SW-HI							1	1	2 units @ min. 1%, 1 stop, Qs~28%
35.0	24.3	10.7	30.5%	633.5	13.0	11.3					SW-HI	1						1	2	Lowest Qr w/ SW-HI per FPP (Note 5)
35.6	24.9	10.7	30.0%	633.5	13.6	11.3					SW-HI	1						1	2	
38.0	27.3	10.7	28.1%	633.5	16.0	11.3					SW-HI	1						1	2	Lowest Qr for U1 special operation (Note 4)
41.9	29.3	12.6	30.0%	633.5	16.0	13.3					SW-HI	1						2	3	
47.7	33.4	14.3	30.0%	633.5	17.5	15.9					SW-HI	1		1				2	4	
51.1	35.0	16.1	31.5%	633.5	17.5	17.5					SW-HI	1		1		1		2	5	2 units, 5 stops, Qs~31%
54.7	38.6	16.1	29.4%	633.5	16.0	11.3	11.3				SW-HI	1		1		1		2	5	3 units, 5 stops, Qs~29%
59.6	41.7	17.9	30.0%	633.5	16.0	12.9	12.8				SW-HI	1	1	1		1		2	6	
65.4	45.8	19.6	30.0%	633.5	16.0	14.9	14.9				SW-HI	1	1	1		1	1	2	7	
71.3	49.9	21.4	30.0%	633.5	16.6	16.7	16.6				SW-HI	1	1	1	1	1	1	2	8	
73.9	52.5	21.4	28.9%	633.5	17.5	17.5	17.5				SW-HI	1	1	1	1	1	1	2	8	Max. Qr w/ 3 units, Qs ~29%
73.9	52.5	21.4	28.9%	633.5	16.0	11.3	11.3	13.9			SW-HI	1	1	1	1	1	1	2	8	Min. Qr w/ 4 units, Qs ~31%
77.6	54.3	23.3	30.0%	633.5	16.0	12.2	12.2	13.9			SW-HI	2	1	1	1	1	1	2	9	
83.9	58.7	25.2	30.0%	633.5	16.0	14.3	14.2	14.2			SW-HI	2	1	2	1	1	1	2	10	
85.0	59.8	25.2	29.6%	633.5	16.0	14.6	14.6	14.6			SW-HI	2	1	2	1	1	1	2	10	Trigger Qr to change SW crest elev. (Note 6)
90.3	63.2	27.1	30.0%	633.5	16.0	15.8	15.7	15.7			SW-HI	2	1	2	1	2	1	2	11	
96.6	67.6	29.0	30.0%	633.5	16.9	16.9	16.9	16.9			SW-HI	2	2	2	1	2	1	2	12	
100.4	71.4	29.0	28.9%	633.5	17.5	17.5	17.5	18.9			SW-HI	2	2	2	1	2	1	2	12	Max. Qr w/ 4 units, 12 stops, Qs ~29%
100.4	71.4	29.0	28.9%	633.5	16.0	13.9	13.8	13.8	13.9		SW-HI	2	2	2	1	2	1	2	12	5 units, 12 stops, Qs~29%
102.9	72.0	30.9	30.0%	633.5	16.0	14.0	14.0	14.0	14.0		SW-HI	2	2	2	2	2	1	2	13	
109.3	76.5	32.8	30.0%	633.5	16.0	15.2	15.1	15.1	15.1		SW-HI	2	2	2	2	2	2	2	14	
115.9	81.1	34.8	30.0%	633.5	16.3	16.2	16.2	16.2	16.2		SW-HI	3	2	2	2	2	2	2	15	
122.6	85.8	36.8	30.0%	633.5	17.2	17.2	17.2	17.1	17.1		SW-HI	3	3	2	2	2	2	2	16	
129.2	90.4	38.8	30.0%	633.5	16.0	14.9	14.9	14.9	14.9	14.8	SW-HI	3	3	3	2	2	2	2	17	
135.9	95.1	40.8	30.0%	633.5	16.0	15.9	15.8	15.8	15.8	15.8	SW-HI	3	3	3	3	2	2	2	18	
142.4	99.7	42.7	30.0%	633.5	16.7	16.6	16.6	16.6	16.6	16.6	SW-HI	3	3	3	3	3	2	2	19	
149.1	104.4	44.7	30.0%	633.5	17.4	17.4	17.4	17.4	17.4	17.4	SW-HI	3	3	3	3	3	3	2	20	
155.9	109.2	46.7	30.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	3	3	3	3	3	3	3	21	Max. PH capacity w/ Qs=30% (Note 7)
157.9	109.2	48.7	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	
159.9	109.2	50.7	31.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	3	3	3	3	3	23	
161.8	109.2	52.6	32.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	3	3	3	3	24	
163.8	109.2	54.6	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	
165.8	109.2	56.6	34.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	3	3	26	
167.8	109.2	58.6	34.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	4	3	27	
169.7	109.2	60.5	35.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	4	4	4	4	4	4	4	28	
171.7	109.2	62.5	36.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	4	4	4	4	4	4	29	
173.7	109.2	64.5	37.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	4	4	4	4	4	30	
175.6	109.2	66.4	37.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	4	4	4	4	31	
177.6	109.2	68.4	38.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	4	4	4	32	
179.6	109.2	70.4	39.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	4	4	33	
181.5	109.2	72.3	39.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	5	4	34	
183.5	109.2	74.3	40.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	5	5	5	5	5	5	5	35	
185.4	109.2	76.2	41.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	5	5	5	5	5	5	36	
187.4	109.2	78.2	41.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	5	5	5	5	5	37	
189.4	109.2	80.2	42.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	5	5	5	5	38	
191.3	109.2	82.1	42.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	5	5	5	39	
193.3	109.2	84.1	43.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	5	5	40	

Table LGS-10 (pg 2 of 2). Little Goose Dam Spill Pattern for Spillway Weir in High Crest (SW-Hi) Configuration (Crest Elev = 622 ft).

					Powerhouse Flow (kcfs) [Notes 1 & 3]						Spillway Flow (stops) [Note 3]									
Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	1 (Note 4)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
195.2	109.2	86.0	44.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	6	5	41	
197.2	109.2	88.0	44.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	6	6	6	6	6	6	6	42	
199.1	109.2	89.9	45.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	6	6	6	6	6	6	43	
201.1	109.2	91.9	45.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	6	6	6	6	6	44	
203.0	109.2	93.8	46.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	6	6	6	6	45	
205.0	109.2	95.8	46.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	6	6	6	46	
206.9	109.2	97.7	47.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	6	6	47	
208.9	109.2	99.7	47.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	7	6	48	
210.8	109.2	101.6	48.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	7	7	7	7	7	7	7	49	
212.8	109.2	103.6	48.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	7	7	7	7	7	7	50	
214.7	109.2	105.5	49.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	7	7	7	7	7	51	
216.7	109.2	107.5	49.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	7	7	7	7	52	
218.7	109.2	109.5	50.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	7	7	7	53	
220.6	109.2	111.4	50.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	7	7	54	
222.6	109.2	113.4	50.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	8	7	55	
224.6	109.2	115.4	51.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	8	8	8	8	8	8	8	56	
226.5	109.2	117.3	51.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	8	8	8	8	8	8	57	
228.4	109.2	119.2	52.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	8	8	8	8	8	58	
230.4	109.2	121.2	52.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	8	8	8	8	59	
232.3	109.2	123.1	53.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	8	8	8	60	
234.2	109.2	125.0	53.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	8	8	61	
236.2	109.2	127.0	53.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	9	8	62	
238.1	109.2	128.9	54.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	9	9	9	9	9	9	9	63	
240.1	109.2	130.9	54.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	9	9	9	9	9	9	64	
242.1	109.2	132.9	54.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	9	9	9	9	9	65	
244.1	109.2	134.9	55.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	9	9	9	9	66	
246.1	109.2	136.9	55.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	9	9	9	67	
248.1	109.2	138.9	56.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	10	9	9	68	
250.1	109.2	140.9	56.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	SW-HI	10	10	10	10	10	10	9	69	
252.2	109.2	143.0	56.7%	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).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (633.5 ft for MOP rules), 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 (Qr<38 kcfs), 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: 85 kcfs is the river discharge trigger to switch from the SW-HI to SW-LO on the rising limb of the spring hydrograph, or from SW-LO to SW-HI on the receding limb, as detailed in the Fish Passage Plan. In other words, 85 kcfs is the lowest river discharge at which the SW-LO should be operated.

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

Table LGS-11 (pg 1 of 2). Little Goose Dam Spill Pattern for Uniform Spill Configuration (No Spillway Weir).

					Powerhouse Flow (kcfs) [Notes 1 & 3]						Spillway Flow (stops) [Notes 3 & 7]									
Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	1 (Note 4)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
11.3	11.3	0.0	0.0%	633.5	11.3						No SW								0	No spill, minimum Qp
13.1	11.3	1.8	13.5%	633.5	11.3						No SW							1	1	
14.8	11.3	3.5	23.8%	633.5	11.3						No SW	1						1	2	
18.0	12.6	5.4	30.0%	633.5	12.6						No SW	1						2	3	Lowest Qr possible w/ 30% spill and no SW (Note 5)
24.0	16.8	7.2	29.9%	633.5	16.8						No SW	1		1				2	4	
26.4	17.5	8.9	33.8%	633.5	17.5						No SW	1		1		1		2	5	1 unit, 5 stops, Qs~34%
31.5	22.6	8.9	28.3%	633.5	11.3	11.3					No SW	1		1		1		2	5	2 units, 5 stops, Qs~28%
35.7	25.0	10.7	30.0%	633.5	13.7	11.3					No SW	1	1	1		1		2	6	
38.0	27.3	10.7	28.2%	633.5	16.0	11.3					No SW	1	1	1		1		2	6	Lowest Qr for U1 special operation (Note 4
41.6	29.1	12.5	30.0%	633.5	16.0	13.1					No SW	1	1	1		1	1	2	7	
47.4	33.2	14.2	30.0%	633.5	16.6	16.6					No SW	1	1	1	1	1	1	2	8	
51.1	35.0	16.1	31.5%	633.5	17.5	17.5					No SW	2	1	1	1	1	1	2	9	2 units, 9 stops, Qs~31%
54.7	38.6	16.1	29.5%	633.5	16.0	11.3	11.3				No SW	2	1	1	1	1	1	2	9	3 units, 9 stops, Qs~29%
60.0	42.0	18.0	30.0%	633.5	16.0	13.0	13.0				No SW	2	1	2	1	1	1	2	10	
66.4	46.5	19.9	30.0%	633.5	16.0	15.3	15.2				No SW	2	1	2	1	2	1	2	11	
72.7	50.9	21.8	30.0%	633.5	17.0	17.0	16.9				No SW	2	2	2	1	2	1	2	12	
74.3	52.5	21.8	29.4%	633.5	17.5	17.5	17.5				No SW	2	2	2	1	2	1	2	12	Max. Qr w/ 3 units, Qs ~29%
76.2	52.5	23.7	31.1%	633.5	16.0	11.3	11.3	13.9			No SW	2	2	2	2	2	1	2	13	Min. Qr w/ 4 units, Qs ~31%
79.0	55.3	23.7	30.0%	633.5	16.0	12.7	12.7	13.9			No SW	2	2	2	2	2	1	2	13	
85.4	59.8	25.6	30.0%	633.5	16.0	14.6	14.6	14.6			No SW	2	2	2	2	2	2	2	14	
92.0	64.4	27.6	30.0%	633.5	16.1	16.1	16.1	16.1			No SW	3	2	2	2	2	2	2	15	
98.7	69.1	29.6	30.0%	633.5	17.3	17.3	17.3	17.2			No SW	3	3	2	2	2	2	2	16	
105.3	73.7	31.6	30.0%	633.5	16.0	14.5	14.4	14.4	14.4		No SW	3	3	3	2	2	2	2	17	
112.0	78.4	33.6	30.0%	633.5	16.0	15.6	15.6	15.6	15.6		No SW	3	3	3	3	2	2	2	18	
118.7	83.1	35.6	30.0%	633.5	16.7	16.6	16.6	16.6	16.6		No SW	3	3	3	3	3	2	2	19	
125.1	87.5	37.6	30.1%	633.5	17.5	17.5	17.5	17.5	17.5		No SW	3	3	3	3	3	3	2	20	
132.0	92.4	39.6	30.0%	633.5	16.0	15.3	15.3	15.3	15.3	15.2	No SW	3	3	3	3	3	3	3	21	
138.6	97.0	41.6	30.0%	633.5	16.2	16.2	16.2	16.2	16.1	16.1	No SW	4	3	3	3	3	3	3	22	
145.1	101.6	43.5	30.0%	633.5	17.0	17.0	16.9	16.9	16.9	16.9	No SW	4	4	3	3	3	3	3	23	
151.7	106.2	45.5	30.0%	633.5	17.5	17.5	17.5	17.9	17.9	17.9	No SW	4	4	4	3	3	3	3	24	
156.7	109.2	47.5	30.3%	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)
158.6	109.2	49.4	31.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	3	3	26	
160.6	109.2	51.4	32.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	4	3	27	
162.6	109.2	53.4	32.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	4	4	4	4	4	4	4	28	
164.5	109.2	55.3	33.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	4	4	4	4	4	4	29	
166.5	109.2	57.3	34.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	4	4	4	4	4	30	
168.5	109.2	59.3	35.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	4	4	4	4	31	
170.4	109.2	61.2	35.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	4	4	4	32	
172.4	109.2	63.2	36.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	4	4	33	
174.4	109.2	65.2	37.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	5	4	34	
176.3	109.2	67.1	38.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	5	5	5	5	5	5	5	35	
178.3	109.2	69.1	38.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	5	5	5	5	5	5	36	
180.3	109.2	71.1	39.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	5	5	5	5	5	37	
182.2	109.2	73.0	40.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	5	5	5	5	38	
184.2	109.2	75.0	40.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	5	5	5	39	
186.1	109.2	76.9	41.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	5	5	40	

Table LGS-11 (pg 2 of 2). Little Goose Dam Spill Pattern for Uniform Spill Configuration (No Spillway Weir).

Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 & 3] 1 (Note 4)	2	3	4	5	6	Spillway Flow (stops) [Notes 3 & 7] 1	2	3	4	5	6	7	8	Total Stops TS	Notes
188.1	109.2	78.9	41.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	6	5	41	
190.1	109.2	80.9	42.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	6	6	6	6	6	6	6	42	
192.0	109.2	82.8	43.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	6	6	6	6	6	6	43	
193.9	109.2	84.7	43.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	6	6	6	6	6	44	
195.9	109.2	86.7	44.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	6	6	6	6	45	
197.8	109.2	88.6	44.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	6	6	6	46	
199.8	109.2	90.6	45.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	6	6	47	
201.7	109.2	92.5	45.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	7	6	48	
203.7	109.2	94.5	46.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	7	7	7	7	7	7	7	49	
205.6	109.2	96.4	46.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	7	7	7	7	7	7	50	
207.6	109.2	98.4	47.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	7	7	7	7	7	51	
209.6	109.2	100.4	47.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	7	7	7	7	52	
211.5	109.2	102.3	48.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	7	7	7	53	
213.5	109.2	104.3	48.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	7	7	54	
215.5	109.2	106.3	49.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	8	7	55	
217.4	109.2	108.2	49.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	8	8	8	8	8	8	8	56	
219.4	109.2	110.2	50.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	8	8	8	8	8	8	57	
221.3	109.2	112.1	50.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	8	8	8	8	8	58	
223.2	109.2	114.0	51.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	8	8	8	8	59	
225.1	109.2	115.9	51.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	8	8	8	60	
227.1	109.2	117.9	51.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	8	8	61	
229.0	109.2	119.8	52.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	9	8	62	
230.9	109.2	121.7	52.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	9	9	9	9	9	9	9	63	
232.9	109.2	123.7	53.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	9	9	9	9	9	9	64	
235.0	109.2	125.8	53.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	9	9	9	9	9	65	
237.0	109.2	127.8	53.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	9	9	9	9	66	
239.0	109.2	129.8	54.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	9	9	9	67	
241.0	109.2	131.8	54.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	10	9	9	68	
243.0	109.2	133.8	55.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW	10	10	10	10	10	10	9	69	
245.0	109.2	135.8	55.4%	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).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (633.5 ft for MOP rules), 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 (Qr<38 kcfs), 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 less than ~35 kcfs, or as an alternate pattern when the SW must be closed for any reason, such as when switching from SW-LO to SW-HI.

Table LGS-12 (pg 1 of 2). Little Goose Dam Spill Pattern for ALTERNATE UNIFORM Spill Configuration (Spillway Weir Crest Change). [Note 7]

					Powerhouse Flow (kcfs) [Notes 1 & 3]						Spillway Flow (stops) [Notes 3 & 7]									
Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	1 (Note 4)	2	3	4	5	6	1	2	3	4	5	6	7	8	Total Stops TS	Notes
11.3	11.3	0.0	0.0%	633.5	11.3						No SW								0	No spill, minimum Qp
13.1	11.3	1.8	13.5%	633.5	11.3						No SW							1	1	
14.8	11.3	3.5	23.8%	633.5	11.3						No SW		1					1	2	
18.0	12.6	5.4	30.0%	633.5	12.6						No SW		1					2	3	Lowest Qr possible w/ 30% spill and no SW (Note 5)
24.0	16.8	7.2	29.9%	633.5	16.8						No SW		1		1			2	4	
26.4	17.5	8.9	33.8%	633.5	17.5						No SW		1		1		1	2	5	1 unit, 5 stops, Qs~34%
31.5	22.6	8.9	28.3%	633.5	11.3	11.3					No SW		1		1		1	2	5	2 units, 5 stops, Qs~28%
35.7	25.0	10.7	30.0%	633.5	13.7	11.3					No SW		1	1	1		1	2	6	
38.0	27.3	10.7	28.2%	633.5	16.0	11.3					No SW		1	1	1		1	2	6	Lowest Qr for U1 special operation (Note 4
41.6	29.1	12.5	30.0%	633.5	16.0	13.1					No SW		1	1	1	1	1	2	7	
47.6	33.2	14.4	30.2%	633.5	16.6	16.6					No SW		2	1	1	1	1	2	8	
51.3	35.0	16.3	31.7%	633.5	17.5	17.5					No SW		2	1	2	1	1	2	9	2 units, 9 stops, Qs~31%
54.9	38.6	16.3	29.6%	633.5	16.0	11.3	11.3				No SW		2	1	2	1	1	2	9	3 units, 9 stops, Qs~29%
60.2	42.0	18.2	30.2%	633.5	16.0	13.0	13.0				No SW		2	1	2	1	2	2	10	
66.6	46.5	20.1	30.1%	633.5	16.0	15.3	15.2				No SW		2	2	2	1	2	2	11	
72.9	50.9	22.0	30.1%	633.5	17.0	17.0	16.9				No SW		2	2	2	2	2	2	12	
74.5	52.5	22.0	29.5%	633.5	17.5	17.5	17.5				No SW		2	2	2	2	2	2	12	Max. Qr w/ 3 units, Qs ~29%
76.5	52.5	24.0	31.3%	633.5	16.0	11.3	11.3	13.9			No SW		3	2	2	2	2	2	13	Min. Qr w/ 4 units, Qs ~31%
79.3	55.3	24.0	30.2%	633.5	16.0	12.7	12.7	13.9			No SW		3	2	2	2	2	2	13	
85.8	59.8	26.0	30.3%	633.5	16.0	14.6	14.6	14.6			No SW		3	3	2	2	2	2	14	
92.3	64.4	27.9	30.3%	633.5	16.1	16.1	16.1	16.1			No SW		3	3	3	2	2	2	15	
99.0	69.1	29.9	30.2%	633.5	17.3	17.3	17.3	17.2			No SW		3	3	3	3	2	2	16	
105.6	73.7	31.9	30.2%	633.5	16.0	14.5	14.4	14.4	14.4		No SW		3	3	3	3	3	2	17	
112.3	78.4	33.9	30.2%	633.5	16.0	15.6	15.6	15.6	15.6		No SW		3	3	3	3	3	3	18	
119.0	83.1	35.9	30.2%	633.5	16.7	16.6	16.6	16.6	16.6		No SW		4	3	3	3	3	3	19	
125.4	87.5	37.9	30.2%	633.5	17.5	17.5	17.5	17.5	17.5		No SW		4	4	3	3	3	3	20	
132.2	92.4	39.8	30.1%	633.5	16.0	15.3	15.3	15.3	15.3	15.2	No SW		4	4	4	3	3	3	21	
138.8	97.0	41.8	30.1%	633.5	16.2	16.2	16.2	16.2	16.1	16.1	No SW		4	4	4	4	3	3	22	
145.4	101.6	43.8	30.1%	633.5	17.0	17.0	16.9	16.9	16.9	16.9	No SW		4	4	4	4	4	3	23	
152.0	106.2	45.8	30.1%	633.5	17.5	17.5	17.5	17.9	17.9	17.9	No SW		4	4	4	4	4	4	24	
156.9	109.2	47.7	30.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	4	4	4	4	4	25	Max. PH capacity w/ Qs=30% (Note 6)
158.9	109.2	49.7	31.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	5	4	4	4	4	26	
160.8	109.2	51.6	32.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	5	5	4	4	4	27	
162.8	109.2	53.6	32.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	5	5	5	4	4	28	
164.8	109.2	55.6	33.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	5	5	5	5	4	29	
166.7	109.2	57.5	34.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		5	5	5	5	5	5	30	
168.7	109.2	59.5	35.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	5	5	5	5	5	31	
170.7	109.2	61.5	36.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	6	5	5	5	5	32	
172.6	109.2	63.4	36.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	6	6	5	5	5	33	
174.6	109.2	65.4	37.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	6	6	6	5	5	34	
176.5	109.2	67.3	38.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	6	6	6	6	5	35	
178.5	109.2	69.3	38.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		6	6	6	6	6	6	36	
180.4	109.2	71.2	39.5%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	6	6	6	6	6	37	
182.4	109.2	73.2	40.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	7	6	6	6	6	38	
184.3	109.2	75.1	40.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	7	7	6	6	6	39	
186.3	109.2	77.1	41.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	7	7	7	6	6	40	

Table LGS-12 (pg 2 of 2). Little Goose Dam Spill Pattern for ALTERNATE UNIFORM Spill Configuration (Spillway Weir Crest Change). [Note 7]

Calc River (kcfs)	PH (kcfs)	Spill (kcfs)	Percent Spill (Note 2)	Forebay WSE (ft) (Note 2)	Powerhouse Flow (kcfs) [Notes 1 & 3] 1 (Note 4)	2	3	4	5	6	Spillway Flow (stops) [Notes 3 & 7] 1	2	3	4	5	6	7	8	Total Stops TS	Notes
188.2	109.2	79.0	42.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	7	7	7	7	6	41	
190.2	109.2	81.0	42.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		7	7	7	7	7	7	42	
192.1	109.2	82.9	43.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	7	7	7	7	7	43	
194.1	109.2	84.9	43.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	8	7	7	7	7	44	
196.1	109.2	86.9	44.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	8	8	7	7	7	45	
198.0	109.2	88.8	44.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	8	8	8	7	7	46	
200.0	109.2	90.8	45.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	8	8	8	8	7	47	
202.0	109.2	92.8	45.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		8	8	8	8	8	8	48	
203.9	109.2	94.7	46.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	8	8	8	8	8	49	
205.8	109.2	96.6	46.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	9	8	8	8	8	50	
207.8	109.2	98.6	47.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	9	9	8	8	8	51	
209.7	109.2	100.5	47.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	9	9	9	8	8	52	
211.6	109.2	102.4	48.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	9	9	9	9	8	53	
213.5	109.2	104.3	48.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		9	9	9	9	9	9	54	
215.6	109.2	106.4	49.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	9	9	9	9	9	55	
217.6	109.2	108.4	49.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	10	9	9	9	9	56	
219.6	109.2	110.4	50.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	10	10	9	9	9	57	
221.6	109.2	112.4	50.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	10	10	10	9	9	58	
223.6	109.2	114.4	51.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	10	10	10	10	9	59	
225.6	109.2	116.4	51.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		10	10	10	10	10	10	60	
227.6	109.2	118.4	52.0%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	10	10	10	10	10	61	
229.6	109.2	120.4	52.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	11	10	10	10	10	62	
231.7	109.2	122.5	52.9%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	11	11	10	10	10	63	
233.7	109.2	124.5	53.3%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	11	11	11	10	10	64	
235.7	109.2	126.5	53.7%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	11	11	11	11	10	65	
237.7	109.2	128.5	54.1%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		11	11	11	11	11	11	66	
239.7	109.2	130.5	54.4%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		12	11	11	11	11	11	67	
241.8	109.2	132.6	54.8%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		12	12	11	11	11	11	68	
243.8	109.2	134.6	55.2%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		12	12	12	11	11	11	69	
245.8	109.2	136.6	55.6%	633.5	17.5	17.5	17.5	18.9	18.9	18.9	No SW		12	12	12	12	11	11	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).

Note 3: Discharges shown on this table are based on an average forebay elevation for the specified range (633.5 ft for MOP rules), 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 (Qr<38 kcfs), 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 alternate uniform spill pattern, with no SW operating, will be used when changing the SW weir crest elevations. Bay 2 is also closed for safety reasons with personnel working in Bay 1 to change the SW crest.